Hydrol. Earth Syst. Sci. Discuss., 8, C139–C142, 2011
www.hydrol-earth-syst-sci-discuss.net/8/C139/2011/


Hydrology and Earth System Sciences Discussions

# *Interactive comment on* "An application of GLEAM to estimating global evaporation" *by* D. G. Miralles et al.

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Received and published: 18 February 2011

General comments

The paper presents global estimates of evaporation produced by a specific modelling framework. The methodology integrates well known formulations (e.g., the Prisley-Taylor equation) with new ideas about how to exploit available satellite, and it has been presented in a separate paper. Here the authors concentrate in discussing specific aspects related to the evaporation processes at the global scale, such as the partitioning of precipitation, or how the different drivers control the evaporation, based on the produced estimates. Although the final goal seems to be to derive a long time series of evaporation estimates using the existing satellite products, only estimates for the period 2003-2007 are presented and discussed in the paper.



In my opinion, the paper is clearly of interest for HESS readers and will certainly be an important contribution to the present efforts in characterizing global evaporation from satellite observations. Compared with some other published satellite based estimates, an important effort has been made in presenting and discussing the different evaporation components, which should be acknowledged. Nevertheless, GLEAM is a modelling framework, so the results obtained will depend on the choices made for the driving datasets and the model formulations, as pointed out by the authors at different occasions in the paper. Therefore the importance of obtaining an idea about the uncertainty in the estimates, and comparing the obtained results and derived conclusions with reported estimated from other methodologies, as pointed out also by other reviewers.

The paper already presents a significant amount of work, but it would undoubtedly benefit from addressing some of the issues raised by the previous reviewers, in particular the need to somehow evaluate the model uncertainty and further discussing some of the obtained results/insights in the context of other reported studies. The authors have already indicated their plans to address those issues, so I will not comment any further on those topics.

A few specific suggestions and comments are given below.

Specific comments

Abstract

Being the main objective of the paper the application of the methodology, the abstract may benefit by making the model description shorter and expanding the summary of the results presented.

P2.L25. Judging by the reference give, I guess the reviewer meant land surface models, instead of GCMs. A very appropriate reference to add for the same modelling exercise, specifically focusing in evaporation, is Schlosser, 2010. Regarding GCMs, a

good reference is also the compilation of IPCC AR4 GCM estimates in Lim and Rhoderick, 2009.

P5.L14. It may be a matter of personal preference, but I would rather call this types of exercises as an evaluation (rather than validation). As pointed out by the authors in the section, all estimates involved (P, E, runoff) are subject to uncertainty, and I would argue that it is difficult to say that one estimate is validating the other.

P6.L14. By methodology, it is meant GLEAM or the P-E? It is not clear to me whether the change of P to obtain P-E also involves the change of P going into the E model.

P6. L20. The scatter may also be placed in perspective by comparison with other P-E versus Q figures published (e.g. Vinukollu et al, 2011).

P6. L28. Simpler to say P-E volumes (instead of volumes in the vertical axes)?

P7.L13. I was wondering whether the fact that satellite soil moisture is assimilated into the model may capture the fact that the land is irrigated, with a possible impact into the evaporation estimates.

P7. L19. Could MBE be defined? If an error, it may be better to use the term difference.

P10. L5. When discussing Figure 5, it would have been useful to also have the P and net radiation maps (though at the price of reducing the level of detail in a necessarily smaller E maps).

P11. L10. I was wondering if the Table 2 estimates have been compared with something else. For instance, as the paper claims the importance of the satellite estimates to benchmark GCMs, I compared Table 2 P-E with the IPCC AR4 GCM multi-model P-E in Lim and Rhoderick, 2009. Even taking into account that the time periods are different (IPCC 1970-1990, GLEAM 2003-2007), for some continents the differences are very large (e.g., for South America GLEAM reports 742 mm, while ISCCP reports nearly half, with closer attention showing that in this case the E agrees well, with the P-E difference coming from the P differences), for others there are not (e.g., for North



America IPCC and GLEAM P and E are relatively closer).

P13.L15. I noticed in Figures 6c and 6d that over the South West Sahara there seems to be a sharp gradient (sort of a straight line separating blues and reds in Figure 6c, light and stronger reds in 6d). I was wondering where that may be coming from, an artifact (or a real feature, e.g., related to aerosol presence) in the radiation data that may shift the balance between prec/radiation control of E in that area?

P14.L15. Not specifically picking on the authors, but here there is a claim indicating that the constituent parts of GLEAM have been successfully validated by comparison with different in situ data. This claim has also been made in other publications reporting estimates by other methodologies/drivers. Nevertheless, the authors are actively participating in a comparison of his product with other global E estimates in the framework of the GEWEX initiative LandFlux and are fully aware that, at the global scale, sometimes and in some regions the differences are relatively large. I was wondering if the authors would like to comment on that.

References

Lim, W., and M. Roderick (2009), An Atlas of the Global Water Cycle Based on the IPCC AR4 Climate Models, ANU E Press, Canberra, ACT, Australia.

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Vinukollu, R., et al. (2011), Global estimates of evapotranspiration for climate studies using multi-sensor remote sensing data: Evaluation of three process-based approaches, RSE, 115, 801–823.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 1, 2011.