EGU22-6508
https://doi.org/10.5194/egusphere-egu22-6508
EGU General Assembly 2022

Global climatology of cyclone clustering

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Cyclone clustering, the succession of multiple extratropical cyclones during a short period of time, has a huge impact on European weather extremes. The idea that several cyclones follow a similar track already dates back to the concept of cyclone families of Bjerknes and Solberg. To investigate the dynamical causes of cyclone clustering, one needs to diagnose where cyclone clustering occurs and determine their characteristics. So far most diagnostics either focused on either local impact-based diagnostics or on a statistical analysis of storm recurrence. While the first cannot be applied globally, the latter is difficult to relate to individual events. We therefore present a new way to globally detect cyclone clustering that is closer to the original concept of Bjerknes and Solberg that extratropical cyclones follow similar tracks.

Using this new cyclone clustering diagnostic based on spatio-temporal distance between cyclone tracks, we analyse cyclone clustering globally in Era-Interim for the period 1979 until 2016. We complement this analysis with a baroclinicity diagnostic based on the slope of isentropic surfaces. With the isentropic slope and its tendencies, the relative role of diabatic and adiabatic effects associated with extra-tropical cyclones in maintaining baroclinicity are assessed. We find that cyclone clustering mainly occurs along the climatological storm tracks. In general, clustered cyclones are stronger than non-clustered cyclones. Moreover clustered cyclones are more often related to atmospheric rivers and stronger isentropic slope, indicating that diabatic effects might be an important mechanism in the formation of cyclone clustering.