

## ***Interactive comment on “Use of GNSS SNR data to retrieve soil moisture and vegetation variables over a wheat crop” by Sib0 Zhang et al.***

### **Anonymous Referee #1**

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The study deals about soil moisture, vegetation height and phenological stages estimation by GNSS for a site in southern France and validation to in situ measurements and model simulations. The approach is sound, the manuscript well-written and adequate for the audience of HESS. Because of its high quality, just few attempts need to be made to improve the presentation of the study.

E.g., a brief discussion how much in situ (soil moisture) data is necessary to retrieve soil moisture from GNSS signal could clarify the need for adequate calibration.

During the investigation period little soil moisture variation has been recorded by in situ and GNSS sensors. The authors should discuss this low range and its relationship to the retrieval accuracy of 0.03 m<sup>3</sup>m<sup>-3</sup>. Similarly, longer time periods should be envisaged for further studies, this delivers the basis for further statistical methods such

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as Triple Collocation. This would better identify the different uncertainties between the data sets. Especially with the very good results of ISBA simulations, one could question the need for (additional) GNSS measurements.

Soil moisture retrieval results could better be discussed by including recent literature and comparing to other GNSS soil moisture retrieval methods.

The authors ask the question if phenological stages can be inferred from GNSS. The outcome and visibility of the paper could be increased by giving more specific information about different stages or managements, e.g. in form of an index or threshold for wheat as an important representative for all cereals.

In total, I would recommend minor revision prior to publication.

Specific comments:

Abstract: More information about the retrieval method should be added.

P. 2, L. 10f: Refer also to the other L-band satellite SMAP.

P. 3, L. 15: introduce L2C.

P. 3, L. 26: What characterizes the dominant period?

P. 4, L. 10: Introduce PBO.

P. 5, L. 15: Start the section with explaining the aim of the calculations.

P. 6, L.10: Again, explain in one or two sentences the general concept of soil moisture retrieval before starting the details of this section.

P. 7, L. 9: A discussion about the reasons and needs for omitting a soil moisture retrieval under vegetation is necessary. Why were alternative methods not used?

P. 10, L. 3: how independent are the in situ data when some have been used for calibration? This needs to be clarified.

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P. 10, L. 11ff: The reason for larger variability in GPS daily soil moisture estimates could be found in the different locations observed. During satellite overpasses the observed location moves within the larger “footprint” of the GNSS system.

P. 11, L. 12: What is the reason for using a curve smoothing procedure? What are the reasons for the levelling effect?

P. 12, L. 22ff: The authors could show the retrieval of a soil wetness index and relate it to in situ soil moisture by multiplying it to porosity (from in situ measurements or soil maps).

P. 13, L. 11: these

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