ASSIMILATION OF REMOTELY SENSED SOIL MOISTURE DATA IN A HYDROLOGICAL FORECASTING MODEL OF THE OVERIJSSELSE VECHT.

Water board Drents Overijsselse Delta (WDOD) uses a Flood Early Warning System (FEWS) to forecast the discharge and water levels in the Overijsselse Vecht. In this study was looked at the hydrological model of the FEWS, the HBV model. Due to the increased resolution and availability of satellite data, the water board wants to know whether the HBV model performance could be improved by assimilation of remotely sensed soil moisture data.

In this study, 3 (out of 14) sub-catchments of the Overijsselse Vecht were investigated, namely the Ommerkanaal, Sallandse Wetering and the Dinkel. For these 3 sub-catchments, the following steps were executed. First, the HBV models of the 3 sub-catchments were recalibrated. For this step, a parameter sensitivity analysis was carried out, from which the parameters for the recalibration were selected. The calibration was done with a Monte Carlo simulation with 2.5 million runs. For all 3 sub-catchments, the model performance improved in comparison to the HBV models used in FEWS.

The sensitivity analysis for the initial conditions showed that the model is most sensitive for the initial soil moisture conditions, for 2 out of the 3 sub-catchments. For the Dinkel, the sensitivity for the soil moisture was not the highest but still relatively large. Therefore, it was expected that updating the soil moisture would have an effect on the simulated discharge.

Subsequently, the correlation between the HBV modelled soil moisture and the remotely sensed soil moisture content was investigated. For both the daily measured and the 3-day moving average soil moisture content, a good correlation was found for all 3 sub-catchments, meaning there are similarities in the pattern between both datasets. The correlation between the 3-day moving average and the HBV modelled soil moisture was higher for all 3 sub-catchments because the peaks are smoothed. The values of the correlation coefficients range from 0.85 for the Sallandse Wetering to 0.91 for the Ommerkanaal (of which the data is shown in Figure 1).

The assimilation of remotely sensed soil moisture data by direct insertion in the HBV model did not show an improvement overall. There are a few exceptions for which the model with assimilation did show an improvement; this was the case when the peak flow occurred during a dry period. The approach of the HBV model is to store the precipitation in the soil moisture reservoir, which will, during dry periods, lead to lower discharges. With data assimilation, the soil moisture was raised leading to a smaller storage capacity and a higher forecasted discharge. In the rest of the cases, the HBV model performed better without data assimilation than with assimilation of soil moisture data. This can partly be explained by the linear transformation of the remotely sensed soil moisture, while the correlation between the remotely sensed and HBV modelled soil moisture is nonlinear (see scatter plot Figure 1).

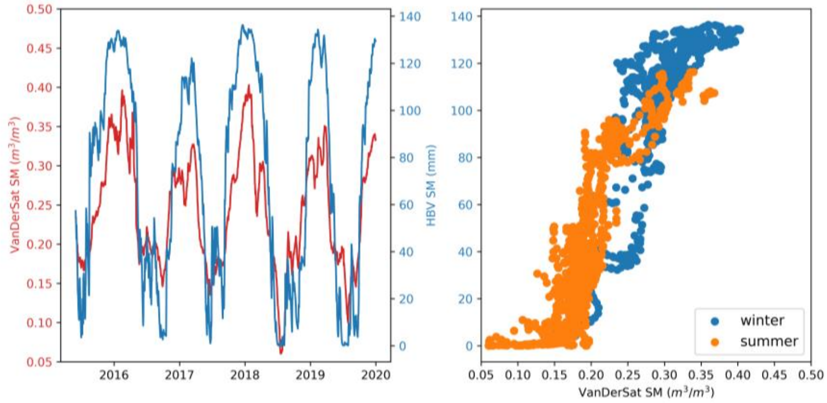

Figure 1: Time series of *the HBV modelled soil moisture (blue line) compared with the 3-day moving average remotely sensed soil moisture of VanderSat (red line) (left) and the same data as scatter plot (right) for the Ommerkanaal.*

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