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Atmospheric blocking in the Northern Hemisphere in the CMCC CMIP5 simulations

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The frequency of occurrence of the Northern Hemisphere blocking is often underestimated by current numerical models, especially over the Atlantic basin. These biases could lead to significant errors in climate and weather predictions. In the present work, an analysis of the blocking activity in the Northern Hemisphere is carried out comparing the NCEP/NCAR Reanalysis (1951-2005) and a set of coupled model simulations performed with different versions of the CMCC global climate model having different horizontal and vertical resolutions. Two of the model versions include a resolved stratospheric component. The set of experiments have been performed within the Coupled Model Intercomparison Project Phase 5 (CMIP5). A new blocking climatology is estimated for all datasets, based on the index by Tibaldi and Molteni (1990) and its bi-dimensional extension developed by Scherrer et al. (2006). The attention is focused on the phenomenology of the blocking in the NCEP/NCAR dataset over the Atlantic basin and its representation in the model simulations. A distinction between blocking laying north of the eddy-driven jet stream (Greenland blocking) and blocking laying at the end of the jet (European blocking) is introduced. Interestingly, Greenland blocking is well represented by the CMCC model even at the coarser resolution, whilst larger negative biases, associated with small improvements with increasing resolution, are seen for European blocking. Furthermore, evidence of a strong linkage in model simulations between the blocking representation and the North Atlantic Oscillation/Arctic Oscillation pattern is found. The evaluation of the blocking mean biases associated to the different simulations is then discussed in terms of the main physical fields (e.g. geopotential height, zonal wind, etc.). Specifically, the relationships among blocking biases and the position and strength of the Atlantic eddy driven-jet and the stratospheric polar vortex are investigated. In this regard possible coupling between blocking and the representation of Sudden Stratospheric Warmings is addressed.