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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Do changes in climate or vegetation regulate evapotranspiration and streamflow trends in water-limited basins?" *by* Q. Liu et al.

Anonymous Referee #1

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General comments

The paper by Liu et al. states an interesting question in its title. The authors attempt to answer this question based on the Budyko-Choudhurry-Porpato model and apply this to the Yellow River basin. I think this is a potentially interesting experimental set-up. However, there is crucial information missing in the methods section. Namely, how α, κ, and especially Z_e are calculated. The effective rooting depth Z_e appears to be crucial in their methodology, but only some vague notions about a decreasing P resulting in a decreasing Z_e, without any formulas are given in the paper. The reader is left puzzled whether and how Z_e this in itself relates to climate or NDVI in their

methodology. Knowing this dependency, however, is crucial to assess the value of the study. A recent paper, for example, showed how Z_e mainly relates to dry spells (Gao et al., 2014) and I suspect that this paper is at odds with that conclusion. Having said this I feel that it would be good if a revised version would again be reviewed in open discussion or, at least by 1-2 new referees. Besides, I have several specific and technical comments.

Specific comments

Abstract and introduction: the study appears to be about the Yellow River Basin, but this is strangely enough not mentioned here.

11184 - L3: "In this study, it was assumed . . . " I would expect the authors first to explain what they are doing in the paper, rather than beginning with the assumptions. This assumption, by the way, has to be defended as I expect rather big land-use changes in the Yellow River Basin in the study period.

11184 - L5: "Budyko's hydrological model" I would in first instance rather call it the Budyko framework or Budyko curve, but later it appears to be the Budyko-Choudhurry-Porpato model, so why not call it that?

11184 - L15-L17: "Z_e scenarions were able . . . on water resources" It is quite logical than changing an important parameter affects the partitioning of precipitation into evaporation and runoff. For that conclusion it was not necessary to perform the study. I agree that rooting depth should be able help to regulate climate change impacts. However, in contrast to what is shown in this paper, I would expect plants to root deeper when precipitation goes down.

11185 – L3-L4: "which the Grain for Green program has shown to exist." Is there a proper reference for this claim?

11185 – L7-L11: same comments as for the abstract

11185 – L22-L25: "While numerous studies . . . to climate change" The study period of

this paper, 1961-2010, is also in the past

Section 2: The study area should be discussed separately. Baseline figures and numbers for evaporation, runoff, precipitation, potential evaporation, effective rooting depth, etc. should be given.

Section 2: A detailed tabulated overview of the two scenarios applied would help the reader.

Section 3.1: The negative trend for potential evaporation came as a surprise to me. In general, potential evaporation is expected to increase with climate change. It would be good if the authors could indicate which factor, radiation, temperature, humidity, wind speed, is mainly responsible for this unexpected negative trend.

11188 – L1: "E_p and P exhibited increasing trends" The sentence before was that they had decreasing trends. Something is wrong here.

11188 – L2-L4: The vegetation fractions ... for calculating Z_e." This should be thoroughly explained in methods!

Section 3.1: As said in the general comments, it is a complete black box how Z_e is calculated.

11189 – L13-L15: "The relative contribution ... was obtained (Fig. 6b)" Could this for clarity be written down in a formula?

11192 – L9-L11: "Z_e response to ... this water-limited region" I do not understand this sentence. I think something is wrong with its structure and to which hydrological processes is referred?

11187 - "Along with climate ... topic to date" This is a redundant repetition of the introduction.

11191: L2-L4 "In this study ... and McVicar (2012)" Details for this calculation should be given transparently elsewhere in the paper, before this discussion could make

sense.

Table 1: What is the left and what is the right part of this table?

Figure 1: in (a) I would write "Temporal trend in P" and in (b) "Temporal trend in E_p". I would also write in the caption that the Yellow River Basin is shown.

Figure 1: The information about grass and trees should be in a separate figure, which should be discussed in methods. Also, it is not very clear what exactly is done with that information. Moreover, this is a quite simple land-use classification, i.e., not even crops are included. This choice should be defended in the paper.

Figure 3: The very small differences between the static and dynamic scenario make it hard to judge whether the changes in the Z_e parameter even make sense. In the text an NSE of 0.85 for the dynamic scenario is mentioned, but what is the NSE for the static scenario?

Figure 4: It took me some time to understand this figure. After a while I think I understood that it is not about temporal changes, but about relative differences between the two scenarios. A formula would be helpful.

Figure 5: In Figs. 1 and 2 the static scenarios are shown in (a) and the dynamic in (b). In this figure the opposite is true. Moreover, the panels are very similar and relative differences as in Figure 4 would be easier to interpret.

Figure 6: If a understand correctly, the assumption is that E is 100 % explained by climate when the changes in E for the static scenario are equal to the changes in the dynamic scenario. Some more text could be spend on why some regions are 100 % explained by vegetation. Is that perhaps related to very low evaporation values?

Figure 6: Why is there not a figure for runoff as well?

Technical corrections

11184 - L22: resource -> resources

11185 – L25: was -> is

11191 L3: calculated -> calculate

Figure 3: E_a -> E

References

Gao, H., M. Hrachowitz, S.J. Schymanski, F. Fenicia, N. Sriwongsitanon and H.H.G. Savenije, "Climate controls how ecosystems size the root zone storage capacity at catchment scale", Geophysical Research Letters, DOI: 10.1002/2014GL061668, 2014.

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