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Sensitivities and applications of a cyclone tracking algorithm

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Various sensitivity studies and applications of an algorithm for the detection and tracking of synoptic scale cyclones from mean sea level pressure (MSLP) data are presented. Both Reanalysis and GCM data are used as input. The scheme considers the cyclone intensity (laplacian of pressure) on the first steps of cyclone intensification. The method, originally developed by Murray and Simmonds (1991) for the SH was adapted to NH cyclone characteristics. With an appropriate setting of the relevant parameters, the algorithm is capable of automatically tracking different types of cyclones at the same time: Comparisons with hand analyses based on manual weather charts shows that both fast moving/intensifying systems as well as smaller scale cyclones can be assessed. The resulting climatology of cyclone variables, e.g., cyclone track density, cyclone counts, intensification rates, propagation speeds, areas of cyclogenesis and decay, gives detailed information on typical cyclone life cycles.
Sensitivity studies based on NCEP, ERA40 and GCM data at different resolutions reveal a significant sensitivity of cyclone statistics to the resolution of the input data. Lower spatial and temporal resolutions lead to a reduced number of cyclones. Reducing the temporal resolution alone contributes to a decline in the number of fast moving systems. Lowering spatial resolution alone mainly reduces the number of weak cyclones.
Extreme cyclones are selected based on the maximum cyclone intensity (typically the 5% strongest), enabling e.g. a comparison of cyclone characteristics of different intensities. Transient cyclones and explosive developments are selected considering the cyclone displacement and changes of intensity over time. The analysis of the factors contributing to the intensification of cyclones (e.g. baroclinity) as well as the link between the cyclone tracks and the associated wind fields is explored.