IAHS2017-131
IAHS Scientific Assembly 2017

Optical satellite data assimilation in Crocus snowpack model to improve forecasting capabilities

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Forecasting snowpack evolution in mountain areas typically relies on numerical snowpack models. However, the high degree of complexity of the processes involved in snowpack evolution and the need for continuous and spatially distributed meteorological data to run the simulations, result in discrepancies between the real and the simulated snowpack. The accumulation of such discrepancies over time due to snowpack memory decreases forecasting capabilities. Satellite data such as MODIS images provide information on the distribution of the snowpack over large areas and account for its high spatial and temporal variability. The assimilation of such data into snowpack models significantly improves simulation results. This works, presents the first results of optical satellite data assimilation on Crocus snowpack model over a large area .
The study area is Arve upper catchment (more than 200km2) in the western European Alps. This site has a wide elevation range with a big extension above 2000m asl and a large glaciated areas. Thereby, the study area is perfect to test the improvement on the forecasting capabilities of the model. The assimilation is based on ensemble meteorological forcing using particle filter technique. When a new satellite image from MODIS of the study area is available with cloud presence below a threshold, the image reflectance and/or the presence of snow deduced from the reflectances is assimilated in the snowpack distributed simulation.
Despite the final goal of this study is to build a real-time data assimilation system, this work presents reanalysis simulations of previous years to analyse the impact on simulation results of satellite data assimilation.