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Interactive comment on "High resolution global grids of revised Priestley-Taylor and Hargreaves-Samani coefficients for assessing ASCE-standardized reference crop evapotranspiration and solar radiation" *by* Vassilis G. Aschonitis et al.

Anonymous Referee #2

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Revision of High resolution global grids of revised Priestley-Taylor and Hargreaves-Samani coefficients for assessing ASCE-standardized reference crop evapotranspiration and solar radiation.

This study analyses the global relationship between ETo annual maps obtained by means of three different methods (ASCE PM, P-T and H-S), with the purpose of determining the accuracy of the methods based on poor data availability (P-T and H-S). In addition, the manuscript includes a calibration exercise to obtain revised coefficients

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Discussion paper

at the global scale for P-T and H-S equations based on the obtained ASCE PM data. The research topic is highly relevant given the relevance of estimating the atmospheric evaporative demand (AED) with accuracy since AED is an important hydroclimatic variable with strong implications in aridity conditions and climate change processes. The manuscript is in general well written, the figures show high quality and it has a good structure. The authors use a high amount of data for analysis and validation, including gridded datasets and meteorological networks in California and Australia.

The manuscript is a bit long and sometimes it is different to follow but independently of formal issues I find major methodological problems in the manuscript, which are related to the treatment of the data used, the spatial resolution of the gridded products and the assessment of the uncertainty in the ETo estimations. I am including some detailed issues below about these issues. I would recommend the authors to work at coarser spatial resolution to reduce the strong uncertainty associated to the selected high resolution (1 km) of final products.

Page 4: I find highly problematic to interpolate the low resolution 0.5° data for wind speed, humidity and solar radiation to 1 km. The results of the bilinear interpolation of the 0.5° data does not really increase the necessary spatial resolution of these variables to be compared with the high resolution of tmax and tmin data (in any case high resolution temperature data from the global dataset used is also affected by spatial errors and uncertainties, which should be also taken into account). The 1 km interpolated wind speed, humidity and solar radiation has a spatial resolution completely unreal. These variables are essential to be taken into account to estimate ETo spatial patterns since ETo is usually more sensitive to these variables than to temperature (McVicar et al., 2012a and b). For this reason, I consider that 1 km gridded maps generated in this study show high uncertainty, which is not quantified/provided in this study.

The authors are computing Eto by PM equation as reference to be compared with H-S and P-T methods, but there is not any assessment of the error in the PM estimations

related to the data inaccuracies and the poor resolution of the input climate data. I think these problems would be solved (not completely since an assessment of uncertainty should be taken into account) if authors consider to focus at coarse (0.5°) spatial resolution, which avoids unnecessary interpolation of wind speed, radiation and humidity variables and the outputs would be useful for continental to global assessments. Thus, the results of figures 8-10 confirms that interpolation of low resolution variables have strong influence on the comparability of different ETo estimations, which can be associated to the poor interpolation approach applied to the coarse climate variables.

I have also doubts on the use of the coefficients calculated in this study to calculate ETo using H-S and P-T equations. The authors obtain the calibration coefficients for the period 1950-2000 and assume stationary climate conditions. Nevertheless, under climate scenarios in which input climate variables change (I refer to wind speed, relative humidity and incoming solar radiation) under a non-stationary scenario, the obtained coefficients would not be useful to calculate ETo based on scarce climate data. Different studies have showed recent changes in solar radiation (Wild et al., 2013), wind speed (McVicar et al., 2012b) and atmospheric humidity (Willet et al. 2014).

Given that the main objective of this study is the re-calibration of the H-S and P-T equations, it would be necessary that authors provide not only the recalibrated coefficients but also a measure of the accuracy considering the errors in the interpolated variables used in P-M calculations.

Page 8. Really I do not find useful the annual coefficients in areas that show strong climate seasonality (as in the majority of world regions). In addition, there are not seasonal accuracy statistics, which can be much more relevant than annual ones.

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