

## ***Interactive comment on “GLEAM v3: satellite-based land evaporation and root-zone soil moisture” by Brecht Martens et al.***

### **Anonymous Referee #1**

Received and published: 30 November 2016

### **OVERVIEW**

The manuscript describes the new version of the GLEAM dataset (v3) that includes land evaporation and root-zone soil moisture. The novelties in the retrieval algorithm and in the input datasets are firstly outlined. Secondly, three different datasets are generated by using different inputs and their quality is assessed through a comparison with in situ observations worldwide. Moreover, a cross-comparison with respect to the previous version of GLEAM (v2) is carried out.

### **GENERAL COMMENTS**

The manuscript is well written and clear. The new release of the dataset is surely of interest for many research applications both in the hydrology and climate disciplines.

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Moreover, the new release explicitly contains the root-zone soil moisture dataset that represent an additional benefit. The new release incorporates significant changes with respect to the previous version. Therefore, I believe the paper and the dataset deserve to be published on Geoscientific Model Development. Before the publication, I recognized some points that, in my opinion, need improvement and clarification.

1) MAJOR: In several Tables and Figures, the comparison between the three versions of v3 dataset, and against v2 dataset, is shown. In terms of soil moisture, it is highlighted that v3 performs better than v2 and that v03a is performing the best. However, I am wondering if the differences in the correlations between datasets are statistically significant. For instance, I believe that the differences reported in Table 3 for the overlap period between the three v3 datasets are not significant (median values between 0.61 and 0.65 for surface soil moisture). Therefore, I wouldn't stress too much that the new dataset is performing the best in terms of soil moisture, as the differences in the performance are quite small.

2) MODERATE: It is underlined several times that v03b and v03c are “fully satellite-based” datasets. It is not correct. The satellite rainfall product used as input is the gauge-corrected version of TMPA. As it is well-known, in TMPA 3B42v7 dataset ground observations are used for correcting the monthly totals month-by-month. They are not used for correcting the long-term bias, as it reads at lines 1-2, page 12). Therefore, in the gauge-corrected product the contribution of ground observations is significant (note that it could happen that the seasonal cycle is inverted between the real-time and the gauge-corrected version). I suggest removing the definition of these datasets as “fully satellite-based”.

3) MODERATE: It would be interesting to show a version “d” of the v3 dataset in which SMOS observations are assimilated in the product using MSWEP as rainfall input. It would allow to disentangle the impact of rainfall forcing and the assimilated soil moisture product on the final quality of GLEAM datasets.

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In the specific comments, I added some corrections and suggestions that should be implemented.

On this basis, I believe the paper deserves to be published only after a moderate revision.

**SPECIFIC COMMENTS (P: page, L: line or lines)**

P5, L2: I missed how snowmelt is computed. Can the authors add some details?

P6, L10: The paper by Lievens et al. (2016) is under review. As it is mentioned in the paper several times, and the readers do not have access to it, I believe some additional details should be included in this paper.

P6, L17-18: This sentence is also repeated below, I suggest removing.

P8, L12: I believe it should be specified that for  $w > w_c$   $S=1$  and for  $w < w_r$   $S=0$ . Also for equation (5).

P10, L15-22: It is the third time in the paper that the three versions of  $v_3$  are described. Please try to avoid repetitions.

P11, L23-24: Why for a thicker model layer the representativeness of soil moisture measurements is lower? It should be explained.

P11, L32: Likely, it should be stressed also in the abstract that the quality assessment of root-zone soil moisture products is mostly carried out in CONUS region.

P12, L8-9: Strictly speaking, also the first model layer (10 cm) is thicker than the sensing depth of SMOS and ESA CCI soil moisture products. It should be acknowledged.

P13, L17: Figure 6 is not described in the text. Remove or add more details.

P13, L34: The possibility to correct for irrigation that is not modelled in GLEAM is highly interesting. However, it is not shown in the paper and, hence, the sentence should be

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smoothed.

Figure 3: Specify explicitly which plot refers to tall and short vegetation.

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