Dear referee #1

Thanks for your pertinent comment of our paper-"Extension of the Hapke bidirectional reflectance model to retrieve soil water content".

(1) - p. 3668, line 20, "data remains largely unavailable": it would be good to elaborate a little, e.g. sparse in-situ measurement networks.

Reply: We agree with your comment. The sentence of "data remains largely unavailable" was replaced by" sparse in-situ measurement networks".

(2) p. 3670, line 2, "the radiation transfer theory": might want to change that to "radiative transfer theory".

Reply: We agree with your comment. The sentence of "the radiation transfer theory" was replaced by" radiative transfer theory".

(3) - p. 3670, line 6, "...to study physical properties of the soil.": reference?

Reply: references were listed follow sentences, respectively.

(4)p. 3675, line 8: adding a short description of Powell's method would be beneficial.

Reply: We agree with your comment. A short description of Powell's method insert" Powell's method, strictly Powell's conjugate gradient descent method, is an algorithm proposed by Michael J. D. Powell for finding a local minimum of a function. The function need not be differentiable, and no derivatives are taken(Matlab, 2000)".

(5) - p. 3675, line 26: consider adding a list of symbols in an appendix; it would be very helpful for the calibration section of the paper.

Reply: We agree with your comment. An appendix was added.

APPENDIX

Variable	Designation
Incident solar zenith angle(deg)	θ_s
Sensor observation zenith angle(deg)	θ_o
Relative azimuth between the sun and the observation direction(deg)	ϕ
Single scattering albedo of soil	ω
Scattering phase function	$P(g)$
Coefficients of the scattering phase function	b, c, b' and c'
Backward scattering function	$B(g)$
Hot spot effect factor	B_0
Soil roughness (cm)	h
Equivalent water thickness(cm)	ξ
Absorption coefficient of water(cm^{-1})	α

The double-hemisphere reflectance of wet soil	r_w
The sampling dry soil reflectance	r_0

(6) - p. 3678, lines 8-9, "...results of the SWAP-Hapke parameters and the RMSE distribution were based on simulated data": this is a bit confusing, weren't observations used to calculate the RMSEs?

Reply: Because we want to test parameters sensitivity of extension Hapke model, 40 sets of random errors of 5% as the test data to perform a sensitivity analysis by the ACA and Powell's Algorithm.

(7) - p. 3678, line 23: were the parameters estimated tested for robustness, i.e. would similar results be obtained if a subset of the measurements were used?

Reply: We agree with this comment. However, we consider this point before taking field measurements. Two sites listed in our paper actually represent normal soil condition and more drouthy soil condition, respectively. Therefore, test data is robust for estimation validation.

(8) - p. 3679, line 8: change "appearing in the" to "appearing in" if the symbol instead of the variable name is used.

Reply: We agree with this comment. change "appearing in the" to "appearing in".

(9)- p. 3679, lines 9-10, "the spatial variability of soil moisture distribution": add a "the" before "soil moisture". In addition,this conclusion begs the question (which is hinted at in the Conclusions section) of the applicability of the model to satellite-scale observations. Moreover, how could the presence of vegetation potentially impact the estimation? Obviously, these would not need detailed answers, but some perspective from the authors would be a valuable addition.

Reply: We agree with this comment. "the spatial variability of soil moisture distribution": add a "the" before "soil moisture".

(10) - p. 3680, line 4, "simulated and compared with the fourth set of multi-angle observation values": was this done with only once? That is, were the other three sets used interchangeably for the validation?

Reply: Actually, three optimal bands of the first three sets were used to estimate model parameters. The fourth set of multi-angle observation used to create BRF to validate the simulated BRF from the extension Hapke model based on aforementioned estimated parameters.

(11)- p. 3680, line 6: change "model simulated values" to "model-simulated values".

Reply: We agree with this comment. change "model simulated values" to "model-simulated values".

(12)- p. 3689, Fig. 2: make the green line thicker.

Reply: We agree with this comment.