

Investigation of Januarys Polar Low genesis conditions over the North Atlantic using satellite, reanalysis and model data for the period between 2003 and 2011

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The polar lows, that owe their name due to their high latitude origin, are small-scale, short-lived and intense maritime cyclones whose winds can be above gale force. Different types of polar lows and their pre-environmental conditions for Januarys during the period 2003-2011 were investigated in this study. Overall 25 cases were identified. We examine the ability of the Arctic System Reanalysis (ASR, 30 km) to represent polar lows observed by the Advanced Microwave Sounding Unit B (AMSU-B) satellite using radiative transfer simulator PAMTRA (Passive and Active Microwave Radiative TRANSfer). A case study of polar low observed on 7th of January 2009 is also present with addition of using regional climate model HIRHAM5. This case was chosen because compared to other cases this one was more intense in terms of temperature difference between sea surface temperature (SST) and temperature at 500 hPa (T_{500}) reaching 52 K and strong winds reaching the magnitude of 25 m/s [1]. It was found that the AMSU-B strong water vapour line, namely channel at 183.31 GHz, is able to reveal strong snowfall around polar low depression centres with differences in brightness temperature (BT) between cloud bands and centres being more than 40 K. Simulations do not show this strong snowfall signal. This could be due to coarse resolution of the ASR that parametrizes precipitation processes. Another explanation for the snowfall missing signal could be the description of snow hydrometeors in terms of size or density distribution. In general, compared to ocean, land emissivity is more variable and harder to model. Therefore simulations show better performance over ocean with degrading agreement over land. In addition we will discuss the amount of snowfall brought by the polar lows due to the different area and conditions of their genesis using data sets mentioned above.

References

[1] Y. Gusdal (2013), Sea Surface Temperature and Altimeter Synergy for Improved Forecasting of Polar Lows (STARS), STARS Data Set Image Data Base, Norwegian Meteorological Institute, Norway, http://polarlow.met.no/STARS-DAT/browser/view_stars-dat.php?area=North&plid=96+-+20090107&prodL=Polar+Low+Track&prodR=AVHRR+Image