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Multiparametric perspective of the North Atlantic eddy-driven jet: configurations, regional impacts and remote drivers

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The North Atlantic eddy-driven jet (EDJ) is the most outstanding component of the Euro-Atlantic atmospheric circulation. Classically, the winter EDJ variability has been described in terms of latitude and intensity. However, this classification has recently been shown as incomplete to fully characterize more complex EDJ states. For instance, the three well established latitudinal states of the EDJ do not match the four preferred flow regimes of the Euro-Atlantic sector. A possible solution to this trouble would be the additional consideration of other EDJ characteristics, such as the tilt, waviness or longitudinal extension among others, but this has not been investigated yet.

This study presents a set of daily parameters of the North Atlantic EDJ that allows for a dissection of the EDJ structure beyond the well-established trimodality in reanalysis data. The set is composed by intensity, sharpness, position, latitudinal boundaries, longitudinal extension, tilt and zonal asymmetries, which provides a manageable treatment of EDJ configurations without the need of high-dimensional 2-D fields. The parameters are computed through new developed diagnostics based on winter North Atlantic daily (zonal) wind, averaged between 925-700 hPa. The multi-parametric approach allowso deepen the structure of the EDJ, as well as the impacts and drivers of its variability.

Recurrent states of the EDJ are assessed via multiparametric clustering, which is able to reconstruct the trimodality of the EDJ and more complex EDJ configurations described in the literature. Furthermore, the considered parameters turn useful for the study of regional surface impacts of the EDJ, which are better explained by a combination of parameters rather than changes in individual parameters such as the jet latitude.

Lastly, the influence of a selected number of potential external drivers of the EDJ is analysed by means of linear regressions and composite analyses based on reanalysis data. The winter stratospheric vortex and previous late summer North Atlantic horseshoe are identified as the most influential drivers of different EDJ parameters, in agreement with some previous studies. However, winter snow, ice cover or sea surface temperature patterns can also affect to some extent specific parameters. These results suggest some potential predictability of the winter EDJ.