Geophysical Research Abstracts
Vol. 15, EGU2013-11602, 2013
EGU General Assembly 2013

On the effects of hydrological model structure on soil moisture data assimilation

Giovanni Corato, Patrick Matgen, Laura Giustarini, and Fabrizio Fenicia

Dep. of Environmental and Agro-biotechnologies, Centre de Recherche Public – Gabriel Lippman, Belvaux, Luxembourg (corato@lippmann.lu)

Nowadays, satellite sensors allow obtaining soil moisture estimates at global scale with an adequate temporal and spatial resolution, thereby offering a theoretical chance to improve flood-forecasting systems based on rainfall-runoff models. In fact, the knowledge of antecedent soil moisture conditions plays a crucial role in predicting catchment response to rainfall events. In the literature, several studies have focused on the assimilation of soil moisture data into hydrological models. The results of these studies tend to show that an improvement in discharge and soil moisture forecasts can be obtained when the assimilated information originates from accurate in situ measurements. When dealing with the assimilation of remote sensing-derived soil moisture data, the reported results are more controversial. There is no doubt that the performances of soil moisture data assimilation studies depend on many factors: data assimilation scheme, hydrological model structure, accuracy and resolution of soil moisture data. As of today, these dependences are not well understood and the disparity of outcomes in past studies arguably reflects the differences in the design of the experiments.

In this general context, the aim of this study is to investigate the effects of hydrological model structures on soil moisture data assimilation performance. The analysis focuses on the vertical “stratification” of the soil column in a conceptual hydrological model. We consider multiple structures that differ by the number of soil reservoirs and their respective sizes. The recently introduced SUPERFLEX hydrological modelling framework is used to this end. In fact, this framework allows building and modifying multiple hydrological models by combining three basic building blocks: reservoirs, lag functions and junctions. As a data assimilation scheme, the particle filter was considered. The area of interest is the Alzette catchment (1200 km2), located in Luxembourg, while the analysed period spans from 2005 to 2011. The results of our study provide some insights on model structure requirements supporting an optimal usage of in situ measured and remotely sensed soil moisture data for operational hydrology.