

Interactive comment Richard de Jeu, Received and published: 31 March 2011

With great interest I read your paper on the international soil moisture network. This is indeed not a typical research paper (as indicated by the editor) but a very important initiative that can also serve as a great example for other communities. Soil moisture is considered one of the key parameters in land atmosphere interactions and the described uniform in situ network could help us to increase our understanding in this field of research. The paper is well written and fits well within this journal. I recommend this paper for publication in HESS after minor revisions.

Personally I think the paper would be improved if it would have a more thorough review on available soil moisture measuring techniques and sites. For example in the past numerous scientists have used tensiometers or heat dissipation sensors to derive soil moisture. A small section on these common techniques in the second section would be appropriate. In addition I think the authors might overlooked some public available soil moisture datasets from big meteorological campaigns (e.g. Botswana experiment, BARC soil moisture dataset, HAPEX Sahel, EFEDA, FIFE) but this might be some work that needs to be done in the near future. Overall I think this paper is a great addition for HESS.

We would like the reviewer for his constructive feedback. We will include all the suggestions in the reviewed version of the manuscript. The issues raised above will be addressed in the following.

Details:

Page 1613, from a historical perspective the BARC soil moisture datasets (Wang et al., 1980) are very important because the BARC campaigns were one of the first field experiments with field soil moisture measurements and remote sensing observations. I think these experiments should be mentioned in this paper because the BARC sets were as well one of the first datasets that became publicly available and triggered many researchers to study the ability to retrieve soil moisture from space observations.

Furthermore, in the eighties/nineties different meteorological field campaigns also acknowledged the importance of soil moisture and soil moisture was measured at several locations. For example a lot of the pioneer work in soil moisture is based on soil moisture datasets from Botswana (obtained from a long term meteorological campaign (Van de Griend et al., 1989). The same holds for other campaigns including HAPEX SAHEL, EFEDA and FIFE. Most soil moisture data from these campaigns are still available and I personally think that it would be great if these sets would be added too in the ISMN in the near future.

In the respective section we included following paragraph: "Of great historical importance were the soil moisture field experiments performed at the Beltsville Agricultural Research Center (BARC) where for one the first times remote sensing measurements were coupled with field observations (Wang et al., 1980). Being one of the first datasets publicly available, the BARC datasets triggered many researchers to study the ability of retrieving soil moisture from space observations. Other historically important experiments include the Botswana experiment (Van De Griend et al., 1989), HAPEX-Sahel (Prince et al., 1995), EFEDA (Braud et al., 1993), FIFE (Peck and Hope, 1995), and the soil moisture experiments coordinated by the United States Department of Agriculture (e.g. Jackson et al., 2002)."

We agree with the reviewer that assimilating these campaign datasets in the ISMN would be of great interest to the scientific community. However, at this moment highest priority is given to recent data sets (in view of satellite validation) and stations providing long time series (for climate research).

Page 1618 Frequency domain reflectometry (FDR) is very sensitive to temperature fluctuations. And need besides a gravimetric correction also a *temperature corrections*. *In this paper it is not entirely clear how you deal with data quality. I would suggest to add a discussion on data quality (this is also indicated by the previous reviewer).*

Concerning FDR, the following sentence will be added: "On the other hand, FDR is sensitive to temperature fluctuations and ideally would need to be corrected for these."

Regarding the data quality issue: we will shift Section "2.2.5 Further considerations" to the discussion section and extend this with a general discussion on data quality (see comments reviewer 1). A more in-depth study and characterization of data quality of the various stations is currently topic of research within the operations phase.

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Please add a section on tensiometers and heat pulse sensors. Although both sensors measure different parameters (tensiometer, measures the soil tension, and the heat pulse measures the thermal behavior of the soil) both are still often used to derive soil moisture. For example in the nineties heat dissipation soil moisture sensors were installed in the Oklahoma soil moisture Monitoring network.

To address this issue, we will include an extra paragraph dedicated to other indirect techniques:

"2.2.5 Other indirect techniques

Tensiometers and electrical resistance blocks are capable of measuring the matric potential of soil water, which is directly related to the ability of plants to extract water from soil. However, each instrument has a limited accessible water potential range. Tensiometers work well only in wet soils, whereas resistance blocks (mostly made of gypsum) do better in moderately dry soils (WMO8, 2008). Keeping in mind these known limitations they are sufficiently reliable and inexpensive. However, tensiometers are relatively service intensive and sensitive to temperature fluctuations while resistance blocks need careful (re-)calibration during longer operation periods. Both sensor types are frequently used for agricultural purposes. A detailed description of these methods can be found in (WMO8, 2008).

Heat dissipation (or pulse) sensors measure temperature changes in response to a heat pulse (Robock et al., 2000). It makes use of the principle that the thermal behavior of the soil is closely related to its water content. Other indirect soil moisture measurement techniques include gamma densitometry (based on the relatively greater gamma radiation attenuation factor of water compared to other soil components) and psychrometers. All these indirect techniques need to be recalibrated with gravimetric samples."

Page 1621 line 18

The design.... consultation with data providers... How did you do this? Did you send a questionnaire or did you interview the users? And what were the key results. I think this is important information, especially for other research communities who want to set up a network for other observations. Please explain in a bit more in detail how you obtained information from the user community.

We will clarify our approach in more detail by adding the following paragraph: "The design and content of the database was established after inventorying potential contributing networks, expected soil moisture and other datasets, possible users, and standards for hydrometeorological and spatial data and metadata (Section 3.2.4). Thus, an overview of expected database entries, data volumes, and data traffic could be established. A prototype

of the data hosting facility was first tested with a selected number of users and data providers and, wherever feasible, modified to their suggestions.”

Page 1631 line 19 RUSWET-GRASS instead of RIUSWET

Corrected

Page 1636 Soil moisture dynamics can have a large impact on the global carbon cycle (see for example the study on the carbon impact of drought over Europe Ciais et al., 2008) and our understanding on the relationship between (rootzone) soil moisture and carbon fluxes is still limited (Van der Molen et al., 2011). I would suggest to add a few words on the importance of soil moisture for studies on biogeochemical cycles

At the end of section 5 we will include following sentences: “Moreover, there is a proven strong relationship between soil moisture and the biogeochemical cycles (e.g. Ciais et al., 2005) while, at the same time, our knowledge on how this interaction exactly takes place is still very limited (van der Molen et al., in press). The ISMN may help to gain further inside in this process.”

References

Ciais et al., European wide reduction in primary productivity caused by heat and drought in 2003, Nature, 0028-0036, 4377058, 529-533, 2008

Van de Griend, M Owe, HF Vugts, SD Prince, Water and surface energy balance modeling in Botswana, Bull. of the American Met. Soc., 70, 1404-1411, 1989

Van der Molen, et al., Drought and Ecosystem carbon cycling, Agriculture and Forest Meteorology, in press, 2011

Wang, et al., Remote Measurements of soil moisture by microwave radiometers at BARC test site, Tech. Rep. TM-80720, NASA GSFC, 1980