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A pan-African medium-range ensemble flood forecast system

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The *African Flood Forecasting System* (AFFS) is a probabilistic flood forecast system for medium- to large-scale African river basins, with lead times of up to 15 days. The key components are the hydrological model LISFLOOD, the African GIS database, the meteorological ensemble predictions of the ECMWF and critical hydrological thresholds. In this study the predictive capability is investigated, to estimate AFFS' potential as an operational flood forecasting system for the whole of Africa. This is done in a hindcast mode, by reproducing pan-African hydrological predictions for the whole year of 2003 where important flood events were observed. Results were analysed in two ways, each with its individual objective. The first part of the analysis is of paramount importance for the assessment of AFFS as a flood forecasting system, as it focuses on the detection and prediction of flood events. Here, results were verified with reports of various flood archives such as Dartmouth Flood Observatory, the Emergency Event Database, the NASA Earth Observatory and Reliefweb. The number of hits, false alerts and missed alerts as well as the Probability of Detection, False Alarm Rate and Critical Success Index were determined for various conditions (different regions, flood durations, average amount of annual precipitations, size of affected areas and mean annual discharge). The second part of the analysis complements the first by giving a basic insight into the prediction skill of the general streamflow. For this, hydrological predictions were compared against observations at 36 key locations across Africa and the Continuous Rank Probability Skill Score (CRPSS), the limit of predictability and reliability were calculated. Results showed that AFFS detected around 70 % of the reported flood events correctly. In particular, the system showed good performance in predicting riverine flood events of long duration (>1 week) and large affected areas ($>10\,000\,\mathrm{km}^2$) well in advance, whereas AFFS showed limitations for small-scale and short duration flood events. Also the forecasts showed on average a good reliability, and the CRPSS helped identifying regions to focus on for future improvements. The case study for the flood event in March 2003 in the Sabi Basin (Zimbabwe and Mozambique) illustrated the good performance of AFFS in forecasting timing and severity of the floods, gave an example of the clear and concise output products, and showed that the system is capable of producing flood warnings even in ungauged river basins. Hence, from a technical perspective, AFFS shows a good prospective as an operational system, as it has demonstrated its significant potential to contribute to the reduction of flood-related losses in Africa by providing national and international aid organizations timely with medium-range flood forecast information. However, issues related to the practical implication will still need to be investigated.