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Assimilating H-SAF and MODIS Snow Cover Data into the Conceptual Models HBV and SRM

Aynur Sensoy (1), Dirk Schwanenberg (2,3), Arda Sorman (1), Bulut Akkol (1), Rodolfo Alvarado Montero (2), and Gokcen Uysal (1)

(1) Dept. of Civil Engineering, Anadolu University, Eskisehir, Turkey (aynur.sensoy@gmail.com), (2) Institute of Hydraulic Eng and Water Resources Management, University of Duisburg-Essen, Essen, Germany, (3) Deltares, Delft, The Netherlands

Conceptual hydrological models are widely used for operational and scientific water resources management applications in mountain catchments. However, current model-based forecasting approaches are jeopardized by input data and model uncertainties. Data assimilation provides a suitable tool to merge information from remotely sensed observations and hydrological model predictions for improving the lead time performance of streamflow forecasts in the context of operational hydrological forecasting systems. In this study, we present a novel variational approach based on Moving Horizon Estimation (MHE). It includes a highly flexible formulation of distance metrics for penalizing the introduction of noise into the model and enforcing the agreement between simulated and observed variables. Furthermore, the MHE setup shows a high robustness regarding non-equidistant, noisy and sometimes missing data and enables the modification of model input as well as state variables.

In situ snowpack measurements are sparsely distributed in mountainous regions. Therefore the data limitations in combination with snowpack heterogeneity prevent a detailed understanding of the variability of snow cover and melt. Remotely sensed images offer an opportunity to supplement ground measurements for performing runoff predictions during the snowmelt season. In this context, EUMETSAT initiated the H-SAF (Satellite Application Facility on Support to Operational Hydrology and Water Management) project for deriving novel products from satellite data and applying it to operational hydrology.

This research contributes to the H-SAF product validation by applying a generic data assimilation test bed for H-SAF snow products in comparison to snow cover data of MODIS. A preliminary performance assessment of the data assimilation framework using the conceptual models HBV and SRM with satellite derived snow data is evaluated for a snow dominated test site of 10250 km2 at the headwaters of Euphrates River in Turkey.