Assessing various options for rain water management in 2030 using prospective land use change scenarii and distributed hydrological modelling in the Yzeron experimental periurban catchment (ZABR/OTHU-OZCAR CZO observatory)

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1. INTRODUCTION

▪ **Growing urbanization : increase of surface imperviousness, modifications of water flow paths ➔** increase of surface runoff, rise of storm peak flows and **flood** magnitude, reduction of groundwater recharge and increasing water **pollution.**

• **Periurban catchments** = combination of natural areas, rural areas with dispersed settlements and urban areas mostly covered by built zones and spots of natural surfaces

➔ **especially affected** by fast anthropogenic modifications

• **General guideline:** European Water Framework Directive (2000) and Floods Directive (2007) ➔ **integrated and sustainable solutions needed** to reduce flooding risks and river pollution **at the scale** of **whole catchments**.

• **Objectives:** set up a distributed hydrological model to **quantify the impact of urbanization and stormwater management on the long-term hydrological cycle of a medium-sized periurban watershed.**

⇒ **Development of the J2000P and application/evaluation in the Yzeron periurban catchment (south west of Lyon, France)**

⇒ **Compare various land use and rain water management scenarii**

1. The Yzeron catchment (150 km²), France

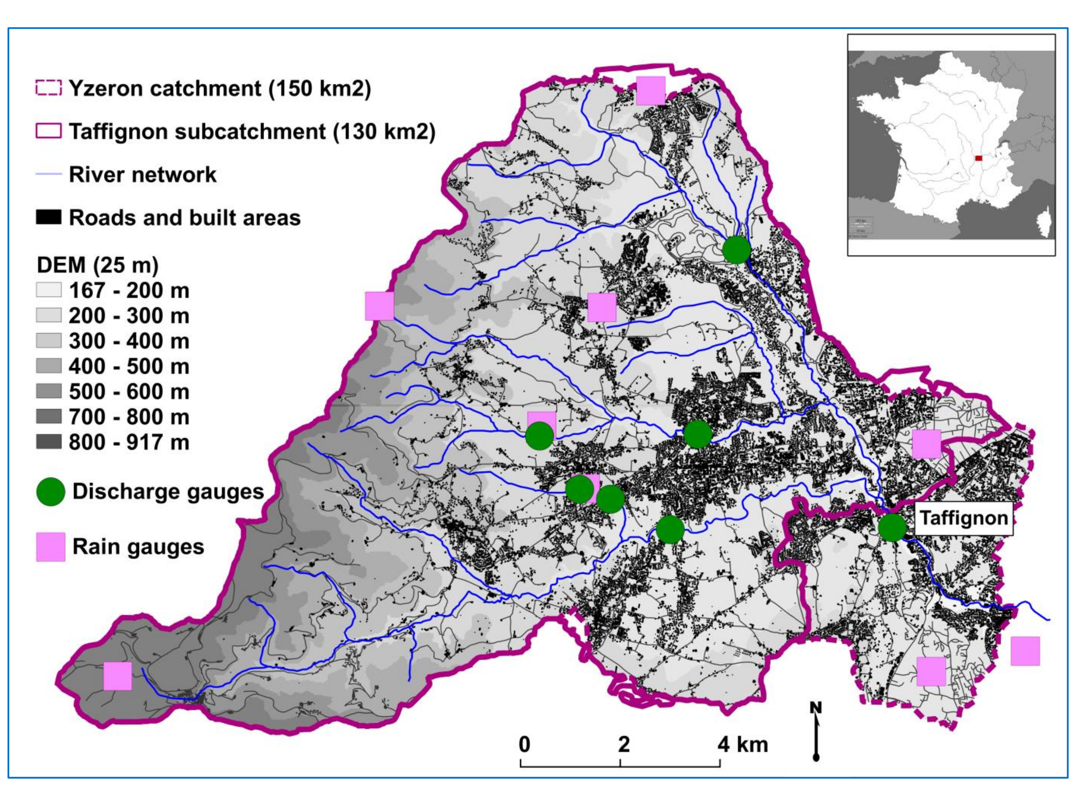

Figure 1: Situation map of the Yzeron and Taffignon catchments with indications of topography, impervious areas and measurement network.

The Yzeron catchment is part of the ZABR/OTHU observatory and RBV network. Monitoring started in 1990 and was enhanced in 2008 (7 rain gauges, 1 meteo station, 7 discharge stations)

• Catchment prone to **quick Mediterranean-type floods**

• **Fast growing urbanization** since 1980's. In 2008, the catchment was covered by 25% of impervious surfaces, 42% of agricultural areas and 33% of forests.

• Urban rainwater mainly directed to the **WWTP outside of the basin** through a **combined sewer network**.

2. The J2000P model

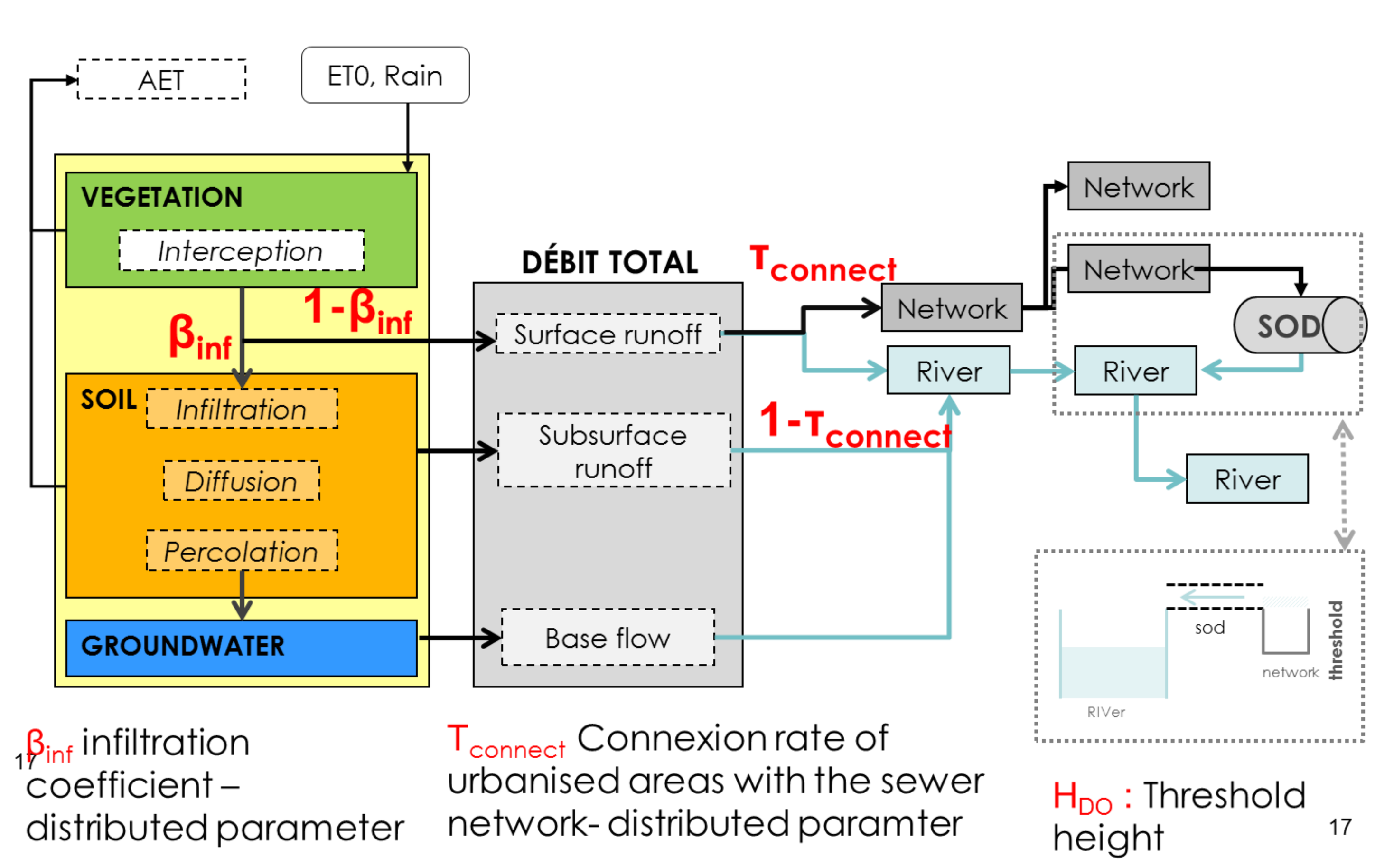

Figure 2: Structure of the J2000P model. Urban rainwater is directed partly to the sewer network according to the Tconnect parameter.

3. MODEL SET UP AND EVALUATION

• 96 HRUs = 47 **rural** and 49 **urban subcatchments** (Fig.3)
→ 1 rural outlet = river
→ 2 urban outlets = river + sewer

• Model parameters based on literature and existing data bases
→ Uniform *Tconnect=0.7* based on average imperviousness
→ No model calibration but a sensitivity analysis of the impact of the main parameters

• Model evaluation at all gauges (Fig. 4, Table 1)
→ Correct simulation of the flood dynamics and tendency to underestimate peak values in summer
→ High sensitivity of the model to the recession parameters and to the *Tconnect* parameter
→ Definition of a reference parameter set

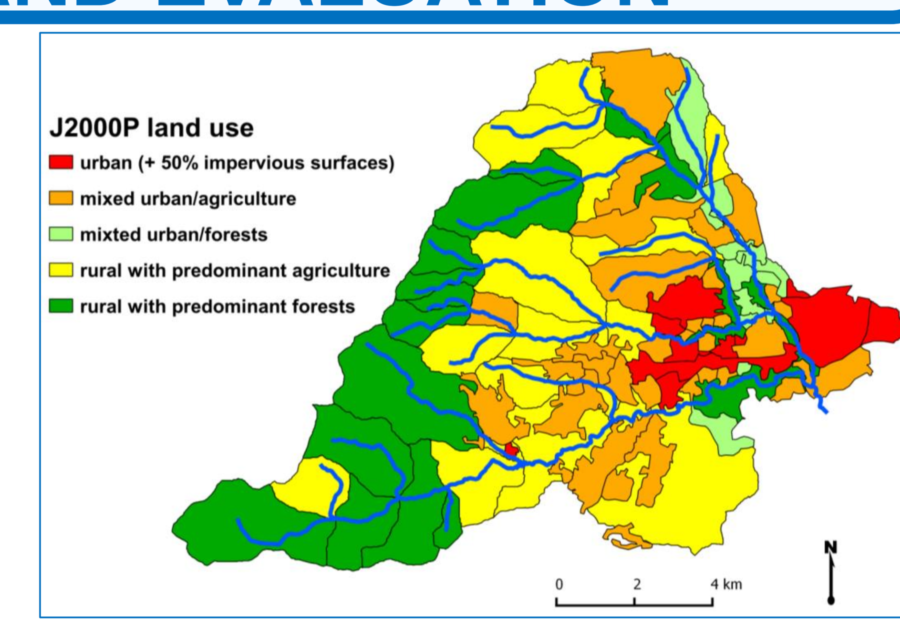

Figure 3: J2000P model mesh.

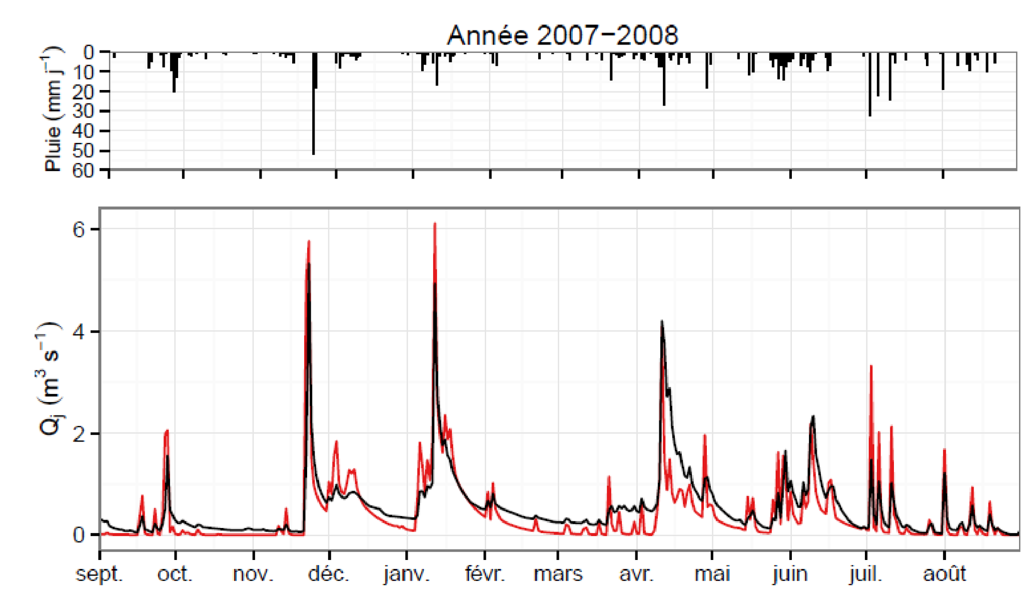

Figure 4: Observed (red) and simulated (black) daily discharge at the outlet (year XXX)

Table 1: Statistical criteria comparing observed and simulated discharge at the various gauging stations

	Période	PBIAIS	Nash (Qj)	Nash(Qh)	Nash (1/Qh)
Taffignon	**2005-2012**	**-10,05**	**0,78**	**0,45**	**-0,14**
Craponne	2005-2012	-42,91	0,72	0,65	-13,41
Charbonnières	2009-2012	-42,86	0,44	0,34	-8,91
Ratier	2010-2012	-17,31	0,41	0,30	-0,85
Mercier	2005-2010	-27,74	0,65	0,64	0,11
Léchère	2005-2012	-34,16	0,69	0,63	-0,34
PontBarge	2005-2012	-6,97	0,60	0,46	0,31

4. 2030 LAND USE AND RAIN WATER MANAGEMENT SCENARII

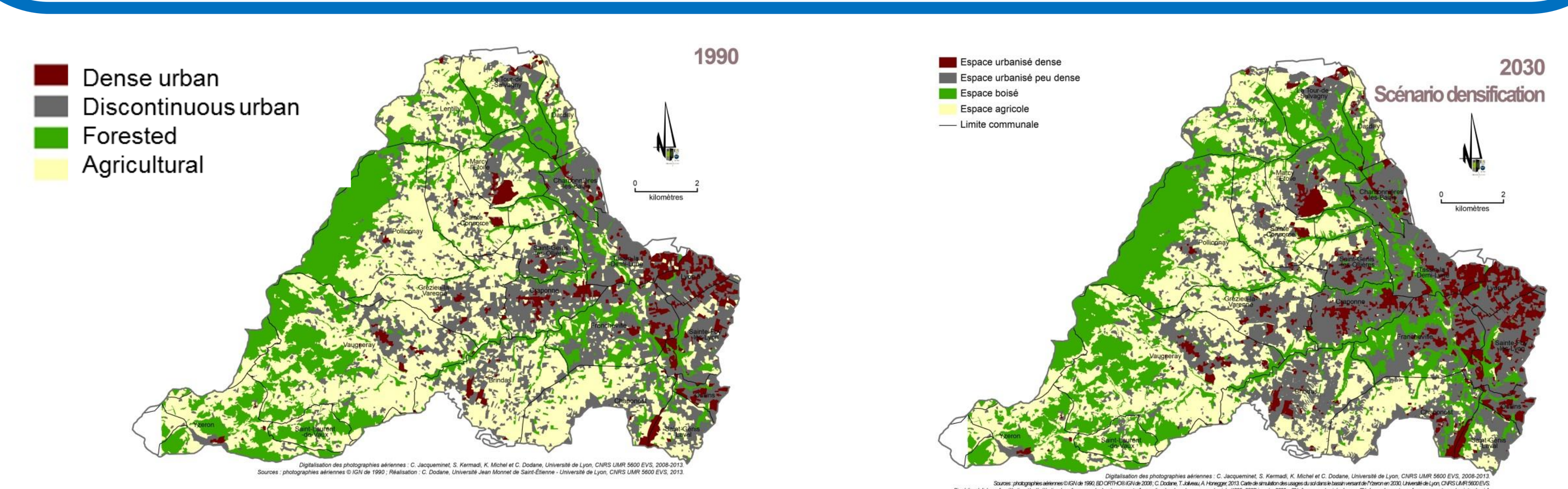

Figure 5: land use map for 1990 (left). Land use map in 2030 simulated with a land use change model (Dodane et al., 2014) (right).

Land use 2030 + 3 rainwater management scenarii (Table 2):

Runoff (mm)	Reference	Spatialized	Disconnection
Q_{river}	**171**	**157**	**160**
Surface runoff	**62**	**47**	**51**
Interflow	40	40	40
Base flow	70	70	70
Q_{sewer}	**40**	**55**	**51**
SOD	**12**	**34**	**25**

Table 2: Catchment water balance in 2030 for three rain water management scenarii

→ 1 Reference: same as present T*connect*=0.7
→ 2 Spatialized: *Tconnect* distributed according to local imperviousness
→ 3 Disconnection: distributed *Tconnect* and disconnection of recent urban areas

Disconnection scenario produces less surface runoff and less sewer overflows than spatialized scenario.

Conclusions:

• **More differences between the rain water management scenarios than between land use change scenarios**
• **High uncertainty in the results**

References: Labbas, 2015; Labbas et al., La Houille Blanche 2015; Dodane et al., Cybergeo, 2014.

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RÉSEAU DES BASSINS VERSANTS

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