



## **Factors contributing to the development of extreme North Atlantic cyclones and their relationship with the NAO**

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The occurrence of extreme cyclones is analysed in terms of their relationship to the NAO phase and the dominating environmental variables controlling their intensification. These are latent energy (equivalent potential temperature 850 hPa is used as an indicator), upper-air baroclinicity, horizontal divergence and jet stream strength. Cyclones over the North Atlantic are identified and tracked using a numerical algorithm, permitting a detailed analysis of their life cycles. Extreme cyclones are selected as the 10% most severe in terms of intensity. Thus, analysis focuses on the main strengthening phase of each cyclone. The environmental factors are related to the NAO, which affects the location and orientation of the cyclone tracks, thus explaining why extreme cyclones occur more (less) frequently during strong positive (negative) NAO phases. The enhanced number of extreme cyclones in positive NAO phases can be explained by the larger area with suitable growth conditions. Moreover, strong intensification of cyclones is frequently linked to the occurrence of extreme values of growth factors. Similar results are found for ECHAM5/OM1 data, demonstrating the relationships between the environment factors and cyclones in both present day and future climate. In particular, a possible stronger influence of latent heat energy on cyclone intensification under future climate conditions is detected. Even though a 10% decrease in cyclone numbers is identified for the A1B scenario, increased activity of extreme cyclones is detected near the British Isles. This is associated with an increase in cyclone intensity and an enhanced frequency of strong intensification (explosive developments) close to

Europe.