Spring 2003

Greenhouse gas emission consequences of large-scale changes in water management of China's rice paddies during 1980-2000

Changsheng Li
University of New Hampshire - Main Campus

Jianjun Qiu
Chinese Academy of Agricultural Science

Steve Frolking
University of New Hampshire - Main Campus, steve.frolking@unh.edu

Xiangming Xiao
University of New Hampshire - Main Campus

William A. Salas
University of New Hampshire - Main Campus

See next page for additional authors

Geophysical Research Abstracts, Vol. 5, 02283, 2003

GREENHOUSE GAS EMISSION CONSEQUENCES OF LARGE-SCALE CHANGES IN WATER MANAGEMENT OF CHINAŠS RICE PADDIES DURING 1980-2000

Changsheng Li (1), Jianjun Qiu (2), **Steve Frolking** (1), Xiangming Xiao (1), William Salas (3), Berrien Moore III (1), Steve Boles (1), Yao Huang (4), and Ronald Sass (5)

(1) Institute for the Study of Earth, Oceans, and Space, University of New Hampshire, (2) Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, Beijing (3) Applied Geosolutions, Durham, NH, (4) College of Resource and Environmental Sciences, Nanjing Agricultural University, (5) Dept. of Ecology and Evolutionary Biology, Rice University, Houston, TX. (steve.frolking@unh.edu / Fax: +1-603-862-0188)

In China, midseason paddy drainage, which reduces growing season methane fluxes and enhances growing season nitrous oxide fluxes, was first implemented in the early 1980s, and has gradually replaced continuous flooding in much of the paddy rice area. We constructed a prediction rice paddy methane and nitrous oxide emissions in China using the DNDC biogeochemical model. Results of continuous flooding and midseason drainage simulations for all paddy fields in China (about 30 million ha) were combined with regional scenarios for the timing of the transition from continuous flooding to predominantly mid-season drainage to generate estimates of total methane (CH_4) and nitrous oxide (N_2O) flux for 1980-2000. By shifting from continuous flooding to midseason drainage management, we estimate that total N_2O emissions from the rice paddies in China increased by about 0.17 Tg N_2O-N yr^{-1} due to the stimulated nitrification and denitrification, while CH_4 emissions decreased by about 4.5 Tg CH_4-C yr^{-1} due to increased soil aeration. Simulated net carbon loss in paddy soils was about 0.65 Tg C yr^{-1} due to elevated decomposition. On a 100-year time frame, CH_4 has a global warming potential (GWP) 23 times that of CO_2, and N_2O has a GWP 296 times that of CO_2. The total GWP impact (2000 vs. 1980) of shifting to predominantly

mid-season paddy drainage was -0.138 Pg CO_2-equiv yr^{-1} from methane, +0.077 Pg CO_2-equiv yr^{-1} from nitrous oxide and +0.0024 Pg CO_2 yr^{-1} from soil C loss, for a total GWP impact of -0.059 Pg CO_2-equiv yr^{-1}. The results imply that more than half of the GWP benefit of decreased CH_4 emissions was offset, primarily by increases in N_2O emissions, and to a small degree by soil C loss.