

Interactive comment on “A general framework for understanding the response of the water cycle to global warming over land and ocean” by M. L. Roderick et al.

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I enjoyed reading the paper: some time ago eminent physicist S. Chandrasekhar published a voluminous book titled "Principia Mathematica for the Common Reader", which was still over my head (in spite of written in English as opposed to Newton's Latin).

This paper could be termed "climate change for the common hydrologist": just like some eminent climatologists are wont to do (e.g., Ramanathan), it aims to capture the bare essentials so the common hydrologist reader can get to the bare essentials.

I want to add a few more comments and suggestions that the authors can make this

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even better.

(1) I felt that the authors went too far in simplifying to the point some parts of the text seem rather cryptic. In view of the potential educational value of this paper, it may be more useful to make this a bit more clear. I give an example: the sentence "... the atmospheric humidity is projected to increase at the Clausius-Clayperon (CC) value of around 7%/K". A similar statement is made later about P, which was clear, but I was confused by the CC reference here.

(2) I can follow the arguments on the authors' interpretation and clarification of the results of Held and Soden. However I am unclear about the take-home message from this. Is the message meant for climate scientists or for hydrologists? As a hydrologist, I don't know what to make of this for my work - may be the authors can clarify.

(3) I will say something similar about the authors' findings about Budyko. It is clearly reassuring that climate models "on average" satisfy the Budyko theory of annual water balance partitioning. Is this the take home message? I agree that this is important: some 20 years ago during the PILPS experiment (inter-comparison of land surface parameterizations) that climate models did not satisfy Budyko, which was a major concern. In spite of the good result, I remain curious - how did this happen? Unlike the comments of one of the reviewers, this is not just a matter of balancing water and energy: it is about co-evolution of climate, soils, vegetation etc. Any insights by the authors would be very valuable.

(4) One more query on the Budyko: again, what is the take home message? Is it that climate models are now able to satisfy Budyko "on average"? Of course they should, if they are to be used with confidence? I am wondering if there is a deeper message here.

(5) Compared to these interpretations (above), to me the more interesting conclusion of climate models is for a global increase of P by around 1-3 %/K. Isn't this the essence of the "response of the water cycle to global warming" (from the title of the paper). I

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was expecting that the paper would also address this point, as this would be of a lot of value to hydrologists. I looked for discussion of this and did not find it (or did I miss it). I felt that the second part of the paper skirted this issue, but I could not make the connection. May be the authors can clarify.

(6) In conclusion, it may be good if the paper can be organized so that clear take-home messages that hydrologists can use. These are already there probably, and only need to be brought out more clearly.

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