Multi-scale estimation of surface moisture in a semi-arid region using ENVISAT ASAR radar data, Zribi, et al., 2010

The study presents two independent methods for soil moisture estimation over two land cover types in Tunisia - non-irrigated olive trees and irrigated wheat fields. The laborious work should be appreciated that included a) collection of in-situ data on the Tunisian site (roughness, surface moisture, and different vegetation measures), b) processing of several sources of satellite data (SPOT, SAR, SRTM) and c) development of algorithms.

I am convinced that below suggested changes can significantly improve the quality of the paper:

Major comments:

➢ Abstract – can you please shortly discuss what novelties your research brings into the soil moisture research and how can your results be used in future research.
➢ The method section prevails over results and discussions. I would recommend reducing the methods and adding section where the results and their significance will be discussed.
➢ Similar study has been published by the author in IJoRS in 2006 "Soil moisture mapping based on ASAR/ENVISAT radar data over a Sahelian region". To avoid any further discussions I suggest adding a section in the introduction that would summarize results of previous study and connection to current study.
➢ Page 8064, line 10: "..two-dimensional estimation of soil moisture…" the methods seem rather independent. What do you mean by the two-dimensionality?
➢ The methodology section needs reductions and changes that would ease its understanding: i.e. a) bring discussion about comparisons between the two methods; where are the differences, where are the similarities, b) improve notations, c) the names of the methodology section do not fully express their content (..mapping of soil moisture..), d) enhance where validation is performed..e) do not discuss methods if citations can be used.
➢ Were all in-situ stations used for calibration of the model and then for consequent validation?

Minor comments

1) Page 8046, line 15, "based on the reduction of a large database.." What do you mean by that?
2) Page 8047, line 15-27, You provided an overview of current research. But can you explain how does your work fall within this recent development?
3) Page 8048, line 3, "we propose a …" Some of the studies you presented also proposed a methodology for SAR. This sentence feels as if the SAR is a novelty in this paper.
4) Page 8050, line 22, Can you better describe (or provide a graphic) the setting of the measurements (location and distance between measurements)?
5) Page 8054, line 15, you said you consider the influence of the vegetation on the radar signal as negligible, but the Alfa is dependant on C and attenuation due to the olive trees. Please explain.
6) Page 8054, line 11, "we make assumption" I would suggest further discussion on possibly introduced errors by this assumption
7) Page 8054, line 25, "defining.." How? At what scale? Refer to a further section if needed
8) Page 8055, line 4, did you perform second normalization?
9) The approach used in 3.1.2 reminds classical change detection approach; in that case I would suggest adding appropriate citations.
10) Page 8056, line 16, You concluded that he backscatter is a function of soil moisture differences. The graphic 6 however represents the backscatter differences as a function of soil moisture. Please explain.

11) Page 8056, line 16, The final formula in graphic 6 presents intercept (constant) and slope in the linear relationship, the intercept should thus be included in the equation 5 and 6

12) Page 8057, line 9, "The accuracy of this outcome demonstrates.." As I understood the accuracy was computed between in-situ stations and satellite data after the same in-situ data were used for model calibration. This applies also on the algorithm over wheat. Please comment.

13) Page 8057, line 11 "It's thus possible".. the effect of vegetation is still incorporated in the Alfa parameter. How do you guarantee that application of the model over different spacing or different kind of olive trees will be successful?

14) Page 8058, line 15, "in order to eliminate the effects of local.." at the beginning of the paper you say that the goal is to use high resolution SAR to monitor strongly localized phenomena why do you want to average?

15) Page 8060, line 16.. should that be Ex. 8?

16) Page 8061, line 9, explain all parameters in the equation

17) Section 3.2.3 can be shortened