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An integrated approach to assess hydrological processes and sediment dynamics in Northern Tanzania

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Semi-arid environments such as in Northern Tanzania are characterized by a variety of degradation processes due to long dry periods and extreme rainfall events. In this study, we present an integrated modelling approach to assess the relevant hydrological processes and the related sediment dynamics. The study area is drained by the Makuyuni River which is flowing into Lake Manyara, Monduli District, Northern Tanzania.

Based on satellite data we derived information about topography, vegetation and land use as well as on mineral composition, soils and stratigraphic details. Moreover, we utilized non invasive techniques such as induced electric susceptibility, colour meters and minimal invasive methods like overland flow detectors and hood infiltrometers to estimate soil hydrological characteristics and overland flow generation dynamics. Soil physical characteristics were also analysed on typical soil profiles to get the respective calibration data. Based on this analysis, we deduced functional morpho-hydrological units as modelling entities. Specific sediment sources such as surface wash, gullies and rills were detected by remote sensing and modelled separately. Finally a connectivity index driven sediment routing was applied to transport the sediments down the river network.

We depict the methodology to set up and the structure of the integrated model and its calibration validation. In conclusion, we conduct first future climate scenarios to test the robustness of the modelling approach.