

September 22, 2014

Umakant Mishra has an open discussion paper in Biogeosciences Discussions

B.S. Drewniak, **U. Mishra**, J. Song, J. Prell, and R. Kotamarthi. Modeling the impact of agricultural land use and management on US carbon budgets. *Biogeosciences Discuss*, 11, 13675-13698, 2014

Abstract. Cultivation of the terrestrial land surface can create either a source or sink of atmospheric CO₂, depending on land management practices. The Community Land Model (CLM) provides a useful tool to explore how land use and management impact the soil carbon pool at regional to global scales. CLM was recently updated to include representation of managed lands growing maize, soybean, and spring wheat. In this study, CLM-Crop is used to investigate the impacts of various management practices, including fertilizer use and differential rates of crop residue removal, on the soil organic carbon (SOC) storage of croplands in the continental United States over approximately a 170 year period. Results indicate that total US SOC stocks have already lost over 8 Pg C (10%) due to land cultivation practices (e.g., fertilizer application, cultivar choice, and residue removal), compared to a land surface composed of native vegetation (i.e., grasslands). After long periods of cultivation, individual plots growing maize and soybean lost up to 65% of the carbon stored, compared to a grassland site. Crop residue management showed the greatest effect on soil carbon storage, with low and medium residue returns resulting in additional losses of 5% and 3.5%, respectively, in US carbon storage, while plots with high residue returns stored 2% more carbon. Nitrogenous fertilizer can alter the amount of soil carbon stocks significantly. Under current levels of crop residue return, not applying fertilizer resulted in a 5% loss of soil carbon. Our simulations indicate that disturbance through cultivation will always result in a loss of soil carbon, and management practices will have a large influence on the magnitude of SOC loss.

<http://www.biogeosciences-discuss.net/11/13675/2014/bgd-11-13675-2014.pdf>