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Comment on essd-2021-68

Anonymous Referee #2

Referee comment on "Operational and experimental snow observation systems in the upper Rofental: data from 2017–2020" by Michael Warscher et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2021-68-RC2, 2021

1 General comments

Warscher et al. present a data set of non-standard measurements of snow properties together with meteorological variables at three alpine stations in the Austrian Alps. However, the unique part (i.e. non-standard measurements at three sites) of the dataset is only available for the beginning of this year and partially for the 2019/2020 snow season. I do not see that this short period is particularly useful compared to other published multi-year datasets (e.g., Morin et al., 2012; Ménard et al., 2019). Therefore, I suggest rejecting the manuscript at this stage and waiting a few more years until more data are available. In addition to the short time frame, I also agree with the first reviewer that the data quality checking is unclear and that conclusions from the data are sometimes incorrect (which I will show in the next section). In addition, I would like to point out that data gaps are a major problem with this dataset. These three issues should be considered before submitting a new manuscript in a few years.

2 Specific comments

2.1 Short time period

I can identify useful and unique parts of this data set, but in too short a time period. These are the spatial distribution (three measurements) in a high alpine environment, with non-standard snow measurements such as SWE from different gauges, liquid and solid fractions of snow, snow temperatures, and snowdrift sensors combined with standard measurements such as snow depth, precipitation, and meteorological variables. However, there is only one complete snow season (2019/20) in which more than one SWE measurement is available, but at leasot one of those is exposed to wind erosion, and the usefulness of this location will not become apparent until the start of the 2020/21 winter season, when a nearby wind-sheltered station was established. Similarly, the non-standard drift sensor and Snow Pack Analyzer (SPA) measurements are not available before early 2020. Therefore, I don't see much use for this data set described here. However, I can very well imagine one developing in a few years.

2.2 Data quality example and quality checks

Since this dataset is not standard and prone to errors, I propose to address typical measurement errors and possible automatic quality check routines in a next manuscript version. Here I would like to describe an erroneous SWE measurement that has already been identified by reviewer 1 as a misinterpretation by the authors. In lines 225ff, the authors described the stage at which the snowpack at Latschbloder becomes isothermal (Figure 8) and explained the subsequent SWE values. This is a typical time when pressure sensors measuring SWE exhibit errors (Johnson and Schaefer, 2002). I do not claim to provide the correct interpretation, but the authors certainly missed something. This description should serve as an example of how future quality control can be designed or how errors in the data set can be described in a future manuscript, especially when more instances of redundant SWE measurements will be available (SPA and snow scale). The authors claim snowmelt starting at midnight on 11 April 2020, explaining the loss of SWE of ~110 mm in less than 18 hours. It is questionable whether this is melt, as air temperatures were well below 0 °C and the snow depth sensor only indicated a constant decrease similar to the days before and after. It appears to be more a measurement error which is typical when the isothermal front reaches the snow-ground boundary as described by Johnson and Schaefer (2002), which was detected based on the snow temperature measurements two days earlier. A decrease in SWE could be explained by snow shear strength being able to bridge the sensor (Johnson and Marks, 2004), which could happen when meltwater near the ground refreezes. The authors describe the later increase in SWE as rain percolating into the snow. However, reviewer 1 correctly pointed out the negative air temperatures during this time (colder than -5 °C). In addition, the rain gauge measured only <3 mm of precipitation, while the SWE sensor increases by more than 150 mm during the same period through April 18. This discrepancy cannot be explained by undercatch of the rain gauge, especially since the snow depth sensor shows the same continuous decrease as in the days before, without any indication of a major snowfall. Thus, it seems more likely that the previously mentioned snow bridges have been continuously weakened as snow temperatures are around the melting temperature. Future availability of redundant SWE data, snow depths, air and snow temperatures will provide more examples in a few years from which the authors can select examples of faulty and good situations. The methods of Johnson and Marks (2004) or others may be included to tag poor quality data.

2.3 Data gaps

The use of this dataset is also limited due to data gaps, which is partially visible in Figure 5. For example, for Bella Vista in 2018, over 33% of all data are missing with gap sizes of 49, 27, 20, ... days. Precipitation is missing 75% of the time, with another gap of 199 days. In 2019, this station typically has 7% data gaps, wind over 11%, with gap sizes of 12, 7, 3, <1 days. Such multi-day data gaps are difficult to fill.

2.4 Other

- A measurement height of 1.50 m does not seem sufficient in alpine terrain. Please provide the exact height for each sensor in the tables. Please provide time periods when a sensor is buried or consider larger masts (if possible).

- Literature describing the quality of the snow pack analyzer should be added. For example, Staehli et al. (2004) and Egli et al. (2009).

- The fact that each year and station is in individual files makes it difficult to use the data. Please consider consolidating the data into one or a few file(s) as much as possible.

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