Geophysical Research Abstracts
Vol. 21, EGU2019-17801-1, 2019
EGU General Assembly 2019

Weakened growth of cropland N2O emissions in China

Ziyin Shang (1,2) and Feng Zhou (2)

(1) University of Aberdeen, Institute of Biological and Environmental Sciences, School of Biological Sciences, Aberdeen, United Kingdom (ziyin.shang@abdn.ac.uk), (2) Laboratory for Earth Surface Processes, College of Urban and Environmental Sciences, Peking University, Beijing, China

China has experienced rapid agricultural development over the recent decades, accompanied by increased fertilizer consumption in croplands, but the trend and drivers of the associated nitrous oxide (N2O) emissions have remained uncertain. The primary sources of this uncertainty are the coarse spatial aggregation of agricultural activity data and the incomplete model representation of N2O emissions in response to management. Here we provide new data-driven estimates of cropland N2O emissions across China from 1990 to 2014, compiled using a global monitoring network, nationwide survey-based reconstruction of N-fertilization and irrigation, and an updated version of spatially-referenced nonlinear algorithm. In addition, we have evaluated the drivers behind changing cropland N2O patterns using an index decomposition analysis approach. We find that China's annual cropland-N2O emissions increased on average by 11.2 Gg N yr ($P < 0.001$) from 1990 to 2003, after which emissions have plateaued until 2014 (2.8 Gg N yr, $P = 0.02$), as found in an ensemble of process-based terrestrial biosphere models (TBMs). The slowdown of an increase in cropland-N2O emissions after 2003 was pervasive across the majority of croplands, accounting in total for $\sim$2/3 of the total sowing areas. This change was mainly driven by the nationwide reduction of N-fertilizer application rates, partially due to the prevalence of the Nationwide Soil Testing and Formulation Fertilization Program, launched in the early 2000s. This reduction has almost offset the policy-driven expansion of sowing areas across most regions, but particularly in the Northeast Plain and the lower Yangtze River Basin. Our results underline the importance of high-resolution activity data and of regional adoptions of N2O emission response to agricultural management practices for capturing cropland-N2O emission patterns. Improving the representation of nationwide policy intervention in TBMs is also recommended for future projections.

Keywords: Nitrous oxide; agricultural soils; emission inventory; flux upscaling; agricultural management; process-based model; temporal trend; spatial pattern