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The influence of antecedent conditions on flood risk in sub-Saharan Africa

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Traditionally, flood risk management has focused on long-term flood protection measures. However, many countries are often not able to afford hard infrastructure that provides sufficient safety levels due to the high investment costs. As a consequence, they rely more on post disaster response and timely warning systems. Most early warning systems have predominantly focused on precipitation as the main predictive factor, having usually lead times of hours or days. However, other variables could also play a role. For instance, anomalous positive water storage, soil saturation and evapotranspiration are physical factors that may influence the length of the flood build-up period. This period can vary from some days to several months before the event and it is particularly important in flood risk management since longer flood warning lead times during this period could result in better flood preparation actions.

This study addresses how the antecedent conditions of historical reported flood events over the period 1980 to 2010 in sub-Saharan Africa relate to flood generation. The seasonal-scale conditions are reflected in the Standardized Precipitation Evapotranspiration Index (SPEI), which is calculated using monthly precipitation and temperature data and accounts for the wetness/dryness of an area. Antecedent conditions are separated into a) a short term ‘weather-scale’ period (0-7 days) and b) a ‘seasonal-scale’ period (up to 6 months) before the flood event in such a way that they do not overlap. Total 7-day precipitation, which is based on daily meteorological data, was used to evaluate the short-term weather-scale conditions. Using a pair of coordinates, derived from the NatCatSERVICE database on global flood losses, each flood event is positioned on a 0.5°x 0.5° grid cell. The antecedent SPEI conditions of the two periods and their joint influence in flood generation are compared to the same period conditions of the other years of the dataset.

First results revealed that many floods were preceded by high SPEI for several months before the flooding event, showing that the area was saturated with a long lead-time. Those that were not preceded by high SPEI had very extreme short-term precipitation that caused the flood event. Furthermore, the importance of seasonal-scale conditions is quantified, which in turn might help humanitarian organizations and decision-makers extend the period of the preventive flood risk management planning.