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What drives the variability of Northern Hemisphere wintertime blocking frequency?

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The variability of atmospheric blocking affects the winter atmospheric circulation in Northern Hemisphere (NH). Although the variability of NH wintertime blocking frequency has been widely studied, the mechanism of its variability still remains unclear. In the present study, the variability of NH blocking frequency and its causal mechanisms are examined by using three reanalysis datasets (NCEP-NCAR, ERA-Interim, MERRA) for the past three decades (1979-2010). NH blocking climatology reveals that principal blocking frequency regions are the Northeastern Pacific (PA) and North Atlantic (AT). The distinct decadal change of the PA blocking frequency occurred in the early-1990s. The PA blocking frequency exhibits a decreasing trend since the early-1990s, and then it recovered after the early-2000s. The variability of the AT blocking frequency has gradually increased in the recent decades. The possible causes of the variability of NH blocking are discussed by examining time-mean flow, high-frequency eddies and energetics. The results here suggest that the influence of the time-mean flow, especially the location of the westerly jet, plays an important role in determining the formation of NH blocking. Energy transfer from high-frequency eddies to low-frequency eddies and barotropic energy conversion from the time-mean flow may be responsible for the variability of NH blocking. In addition, the combined effect of the Arctic Oscillation and El Nino-Southern Oscillation on the NH wintertime blocking activity will be further discussed.