

Response to Reviewer 1

We thank the reviewer for the time spent to track the errors and inaccurate language. The revised manuscript significantly benefited from this input and is hopefully clearer.

Abstract:

Page 1 Line 6: Change “copies” to “instruments” and following “Antarctic” and “French Alps” add “(Dome C)” and “(Col de Porte)”. Consider changing “daily” to “continuously”.

done

Line 11: It might be unclear to some readers what is meant by “disconnected from snowfalls” so please clarify.

We have changed to “without apparent link to snowfalls”

Line 12: Suggest changing “At last” to “Finally, ”.

done

Line 13: Define RLS

We have simply changed to “laser scanning”

Introduction:

Page 2 Line 10: “their formation are still not...”

done

Page 3 Lines 7 - 8: The wording in this sentence is a bit off. Try “The instrument is able to scan areas of over 100 square metres, every day, for a cost less than ten single ranging probes, or a tenth of the cost of a common TLS.”

done

Line 10: change “copies” to instruments (perhaps other occurrences of this as well)

done

Line 12: “...during one of the winter...”

done

Lines 16 - 18: The sentence “The specific...” is awkward and needs to be re - worded.

We have changed to “The specific objective was to observe the snow accumulation processes at daily to weekly temporal scales which are inaccessible with other glaciological methods such as

readings of stake emergence“

Materials and method:

Line 30: I assume that you mean that you tested the Dimetix as a stand-alone instrument for several years. You should clarify this.

We have changed to “To minimize the risk, we based this development on an industrial lasermeter (DIMETIX FLS-CH 10) which had been used at both sites for several years to carry out point measurements.”

Line 31: “...take point measurements into a 2D scanner...”. Remove “only”

done

Page 4 Lines 2-3: Are these specifications from the manufacturer? Reference?

The information comes from the User Manual which can not be referenced but we have changed to : “We selected the FAST mode which offers a range accuracy of $\pm 2\text{mm}$ (statistical confidence level of 95.4%) at a rate of up to 20Hz according to the user manual of the device.”

Line 4: I’m not sure what you mean by “...and individual range measurements.” Do you mean “...with individual range measurements” as in not to get the two confused. Perhaps clarify this.

We have removed since it was not useful.

Line 5: Perhaps use the term “manufacturer” instead of “constructor”. This occurs in several other places as well.

Yes we have changed this everywhere.

Line 8: “Among them, it was found that the brightness of the environment during our early tests was an important...”

We have changed to “Among them, it was found during our early tests that the brightness of the environment was important factor,”

Line 19: “drop from 0.8 ms^{-1} on...” is confusing, re-word.

We have changed to “Higher speeds have been tried to reduce the scan duration but the measurement rate tends to degrade and even abruptly drop for speeds of 0.8m/s and higher, which completely cancel out any gain.”

Line 20: should be a comma after 10 m and again after 30 m to make the sentence read better.

done

Line 30: “The chosen potentiometer model has a linearity...”

done

Page 5 Line 1: What is “(1 unitcm resp.)” mean. I don’t understand what the respective reference

means. Please clarify.

Sorry, this is a misspelled LaTeX command.

Line 2: “...but is not compensated by differencing.”

done

Line 4: “...the other above mentioned sources...”.

done

Line 13: should be a comma after “parameters”

done

Line 14: Is the lifetime of the laser provided anywhere? This might be a good place to do this.

We have slightly changed the sentence “One scan is acquired every day, a balance between scientific relevance and lifetime of the lasermeter and mount (the laser itself has a lifetime of 50,000h at 20°C according to the manufacturer).”.

To our experience, the laser has never been the problem. Instead we had several issues with the power supply (which is probably due to the quality of the power at Dome C) and heating as explained in the paper.

Line 22: The formatting of the equation seems to be messed up.

We do not reproduce the problem. This is how it appears in our viewer:

length and is easily calculated from x and y . In con-
known and is actually the value we want to measu-
horizontal distance between the target point (x, y) and
is given by $\left| r \sin(\theta) - \sqrt{x^2 + y^2} \right|$ where r is the
stance is minimized to within a specified toleranc-
l and averaged with the aims of reducing the repr-
a formula as for the open mode. To speed up th-

Line 26: “...allows us to sample...”

done

Line 27: comma after “30 s”

done

Line 28: “...except during the 4 hours when the RLS...”

done

Lines 31-32: add “(left)” and “(right)” after Col de Porte and Dome C to indicate their position in the figure.

done

Page 6 Line 4: “consequence” should probably be plural

probably yes.

Line 7-8: I think you could find a way to more simply state that the structure sinks as the snow beneath the mount densifies.

We changed to “ The structure thus sinks as the snow beneath the board densifies. However, this movement is considered negligible compared to the surface elevation variations occurring at the surface due to accumulation, surface snow densification,”

Line 10: Is “stacks” supposed to be “stakes”?

Yes.

Line 23: “It consists of the following...”

done.

Line 27: should be “...to remove ranges that are too short...and ranges that are too long...”

done

Page 7 Line 30: Is there a reference for the WMO-SPICE experiment? Several papers have been citing

“Nitu, R et al.(2012) “ WMO intercomparison of instruments and methods for the measurement of solid precipitation and snow on the ground: organization of the experiment” or Rasmussen et al (2012) “How well are we measuring snow: The NOAA/FAA/NCAR winter precipitation test bed”.

We have added the latter reference.

Results:

Page 8 Lines 14-15: The sentence might read better if the i.e. part of the sentence is contained in parenthesis

We have added parenthesis but to simplify the sentence, we have remove the first information in parenthesis which was not necessary.

Line 26: Perhaps “dysfunction” should be “malfunction”

changed.

Line 28: “...the specifications for the lasermeter is for a ...”

We changed to “Considering that the lasermeter has a minimum operating temperature of -40°C according to the manufacturer and that it was exposed for several months to less than -70°C,”

Line 31: I may have missed something but why the interruption period during Austral spring?

Please clarify this is you haven't done so.

It was not clear, we changed to: "Overall, the success rate over the period is 65%, and 75% when excluding the long interruption period due to internal heating failure". The information could also be removed.

Page 9 Lines 1-2: "...is the jamming of the stages. This could be caused from snow accumulating in the cap housing of the device or possibly because ..."

We changed to "This could be caused by snow accumulation in the housing of the device or possibly ice formation on the motors."

Line 27: "...variations give a higher bound..."

done

Page 10 Line 11: "weak" should maybe be "low" or "unacceptable"

We have used "acceptable".

Line 23: "measure" should be plural

a "s" is added.

Line 26: "...which prevents any further exploration of this hypothesis."

done

Page 11 Line5: "technique" should probably be plural

done

Line 7-8: "...it would tend to negatively bias all the snow depth measurements at Col de Porte while Dome C would not be affected."

done

Line 17: "similarly" should just be "similar".

done

Line 20: "...averages a hundred single..."

done

Line 24: "...when evaluated at single points."

done

Page 12 Line 32: sentence would be more readable by changing to "...which remained high (around 8 cm) until 22 April 2015, only a few days before..."

done

Page 13 Line 11: Change “vain” to “it difficult”.

Done

Line 14: “...(Figure 3) than it is at Col de Porte.”

Line 19: “of the failure” should be “for the failure”

Lines 20-23: The sentence “...and it was shown that...” is a bit confusing and should be reworded.

The sentence and the paragraph have been reworded as follows:

“It is well known that the deposition is mainly driven by wind on the Antarctic Plateau (Grootzwaaftink et al. 2013, Libois et al. 2014}. Both of these studies showed that when modelling the time evolution of snow accumulation, adding new snow to the snowpack at time of precipitation events as commonly done in Alpine environments was found generally inadequate on the Antarctic Plateau. Instead, better results are obtained by pooling snow precipitation in a virtual reservoir until some criteria on the wind speed are met. The reservoir is then emptied on the surface resulting in a single large deposition event. This tends to delay and reduce the number of the deposition events. Our observation is consistent with this approach, showing that more than 6 significant snowfalls and a dozen of strong wind events...”

Line 24: insert comma after “period”

done

Line 25: remove “of” from the first sentence. What is mms -1 ? Should that just be ms -1 ?

removed and corrected.

Page 14 Line 7: “value” should probably be plural. Same in line 8.

done for both.

Line 10: “due to redistribution...” and “measured at any...”

done

Line 15: Missing a parenthesis after “...for the RLS.” Remove the rest of that sentence.

done

Line 16: “...are similar except for a general...”

done

Section 3.6: These sections provide the “proof-of-concept” test for the sensors which is appropriate, but they do have some extraneous information that has been added about the conditions of the snow pack at the sites. Some of this is relevant for the testing of the instrument and some,

although interesting, is not as relevant. You should consider reducing these sections.

We agree with the reviewer that the main purpose of the manuscript is the description of the instrument and the assessment of its performance. However, we consider useful to describe in more details, taking an explicit example of significant geophysical relevance, how the system can be applied to address scientific issues. Which current monitoring systems cannot adequately observe. The time-series at Dome C is particularly relevant in this matter and we believe it worth the short diversion.

Discussions:

Page 14 Line 27: "...designing a snow depth survey..."

done

Line 28: "determine" should be "determining"

done

Page 15 Line 4: "...in 2015, the trends in the 5-point mean..."

done

Line 16: "snowfalls" and "events" should be singular

done

Lines 18-19: I think the sentence should be "...that are sufficient to reduce the error due...".

done

Conclusions:

Lines 31 onward: put this paragraph into the context of the sensor test, otherwise it is just extraneous information.

Page 16 Line3: "Further work includes improvement..."

done

Line 8: "...is continuous" should be "are a continuous"

done

Line 16: "...paves the way to answer questions..."

done

Line 21: "communicate" should probably be "determine".

done

Figures:

Page 22 Figure 2: a close up photo of the instrument would be useful and interesting.

It has been added

Page 28 Figure 8: Scale on the right hand side should indicate units. A north arrow on the figure would also be good. In the caption, wind slab should be two words.

Label has been added to the colorbar and the information regarding the north is added in the legend.