

Cyclone activity in the Arctic from an ensemble of regional climate models (Arctic CORDEX)

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The Arctic region is characterized by strong and rapid climate changes. The surface air temperature in the Arctic is growing two times faster than the average global temperature (Arctic amplification). The reduction of sea ice in the Arctic leads to changes in atmospheric circulation and, hence, to changes in cyclone activity over the Arctic. Cyclones contribute to the meridional atmospheric heat and moisture transfer from mid-latitudes into the Arctic, thereby changing cloud feedbacks with impacts on the sea ice retreat. Most of the heat is delivered by atmospheric circulation and its small part, by oceanic circulation. Inadequate representation of cyclone activity characteristics can lead to errors in resolving important processes in the Arctic and their variability.

The ability of the regional climate models (Arctic CORDEX) to simulate cyclone activity for the Arctic region is investigated. 10 regional climate models (RCMs), including models with and without “nudging” are considered. Comparing the characteristics of cyclone activity with the use of an ensemble of RCM’s hindcast simulations and reanalysis data (ERA-INTERIM, NCEP-CFSR, NASA-MERRA2) for four seasons (winter, spring, summer, autumn) and for the period 1981-2010, biases in cyclone frequency, intensity and size over the Arctic (region ca. north of 65°N) are quantified (fig. 1). In spite of these biases RCM’s are able to represent the characteristics of cyclone activity in the Arctic region, in particular RCM’s with “nudging”. The spread across the models is estimated (fig. 2).

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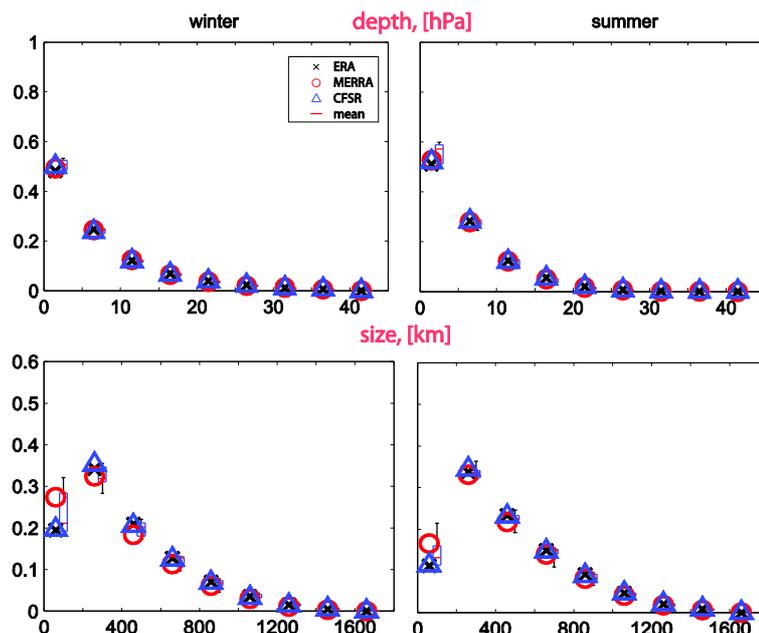


Fig. 1. The frequency of cyclones as a function of their depth and size from various reanalysis data and the multi-model ensemble mean in winter and summer.

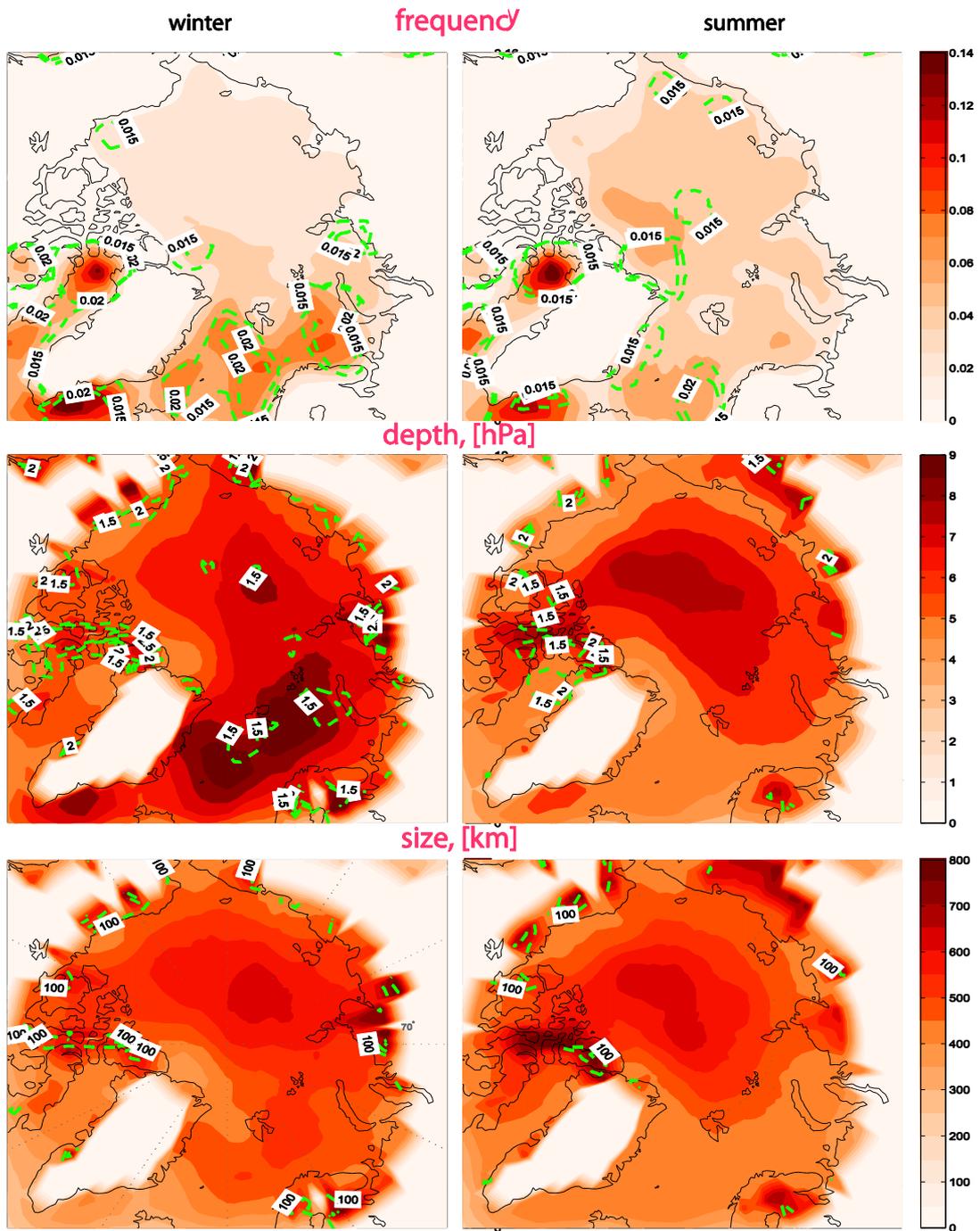


Fig. 2. Spatial distributions of cyclone characteristics from the multi-model ensemble mean (color shading) in winter and summer. Isolines show standard deviation across the data.