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Spatial sensitivity analysis of remote sensing snow cover fraction data in a distributed hydrological model

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Distributed hydrological models enhance the analysis and explanation of environmental processes. As more spatial input data and time series become available, more analysis is required of the sensitivity of the data on the simulations. Most research so far focussed on the sensitivity of precipitation data in distributed hydrological models. However, these results can not be compared until a universal approach to quantify the sensitivity of a model to spatial data is available.
The frequently tested and used remote sensing data for distributed models is snow cover. Snow cover fraction (SCF) remote sensing products are easily available from the internet, e.g. MODIS snow cover product MOD10A1 (daily snow cover fraction at 500m spatial resolution). In this work a spatial sensitivity analysis (SA) of remotely sensed SCF from MOD10A1 was conducted with the distributed WetSpa model. The aim is to investigate if the WetSpa model is differently subjected to SCF uncertainty in different areas of the model domain. The analysis was extended to look not only at SA quantities but also to relate them to the physical parameters and processes in the study area.
The study area is the Biebrza River catchment, Poland, which is considered semi natural catchment and subject to a spring snow melt regime. Hydrological simulations are performed with the distributed WetSpa model, with a simulation period of 2 hydrological years. For the SA the Latin-Hypercube One-factor-At-a-Time (LH-OAT) algorithm is used, with a set of different response functions in regular 4 x 4 km grid.
The results show that the spatial patterns of sensitivity can be easily interpreted by co-occurrence of different landscape features. Moreover, the spatial patterns of the SA results are related to the WetSpa spatial parameters and to different physical processes. Based on the study results, it is clear that spatial approach of SA can be performed with the proposed algorithm and the MOD10A1 SCF is spatially sensitive in the WetSpa model.