

Quantifying the Intra-Regional Precipitation Variability in Northwestern China over the Past 1,400 Years

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There has been a surge of paleo-climatic/environmental studies of Northwestern China (NW China), a region characterized by a diverse assortment of hydro-climatic systems. Their common approach, however, focuses on "deducing regional resemblance" rather than "exploring regional variance." To date, efforts to produce a quantitative assessment of long-term intra-regional precipitation variability (IRPV) in NW China has been inadequate. In the present study, we base on historical flood/drought records to compile a decadal IRPV index for NW China spanned AD580-1979 and to find its major determinants via wavelet analysis. Results show that our IRPV index captures the footprints of internal hydro-climatic disparity in NW China. In addition, we find distinct ~120-200 year periodicities in the IRPV index over the Little Ice Age, which are attributable to the change of hydro-climatic influence of ocean-atmospheric modes during the period. Also, we offer statistical evidence of El Niño Southern Oscillation (Indo-Pacific warm pool sea surface temperature and China-wide land surface temperature) as the prominent multi-decadal to centennial (centennial to multi-centennial) determinant of the IRPV in NW China. The present study contributes to the quantitative validation of the long-term IRPV in NW China and its driving forces, covering the periods with and without instrumental records. It may help to comprehend the complex hydro-climatic regimes in the region.

Keywords: Precipitation variability, Asian Summer Monsoon, El Niño Southern Oscillation, Indo-Pacific warm pool, Temperature, Northwestern China