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ASSESSING THE CONTRIBUTION OF THE MAIN AQUIFER UNITS OF THE LOIRE BASIN TO RIVER DISCHARGE DURING LOW FLOW

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Summary. The Loire River discharge (117 000 km²) is very variable, and this contrasted hydrological behaviour should evolve in response to climate changes. Reservoirs have been built in the upper valley in order to sustain low flow during droughts. The evolution of low flows is a key issue for the industry such as electricity production from nuclear power plants which uses water from the Loire for cooling. To estimate the evolution of low flows, it is necessary to have a good estimate of the contribution of a complex aquifer system to the river discharge.

The main sedimentary aquifer units that contribute to the Loire discharge are located in the centre of the basin and cover an area of 35 000 km². The contribution of these aquifer units to river discharge is assessed using the distributed physically-based model Eau-Dyssée which allows to simulate three overlaying aquifer units: Beauce Limestones (Oligocene), Chalks (Seno- Turonian) and Sands (Cenomanian).

The hydrological processes in Eau-Dyssée are computed by the coupling of surface and groundwater flows. The surface model computes the water balance that allows to split precipitation into evapotranspiration, runoff and infiltration by the mean of an eight-parameter conceptual model. Parameters are derived from a set of distributed data composed of land use and geology. The groundwater model solves the diffusivity equation using finite differences method on a multilayered system. Its structure is built according to the geometry of the main aquifer units. Streams network is obtained from a 1 km - Digital Elevation Model. The measured Loire River flow is imposed as a boundary condition upstream from the modelled basin.

This study presents the calibration of the model by comparing measured and simulated discharges in the stream network and using both hydraulic head distribution at specific date and time series of hydraulic head in 200 piezometers. The calibration phase covers a ten years period (1996-2006) during which water withdrawals (irrigation, drinking water supply, industrial withdrawals) are taken into account. First estimates of hydrodynamic parameters were obtained from several studies focusing each on one aquifer unit of the central aquifer system.