**Hydrology and
Earth System
Sciences
Discussions**

Interactive
Comment

Interactive comment on "Spatial variation of soil physical properties in adjacent alluvial and colluvial soils under Ustic moisture regime" *by* M. Sağlam et al.

M. Sağlam et al.

hozturk@agri.ankara.edu.tr

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Dear Dr. CASTRIGNANO

Thank you for your comments and suggestions on structure of our manuscript. We have revised the manuscript, accordingly. Please see the revised version.

For the point of site specific management, I have already added a paragraph at the end of the 'Discussion' section.

I agree with the critiques on extension of the text. We initially included the information

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on the impact of management on soil properties. Present paper is mainly focuses on description of spatial variations of some soil properties in two geological units. For another paper, we have collected soil management information (soil use, crop type, crop rotations, fertilizers used etc,) for past 5 years. These data statistically analyzed and compared the founding of present paper. We tried to combine everything in a single paper, but unfortunately it was not possible.

Specific comments

1. P.4263, L.18: after "distribution" it should be added: "at the scale required by site-specific management". In order to establish significant relationships among the variables, it is important that all variables (texture, soil water content, plant available water, etc.) are referred to the same spatial support. 'at the scale required by site-specific management' is added to appropriate place.

2. P.4265, section2.3: Write "twenty eight" instead of the figure of the transects. The creek should be clearly localized in fig. 1. The criteria of selection of samples on each transect should be specified. '28' is replaced by 'twenty eight'. The creek is shown in new Figure 1. We have randomly selected these transects in all directions equally. However, the soil samples on the transects were collected on a regular basis mentioned in Section 2.3.

3. P.4265, section 2.4: not all statistics are reported in table 1; minimum and maximum values, skewness and kurtosis are missing. Moreover, in table 1 there are reported Ks and AWC which are not described in the text. The methods of analysis and the measurement units should be reported.

All the statistics (including min., max., skewness and kurtosis) are presented in Table 1. We, earlier, deleted some of the results due to shortage of the place in Table 1. Ks and AWC is added to the text (Section 2.4). The methods of the analysis are added to section 2.3.

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4. P.4265, Section 2.5. substitute "distribution" with "dependence", because semivariogram is a measure of dissimilarity and then of spatial association between samples.

Your suggestion is applied. 'dependence' is replaced by 'distribution'

5. P.4266, L.6-8. it is the number of pairs that varied in each lag. Substitute "safe calculation" with "reliable estimate".

This sentence is written as 'The number of data pairs in each lag varied'. 'reliable estimation' is written instead of 'safe calculation'

6. P.4266, L.10-14. the least squares technique was used to estimate the semivariogram parameters but the goodness of fitting was evaluated by crossvalidation. This test should have been used to select the semivariogram model.

We used least square technique to estimate the semiovariogram parameters. Correction has already been done.

7. At page 4266 lines 22-24: since the textural components sum to 100, only two of them should be independently estimated and the third one derived from the estimates of the previous two.

We did not understand what the referee wanted us to do.

8. P.4267, L.9-19. I cannot understand if this description of the fields derives from the authors' knowledge or from the results, because in this last case the authors have to refer their comments to tables or figures in the text as they actually do afterwards. The authors should clarify why they assert that "clay content in the alluvial area is higher", since the means are the same and only the variation degree is different.

The description has been revised in regard with data on clay content. All these description about the fields actually bases on our results. I have already referred Table 1 for the soil description of the field. I have deleted first sentence (In contrast to sand and silt content, clay content in the alluvial area is higher) since it is not true.

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9. P.4267, L.25-27. lines 25-27: at this point the authors should comment the characteristics of the variograms for the two soils and how they impact the type of spatial distribution (short- against long-range, structured (low nugget ratio) against more erratic variation) without several repetitions in the text.

We inserted following steatments at 3. Results: " Camberdella et al. (. . . .) classified semvairograms according to their nugget ratio ((Nugget/sill)x100). A semivariogram with a nugget ration <25 is deemed strongly spatially dependent, between 25-%50 moderately dependent and %75< is deemed weakly dependent. Based on this classification, except Ks, all the variables are strongly spatially dependent in three cases (alluvial, colluvial and whole area). However, except AWC, al the variables have a shorter geostatistical range in colluvial site. The geostatistical range is an important criterion in a variable rate application in managing soils site-specifically. Soil organic matter is on important determinant in a variable application of fertilizers. The Table 1 shows that geostatistical range of SOM is almost two times greater in alluvial site that colluvial site, implying that it would not be safe to apply the same mean correlation distance in a variable rate application program in these two adjacent sites. However, geostatistical range of AWC implies that two sites can be combined in a water application program.

10. P.4268, L.1-7. : the variograms should be analysed in terms of sill and range, because the increase in semivariances depends on the scales of graphs which are different, because the sills are different. It is the sill of SOM (not AWC) that is higher in colluvial soils compared with alluvial soils.

Page 4268 lines 1-7 was revised accordingly. Please see the revised version of the manuscript.

11. P.4268, L.13-16. before pooling the data from the two soils, heteroscedasticity of variance should be tested; the two soils seem to show different variances (different sills) for most variables.The objective of this paper is to show that the two sites are different in the spatial variation of soil variables to be important in site specific management of

water and nutrients. The semivarograms and their parameters showed that. In pooling data we assumed intrinsic stationarity, which assumes that a semivariance has a finite variance (sill). Fig.5. shows that all the variables have a finite semivariance, indicating intrinsic assumption of stationarity. Therefore, we believe that there is no need to test heteroscandasticity here.

In Discussion section the authors try to establish spatial relationships between the variables and disclose similarities or dissimilarities between the two types of soil. All these comments are based on visual inspection, they are too generic and qualitative and mostly even questionable. Each assertion should be verified and justified. Any multivariate analysis is lacking in the text. The paper would be greatly improved by a multivariate geostatistical approach, however the authors have to add some sort of correlation and/or regression analysis so to prove what they assert.

We don't agree with the referee on this. First of all, we justified our discussion with sill, range, nugget ratio, and spatial class (strong, moderate, and weak spatial variation as set by Camberdella, et al....). All these criteria are quantitative. Also, we discussed our data by kriging maps, which are the product of corresponding semivariograms. Secondly, the main objective of the study was to show that the spatial variation soil variables at these two adjacent sites are different and that this should be taken into accent in a variable rate application of water and fertilizers. Therefore, we believe that a multivariable analysis would not improve quality of the paper in this respect. For example, cross-semivariogram analysis would add nothing but confusion.

12. P.4270, L 4-13. The authors speak about "trends" but all the variograms are upper bounded, i.e. the variables are stationary. Probably they mean that anisotropies occur on the field but this has to be proved through directional variograms.

13. P.4270, L.26. change "rigorous" with "vigorous" or luxuriant.

In the revised version, the use of 'vigorous' or either of them was not used.

14. P.4271, L.26: check the percentages.

There was a problem on this part. It was revised without given the percentages.

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