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Interactive comment on "Derived Optimal Linear Combination Evapotranspiration (DOLCE): a global gridded synthesis ET estimate" *by* Sanaa Hobeichi et al.

Anonymous Referee #2

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Six existing gridded ET products are combined using a weighting approach trained by 159 Fluxnet sites. The method is based on the ensemble weighting and rescaling technique suggested by Bishop and Abramowitz (2013). The technique provides an optimal linear combination of ensemble members by using flux tower observational dataset. I have questions about why do you choose to produce DOLCE at 0.5 deg. resolution? Not 0.25 deg or 0.05 deg (the possibilities provided by MOD16, GLEAM ET), even as high as 1km (the possibility will discussed later in my report). I need a strong rebuttal from the authors here. In addition, before producing DOLCE, are the weighting ETs resampled to 0.5 degree? Or how did you combine ET at different resolution into 0.5 degree DOLCE? My understanding is that ET product at either 0.5,

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or 1 deg., most of the flux site grid is in-homogeneity, thinking about the land surface covers can varies a lot in 50km*50km resolution. The more higher resolution of ET, the more higher chance could the site measurement represent information for a gird. Please check the reference: (Anderson et al., 2012).

DOLCE in this work does not make an extension for spatial resolution, or temporal resolution, even time coverage (10 years, 2000-2009). It is not encouraged for publication, which is similar to already published by Mueller et al. 2015. However, the method used to merge ET products is very useful. But the way of using it at 0.5 deg is not an optimal one.

I would say whether the site is reported homogeneous in the evaluations is related to the scale. To asses site homogeneity by ET producer is not fare for the operation of these flux sites. I understand site PIs would seek to ensure the site represent one typical land surface. All the flux tower can be taken as homogeneous sites when the evaluated ET is at 10 meter resolution. Move to 0.5 deg grid, all the flux is located in an in-homogeneous grid. Thus you cannot say 'homogeneous sites', but 'homogeneous site grid'. Or most likely homogeneous due to good matching between 0.5 deg grid and flux site. This also intrigue my interests, if you use the method to combine and calibrate existing ET to be a ET at 1km or higher resolution, which makes all available flux sites homogenous at this scale and can be used to calibrate weighting ET, more land covers can also be used not only DOLCE Tier 1, 2 and 3, say as IGBP 18 land covers. Why don't you use IGBP land covers to replace tier 1, 2 and 3 to derive weight for the 18 land covers? More classification or tiers can also help you produce DOLCE at higher resolution. You may say weighting ET cannot provide information at lower resolution. But the weighting ET can be calibrated with flux site at higher spatial resolution. Each weighting ET can be resampled and calibrated to e.g. 1km resolution. Then you can further combine them into a DOLCE high resolution ET. This work will make the DOLCE more useful. The current 0.5 deg. ET does not differentiate from other fused/merged ET at coarse resolution, e.g. Landflux.

In addition, I also think about if your collection of flux tower data is not enough, which may lead to an biased weight for DOLCE calculation. One reviewer also pointed out the limitation of flux tower for the tropical region. Especially, the flux tower play an important role in your method. You mentioned that 'irrigated sites' was excluded. What's the purpose of doing this? is it believed that all the weighting ET product cannot estimate ET for irrigated crops? If yes, this means DOLCE can also has a big errors for irrigated regions or human influenced regions. Then this need pointed out or at lease add discussion about shortage of this dataset. If no, I would be interested to look at the performance of weighting ET products and DOLCE at irrigated flux sites, since irrigated crops may also influence global water balance. We cannot blind to this issues when producing a global ET. Can't we? I agree if you remove irrigated sites or HT sites, this will makes your ET or paper looks better, but in reality it also expose the shortage of the method and products.

More specific comments list below.

There are a lot of errors in the Table 1. This has been pointed out by Carlos Jimenez. In addition, I also found some ET not included. This is also a 0.05 deg. monthly ET. You may find here: http://en.tpedatabase.cn/portal/MetaDataInfo.jsp?MetaDataId=249454

Table3. Weighting ET products have negative or positive mean bias, if you give 0.5 weight to MPIBGC (3.837 mean bias) and GLEAM-v2B (-3.571) respectively, then DOLCE tier 1 will have a mean bias of 0.266 W/mˆ2. I also calculate mean bias with the weight and mean bias in table 3 for tier 1, then I get a mean bias of 0.9021 (0.041*3.756+0.495*3.837+(-0.026*6.180+. . ..=0.9021), why do you think the weight provided in table 3 is better than my suggested weight of the two ETs?

Page 11 line28-30, please see my comments above

Page 5, at what time resolution did you do the energy balance correction in the two equations or methods? Monthly or half-hourly? I would not expect 'no qualitative differences' between bowen and residual term correction at half-hourly flux data. Secondly,

most of the flux sites have no ground heat flux but soil heat flux at 5cm. What's your consideration of G used in the correction.

Fig.4 LFD or LDF*,LFA or LFA*?

Figure 7, there is no values for the Sahel desert. This is due to non-values from DOLCE or LandFlux? Then I found DOLCE has ET estimate for Sahel desert in Fig. 8. Please explain it.

Fig. 8. How did you say reliability of uncertainty is low? DOLCE has uncertainty with monthly temporal resolution, am I right? I have difficulty understanding 'seasonal variability of global mean ET and its associated uncertainty'. It's better say 'spatial distribution of a) global ET and (b) its associated uncertainty (standard deviation)in Winter and Summer,'.

Line 10. 'Together with the reasonable density .. are reasonably well constrained.' need rephrase.

Page 1, Line 16, 'point-based estimates of flux towers provide information at the grid scale of these products.', are you sure point flux tower can provide information at 50*50 km pixel? Please check my comments above.

Page 1, Line 21, These ET products differ in their data requirements, the approaches used to derive them and their estimates (Wang and Dickinson, 2012). This is well known. No need citation here.

Line 24, we provide an even stronger vindication of this relationship. Which part show this? Please give some explanation.

Please use either 'Time-space step' or 'Space-time step';

Acknowledgements Where did you use ERA-inerim by saying 'The ERA-Interim reanalysis data are provided by ECMWF and processed by LSCE'.

References: Annan,. . ...n/a-n/a

Fisher, JB has been listed two times.

Miralles, D.G, also listed two times.

Please check the standard format for references used on HESS website

Table s1, please also add RMSE, correlation and mean bias values for each site. These information is also important for DOLCE dataset users.

Reference: Anderson, M.C., Allen, R.G., Morse, A. and Kustas, W.P., 2012. Use of Landsat thermal imagery in monitoring evapotranspiration and managing water resources. Remote Sensing of Environment, 122: 50-65.

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