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Atlantic weather regimes and poleward heat transport by transient eddies in polar regions

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Transport of heat by transient atmospheric eddies (TEHT) is a key component of the heat budget of the Arctic and high latitude regions. While TEHT in the midlatitudes is known to be modulated by large scale low frequency flow regimes, little is known about the link between TEHT in the polar cap and midlatitude circulation regimes. Recent studies suggest that heat and moisture transport into the pole happens in "bursts" that are associated with atmospheric blocking. While the picture is evolving, a systematic assessment is still lacking.

In this study we investigate the relationship between the poleward heat transport by atmospheric transient eddies and North Atlantic weather regimes in reanalysis data.

Weather regimes are estimated via clustering methods and a jet latitude index. Heat transport is defined as advection of moist static energy, and poleward TEHT has been computed for selected frequency bands between the midlatitude baroclinic life cycle and the sub-seasonal range.

Results show that TEHT is substantially modulated by weather regimes on a regional scale also in polar regions. On a zonal mean sense, the two phases of the NAO do not change significantly the synoptic TEHT in polar regions, whereas Scandinavian blocking and Atlantic Ridge are associated with an intensification of the heat flux at high latitudes.

The relationship between extreme events of strong heat flux and circulation regimes is also assessed and the analysis indicates a fundamental role of blocking in the North Atlantic sector.

The implications of our findings for sub-seasonal predictability and systematic errors in coupled models are discussed. Applications of the proposed approach to seasonal forecast systems (Blue-Action) and multi-model frameworks (PRIMAVERA) are planned. This study is supported by the Blue-Action project (European Union's Horizon 2020 research and innovation programme, grant: 727852)