

Analysis of specific energy in zonal currents focusing on the analogy between jet stream and open channel flow

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Atmospheric blocking is one of the important causes of meteorological extremes in mid-latitude, such as cold spells, heat waves and long-term heavy rainfalls. Rossby (1950) focused on dynamical analogies between the hydraulic jump in open channel flow and the atmospheric blocking in jet stream, and proposed a theoretical formula to explain the two dynamically possible states in zonal currents which are compatible with supercritical and subcritical flow in an open channel flow. Armi (1989) focused on the specific energy flux in zonal currents and showed that a dimensionless parameter, which is called Froude/Rossby number, is analogous to the Froude number of open channel flow. Kitano and Yamada (2017) extended these theories to realistic conditions in atmosphere and showed a relationship between typical blocking flow and specific energy flux in jet stream. In this study, we analyzed several blocking episodes using specific energy flux and found energetic signals over Japan and its surroundings before Pacific blocking occasions. These signals may contribute to prediction on blocking.

Keywords: atmospheric blocking, jet stream, open channel flow