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Rossby wave propagation in different background states

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Extreme weather is often linked to persistent atmospheric circulation patterns. This study looks at how different background states affect stationary Rossby waves propagating with non zero group velocity. Better understanding of their propagation can help reduce the uncertainty in forecasting extreme and persistent weather.

Temporal filtering separates atmospheric reanalysis data into intermediate (periods between six and thirty days) and long timescales (periods over thirty days). Over the Atlantic, the two leading empirical orthogonal functions (EOFs) of the long timescale of the 500hPa geopotential height are the North Atlantic Oscillation (NAO) and the East Atlantic (EA) pattern. The two leading EOFs for the intermediate timescale show Rossby wave propagation. Using stationary wavenumber analysis and lag correlation maps, Rossby waves show different propagation depending on the phases of the NAO and EA background states.

The stationary wavenumber map shows a more northeastward tilted Atlantic waveguide in the positive phase of the NAO than the negative phase. This waveguide is weaker in the northern hemisphere summer than the winter. Lag correlation maps confirm a more northeastward Rossby wave propagation in the positive phase. For the EA pattern, the stationary wavenumber map shows a waveguide that extends further eastward into Europe in the positive phase than in the negative phase. Lag correlation maps show Rossby waves propagating over Europe in the positive phase, but not reaching Europe in the negative phase.