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Open Access Earth System Science Data Discussions

Interactive comment on "A 20-year record (1998–2017) of permafrost, active layer, and meteorological conditions at a High Arctic permafrost research site (Bayelva, Spitsbergen): an opportunity to validate remote sensing data and land surface, snow, and permafrost models" *by* Julia Boike et al.

Anonymous Referee #2

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Good dataset.

Major questions:

I do not quite understand why you only list the usefulness of the dataset for RS validation and permafrost modelling?

Why not at least include information on the overall results that the dataset provides such as active layer thickness (ALT) and its variations and one the permafrost thermal state?

Why not provide information if there are some CALM measurements and what they show compared to your dataset on ALT?

Do you have any stratigraphical information from the drilling of the borehole (would strengthen the use of the dataset in many ways) ? and some info on the drilling method (hammer or coring) ?

Otherwise only smaller detailed questions:

Line 50: 'The data set also includes a high resolution digital elevation model that can be used together with the snow physical information for snow pack modeling'. This is the second mentioning of the high res. DEM in the abstract.

Line 60: (the "active layer"), I would use the active layer as this is standard scientific terminology within permafrost science.

Line 61-63: 'Thermal degradation of permafrost over the last few decades has been reported from many circum-Arctic boreholes (Romanovsky et al., 2010)'. Well not many. Most boreholes do not actually have very long records, so please include the number or say some.

Line 70: 'and temperature'. This is a listing of additional parameters to temperature, so this should not be here as well.

Line 71: 'can blanket the permafrost surface' normally snow is isolating the permafrost

Line 75: 'resulting datasets' are some dataset not resulting..I do not quite follow the use of resulting datasets..why not simply say datasets ?

Line 82: 'has been investigated by the AWI'. A site cannot be investigated, but used for research..

Line 101-102: 'The West Spitsbergen Ocean Current, a branch of the North Atlantic Current, warms this area to an average air temperature of about -13°C in January and $+5^{\circ}$C in July'. Please add reference and time period.

Line 102-103: 'It also provides about 400 mm of precipitation annually, which falls mostly as snow between September and May. An ocean current cannot provide precipitation.

Line 104: 'Significant warming of air temperatures'. Air temperature either increases or decreases, but do not warm or cool.

Line 106-108: 'This warming is also reflected in the permafrost temperatures, as recorded from deep boreholes (up to 102 m deep) in the mountains at Janssonhaugen'. Do you mean that the permafrost has warmed down to 102 m due to which air temperature increase?

Figure 1: On the overview figure the arrow point in the sea? Could point at the site, or make a dot of the site, which then shows on the next top right figure. C and d show the area in summer and winter simply.

Figure 2 Suggest to change the figure text to: Topographical map (a) and overview of the Bayelva study site (b) in Ny-Ålesund, Svalbard. (a) Aerial orthophoto (20 cm/px) with topographic information (2.5 m contour lines) derived from a Digital Elevation Model (DEM) with a cell size of 0.5 m. The locations of the instruments and sampling sites are marked by coloured symbols. The site is located on a small hill; white areas are snow fields remaining late in the season. The orthophoto and DEM were obtained with an HRSC-AX camera in August 2008 (data and metadata for the high resolution digital elevation model covering the entire area shown in Figure 1b are provided in Appendix B).

Line 141-143: 'The hill consists mainly of rock but is partly covered by a mixture of sediments that consist of glacial till, together with fine grained glacio-fluvial sediments

and clays from the last glacial advance' could you make a reference to this important stratigraphical information please.

Line 146; 'below the maximum height for marine sedimentation' you must mean below the upper marine limit?

Line 155: 'These non-sorted circles formed under localised favourable conditions following the last glacial period'. Please provide reference, or explain how you know this timing.

Line 171: 'The depth of the snow cover', The snow depth..

Figure 3: Please make sure to print these figures horizontally then much easier to directly read and probably also to compare the 3 parts on one page. What is the snow temperature in the snow free period? probably best to remove..Precipitation is normally shown upwards not downwards. Soil temperature is actually the active layer temperatures, which would fit better with permafrost temperatures below.

Line 208-209: 'Climate records covering a longer period of time (since 1989) are available from the airport in Longyearbyen. . ..' They go much further back more than 100 yrs.

Line 222: 'PT00 temperature sensors'..must be PT100 temperature sensors.

Line 258: argely – largely

Line 259-260: The Q7 sensor was destroyed by reindeer in September 2003 and was not replaced. When was the reindeer fence put up and why did it not work?

Line 265: 'ground Level' – ground level.

Line 280: (about 85 m; Figure 2), (about 85 m away ?...

Line 284-285:'To obtain the snow depth the distance of the sensor from the ground surface was recorded annually and subtracted from 285 the corrected distance

data'. . .What about frost lifting of the measuring pole, is this taken into consideration ?

Line 296-298: 'It should be noted that two of the sensors (an SR50 sensor and the laser sensor) were located within 5 m of each other, while the second SR50 (at the eddy covariance site) was located 85 m away, downhill from the Bayelva site (Figure 2)' This is repeating already provided information.

Line 303: to monitor the timing and pattern of snow melt. . .must be for all snow cover changes not only melt

Figure 4. 'Bayelva soil temperature trends for three depths from 1998- September 2017 using Level 2 soil temperatures'. So this is active layer and top permafrost temperatures, would be good to use this terminology. 'a) yearly trends at all three depths of 4, 58, 138 cms are 0.18°C/year (standard error of trends: ± 0.07, 0.06, 0.05 °C/570 year) b) winter trends (months December, January, February) are 0.25, 0.25, 0.23°C/winter (standard error of trends: ± 0.12, 0.11, 0.07 °C/winter) and c) summer trends (months June, July, August) are 0.08, 0.1, 0.12°C/summer (standard error of trend ± 0.05, 0.04, 0.03 °C/summer). Years in which data gaps of more than 48 hours exceeded 5% of data were included. Data gaps were interpolated linearly'. Suggestion for changes: a) the mean 20 year temperature increase in the active layer at 4 and 58 cm depths and in the top permafrost at 138 cm was 0.18°C/year, the mean 20 year winter temperature increases were. . ..., while the mean 20 year summer increases were. . ..

Line 341: 'stockpiled separate'- stockpiled separately

Line 378: 'After installation, the sensors cannot be re-calibrated' – why not? Could be dug up for recalibration..

Line 383-384: 'Subsequently, temperature readings from nine of the 32 sensors subsequently started to drift and' please not more than one subsequently..

Line 396-397: 'increased noise Levels' increased noise levels..

Line 407: 'the permanently frozen soil'- the permafrost

Figure 4 interpretation. . .you list means for the entire period, but very interesting there was a large increase before 2002 and then more stable conditions since then..would be good to comment on this

Line 424: were installed were installed..only once..

Line 451: The lack of calibration

Line 467-468: Ten thermometers were installed, one above the ground surface and nine from the surface down to 9 m depth..you mean a thermistor string !

Line 488: data Levels – data levels

Line 502: soil temperature – sediment temperature..no information given on soil development, so sediment would be the most natural to use in this connection.

Line 508-509: The data from this Bayelva site have been widely used for the development and evaluation of land surface models. Include references.

Line 519: Permafrost around the Arctic is thawing and warming – permafrost around the Arctic is warning and thawing.

Line 521: soil temperature – you need to specify is this is sediment or mixtures on rock and sediment?

Line 523: (Figure 4 h). Such a figure does not exist (Fig. 4 a, b and c only)! Line 523-524: Interannual to sub-decadal variability is evident in the data and results mostly from differences during the winter months. But you do not at all explain these here, which is a pity, so why include this sentence?

Table 2. Permafrost temperature is Active layer and permafrost temperature.

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