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Greenhouse gas emissions of different land uses in the delta region of Red River, Vietnam

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Agricultural activities are responsible for up to a third of total anthropogenic GHG emissions. The subtropical/tropical delta areas of the large rivers in Southeast Asia are long-term history agricultural regions in the world. However, due to lack of field measurements, the estimation of the contribution of agro-ecosystems in the subtropical/tropical delta areas to global greenhouse gas emissions remains largely uncertain. Here, we conducted field experiments since January 2016 to quantify greenhouse gases (CO_2, CH_4 and N_2O) emissions from four agricultural land uses of annual rice-rice, rice-vegetable, continuous vegetable system and fish pond in Red River delta region of Vietnam by using the transparent static chamber-gas chromatography technique. Higher N_2O emissions were observed in the rice-vegetable and continuous vegetable systems, while lower N_2O emissions were observed in the rice-rice and find pond systems. Compared to rice-rice system the cumulative N_2O fluxes were on average twenty-fold higher in the rice-vegetable and continuous vegetable systems but significantly lower (75%) in the fish pond. Overall the net CO_2 sinks were observed in the rice-rice system while other three land uses of rice-vegetable, continuous vegetable and fish pond acted as the net CO_2 sources. The rice-rice and fish pond showed net CH_4 emissions while variations of CH_4 emissions (i.e. shifting between sources and sinks) along variations of soil moisture and temperature were observed in rice-vegetable and continuous vegetable systems. Compared to rice-rice system, the cumulative CH_4 fluxes were significantly decreased by 100% for continuous vegetable system, 94% for rice-vegetable system and 89% for fish pond. Overall, the data suggest that conversion of traditional rice-rice paddy system to rice-vegetable, continuous vegetable system and find pond, which are currently undergoing driven by the economical requests and environmental changes (e.g., salinity intrusion) in this delta region, could alter CH_4, CO_2 and N_2O emissions.