Review of "Satellite products of incoming solar and longwave radiations used for snowpack modelling in mountainous terrain," by Queno, Karbou, Vionnet, and Dombrowski-Etchevers.

Summary: This paper examines radiation data from satellite and model products for their potential use in snowpack modelling. Following the approach of Hinkelman et al., 2015, the general accuracy of the longwave and shortwave irradiances from a forecast model (AROME), a reanalysis product (SAFRAN), and satellite-related data sets (DSSF and DSLF from the LSA SAF) is first assessed through comparisons to measurements at in situ stations in the French Alps and Pyrenees. After this assessment, the various irradiance data sets are used as inputs to a snowpack model (CROCUS) and the accuracy of the respective model runs is evaluated. Based on these analyses, the authors conclude that the most accurate shortwave irradiance values are those in the satellite-related irradiance product while the longwave irradiance products all perform similarly in comparisons to measurements. The snow depth was overestimated in all of the CROCUS runs, with the worst overestimation occurring when the satellite-related data was used as input.

In general, although this study closely follows the lines of Hinkelman et al., 2015, it is useful to show results from different conditions, i.e., different satellite products, different location, different snowpack model, to confirm the results of that study. In addition, detailed evaluation of a number of different irradiance data sets against ground-based measurements and discussion of analyses in terms of altitude are new and useful. I find no major issues with the manuscript and recommend publication after the following comments are addressed. A marked copy of the manuscript with suggested English corrections has been returned to the authors.

Comments:

Lines 141-151. What type of method is used to calculate the shortwave fluxes from the satellite data? I would at least like to know whether it's an explicit radiative transfer calculation, a parameterisation, or something else.

Lines 153-161. Calling the DSLF a satellite product seems a stretch, considering that the underlying algorithm is the Prata parameterisation and the only satellite input is cloud fraction.

Lines 150-151 and 160-161. Can you say whether these targets have been met?

Line 175. What is the source of the -6.5 Kkm^{-1} temperature gradient used in computing DSLFnew?

Lines 192-195. The quoted 5-8% accuracy of the Meteo-France pyranometers is probably based on laboratory measurements, not field tests. It would be easier to estimate the actual performance of the Meteo-France instruments if the maintenance regimen was described. It seems unlikely that the uncertainty of these measurements would be the same as those made using better instruments with regular maintenance at Col de Porte.

Line 225. Why were the impact of slope and aspect on the solar irradiance not taken into account in the modeling? Using horizontal irradiances in the comparisons makes sense because all of the data sets provide values in this form, but surely this would have a large impact on the model results. (Incidentally, "supposed to be" suggests that they should meet these conditions, but not that they necessarily do.)

Line 253 says that topographic shading was included in the comparisons to measured irradiance despite the previous statement that slope and aspect could be ignored when running CROCUS. This seems to be a contradiction. Was the shading correction applied to all of the data sets? Was there, in fact, topographic shading at these locations? The method used to make this correction could affect the comparison results.

Lines 267-268. It might be useful to list standard deviations along with biases and RMSEs to allow explicit distinction of the contribution of bias and random error to the RMSE, as was done by Geiger et al., 2008b, Trigo et al., 20ll, and Hinkelman et al., 2015, among others.

Lines 295-296. Based on the shape of the bias plots, it appears that DSSF is out of phase with the measurements. Perhaps you should check the meaning of the time stamps in the satellite data. Misinterpretation could cause the data to be shifted in time relative to the measurements.

Line 318. How can a West-East mountain chain provide a barrier to westerly winds, to create differences on the north and south sides?

Lines 403-404. Please define AL_{SW}-Cro and AL_{LW}-Cro.

Lines 464-490. The discussion of possible errors in the Crocus model is appreciated.

Lines 491-493. How would using an ensemble of simulations eliminate systematic biases? Do you mean an ensemble of simulations from a number of different models or just one?

Lines 500-501. I don't understand why the greater importance of LW irradiance relative to SW would be "specific to high latitudes." Solar irradiance is also low during the winter in the midlatitudes, so the LW should be of greater importance, at least during the accumulation season. It seems odd that the study by Lapo et al. (2015) is cited in lines 512-514 but then discounted. Although that paper discusses the importance of albedo to the effect of SW irradiance, it also assumes that the changes in the LW and SW energy inputs are similar. Looking at Figure 11, I would not say that the SW is more important than the LW because the albedo is lower in the spring (lines 513-514). Rather, there is a very large SW bias in DSSF (-56 W/m2) and no bias in the DSLFnew LW, such that the total bias is -56 W/m2 relative to AROME. This contrasts with the situation in SAFRAN in which the LW bias offsets that in the SW, yielding a total bias of -18 W/m2.

Lines 553-554. The study did not show that "there is a clear benefit of using LSA SAF satellite products of incoming radiation for snow cover modelling in mountains." To the contrary, the model performed worse when the LSA SFA products were used. Consider changing this to say that, until snowpack models are improved, the LSA SFA products could be used to improve understanding of the models as well as in other snowpack related studies because they provide irradiance data of reasonable quality in mountainous areas (without measurement stations).

Note:

The word "radiation" can be considered either to refer to a process, and hence derived from a verb form (like "differentiation" or "automation"), or a noncountable noun (like "granite" or "wheat.") As such, it is generally not pluralized. Note that it is also not measureable. Like water, only its characteristics can be measured. The relevant SI quantity is irradiance, measured in units of W/m^2. It would thus be better in most cases to stick with "irradiance" or the historically used term "(radiative) flux" unless it is being discussed in general (e.g., "Radiation is important to many land surface processes.")

The word "score" usually refers to a tally of points and is thus usually a unitless integer. It isn't really appropriate to refer to RMSEs or means as "scores." As used in this paper, a better word would be "statistics," or possibly "metrics."