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Atlantic weather regimes and poleward heat transport by transient eddies

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In this study the relationship between the poleward transport of moisture and heat by atmospheric eddies and North Atlantic weather regimes is assessed in reanalysis data. Weather regimes are patterns of large scale atmospheric circulation that are often regarded as recurrent, quasi-stationary states of the atmospheric flow. Transport of heat by transient atmospheric eddies is a key component of the heat budget of the Arctic and high latitude regions.
Recent studies suggest that heat transport into the pole happens in “bursts” of warm air. Time scales involved are between the midlatitude baroclinic life cycle and the sub-seasonal range. In our work, the four optimal North Atlantic weather regimes, namely the two phases of the NAO, Atlantic ridge and Scandinavian blocking, are identified, then their relationship with storminess, baroclinicity and transport of moist static energy (MSE) by transient synoptic and intraseasonal eddies is analysed. The focus of the analysis is on the extended winter season and on the lower troposphere. We demonstrate that the spatial distribution of aforementioned quantities is substantially modulated by the occurrence of weather regimes and that the convergence of the MSE flux into the pole is significantly affected. Particular emphasis is posed on link between Scandinavian blocking and heat flux convergence in the Nordic Seas. The link between WRs and surface temperature, sea ice cover, snow cover and soil moisture is also documented and 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) is ongoing. This study is supported by the Blue-Action project (European Union’s Horizon 2020 research and innovation programme, grant: 727852)