Assimilation of the MODIS Snow Cover Area in the LISFLOOD model for the European Flood Alert System (EFAS)

Guillaume Thirel, Peter Salamon, Peter Burek, Milan Kalas, and Jutta Thielen
Institute for Environment and Sustainability, European Commission - Joint Research Centre, Ispra, Italy
(guillaume.thirel@jrc.ec.europa.eu)

LISFLOOD is a semi-physical rainfall-runoff model that allows the simulation of hydrological processes in medium to large scale European river basins. This model is used at the European Commission Joint Research Centre for studying floods, hydrological global changes and droughts. LISFLOOD is the basis of the European Flood Alert System (EFAS), which is a real-time probabilistic flood prediction system aiming at warning European partner members with a lead-time of up to 10 days.

The aim of this study is to evaluate the feasibility of assimilating snow satellite data into LISFLOOD. This should enhance the simulation of flood events that occur during the snow melting period, which can be badly simulated due to a weak reproduction of the snow content within the model. Therefore the use of the observed MODIS Snow Cover Area (daily available for the whole Europe) has been tested.

First, the improvement of the MODIS data by removing cloud covering using various methods will be described:
- Combination of the data from the two MODIS satellites
- data from previous days
- data from neighbors' pixels
- data from pixels with similar altitudes.
Then, the conversion of the Snow Cover Area data into Snow Water Equivalent (SWE) using a Snow Depletion Curve will be explained.
Finally, the zones where the SWE is modified within the model will be described.

Two data assimilation methods were tested: the ensemble Kalman filter (EnKF) and the particle filter. The application of these two methods for a European basin will be explained and their performance will be assessed. The results show that the EnKF improves the snow cover but deteriorates the discharges, whereas the particle filter shows interesting results for both snow cover and discharge simulation. An evaluation of these results will be given.