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New view of Arctic cyclone activity form the Arctic System Reanalysis

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Arctic cyclone activity is of great interest due to its potential association with the large magnitudes of the Arctic warming, and particularly unprecedented Arctic sea ice decline over the last decades. There is an evidence of a direct influence of very intense cyclones on the sea ice cover at synoptic time scales. At the same time, cyclone dynamics reflects atmospheric circulations changes and play an important role in high latitude atmospheric heat and moisture transport. The recently released Arctic System Reanalysis (ASR) - Interim version opens a new avenue in studying atmospheric circulation in the Arctic. ASR performed with the high-resolution version of the non-hydrostatic Polar Weather Research and Forecast model (Polar WRF V3.3.1) using ERA-Interim reanalysis data as lateral boundary conditions. ASR assimilates much more data compared to standard assimilation input, particularly surface weather observations, and more accurate lower boundary condition descriptions over land and ocean that are frequently updated.

We present analysis of the Arctic cyclone activity in 11-year (2000-2010), 3-hourly output from the (ASR) - Interim version with 30km spatial resolution, covering Arctic north from 50°N. To track cyclones we use sea level pressure fields and IORAS numerical tracking scheme, that was specially adjusted for limited area tracking. ASR provides a new vision of the cyclone activity in high latitudes, showing that the Arctic is more densely populated with cyclones, especially in summer, than suggested by three the modern era global reanalyses: ERA-Interim, MERRA, NCEP-CFSR. ASR reveals 35% more cyclones mostly due to capturing shallow and moderately deep cyclones over the high latitude continental areas. Over the Arctic Ocean ASR reports slightly higher cyclone counts compared to the global reanalyses with the largest differences being identified in summer. Over the Arctic Ocean during both seasons ASR well captures the cyclone maximum in the Eastern Arctic which has 30% less cyclones in summer and is hardly detectable in ERA-Interim. High resolution of the ASR model coupled with more comprehensive data assimilation allows for more accurate (compared to the global reanalyses) description of the life cycle of the most intense Arctic cyclones, for which ASR shows lower central pressure, faster deepening and stronger winds.