Interactive comment on “Evapotranspiration modelling at large scale using near-real time MSG SEVIRI derived data” by N. Ghilain et al.

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The authors thank Bob Su (HESS Editor) for his comments.

The reply is structured in the same order than the given comments. The editor comments are first reported and are followed by the authors’ reply.

Two reviewers have provided very useful comments to your manuscript. While the general issues noted by both reviewers appear similar and both are positive about the manuscript, they have also pointed out some specific critical issues. The energy balance closure needs special attention, with specific references to the use of the eddy covariance (EC) data for comparison. Referee 1 “On page 7089 (15) you state correctly
that the energy balance closure can lead to 20% uncertainty in your E estimation.”
should read as “On page 7089 (15) you state correctly that the energy balance closure
can lead to 20% uncertainty in your E estimation.” but needs an error analysis as a
quantification. You are invited to provide a point by point response to both reviews.

Response: We have addressed every point raised by the two referees, and we have
taken into account most of their suggestions in the new version of the manuscript. We
will reply hereafter to both specific questions (or suggestions) you posted.

1. “You need to analyze the relationship between the EC fetch area and the footprint of
the satellite product. A critical question that needs to be answered is - are those spatial
scales comparable to each other?”

Response: The footprint issue is indeed of great concern while performing compar-
isons between model estimates and data derived from observation at measurement
sites. EC fetch is estimated to be included between 100 m and 1.5 km, depending on
the CarboEurope site and the actual instability condition of the atmosphere. A typical
pixel size for MET over Europe would be around 4x3 km2. Nevertheless, in-situ mea-
surements are generally considered as the best reference for model validation. Data
availability is a critical issue and we have to rely on the measurements available with
sufficient quality. FLUXNET has now developed the wider network able to measure
in-situ evapotranspiration, and it is a great opportunity to use it to validate land surface
models and remote sensing based ET models. Taken into account this opportunity, EC
data have already been used for the validation of coarse resolution models in indepen-
dent studies (e.g. Sun et al., 2010; Miralles et al., 2010; Stisen et al., 2008). Aware
of the footprint issue, an accompanying internal “validation file” is also created in the
operational model implementation, for every generated ET image. In this file, variables
calculated at tile level are stored for a selected set of flux sites and are used for val-
idation purposes. When the energy balance for all tiles in pixel has been estimated,
the pixel value is calculated as a weighted contribution of every tile in pixel. The scale
impact is therefore reduced by performing the comparisons only with vegetation types
that best corresponds to real vegetation type at the station. Of course, there are still differences due to the scale and the exercise has still its limitations (as pointed out in p.7091 §1). That is one of the reasons of introducing the “Product Requirement on Data Quality” in our statistical analysis.


2. “What is the difference or consistency between the LST from LandSAF and Tsk? What is the implication if they are different?”

Response: Although the use of remote sensing derived LST is not in the scope of the proposed contribution, we will try to answer it by providing some results we have obtained and their possible implications.

Consistence between LSA-SAF LST and Tskin computed by MET algorithm at selected locations has been investigated.

The computed Tsk is neither radiative nor aerodynamic temperature, but a mixture of both definitions. Physical interpretation of LST, derived by split-window technique, is neither straightforward. While LST and Tskin correspond to slightly different concepts and therefore should not be equal, we expect a coherent evolution between both. For example, comparisons of time series are shown for 3 MSG pixels encompassing 3 locations in Europe: Carpentras (44°N 5°E), Evora (38.5°N 8°W) and Melle (51°N 3.8°E) in Fig.1. On each figure, RMS is shown, as well as the size of the LST and
Tskin samples.

Globally, the two variables are relatively well comparable (RMS between 2.5 K and 3.5 K) for the considered period, keeping in mind that error associated to LST is of the order of 2K and that uncertainty of input variables has an impact on Tsk. In Evora, LST bias has been evaluated to $3.0 \pm 1.5$ K during the day (Kabsch et al., 2008). However, since LST and MET algorithms use different land cover maps and vegetation parameters, it is obvious that differences are expected. For the station of Melle (Belgium), radiative temperature is computed from the long-wave upward radiation measured at the station. Most of time, LSA-SAF LST and Tsk agree very well with the in-situ data. For some days, LST presents a different diurnal evolution. These differences could be due to a different characterization of surface, cloud contamination or viewing angle effect.

Other results are included in the MET validation report (see http://landsaf.meteo.pt/). This is an on-going research and overall results presentation will be the subject of a separated paper.


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Fig. 1. Comparison of LSA-SAF LST (green triangles) and Tsk (red circles) for Carpentras, Evora and Melle (5 to 14 April 2007). Observations from Melle (black crosses), RMS and sample size (#).