研究论文

基于模型和GIS技术的中国稻田甲烷排放估计

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摘要　　将一个比较成熟的稻田甲烷排放模型CH_4MOD和GIS空间化数据库结合，模拟估计了中国大陆2000年水稻生长季稻田甲烷的排放。模型的空间输入参数包括：逐日气温、耕层土壤砂粒含量、外源有机质施用量、稻田水分管理模式、水稻移栽期与收获期、水稻种植面积与单产，空间分辨率为10km×10km。模拟结果表明：2000年稻田甲烷排放量为6.02Tg，其中：早稻生长季排放1.63Tg、晚稻1.46Tg、单季稻2.93Tg。提高区域稻田甲烷排放估计精度的进一步目标应放在减小输入参数误差和提高空间数据精度上，在现有数据库基础和模型——GIS技术下探讨我国稻田甲烷排放估计的不确定性范围是必要的。

关键词　　CH_4MOD；GIS；模型；稻田；甲烷

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Estimates of methane emission from Chinese rice paddies by linking a model to GIS database

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Abstract　Methane is one of the principal greenhouse gases. Irrigated rice paddies are recognized to contribute to the atmospheric methane concentration. Methane emission from rice paddies is among the most uncertain estimates of the agricultural sector in rice-growing countries. Efforts have been made over the last decade to estimate CH4 emission from Chinese rice paddies via model method. However, these estimates showed great uncertainties due to different models and up scaling methods. Reduction in the uncertainties might be achieved by coupling field-scale model to regional databases. The objective of this paper is to develop a methodology of coupling a CH4 emission model to regional databases by which the CH4 emission from Chinese rice paddies is then estimated.

CH_4MOD, a model for simulating CH_4 emission from rice paddies with a minimal number of inputs and parameters that are commonly available, is of great potential for up scaling as it has provided a realistic estimate of the observed results from various soils, climates and agricultural practices. By linking spatial databases to CH4MOD, CH4 emission from Chinese paddies in 2000 rice growing season was simulated with a daily step. The spatial databases were created by GIS with a spatial resolution of 10km×10km, which include soil sand percentage, amounts of crop straw and roots from previous season as well as farm manure, water management pattern, dates of rice transplanting and harvesting, acreage of rice planted, rice grain yield and daily air temperature. The software of ArcGIS was used for all of the GIS needs, including the data access, the projection definition, the overlaying of different vector layers, the creation of grids (an raster format of ArcGIS software) by converting vector data, and the conversion of data between grid and ASCII formats.

Methane emission from rice paddies of mainland China in 2000 rice-growing season was estimated to be 6.02 Tg (1 Tg=109 kg). (1.46Tg) are from the early-rice and the late-rice growing seasons, respectively.

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It was concluded that regional CH_4 emission from rice paddies could be estimated by coupling CH4MOD to regional databases with a high spatial resolution. A further effort should be focused on improving the quality of the spatial databases, especially in the amount of added organic matter and water regime. It is also necessary to evaluate the uncertainties of the present estimates by which the way to improving accuracy could be approached.

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