Hydrol. Earth Syst. Sci. Discuss., 8, C12–C14, 2011
www.hydrol-earth-syst-sci-discuss.net/8/C12/2011/

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: 19 January 2011

I enjoyed reading the paper by Miralles et al, which tries to estimate evaporation at the global scale. The paper is one of the few papers which attempt to separate interception, transpiration, bare soil evaporation and snow sublimation at the global scale. To calculate the evaporative fluxes, the authors assume that the land surface can be divided into three surface types: land covered by tall canopies, land covered by short vegetation, and bare soil. Per surface type they apply GLEAM, which consists of 4 modules, and calculate the evaporative fluxes by means of a weighted average per pixel. One of the modules calculates interception by the Gash model. From Miralles et al 2010a, I understand that the authors use a single value for the storage capacity, Sc, which is the mean of 21 studies world wide. Miralles et al 2010a finds an average

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value of 1.2mm, which they use in the Gash model for the entire globe. In my opinion this is a major assumption, but acceptable for the objective of the study. Personally, I would suggest a spatially distributed Sc based on e.g. LAI (e.g. Van Dijk et al 2001). Nonetheless, my main concern is not about the spatial distribution of Sc, but about the low value for Sc. The mean value of 1.2mm is based on studies where only canopy interception is considered. While in forests you often have more interception processes, then only interception by the canopy. For example the forest floor also intercepts a significant amount of throughfall (see Gerrits et al 2010 and Table 1.2 in Gerrits, 2010), and what about interception by understory vegetation, and epiphytes (e.g. Pypker et al 2006)? If these interception processes are also included the total storage capacity will be much higher. Although officially you can not simply add the storage capacities of the different components due to the cascading effect and the difference time scales, I think the paper will benefit if at least a higher value of Sc is taken to also consider other interception processes.

Furthermore, I have some questions about the validity of Section 3 “Validation of the volumes of water available for runoff”. If I understand correctly, the authors analyze two rain products by comparing Q (observed) with P-E (model) to say something about the used rain product. This is incorrect, since the model results are the sum of input errors and model errors and you cannot distinguish the two. A good rain product with a bad model can result in a bad fit. Assuming that the model is perfect is in my view not a valid assumption. But maybe I do not understand the methodology correctly since the authors state that GLEAM is not a tuned or calibrated model (p6, line 20), which I also not understand. As an example, GLEAM incorporates the Gash model, which has calibration parameters. These parameters have a large impact on the results, because interception is a threshold process. Hence, I think it is better to validate the rain product by comparing the two rain products with ground observations.

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8, C12–C14, 2011

To conclude, I think the paper by Miralles et al is a highly valuable paper for global evaporation studies, but would mainly benefit from incorporating other interception processes like interception by the forest floor and short vegetation.

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