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Hydrology and Earth System Sciences
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Discussions

Interactive comment on "Benchmark products for land evapotranspiration: LandFlux-EVAL multi-dataset synthesis" *by* B. Mueller et al.

B. Mueller et al.

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Reply to Referee Comment No.1

Thank you very much for your comments on this paper. Hereafter, we include your comments in italic font and our reply in normal font.

General comments *General The authors have compiled an impressive collection of ET estimates to put forth a benchmarking product. Overall, the analysis contains thoughtful commentary and may be of value to several categories of users within the scientific community. It is this last point that the authors need to consider more carefully in their presentation. Given the array of uncertainties in each product, mostly driven by forcing issues, but also perhaps related to divergent land cover classification, it is not imme-*

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diately clear how a potential user of these data would select among the different data sources, or towards a blended merger of multiple products. Given the broad scope and promise of this work, I feel that it is of value and worth publication. However, there are several major issues within the manuscript that need to be resolved/expanded upon prior to publication.

Answer:
Thank you for the positive feedback. By providing several different merged synthesis products, i.e. 1) from all dataset categories, 2) diagnostic datasets only, 3) LSMs only and 4) reanalyses only, we assume that we address the different requirements by potential users. We think that for example a LSM-developer would most probably use the synthesis product based on diagnostic datasets only to perform comparison to a specific LSM (although the comparison to the LSMs-only dataset could be of interest for this user if he/she is interested in a comparison with other LSM products). However, we leave this decision to the user and tried to provide enough information about the different products in our manuscript to allow the user to make this decision. We also hope that the series of data products will be useful for a wide range of users and we will provide support in case that any questions arise.

Major Beyond the controls of model forcing, the other dominant mechanism behind ET will be land-cover (i.e. vegetation). Two major limitations of the present analysis must be clarified addressed in this regard. First the issue of land-cover agreement between products/models needs to be addressed, since this alone could be responsible for differences among products, e.g. if one product is assigned forest over a pixel where another product is assigned grassland. The second issue is spatial aggregation, which is related to the first issue. How are land-cover classes aggregated? Was interpolation linear, and how were land-cover discrepancies handled? These issues may provide additional insights into inter-product discrepancies (e.g. differences in albedo, roughness must affect latent heating).

A:

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The reviewer is certainly right in pointing this issue. The issue of land-cover disagreement in the different ET products is implicitly included in the provided uncertainty information of the merged synthesis products. But unfortunately the sheer number of considered datasets prevents us from performing the suggested analysis. However, we now note this issue in the manuscript.

Data constraints: the authors constrained ET by net radiation. Is this a physically reconcilable approach? Can the authors cite another study employing this method, or would a Bowen ratio approach be more suitable?

A:
The advantage of constraining ET with net radiation as opposed to Bowen ratio is the better availability of data over the considered period. SRB radiation data are based on measurements from a spectroradiometer, i.e. they rely mostly on satellite data, and are widely used in the climate research community.

PG9, L8: Why can ground heat flux not be neglected for ET values less than 0.3 mm/day?

A:
Ground heat flux (GHF) can be as high as 10 W/m2 (roughly 0.3 mm/d) in most of the global land masses (see Bennett et al. 2008). Therefore, at such small values of ET, GHF can play a substantial role in the radiation budget.

Clearly there is a very large coefficient of variation among ET estimates with respect to precipitation (Figure 5). In addition there are frequent conflicting trends (Table 3,4) among products. Given such large disagreements in the data, how can a potential user of such a dataset be confident in their hydrological-consistency? Should the ensemble mean, median be used? Should certain products be thrown out? A much broader discussion of these points is needed in order to provide the context of this benchmarking effort for the scientific community.

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A:
Since variables of the water cycle such as precipitation are afflicted with quite large uncertainties, precipitation has not been used as a constraint to exclude certain datasets. The first constraint that we applied is statistical (excluding outliers). The second constrain is based on the energy budget (radiation). Both constraints do not throw out certain products, but individual values of certain products at certain pixels since we assume that no product is consistently better or worse than another. We provide both mean and median of the synthesis product. Median has a physical meaning and is not sensitive to outliers. If extreme values are more interesting, it is recommended to use the mean. We add some information about the different statistics and products (based on LSMs, diagnostics etc.) and their use to the discussion section in order to address this concern.

Introduction: Page 5, line 1-2: The authors describe a precipitation trend 1900-1988 as important, but then only offer unsubstantiated explanations, such as intensification of the hydrologic cycle. This issue is certainly linked to changes in ET, which the authors use to reconcile potential trends. A simulated ET product is certainly a product of it's forcing, such that the issue of changes in radiative forcing due to solar cycling seems relevant in this context and should be included by the authors.

A:
The link between ET and precipitation has been added to the section mentioned here (page 5). It illustrates the importance of changes in precipitation to ET. A discussion on changes in radiative forcing is also added to the introduction section. A complete validation of different radiation datasets, however, is beyond the scope of this study and has been done elsewhere (Troy and Wood 2009, Vinukollu et al. 2011, Jimenez et al. 2011).

References

Bennett, B., Wang, J. and Bras, R., 2008: Estimation of Global Ground Heat Flux. J.

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Hydrometeor, 9, 744-759.

Troy, T., and Wood, E.F., 2009: Comparison and evaluation of gridded radiation products across northern Eurasia. Environ. Res. Lett. 4, 045008.

Vinukollu, R., Wood, E.F., Ferguson, C.R. and Fisher, J.B., 2011: Global estimates of evapotranspiration for climate studies using multi-sensor remote sensing data: Evaluation of three process-based approaches. Rem. Sens. Environ. 115, 3.

Jimenez, C. and Coauthors, 2011: Global inter-comparison of 12 land surface heat flux estimates. J. Geophys. Res.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 769, 2013.