The Cryosphere Discussions

The Cryosphere Discuss., referee comment RC2
https://doi.org/10.5194/tc-2021-260-RC2, 2021
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on tc-2021-260

Anonymous Referee #2

Referee comment on "The statistics of blowing snow occurrences from multi-year autonomous snow flux measurements in the French Alps" by Zhipeng Xie et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2021-260-RC2, 2021

The statistics of blowing snow occurrences from multi-year autonomous snow flux measurements in the French Alps

The authors present a statistical analysis of blowing snow transport at a number of meteorological stations in the French Alps. Relying on blowing snow flux information from FlowCapt instruments, the authors analyze the spatiotemporal variability of blowing snow in one region of one mountain range. Even in such a relatively small domain, this is a significant open question, largely because of the strong presence of spatiotemporal variability in snow cover characteristics and turbulent winds in complex topography. While the authors provide a detailed breakdown of FlowCapt time series, they do little to describe the inherent differences between meteorological sites, and they do nothing to address well known problems with FlowCapt data for quantitative studies.

Major and minor comments are detailed below. If the editor finds the manuscript fit for resubmission, there are grammatical and spelling issues that need to be addressed as well.

Major Comments:

I don’t think the FlowCapt data can be accurately used in the ways that the authors are

intending. There is a very strong critique of the product (i.e. Cierco et al., 2007) that highlights fundamental issues with the data, specifically for the kind of work that is being submitted here. However, the work of Cierco et al., (2007), nor the issues detailed by them are nowhere mentioned in the present work.

To quote a few key conclusions from Cierco:

"Particle velocity has been shown to be a very important parameter in the measurement process. Flowcapt still appears to be unable to consider it properly because of erroneous assumptions at the basis of the calibration process. As a result, the proposed calibration of the sensor produces large overestimation of the snow flux. Moreover, this trend appears to drastically increase with height because of the properties of the atmospheric boundary layer...

If we consider a 1-m long tube, the variation in wind speed between the top and the bottom of the sensor produces an error in the estimation of a mean speed for particles...

It should be stressed that with the best correction found we do not expect major improvements in terms of measurement accuracy. Indeed, because of the power law that relates snow flux to the signal, substantial changes in snow flux only led to a small range of variations in the recorded signal...

To conclude, sensor saturation must be considered when extreme wind occurs, even in natural flows, and vibration de-coupling at low temperatures needs to be improved...

The recordings from Flowcapt may be efficiently corrected so as to constitute database containing extensive amounts of field data, but a great deal of work is still needed to determine the data reliability...

If Flowcapt is still used efficiently for operational purposes (to accurately determine the time step of blowing snow occurrences and to obtain a qualitative estimation of snow fluxes), its usefulness in research works is quite limited : the device requires additional calibrations and its output signal needs further corrections. "

In light of these conclusions, I do not think the numerical flux measurements can be used in this quantitative way, especially as the data are treated as is. Furthermore, I am

skeptical that using the three thresholds as qualitative ranges (e.g. low, medium, high) can be performed as we do not know if 0.1 gm^-2s^-1 means the same thing from one storm (or gust) to the next. This significantly undercuts the analysis in this manuscript, and I do not see a clear path to publication given these large uncertainties as the conclusions heavily rely on these quantitative flux values.

Given the uncertainty in FlowCapt data, there is room for the manuscript to calculate a binary blowing snow presence from the FlowCapt data, but this would likely result in a significant change to the manuscript and its conclusions to maintain scientific interest.

Minor Comments:

L21 Define ISAW

L41 “plays”

L53 Pomeroy

L60 avalanche

L83 spatiotemporal

L87 uneven

L92 move comma

L116 compiled

Figure 1. We need significantly more information about the meteorological stations, including aspect, elevation, lat/lon, and a site description (treeline, clearing, alpine,

glacier, ridgeline, valley bottom, moraine, etc.)

L134 air not theair

L136 If you are dealing with wind speed, you only have non-negative scalar values. Therefore a mean windspeed of zero, means a constant windspeed of zero, and you automatically know what the maximum windspeed is.

L148-149, This is troubling. What do you mean "only relative values of snow flux"? How can one measurement be compared to another measurement, when they may both contain different errors?

L153-154 How did you calculate whether snow was melted? A zero-degree threshold is not an indicator of snow surface water content. This method needs to be elaborated on, or possibly refined.

L158-159 In light of the accuracy study of Cierco, it needs to be clarified that these numerical thresholds have little to do with the physical fluxes that they represent. The authors have essentially studied different numerical output from the FlowCapt sensors, which may or may not be caused by different blowing snow conditions, and may or may not be related to the reality in the field.

L410-412: How does this correspond with the wind characteristics at the site? This would seem to imply that either the wind is more often strong than weak, snow scours only during strong storms and then transport would ceases (but there is still a large reservoir of available snow for transport), or that the FlowCapt instrument is biased towards high fluxes.

Reference:

Cierco, F.-X., Naaim-Bouvet, F. and Bellot, H.: Acoustic sensors for snowdrift measurements: How should they be used for research purposes?, Cold Reg. Sci. Technol., 49(1), 74–87, doi:10.1016/j.coldregions.2007.01.002, 2007.