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Influence of magnitude and location of tropospheric growth factors for the transformation of cyclones to severe storms over the North Atlantic

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The development of European surface wind storms out of normal mid-latitude cyclones is substantially influenced by upstream tropospheric growth factors over the Northern Atlantic. The main factors include divergence and vorticity advection in the upper troposphere, latent heat release and the presence of instabilities of baroclinic waves of suitable wave lengths.
In this study we examine a subset of these potential growth factors and their related influences on the transformation of extra-tropical cyclones into severe damage prone surface storm systems.

Previous studies have shown links between specific growth factors and surface wind storms related to extreme cyclones. In our study we investigate in further detail the relevant processes, spatial coherence and temporal variability between surface developments and upstream growth factors at different vertical levels of the troposphere. The analyses will primarily comprise of the three growth factors baroclinicity, latent heat release and upper tropospheric divergence.

Firstly we will examine the relation of the magnitude of an upstream growth factor anomaly to the strength of the storm system. Secondly we will analyse the influence and variability of the positions of these anomalies and their relation to the location of a surface storm event. We thus address the question whether the link between storm intensity and related growth factor anomalies taking into account their spatial variability can be quantified.

Using ERA Interim Reanalysis from 1979-2012 for an extended winter season (October to March), results for baroclinicity show a zonally elongated enhancement of baroclinic instability over the mid North Atlantic. While our findings suggest that baroclinicity increases up to more than double of the long term mean previously to the occurrence of a wind storm, a clear relation between its magnitude and resulting cyclone intensity has yet to be established. Factors steering these anomalies are investigated including the link to hemispheric anomaly patterns such as the North Atlantic Oscillation.