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A simple groundwater scheme for global hydrology and climate applications : development and off-line evaluation over France

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In climate models, the partitioning of precipitation between evapotranspiration and runoff has a major influence on the terrestrial water and energy budgets, and thereby on simulated weather or climate. Nevertheless, most global climate models do not account for the groundwater processes while their influence on surface exchanges are important to understand the hydrological cycle at regional and global scales and its response to anthropogenic perturbations.

At the "Centre National de Recherches Météorologiques", we use the ISBA-TRIP continental hydrological system to simulate both surface hydrology and river discharges at global scale. Previous studies have shown that uncertainties in river routing and groundwater processes could play an important role on the quality of the simulated discharges (Alkama & al. 2010; Decharme & al. 2010).

In this context, we propose to develop a simple global groundwater scheme directly implemented in TRIP and based on the MODCOU hydrogeological model. Nevertheless, since MODCOU uses parameterizations tuned for fine scale studies, some hypothesis have been made to estimate the parameters in the diffusive groundwater flow equation and to quantify the exchanges between the river and the aquifer.

This new scheme is first applied over France at fine resolution ($1/12^{\circ} \times 1/12^{\circ}$) over the 1995-2006 period. The choice of this domain is motivated by a dense network of in-situ discharges and water table depth observations and the possibility to compare our results with MODCOU. Flow directions are derived from the global 30 arc-second elevation data set GTOPO30 and TRIP is here forced by runoff and drainage coming from an high quality and independent ISBA simulation (Quintana Segui & al. 2009). The evaluation is also made against terrestrial water storage variations estimated from the Gravity Recovery and Climate Experiment (GRACE) satellite missions.