EGU2020-12927
https://doi.org/10.5194/egusphere-egu2020-12927
EGU General Assembly 2020

Implementation of a flood forecasting system in a transboundary river basin, Peru – Ecuador

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The Peruvian Service of Meteorology and Hydrology (SENAMHI) provides hydro-climatological hazard information to population and decision-makers about flood forecasting and warning on the whole territory of Peru. For flash floods monitoring, a sub-daily simulation is critical to properly address the response of the watershed and prepare timely flash flood warnings. Over the last years, the city of Tumbes has been affected by the overflowing of Puyango-Tumbes river, which is born in Ecuador and flows to northwestern Peru. For this reason, the aim of this work is to develop an operational sub-daily hydrological forecast service for Puyango-Tumbes river basin.

To establish this forecasting system, we performed a continuous hydrological modelling approach on an hourly time scale for the Puyango-Tumbes basin at El Tigre stream gauge (4710 km^2) in a semi-distributed way. We used the Sacramento Soil Moisture Accounting (SAC-SMA) model to simulate rainfall-runoff process and Saint-Venant equations for flow routing. Gridded hourly precipitation (~10 Km) was obtained by merging satellite-based precipitation estimates (IMERG-Early Run and GSMaP Near-Real-Time products) with rain-gauge data applying a simple bias adjustment. The model was calibrated and validated for the 2014/15 - 2018/19 period. Results show good agreement between observed and simulated hydrographs with Nash-Sutcliffe efficiency (NSE) between 0.6 and 0.8, for both products. For the highest floods, the peak is reasonably reached although there is an underestimation of 22% and 38% for calibration and validation period. The best performance was obtained for the SAC-SMA-IMERG scheme; however, sometimes rainfall at the upper Puyango-Tumbes is not well represented.

The flood forecasting operation will be performed on a daily-basis using an hourly meteorological forecast from ETA-SENAMHI climate model, at ~10 Km resolution. During this austral summer, the system will be evaluated and distributed to stakeholders.