Biogeosciences Discuss., 7, C1543–C1546, 2010
www.biogeosciences-discuss.net/7/C1543/2010/

Biogeosciences Discussions

Interactive comment on "Spatial and temporal patterns of CH_4 and N_2O fluxes in terrestrial ecosystems of North America during 1979–2008: application of a global biogeochemistry model" *by* H. Tian et al.

H. Tian et al.

tianhan@auburn.edu

Received and published: 24 June 2010

First of all, thank reviewer for the positive comments on our manuscript. For the five questions, we would like to answer them as following; 1) We have compared our results with Kort et al's continental-level estimate (Kort et al., 2008b). The spatial distribution of CH4 and N2O are quite correlated between Kort et al's study and ours. The difference between two studies is the CH4 emission from wetland. Our model study assumed that one single grid is occupied by one biome, so the spatial coverage of CH4 source is limited, compared to Kort et al's study. So a fractional simulation to show the CH4 flux

are necessary, we are currently working on this effort and will compare it with Kort et al's results and CH4 fluxes derived from satellite imageries (Bergamaschi et al., 2007; Bergamaschi et al., 2009) and empirical model (Bloom et al., 2010). 2) Thanks for the suggestion; examination of the factorial contribution of all global change factors is very important for policy making because it could provide direct suggest for mitigating emission of gases. We have finished this effort and one manuscript partitioning CH4 flux to global change factors has been accepted to publish in Biogeosciences Discussion, and another manuscript partitioning of N2O flux to all global change factors is under review in the journal Global and Planetary Change. 3) Yes, we agree that both temperature and precipitation are two key controllers for CH4 and N2O fluxes (Conrad, 1996; Mer and Roger, 2001; Xu et al., 2008a). In current study, temperature and precipitation were combined as one global change factor, climate change. It will be an important contribution if the contribution from temperature and precipitation could be separated, as Bridgham et al suggested (Bridgham et al., 2006b). We will conduct further study to separate temperature and precipitation's influences on CH4 and N2O fluxes in near future. 4) The consistency between Xu et al (Xu et al., 2008a) and our study suggest that our study captured the continental level N2O flux. The dominant role of climate variability (mainly temperature and precipitation) on the inter-annual variability in CH4 and N2O fluxes has been confirmed in our study (section 4.3.Environmental controls on CH4 and N2O fluxes). Yet it does not mean temperature and precipitation solely control CH4 and N2O flux on which Xu et al's study was based (Xu et al., 2008a). Our current study also considered the influence from atmospheric CO2, nitrogen deposition, ozone pollution, and land use change etc. 5) All the correlations between fluxes and temperature and precipitation are based on continental-level average. It might not totally represent site-level results. We conducted this analysis is to show the potential effects of climate change on continental-level fluxes of CH4 and N2O. The controlling of precipitation on terrestrial fluxes of CH4 and N2O is due to the high dependence of CH4 and N2O production on soil moisture. The temperature also exerts control on the CH4 and N2O production; the insignificant correlation between CH4 and temperature at continental-level does not mean the temperature did not influence CH4 flux. It might due to spatial variation of the temperature control on CH4 block the correlation at continental-scale. Grid-level correlation has been found between CH4 flux and temperature for majority of continental North America.

Barlett, K.B. and Harriss, R.C., 1993. Review and assessment of methane emissions from wetlands. Chemosphere, 26(1-4): 261-320. Bergamaschi, P. et al., 2007. Satellite chartography of atmospheric methane from SCIAMACHY on board ENVISAT: 2. Evaluation based on inverse model simulations. Journal of Geophysical Research, 112(D02304): doi:10.1029/2006JD007268. Bergamaschi, P. et al., 2009. Inverse modeling of global and regional CH4 emissions using SCIAMACHY satellite retrievals. Journal of Geophysical Research, 114(D22301): doi:10.1029/2009JD012287. Bloom, A.A., Palmer, P.I., Fraser, A., Reay, D.S. and Frankenberg, C., 2010. Large-scale cotnrols of methanogenesis inferred from methane and gravity spaceborne data. Science, 327: 322-325. Bridgham, S.D., Megonigal, J.P., Keller, J.K., Bliss, N.B. and Trettin, C., 2006a. The carbon balance of North American Wetlands. Wetlands, 26(4): 28. Bridgham, S.D., Megonigal, J.P., Keller, J.K., Bliss, N.B. and Trettin, C., 2006b. The carbon balance of North American Wetlands. Wetlands, 26(4): 889-916. Chen, Y. and Prinn, R., 2006. Estimation of atmospheric methane emissions between 1996 and 2001 using a three-dimensional global chemical transport model. Journal of Geophysical Research-Atmospheres, 111(D10): D10307. Conrad, R., 1996. Soil microorganisms as controllers of atmospheric trace gases(H2, CO, CH4, OCS, N2O, and NO). Microbiological Reviews, 60(4): 609-640. Kort, E.A. et al., 2008a. Emissions of CH4 and N2O over the United States and Canada based on a receptor-oriented modeling framework and COBRA-NA atmospheric observations. Geophysical Research Letters, 35(L18808). Kort, E.A. et al., 2008b. Emissions of CH4 and N2O over the United States and Canada based on a receptor-oriented modeling framework and COBRA-NA atmospheric observations. Geophysical Research Letters, 35(L18808): doi:10.1029/2008GL034031. Li, C.S., Narayanan, V. and Harriss, R.C., 1996. Model estimates of nitrous oxide emissions from agricultural lands in the United States. Global

Biogeochemical Cycles, 10(2): 297-306. Mer, J.L. and Roger, P., 2001. Production, oxidation, emission and consumption of methane by soils: a review. European Journal of Soil Biology, 37: 25-50. Potter, C. et al., 2006. Methane emissions from natural wetlands in the United States: satellite-derived estimation based on ecosystem carbon cycling. Earth Interactions, 10: Paper 10-022. Xu, X., Tian, H. and Hui, D., 2008a. Convergence in the relationship of CO2 and N2O exchanges between soil and atmosphere within terrestrial ecosystems. Global Change Biology, 14(7): 1651-1660. Xu, X.F., Tian, H.Q. and Hui, D.F., 2008b. Convergence in the relationship of CO2 and N2O exchanges between soil and atmosphere within terrestrial ecosystems. Global Change Biology, 14(7): 1651-1660.

Interactive comment on Biogeosciences Discuss., 7, 2831, 2010.