Natural Hazards
and Earth System
Sciences

Open Access

Discussions

Interactive comment on "Comparison of different methods for the in situ measurement of forest litter moisture content" *by* C. Schunk et al.

Anonymous Referee #1

Received and published: 16 July 2015

General comment This paper deals with the comparative analysis of different sensors used to measure forest litter moisture content. This is an interesting and, as far as I now, novel topic which may have practical implication for monitoring forest floor moisture conditions useful for wild fire prediction. The paper stems from a gap in the current knowledge about the lack of automated measurements of forest litter moisture content. The authors set up a good experimental framework, and performed robust analyses. The paper is generally well written and presents results in a clear way. However, some data presentation could and should be improved (inclusion of a new Table, a new Figure, change of another Figure…see comments below). Moreover, some more discussions, especially to show more clearly potentials and limitations of the tested methods, are necessary. In general, I recommend a major revision before publication on NHESS.

C1254

Specific comments 3737, 12. Please, specify what EMC are, how they can be useful and give references.

3739, 1. What I know are sensors to measure soil water content that are based on the apparent dielectric constant and the ionic conductivity of the soil (or, more in general, any porous media). Please, check what term is more correct/appropriate between 'permittivity' and 'conductivity'.

3739, 1-8. Explain better how these sensors works. Explain what the permittivity (conductivity?) is and is used for.

3739, 1-18. Recently, new moisture sensors based on the TDT (Time Domain Transmission) technology have been introduced in the market. I understand that these were not tested in the present study but at least they should be mentioned here since the technology is very similar to TRD and FDR and is considerably cheap. Reference on the technology: J.M. Blonquist Jr., S.B. Jones, D.A. Robinson, 2005. A time domain transmission sensor with TDR performance characteristics. Journal of Hydrology 314 (2005) 235–245

3741, 7-11. This paragraph should be remove from here since it's not an objective but more a result. Moreover, I suggest to include a couple of specific objectives (that should be picked up the Results section) in order to make the aim of the paper immediately clear.

3742, 10. Here the authors have to include a new Fig.1 showing the experimental site, the 30-m transect and the area where measurements were collected through each sensor.

3743, 1. The instrumental precision for each sensor tested is missing and should be reported. Moreover, a discussion, even if short, about how the instrumental precision affects/can affect the total measurement uncertainty-and so the reliability of the results-should be added.

3743, 10. Again, check if 'permittivity sensing' is the correct definition.

3744, 13. I suggest to include a new table (and a short description in the text) reporting basic statistics (total number of measurement, mean, SD) of all gravimetric measurements as well as measurements from each of the tested instruments for i) the total period; ii) for the dry period 1; iii) for the dry period 2; iii) and for the dry period 3. Please, state also in the header the DOYs of each period.

3745, 3-ff. I understand that rescaling allows raw data of the various sensors to be compared. However, this is an asset but it's probably not strictly necessary in order to compare the gravimetric and the sensor-based data. I think that the authors should be better explain the need for such an operation. Moreover, I wonder how and if the rescaling process affects the results, and I suggest the authors to provide some data on this.

3746, 12. The title of section 3.2 is not convincing. I suggest to change it. A possible solutions are 'Litter water content variability' but similar ones are acceptable. 3747, 17-ff. I suggest not to talk about 'calibration' but simply about 'relationship between gravimetric and automatic measurements' or some similar definition. 'Calibration' is misleading for the reader because it implies that all relationship are robust and can actually be used to convert raw data into moisture content data. However, this is not perfectly the case.

3748, 9-ff. The Discussion section should be expanded, especially around three main points: i) inclusion of a mention of instrumental precision on the fitness of the sensor estimates; ii) potential and limitations of these methods according to the obtained results; iii) short mention about how the dry period values compare with data found in the literature that were considered critical for wild fire starting. The last parts is important because it gives a closer connection with the main topics addressed in this journal.

3748, 20. This sounds speculative. Please, make clearer hypotheses, explaining the reasons, on the observed variability of gravimetric measurements. Otherwise, say that

reasons are unknown.

3748, 20. '. . .suboptimal transformation'. Again, this is a bit speculative. Moreover, why the electric resistance technique should be affected by not optimal transformation of raw values and not the other sensors, that were subject to the same process?

3750, 9-ff. Why the increased bulk density should not have influenced the groups a, c, d as well? Please, explain.

Minor comments and technical corrections 3739, 2. Why 'dielectric' is in parenthesis? Moreover, I think that the correct definition is 'dielectric constant', and not 'dielectric number'. Please, correct. Also at lines 5, 12, and at 3740, 4.

3739, 2. The most used and accepted definition is 'FDR (Frequency Domain reflectometry)'. I suggest to change it this way here and anywhere in the manuscript.

3739, 24. Add that mw, md have the same meaning than in Eq. 1.

3740, 3. '. . .discussed later in this paper.' Give a reference to the appropriate paper Section.

3740, 3. Add 'to' before 'compare'.

3742, 4. I don't like the definition 'standard parameters' and suggest to change the sentence here (and in the rest of the manuscript) into 'meteorological data (so, skip also 'observations).

3742, 10. 'Well within' is rather vague. Please, give more precise information (and refer to the new Fig. 1)

3742, 12. I suggest to replace 'coincidental' with 'concurrent' or 'at the same time'. I think that the author mean that, whereas 'coincidental' means something else. Please, also change it at 3748, 21

3743, 6. After '. . .similar conditions' add 'than the transect'.

3744, 22. Dead batteries? Are there no solar panels for most of the sensors? Please, specify which sensors are battery-operated and solar panel-operated.

3745, 1-2. 'daily sum of precipitation' should be changed into 'daily cumulative precipitation'. The same holds for 3746, 3.

3745, 21. 'weather' should be replace by 'meteo data'. Moreover, the sentence is not very clear: please, rephrase.

3746, 17. 'Logistic relationship'. Yes, but it could be also defined a non-linear relation with a sort of threshold around 100% UG and saturation above 300 sensor value. I suggest to change the term 'logistic' into the more general 'non-linear'.

3748, 16. It's not the technique itself that produces variability (I suggest to use this term instead of 'variation') but it's the data themselves. I suggest to change into 'data are characterized by high variability. . .'.

3748, 16. Why 'relative'?

3748, 24. Add '(group c)' after 'electric resistance technique'.

3750, 16. 'relatively poor weather conditions'. . .this is a bit vague and controversial (it can be very good weather for hydrologists. . .). Please, specify.

3750, 20. Check my comment above about 'calibration'.

Tables and Figures

3755, Table 1, caption. Replace 'calibrations' with 'relationships'.

3756, Fig. 1. I'm not sure I understood how the daily moisture mean was calculated (I found no explanation neither in the text nor in the caption). Why don't the author simply connect the point with a line? Moreover, change 'parameters' into 'data' and perhaps 'test' into 'study'. In the legend of the bottom panel, change 'precipitation' into 'daily cumulative precipitation' or 'daily precipitation'. Most of all, add three new horizontal

panels displaying the three relationships reported in Fig. 4 (see comment below).

3757, Figure 2. Add '-' between the parentheses '[]' to indicate the lack of measurement unit. Replace 'cor' with 'r' (rho), and of course mention this symbol for the Speaman rank correlation also in the text. Explain in the caption what the asterisks mean. Please, also consider to add a linear interpolation to panels a, b, d.

3758, Figure 3. Replace 'by' with 'as a function of'. Less than three observations means necessarily two (one cannot compute a mean and SD of one value!). Please, explain better. I suggest to change 'correlated linearly' into 'more correlated'.

3759, Figure 4. I suggest to skip this Figure (the panels are too narrow and are difficult to read) and to incorporate it in Fig. 1 (that will become Fig. 2 after adding the new Fig. 1, with the study area).

3760, Figure 5. Use colours that differentiate more. Add '-' between the parentheses '[]' to indicate the lack of measurement unit. Replace 'calibrations' with 'relationships'. Skipping the confidence interval would make the subplots clearer.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 3733, 2015.