Anonymous Referee #1

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This paper presents a new soil moisture data base used as a centralised data hosting facilities where soil moisture measurements from different soil moisture networks and validation campaigns around the world are gathered and harmonised, it is called the International Soil Moisture Network (ISMN). In this way, data are made available to users in a unique format which is easier to handle for scientific purposes. The paper is well written, well structured and clear. The title clearly describes the contents of the paper. The abstract provides a concise and complete summary and the reference list is appropriate (but should be enlarged). The presentation is clear and the language is fluent and precise.

While the article is not a 'Research Article' but mostly a description paper, it is certainly useful to the scientific community and deserves publication. This is an interesting paper which is within the scope of HESS.

I recommend this paper for publication. However, I do have a couple of comments that should be considered prior to publication, mainly to increase its relevance. On one hand, the different datasets mentioned in this paper are already published, on the other hand, gathering them into a unique data base to make them available is such a important and valuable effort that it needs to be known by the scientific community.

Dear reviewer, thanks for your positive and constructive feedback. Indeed, many datasets have been published before. Nevertheless, this study is the first known initiative that harmonizes to a large extent historic and current in-situ soil moisture measurements. Given the different nature of the datasets, the measurement techniques adopted, and the data manipulations required for harmonization, we consider it appropriate to summarize again all datasets in a consistent manner.

It should be noticed however that not all datasets were published before (e.g. CALABRIA). In addition, the ISMN is the only access to many of the datasets (e.g. CALABRIA, CAMPANIA, CNR-IRPI, SMOSMANIA, all datasets formerly contained in the Global Soil Moisture Data Bank), so we think that a short description of all networks contained is appropriate here.

Some information is redundant and the description of the different data set available so fare in the ISMN could have been more detailed (or at least described in a similar way).

The description of the various networks will be made more consistent. Redundant information (which is already listed in the tables) will be removed from the description. See also below.

One omission in the paper is the lack of discussion about the quality and the use of the different datasets, in this way the use of more references about them is a prerequisite e.g., bibliography on the use of the mentioned datasets is missing, for what purpose the different soil moisture networks were developed? Example of their use could be added and will add more interest for the paper, also.

For each network we will include the most important studies that have made use of the data. For the recent networks this list may be almost exhaustive, whereas for the datasets that were formerly contained in the Global Sol Moisture Data Bank, the studies based on these datasets are so numerous that we only provide a small selection of references covering the various applications. In addition, for every network we will provide details on the initial purpose of the network so that the user can better judge the quality of datasets and the usability for his/her application.

The relative quality of the data sets is something that still needs to be studied in more detail. Quality control is one of the major focuses of the Operational Phase (ESA ESTEC Contract No.4000102722/10). which is currently being performed. Results of this analysis will be published in a future study. Nevertheless, a few remarks on the quality of the datasets will be added to the discussion section (based on the Section 2.2.5 "Further considerations" *section listed below).*

P. 1616, L.22 : Most of the measuring methods do not directly measure soil moisture (as you mentioned in section 2.2), which is obtained through model inversion or calibration curves (e.g. a Theta probe will provide a signal in units of volt and its variation is virtually proportional to change in the soil moisture). Hence, could you please replace "[. . .] measure only soil moisture in [...]" by "[. . .] sample only soil moisture in [...]".

This is a very concise observation made by the reviewer. We changed the text accordingly.

P. 1619-1621 : Section 2.2.5 "Further considerations" should be moved to the discussion part.

This section will be moved the discussion part and extended with some general remarks concerning the quality of the data:

"5.2 *Considerations on data representativeness and quality*

The appropriateness of one or more soil moisture datasets from the ISMN for a specific application strongly depends on the spatial and temporal scales of the in-situ measurements and of the process that the user wishes to describe. For example, if the aim is to validate satellite-derived surface soil moisture, the user should be aware that these products contain information only about the upper few millimeters to centimeters of the soil column, whereas a technique based on cosmic-ray neutrons provides information up to a depth of ~70 cm. On the other hand, the latter provides estimates that are spatially more consistent than single electromagnetic devices or gravimetric measurements.

Apart from the choice of the measurement technique itself, also its employment has a strong impact on what is exactly observed. The in-situ measurements are influenced by several factors including:

- *Installation depth of the sensor.*
- *Placement of the sensor, e.g., is sensor positioned horizontally or vertically?*
- *Is soil moisture measured at a specific depth or integrated over a certain soil depth interval? This is often closely related to the positioning of the instrument.*
- *Density and geographical distribution of measurements.*

- *Characterization of the soil, including texture, porosity, and organic matter content.*
- *Calibration of the sensor*

Ideally, all these factors should be accounted for when harmonizing in situ soil measurements from different sites, so that observed variations are related only to real differences in soil moisture. However, such a harmonization of data would go beyond the current objective of the ISMN.

The choice of the measurement technique may also have a strong impact on the data quality. In Section 2.2 and several advantages and disadvantages of the different techniques were highlighted while the relative performance of various sensors has been extensively documented in literature (Baumhardt et al., 2000; Walker et al., 2004; Czarnomski et al., 2005; Mittelbach et al., 2011). Even if TDR sensors nowadays are often considered as benchmark for operational field monitoring of soil moisture, other, less expensive systems may in many situations show comparable performance (e.g. Czarnomski et al., 2005) and therefore should not be excluded on beforehand from data analysis.

The relative accuracy and precision of stations may differ from site to site (even when employing similar instruments) and can shift over time due to sensor degradation or external disturbances. Not considering these differences in further usage of the data may falsely affect results obtained and conclusions drawn by a study. Therefore, adequate quality characterization of the individual networks and stations is highly desired. As the current quality control procedure is only able to detect evident outliers but does not give us any information about subtle differences between stations, future efforts will primarily focus on improved quality control. This will be done at the level of individual measurement values as well as at the station and network level. "

P.1626, L.5-7 : Last sentence should be rephrased or removed.

The sentence will be rephrased: "For example, satellite validation and calibration typically require observations of the 0-5 cm layer while for evaluation of land surface models required measurement depths depend on the definition of the depth intervals of the different layers."

P. 1627, section 4 : Description of the different soil moisture datasets is not consistent, sometimes the number of stations, the period covered and the techniques used are given, sometimes not. Please be consistent in the description of the different datasets.

Thanks to the reviewer for noting these inconsistencies. We will make the descriptions more consistent by discussing for each network the following items

- *Responsible organization*
- *Specifications on the location*
- *Primary purpose of networks*
- *Particularities concerning the measurements (e.g. basin averages, irregular measurement periods, different install dates of the various stations), if applicable*
- *Special treatment of the data with respect to harmonization, if applicable*
- *References to studies that already made use of these networks*

Other details (number of stations, measurement period etc.) will be given in the tables and not repeated in the text.

Examples of how these data have been used so far should be included (e.g. modelling with Brocca et al., 2008, 2010 for CNR-IRPI, evaluation of modelled or remotely sensed surface soil moisture with Albergel et al., 2010).

Albergel, C., J.-C. Calvet, P. de Rosnay, G. Balsamo, W. Wagner, S. Hasenauer, V. Naemi, E. Martin, E. Bazile F. Bouyssel, and Mahfouf, J.-F.: Cross-evaluation of modelled and remotely sensed surface soil moisture with in situ data in southwestern France, Hydrol. Earth Syst. Sci., 14, 2177-2191, doi:10.5194/hess-14-2177-2010, 2010.

For each network we will include some key references to studies that utilized the data sets. See also above

P.1628, L.14 : You define as "a small network" the four stations of CNR-IRPI whilst nothing is mentioned about the CAMPANIA network of two stations (P.1627, L.24).

The adjective "small" will be removed.

P. 1634, L. 16 : References of evaluation between the mentioned satellite based soil moisture and in soil moisture network included in the ISMN should be added.

The intention of this statement is to show that the ISMN would like to go beyond the role of validation platform for SMOS, and not to give an exhaustive overview of studies that used the data for validation of other products. Nevertheless, we will include a couple references to studies who evaluated existing satellite soil moisture products with data that has been ingested into the ISMN. It should be noticed however, that the SMAP mission has not been launched yet, so no reference can be provided.

P.1636, L.11-12 : " Are land surface models accurate and unbiased enough to be used in data assimilation?" This question is really not clear to me, if you want to assimilate data such as surface soil moisture (e.g. from remote sensing), you need a land surface model and if it is not " [. . .] accurate and unbiased enough [...]" what do you suggest to use? Please consider to revise or delete this sentence as it is not clear and could leads to misunderstanding.

We agree with the reviewer that this sentence is not well formulated. We decided to remove this point as the previous paragraph already addresses the use of the ISMN for land surface model evaluation.