

Biogeosciences Discuss., author comment AC3
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Reply on RC2

Leander Moesinger et al.

Author comment on "Monitoring vegetation condition using microwave remote sensing: the standardized vegetation optical depth index (SVODI)" by Leander Moesinger et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-360-AC3>, 2022

We thank you for taking the time to write this constructive review!

Your comments are in italics, our answers are plain text.

Comment R2.1 *The paper should justify the strategy of rescaling all products to AMSR-E. Why not use the newer sensor AMSR2 as the reference? This rescaling approach will smooth out the contribution of each band, which as noted in the manuscript has different sensitivity to different parts of the vegetation. The implication of potential loss of information should be discussed.*

Answer to R2.1 AMSR-E is used due to its temporal overlap with most other sensors, allowing for a direct rescaling using concurrent observations. AMSR2, while being newer, only overlaps with TMI. Also note that at its base, the bias correction to AMSR-E is just a piece-wise linear scaling, therefore the dynamics of each sensor are not altered. We will expand the corresponding section to elaborate our choice.

Comment R2.2 *The paper compares data an older sensor (AVHRR) as analogs for optical data. I strongly suggest the use TCI and VCI from more modern sensor such as MODIS.*

Answer to R2.2 Generally the main advantages of MODIS to AVHRR are both a higher spectral and spatial resolution. For our application however neither the higher spectral resolution (not relevant for VCI calculation) nor the higher spatial resolution (AVHRR resolution is already much higher than our 0.25 degree grid) are of any benefit. MODIS and AVHRR NDVI correlate very strongly with each other [1, 2, 3], so the results would not get much more accurate. However, AVHRR has the practical benefit of being available for the whole duration of SVODI, while MODIS is only available since 2000, which means that AVHRR allows for a more robust analysis.

- [1] <https://doi.org/10.5589/m06-001>
[2] <https://doi.org/10.1016/j.rse.2005.08.014>
[3] <https://doi.org/10.3390/rs5083918>

Comment R2.3 *The patterns of improvements (Figure 7) is not consistent with prior studies, as claimed in the article. In Figure 4a of Moesinger et al. 2020, the correlation pattern is very different. For example, the correlations are strong in the eastern US and weak in the west. Similarly correlations are strong in vegetated areas like Amazon and Congo. Here, because SVODI is an anomaly product, the semi-arid areas stand out more?*

Answer to R2.3 Figure 4a in Moesinger et al. 2020 shows mean VOD-C and is thus not related to figure 7 of this paper. The equivalent figure in Moesinger et al. 2020 are figures 11b, 11d and 11f which show the correlation between VODCA anomalies and MODIS LAI anomalies and exhibit the same pattern, both globally and in sub regions such as the US. Also both papers agree that the strongest correlations are found in grasslands/semi arid areas.

Comment R2.4 *Similarly, the patterns in Figure 8 backup the statement that correlations are strongest in places where vegetation growth is limited by water availability. For example, over the agricultural areas in North America degradations are seen (see Kumar et al. 2020 ; <https://hess.copernicus.org/articles/24/3431/2020/>). Is that because ERA5 doesn't get the soil moisture patterns over agricultural areas, but SVODI do? You can also see similar features over Eastern China and Indus(?)*

Answer to R2.4 We understand the issue as to why the correlations between ERA5 soil moisture anomalies and SVODI in the Eastern US, Eastern China and the Indus are negative. In this light, indeed, the correlations are generally highest in water-limited areas. The Eastern US and Eastern China however are mostly limited by radiance [4]. The Indus is generally water-limited [4] and shows near-zero correlation coefficients for surface soil moisture and positive correlations for deeper soil moisture. Therefore in all these regions the correlation coefficients are not unexpected with respect to the main climatic constraints of vegetation growth.

- [4] <https://www.science.org/doi/10.1126/science.1082750>

Comment R2.5 *Some of the discussions around the Figures is pretty minimal and doesn't go into any depth. For example, for Figure 11 – there is no discussion of the middle and the right columns. Why have them? Similarly, Section 4.2.5 and Figure 12 provide little added information to the paper. I encourage the authors to remove extraneous and distracting results and focus on tightening the key contributions of the paper.*

Answer to R2.5 This is a very good point. Figure 12 was supposed to replace the center and right columns of figure 11, but we mistakenly left those in. We will remove the middle and right column of figure 11. As SOI/DMI are traditionally used in the analysis of global extreme events, there is merit to analyze their relationship to SVODI, whose purpose is also to monitor extreme events. Therefore we propose to keep figure 12 in. We will generally also flesh out some of the figure descriptions and their interpretation.

Thank you a lot for the very thorough list of minor corrections and

improvements, we will fix them!