Geoscientific

Model Development

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Discussions

Interactive comment on "Using satellite-based estimates of evapotranspiration and groundwater changes to determine anthropogenic water fluxes in land surface models" *by* R. G. Anderson et al.

Anonymous Referee #1

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The authors use satellite-estimated ET over the California Central Valley to modify the CLM land surface model in order to better represent diversion and extraction for irrigation. This is an interesting analysis. As it stands, the m/s lacks context, explanation and interpretation in some important aspects, but with moderate revision it should be a worthwile addition to the literature.

General comments:

- More description of the Central Valley water system is needed : hydrogeology, the surface water system (sources, reservoirs, diversion points)where does the surface water come from, what is the spatial and/or temporal pattern of surface vs groundwater

use?

- in several instances you use "observed" when referring to satellite-based ET estimates. In my view that is stretching the term to far; ET is estimated using a model that requires not only satellite data but also other input data, and the uncertainty in the assumptions and input data is considerable. Using "satellite ET" or "remotely sensed ET" would be appropriate.

- The relevance of comparing to GLDAS-1 and NLDAS-2 for this study is not clear. Please explain better.

Specific comments:

Page 3567, Line 6) "for" rephrase

8) "against" replace with "using"?

10) Pls better explain what you mean by iterative and partition

11-12) Is it surprising it matches it well? That is by design, is it not?

P3568, l1) consider including China.

4) You can find more analysis on the effect of groundwater extraction on sea water level in this paper: http://www.hydrol-earth-syst-sci.net/18/2955/2014/hess-18-2955-2014.html

10) it may be worth adding that many irrigation areas are in (semi-) arid areas, which increases the contrast.

21-25) Pls be explicit which of these limitations apply to which of the numbered items. More in general, please explain in more detail the assumptions and approach in each case, along with the benefits and limitations.

24) "drought and pluvial" change to "dry and wet"; more generally, please do not use the terms dry (below-average rainfall) and drought (extremely low rainfall) indiscriminately.

29) Why "although" what is the apparent contradiction?

3569, 5) change to "more robust"

15) Explain what exactly they did that you are building on here.

18) Provide reference for CLM

24) suggest "value" instead of "importance"

3570, 22-25) Don't see why this is relevant here?

3571, 3) Does it have a name?

7) Sounds like the trapezoid method. Is it different?

11-14) How do irrigation areas stand out using this method, not explained.. Also, pls explain why the several publicly available ET products (e.g., MODIS, MPI, GLEAM etc) are not used. I imagine it may be because of their coarse resolution, but it is left unexplained.

3572, 19) Confused terminology: I assume you mean groundwater discharge into rivers, rather than runoff; furthermore that is not equal to baseflow (baseflow describes a part of the hydrograph, it's not itself an interpretation of hydrological pathway)

3573, eq. 4) Your figure shows an unconfined and a confined aquifer. Please discuss this conceptualisation and explain which of these terms you assume affect which.

9) that doesnt sound very realistic; presumably farmers would not apply water if it rains. Perhaps summer rain is a rare event? Pls discuss.

14-15) I am confused about this. Presumably q_recharge is a function of soil water content?

15) But GRACE total water storage anomales include contributions from both soil moisture (DELTA SMH) and groundwater (DELTA GW), whereas here you appear to ignore the former. If I interpret this correctly you need to demonstrate that that is a reasonable

assumption.

21) "locate"do you mean "spatially ditribute"?

3573, 3) What basis do you have for thjat assumption? Needs discussion and potentially uncertainty analysis.

3574, 7) "occurring" rather than "coming"

12) Are there no reservoir dams? Or are they too small to mitigate against year-to-year variations? Pls explain.

17-19) That suggests to me that additional constraints are needed. Are there no data on dam releases or the surface water budget that you could use?

3575, 1) Presumably you mean fig. 5? I don't understand how to interpret fig. 5, pls explain.

9) why call it an inventory approach? What you describe sounds like a water budget approach.

11) "Agreement" not "comparison". Also, how did Anderson et al estimate GW_wd?

25-26) This needs an interpretation. I assume this may be a consequence of wetter soil conditions causing greater rainfall-runoff response, but given it is modelled you can (and should) trace why this is predicted.

29) losing streams – this term is missing in Eq. 4. Pls discuss.

3577, 2) once again, no need for "may" – you should be able to deduct this from your modelling.

28) "global inventory" - pls explain.

3578, 14-17) sounds like a fairly speculative thought bubble. Argue better or delete.

18) "sufficiently coarse"?? Rephrase.

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26) "dry" not "drought". "missions" - what missions?

28) "higher spatial scales" – do you mean higher spatial resolution?

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Interactive comment on Geosci. Model Dev. Discuss., 8, 3565, 2015.

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