Assessment of European Cyclones and Windstorms in Simulations of present Day and Future Climates

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The first part of this study investigates in how far GCM based climate simulations reproduce observed climatologies of cyclones and extreme storm events. For this purpose the distribution of cyclone tracks is determined from Re-Analysis data and from control simulations of GCMs. The identification uses an automatic cyclone identification and tracking scheme which was originally developed by Murray and Simmonds for the Southern Hemisphere. It turns out that the GCMs reproduce the basic patterns provided that the temporal and spatial resolution of the re-analysis is reduced to that of the GCM. This agreement is confirmed by considering the so-called storm tracks instead of the cyclone tracks. Storm tracks are defined as the standard deviations of bandpass (2-6 day) filtered geopotential height or MSLP variability. With respect to extreme wind speeds near the surface, it is found that the models' extremes are much lower than observed gusts. This is not only the case for the GCMs, but also for the Regional Climate Model simulations without a gust parameterization, in spite of their higher resolution.

The second part of the study demonstrates a basic agreement between the climate change signals which different models produce in transient scenario simulations at the end of the current century. There is also consistency between the signals in the different parameters considered. Part of the common signal is an increase of the storm tracks over the eastern North Atlantic and Western Europe, which is reflected by an increase of the most intense cyclones in this region. The number of weaker cyclones in this region, however, is decreasing at the same time, so that there are two opposing trends. In other regions, for example in the Mediterranean basin, a decrease is found for both weaker and stronger systems. Consistently, the simulated number of extreme wind events over Europe's north-west is increasing both in terms number and intensity.