Earth Syst. Dynam. Discuss., 4, C122–C124, 2013
www.earth-syst-dynam-discuss.net/4/C122/2013/

Earth System Dynamics Discussions

Interactive comment on "Global modeling of withdrawal, allocation and consumptive use of surface water and groundwater resources" *by* Y. Wada et al.

P. Döll

p.doell@em.uni-frankfurt.de

Received and published: 19 March 2013

I would like to make some suggestions which aim at making the article more informative. I think the article could be improved by explaining more clearly the new modeling algorithm, and the motivation for choosing the algorithms. This refers to, for example, equations 6 to 8. More importantly, please add information on how you compute the soil water balance, in particular how you compute runoff. In addition, I suggest showing the computed consumptive (irrigation water use) as compared to (gross) IWR.

Regarding data, what is the source of the saturated and residual/wilting point water contents? For the temporal development of irrigation, did you use FAOSTAT data of

time series of irrigated areas per country?

In particular, even though section 2.6 is titled "Water allocation and return flow", nothing at all is mentioned about return flows even though the assumptions made on return flows are important for the estimation storage and flow changes. Regarding the description of water allocation, please clarify, if Qbase is the long-term average value or not. Please clarify also what "predominantly" and "available groundwater storage" means in the case of existing reservoirs: "We first allocated surface water predominantly to meet the water demand, and the remaining water demand was met from available groundwater storage or S3".

With the allocation algorithm, you compute (page 370 line 15) that "during the recent period 1990-2010, the rate of groundwater withdrawal increased to 3% per year (or rather "groundwater withdrawals" increased yby 3% per year), ...". But unless there are upstream reservoirs, groundwater is, in the model, abstracted first (with a fixed percentage of total water demand), so that gw abstraction and sw abstraction should change at the same rate as total water demand. So the stronger increase of gw use after 1990 is calculated due to water demand increases in grid cells downstream of reservoirs? Is the percent changes in groundwater and surface water withdrawals just a function of changing reservoir numbers? In the model, do you take into account the construction date of all the 6800 reservoirs? What happens in your allocation scheme if available surface water on day x is smaller than demand for it? Please explain how certain you are about the computed temporal changes in the fraction of groundwater withdrawals (in particular as you include this result prominently in the abstract.

When comparing modeled groundwater and surface water withdrawals with data (as in Fig. 2 and Table 3), a clearer picture of the fit can likely be obtained by comparing the modeled groundwater withdrawals (or surface water withdrawal) as a fraction of total water withdrawals to the respective ratio computed for the independent data. In Fig. 2/Table 3, both the ability of the model to compute total water withdrawals (which is at least partially covered already in Fig. 1) and the source fractions are confounded.

On page 373 line 27, I think you wanted to refer to Döll et al. 2012, not Döll et al. 2009.

Interactive comment on Earth Syst. Dynam. Discuss., 4, 355, 2013.