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# Comparative Suitability of the Global Flood Awareness System and a Catchment-based Model to Simulate Floods in Uganda

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This study aims to evaluate the comparative suitability of a global hydrological forecasting and monitoring system, the Copernicus-Emergency Management Service - Global Flood Awareness System (GloFAS), and a local catchment-based model (GR4J) as possible alternative or complementary flood forecasting tools in Uganda. Local stakeholders and end-users in Uganda need to understand whether flood forecasts from ready-to-use global systems can be relied on as one of the available tools to inform flood preparedness actions or whether other easy-to-set-up local hydrological models can provide more reliable information at the catchment scale or some advantages in particular regions. While GloFAS provides probabilistic extended-range forecasts, it has only been calibrated at a few locations in Africa and remains uncalibrated at most locations in Uganda and eastern Africa. A simpler catchment-based model can be calibrated more easily by local national authorities using observed hydrological data. This research investigates whether the reanalysis data from GloFAS can perform satisfactorily in Uganda with respect to the simulation of a lumped catchment-based model (GR4J) using the same meteorological inputs across Uganda.

Results are presented for four Ugandan catchments with different morphological and hydrological characteristics. An evaluation of both GloFAS reanalysis (GloFAS-ERA5) and extended-range (re-)forecasts has been carried out against observed streamflow data, analysing performance statistics including the Kling-Gupta Efficiency (KGE) for the reanalysis, and the False Alarm Ratio and Probability of Detection for forecasts at short lead times (< 15 days). The GR4J model simulations were run using the ERA5 meteorological reanalysis as input. In both calibration and validation mode, on average, the calibrated GR4J model provides better KGE scores than GloFAS, especially for the smaller catchments (< 2000 km2). However, GloFAS performance is relatively

good for the two largest basins (>2200 km2) and is acceptable with respect to a mean flow benchmark for all catchments, except the smallest (500 km2). Our results suggest that in small- to medium-size basins in Uganda, a simple lumped catchment-based model may outperform GloFAS, but even without calibration GloFAS performs satisfactorily in larger basins. Thus, GloFAS can be relied on as interim solution for flood forecasting in Uganda, especially for larger river catchments. An evaluation of the accuracy of the rainfall reanalysis (ERA5) with respect to local rainfall observations showed significant differences in biases and correlation of rainfall input data across catchments and this can explain the different performance of the hydrological models across Uganda. Finally, the importance of assessing and calibrating flood forecasting models with action-relevant scores to support humanitarian actions is highlighted by analysing the discrepancies between traditional general scores (as the KGE) with other more specific flood event-based scores.