Microwave brightness temperatures simulations at AMSU-B frequencies for a polar low case on 7th of January 2009

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A polar low is a is a small-scale, short-lived and intense maritime cyclone whose horizontal scale is typically less than 1000 km and surface winds can be above gale force. These small, but very intense cyclones can bring huge amount of precipitations which combined with strong winds can cause severe damage in coastal communities. Here we investigate how well Arctic System Reanalysis (ASR, 30 km) based simulations are able to represent the polar low observed on 7th of January 2009. We choose this case 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]. Simulations of microwave brightness temperatures (BT) at Advanced Microwave Sounding Unit B (AMSU-B) frequencies (89, 150, 183.31± 7, 183.31± 3, 183.31 ± 1 GHz) were performed using radiative transfer model PAMTRA (Passive and Active Microwave Radiative Transfer Model). It was found that AMSU-B 183 GHz channels reveal strong snowfall around polar low cores that match well with BT difference between core and the cloud band of more than 40 K. Strong depressions that are present in the simulation could be due to the coarse resolution of the ASR that parametrizes precipitation processes. Another reason could be the description of snow hydrometeors in terms of size or density distribution. In general, the simulations show better performance over ocean with degrading agreement over land mostly because of emissivity being more variable over land than over open ocean. The presentation will give an overview on the methodology how reanalysis is related to BT and quantitatively evaluate its performance.

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References

[1] http://polarlow.met.no/STARS-DAT/browser/view_stars-dat.php?area=North&plid=96+-+20090107&prodL=Polar+Low+Track&prodR=AVHRR+Image