Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2019-174-AC2, 2019

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Assessment of potential implications of agricultural irrigation policy on surface water scarcity in Brazil" *by* Sebastian Multsch et al.

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Received and published: 21 August 2019

Dear Referee #2,

thank you very much for your thorough review. We respond to your queries below.

Kind regards, the authors

Major points

Referee#2: Methodology: As R1 it is important to note when the Q95 values were derived. However, unlike R1, I think the derivation of Q95 for each catchment basin should incorporate the spatial variability in flow and hydrologic conditions.

Authors: Thank you. Note that Q95 data were available for all 166,842 sub-catchments and calculated on the basis of the years 2008-2016 as provided in the publicly available data by the Geonetwork of ANA (http://metadados.ana.gov.br/geonetwork/srv/pt/main.home). The text has been modified in order to clarify the basis of Q95 (page 7, lines 194-195):

Note that ANA provides the Q95 values as averages over the time period 2008 to 2016. The study year 2012 is at the centre of this average.

And on p. 4, lines 109-110: Catchment-scale data on surface water supply were obtained from the ANA Geonetwork (http://metadados.ana.gov.br/geonetwork/srv/pt/main.home).

Referee#2: The methods section needs to be reworked and clarified. Or at least included in some sort of supplementary material – as much of the details or the methodology are discussed in broad and vague terms. It is unclear how the grid scale (and what spatial resolution grid scale) relates to catchment basins related to municipality scale (where the areal ratio of crops was used to determine water consumption) when performing these analysis – as these boundaries surely overlap. Thus, the spatial components and nuances associated with these methods need to be described in more detail.

Authors: Thank you. We have added a Figure in the Appendix (Figure A1) to further clarify. We refer to this new figure on p. 5, lines 137-138.

Referee#2: Moreover, how were the individual crop-calendars used and applied? A table of which crop calendars and where they were used and how would be useful.

Authors: Thank you. Please note that the crop calendars have been supplied at Appendix Table A2. We explain the use of the data therein on p. 4, lines 107-108.

Referee#2: I also agree about R1's point conveyance and distribution losses. Although they do not have to be explicitly incorporated in the model, they do warrant considera-

tion in the discussion.

Authors: Thank you. The discussion has been expanded to include this aspect. We note that in this work blue water consumption was presented, which does not include conveyance or distribution losses. Confusion may have arisen due to the following: A factor of two was applied to adapt the water scarcity levels for this study (i.e. without conveyance and distribution losses) to those given by ANA, which are provided increased by regulated flow from reservoirs. We base this on Wriedt et al. (2008). Thus, the quantities of blue water calculated in the present paper are actually removed from the system by evaporation and transpiration. We acknowledge that evapotranspiration fluxes may return to a given system as precipitation (e.g. Berger et al., 2014). This is process is less important in our study, as we have subdivided the study area into 166,842 sub-catchments, i.e. we have subdivided the large-scale system where 'evapotranspiration recycling' may be important to consider into smaller sub-units. An explanation of this issue has been added to the discussion (p. 13, lines 380-384):

An important aspect when assessing water scarcity caused by agricultural water consumption are return flows, e.g. due to evapotranspiration recycling (Berger et al., 2014) or water losses in irrigation systems (Pereira et al., 2002; Jägermeyr et al., 2015). We neglect evapotranspiration recycling effects in the present study, since great care has been taken to subdivide the study area into sub-catchments with sizes where this effect does not play a significant role. The calculated blue water consumption represents net water requirements, which only includes evapotranspiration by crops and from soils.

Minor points

Referee#2: Define 'green water.' I'm not sure why green water is discussed at all – it is just brought up seemingly randomly throughout the manuscript. Either go into more detail re: green water, or intentionally focus the manuscript on blue water.

Authors: Thank you. We have defined green water on p. 2, line 65. Section 2.3.1 explains how blue and green water have been determined. This section explains why

we need to work out both, blue and green water. Furthermore, even though irrigation and hence blue water is the main focus of this study we do discuss green water and green water management in the discussion section 5.3. Hence contrasting these two in the paper by providing results for both, to then discuss both in the discussion section is in our view logical and sound.

Referee#2: Move Section 3, "Data" to before Section 2, "Methods"

Authors: Thank you, this reordering will help to clarify matters. We have switched order, i.e. section 3 Data is now section 2, and section 2 Methods is now section 3.

Referee#2: There are many sentences throughout the manuscript that could be improved for clarity.

Authors: Thank you, we have worked through the entire document once more and have made adjustments to improve readability and clarity.

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2019-174/hess-2019-174-AC2-supplement.pdf

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