# Characteristics and Genesis Conditions of January Polar Lows: Microwave satellites, Radiative Transfer Simulations and Arctic System Reanalysis

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Polar lows (PLs), often called “hurricanes of the Arctic” are intense, high-latitude maritime cyclones that bring heavy precipitation, (mostly in the form of snow), and whose winds are above gale force. Their intense winds combined with large amounts of snow, can cause significant infrastructural damage to coastal communities and disruption of shipping routes. However, their small horizontal scale (less than 1000 km) and short life time (sometimes only 3 h) makes them hard to predict. Therefore, improved understanding and prediction is of high importance. Satellite observations in the microwave range that have a good coverage of the Arctic region offer high potential due to theirs sensitivity to snow. In this study, two such satellite instruments, namely Advanced Microwave Sounding Unit –B (AMSU-B) and Microwave Humidity Sounder (MHS) have been used. The investigation of PLs is done for the period of 12 years (January, 2000-December, 2011) over which 33 January cases were reported. Arctic System Reanalysis version 1 (ASRv1) is used for the analysis of atmospheric genesis conditions of PLs and compared with AMSU-B and MHS observations. For the latter, radiative transfer simulator called PAMTRA (Passive and Active Microwave Radiative Transfer Model) that is able to simulate microwave brightness temperatures (TB) in the 1-800 GHz range has been employed. We found that AMSU-B and MHS are performing well in representing the PLs, where channels around strong water vapour line, namely 183.31, ±1, ±3, ±7 and 190.31 GHz, are showing strong depression in PL convective cores. The depression at times can be more than 40 K for the 183.31 ±7 and 190 GHz channels. Generally, simulations show good agreement with the AMSU-B and MHS observations, though not all cores of multi-low PL are resolved. Possible explanation for that could be coarser resolution of the ASR as well as the parameterization of the precipitation processes. Furthermore, we investigate PL cases originating in different geographical area and the amount of snowfall they bring.