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Hydrology and Earth System Sciences
Discussions

Interactive comment on "The WACMOS-ET project – Part 1: Tower-scale evaluation of four remote sensing-based evapotranspiration algorithms" *by* D. Michel et al.

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Thank you, Paul Dirmeyer, for your kind review. The positive comments are highly appreciated. Find below my response to your comments.

P10747 L11: "EC" has not been defined yet.

Introducing EC in the introduction: " This is followed by an evaluation of ET model performance at the tower scale using the tower eddy-covariance (EC) fluxes as the

reference data set."

Consequently, "(EC)" on page 10754.L21 is deleted.

Fig 2: There are only 22 dots apparent in the figure, not 24.

Stations close to each other are not visible individually - smaller and different (empty) symbols are now used. Additionally, coordinates of DE-Meh corrected, also in Table 2 (were erroneously the same as for DE-Kli).

Fig 3: Please explain why the grey areas are not identical between the two panels. Also, why are the stations in a different order? It confounds visual comparison of the two panels. Please put the land use types and stations in the same order.

For the different forcing types the respective forcing Rn was used (also for the tower data) to calculate the evaporative fraction with focus on the ET simulation performance compared to a common reference. This is, however, counter-intuitive, as stated by Prof. Wang. The figure should focus on the evaporative fraction as produced by the model (and the tower). Hence, Fig. 3 has been changed accordingly (using tower Rn for tower EF and forcing Rn for modeled EF). This affects only the bottom panel. The same is applied in Fig. 7. These changes mainly effect the order of biomes, not the model agreement to the reference nor the inter-model agreement. Hence, the statements in the text still hold in all cases. The figures (mainly Fig. 3) are more easily understood with these changes.

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Table 3: Please put all RMSDs in the same units to facilitate comparison.

RMSD are now given in mm/h for 3-hourly runs as well as daily runs. This is now consistent with all units used in the plots.

Conclusions: Best results are found in wet climates, where evapotranspiration is controlled by energy availability, not water availability. Is this behind the difference in model fidelity between these two regions? There is an opportunity here to inform model development (cf. the conclusions from PLUMBER in Best et al. 2015; doi: 10.1175/JHM-D-14-0158.1).

Thanks for this comment. Indeed, the results highlight the importance of focusing on how to incorporate water availability in ET models. In this regard, the models differ in their parameterizations. The fact that the regions, where water availability is of importance, seem to present more inter-model differences, could be an indication of model deficiencies. In short, PM-Mu and PT-JPL use a soil moisture constraint based on the complementary hypothesis (land–atmosphere interactions are defined from air vapor pressure deficit and relative humidity). GLEAM works in the way of a small hydrological model, updating the soil state by ingesting precipitation and soil moisture observations, and in principle is the more detailed in terms of parameterizing water availability. SEBS is different, as it relies on surface temperature and how the changes in the soil thermal inertia associated to soil moisture variations are reflected in changes in the surface temperature and its difference with the air temperature above the surface.

The importance of working on model deficiencies in the way how water availability is handled, is expressed by adding the following sentence in the conclusions:

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The ET models generally perform best in wet biomes and tend to overestimate in dry biomes, where ET is constrained by water availability. Focusing on water stress in the model development within the community would thus provide the opportunity to obtain more robust simulations of surface fluxes for global scale employment.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 10739, 2015.