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Mechanisms of Poleward propagation of North Atlantic jet

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The poleward propagation of zonal wind anomalies is an important variation of the tropospheric mid-latitude jet. The poleward propagation influences both weather and climate. This study examines the physical mechanisms that drive the poleward propagation of mid-latitude jet over the North Atlantic during the boreal winter with ECMWF ERA40 reanalysis data.

An EOF analysis is performed on the zonal wind anomalies for the North Atlantic domain. Based on time-lag correlations between the first two EOFs, 14 poleward propagation events are identified.A series of lagged composite calculations of the poleward propagation events reveals the following processes: midlatitude synoptic-scale Rossby waves propagate equatorward and break when they encounter their critical latitudes in the tropics and subtropics; a new critical latitude is generated slightly poleward of the previous critical latitude, and the subsequent wave breaking occurs at this new critical latitude. This interaction between the wave breaking and the critical latitude drives the poleward propagation of zonal-mean zonal wind anomaly.

A comparison between the poleward propagation events and zonal index events indicates that the poleward propagation is associated with a relatively weak potential vorticity gradient over the subtropics. These North Atlantic poleward propagation events are found to be preceded by anomalously strong transient eddy activity over the subtropical North Pacific, and by anomalously weak tropical convection over the tropical Atlantic Ocean and the Amazon.