
Variability in seasonal East African droughts and flood magnitudes recorded in Central Afar lakes sediments (Ethiopia and Djibouti) and their connections with ENSO

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Résumé

In East Africa, the El Niño-Southern Oscillation (ENSO) was identified as one of the primary drivers of precipitation variability affecting hydro-systems water availability. However, the northern part of the East African Rift System still suffers from ENSO climate teleconnection and prediction models underrepresentation. This highlights the need of local-to-regional

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hydro-sedimentary data improvement from the recent past until today. In this paper, we provide a regional flood/drought chronicle of the Awash River catchment from the study of laminated sediment from Gemer and Afambo lakes (Lake Abhe basin, Central Afar region, Ethiopia), with the aim of reconstructing the magnitude of high-impact hydrological events. Thanks to radiocarbon, short-lived radionuclides, palaeomagnetic field variations and varve counting dating methods, we built a high-resolution age model, which allowed us to discuss the regional hydro-sedimentary dynamics of the Awash River at two times scales: the last ~700 years and the last fifty years with and interannual resolution. Crossing sedimentological, geochemical methods and hydrological modelling of instrumental data, we reconstructed an hydrological chronicle of the Awash River with 5 main phases. Between ~1300 and 1979 CE a multi-centennial enhanced hydrological period occurred. Between 1979 and 1991 CE the Gemer and Afambo lakes experienced a gradual decrease in river load inflow and flood frequency, attaining extreme drought and high-evaporative conditions between 1991 and 1997 CE in concomitance with enhanced SST ENSO anomalies. Between 1998 to 2010 a slight reactivation of hydro-sedimentary dynamics has been detected. Finally, since 2014 to today, the improvement of agricultural hydraulic management in the lower Awash River plain connected to a dam construction project has strongly increased the hydro-sedimentary budget of the Central Afar Lakes during the last decade.

Our studies show that the lakes connected to the Awash River have a great potential for the reconstruction of past climate changes. We conclude with perspectives of new researches, particularly preliminary results from new seismic and sediment coring acquired in 2023 in the Lake Abhe, a third endorheic lake connected to the Awash River.

Mots-Clés: East African Rift System, regional flood/drought chronicle, ENSO, lake sediments