

Interactive comment on “Temporal stability of soil moisture patterns measured by proximal ground-penetrating radar” by J. Minet et al.

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Received and published: 8 May 2013

We thank the referee for his constructive comments. We agree with most of the comments and it is worth noting that similar issues were raised by the other referee Wei Hu. In particular, the weaknesses of the intersection method were better underlined and this has to be better discussed in the paper. Please find below a quick response to the major comments of the paper. A detailed review will be prepared soon.

1. About the GPR data

I fully agree that the GPR method and data was presented with a lack of critical mind. In particular, the depth characterization issue and the line effect need to be more discussed. It will be done in the review, especially concerning the last two dates that

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showed larger discrepancies with reference soil moisture and a larger line effect.

2. About the gravimetric soil moisture determination method

This comment is to be related with the previous one, so we agree with it. Actually, it is worth noting that most of the discrepancies between the reference and GPR method can be explained by the different support scales, among other sources of uncertainties, even if these other sources may be also important.

This will be better balanced in 3.3 (Comparison with soil core sampling). In addition, the GPR method w.r.t. the reference method will be better presented as a digital soil mapping method, i.e., a method giving a large number of measurements that can be less accurate but that are better catching the spatial variability than an accurate but cumbersome method.

3. About the line effect and the compaction

The observed line effect is an important issue in this GPR dataset. As it is observed at the same locations at different dates, we could exclude a sensor drift. The soil compaction may be the main responsible of the line effect observed in volumetric soil moisture, either due to the passes of the ATV or previous agricultural machinery. Note that the compacted-tracks due to the ATV are situated at the edge of the GPR antenna footprint and that the antenna is mostly sensitive to the backscattered signal from the center of the antenna. The effect of soil compaction on the GPR data was also raised by the other referee Wei Hu.

The soil compaction will be more strongly affirmed as the main cause of the line effect in the chapter 3.2 (Line effect) of the paper.

4. About the GPR data interpolation

The GPR-derived soil moisture data interpolation is an important issue as it smooths a lot of local variability. However, we don't fully understand the request of the referee here: - The soil moisture data were not aggregated before the kriging but the kriging

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equation were adapted by taking into account a rectangular neighborhood window for computing the kriging weight to be assigned to each data point (instead of a circular in usual kriging algorithm). If I'm not making a mistake, this is not resulting in a aggregation. - The resolution of interpolated map is exactly 2 m and it will be stated in the revised version. The spacing of the measurements in the field varies between 2 and 5 meters along an acquisition line. It should be 2 meters according to the GPS but communication issues between the instruments (i.e., the PC, the GPR and the GPS) could increase the spacing between points. The interpolation resolution (2 m) was chosen between the support scale (2 m²) and the measurement spacing (min. 2 m, but more generally about 2.5 m along the line and 5 m between the lines). The mode of data acquisition using the GPS will be more detailed in the paper. - A map using a moving window aggregation will be tested as requested by the reviewer.

5. About the intersection method

The other referee, Wei Hu, also remarked that this method could not be used in all conditions and that it is also not quantitatively comparable with the first method (i.e., temporal stability indicators). As a result, the description (2.4) and the interpretation (4.2 and 4.4) of the intersection method will be drastically modified in the revised version. We will also better balance the choice between the two methods, probably by stating that the intersection method may be poorly generalizable.

6. About the copying from other papers The methodology for the paragraphs will be revised to avoid repetition from previous papers and we will focus on the particularities of the paper, namely, the data acquisition in the field at 5 different dates.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 4063, 2013.

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