

East Asian Winter Monsoon: Ural Siberia Blocking and East Asian Trough



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The East Asian Winter Monsoon (EAWM) is the most energetic global monsoon system, involving Ural-Siberia blocking (USB) and East Asian trough (EAT). In climatology, horizontal advections play a fundamental role in constructing a USB event, in which the anticyclonic center is a warm core in the troposphere and a cold core in the lower stratosphere. The decay of the thermal structure is related to diabatic cooling along the vertical structure and warm advection in the lower stratosphere. Meanwhile, the collapse of the height structure is caused primarily by cyclonic vorticity advection. The strong events are probably preceded by an open ridge over Europe and a cyclogenesis over the Mediterranean Sea, and their formation is followed by the stronger amplification of a Rossby wave packet across Eurasia. On the other hand, the weak events are likely to be triggered by surface cold anomalies over Siberia. Overall, the evolution of a USB event forms a dynamic linkage with the Siberian high, in which the decay stage of the USB event is accompanied by a southeastward migration of the Siberian high and a subsequent cold air outbreak in East Asia. These results advance our understanding of USB and its relationship with East Asian winter monsoon activities. The relation between variations of the EAT and the East Asian winter monsoon is also examined. The variations investigated include the trough's strength and its meridional and zonal displacements. Anomalous cold (warmth) in Southeast Asia is concurrent with the southward (northward) displacement of the EAT. The southward displacement of the EAT is likely associated with an anomalous strong Siberian high and Aleutian low, which manipulate anomalous northerly wind between them. On the other hand, the temperature in northeast Asia is influenced by both the strength and the zonal displacement of the trough. These properties of the EAT are closely linked to temperatures in the northern and southern portions of East Asia.



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