

Interactive comment on “Soil water content evaluation considering time-invariant spatial pattern and space-variant temporal change” by W. Hu and B. C. Si

Anonymous Referee #1

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With pleasure I have read this manuscript which intends to evaluate soil water content while separating it into time-invariant spatial pattern, space-invariant temporal changes and space- and time-dependent redistribution term. The manuscript is written in a proper English but should be written in a more consistent way. The manuscript is carried out in a scientifically sound way and is built upon recent scientific studies (Mittelbach and Seneviratne, 2012) and have introduced a further investigation and separation of the time-varying component of soil moisture by applying the EOF-concept. However, by introducing this further separation, the paper have to be discussed more in detail and the consistency in the paper should be increased. I very much like the

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idea of further investigation of the time invariant component. However applying this to a small scale experiment lead not to surprising and new results. I therefore recommend major revisions.

One main part making the readiness of the paper difficult is the nomenclature. I understand that finding the write expressions is not easy for the complex description. But the authors build upon the paper by Mittelbach and Seneviratne, 2012, so I highly recommend to use the one introduced by Mittelbach and Seneviratne, 2012 – and to extend them with respect to the redistribution term (e.g. use $R_{n,t}$ instead of $S_r(l,j)$). This gives also the possibility to see the connection and extension to this study. For better readiness I suggest to change the nomenclature and adapt the formulas.

Reading the paper I associate the introduced S_r to depend on vegetation and meteorological and climate conditions, respectively. This made me very curious. However, by applying the concept to measurements at small scale (hydrological/land surface scale) and thus focusing on small scale processes results are too obvious and the innovativeness degrades. Applying the concept to a larger scale, soil properties and the respective static characteristics could most probably associated with the time-invariant spatial pattern. Thus it would be very interesting to apply the concept to larger scale or at least to soil moisture measurements across different land covers in order to identify the attribution due to vegetation and meteorological forcing. Furthermore, the difference between the “conventional EOF” and the “new method” is not really clear to me. Strengthen its added value.

Please add in the abstract that you apply your method to a small scale experiment. Please write, e.g. in the text, which periods are recharge or discharge periods. P12833: could you implement also other reasons than the soil hydrological processes for the redistribution term. Would vegetation and meteo conditions play a role if one investigate larger scales? P12836: I do not understand why “ ‘ ” is introduced here. What are the S' and the difference to previous variables? P 12839 Paragraph 2: how high are the correlations? Significance is important but needs to be connected with the correlation

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value. P12841 L 27:vegetation would be interesting to implement as indicator for variability. If measurement errors are included: they have to be removed for the analyses (!). P12842 L5: Please refer to respective figure P12845: 2nd paragraph is not written in an understandable way and confusing. Please rewrite. Figure 7: is the fit of relevance? Figures in general: (i) Please locate the a) and b) in a way more often used in scientific papers, i.e. in upper left corners. (ii) some label can be more describing. E.g what are wet and dry periods? Table 1: please use SWC and not SP for soil water content Table 1, 2: Both include a lot of numbers. For better overview I suggest to write only correlation e.g. $R > 5$ (as this is used by the authors in the text) and indicate, if they are significant.

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