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Modelling the coupled surface water and groundwater system of the Middle Upper Rhine Valley and its response to climate change.

Solen Queguiner (1), Eric Martin (1), Charlotte Thierion (2), Florence Habets (2), Philippe Ackerer (3), Simon Lecluse (3), and Samer Majdalani (4)

(1) METEO-FRANCE, CNRM-GAME/GMME, Toulouse, FRANCE, (solen.queguiner@meteo.fr), (2) SISYPHE, UMR7619, Mines Paris Tech, Fontainebleau, FRANCE, (3) LHyGeS, UMR7517, Strasbourg, FRANCE, (4) HydroSciences, UMR5569, Montpellier, FRANCE

The Upper Rhine Graben hydrosystem holds one of the most important groundwater resources in Europe. This alluvial aquifer provides three-quarters of the regional needs for water. Its functioning is tightly linked to the hydrographic network in the alluvial plain. Indeed an important part of the available groundwater comes from the infiltration of rivers in the very permeable alluvial material of the plain. In other places in the plain a heavy drainage of the aquifer occurs, contributing to the very dense river network. Consequently, this hydrosystem has to be studied in a coupled way, taking into account the complex interaction between surface and subsurface processes.

In the framework of the VULNAR project several surface, hydrological and aquifer models are used to study the vulnerability of the Rhine aquifer. This presentation will focuses on the meteorological and surface aspects and their coupling with hydrological models. The Safran-Isba-Modcou (SIM) chain is used to estimate the climate change impact on the hydrology of the region. SIM is composed of a meteorological analysis system (SAFRAN), a land surface model describing the exchange with the atmosphere (ISBA) and a hydrogeological model (MODCOU). A specific version of MODCOU is currently being developed for the region of study.

The mass and energy exchanges between the continental surface (including vegetation and snow) and the atmosphere are simulated by ISBA. The LAI (Leaf Area Index) is provided by the ECOCLIMAP2 database and the vegetation is divided into 12 types. The SAFRAN meteorological analysis is used at a resolution of 8 km in the plain and down to a 1km resolution on the mountains bordering the alluvial plain.

In a first step a simulation of the water balance on the studied area is presented. The simulation covers a period of 17 years: 1986-2002. The drainage and the runoff are provided to MODCOU and a comparison of the discharges with the observations is presented.

Several developments are undertaken in order to account for the interaction between the root zone and the ground water in the plain area, in order to quantify the importance of this process that may be important, especially in the context of a climate change. Finally a first assessment of the impact of a climate change will be presented, using a downscaled GCM simulation over the region.