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Interactive comment on "Modeling the effects of organic nitrogen uptake by plants on the carbon cycling of boreal ecosystems" *by* Q. Zhu and Q. Zhuang

Anonymous Referee #2

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This paper incorporated, for the first time, the effects of plant absorption of soil amino acids into an ecosystem carbon/nitrogen cycling model for tundra and boreal forest. This is an important advancement of carbon cycling models in these ecosystems because both ecosystems are known to be nitrogen-limited, and observational studies indicate that roots absorb substantial quantities of amino acids. This addition of organic N uptake to integrated carbon/nitrogen cycling models thus improves the fit between model structure and field observations.

The study made a rigorous comparison between model performance with and without organic-N uptake and found that the addition of the organic N module improved the fit between modeled and observed ecosystem carbon fluxes (GPP and NEP). Although

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the carbon-flux parameters were calibrated to provide a reasonable fit to data, there was no fitting of N uptake parameters, so the improved performance of the organic-N version of the model appears to represent improved representation of N flux dynamics in the model.

Every model makes simplifying assumptions about how processes are modeled, and this model is no exception. The model assumption that differed most strongly from field observations was that plants preferentially take up inorganic N and add organic N uptake, only if inorganic N is insufficient to meet plant demand. In contrast, field kinetic studies indicate that tundra and boreal plants absorb some organic acids more rapidly than ammonium, which is absorbed more rapidly than other amino acids and nitrate. However, the simplifying assumption in the model (preferential absorption of inorganic over organic N) is the most appropriate assumption to make if the primary purpose of the modeling exercise is to determine whether addition of an organic-N uptake module improves performance of the C/N cycling estimates made by the model. As the authors point out, variation in uptake kinetics among the forms of organic and inorganic N could be the topic of future studies. The authors succeeded in demonstrating that incorporation of organic N uptake into ecosystem carbon balance models makes a difference. I congratulate the authors in this important and rigorous study.

A minor editorial point: In some places (e.g., some places in the abstract and introduction), the authors mention only boreal ecosystems, whereas I think they mean arctic and boreal.

Interactive comment on Biogeosciences Discuss., 10, 13455, 2013.