

## ***Interactive comment on “McMaster Mesonet soil moisture dataset: description and spatio-temporal variability analysis” by K. C. Kornelsen and P. Coulibaly***

### **Anonymous Referee #1**

Received and published: 10 January 2013

### **Overview**

The study describes the soil moisture dataset recorded by the McMaster Mesonet network in the Southern Ontario, Canada. The network is composed by 36 TDR probes continuously measuring volumetric soil moisture at different depths (10–100 cm) in four sites (9 probes per site) since autumn 2006. The description of the soil moisture dataset and some preliminary analyses on its spatial-temporal variability are shown in the paper.

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## General Comments

The paper is mostly well written and clear; the language is fluent and precise. The description of the soil moisture dataset and of the study area is almost clear. Notwithstanding the technical character of the manuscript, the topic is definitely of interest for the HESS readers. In fact, the soil moisture dataset described in the paper is characterized by high temporal resolution (hourly) and a good accuracy. Moreover, the data are freely available and this is highly relevant as no other similar dataset is nowadays available in Canada, and only a few in high-latitude regions.

However, I found some issues in the description of the dataset (some of them reported in the Specific Comments) and, mainly, in the presentation of the preliminary results that should be addressed before the publication.

### 1) DATA DESCRIPTION

I found quite surprising that the authors refer to four sites. In fact, two sites (i.e., Kelso 1 and Kelso 2) are located in the same hillslope and I do not understand why they are considered separately in the paper. Can the authors add the explanation for that?

Moreover, it is not clear to me if the network is aimed at monitoring soil moisture for the whole basin (Hamilton-Halton Watershed) that has a drainage area of 1250 km<sup>2</sup>. Likely, the spatial representativeness of the three sites could be limited, even though the soil moisture temporal stability properties might allow the upscaling of the measurements. This is an interesting point that might be analyzed in further studies. However, I suggest adding a discussion on these aspects also in the present paper.

I expect that frozen and snow conditions usually occur in the study area during the winter season. This has a significant impact on the accuracy and reliability of in situ soil moisture measurements but no mentioning is made in the paper. I believe this is an important aspect that has to be better analyzed.

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## 2) RESULTS

In the "Results" section, the statistical and temporal stability analyses of the measured soil moisture dataset is carried out. However, the description is difficult to be followed. In my opinion, too much emphasis is given in describing the behaviour at single stations for single storm events (e.g. at pages 14012 and 14013-14014). I am lost in the analysis of GR site where the behaviour of each single location is investigated. The same in the analysis for the single storm events where the change in the rankings between locations should be analyzed. I am not saying that these analyses should be removed, but synthesized for giving space to the analysis of the overall dataset (neglected in the current version of the paper).

For instance, it would be interesting to visualize the relationship between spatial variability (variance or standard deviation) and mean soil moisture at different sites and depths. This is shown in Figure 6 but it is difficult to be seen. The same applies for the temporal stability analysis, the classical figure of the relative differences might be included. In fact, this data set could provide further insights for understanding the soil moisture temporal stability in a "new" (with respect to previous studies) climatic region (see the recent review paper by *Vanderlinden et al. (2012)*). I am aware that many papers have the same figures and analysis, but it is fundamental for this type of works the intercomparison of the results that can be easily done if some "standardization" is made (e.g. *Brocca et al. (2007)*, also cited in the paper).

On this basis, I find that the paper may become worthy of publication on HESS after a moderate revision.

### **Specific Comments/ Technical Corrections (P: page, L: line or lines)**

P14004, L4-5: Some further information on the measured weather parameters might be added. For instance, are water level and discharge data available in the catchment? This could be of interest for the combined use of soil moisture and runoff data from

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hydrologists. Are snowfall and snow height measured?

P14004, L15: It is not clear if Stevens Hydra Probes are installed for each TDR probe at K1. Please specify.

P14004, L17: It would be interesting to see at the comparison between gravimetric and TDR soil moisture measurements to evaluate the accuracy of the data.

P14006, L7: In Equation (5) it should be  $\overline{\theta_{ij}}$  (as in equation (2)).

P14006, L18: Should be  $\delta_{ijk}$  (not  $\delta_{jk}$ ) at station  $i$ , at depth  $j$  and time  $k$ .

P14007, L15: Tables 1 and 3 are hard to read. Probably it would be better to visualize the data in a figure.

P14007, L21: Change "deep soil" with "wet soil"?

P14007, L23: Should be Table 1.

P14008, L11-13: This sentence is not clear here, please explain better.

P14009, L2-3: The higher spatial variability in the "no-transition" periods is hard to be seen (see General Comments).

P14013, L10-...: This analysis is very hard to be followed.

Figures: Some figures need improvements. The labels in most of them are too small. For instance, it will be very difficult to see figure 7 labels and details also in the published version.

### Additional Reference

Brocca, L., Morbidelli, R., Melone, F., Moramarco, T. (2007). Soil moisture spatial variability in experimental areas of central Italy. *Journal of Hydrology*, 333 (2-4), 356-373.

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Vanderlinden, K., Vereecken, H., Hardelauf, H., Herbs, M., Martínez, G., Cosh, M.H., Pachepsky, Y.A. (2012). Temporal stability of soil water contents: a review of data and analyses. *Vadose Zone Journal*, 11(4), doi: 10.2136/vzj2011.0178.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 13995, 2012.

**HESD**

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