Hydrol. Earth Syst. Sci. Discuss., 9, C6683–C6687, 2013
www.hydrol-earth-syst-sci-discuss.net/9/C6683/2013/

Hydrology and Earth System Sciences Discussions

Interactive comment on "A global water scarcity assessment under shared socio-economic pathways – Part 1: Water use" *by* N. Hanasaki et al.

Anonymous Referee #1

Received and published: 11 February 2013

General comments:

The objective of this manuscript was to estimate sectoral future water withdrawals under the recently developed shared socio-economic pathways (SSPs). Simplified models were developed to simulate future water withdrawals for the agricultural, industrial and municipal sectors. Historical and base year data from FAO built the basis of each model, i.e. the calculation of future municipal and industrial water withdrawals is based on historical trends. For the agricultural sector, the extent of area equipped for irrigation, crop intensity, and irrigation efficiency were estimated in a very simplistic way. This manuscript is a good one, a well-structured text that is clearly written. Nevertheless, some changes need to be made in order to get the manuscript published. Two

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

general remarks: first, the title says “water use” but the authors calculated only water withdrawals. The authors should make clear that water use and water withdrawal have the same meaning. Second, the authors use agricultural sector but refer only to irrigation. Here, the authors should exchange "agricultural water withdrawals" by “irrigation water withdrawals” in the text. This may help to avoid confusion. The authors may check other statistics next to FAO as for many countries (e.g. in Northern America, Europe) more measured data records are available. Historical data is also available from Shiklomanov and Rodda (2003). Unfortunately, there is no conclusion summarizing the main outcomes. I am sure the authors can do better. Some more specific comments are given in the following text:

Comments abstract:

Page 13880, line 17: The numbers for irrigated area are far too small.

Comments chapter 1:

Page 13881, lines 11-16: The authors should clearly state that the climate scenarios and shared socio-economic pathways have been independently developed. Page 13881, lines 19-23: I do not agree with these statements. What is your basis for this statement? Water use scenarios have been associated with socio-economic scenarios, e.g. MA, GEO. Page 13881, line 28: In order to assess local water scarcity, a higher spatial resolution would be required. Page 13882, line 1: The novel global water scarcity assessment is not part of this manuscript. If mentioned, please add few words about the novel. Page 13882, line 4: Calculation of water withdrawals on a daily temporal resolution only valid for irrigation. Municipal and industrial water withdrawals are simulated annually. Page 13882, lines 8-10: There are several scenario assessments available which could be used as guidelines, however, the model assumptions behind these assessments are seldom published. Page 13882, line 11, 12: please exchange “report” by “manuscript”.

Comments chapter 2:

HESSD

9, C6683–C6687, 2013

Page 13885, lines 1-2: This information is of importance, and thus needs more explanation.

Comments chapter 3:

Page 13885, line 20: when omitting livestock, please use the wording irrigation instead of agricultural water withdrawal. Page 13886, line 9: add Siebert et al. 2006 Page 13886, line 21: better "multiple cropping" instead "The planting of multiple crops. . ." Page 13887, line 19: MA scenarios reference: MA scenarios differ widely as climate, socio-economics, agriculture, energy and water were simulated by different global models. E.g. simulations for estimating future agricultural land and irrigated areas were carried-out by IMAGE and IMPACT. IMPACT provided results for irrigated areas as well as irrigation efficiencies on FPU level. This modeling framework is probably not well documented. Page 13887, lines 26-29: Same as above. Page 13888, lines 4-6: I agree, still missing! Page 13888, line 20: Voß et al. (2010) should be updated by Flörke et al. 2012 (in press) Page 13889, line 3: GDP per capita Page 13889, line 5: ". . .similar to the. . ." Needs some explanation, unclear what is meant. Page 13889, lines 13-17: well, in this sense the whole future is unclear and uncertain. Page 13889, lines 20-21: But different future conditions lead to different water use results although the modeling concept is the same for both due to the fact of different future assumptions. The problem here is the national breakdown of future projections and assumptions, not the modeling approach itself.

Comments chapter 4:

Page 13890, line 18: irrigate area increases everywhere, no decrease possible. Does the model distinguish between different crops to be irrigated? If so, what crops will be irrigated on the extended area? Page 13890, line 20: irrigation efficiency: Is there an efficiency threshold, i.e. to make sure that e becomes larger than e.g. 0.9 or 1? The latter could be possible in regions where efficiency is already high. Page 13891, line 7: efficiencies from Döll and Siebert are rather old, better to use data from e.g.

HESSD

9, C6683–C6687, 2013

Rohwer, J., Gerten, D., and Lucht, W.: Development of functional irrigation types for improved global crop modeling, PIK, Potsdam, Germany, PIK-Report 104, 2007. Page 13891, lines 8-9: Does each grid-cell belonging to a region or country get the same information? Page 13891, lines 13-14: MA goes beyond 2050, projections cover the whole 21st century. Page 13892, line 12: industrial water withdrawals may be overestimated in countries where a huge part of electricity is produced by hydropower. Page 13892, line 16: only 16 countries to validate global model. This should be judged in the uncertainties' chapter. Page 13893, line 28: downscaling industrial water withdrawals with population data has its disadvantages. Page 13894, lines 5-7: Not clear what is meant. Page 13894, line 10: 20 years time series but only 3 to 6 data points. This should be mentioned. Page 13894, lines 24-25: there are several studies available giving an opposite answer as household (domestic, municipal) water use is not only price elastic but also income elastic (Zhou and Tol 2005, Dalhuis_et_al_2003).

Comments chapter 5:

Page 13897, line 7: How is environmental consciousness set for SSP4?

Comments chapter 6:

Page 13898: agricultural (irrigation) water withdrawals are not shown in graphs and maps. Page 13901, lines 12-13: replace Voß et al. (2011) by Flörke et al. 2012 (in press). Some text about model uncertainty may already been mentioned in the text describing the models.

Comments chapter 7:

What are the main conclusions? The summary does not provide the main conclusions or outcomes from this study.

Comments on Tables and Figures:

Table 1: The problem of SSP5: it's true that technological development is high and it is also true that environmental consciousness is low. But the interpretation regarding

HESSD

9, C6683–C6687, 2013

estimating future water withdrawals is questionable. I think that SSP5 high technology leads to getting each drop of water (resources) but not saving water. If efficiency is high, future will not become water intensive! That is a contradiction. Table 2: Irrigation efficiency has increased under MA, TG scenario (differentiation between 19 regions). Table 3: Revise Voß et al. (2010): Driver is: thermal electricity production Table 4: Revise Voß et al. (2009): Driver: population and GPD per capita, technological change (parameter), structural change (parameter) Table 7: caption does not explain the content Table 9: HE for SSP5 is questionable. (see comment to table 1)

Figure 1a: please cf to O'Neill et al. 2012 (similarity between figures is too high) Figures 4 and 5: few number of data points. Figure 4: Does India use 0 water in the industry sector in 2000? Approach is based on few measured data, although many more exist from other statistics, e.g. Japan. Figure 5: same as for Figure 4. The figures shown do not really represent the "typical" industry nations, e.g. USA, Germany, France, also Brazil as an emerging country. Figures 7 and 8: few number of data points.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 13879, 2012.