

The interannual wintertime climate modes over mid-high latitude Eurasia and their climate impacts

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Eurasian teleconnection pattern (EU) and its two variants (EU1 and EU2) are the representative wintertime atmospheric teleconnections over Eurasian continent. They are mainly indicative of the local features and closely related to other teleconnection patterns. What are the major interannual climate modes over mid-high latitude Eurasia in boreal winter is still an open question. With the ERA5 reanalysis datasets after removing the linear impact of El Niño-Southern Oscillation (ENSO), three wintertime climate modes over mid-high latitude Eurasia are identified by the first three empirical orthogonal function (EOF) modes of the anomalous relative tendency (ART) of 500 hPa geopotential height. They approximately explain 75% of the interannual variance in total. The three climate modes have combined features of EU-like patterns with Arctic Oscillation (AO), North Atlantic Oscillation (NAO) and West Atlantic (WA) teleconnections, respectively, and they are named EU-AO, EU-NAO and EU-WA climate modes accordingly. All the three climate modes originate mainly from the North Atlantic and demonstrate clear Rossby wave trains downstream to East Asia along the great circle route, and they can be primarily stimulated and maintained by positive air-sea feedback over North Atlantic regarding to the obvious North Atlantic tripole-like (NAT-like) sea surface temperature (SST) patterns. Interannual climate variations over the most Eurasian continent are strongly linked to and well reproduced by the three ENSO-independent climate modes, which can be applied as the important signals for monitoring and predicting winter interannual climate variabilities over mid-high latitude Eurasia.

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