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Interactive comment on "Integrating microbial physiology and physiochemical principles in soils with the MIcrobial-MIneral Carbon Stabilization (MIMICS) model" *by* W. R. Wieder et al.

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This well-written paper adds some important mechanisms into microbial models of soil carbon dynamics. In particular, previous microbial models (and many conventional models) have ignored the direct physical and mineralogical controls over soil carbon storage. The MIMICS model includes a nice balance of plausible biological and physical mechanisms. No other model has integrated microbial physiology, microbial functional groups, and physical protection mechanisms in this way. The model validation exercise was limited to litter but encouraging in the match between model and data.

This paper also poses a challenge for biogeochemists. In a sense, the cart is go-

ing before the horse because MIMICS includes many perfectly reasonable hypotheses and parameters, but very few are backed up with good empirical data across a range of sites. Enzyme kinetics and MGE are probably the best studied parameters in the model, and yet they are derived from only a few measurements at a handful of sites. Microbial turnover and partitioning are rarely studied quantitatively or in relation to soil type. Even for microbial functional groups, there is a discord between the huge amount of molecular data collected today on microbes and the functional properties that are needed to drive MIMICS. This new model is potentially valuable and better than conventional models, but we have a lot of work to do before we can be sure.

The model does make an important theoretical contribution that I think is overlooked. Wieder and I have both participated in recent manuscripts that question microbial models for producing transient dynamics and responses to inputs that are potentially unrealistic (Wang et al. 2013, Li et al. 2014). I'm not certain, but it looks like the MIMICS framework may address these issues by adding some more complexity and realism. Specifically, the inclusion of multiple functional groups and mineral processes may dampen oscillations that are otherwise predicted by microbial models. There is also a more reasonable relationship between inputs and SOM, at least in some soil types. Thus MIMICS may be approaching the right balance between complexity and realism.

References

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