The Cryosphere Discussions

The Cryosphere Discuss., referee comment RC1
https://doi.org/10.5194/tc-2021-9-RC1, 2021

Comment on tc-2021-9

Anonymous Referee #1

Referee comment on "Snow model comparison to simulate snow depth evolution and sublimation at point scale in the semi-arid Andes of Chile" by Annelies Voordendag et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2021-9-RC1, 2021

In this manuscript the authors present a sensitivity analysis of two commonly used snowmodels, SNOWPACK and Snowmodel, for a semi-arid Andes catchment. The authors aim to quantify the impact of various parameter and parameterization selections and impact of forcing uncertainty on a sublimation dominated catchment.

Overall, this manuscript is clear, well written, and provides useful results. Research topics like this have a tendency to end up very location-centric and not widely applicable to the larger community. However, I do not believe that is the case here. There are sufficient linkages with existing work.

I have two concerns:

One, the description of precipitation measurements is unclear to me. Figure 1 suggests an unshielded Genor gauge is used. However, the authors use an Alter-shielded correction factor. This should be clarified in the text. If an unshielded gauge was indeed used, then a) a different factor should be used and b) the uncertainty in the precipitation is massive and I am then not completely convinced. I also note that MacDonald (2007) is a grey-literature source (conference proceedings), and I am curious as to why the authors chose

this correction versus some of the "more standard" WMO/Goodison corrections?

Two, it seems to me the authors are using only the instrument measurement uncertainty. This should be noted in the text. However, I'm surprised the authors did not use the uncertainty ranges and distributions from Raleigh (2015; table 3) which include more 'real-world' uncertainty ranges. I believe the manuscript would benefit from using these distributions and ranges. I believe this would more cleanly link this work with existing studies and increase the contribution.

Detailed notes

L18 "complexities" should be elaborated on as to what the authors mean by this, as everyone has different definitions

L18 "physical approaches" do you mean "physically-based" or "physics-based" here? All approaches should be physical.

L22 "These approaches, coupled with snow models" I don't understand what you mean by this

L32 Should cite Essery (2015) as well

L53 "this" refers to what?

L54 I would also note dry air (important for sublimation)

L65 1000 seems arbitrary, perhaps note as much or describe why this number was chosen

L72 “to assess the sensitivity” of what?

L72 “a permanent station” clarify this is a meteorological station

L80 If this table can be included in the main text, I think you should do so

L80 Describe shielding for Genor here

L96 “Physical equilibrium” what does this mean?

L97 “June 11:00 and 31 Oct” replace ‘and’ with ‘to’

L110 describe shielding

L118 Blowing snow sublimation will also lower on ground swe and should be noted as this further adds uncertainty to the reconstruction

L165 add “snow” roughness

L165 I’m surprised the roughness length is so small. This is well on the lower end of what is reported in the literature. It seems to me to be calibrating sensitivity to the turbulent fluxes, suggesting that they are being overestimated with more ‘reasonable’ z0 values. Could this be related to the stability parametrization being insufficient in this area?

L230 all RMSE values need a unit, even if it’s (-) for albedo

L230 “compared to the albedo” what is compared ?

L241 rmse units

Figure3: Legend should be added. Albedo yaxis needs more ticks, at least in the 0.5-1 range.

L321 remove “total”

L321 add “in other alpine”

L351 fix reference ( )

References

Essery, R. A factorial snowpack model (FSM 1.0). *Geoscientific Model Development* **8**, 3867 3876 (2015).

Raleigh, M. S., Lundquist, J. D. & Clark, M. P. Exploring the impact of forcing error characteristics on physically based snow simulations within a global sensitivity analysis

framework. *Hydrology and Earth System Sciences* **19**, 3153–3179 (2015).