Variability of Holocene climate and geomorphological dynamics in the Middle Atlas, Morocco

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The Western Mediterranean region including the North African desert margin is considered one of the areas most sensitive to future climate changes. In order to refine scenarios for hydrological and environmental responses to future climate changes in the Western Mediterranean and at the North African desert margin, it is important to improve our knowledge about the climatic history and past responses of geomorphological systems to rapid climatic variability at multi-decadal to millennial timescales. During the last two decades, the recovery and compilation of Holocene and Last Glacial records from the subtropical North Atlantic and the Mediterranean Sea has improved our knowledge about the millennial-scale variability of the Western Mediterranean palaeoclimate and the Saharan dust cycle. In contrast, the multi-decadal to centennial variability appear to affect regional precipitation patterns and geomorphological systems in the Western Mediterranean but remain poorly known. High resolution terrestrial records with precise age models are lacking. To compare the changes in Holocene climate variability and geomorphological processes across temporal scales, we recovered a 19. 63-m long sediment record from Lake Sidi Ali (33°03’ N, 5°00’ W, 2080 m a. s. l.) in the sub-humid Middle Atlas that spans the last 12,000 years (pollen-based radiocarbon dates accompanied with 210Pb results). We use XRF-scanning data with a sub-decadal scale resolution to disentangle the complex interplay between climate changes and geomorphological dynamics during the Holocene. Data exploration techniques and time series analysis (Redfit, Wavelet) revealed long-term changes in lake behaviour (e. g. lake productivity) and cyclic variation of specific elements and element ratios. Two main groups were identified (temperature proxies vs. sediment dynamic proxies). Both groups show specific periodicities throughout the Holocene, demonstrating their particular climatic and geomorphological dependencies.

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