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Studying polar lows with satellite data

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Polar lows are intense maritime mesocyclones at mid to high latitudes. They form during outbreaks of cold air over a relatively warm ocean. Polar lows are associated with severe weather in the form of high wind speeds and heavy precipitation. As such, they pose a serious threat to ships and coastal communities. Knowledge about the phenomenology, origin and life cycle of polar lows is limited. This is mostly due to a lack of meteorological in-situ data in polar low genesis regions. Moreover, the small scale and short lifetime of these systems complicates their representation in numerical models. However, polar lows are well observed by polar orbiting satellites.

Firstly, the new 2-year data set of polar low events over the Nordic Seas by Blechschmidt [2008] is presented. Polar lows are detected by combined use of thermal infrared satellite imagery and passive microwave wind speeds. In contrast to previous studies, satellite based wind speeds have been used to exclude less intense mesocyclones from further analysis. The resulting data set documents the evolution and pathways of a total of 90 polar low events. Characteristics of these small scale cyclones are described by statistics of satellite derived parameters (e.g., observed lifetime, wind speed, precipitation, latent heat flux).

Secondly, the large scale circulation during polar low events is investigated based on the 2-year data set. Schematic charts of four different polar low types (western polar lows, eastern polar lows, Greenland lee polar lows and storm track polar lows) are derived from NCEP Reanalysis data. Eastern polar lows are found to be associated with a strong blocking situation caused by anomalously high pressure over Iceland and a synoptic scale low-pressure anomaly over the Barents Sea. A weaker blocking situation with an anomalous ridge reaching into the Irminger Sea and a low-pressure anomaly over the Norwegian Sea favors the development of western polar lows. The location of upper level anomalies relative to the location of related anomalies at the sea level shows, that eastern and western polar lows form, on average, in a much less baroclinic large scale environment than Greenland lee and storm track polar lows. Finally, the applicability of the type specific schematic charts for polar low forecasts are discussed.