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Hydrology and Earth System Sciences Discussions

Interactive comment on "Effective roughness modelling as a tool for soil moisture retrieval from C- and L-band SAR" *by* H. Lievens et al.

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Estimation of soil moisture from radar signal needs details about roughness parameters. This is generally complicated particularly if measurements are realized with one radar configuration. In this paper, authors propose an original approach considering effective roughness parameters and IEM model to estimate soil moisture without needed information about roughness. This could be useful particularly for one-configuration data. However, some aspects need further clarifications. They are indicated below:

1) Page 5003: Authors write: "Effective RMS heights are obtained by setting the correlation length to a certain fixed value. As an example, Fig. 3 shows a box plot of the obtained RMS heights for l=10 cm per study site according to the index in Table 1. This figure illustrates that seff is consistently larger at L-band (sites 12–15) than at C-band (sites 1–11), which may be attributed to a failure of the IEM in describing surface roughness as a scale-dependent phenomenon rather than to large in situ differences in roughness, since all fields were relatively smooth and tilled using similar machinery". It is important to note also, that IEM model shows generally good coherence with radar data in L band (Zribi et al., 1997 for example). In C band, we observe generally an over-estimation of simulation to real data. If we consider effective parameters, you will necessary decrease model level in C band and therefore decrease roughness value comparing to those of L band. This could be one reason of this difference that is particularly due to IEM validity. 2) Authors propose an explanation for difference between correlations in results illustrated in figure 1. However, there are two other reasons that could be added. The number of points is not the same, particularly for figure (c), and second, variation is difference between data with different incidence angles. In fact this could induce more or less roughness effect on radar signal. For example, we know that rows could induce high variation in low incidence angles. 3) Authors choose Lambert's law to describe normalisation to a reference incidence angle. This is perhaps valuable for a Gaussian surface (the minority of rough surfaces), but not necessary for the other surface types (particularly exponential), why authors choose to limit this relationship to Lamber's law. 4) Authors select rms height equal to 1 and 2 cm for C and L band. Is it possible to select more precise parameters, based on IEM simulations? 5) Page 5000: Authors write: "To minimise the effect of the wheat vegetation, only the first three and last two acquisitions are used in this study. During these acquisitions, the vegetation was characterised by a low volumetric plant water content (VWC<1.7 kgm-2 which is often reported as being the driving factor for direct canopy backscatter (e.g., Attema and Ulaby, 1978; Bindlish and Barros, 2001)." Authors use only IEM model, what about vegetation effect on radar signal, particularly for high incidence angles. In

fact, VWC=1.7Kgm-2 is not very weak as level. It corresponds to probably more than 20cm for wheat height. Do authors try to validate this hypothesis? 6) What about roughness parameters for three data base. Authors illustrate results of correlation between moisture and radar signal. It could be important to discuss effect of roughness in the relationship between moisture and radar signal. Authors could add roughness interval (rms height, correlation length) in Table 1. 7) In conclusion, authors write: "As a consequence of these large differences, one should be cautious when applying a multi-frequency approach for the retrieval of surface parameters from SAR." Change of roughness between L and C band is due to validity of IEM model and not to the use of multi-frequency data. So, if we consider other approach than IEM model, I don't see why we can have a problem of roughness definition. Off course, the effect of roughness is not the same for L and C band.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 4995, 2010.