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Comment on bg-2021-248

Anonymous Referee #2

Referee comment on "Assimilation of passive microwave vegetation optical depth in LDAS-Monde: a case study over the continental USA" by Anthony Mucia et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-248-RC2>, 2021

Data assimilation is important for improving our understanding of Earth system via combining models with data. The booming of satellite data provide the chance to constrain large scale Earth system processes and can give us a more accurate estimate of land surface variables (LSVs). In this paper, the authors discussed the possibility of assimilating VOD into the land surface model (LSM) together with soil moisture. This is a good starting point, as pointed out by the authors, because the LSMs need a better constraint with more observations. After reading this work, I admit that the data assimilation algorithm and the experiments conducted with LDAS-Monde is reasonable, but the only thing I am not convinced is the replace of LAI with VOD. This paper made the assumption mainly based on Kumar et al. (2019) with showed VOD can be seen linear with LAI. But we need to keep in mind that Kumar et al. (2019) also pointed out that VOD is different from LAI. The authors also showed in Fig.2. From a modeler's perspective, I feel this is too bold to do so and use this data for assimilation. Because this looks more like a forced matching of VOD to LAI. Some other papers (e.g. Rodríguez-Fernández et al., 2018) have pointed out that VOD contained both information about LAI and biomass, and the assimilation of VOD together with soil moisture has been successfully conducted in the Carbon Cycle Data Assimilation System (CCDAS) by Scholze et al. (2019). So I think the simulation of VOD by LSM is already possible. Therefore I do not agree that the re-scaling of VOD to LAI is due to the lack of model representation on VOD. Therefore, I do not think this paper can be published in its current shape, unless the authors solve the problems in simulating VOD by the LSM. Before doing that, I do not think the detailed comments on the context is helpful for the authors, even I made some from my side.