Geoscientific

Model Development

Discussions

[GMDD]

Interactive

comment

Interactive comment on "A multi-isotope model for simulating soil organic carbon cycling on an eroding landscape (WATEM_C v1.0)" *by* Zhengang Wang and Kristof Van Oost

Anonymous Referee #2

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comments to the GMD manuscript # A multi-isotope model for simulating soil organic carbon cycling on an eroding land scape

The authors developed a soil carbon model with coupled processes of decomposition, advection-diffusion and erosion-deposition. The model includes all carbon isotopes and 137Cs. It is a great effort to include all the carbon isotopes in the model. I have several suggestions and concerns below hoping to improve the manuscript.

1.Lack of technical details in the methods section is obvious. To name a few: how did the authors implement plant type change (changes in input, roots and/or else?)? how did the authors test Suess effect in the model? How did the authors simulate spatial

variability? How did the authors determine the initial conditions of the model? What are the depth and depth intervals of the model? More descriptions are necessary for 137Cs dynamics, such as equations and parameter values.

2.A data-model comparison is necessary for model evaluation. I suggest a direct comparison between model outputs and data in figure 7 and figure 8. For example, plot them together.

3.Routine modeling activities such as sensitivity and uncertainty analysis are needed for model evaluations. Relative importance of the three main processes (decomposition, advection-diffusion, and erosion-deposition) need to be shown in some way.

4.An introduction and discussion of progress in model development in carbon isotopes would be very relevant.

5.The results could use some more work. For example, I would not use current figure 1 as the first figure. It is not your central figure. I would first show some figures in model-data comparisons.

A few more comments: 1. What is WATEM_C short for? I did not find its full name throughout the text. 2. Lines 100-105: L and S are slope steep and length factors, or the other way around? 3. Line 211: developED 4. Would a table be helpful for presenting all the modeling scenarios? 5. A, S, and P in equations 7, 8, and 9: are not they carbon concentration (in the unit of for example, gC/m3) instead of carbon content? Because the authors model them with explicit depth. Please clarify. 6. Equation 18: the terms on the right side are supposed to be partial differentials and K(z) is supposed to be inside the second-order differential due to the fact that K changes with z. 7. what are the K values for Fig.1c? and similar issues for other relevant figures. 8. I am surprised to see lack of depth dependence of 13C in Scenario 1. (Fig. 3a). Could the slower decomposition and lower carbon input along depth result in changes in 13C with depth, like 12C and 14C? Please clarify. 9. Fig. 6 is difficult to read. I'd suggest the authors use colored scheme. 10. Line 280: negligence instead of negelation

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Discussion paper