

Assimilation of satellite altimetry on the Lake Victoria to enhance impact-based flood forecasting in the Nile Basin

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Every year Africa is hit by extreme floods which, combined with high levels of vulnerability and increasing population exposure, often result in humanitarian crises and population displacement. Impact-based forecasting and early warning for natural hazards is a step forward in disaster risk reduction, thanks to its focus on people, livelihoods, and assets at risk. Yet much of the African population is not covered by early warning systems that explicitly consider the potential impacts of upcoming disasters. This contribution illustrates recent advances in FloodPROOFS East Africa, an impact-based riverine flood forecasting system for the Greater Horn of Africa (GHA), running operationally every day since 2022. The system is based on a modeling cascade relying on distributed hydrological simulations forced by multiple weather forecasts, the creation of coherent scenarios of maximum inundation, and application of a risk assessment framework to estimate population and assets potentially impacted by the upcoming floods in the next 5 days. The system is operational and supports the IGAD Climate Prediction and Applications Centre (ICPAC) as well as regional and national hydro-meteorological services in East Africa in their daily monitoring and early warning from impending floods. Recent development activities have focused on improving the streamflow modeling in the Nile basin, through implementation of an assimilation scheme of satellite altimetry on Lake Victoria, Africa's largest lake. To this aim we developed novel techniques to extract water level - area - storage curves based on high resolution DEM, introduced an assimilation scheme for reservoir water storage to merge satellite and model-based estimates, improved the lake outflow function using observed discharges at downstream stations, and recalibrated the hydrological model parameters to improve the flow dynamics following such updates. The resulting framework improves the hydrological initial conditions at the start of the forecasts and the lake water balance, enabling more realistic flows representation which is key to better capture the flood dynamics in the downstream countries, such as during the South Sudan floods in 2020-2022.

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