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Channel-morphology based palaeohydrological analysis of the Achelouma valley, NE-Niger

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Paleohydrology is an important component of palaeoenvironmental investigations, nevertheless, in the past it was frequently neglected or reduced to a qualitative-descriptive analysis. Especially in semi-arid and arid regions modern hydrological modelling tools offer the possibility to estimate runoff, and thus to give an idea on the dimension of runoff-events and the triggering precipitation events, where on-field observations are rare due to the lack of rainfall. It is well known that fluvial dynamics characterize relief of arid and hyper-arid areas. However, comprehension of runoff dynamics and rainfall-runoff-relationships is still poor. To analyze the morphodynamic caused by running water in spatial and temporal resolution a conceptual hydrological water balance model is used. For the central Sahara and its spatio-temporal modeling of the Young Quaternary runoff dynamics is performed incorporating different landscape types. This proceeding requires knowledge on the past and present morphodynamics as an emphasized aspect of the past and present runoff conditions. The research area is a tributary of the Achelouma valley (22°20'N, 12°41'E) which detaches the Plateaus de Mangueni and Plateau du Djado in NE Niger. The catchment sizes about 30 km2. The topography of the present river bed and adjoining terraces, corresponding to past river beds, was analyzed by a detailed Differential GPS (DGPS) survey. Focusing on channel length profiles and cross profiles as well as the recording of pebble clusters for the respective channel generation, these data are used to estimate the hydraulic radii and, thus, to determine the peak discharge of extreme precipitation events. The development of the channel bed and the fluvial dynamics necessary for their forming can be derived from these cross profiles in combination with the pebble clusters. The low order drainage system (3rd order after Strahler) points to the youth of the regional landscape evolution. Landslides particularly affect the course of the

channel, directly along the channel bed as well as in the slope area. As the channel is deeply incised into the escarpment there is a dominance of morphodynamics related to concentrated surface run-off in the catchment. A main character of the channel bed is the frequent change of erosion and accumulation zones from headwater area until the apex of the fan. This causes a sequence of sediment traps corresponding to a sediment cascade along the channel, alternating in magnitude and frequency. The channel length-discharge relationship shows upstream an increase of discharge, changing in its middle course into downstream continuous declining discharge while downstream the drainage area continuously increases. This phenomenon is typical for small river courses in arid areas and is caused by high infiltration rates in the local accumulation areas. These preliminary results show an event-induced change of the channel characters. For the respective terrace levels linking of channel morphometry with paleoclimate is the prerequisite to identify past runoff dynamics. Coupling these data with other paleoenvironmental proxies will allow to derive not only static information on paleoenvironmental conditions but on process dynamics changing them.