

## ***Interactive comment on “Land Surface Model Representation of the Mutual Information Context between Multi-Layer Soil Moisture and Evapotranspiration” by Jianxiu Qiu et al.***

**Jianxiu Qiu et al.**

qiujianxiu@mail.sysu.edu.cn

Received and published: 15 October 2019

We would like to thank Dr. Diego G. Miralles for his constructive comments. We are generally in agreement with his sentiments. Most importantly, we agree that our original manuscript was overly aggressive in lumping various evapotranspiration (ET) estimation approaches into a single conceptual category. As Diego points out, there are important differences between these approaches that are relevant for the stated purposes of our paper.

Nevertheless, we would like to stress that all approaches considered in our paper contain (at their core) a parameterized relationship between soil moisture (SM) and evap-

C1

otranspiration (ET). While the implications of mis-parameterization this relationship are arguably more severe for a land surface model, we'd argue that the issue remain relevant for any approach (such as GLEAM) that utilizes a water balance (and/or data assimilation system) approach to estimate SM and, in turn, uses SM to constrain ET. Regardless of the complexity that a given approaches employs, failing to accurately describe the relationship between ET and (large number of potential) environmental constraints should eventually degrade the robustness of the model. We'd argue that this is true regardless of whether a model is employed as a retrospective, diagnostic or predictive manner. Our paper is an attempt to "open the lid" on these models to measure internal SM/ET coupling and explore the impact of potential mis-coupling on ET estimation.

Given this emphasis, Diego's suggestion to expand our analysis to include direct flux validation is an excellent one. Indeed, preliminary results suggest that, despite its simplicity, GLEAM does not underperform more complex land surface models with respect to daily ET predictions. Therefore, as Diego points out, any criticism of GLEAM must be tempered by this bottom-line result.

Therefore, if given the opportunity, we'd make the following changes to our current manuscript:

1. Change the characterization of GLEAM from a "land surface model" to "retrieval algorithm" in the revised manuscript and rather a more complete discussion of differences in complexity and envisioned application for various modelling approaches. However, regardless of how we characterize GLEAM, stress that it remains valuable to understand if its ET predictions respond to environmental factors (like soil moisture) accurately.
2. Look directly at the ET accuracy issue and better describe the connection between accurate coupling and the absolute accuracy of GLEAM ET predictions.

