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I find the manuscript very well written and full of useful information both for using GLEAM algorithm and the generated datasets. This document is of high importance to document recent advances in the generation of datasets of water cycle components for climate studies.

We would like to thank Dr. Ghilain for his interest in the manuscript and for posting some interesting comments and questions.

As this paper aims at clearly and fully describing the new algorithm and validation, I have a couple of questions regarding its implementation.

- GLEAM v3 uses MOD44B product for partitioning the land cover classes. Which version and how is it used (updated regularly throughout the time period of the dataset or fixed at one specific date or else?) In the conclusion (on p16, l.31-33), there is mention of an update. Does it mean the land cover fraction is different from a previous GLEAM dataset?

As discussed in the paper at P10_L5-8, the land cover fractions used in GLEAM are static. The product used here is the fine resolution (250 m) MOD44B v51 (the version will be added to Table 2 in the revised version of the paper). The product was upscaled to the required 0.25 degree resolution of GLEAM. While this product is available on a yearly basis, the data providers suggests to “exercise caution when considering performing inter-annual comparisons¹”. This suggest that part of the inter-annual variability observed in the land cover maps cannot be physically explained, and that the uncertainties in the temporal dynamics preclude from using the product other than as a static dataset (i.e. average of the individual yearly products). As listed at P10_L5-8, a similar coarse-scale product (0.25 degrees, provided directly by the MODIS team) was used in the previous versions of GLEAM. However, in this v3 we have chosen to upscale the higher native resolution dataset ourselves, by means of averaging the 250 m grid-cells contained in each 0.25 degree pixel.

- Air temperature is used to force GLEAM v3. While details are given about forcing v3a (ECMWF ERA-Interim, 3h spacing), I do not find the complete information regarding the forcing of v3b and v3c. Could you indicate the source providing the dataset, and its temporal frequency?

We would like to point out that the details of the air temperature forcing are listed in the paper at P9_L3-5 and Tables 1 and 2. For the v3.0b and c datasets, air temperatures derived from measurements of the Atmospheric Infrared Sounder (AIRS) were processed (the AIRS L3RetStdv6.0 product is used here). These datasets are available on a daily resolution.

¹https://lpdaac.usgs.gov/products/modis_products_table/mod44b

- Thank you for providing the link to the dedicated website. I found also a visualizing tool on the H2Observe project portal (<https://wci.earth2observe.eu/>), it may also be mentioned.

We agree with the reviewer on the value of the visualization tool from Earth2Observe. However, since we are only responsible for the management of the records hosted at www.gleam.eu, we can only guaranty the availability of the latest product versions via this platform.

- For the validation, if I am not mistaken, the choice of correcting here the observed fluxes using the Bowen ratio (p10, l29) differs from the strategy of validation presented in Michel et al, 2016, for evaluating WACMOS-ET datasets. Is there a reason for that?

We would like to thank Dr. Ghilain for this comment. Because a lot of *in situ* datasets have no corrected measurements (due to missing variables necessary for the correction), the direct measurements were used in the end to validate the GLEAM datasets. This will be updated in the revised version of the manuscript. Note that in Michel *et al.* (2016), the datasets were validated against both the direct measurements and the energy balance residual. However, due to the lack of towers with measurements of all components of the surface energy balance, the latter approach was not considered here.

- Extreme outliers are screened, what is the mask applied For gaps in data, what is the strategy if less than 25.

Outliers are (subjectively) defined as measurements falling outside the following window, calculated for each time series separately: $[q_{25}-1.5(q_{75}-q_{25}); q_{75}+1.5(q_{75}-q_{25})]$, where q_{75} and q_{25} are the 75% and 25% quantiles of the dataset, respectively. Gaps in the remaining time series are not filled. This information will be added to the manuscript.