Hydrol. Earth Syst. Sci. Discuss., 12, C3002–C3005, 2015
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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Estimating spatially distributed soil water content at small watershed scales based on decomposition of temporal anomaly and time stability analysis" *by* W. Hu and B. C. Si

Anonymous Referee #2

Received and published: 5 August 2015

Overview

The study describes a new approach (likely better "new concept") for investigating spatial-temporal variability of soil moisture at catchment scale. Specifically, the decomposition of spatiotemporal soil moisture patterns in three components was carried out: temporal mean, space-invariant temporal anomaly, and space-variant temporal anomaly. The new model (TA) was compared with the approach (SA) by *Perry and Nie-*

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mann (2007) who decomposed spatiotemporal soil moisture patterns into spatial mean and spatial anomaly. By using in situ observations from a transect in the Canadian Prairies, the authors obtained that TA model performs better than SA model, mainly in dry conditions in which the variability of the space-variant temporal anomaly is stronger.

General Comments

I found the paper well written, well-structured and clear. I also believe the topic is of interest for the readers of HESS as it describes a new concept for analysing spatiotemporal soil moisture patterns, based on new understanding of the different components driving soil moisture variability.

However, I believe that one aspect (method presentation) should be improved and I have two major comments to be addressed before the publication.

MINOR COMMENT: The method is well-written, but still quite complex to be understood. By using a soil moisture dataset I have collected, I tried to visualize the different components in a 2D plot (see e.g., *Fig. 1*). Hoping to be correct, from the figure it's easier for me to understand how the SA and TA models work. I believe that this kind of visualization will facilitate the readers.

MAJOR COMMENT: Only one study site is used to test the SA and TA models. Even though I am aware that the main purpose of the paper is the presentation of the "new concept" (TA model), I believe that the analysis for a different test site might be added. The dataset of the Canadian Prairies is quite famous (I have in mind at least 6 papers that makes use of this dataset), and the correlation between topographic and soil data with soil moisture for this dataset is well-know. I was wondering what could happens if a different dataset were employed (freely available or collected by the authors).

MAJOR COMMENT: In the last sentence of the abstract it reads that "the TA model has potential to construct a spatially distributed SWC at watershed scales from remote sensed SWC." Even though it is potentially true, I believe that the paper makes only

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a first (short) step toward this interesting application. Indeed, for building the SA and TA models, the whole (spatially distributed) soil moisture dataset is used in the study. Therefore, it was not demonstrated that TA (or SA) model provides good performance in reproducing spatial soil moisture pattern by using single measurements. At least, I suggest splitting the soil moisture dataset in a calibration and validation set. Otherwise, the models can be used only for understanding the different components driving soil moisture variability, not really as predictive tools (at least, it is not shown in the paper).

Moreover, it should be clarified how the authors believe to use the TA model to construct spatially distributed soil moisture from remote sensing observations.

As mentioned by the first reviewer, some polishing of the text should be given (e.g., at page 6481, line 19 it reads NSCE of 4.05 and it should be -4.05) but it can be easily accomplished by the authors through a careful rereading of the manuscript.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 6467, 2015.

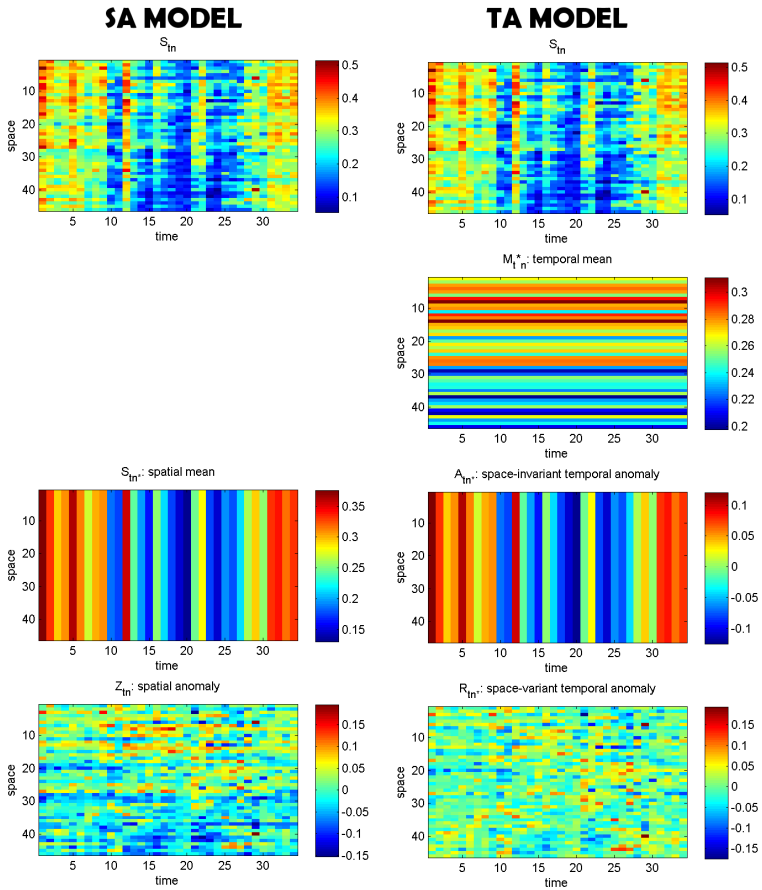

Fig. 1. Different components of SA and TA models

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