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Can satellite-derived water surface changes be used to calibrate a hydrodynamic model?

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The limited availability of recent ground observational data is one of the main challenges for validation of hydrodynamic models. This is especially relevant for real-time global applications such as flood forecasting models. In this study, we aim to use remotely-sensed data from the Global Flood Detection System (GFDS) as a proxy of river discharge time series and test its value through calibration of the hydrological model LISFLOOD. This was carried out for the time period 1998-2010 at 40 sites in Africa, Europe, North America and South America by calibrating the parameters that control the flow routing and groundwater processes. We compared the performance of the calibrated simulated discharge time series that used satellite-derived data with the ground discharge time series. Furthermore, we compared it with the independent calibrated run that used ground data and also, to the non-calibrated simulated discharge time series. The non-calibrated set up used a set of parameters which values were predefined by expert-knowledge. This is currently being used by the LISFLOOD set up model embedded in the pre-operational Global Flood Awareness System (GloFAS). The results of this study showed that the satellite surface water changes from the Global Flood Detection System can be used as a proxy of river discharge data, through the demonstration of its added value for model calibration and validation. Using satellite-derived data, the skill scores obtained by the calibrated simulated model discharge improved when comparing to non-calibrated simulated time series. Calibration, post-processing and data assimilation strategies of satellite data as a proxy for streamflow data within the global hydrological model are outlined and discussed.