Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
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Comment on hess-2022-398

Anonymous Referee #1

Referee comment on "A global analysis of water storage variations from remotely sensed soil moisture and daily satellite gravimetry" by Daniel Blank et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-398-RC1, 2022

OVERVIEW

The study investigates the relationship between soil moisture and satellite gravimetry total water storage variations at daily scale and on a global scale. Multiple soil moisture products have been analysed, both for the surface layer and the root zone. The correlation and the time shift among satellite gravimetry total water storage and soil moisture products have been investigated in depth.

GENERAL COMMENTS

The paper is well written and clear. The investigation of daily terrestrial water storage (TWS) variations from GRACE(-FO) has been carried out only in a very limited number of studies and hence their global analysis is surely of interest for the readership of Hydrology and Earth System Sciences. However, I have found some major comments that needs to be addressed carefully.

- MAJOR: In the analysis of different soil moisture products, any disagreement with TWS variations from GRACE is attributed to error in soil moisture product. For instance, when SMOS L4 product has positive time shift with GRACE it is attributed to errors in the algorithm for obtaining root zone soil moisture from SMOS, but it might be an error on GRACE (of course, particularly at daily temporal resolution). Instead of only identifying the area of disagreement, a more detailed discussion should be carried out to shed light on the potential causes for that.
- MAJOR: The investigation with SMAP L4 product should be carried out separately from the other products. SMAP L4 is mostly a modelled product, the contribution of SMAP data is quite limited as highlighted in the analysis for the pixel in India. All satellite soil moisture products are able to identify the irrigation signal, whereas it is not the case for

SMAP L4 as it is mostly modelled and it does not include the irrigation component. A paper clearly showing this aspect is going to be published soon. I believe the analysis with SMAP L4 should be likely removed, or considered completely separately (note that many other modelled products can be considered as well).

- MINOR: Throughout the paper many acronyms are present without the definition, please add.
- MODERATE: At line 192 it reads that the linear trend is removed. I believe it would be very interesting to compare the products in terms of their long-term trends. Can the authors add this analysis?

In the specific comments I have added several suggestions to improve the manuscript.

SPECIFIC COMMENT (L: line or lines)

L39: Soil moisture can be obtained from microwave but also optical data. If GNSS is mentioned, also optical data should be.

L53-55: Currently, well established approaches have been exploited for estimating root zone soil moisture from satellite surface soil moisture data. For instance, the operational service under Copernicus providing the Soil Water Index and the EUMETSAT H SAF root-zone soil moisture products. These products should be mentioned and I believe the sentence should be revised.

Figure 2: I would change the text in the legend for “soil moisture”. For instance, “committed area”, or something similar.

L241: These evaluations are valid for the analysed pixel, it should be clear. It seems to read general results.

L256: It’s not merely extrapolation, there’s a physically approach for getting root-zone soil moisture from surface data.

L260-261: It clearly shows that SMAP L4 is a modelled product not including irrigation, should be considered apart.

Figure 3: In the figures the anomalies are shown. It should be clarified in the y-axis labels.

L288: Exactly, GRACE TWS cannot be considered as a reference.

L294-295: SMAP L4 does not remove the noise, it is simply a modelled product.

L329-333: Deficiencies might be due also in GRACE data, right?

Figure 7: It is not readable, please improve.

Figure 8: In the caption it reads "Data gap between …" Not clear, please revise.

L364-365: It seems to me the authors are overselling the results, the correlations in the high-pass filtered signal are very low. Only relatively better with SMAP L4, but it's not a satellite-based product.

Figure 9: The range of the colorbar should be reduces. Otherwise the figure provides little information.

RECOMMENDATION

Based on the above comments, I suggest a major revision before the possible publication on Hydrology and Earth System Sciences.