Hydrology and Earth System Sciences Discussions

Interactive comment on "Groundwater use for irrigation – a global inventory" *by* S. Siebert et al.

S. Siebert et al.

s.siebert@uni-bonn.de

Received and published: 2 August 2010

Many thanks to the anonymous reviewer for these very helpful comments that will help to improve our manuscript! In the following section we are giving a detailed response to any of the reviewer comments. The improved manuscript will be submitted later accounting also for the comments of other reviewers.

Response to Comment #1 Hydrol. Earth Syst. Sci. Discuss., 7, C1502–C1503, 2010

Reviewer Comment: The description of the methods was not always that easy to read, and I don't think it would allow the reader to replicate. For example, in one spot it just says a scaling procedure was used without being specific as to what it was. I wonder if section 2.2 couldn't be greatly simplified and a longer and complete description of methods added as an appendix or put on line for reference?

Response: A scaling procedure is mentioned in the manuscript only one time (page 3986, line 22) but explained afterwards in detail (page 3986, line 25 – page 3987, line 21). We agree that it might become difficult to replicate our results independently just based on the methods and data provided by the manuscript and its supplements. Therefore, to ensure a maximum of transparency, we provide in the revised version of the manuscript another supplement that is listing all variables mentioned in the manuscript (including the scaling coefficients cs1 and cs2) for all 15 038 administrative units used in this inventory. By using equations 1-3 it is then possible to re-compute our results for each single administrative unit. The remaining uncertainty is then related to the assumptions made when selecting the input data used in this inventory and when filling the data gaps. This procedure is described in detail in supplement S1 and references to the data sources are given there as well.

Reviewer Comment: In many places data is put in the text that is already in the tables. The worst offending spot is around line 350, but there are other areas that could be trimmed of repeat information if it is not used to make specific points.

Response: It is true that we list in some places in the manuscript numbers that are also contained in the tables. However, this is then made as a ranking by listing regions or countries with the largest and lowest quantities. It is therefore not just a repetition because the tables are sorted by country or region names and not by different quantities. Furthermore some of the tables are provided as a supplement and can be very large (e.g. supplement S2). Therefore we believe that it is more convenient for the readers when we report the related values in the text section directly.

Reviewer Comment: I did not find section 4.3 very satisfactory. The conclusion was that availability is a good predictor of use. As a simple example of my concern, think of how the picture would have differed 50 years ago. Availability was the same but use very different. Given that, how can you know that availability would predict use in another 10 or 50 years? Perhaps you found an accidental correlation for this moment in time? Best case scenario, the degree of correlation would be expected to change

substantially over time. Also see my final point about Shah, at least for South Asia.

Response: The inventory presented in the manuscript refers to the situation around year 2000 (page 3985, lines 22-24) and we do not say the scheme presented in section 4.3 is valid over time or can even be used to predict future groundwater withdrawals. We also make very clear that groundwater use in irrigation was changing in time in absolute terms but also in relative terms as fraction of total irrigation water use (e.g. on page 3993, lines 8-27; page 3998, lines 3-8). Of course it is true that the aquifer properties did not change much in time but in practical terms availability of groundwater also depends on the technology that is available to extract the water (e.g. drilling and pumping technology). In the revised version of the manuscript we will add a remark to make these points very clear.

Reviewer Comment: The final part of the conclusion, 680-690, doesn't say much. Its main point is to say that the new method highlights hotspots. My question I guess is whether any "new" hotspots were found or if this work just confirmed the existing consensus. My guess is the later.

Response: In the final version of the manuscript this section will be shortened.

MINOR COMMENTS Reviewer Comment: Line 105. Awkward.

Response: We will modify this sentence for the revised version of the manuscript.

Reviewer Comment: 114. I would reword a little. I don't think you can say it is the preferred approach, but rather that this is a new, alternative approach which (may) improve on previous efforts. I don't think in the end you can prove that any estimates are any better than others because of all the assumptions involved in the various models, parameters and even data. There hasn't real verification of this approach either. This may well be the best effort, but I think you have to let the readers decide based on the evidence you present.

Response: In the HESSD-paper, the related section is beginning on page 3981, line

27: "Acknowledging of the severe limitations of statistical data on groundwater use, we think that compilation of statistical data is the preferred approach." In the section before we described limitations of different approaches and we just explain here why we used a collection of subnational statistics as method. We say that according to our opinion (we think …) the compilation of statistical data should be preferred. This does not mean that other scientists can have a different opinion and may use other approaches.

Reviewer Comment: 152-what does it mean that some definitions are consistent with aquastat? I think you are using aquastat definitions, which is fine.

Response: (In the HESSD-paper, the related section is on page 3983, lines 12-13) Accepted, we will change this accordingly.

Reviewer Comment: 183-"unless proved wrong". Well, I guess all the statistics are wrong. So when do you decide it is wrong enough to use a different source?

Response: (In the HESSD-paper, the related section is on page 3984, lines 18-19) Wrong means for example that the sum of areas reported at the subnational scale differed completely from totals reported for the whole country, that areas irrigated with groundwater were larger than the total irrigated area or that a survey was undertaken only in some regions but the result reported as totals for the whole country. Sources containing this type of mistakes or inconsistencies were excluded.

Reviewer Comment: 321 The citation seems rather random since nothing else is backed up with citations.

Response: (In the HESSD-paper, the related section is on page 3990, line 5) The reference (Oosterbaan, 1999) is used for the use of drainage water in irrigation in Egypt. References to explain low consumptive fractions in Northern Europe, Eastern Europe or the Russian Federation are given further below on the same page of the HESSD-paper (Brånvall et al., 1999; Statistics Sweden, 2007; Federal State Statistics Service, 2006; Federal State Statistics Service, 2008). It is therefore incorrect that

nothing else is backed up with citations.

Reviewer Comment: 501 Tushaar Shah posits that for South Asia, use is connected with population and not so much aquifer/climate conditions.

Response: (In the HESSD-paper, the related section is on page 3996, line 28 to page 3997, line 3) We think that there maybe a misunderstanding. Irrigation is often used to intensify agricultural production. Therefore we completely agree that the density of irrigated land is in many regions related to the density of population. However, we cannot see any indication that in regions of high population density groundwater is preferred in irrigation as compared to surface water. There are many regions of high population densities in which irrigation is almost completely based on surface water resources (e.g. the Nile delta, many regions in Southeast Asia) and there are many regions in the deserts where population density is low and irrigation is completely based on groundwater. Furthermore it is obvious that groundwater cannot be used if it is not available, independently of any population density. Therefore we are convinced that the availability of the water resource is determining to a large extent whether groundwater or surface water is being used for irrigation while the total density of irrigated land is likely related to population density. We will modify this section in the final version of the manuscript to make this context clearer and to avoid a misunderstanding of our statements.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 3977, 2010.