

***Interactive comment on* “Northern peatland carbon stocks and dynamics: a review” by Z. Yu**

Anonymous Referee #2

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This is an interesting meta-analysis of peatland C accumulation over diverse spatial and temporal scales. Although estimates of total C stocks in northern peatlands are useful albeit uncertain as indicated in Section 2, estimates of how these stocks change with climate and hydrology are likely more relevant to current concerns about rising atmospheric C. Some analysis of how changes in NECB vary with climate (temperature, precipitation) and hydrology (water table depth) at annual to millennial time scales, and the ‘process understanding’ that such analysis would require, would be an extremely useful addition to this paper. What inferences about variation in NECB with climate might be drawn from the early vs. late Holocene accumulation rates in Sec. 3? For current changes in NECB with hydrology, papers by Sulman et al. 2010 (Geophys Res Lett, 37(19), L19702, doi:doi:10.1029/2010GL044018) and 2012 (this journal) might be helpful. Concerning the calculation of these changes, what is the sensitivity of NCB to assumptions about decomposition rates, and does this sensitivity cause the earlier

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C accumulation in Fig. 2e in comparison to findings from other studies? What are the implications of these different rates for global C cycling as mentioned at the end of Section 3? Is there any way to test these assumptions at an annual time scale under site-specific conditions with estimates of ecosystem respiration from eddy covariance measurements? Such testing would improve confidence in NCB estimates. The causes of larger NECB vs. NCB in Fig. 4 could be elaborated upon. To what extent can these be attributed to assumptions in gap-filling fluxes to derive NECB? Too great an acceptance of smaller CO₂ effluxes measured under marginally turbulent conditions (low u^*) could lead to underestimates in gap-filled effluxes and hence overestimates of annual NECB. However greater contemporary vs. historical estimates of C accumulation at Mer Bleue have also been attributed to recent rises in N deposition. Can the NECB – NCB comparisons in Sec. 4 be more resolved in climate space (i.e. under comparable temperature and precipitation) while removing disturbance effects in NCB? Specific comments: p. 5075 l. 15: ‘studies of using’ p. 5079 l. 6: Check this accumulation rate – it seems large. Fig. 1 seems redundant.

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