Hydrology and
Earth System
Sciences

Open Access

Discussions

EGU

HESSD

Interactive
comment

Interactive comment on "Information – based uncertainty decomposition in dual channel microwave remote sensing of soil moisture" *by* Bonan Li and Stephen P. Good

Anonymous Referee #1

Received and published: 1 December 2020

General comment

This paper presents a performance analysis using information theory to better understand the characterisation potential of the data (TB) and the performance of the inversion algorithms (MCDA). To my knowledge it is a very original approach in the field of application which is targeted and the approach seems to be very relevant. As a naive reader with regard to the analysis method used, I had a little difficulty to follow the details of the calculation (some quantities would gain to be defined), but the essence of the method is well restored and allows a non-specialist reader to understand the approach. My main criticism lies in the scope of the data used to make the analysis.

[Printer-friendly version]

[Discussion paper]

Indeed, 58 data sets corresponding to 58 stations located in the USA are treated independently. It seems useful to me to recall that the MCDA method aims at exploiting the H and V polarisations in order to separate the reflectivity of the soil from the scattering phenomena linked to vegetation and roughness, the latter being represented by the difference between Tbh and Tbv. By working locally, the variability (humidity, vegetation) is only partially taken into account, taking into account only the annual variations which at the scale of a SMAP pixel present small variations. In fact, by limiting ourselves to a stationary analysis, we underestimate the interest of the MCDA algorithm which is applicable everywhere and allows an estimation of humidity whatever the vegetation cover. This leads to find that the quality of the estimates (here seen by the correlation coefficient between the moisture retrieved and the observed moisture) is all the better as the redundancy term is high, a criterion which is proposed for the following analysis of the quality of the algorithm. The interpretation of R could be better described in the material and method and in particular it is important to specify if a good model is characterized by large value of R, meaning that the model outputs and its input data are well interdependent. The largest R is probably found in low vegetation situations where the ranges of moisture and Tb are greatest. This is a known feature and it seems to me that the quality of the MCDA model is more in its ability to represent the diversity of ecosystems and the associated plant formations. Would it be possible to process a data set of all the stations?

Detailed Comments L85 I think that part of uncertainty is due to the scale of the pixel with mixed surface and in situ moisture that is sparsely sampled (here I think it is local measurement) while the moisture is stongly variable within the pixel.

Eq 5, I suggest to the equation I(TB H or V; Yobs) which is used In equations 7 and 8. It would help me to follow the text

Eq 9 : RMMI is not defined

L209 : an explanation how to interpret The quantity in the context of the study. A good

model should lead to high or low values of U, R and S. At least for S which is the most commented quantity;

L245 : I(h, v ; in situ)? rather than I(MCDA, insitu)

L245 and 247 : honestly i don't see where 0.88 and 0.12% come from. Not evident to see such values in Fig3

L251 : what are the fraction of model uncertainty

L261;263 : how I cand tale 0.55 of I

L264 Uv likely takes greater value if data from different sites are merged

L266:268: yes but at local scale only. Independence of H and V will be much stronger when different location with different ecosystem are taken into account

L279:280 : Interpretation of R should be better explained. I did not see interest of evaluating the quality of retrieval by taking the correlation between H and V into account. It is the negation of the MCDA model that takes the synergy of H and V. This synergy is expressed by taking different sites concurrently, staying at the local scale reducing the interest of having H and V

L303:304 : not only : see comment on L85

L312:315 : What are the parameter considered (tau is derived from H an V) here

L315:317 : speculative ? references

L332:332 : I am not you can say date. The correlation between H and V is well known, the expected ortogonality is more on V-H and H, that is expressed using various ecosystems. Here we are lacking interpretation key. But correlation between inputs does not means that inputs and output are redundant, which my understanding of R

L355 : making the analysis on individual station is a strong limitation, as MSDA capacity were not fully analysed

L358:361 : speculative (reference – difficult to understands without additional information)

L370 : I don't what is the HESS policy. It would be better to have codes in open repository

Figure 2 : remove MI in Y legend

Figure 7 d : the y axis of the embedded graph is not described. The interest of th H V correlation is really limited (see comment above). I suggest to remove it.

In conclusion beside the minor improvement suggested in my comment I expect the authors: 1) better defining the interpretation scheme of the R S and U quantity 2) extending the analyse to merged data set, or at least a subset gathering sites having contrasted ecosystems. This will give stronger overview of the MCDA models and its interes. This might have an impact on the discussion and conclusion.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-534, 2020.