Interactive comment on "Technical Note: Analytical Inversion of the Parametric Budyko Equations" *by* Nathan G. F. Reaver et al.

Anonymous Referee #2

Received and published: 21 December 2020

This manuscript is an attempt to investigate the mechanistic understanding of the catchment-specific parameter in parametric Budyko equations. It is an interesting topic in the hydrological studies. However, I have some major concerns on this manuscript. I did not see how this manuscript has made a further step towards explaining the long-term water balance at the catchment scale. By obtaining the mathematical inversion of the catchment-specific parameter from Budyko equations is not helpful in understanding the possible hydrological processes that remain hidden when the non-parametric or parametric Budyko representation is chosen. As mentioned in this paper, what climatic and physiographic features and how they control the long-term water balance are important for explaining the Budyko curve. To achieve this goal, one approach is to express the parameter of parsimonious Budyko equation (e.g., n or ω) in terms of

biophysical features in a way that could be applied to different catchments; the other approach is to explicitly represent the features in the model.

In addition, this paper treats n or ω as a function of long-term P, E0, and E, and E actually is treated as a function of P, E0. Does it mean that the value of n or ω is only dependent on the long-term climate? It seems conflict with the existing studies that found the short-term climate variations and catchment features (those could not be explained by the long-term climate) also have impacts on the long-term water balance.