Review of the Article hess-2017-573

Satellite products of incoming solar and longwave radiations used for snowpack modelling in mountainous terrain

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This paper compares different products for estimating incoming solar and longwave radiations to be used for snowpack modelling in mountainous terrain using the CROCUS snow model, at the scale of an entire mountain range.

General comments:

The accuracy of incoming solar radiation is one of the key source of errors for snowpack modelling. This is particularly true in in mountainous terrain, because complex topography. For this reason, the topic of the paper is relevant. However, this paper seems to be a very technical review of existing products and it adds very little novelty to the science on this topic. I expected indications that are more concrete on how to improve existing products or propose new, better products. Even if the paper is quite boring to read, the analysis is accurate and the discussion is quite interesting. The results part is instead very boring with many technical details, which are not interesting for the general reader. I suggest making this part much more compact, eventually leaving details on the comparison for a supplementary material section. I have some methodological observations on how complex topography has been taken in account in processing the radiation data and on the role of uncertainties in precipitation data (see specific comments).
Nevertheless, I would recommend publication after a careful revision, since the paper could provide useful guidelines on how to interpret remote sensing radiation observations in Alpine regions.

Specific comments:

1. Introduction

The major source of uncertainty in snow models is likely to be the correct estimation of precipitation and of the rain/snow limit. Then, especially during the melting season, radiation and snow surface radiative properties, and this is the focus of the paper. However, precipitation remains the first uncertainty reason (*Günther et al, 2019; Engel et al., 2017*).

2. Methods

In all the compared products, are precipitation and other meteorological variables the same, besides radiation? Otherwise, the comparison could be biased by other sources of errors.

3. Evaluation of radiation products

Line 255. You justify the fact that the effect of slope and aspect were not taken in account because the evaluation were made over flat terrain. However being in the mountains, sky view factor should be taken

in account. The sky view factor reduces the amount of diffuse shortwave radiation and can affect the longwave radiation balance (i.e. Corripio, 2003; Rigon et al. 2006, eq.5). Was this effect taken in account while evaluating with ground observations?

3. Impact of products on snowpack simulations

Line 363. Please clarify immediately the meaning of A-Cro, AL-Cro, AS-Cro.

Line 366. A-Cro overestimates the snow depth … this can be due different reasons. This should be already clearly stated here. (I´ve seen that later in the discussion this point is addressed).

5. Discussion

Line 477. Which are the reasons of A-Cro overestimation? Why you state that there is not overestimation of snow accumulation? What about precipitation or snow/rain limits? **Figure 8** seems to suggest that the model´s overestimation is mainly due to an overestimation of the snow precipitation in the accumulation season (or to wind erosion in the snow observations …). In **Figures 8 and 10** it seems also that there are already during the accumulation season differences in the modelled scenarios. Do have all scenarios the same solid precipitation input? Are the differences only caused by the different radiation input?

Line 482. Underestimation of the turbulent fluxes can be related to a variety of reasons: surface roughness length, atmospheric stability parametrization, air humidity, temperature and wind biases. Is it possible to discriminate among the different reasons?

Line 484. This is a key point for snow modelling. See also the recent work of Günther et al, 2019.

References

Corripio, J.: Vectorial algebra algorithms for calculating terrain parameters from DEMs and solar radiation modelling in mountainous terrain, Int. J. Geogr. Inf. Sci., 17, 1–24, 2003.

Engel, M., Notarnicola, C., Endrizzi, S., Bertoldi, G., 2017. Snow model sensitivity analysis to understand spatial and temporal snow dynamics in a high-elevation catchment. Hydrol. Process. 31, 4151–4168. https://doi.org/10.1002/hyp.11314

Günther, D., Marke, T., Essery, R., & Strasser, U. (2019). Uncertainties in snowpack simulations—Assessing the impact of model structure, parameter choice, and forcing data error on point-scale energy balance snow model performance. Water Resources Research, 55, 2779–2800. https://doi.org/10.1029/2018WR023403

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