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Comparison of Mid-latitude Cyclones in Sea Level Pressure, Gepotential Height and Vorticity Fields

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The mid-latitudes are dominated by diurnal variability, which is related to traveling high- and low-pressure systems. The lows or cyclones are a major source of natural hazards. This has led to growing interest in the scientific community to develop Eulerian and Lagrangian measures and to analyze the atmospheric high-frequency variability. One important issue is that there is no straight forward definition of cyclones resulting in a large variety of so-called cyclone detection and tracking methods. Each of these methods relies on different input fields which are related to specific features of a cyclone, e.g., sea level pressure (SLP), which specifically focuses on the mass aspect of the velocity field. Recently, the available methods have been compared with respect to climatology and life cycles using the ERA interim data set (Neu et al. 2013). Based on this study we investigate different fields as input for one specific method. We focus on the three mostly used input data, sea level pressure (SLP), 1000-hPa gepotential height (Z1000) and 850-hPa vorticity (850VOR).
The cyclone detection and tracking method developed by Blender et al. (1997) is used and we apply it to ERA interim data in the 1.5 x 1.5 resolution. The method was mainly applied for Z1000 and the Northern Hemisphere (e.g., Blender et al. 1997; Raible et al. 2008). To compare the tracks and cyclone characteristics obtained from the different input data we need to adapt critical parameters of the method in such a way that comparable numbers of cyclone centers are identified in either field. The target is set to the number of cyclone centers in northern hemispheric winter. This enables us to assess the seasonal and hemispheric dependence.
Preliminary results show that the agreement between cyclones based on SLP and Z1000 varies between roughly 70 to 80% depending on the season and the hemisphere. Spatially, most of the differences are found around orographic features like Greenland. An interesting finding is that the number of cyclones based on Z1000 is increased comparing the winter and summer season as the number of heat lows increases in summer. However, the behavior is vice versa for cyclones based on SLP.

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