



Westerlies Asia and monsoonal Asia: spatial difference in climate change and possible mechanisms on decadal to sub-orbital scales

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'Anti-phase' or 'out-of-phase' relationships in precipitation/moisture changes between inland arid Asia and eastern monsoonal Asia occurred on different timescales during the Holocene. Moreover, we can propose the existence of a 'Westerlies-dominated climate regime' (WDCR) in mid-latitude Asia in the present interglacial period. In this study, we first review the development of a theoretical framework for the WDCR, and define the boundary of its core area: from the Caspian Sea in the west to the western region of the Hexi Corridor in the east, while the northern and southern limits coincide with those of arid central Asia. This spatial extent approximates to Central Asia and Xinjiang Province in China (36-54°N, 50-90°E). Second, we review all the evidence for the existence of the WDCR on sub-orbital ('multi-millennial' herein) to decadal timescales during the Holocene. Finally, using climate simulation and reanalysis data, we consider the drivers of the WDCR and conclude that external factors (insolation changes induced by orbital factors) dominate the WDCR on a sub-orbital timescale, while a circum-global teleconnection was the most significant factor on centennial and decadal timescales. This study represents a comprehensive summary of the development of our knowledge about the WDCR over the past several decades, which we hope provides an initial theoretical framework for understanding climatic and environmental changes in this arid region, as well as a scientific basis for its environmental management and ecological restoration in the context of global warming.