Geophysical Research Abstracts
Vol. 18, EGU2016-16549, 2016
EGU General Assembly 2016

Evaluation of snow dynamics modelling on a pixel scale using terrestrial photography and Ensemble Transform Kalman Filtering

Rafael Pimentel (1), María José Pérez-Palazón (1), Javier Herrero (2), and María José Polo (1)

(1) Fluvial Dynamics and Hydrology Research Group. Andalusian Institute for Earth System Research. University of Cordoba. Cordoba, Spain (rpimentel@uco.es), (2) Fluvial Dynamics and Hydrology Research Group. Andalusian Institute for Earth System Research. University of Granada. Granada, Spain

Snow plays a crucial role in the hydrological regime in mountainous catchments, which increases in semiarid regions, where the recurrence of drought period makes it necessary to accurate the determination of the water availability from the snowpack. Physically based approaches constitute one of the best ways to reproduce the snow dynamics over these highly variable conditions. Moreover, they allow further understanding the processes involved, the snowpack behaviour and evolution. However, in some cases the complexity of the modelled process and the non-availability of all the required data for such models, avoid a correct representation of certain aspects. In these cases, data assimilation techniques can help to improve model performance and may also act as an indirect tool to understand the represented processes.

This work assesses snow dynamics on a pixel scale (30x30m) in a Mediterranean site (Sierra Nevada Mountain, southern Spain) combining physical snow modelling (WiMMed, a physically based hydrological model developed for Mediterranean environments), ground sensing information (terrestrial photography) and data assimilation techniques (Ensemble Transform Kalman Filter), throughout a study period of two hydrological years: 2009-2010 and 2010-2011. Snow cover fraction and averaged snow depth were obtained from the terrestrial photography images and used as observations in the assimilation scheme. The model performance was evaluated using different combinations of the variables assimilated: 1) only snow cover fraction, 2) only snow depth, 3) and both variables.

The results show how the assimilation enhances the model performance. This improvement is higher if the variable assimilated is snow depth, with RMSE= 0.14 $m^2m^{-2}$and RMSE=12.16 mm for snow cover and snow depth respectively. However, this enhancement varies throughout the study period. During short snowmelt cycles, for example, the assimilation of the snow cover fraction is the most efficient.

Nevertheless, certain periods can still be identified for which the assimilation does not reproduce adequately the snow dynamics, and and further representation of the snow processes in the model must be included to achieve such cases. Data assimilation not only improves the model results but also helps to understand the limitations of the modelling.