

Answer to Referee No 2

1) As the reviewer mentioned, several studies have been published in the past. However, until now, there is no universal and perfect method for soil moisture and soil surface roughness estimation. The presented algorithm can be considered as a new study with ability to improve the accuracy of the results at least for study areas.

In the manuscript, some of the previous studies with a direct impact on this work were discussed, however in the revised manuscript some references were added according to the reviewer's comments. In addition we tried to apply the reviewer comments.

2) In general this is a practical limitation of the proposed algorithm. This limitation was discussed in conclusion section of the first version. Moreover, more discussion has been added in Results and Discussion section in the revised version of the manuscript. However, this limitation cannot completely prevent the applicability of the algorithm. For instance the case study was realized over the worse study area on the score of neglect but for many other areas such as arid or semi-arid area this limitation has a negligible impact.

3) We tried to apply all mentioned comments.

Specific comments:

1. The requested corrections have been applied.

2. About the limitation a paragraph has been added. About data from the 12 November please see below (No 4).

3. The first two paragraphs were replaced and corrected.

3.1. One of the most important characteristic of the models is the validity range which was considered as the main characteristic for selection of the model. This point has been mentioned in the second paragraph of section 3.1.

The authors do not agree with this opinion that more recent version of the OM is the best and we should reject the original model.

We add some information about MDM in the revised manuscript.

IEM is one of the most applied models. However, this model, such as the other models, has a validity range. This model can be applied for smooth to medium roughness surface (for instance $ks < 3$ cm, for C band the condition is $s < 2.7$ cm). The surface of our study area is very rough therefore; we cannot use the IEM in this study. In fact, only theoretical model that can be used in this study is GOM. This fact also is more discussed in the revised version of the manuscript.

The equation 3 is correct.

4. For GOM, as mentioned in inversion methods section, three images were used. The subsection 4.1 was revised.

5. It is correct that dielectric constant depends on the frequency however, the error introduced by the difference frequency between calculated dielectric constant from images and Tetaprobe is negligible. This fact was also approved by comparing soil moisture in-situ and laboratory measurement. This is mentioned in the 4th paragraph of Study site and data description section.

The results have been presented in both dielectric constant and soil moisture content. Figures 3-5 have been illustrated based on soil moisture content.

- *Page 218 Line 7:* As there is no correlation length for the other models and the aim of this section is to compare the results of soil moisture and rms height, adding the correlation length graph, wouldn't help the readers to have a good conclusion about the comparison.

- *Page 218 Line 10:* The phrase has been revised

- *Page 218 Line 15:* The phrase has been revised

- *Page 218 Line 20:* The difference between two incidence angles and its influence of backscattering coefficient is an important subject which calls for another deep and complete study. For instance when θ is shallow (near to 10), dielectric constant is dominated and practically the signal information is about this parameter however the signal should contain the information about both soil roughness and soil moisture in this approach. In this paper we have presented the algorithm and some sources of errors. The exact analysis of each error including the mentioned point is out of scope of this paper and should be presented in separate paper.

- *Page 218 about Figure 9:* The requested phrase was added.

- *Page 219 Line 10-15:* To be more clear the phrase has been revised and some references have been added.

- *Page 219 Line 18:* The variation of bare soil in agriculture area varies particularly when the soil is wet. In the SAR images the variation of pixel values is considerable. The averaging reduces the speckle and uncertainty of pixel sampling but as standard deviation of pixel values is height, the averaging operational decreases the accuracy. However for respecting the viewer point of view, this phrase was removed.

- *Page 219 Line 21:* As mentioned previously, we have presented the algorithm as well as some sources of errors and this kind of detailed analysis is out of scope of this paper and should be presented in separate paper.

5.2. Working on field scale is another way, but because of high variation in soil moisture, we can not conclude that the field scale is better way than homogenous

zone. Based on the geographical discrimination the field might be the best way, however, we believe that the homogenous way is based on the signal behavior and generally has an acceptable accuracy. For pixel by pixel maps, as we measured the exact coordinate of field measurement by using GPS, then the pixel by pixel measurement in general is correct. However it is possible that few control points was infected by speckle but the majority of the control points are correct.

Page 220 Line 13: The results of all maps were compared with the control points obtained by in-situ measurements. Some explanations about the maps and the influence of the filters were added.

6. The comments have been considered by adding, deleting and changing several parts of conclusion.