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Interactive comment on "Modeling impacts of management alternatives on soil carbon storage of farmland in Northwest China" *by* F. Zhang et al.

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For general comments:

We appreciate the two comments on (1) analyzing the impacts of different cropping systems on the regional C dynamics, and (2) impact of alternative management practices on net greenhouse gas emissions.

To respond the first comment, we made a further analysis to compare the contributions of two major cropping systems, i.e., corn and paddy rice, to the C dynamics in Shaanxi Province. The result indicated that the corn fields in Shaanxi sequestered 0.096 Tg C/yr under the baseline scenario, and the sequestration rate increased to 0.138 and 0.339 Tg C/yr under the manure and 90% of crop residue incorporation scenarios, respectively. The rice fields lost 0.008 Tg C/yr under the baseline scenario, and gained

0.001 and 0.034 Tg C/yr under the manure and 90% of crop residue incorporation scenarios, respectively. Model results indicated that the difference in impact of the alternative farming practices on SOC was related to the acreage, location and gross litter production of the crops. The results have been described in a new paragraph, which will be amended into the manuscript.

To respond the second comment, we calculated N2O and CH4 emissions at the regional scale under the baseline and alternative management scenarios. By converting the baseline practice to the alternative scenarios, the regional N2O emission increased from 0.0258 to 0.0259 and 0.0267 Tg N per year due to the increase in crop residue incorporation and the manure use, respectively. The increases in N2O emissions (0.0001 and 0.0009 Tg N2O-N for crop residue increase and manure application, respectively) are equivalent to 0.049 and 0.438 Tg CO2. Since the C sequestration rates induced by the increase in crop residue incorporation and manure use are 7.7 and 0.66 Tg CO2 (or 2.1 and 0.18 Tg C), respectively, the increases in N2O offset 0.6% and 66% of the benefits gained by the C sequestrations with the two alternative management practices, respectively. The results implied that amendment of manure could increase N2O emissions with a higher rate than crop residue incorporation. That makes sense as manure usually possesses much lower C/N ratio than crop litter. The modeled results indicated that the impact of alternative practices on CH4 is negligible with a total flux of bout 0.17 Tg CH4-C across the different management scenarios for the croplands in Shaanxi. The above-mentioned results about net GHG emissions will be added into the discussion of the manuscript.

For specific comments:

The soil bulk density (1.7 g cm-3) for Xinyi site could have been overestimated. Since the lack of observed soil density data for the site, we estimated the value based on the information from book Soil Species of China (National Soil Survey Office, China Agricultural Press, Beijing, 1994, in Chinese). According to Soil Species of China (Volume3, pp.54, pp. 76, pp. 614, pp. 714), the soil type in Xinyi County is red soil

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with loam, clay loam and sandy loam textures. The soils are highly compacted with manganese-iron nodules. The bulk densities range from 1.1 to 1.7 g cm-3. The upper limit (1.7 g cm-3) of the range was adopted for the simulation for the Xinyi soil. Since bulk density is not among the top sensitive factors for SOC dynamics, we assume the error introduced by the incorrect bulk density may not affect the modeled SOC trends very much for this case.

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Interactive comment on Biogeosciences Discuss., 3, 409, 2006.