



A new interpretation of the North Atlantic Oscillation

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The North Atlantic Oscillation (NAO) is essentially a measure of variations in the zonal wind across the Atlantic. Here we suggest that on interannual and longer timescales, this is largely determined by variations in the occurrence of blocking-like Rossby wave-breaking events over the North-west Atlantic. In our new interpretation, NAO- is understood as a period of frequent wave-breaking, while NAO+ is simply a period with infrequent wave-breaking.

A two-dimensional potential vorticity based index is applied to Northern Hemisphere data from the ERA-40 reanalysis, to identify Rossby wave-breaking on the dynamical tropopause. This shows two dominant regions of wave-breaking, over the North-west Atlantic and Pacific basins, and wave-breaking in these regions is shown to have an extremely close relationship with the NAO, and the West Pacific Pattern, respectively.

Several clear patterns are often seen as precursors to Atlantic wave-breaking. These include a Rossby wave-train stretching across North America from the Pacific, a shift of the stratospheric polar vortex, and SST anomalies in the North Atlantic. These suggest mechanisms by which lower-frequency variability in the oceans and in the stratosphere can influence the frequency of wave-breaking occurrence, and hence the NAO.