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A 4D approach to unravel the impacts of geodynamics, climate and human activities on biogeochemical cycles, hydrological thresholds, and ecosystems: the Rungwe Environmental Science Observatory Network (Tanzania)

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At decennial resolution, sedimentary or biochemical records (e.g., tree rings, stromatolites) enable to reconstruct the local environment variability far beyond the instrumental record. However, unravelling the local processes and their geodynamic, climatic

and/or human-induced controls requires considerable calibration work and pluridisciplinary focus, most especially when the observed environmental changes are further used to validate climate or ecosystem models. Here, a topo- and climosequence from the east African rift showing a steep temperature decrease/moisture increase from the (western) lowlands to the (eastern) highlands was chosen to combine the study of present-day and past environments and processes, respectively. It is centred on the Rungwe volcano (9°S, 2960m alt.), which occupies a triple junction between the Malawi, Usangu and Rukwa rifts in southern Tanzania. Several freshwater to saline maar and rift lakes and peatbogs contain natural archives of the dynamics of current hydro- and ecosystems (Miombo, afromontane forest, montane grassland), together with local, human or geothermal impacts. Ash layers in lake deposits or in soil profiles provide isochrones for studying past environments. The monitoring of climate (meteo stations) and the subsampling of waters, suspended materials and soils started at the Lake Masoko Basin station (800m), together with geological, botanical and sedimentological surveys at regional scale. New stations are currently developed in partnership with local to national education and research institutions. Based on past and present-day evidences, a tremendous sensitivity of the water unsaturated-saturated boundaries (lake and river shores, aquifer tops, springs) to geodynamic, climate and human impacts is inferred, with major implications for resources and risks.