Review of “*HESS Opinions: Beyond the Long-term Water Balance: Evolving Budyko’s Legacy for the Anthropocene towards a Global Synthesis of Land-surface Fluxes under Natural and Human-altered Watersheds*” by *Sankarasubramanian et al.*

The article written by Sankarasubramanian et al., considers the Budyko-framework and the authors explain the framework in a demand-supply setting. They give several examples relating to infiltration, reservoir operations, environmental flows and sensible and latent heat fluxes. The authors argue that formulating especially anthropogenic influences in a demand-supply framework will help explain land-surface responses.

I think the article is very interesting. I fully understand the point of the authors, and I like the idea to use simple demand-supply approaches to understand complex system responses. The article is also well written, and I only have several relatively minor comments.

The proposed method strongly depends on what is defined as demand, and what is defined as supply. For example, in the Budyko-framework one could define the supply in terms of precipitation (i.e. normalize by the precipitation), but also by the potential evaporation. Placing the data in different projections of supply and demand will probably lead to different interpretations, and I wondered if the authors have any suggestions on how to do this systematically.

In addition to this, the authors argue that putting variables in a demand-supply framework will help to understand also spatial-temporal variability. However, the definitions of supply and demand will change depending on the time scale or the spatial scale. For example, the Budyko-framework can be applied on longterm-data for large catchments as the storage term in the water balance and small scale spatial variations (i.e. extractions, leaky catchments) become negligible, but as timescales change, the definitions of demand and supply will probably change too.

I wonder if the example in Figure 2 is appropriate. The Budyko-framework generally works best for larger basins, whereas here a 0.25 degree resolution is used. More small scale variation might come in, which is often not particularly well-handled in land surface models. For lower values of Ep/P the data also seems to plot always rather far below the analytical curve. I know the authors just want to show an example here, but the spread of the data could also just be explained by model deficiencies in this case. It may better to use observed data, for example the Camels-dataset might be of use for the authors.

The last example seems a bit off in my view. Generally, “actual” is a realization (or a percentage) of the “demand”, varying between 0 and 100%. In this example this is not the case, sensible heat is not a percentage of the latent heat. I think, and the authors mention it themselves on page 12, lines 254-257, putting the framework in terms LE as “actual”, Rn as “supply” and potential evaporation as “demand”, makes more sense and is more in line with the other examples.

Related to this, and actually also my first points, I think it might help to elaborate in the general description of the approach (Budyko Framework Adaptation in Watershed Modelling, p5, line 95) on how to define supply and demand in a consistent way. I my view, the “actual” realization should always be a certain percentage of the “demand”, but I’d like to know what the authors propose here.

My last point is merely just a suggestion from my side, but the title does not seem to fully capture the content. At first, I expected (another) extension of the analytical equations in the Budyko framework with a new term accounting for the anthropogenic impact, similar to how some of the cited studies included soil moisture or seasonality in the analytical equations. However, the authors make their argument a lot more general, which I really like, by simply using a demand-supply formulation for complex problems, and from which the Budyko-framework is actually just an example. I think it is important to add at least the supply-demand terms in the title.

Concluding, it is an interesting article that made me really think about how to use supply-demand formulations in hydrology. I hope my comments are useful for the authors and look forward to a new version of the manuscript.

Minor comments

P3.L47. Darwinian approach → The Darwinian approach?
P6.L129-130. Suggestion: see the review paper of Wang et al. (2016)
P6.L131-132. Suggestion: this cloud of long term water balance data
P6.L133. Please note, it's not only energy and soil moisture, the vegetation and thus the transpiration will be affected too.
P9.Eq2. Is the third condition correct? Shouldn't it be when Smin > Aw – D ?
P10.L207. Not sure if this is true, especially when hedging is applied, when there is storage, more water can theoretically be released than the demand. I would also expect that points would fluctuate around the line, due to delays in a target-feedback-loop, i.e. the actual hedging factor will never be reached exactly and always be slightly bigger or smaller compared to the operational rule. This is different compared to Budyko, where the limits are really physical limits, and not operation based limits.
P11.L235-236. Increased allocation human use → increased allocation for human use
P13.L275-276. For long-term water balance –> for the long-term water balance
Figure 5. I suggest to use a colorscale for the yearly points, so see if there is a temporal trend.
Figure 6. This figure looks like a matlab-screenshot, I would suggest to format the plot a bit nicer.