EGU2020-20254
https://doi.org/10.5194/egusphere-egu2020-20254
EGU General Assembly 2020

Assessing spatially distributed hydrological drought hazard in data scarce tropical catchments

Alexandra Nauditt[1], Hamish Hann[1], and Marko Kallio[2]
[1]TH Köln, University of Applied Sciences, Cologne, Germany
[2]Aalto University, Finland

Although water-rich, tropical regions are facing severe drought disasters worldwide, especially during their dry seasons. To design site appropriate adaptation measures, a profound understanding of spatially varying hydrological drought severity and frequency is of crucial importance. However, low flow behaviour can strongly vary in space and time, depending on catchment characteristics, but discharge datasets of high temporal and spatial resolution needed for its assessment are rarely available. Our objective was therefore to provide hydrological drought hazard information to detect hydrological drought anomalies in quickly responding tropical environments.

We used daily discharge time series of an unregulated rural tropical test catchment, the Muriaé in southeast Brazil, to calibrate the semi distributed hydrological model SWAT2012. For the outlets of 93 hydrological response units, we simulated discharges to obtain an adequate spatial distribution. The hydrostreamer 4.0 downscaling approach (https://github.com/mkkallio/hydrostreamer) was applied to the ISIMIP 2a global discharge data product and calibrated with discharge observations and the simulations. Downscaling to a resolution of 450 m was carried out by evaluating the relationship between a spatial unit of discharge and the overlaid river network. To assess hydrological drought hazard, we applied the daily variable Q95 threshold to the dry season flow time series for each grid cell (0.1°). Drought events were defined for periods when the discharge values fell below this dry season threshold during 5 days (and 12 days respectively). To further understand the role of catchment characteristics in low flow evolvement, we tested the sensitivity of different climate and catchment related model input variables against low flow events and simulated artificial drought risk scenarios.

Drought hazard assessment results showed the largest number of drought events in the downstream area, probably attributed to geological and tectonic fracturation and hence increased infiltration, followed by the Western upstream region – that could be linked to smaller subcatchment sizes and lower precipitation inputs.
Only limited hydrological drought sensitivity of the system against changes in land cover type and temperature was found in the model results, while geology and soils turned out to play a larger role for low flows. The drought scenarios also indicated that low flows were more severely affected

than high flows by climatic changes such as decreased precipitation.

Our findings related to the ocurrence of hydrological hazards in the region coincide with institutional records by government institutions (CEMADEM), newspaper reports and stakeholder communication about water shortage in communes and districts. We conclude that the here presented hydrological drought assessment approach provides science based data sets, indicators and information to be used in regional and local drought management in tropical regions.