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Hydrology and Earth System Sciences Discussions

Interactive comment on "Soil Infrastructure, Interfaces and Translocation Processes in Inner Space (Soil-it-is): towards a road map for the constraints and crossroads of soil architecture and biophysical processes" *by* L. W. de Jonge et al.

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This is an interesting paper and a valuable contribution to promote renewed thinking about the complex but fundamental soil architecture in understanding diverse soil functions. The authors have made an attempt to highlight inner soil space through comparing a high-C and a low-C soils in terms of their clay/OC ratio, complexed vs.

non-complexed clay and OC contents, as well as their relationships to gas diffusivity, colloid transport, water repellency, volatile organic vapor sorption, preferential gas flow, fingered water flow, and inferred soil pore structure (sponge-like vs. pipe-like). The "Soil-it-is" project is the motivation behind this writing and the proposed "road map" towards portraying the constraints and crossroads of soil architecture and biophysical processes is thought-provoking. The manuscript is generally well written. The authors have reasonably addressed the review comments in the revised manuscript.

Nevertheless, I have the following comments that hopefully would help the authors to further improve the manuscript (page numbers etc. refer to the revised manuscript):

1. I agree with the 3rd reviewer that the paper falls short in discussing biological aspects of soil inner structure and lacks direct measurements of soil inner space which is now widely available (such as computed tomography images that can show high resolution inner soil pore space in 3D and various pore structural parameters can be well quantified from such images). I would suggest further strengthening these aspects in the proposed "road map" so that such a map is more comprehensive and receptive to a broader community. For example, microbial factors could be added to Fig. 14. In addition, it would be helpful to have some discussions on how to obtain a "road map to soil inner space" – or a series of maps at different spatial and temporal scales – including what to measure and how to measure etc. (e.g., how m could be effectively determined?)

2. Perhaps this paper is more an index or mechanism focused, thus considerable spatial and temporal variability that is nearly universally encountered in the field is not considered in this paper's road map. However, the issue of spatial and temporal variability has implications for how to sample soil in a field plot and how many samples are needed to obtain meaningful clay/OC ratio and other soil structural indices discussed in this paper. Thus perhaps this issue could be added (briefly) to the "road map" that can help develop a more universal principle regarding soil architecture and biophysical processes.

3. Regarding Dexter et al. (2008) threshold of clay/OC ratio and the soil samples reported in this paper, a clear differentiation between A and B or C horizon soils would probably be needed since subsoils generally would exhibit a different threshold compared to surface soils. Another differentiation likely needed is different types of soils and land uses, thus one specific clay/OC ratio of 10 is likely debatable. It seems that most discussed in this paper applies to surface soils rather than subsoils, and to agricultural soils rather than forest soils or other land uses. P. 9 lines 22-23: mostly applies to surface soils, but not necessarily subsoils.

4. Abstract p. 3 line 18: please add after "poorly functioning soils" in terms of what functions? Also, p. 27 line 11: "unhealthy pibes" should be "unhealthy pipes." But I also wonder whether it is true that downpipe-like pore system is always "unhealthy"? This will likely depend on intended land use as well as whether it refers to surface soil or subsoil. Many subsoils do have "pipe-like" pore system but function well for soil drainage (e.g., earthworm channels).

5. p. 5 line 15: "critical zone" should be capitalized as "Critical Zone". Also in p. 13 line 18.

6. p. 7 definition of "soil architecture": I wonder whether "a few basic building blocks" is adequate? We know that soils are complex systems and this paper has discussed a number of properties and processes that influence soil architecture.

7. p. 8: I found the definition of "self-organization" is still less satisfactory. Self-organization is a process which represents a spontaneous formation of a special ordered structure. An extensive discussion on self-organization can be found at http://en.wikipedia.org/wiki/Self-organization

8. p. 13 line 6: I'm not sure the effect of organic depletion on soil pores is visible in Fig. 2. Also, it would be desirable to indicate whether the two soils shown came from the same soil type and parent material? Otherwise, the color difference of the two soils may be due to other factors (such as parent material, soil drainage or redox condition

etc.)

9. p. 14 line 24: not sure what "opposite water and dissolved tracer experiments" mean?

10. p. 15 line 17: it is not completely clear to me what "blocked soil space" is.

11. p. 17 lines 12-14: I'm not completely clear about this. Could this be elaborated a bit more?

12. p. 24 line 10 Or et al.: shouldn't it be 2007?

13. p. 26 line 17: Suggest add "functional" in front of soil architecture.

14. p. 28 line 9: suggest spell out "WLR". Also p. 29 line 6: spell out "PAHs"

15. p. 43 line 8: suggest add "(WR)" after "water repellency" and add "(K'D)" after "TCE sorption"

16. Table 1: please explain what the superscripts of a, b mean? If they are significance level of mean value comparison, please indicate sample size n in the table caption. Also, need to indicate what soil horizon from which the samples were collected.

17. Table 3: I assume all surface soils? Also need to indicate this for all Fig. 1 soils.

18. Figs. 3 to 5: error bars mean what? What is sample size n=? For Fig. 5: x-axis should have "-" sign added to each number. Fig. 6 x-axis label: change e to the right symbol.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 2633, 2009.