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Hydrology and Earth System Sciences Discussions

Interactive comment on "Spatio-temporal variations in soil hydrology of a typical semiarid sand-meadow-desert landscape" *by* L. Duan et al.

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The manuscript overall objectives and conclusions address relevant scientific questions within the scope of HESS, especially the study of the spatial and temporal characteristics of the water resources in land masses and the study of the interactions with human activity. The paper provides a detailed description and interpretation of spatio-temporal variation of soil moisture hydrology and present supporting evidence for land cover/use influences on soil physiochemical properties. A highlight of this study is the simple fact that variation of soil moisture and the influence of land use on soil properties in a semi-arid/ desert ecosystem remain poorly studied.

Thanks!

Although, the manuscript presented in its current form does provide a contribution to the field, there are several minor revisions that should be addressed before publication, in my opinion. I have attempted to provide helpful, specific suggestions (below) that might be considered. Specific suggestions:

1. Title: The paper has two main components (1) tempo-spatial variation in soil moisture and soil physiochemical properties, and (2) the influence of land cover/use of these variations. The title as presented in current manuscript just highlights on the variation of soil moisture. I recommend changing it so that it reflects more on all paper components.

The revised title is: "Spatio-temporal variations in soil hydrology of a typical semiarid sand-meadow-desert landscape as influenced by land use"

2. P: 1897, lines 21-24. "Their results showed that the spatial variations in the soil physicochemical properties (e.g., total P) were more uniform in the areas of grazed dunes, but that the variations of soil moisture were more diverse in the areas of recovered sand dunes". As it reads now, I understand that both soil physiochemical properties and soil moisture were more uniform in grazed dunes. Is this right? If so, then I suggest rephrasing it.

Yes. This sentence is rephrased as: "Their results showed that the spatial variations in the soil physicochemical properties (e.g., total P) and soil moisture were more uniform in the areas of grazed dunes, but that the variations of soil moisture were more diverse in the areas of recovered sand dunes."

3. P: 1898, lines 18-19. "The study was conducted in a selected area of the Horqin Sandy Land that is typical in terms of hydrologic condition, topography, soil, and land cover". You are using the term "typical" but it is not clear if it is typical for the Horqin Sandy land or for semi-arid/sand-meadow landscape.

This sentence is rephrased as: "The study was conducted in a selected area of the

Horqin Sandy Land that is typical for semiarid sand-meadow-desert landscape in terms of hydrologic condition, topography, soil, and land cover."

4. P 1899, lines 16-18. Add the last name(s) of the person(s) who described each species (e.g., was it Linnaeus? If so, add an "L." after "halodendron". Do this once for every species mentioned it in your text.

Done! This sentence is rephrased as: "Artemisia halodendron L., Caragana microphylla Lam., Salix gordejevii Chang & Skvortsov, and/or Populous L., whereas the lowlands are mainly covered with Leymus chinensis Tzvelev, Phragmites australis Trin., and/or Lxeris chinensis Nakai."

5. P: 1900, line 4. "Similar concerns also exist in other regions in the world". It would be good to provide some examples of these regions.

This sentence is rephrased as: "Similar concerns also exist in other regions in the world, such as the southern Kalahari of South Africa (Rooyen, 1998), the Gangetic basin of India (Dey et al., 2004), and the Negev of southern Israel (Portnov and Safrielb, 2004)."

6. P: 1900, lines 16-17. "Soils at 10, 20 and 30 cm vertical depths were extracted for tests of 14 soil parameters (Table 1)". Add a sentence to explain your rationale behind. Also in Table 1, what is representing? (Is it representing NO3-N and NH4-N ?). Same for Available P and Available K.

Just after this sentence, insert an explanation statement of: "Because detailed data on soil horizons are not available, these three sampling depths were chosen to represent root-zone soils whose physicochemical properties have direct influences on vegetation."

On P1916, add third footnote of: "3 AN includes nitrate-nitrogen (NO3-N) and ammonia-nitrogen (NH4-N); AP is phosphate (P2O4−7, P3O5−10, and PO3−); and AK includes exchangeable, nonexchangeable, and soil solution K."

7. P: 1902, lines: 4-5. "The median was assumed to be the daily value of the parameter at that soil depth on that day". Add a sentence that explains your rationale of using the median instead on the mean?

The rationale of using median instead of mean has been presented in Lines 23-25 on P1901. It is due to inconsistent number of measurement years as well as inconsistent measurement frequency.

8. P: 1903, lines 9-19. "A paired t-test (two-sample for means) was performed to identify whether the values of a parameter for one land cover were significantly different from the corresponding values of the same parameter for another land cover at a significance level of 0.05". It is not clear to me why you used t-test to compare parameters in two different land use groups then you used ANOVA to compare the five of them. Were same parameters examined in t-test and ANOVA? If this is the case then I recommend excluding t-test and just mention ANOVA and add a sentence that clearly state the mean separation method that you have used (like LSD, Duncan or Tueky...). Then use the results of the mean separation to show significant differences on figures 6-7-8 and 9 (use designated letters: a, b, c,...).

For the hydrometeorologic parameters (e.g., soil evaporation and soil moisture), we are much interest in identifying whether they were significantly different from site to site. This can be well done using a paired t-test. On the other hand, for the soil physicochemical parameters, we are much interested in determining whether the within-group means of a given parameter were significantly different among the 5 land covers, namely semi-fixed dune, fixed dune, cultivated land, general meadow, and control meadow. This is a multiple comparison problem that can be solved by an ANOVA test.

Bonferroni correction was used in the ANOVA test. This is clarified by change Line 20 on P1903 as "Bonferroni multiple comparisons and analyses of. . ."

9. P: 1904, lines 19-21. "This is because vegetation roots can improve soil structure, increasing the soil water retention capacity of soils (Marshall and Holmes, 1988)."

Provide other/alternative explanations of the results (vegetation density can affect soil moisture in several ways beside improving soil structure, for instance they might influence water uptake/ soil water evaporation,...).

Following this sentence in Line 21 on P1904 insert the alternative explanation of: "Another possible reason is that the dense vegetation coverage might intercept more incoming solar radiation, resulting in less net soil water loss (i.e., greater reduction of soil water evaporation and smaller increase of vegetation transpiration)."

10. P: 1905, lines 23-25. "The marginal decrease of soil moisture at site C2(G) and C3 (Fig. 3) can be attributed to the development of roots of Leymus chinensis tending to break the ca and/or that the depth to water table at site C3 was deep (>1.0 m; Fig. 4)". Provide other/alternative explanations of this result, especially that Leymus chinensis is dominant in C2(G), C3, D2, E2(C), E2(U), and E3(C) but the lower moisture content was only observed in C2(G) and C3.

Following this sentence in Line 26 on P1905 insert a clarification statement of: "This similar effect on capillary rise at site D2, E2(C), E2(U), and E3(C), which also are dominated by Leymus chinensis Tzvelev, was not observed because the depths to water table at these sites were shallow."

11. P:1907, lines 11-13. "An ANOVA test indicated insignificant differences for bulk density, K, pH, and electrical conductivity, but revealed significant differences for the other physicochemical properties". I suggest that you list the physiochemical properties that were significantly different as well.

Done! This sentence is rephrased as: "An ANOVA test indicated insignificant differences for bulk density, K, pH, and electrical conductivity, but revealed significant differences for the other physicochemical properties (i.e., N, P, soil organic matter, soil moisture characteristics, sand content, and silt-clay content), among dunes, cultivated lands, grazing meadows, and control meadows, at a family significance level of 0.05."

12. P 1907, lines 24-25. "This indicates that the decrease of silt-clay content will likely cause the decrease of soil organic matter, nutrients, and water holding capacity". Soil organic matter is mostly related to vegetation cover and microbial activity in a given plot/area. I don't think that it's right to conclude that the decrease of silt-clay will likely cause a decrease in soil organic matter. I suggest that you rephrase the sentence to "the decrease of silt-clay and/or soil organic matter will likely cause the decrease of nutrients and water holding capacity".

Yes. This sentence is rephrased as: "This indicates that the decrease of silt-clay content will likely cause the decrease of nutrients and water holding capacities (Lo′pez, 1998; Su and Zhao, 2003; Li et al., 2004), and that soil organic matter is key to maintaining soil nutrient and moisture levels (Larney et al., 1998; Zhao et al., 2006)."

13. P: 1908, lines 1-3. "however, insignificant correlations were found between any of these soil properties and total K, available K, pH, bulk density, and EC, though the latter five physicochemical properties exhibited variations from site to site (Figs. 5–8)". I recommend that you provide some interpretations/explanations of the lack of correlation between these variables and the other ones.

Following this sentence in Line 3 on P1908 insert an explanation of: "The reason for the insignificant correlations is because those physicochemical properties have no causal relations. For example, total N is independent of total K, and soil moisture characteristics are independent of EC."

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/8/C1221/2011/hessd-8-C1221-2011-supplement.pdf

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 1895, 2011.