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Application of remote sensing in distributed hydrological modelling. -Towards the remote sensing-driven model

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The main obstacles in current distributed hydrological modelling are the lack of sufficiently distributed input data and insufficient spatial model validation. Remote sensing can potentially close some of the gaps in data availability and provide means for spatial calibration and validation of distributed hydrological models.

In this study we propose the use of remotely sensed estimates of the driving variables in the MIKE SHE model code; precipitation, potential evapotranspiration and leaf area index. Hence, the present study describes the setup and performance of a completely remote sensing-driven large scale distributed hydrological model. The advantages of using remote sensing data in distributed hydrological models are many. The remote sensing data provide input as spatially averaged measurements that cover the entire catchment in a grid based format easily integrated in the model structure. The input can be of relatively high resolution in both time and space and is often available in near real time.

The model setup presented in this study covers the 350.000 km^2 Senegal River Basin, divided into 8 subcatchments. The spatial resolution of the model grid is 6 km and model input and output are on a daily timescale.

The remote sensing input is estimated using common techniques based on NOAA AVHRR and geostationary METEOSAT 7 data. Potential evapotranspiration is re-

trieved through an estimation of incoming global radiation using 9 daily METEOSAT VIS images converted into cloud cover indices. The leaf area index, LAI, is estimated from the AVHRR GIMMS 10 day NDVI dataset using a look-up table method. Precipitation is estimated by the TAMSAT method based on cold cloud duration maps originating from METEOSAT IR data. An ensemble approach is used for uncertainty estimation for the satellite-based rainfall estimates.

Finally the model is calibrated against daily discharge data from 7 stations using automatic calibration for the period 1998-2002 and validated against the same stations for the remaining period, 2003-2005.