

Interactive comment on “A vital link: water and vegetation in the Anthropocene” by D. Gerten

Anonymous Referee #3

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The manuscript, titled “A vital link: water and vegetation in the Anthropocene”, is a very interesting research topic. The author conducted a good literature review on the interactions among water, vegetation, human land use, and climate change, and outlined future challenges for better quantifying the interactions among above subjects. Overall, this review study is of high quality and significance. The manuscript was well written though some clarifications are needed. The content of the manuscript is suitable and qualified for publication in “Hydrology and Earth Systems Sciences” after some minor revisions. My biggest concern is that the use of some phrases or words in the manuscript is too vague or general. Additional and specific information related to these phrases should be provided for clarity and readability. I list my specific comments as follows:

Lines 3 on page 4440: “to some global trends”. I think one or two specific examples of

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global trends should be given for enhancing readability.

Line 16 in on page 4440: The author described “climate change regionally increases irrigation demand and decreases freshwater availability”. To my knowledge, climate change also includes precipitation change. Will increase in regional precipitation also decrease freshwater availability? Be more specific about climate change. Climate or global warming?

Line 29 on page 4441: The definition of “planetary opportunities” should be given here for clarity and readability even the author cited deFries et al. [2012].

Second paragraph on page 4442: Actually, the study focused on four topics instead of just three. The topic “effects of climate change and CO2 change on irrigation” should also be introduced in this paragraph.

Line 3 on page 4443: Is it better to change freshwater to water? I understand that freshwater is the main topic in this manuscript and used for irrigation and human consumption.

Second paragraph on page 4443: The author described the decoupling of soil moisture and NPP water limitation in high latitudes, which is important and useful information for readers. What are the general relationships between soil moisture and NPP water limitation in temperate and tropical regions? I would like the author to briefly summarize these relationships because they are also important information for readers.

Line 5 on page 4445: “than” or “as”?

Line 16 on page 4445: Through specific on-farm management practices. Some examples should be given here for readability.

Line 19 on page 4446: The definition of “planetary boundaries” should be given here even though the source was cited.

Line 27 on page 4446: Again, the use of term “climate change” is too vague and

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general. I understand this is global-scale review study. However, I would like the author to introduce some specific information about climate change at the global scale? For example, how did global temperature and precipitation generally change in the future in Rost et al. [2009]?

Paragraph 2 on page 4447: Yes, it seems that the effects of CO₂ on river discharge and runoff are controversial among scientists. Are there any published data that were based on lab/field experiments suggesting that elevation in CO₂ concentration tends to increase subsurface runoff or soil moisture content?

Line 1 on page 4448: According to the content described in this section, the subtitle “Role of vegetation changes in the global water balance” had better be changed to “Role of land cover and land use changes in the global water balance”.

Lines 8-10 on page 4448: Without human land use, the current global river discharge is estimated to decrease. Thanks, the author explained why river discharge tends to decrease if current land use was converted to natural forest covers. Personally, I still doubt this kind of conclusion though lots of similar studies made it too. I do not have evidences to oppose this conclusion. What I am confusing is that it sounds like better for us to remove all trees if our human beings only need freshwater. In some mountainous watershed, the removal of trees can cause water in small creeks to disappear. The author does not have to answer my comment here.

Line 17 on page 4448: Any citation for “two third”?

Line 12 on page 4450: Could “some of the global trends” be more specific?

Fig. 1 on page 4460: What lines (solid or dashed) represent present or future soil moisture and NPP water limitation, respectively? Can one to two sentences be added here to describe the physical meaning of two indices, respectively? For example, does the low value of soil moisture index generally mean a dryer soil?

Fig. 2 on page 4461: “analogous to the index in”, is “in” an index? It is not clear about

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what specific index is here and calculated in LPJmL?

Fig 3 on page 4462: Again, what are the general future global trends in temperature and precipitation according to the 18 GCMs used to force the LPJmL model? Some brief information about future climate prospects averaged across the 18 GCMs should be provided for reader to better interpret this figure and related contents in the manuscript.

Finally, additional efforts are needed to enhance the quality of figures. For example, diverging color scheme could be much better to show the changes in irrigation demand by 2080s.

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