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Feedbacks of the high-frequency synoptic eddy activity onto the North Atlantic Oscillation

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Our study focuses on feedbacks of the high-frequency eddy activity onto the quasi-stationary circulation, particularly with regard to the North Atlantic Oscillation (NAO). The methodology consists in analyzing observations from NCEP reanalysis data and sensitivity runs from a high resolution non hydrostatic regional model.

Very recent studies show that the jet displacement characteristic of the NAO phenomenon depends strongly on the dynamics of the synoptic-scale waves and the way they break. Positive and negative phases of the NAO are closely related to anticyclonic and cyclonic wave breaking respectively. In order to better understand the NAO, it is thus important to analyze the reasons that make the waves break one way or another.

An important issue determining the type of wave breaking and the phase of the NAO is related to upstream effects. By considering a domain extending from Eastern Pacific to Western Europe and by forcing the regional model with real data at the western boundary, sensitivity runs show that the right sign of the NAO index can be recovered. These studies further indicate that waves coming from Eastern Pacific and North America are crucial for determining the NAO phase. According to their spatial scales and frequencies when they reach the Atlantic domain, they can break one way or another and push the Atlantic jet equatorward or poleward.

Another crucial factor concerns surface effects. Cyclonic wave breaking in the upper levels is strongly connected with an explosive cyclonic development at the surface accompanied by strong surface moisture fluxes whereas such an explosive growth is not present in the anticyclonic wave breaking case.