

## ***Interactive comment on “The green, blue and grey water footprint of crops and derived crop products” by M. M. Mekonnen and A. Y. Hoekstra***

**Anonymous Referee #2**

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### **Overall quality of the discussion paper ("general comments")**

#### **Scientific Significance:**

Fair – while the spatially explicit and high resolution assessment of crop water use and productivity for a large number of crops and derived products is a significant scientific contribution within the scope of HESS, the concept and method are not entirely new – see previous work cited in the manuscript. In particular Siebert et al (2010) have developed a similar model (but Mekonnen and Hoekstra are the first to account also for water quality deterioration in the same framework)

#### **Scientific Quality:**

Good - the scientific quality of the approach and method are good and thoroughly de-

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scribed, the conclusions are well supported by the analysis and relevant, related work is well referenced and the list of references is comprehensive, the abstract summarizes the manuscript well, there is scope for some complementary analyses.

However I suggest to qualify the statement (e.g. in the abstract) that crop water footprints are estimated at 5 min “high resolution” by clearly stating that the reference ET at 10 min and precipitation at 30 min resolution was used for that.

#### **Presentation Quality:**

Excellent – the results are presented in a very clear and well structured way, there is a good balance between text and figures/tables. The manuscript reads well.

#### **Individual scientific questions/issues ("specific comments")**

I am not sure about the use of the term “water footprint” (for which the authors refer to “the guideline of the water footprint network”). Depending on the context in the manuscript, sometimes it seems to replace the term “water use” or in the case of green and blue water the term “consumptive water use”, e.g. in figures 2 and 3 and tables 5, 6, and 8.

In other places it is used synonymously for “crop water productivity” (or the invers: “virtual water content”).

On the water footprint website, the water footprint is explained as “the volume of water used”.

In more detail, the web-site says that the water footprint is: the volume of water used by... a nation... to produce the goods... consumed. According to that explanation, trade has to be included when calculating country water footprints.

The authors should provide their precise definition of water footprint in the manuscript.

Another difficulty with the term “water footprint” is mentioned by the authors in the conclusions: for performing a true water footprint analysis it would be “important to

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assess the spatio-temporal variability of blue water availability" (and if possible also green water availability). For the river basin / country blue water footprints presented in the manuscript, it would not be too difficult to express the consumptive water use relative to blue water availability.

The authors refer to regional differences. Would it be possible to perform an analysis of regional patterns of crop water productivity ("water footprints") either for individual crops or crop groups or total crops? That could also provide some indication on the impact of agricultural practices and / or climate on crop water productivities ("water footprints"), which are also mentioned by the authors.

An interesting complementary information to the total basin or country (state / province) water footprints would be per-capita footprints (which however would raise again the trade issue).

It would be good to briefly explain in the manuscript, if the product and value fractions account for by-products or residues, or if no consumptive water use is allocated to them (the reference given in the text may explain this, but it would be good to have it included in the manuscript).

Can you explain, what is included in the category "fodder"? Any grasses and hay? Are these part of your "crop water footprint"? And if so, what fraction of the total livestock grass consumption do you include in your calculation that way?

#### **"technical corrections"**

Introduction, page 765, line 14: Rosegrant and RiNgler

line 18: 85% of global BLUE water consumption

Method, page 767, lines 24-27: why was CROPWAT used for the other 20 crops, different from the 126 primary crops?

page 770, line 12 / page 772, line 4: briefly explain the terms "product fraction" and

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#### **"value fraction"**

Discussion page 780, line 25: could you explain why your calculated irrigation requirements "are generally met only partially"? I understood from page 769, line 4, that you model irrigation so that "actual irrigation is sufficient to meet the irrigation requirements".

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 763, 2011.