

Frequency of winter atmospheric blockings in the Northern Hemisphere in different phases of El Niño, Pacific Decadal and Atlantic Multidecadal Oscillations

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Estimates of regional anomalies in the frequency of winter atmospheric blockings in different phases of the El Niño events, the Pacific Decadal (PDO) and Atlantic Multidecadal (AMO) Oscillations are presented using ERA-Interim reanalysis data (<https://apps.ecmwf.int/datasets/data/interim-full-daily/>) for the period 1979-2018. Regional features of blockings during El Niño of different types are estimated.

Atmospheric blockings were detected similarly to [1-4] using the approach proposed in [5] (see also [6]).

Positive (> 0.1 °C), negative (< -0.1 °C), neutral phases of AMO and positive (> 0.5 °C), negative (< -0.5 °C), neutral phases PDO were determined for winter seasons (DJF) using data from (https://psl.noaa.gov/gcos_wgsp/). Positive, negative and neutral phases of El Niño were determined by anomalies (with a threshold of ± 0.5 °C) of Niño3 and Niño4 indices (5-months running means) during the 6 consecutive months using data from (https://psl.noaa.gov/gcos_wgsp/).

Figure 1 shows winter blocking frequency in the mid-latitudes of the Northern Hemisphere for years beginning in the different phases of El Niño using the Niño3 and Niño4 indices, with different phases of wintertime AMO and PDO phases for the period 1979-2018. The obtained results show significant regional anomalies of the frequency of winter atmospheric blockings in the Northern Hemisphere in different phases of El Niño phenomena, PDO and AMO according to data for recent decades. Remarkable differences of blocking frequency were noted with the use of different El Niño indices.

During the neutral phase of El Niño, the frequency of winter blockings in the Northern Hemisphere is generally higher in the positive PDO phase than in the negative one, and relative to the mean values for the entire analyzed period (1979-2018). In the negative PDO phase over extended areas, reduced blocking frequency values were noted, in particular, over the Atlantic and Pacific oceans and over Asian regions. Also, the frequency of winter blockings in the negative AMO phase is greater than in the negative phase and relative to the mean values for the entire analyzed period for many regions, in particular, over the Pacific Ocean and most of Eurasia.

In the warm phase of El Niño over many areas, a reduced frequency of winter blockings was noted during positive PDO phase. Extreme patterns of frequency for winter blockings during El Niño, characterized by the Niño4 index, were noted in the negative PDO phase. The maximum blocking frequency values were noted over the Pacific Ocean and European regions, and the minimum values were noted over the Asian and North American regions and the Atlantic Ocean. In the warm El Niño phase, the blocking frequency values were estimated to be larger in the positive AMO phase than in the negative one over the Pacific and Atlantic Oceans and North American regions and smaller over the European regions.

In the La Niña phases, large variations in the frequency of winter blockings depending on the PDO and AMO phases were noted, in particular, over the Ural Mountains and adjacent regions.

It should be noted the low frequency of some combinations of the El Niño and La Niña phases with the PDO and AMO phases. In particular, for the analyzed period, not a single combination of the canonical El Niño phase (characterized by the Niño3 index) and the negative PDO phase was identified.

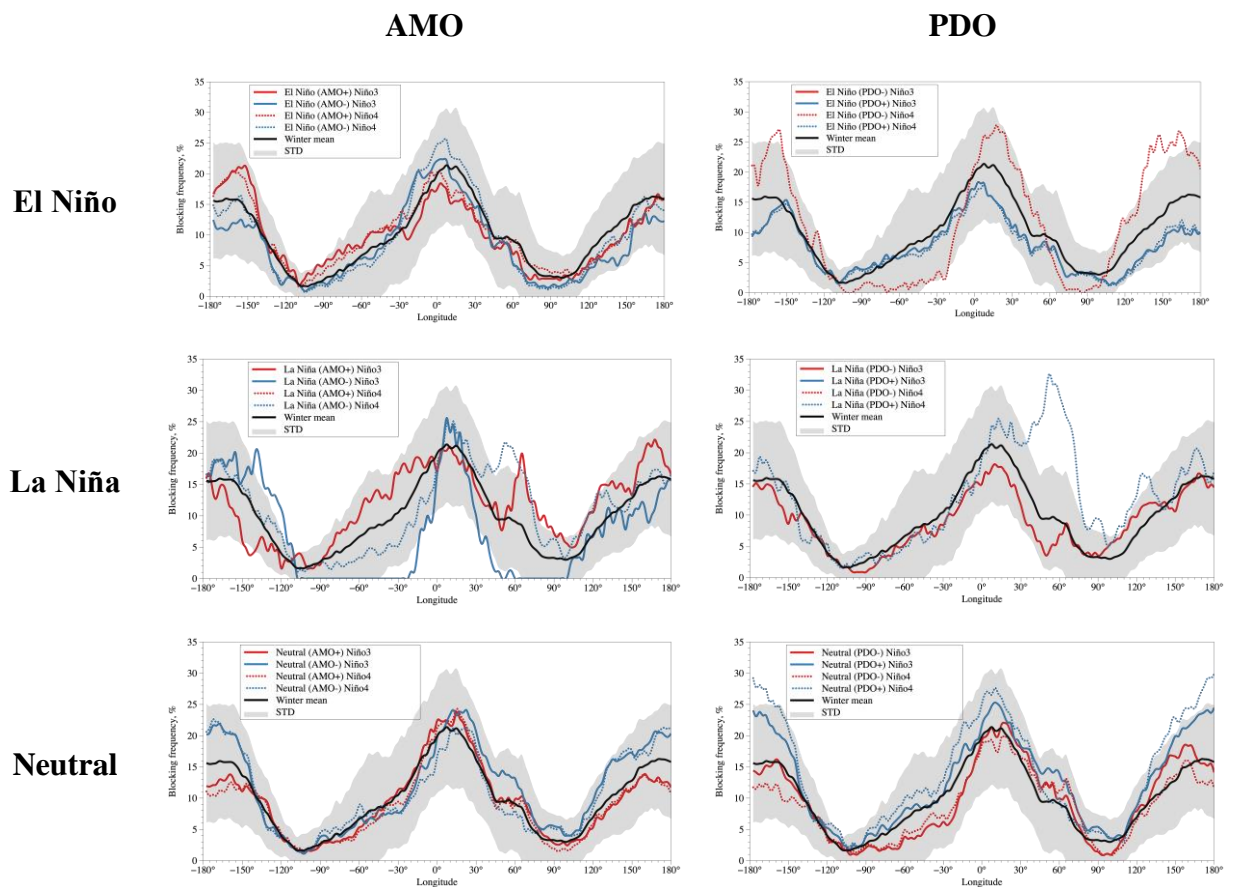


Figure 1. Winter blocking frequency in the mid-latitudes of the Northern Hemisphere for years beginning in the different phases of El Niño using the Niño3 and Niño4 indices, with different phases of wintertime AMO and PDO phases against the background of means with shaded range of standard deviations (STD) for the period 1979-2018.

References

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