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Earth System Science Data Discussions

Interactive comment on "Climatology and time series of surface meteorology in Ny-Ålesund, Svalbard" *by* M. Maturilli et al.

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We thank Reviewer #3 for his comments on data quality and representativeness, and the suggestions for scientific analysis based on the presented dataset. We would like to point out that this is a technical data paper and not a scientific analysis paper.

One of the major concerns of the reviewer is the representativeness of our data for the surrounding area, assuming that our measurements capture only microclimate processes not even representative for the Ny-Ålesund area. While surface meteorology measurements on the ice covered Arctic ocean may be representative for large parts of the Arctic, they never provide long-term observations. Generally, the number of stations with a long-term observation program in the Arctic is very limited due to the challenging logistics and operating expenses. Ny-Ålesund is one of the key stations

to provide long-term information, and the presented data report is intended to present a part of it. As mentioned in the paper, Ny-Ålesund is situated at a fjord, surrounded by glaciers, moraines, rivers, mountains and a typical tundra system. Indeed, this is a complex environment with accordingly complex microclimate processes in the lower part of the atmosphere. We are aware that these processes contribute to our long-term observations, and that similar measurements in other parts of the fjord or in other parts of Svalbard may differ. Yet, by presenting this dataset we are convinced to provide important climate data that are useful not for the Ny-Ålesund science community but that may contribute also to general Arctic climate research. Svalbard and other solid terrain are part of the high Arctic, and atmospheric processes induced by their orography contribute to the complex Arctic atmosphere-ocean-land system and their long-term data cannot be ignored. It is not the aim of this data paper to analyze the complex physical processes occurring at Ny-Ålesund, but the presented dataset will be one component to enable such analysis. Overall, the investigation of the Ny-Ålesund microclimate will require the combination of several measurement sites (e.g. Zeppelin mountain station, the Italian climate tower, Corbel station, and others) providing reliable data with high temporal resolution.

The reviewer also challenges the uniqueness of the presented dataset, referring to the nearby longer-term NMI measurements. While the NMI data have a 6-hour resolution, our data have the advantage of a 1-min (5-min) temporal resolution, allowing to analyze smaller scale processes. We will introduce a section to the revised manuscript, presenting examples of small-scale processes that are captured by the data (like e.g. gravity waves induced by catabatic outflow) to show the potential of the dataset. In the following, we respond to the major and minor comments listed in the review.

Major Comments:

1) Comments related to the data quality:

a) While listing the used instruments and their changes may shorten the text, we feel

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that information would get lost, e.g. for changes in humidity sensors and the use of external temperature for the calculation of relative humidity. As the other reviewers described our manuscript as 'very well presented', we would like to keep this part in the text.

b) Generally, 1/5 DIN PT100 temperature sensors are not calibrated. The AWI temperature sensors are regularly checked with mercury thermometers, so an accuracy of 0.1K is granted.

c) Both in the dataset as in the data paper, we refer to the directly measured parameters. Derived parameters like the low-level stability or the sensible heat flux are subject to the interpretation of the measured data, and are out of the scope of this paper.

d) We will add a section on relative humidity with respect to ice in the revised version of the manuscript.

2) Comments related to the uniqueness of the dataset:

a) As mentioned above, we will include a section presenting examples of small-scale processes that are captured by our measurements. The measurement site of the Norwegian Meteorological Institute is at about 200m distance parallel to fjord and mountain ridge, but has been moved during the investigated time period. The NMI dataset has a time resolution of 6 hours, and we need to correct the length of the time series reaching back only to 1974.

3) Comments related to the representativeness of the data:

a) (pg. 1060, l.23-25) We will change the phrasing to be more comprehensible. When looking at the data on synoptic time scales of e.g. 3-5 days, larger spatial systems like passing cyclones are detected. These are not local events, and statistics on them may be valid for the Svalbard region or the European Arctic. The smaller the analyzed time scale, the smaller also the spatial scale of detected processes, from frontal passages down to gravity waves induced by catabatic outflow. So when taking advantage of the

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high temporal resolution, the data are valuable for small-scale process studies. When using temporal averaging, it is possible to look at synoptic events up to the climate scale. We do not neglect an influence of the local topography on the presented climatology. Local wind effects may interact with the general synoptic flow. Yet, temperature increase and decrease related to the passing of a warm or cold front, respectively, and the related changes in surface pressure and also in wind direction are part of the presented dataset. While the observed long-term warming is consistent with e.g. the IPCC report on Arctic climate, we may not exclude that local effects do contribute to our observations. Yet, it is out of the scope of this technical data paper to scientifically analyze the atmospheric processes that lead to the observed data.

b) We will include a topographic map of the fjord region, and indicate the position of our measurement site. We will not indicate the location of other observing sites since they have changed during the investigated time period.

4) Comments related to data interpretation:

a) Temperature variability is larger in winter than in summer (both in Tmax-Tmin and interannually), since surface pressure variability is equally larger. The passing cyclones in winter have a larger amplitude in pressure gradient compared to the summer months, and their occurrence is more frequent. The higher cyclonic activity in winter is reflected in the higher wind speed, although the wind is channeled due to orography. Depending on their position relative to Svalbard, cyclones transport warmer air from lower latitudes or cold air from the central Arctic to Ny-Ålesund, causing large temperature variability. On the synoptic scale, the Ny-Ålesund data show an anti-correlation of surface pressure and temperature, leading to temperature changes up to 10 degrees within a few hours. Long-wave radiative forcing from clouds may have an additional effect, from potential inversion-top clouds as well as from cyclone related cloud cover, but the effect on temperature is much smaller in magnitude.

b) This is an excellent suggestion for a scientific analysis based on the dataset pre-

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sented in this technical data paper.

c) The presented time series of temperature and humidity (Figs. 5 and 6) provide a climate scale example for potential studies with the dataset. As mentioned above, we will extend the manuscript including examples for small-scale processes found in the data. We do not obtain trends from our observations, and at no point we define the observations valid for the broader Arctic. Here, the observations are summarized as "Climatology and Time Series of Surface Meteorology in Ny-Ålesund, Svalbard", we are presenting a technical data paper, and the interpretation of the data and their representativeness beyond the Ny-Ålesund area will be subject to scientific analysis.

Minor Comments:

1) We will include Curry et al. (J.Clim., 2005) to the references.

2) We will update the Stroeve et al. reference.

3) See Major Comment 4 a.

4) Yes

5) The minima/maxima are based on 1-hourly data (will be added to Figure caption).

6) We will add a curve for the monthly mean over the whole period to the Figure.

7) It is absolute pressure change (will be added to Figure caption).

8) A similar dataset publication for the Ny-Ålesund BSRN radiation data is under work and will be submitted soon. So far, the according dataset is found at the Pangaea database (www.pangaea.de) searching for 'Basic and other measurements of radiation at station Ny-Ålesund'. We will add an according reference note to the revised manuscript.

9) The data can be downloaded as tab-delimited text. Software for data reading, converting and plotting is available at the database (www.pangaea.de/software).

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10) The time code is database convention.

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