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Holocene climate variability in lake Sonkul sediments (Kyrgyzstan, Central Asia) based on vegetation changes

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Western Central Asia, as a remote intracontinental setting located far from oceanic influences, is a key place for high-resolution paleoclimatic studies because different climate systems interact at different timescales and control the regional climate variability. A multiproxy study (pollen grains, palynofacies, and magnetic susceptibility) was conducted on Holocene sediments from the alpine lake Sonkul (3010 m, 41°48'33N / 75°07'38E; Tien Shan, Kyrgyzstan). The combination of sediment core proxies allowed the reconstruction of palaeoenvironmental and palaeoclimatic changes through lake level variations and vegetation dynamics between 8400 and 2000 cal. BP. A high-resolution age model was built on Holocene sediments, constituting one of the most accurate chronologies available in the Central Tien Shan. A quantitative reconstruction of climatic parameters using the "modern analogue vegetation types" (MAV) method was carried out to establish variations in temperature and precipitation patterns during the Holocene as based on variations in fossil pollen assemblages. Between 8400 and 5900 cal. BP, the climate conditions are cold and wet associated with a very low lake level. The Siberian High Pressure (SHP) and the Pacific Summer Monsoon (PSM) are the main mechanisms controlling climatic conditions during the early to mid-Holocene. Between 5900 and 4300 cal. BP, warm and moist conditions characterized the "Mid Holocene Optimum" interval where the combined influence of the Westerlies and the PSM is recorded. Our results reveal that the "Mid Holocene Optimum" period in Lake Sonkul sediments appears to be of shorter duration than in other lakes from the Tibetan plateau. Finally, between 4300 and 2000 cal. BP, the climate becomes persistently arid and warm, as it is nowadays, with a predominant influence of the Westerlies in summer and the SHP in winter. Our results show, therefore, that the lake Sonkul represents an excellent sedimentary archive in Central Asia for high-resolution climatic studies. It allows deciphering, at a high time resolution, the interactions between different climatic systems on environmental dynamics in Central Asia during the Holocene.