

Interactive comment on “An algorithm for generating soil moisture and snow depth maps from microwave spaceborne radiometers: Hydroalgo” by E. Santi et al.

E. Santi et al.

s.paloscia@ifac.cnr.it

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The authors present a new algorithm based on artificial neural networks (ANN) for retrieving soil moisture as well as snow depth from passive microwave observations. Thereby they present an alternative for the currently available global soil moisture products from spaceborne radiometers, which highly desirable since differently algorithms may have different sources of uncertainty. The authors adopt a rigorous approach for the development their HydroAlgo based upon an enormous data set and validate it again with another independent. The manuscript is very well written and true plea-

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sure to read. I would, therefore, recommend to publish the manuscript in HESS after consideration of a few comments.

A: we are grateful to the referee for his/her very positive comments concerning our paper. We will revise the paper according to the following comments.

One of these comments is, if the authors truly intend to present an alternative to for example the LPRM for soil moisture and others for snow depth, then I would recommend the authors to include also these products in their validation.

A: some examples of the comparison between the products (soil moisture and snow depth) derived from our and other available algorithms have been carried out and will be included in the paper.

The other major comment is that the authors can improve the quality of the figures, especially the maps. Fig. 13 and Fig 15 have a continuous color scale, while the Fig.12 and 14 have discrete color scale. It would be nice to see some consistency in this perspective and I would prefer the usage of a continuous scale. Further I note that the authors have made use MS Excel for the scatter plots and time series plots. Perhaps the authors could also see an opportunity to create these plots with more professional software that make it possible to better define the time scale.

A: the referee is right: the quality of the figures is not very good and we will improve them. The discrete color scale will be replaced with a continuous color scale for all figures.

Minor general comments/questions: - A question is on how they would like to name their algorithm? Is Hydroalgo an abbreviation of Hydrology Algorithm or something else? This is not clear to me. Perhaps the authors would like to consider this because ones it is written is it so.

A: The name HydroAlgo is an abbreviation for Algorithm for Hydrological purposes (or for Hydrology). This has been better specified in the text and the abbreviation

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HydroAlgo will be checked.

- The authors express soil moisture in $\text{cm}^3 \text{cm}^{-3}$, while I believe that nowadays $\text{m}^3 \text{m}^{-3}$ is preferred.

A: the SMC has been expressed in m^3/m^3 , now.

- Please refer on P3863 L2 to the explanation on why the V polarization is used for retrieving soil moisture.

A: since the explanation about the choice of V pol. instead of H pol. is given on P3865 (L23-26) and P3866 (L1-8), we preferred to skip the words “at V polarization” on P3863

- P3863: Essentially, HydroAlgo does not only use TbV at C-band. It also uses the Pix for masking vegetation and TbV at Q-band for normalized the diurnal and seasonal variations. I think that especially the latter should also be made clear.

A: On P3864 there is a wide description on the use of PIX, which has been used not only for masking densely vegetated areas but even ‘to estimate the vegetation optical depth and to identify different levels of biomass’, and thus correcting the effect of low vegetation on the SMC estimate. TbV at Ka band (37 GHz) is used to normalize Tb for surface temperature variations. This has been better specified in the text and the following sentence has been added along with two references: “The brightness temperature at Ka-band, V polarization, used to normalize for the daily and seasonal variation of the surface temperature, due to its strong relationship with the latter parameter (Owe and Van De Griend, 2001 and Paloscia et al. 2006)”.

- P3865L1: The authors refer Jackson et al. (2004) for the relationship between NDVI and VWC, but Jackson et al. developed this relationship for corn and soybean vegetation in Iowa (USA). I am not sure whether this relationship is directly transferable to other regions and other vegetation type. Please provide a reference that supports this or just mention it with a justification of this assumption.

A: The authors already used the relationship found by Jackson between NDVI and VWC

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for other types of vegetation and they found that it is valid for other types of vegetation too, by using data from their archives (Paloscia, S., Pettinato, S., Santi, E., Pierdicca, N., Pulvirenti, L., Notarnicola, C., Pace, G., Reppucci, A., “Soil moisture mapping using Sentinel 1 images: The proposed approach and its preliminary validation carried out in view of an operational product”. Proc. of SPIE Remote Sensing conference 8179 on SAR Image Analysis, Modeling, and Techniques XI; Prague; 21-22 September 2011; 817904).

- P3867-3871: The vegetation component of the Radiative Transfer simulations is very well described, but it is not clear how the authors treated the surface roughness.

A: the effect of surface roughness is included in the ANN, which has been trained with a dataset containing values of T_b corresponding to different surface roughness conditions.

- P3870L11: I think that the units should be $m^3 m^{-3}$ or $cm^3 cm^{-3}$ and not %

A: the units have been changed in m^3/m^3

- P3873: I find the validation of the soil moisture the weakest part of the manuscript. I see that the authors presented the nine measurements and retrievals in a table, but aren't there nowadays more soil moisture measurements available for validation. For example from the US or from the Soil Moisture Data Bank. It would be nice if the authors could come with more.

A: we agree with the referee that indeed the soil moisture validation is weak, due to the scarcity of available ground truth on large scale. We could perform some more in-depth validation using AMSR-E data compared with the ground data of the experimental watersheds of the Agricultural Research Service (ARS), kindly provided by Dr. Tom Jackson.

- In the conclusions: I would start with 'A new algorithm' instead of 'An innovative algorithm' because one can always argue the innovative part. As is said in the introduction

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ANNs have been used for both soil moisture and snow depth retrieval many time before.

A: the referee is right and then the sentence has been modified accordingly.

- Fig 2 caption. Please highlight that the PWC is estimated using the relationship of Jackson et al.

A: the reference to Jackson et al. has been added to the figure caption

- Fig 7, the units of soil moisture are missing and the scale should be consist with the units $\text{cm}^3 \text{ cm}^{-3}$ or $\text{m}^3 \text{ m}^{-3}$ used earlier. This comment is also applicable to the other figures.

A: the units of soil moisture have been better specified and unified everywhere in m^3/m^3

- Fig 9, some text has fallen of the x-axis

A: Fig.9 has been modified. The modified version of the paper will be submitted as soon as possible

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