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Geoscientific Model Development Discussions

Interactive comment on "A Hydrological Cycle Model for the Globally Resolved Energy Balance Model (GREB) v1.0" *by* Christian Stassen et al.

Anonymous Referee #2

Received and published: 19 July 2018

Title: A Hydrological Cycle Model for the Globally Resolved Energy Balance Model (GREB) v1.0 Authors: Christian Stassen et al. Recommendation: major revision

Summary

The authors present a new version of the Globally Resolved Energy Balance (GREB) model, which adds parameterizations for the three elements of the global hydrological cycle: precipitation, evaporation, and moisture transport. This new version of GREB is more successful in reproducing the behavior of the hydrological cycle in observations and in CMIP5 models, as the authors illustrate with case studies that include interannual variability and greenhouse gas forcing.

The model development and its performance are well presented and sufficiently doc-

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Discussion paper

umented with figures. I believe, however, that the authors need to explain better how this model can be used. While I realize that this is a technical paper describing the model, I think there needs to be some justification as to why we need this model in the first place.

Major comments

1) It is nice that the new version of GREB is more successful in reproducing certain aspects of the hydrological cycle. On the other hand, given that the new version has more fitting parameters, is this really surprising? Using more parameters gives you a better fit but also carries the risk of overfitting. In particular, the model might be too constrained by present day climate to be useful for climate change projection because basic features of the present climate, such as the width of the Hadley circulation or the position of the ITCZ, may change.

2) Another way the model could be used is for understanding the climate change response of more complex models. For this purpose, it would seem that GREB's mixture of basic principles (e.g. energy balance), ad-hoc parameterization (e.g. standard deviation of omega), and fitting to observations (e.g. mean omega) does not lend itself to interpretation any more than model output itself.

3) section 3.3 What causes f to be 2.5 rather than 1.0? Could there be an error in the calculation? Is this mismatch horizontally uniform?

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