Hydrol. Earth Syst. Sci. Discuss., 10, C7218–C7221, 2014
www.hydrol-earth-syst-sci-discuss.net/10/C7218/2014/

Hydrology and Earth System Sciences
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Discussions

Interactive comment on "Modelling overbank flood recharge at a continental scale" *by* R. Doble et al.

Anonymous Referee #2

Received and published: 13 January 2014

The authors performed a study on introduction of an overbank flood recharge scheme to the Australian Water Resources Assessment (AWRA) model, with an attempt to improve the modeling of groundwater recharge. Modeling results were compared with independently observed bore hydrograph responses and point-scale recharge modeling. This study could be an incremental, though not earth-shattering, contribution to the modeling of overbank flood recharge as claimed by the authors that the simulated overbank flood recharge, despite underestimated, accounted for 4-15% of the total recharge at the basins during the study period from Nov 2010 through Mar 2011.

In general, this manuscript is written very well. I recommend it be considered for publication in the journal of Hydrology and Earth System Science after the issues raised below are fully considered and the manuscript is revised accordingly.

(1) The overbank flood recharge may have been underestimated in the Lachlan, Daly,

Logan, and Campaspe watersheds. The underestimation is likely because MODIS data you used were not able to detect open water bodies and consequently inundated areas due to cloudiness or that Terra and Aqua satellites were not synchronized with the occurrence of flooding. To further examine this issue, this review suggests that the authors show maps of water bodies detected by MOD09 products to look at how large the influence of clouds could be, and try to quantify uncertainties associated with open water detection using MODIS. Use of Satellite Aperture Rader (SAR) could be a promising alternative to detecting flooding areas. The authors are encouraged to look at these papers (Dellepiane and Angiati 2012; Hostache et al. 2009; Martinis et al. 2011) and discuss this issue in your manuscript.

(2) The authors claimed that the simulated overbank flooding recharge contributed to a "significant" part to the total groundwater recharge, with a lion's share of 15% for riparian recharge and 4% for the Loddon catchment. I do not think this is a significant contribution of the total recharge; it could be within the uncertainties of the total groundwater recharge from the AWRA model. In other words, the motivation of this study should be expressed in a more convinced way.

(3) Calibration of the AWRA model is not clear to this reviewer. What parameters need to be calibrated prior to your modeling effort? How long is the warm-up period? What uncertainties are involved in the forcing data? How do you validate model output (surface flow and drainage) in addition to looking at the groundwater recharge term?

Minor issues:

Page 12574 Line 24: OFR is an important, but often overlooked, requirement. . .

Page 12575 Line 3: Please consider citing the papers (Reager and Famiglietti 2013; Singh and Woolhiser 2002)

Page 12577 Lines 3-5: Please indicate clearly the temporal scale of your simulations for the study period, hourly? daily? Or others?

Page 12579 Lines 21-24: Can you provide the name of the MODIS reflectance product? MOD09?Further, one of the fundamental questions of the use of MOD09 to determine the extent of open water bodies is that during flooding periods, multispectral remote sensing is extremely susceptible to image quality that is greatly influenced by clouds. Please refer to the paper (Long and Singh 2010). I am wondering how you dealt with this issue, and indeed suspect the usefulness of MODIS data to provide open water extent due to the limits of temporal resolution in the context of flooding and recharge simulations and cloud impacts. At least, the authors should comment on it.

Pages 12580 Lines 1-7: If I understand correctly, here you are trying to construct the relationship between open water extent and the elevation inundated, and then subtract elevation without inundation to derive the flood depth. If so, please make it clearer.

Page 12581 Lines 7: from areas that are climatically distinct... I suggest that the authors include areas of the seven study basins in your Table 2.

Page 12591 Line 17: There were no available flood inundation mapping and soil properties... Section 5.3 is concerned with the motivation of this study. It should be put earlier in the discussion section, instead of in the last part.

References

Dellepiane, S.G., & Angiati, E. (2012). A New Method for Cross-Normalization and Multitemporal Visualization of SAR Images for the Detection of Flooded Areas. IEEE Transactions on Geoscience and Remote Sensing, 50, 2765-2779

Hostache, R., Matgen, P., Schumann, G., Puech, C., Hoffmann, L., & Pfister, L. (2009). Water Level Estimation and Reduction of Hydraulic Model Calibration Uncertainties Using Satellite SAR Images of Floods. IEEE Transactions on Geoscience and Remote Sensing, 47, 431-441

Long, D., & Singh, V.P. (2010). Integration of the GG model with SEBAL to produce time series of evapotranspiration of high spatial resolution at watershed scales. Journal

of Geophysical Research-Atmospheres, 115

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Reager, J.T., & Famiglietti, J.S. (2013). Characteristic mega-basin water storage behavior using GRACE. Water Resources Research, 49, 3314-3329

Singh, V.P., & Woolhiser, D.A. (2002). Mathematical modeling of watershed hydrology. Journal of Hydrologic Engineering, 7, 270-292

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 12573, 2013.