

## ***Interactive comment on “Regional scale evaluation of a MSG solar radiation product for evapotranspiration modeling” by J. Cristóbal and M. C. Anderson***

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RC: 1) The authors may change the title to e.g.: Validation of a MSG solar radiation dataset over northeastern Spain. Remove all introduction, discussions and references to ET modeling, this will shorten the article very much. Make it a pure validation paper. OR 2) The authors may leave the title. This would however mean that the paper has to be re-written, focusing on the sensitivity of modeled ET to satellite-derived  $R_s$  uncertainty. Please then remove e.g. figures 4 and 5 and one of the tables, to be replaced by figures and tables showing the sensitivity of ET to  $R_s$ . Perform sensitivity

C4839

experiments by using a few (or a single) ET schemes at the observation sites where you have performed the  $R_s$  validation. I assume that the complete Meteorological data at the Catalonian met stations is available (SW and LW radiation fluxes, air temperature, air humidity, wind speed, air pressure. If LW radiation fluxes are missing, ERA Interim-based LW fluxes will provide a high quality replacement). The sensitivity of ET to  $R_s$  possibly cannot be oversimplified to a single % value as it comes out in the current section 6.4. The sensitivity might be very different depending on whether the vegetation is water limited, light limited or temperature limited, depending on season and vegetation type. So the outcome of the study could be a very interesting matrix of  $R_s$  requirements w/r to ET modeling. One axis of the matrix could be climate (mediterranean, temperate, mountainous), and the other could be surface type (bare soil, grass, tall tree, crops). Once the sensitivity matrix is available, the authors should check what kind of ET uncertainty is generated with the uncertainty of LSA SAF DSSF for each of the climate/surface classes in the matrix. This will in turn allow the authors to see if that uncertainty exceeds the maximum ET uncertainty currently required for ET datasets. Unfortunately there is no GCOS ECV with associated accuracy requirement for ET, but you may be able to consult for instance the GEWEX land flux project to find out what the target accuracy of ET is and whether that target accuracy is met with the uncertainty coming from DSSF  $R_s$  uncertainty.

Also: Several Evapotranspiration schemes as part of Land Surface Models include basic assumptions on canopy radiative transfer. They make use of both direct and diffuse component of solar irradiance. If components are not available, oversimplified assumptions have to be made these schemes to split global radiation into its components. Would it be possible to include a paragraph in the discussion (Section 6.4?) on why you have not analyzed the accuracy of radiation components or how the satellite based estimation of radiation components could help to constrain ET schemes? I think that they are available for LSA SAF (and for CM SAF or OSI SAF) datasets.

AC: We do agree with the referee that this is a validation paper so we are going to

C4840

follow the option 1, and we have reoriented the paper in this way, considering that option 2 is out of the scope of this paper. However, since we are interested in the validation of solar radiation as well as its usefulness as input data in other models, especially those relevant to hydrology using radiation-based methodologies, we would like to maintain section 6.4 but modified according to referee's comments. We also know that this section is purely based on other references but we have not found this type of discussion in other papers, so we think that could be of further interest for the reader. Nevertheless, we also know that option 2 should be followed to verify what the actual role is in evapotranspiration modelling and we have clearly stated this in the paper. These will be good questions to address in a follow on paper. We also agree that accurate partitioning of solar radiation between direct and diffuse beam components is important for both water use and carbon flux modelling. Unfortunately, in Catalonia, we do not have the complete instrumentation spread all around the country to perform this analysis, but data coming from FLUXNET could be used.

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Detailed comments:

RC: p. 8906, l.13/14 and l.16/17: why are hourly accuracies given in  $W m^{-2}$  and daily, monthly accuracies given in  $MJ m^{-2}$ . One unit corresponds to a flux and the other to energy content per surface area. For  $MJ m^{-2}$  it is needed to indicate the integration time in the text in order to make it consistent with  $W m^{-2}$ . I think that the  $MJ m^{-2}$  are per day, but I would like to suggest to have all statistics in the same units in order to allow better comparability between the different aggregation steps. How about choosing  $W m^{-2}$  everywhere, which is the most common unit for the solar irradiance (flux)?

AC: You are right. We have chosen  $W m^{-2}$  to help the reader more easily compare the results at different timescales.

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C4841

RC: p. 8907, l. 3: I would say over the last 50 years (or say, over the last decades). You may also cite:

R. E. Dickinson. Modeling evapotranspiration for three-dimensional global climate models. In J. E. Hansen and T. Takehashi, editors, *Climate Processes and Climate Sensitivity*, pages 58-72. American Geophysical Union, Washington, 1984.

S. Manabe. Climate and the ocean circulation. 1 the atmospheric circulation and the hydrology of the earth's surface. *Monthly Weather Review*, 97(11):739-774, November 1969.

J. L. Monteith. Evaporation and environment. the state and movement of water in living organisms. Symposium of the Society of Experimental Biology. Cambridge University Press., 19:205-234, 1965.

AC: This has modified in the text adding "over the last several decades" and references have been included in.

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RC: p.8909, l. 21: I cannot find the LSA SAF 2010 reference in the reference list. You may at least give a web site for the LSA SAF algorithm, or a technical report (ATBD) of LSA SAF as a reference. LSA SAF 2010 also appears further down in the text.

AC: The reference has been added in the text as well as a web site.

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RC: p.8911, l. 9: of the DSSF product

AC: This has been modified in the text

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RC: p.8911, l. 22-27, cont. on next page: I would suggest that the sentences on the HDF5 format, the IDL and SQL routine and the MiraMon file format are omitted since it

C4842

is not of importance for the reader which format and software you used. It is however important to keep the information on how many days you downloaded and that not all 48 slots were present at each day, and that you used the original projection of the LSA SAF data.

AC: This has been modified in the text

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RC: p. 8915, l. 16/17: ... , future research needs to address the representativeness ... You may also cite this paper here, since work has been performed on this topic already: A. Zelenka, R. Perez, R. Seals, and D. Renne. Effective accuracy of satellite-derived hourly irradiances. *Theor Appl Climatol*, 62(3-4):199-207, Jan 1999.

AC: This paper was already included as a reference in the same section "Hourly evaluation" p. 8917, l. 15. addressing the same issue.

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RC: p. 8917, l. 7: Duerr et al. (2010) have validated a MSG solar irradiance dataset over 10 Alpine sites which include snow and ice conditions. You may cite this paper here: B. Durr, A. Zelenka, R. Mueller, and R. Philipona. Verification of cm-saf and meteoswiss satellite based retrievals of surface shortwave irradiance over the alpine region. *International Journal of Remote Sensing*, 31(15):4179-4198, 2010. doi: 10.1080/01431160903199163.

AC: We have cited this paper in the text and rewritten this paragraph.

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RC: p. 8918, l. 5 and caption of Fig. 3: dusk to dawn: you want to say from dawn to dusk. Or you might referring to the great movie "from dusk till dawn", which plays at night. However, night is not plotted in Fig. 3. ;-)

AC: This has been changed. Since I'm currently living in Alaska, I prefer the movie "30

C4843

days of night", and in this case it is easy to estimate solar radiation in winter as long as there is no difference between dawn and dusk :-).

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RC: p. 8918, l. 16: it is clear that in terrain, the local-area shadowing of a measurement site cannot be reproduced by a 3x3 km pixel, however, is LSA SAF DSSF not even using a DEM to calculate pixel-average shadowing?

AC: According to LSA SAF DSSF product documentation, there is no DEM to calculate pixel-average shadowing.

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RC: p. 8921, l. 20: R\_s instead of Rs

AC: This has been modified in the text.

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Interactive comment on *Hydrol. Earth Syst. Sci. Discuss.*, 9, 8905, 2012.