

## ***Interactive comment on “Analyzing the impact of groundwater flow and storage changes on Budyko relationships across the continental US” by Laura E. Condon and Reed M. Maxwell***

**Anonymous Referee #4**

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The authors have used a physically based hydrological model to improve water-budgeting at catchment scale. In particular, they have considered the original Budyko model as a reference and shown that by accounting for ground water inflow/outflow, water budgeting can be done more accurately. I really appreciate the authors' effort to undertake such an extensive numerical analysis. The article looks suitable for publication although I think a couple of key concerns the authors need to address.

### 1. Purpose of the study

The authors need to elaborate on the usefulness of their study. The physically based hydrological model they are using has many parameters; they cannot take that model to a random ungauged catchment and predict its hydrological variables. On the other

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hand, the Budyko model is a universal deterministic model which can be applied to any ungauged catchment. It is thus not surprising that the multi-parameter model will perform better after calibration. I don't think their study is very informative unless they integrate a deterministic physically based hydrological model with the Budyko model to improve prediction.

### 2. Clarity of presentation.

It is quite hard to follow what the authors are saying at many places. In my opinion, the presentation needs to be simple. If the authors' objective is to show how the physically based hydrological model is doing a better job at water budgeting, they need to focus on that part more. There is not a single figure showing a direct comparison between prediction by the physically based hydrological model and that by the Budyko model... Terms need to be defined prior to their usage. For example, in Line 27 the authors are talking about Budyko curve parameters. The authors are actually talking about Fu model's parameters (Budyko model does not have any parameter).

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