

Interactive comment on “The high sensitivity of SMOS L-Band vegetation optical depth to biomass” by Nemesio J. Rodríguez-Fernández et al.

Anonymous Referee #2

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The study is aimed to introduce the sensitivity of the vegetation optical depth (VOD) at L band to the biomass. Different SMOS datasets, produced by different algorithms, are compared to some above ground biomass (AGB) datasets over Africa. The analysis is carried out to show the higher correlation of the L band VOD with respect to higher frequencies VOD and optical vegetation indices. The paper also presents the correlation of the SMOS VOD with other parameters like tree height and cumulated precipitations.

General comments:

The study's goal is well defined in the paper introduction where the authors claim that the retrieval of the VOD at L band can provide an important tool for the monitoring of

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the vegetation properties at large scales. In the first section of the manuscript is highlighted that, besides optical measurements, passive microwave observations acquired by the SMOS radiometer can provide an important complementary information to infer the state of vegetation. Here, several references are correctly reported to introduce the study and it is emphasized how the L band observations are less attenuated through the vegetation canopy. Therefore, L band VOD is expected to sample the vegetation layer up to higher biomass values compared to higher frequency observations. This aspect represents the key point of the manuscript and it is supported by the figure 4 of the results section. Anyway, just few comments are deserved to this point while a deeper explanation of the high sensitivity of the L band should be provided in the last section of the results. Moreover, it seems that the presented research is a progress of a previous work in which some of the authors have already addressed the topic in 2016, including some results about the SMOS VOD sensitivity to tree height and AGB. I would suggest citing also this preliminary study in the introduction (doi 10.1109 / IGARSS.2016.7730383). Another general concern it is related to the use of three different VOD datasets derived from the SMOS data (L2, L3 and SMOS IC) that could confuse the reader. In my opinion, this point of view is interesting but can defocus the attention from the study objective, that it is claimed in the manuscript title. In some parts of the article it seems that too much importance is given to the intercomparison of the different VOD retrieval algorithms, instead of supporting the relevance of the VOD at L band for AGB monitoring. Furthermore, a potential user of SMOS data, could ask himself what is the product to adopt between the L2, L3 and SMOS IC for vegetation monitoring, since the strengths and weaknesses of the different approaches can be highlighted more clearly. A suggestion to address this point could be to provide a general overview of the specific aims of the different products and maybe to update the title of the research to highlight that different L-band products are compared. Despite these general issues I believe that the topic is relevant, the results are obtained with a sound scientific approach and the supporting figures and tables are clear. Therefore, I would recommend the paper for publication after a careful revision process.

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Specific comments:

In the section 2, "Data", is introduced the SMOS mission and the three different algorithms, considered to retrieve the L band VOD from the SMOS brightness temperature. At line 28 of page 2 is stated that only ascending orbits are considered in the study but the declaimed better overall quality of ascending pass acquisitions appears not justified. Therefore, the authors should provide a better explanation about this important constrain. In the following subsection are introduced the ESA L2 algorithm, the CATDS L3 algorithm and the INRA-CESBIO algorithm that were applied to obtain three different L band VOD data sets. If the Authors are inclined to stress the intercomparison between the outcomes of the different retrieval approach, a deeper discussion about the different algorithm could be effective to introduce the subsequent results, i.e. figure 1 and table 1. This choice, could be a good solution to solve some ambiguities between the study aim, as claimed on the paper title, and the interesting overview of the different algorithms performances. Anyway, a better explanation on the assumptions (i.e. soil roughness and albedo) under which the three different algorithms are based should be provided. After the introduction of the VOD datasets the different benchmark sets are presented. In the section 2.2.1 it is introduced the Worldclim data set, that is used to infer the relationship between the L band VOD and the mean annual precipitation. This analysis seems meaningless since, as it is reported at line 15 of page 5, the considered precipitation is extracted from a dataset ranging only between "1970-2000". This point should be clarified also considering that the relationship between the precipitation and the VOD are not well commented in the paper. In the section 2.2.4 are presented the different AGB datasets considered as benchmarks. Here the sentence "This study used four static AGB benchmark maps (Baccini et al., 2012; Saatchi et al., 2011; Avitabile et al., 2016; Bouvet et al., 2018) each with specific strengths and limitations to assess L-VOD's ability to reflect aboveground biomass in different" is questionable and not well supported by the results. In particular, the Avitabile dataset is obtained by the fusion of the Baccini and Saatchi maps through a machine learning approach and it is proved to outperform the previous datasets in terms of retrieved AGB

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accuracy. The Authors should argue better the aspects related to the analysis carried out with these three different AGB data sets. On the contrary the consideration of the Bouvet dataset is very interesting and should be emphasized. In the Results section it should be provided a deeper explanation of the research outcomes, in particular the scatterplots reported in figure 2 need to be better commented.

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