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Linkage of atmospheric blocks and synoptic-scale Rossby waves: A climatological analysis

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The link between atmospheric blocking and propagating and breaking synoptic-scale Rossby waves is explored for the climatological period (1958-2002) using the ERA-40 re-analysis data. To this end potential vorticity (PV) based climatologies of blocking and breaking waves are used. The information on propagating waves is extracted from Hovmöller diagrams. The analyses cover the northern hemisphere during winter and are carried out for the Atlantic and Pacific basin separately.

The results show statistically significant wave precursor signals up to five days prior to the blocking onset. In the Atlantic the precursor signal takes the form of a coherent wave train emanating from 110° upstream of the blocking location. In the Pacific a single long lived (10 days) northerly velocity signal preludes the blocking onset.

A spatial analysis of the location, frequency and form of breaking synoptic-scale Rossby waves prior to the onset, during the lifetime and after the blocking decay reveals that streamers are present in the south-west (cyclonic streamers) and in the south and south-east (anticyclonic streamers) in approximately 43% (36%) of the time in the Atlantic (Pacific) basin which is significantly above a climatological distribution.