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Influence of the North Atlantic Oscillation on the development of extreme cyclones over Europe

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Extreme cyclones over the North Atlantic and Europe are investigated with respect to their development mechanisms. Analysed pertinent factors with relevance to the intensification of cyclones include upper-air baroclinicity (300/500 hPa), latent energy (equivalent potential temperature 850 hPa is used as an indicator) and jet stream location and strength (250 hPa). Moreover, the role of the North Atlantic Oscillation (NAO) for short time scales is analysed, in order to assess the importance of the NAO for the development of extreme cyclones and to answer the question if the NAO is the dominating pattern for cyclone activity. The investigations are performed for present and future climate conditions by considering both NCEP reanalysis data and GCM ECHAM5/OM1 data. Cyclones are identified and tracked using a numerical algorithm. For each cyclone, variables like e.g. core pressure, displacement speed, deepening rates are obtained for every time step. A thorough assignment of the cyclone development to the above mentioned environmental variables is performed every six hours. Considered are only extreme cyclones, defined as the 5% most intense for the whole period. Cyclone intensity is quantified in terms of the Laplacian of SLP. There is evidence of a relationship between high frequency NAO variability and extreme systems: many of such systems occur on very high NAO phases, even though some may also occur on negative NAO phases, though less frequently. Preliminary results show indication that the development of individual systems is strongly coupled with baroclinicity, jet stream strength and latent energy, particularly during the most intense deepening phase of cyclone development. The strength of these coupling is also investigated for different NAO phases.