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Hydrology and Earth System Sciences
Discussions

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 #3

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I read the paper by Tangdamrongsub et al. with an interest. Most of researches to date address the recovery of time-variable gravity fields from GRACE level-1 observations. These data are then used to estimate total water storage (TWS) changes, which represent a vertical summation of mass changes within different compartments including the Earth's surface and its sub-surface. Although, having an access to TWS is a unique opportunity and therefore these data have been used to study regional and global mass redistribution, separated estimation of water storage as surface water storage, soil water storage and groundwater quantities are of interest of many hydrological and water resources studies. This study suggests an inversion approach to directly estimate the contribution of water storage in soil and groundwater, while inverting GRACE level 1

measurements. The idea of this paper is very good and has been somewhat a 'dream' since starting the GRACE mission. However, there are many technical issues that have not been correctly addressed here, which prevent me to recommend a positive decision. In the following my major concerns are listed:

L15-L16–> This is not true that "there is no covariance matrix for L2 products". After filtering and conversion to TWS, this error can be propagated, which is addressed e.g., in DOI:10.1007/s10712-014-9309-8. L48 repeats the same claim!

L16-L17: The consequence is undesired alteration of ... data and its statistical property. –> It is not clear what this means. Are you suggesting that all other published papers are wrong!?

L21-L22–> This is not clear which approach has been used.

L61-L64–> Inversion techniques for signal separation have been applied, which consider errors in GRACE and complementary data used for signal separation. DOI:10.1016/j.jog.2012.03.001; DOI:10.1016/j.jog.2011.02.003; DOI:10.1007/s10712-016-9403-1

The Methodology section needs to be specified, please add appendices to clearly how the equations are built. I cannot figure out how the normal equation is formulated, whether it includes KBRR and any orbital information? The accuracy of recovery has not been justified, which is essential for any scientific appliction to show that the accuracy of software is comparable with official products. Please include comparisons with the official ITSG2016 monthly solutions. L120–> Please describe how the matrix A is derived and what are the entries. Similarly L128-L130 are unclear.

Results of the inversion might be compared with those that assimilate GRACE into hydrological models to improve the surface/sub-surface storage compartments. Recent studies over Australia include: DOI:10.1002/2016WR019641; DOI:10.1016/j.advwatres.2017.07.001

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