



**HAL**  
open science

# Future evolution of river discharge for the French Rhine basin in a context of climate change - An updated evaluation based on the AR5 IPCC climate simulations

Guillaume Thirel, Charles Perrin, G. Drogue, K. Gerlinger, J. Krumm, J.-P. Wagner

## ► To cite this version:

Guillaume Thirel, Charles Perrin, G. Drogue, K. Gerlinger, J. Krumm, et al.. Future evolution of river discharge for the French Rhine basin in a context of climate change - An updated evaluation based on the AR5 IPCC climate simulations. Les tensions sur l'eau en Europe et dans le bassin méditerranéen : des crises de l'eau d'ici 2050 ?, Oct 2015, Marne-la-Vallée, France. pp.1, 2015. hal-02601883

**HAL Id: hal-02601883**

**<https://hal.inrae.fr/hal-02601883>**

Submitted on 16 May 2020

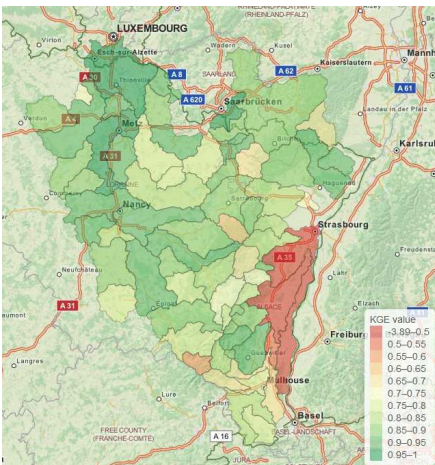
**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Future evolution of river discharge for the French Rhine basin in a context of climate change

**The MOSARH21 project**  
An updated evaluation based on the AR5 IPCC climate simulations

Fig. 1: Performance of the GRSD model over the MOSARH21 area



## Needs to assess the future of water resources

The MOSARH21 project aims at updating our knowledge of future discharge for the Moselle-Sarre-Rhine area (Fig. 1) and at linking results with past studies that made use of different hydrological models, climate models/projections and study periods (Tab. 1).

## The MOSARH21 methodology

- Multi-hydrological model (HM) approach (Fig. 2&3).
- Re-use of AR4 climate simulation used in the Explore 2070 and Flow MS projects
- Use of new AR5 projections.
- Sources of uncertainties considered in the project: ARs, GCMs, downscaling methods, HMs, HMs calibration conditions.

## First results

Limited dependence of the performances of the semi-distributed model (GRSD) to the calibration periods. High uncertainty on future precipitation evolution (Fig. 4&5).

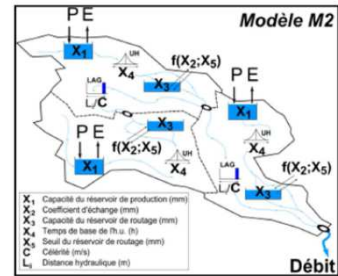


Fig. 2: The semi-distributed GRSD model (GRSD)

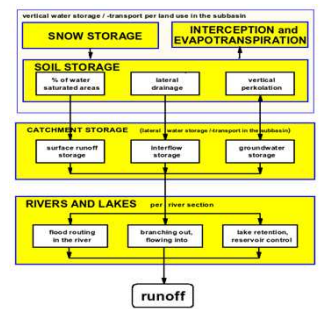


Fig. 3: The distributed LARSIM model

Some past studies on the basin  
The high diversity in past studies settings makes it difficult to compare results, especially for transboundary basins.  
Necessity to make links between studies to better understand differences.

| Project               | Rheinblick 2050         | VULNAR                            | Explore 2070                      | FLOW MS                |
|-----------------------|-------------------------|-----------------------------------|-----------------------------------|------------------------|
| AR4 scenario          | A1B                     | A1B, A2, B1                       | A1B                               | A1B                    |
| GCMs                  | 2                       | 7                                 | 7                                 | 1                      |
| Downscaling method    | Regional Climate Models | Statistical weather-type approach | Statistical weather-type approach | Regional Climate Model |
| Hydrological model(s) | HBV                     | MODCOU and HPP-inv                | GR4J and Isba-Modcou              | LARSIM                 |
| Reference period      | 1961-1990               | 1961-2000                         | 1961-1990                         | 1971-2000              |
| Future period(s)      | 2021-2050 and 2071-2100 | 2046-2065 and 2081-2099           | 2046-2065                         | 2021-2050              |

Tab. 1: Outlook of past studies

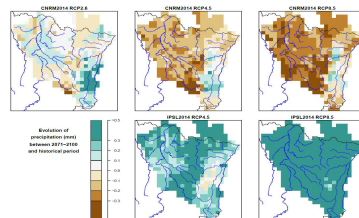


Fig. 4: Evolution of precipitation (left) and temperature (right) in far future for CNRM and IPSL Drias projections.

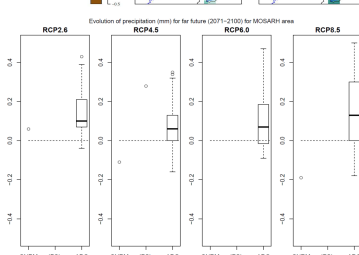
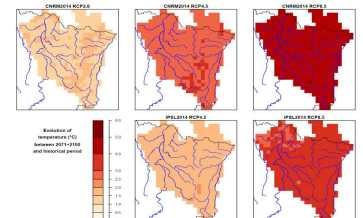
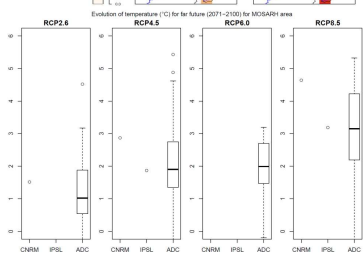


Fig. 5: Evolution of precipitation (left) and temperature (right) for future for CNRM and IPSL Drias projections and for the Advanced Delta Change projections.



## Where we are...

The MOSARH21 project is ongoing. The HMs are almost ready (Fig. 1) and the climate simulations have been processed.

During the next months, the calibrations of LARSIM will be done and the hydrological projections will be run. An analysis of these outputs will be made through the computation of various floods and droughts indicators originating from previous studies.

G. Thirel<sup>1</sup>, C. Perrin<sup>1</sup>, G. Drogue<sup>2</sup>, K. Gerlinger<sup>3</sup>, J. Krumm<sup>3</sup>, J.-P. Wagner<sup>4</sup>

1: UR HBAN, équipe HYDRO – Irstea Centre d'Antony

2: LOTERR, Univ. Lorraine, Metz

3: HYDRON, Karlsruhe, Germany

4: DREAL Lorraine, Metz

Contacts :

Guillaume Thirel ; [guillaume.thirel@irstea.fr](mailto:guillaume.thirel@irstea.fr)

Jean-Pierre Wagner ; [Jean-Pierre.WAGNER@developpement-durable.gouv.fr](mailto:Jean-Pierre.WAGNER@developpement-durable.gouv.fr)