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Impact of nitrogen nutritional status on the dynamics of xylem hydraulic failure and non-structural carbohydrates under moderate and severe droughts in fast-growing trees (Populus spp.)

Laure Bouyer, L. Marchand, Cécile Vincent-Barbaroux, Cochard, Muriel Feinard-Duranceau, Isabelle Le Jan, Alain Delaunay, Sylvain Chamaillard, Tete Severien Barigah, Franck F. Brignolas, et al.

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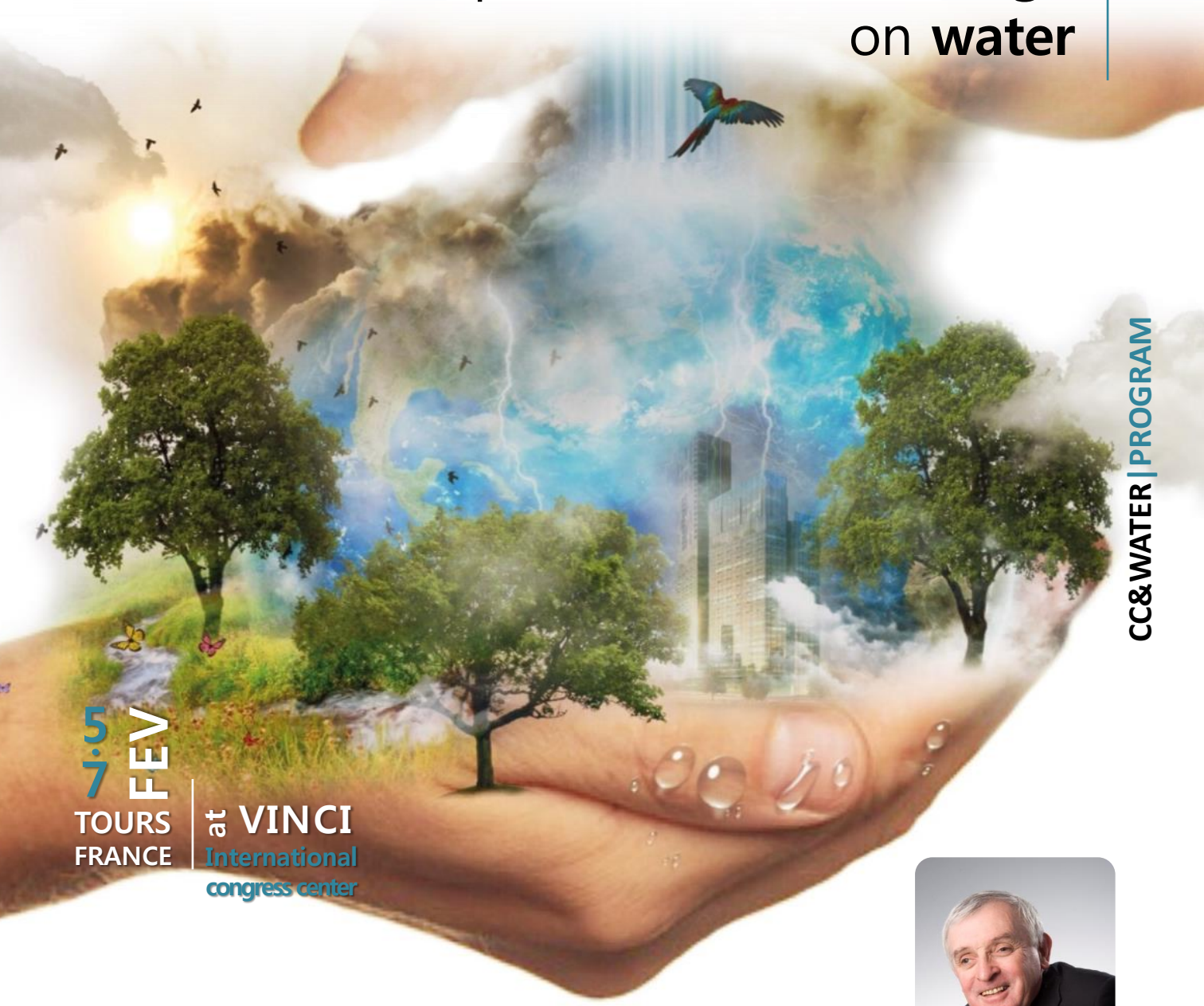
INTERNATIONAL CONFERENCE

Climate Change and Water 2018

Diversity of local responses to the impacts of **climate change** on **water**

CC&WATER | PROGRAM



5 · 7 FEV

TOURS FRANCE | at VINCI International congress center

Opening by Jean Jouzel

Info | climatechangeandwater.org

Partners | citeres UMR 7324 · ECRA · Agence de l'eau Loire-Bretagne · ZA Zones Ateliers LTSER FRANCE LOIRE · IRBI

Supports | météo et climat · SHF · LHB · MSH Val de Loire

MiDi | Centre-Val de Loire · INRA Science & Impact · cnrs · irstea · brgm · Université d'Orléans · Muséum national d'Histoire naturelle · université de Tours

International conference
Climate change & WATER 2018
February 5-7
Tours, France

WORDS OF WELCOME

Dear participants,

Welcome to the Climate Change & Water Conference 2018!

This international conference, with participants coming from 46 countries and more than 100 communications, wants to stimulate exchanges and new developments that will enrich our view of **local responses to the impacts of climate change on water, including biological, technical and societal adaptations**.

The objective is to gain insight on how threats to the water resource can be tackled by illustrating the different impacts of climate change on the water cycle from region to region, from the ecosystem to the biogeographic scale, and taking into account the functional, institutional and socio-political dimensions.

Following our expectations, this conference, open to academics and non-academics, proposes communications from researchers, water managers and water professionals.

Enjoy this opportunity of interdisciplinary and inter-professional exchanges!

Isabelle La Jeunesse & Sylvain Pincebourde

University of Tours, Citeres and IRBI laboratories

MONDAY 5

8:30 Welcome and registration

Opening session
9:00-11h45

Benoît FAUCHEUX Centre-Val de Loire Region
Philippe VENDRIX President Univ. of Tours

Jean JOUZEL- Météo & Climat (FR)
The need to keep below 2°C

Eric BRUN - ONERC (FR)
Water issues in the next French Adaptation Plan to Climate Change

10:30 Coffee Break

Philippe QUEVAUVILLER - EC (BE)
Community-building to link EU-research to policy and practitioner's needs in the area of climate-related extreme events

Overview of the conference themes in the climate-water-adaptation nexus
11:45-12:30

Philippe KER RAULT (NL)
Sarah FEUILLETTE (FR)
Ana IGLESIAS (ES)

12:30 Lunch Break

Poster session

Adaptation and water resource management
14:00-15:30

Julie FABRE (FR)
Amandine AMAT (FR)
Aldo PENASSO (FR)
Benoît ROSSIGNOL (FR)
Omer CHOUINARD (CA)
Eirini SKRIMIZEA (IT)

15:30 Coffee Break

Adaptation in urban areas
16:00-16:45

Lydia VAMVAKERIDOU-LYROUDIA (UK)
Thomas THALER (AT)
Adeline CLIFFORD (FR)

ECRA Session
Societal challenges related to climate change impacts on the hydrological cycle - risk analysis, vulnerability and adaptation
17:00-18:30

Welcome: **Peter BRAESICKE**, ECRA chair, Helmholtz Association, KIT
Keynote 1: **Chantal GASCUEL** - Agrohydrology, INRA, FR / Keynote 2: **Eric MARTIN** – IRSTEA, FR
Panel discussion : **Jean JOUZEL** (CEA/CNRS /UVSQ) - **Chantal GASCUEL** (INRA) - **Isabelle LA JEUNESSE** (Tours U.) - **Eric BRUN** (ONERC) - **Peter BRAESICKE** (KIT, ECRA-Chair)

19:00 Cocktail at the city hall -
Offered by ECRA and the Municipality of Tours

TUESDAY 6

8:15 Welcome

Signals and indicators of impacts on natural environments
8:30-10:30

Dan ISAAK - U.S. Forest Service, Boise (US)
Big data compilations to engage conservation communities and assess climate change effects on aquatic environments

Quentin CHOFFEL (FR)
Mathieu FLOURY (FR)
Verena HUBER-GARCIA (DE)
Apostolos-Manuel KOUSSOROPLIS (FR)
Michel LAFFORGUE (FR)
Laure BOUYER (FR)

10:30 Coffee Break

Signals and indicators of impacts on water resource 1
11:15-12:30

Renaud BARBERO (FR)
Magali DECHESNE (FR)
Sihem BENABDALLAH (TU)
Pratima BHURTUN (FR)
Isabelle COUSIN (FR)

12:30 Lunch Break

Poster session

Management of ecosystems and agrosystems as adaptation strategies
14:00-15:45

Wilco VERBERK - Radboud U.Nijmegen (NL)
Climate change and hypoxia in aquatic ecosystems: which species are most vulnerable and what can we do ?

Virginie ANQUETIL (FR)
Philippe BALANDIER (FR)
Dalenda MAHJOUD BOUJNAH (TN)
Nathalie OLLAT (FR)
Elisa MARGUERIT (FR)

15:45 Coffee Break

Technical innovation for water resource management
16:15-17:30

Martin DREWS (DK)
Raed FEHRI (BE)
Sonja BEHMEL (CA)
Julien ORSONI (FR)
Ewert AUKES (NL)

17:30 Break

18:30 Gala Dinner

WEDNESDAY 7

8:15 Welcome

Governance and water management
8:30-10:30

Hans BRESSERS - Twente U. (NL)
Analysing the quality of the governance context for multi-stakeholder adaptive river management

David AUBIN (BE)
Fariba EBRAHIMIAZARKHARAN (IR)
Marie FOURNIER (FR)
Maia LORDKIPANIDZE (NL)
Ophélie TOUCHARD (FR)

Poster session

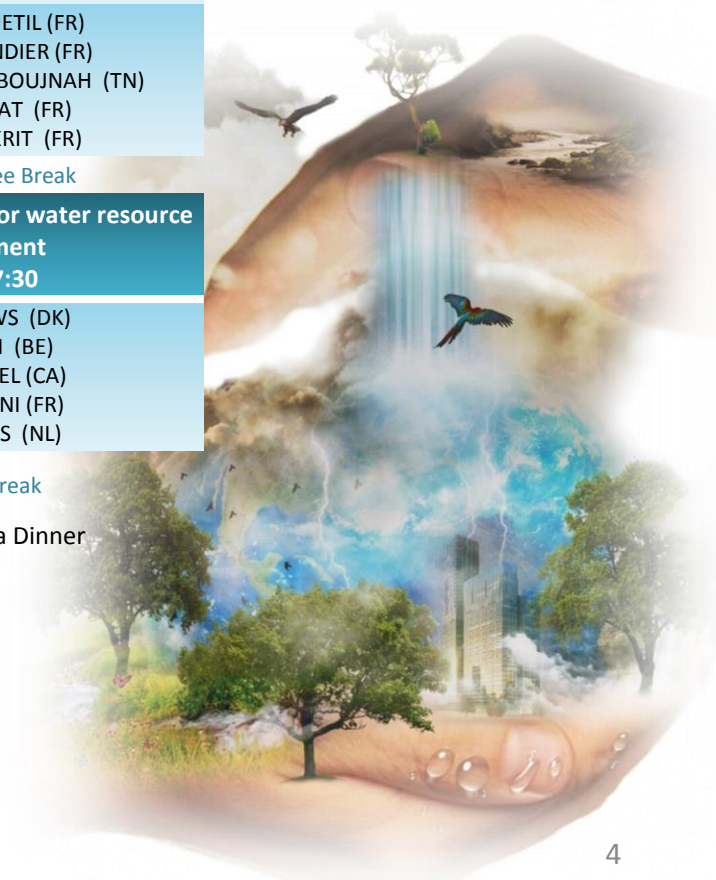
10:30 Coffee Break

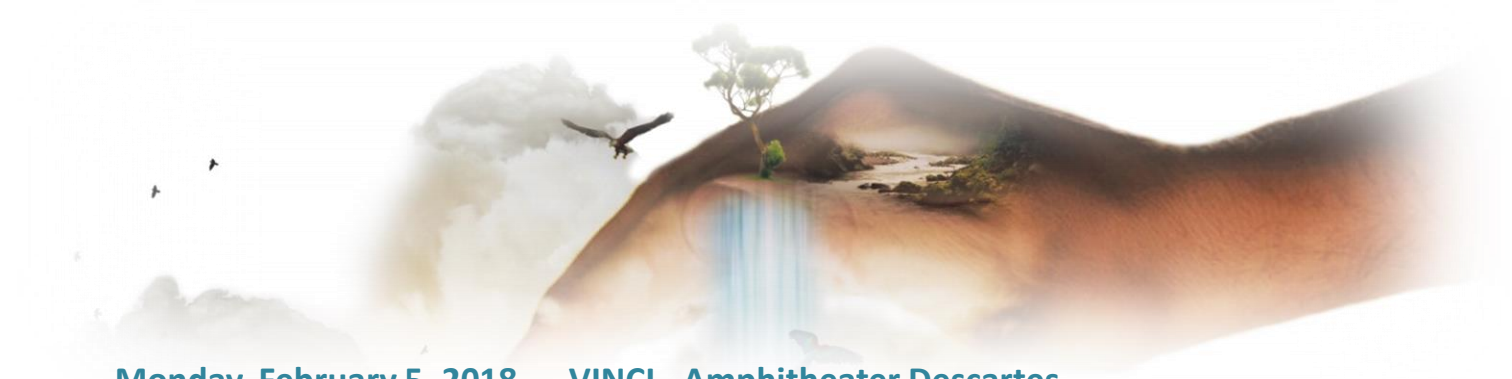
Signals and indicators of impacts on water resource 2
11:15-12:30

Arnaud WUILLEUMIER (FR)
Eric MARTIN (FR)
Fabian VON TRENTINI (DE)
Janja VRZEL (DE)
Bruno MOUGIN (FR)

Concluding remarks
12:30-13:00

14:00 Excursion the Royal Château of Amboise





Monday, February 5, 2018 VINCI - Amphitheater Descartes

08h30		*Welcome & Registration*
Opening session (chaired by Isabelle LA JEUNESSE, U.Tours, FR)		
09h00-09h10	**Benoît FAUCHEUX** **Philippe VENDRIX**	Opening by, Centre-Val de Loire Region President of the University of Tours
09h10-9h15	**D. MARTOUZET C. HENAULT**	MiDi Network (Environments & Diversity)
09h15-09h20	**F. BERTRAND**	French cluster Dream (Water & Environments)
09h20-09h30	**I. LA JEUNESSE, S.PINCEBOURDE**	Opening CCW 2018 conference
09h30-10h15	**Jean JOUZEL, *Invited speaker***	Global warming: the need to keep below 2°C
10h15-10h30	**Eric BRUN, *Invited speaker***	Water issues in the next French Adaptation Plan to Climate Change
10h30		*Coffee Break*
11h15-11h45	**Philippe QUEVAUVILLER, *Invited speaker***	Community-building to link EU-research to policy and practitioner's needs in the area of climate-related extreme events
Overview of the conference themes in the climate-water-adaptation nexus (chaired by Isabelle LA JEUNESSE, U.Tours, FR)		
11h45-12h00	**Ker Rault, Koundouri, E. Akinsete, Ludwig, Huber-Garcia & Tsani**	Downscaling of climate change scenarii to river catchment level: a transdisciplinary methodology and application in ecosystem services and land-use change at European catchments
12h00-12h15	**Feuillette & Raout**	Adaptation strategy of the Seine-Normandie Hydrographic district
12h15-12h30	**Santillan, Iglesias, La Jeunesse, Garrote & Sote**	Vineyards in transition: a global assessment on the adaptation needs to climate change
12h30		*Lunch Break*
Poster session		
Adaptation and water resource management (chaired by Ralf LUDWIG, LMU, DE)		
14h00-14h15	**Fabre, Pelte, Duboulet & Goulard**	A semi-quantitative assessment of climate change vulnerability in the water sector to determine priorities for adaptation
14h15-14h30	**Amat, Martin, Rudolf & Giacona**	Identifying impacts of climate change on the sharing of water resource between industrial users
14h30-14h45	**Penasso & Arrondeau**	Assessment of climate change impacts on the management of the Arzal dam
14h45-15h00	**Rossignol**	Adaptation to the impacts of climate change on the Loire basin and its tributaries: Zoom on two cases of operational integration of scientific knowledge
15h00-15h15	**Chouinard, Weissenberger & Fauré**	Community mobilization in two rural communities on the Acadian coast, New Brunswick Canada, to address water and climate change.
15h15-15h30	**Skrimizea, Haniotou & Papakrivou**	What kind of adaptation strategies for the Mediterranean islands? Water mismanagement, tourism, and climate change
15h30		*Coffee Break*
Adaptation in urban areas (chaired by Fatima LAGGOUN, U.Orléans, FR)		
16h00-16h15	**Vamvakeridou-Lyroudia, Chen, Khoury, Stewart, Wood, Savic & Djordjevic**	Enhancing the resilience of interconnected critical infrastructures to urban flooding in Torbay, UK
16h15-16h30	**Thaler, Gatien-Tournat, Fournier, Bonnefond, Gralepois, Servain, Clarke, Driessen, Hegger, Mees, Murphy, Uittenbroek & Fuchs**	Motivation and drives in bottom-up developments in flood hazard management: why societal transformation is needed?
16h30-16h45	**Clifford & ASTEE working group on river restoration**	Restoring Small Rivers Located in Urban Environments: Key Findings
16h45		*Break*
ECRA Session (chaired by Ralf LUDWIG) **Societal challenges related to climate change impacts on the hydrological cycle - risk analysis, vulnerability and adaptation**		
17h00-17h15	**Peter BRAESICKE**	Welcome by *ECRA chair, Helmholtz Association, KIT*
17h15-17h30	**Chantal GASCUEL**	*Keynote 1- Agrohydrology, INRA, FR*
17h30-17h45	**Eric MARTIN**	*Keynote 2 - IRSTEA, FR*
17h45-18h30	Panel discussion : **Jean JOUZEL** (CEA/CNRS/UVSQ) – **Chantal GASCUEL** - **Isabelle LA JEUNESSE** (Univ. of tours) - **Eric BRUN** (ONERC) - **Peter BRAESICKE** (KIT, ECRA-Chair)	
19h00		**Cocktail (end ~ 20h30) - at the city hall, Tours**

Tuesday, February 6, 2018 VINCI - Amphitheater Descartes

8h30		*Welcome & Registration*
Signals and indicators of impacts on natural environments (chaired by Sylvain PINCEBOURDE, U.Tours, FR)		
08h30-09h00	**Daniel ISAAK, *Invited speaker***	**Big data compilations to engage conservation communities and assess climate change effects on aquatic environments**
09h00-09h15	**Choffel, Cairault, Donati, Touchart & Bartout**	High accuracy thermal study of one Vosges du Nord Natural Regional Park's watershed: starting point of a climate changes diagnostic at the local scale.
09h15-09h30	**Floury, Delattre & Souchon**	Long-term trends in macroinvertebrate communities of the Middle Loire River: functional responses to climate change and local confounding factors
09h30-09h45	**Huber-Garcia, Ker Rault, Meyer & Ludwig**	Developing future scenarios of spatially distributed land and water use to assess the effects on aquatic ecosystems in four European river basins
09h45-10h00	**Koussoroplis & Wacker**	The nutritional quality of phytoplankton influences the tolerance to extreme water temperatures in the waterflea Daphnia magna
10h00-10h15	**Lafforgue**	Expected impacts of global warming on water-forests interactions
10h15-10h30	**Bouyer, Marchand, Vincent-Barbaroux, Cochard, Feinard-Duranceau, Le Jan, Delauney, Chamaillard, Barigah, Brignolas & Fichot**	Impact of nitrogen nutritional status on the dynamics of xylem hydraulic failure and non-structural carbohydrates under moderate and severe droughts in fast-growing trees (Populus spp.)
10h30		*Coffee Break*
Signals and indicators of impacts on water resource 1 (chaired by Florentina MOATAR and Marc DESMET, U.Tours, FR)		
11h15-11h30	**Barbero, Lewis, Westra, Fowler & Lenderink**	Intensification in short-duration precipitation extremes in the data-covered regions of the world
11h30-11h45	**Dechesne, Pellet & Thouvenel**	Local impact of climate change on drinking water production systems on the horizon 2050
11h45-12h00	**Benabdallah**	Assessment for technological needs for climate change adaptation in Tunisia
12h00-12h15	**Bhurtun, Lesven, Dumoulin, Criquet, Prygiel, Gorny & Billon**	Towards the comprehension of the impact of climate change on surface water quality in Northern France - A case study of the River Selle (France)
12h15-12h30	**Cousin, Tibi, Constantin, Meillet, Poméon & Therond**	Estimating the Available Water Content by coupling pedological approaches and inverse modelling: the RUEdesSOLS project
12h30		*Lunch*
Poster session		
Management of ecosystems and agrosystems as adaptation strategies (chaired by Frédéric ARCHAUX, IRSTEA and Sébastien DUPRAZ, BRGM)		
14h00-14h30	**Wilco VERBERK, *Invited speaker***	**Climate change and hypoxia in aquatic ecosystems: Which species are most vulnerable and what can we do?**
14h30-14h45	**Anquetil, Boudes, Koerner & Citeau**	River restoration as an adaptation to climate change: Towards a definition of socio-ecological resilience, the case of Flume river in Brittany
14h45-15h00	**Bello, Korboulewsky, Vallet, Bonal, Perot, Seigner, Perret, Couteau, Dumas & Balandier**	Can mixed forests help to save water?
15h00-15h15	**Mahjoud Boujnah, Bel Hadj Sghayer, Ben Salem, Mahjoub, Lamari, Chikhaoui & Chehab**	Assessment of the olive tree adaptation to water stress and tool to increase crop performance in the context of climatic changes
15h15-15h30	**Ollat, Lebon, Garcia de Cortazar-Atauri, Ojeda, Saurin, Prévot, Simonneau & van Leeuwen**	Wine and water: which challenges ?
15h30-15h45	**Marguerit, van Leewen, Simonneau & Ollat**	The use of genetic variability in plant material of the grapevine: an environmentally friendly way to adapt to increasing drought
15h45		*Coffee Break*
Technical innovation for water resource management (chaired by Nathalie DÖRFLIGER, BRGM, FR)		
16h15-16h30	**Larsen Morten, Drews, Petrovic, Engström, Liersch, Karlsson & Howells**	Challenges of Data Availability for Analysing the Water-Energy Nexus
16h30-16h45	**Fehri, Van Grootenbrulle, Vanclooster, Mens & Khlifi**	Together4water: Implementing an open-source database to monitor SDG related water indicators in Tunisia
16h45-17h00	**Behmel, Damour, Ludwig & Rodriguez**	Intelligent decision support system to plan, manage and optimize water quality monitoring programs based on a participative approach
17h00-17h15	**Bortoli & Orsoni**	Project of an Indirect Potable Reuse (IPR) demonstrator in Vendée to face water scarcity
17h15-17h30	**Aukes**	Climate change adaptation in coastal systems: Framing for adoption of innovative technologies
18h30		**Gala Dinner (end ~ 23h30)**

Wednesday, February 7, 2018 VINCI - Amphitheater Descartes

08h30		*Welcome*
Governance and water management (chaired by Corinne LARRUE, UPEC, FR)		
08h30-09:00	**Hans BRESSERS, *Keynote speaker***	**Analysing the quality of the governance context for multi-stakeholder adaptive river management**
09h00-09h15	**Aubin, La Jeunesse, Riche & Vande Water**	The central role of basin authorities in the governance of water: A social network analysis of the Thau Basin in France
09h15-09h30	**Ebrahimiazarkharan, Ghorbani, Malekian & Bressers**	The analysis of social relations of water resources beneficiaries networks toward water resources co-management and adaptation in the face of the effects of climate change (Case study: Iran, Taleghan watershed)
09h30-09h45	**Fournier, Bonnefond, Gatien-Tournat, Gralepois & Servain**	What challenges for land use governance in wetlands, in a context of climate change? The case of the Ile Saint Aubin (Angers, France)
09h45-10h00	**Lordkipanidze, Lulofs & Bressers**	Towards a new model for the governance of the Weerribben-Wieden National Park
10h00-10h15	**Touchard**	The Truth is out there": urban governance in the age of ecological uncertainty – The Wetlands issue in Bordeaux Metropole (France)
10h30		*Coffee Break*
Poster session		
Signals and indicators of impacts on water resource 2 (chaired by Haykel SELLAMI, CERTE, TU)		
11h15-11h30	**Seguin & Wuilleumier**	Looking for trends within the water cycle of the “gave de Pau” and “gave d'Oloron” catchment areas
11h30-11h45	**Folton, L’Hermite, Martin & Arnaud**	Observed impact of climate change on the water resources of a small Mediterranean catchment (the Réal Collobrier, France)
11h45-12h00	**von Trentini, Schmid, Willkofer, Wood & Ludwig**	Climate indicators and their local hot spots in Bavaria, Germany, derived from a large ensemble of climate models
12h00-12h15	**Vrzel, Ludwig, Vizintin & Ogrinc**	Multi-tool simulations to assess the hydrological system behavior of the Ljubljansko polje aquifer under climate change conditions
12h15-12h30	**Mougin, Vigier, Bessière, Nicolas & Loigerot**	MétéEau des nappes, a tool able to show impacts of climate change on groundwater resource at local scale
12h30-13h00	**Concluding remarks CCW2018 by Isabelle LA JEUNESSE and Sylvain PINCEBOURDE**	
14h00		**Excursion to Amboise – Château Royal (end ~ 17h30)** **www.chateau-amboise.com**

Poster session

Number	Authors	Title	Country
1	**Allier, Pinson, Seguin, Wuilleumier & Amraoui**	Testing different approaches to evaluate groundwater vulnerability to climate change	FR
2	**Bhurtun, Lesven, Dumoulin, Halkett & Billon**	Vulnerability of surface water quality in northern France to climate change	FR
3	**Clifford & ASTEE's working group on ecological engineering**	Promoting the Added Value of Ecological Engineering to Elected Officials	FR
4	**Meitern, Ounapuu-Pikas, Aigar, Tullus, Lohmus, Ostonen, Rosenwald, Kupper & Sellin**	Free Air Humidity Manipulation (FAHM) experimental site - the effect of elevated air humidity on growth rate, photosynthetic capacity, hydraulic properties and biomass allocation in silver birch	FR
5	**Dhaouadi, Chedia & Hedi**	Saving water irrigation: Irrigation systems under date palm in climatic oasis conditions	TN
6	**Ebrahimiazarkharan & Ghorbani**	The role of Social Network Analysis for Water resources Management and sustainable development (Case study: Darbandsar Watershed)	IR
7	**Fares, Serir & Lounis**	Determination of the sea waters quality of Arzew-Algeria Gulf	DZ
8	**Fauré & Chouinard**	The role of land-use planning and civil society in protecting water resources in small rural coastal communities in New Brunswick in the context of climate change	CA
9	**Ghrab**	Climate change in Tunisia: Rainfall trend analysis in Tunis City in a context of climate variability	TN
10	**Gralepois**	Are Flood Sustainable ? Reasons of non-integration of flood prevention in sustainable development	FR
11	**Mbog Ibock**	Répondre À L'assèchement Des Eaux Du Lac Tanganyka. Une Approche De La Gouvernance Par « Le Haut »	CM
12	**Isaak, Wenger, Peterson, Hoef, Nagel, Hostetler & Luce**	The crowd-sourced NorWeST temperature database and massive microclimate scenarios for streams and rivers in the western U.S.	US
13	**Isaak, Wenger & Young**	Big biology meets microclimatology: Defining thermal niches of aquatic species for conservation planning using large interagency databases	US
14	**Isaak & Young**	Identifying Climate Refuge Streams for Bull Trout Using Crowd-Sourced Databases, Microclimate Scenarios, and High-Resolution Species Distribution Models	US
15	**Mokrane, Fehri & Vanclooster**	Étude des régimes d'altération hydrologique sur le bassin transfrontalier Tuniso-Algerien de la Medjerda	BE
16	**Kozhemyakin, Chornomoretz & Filippova**	Climate Change Impacts on the Water Balance of the Upper Dnister River	UA
17	**Ludwig, Frigon, Kranzlmüller, Turcotte, Komischke & Brissette**	Climate change and hydrological extreme events – risks and perspectives for water management in Bavaria and Québec	DE
18	**M2ETP & La Jeunesse**	Vineyards and water cycle changes: a short, mean or long term challenge for the UNESCO Loire-Valley world heritage landscape?	FR
19	**M2ETP & La Jeunesse**	Enjeux du changement climatique pour le vignoble de la région Val de Loire	FR

Poster session			
Number	**Author**	**Title**	**Country**
20	**Mounir, El Khanchoufi & La Jeunesse**	Relation between water stress and the necessity of changing the agricultural practices	MA
21	**Nasser, Choffel & Touchart**	The vulnerability of agricultural system related to climate change in Beqaa plain, Lebanon: which strategies for better adaptation and management of water resources?	FR
22	**Chae & Lee**	The Spatiotemporal Variation of Soil Moisture in the Agriculture Region Based on the Temperature Vegetation Dryness Index derived from satellite image	KO
23	**Robert, Yengue, Augis, Motelica-Heino, Hien & Sanou**	When waste water becomes solution for urban agriculture…Case study in Ouagadougou (Burkina Faso)	FR
24	**Taabni & Eljihad**	La multifonctonnalité des ressources en eau à l'épreuve du changement climatique : Evaluation des démarches et instruments territorialisés pour une gestion adaptative mis en œuvre en Poitou-Charentes.	FR
25	**von Trentini, Schmid, Braun, Brisette, Frigon, Leduc, Martel, Willkofer, Wood & Ludwig**	Evaluating hydrometeorological extreme events in the ClimEx single model large ensemble in comparison with CORDEX results over Europe and Québec	DE
26	**Wantzen & Hesselschwerdt**	Global heating breaks down thermal barriers of invasive species freshwater ecosystems (but reoligotrophication may help to build new ones) – a study from Lake Constance	FR
27	**Delpla & Rodriguez**	Assessing the impacts of climate variability on drinking water quality: Results from an observational and experimental study during spring rainfall events	CA

The abstracts of all communications, both oral and poster, are available in the electronic version of the abstract book, which can be uploaded from the web site or on your USB key. Alternatively you can use the friendly-user interface of the web site of the conference at http://www.climatechangeandwater.org/ to retrieve the abstract of the poster you are interested in (by searching using the author's name or title).

Information about sponsors and stands are also available on the website of the conference or at the DREAM website http://www.poledream.org/

Enjoy the conference!
The organizing committee of CC&Water2018

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As a major player in the regional economy, the CCI Alsace Eurométropole is committed to promoting the economic development of its territory and supporting on a daily basis the projects of 65,000 Commerce, Industry and Services companies that make Alsace a region with remarkable know-how.

Programme INTERREG V - Clim'Ability

Clim'Ability project aims to give companies in the Upper Rhine the means to adapt their strategies and processes to the expected climate changes through knowledge, innovation and risk management reduction. The project, funded by the INTERREG V A Upper Rhine program, started on 1 January 2016 for a period of three years. The overall budget is 2.6 million euros with the contribution of 13 co-financing partners.

Enterprises at the heart of Clim'ability

The main objective of the project is to support companies in identifying their sensitivity to climate hazards. The sensitivity of an economic activity to the climate can be translated into vulnerability or be presented as an opportunity according to the situations and the sector of activity. In any case, the company must be prepared for changes in its setting environment but also be vigilant about the indirect impact that climate change may have on its business and operations. For example, the Clim'Ability toolbox, which is being co-constructed, has been offering a training and meeting program for companies since October 2016 (dedicated to the consequences of climate change in the Upper Rhine). The courses are punctuated by contributions from various climate experts such as Météo-France, Deutscher Wetter Dienst, INSA Strasbourg, UHA or advisers from the CCI Alsace Eurométropole. More information at: http://www.clim-ability.eu/

Amandine AMAT
Chargée de mission projet Clim'Ability
Direction Industrie & Développement Durable
a. amat @ alsace.cci.fr
CCI Alsace Eurométropole
10 place Gutenberg CS 70012
67081 Strasbourg Cedex

T.+33 3 88 76 42 13
www.alsace-eurometropole.cci.fr

International conference
Climate change & WATER 2018
February 5-7
Tours, France

Conference organization: MIDI Network

RÉSEAU MiDi Milieux & Diversité
Réseau thématique de recherche en Région Centre Val de Loire

The MiDi network
Habitats & Diversity

The MiDi (Habitats & Diversity [Milieux & Diversité]) network is a **Thematic Research Network** in the Centre-Val de Loire Region. An extension of the RESONAT Cluster since 2014, it has brought together the laboratories of INRA, BRGM, the Universities of Tours and Orléans, IRSTEA and CNRS involved in the **observation and management of natural resources**.

Its Ambitions

• In the Region, promote **cross-disciplinary** and **integrated** activities in the **BioGeosciences** and the **Human Sciences** on the theme of **interactions between Habitats, Biodiversity and Society;**
• **strengthen the international visibility of the** Region's **academic competences** relating to this theme**;**
• promote implementation in relation with socioeconomic and territorial partners.

Its Scientific & Technical Perimeter

On the basis of the competences present in the Region on habitats, biodiversity and societal dynamics, MIDI has defined 3 directions of activity:

The dynamics of natural resources concerns their composition, functioning and utilisation (economic, social and political dimensions) under conditions sof global change.
Coordinators: F. Laggoun (OSUC) and C. Hénault (UR SOLS)

Adaptation mechanisms of living organisms to variations in habitats subject to anthropic forcing, and the impacts of these adaptations on habitats (retroaction).
Coordinators: F. Guillou (PRC) and S. Dupraz (BRGM)

The technical and social engineering of habitats and biodiversity, and **decision aids** for the sustainable management of natural resources.
Coordinators: F. Archaux (EFNO) and D. Martouzet (CITERES)

The network's organisation

The academic members of the MiDi network:

Centre-Val de Loire, INRA Science & Impact, CNRS, irstea, brgm, Université d'Orléans, Muséum national d'Histoire naturelle, Université de Tours

Partners and support:

DREAM Eau & Milieux, Intelligence Patrimoines, LABEX Voltaire, Parc naturel régional Loire Anjou Touraine, SATT Grand Centre, Zone Atelier LTER France Loire, Conservatoire d'espaces naturels Centre-Val de Loire

International conference
Climate change & WATER 2018
February 5-7
Tours, France

Conference organization: MIDI Network

RÉSEAU MiDi Milieux & Diversité
Réseau thématique de recherche en Région Centre Val de Loire

The MiDi network
Habitats & Diversity

Its key figures

MiDi has forged a network of more than 1500 researchers in the academic world.
7 research organisations: INRA, CNRS, IRSTEA, BRGM, MNHN, the Universities of Tours and Orléans.

24 units: **AGPF** (INRA), **BBV** (UT), **BGE** (BRGM), **CEDETE** (UO), **CITERES** (CNRS, UT), **D3E** (BRGM), **EFNO** (IRSTEA), **GBFor** (INRA), **GéHCO** (UT), **ICARE** (CNRS), **ICOA** (UO), **InfoSol** (INRA), **InTRu** (UT), **IRBI** (UT, CNRS), **ISTO** (CNRS, UO,BRGM), **LBLGC** (UO), **LEO** (UO CNRS), **LPC2E** (CNRS, UO), **OSUC** (UO, CNRS), **PRC** (INRA, CNRS, UT, IFCE), **RHT** (MNHN), **URA** (INRA), **UR SOLS** (INRA), **URZF** (INRA).

7 partners: DREAM cluster, SATT Grand Centre, Intelligence des patrimoines (I-PAT), the Zone Atelier Loire (ZAL), Labex Voltaire, the Natural Regional Park of Loire Anjou Tourraine (PNR LAT), the Conservatory of Natural Areas of Centre-Val de loire (CEN).

Its actions

• **Bring the laboratories in the Region that focus on environmental themes to work in a network** so as to facilitate meetings and exchanges between the researchers and the different actors.
• **Create scientific and technical events of national and international scale** to promote and give prominence to the research carried out in the Region.
• **Favour interactions between the region's research and socioeconomic activities.** The objective for the academic and socioeconomic worlds and the Region is to permit the **production of scientific knowledge**, **share and disseminate** knowledge to drive the **emergence of new concepts in the environmental sciences**, the emergence of collaborative platforms, and **technology transfers.**

RÉSEAU MiDi

Contact

www.reseau-midi.fr
Région Centre-Val de Loire
Alexia Soussen, responsible for coordination (alexia.soussen@univ-tours.fr)
Management:
Catherine Hénault (catherine.henault@inra.fr)
Denis Martouzet (denis.martouzet@univ-tours.fr

Conference organization: Dream cluster

The Dream cluster
Water & Habitats

The DREAM cluster (Durabilité de la Ressource en Eau Associée aux Milieux [sustainability of water resources and aquatic environment]) is a competitiveness cluster in the Region Centre (France) that brings together key players in the fields of research and training, as well as economic stakeholders. It is now the recognized representative for the field of green technology related to water and aquatic environment. It develops tailor-made, sustainable solutions, both technical and socio-economic. The cluster supports growth and competitiveness of its SMEs through innovation, a focus on research and technology transfer.

DREAM'S Strategic activities

- **Diagnosis, monitoring, environmental information systems of water resources and aquatic ecosystems**
- **Management of water resources and aquatic ecosystems**
- **Alternative water and soil treatments**
- **Adaptation of technologies, products, services and processes to emerging and developing countries**

Who is DREAM designed to support?

•SMEs
•Large groups
•Laboratories
•Trade associations
•Training agencies
•Organisations Clusters

What is a Competitiveness Cluster?

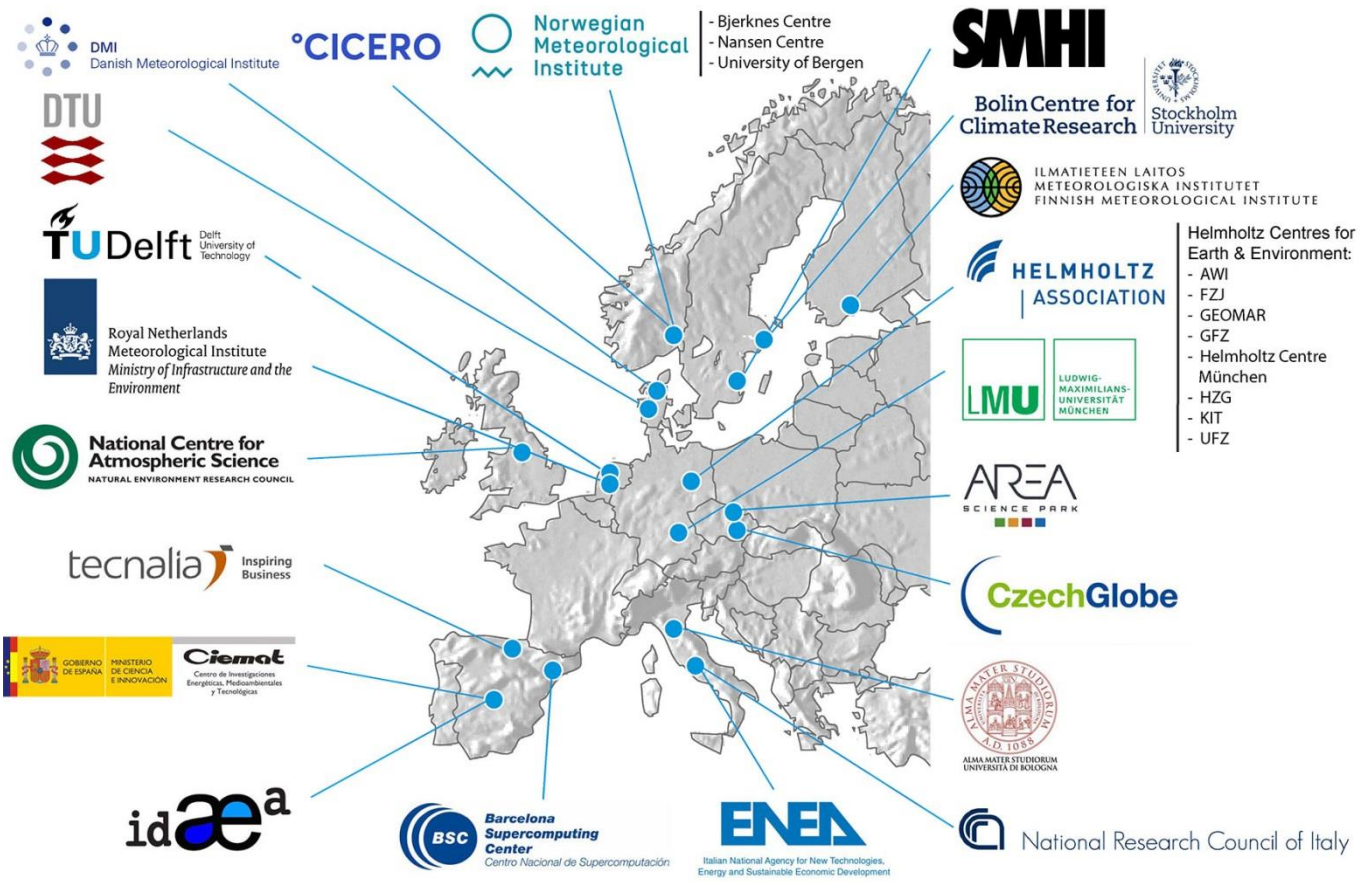
A partnership based around a particular theme in a particular region...
A competitiveness cluster brings together research laboratories, training organizations and businesses of all sizes in a particular region to develop synergies and cooperative initiatives. It may also include other partners, such as local and national public authorities and business service providers.

Conference partners: ECRA

ECRA - "Strengthening Climate Research in Europe"

The European Climate Research Alliance (ECRA) is an association of 23 European research institutions from 10 countries. Its overall objective is to strengthen, expand and optimize EU climate research capabilities to advance the understanding of climate variability, predictability and change. ECRA embodies four dedicated collaborative programs to shape emerging research topics in a bottom-up approach, to provide a knowledge base for future mitigation and adaptation measures:

Arctic Climate Stability and Change (Arctic); *coordinated by Bjerknes Centre Norway & EPB/Norway*
High Impact Events and Climate Change (HIE); *coordinated by FMI/Finland and DTU/Denmark*
Sea level and Climate Change (SLC); *coordinated by ENEA/Italy*
Changes in the Hydrological Cycle (CHC)*; coordinated by CNR/Italy and LMU/Germany*



ECRA @ Climate Change and Water 2018

The Climate Change and WATER conference welcomes ECRA as a partner of the event. ECRA's Collaborative Programs "High Impact Events" and "Changes in the Hydrological Cycle" will co-organize a side event, comprised of keynote presentations and a panel discussion on **"Societal challenges related to climate change impacts on the hydrological cycle - risk analysis, vulnerability and adaptation"**. This ECRA side event aims to bring together different target audiences including researchers, policymakers and data users providing input to the current discussion about designing 'climate services'. **It will address the following questions: i)** How can we inform users about the quality and uncertainties of projections? ii) How can we incorporate the human dimension more explicitly? iii) How can/should the model results be effectively applied and interpreted for an improved management of water resources, adaptation/mitigation or sustainable water security?

The ECRA's session will be followed by a welcome cocktail offered by ECRA at the city hall.

More information : http://www.ecra-climate.eu/

Contact:
Dr. Tina Swierczynski
Executive Secretary
European Climate Research Alliance
tina.swierczynski@ecra-climate.eu
http://www.ecra-climate.eu/

Prof. Dr. Ralf Ludwig
Faculty of Geosciences
Ludwig-Maximilians-Universitaet Muenchen
r.ludwig@lmu.de

International conference
Climate change & WATER 2018
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SCIENTIFIC COMMITTEE

Our scientific committee reflects the interdisciplinary nature of the conference:

BENABDALLAH S. CERTE - Borj Cédria, Tunisia
BERTRAND F. CITERES - ERACLES, France
BRESSERS H. CSTM - University of Twente, Netherlands
DANGLES O. IRD - Quito, Ecuador
DÖRFLIGER N. BRGM - Orléans, France
GASCUEL C. INRA - Rennes, France
LA JEUNESSE I. CITERES - University of Tours, France - COORDINATION
LUDWIG R. Géographie - University of Munich, Germany
MARTIN E. IRSTEA - Aix-en-Provence, France
MOATAR F. GéHCo - University of Tours, France
PINCEBOURDE S. IRBI - University of Tours, France
QUEVAUVILLER Ph. DH - Univ. libre of Bruxelles (VUB), Belgium
RINAUDO JD. BRGM UMR G-EAU - Montpellier, France

ORGANIZING COMMITTEE

The members of the organizing committee will guide you through the conference to make sure you will take the best of this event:

ARCHAUX F. IRSTEA - Nogent-sur-Vernisson, France
CHAMAILLARD S. DREAM - Orélans, France
CIRELLI C. CITERES - University of Tours, France
DUPRAZ S. BRGM – Orléans, France
HENAULT C. INRA CVL - Orléans, France
LAGGOUN F. ISTO - University of Orléans, France
LA JEUNESSE I. CITERES - University of Tours, France
MARTOUZET D. CITERES - University of Tours, France
PINCEBOURDE S. IRBI – University of Tours, France
SELLAMI H. CERTE - Borj Cédria, Tunisia
SERVAIN S. INSA CLV, Zone Atelier Loire – Blois, France
SOUSSEN A. MiDi – Tours, France - COORDINATION

SOCIAL EVENTS

The conference includes three official social events. Your registration fare includes the participation to these three events (except for particular cases).

The European Climate Research Alliance (ECRA) will organize a session on Monday evening (see program). Following this meeting, the ECRA will offer a cocktail to all participants of the CCW18 at 19:00 at the City Hall of Tours (Hotel de Ville, place Jean Jaurès) which is 5min walking from the Vinci congress centre (go straight on your right when leaving the Vinci, until you reach the place Jean Jaurès). The building is localized in the North-East corner of the place Jean Jaurès.

(Left) City hall (Hotel de Ville) at the place Jean Jaurès.
(Right) The restaurant La Cave, 69 quai Albert Baillet 37270 Montlouis-sur-Loire, France.

A gala dinner will be organized on Tuesday evening at the restaurant La Cave at Montlouis sur Loire, a small town localized about 15 km away from the conference center. A bus will take us to the restaurant, leaving from the area in front of the Vinci center around 18:30, and returning to the same place around 23:30.
Antier family, owner of the " Domaine de Cray ", was using a troglodyte cave for the wine maturation process. This cave, too far away from the vineyard, has been released. The idea was to use this cave offering a lot of possibilities in order to create a friendly atmosphere place. The Restaurant La Cave was born !... The " Chef ", Renaud Dugoujon has received the label "Maître Restaurateur" (completely hand-made cooking). He illustrates an in vogue cooking by mixing creativity and traditions. The menu changes according to the seasons and he takes care to the products he selects by working with local farmers and producers. When arrives the season of truffles, starting at mid-November, dishes are dedicated to this black diamond named “Tuber Melanosporum” coming from the family’s truffles field.

SOCIAL EVENTS

Finally, an excursion is organized on Wednesday afternoon to the Cité Royale d'Amboise (Amboise castle). A bus will take us at the Vinci center around 14:00. A place of residence for French kings from the 15th to the 19th centuries, its destiny is inextricably linked to the history of France. Numerous literary figures and artists were invited here, like Leonardo da Vinci whose tomb is preserved at the château. This royal château is thus the expression of French-style luxury. From its balconies, its roofs and its terraced gardens, visitors can take in the Loire landscape and delight in what the kings enjoyed.

Amboise, architectural jewel of the Renaissance, dips its majestic silhouette into the Loire, a UNESCO World Heritage river.

CONFERENCE VENUE

The conference will be held at the international congress centre "Le Vinci" in Tours. This congress centre is ideally located in front of the Tours Centre train station and near several hotels. It is at a walking distance from the main areas of interest downtown (Cathedral, Plumereau place with many bars, National street with many shops etc.).

All conferences and poster sessions will happen at this congress centre. The lunches (Monday and Tuesday) as well as the coffee breaks will also be offered at this place. The registration desk will be positioned inside the congress centre, right in front of the main entrance. It will open at 8:30 on Monday morning. First thing upon your arrival will be to show up at the registration desk to get your conference bag. Please note that you must have registered to the conference to have the possibility to enter the conference centre. For security reasons, your bag(s) may be checked at the entry of the building.

The registration desk will also guide those who will present a poster. Each poster will have a unique number which will be used to identify the place where you need to hang up your poster. This number will be provided at the registration desk. The format of posters is should be A0 max (84,1 x 118,9 cm) in vertical orientation only. We do not accept digital posters. We recommend posters be put up at the morning coffee break on first day (Monday). All posters can remain in their position throughout the conference. The posters can be seen any time but specific times to poster sessions are allocated during lunches. Please take your poster back with you in the morning on Wednesday.

Oral presentations will be 15 minutes long, including questions. We recommend to talk for no longer than 12 minutes to allow exchanges with others. All presentations (powerpoint or pdf) of a given session should be uploaded ahead of the session directly on stage. Oral presentations of Monday morning should be uploaded asap upon your arrival.

The Vinci congress centre: 26 Boulevard Heurteloup, 37000 Tours, France

TRAVEL INFORMATIONS

» **A10** Highway (Paris/Tours/Bordeaux/South Europe)

» **A28** Highway (Tours/Le Mans/ Rouen/ North Europe)

» **A85** Highway (Nantes/Angers/Tours/Lyon)

» International airport **Tours-Val de Loire**

» **TGV** stations Tours and Saint-Pierre-des-Corps

By Road

- » Poitiers 1h00
- » Le Mans 1h05
- » Angers 1h15
- » Vierzon 1h15
- » Paris 2h25
- » Rennes 2h25
- » Nantes 2h30
- » Rouen 3h00
- » Bordeaux 3h20
- » Lyon 5h15
- » Toulouse 5h30
- » Strasbourg 6h45
- » Marseille 7h40

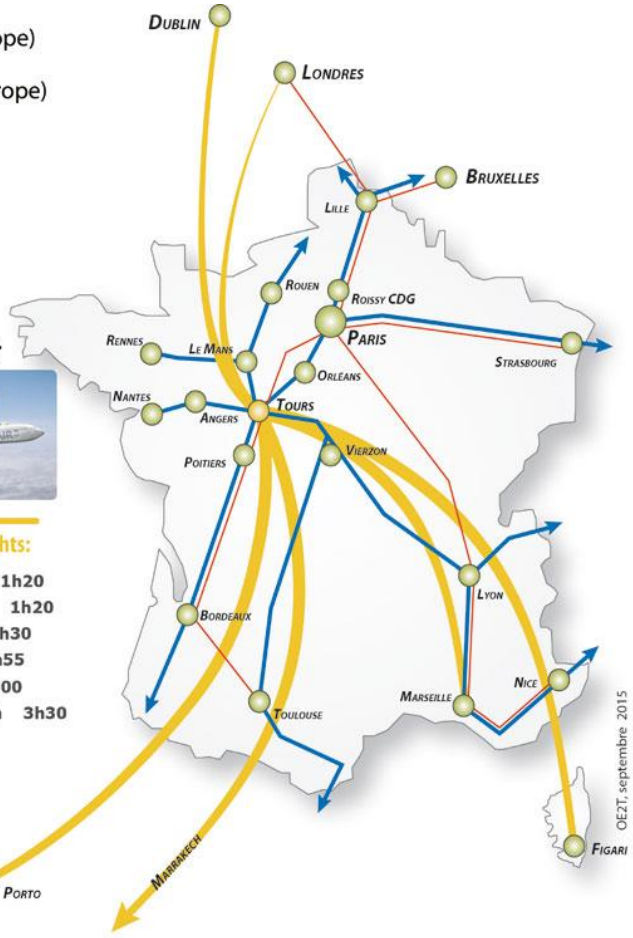
By Rail

- » Poitiers 45 mn
- » Paris 1h10 mn
- » Roissy CDG 1h45
- » Bordeaux 2h20
- » Lille 2h50
- » Lyon 3h00
- » Bruxelles 3h45
- » Strasbourg 4h00
- » Londres 4h20
- » Marseille 5h10

By Air

Regular flights:

- » Londres 1h20
- » Marseille 1h20
- » Dublin 1h30
- » Figari 1h55
- » Porto 2h00
- » Marrakech 3h30



Source : Observatoire de l'Économie et des Territoires de Touraine (OE2T).
http://www.economie-touraine.com.

Located 240 km from Paris, the city of Tours is easily accessible by air, rail or road infrastructure. Tours is accessible from Paris (55 min), Roissy international airport (1h35 min), London (4h20 min), Brussels (3h30 min) and Geneva by high-speed train (TGV), as well as by motorways from Northern Europe, North-Eastern Europe, Spain, Italy and Switzerland. The Tours airport has direct flights to and from London (Ryanair), and is connected with most European capitals through Lyon (Airlinair). Tours has two TGV stations: Tours-Centre in the heart of the city and Saint-Pierre-des-Corps, located 5-20 minutes from downtown Tours, accessible via a shuttle train or bus. Tours is directly connected by high speed train (TGV) to Paris (Montparnasse station; 1h10), Paris Charles de Gaulle Airport (1h45), Lyon, Lille, Strasbourg and Marseille (SNCF), but also Brussels (Thalys) and London (Eurostar). From Paris you can also choose a slower way to discover French landscapes by taking the regional express train (TER) from Austerlitz station (about 2h-2h30).

Tips. There is a shuttle train from Saint-Pierre-des-Corps to Tours after almost every TGV train. The shuttle usually departs from the next platform (you may have to go down the stairs and up again – look for information on screens). When buying a ticket you will be assigned a car and a seat number. If you don't have an electronic ticket don't forget to validate your train ticket before entering the train using yellow boxes available throughout the station.

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SPECIAL ISSUES OF CC&Water2018

Participants whose abstracts have been accepted for oral or posters communications are invited to submit a manuscript to special issues of the conference. **Three peer reviewed journals** were selected:

Science of the Total Environment of Elsevier (STOTEN)

Authors are invited to submit full papers in **English by 15th March 2018**.
La Jeunesse I. , R. Ludwig and S. Pincebourde Guest Editors to be contacted.
Isabelle.lajeunesse@univ-tours.fr ; r.ludwig@lmu.de ;
sylvain.pincebourde@univ-tours.fr
Please find scope of the Journal and Guidelines for authors on the following website:
https://www.journals.elsevier.com/science-of-the-total-environment

La Houille Blanche – Revue Interntationale de l'Eau de la Société Hydrotechnique de France
International Review of Water of the French Hydrotechnic Society

Authors are invited to submit full papers in **English or in French by 15th March 2018**.
La Jeunesse I. and F. Moatar to be contacted.

Please find scope of the Journal and Guidelines for authors on the following website:
https://www.shf-lhb.org/fr/

Techniques Sciences et Méthodes (TSM) of ASTEE

Authors are invited to submit full papers in **French by 15th March 2018**.

Chamaillard S. to be contacted. sylvain.chamaillard@poledream.org

Please find scope of the Journal and Guidelines for authors on the following website:

https://tsm.astee.org/

INVITED SPEAKERS

Jean JOUZEL

Jean Jouzel is Research Director at CNRS in paleo-climatology. He is emeritus Professor at the Laboratory for Climate and Environmental Sciences at the Pierre-Simon Laplace Institute (CEA / CNRS / UVSQ). His career began at the CEA with drilling projects in the Antarctic (Vostok, Grip, Epica). Since then, he has actively participated in many major international glacial drilling programs and has significantly contributed to the international development of water isotope modeling in the atmosphere.

Jean Jouzel has received several awards and honors during his career. First of all, along with his colleague Claude Lorius, he awarded the gold medal of CNRS, the highest scientific distinction in France. In 2012, he received the Vetlesen Award for developing the longest climate series ever recorded (800,000 years) from ice cores harvested in Antarctica and Greenland. Last but not least, on the 12th October 2007, he received the Nobel Peace Prize, along with the IPCC members and the US Vice President Al Gore. On May 3, 2016, he was elected to the American Academy of Sciences.

During his career, he authored over 250 important scientific publications for the study and understanding of Earth's climate change. Jean Jouzel, Vice-Chairperson of IPCC Working Group I, co-author of several IPCC reports and a series of reports on the climate of France in the 21st century, was a member of the Steering Committee of the COP21.

Since 2009, Jean Jouzel is the President of the French association Méteo et Climat, which actively contributes to the dissemination of scientific knowledge on climate change.

INVITED SPEAKERS

Philippe QUEVAUVILLER

Research Programming and Policy Officer
European Commission, Brussels

Researcher in chemical oceanography, Philippe Quevauviller started his career at the European Commission in 1989, firstly as a Scientific Officer at the Research General Directorate, then as a Policy Officer at the Environment Directorate-General. he has been responsible for the development and implementation of two EU directives linked to the Water Framework Directive (dealing with groundwater protection and chemical monitoring) and he managed research projects on climate change impacts on water systems/resources and natural hazards. Since 2013, he moved to the Secure Societies Programme (firstly at DG Enterprise, then DG Home Affairs since early 2015) where he is responsible for programming and managing security research projects, in particular on disaster risk and crisis management (natural catastrophes, accidents, terrorist threats).

He is author or co-author of approximately 240 articles published in the international peer-reviewed literature and 20 books (co-authored or –edited).

Besides his work at the European Commission, he is also Associate Professor at the Vrije Universiteit Brussel (VUB) where he teaches integrated water resource management in an International Master.

Eric BRUN

General Secretary
ONERC, National observatory on the effects of global warming

Eric BRUN is from the world of scientific research since 1984 as a researcher and then as a manager notably as Director of Research of Météo-France from 2003 to 2009. Since 2014, he has been involved in public policies in the context of climate change, within ONERC. He became the Secretary General in November 2016. He is the former President of the International Glaciological Society, the current President of the Board of the French Polar Institute Paul-Emile Victor (IPEV) and the current President of the Scientific Council of the Pierre-Simon Laplace Institute (IPSL).

Created by the law of 19 February 2001, ONERC materializes the will of Parliament and the Government to integrate the effects of climate change into environmental public policies. Attached since 2008 to the General Directorate of Energy and Climate (DGEC), within the Ministry in charge of the Environment, ONERC coordinates the national policy of adaptation to climate change.

ONERC is the IPCC focal point for France.

INVITED SPEAKERS

Dan ISAAK

Research Fisheries Scientist

Forest Service, Boise, ID, USA

Dan Isaak is a Research Scientist with the United States Forest Service Rocky Mountain Research Station where he has worked on cold-water fish conservation and management issues in the western U.S. the last 25 years. His research focuses on understanding the effects of climate change, environmental gradients, and natural disturbance on stream/river habitats and fish communities, stream temperature and species distribution monitoring and modeling, development and implementation of geostatistical models for data on stream networks as part of the National Stream Internet project, use of crowd-sourcing to build large open-access interagency databases, and use of digital and social media to connect people, information, and landscapes.

Google Scholar profile:
https://scholar.google.com/citations?user=mnzmXpUAAAAJ&hl=en

Wilco VERBERK

Assistant professor

Radboud University Nijmegen, The Netherlands

Wilco Verberk is an Assistant professor at the Department of Animal Ecology and Physiology, Radboud University Nijmegen, the Netherlands. He obtained his PhD in Freshwater Ecology in 2008, for his study on species traits to explain patterns in assemblages of aquatic invertebrates. During his 3-year post-doc in the UK he developed a lasting interest in ecophysiology and he continues to study the (respiratory) physiology of ectotherms to better understand their thermal niche and their life-history.

KEYNOTE SPEAKER

Hans BRESSERS

Professor of Policy Studies and Environmental Policy University of Twente, Netherlands
CSTM

Prof.dr. Hans Th.A. Bressers (1953) is professor of Policy Studies and Environmental Policy at the University of Twente in the Netherlands and founder of the CSTM, the Department of Governance and Technology for Sustainability, one of the departments of the Faculty of Behavioural, Management and Social sciences.

At the university level, he is the Chair of the Twente Water Centre, that bundles the over 150 water management researchers of all technical, natural science and policy oriented faculties of the University of Twente. In over three hundred articles, chapters, and books and a similar number of reports, conference papers and presentations (both in Dutch and in English) he published on policy -evaluation, - instruments, -networks, and -implementation, mostly applied on environmental and sustainability oriented policies.

He has been researcher and project leader of numerous externally funded projects, including several projects funded by EU research frameworks, Dutch national science foundation, national priority research programmes, Dutch ministries, etc.

As a PhD advisor, he has led 50 researchers to their graduation until 2018.

Google Scholar profile:
https://scholar.google.nl/citations?user=6oiteUcAAAAJ&hl=nl

KEYNOTE SPEAKER AT ECRA SESSION

Chantal GASCUEL

Director of Research
INRA, National Institute for Agronomy
Agrocampus Ouest Joint Research Unit "Soil, Agro and Hydrosystem, Spatialisation" (UMR SAS)

Research director at the INRA, Chantal Gascuel is assistant director of the INRA Environnement Scientific Department. She has devoted her career to soils, water and the relationship between agriculture and water quality. Engineer agronomist, graduate of the Ecole Nationale Supérieure Agronomique of Montpellier, holder of a thesis of the Ecole des Mines de Paris and a habilitation to direct the research of the University of Rennes, she worked with her colleagues to understand how water circulates in soils or aquifers, and reaches watercourses.

In 2015, Chantal Gascuel has received from the Academy of Sciences, the insignia of Chevalier in the order of the Legion of Honor. This decoration rewards her involvement in the development of research on water in agricultural areas and as a woman engaged very early in the animation of collective research and in the promotion of a science for knowledge and action.

Eric MARTIN

Engineer
Irstea, Rural Engineering, Water and Forests Administration
Regional director of the Irstea Aix-en-Provence center, France

For Eric Martin, chief engineer in the Rural Engineering, Water and Forests Administration, this is familiar territory. On August 17, 2015, Martin became director of the Irstea Aix-en-Provence regional center, which he knew well for having participated in many of the institute's projects, namely the RHyTMME project.

A graduate of the Toulouse National School of Meteorological Studies, Martin specializes in the study of snowpack sensitivity, and was director of the French Center for Studies of Snow and Weather (CEN) from 1998 to 2004. He joined the Medium-Range Weather Group at the CNRM in Toulouse in 2004, and was in charge of developing the externalized surface model SURFEX. His research on the impact of climate change on the hydrology of large French catchment areas and on retrospective studies from the last century is internationally renowned. He is also one of the experts selected to be a main contributor to the 4th
and 5th assessment reports by the IPCC (Intergovernmental Panel on Climate Change).

Monday, February 5, 2018 VINCI - Amphitheater Descartes

08h30		*Welcome & Registration*
Opening session (chaired by Isabelle LA JEUNESSE, U.Tours, FR)		
09h00-09h10	**Benoît FAUCHEUX**	Opening by, Centre-Val de Loire Region
09h10-9h15	**D. MARTOUZET C. HENAULT**	MiDi Network (Environments & Diversity)
09h15-09h20	**Francis BERTRAND**	French cluster Dream (Water & Environments)
09h20-09h30	**LA JEUNESSE, S.PINCEBOURDE**	Opening CCW 2018 conference
09h30-10h15	**Jean JOUZEL, *Invited speaker***	Global warming: the need to keep below 2°C
10h15-10h30	**Eric BRUN, *Invited speaker***	Water issues in the next French Adaptation Plan to Climate Change
10h30		*Coffee Break*
11h15-11h45	**Philippe QUEVAUVILLER, *Invited speaker***	Community-building to link EU-research to policy and practitioner's needs in the area of climate-related extreme events
Overview of the conference themes in the climate-water-adaptation nexus (chaired by Isabelle LA JEUNESSE, U.Tours, FR)		
11h45-12h00	**Ker Rault, Koundouri, E. Akinsete, Ludwig, Huber-Garcia & Tsani**	Downscaling of climate change scenarii to river catchment level: a transdisciplinary methodology and application in ecosystem services and land-use change at European catchments
12h00-12h15	**Feuillette & Raout**	Adaptation strategy of the Seine-Normandie Hydrographic district
12h15-12h30	**Santillan, Iglesias, La Jeunesse, Garrote & Sote**	Vineyards in transition: a global assessment on the adaptation needs to climate change
12h30		*Lunch Break*
Poster session		
Adaptation and water resource management (chaired by Ralf LUDWIG, LMU, DE)		
14h00-14h15	**Fabre, Pelte, Duboulet & Goulard**	A semi-quantitative assessment of climate change vulnerability in the water sector to determine priorities for adaptation
14h15-14h30	**Amat, Martin, Rudolf & Giacona**	Identifying impacts of climate change on the sharing of water resource between industrial users
14h30-14h45	**Penasso & Arrondeau**	Assessment of climate change impacts on the management of the Arzal dam
14h45-15h00	**Rossignol**	Adaptation to the impacts of climate change on the Loire basin and its tributaries: Zoom on two cases of operational integration of scientific knowledge
15h00-15h15	**Chouinard, Weissenberger & Fauré**	Community mobilization in two rural communities on the Acadian coast, New Brunswick Canada, to address water and climate change.
15h15-15h30	**Skrimizea, Haniotou & Papakrivou**	What kind of adaptation strategies for the Mediterranean islands? Water mismanagement, tourism, and climate change
15h30		*Coffee Break*
Adaptation in urban areas (chaired by Fatima LAGGOUN, U.Orléans, FR)		
16h00-16h15	**Vamvakeridou-Lyroudia, Chen, Khoury, Stewart, Wood, Savic & Djordjevic**	Enhancing the resilience of interconnected critical infrastructures to urban flooding in Torbay, UK
16h15-16h30	**Thaler, Gatien-Tournat, Fournier, Bonnefond, Gralepois, Servain, Clarke, Driessen, Hegger, Mees, Murphy, Uittenbroek & Fuchs**	Motivation and drives in bottom-up developments in flood hazard management: why societal transformation is needed?
16h30-16h45	**Clifford & ASTEE working group on river restoration**	Restoring Small Rivers Located in Urban Environments: Key Findings
16h45		*Break*
ECRA Session (chaired by Ralf LUDWIG)		
Societal challenges related to climate change impacts on the hydrological cycle - risk analysis, vulnerability and adaptation		
17h00-17h15	**Peter BRAESICKE**	Welcome by *ECRA chair, Helmholtz Association, KIT*
17h15-17h30	**Chantal GASCUEL**	*Keynote 1- Agrohydrology, INRA, FR*
17h30-17h45	**Eric MARTIN**	*Keynote 2 - IRSTEA, FR*
17h45-18h30	Panel discussion : **Jean JOUZEL** (CEA/CNRS/UVSQ) – **Chantal GASCUEL** - **Isabelle LA JEUNESSE** (Univ. of tours) - **Eric BRUN** (ONERC) - **Peter BRAESICKE** (KIT, ECRA-Chair)	
19h00		**Cocktail (end ~ 20h30) - at the city hall, Tours**

Opening session (chaired by Isabelle LA JEUNESSE, U.Tours, FR)

Invited keynote communication

Monday 5th, 09:30

Corresponding author: Jean JOUZEL

Global warming: the need to keep below 2°C

Jean Jouzel

LSCE / IPSL (CEA-CNRS-UVSQ), CEA Saclay, France

If nothing is done to manage the increase of the greenhouse effect tied to human activity, we should see, at the end of this century, a minimum average 4°C increase in temperature worldwide above the pre-industrial level which will increase well beyond 2100. The impacts of such a « business as usual » scenario would be difficult if not impossible to handle. And, even if easier to manage, these difficulties will hold true for a +3 °C climate change a level which could be reached in the current context of the Paris agreement. We will focus on the impacts on the water cycle which will be particularly important both at global and regional scales and conclude on the absolute need to keep global warming well below 2°C, if we want today young generations be able to adapt to future climate change in the second part of this century and beyond. We will argue that research, innovation and creativity are essential for going towards this low carbon society but that this transition also requires large dedicated private and public investments.

Opening session (chaired by Isabelle LA JEUNESSE, U.Tours, FR)

Invited communication

Monday 5th, 10:15

Corresponding author: Eric BRUN
eric.brun-barriere@developpement-durable.gouv.fr

Water issues in the next French Adaptation Plan to Climate Change

Eric Brun

MTES/DGES/ONERC 92055 LA DÉFENSE CEDEX

In the context of Paris Agreement, the French government is actively combating climate change, both in terms of attenuation and adaptation.
A second national adaptation plan (PNACC-2) will cover the period 2018-2022. This plan has been prepared in broad consultation with a large diversity of stakeholders, including experts and scientists, national and local decision makers, representatives of professional and worker unions, NGOs.
All sectors have been considered in the preparatory discussions, including agriculture and water resources. The presentation will address the specific questions and objectives which have been raised for water resources in the context of adaptation to climate change in PNACC-2.

Keywords: water resources, adaptation, climate change.

Opening session (chaired by Isabelle LA JEUNESSE, U.Tours, FR)

Invited communication

Monday 5th, 11:15

Corresponding author: Philippe QUEVAUVILLER
philippe.quevauviller@ec.europa.eu

Community-building to link EU-research to policy and practitioner's needs in the area of climate-related extreme events

Philippe Quevauviller

European Commission, DG Home Affairs, Rue de la Loi 200, B-1049 Brussels, Belgium

The European Union is funding a wide range of (research and capacity-building) activities in the area of risk prevention, preparedness and response related to climate extreme events, including water-related threats, which are supporting specific policies dealing with civil protection, security of citizens, environmental risks, etc. While these activities are in principle followed-up at international level, they are however frequently unknown or not well communicated to different stakeholders at Member State and regional levels. This often results in an insufficient awareness of EU policy implementation and supporting tools and technologies developed by research by a range of potential users, in particular policy-makers, scientists, industry (including SMEs) and practitioners (e.g. first responders, civil protection units etc.). A recent EU initiative called "Community of Users on Secure, Safe and Resilient Societies" is striving to improve the transfer of research knowledge to the users. One of the thematic discussions of this community deals with weather extreme events with a focus on prevention and response. This presentation will discuss the involvement of key players in this activity which has to rely on national/regional networks.

Overview of the conference themes in the climate-water-adaptation nexus (chaired by Isabelle LA JEUNESSE, U.Tours, FR)

Oral communication

Monday 5th, 11:45

Corresponding author: Philippe Ker Rault
philippe.ker_rault@wur.nl

Down scaling of Climate Change scenarii to river catchment level: a transdisciplinary methodology and application in ecosystem services and land-use change at European catchments

Philippe Ker Rault[1], Phoebe Koundouri[2], Ebun Akinsete[2], Ralf Ludwig[3], Verena Huber-Garcia[3], Stella Tsani[2]

[1]*Wageningen Environmental Research, 6708 PB Wageningen, Netherlands*
[2] *Athens University of Economic and Business, Athens, Greece*
[3] *Ludwig-Maximilians-Universitaet Muenchen, Luisenstr. 37, 80333 Munich, Germany*

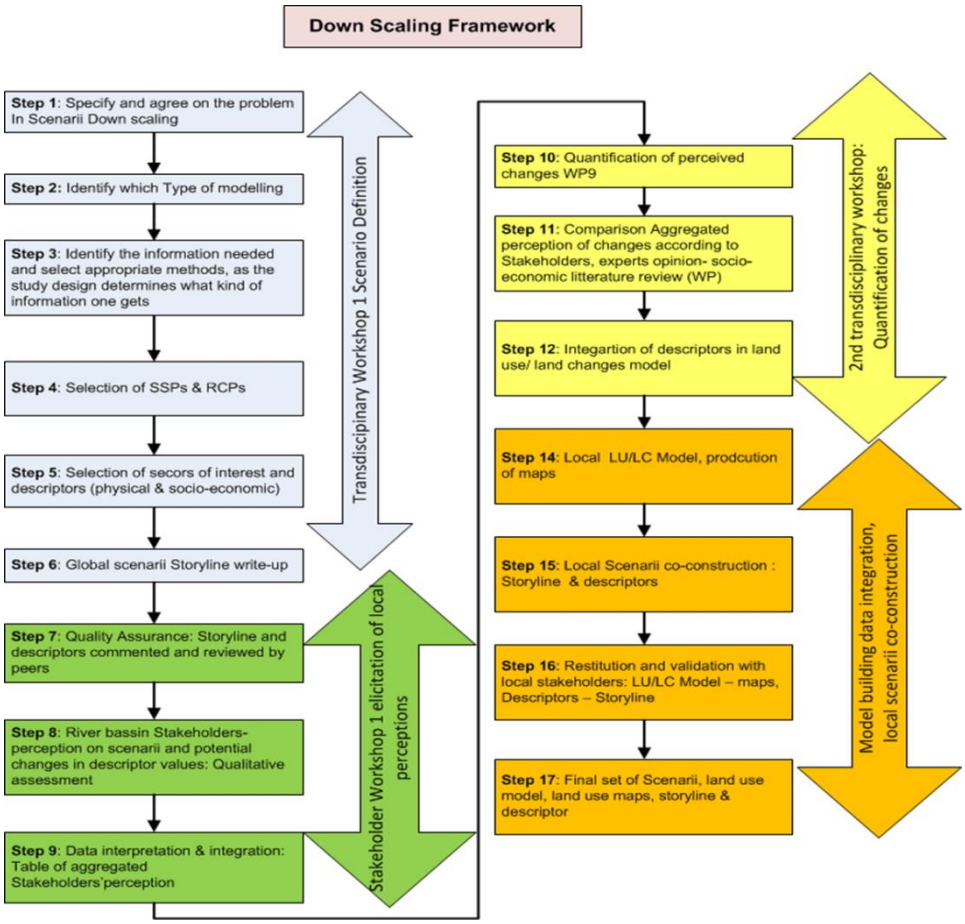
Freshwater ecosystems are under threat from the effects of multiple stressors. Little is known beyond the described effects of single stressors on the chemical and ecological status of water bodies and on their ecosystem functionality. This lack of knowledge limits our capacity to understand ecosystem responses to multiple stressors and to define a programme of measures that can improve the ecological status of water body as sought by the European Water Framework Directive. People rely on ecosystems to provide water related services. Climate change is impacting natural resources including water, land use and land use management and on the functioning of ES. The challenges (choice of models, values of variables, arbitration) about modelling climate change impact on water cycle in general and specifically on socio-economic dynamics of the society leads to an exponential amount of results that restrain interpretation and added value of forecasting at local level.
Stakeholders, the beneficiaries of ecosystem services (ES) managers of river bodies and landscapes play a key role in ecosystem service understanding and in providing insights to interpreted impact of CC.

The objectives of this transdisciplinary research are:
Describe and reflect on the IPCC scenarii co-construction at river scale level and land use modelling;
An attempt to develop a rigorous approach for downscaling integrated scenarios to catchment level : eventually a standard methodology to create CC local scenarii (figure 1);
Reflect on transdisciplinary approach and creating added intellectual value to combine a wide range of expertise and paradigms to society and decision makers.
Include stakeholder's perception, choice and acceptance level in defining impact of climante change, mitigation, adatation strategies and programme of measures.

Overview of the conference themes in the climate-water-adaptation nexus (chaired by Isabelle LA JEUNESSE, U.Tours, FR)

Extensive series of workshops were organized within disciplines (Economics, geography and scoiology), between disciplines and with external stakeholders to enrich coherence and point of view.
Climate change scenarios were developed tested and reviewed in participative workshops. Scenarii are made of 2 elements: a storyline and the table of descriptors. It is a combination of socio-economic elements and trends. These scenarii are describing potential future at global scale, based on existing IPCC output. Two (2) scenarii based on a combination of SSP (shared Social Pathway) and RCP (Representative Concentration Pathway) according to current IPPC work where tested:
Storyline 1 describes at global level the combination SSPs 5 with RCP 8.5. It is also referred as “MYOPIC” scenario or “short-term Economy rules” or “fossile fuel driven” and represents an Extreme scenario with high CO2 emission.
Storyline 2 describes at global level the combination SSP 1 with RCP 4.5 is called “Sustainable scenario”or “protection of natural and Human capital” and represents a scenario with low C02 emission.
Together, researchers and stakeholders, created the opportunity to adapt this global scenario to the local river basin with local knowledge, preferences and perception, all of which provide insights and enable to ground academic work onto local reality.
Case studies are river basins in Greece (Evrotas), Italy (Alto Adige), Morocco (Souss Massa River Basin), Slovenia (Sava), Spain (Ebro), The UK (The Broads).

Keywords: Downscaling, land-use management, Ecosystem services, water-stress.



Overview of the conference themes in the climate-water-adaptation nexus (chaired by Isabelle LA JEUNESSE, U.Tours, FR)

Oral communication

Monday 5th, 12:00

Corresponding authors: Sarah FEUILLETTE & Frédéric RAOUT
feuillette.sarah@aesn.fr; frederic.raout@developpement-durable.gouv.fr

Adaptation strategy in the basin Seine-Normandie, from strategy to actions

Sarah FEUILLETTE & Frédéric RAOUT

[1]*Agence de l'eau Seine-Normandie, 51 rue Salvador Allende, 92027 Nanterre Cedex, FRANCE*
[2]*Direction régionale de l'environnement et de l'énergie d'Ile -de-France, 10 rue Crillon, 75194 Paris, Cedex 04, FRANCE*

Climate change will affect water cycle in the Seine-Normandy river basin : reduction of water flows by 30% and of groundwater recharge by around 30% by 2100, increase of around 2°C of surface water temperature, increase of extreme droughts and heavy rains in both intensity and frequency.
To anticipate water using conflicts, it is urgent to develop adaptation strategies for water : that's the action's sense decided by the French Ministry of environment in each river basin and conducted in the Seine-Normandy river basin by the Water Agency and the Direction of environment (district delegation). This plan has been established with the river basin Committee, which is a kind of Water Parliament, composed of users, local authorities and the State.
Built on a participative method and nourished by existing local strategies, the adaptation strategy of the Seine-Normandy river basin is based on simple principles: non regrettable solutions (available for a large range of climate scenarios), multifunctional (concerning several challenges), mitigating for climate, and fitting with current water policies. To limit pressures on water, we have to aim at more abstemiousness of human activities and globally make the territories more resilient to climate risks.
More than 30 local or thematic meetings have been organized, with the participation of many stakeholders. An expert committee, presided by M. Jean Jouzel, former GIEC vice-president, has followed the whole project.
Finally, the Seine-Normandy's adaptation strategy proposes 11 « strategic answers » to be locally implemented depending on territories characteristics: urban, rural, coastal or peri-urban.
The 5 first « strategic answers », which have priority, use natural functions of hydrosystems to improve territorial resilience: infiltration into the ground as soon as possible, restoration of natural connections and river morphology, sustainable agriculture and forests, reduction of pollution at its source.
The 11 strategic answers are detailed in 46 practical actions, illustrated by local examples.
For instance, the strategic answer « A: Facilitate infiltration into the ground and revegetate cities » is composed of 5 actions, among which, the action A2 « limit waterproofing and help inverted waterproofing» is made of using filtering covers on streets and pavements, during renovation work.
A commitment declaration invites each partner to implement the district adaptation strategy on his own territory and in his field. […]

Overview of the conference themes in the climate-water-adaptation nexus (chaired by Isabelle LA JEUNESSE, U.Tours, FR)

The Seine-Normandy's adaptation strategy has been approved unanimously by the river basin Committee in December 2016.
Currently more than 120 partners have signed the commitment declaration.
Details: http://www.eau-seine-normandie.fr/domaines-d-action/adaptation-au-changement-climatique

Overview of the conference themes in the climate-water-adaptation nexus (chaired by Isabelle LA JEUNESSE, U.Tours, FR)

Oral communication

Monday 5th, 12:15

Corresponding author: Ana Iglesias
ana.iglesias@upm.es

Vineyards in transition: A global assessment on the adaptation needs to climate change

Santillan, D.[1], Iglesias, A[2]. , La Jeunesse, I. [3], Garrote, L[1]., Sotes, V. [2]

[1]ETSI Caminos, Universidad Politecnica de Madrid, 28040 Madrid, Spain
[2]ETSI Agraria, Alimentaria y de Biosistemas, Universidad Politecnica de Madrid, 28040 Madrid, Spain
[3]Département de Géographie, Université de Tours, France

We wish to suggest how climate change will transform global vineyards. We only consider changes in climate variables as drivers, and recognise the limitations of excluding numerous social and environmental changes. However, this assessment has novel features which are of interest for developing policies that may drive adaptation. We use two climate scenarios at 0.5º resolution forced by two emission scenarios, to estimate the transition of potential vineyards in the mayor grape production world areas by the late 21st century. Here we present and discuss the analysis of three impact indicators aimed at exploring the benefits of transition-based policies. A drought indicator provides insights to prepare for extreme events in probabilistic terms. Two temperature indicators provide information on the transition towards suitable zones of production.

Keywords: Vineyards, climate change, drought, adaptation

Adaptation and water resource management (chaired by Ralf LUDWIG, LMU, DE)

Oral communication

Monday 5th, 14:00

Corresponding author: Julie FABRE
j.fabre@acterraconsult.com

A semi-quantitative assessment of climate change vulnerability in the water sector to determine priorities for adaptation

Fabre Julie[1], Pelte Thomas[2], Duboulet Anne-Paule[3] & Goulard Françoise[4]

[1] Acterra Consulting, 26 rue de la Boétie 13012 Marseille, France
[2] agence de l'eau Rhône Méditerranée Corse, 2-4 allée de Lodz 69363 LYON cedex 7, France
[3] agence de l'eau Loire-Bretagne, 9 avenue Buffon - CS 36339 - 45063 Orléans cedex 2, France
[4] agence de l'eau Adour-Garonne, 90 rue du Feretra 31078 Toulouse cedex 4, France

The impact of climate change on water management is receiving growing attention and the need for climate change adaptation plans is often highlighted. As knowledge on climate change impacts and data availability grows, there is a need to transfer this knowledge and information from science to water management and decision making. In this context, three French Water agencies (Rhone Mediterranean, Loire Brittany and Adour Garonne) carried out semi-quantitative assessments of climate change vulnerability aimed at mapping vulnerability, communicating on climate change uncertainties, and prioritizing adaptation measures. The water agencies built on their many years of practice in integrated water resources management and on solid monitoring databases to bridge the gap between qualitative and quantitative vulnerability assessments, using quantitative climate change and environmental data to complete bottom-up knowledge on climate change vulnerability.

The main issues for water management in the face of climate change were defined based on literature reviews of the impacts of climate change on the water sector. This communication will concentrate on issues common to the three water agencies: surface water availability, aquatic biodiversity and water quality using eutrophication as a proxy.
Vulnerability was considered to be a combination of exposure (climatic factors) and sensitivity (non-climatic factors). Indicators for exposure and sensitivity were scored from one (less exposed, less sensitive) to five (more exposed, more sensitive) and vulnerability scores were attributed according to a combination of exposure and sensitivity. Data from the "Explore 2070" project was used to define exposure according to indicators of precipitation, temperature, evapotranspiration and streamflow changes under climate change. These projections were based on seven climate change scenarios and two hydrological models and therefore accounted for a part of climate change uncertainties. Indicators of sensitivity were based on data produced by the water agencies reflecting the state of water resources and the aquatic environment, linked to the European Water Framework Directive and local studies carried out by the water agencies. The indicators were chosen by a vulnerability task force in each agency, with the aim of defining what characteristics made the basin more vulnerable to climate changes in terms of water availability, aquatic biodiversity and water quality.

The scores for exposure were assigned based on the level of change between current and future climate, rather than on absolute values. The scores for sensitivity were based on local minimum and maximum values and thresholds based on equal effective intervals, for each indicator. The thresholds were adjusted to reflect local heterogeneities and based on expert knowledge of the basins. The results were presented through maps reflecting different levels of vulnerability in the sub-basins and the spread between the 14 hydro-climatological projections.

The vulnerability assessments led to an appropriation of the projections of climate change and hydrological impacts by the vulnerability task forces. The process of defining the appropriate indicators and combinations of indicators for sensitivity also helped water managers to reflect on the quality of their monitoring data, on what defines their vulnerability to climate change, and on what the object of adaptation should be.

Keywords: vulnerability – adaptation – IWRM – indicators – GIS.

Adaptation and water resource management (chaired by Ralf LUDWIG, LMU, DE)

Oral communication

Monday 5th, 14:15

Corresponding author: Amandine AMAT
a.amat@alsace.cci.fr

Identifying impacts of climate change on the sharing of water resource between industrial users

Amat Amandine[1], Brice Martin[2], Florence Rudolf [3], Florie Giacona[4]

[1] *Post PHD-Sociologist, Interreg Project Clim'Ability,* CCi Alsace Eurométropole *10, PLace Gutenberg 67000 Strasbourg . Pays : France*
[2,] *Maître de conférence en géographie, UHA,* 16 rue de la Fonderie 68093 MULHOUSE CEDEX*, Pays : France*
[3] *Sociologue, Professeure des Universités, INSA,* 24 bd. de la Victoire
67084 Strasbourg *Pays : France*
[4] *PostDoc Position, Interreg Project Clim'Ability, Cresat – Université de Haute-Alsace, 16 rue de la Fonderie, 68093 Mulhouse cedex, Pays : France.*

Our communication aims to present the first results of a case study* dedicated to the problem of water resources between industrial users and other actors in an Alsatian valley. In this valley the water resource represents a critical stake, which is mainly supplied with a pure water of mountain: with climate change, the periods of drought are increasingly intense and numerous. At the same time, industrial activity increases, which leads to important conflicts of use because the available water can be scarce during periods of drought. We build a survey to understand in the existing conflicts of use that may arise with climate change around water resources (quality and quantity) and possible solutions to limit these conflicts of use and ensure a balance in the distribution of consumption of water resources.
First, we identify how the water needs are distributed according to the different actors of the territory (human-related consumption between industrial activities, tourism activities, natural areas and biodiversity). Then, we seek to identify existing networks/ cooperation around the distribution of the resource, based on existing agreements.
The final purpose of the study is to identify adaptation scenarios to respond to them, to reduce the vulnerability of the territory to climate change.
We used different complementary survey techniques: interviews, documentary research, participant observation (meetings, workshops and local commissions), questionnaires in order to achieve the objectives.

**This field survey was conducted for the European Interreg Clim'Ability project (2016-2018).*
Keywords : water ressource, enterprise, climate change, adaptation, valley.

Adaptation and water resource management (chaired by Ralf LUDWIG, LMU, DE)

Oral communication

Monday 5th, 14:30

Corresponding author: Aldo PENASSO
aldo.penasso@eptb-vilaine.fr

Evaluation de l'impact du changement climatique sur la gestion du barrage d'Arzal

Aldo Penasso[1], Jean-Pierre Arrondeau[2]

[1]EPTB (Etablissement Public Territorial de Bassin) Vilaine, Boulevard de Bretagne – 56 130 La Roche Bernard, Country: France
[2]EPTB (Etablissement Public Territorial de Bassin) Vilaine, Boulevard de Bretagne – 56 130 La Roche Bernard, Country: France

EPTB Vilaine administrates the Arzal Dam, key works that controls flows on the downstream part of the Vilaine basin. Originally built for flood prevention, it has retained its original purpose, which is now part of a shared management approach of the water resource. Many uses have indeed been developed since the commissioning of the structure in 1970: water supply (the dam controls a fresh water reserve of about 50 million cubic meters), sailing (17 000 boats cross on average the Arzal lock each year), agriculture (the marshes located upstream the dam are used for hay production)…

Its estuarine position makes the dam unique in Europe. It does not work like a classic structure: its role is not to store water to cut floods or achieve low water support, but to block the tide to prevent it from going up the Vilaine. In winter, by avoiding the superposition of a tidal wave and a flood, it contributes to increase the level of protection of the city of Redon. In low water periods, by limiting the upwelling of salt water, it preserves the freshwater resource. But brackish water intrusions, penalizing for human consumption, still occur via the lock and may lead to restrictions on its use.

The management of the dam, based on the transparency of the flows, obeys different logics according to the periods of the year: maximum water evacuation during the floods, maintenance of a level compatible with all the uses the rest of the time. The operation is set on the tidal cycles: evacuation of flows can only be done when the sea level is below the level of the Vilaine. The will to conciliate all the uses sometimes contradictory associated with the river, without compromising the two priority missions of flood protection and water supply, can lead to conflicts sometimes difficult to solve, especially during low water periods, when the availability of water resource decreases.

Furthermore, foreseeable consequences of climate change could in the future aggravate conflicts of use and even compromise some: sea level rise limiting the capacity of evacuation of the dam and making saline intrusions more penalizing, multiplication of droughts leading to periods of total closure of the structure to preserve water resource…

In order to anticipate these negative consequences, EPTB Vilaine has been running since 2012 several projects in parallel: hydraulic study to determine the impact of climate change on the operation of the dam and flood risks, feasibility study of a low flows forecasting system, three-dimensional modeling of saltwater intrusions into the freshwater resource via the lock, operational study of a new anti-salinity lock ... The goals are at the same time to improve the knowledge of some complex phenomena still poorly known, quantify the impact of climate change at different time horizons and build an action plan to sustain the structure in its multi-purpose vocation.

Keywords: barrage, inondations, ressource, changement climatique.

Adaptation and water resource management (chaired by Ralf LUDWIG, LMU, DE)

Oral communication

Monday 5th, 14:45

Corresponding author: Benoît ROSSIGNOL
benoit.rossignol@eptb-loire.fr

Adaptation to the impacts of climate change on the Loire basin and its tributaries: Zoom on two cases of operational integration of scientific knowledge

Rossignol Benoît[1]

[1]*Etablissement public Loire, 2 quai du Fort Alleaume, CS 55708, 45057 Orléans Cedex, France*

To meet the challenges of adapting to the impacts of climate change on the territory of the river basin, particularly in terms of water resource management, Etablissement public Loire has carried out and supported various actions since 2007, which have made it possible to :
- develop knowledge, in particular on the observed and expected effects of climate change on the Loire basin and its tributaries, as well as on the vulnerabilities of human activities and associated environments.
- contribute to highlighting the challenge of adaptation at river basin level, through the sharing and exploitation of acquired knowledge, as well as the development of exchanges and synergies between the scientific community and public decision makers.
- initiate the operational integration of the knowledge acquired by certain operators in some of their tasks.

This third point will be developed on the basis of two concrete cases, highlighting the stakes, the work carried out, as well as the follow-up given and planned:
- study of the adaptation of the operating practices of the Naussac and Villerest dams , which are owned and managed by Etablissement public Loire. By mobilizing the data and projections resulting from the research projects, the impact of climate change and socio-economic evolutions on the 2 dams' functioning by 2065 was analyzed. A strategy for adapting the current management mode was sought, based on the following question : on the basis of the evolution trends of the various hydrological indicators, what are the adaptation levers that would make it possible to provide the support for low-water levels needed downstream of the two dams without jeopardizing their safety or their priority functions. For Villerest dam, the study thus consisted in identifying adaptation scenarios that reconcile the capacity of the structure to store part of the floods, taking into account their intensity and frequency, with the need to optimize the filling of the reservoir in order to satisfy the support for low-water level downstream. The approach resulted in the development of a modeling tool, reproducing the functioning of the two dams and their management rules, and allowing testing the different adaptation levers. For the purpose of information and appropriation, a popularized presentation of highly technical results was produced in 2017.

- restitution of available knowledge on the impacts of climate change on the territories of SAGEs (sub-basin management plan) supported by the Institution. This action, carried out at the end of 2016-early 2017, aimed to ensure and facilitate the restitution of available data on the impacts of climate change on the territories of the 9 SAGE procedures for which the Etablissement public Loire acts as a supporting structure.
The objective was to inform stakeholders in the territories of existing knowledge, as well as the potential impacts of climate change on water management and associated risks, and also to make them aware of the challenges of adaptation for their territory.

Link : www.eptb-loire.fr

Keywords: Adaptation, Loire, bassin fluvial, barrage, ressource en eau.

Adaptation and water resource management (chaired by Ralf LUDWIG, LMU, DE)

Oral communication

Monday 5th, 15:00

Corresponding author: Omer Chouinard
omer.chouinard@umoncton.ca

Community mobilization in two rural communities on the Acadian coast, New Brunswick Canada, to address water and climate change

Omer Chouinard[1], Sebastian Weissenberger[2] &Anne Fauré[1]

Université de Moncton, Campus de Moncton, Pavillon Léopold-Taillon, 18, avenue Antonine-Maillet Moncton, NB, E1A 3E9, Canada
Département Science et Technologie, Telé-Université du Québec, 5800, rue Saint-Denis, bureau 1105, Montréal (Québec) H2S 3L5, Canada

The province of New Brunswick, Atlantic Canada, is characterized by a significant weakness of local governance, especially because of the presence of local service districts without political representation (Finn, 2008). The province is also struggling with structural economic challenges and high levels of poverty in the Canadian context (Statistics Canada, 2011). In parallel, environmental issues such as water quality and climate change have emerged as significant concerns of society in recent years (Natural Resources Canada, 2015). As a result of these concurrent evolutions, civil society has learnt to develop collective modes of actions through cooperatives, associations and informal collaboration aiming at improving living conditions, environmental quality, local economy, and respecting local culture and traditions. The research question was : how can a cooperative and an association address the question of climate change and water and what are their role as agent of change? Two case studies for such collective development initiatives as agency are presented here: the creation of a renewable energy cooperative in the Lamèque Island on the Acadian Peninsula, and the evolution of the Pays de Cocagne Sustainable Development Group (PCSDG) in Kent County. These two cases were chosen because connexion between twenty to twenty five years of our collaborative and participatory research between these two communities and academic researchers. These cases were investigated through community-based research using qualitative methodological tools, direct observation, semi-directed interviews, descriptive statistics and focus groups. In both cases, economic, social and environmental concerns were addressed through the projects undertaken. Both cases also implicitly adopt the Agenda 21 principle of “acting locally and thinking globally” through networking at an international level while addressing local issues. Participants define their territory as a place of collaborative action and social innovation that can improve living conditions through local development approach by mitigating and adapting to climate change and to improve the quality of water. In both territories, social economy projects with cooperatives and associations have contributed to reinforce the "territorial consciousness". Our study demonstrate that cooperatives and associations despite of the weakness of local government in this province of Canada have played a major role in the adaptation to climate and environmental changes and efforts to improve water quality.

The cooperative in partnership with local collectivity of 1600 persons have more tools to mobilize social capital at the regional level and the province and also have the capacity to hire technicians to face the question of adaptation and to mitigate climate change. The association also draws on local and traditional knowledge to promote a culturally and historically rooted mode of sustainable development. The association in a collectivity of 2600 persons have succeeded to mobilize people to protect the water and adapt to climate and other environmental changes and to find solutions through education and engaging with regional institutions and the provincial government.

Keywords: Adaptation, water, local collectivity, mobilization, community based research.

Adaptation and water resource management (chaired by Ralf LUDWIG, LMU, DE)

Oral communication

Monday 5th, 15:15

Corresponding author: Eirini SKRIMIZEA
eirini.skrimizea@gssi.it

What kind of adaptation strategies for the Mediterranean islands? Water mismanagement, tourism, and climate change

SKRIMIZEA Eirini[1], HANIOTOU Helene[2] & PAPAKRIVOU Anastasia[3]

[1]PhD Candidate, Urban Studies Department, Gran Sasso Science Institute, viale Francesco Crispi 7, 67100 L'Aquila, Italy
[2]Associate Professor, Laboratory of Urban Design, Department of Urban and Regional Planning, School of Architecture, National Technical University of Athens, Patision 42, 10682 Athens, Greece
[3]Head of Agrometeorology Department, Climatology Division, Hellenic National Meteorological Service, El. Venizelou 14, 16777 Hellinikon Athens, Greece

Problems relating to water availability are complex social-ecological issues formulated by factors such as consumption patterns, local development choices, ecological dynamics, and climate change. It is rather difficult, sometimes irrelevant, to try to disassemble and address individually the different parameters constituting such issues and, instead, a systemic approach is needed. That being said, in this paper we argue that the responses to the impacts of climate change on water should be integrated within broader adaptation to future water availability strategies. In fact, such adaptation strategies would be very relevant for many regions of Europe, especially in the Mediterranean. Many regions of the Mediterranean experience water deficits that are projected to increase due to accumulated overexploitation of resources, increasing consumption rates, salinization phenomena, and climate change. The islands are particularly vulnerable to such water risks due to a number of factors relating to their geographic situation (i.e. insularity). This is especially important if considering that the insular Mediterranean is one of the world's most popular tourist destinations and that tourism is directly or indirectly dependent on water. In this context, there is certainly a need for discussing planning mechanisms that will help these islands adapt to the uncertain future water availability. Thus, in this paper, we investigate the unfolding water issue in the touristic Mediterranean islands and we examine options for local responses. To do so, following a complex systems perspective, we analyse the example of the island of Rhodes in Greece. Rhodes, one of the most touristic islands in the Mediterranean, in the summers of 2016-2017 experienced significant water deficits due to a combination of a period of drought and increased water demand. The mechanisms that produce today's water situation in the island are being analysed focusing on a) water (mis)management on the local level, b) tourism as the main user, c) climate variability and climate change. The analysis is based on interviews with stakeholders and experts, statistical and meteorological data, literature review, and documentation analysis. The research showcases the challenges to acquire relevant data that will help to produce adaptation strategies at the local level. It also suggests the necessity to incorporate adaptation to climate change and future water availability within the local development strategies of the island. Finally, considering that the insular Mediterranean makes sense as a unit of analysis, Rhodes could be certainly used as a laboratory capable to provide interesting insights at least for other Mediterranean islands.

Keywords: water, climate change, tourism, Mediterranean, islands.

Adaptation in urban areas (chaired by Fatima LAGGOUN, U.Orléans, FR)

Oral communication

Monday 5th, 16:00

Corresponding author: Lydia Vamvakeridou-Lyroudia
L.S.Vamvakeridou-Lyroudia@ex.ac.uk

Enhancing the resilience of interconnected critical infrastructures to urban flooding in Torbay, UK

Vamvakeridou-Lyroudia L.S.[1], Chen A.S. [1], Khoury, M. [1], Stewart D.[2], Wood, M.[2], Savic, D.A.[1], Djordjevic, S.[1]

[1] *Centre for Water Systems, University of Exeter, UK*
[2] *Torbay Council, UK*

Critical infrastructures are commonly designed, built and maintained based on rigorous standards in order to withstand the climate and weather-related pressures, but shifts in climate characteristics may result in increases of the magnitude and frequency of potential risks, or expose specific CI to new or increased risks not previously considered. In this work we propose a methodological risk and resilience framework to assess comprehensively multiple climate risks and related natural hazards, such as floods, forest fires, and droughts, for interconnected Critical Infrastructures (CI). As vital components of the normal functioning of modern societies, their resilience encompasses the operational elements, their structural integrity and the capacity to maximize business output under climate stressors. A main objective of the proposed methodology is to provide scientific evidence for better understanding of how future climate regimes might affect the interconnected CI during their lifespan and accounting for ageing, and how to assess the cost-effectiveness of different adaptation measures. The paper focuses on an example in the flooding impact to Torbay in South West UK, where innovative modelling techniques, combined with high visualization act as a Decision Support tool for local stakeholders to select adaptation measures to increase resilience.

The work presented here is being funded by the ongoing EC H2020 project EU-CIRCLE (2015-2018), receiving funding under grant agreement No 653824.

Keywords: Climate Change, Flooding, Critical Infrastructures, Natural Hazards, Risk Assessment, Modeling, Visualization

Adaptation in urban areas (chaired by Fatima LAGGOUN, U.Orléans, FR)

Oral communication

Monday 5th, 16:15

Corresponding author: Thomas THALER
thomas.thaler@boku.ac.at

Motivation and drives in bottom-up developments in flood hazard management: why societal transformation is needed?

Thaler Thomas[1], Gatien-Tournat Amandine[2], Fournier Marie[3], Bonnefond Mathieu[3], Gralepois Mathilde[2], Servain Sylvie[4], Clarke Darren[5], Driessen Peter[6], Hegger Dries[6], Mees Heleen[6], Murphy Conor[5], Uittenbroek Caroline[6], Fuchs Sven[1]

[1]*University of Natural Resources and Life Sciences Vienna, Austria*
[2] *François Rabelais University, Tours, France*
[3] *National Conservatory of Arts and Crafts, Geomatics and Land Tenure Laboratory, Le Mans, France*
[4] *INSA Centre Val de Loire, Blois, France*
[5] *Maynooth University, Co. Kildare, Ireland*
[6] *Utrecht University, The Netherlands*

This paper focuses on the necessary societal transformation in flood risk management to manage the dynamics behind it. Societal transformation is understood and conceptualized as specific local governance initiatives instigated by local governments, residents, NGOs or private parties with the aim of complementing conventional flood policies. The transformative potential of these initiatives may come from replication or transfer of these initiatives to other contexts or they may induce wider institutional changes facilitating uptake of novel initiatives. These initiatives are often pursued by local actors and stakeholders, not with the aim of contributing to broader societal transformation but to address local problems or to seize local opportunities. Motives of community-based initiatives with multiple functionality and use are: (i) lack of funding, (ii) lack of legal protection to include local interests or (iii) lack of space, where classical flood risk management measures, which are dominated by one type of use (flood protection), cannot respond to the new circumstances. We present the motivations for the use of multi-functional flood risk management strategies as well as the barriers and limitations within the current governance and management structures. This paper will be centered on case studies in Austria, France, Ireland and the Netherlands. In these countries flood risk management has been institutionalized for decades, but with different institutional settings. As a result, multiple dimensions of vulnerability as well as challenges at the science-policy intersection can be comprehensively studied. This will help to identify wider lessons for other European regions currently working on the implementation of climate change adaptation strategies arising from flood risk.

Keywords: adaptation; bottom-up; drivers; barriers; natural hazards.

Adaptation in urban areas (chaired by Fatima LAGGOUN, U.Orléans, FR)

Oral communication

Monday 5th, 16:30

Corresponding author: Adeline CLIFFORD
adeline.clifford@astee.org

Restoring Small Rivers Located in Urban Environments: Key Findings

ASTEE's working group on the restoration of small rivers located in urban environments

ASTEE, 51 rue Salvador Allende 92 027 Nanterre, France.

Created in 1905, ASTEE is a scientific and technical association working on public services issues specific to the environmental field. Indeed, the Scientific and Technical Association for Water and the Environment (ASTEE) brings together key experts, researchers, scientists, practitioners and representatives of public and private institutions working in different sectors of the environmental field. The association carries-out in-depth reflections on various methodological, technical and regulatory aspects linked to the management of drinking water, waste, sanitation and aquatic environments in France. Its mission is to build consensus, develop common references and recommendations, as well as produce and disseminate technical information. ASTEE has over 3,800 members. It counts 45 working groups composed of approximately 400 volunteers, and has a network of 13 regional units located throughout the French territory to ensure the true consideration of local specificities and the dissemination of information.

ASTEE's working group on the restoration of small rivers located in urban environments was created in 2016. The objective of this group is to study the ecological gains and the reduction of the risks of flooding related to the restoration of small rivers in urban environments. A second focus of the group is to identify the role which plays the restoration of small urban rivers in urban design processes. Approximately 60 restoration projects have been surveyed so far (the survey is conducted at the national level) and a first selection of cases to analyze has been made. ASTEE offered two internships this year to progress on the survey and the analysis. These internships present two complementary approaches: a technical angle on the ecological gains linked to the restoration of small urban rivers and a socioeconomic angle.

One of ASTEE's regional units, located in the south of France, is also planning a seminar, in October 2017, on the topic of restoring small rivers in urban environments. The aim of this meeting is to identify planned or ongoing restoring operations in the region. Several topics will be discussed such as the social acceptability of these operations, cost benefit analyses of restoration projects, the legal framework, as well as difficulties encountered by managers when completing projects. The conclusions of this seminar will complement the ongoing analysis and survey.

ASTEE offers to present the findings of the working group's study on the restoration of small rivers located in urban environments at the Climate Change and Water 2018 international Conference.

Keywords: river restoration; small urban rivers; ecological engineering; urban design.

ECRA Session (chaired by Ralf LUDWIG) - Societal challenges related to climate change impacts on the hydrological cycle - risk analysis, vulnerability and adaptation

Keynote communication

Monday 5th, 17:15

Corresponding author: Chantal Gascuel-Odoux
chantal.gascuel@inra.fr

Water challenges for rural areas

Chantal Gascuel-Odoux,

Inra (National Institute on Agronomical Research), Rennes, France

Rural areas will have to deal with less water, particularly in some regions, but also with a higher variability in its availability, including alternate drought and flooding periods, impacting economic activities such agriculture and forestry as well terrestrial and aquatic ecosystems.
The first issue is the adaptation of agriculture and forestry as they are the higher water consumers, are highly vulnerable to water scarcity and excess. Agricultural activities have to improve their water efficiency at different level: plant and tree (species, phenotypes), cropping systems (crop succession, agricultural practices such as irrigation but also fertilisation), agricultural landscape management (crop spatial distribution). This could be done by ecotechnology (sensors, remote sensing, irrigation technics, small tank) at plot and landscape level. They also have to increase their resilience to variable climate conditions. Agroecology, i.e., an agriculture based on ecosystem functioning, including more biodiversity at all levels, can contribute to a more resilient agriculture. Water recharge, particularly in drinking water catchment is essential in quantity and quality. Developing then coupling models representing the cropping systems, the water recharge to the groundwater, and even socio-economic dimensions, and elaborating and simulating scenarios with societal actors can help in realistic and efficient transition of agricultural systems to preserve water resources. This issue will be illustrated by different examples.
The second issue is the preservation of soil and water ecosystems which will be more vulnerable in highly variable climatic conditions. The soil erosion and the soil carbon storage will depend on the combination of climatic but also land use conditions, particularly of time and space distribution of soil covering vegetation. According to models, wetlands could be affected, particularly in headwater catchments. Controlling nutrient and crop diseases could be more difficult. A recent scientific expertise on eutrophication has pointed out higher risks of eutrophication, due to more variable nutrient concentrations, lower discharge, and therefore dilution, and higher temperature, and therefore biomass production, in reservoirs and rivers. To prevent such risks, we need to develop methods on impact and risk assessments, on trade-off between different water uses and their consequences on ecosystems, on economic ways such as insurance to promote transition and push the adaptation on soil and water management.
The effect of climate change on soil and water resources is not yet enough known from water managers as well citizens. The uncertainties on climate change cannot hide certainties on soil and water vulnerabilities in the current and next future. In such context, the development of climate services, at seasonal level as well on a long term, can help in appropriating new knowledge and promote adaptation. Such challenge is a common challenge for society and research.

ECRA Session (chaired by Ralf LUDWIG) - Societal challenges related to climate change impacts on the hydrological cycle - risk analysis, vulnerability and adaptation

Keynote communication

Monday 5th, 17:30

Corresponding author: Eric Martin
eric.martin@irstea.fr

Challenges in the quantification and management of future water resources

Eric Martin[1]

[1]*IRSTEA UR RECOVER 3275 route de Cézanne, 13182 Aix-en-Provence Cedex 5, France*

Both Climate and anthropogenic changes will conduct to an increase pressure on water resources. Today, more and more basins show a deficit between supply and demand. Hence regulation and management plans are implemented. A coherent strategy is needed in order to manage the water resource in the future and to meet the challenges of the adaptation of our rapidly evolving societies in the context of the global change. Extreme events and their evolution are also an important issue to be addressed. We will review some research to be developed in order to provide objective material in this context. It concerns: 1) the quantification of future water resources at various scale, including uncertainties and climate change impact; 2) the management aspects in order to verify the sustainability of the socio-hydrosystem and propose solutions for that purpose; 3) the analysis of the vulnerability of the basins to any changes; 4) the knowledge of the climate and management history of water resources in order to strengthen our confidence in future scenarios.

Keywords: Water resources, climate change, management.

Tuesday, February 6, 2018 VINCI - Amphitheater Descartes

8h30		*Welcome & Registration*
Signals and indicators of impacts on natural environments (chaired by Sylvain PINCEBOURDE, U.Tours, FR)		
08h30-09h00	**Daniel ISAAK, *Invited speaker***	**Big data compilations to engage conservation communities and assess climate change effects on aquatic environments**
09h00-09h15	**Choffel, Cairault, Donati, Touchart & Bartout**	High accuracy thermal study of one Vosges du Nord Natural Regional Park's watershed: starting point of a climate changes diagnostic at the local scale.
09h15-09h30	**Floury, Delattre & Souchon**	Long-term trends in macroinvertebrate communities of the Middle Loire River: functional responses to climate change and local confounding factors
09h30-09h45	**Huber-Garcia, Ker Rault, Meyer & Ludwig**	Developing future scenarios of spatially distributed land and water use to assess the effects on aquatic ecosystems in four European river basins
09h45-10h00	**Koussoroplis & Wacker**	The nutritional quality of phytoplankton influences the tolerance to extreme water temperatures in the waterflea Daphnia magna
10h00-10h15	**Lafforgue**	Expected impacts of global warming on water-forests interactions
10h15-10h30	**Bouyer, Marchand, Vincent-Barbaroux, Cochard, Feinard-Duranceau, Le Jan, Delauney, Chamaillard, Barigah, Brignolas & Fichot**	Impact of nitrogen nutritional status on the dynamics of xylem hydraulic failure and non-structural carbohydrates under moderate and severe droughts in fast-growing trees (Populus spp.)
10h30		*Coffee Break*
Signals and indicators of impacts on water resource 1 (chaired by Florentina MOATAR and Marc DESMET, U.Tours, FR)		
11h15-11h30	**Barbero, Lewis, Westra, Fowler & Lenderink**	Intensification in short-duration precipitation extremes in the data-covered regions of the world
11h30-11h45	**Dechesne, Pellet & Thouvenel**	Local impact of climate change on drinking water production systems on the horizon 2050
11h45-12h00	**Benabdallah**	Assessment for technological needs for climate change adaptation in Tunisia
12h00-12h15	**Bhurtun, Lesven, Dumoulin, Criquet, Prygiel, Gorny & Billon**	Towards the comprehension of the impact of climate change on surface water quality in Northern France - A case study of the River Selle (France)
12h15-12h30	**Cousin, Tibi, Constantin, Meillet, Poméon & Therond**	Estimating the Available Water Content by coupling pedological approaches and inverse modelling: the RUEdesSOLS project
12h30		*Lunch*
Poster session		
Management of ecosystems and agrosystems as adaptation strategies (chaired by Frédéric ARCHAUX, IRSTEA and Sébastien DUPRAZ, BRGM)		
14h00-14h30	**Wilco VERBERK, *Invited speaker***	**Climate change and hypoxia in aquatic ecosystems: Which species are most vulnerable and what can we do?**
14h30-14h45	**Anquetil, Boudes, Koerner & Citeau**	River restoration as an adaptation to climate change: Towards a definition of socio-ecological resilience, the case of Flume river in Brittany
14h45-15h00	**Bello, Korboulewsky, Vallet, Bonal, Perot, Seigner, Perret, Couteau, Dumas & Balandier**	Can mixed forests help to save water?
15h00-15h15	**Mahjoud Boujnah, Bel Hadj Sghayer, Ben Salem, Mahjoub, Lamari, Chikhaoui & Chehab**	Assessment of the olive tree adaptation to water stress and tool to increase crop performance in the context of climatic changes
15h15-15h30	**Ollat, Lebon, Garcia de Cortazar-Atauri, Ojeda, Saurin, Prévot, Simonneau & van Leeuwen**	Wine and water: which challenges ?
15h30-15h45	**Marguerit, van Leewen, Simonneau & Ollat**	The use of genetic variability in plant material of the grapevine: an environmentally friendly way to adapt to increasing drought
15h45		*Coffee Break*
Technical innovation for water resource management (chaired by Nathalie DÖRFLIGER, BRGM, FR)		
16h15-16h30	**Larsen Morten, Drews, Petrovic, Engström, Liersch, Karlsson & Howells**	Challenges of Data Availability for Analysing the Water-Energy Nexus
16h30-16h45	**Fehri, Van Grootenbrulle, Vanclooster, Mens & Khlifi**	Together4water: Implementing an open-source database to monitor SDG related water indicators in Tunisia
16h45-17h00	**Behmel, Damour, Ludwig & Rodriguez**	Intelligent decision support system to plan, manage and optimize water quality monitoring programs based on a participative approach
17h00-17h15	**Bortoli & Orsoni**	Project of an Indirect Potable Reuse (IPR) demonstrator in Vendée to face water scarcity
17h15-17h30	**Aukes**	Climate change adaptation in coastal systems: Framing for adoption of innovative technologies
18h30		**Gala Dinner (end ~ 23h30)**

Signals and indicators of impacts on natural environments (chaired by Sylvain PINCEBOURDE, U.Tours FR)

Invited communication

Tuesday 6th, 08:30

Corresponding author: Dan Isaak
disaak@fs.fed.us

Big data compilations to engage conservation communities and assess climate change effects on aquatic environments

Daniel J. Isaak

US Forest Service Rocky Mountain Research Station, Boise, Idaho, USA

Anthropogenic climate change and the environmental trends it drives this century will profoundly affect aquatic biodiversity and ecosystem services. Effects will be compounded by growing human populations and consumption patterns, static or shrinking budgets for natural resource conservation, and a general lack of precise information about status and trends of aquatic landscape components that is necessary to guide efficient investments for conservation and management. In that context, data are precious but needed at unprecedented extents and grains and are likely to be too expensive to obtain via traditional funding mechanisms and programs. In much of Europe and North America, however, many resource agencies, universities, watershed councils, and governmental groups have collected similar types of aquatic data for independent studies and monitoring programs in previous decades. Aggregation and organization of those “crowd-sourced” data into open-access, centralized databases is a powerful means of enabling new research that provides large amounts of valuable information relatively inexpensively. Creation of large databases requires small teams with information technology expertise associated with relational databases, geospatial analyses, website design, and digital media to solicit data and provide customer service for data contributors and scientists that use the databases. In this talk, I illustrate how collaborative teams are using a big data, crowd-sourcing approach in the western U.S., which is similar in size to western Europe, to develop precise climate scenarios, species distribution models, and forecasts of climate-refuge streams throughout approximately 350,000 km of perennial rivers and streams. The information is used for long-term conservation planning to protect aquatic biodiversity and to coordinate next-generation climate monitoring programs and aquatic environmental DNA sampling among many agencies. Advantages of the approach include decreased costs for new research enabled by database mining, increased efficiency of new data collection efforts, and strong engagement and communication among researchers, regulators, and grassroots conservationists and local managers.

Keywords: species distribution model, big data, stream network, climate refuge, crowd-sourcing.

Signals and indicators of impacts on natural environments (chaired by Sylvain PINCEBOURDE, U.Tours FR)

Oral communication

Tuesday 6th, 09:00

Corresponding author: CHOFFEL Quentin
quentin.choffel@gmail.com

High accuracy thermal study of one Vosges du Nord Natural Regional Park's watershed: starting point of a climate changes diagnostic at the local scale

CHOFFEL Quentin[1], CAIRAULT Alban[2], Francesco Donati[1], Laurent Touchart[1] et Pascal Bartout[1]

[1] *Université d'Orléans, laboratoire EA1210 CEDETE*
[2] *Parc Naturel Régional des Vosges du Nord*

The increase in global atmosphere temperature will probably lead to an increase in waterbodies and streams temperature. On waterbodies, the change in temperature may impact the duration and strength of the thermal stratification. In all lakes, and especially the small polymictic ones (cf; ponds), the stability of the stratification will increase and then step the oxygen depletion up in the deepest water and impact the lake ecosystem. The fish population in streams will probably be limited to species with high temperature tolerance in the future and then, reducing the biodiversity. Some critical values in temperature may be reached more frequently and then lead to a higher mortality in some fish communities as the *Salmo trutta fario* in our regions. Headwater region is the most sensitive and reactive environment to the global warming, when they host the highest biodiversity with plentiful of streams and ponds.

A developed streams and waterbodies network has been instrumented in order to measure the temperature and dissolved oxygen variations on the Zinsel du Nord watershed (71 km²).8 streams have been implemented with 23 temperature data loggers and one pond with 5 mooring chains with a total of 35 thermometers, in order to measure the hourly temperature evolution over several years with a high spatial and temporal accuracy. The internal pond's dynamic study including thermal stratifications, stability, mixing and heat content variations is correlated with the local meteorological conditions. Combined with the concentrated streams' temperature analysis, the two indicators are a starting point for the knowledge of the climate change's vulnerability of the territory at the local scale. the Regional Natural Park of Vosges du Nord gather all the needed elements for the study, with several headwater streams, ponds and wetlands and is located in one of the places where the temperature growth from 1971 to 2000 is the highest in France, according to Joly *et al.*, 2010.

The Northern Vosges Regional Nature Park's Charta plans to involve stakeholders, environmental managers and inhabitants in the management of the rivers and ponds. The Park organizes a participative program including scientist, local population, Non-Governmental Organizations and communes. The goal is to make local and regional environmental studies more visible with common fieldwork and the involvement of the population with conference-culinary workshop to make population sensitive to the climate change.

Signals and indicators of impacts on natural environments (chaired by Sylvain PINCEBOURDE, U.Tours FR)

Oral communication

Tuesday 6th, 09:15

Corresponding author: Mathieu FLOURY
mathieu.floury@irstea.fr

Long-term trends in macroinvertebrate communities of the Middle Loire River: functional responses to climate change and local confounding factors

Floury Mathieu[1], Delattre Cécile[2], & Souchon Yves[1]

[1]Irstea, UR MALY, Milieux Aquatiques, Ecologie et Pollutions, 5 rue de la Doua, CS 20244, 69625 Villeurbanne, France
[2]EDF R&D, Laboratoire National Hydraulique et Environnement, 6 Quai Watier, BP 49, 78401 Chatou, France

Streams and rivers are among the most vulnerable ecosystems to climate change. As a result, aquatic species living in running waters are strongly exposed to climate-induced, thermal and hydrological fluctuations. Moreover, global hydroclimatic changes can interact with other environmental factors to shape structural and functional attributes of biological communities. Here, we present insights gained from different works assessing the relative effects of hydroclimatic and water quality factors on invertebrate assemblages of the Middle Loire River (France) over more than three decades. Consistently with other European large rivers, the Loire River has exhibited a significant rise in water temperature over the 30-year period (+0.9°C), along with a significant discharge reduction (-80 m^3/s^{-1}), mainly driven by global warming. According to several projections, such hydroclimatic changes should have led to an increase in nutrient concentrations and associated eutrophication phenomena. Nonetheless, we highlighted that these expected trends have been balanced out by the local reduction in phosphorus inputs thanks to wastewater treatment improvement, substantially limiting phytoplankton development. Ecological consequences on macroinvertebrate communities of these joint environmental changes have been twofold. On the one hand, hydroclimatic changes have given rise to a gradual replacement of pollution-sensitive and rheophilic taxa by pollution- and/or thermo-tolerant and limnophilic taxa, including invasive species like the Asian clam (*Corbicula sp.*). On the other hand, this shift towards assemblages more tolerant and resistant has been partially confounded by the local water quality improvement enabling the settlement of new pollution-sensitive taxa during the last years. Functionally speaking (i.e. with respect to life-history traits), the two trends have involved (i) a growing proportion of taxa exhibiting resistance and resilience strategies adapted to hydroclimatic changes (e.g. small-sized organisms, ovoviviparity), and (ii) a likely transfer of the primary production from phytoplanktonic organisms to epilithic biofilms and macrophytes. Finally, they have concomitantly resulted in a significant increase in diversity of invertebrate communities of the Middle Loire River. Therefore, improved water quality management can significantly help to reduce some adverse effects of climate change, with wider implications for the whole ecosystems.

Keywords: Climate change, Confounding effect, Invertebrates, Large rivers, Long-term trends.

Signals and indicators of impacts on natural environments (chaired by Sylvain PINCEBOURDE, U.Tours FR)

Oral communication

Tuesday 6th, 09:30

Corresponding author: Verena HUBER GARCÍA
v.hubergarcia@lmu.de

Developing future scenarios of spatially distributed land and water use to assess the effects on aquatic ecosystems in four European river basins

Verena Huber García[1], Philippe Ker Rault[2], Swen Meyer[1], Ralf Ludwig[1]

[1]Department of Geography, Ludwig-Maximilians-Universität (LMU) Munich, Luisenstraße 37, 80333 München, Germany
[2]Wageningen Environmental Research, The Netherlands

The over-exploitation of land and water resources is a common issue in most European river basins. It has had a huge, mostly negative, impact on the landscape, ecosystems and has caused water quality and quantity problems. Nevertheless, it is of utmost importance for mankind to preserve habitats and be able to provide enough clean water for various human activities also in the future.
The FP7-GLOBAQUA project analyses the effects of multiple stressors on aquatic ecosystems in four European river basins (Adige, Ebro, Evrotas, Sava) suffering water scarcity. Besides understanding the complex interactions of several stressors, the project aims at defining new management strategies for the future to reduce the impacts on aquatic ecosystems also under changing conditions. For this reason, a modelling framework is set up
to develop integrated scenarios of climate change, land use and water management. These scenarios are based on the Representative Concentration Pathways (RCPs) and Shared Socio-economic Pathways (SSPs), climate scenarios and storylines describing socio-economic aspects of various future worlds, both used by the International Panel on Climate Change (IPCC).
Several environmental models are applied in GLOBAQUA to understand the complex interactions between ecosystems and their stressors. They demand for data with a high spatial and temporal resolution for carrying out precise studies. Information on land and water use is indispensable in this context. For this purpose, spatially distributed land use maps have been simulated with the iCLUE land use change model for two future scenarios until 2050. Furthermore, spatially distributed water use maps have been derived from the land use maps. The spatial distribution of water consumption was obtained by combining official sectoral water statistics for the present with single land uses. In a second step, the overall water demand was adapted to the specifications for the future scenarios. These land and water use maps set the boundary conditions for all further modelling activities in GLOBAQUA. The results will be presented for the MYOPIC and the SUSTAINABLE scenario.

Keywords: River Basin Management Plans, sectoral water use, land use modelling, irrigation.

Signals and indicators of impacts on natural environments (chaired by Sylvain PINCEBOURDE, U.Tours FR)

Oral communication

Tuesday 6th, 09:45

Corresponding author: Apostolos KOUSSOROPLIS
a-manuel.koussoroplis@uca.fr

The nutritional quality of phytoplankton influences the tolerance to extreme water temperatures in the waterflea *Daphnia magna*

Koussoroplis Apostolos-Manuel[1,2] & Wacker Alexander[2]

[1]UMR CNRS 6023 Laboratoire Microorganismes, Génome et Environnement, Université Clermont Auvergne, 1 impasse Amélie Murat, 63178 AUBIERE CEDEX , France.
[2]Theoretical Aquatic Ecology and Ecophysiology, University of Potsdam, Institute of Biochemistry and Biology, Am Neuen Palais, 14469 Potsdam , Germany.

Climate change is affecting aquatic ecosystems through multiple and interacting stressors. For example, the frequency and the intensity of summer heat waves are expected to increase thereby challenging the thermal limits of many aquatic ectotherms such as zooplankton. In parallel, higher average temperatures are also expected to promote the frequency of algal and cyanobacterial blooms. Cyanobacteria represent an important nutritional challenge for zooplankton because they lack essential biochemicals such as sterols and polyunsaturated fatty acids (PUFA). During cyanobacterial or algal bloom situations the stoichiometric carbon to phosphorus (C:P) ratio of phytoplankton can also dramatically increase leading to a nutritional P limitation of zooplankton. Within the temperature tolerance range of zooplankton, the nutritional traits above (i.e. Sterols, PUFA, C:P) are known to strongly interact with temperature to affect zooplankton growth and reproduction. However, the role of nutrition for survival at extreme temperatures remains unstudied. In a series of thermal tolerance tests at temperatures ranging from 34.5° to 38.5°, we determined the survival time of juvenile Daphnia manga fed highly controlled diets with contrasting cholesterol, eicopentaenoic acid (EPA, an important PUFA) and C:P ratios. We find evidence that dietary cholesterol and C:P ratio, but not EPA can modulate thermal tolerance. Low cholesterol levels significantly decreased the projected critical thermal maximum (CT_{max}) by up to 0.7°C. For P, the decrease of the CT_{max} was also significant but less important (0.3°C) and quite surprisingly occurred only at moderately low P levels. Although moderate, these CT_{max} differences imply that at ecologically relevant temperatures for temperate water bodies (<34°C), sterol and P nutrition can lead to survival time differences of more than 12h, and hence determine whether *Daphnia* can survive an extremely hot day or not. Our results indicate that phytoplankton food quality, which, is also affected by climate change, can play an important role in mitigating or amplifying the negative effects of extreme climatic events on zooplankton.

Keywords: Climate change, Sterols, Phosphorus, Trophic interactions, Zooplankton.

Signals and indicators of impacts on natural environments (chaired by Sylvain PINCEBOURDE, U.Tours FR)

Oral communication

Tuesday 6th, 10:00

Corresponding author: Michel LAFFORGUE
michel.lafforgue@suez.com

Expected impacts of global warming on water-forests interactions

Lafforgue Michel[1]

[1]Suez Consulting, - *Le Bruyère 2000 - Bâtiment 1 - Zone du Millénaire 650, Rue Henri Becquerel - CS79542, 34961 MONTPELLIER CEDEX 2 – France*

Global warming will progressively impact all of the water cycle. Hence, we can expect major bioclimatic variations from now up to the end of the century. One of the main effects will be summer drought with concomitant negative impacts on forest ecosystems (rise of water stress, increase of forest fires). But a lot of indirect effects are also suspected. It concerns trees species, forestry activities, pest infestations, water resources availability, water and soil qualities, then economic, environmental and leisure's activities linked with forest ecosystems. These effects will also concern rivers, lakes and coastal waters downstream of forests. It means potential huge impact on associated water uses, more especially on water abstraction for drinking water.
At the same time, forests are supposed to be a major actor against global warming (more especially through carbon sink and renewable energy) whereas forests will be disturbed by climatic changes, and their growing takes 30 to 50 years.
It is then essential to anticipate global warming impacts on forests in order to prevent forest disturbances and adapt forestry practices to the new environmental conditions. It necessitates a proper understanding of the involved processes. One of the major target is the forest-soil-water link that should be quantitatively and qualitatively estimated. Moreover, forestry practices, economic and institutional rules must be studied for potential improvement of forest's resilience. One of the key option is the development of agroforestry, and it is useful to describe how it can improve environment, forestry and agricultural practices in the global warming context.
As a consequence, forests appear to be at the same time strongly impacted by climate changes and one of the key actors for adaptation and resilience to these changes.
These various issues and assessments are extracted from the book « *Forest and the Water Cycle: Quantity, Quality, Management* », and more especially from the chapter dedicated to climate change. This book provides a global overview of the links between water and forest.

Keywords: Agroforestry, forest, global warming, hydrology, water.

Bibliography:

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Signals and indicators of impacts on natural environments (chaired by Sylvain PINCEBOURDE, U.Tours FR)

Oral communication

Corresponding author: Regis Fichot
regis.fichot@univ-orleans.fr

Tuesday 6th, 10:15

Impact of nitrogen nutritional status on the dynamics of xylem hydraulic failure and non-structural carbohydrates under moderate and severe droughts in fast-growing trees (*Populus spp.*)

L. Bouyer[1], L. Marchand[1], C. Vincent-Barbaroux[1], H. Cochard[2], M. Feinard-Duranceau[1], I. Le Jan[1], A. Delaunay[1], S. Chamaillard[1], T. Barigah[2], F. Brignolas[1], R. Fichot[1*]

[1]*Université d'Orléans, LBLGC EA 1207, INRA USC 1328 ARCHE, Orléans F-45067, France*
[2]*UMR 547 PIAF INRA – Clermont Université, Clermont Ferrand F-63000, France*

Water and nutrient availability are among the most limiting factors affecting the productivity of trees and forests. Forest declines and mortality events have increased dramatically over the past 30 years throughout the world, with drought being one of the main reasons. The mechanisms leading to tree death in response to water deprivation are far from being completely resolved, but xylem hydraulic failure and carbon starvation are regarded as two main causes. However, the role of nutrients in modulating these water- and carbon- associated mechanisms is largely understudied.

Here, we investigated the effects of nitrogen nutritional status on the dynamics of xylem hydraulic failure and non-structural carbohydrates (NSCs) under moderate or severe drought scenarios. Experiments were conducted under greenhouse conditions on two poplar hybrid genotypes showing contrasting stomatal control (*Populus deltoides* × *P. nigra* cv. 'Koster' and *P. trichocarpa* × *P. maximowizcii* cv. 'Skado'). Acclimated 3 months-old cuttings were allocated to six different treatments corresponding to the combination of two levels of nitrogen fertilization (0,5 vs. 10 mM of NH_4NO_3 in a complete nutrient solution) with three levels of water availability (field capacity = control, 20% of field capacity = moderate drought, irrigation cessation = severe drought). Dynamic measurements encompassed primary and secondary growth, leaf gas exchange, minimum xylem water potentials, stem vulnerability to cavitation and native embolism, and NSC contents in the leaves and woody compartments (stem and roots).

As expected, nitrogen fertilization stimulated growth and increased vulnerability to cavitation for both genotypes. Trees subjected to irrigation cessation reached the lethal 90% loss of xylem hydraulic conductivity after 15 weeks while under moderate drought native embolism was maintained under 50%. Nitrogen fertilization did not impact significantly the time-course of xylem hydraulic failure, suggesting that the higher vulnerability to cavitation was compensated by other mechanisms such as adjustments in leaf *vs.* xylem surface areas. Trees growing with a higher N dose showed decreased carbohydrate contents, especially in leaves and roots. When trees had reached 90% of xylem embolism, starch contents were null indicating that carbon starvation may co-occur with xylem hydraulic failure under severe drought. Overall, our first results suggest that nitrogen nutritional status may primarily affect drought response through NSC dynamics and that higher nitrogen availability may be a predisposing factor reducing the ability of trees to cope with drought by reducing carbohydrate reserves.

Keywords: carbon starvation, drought, hydraulic failure, nitrogen nutritional status, poplar.

Signals and indicators of impacts on water resource 1 (chaired by Florentina MOATAR and Marc DESMET, U.Tours, FR)

Oral communication

Tuesday 6th, 11:15

Corresponding author: Renaud Barbero
renaud.barbero@irstea.fr

Intensification in short-duration precipitation extremes in the data-covered regions of the world

Barbero Renaud[1], Lewis Elizabeth[2], Westra Seth[3], Fowler Hayley[2], Lenderink Geert[4]

[1]*Irstea, UR EMAX, Aix-en-Provence, France*
[2]*School of Civil Engineering and Geosciences, Newcastle University, Newcastle-upon-Tyne, United-Kingdom*
[3]*School of Civil, Environmental and Mining Engineering, University of Adelaide, Adelaide, Australia*
[4]*Royal Netherlands Meteorological Institute, Debilt, The Netherlands*

Extreme rainfall events are expected to intensify with a warming climate and this is currently driving extensive research. While daily rainfall extremes are widely thought to have increased globally in recent decades, changes in rainfall extremes on shorter timescales, often associated with flash flooding, have not been documented at global scale due to surface observational limitations and the lack of a global sub-daily rainfall database. The access to and use of such data remains a challenge. For the first time, we have synthesized across multiple data sources providing gauge-based sub-daily rainfall observations across the globe over the last 6 decades. Because of the physical connection between global warming and the moisture budget, we sought to infer long-term changes in sub-daily rainfall extremes contingent on global mean temperature. Whereas the potential influence of global warming is uncertain at regional scales, where natural variability dominates, aggregating surface stations across parts of the world may increase the global warming-induced signal. Changes in terms of annual maximum rainfall across various resolutions ranging from 1-h to 24-h are presented and discussed.

Keywords: short-duration precipitation extremes, climate change, precipitation scaling, Clausius-Clapeyron equation.

Signals and indicators of impacts on water resource 1 (chaired by Florentina MOATAR and Marc DESMET, U.Tours, FR)

Oral communication

Tuesday 6th, 11:30

Corresponding author: Magali DECHESNE
magali.dechesne@veolia.com

Local impact of climate change on drinking water production systems on the horizon 2050

Magali DECHESNE, Antoine PELLET 1 François THOUVENEL

Veolia Recherche & Innovation, Chemin de la digue - BP76 - 78603 Maisons-Laffitte, France

Climate change will strongly impact water resources and consequently all relying services. In France, for example, hydrological projections are: uncertain trend for rainfall, with most models agreeing on a declining trend in summer precipitation from -16% to -23% ; significant overall decrease in the annual average river flows from 10% to 40% ; nearly general decrease in groundwater levels associated to a 10% to 25% decline of aquifer recharge. Drinking water utilities will be affected. They may need to adapt their production to prevent shortages and continue delivering safe water. It is essential for them to be able to quantify the impact of climate change on water resources and supply availability.

The objective of the project is to estimate the quantitative impact of hydrological climate change scenarios on the availability of water supply at the regional scale, and assess the sustainability of a drinking water production service by the horizon 2050. This communication will present the different stages of this work:

- Construction of prospective hydrological scenarios (2050) on a regional scale,
- Construction of prospective drinking water demand scenarios (2050),
- Simulation with the water supply management model (test case in Western France),
- Result analysis and discussion.

Modeling regional hydrological scenarios was up to recently a real challenge. Our methodology uses regional scale European climate models (EUROCORDEX) and the GR2M hydrological model (IRSTEA) to simulate monthly river flow on our test site in 2050. Firstly, the climate models are used to generate present precipitation and temperature data on 8 km² grid cells. These serve as inputs to the GR2M model to simulate present river flow for comparison with observations, so as to calibrate catchment parameters. Then, the climate models are forced with IPCC emission scenarios to produce precipitation and temperature data on the horizon 2050. These once again feed the GR2M model for simulation of future monthly river flows, which will be inputs to our water supply management model.

Drinking water demand is modeled based on the methodology developed by the French Environment Ministry and its partners in the Explore 2070 project. Key factors of demand evolution are population growth, family structure, habitat, water consumption and distribution network performance, with local geographical considerations. We derived annual scenarios into monthly scenarios to feed our water supply management model.

Signals and indicators of impacts on water resource 1 (chaired by Florentina MOATAR and Marc DESMET, U.Tours, FR)

Veolia developed a tool for the predictive management of water supply during periods of water stress. This optimization model proposes water production strategies that ensure the best balance between water demand and water withdrawals, at the scale of a drinking water production system. The prospective scenarios of river flow and water demand are used as
inputs to the simulations to assess the sustainability of the service by 2050. This methodology is tested on a case in Western France which consists of two drinking water plants and two watercourses, each supplying a reservoir, on a 180 km² area. Our example applies to the production of drinking water, but this methodology could easily be extended to other water uses and allocation issues.

Keywords: Climate change, water resource, water supply, modeling, drinking water.

Signals and indicators of impacts on water resource 1 (chaired by Florentina MOATAR and Marc DESMET, U.Tours, FR)

Oral communication

Tuesday 6th, 11:45

Corresponding author: Sihem Benabdallah
sihem.benabdallah@certe.rnrt.tn

Assessment for Technological Needs for Climate Change Adaptation in Tunisia

Sihem Benabdallah[1]

[1]*Centre de Recherches et des Technologies des Eau, BP273 soliman 8020, Tunisia*

Within a technology need assessment project under climate change adaptation, a national network of experts, representatives of the national stakeholders, addressed a set of activities to identify and prioritize technologies that can contribute to national adaptation goals. The activities were based on a participatory process. For the first step, the selected priority sectors were water resources, agriculture and coastal areas. These sectors were considered representative of the national economy and vulnerable to climate change. In fact, the agriculture represents almost 12% of the GDP. The water resources are already scarce and limited. The coastal areas are under high risks due to probable sea level rise. For each sector, several sets of technologies were identified. For instance, seven technologies were suggested for the water sector. They related to water harvesting techniques, artificial recharge of groundwater, early warning system of floods, intelligent water supply systems and sea water desalination. For the agriculture sector, the suggested technology needs related to the techniques of conservation in agriculture, the agriculture mapping, the mechanisms for payment of environmental services, climatic insurance, use of renewable energy and use of treated wastewater. For coastal areas, recommendation related to the elaboration of decision support systems and follow up environmental indicators, the type of coastal management, the protection from pollution due to industries and agriculture. The second part of this work concerned the identification of the barriers hindering the acquisition, the deployment and the diffusion of the prioritized technologies. Only two options were taken for each sector to be developed into action plans. In this paper, we will expose the methodology used for the identification of technology needs and the barriers in their application as well as the identified results.

Keywords: Climate Change.

Signals and indicators of impacts on water resource 1 (chaired by Florentina MOATAR and Marc DESMET, U.Tours, FR)

Oral communication

Tuesday 6th, 12:00

Corresponding author: Pratima Bhurtun
pratima.bhurtun@ed.univ-lille1.fr

Towards the comprehension of the impact of climate change on surface water quality in Northern France - A case study of the River Selle (France)

Bhurtun Pratima[1], Lesven Ludovic[1], Dumoulin David[1], Criquet Justine[1], Prygiel Jean[1,2], Gorny Josselin[1,3] & Billon Gabriel[1]

[1] LASIR, UMR 8516 – Université de Lille, Cité Scientifique, 59650 Villeneuve d'Ascq, France
[2] Agence de l'Eau Artois-Picardie, 200 Rue Marceline, 59508 Douai, France
[3] Present address : Institut de Radioprotection et de Sûreté Nucléaire (IRSN), PSE-ENV, SEDRE, LELI, Fontenay-aux-Roses, France

The present study aims to better understand the evolution of the water quality of the River Selle (Northern France) in a context of climate change. This study shows the importance of understanding the current dynamics of the water quality and the behaviour of a given river towards dry and rainy periods, before suggesting local scenarios of the impact of climate change on surface water quality.
The sampling strategy consisted of a 4-month high-frequency monitoring of the key parameters of the water quality (conductivity, temperature, turbidity, pH, O_2, NO_3^-, NH_4^+ and PO_4^{3-}) in 2016. A low-frequency monitoring was performed in parallel along the River Selle, combining classical sampling (4 campaigns in 2016) and passive sampling (4 campaigns in 2016 and 2017). A wide range of urban and agricultural tracers was measured during the low-frequency campaigns, notably major and trace elements (Na, K, Ni, Co, Zn, and Cu), anionic species (NO_3^-, PO_4^{3-} and SO_4^{2-}), pesticides (atrazine and its degradation products, propazine and triallate) as well as some pharmaceutical residues and other anthropogenic tracers for wastewater contamination (carbamazepine, diclofenac, gadolinium and caffeine).
This multi-tracer approach helped to estimate the sources and fate of pollution along the river. Several key points will be detailed during the presentation: (i) atrazine and nitrates are excellent tracers of groundwater inputs into the river; (ii) the fluxes of some tracers are proportional to the number of inhabitants in the upper part of the watershed (*e.g.,* Na, K); and (iii) at the mouth of the river, an unexpected sharp increase was recorded for the fluxes of several species (Na, K, Co, Ni, SO_4^{2-}). This finding has been investigated during a last campaign performed in July 2017. Finally, it will be shown that the high-frequency monitoring allows a better understanding of the water quality and the behaviour of some pollutants during dry and rainy periods.

Keywords: River Selle (Northern France), surface water quality, anthropogenic tracers, climate change.

Signals and indicators of impacts on water resource 1 (chaired by Florentina MOATAR and Marc DESMET, U.Tours, FR)

Oral communication

Tuesday 6th, 12:15

Corresponding author: Isabelle COUSIN
Isabelle.Cousin@inra.fr

Evaluating the ecosystem services linked to water in agricultural ecosystems

Cousin Isabelle[1], Tibi Anaïs[2], Constantin Julie[3], Meillet Anne[4], Poméon Thomas[4], Therond Olivier[5]

[1]INRA, UR 0272 SOLS, 2163 avenue de la Pomme de Pin, CS40005 Ardon, 45075 Orléans Cedex 2, France
[2]INRA, UAR 1241 DEPE, 147 rue de l'Université, 75007 Paris, France
[3]INRA, UMR 1248 AGIR, 24 chemin de Borde-Rouge, Auzeville CS 52627, 31326 Castanet-Tolosan cedex, France
[4]INRA, US 0685 ODR, 24 chemin de Borde-Rouge, Auzeville CS 52627, 31326 Castanet-Tolosan cedex, France
[5]INRA, UMR 1121 LAE, Université de Lorraine, 2 avenue de la Forêt de Haye, BP 172 54500 Vandoeuvre-Les-Nancy cedex, France

Soils contribute significantly to ecosystem services, including the production of food and non-food items, and the regulation of many ecological processes: climate regulation, supply of elements for plant growth, control of water quality. In particular, as porous media, they store water and control its flows, whether these are transpired by plants for their biomass production, infiltrated or runoffed to groundwater or surface water, or evaporated toward the atmosphere. In an agricultural context, the evaluation of the ecosystem service "soil capacity to store and return water" is delicate, insofar as the contribution of the farmer, through its agricultural practices in the broad sense (including tillage, irrigation, fertilization, etc...) is constitutive of the agricultural ecosystem.
In this work, we have defined two new indicators of this service for an agricultural context: (i) the annual water yield, i.e. the difference between the amount of water brought by rainfall and irrigation, and the amount of water evapotranspired over a year (a “blue water” indicator), and (ii) the transpiration of the cash crop between its seedling and its harvest (a “green water” indicator). These indicators were assessed throughout the national territory by using the STICS crop model used in 30-years simulations in two situations: on the one hand, when irrigation practices on croplands are in line with actual practices and, on the other hand, when irrigation is suppressed (even on crops where it is traditionally practiced). Our simulations show that the amount of water transpired by the cash crop and the water yield, evaluated in irrigation-free situations, strongly correlated with the soil Available Water Content, and were little dependent on the type of climate or the length of crop rotation. We have also shown that for crop systems containing irrigated crops, the contribution of irrigation to the cash crop transpiration usually exceeds 40%, and can reach 90 % in some situations. The annual water yield, calculated on average over 30 years in the whole country, is not affected by the presence of intermediate crops in the rotation: a regional analysis of this result needs to be further explored, but it opens the door to the development of new ways of managing intermediate crops.

Keywords: soil, crop model, ecosystem services, blue water, green water.

Management of ecosystems and agrosystems as adaptation strategies (chaired by Frédéric ARCHAUX, IRSTEA and Sébastien DUPRAZ, BRGM)

Invited communication

Tuesday 6th, 14:00

Corresponding author: Wilco C.E.P. Verberk
w.verberk@science.ru.nl

Climate change and hypoxia in aquatic ecosystems: Which species are most vulnerable and what can we do?

Verberk, Wilco

[1] *Department of Animal Ecology and Physiology, Institute for Water and Wetland Research, Radboud University, Heyendaalseweg 135, 6525 AJ Nijmegen, The Netherlands.*

In order to predict which species can successfully cope with global warming and how other environmental stressors modulate their vulnerability to climate related environmental factors, an understanding of the underpinning ecophysiological mechanisms is essential. One hypothesis is that with increasing temperature, the demand for oxygen increases more than the rate at which oxygen can be supplied[1]. Consequently, oxygen could become limiting, constraining aerobic energy metabolism necessary for reproduction, growth, and physical activities, including predator avoidance, feeding, and locomotion. The problem of insufficient oxygen under warm conditions may be more immediate in water than in air as aquatic gas exchange is challenging due to the lower rate of oxygen diffusion in water and the larger effort required for ventilation as water has a higher density and viscosity[2]. Moreover, oxygen availability is more variable in an aquatic setting, declining at night and increasing during the day by primary producers, and options for thermoregulation to adaptively modulate body temperature are limited. Consequently, interactions between warming, dissolved oxygen concentrations and organic pollution may be relevant especially in aquatic systems[3]. Drawing on laboratory experiments and field surveys I will address two questions: Which aquatic species are most vulnerable? And what management options do we have? I will show that oxygen limitation limits heat tolerance in some species but not in others and that these species differ in several ways. Monitoring data on stream invertebrates shows that oxygen and temperature interactively restrict abundance of mayflies in the field. Consequently, poor oxygenation lowered optimal stream temperatures. Stream oxygenation could thus be involved in shaping the vulnerability of aquatic ectotherms to global warming. Improving water oxygenation and reducing pollution thus provide key facets of climate change adaptation for aquatic ecosystems.

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Keywords: Body size, Ecophysiology; Heat tolerance; Respiration; Water quality.

Management of ecosystems and agrosystems as adaptation strategies (chaired by Frédéric ARCHAUX, IRSTEA and Sébastien DUPRAZ, BRGM)

Oral communication

Tuesday 6th, 14:30

Corresponding author: Virginie ANQUETIL
virginie.anquetil@agrocampus-ouest.fr

River restoration as an adaptation to climate change: Towards a definition of socio-ecological resilience, the case of Flume river in Britany

Anquetil Virginie [1], Boudes Philippe[1], Elsa Koerner[1], Citeau Laëtitia[2]

[1] UMR6590 CNRS Espaces et Sociétés, Agrocampus Ouest, 65 rue de Saint-Brieuc CS84215, 35 042 Rennes Cedex / France
[2] Syndicat mixte du bassin de la Flume, Mairie de Pacé, 11 avenue Bizeux, 35740 PACE / France

In Britany (France), river basins organisations are concerned with the morphological restoration of rivers to recover a good water quality and a proper ecological and hydrological functioning. However, the implementation of these restoration projects is complex. The involvement of a large spectrum of stakeholders is required to enable them to understand and accept the restoration and its issues, but also to integrate the community values and expectations. Our research program 'Morpheus' studies the participation process in river restoration projects. Adaptation to climate change may be an argument to legitimate ambitious restoration projects, particularly when agricultural activities are impacted.
One of our case studies, the Flume river basin, faces two main issues. First, enhancing the storage capacity of hydrological annexes to insure water supply during drought episodes is a critical issue for human consumption, agriculture and ecosystems health. Moreover, to maintain a sufficient baseflow provides the river's capacity to cope with pollutions rejected by wastewater treatment plants. Both the development of territories and ecosystems' health are dependent on this assimilative capacity of the river.
Secondly, the modifications of land use patterns and river channel cause hydraulic peak-loads phenomenon, leading to floods downstream the river and to a degradation of river's morphology. This phenomenon is amplified by growing urbanisation of surrounding lands and related rainwater runoffs increase. For the restoration to be fully effective, this pressure should be properly addressed and managed. Thus, urban planners and municipalities should be involved in the restoration process.
We would like to explore the social and political construction of rivers and related territories environmental resilience. Based on the literature on hydrosocial systems and socio-ecological systems and mainly through the Flume river basin case study, we address a definition and indicators of socio-ecological resilience from three perspectives: (i) the legitimacy of restoration and its construction throughout the project; (ii) the interface of forms of knowledge about the river's history, its functioning and the issues of its restoration; (iii) the model of governance implemented, either formal or informal, planned or spontaneous.

Management of ecosystems and agrosystems as adaptation strategies (chaired by Frédéric ARCHAUX, IRSTEA and Sébastien DUPRAZ, BRGM)

We assume that socio-ecological resilience results from the construction of these three components and that it evolves through time by constant reframing of the issues and values associated with river restoration. The collaboration with a practitioner of river restoration and management offers a reflexive support to this resilience and will allow us to identify the possible pathways to help rivers and territories to adapt to climate change.

Keywords: river restoration, governance, socio-ecological resilience

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Management of ecosystems and agrosystems as adaptation strategies (chaired by Frédéric ARCHAUX, IRSTEA and Sébastien DUPRAZ, BRGM)

Oral communication

Tuesday 6th, 14:45

Corresponding author: Philippe BALANDIER
philippe.balandier@irstea.fr

Can Mixed Forests Help To Save Water?

Bello Jordan[1], Korboulewsky Nathalie[1], Vallet Patrick[1], Bonal Damien[2], Perot Thomas[1], Seigner Vincent[1], Perret Sandrine[1], Couteau Camille[1], Dumas Yann[1] & Balandier Philippe[1]

[1] Irstea, Research Unit on Forest Ecosystems (EFNO), Domaine des Barres, F-45290 Nogent-Sur-Vernisson, France
[2] INRA, Mixed Research Unit INRA – UL 1137, Forest Ecology and Ecophysiology (EEF), F-54280 Champenoux, France

Water shortage in relation with climate change is endured in many regions and is expected to increase in the next decades. To cope with this increasing pressure, the use of a mixture of tree species is nowadays promoted in commercial forestry instead of the standard monoculture widely practiced. The first objective of establishing mixed forest stands is to maintain productivity under the insurance hypothesis; at least one species of the mixture would resist and be resilient to different biotic and abiotic pressures. A postulate often claimed is that mixed forest stands would also help to save water, under the main hypothesis of niche complementarity; the competition for water would be lesser when two or more different species uptake it at different times, or at different locations. However the literature on the effects of mixing species on the forest ecosystem water balance showed contrasted and sometimes contradictory results. Where and under which conditions the complementary effect occurs remain to be specified.

This question is addressed in the OPTMix project (Oak Pine Tree Mixture, https://optmix.irstea.fr/?page_id=179) designed to test the effect of mixing oak (*Quercus petraea*) and pine (*Pinus sylvestris*) on different functions (wood production, biodiversity, resource availability among which, water) of the ecosystem. Thirty three plots divided in three replications were established in the national forest of Orléans, section of Lorris-Les-Bordes, and where mixed stands were compared to even-aged monospecific stands of either oak or pine. Two stand densities were managed, a relatively high one corresponding to traditional silviculture and a low one, assumed to reduce water consumption by trees at the ecosystem level. In each plot, 3 subplots were set up and designed to measure soil water content at 3 depths (-20, -40 and -60 cm from soil surface) as well as the temporary water table depth. Water resource has been measured every 2 hours and recorded every 12 h in dataloggers since the year 2014. In parallel tree water fluxes and water potentials were measured on critical periods of water deficit.

Management of ecosystems and agrosystems as adaptation strategies (chaired by Frédéric ARCHAUX, IRSTEA and Sébastien DUPRAZ, BRGM)

Data recording and analyses are still in progress. So that preliminary results should be interpreted with caution. There are as follows. Mixing species had overall little influence on the different measured water variables. This probably results from the shallow soils of the Orleans' forest where both species share a reduced soil volume so that roots take off water in the same soil layers. However oak was a little less constrained by drought when mixed with pine, whereas pine was slightly affected by the presence of oak. These results are in accordance with species functional traits, oak regulates little water spending, whereas pine is much more conservative, i.e. its transpiration is reduced during drought. Consequently a little more water is available for oak when neighbour tree is a pine rather than an oak, decreasing thus competition. Consequences at the ecosystem scale will be discussed as far as the water preservation is concerned.

Keywords: Competition, Interaction, Mixture, Oak, Pine

Management of ecosystems and agrosystems as adaptation strategies (chaired by Frédéric ARCHAUX, IRSTEA and Sébastien DUPRAZ, BRGM)

Oral communication

Tuesday 6th, 15:00

Corresponding author: Dalenda MAHJOUB BOUJNAH
dalenda_boujnah@yahoo.fr

Assessment of the olive tree adaptation to water stress and tool to increase crop performance in the context of climatic changes

Boujnah D[1]., Bel Hadj Sghayer A[2], Ben Salem A[2], Mahjoub Z[1], Lamari S[1], Chikhaoui B[1], Chehab H[1].

[1]*Institut de l'Olivier Station de Sousse BP.14 -4061 Sousse, Tunisie*
[2]*Institut National Agronomique de Mariem Sousse, Tunisie.*

Global climate change will introduce substantial changes to the agricultural ecosystems and consequently will affect the agricultural productivity. Water stress is the most important factor limiting plant growth and production. Thus, monitoring of plant water status in field grown is considered of great interest, as it would allow the diagnoses of the onset and severity of water stress so as to optimize the cultural practices according to the actual plant needs. Changes in plant water status could be described by using a sensitive physiological indicator, which integrates both soil and climatic conditions. The aim of our study is to evaluate a quantitative direct relationship of the olive tree water status and the environmental conditions that might be used to evaluate the response of the tree to some unconventional cultural practices: use of hydro absorbent, reducing transpiration area by pruning and providing supplement water of traditional olive tree grove. For online control water plant state techniques we used: the leaf patch clamp pressure probe (LPCP) which give information about the relative changes in turgor pressure (Pc) of the monitored plant.
The results of the LPCP measurement allowed us to have accurate information on the hydraulic behavior of the olive trees and the efficiency of hydro absorbent injected in the soil to enhance the effect of the available water. Indeed, we found that the effect of the water provided by the hydro-absorbent doesn't act directly on the olive trees as is the case of direct water supply; its effect is delayed for a few days. This product can be used effectively to support the tree during periods of intense biological activity. The results related to tree pruning show that in case of moderate pruning (reduction in foliage volume by 50%) plant support the water deficit better than the plant with severe pruning trees (reduction in foliage volume by 80%).

Keywords: Irrigation, pruning, hydroabsorbent, water stress.

Management of ecosystems and agrosystems as adaptation strategies (chaired by Frédéric ARCHAUX, IRSTEA and Sébastien DUPRAZ, BRGM)

Oral communication

Tuesday 6th, 15:15

Corresponding author: Nathalie OLLAT
Nathalie.ollat@inra.fr

Wine and water: which challenges?

Ollat Nathalie[1], Lebon Eric[2], Garcia de Cortazar-Atauri Inaki[3], Ojeda Hernan[4], Saurin Nicolas[4], Prévot Laurent[5], Simonneau Thierry[2] & van Leeuwen Cornelis

[1]EGFV, Bordeaux Sciences Agro, INRA, Université de Bordeaux, ISVV, 210 chemin de Leysotte, 33882 Villenave d'Ornon, France
[2]LEPSE, INRA, Montpellier SupAgro, 2 place Viala, 34060 Montpellier, France
[3]AgroClim, INRA, Centre de recherche PACA, 228, route de l'Aerodrome CS 40509, 84914 Avignon, France
[4]UE0999 Pech Rouge, INRA, 11430 Gruissan, France
[5]LISAH, INRA, Montpellier SupAgro, 2 place Viala, 34060 Montpellier, France

As for other crops, water is a decisive environmental factor which controls yield and quality in grape growing. Grapevine is very drought tolerant which can adapt to low water availability because it can develop a deep root system and control efficiently water loss by transpiration. There are large differences among varieties and rootstocks for their responses to drought. Yield is the most sensitive parameter, but severe drought can also affect negatively fruit composition and wine quality. However in vineyards located at and above the 45° parallel, and for red wines, the best quality is usually obtained for the driest years so far. For wine making purpose, grapevine has been (is still) grown rainfed for ages in many Mediterranean countries. A combination of drought tolerant varieties/rootstocks and efficient training systems (low planting density, low vigour, no trellis, appropriate soil management) ensured sustainable conditions for grape growing. Until recently, irrigation was not allowed in French vineyards. Under the pressure of the industry and because drought problems have been more severe for the last 20 years, irrigation is now permitted with restrictions within "Appellation" areas. Currently about 3% of the French vineyard has access to water for irrigation. Substantial experimental work was performed to design watering strategies based on the vine water status and the required target in terms of wine quality, and to use alternative sources of water. Several projects were also dedicated to the analysis of grapevine drought tolerance in order to select more adapted plant material.

Even if uncertainties are larger for precipitation than for temperature, there is a high probability that rainfall may decrease during the XXIst century, especially in the South of Europe, and that drought may become more severe, especially in summer. Technical strategies to sustain grape growing in terms of water management have to be questioned seriously. In the future, would the grape production industry rely on irrigation or should it choose more sustainable ways to cope with drought?

Management of ecosystems and agrosystems as adaptation strategies (chaired by Frédéric ARCHAUX, IRSTEA and Sébastien DUPRAZ, BRGM)

On one side, yield is a major component of the economic sustainability in Mediterranean vineyards, and irrigation is a short-term solution, fairly easy to implement, as long as there is access to water. In addition, water requirements of vineyards are low in comparison with other crops. The management of water supply is also possible in order to smooth the inter-annual variability of precipitation. On the opposite, the development of irrigation facilities is expensive both at individual or collective bases. In addition, water will probably become a scarce resource which will be shared among several uses. Agriculture will be one recipient. As most grapes are not used for alimentary purposes, there is no guarantee that vineyards will get any priority when this resource will become limiting for agriculture. Some problems have already been reported for irrigated vineyards in south of Spain.

Consequently research needs to provide all the information required to define strategies allowing for the maintenance of economically sustainable vineyards in areas where water may become a limiting parameter. An overview of these strategies will be given.

Keywords: grapevine, drought, training systems, varieties, water saving

Management of ecosystems and agrosystems as adaptation strategies (chaired by Frédéric ARCHAUX, IRSTEA and Sébastien DUPRAZ, BRGM)

Oral communication

Tuesday 6th, 15:30

Corresponding author: Elisa Marguerit
elisa.marguerit@agro-bordeaux.fr

The use of genetic variability in plant material of the grapevine: an environmentally friendly way to adapt to increasing drought

Marguerit Elisa[1], van Leeuwen Cornelis[1], Simoneau Thierry[2] & Ollat Nathalie[1]

[1] *UMR EGFV, Bordeaux Sciences Agro, INRA, Université de Bordeaux, F-33882 Villenave d'Ornon, France*
2 UMR LEPSE, INRA, SupAgro Montpellier, F-34000 Montpellier, France

A large proportion of vineyards in the world faces seasonal drought, where atmospheric and edaphic water deficits, together with high temperature and irradiance, exert large constraints on yield and possibly also on grape quality. While grapevines are mostly non irrigated, especially in Europe, there is a substantial risk of more frequent and more severe droughts in the near future due to climate change. These new challenges for the international wine industry will require adaptations in viticulture, which may arise from both an appropriate exploitation of genetic diversity in plant material and a better understanding of plant response to water deficit. From an agronomical point of view, adaptation must be defined to maintain yield and target fruit composition under increasing water limitations.
The genetic variability can be explored at three levels: the rootstock, the variety and the clone (*i.e.* genetic variability within cultivated grapevine varieties). In recent years, research in ecophysiology evidenced a large diversity of responses to drought, originating both from scions and rootstocks. New methods have been developed for characterizing scions and rootstocks with regard to their susceptibility to drought conditions. Genetic determinism of some key traits has been unraveled, in particular the amount of biomass produced per volume of water transpired, *i.e.* water use efficiency.
Clonal selection largely exploited the genetic variability within cultivars. During the XXth century, the priority used to be the selection of early ripening and high sugar producing clones. However, today, new clones have to be selected on opposite criteria.
Rootstocks are highly variable in their adaptation to dry conditions. Although drought tolerant and drought sensitive rootstocks are well identified in the vineyard, the mechanisms involved in drought tolerance are poorly understood. The Greffadapt project was set up at the Institut des Sciences de la Vigne et du Vin (ISVV) in Bordeaux to compare French and non-French rootstocks in their tolerance to water deficit. Quantitative classifications were built to characterize the different strategies developed by drought tolerant rootstocks.
The Vitadapt project was set up at the ISVV to study the behavior of a wide range of varieties in a context of climate change. Differences in drought tolerance among grapevine varieties have been reported, although the mechanisms involved are not fully understood. A classification of these varieties with regard to drought tolerance has been undertaken based on phenological responses and indirect estimates of water used efficiency.

Management of ecosystems and agrosystems as adaptation strategies (chaired by Frédéric ARCHAUX, IRSTEA and Sébastien DUPRAZ, BRGM)

In previous projects, quantitative genetics revealed several genomic regions as being involved in the genetic architecture of transpiration rate, water use efficiency, hydraulic conductivity and water extraction capacity. At the scion level, such genomic regions were involved in the variability of water use efficiency and reduced transpiration rate at night. At the rootstock level, one genomic region was specifically implicated in the variability of water extraction capacity. These results open new horizons for breeding crops with high water-use efficiency.
Beyond the selection of new rootstocks and scions adapted to climate change, defining ideal rootstock/scion combinations comes forward as the next, likely more complex challenge. This will be one objective of an INRA metaprogram LACCAVE.

Keywords: variety, rootstock, clone, water deficit, $\delta^{13}C$.

Technical innovation for water resource management (chaired by Nathalie DÖRFLIGER, BRGM, FR)

Oral communication

Tuesday 6th, 16:15

Corresponding author: Martin Drews
mard@dtu.dk

Challenges of Data Availability for Analysing the Water-Energy Nexus

Larsen Morten Andreas Dahl[1], Drews Martin[1], Petrovic Stefan[1], Engström Rebecka[2], Liersch Stefan[3], Karlsson Kenneth Bernard[1] and Howells Mark[2]

[1]Technical University of Denmark, Produktionstorvet, Building 426, 2800 Kgs. Lyngby
[2]KTH Royal Institute of Technology, Brinellvägen 68, S-100 44 Stockholm, Sweden
[3]Potsdam Institute for Climate Impact Research, Telegraphenberg A 62, 14473 Potsdam, Germany

Resolving the competing demands of interrelated water, energy and food systems is in many regions of the world a matter of critical mutual interest to policy-makers, practitioners, scientists and society in general. Thus, challenges connected with, e.g., population increase, migration, food shortages, water scarcity and insufficient energy resources demand solutions. In addition, climate change is likely to influence many of these factors, in particular concerning changes in the variability and availability of water for human and natural systems, calling for effective adaptation of infrastructure and management practices.

Analyzing the interdependencies of water-energy-food (WEF) nexus, e.g., as a basis for inter-disciplinary dialogue between different actors, at different spatio-temporal scales, across sectors, and climatic conditions, requires systematic approaches, ranging from purely qualitative methodologies to the use of comprehensive integrated modelling tools. This in turn prescribes the availability of data and indicators of varying complexity on different sub-domains of the WEF nexus, considering whether the context is policy discussion or complex quantitative modelling of water management scenarios. Further, detailed information on how the different elements of the nexus relate to each other like water usage by energy and food production, energy consumption by water treatment processes, etc. is required.

In this study, based on a small set of conceptual case studies, we examine specifically the linkage between water and energy systems, highlighting the availability and relevance of commonly used data sources from the domains of water, climate and energy. The reviewed data sources include data sets and indicators, provided by, e.g., the World Meteorological Organization (WMO), COordinated Regional climate Downscaling EXperiment (CORDEX), European Space Agency (ESA), European Environment Agency (EEA), and the World Bank.

What we find is that comprehensive and integrated data sets or indicators spanning in a consistent way all three domains of water, climate and energy under current and climate change conditions are mostly lacking. The alternative, i.e. to use recorded estimates of water usage from the literature as means to bridge the gap between water and energy systems, is likely to introduce large uncertainties due to considerable variations in existing assessments.

Regional hydro-climatic conditions, local regulations, power plant technology and optimization, erroneous reporting, etc. are typical causes of this variability. Finally, there is an evident mismatch between the spatio-temporal resolution of existing hydrological data and hydro-climatic projections and the currently available energy systems data.

To further support quantitative WEF nexus studies, we therefore, ambitiously, recommend an effort towards a cross-discipline coordinated, transparent, and sustained open-access data framework holding energy sector water usage information at fine spatio-temporal scales alongside hydro-climatic observational and modelled data using common forcing, scenarios and assumptions.

Keywords: Water-energy nexus, water-energy data, energy systems, integrated management, natural resources.

Technical innovation for water resource management (chaired by Nathalie DÖRFLIGER, BRGM, FR)

Oral communication

Tuesday 6th, 16:30

Corresponding author: Raed FEHRI
raed.fehri@uclouvain.be

Together4Water: Implementing an open-source database to monitor SDG related water indicators in Tunisia

Fehri Raed[1], Van Grootenbrulle Antoine[2], Vanclooster Marnik[1], Mens Kim[2] & Khlifi Slaheddine[3]

[1]Université catholique de Louvain/Earth and Life Institute, Address: Croix du sud 2, 1348 Louvain-la-Neuve (Belgique), Country: Belgium
[2]Université catholique de Louvain/ICTEAM, Address: Place Sainte Barbe 2 - 1348 Louvain-la-Neuve, Belgium
[3]Ecole Supérieure des Ingénieurs de Medjez El Beb (ESIM), Address: Medjez El Beb, Country: Tunisia

Together4Water is a scientific project that aims at designing and implementing a participatory approach to monitor the implementation of water-related Sustainable Development Goal (SDG-6) in Tunisia at the scale of the Medjerda Catchment. The Medjerda catchment is the most important river basin in Tunisia. It plays a sensitive economical role at national and regional level, but also at international level, as it is a transboundary catchment with 30% of the basin situated in Algeria. The catchment is expected to be heavily impacted by climate change.
The proposed monitoring concept is coherent with the indicators' framework that is negotiated at the UN level (UN Statistical Commission) but consider the specificity of current and future water data infrastructure of the Medjerda catchment. Two key pillars in order to meet SDG-6 are data availability and quality. It is necessary to provide not only large amount of diverse data but also high quality data.
We collected and formatted existing hydrometrological data and augmented the data with water related data that can be inferred from open source platforms. Google Earth Engine, an open-source cloud-based tool, was used to analyze and extract remote-sensed data for the catchment such as NDVI, land cover … Data quality was enhanced through statistical data quality assessment procedures and metadata reinforcement of each dataset. For increasing water data availability even more, we've added an open-source online platform allowing to process data that can be collected using a Citizen Science approach. In order to provide high quality data-sharing and visualization, the architecture of the designed database is based on the open-source standard, Open Geospatial Consortium (OGC), involving WaterML 2.0 for data standardization and Web Map Service (WMS) together with Web Prosessing Service (WPS) and D3.js for data visualization. Lastly, a prototype of the platform with historical processed and quality-enhanced data is available. An upgraded version, currently under development, will provide feedback on the participatory approach of the project, which will be tested in 2018, together with visualization of collected data.

Keywords: Sustainable Development Goals, Open-source, Google Earth Engine, Indicators, Water resources management.

Technical innovation for water resource management (chaired by Nathalie DÖRFLIGER, BRGM, FR)

Oral communication

Tuesday 6th, 16:45

Corresponding author: Sonja BEHMEL
sonja.behmel.1@ulaval.ca

Intelligent decision support system to plan, manage and optimize water quality monitoring programs based on a participative approach

Sonja Behmel[1], Mathieu Damour[2], Ralf Ludwig[3], Manuel J. Rodriguez[1]

[1] *Université Laval, Canada*
[2] *DATALEA, France*
[3] *Ludwig-Maximilians-Universitaet Muenchen, Germany*

Hydrologic alterations induced by climate change as well as land use changes are impacting water quality and quantity of surface waters and groundwater. These changes must be monitored through water quality monitoring programs (WQMPS) in order to provide stakeholders with the necessary information to adapt to these changes and implement management strategies accordingly. Also, WQMPs must be adapted to the knowledge needs related to climate change, targeting at an higher level of awareness and preparedness for the possible range of upcoming challenges; such considerations will further help to improve models that predict changes of water quality and quantity under different land use and climatic scenarios.

Integrated watershed management (IWM) is employed to achieve targets on preventing and managing water pollution; being forward looking and adaptive, it must take climatic changes into account. IWM faces two major challenges: (1) to get a reliable assessment of surface water quality and quantity through water quality monitoring programs (WQMPs); and (2) to encourage stakeholders to get more involved in the decision-making processes regarding water resources protection. Planning, managing and optimizing WQMPs are very complex processes due to the number of stakeholders involved and the variety of factors that must be considered in the process: monitoring objectives, sampling location, water quality parameters, sampling frequencies, field and laboratory logistics, communication of results, availability of human, financial and technical resources, etc.

This study develops the conceptual model of an intelligent decision support system (IDSS) to assist watershed managers in the planning, managing and optimizing of WQMPs. The IDSS's conceptual model is based on an information collection methodology consisting in a review of the literature, a series of interviews conducted with forty-four international water quality experts (from Canada, the United States, Germany, France, Switzerland and Spain), meetings with information technology specialists, and workshops with potential end-users. The conceptual model is mainly described in the unified modeling language. The sequence of operations performed by the system (use cases) and related deliverables (use case scenarios, libraries, decision support trees, etc.) are described according to the concepts of agile development and use case 2.0.

Technical innovation for water resource management (chaired by Nathalie DÖRFLIGER, BRGM, FR)

A participatory approach is developed to identify all concerns from interested stakeholders in a watershed—both organizations and citizens—regarding water quality. This approach involves three steps: stakeholder analysis, conduction of an on-line survey featuring an interactive map, and organization of workshops with stakeholders responsible for water management. The aim of these workshops is to assess the achievement of past monitoring objectives and to identify future objectives and needs of a WQMP.

In this conference, we propose to present (1) the results of the information gathering on the planning, management and optimization of WQMPs; (2) the IDSS's conceptual model as well as some of the completed software features; (3) the results of the pilot tests of the participatory approach implemented in two watersheds located in the Province of Quebec, Canada; and (4) the implications and challenges of better including climate change information in the decision support process.

Keywords: decision support, water quality, monitoring, water resources management, climate change, participatory approach.

Technical innovation for water resource management (chaired by Nathalie DÖRFLIGER, BRGM, FR)

Oral communication

Tuesday 6th, 17:00

Corresponding author: Julien ORSONI
julien.orsoni@vendee-eau.fr

JOURDAIN: Project of an Indirect Potable Reuse (IPR) demonstrator in Vendée to face water scarcity

Jérôme BORTOLI[1], Julien ORSONI[1]

[1]*Vendée Eau, 57 rue Paul-Emile Victor, 85000 La Roche sur Yon, France*

The current situation of water availability in Vendée is approached by the WULCA working group which developed the AWARE index to describe the pressure on the water resource all over the world. AWARE is to be used as a water use midpoint indicator representing the relative Available WAter REmaining per area in a watershed, after the demand of humans and aquatic ecosystems has been met. The last AWARE publication (2016) highlights that the Vendée coastal area is suffering high water stress the water scarcity. Furthermore the French Environment Ministry lead in 2013 a big prospective study in order to estimate the anthropic pressure and the future water needs taking into account the population growth, the climate change and the adaptation and mitigation measures at 2070 time horizon. Vendée appears as a region where freshwater withdrawals for drinking water needs are to increase. Hence, regardless of the adaptation to climate change scenario, the Vendée coastal area emerges as the only French region with a lack of water for drinking water needs during a dry year in 2070. On the basis of these scientific evidences, it is essential to implement a territorial strategy to integrate the effects of climate change on the sustainable and integrated management of water resources. VENDEE EAU, the public body in charge of water supply on the Vendée department (264 municipalities, 600.000 inhabitants), produces 40 millions m3 of drinking water per year, mainly from surface resources. VENDEE EAU has developed a large range of solutions to balance the risk of water shortage for future generations, including indirect potable reuse (IPR). In order to face an estimated water deficit of 8 millions m^3 during a hot year, indirect potable reuse from a coastal WWTP (Sables d'Olonne) could complete the volume of a fresh water reservoir (Jaunay) used for drinking water production. On account of the absence of regulations and unprecedented cases of IPR in France, VENDEE EAU envisions the implementation of a 1:4-scale demonstrator ("JOURDAIN") during the 2018-2024 period including: tertiary treatment unit, transfer pipe, discharge zone and an extensive analytical program, supported by a social acceptance accompaniment. The demonstration step will give the opportunity to precisely define the impacts of the reuse discharge in the aquatic compartments and to demonstrate that this system meets all the sanitary and environment requirements. Reuse of treated wastewater for all types of use (not only irrigation and watering) should be part of the solutions for adaptation to climate change for the French and European territories. The example of the JOURDAIN project of IPR demonstrator in Vendée is intended to expose the approach undertaken by the territorial community and the difficulties to overcome for the implementation of such an innovative solution.

Keywords: Water Reuse, recycling, demonstrator, experimentation.

Technical innovation for water resource management (chaired by Nathalie DÖRFLIGER, BRGM, FR)

Oral communication

Tuesday 6th, 17:15

Corresponding author: Ewert Aukes
e.j.aukes@utwente.nl

Climate change adaptation in coastal systems: Framing for adoption of innovative technologies

Ewert Aukes[1]

[1]*University of Twente, Faculty of Behavioral, Management and Social Sciences, P.O. Box 217 7500 AE Enschede, The Netherlands*

In densely-populated coastal areas, balancing spatial interests is a challenge. Where space is scarce, policy-makers have to take into account demands for recreational, economic, and nature areas. Climate change-induced sea-level rise adds to this pre-existing complexity. If policy-makers intend to balance all of these demands, while at the same time adapting to climate change, innovation in coastal protection technologies is one way to go. Two coastal projects at the Dutch North Sea coast – the 2011 Sand Motor and the 2013 Hondsbossche Duinen projects – attempted to find an answer to this complex spatial planning challenge. In these projects, mega-nourishment schemes, i.e. large-scale sand depositions in front of or on the beach, presented as innovative technology, were constructed to improve spatial functions. The present paper explores how forms of meaning-making by actors involved in the policy processes have led to the implementation of these mega-nourishment schemes as answers to coastal safety and spatial planning challenges. Specifically, the paper studies aspects of policy framing in retrospective accounts of involved actors. For both cases, a set of actors who actively participated in the design and decision-making processes of the two projects were interviewed (Sand Motor: fourteen interviewees; Hondsbossche Duinen: eleven interviewees). Based on these in-depth accounts, an interpretive analysis distinguished different aspects of framing at work in the two cases. These aspects of policy framing include the policy substance of the present frames, scale characteristics of those frames, characteristics of framing interactions, and characteristics of the framing performers. The specific expressions of these framing aspects were compared as contextually unique ways of dealing with the problem of protecting coastal areas against sea-level rise while taking into account complex spatial demands. Three main findings with regard to framing are distilled from the two cases. First, both projects benefitted from the presupposed multifunctionality of mega-nourishments, albeit in different ways. Multifunctionality allows for tailor-made framing interactions, because different functions may be highlighted, depending on the receiver of the message. The advantage of the multifunctionality characteristic also translates into the degree of transcendence of scale frames in both projects. Designing a mega-nourishment allows thinking outside the location of the sand deposition. Furthermore, a broad range of actors was included in the decision-making process. Second, with regard to the framing interactions, the experience of urgency distinguishes the experimental Sand Motor case from the Hondsbossche Duinen case, which was non-experimental.

In the Hondsbossche Duinen case, the livelihoods at stake made for more conflict in the process of finding suitable project design. Third, the cases differ in the role of individual actors as interpretive policy entrepreneurs. The provincial government in charge of the Sand Motor project was capable of argumentatively convincing other actors to join the epistemic community. Instead, there was not such a clear argumentative protagonist in the Hondsbossche Duinen case. As such, the cases in this paper are useful examples for both scholars and practitioners for how framing influences the adoption of innovative climate change adaptation technologies.

Keywords: Coastal governance; Interpretive policy analysis; Framing; Comparison; The Netherlands

Wednesday, February 7, 2018 VINCI - Amphitheater Descartes

08h30		*Welcome*
Governance and water management (chaired by Corinne LARRUE, UPEC, FR)		
08h30-09:00	**Hans BRESSERS, *Keynote speaker***	**Analysing the quality of the governance context for multi-stakeholder adaptive river management**
09h00-09h15	**Aubin, La Jeunesse, Riche & Vande Water**	The central role of basin authorities in the governance of water: A social network analysis of the Thau Basin in France
09h15-09h30	**Ebrahimiazarkharan, Ghorbani, Malekian & Bressers**	The analysis of social relations of water resources beneficiaries networks toward water resources co-management and adaptation in the face of the effects of climate change (Case study: Iran, Taleghan watershed)
09h30-09h45	**Fournier, Bonnefond, Gatien-Tournat, Gralepois & Servain**	What challenges for land use governance in wetlands, in a context of climate change? The case of the Ile Saint Aubin (Angers, France)
09h45-10h00	**Lordkipanidze, Lulofs & Bressers**	Towards a new model for the governance of the Weerribben-Wieden National Park
10h00-10h15	**Touchard**	The Truth is out there": urban governance in the age of ecological uncertainty – The Wetlands issue in Bordeaux Metropole (France)
10h30		*Coffee Break*
Poster session		
Signals and indicators of impacts on water resource 2 (chaired by Haykel SELLAMI, CERTE, TU)		
11h15-11h30	**Seguin & Wuilleumier**	Looking for trends within the water cycle of the “gave de Pau” and “gave d'Oloron” catchment areas
11h30-11h45	**Folton, L’Hermite, Martin & Arnaud**	Observed impact of climate change on the water resources of a small Mediterranean catchment (the Réal Collobrier, France)
11h45-12h00	**von Trentini, Schmid, Willkofer, Wood & Ludwig**	Climate indicators and their local hot spots in Bavaria, Germany, derived from a large ensemble of climate models
12h00-12h15	**Vrzel, Ludwig, Vizintin & Ogrinc**	Multi-tool simulations to assess the hydrological system behavior of the Ljubljansko polje aquifer under climate change conditions
12h15-12h30	**Mougin, Vigier, Bessière, Nicolas & Loigerot**	MétéEau des nappes, a tool able to show impacts of climate change on groundwater resource at local scale
12h30-13h00	**Concluding remarks CCW2018 by Isabelle LA JEUNESSE and Sylvain PINCEBOURDE**	
14h00		**Excursion to Amboise – Château Royal (end ~ 17h30)** **www.chateau-amboise.com**

Governance and water management (chaired by Corinne LARRUE, UPEC, FR)

Invited communication

Wednesday 7th, 08:30

Corresponding author: Hans Bressers
hans.bressers@utwente.nl

Analyzing the quality of the governance context for multi-stakeholder adaptive river management

Bressers, Hans[1] & Bressers, Nanny[2]

[1]*Affiliation: University of Twente, Enschede, The Netherlands*
[2]*Affiliation: Vindsubsidies consultancy, Goor, on behalf of Water board Vechtstromen, Almelo, The Netherlands*

Climate change has modified weather patterns all around Europe, not only by rising temperatures, but moreover by making rainfall more extreme, with both more intense showers and longer dry periods. Rain fed rivers are vulnerable for the resulting variation in water flows, especially the ones that have a relatively small catchment area that is affected by the same weather events in the whole area.

Interventions in the water system to make it more robust under varying and more often extreme weather conditions are in many cases long-term, thus dynamic, implementation processes that affect many existing interests and thus are also very complex. Implementation of such climate adaptation strategies is only possible under supportive governance conditions, including multi-level integration, good relations between many public and private stakeholders in networks, acknowledgement and respect for varying problem perspectives, mutually reinforcing concrete measures and clear responsibilities and adequate resources assigned for their application. Such supportive governance conditions are far from common, while the degree to which they are fulfilled can make or break adequate climate adaptation. To analyse the degree of supportiveness of a governance context a Governance Assessment Tool (GAT) has been developed (Bressers, Bressers & Larrue 2016) valuing its extent (completeness), coherence, flexibility and intensity. It has been and is currently applied in several cases in The Netherlands, United Kingdom, Germany, France, Belgium, Sweden, Denmark, Romania, Turkey, Palestine, Iran, Vietnam, Mexico and Canada. In the first part of the presentation this method to assess the degree of supportiveness or restrictiveness of the governance context will be explained. In a second part, it will be illustrated by a real-life case.

The illustrative case that is central in this presentation is that of River Vecht. River Vecht is often labelled as the smallest of the Dutch main rivers and the largest of its small rivers. From its source in Germany, River Vecht runs for 167 kilometres, of which some 60 kilometres in the Netherlands. At the beginning of the twentieth century this was still 85 kilometres, but during the first decades of that century many meanders were cut off. All in all, the river was changed into a “heavily modified water body”, geared towards efficiency for agriculture under stable hydrological conditions.

In 2007, the initiative was taken to start a large scale multi-stakeholder program "Space for River Vecht", with aside from goals as flood safety, spatial quality and biodiversity also supporting the tourism industry and community identity. Although the Province took the lead and provided millions in co-funding, the actual realization of integrated projects the program depends on the collaboration of all partners. These partners are water boards, municipalities, and NGO's related to nature, industry and agriculture. Examples of projects conducted thus far are: re-meandering, art, cultural history, improved flood defence, widening, cityscaping towards the river, restoration of soft natural river banks for flora and fauna, nature development, side-riverbeds for high water levels, parks and playgrounds alongside the river, hiking paths, bicycle routes, wharfs for small boats, promenades, small locks 50 cm deep, and watch towers with view on Vecht valley. The program has a long-term outlook that runs until 2050 envisioning to make Vecht a "semi natural lowland river". Its multiple stakeholders and ambitions and long time horizon gives its implementation a complex and dynamic character, requiring a very supportive governance context.

In an initial analysis, the governance arrangements of the programme were assessed as supportive, reflected by a successful implementation. This situation is however far from stable as the Province announced to withdraw after 2018, no longer providing budgets and guidance. The Governance Assessment Tool forecast for this period was therefore quite negative. New governance arrangements need to be found to bend this future into a more supportive governance context for the period after 2018. This was the purpose of the project reported here. On the basis of interviews with the stakeholders and in frequent interaction with the Program Team in which all partners are represented, various scenarios were developed and later discussed with decision makers. The advice based on these interactions (the "preferred scenario") was again assessed with the governance assessment tool. The study illustrates how an integrated program can turn the challenge of climate change adaptation into an opportunity, the dependence of the implementation of such programs on adequate governance conditions, and the usefulness of the GAT as a device for the interactive development of governance arrangements.

Keywords: governance assessment; integrated programs; climate change adaptation; stakeholder cooperation.

Governance and water management (chaired by Corinne LARRUE, UPEC, FR)

Oral communication

Wednesday 7th, 09:00

Corresponding author: Cécile RICHE
cecile.riche@uclouvain.be

The central role of basin authorities in the governance of water challenges induced by climate change: A social network analysis of the Thau Basin in France

David Aubin[1], Isabelle La Jeunesse[2], Cécile Riche[1] & Vincent Vande Water[1]

[1] *Université catholique de Louvain, Belgium*
[2] *Université de Tours, France*

Due to the effects of global warming, water management has become more complex because water is a non-excludable resource. Increased water scarcity creates rivalries between water users for the access and use of the resource. Since 1992, the French government has elaborated the water management and development plans (*Schéma d'aménagement et de gestion de l'eau*, SAGE). In 2015, 179 SAGE were approved of which 108 already implemented throughout the French territory. In line with the European Water Framework Directive, these local plans aim at allowing an integrated and concerted water management that combines environmental protection with the human-induced water usages. They rely on a water basin authority which designs and implements the plan in a consensual way and encourages the definition of common goals between the local users. The aim of this communication is to question the actual role of the basin authority and asks whether it is central in the local water management. Alternatively, some major stakeholders or public authorities may be the de facto decision-makers in the distribution of the water uses. It will also determine if, in the future, this basin authority will still be central in dealing with the rivalries generated by climate change and increased water scarcity. The communication relies on a case study conducted in the Thau basin in 2012. Drawing on social network analysis, a method used to visualize and describe social structures, it identifies the actors which occupy central positions and hold effective power. Specifically, the analysis looks at three measures of centrality linked to different forms of power: degree centrality, from which derives direct influence, closeness, which determines how quickly an actor may influence the whole network and brokerage, which identify actors that may exert control over the flow of information by bridging otherwise non-connected actors. As a result, we will observe whether the key actors of the SAGE, in particular the local water basin authority, are indeed central actors and whether there is a difference between "jure" governance and "de facto" governance in the Thau case. The results of this synchronic survey will be extrapolated to assess the consequence of climate change and the capacity of the local institutional arrangement to resolve the resulting rivalries between users. This extrapolation will use the projections at the horizon 2040-2060 from the models used in the CLIMB research project which have combined hydrological models with climate models in order to predict the influence of climate change on water in the Mediterranean regions.

Keywords: social network analysis, integrated water management, climate change, rivalries, actual governance

Governance and water management (chaired by Corinne LARRUE, UPEC, FR)

Oral communication

Wednesday 7th, 09:15

Corresponding author: Fariba Ebrahimiazarkharan
F.aebrahimiazarkharan@utwente.nl

The analysis of social relations of water resources beneficiaries networks toward water resources co-management and adaptation in the face of the effects of climate change (Case study: Iran, Taleghan watershed)

Fariba Ebrahimiazarkharan[a], Mehdi Ghorbani[a], Arash Malekian[a], Hans Bressers[b]
[a] *Faculty of Natural Resources, University of Tehran, Karaj, Iran*
[b] *Department of Governance and Technology for Sustainability (CSTM), University of Twente, Enschede, The Netherlands*

Temperature and moisture regimes have an important influence on the distribution, growth, and reproduction of plants and animals. During the past 100 years, the earth's climate has warmed on the Northern Hemisphere have become significantly wetter. Plants and animals also respond to secondary and higher order effects of increasing global temperature and changes in precipitation patterns. All these changes take place in a system where all the ecological and human conditions interact directly and indirectly. The human-environmental system must be managed in such a way that the bad effects are as low as possible. On the other hand, natural changes are partly beyond human management. But human beings need to pay more attention to future developments to enable timely adaptive measures and prevent developments that worsen the situation. In the literature the importance of an adequate water governance approach for this purpose is emphasized. In this paper we will focus on one very important aspect of such adequate water governance, being the aspect of social cohesion among stakeholders. Social cohesion, including trust relationships, is essential to enable collaborative measures to increase or protect the quantity and quality of water resources in order to increase the resilience of the watershed. In this paper, in a small pilot in a warm and dry country (Iran), the amount of trust and cooperative relations among 28 organization that effect on water resources were analyzed, using a social network analysis method (SNA) and using (UCINET & NETDRAW) software to analyze density and cohesion indices. This research shows the social cohesion as an important factor for the ability of a human-ecological system to adapt to climate change. This is even so while this part of the governance context is subject to policy and managerial changes in all national, provincial, and local sectors. In this research the Taleghan watershed, north of Alborz, 120 Km north west of Teheran in Iran acts as a pilot area at local level. One of the conclusions that was reached is that there are many conflicting relationships. Organizations work at different levels that make it hard to manage. One of the most important issues is the lack of coordination and consensus on strategies, and another is the inappropriate distribution of financial resources between organizations at different levels. The main issue is the management from top to bottom level. Most conflicts occur between the development oriented and conservation oriented organizations. These conflicts seem inevitable given the scarcity of water resources in Iran regarding the global climate change on one hand and the needs for development on the other hand. But this observation also points to the important role of more central network organizations to solve problems and decrease conflicts.

Keywords: Climate change, Water Governance, Human-Ecological System, Trust and cooperation relationships.

Governance and water management (chaired by Corinne LARRUE, UPEC, FR)

Oral communication

Wednesday 7th, 09:30

Corresponding author: Marie FOURNIER
marie.fournier@lecnam.net

What challenges for land use governance in wetlands, in a context of climate change? The case of the Ile Saint Aubin (Angers, France)

FOURNIER Marie[1,2], BONNEFOND Mathieu[1,2], GATIEN-TOURNAT Amandine[3] Mathilde GRALEPOIS[2], Sylvie SERVAIN[2]

[1]Laboratory of Geomatics and Land tenure (GeF), CNAM/ESGT, 1 boulevard Pythagore, 72000 Le Mans, France.
[2] CITERES, Université F. Rabelais de Tours/MSH, 33 allée Ferdinand de Lesseps, 37200 Tours, France.
[3] ESO Le Mans (Espaces et Sociétés), Le Mans Université/MSHS, Avenue Olivier Messiaen, 72000 Le Mans, France.

In the context of climate change, wetlands are likely to face dramatic changes in the decades to come. Various researches point out how climate change might affect the hydrology of individual wetland ecosystems mostly through changes in precipitation and temperature regimes with great global variability (Erwin, 2009; Millennium Ecosystem Assessment 2005). Those evolutions are particularly critical when dealing with the flood risk management. Indeed, wetlands play an important role in the hydrological cycle (Acreman, 2013) and their management cannot only be focusing on biodiversity issues, as they have various functions for humans (Mitsch, 2000). If we focus on the French context, we can see more and more innovative initiatives launched by local authorities to accommodate rather than resist the flood risk and integrate wetlands and natural floodplains in their flood mitigation plans (Fournier, 2016).
In this presentation, we will focus on the case of the Ile Saint Aubin (Maine-et-Loire, France), which was one on the French case studies within the TRANS-ADAPT project (JPI Climate, coord. S. Fuchs/M. Gralepois (France)). This area is about 600ha wide. It is located at the confluence of two rivers and is partly flooded every year. The Ile Saint Aubin (ISA) a large green area located at the outskirts of Angers, mainly constituted of wet meadows, which have progressively been drained to facilitate extensive farming (grazing and mowing today). However, for the city of Angers, it plays the role of a “natural sponge”, a natural retention area upstream the city centre. In 1995, Angers was hit by a major flood; this event reminded local authorities of the great importance to maintain the Ile Saint Aubin as a flood retention area. However, various other issues are at stake locally. The ISA is part of a Natura 2000 site (*Basses Vallées Angevines*) and contributes to several environmental services (fish reproduction, corn crake nesting, resting area for migrating birds, landscape, etc…). By the same, a large number of farmers still make use of common pastures. At last, the ISA tends to become an attractive area for leisure, as it is located at the outskirts of Angers city center.

In this presentation, we will describe the local arrangements which exist today to coordinate at best those various uses. We will also point out how the control of the water level on the island is becoming a very debated topic locally, in particular within a context of climate change. On the ISA, several hydraulic works (ditches, dikes, gates) enable the control of the water level and the various stakeholders do not have the same needs. Those latter might even change more drastically in the years to come, in a context of climate change. This presentation will end with an overview of some potential solutions for the future in order to build synergies between those uses.

Keywords: multi-use, governance, flood management, wetlands, Loire valley (France).

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Governance and water management (chaired by Corinne LARRUE, UPEC, FR)

Oral communication

Wednesday 7th, 09:45

Corresponding author: Maia LORDKIPANIDZE
m.lordkipanidze@utwente.nl

Towards a new model for the governance of the Weerribben-Wieden National Park

Lordkipanidze Maia [1], Lulofs Kris [2] & Bressers Hans [3]

[1] Department of Governance and Technology for Sustainability, CSTM, University of Twente, Drienerlolaan 5, Building 10: Ravelijn; PO Box 217, 7400 AE Enschede, The Netherlands
[2]Department of Governance and Technology for Sustainability, CSTM, University of Twente, Drienerlolaan 5, Building 10: Ravelijn; PO Box 217, 7400 AE Enschede, The Netherlands
[3]Department of Governance and Technology for Sustainability, CSTM, University of Twente, Drienerlolaan 5, Building 10: Ravelijn; PO Box 217, 7400 AE Enschede, The Netherlands

The paper aims at assessing the governance context and processes in the case of a Dutch national park in an effort to foster ecological resilience in the face of on-going climate change and human disturbances. The area in focus is the Weerribben-Wieden National Park which is identified as unique while it is the largest fresh water wetland in northwest Europe. It is characterised by special nature values with water as an important resource producing ecosystem services for the environment. Nowadays threats to resilience are observed in terms of insufficient water quality and poor environmental conditions due to peat excavations and intensive farming in the past, which changed the natural processes and turned the landscape into marshy woodland with poor biodiversity. This paper will examine to what extent the care for resilience is supported by the governance context of the studied area. The governance context in this particular case has been subject to major challenges and restructurings in the recent past. The national government implemented drastic changes in nature policy in the Netherlands, withdrawing from their central role and decentralizing the authority with regard to nature tasks to the provinces. The province in this case has in turn also withdrawn itself from a leading position, decentralizing all the way down to the municipality. The changes in nature policies are particularly challenging regarding biodiversity and resilience, since these require coherent and multi-scale approaches. To analyse the governance context the "governance assessment tool" has been used. The tool provides a systematic assessment of all relevant elements and qualities of the governance context and helps to understand the circumstances for the implementation of measures. The research highlights the importance of the governance context in complex and diverse governance processes.

Keywords: governance, water, resilience, national park.

Governance and water management (chaired by Corinne LARRUE, UPEC, FR)

Oral communication

Wednesday 7th, 10:00

Corresponding author: Ophélie TOUCHARD
ophelie.touchard@gmail.com

"The Truth is out there": urban governance in the age of ecological uncertainty – The Wetlands issue in Bordeaux Metropole (France)

Touchard Ophélie

PASSAGES UMR 5319, 12 Esplanade des Antilles, 33607 Pessac (France)

Over the past two decade or so, it has become increasingly apparent that climate change calls into question the way cities handle water management. Mass urbanization brings a range of challenges from improving water quality to providing natural resources. Despite several attempts of different cities, integrating aquatic ecosystems as a natural infrastructure has not been successful yet. Urban wetlands are a case in point. While playing a fundamental role in sustaining biodiversity and reducing water-related disaster – such as floods and droughts – urban pressure is still a major cause of wetlands destruction. This study examines the urban wetlands management and the strategies led by the metropolitan government of Bordeaux, Bordeaux Metropole (France). There is a clear ambiguity in what local authorities are understanding and forecasting for wetlands. Improving wetlands knowledge does not systematically lead to a beneficial balance between built and natural infrastructures. To illustrate this ambiguity, I will cite the example of an urban wetlands inventory carried out by the city. It tackles two interdependent problems.

First, aquatic ecosystem knowledge in town are relatively recent and insufficient. Carried from 2012 to 2014 in order to comply with environmental implementations, the inventory deals only areas yet to be urbanized. Results confirmed the importance of urban wetlands: half of development areas were located on aquatic habitats. Local authorities faced a tricky situation since urban wetlands conservation undermined the metropolitan densification strategy. Secondly, the presence of aquatic ecosystems destabilizes urban sector-based practices. The concepts of biodiversity or ecosystems dispute the idea of universal and systematized solutions on nature (Latour, 1999). It requires interdisciplinary approaches hardly consistent with the sector-based legacy of Bordeaux Metropole. Local authorities further have decided to reinforce the technical approach. Additional inventories invalidated some results of the former study and thus, damaged its legitimacy. Inventories became a part of vicious circle where “precisions refute precision” (Beck, 2002).

Governance and water management (chaired by Corinne LARRUE, UPEC, FR)

To a certain extent, urban wetlands act as a third space – a UFO – that creates local conflicts, if not conspiracy, between pro and con. And as the famous TV show X Files taglines says, "The Truth is out there". It reveals the dual meaning of (1) the truth is very strange, and (2) the truth can be found. On one hand, wetlands recognition is strange because it demands to rethink the urban environment in terms of ecological scales. On the other hand, urban technical rationality locks Bordeaux Metropole in a case by case approach. This is both a technical and political matter to be recognized. This study is based on an urban and political approach elaborated in PhD dissertation carried out in partnership with Bordeaux Metropole. I've worked with technical officers and elected representatives in order to create an interdisciplinary perspective and dialogue and re-articulate the spatial and political dimensions within wetlands planning (460 words).

Keywords: Wetlands management, Urban planning, Local authorities, Ecological expertise, Regional strategy.

Signals and indicators of impacts on water resource 2 (chaired by Haykel SELLAMI, CERTE, TU)

Oral communication

Wednesday 7th, 11:15

Corresponding author: Arnaud Wuilleumier
a.wuilleumier@brgm.fr

Looking for trends within the water cycle of the "gave de Pau" and "gave d'Oloron" catchment areas

Seguin J.J., Wuilleumier A.

BRGM, 3 av. C. Guillemin, BP 36900 45060 Orléans Cedex 2 (France)

Studies carried out in France show that the south-western part of the country will be one of the regions most impacted by climate change. The present study aimed at identifying trends within the different components of the hydrologic cycle in this area. The study has been performed using statistical methods commonly used to analyse hydrologic time series, such as the Mann-Kendall and Pettitt non-parametric tests. The tests were applied to several variables, such as rainfall, efficient rainfall, mean annual discharge, low-flow discharge, piezometric level. On the long term (1959-2014) and using Meteo-France data, negative trends are significantly identified for the evapotranspiration on both catchment areas and for efficient rainfall for the "gave d'Oloron". Regarding river discharge, negative trends are significantly identified during the 1965-2011 period for the mean annual discharge of the 8 studied rivers and for the low-water discharge of 6 of them. The calculated Sen slopes show drastic diminutions of the mean discharge over this period of time (up to 50%). However, the same test applied over a longer period is not always significant (1912-2016, "gave d'Oloron"), highlighting the importance of the time-period choice. Regarding piezometric level, significant positive trends are identified for the mean annual water level and for the available period of data (2001-2015). It is relevant to notice that positive significant trends are also identified for the mean annual discharge of rivers over the same period of time.

Keywords: groundwater, climate change, time series, trend.

Signals and indicators of impacts on water resource 2 (chaired by Haykel SELLAMI, CERTE, TU)

Oral communication

Wednesday 7th, 11:30

Corresponding author: Eric Martin
eric.martin@irstea.fr

Observed impact of climate change on the water resources of a small Mediterranean catchment (the Réal Collobrier, France)

Nathalie Folton[1], Pierre L'Hermite[1], Eric Martin[1] & Patrick Arnaud[1]

[1]IRSTEA UR RECOVER 3275 route de Cézanne, 13182 Aix-en-Provence Cedex 5, France

The Réal Collobrier hydrological observatory in southeastern France, managed by Irstea since 1966, constitutes a benchmark site for regional hydro-climatology. Because of the dense network of streamgauges and raingauges available, this site provides a unique opportunity to evaluate long term hydro-meteorological Mediterranean trends. The catchment (70 km²) and its sub-catchments are located in Maures highlands of Southeastern France, close to the Mediterranean coast. The vegetation is composed of forest essentially calcified on crystalline soils (maquis of heath, cork-oak, maritime pine and chestnut). The direct human influence remained negligible over the past 50 years. The land use /land cover remained almost unchanged, with the noticiable exception of a wildfire in 1990 that impacted a small sub-basin. Hence changes in the hydrological response of catchments are caused by changes in climate and/or physical conditions.

This study investigates changes in observational data using up to 50 year-long of daily series of temperature, precipitation and streamflow. The analysis uses several climate indices describing distinct modes of variability, at inter-annual and seasonal time scales. Trends are assessed using Man-Kendall and linear regression methods in different flow and precipitations index (Standardized Precipitation Index, ISSP (Standard Drought Precipitation), Standardized Hydrological Index, Base Flow Index…). The analysis uses also hydrological indices describing drought events based on daily data for a description of low flows, in particular in terms of timing and severity.

On an annual basis, a significant trend is observed for temperature, while precipitation trends are not significant, due to the high variability of precipitation in this region. At the seasonal scale, negative precipitation trends are observed for both precipitation (February and March) and discharge (March and April).

The Spring trends were investigated with the help of two hydrometeorological models: the lumped rainfall-runoff model GR4J and the land surface model ISBA. Both models showed that the trends in discharge are associated with a negative trend for the soil wetness in spring, while an uncertainty remains concerning trends in evapotranspiration.

The analysis shows clearly that there is a marked tendency towards a decrease of the water resources of the Real Collobrier catchment in response to the climate trends with a consistent increase of drought severity and duration.

Keywords: Water resources, Trend, Index, Mediterranean catchment.

Signals and indicators of impacts on water resource 2 (chaired by Haykel SELLAMI, CERTE, TU)

Oral communication

Wednesday 7th, 11:45

Corresponding author: Fabian VON TRENTINI
fabian.trentini@lmu.de

Climate indicators and their local hot spots in Bavaria, Germany, derived from a large ensemble of climate models

von Trentini Fabian[1], Schmid Josef[1], Willkofer Florian[1], Wood Raul[1] & Ludwig Ralf[1]

[1] *Department of Geography, Ludwig-Maximilians-Universität, Luisenstr. 37, 80333 Munich, Germany*

A large variety of climate indicators is used in studies worldwide to assess climate change impacts on different sectors of economy and society. As many end-users of climate model data, such as public agencies, are not able or willing to analyze the vast amount of model outputs to their needs, the BayKliZ project in Bavaria aims to provide a framework for auditing and selecting models by their specific performance for a particular target, and for processing these model data to information that can be used as a basement for adaptation strategies at local scale.
The first step is to create a database by collecting all available datasets for the particular region – the province of Bavaria in this case – and to calculate climate indicators from the variables provided by the climate models, which are then interpolated to a 5 km grid to make results comparable, independent from the spatial resolution of the climate model. In close coordination with the Bavarian environmental agency, this includes indicators like dry/wet days, heavy precipitation days, dry spells, phenologic information as well as precipitation sums for different seasons and vegetation periods, thus covering many different sectors where climate change impacts connected to water are expected. After that the future behaviour of the selected ensemble and the inter-model spread in the resulting climate change signals can be analyzed. Since impacts of climate change can be very local, a spatial distinction of the severness of impacts is often required by end-users. Hence, hot spots of a particular strong signal can be identified by combining the information of (1) robustness, i. e. model agreement in the sign of change, (2) a significance test and (3) a percentile threshold (of the change signal) method for each pixel. With this approach, areas can be classified as hot spots of climate change for the respective indicator, and adaptation strategies can be developed in a more targeted manner. Further analysis includes the influence of bias-correction and scale effects on the indicator calculation.
The overall goal of the project is to provide tools and advice for agencies how to deal with large amounts of climate model data and how local impacts of climate change and their implicit uncertainties can be analyzed for adaptation measures.

Keywords: Climate Indicators, Dry Spells, Heavy Precipitation, RCM, Climate Change.

Signals and indicators of impacts on water resource 2 (chaired by Haykel SELLAMI, CERTE, TU)

Oral communication

Wednesday 7th, 12:00

Corresponding author: Janja VRZEL
j.vrzel@iggf.geo.uni-muenchen.de

Multi-tool simulations to assess the hydrological system behavior of the Ljubljansko polje aquifer under climate change conditions

Janja Vrzel[1], Ralf Ludwig[1], Goran Vižintin[2], Nives Ogrinc[3]

[1]*Department of Geography, Ludwig-Maximilians-Universität (LMU) Munich, Luisenstraße 37, 80333 München, Germany*
[2]*Department of Mining and Geotechnology, University of Ljubljana, Ljubljana, Slovenia*
[3]*Department of Environmental Science, Jozef Stefan Institute (JSI), Ljubljana, Slovenia*

Our study focuses on the assessment of climate change impacts on the hydrological system of the Ljubljansko polje, located in the Slovenian part of the Sava River Basin. We are building on a comprehensive description of the system behaviour, where understanding of the interfaces between surface water, groundwater and river flow is crucial. System characterization includes geochemical analyses for identification of groundwater sources ($\delta^{18}O$ and $\delta^{2}H$) and estimation of groundwater mean residence time (^{3}H, $^{3}H/^{3}He$). The results of the geochemical analyses were compared with long-term data on precipitation, river discharge, hydraulic head and groundwater pumping rates. The results show that the Sava River water and local precipitation are the main groundwater sources in this alluvial aquifer with high system sensitivity to both sources, which ranged from a day to a month. For a simulation of such a sensitive system different tools describing water cycle were coupled: simulation of the percolation of the local precipitation was done with the WaSiM-ETH, while the river and groundwater dynamics were performed with the MIKE11 and FEFLOW, respectively. The WaSiM-ETH and MIKE11 results were later employed as the upper boundary conditions in the FEFLOW model. The models have high spatial and daily temporal resolutions. A good agreement between geochemical data and modeling results is observed with two main highlights: (1) groundwater sources are in accordance with hydraulic heads and the Sava River water level/precipitation; (2) responsiveness of the aquifer on the high water level in the Sava River and on precipitation events is also synchronic with the mean groundwater residence time. The established and validated multi-tool model system is then driven with a small ensemble of climate model data taken from the CORDEX database to perform long-term simulations of the hydrological system and its dynamic changes over time. Results of this analysis elucidate the impacts of a changing climate on (ground)water flow regimes and provide estimates of related uncertainties, which are crucial in terms of developing management routines and alternatives. The study shows that links between MIKE11-FEFLOW-WaSiM tools is an interesting and practical solution for a precise groundwater flow simulation, since all the tools are compatible and at the moment there is no routine approach for a precise parallel simulation of groundwater and surface water dynamics. The results illustrate the capacity to provide the required robustness to investigate the system dynamics even under long-term climate change conditions. It can thus be considered as a useful toolbox for (ground)water resources management.

The Project was financially supported by the the EU-FP7 Research Project – GLOBAQUA.

Keywords: Ljubljansko polje, aquifer, groundwater recharge, multi-model simulation, climate change scenarios.

Signals and indicators of impacts on water resource 2 (chaired by Haykel SELLAMI, CERTE, TU)

Oral communication

Wednesday 7th, 12:15

Corresponding author: Bruno MOUGIN
b.mougin@brgm.fr

"MétéEau des nappes", a tool able to show impacts of climate change on groundwater resource at local scale

Mougin Bruno[1], Vigier Yannick[2], Bessière Hélène[3], Nicolas Jérôme[3], Loigerot Stéphane[2]

[1] BRGM French geological survey, Direction régionale Bretagne, Rennes, France
[2] BRGM French geological survey, Direction des Infrastructures et Services Numériques, Orléans, France
[3] BRGM French geological survey, Direction Eau Environnement et Ecotechnologie, Orléans, France

In a climate change context, the availability of real time and forecast piezometric data is essential information for decision makers. Indeed, associated with threshold values (groundwater levels corresponding to different alert discharges values) those data can indicate if a crisis situation is expected, either drought or flooding episodes. To meet societal expectations, BRGM (French geological survey) currently works on improving its national piezometric data network. Raw data from sensors are exposed in interoperable formats and services in accordance with international open standards for sensorWeb interoperability and European rules (INSPIRE directive guidance on the use of Observations & Measurements and OGC SWE - Sensor Web Enablement Framework). The objective of the "MétéEau des Nappes" project is to deploy an interoperable communication tool able to cross data from different networks (meteorology, river flow, piezometric) in order to characterize in almost real-time groundwater quantitative state. A prototype of this tool was deployed on 6 case studies in 5 selected French regions with different hydrogeological characteristics and various issues (drought, flooding, or climate change).
Preliminary steps were to define case studies (watersheds) to select the representative piezometers and the corresponding measuring stations and, eventually to calibrate models that provide piezometric level forecasts. At the present stage, the tool shows maps giving the location of measuring stations and charts drawing the real time evolution of data compared to thresholds and model predictions. It also provides the model predictions as a Sensor Observation Service in addition to the raw data flows. BRGM also contributes to the achievement of the national hydrological situation report (monthly evolution of water resource) on behalf of the French Ministry of Environment. Then the final step of the project is to integrate into the tool a map showing specified indicators of the groundwater state (evolution of water resources: rising, stable, decreasing) and trends (with Standard Piezometric Level Index). Perspectives of the project are the implementation of data assimilation and automatic forecasting processes into the models.
Among the French stakeholders interested in the tool, we can include: Water agencies, decentralized services of ministries (DREAL, DDT), Regions and Departments, Association of Municipalities, Industrial water producers…

Keywords: 6 case studies, modeling, groundwater level forecasting, almost real-time data flows, interoperability.

Poster session

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15	**Mokrane, Fehri & Vanclooster**	Étude des régimes d'altération hydrologique sur le bassin transfrontalier Tuniso-Algerien de la Medjerda	BE
16	**Kozhemyakin, Chornomoretz & Filippova**	Climate Change Impacts on the Water Balance of the Upper Dnister River	UA
17	**Ludwig, Frigon, Kranzlmüller, Turcotte, Komischke & Brissette**	Climate change and hydrological extreme events – risks and perspectives for water management in Bavaria and Québec	DE
18	**M2ETP & La Jeunesse**	Vineyards and water cycle changes: a short, mean or long term challenge for the UNESCO Loire-Valley world heritage landscape?	FR
19	**M2ETP & La Jeunesse**	Enjeux du changement climatique pour le vignoble de la région Val de Loire	FR

Poster session			
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22	**Chae & Lee**	The Spatiotemporal Variation of Soil Moisture in the Agriculture Region Based on the Temperature Vegetation Dryness Index derived from satellite image	KO
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25	**von Trentini, Schmid, Braun, Brisette, Frigon, Leduc, Martel, Willkofer, Wood & Ludwig**	Evaluating hydrometeorological extreme events in the ClimEx single model large ensemble in comparison with CORDEX results over Europe and Québec	DE
26	**Wantzen & Hesselschwerdt**	Global heating breaks down thermal barriers of invasive species freshwater ecosystems (but reoligotrophication may help to build new ones) – a study from Lake Constance	FR
27	**Delpla & Rodriguez**	Assessing the impacts of climate variability on drinking water quality: Results from an observational and experimental study during spring rainfall events	CA

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Poster communication

Poster #1

Corresponding author: Delphine ALLIER
D.allier@brgm.fr

Testing different approaches to evaluate groundwater vulnerability to climate change

Allier D., Pinson S., Seguin J.J., Wuilleumier A. & Amraoui, N.

BRGM, 3 av. C. Guillemin, BP 36900 45060 Orléans Cedex 2 (France)

Today, the impacts of climate change to the groundwater resources started to be quite well described for quantitative aspects and hydrogeological risk assessment. Some studies, such as EXPLORE2070, allowed highlighting the importance of climate change on, groundwater recharge reduction in some parts of the French territory, a change in recharge seasonality or the elevation of the sea water level. If the estimation of the climate change impact is possible based climatic scenarios proposed by the IPCC for aquifers for hydrogeological models exist, it remains difficult and delicate for sectors without models. The evaluation of climate change impact is more difficult knowing that a reduction of efficient rainfall will be variable impact from one aquifer to another. Thus, analysing the sensibility of aquifers to climate changes needs to take into account different hydrogeological parameters. Multiples methodological approaches can be envisaged.

The first approach developed was based on the use of IDPR (infiltration capacity), possible overflowing and drying areas, density of intermittent rivers, thickness of the unsaturated zone and hydrogeological dynamic (captive, free aquifer, cumulative effect, inertia,…). Mapping the groundwater vulnerability to climate change was then constructed using GIS multicriteria data treatment. Two calculations were carried out; a typology of aquifer comportment following two scenarios and the establishment of the vulnerability map combining the typology and the mean aquifer recharge.

Other methods, such as the use of drought resistance indicators can also be relevant for climate change impact evaluation. This indicator is based on three criteria i) half-decay time of water levels, ii) index of development and persistence of water network (IDPR) and iii) size of the aquifer system as, together with the thickness, determine the importance of its inertia. Mapping the drought resistance could be useful for example to look at the resilience of aquifer systems (capacity of the system to come back to a normal status) after severe drought episodes, one of the effects of climate change being more intense drought periods.

Confronting the different methods is a good way to evaluate uncertainties and to find new directions for investigations.

Keywords: groundwater, drought resistance, vulnerability, climate change.

Poster communication

Poster #2

Corresponding author: Pratima BHURTUN
pratima.bhurtun@ed.univ-lille1.fr

Vulnerability of surface water quality in northern France to climate change

Bhurtun Pratima [1], Lesven Ludovic[1], Dumoulin David[1], Halkett Cedric[2] & Billon Gabriel[1]

[1] LASIR, UMR 8516 - University Lille 1, Cité Scientifique, 59650 Villeneuve d'Ascq, France
[2] Agence de l'Eau Artois-Picardie, 200 Rue Marceline, 59508 Douai, France

In order to help decision makers develop relevant adaptation and mitigation strategies so as to limit the impact of climate change, researchers are getting more and more concerned about the regional impacts of climate change. The "Explore 2070" study suggested some alarming predictions about the climate evolution and its impacts on aquatic environments in France by the end of 2070. According to this study, the mean water temperature in Artois-Picardie watershed (Northern France) is likely to increase by 1.6°C and the mean river flows are likely to decrease by 25 to 40%. These changes can either have a positive or negative impact as described in this poster. For example, on one hand the rise in water temperature can enhance photosynthesis, but on the other hand can lead to eutrophication of the system due to the rapid growth of algae.
To better understand the vulnerability of surface water quality to climate change, it is also important to assess the dynamic of the current water quality through a relevant monitoring strategy. In this present study, a 4-month high-frequency monitoring of the River Selle (Northern France) in 2016, helped to better understand the behaviour of several key parameters and pointed out impacts of one-off climatic events. For example, conductivity and nitrate concentrations decreased with rainfall whereas turbidity increased. An increase in copper concentrations was also observed (from 0.4 to 0.8 µg L^{-1}). However, these disturbances were time-limited after rainfall events. The fact that the River Selle is mainly fed by groundwater could explain these observations.

Keywords: River Selle (Northern France), surface water quality, high frequency monitoring, climate change.

Poster communication

Poster #3

Corresponding author: Adeline CLIFFORD
adeline.clifford@astee.org

Promoting the Added Value of Ecological Engineering to Elected Officials

ASTEE's working group on ecological engineering

ASTEE, 51 rue Salvador Allende 92 027 Nanterre, France.

Created in 1905, ASTEE is a scientific and technical association working on public services issues specific to the environmental field. Indeed, the Scientific and Technical Association for Water and the Environment (ASTEE) brings together key experts, researchers, scientists, practitioners and representatives of public and private institutions working in different sectors of the environmental field. The association carries-out in-depth reflections on various methodological, technical and regulatory aspects linked to the management of drinking water, waste, sanitation and aquatic environments in France. Its mission is to build consensus, develop common references and recommendations, as well as produce and disseminate technical information. ASTEE has over 3,800 members. It counts 45 working groups composed of approximately 400 volunteers, and has a network of 13 regional units located throughout the French territory to ensure the true consideration of local specificities and the dissemination of information.

In 2013, ASTEE's working group on ecological engineering published a book titled "Ecological engineering in aquatic environments: why and how?" (The English synthesis of the book, published in 2016, is available through this link: http://www.astee.org/en/production/synthesis-ecological-engineering-in-aquatic-environments-why-and-how/). Intended for decision-makers and their advisors, this document offers a framework to clarify the concepts and practices of ecological engineering. It demonstrates that acting by and for nature can meet various societal demands, from the preservation of water quality to the valuation of river banks and flood protection.

Ecological engineering is a growing field at the present time, especially in the context of climate change. However, some obstacles to its development and use remain. In order to address these hindrances and promote this practice, the production of information targeted at elected representatives appears to be essential. Indeed, commitment of political officials is fundamental for the acceptance and emergence sustainable projects. This commitment is the result of a good understanding of the added value provided by ecological engineering, and the benefits that this practice can bring to communities.

Poster communication

In order to contribute this objective, ASTEE's working group is currently producing a video promoting the use of ecological engineering and destined to local representatives. The objectives of this project are to raise awareness and demonstrate the benefits of ecological engineering, in order to spur innovative and sustainable projects. The video will last approximately four minutes. One minute will be given to present ecological engineering, and three minutes will be dedicated to present different subthemes which are:
- Restoration measures on riverbeds;
- Development of a buffer zone at the peri-urban / agricultural interface;
- "Soft" management of storm water in a (peri)-urban environment;
- Creation of habitats in industrial/port areas along small coastal zones.

ASTEE offers to present this video and its publications on ecological engineering at the Climate Change and Water 2018 international Conference.

Keywords: ecological engineering, water, integrated water resources management, raising awareness.

Poster communication

Poster #4

Corresponding author: Annika Meitern
annika.meitern@ut.ee

Free Air Humidity Manipulation (FAHM) experimental site - the effect of elevated air humidity on growth rate, photosynthetic capacity, hydraulic properties and biomass allocation in silver birch

Authors: Meitern Annika[1], Õunapuu-Pikas Eele[1], Aigar Niglas[1], Tullus Arvo[1], Lõhmus Krista[1], Ostonen Ivika[1], Rosenwald Katrin[1], Kupper Priit[1] & Sellin Arne[1]
[1]*Institute of Ecology and Earth Sciences, University of Tartu, Vanemuise 46, 51014 Tartu, Estonia*

Changes in air temperature, precipitation, and air humidity are predicted in the coming decades, therefore studies on the impact of these environmental shifts on plant growth and functioning are very important. In Estonia Free Air Humidity Manipulation (FAHM) experimental site was established to investigate the effect of increased air humidity on trees' performance and their canopy functioning with respect to rising air humidity predicted for Northern Europe. The FAHM system enables air relative humidity (RH) to be increased up to 18 units (%) over the ambient level during mist fumigation, depending on the wind speed inside the experimental stand. Water is dispersed inside 14 × 14 m experimental plots, half of it is covered with hybrid aspens (*Populus tremula* L.×*P. tremuloides* Michx.) and half of it with silver birches (*Betula pendula* Roth). Greatly understudied aspects of climate change include consequences of increasing air humidity on forest ecosystems, predicted for high latitudes. Aim of this study was to investigate in silver birch humidity-driven changes in growth rate, photosynthetic capacity and hydraulic properties, resource allocation and look whether the changes in hydraulic architecture depend on tree size. Enhanced relative humidity (RH) causes transpirational flux to decrease; leaf nitrogen content, phosphorus content and P:N ratio decrease and declined nutrient supply to the foliage, which brought about a considerable decrease in both photosynthetic capacity (A_{max}, V_{cmax}, J_{max}) and tree growth rate. Different segments of the soil-to-leaf water transport pathway responded differently: leaf hydraulic conductance (K_L) decreased, while leaf-specific conductivity of stem-wood and hydraulic conductance of root systems (K_R) increased in response to elevated RH, while K_R (expressed per unit leaf area) decreased and leaf hydraulic conductance increased with tree size. Humidification caused the Huber values of stems to increase, thus reflecting changes in allocation patterns: increased RH decreased the biomass accumulation in birch saplings, but the biomass partitioning among aboveground parts (leaves, branches, and stems) remained unaffected. The elevated RH induced substantial changes in specific leaf area (increased), branch- (decreased) and stem-wood density (decreased). **Keywords:** Relative humidity, Hydraulic conductance, Photosynthetic capacity, Biomass allocation, P:N ratio.

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Poster communication

Poster #5

Corresponding author: Latifa Dhaouadi
latifa_hydro@yahoo.fr

Saving water irrigation: Irrigation systems under date palm in climatic oasis conditions

Latifa Dhaouadi

Mkademi Chedia, University assistant, Gafsa University
Daghari Hedi, Professor, INAT Tunisia.

The irrigation water Scarcity combined with the effect of climate change and poor management in oases pose a major threat to the sustainability of the oasis ecosystem. The aim of this research work is to identify the most efficient irrigation techniques to adapt the climate changes impacts. A preliminary diagnosis was made in the Tunisian oases revealed the existence of many irrigation techniques in the. An evaluation and a comparative study of the different existing irrigation techniques were also carried out either in the Degueche oasis in Tozeur and / or in the Aguilla oasis in Gafsa. The assessment and comparative study between the different irrigation different techniques, as applied by farmers, were able to detect that: the amount of lost water through percolation after bubbler irrigation did not exceed 42mm. In contrast with those losses were often greater than 80 mm for other techniques, CU uniformity coefficient exceed 88% regardless of the irrigation technique. The efficiency of water application in various technical localized Ea exceeds 50% while it is only 13% under basin irrigation. The most important desalination efficiencies were observed under bubbler and basin irrigation. Under a regime of equal volume of distributed irrigation water (3.6m3) and regardless of the applied irrigation technique, it points out that the uniformity coefficient exceeds 85% for the three localized techniques. The best irrigation water application efficiency is in the case of bubbler (62%). An increase, in palm yields of 36%, 30% and 28% respectively by bubbling irrigation, subsurface irrigation and mini-diffuser, was recorded at the site of Degueche for a period of three successive companions.

Keywords: Oasis climate change, Date palm, irrigation systems, efficiencies.

Poster communication

Poster #6

Corresponding author: Fariba Ebrahimiazarkharan
F.aebrahimiazarkharan@utwente.nl

The role of Social Network Analysis for Water resources Management and sustainable development (Case study: Darbandsar Watershed)

Fariba Ebrahimiazarkharan[a] & Mehdi Ghorbani[a]

[a] *Faculty of Natural Resources, University of Tehran, Karaj, Iran*

The importance of water in sustainable development, water resources co-management is one of the basic strategies for obtaining sustainable management according to climate change in the world. In recent years, the application of SNA method (social network analysis) is regarded as a new approach in water co-management. In this study, structural analysis of the social relations among local beneficiaries has been studied in Darbandsar village located in Latina watershed in Tehran. It is used the social network analysis approach as method with emphasis on trust and collaboration ties and quantitative and mathematical indicators on the macro-level of local level network (Density, Centralization and Reciprocity) by the (UCINET & NETDRAW) software. The results showed that the level of social cohesion is medium and poor based on trust and collaboration matrixes. Also the level of social capital in the village has been measured about middle to poor. Based on the results, it can be concluded that amplification trust and social participation in this village to speed up the flow of information and resources, as well as an increase in unity among beneficiaries are necessary. So that we can reduce time of the implementation, water resource co-management and to succeed in this field, this study elicited actors that can change unstable state in Latian watershed. This research is just a pilot that can generalize for another watershed in everywhere in the world. SNA identified weakness ties and nodes so help to water manager for solving problem for improving water management in local level then develop it in the world. This research is a positive point for change approach up to dawn water management for improved water resources.

Keywords: Water Management, sustainable development, Climate change, Social Network Analysis, Darbandsar village, Latian Watershed.

Poster communication

Poster #7

Corresponding author: FARES Redouane
fares-redouane@hotmail.com

Determination of the sea waters quality of Arzew-Algeria Gulf

FARES Redouane[1], SERIR Lakehal, LOUNIS Mourad[1]

[1]LAAR, University of Science and Technology - Mohammed Boudiaf - BP 1505 - Oran – Algeria

This work consists of assessing the degree of pollution caused by wastewater near the gulf of Arzew-Algeria. This study is based on the analysis of the physicochemical parameters, the parameters indicating pollution and the determination of heavy metals (Pb, Zn, Cd, Fr, Cr, Ni) on seawater samples taken from the site.

Four companions of seasonal sampling were carried out during the year 2015.

The result obtained show significant values in physicochemical parameters, pollution indicator parameters and heavy metal content in seawater samples.
The results of the pollution indicator parameters show the presence of important pollution at the site studied. The results obtained are far superior to the Algerian standards defined.
It is clear from the determination of heavy metals that the site under investigation shows a slight contamination by metals. The absence of treatment and the long-term exposure to these discharges will lead to severe metal pollution in seawater.

Keywords: Arzew - marine pollution - physicochemical parameters - pollution indicators - heavy metals.

Poster communication

Poster #8

Corresponding author : Anne Fauré
anne.faure@umoncton.ca

The role of land-use planning and civil society in protecting water resources in small rural coastal communities in New Brunswick in the context of climate change

Anne Fauré & Omer Chouinard

Université de Moncton, Campus de Moncton, Pavillon Léopold-Taillon, 18, avenue Antonine-Maillet Moncton, NB, E1A 3E9, Canada

Our communication aims to show how, at the local level, water issues help address issues and challenges around local governance in New Brunswick (Canada) in the context of climate change. The territory of the Cocagne/Grande-Digue watershed in New Brunswick (Canada) has, after a consultation process, developed land-use planning instruments to preserve the various resources of its territory in the context of climate change. These instruments, designed locally and regionally, are the first steps towards taking control of the future of these territories in terms of adaptation to climate change.

Since the 1990s, the issue of water quality has become central to this small rural area located by the sea. These concerns have been addressed by various associations while the territory did not have any governance structure or tools for managing its water resources (Chouinard, 2016, p.108-109)

The inhabitants of its coastal communities are supplied with water by artesian wells which makes them all the more vulnerable to the various sources of contamination related to the different uses of the territory (agriculture, maintenance of septic tanks …). In addition, heavy storms that followed one another in the 2000s caused flooding and contaminated water wells, while several cottage houses were located directly in marine submergence zones. Ten years later, in 2008, citizens and a few associations are mobilizing to protect their water resources while several mining companies are prospecting and exploratory uranium drilling on their territory. Between 2011 and 2014, while the New Brunswick government intends to engage in the development of the shale gas industry, many citizens and associations strongly oppose it and call for a moratorium. The risks around water well contamination, use and lack of knowledge about the long-term effects of this industry are at the heart of the concerns. The latter extend to agricultural lands and the forest sector, which are recognized as activities that can contribute to the local development of these small communities. These struggles are part of the energy transition and the reduction of greenhouse gases.

In the context of climate change, the problem of water quality has increased while, in addition to these issues, water sources can be contaminated by salt water and / or be restricted in the case of freezing rain episodes. The two rural plans produced in our case study allow a first framework of the uses on the territory and proposes tools of adaptation (enhancement of the ecosystem services, elevation of the constructions). These public action instruments are first steps in anticipating adaptation to climate change and preserving a common territorial good (Lascoumes and Le Bourhis, 1998) in a context of democratic deficit. This construction is done through the commitment (Sauvé, 2016) of associations rooted in their community and using several means to feed this common good, including the partnership with university researchers. We will show the process dimension of these actions and the role of policy entrepreneurs (Kindgon, 2003) that stimulate local environmental public action and problematize the governance system in place.

Keywords: Land use planning, local governance, coastal communities, engagement.

Poster communication

Poster #9

Corresponding author: Ali GHRAB
alighrab28@yahoo.fr

Climate change in Tunisia: Rainfall trend analysis in Tunis City in a context of climate variability

Ali Ghrab

Bicade-Tunisie

The floods have made a major threat to the country, especially in the towns at the north of Tunisian ridge. City Tunis is an example of the cities that are constantly flooding, sometimes called catastrophic (damage, loss of life…) with a frequency of one year to five (F1/5). Admittedly City Tunis faces the risk of flooding due to its bowl situation. This is certainly linked to the increase in rainfall inputs throughout the city. This study is to analyze the variations of rainfall events through a statistical analysis of rainfall data of Tunis Carthage station for chronic 67 years (1950-2016). The main objective is to extract all the information that can inform us about the rainfall characteristics of this period, to determine rainfall patterns, extract rainfall variability, identify rainfall extremes that are the source of all the disasters that have occurred in the city of Tunis and define the role of rainfall amounts, to provide explanations for the floods that knowledge.

Poster communication

Poster #10

Corresponding author: Mathilde GRALEPOIS
Mathilde.Gralepois@univ-tours.fr

Are Floods Sustainable?
Reasons of non-integration of flood prevention in sustainable development

Mathilde GRALEPOIS

Enseignante – chercheuse, Université de Tours, Ecole Polytechnique Universitaire, Département d'Aménagement & Environnement, Tours, France

Since the 1990's, sustainable development is a common concern. Local public policies have integrated the concept and prioritized sustainable development programs in their agenda. At the same time, Europe is facing flood disasters and huge losses. If -in theory- sustainable development is supposed to enhance natural disaster in a systemic approach of environment, society & economy, in facts we observe that concrete implementation of sustainable development excludes the issues related to flood management. For example, in French local authorities, flood management and sustainable development are two world apparts : two different administrations, two different public policies, two different professional fields, etc. Why flood management and sustainable development local public policies have been built according a centrifugal logic ? Above the general common challenges of climate change adaptation, local policies remain substantially sectoral : how can we explain ? Is the recent local implementation of climate change adaptation public policies a new possibility to integrate flood management?

The data have been collected with survey carried out in Nantes and Lyon cities, based on interviews of local public stakeholders from 2008 to 2015. Our framework is grounded in sociology of administration approach, through a framework of pulic policies instruments (Lascoumes and Le Galès, 2004). We mostly observed national strategies at local level, Agenda 21 and Climate Plans. Concretely, we look and analyse the reasons of sustainable development administration stakeholders in local authorities to exclude the issues of flood disaster management, thanks to the analysis of the implementation of policy instruments of local sustainable development.

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Poster communication

Poster #11

Corresponding author: Martin IBOCK
ibock_martin@yahoo.fr

Répondre à l'assèchement des eaux du lac Tanganyka : une approche de la gouvernance par « le haut »

Martin Raymond Willy **MBOG IBOCK**

Département de Science politique, Université de Douala, Tél : + 00 237 6 96 11 87 52

Le lac Tchad peut-il disparaître dans les années à venir ? Posée de façon aussi simple cette question peut recevoir une réponse positive si aucune période n'est fixée. Déjà l'échelle géologique des variations climatiques telles que celles qui se sont déjà produites conduisent à un assèchement du Lac Tanganyka. Un tel phénomène n'est pas sans conséquences socio-économiques : la baisse de la capacité de production agricole de la région et la diminution de son potentiel halieutique. Au regard de cela, il semble intéressant pour les décideurs de répondre à ce problème public d'assèchement du Lac Tanganyka en mettant sur pied une approche de la gouvernance par « le haut ». Prêter attention à l'approche de la gouvernance par « le haut », nous intéresse dans la mesure où l'on entend de mettre un point d'honneur sur l'univers des pratiques « situées » (décisionnelles) mobilisées par les décideurs de région des grands lacs pour faire face à l'assèchement du Lac Tanganyka. Un tel objectif conduit à l'examen de la question de l'efficacité de l'approche de l'approche de la gouvernance par « le haut » à l'épreuve de l'assèchement du Lac Tanganyka. Mieux encore, comment saisir confronter la décision publique avec l'épreuve de l'assèchement du Lac Tanganyka ? De cette question centrale, jaillissent deux questions subsidiaires : comment appréhender le glissement de l'approche de la gouvernance par « le haut » ? Et comment parvenir à un redressement de l'approche de la gouvernance par « le haut » ? L'architecture d'un pareil questionnement augure une bonne collecte des données. L'on y ira collecter par le biais de l'enquête par les documents les rapports des décideurs et d'expertise ; les instruments en termes de textes juridiques, les plans y compris les dispositifs. L'on ne se montrera pas oublieux de recourir à l'enquête par le terrain pour expérimenter la décision publique. Comme épure théorique, nous mobiliserons le paradigme de la complexité d'Edgar Morin afin de découvrir la dialogie décisionnelle dans la perspective de découvrir la dialectique désordre/ordre que structure cette approche. Dans cet article, nous défendons l'idée que l'approche de la gouvernance par le haut se révèle complexe au regard des conflits d'usage et même des conflits dans le processus de décision qui ont un impact sur son implémentation. Pour vérifier cette hypothèse, l'on évoquera en amont qu'il existe un glissement de l'approche de la gouvernance par « le haut » au regard des outils imparfaits de la décision publique et de la complexification croissance des processus décisionnels. Et en aval, ce sera l'occasion, bien entendu, de songer à un redressement de l'approche de la gouvernance par « le haut » afin qu'elle soit davantage efficace en intégrant le logiciel de la culture de la paix et en introduisant le progiciel visionnaire de l'environnement.

Mots-clés : *assèchement ; eaux ; décision publique ; gouvernance ; conflit d'usage ; lac Tanganyka*.

Poster communication

Poster #12

Corresponding author: Dan Isaak
disaak@fs.fed.us

The crowd-sourced NorWeST temperature database and massive microclimate scenarios for streams and rivers in the western U.S.

Daniel J. Isaak[1], Seth J. Wenger[2], Erin E. Peterson[3], Jay M. Ver Hoef[4], David E. Nagel[1], Steven W. Hostetler[5], Charlie H. Luce[1]

[1]US Forest Service Rocky Mountain Research Station, Boise, Idaho, USA
[2]University of Georgia Odum School of Ecology, Athens, Georgia, USA
[3]ARC Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS) and the Institute for Future Environments, Queensland University of Technology, QLD, Australia
[4]NOAA-NMFS Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, Washington, USA
[5]US Geological Survey, Corvallis, Oregon, USA

Climate change is warming streams and rivers globally and threatens investments made to conserve and manage aquatic biodiversity. Efficient threat response requires prioritization of limited conservation resources and investments guided by accurate information about climate at scales relevant to species distributions within landscapes. To achieve that goal in the western U.S., we developed a database team to aggregate and organize most of the stream temperature data collected by >100 natural resource agencies in recent decades into the publically accessible NorWeST database that hosts >220,000,000 temperature recordings from >23,000 unique stream and river sites. A subset of those data were extracted from the database and used with accurate geostatistical spatial-stream-network (SSN) models (r^2 ~ 0.90; RMSPE ~ 1.1°C) to predict mean August temperatures and map predictions at 1-km resolution for 36 historical and future scenarios in all streams. This poster shows a historical scenario for 1993–2011 of the 343,000 km of perennial streams in the western U.S. Temperature data and scenarios are available in user-friendly formats through the NorWeST website (http://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST.shtml) to facilitate inter-agency coordination of monitoring, climate vulnerability assessments, and research on thermal ecology. NorWeST information has been rapidly adopted by the conservation community because of its accuracy, convenient use, and development from data collected by the people working in local landscapes.

Keywords: climate change, stream temperature, sensor, big data, crowd-sourcing

Poster communication

Poster #13

Corresponding author: Dan Isaak
disaak@fs.fed.us

Big biology meets microclimatology: Defining thermal niches of aquatic species for conservation planning using large interagency databases

Daniel J. Isaak[1], Seth J. Wenger[2], Michael K. Young[3]

[1]US Forest Service Rocky Mountain Research Station, Boise, Idaho, USA
[2]University of Georgia Odum School of Ecology, Athens, Georgia, USA
[3]US Forest Service Rocky Mountain Research Station, Missoula, MT, USA

Temperature strongly affects the ecology of ectotherms and is an environmental characteristic subject to change from global warming and habitat alteration. Information about the realized thermal niches of species and where temperatures are most constraining is needed for conservation planning this century. We developed a large species occurrence database (>23,000 electrofishing surveys) from contributions by several natural resource agencies in the northwestern U.S. and linked the information to high-resolution NorWeST stream microclimate scenarios for a 149,000-km network to describe thermal niches of 14 fish and amphibian species. Thermal response curves showed that species occurrence peaked across a wide range of temperatures (7–19°C) and that all species had distinct warm- or cold-edge distribution boundaries. Bull trout, cutthroat trout, brook trout, and tailed frogs had especially cold thermal niches and showed warm-edge boundaries; whereas rainbow and brown trout had warmer niches with cold-edge boundaries that indicated some streams were unsuitably cold. Remaining species (longnose dace, speckled dace, redside shiner, longnose sucker, mountain whitefish, Chinook salmon, slimy sculpin, and Columbia spotted frog) also had warm niches showing cold temperature constraints. Thermally-mediated boundaries are where populations are most sensitive to thermal changes associated with climate change, so habitat protection or restoration efforts could be targeted at these areas to protect local populations.

Keywords: big data, species distribution, stream network.

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Poster communication

Poster #14

Corresponding author: Dan Isaak
disaak@fs.fed.us

Identifying Climate Refuge Streams for Bull Trout Using Crowd-Sourced Databases, Microclimate Scenarios, and High-Resolution Species Distribution Models

Daniel J. Isaak[1] and Michael K. Young[2]

[1]*US Forest Service Rocky Mountain Research Station, Boise, Idaho, USA*
[2]*US Forest Service Rocky Mountain Research Station, Missoula, MT, USA*

Climate change and nonnative species invasions raise concerns about range contractions and extinctions of native species this century. Concerns are amplified by a lack of precise information about where native species occur and where there habitats will occur later this century. Using crowd-sourced biological datasets of species occurrence and NorWeST microclimate stream temperature scenarios, we developed high-resolution species distribution models to predict the locations of invasion resistant climate refuge streams for endangered bull trout (*Salvelinus confluentus*) populations throughout a 200,000 kilometer network in the northwestern U.S. This poster shows the probability of bull trout population occurrence for different climate scenarios within >5,000 discrete stream habitats where summer temperatures are cold enough to preclude invasions by nonnative trout competitors (Brown Trout and Rainbow Trout). Bull trout probabilities were predicted from four variables (habitat size, slope, minimum temperature, and brook trout abundance) in a logistic regression model developed from 512 cold-water streams with known occupancy status (present or absent). Classification accuracy of the model was 78% (AUC = 0.83) and its application to the universe of potential stream habitats in the region revealed ~300 streams with bull trout occurrence probabilities >0.9 in the historical conditions scenario. Between the historic and future scenarios, the number of >0.9 climate refuge streams was predicted to decline from 300 to 100 but bull trout do not appear threatened with regional extinction for the foreseeable future. Most climate refuge streams occur on federal lands (80% - 90%) where only a small portion currently have protected status (13% - 15%) as Wilderness Areas or National Parks. Forecasts about stream climate refuge locations are available as GIS data files at the Climate Shield website (https://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST.html) and are used to prioritize stream protections and rally support among multiple conservation groups while improving the odds that many bull trout populations are preserved through the 21st century.

Keywords: species distribution model, occurrence data, stream network, climate refuge, crowd-sourcing.

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Poster communication

Poster #15

Corresponding author: KADIR Mokrane
mokrane812002@yahoo.fr

Étude des régimes d'altération hydrologique sur le bassin transfrontalier Tuniso-Algerien de la Medjerda

Kadir mokrane[1], Raed Fehri[1] & Marnik Vanclooster[1]

[1]*Université catholique de Louvain, Earth and Life Institute, Croix du Sud 2, B-1348 Louvain-la-Neuve, Belgium*

Les pressions sur les ressources en eau sont une préoccupation majeure des sociétés et des États africains. Depuis une vingtaine d'années, un intérêt soutenu se manifeste pour l'étude du climat et de sa variabilité, compte tenu des conséquences parfois dramatiques que celle-ci peut entraîner sur les ressources en eau. Le travail présenté dans cette étude repose sur plusieurs approches. Nous nous proposons d'étudier les régimes d'altération hydrologique en se basant sur une base de donnée déjà observées en Algérie (débits, précipitations, occupation du sol, …) et la mise en évidence des facteurs explicatifs de ces altérations qui en découlent. Nous utilisons des méthodes avancées d'analyse des séries chronologiques, l'application des outils de fouille de données avancés (CCM/DFA/…) sur la base de données hydrométéorologique du bassin Transfrontalier Tuniso-Algérien de la Medjerda. Ce bassin s'étend sur 23 600 km^2 dont 7500 km^2 sont en Algérie, soit 30% de la superficie globale. Nous implémentons des méthodes avancées telles que la méthode 'Cross Convergent Mapping', qui fera l'objet d'une application et de test pour évaluer les facteurs d'altérations. Pour appliquer ces méthodes, il sera nécessaire de reconstituer une base de données hydrométéorologique (débits / pluviométrie déjà disponible avec un pas de temps journalier) et de la compléter par des données génériques. Pour ces dernières données, nous nous basons sur le Google Earth Engine Google à partir duquel nous caractérisons des séries chronologiques de l'évaporation, de la température, du NDVI.

Keywords: Algérie, Tunisie, Medjerda, hydrométéorologique, Google Earth Engine.

Poster communication

Poster #16

Corresponding author: Dmitry Kozhemyakin
dmitriy_koshemjakin@ukr.net

Climate Change Impacts on the Water Balance of the Upper Dnister River

Dmitry Kozhemyakin[1], Yulia Chornomoretz[2] & Yulia Filippova[3]

[1] Kiev region, Vita Pochta village, Hrushevsky Street, 4, Country: Ukraine
[2]Kiev region, Vita Pochta village, Polevaya Street, 2 , Country: Ukraine
[3] Kyiv, Lomonosov street, 59/244, Country: Ukraine

The global climate change impact on local water bodies is assessed through the water balance. As a consequence, we must determine the relations between precipitation-evaporation, precipitation-runoff.
The water balance is calculated for the Dniester river - Galich. The period of observations was 60 years from 1956 to 2015. It was divided into 3 cycles of 20 years, respectively. Meteorological components were processed in accordance with 14 meteorological stations in the Upper Dnister River basin. After that, we identified 5 high-altitude zones and constructed graphic dependencies of precipitation, temperature and humidity of air from the heights of meteorological stations. The general evaporation was determined using Konstantinov's method. The average water balance was calculated for 3 cycles (20 years each of them). Then we conducted a comparative analysis of their constituents.
The results show that the annual evaporative fraction (ET/P) indicating changing aridity of the Upper Dnister River.

Keywords: climate change impact, water balance, precipitation-evaporation.

Poster communication

Poster #17

Corresponding author: Ralf LUDWIG
r.ludwig@lmu.de

Climate change and hydrological extreme events – risks and perspectives for water management in Bavaria and Québec

Ralf Ludwig[1], Anne Frigon[2], Dieter Kranzlmüller[3], Richard Turcotte[4], Holger Komischke[5], Francois Brissette[6]

[1]Department of Geography, Ludwig-Maximilians-Universität (LMU) Munich, Luisenstraße 37, 80333 München, Germany
[2]Consortium Ouranos, Montreal (PQ), Canada
[3]Leibniz Rechenzentrum (LRZ), Munich, Germany
[4]Direction d'Expertise hydrique du Québec (DEH), Québec (PQ), Canada
[5]Bavarian State Office for the Environment (LfU), Augsburg, Germany
[6]École de Technologie Superieure (ETS), Montreal (PQ), Canada

The recent accumulation of extreme hydrological events in Bavaria and Québec has stimulated scientific and also societal interest. In addition to the challenges of an improved prediction of such situations and the implications for the associated risk management, there is as yet no confirmed knowledge whether and how climate change contributes to the magnitude and frequency of hydrological extreme events and how regional water management could adapt to the corresponding risks.
The ClimEx project (2015-2019) investigates the effects of climate change on the meteorological and hydrological extreme events and their implications for water management in Bavaria and Québec. High Performance Computing is employed to enable the complex simulations in a hydro-climatological model processing chain, resulting in a unique high-resolution and transient (1950-2100) dataset of climatological and meteorological forcing and hydrological response:
(1) The climate module has developed a large ensemble of high resolution data (12km) of the CRCM5 RCM for Central Europe and North-Eastern North America, downscaled from 50 members of the CanESM2 GCM. The dataset is complemented by all available data from the Euro-CORDEX project to account for the assessment of both natural climate variability and climate change. The large ensemble with several thousand model years provides the potential to catch rare extreme events and thus improves the process understanding of extreme events with return periods of 1000+ years.
(2) The hydrology module comprises process-based and spatially explicit model setups (e.g. WaSiM) for all major catchments in Bavaria and Southern Québec in high temporal (3h) and spatial (500m) resolution. The simulations form the basis for in depth analysis of hydrological extreme events based on the inputs from the large climate model dataset. The specific data situation enables to establish a new method for 'virtual perfect prediction', which assesses climate change impacts on flood risk and water resources management by identifying patterns in the data which reveal preferential triggers of hydrological extreme events.

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The poster presentation will highlight first results from the analysis of the large scale ClimEx model ensemble, showing the current and future ratio of natural variability and climate change impacts on meteorological extreme events. Selected data from the ensemble is used to drive a hydrological model experiment to illustrate the capacity to better determine the recurrence periods of hydrological extreme events under conditions of climate change.

Keywords: model ensembles, hydrometeorological extreme events, natural variability, climate change.

Poster communication

Poster #18 &19

Corresponding author: Isabelle La Jeunesse
isabelle.lajeunesse@univ-tours.fr

Vineyards and water cycle changes: a short, mean or long term challenge for the UNESCO Loire-Valley world heritage landscape?

Fanny Augis, Laura Bourguignon, Léa de Michiel, Mariétou Diouf, Christophe Emaille-Boireau, Alicia Foisnet, Camille Godfrin, Kauline Gonzalez-Pulido, Adrien Hérisson, Corentin Linas, Emma Maupetit, Lolita Pagé, Laurine Ramé, Audrey Ripault, Damien Rocher, Cristiana Silva-Rodrigues, Baudouin Ville, Hamdi Youssouf-Ali, Alain Dutour, Alain Génin, Evelyne Gauché, Amélie Robert, Damien Thierry, Isabelle La Jeunesse

Université de Tours, Master 2 Environnement, Territoire, Paysage, France

By 2050, the vineyards of the Loire Valley will have to be adapted to climate change in terms of temperature evolution, late frost and prevention of extreme events such as droughts. These climate changes are not without impacts on the vine and the wine and some adaptation strategies' are supposed to be already drawn.
Where will be located the wine growing areas by 2030 and 2080? How the Loire landscapes would change in a context of nomadic cultures? Will the vine descend closer to the water resource availability? Could innovation of practices lead to a diversification of land use? In this hypothesis, how could the landscapes of the wine-growing area evolve? What will be the relevance of a protected agricultural zone perimeter, defined according to the current climatic criteria, in 2030 and 2080?
After a presentation of the outputs of climate models impacts on agro-climatic variables for the Montlouis appellation in the city of Montlouis-sur-Loire in 2030 and 2080, the main possible impacts on the landscape are discussed. More in particular, two potentials adaptation strategies are explored: nomadism and innovation. Through these hypotheses, is the protected agricultural zone perimeter still pertinent for the Montlouis appellation?

Acknowledgements
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Keywords: Loire-Valley world heritage, climate change, wine production areas, urban planning, adaptation.

Poster communication

Poster #20

Corresponding author: Kaoutar MOUNIR
kaoutar.mounir@usmba.ac.ma

Relation between water stress and the necessity of changing the agricultural practices

Kaoutar MOUNIR [(1)], Abdessalam EL KHANCHOUFI [(1)], Isabelle LA JEUNESSE [(2)]

[(1)]Laboratoire de Géodynamique et Ressources Naturelles,
Université Sidi Mohamed Ben Abdellah, Maroc
[(2)] UMR CNRS Citeres, Département de Géographie, Université de Tours, France

According to the WRI (World Resources Institute) and the 5th IPCC assessment report, Morocco, included in the hot spot Mediterranean region, will be one of the countries the most exposed to water stress in the next 25 years.
Morocco is already often affected by long periods of drought, which causes an imbalance in the crop production and which represents the main constraint of the agricultural expansion.
Consequently, soil water capacity storage and water resource preservation are a key indicators to assess the evolution of food production.
Fes-Meknes region is characterized not only by a geomorphologic mosaic but also by a non-homogeneous climate due to the presence of mountainous landscapes. This region has great potentialities due to its well-known richness in both surface and underground waters, which justifies its name « Moroccan Water Castle ».
The objectives of this study is to assess the vulnerabilities of this region to a decrease of water resources and to propose local adaptation measures.
First of all, a crop model will be applied to the region to feign the impact of both water management and water stress on the agricultural production. Exchanges with farmers will permit to provide a list of feasible actions to remediate to possible water scarcity periods.

Keywords: Water Stress, Agriculture, Fes-Meknes Region

Poster communication

Poster #21

Corresponding author: Tarek NASSER
tarek.nasser@univ-orleans.fr

The vulnerability of agricultural system related to climate change in Beqaa plain, Lebanon: which strategies for better adaptation and management of water resources?

Tarek NASSER[1], Quentin CHOFFEL[1], Laurent TOUCHART[1]

[1]*Université d'Orléans, laboratoire EA1210 CEDETE*

The drought is one of the major problems in the absence of an effective management of the water resources and policies of development in Lebanon. In the last decade, a great decline in groundwater has been noticed in the Eastern Mediterranean area (NASA, 2016). Among the sectors related to human activity, agriculture is the first vulnerable sector affected by drought. Hence, we studied the evolution of the drought intensity in an agricultural area located at the center of the Beqaa, for which climatic and satellite data was available.Our results showed that the intensity of drought varied considerably in time and space. Therefore, the tendency to increase the frequency and intensity of droughts has been particularly marked over the last three decades. The climate change envisaged in the years to come predict an increased pressure on environmental resources and particularly on water resources, which are increasingly scarce. These results give rise to a series of questions. Can drought be anticipated in order to preserve natural resources? How can the farmer carry out an agricultural activity in a dry season without exhausting the water resources? Including farmer opinion may help to improve the management of natural resources in order to maintain a sustainable agriculture.Many recommendations are suggested to policymakers involved drought planning for Beqaa. Regarding agriculture, better drought forecasting and improved monitoring techniques would provide farmers with more time to prepare for drought and would lessen the drought impacts. Also, the implementation of more advanced agricultural technology and practices would reduce agriculture's vulnerability to drought. Regarding water resources, water conservation practices may be more effective than water suppliers and it would provide better protection from unpredictable droughts.In conclusion, the regional actors are faced with challenges presented by the ambiguous nature of drought that cannot be resolved without a plan in which Beqaa's citizens can be involved to reduce the impacts that droughts cause for years to come.

Keywords: Drought, sustainable agriculture, water resources, climate change.

NASA., (2016). NASA Finds Drought in Eastern Mediterranean Worst of Past 900 Years. Consulté en ligne: https://www.nasa.gov/feature/goddard/2016/nasa-finds-drought-in-eastern-mediterranean-worst-of-past-900-years.

Poster communication

Poster #22

Corresponding author: Moung-Jin Lee
leemj@kei.re.kr

The Spatiotemporal Variation of Soil Moisture in the Agriculture Region Based on the Temperature Vegetation Dryness Index derived from satellite image

Sung-Ho Chae[1] and Moung-Jin Lee[1]

[1] *Korea Environment Institute (KEI), Sejong, Republic of Korea*

The purpose of this study is to observe and analyze soil moisture conditions with high resolution and to evaluate its application feasibility to agriculture. For this purpose, we used three Landsat-8 OLI (Operational Land Imager)/TIRS (Thermal Infrared Sensor) optical and thermal infrared satellite images taken from May to June 2015, 2016, and 2017, including the rural areas of Jeollabuk-do, where 46% of agricultural areas are located. The temperature vegetation dryness index (TVDI) was calculated to observe the soil moisture status from the Landsat-8 OLI/TIRS images with different soil moisture conditions and to compare and analyze the soil moisture conditions obtained from the SPI (Standardized Precipitation Index)3 drought index. TVDI is estimated from the relationship between LST (Land Surface Temperature) and NDVI (Normalized Difference Vegetation Index) calculated from satellite images. The results of TVDI image classification, especially field area, corresponded roughly to the SPI3. Especially, the field area did not correspond to the SPI3 drought index in the normal classification. There are problems in TVDI calculation by dry/wet edge estimation using high resolution images. However, it is possible to observe the spatial and temporal variations of soil moisture in agricultural area and there is potential for application in agriculture.

Keywords: Soil moisture, Landsat-8 OLI/TIRS, Temperature vegetation dryness index (TVDI), Agriculture

Poster communication

Poster #23

Corresponding author: Amélie ROBERT
amelie.robert@univ-tours.fr

When waste water becomes solution for urban agriculture
Case study in Ouagadougou (Burkina Faso)

ROBERT Amélie[1], YENGUE Jean Louis[2], AUGIS Fanny[3], MOTELICA-HEINO Mikael[4], HIEN Edmond[5] & SANOU Alain[6]

[1] UMR CITERES (CNRS / Université de Tours) ; UMR CITERES - MSH Val de Loire - Bureau 253 - 33 allée F. de Lesseps - BP 60449 - 37204 Tours Cedex 3, France
[2] EA RURALITES (Université de Poitiers) ; EA RURALITES - Université de Poitiers - MSHS Bâtiment A5 - 5 rue Théodore Lefebvre - TSA 81118 - 86073 Poitiers Cedex 9, France
[3] Université de Tours ; UMR CITERES - MSH Val de Loire - 33 allée F. de Lesseps - BP 60449 - 37204 Tours Cedex 3, France
[4] UMR ISTO (CNRS-Université d'Orléans) ; UMR ISTO - 1A rue de la Férollerie - 45071 Orléans Cedex2, France
[5] UMR 210 Ecologie Fonctionnelle & Biogéochimie des sols & des Agro-écosystèmes (Montpellier SupAgro, CIRAD, INRA, IRD) ; IRD Centre de Ouagadougou - 688 avenue Professeur Joseph Ki-Zerbo - Ouagadougou - secteur 4 - 01 BP 182, Ouagadougou 01, Burkina Faso
[6] Université Ouaga I Pr Joseph Ki Zerbo, UFR Sciences humaines ; Université Ouaga I Pr Joseph Ki Zerbo - 03 BP 7021 - Ouagadougou 03, Burkina Faso

Burkina Faso is faced by an increase of droughts since 1970's, even if floods are also recurrent: rains are more sparse and torrential, due to the climate change. In this context, water becomes a higher problem, particularly for farmers, who constitute 80% of the people in employment. At the same time, the country knows a rural exodus, which contributes to increase the pressure on the water resource in cities, especially in Ouagadougou. Yet, cultivated areas extend, even when they need great quantities of water and increase the pressure on the resource too. How farmers achieve to cultivate in this context of water rarefaction? What strategies are set up for water access and by who? In the framework of an interdisciplinary research program (funded by the national Network of human sciences House in France), we studied urban agriculture in Ouagadougou, associating different sources: field surveys, non-participative observations, interviews of farmers and public managers and analysis of official documents. In this proposal, we focus on the results we obtained about the strategies set up for water access, in spots of market gardening – the main agriculture category in Ouagadougou.
First, we have to specify the context, in which the strategies are set up. Indeed, agriculture in Ouagadougou, like in other African cities, is faced to another difficulty: it is not recognized as an urban activity. Consequently, farmers are not supported by authorities and they set up alone their strategies to develop and even maintain their activity. The access to water resources is crucial for them and solidarity can be observed at the occasion of irrigation works, more than for other activities.

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The water access influences the localization of cultivated lands, what confirms its importance. First, these plots were localized near dams. Nowadays they also appear near canals. These two sources can be associated in some sites and completed by a third one: water is extracted from wells too. Here appear the strategies set up by farmers: they multiply water sources, using all they can find. They cultivate at the nearest and thus even in dams and canals, when water becomes sparser and goes away during the dry season. They also adapt sometimes their crops to the water availability, choosing others during the rainy season, when their spots are flooded. But the most original strategy for water access is the use of the canals water. Indeed, theses canals collect rainwater but also waste water, poured out by households and industries. This water has the advantage to be fertile and thus provide nutrients to soil, which is not very fertile in Ouagadougou. But it has a great disadvantage to be contaminated by bacterium, metallic and chemical elements. It is used without preliminary treatment and can thus contaminate crops, becoming then a source of risk for the public health. This strategy coming from the bottom is interesting because it is a solution facing water rarefaction in a climate change context, providing a new source of water. But it needs to be improved to go beyond its limits, maybe thanks to the phytoremediation, what we begin studying.

Keywords: drought, strategies, waste water, urban agriculture, Ouagadougou.

Poster communication

Poster #24

Corresponding author: Mohamed TAABNI
mohamed.taabni@univ-poitiers.fr ; d.eljihad@yahoo.fr

La multifonctionnalité des ressources en eau à l'épreuve du changement climatique : Evaluation des démarches et instruments territorialisés pour une gestion adaptative mis en œuvre en Poitou-Charentes

TAABNI Mohamed[1], & ELJIHAD Moulay Driss[2]

[1]Université de Poitiers, Laboratoire RURALITES, Adresse : MSHS Bât A5, 5 rue Théodore Lefebvre - TSA 81118, 86073 Poitiers Cedex 9, Pays : France

[2] Université de Poitiers, Laboratoire RURALITES, Adresse : MSHS Bât A5, 5 rue Théodore Lefebvre - TSA 81118, 86073 Poitiers Cedex 9, Pays : France

En Poitou-Charentes, les ressources sont soumises à la fois à la variabilité interannuelle des pluies et à des tensions récurrentes depuis les années 1980 avec la montée en puissance des besoins pour l'irrigation estivale des céréales, principalement le maïs grain, la forte fréquentation touristique sur le littoral, sans oublier les besoins en eau douce pour la conchyliculture. Le risque de raréfaction de l'eau et de non satisfaction des besoins en eau potable des villes et agglomérations est aggravé par le changement climatique. Les effets du réchauffement climatique, évalué par différents scénarios climatiques régionalisés, va influer sur le régime des précipitations et surtout sur l'élévation des températures, augmentant ainsi la réduction des « eaux vertes » (l'eau du sol) par l'évapotranspiration, les cours d'eau quant à eux subiront des étiages plus sévères. La détérioration par les activités humaines de la qualité des eaux de surface et souterraines constitue un autre facteur d'exacerbation des concurrences pour l'accès à cette ressource environnementale. La mise en œuvre de la DCE 2000 avait permis d'évaluer la qualité des masses d'eau qui se révèlent moyennes à médiocres. 400 captages d'eau souterraine ont été abandonnés depuis les années 1970, réduisant dangereusement les réserves de sécurité pour l'alimentation en eau potable des bourgs et villes de l'ex Région Poitou-Charentes. Face à cette trajectoire négative des ressources en eau, différents dispositifs , programmes et politiques locales de préservation au départ, et plus récemment pensées en termes de réponses à l'enjeu d'adaptation au changement climatique ont été développés et appliqués. La contribution propose une analyse de l'état des ressources en eau en Poitou Charentes, leur .évolution sous l'impact du changement climatique, ainsi que les modalités de mobilisation des acteurs et les outils de gestion territorialisée mis en place (gestion volumétrique et des étiages, Schéma d'Aménagement et de Gestion des Eaux des bassins versants, Contrat territoriaux…) en vue d'une utilisation durable et d'une gestion adaptative. La reconquête de la qualité est un autre axe d'actions et programmes menés par le biais de différents programmes et institutions. Ces derniers ont été initiés sous la tutelle et coordination de plusieurs structures telles que le ministère de l'Agriculture (Ecophyto 1 et 2), les collectivités locales pour la sécurisation de leurs captages d'eau potable (Programme Re-Sources, Terre Saine) depuis les années 2000. Cette communication vise également à évaluer le degré de de complémentarité de ces actions, les modalités de prise en compte des effets du changement climatique par ces outils et démarches opérationnelles et leur niveau d'intégration dans les objectifs de planification et de garantie de la multifonctionnalité de l'eau dans les départements Picto-charentais.

Mots clefs: Eau, changement climatique, territoires, Poitou-Charentes.

Poster communication

Poster #25

Corresponding author: Fabian VON TRENTINI
fabian.trentini@lmu.de

Evaluating hydrometeorological extreme events in the ClimEx single model large ensemble in comparison with CORDEX results over Europe and Québec

von Trentini Fabian[1], Schmid Josef[1], Braun Marco[2], Brisette Francois[3], Frigon Anne[2], Leduc Martin[2], Martel Jean-Luc[3], Willkofer Florian[1], Wood Raul[1] & Ludwig Ralf[1]

[1] *Department of Geography, Ludwig-Maximilians-Universität, Luisenstr. 37, 80333 Munich, Germany*
[2] *Ouranos, Montreal, Québec*
[3] *École de technologie supérieure, Montreal, Québec*

Meteorological extreme events seem to become more frequent in the present and future, and a separation of natural climate variability and a clear climate change effect on these extreme events gains more and more interest. Since there is only one realization of historical events, natural variability in terms of very long time series for a robust statistical analysis is not possible with observation data. A new single model large ensemble (SMLE), developed for the ClimEx project (Climate change and hydrological extreme events – risks and perspectives for water management in Bavaria and Québec) is supposed to overcome this lack of data by downscaling 50 members of the CanESM2 (RCP 8.5) with the Canadian CRCM5 regional model (using the EURO-CORDEX grid specifications) for time series of 1950-2099 each, resulting in 7500 years of simulated climate. This allows for a better probabilistic analysis of rare and extreme events than any preceding dataset. Besides seasonal sums, several extreme indicators like R95pTOT, RX5day and others are calculated for the ClimEx ensemble and several EURO-CORDEX runs. This enables us to investigate the interaction between natural variability (as it appears in the CanESM2-CRCM5 members) and a climate change signal of those members for past, present and future conditions. Adding the EURO-CORDEX results to this, we can also assess the role of internal model variability (or natural variability) in climate change simulations. A first comparison shows similar magnitudes of variability of climate change signals between the ClimEx large ensemble and the CORDEX runs for some indicators, while for most indicators the spread of the SMLE is smaller than the spread of different CORDEX models.

Keywords: Climate Indicators, Dry Spells, Heavy Precipitation, Natural Variability, Climate Change.

Poster communication

Poster #26

Corresponding author: Karl M. WANTZEN
karl.wantzen@univ-tours.fr

Global Heating breaks down thermal barriers of invasive species freshwater ecosystems (but reoligotrophication may help to build new ones) – a study from Lake Constance

Wantzen, Karl M. [1] & Hesselschwerdt, John [X]

[1] *UNESCO Chair River Culture – Fleuves et Patrimoines, Université François Rabelais, UMR 7324 – CITERES, 33 Allée Ferdinand de Lesseps, 37204 Tours Cedex 03, France*
[X] *RHEOS.eu Scientific Imaging, Brandenburger Strasse 18, D-78467 Konstanz, Germany*

European freshwater ecosystems are increasingly invaded by exotic animal and plant species. Apart from increased passability of previously separated watersheds, e.g. by the canal between Danube, Main and Rhine, connecting the Ponto-Caspian and the Central European biogeographic zones, the increasing temperature of the hydrosystems favors the spread of thermophilous exotic species. The freshwater fauna of Central Europe is still shaped by the cold-adapted animal assemblages resulting from the last glaciation. It is less diverse, and the species are putatively less performant competitors, compared to the warm-adapted, species-rich fauna of the Ponto-Caspian realm. Cold winter temperatures may locally eliminate the warm-adapted species, or at least reduce their competitive success over the native fauna for a certain period. Our study shows how local heating diminishes this thermal barrier for one of the most aggressive aquatic invaders of the past decades, the predatory crustacean *Dikerogammarus villosus*, over the local amphipod *Gammarus roeselii* in Lake Constance. *D. villosus* has dramatically reduced and changed the composition of benthic invertebrates in European freshwaters since its arrival in the 1990ies. We also studied the potential mechanisms for coexistence of both species using laboratory predation experiments and field surveys. Our results indicate two key drivers: the substrate *Chara* sp. and low temperatures. The macroalga *Chara* sp. completely inhibited predation of *D. villosus* on *G. roeselii*, probably because the charophyte physically hampered movement of the amphipods. Charophytes are scarce in regulated rivers invaded by *D. villosus,* but they recently spread widely in Lake Constance after the return of the water quality to phosphate nutrient concentrations at pre-WWII levels (reoligotrophication). At temperatures below 6 °C, the predation pressure on *G. roeselii* was strongly reduced; *G. roeselii* can therefore disperse throughout the littoral in winter, avoiding predation from *D. villosus*. Experimental heating of a section of the lake shore, however, resulted in local extinction of *G. roeselii* by *D. villosus*. Climate change scenario indicates that global warming might destroy this thermal refuge during winter within the next 40 years. For the survival of *G. roeselii* in the future it will be crucial which part of the *Chara* population will maintain epigeic plant parts during winter. The complex interplay between thermal and physical refuges for native species in the context of climate change and changing trophic status of freshwater systems, as disentangled by our study, shows that ecosystem management and restoration strategies need to consider multiple stressors (and their rather complex mitigation strategies) better in the future.

Poster communication

Poster #27

Corresponding author: Ianis Delpla
Ianis.Delpla@crad.ulaval.ca

Assessing the impacts of climate variability on drinking water quality: Results from an observational and experimental study during spring rainfall events

Ianis Delpla, Manuel J. Rodriguez

École Supérieure d'aménagement du territoire et de Développement Régional, Laval University, Québec city, QC, Canada, G1K 7P4

Heavy spring rainfall events could have deleterious impacts on raw and drinking water quality for water treatment plants (WTP) using surface waters by transporting contaminants into surface waters. Deicing salts, which are frequently applied onto roads in North America, could also produce saline waters that run-off into the environment and contaminates surface waters during rainfalls. Organic matter (OM) is of primary importance for drinking water treatment since it represents an important precursor of disinfection by-products (DBPs), e.g. trihalomethanes (THMs) and haloacetic acids (HAAs) following disinfection. Consequently, since the occurrence and the intensity of heavy rainfalls events are predicted to increase with climate changes, there is a need to better characterize their impacts on drinking water quality. This study aims to evaluate the impact of climate on DBP precursors in one catchment of the region of Québec City, Canada, and assess the DBP variability in concentration and speciation.

This work was conducted in the Saint Charles river watershed (Québec, Canada) which is used as water source to produce drinking water by a large size WTP. Two autosamplers were installed (at the raw water intake and after the filtration step before final chlorination) and treated waters were sampled manually. Four heavy rainfalls events (>10mm/24h) were monitored in spring 2015. Regulated DBPs (THM4 & HAA6) and their precursors (e.g., pH, temperature, total organic carbon (TOC), bromide ion, free chlorine) were analysed. Simulated distribution system (SDS) tests were performed to assess the rainfalls impact on the OM reactivity and the DBP variations in the distribution system (DS). SDS tests were conducted by applying the same operational conditions used in the WTP at the time of sample collection (pH, temperature, chlorine dose) for two contact times (3h and 20h) representing the beginning and the end of the DS.

Significant differences between the three hydroclimatic periods (Pre, Rain, Post) were observed with Turbidity and TOC increases during rainfalls. For post rainfalls periods, a prolonged impact of rainfalls on source water TOC levels was observed. Chloride/Bromide ratio remains elevated during and after rainfalls for all campaigns and also shows an increase in the first campaign revealing a potential leaching of road salts following rainfalls. Bromide levels remain relatively constant for the others campaigns even during the rainfall period. Changes in raw and filtered water quality lead to increases in THM4 and HAA6, whose maximums were monitored in post-rainfall periods. These increases are mainly related with chlorinated DBPs increases (chloroform, dichloroacetic and trichloroacetic acids). Brominated DBPs such as bromodichloromethane (BDCM) show no significant variation with rainfalls.

Poster communication

SDS tests show a significant increase in OM reactivity with a 2-fold increase in THM4 and HAA6 for waters sampled during rainfalls compared to waters sampled during pre or post rainfall period. BDCM was slightly impacted by rainfalls but remained at low levels (<6µg/L).
This study confirm the importance of strictly controlling OM levels in drinking water treatment in a context of intensification of rainfall events with climate change for ensuring a safe drinking water quality within all the DS.

Keywords: Climate, Rainfalls, Drinking water, SDS, Disinfection by-products formation.

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