

Hydrol. Earth Syst. Sci. Discuss., referee comment RC3  
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## **Comment on hess-2020-665**

Anonymous Referee #3

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Referee comment on "Development and evaluation of 0.05° terrestrial water storage estimates using Community Atmosphere Biosphere Land Exchange (CABLE) land surface model and assimilation of GRACE data" by Natthachet Tangdamrongsub et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2020-665-RC3>, 2021

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The manuscript presents a high resolution model (0.05°) for Terrestrial Water Storage (TWS). The model implemented (CABLE SubgridSoil GroundWater), that was previously used to estimated TWS at 0.5°, is 'upgraded' to 0.05° resolution and extended with GRACE satellite observations via Ensemble Kalman Smoother. The method is demonstrated on Australia, a complex case study, with different climatological regions. Processing of the 32-year time span on continental scale is an impressive test case.

### **§ 1 Introduction**

The authors neglect to highlight the contribution and impact of their product and method on society.

In detail:

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The introduction highlights the importance of high resolution TWS modeling for risk management (l. 31), however, the temporal range of 1981-2012 does not reflect this application. The conclusion states that this would have been possible with different data (l. 461), at even higher resolution (l. 463). Why wasn't this done?

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The open character of the model (l. 81) is an important characteristic that deserves more attention, due to its high potential. (N.B. other reviewers signaled that the public code may not include the GRACE data assimilation, this is unclear to me from the text.)

Likewise, the novelty of the method is not clear from the text. In detail:

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l. 56-64 list various models of comparable spatial resolution.

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l. 76 "GRACE DA has shown positive impacts [...]", combined with l. 90 "[t]he objectives of this paper are [...] 2) to assess the GRACE DA impact on [...] CABLE [...]". What does CABLE provide that previous studies did not?

The paper would benefit from a high level overview of the problem to be solved.

## **§ 2 Study area and data**

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The GRACE data set spans only a small part of the 1981-2012 time span of the

study. How is GRACE data integrated, outside the periods of data assimilation?

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I would suggest to report both input and validation/evaluation data sets (§ 2.4) in similar fashion. For example, include the evaluation (satellite) data in a similar fashion in Table 2.

■

Upsampling of precipitation (l. 144) may not reflect natural precipitation patterns. Likewise, nearest neighbor interpolation (l. 142) may introduce strong gradients.

### § 3 Methods

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What is provided to CABLE, and what is optimized in the Ensemble Kalman Smoother. A 'data flowchart' would be a helpful extension to Figure 3.

■

l. 243 "[...], the daily increment ( $\Delta A_d$ ) of the update is computed by dividing  $\Delta A$  by the total number of days in that month." How does this influence high frequency signals (e.g. precipitation spikes)?

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§ 3.2 The use of these metrics is not clear to the reader.

■

§ 3.2.1 How is in-situ (point) data (§ 2.4.2) handled?

▪

§ 3.2.3 What will this metric express?

▪

Is there any indicator for the timing of the signal (e.g. systematically late detection)?

▪

§ 3.2.4 The term 'spatial resolution' is very confusing in the context of the study, see also l. 289. Also l. 450 "the 0.05° model also improves the spatial resolution by a factor of two to three over the 0.5° version," is counter-intuitive.

▪

There are no comments on the computational resources required by the model. Given the open character of the model, some hints would be welcome.

## **§ 4 Results and discussion**

More overarching conclusions/summaries, for each comparison, would make the section more readable. What is the 'take home message' from each comparison.

## **§ 5 Conclusion**

Comments covered in relevant sections.

## Technical remarks

Various spatial units are mixed together, making difficult to compare between models and sources. The resolution of this model is reported in degrees, while the resolution of relevant models are mentioned in kilometers (l. 56-64). A single unit would be best, or report both.

Furthermore:

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Ambiguous terminology, e.g.:

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meaningful, l. 8, l. 33;

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sufficiently, l. 43, l. 52;

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can, l. 44 (instead, provide a figure such as the longest available time series).

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l. 30, "[...] spatial resolutions are relatively coarse [...] models that primarily focus on global or continental scale"; l. 190 "[...] distributed unevenly across the continent."

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Inline hyperlinks, except for the sources (l. 467 onward), make the text difficult to read, l. 60, l. 62, l. 114, l. 156, l. 161, l. 189.

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Table 1, l. 110, appears to be misplaced, l. 69. The reference in l. 106 could point back.

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l. 130, "still"?

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l. 132, Figure 1 does not show the high resolution of the data. Maybe include a detail?

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l. 149, 320 years  $\square$  32 years

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l. 185, "Murray-Darling Basin", see Figure 1.

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l. 250, § 2.3 should be § 2.4.