

Reviewer 1

General Comments

- I think that the long introduction related to “Plant and soil water relations in terroir” should be shortened, because it allows only to emphasize the importance of monitoring soil water status spatial/temporal variability.

This section has been added because the work has been submitted to a Special Issue, having the title "Geosciences and wine: the environmental processes that regulate the terroir effect in space and time". Therefore the aim of the section is not only to emphasize the importance of monitoring soil water status spatio/temporal variability, but it tries to summarise the current understanding of the role of soil water in the terroir effect. This idea was previously discussed with the Editor of SOIL Journal and with the Editors of the current Special Issue. Editors expressly asked for enlarging the vision of the article because of the multidisciplinary editorial policy of the SOIL journal, and we proposed to write this first section. The Anonymous Referee #2, qualified this section as a "comprehensive and upto-date review of the soil-plant water relations in vineyards".

Anyway, reviewer 2 suggested to move a paragraph from this section to improve the very short introduction. This was the paragraph that more emphasized the subject of the work, and is better suited for the introduction. This had the double purpose of shortening and limiting the emphasis from the "Plant and soil water relations in terroir" section as you relevantly suggested.

- As following suggested, I propose the Author to add a new paragraph as well as to clarify, for the readers benefit, some aspects of the research. Following, there are a few indication, some of which represent minor corrections, that should help Authors to improve the quality of the manuscript.

As we understand, you suggest the introduction of a new paragraph where Materials and Methods are better described. Such request was also suggested by Reviewer #3 and the paragraph has therefore been inserted.

Specific Comments

- P.2 L.11** Probably it is better to say “ERT derived variations of the Fraction of Transpirable Soil Water (FTSW)”

CORRECTED

- P.2 L.12** I suggest to change “depending on” with “depend on”.

CORRECTED

P.4 L.27 Authors should precise on which soils “Water in macro and mesopores is generally more easily available to plants, but it is also more mobile, as it is not retained by capillary forces.”

PRECISED

P.9 L.8 Delete a parenthesis

CORRECTED

P.15 L.1 Change “more” with “most”

CORRECTED

P.15 L.13 Authors wrote that “However, the relationship between SW and ER appears linear only when considering a limited range of variations.” Is the range of variations related to both the variables? Please, clarify.

It is related to both variables. It has been specified.

P.16 L.5 To benefit the readers, some information of the model to predict the Fraction of Transpirable Soil Water should be provided.

They have been inserted in the material and methods section.

P.16 L.6 Authors show the maps of the variations of the FTSW in a vineyard soil, without providing any detail about the field dimensions, the period of measurement and other information (i.e. irrigation, rainfall, etc.) that could help the readers to better understanding the methodology. It seems that the methodology is presented in other papers, but I suggest to insert a new paragraph in which, even shortly, the experimental setup is presented. Moreover, the soil characteristics should be anticipated in this new paragraph.

True. Following your previous request a paragraph presenting the experimental setup has been inserted and also include these informations. Note that the field dimension can be read on the x axis, which as the label indicates is expressed in meters. While the rainfall amount is given in the ombrothermic graphic in the same figure; the vineyard is not irrigated.

P. 16 L.7 Which measurements? At what time the measurements were carried out?

The sentence has been removed because of the insertion of the material and method section where this is explained with greater details.

P. 16 L.20 The sentence “Maps of the FTSW can at first sight be somewhat misleading, because the period of variation of all pixels is not equal” is not clear, probably because the lack of methodological info.

I agree with you the sentence has been reformulated and therefore substituted by these: “Maps of FTSW can at first sight be somewhat misleading, because even if all pixels are on the same scale (being FTSW a normalised variable) the numerical relationship between FTSW and ASW varies across pixels. It has to be considered that FTSW maps do not shows dry and wet soil regions, but they shows differences in soil water depletion. Because of the relative scale the amount of water needed to bring to 100 the FTSW of two depleted pixels having the same FTSW can be different and these maps cannot be read in this way.”

P.17 L.20 Change “longer” with “longest”.

CORRECTED

P.17 L.20 Moreover, values of leaf water potential (LWP) in the period from July 9 to 16 are not showed in fig. 1, so it is not possible to verify the drop off in LWP commented by the Authors.

There was an error in the figure which has been changed.

P.16 L.22 Errors could cumulate, but even compensate. Of course only in the first case the final errors will result higher.

For sure this is true, and you highlight an interesting point which will merit further considerations. With the assumption that errors are normally distributed with mean equal to zero, the most accurate estimation is the given accuracy of the model, without reduction (as in the case of this article) or improvement. However, the behaviour of errors cannot be exactly estimated without knowing the true values of FTSW (and not the TDR ones, which are also inaccurate). These values are not available and therefore in our opinion the most realistic estimation, although pessimistic biased is to consider all errors as cumulating. Doing so the method loose in power, but remaining patterns have more chances to be significant. The loose in power is therefore just apparent because it allows to discriminate and identify the main patterns.

P.18 L.1 Authors refer to the “maps of August when water deficit is higher”. Probably they should precise to which map or maps are they referring to, because only on Aug. 21 the water deficit is relatively higher than the other periods. In any case, it should be noticed that, according to

the measured predawn LWPs it seems that the plants, in the considered period, have been never under severe stress conditions.

The map has been specified, it is the 21st August. The plant water stress is never severe, but here we speak in relative and compare to other measurement dates. This has also been specified but we think that the best place would be when introducing the data at P.17 L.6. We introduced it here by modifying the sentence: “The grapevine water deficit followed the same pattern” with this addition “even if it never indicated a severe plant water stress but moderate”.

P.18 L.8 Correct “les” with “less”

CORRECTED

P.18 L.15 Fig. 3 is now related to the “two years of observations” and “28 measurements”, but no details, again, were provided on the materials and methods.

Material and methods section has been inserted, we hope this should be clearer now.

P.18 L.15 In any case all the comments are qualitative and no discussion has been related to the possible effects of soil evaporation, as well as those related to vegetation that should be present between the plant rows.

All comments are qualitative because the purpose of the paper was to review the technique and describe its application, while the case study was just a way to let the uninformed reader figure out the subject of the article, and then fire up the curiosity for the technique. This was also the reason why a material and method section was not inserted, being this generally avoided in a review. The paper never had the scope to solve a specific scientific question. Furthermore, in P.17.L.23 we specify : “A low FTSW value is not necessarily the sign of greater root absorption, but is primarily the sign of the depletion of the water reservoir”, meaning that all factors such as evaporation, etc. are included without distinction.

P.19 L.4 I suggest, again to change “depending on” with “depend on”.

CORRECTED

Fig. 1 – It is better if Authors provide the color palette near the figure.

INCLUDED

The x-axes of the “ombrotermic diagram” should be a temporal scale, but the numbers indicated do not allow readers an immediate comprehension of their meaning. Considering that they indicate the period of investigation (from begin of July 2013 to September 13, 2013), Authors should avoid to use 2013 as written on the top of the graph, but the exact period to which the data are referred to.

This diagram has been modified

Moreover, are the maps related to a vine row, being the distance between plants about 0.9 m? This information should be specified in the text.

It has been specified in material and method section.

Why the temporal scale in the lower left side starts from July 16 and not from July 1, as indicated in the graph on the right?

To better understand the plant water stress which is illustrated by the graphic on the right the reader will probably want to know the meteorological conditions of the previous weeks.

Review 2

General comments:

- The determinants of ER other than water should be clearly identified.
 - *This aspects has been well reviewed in Samouelian et al. 2005, that we cite. We better specify it with this sentence, included in the section 4.3 Modelling of relationship between ER and SW. “Soil ER is dependant on soil properties other than water, such as gravel content, texture class, salinity, temperature, etc. (as reviewed in Samouelian et al. 2005).”*
- It should clearly be stated that both SW and FTSW can be estimated from ER; the cited reference Brillante et al. 2014 deals with SW and not FTSW.

Both SW and FTSW and ASW can be estimated by ER, and a new reference paper has been included to state it: Brillante et al., “Spatio-temporal analysis of grapevine water behaviour in hillslope vineyards. The example of Corton-hill, Burgundy.” Conference proceedings of the International Terroir Congress 2014.

The paper is available at www.researchgate.net/profile/Luca_Brillante.

Furthermore, this has been clearly stated in the material and method section which as been added with this review.

Specific comments:

generic The authors alternate “terroir expression” and “terroir effect”; I suggest they use only one formulation, “effect” being the simplest.

CHANGED.

P.679 L.4-14 The introduction introduces (shortly) the issue of soil–plant water relations, not the methodological issue of estimating SW (or FTSW) from ER.

Some lines on methodological issues of estimating SW from ER have been inserted. This paper focuses on soil and vine water relationships and it will review the methodology for a new approach to measure soil water and its availability to plants. They are reported here below.

“This paper focuses on soil and vine water relationships and it will review the methodology for a new approach to measure soil water and its availability to plants.

At today, Soil Water (SW) measurements are generally obtained with in-soil devices such as Time Domain Reflectometry (TDR), which can be difficult to carry out in field conditions. Furthermore, these devices only measure a very small volume of the soil, and even when increasing the number of probes, no information is generally obtained about the lateral variation of SW, and only a vertical soil moisture profile can be established. In addition, the number of such devices cannot be increased indefinitely without major perturbations of the system and attaining prohibitive costs. Geophysical imaging techniques, which are rapid, cost effective and low perturbs the soil, have recently been proposed as a good proxy for the spatialisation of SW measurements (to name but a few, Michot et al., 2003; Beff et al., 2013; Garré et al., 2011). Being the technique recent a generalised method does not exist, neither exists a review of the possible approaches to spatially measure SW and its availability through these geophysical techniques, and especially those based on Electrical Resistivity (ER). This is the aim of the present work.”

In addition, the introduction has changed again after your following remark.

P.678 L.21 vegetative growth and yield formation are also affected by the environment of grapevines

True. The sentence has been reformulated to take this into account.

P.680 L.4 It could be stated here that all processes of crop physiology do not have the same sensitivity to water stress (Pellegrino et al, 2005. Towards a simple indicator of water stress in grapevine (*Vitis vinifera* L.) based on the differential sensitivities of vegetative growth components. Aust. J. Grape Wine Res. 11, 306-315.

It has been included with this the sentence: "During water stress apexes reduce and then stop their growth, but the reduction in the vegetative growth varies across vegetative organs and physiological processes (Pellegrino et al., 2005)"

P.681 L.17 what is the meaning of more consistent?

It was an unseen error, the word to use here was constant. The word has been changed "stomatal conductance was highly variable, while it was more constant in clayey soil".

P.682 L.11 "soil is not a homogeneous medium", this is what justifies the interest for mapping soil water from ER measurements; it could appear earlier, in the introduction

Great suggestion! This clearly improve the introduction and shorten this section as asked by reviewer 1. Introduction has therefore greatly changed with the answer to your comments (look also above).

P.687 L.24 "inverted ER" should be explained

Geophysical inversion is the mathematical treatment used in post-processing electrical resistivity data, when using ERT techniques. Here, inverted just stay for post-processed data, in order to difference it from raw data. Explanation of geophysical inversion cannot be given in few words, in our opinion this is really out of the scope of the present review.

P.690 would it be too long to provide the mathematical formulation of one of the cited models?

We inserted the Archie law, which is the first to be cited.

P.691 L.25 does SVW differ from SW? what is the meaning of ASW and FTSW? (FTSW is defined in the following page)

SVW has been replaced with SW for consistency, it was for Soil Volume Water. The meaning of the other two acronym has been specified.

Figures The title of the ordinate is missing (elevation?)

Yes, it was depth. Has been inserted.

Conclusion This conclusion is very similar to an abstract. It should rather “conclude” about the relevance, the possible limitations and the perspectives opened by the use of ERT for monitoring and mapping the soil water availability.

Conclusion has changed, as also asked by reviewer #3.

Reviewer 3

General Comments

– The second part need to be improved due to lack of details related to materials and methods used for the experiments. The second part is not very clear, figures have to be improved, as well as the captions.

A material and method section has been inserted. Figures have been improved.

Specific Comments

P.679, L.3 The aim of the work is not clear.

Introduction has been submitted to great changes now it would be clear.

P.679, L.14 Which are “these phenomena”?

They are plant-soil-atmosphere water relations. It has been changed.

P.679, L.3 The paragraph 2 is too long and redundant in the first part.

It has been shortened

P.680, L.8-13 Are there effects of water on phytopathology?. For example, could water stress reduce Botritis? This aspect is not mentioned in the paragraph. I suggest to improve line 8-13 page 680.

I'm sorry, but I'm not aware of such a study, that you do not mention anyway. I cannot understand the way I should improve line 8-13 which is a sentence were several case study are cited. These are works where has been shown that the terroir effect is mediated through a moderate water stress. For sure it is not exhaustive, but I think is long enough (7 works).

P.685, L.9 Change this sentence “The magnitude of such variations in soil moisture has rarely been studied and their impact on vine physiology has rarely been taken into account (among few, Bauerle et al., 2008)”

with “The magnitude of such variations in soil moisture and their impact on vine physiology has rarely been studied (among few, Bauerle et al., 2008).”

CHANGED

P.685, L.7 . delete the “(“

CORRECTED

P.685, L.9 This sentence is a repetition

We do not agree. It is the first time that ERT and EMI are word appear in the text, and reference for those acronym are given here.

Paragraph 4.1 Add bibliography after “The relationship between Electrical Resistivity (ER) and Soil Water (SW) has been observed in many studies, by many authors and in many different settings”

This section is just an introduction to the following parts, where bibliography citations about this subjects are abundant. To honour this remark we will introduce a reference to the subsection 4.3 where the argument is expanded and citation largely given.

P.688, L.20 Which are the other soil characteristics.?

They have been specified : “However, the electrical resistivity is also dependent on other soil characteristics, such as for example the amount of gravels and clay, salinity and temperature. This last because of kinetic effects on ion mobility in pore water.”

Section 5 Miss information of the model to predict the Fraction of Transpirable Soil Water. How was managed the soil? When the measurement were carried out? To understand the figure and the last part of the manuscript a very short material and method is necessary. For instance, the measurement (28) of the figure 3 are not clear, as well as the explanation in the text.

Material and method section included. All these question would find an answer there.

Figure 3 The dot in figure 3 has the same meaning of the figure 2? Add the title of ordinate in the figures.

Caption improved, title inserted.

Change the conclusion. It is too similar to abstract

CHANGED

Reviewer 4

Dear author I found your paper very innovative, very advanced and probably one of the best paper I am reviewing in this season. I think you must highlight how new and innovative is your research and for this you should mention what is traditional in the vineyard research to highlight your contribution I suggest that you will have an introductory sentence such as the following one: The vineyards are being studied due to the high erosion rates (Novara et al., 2011; Lieskovský & Kenderessy, 2014; Martínez Casasnovas et al., 2015), their special man-made landforms (Tarolli et al., 2015); pollution (Fernández Calviño et al., 2013; Novara et al., 2013; Luis Parras et al., 2013) within an interdisciplinary view of the soil system (Brevik et al., 2015). However, very little is known about the soil and water relationship on vineyards, although this is the key factor in the fate of the vineyards production due to his control on the vine quality and the vineyards management. This paper shed light on this topic.

The sentence has been added with all the proposed references. Line 55-61