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Coupling among the North Atlantic Oscillation, atmospheric blocking and the Atlantic jet stream variability in climate models

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Atmospheric blocking associated with Rossby Wave Breaking events is a major source of variability over the Euro-Atlantic sector, having a strong impact on the North Atlantic Oscillation (NAO). In reanalysis data, blocking over Greenland is tightly coupled with the occurrence of the negative phase of the NAO and with the equatorward displacements of the Atlantic eddy-driven jet stream. Making use of a large set of blocking and jet stream diagnostics, we confirm previous results and we find that blocking occurrence on the equatorward side of the jet is linked with the poleward displacement of the jet itself. Through the adoption of several climate and atmospheric models with different spatial resolution from NCAR and CMCC we show that the North Atlantic Oscillation, even though it possesses similar geographical pattern, can represent a zonal mode of variability that differs from the "Greenland blocking dependent" mode seen in reanalysis data. This mode of variability seems to be dependent upon the spatial distribution of the blocking frequency over the Euro-Atlantic sector. Such a feature could impact the reliability of climate simulations that shows future changes in the patterns of the NAO. We also investigate the impact of horizontal resolution on blocking representation and we show that, at all resolutions, the biases in the spatial structure of the NAO are correlated with the biases in the blocking representation.