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Investigation of polar mesocyclones in Arctic Ocean using COSMO-CLM and WRF numerical models and remote sensing data

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Polar lows (PL), high latitude marine mesoscale cyclones, are an enigmatic atmospheric phenomenon, which could result in windstorm damage of shipping and infrastructure in high latitudes. Because of their small spatial scales, short life times and their tendency to develop in remote data sparse regions (Zahn, Strorch, 2008), our knowledge of their behavior and climatology lags behind that of synoptic-scale cyclones. In case of continuing global warming (IPCC, 2013) and prospects of the intensification of economic activity and marine traffic in Arctic region, the problem of relevant simulation of this phenomenon by numerical models of the atmosphere, which could be used for weather and climate prediction, is especially important.

The focus of this paper is researching the ability to simulate polar lows by two modern nonhydrostatic mesoscale numerical models, driven by realistic lateral boundary conditions from ERA-Interim reanalysis: regional climate model COSMO-CLM (Böhm et. al., 2009) and weather prediction and research model (WRF). Fields of wind, pressure and cloudiness, simulated by models, were compared with remote sensing data and ground meteorological observations for several cases, when polar lows were observed, in Norwegian, Kara and Laptev seas. Several types of satellite data were used: atmospheric water vapor, cloud liquid water content and surface wind fields were resampled by examining AMSR-E and AMSR-2 microwave radiometer data (MODIS Aqua, GCOM-W1), and wind fields were additionally extracted from QuickSCAT scatterometer. Infrared and visible pictures of cloud cover were obtained from MODIS (Aqua).

Completed comparison shown that COSMO-CLM and WRF models could successfully reproduce evolution of polar lows and their most important characteristics such as size and wind speed in short experiments with WRF model and longer (up to half-year) experiments with COSMO-CLM model. Improvement of the quality of polar lows reproduction by these models in relation to source reanalysis fields were investigated.

References:

1. Böhm U. et al. CLM - the climate version of LM: Brief description and long-term applications [Journal] // COSMO Newsletter. - 2006. - Vol. 6.

2. IPCC Fifth Assessment Report: Climate Change 2013 (AR5) Rep.,Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

3. Zahn, M., and H. von Storch (2008), A long-term climatology of North Atlantic polar lows, Geophys. Res. Lett., 35, L22702