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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Soil dielectric characterization at L-band microwave frequencies during freeze-thaw transitions" *by* Alex Mavrovic et al.

Anonymous Referee #3

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Review of the manuscript "Soil dielectric characterization at L-band microwave frequencies during freeze-thaw transitions" by Mavrovic et al.

The manuscript presents interesting measurements of soil permittivity at L-band during the freeze-thaw cycles. Results are compared with two commonly used models (Mironov's model and Zhang's model) and hysteresis effects are observed especially for the fast freeze/thaw transitions. The reviewer found these experimental results are valuable and suggests to accept it for publication after addressing the following concerns.

Lines 63-64: Not only for L-band, higher frequencies are also able to retrieve the land-

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Discussion paper

scape freeze/thaw state. (e.g. Zuerndorfer et al., 1990; Judge et al., 1997; and Zhao et al., 2011). And if possible, future measurements could be extended to higher frequencies, which is important to retrieve snow properties and soil properties under the snow. Please refer to: Zuerndorfer, B. W., England, A. W., Dobson, M. C., & Ulaby, F. T. (1990). Mapping freeze/thaw boundaries with SMMR data. Agricultural and Forest Meteorology, 52(1-2), 199-225. Judge, J., Galantowicz, J. F., England, A. W., & Dahl, P. (1997). Freeze/thaw classification for prairie soils using SSM/I radiobrightnesses. IEEE Transactions on Geoscience and Remote Sensing, 35(4), 827-832. Zhao, T., Zhang, L., Jiang, L., Zhao, S., Chai, L., & Jin, R. (2011). A new soil freeze/thaw discriminant algorithm using AMSRâĂŘE passive microwave imagery. Hydrological Processes, 25(11), 1704-1716.

Lines 125: Would it cause uncertainties of measurement when applying different pressures to the soil with the OECP probe?

Lines 248: How are the data points selected for Figure 9, as there are many measurements as shown from Figure 5 to 8. The challenge is how to well model the soil permittivity during the freeze-thaw transitions, and data points during the freezing/thawing period should be included.

Figure 9: please specify those numbers are for RMSE in the figure.

Lines 290: It is very interesting that the hysteresis effects were observed during the permittivity measurement. As mentioned below by the authors, an empirical approach could be used by implementing a double threshold. It is suggested to do so to discuss the improvement of the model performance compared with results from Figure 9.

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