

## ***Interactive comment on “Modeling dissolved organic carbon in temperate forest soils: TRIPLEX-DOC model development and validation” by H. Wu et al.***

**Anonymous Referee #1**

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### Overview

Overall the research and development of a robust and improved soil/DOC processing model is needed towards better constraining organic carbon dynamics across the land-water continuum. The authors are correct to identify this as a significant weakness, and thus limiting the community in their efforts to close terrestrial carbon cycles in watersheds. The authors attempt to incorporate sorption/desorption, throughfall DOC, as well as soil microbial consumption into a submodel of the Forest-DNDC framework and successfully simulated soil organic carbon dynamics within a temperate pine forest across 2-65yr stand ages. The authors then simulate the effect of land cover change – the clear of 50

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### General Comments

Overall the discussion manuscript should be checked for grammar throughout. There are some specific comments below but a more thorough reading by the authors would benefit the flow of the discussion. One point that could be expanded upon centers on the comparison of the different DOC models starting on page 3488. It is important to acknowledge all of these models, and their alternate assumptions on how DOC is regulated and processed within soils environments. What would strengthen this argument significantly is if the authors could take the very complete datasets that exist for the Turkey Point site and run them through the DyDOC, Neff and Asner, as well as any other one that is within the discussion. It would not appear to be a significant additional effort given the depth of observational data that exists across these sites. This suggestion may not be feasible where  $^{14}\text{C}$  is needed for the model, but non-the-less it would greatly enhance the manuscript to have a presentation of the difference in predicted DOC across soil layers, across models. The authors could also strengthen this manuscript by providing a more thorough presentation of uncertainty across the model. Inherent in the improved model is a very simple sub routine for the estimation of DOC in throughfall, sorption and desorption of organic carbon within soils etc, without adequate discussion on the strengths and weaknesses of these routines. A couple of additional sentences on uncertainty added within Section 2 – model description would provide context for future users of the model to have caution regarding assumptions associated with these sub-routines. Along those lines, the authors are correct to suggest that this model is limited by the assumption of an equilibrium distribution constant for the sorption/desorption kinetics. If possible, could the authors also provide some indication of uncertainty on the figures for calculated DOC fluxes. This seems especially important for the efforts to quantify the impact that land conversion – forest harvest has on DOC flux. With this said, the use of the TRIPLEX-DOC is a strong step forward from previous models and should be further developed. In addition, the authors allude to the accompanying manuscript by Wu et al. 2013, integrating a water routing model to Forest-DNDC. The coupling of these two efforts would be a strong contribution to

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understanding the processing and partitioning of organic carbon across both terrestrial and aquatic carbon cycles. More discussion on this point would benefit the reader by providing a broader context for why this effort is so needed right now.

#### Technical Comments

3475-1: Soil organic carbon is included in many global carbon budgets – and in fact DOC is ‘modeled’ extensively, however it is not routed to riverine networks effectively, this seems to be the argument of the authors, however the first statement is written incorrectly. 3476-5: There are some larger more recent articles that have better quantified these outgassing of CO<sub>2</sub> from streams and rivers. . .specifically in temperate systems. 3476-20: The citation of 1.9Pg C yr<sup>-1</sup> for DOC is incorrect- the Cole article includes inorganic carbon in that number as well. 3477-25: There are obviously many studies that are looking at DOC leaching from soils, but one of interest in also [Raymond and Saiers, 2010] 3479-1: grammar 3479-10: This figure is the Forest-DNDC model almost in its entirety, be more specific on which component this research is changing or adding. 3480-20: Can the authors give a sense for the magnitude of throughfall DOC – as it is unclear in temperate systems how important this will be to the overall soil DOC pool and hence the land water connection. 3481-24: Because decomposition. . .not a sentence. 3483-15: See Raymond and Saiers 2010 for additional information on flow rates and DOC, leaching through soils, as well as [Xu et al., 2012] 3487-2: spelling issues

#### Tables and Figures:

Figure 1. Can the authors differentiate their efforts from the former figure of the Forest-DNDC model? Figure 2. This figure does not add much to the discussion, and could simply be included in text with Figure 4. this is difficult to read – can you make the grey lines more distinct.

In general – the error bars are difficult to see and should be described in every figure legend.

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#### Suggested References:

Raymond, P. A., and J. E. Saiers (2010), Event controlled DOC export from forested watersheds, *Biogeochem*, 100(1-3), 197-209. Xu, N., J. E. Saiers, H. F. Wilson, and P. A. Raymond (2012), Simulating streamflow and dissolved organic matter export from a forested watershed, *Water Resour Res*, 48(5), W05519, doi:10.1029/2011WR011423.

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Interactive comment on *Geosci. Model Dev. Discuss.*, 6, 3473, 2013.

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