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中国农田肥料 N_2O 直接和间接排放重新评估

Re-quantification of the direct/indirect N_2O emissions from agricultural fertilizer in China

关键词: [氧化亚氮](#) [温室气体](#) [氮循环](#) [本土排放因子](#) [空间格局](#) [不确定性估计](#)

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摘要: 农田肥料(氮肥、复合肥、有机肥)是我国 N_2O 最大的排放源,其估计直接决定了排放总量的可靠性.为此,重新评估了中国农田肥料 N_2O 的直接和间接排放,选择2008年县域尺度活动数据、具有空间分异性的本土排放因子和参数来重新评估其排放规模、结构、空间格局及不确定性;通过与IPCC、EDGAR等国内外研究结果的对比分析,阐述该排放清单的可靠性和全面性.结果表明,2008年我国农田肥料 N_2O 排放总量为617.1 Gg(处于213.7~1149.2 Gg之间),其中,氮肥直接排放为458.8 Gg(74.5%),有机肥直接排放为121.0 Gg(19.6%),挥发沉降和淋溶径流造成的间接排放分别为28.0 Gg(4.5%)和9.3 Gg(仅占1.5%左右).排放集中在华北平原、东北的松辽平原、华中的淮河流域和四川盆地,以及华南的珠三角、雷州半岛和台湾地区的县(区、市、旗),主要分布在江苏(52.4 Gg)、四川(48.0 Gg)、湖北(43.2 Gg)、广东(40.8 Gg)、河南(39.6 Gg)、安徽(38.4 Gg)、湖南(31.6 Gg)、山东(28.9 Gg),其累积规模为全国总量的52%,其中,近50%的贡献源于164个县(区、市、旗).本排放清单具有更高的准确度和空间分辨率,而基于IPCC(2006)排放因子及参数的估计排放总量高估了约8.3%,对直接排放和间接排放则分别低估了12.5%和高估了330%.此外,在空间格局上还表现出高值区低估和低值区高估的特点,在491和1225个县(区、市、旗)的相对偏差超过了100%和50%,特别指出的是,间接排放在大部分县(区、市、旗)的相对偏差达到135%左右.

Abstract: Agricultural fertilizer, including straight N, compound N, and organic fertilizers is the largest contribution of China's N_2O emissions; its accuracy determines the reliability of total N_2O estimations. By using county-scale activity data, regional emission factors and related parameters derived from local studies, a high-resolution N_2O emission inventory of China's agricultural fertilizer is therefore established to re-quantify the emission loadings, source apportionment, spatial patterns and their total uncertainties. The proposed emission inventory is more reliable and comprehensive compared with previous ones determined by IPCC, EDGAR and other works. The main advantages could be reflected by (i) the total N_2O emission from China's agricultural fertilizer was estimated as 617.1 Gg in 2008 with the range from 213.7 to 1149.2 Gg, and emission sources in consideration included direct emission from straight N fertilizer (458.8 Gg, 74.5%), direct emission from compound N fertilizer (121.0 Gg, 19.6%), indirect emission produced through atmospheric deposition of N volatilized from agricultural fertilizer (28.0 Gg, 4.5%) and indirect emission from leaching/runoff (9.3 Gg, 1.5%); (ii) spatial pattern of China's N_2O emission from MMS was concentrated in the counties of Northeast Plain, Huaihe River Basin, Sichuan Basin, Pearl River Delta, Leizhou Peninsula and Taiwan, and the provinces with the highest emission rates included Jiangsu (52.4 Gg), Sichuan (48.0 Gg), Hubei (43.2 Gg), Guangdong (40.8 Gg), Henan (39.6 Gg), Anhui (38.4 Gg), Hunan (31.6 Gg), and Shandong (28.9 Gg), contributing of 52.4% of total emissions in total, in which more than 25% of total the N_2O emission was from only 164 counties; (iii) the proposed emission inventory was more accurate with higher spatial resolution. Previous estimation of direct emission underestimated by 12.5% while that of indirect emission overestimated by 3.3 times. Additionally, the emissions from 491 counties with higher emission rates were underestimated by more than 100%, while indirect emissions were overestimated by 135% in most counties.

Key words: [nitrous oxide](#) [greenhouse gas](#) [nitrogen cycle](#) [localized emission factor](#) [spatial pattern](#) [uncertainty estimation](#)

