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Interactive comment on "On the use of GRACE intersatellite tracking data for improved estimation of soil moisture and groundwater in Australia" *by* Natthachet Tangdamrongsub et al.

Anonymous Referee #1

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The satellite gravimetry mission GRACE is a unique tool to remotely monitor mass transport processes in the Earth System. Temporal changes in gravity are determined from mass anomalies at, above, or beyond the Earth's surface, thus allowing to quantitatively determine water mass losses at global-to-regional scales.

The current paper explores ways to utilize GRACE for the validation of a numerical land surface model over Australia. In contrast to most previous studies, the authors do not utilize high-level processed GRACE data, but start from monthly normal equations as provided by Mayer-Guerr et al. of the University of Graz. Various alternative observational data-sets are utilized to discuss the GRACE results and relate them to the

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hydroclimatological conditions of Australia over the last 13 years. The paper appears to be a generally very valuable contribution to the literature and I strongly recommend its further consideration for publication in HESS. A number of points might be, however, considered during a revision in order to improve the presentation.

(1) The description of the GC approach appears to be somewhat ambiguous: While Sect. 2 is claiming to use L1B KBRR data only, it becomes clear from Sect. 3 that in fact L2 monthly normal equations from ITSG2016 are applied. Those NEQ, however, include not only KBRR but all GRACE sensor information (KBRR, ACC, GPS, attitude) and a priori background models (AOD1B, earth, ocean, and atmospheric tides, third body effects). I suggest that comparisons with the official ITSG2016 monthly solutions are included in order to demonstrate the added-value of the GC approach over the standard L2 data. Note that comparisons against GRGS or JPL monthly solutions as already (partly) included in the paper will not be sufficient since ITSG2016 is commonly perceived as a GRACE series of particularly high quality.

(2) The GC approach assumes that model errors are normally distributed with zero mean (eq. 1). Authors should provide more evidence that this assumption is indeed justified in their setting.

(3) line 284: It is optimistic to assume that the model omission error can be fully accounted by just increasing the model covariance by 20%, in particular since this assumes that omission errors do not contribute to biases (which is quite unlikely). More evidence need to be provided for the (approximate) validity of this assumption.

(4) The statement of line 212ff is unclear (and apparently not picked up again in the remainder of the paper). Please elaborate.

(5) Line 289: What does "cooperating" mean in that case?

(6) The specific yield for the Queensland and Victoria networks differ by a factor of 2: Is there any geologic evidence/argument available for those very different yield factors?

(7) Sect. 6.2 appears to be rather an outlook to a future study. Since no actual results are presented, I am wondering if this section should not be better removed entirely?

(8) Major mining activities are currently taking place at the North West Plateau where GRACE picks up negative mass trends: What measures have been taken to reduce mass loss un-related to the terrestrial water cycle from the GRACE data in particular in that area?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-318, 2017.