



Severe European cyclones: a storm-prone situation perspective

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Severe extra-tropical cyclones are the most damaging weather phenomena affecting Europe. Agreement on how these cyclones will change under global warming conditions is low. Past studies have shown that many climate models systematically underestimate the frequency of very deep cyclones. Understanding the reasons for this underestimation is an important step on the way towards better predictions of climate change and its associated socio-economic impacts.

One way to divide the potential sources of uncertainty is to ask whether climate models correctly simulate the synoptic situation at the point when the storm develops – a storm-prone situation (SPS). If a climate model does have a realistic frequency of SPSs, but too few intense storms, issues may lie in the dynamics of storm deepening, i.e. the conversion of potential energy from the large scale and diabatic energy to the kinetic energy of the cyclone. This work, funded by the AXA Research Fund, discusses possible approaches to characterising SPSs. The first of these is to use the Eady parameter, as a measure of the large-scale baroclinicity of the atmosphere, calculated using European Centre for Medium-Range Weather Forecasts (ECMWF) Interim reanalysis data (ERA-Interim) for the winters 1979–2010. The Eady parameter averaged over the North Atlantic upstream of Europe is analysed in terms of its evolution when a severe cyclone develops. Many intense cyclones form during periods of large Eady parameter, and show sudden drops as the storm passes through the study area. However, many periods with high Eady parameters do not show strong cyclogenesis, indicating that this is a necessary condition only. Future work will include considering potential links between the storm type (for example, what processes dominated its deepening) and the SPS exhibited, and assessing how well climate models represent SPSs.