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Atmospheric blocking and Arctic Amplification: climatology and associated impacts in ERA5 data

Marco Cadau[1], Marco Gaetani[1], Giorgia Fosser[1], and Simona Bordoni[2]
[1]Departement of Science, Technology and Society, IUSS Pavia, Pavia, Italy
[2]DICAM (Department of Civil, Environmental and Mechanical Engineering), University of Trento, Trento, Italy

In the context of the accelerating global warming, surface air temperature in the Arctic region is increasing faster than the Northern Hemisphere or global average. This phenomenon is expression of the so-called Arctic Amplification (AA), and is related to the interaction of several processes, including the observed reduction in sea ice and the associated ice-albedo feedback. The AA potentially affects atmospheric circulation patterns in the Northern Hemisphere, namely by modifying the westerly jet stream dynamics and the occurrence of weather regimes. In particular, atmospheric blocking at mid-to-high latitudes may be subject to significant variations in formation, frequency, spatial patterns and intensity due to of the changes in the AA-induced changes in atmospheric circulation.

The objective of this study is to investigate the dynamics of atmospheric blocking in the Northern Hemisphere, by analysing the variability and frequency of the associated spatial patterns at decadal time scales. To this aim, the ERA5 reanalysis is used, and blocking events are detected based on geopotential height gradients between mid and high latitude regions.

Results highlight that blocking is associated with the occurrence of extreme events, in particular with increased likelihood of heatwaves and cold spells in the blocking high. Moreover, impacts are observed in the region adjacent to the blocking high, due to the persistent deflection of synoptic disturbances. The relationship between AA and blocking events is also analysed, to identify possible mechanisms controlling the variability of atmospheric blocking in the last decades.