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Hydrological changes in the southeastern African tropics during the deglaciation and Holocene

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Hydrological changes in Africa are intensively coupled to the positions of the Intertropical Convergence Zone (ITCZ). Seasonal migrations as well as the mean latitudinal positions of these boundary conditions determine precipitation patterns on the African continent. Here we report on a 6.51 m long sediment core (GeoB 9307-3) off the Zambezi river in 542 m water depth, covering the last 16.8 kyrs BP. Grain-size analyses and associated end-member modelling allow us to characterize different sources of the terrigenous material. The fine-grained end-member as well as the XRF-Scanner derived Fe record representing fluvial input is indicating precipitation pattern of the Sambesi catchment area, which is located at the southern border of the present January-ITCZ position. Therefore, it is an ideal record to study latitudinal shifts of the ITCZ in SE Africa. Many paleoclimatic reconstructions reveal dry conditions in tropical central and northern Africa during the last glacial maximum (LGM) and wetter phases during the Holocene. South of the present ITCZ location we observe enhanced river runoff in times of arid conditions in Tropical Africa, which can be explained by a southward shift o f the ITCZ during the Younger Dryas and Heinrich Event 1.

Sediment core GeoB 9307-3 was retrieved during RV METEOR Cruise M63/1 in 542 m water depth. The 6.51 m long sediment core is located off Mozambique (Zambezi river) at 18°33.90´S, 37°22.80´E . The age model of core GeoB 9307-3 is based on 20 14C-AMS dates, calibrated after Stuiver and Reimer 1993 assuming a reservoir age of 137 years using the ‘SW Indian Ocean Mean´ after Southon et al., 2002. The core has max. age of about 16800 cal. years B.P. and shows high sedimentation rates (about 100 cm/kyr) from 13 to 11 kyrs and lower values (<20 cm/kyr) for the last 9.5 kyrs.

High sedimentation rates coincide with high Fe intensities during the deglaciation. As dust input is negligible in this area we assume fluvial transport by the Sambesi river as major pathway for the terrigenous Fe into the marine sediments. The identical shape of the finest end-member (EM3) supports this assumption. Therefore, we can use the Fe record as indicator for freshwater discharge of the Sambesi river and hence precipitation in the catchment area. From our record it results that precipitation peaks occur when tropical African lakes north of the investigation site indicate arid conditions, corresponding with Atlantic and northern hemisphere cold events (YD and H 1). We conclude southward shift of ITCZ during these episodes. This is in good agreement with modelling studies indicating that this southward shift is possibly originated by northern Hemisphere ice sheet buildup and a weakening in the Atlantic thermohaline circulation