Geophysical Research Abstracts
Vol. 15, EGU2013-4302, 2013
EGU General Assembly 2013

Distributed River Stages and Stream-Aquifer Exchanged Fluxes Simulation at Regional Scale

Firas Saleh (1), Nicolas Flipo (1), Alexandre Pryet (2), and Baptiste Labarthe (1)
(1) Geosciences Department - MINES ParisTech, France (firas.saleh@mines-paristech.fr), (2) ENSEGID - IPB, Pessac, France

The goal of this study is to accurately simulate river stage in regional river networks in order to improve the quantification of stream-aquifer exchanges and better assess the associated aquifer responses that are often impacted by the magnitude and the frequency of the river stage fluctuations.

This study focused on the Seine River basin (76 500 km2), located in the north of France. The Seine basin is located in the Parisian sedimentary basin, which is a composite of several geologic formations of which six are modeled in this study. The exchanged stream-aquifer water fluxes are modeled in the main Seine river network ($\sim$ 4350 km) using a regional distributed process-based hydro(geo)logical model, Eau-Dyssée.

Eau-Dyssée simulates pseudo 3D flow in aquifer systems solving the diffusivity equation with a finite difference numerical scheme. River flow is simulated with a Muskingum model. In addition to the in-stream discharge, the river level is estimated to calculate the stream-aquifer water exchange with a conductance model. The river stages themselves are assessed from river flow using a simplified Manning Strickler model, which assumes a steady-state flow. For each river cell, this approach requires the fitting of two parameters: the elevation of the bottom of the river bed and the Manning friction coefficient. While this fitting is performed following a Monte Carlo approach, the future SWOT mission and its high-spatial resolution imagery will provide surface water level measurements at the regional scale that will permit to better characterize the Seine complex hydrological system.

Eventually the different components of the hydrosystem model (surface component, groundwater component and stream-aquifer component) were calibrated following a nested methodology over the period 1996-2006. The overall performances of the model are satisfactory with a RMSE between simulated and observed piezometric head of 4 m (for 200 piezometers), and a Nash criteria of 0.9 at the basin outlet. The fitted model provides the spatial distribution of stream-aquifer exchanges associated with their seasonal variability. At the basin scale, aquifer units discharge in average 100 m3/s in the downstream river network (4350 km), while rivers re-infiltrate 20 m3/s, the net water exchanges being 80 m3/s. Most of the uncertainties are due to the calibration of the groundwater flow, as well as to the estimation of the in-stream water levels, which constitutes the aim of the SWOT mission.