Attribution of agricultural N_2O emission changes in China

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Reactive nitrogen (Nr) entering agricultural soils from fertilizer applications worldwide results into a 43%~63% of global anthropogenic N_2O emissions (EDGAR, 2014; Saikawa et al., 2014; Tian et al., 2014). Yet the patterns, trends, and the associated causes of Chinese emissions remains subject to large uncertainty, and inventories of China's total agricultural soils N_2O emissions at present varied by ~150% (Zhou et al., Environmental Sciences & Technology, 2014, 48: 8538-8547; Zhou et al., Global Biogeochemical Cycles , 2015, 29: 885-897). The primary sources of this uncertainty are conflicting estimates of emission factors, nitrogen inputs, and the associated environmental conditions, yet none of previous estimates are based upon large-scale measurements and high-resolution activity data. Here, we re-quantify China's N_2O emissions from croplands from 1990 to 2012, including direct and indirect pathways, using updated and harmonized N input data, high-resolution environmental factors data, and a comprehensive dataset of global N_2O observation networks. The spatially-variable emission factors are derived by empirical upscaling of ground-based observations, but validated by ecosystem models and atmospheric inversions of N_2O concentration data. Three main tasks have been performed in this study: i) the magnitude and spatiotemporal patterns of N_2O emissions over China croplands from 1990 to 2012; ii) the attributions of anthropogenic causes of the spatial variations, interannual variability, temporal trends, and growth rates of China's N_2O emissions from croplands. Overall this study may broaden our knowledge of the nitrogen cycle model for agro-ecosystem, which is important for refining IPCC default values of emission factors and designing China's N_2O mitigation protocols.