Methane from rice paddies: isotopic signals, microbial pathways and fluxes

From 1997-11-01 to 1999-10-31

Project Details

Ziel

The overall objective of RICEOTOPES is to improve the understanding of the relationships between the mechanisms that control methane emissions from rice paddies and temporal variations in the 13C/12C and 2D/1H ratios of the methane. Recent work in a Chinese rice paddy has shown that the temporal variations in isotopic composition (delta13C and deltaD) of the CH4 emissions are large. These variations are related to the processes of production, transport and oxidation of methane in rice paddies, but the quantitative relationships with these processes have still to be established. Achieving this goal is necessary in order to be able to interpret observed isotopic ratios in atmospheric CH4 in the main rice-growing areas of the world, so as to improve the modelling of regional and global fluxes from this source.

The principal experimental approaches to be used in RICEOTOPES are: CH4 flux measurements by static chambers throughout 3 growing seasons and the periods of soil drying at harvest, with intercomparisons with the eddy correlation technique during campaigns at selected times during the seasons; measurement of isotopic signatures (13C, D) of the CH4 emitted from rice paddies using high-precision isotope ratio mass spectrometry (IRMS) and tunable diode laser absorption spectroscopy (TDLAS); 14C tracer studies and use of microbiological inhibitors to establish the relative amounts of CH4 produced by different pathways, and the percentage reduction of methane emission due to CH4 oxidation.

The results will be modelled, by adapting an existing mathematical model of diffusion and reaction of CH4 and O2 in saturated systems.

An additional small study will investigate the emission of nitrous oxide from the paddy at times (flooding and drying out) when the soil aeration regimes are changing rapidly: conditions in which significant fluxes of this other greenhouse gas are thought to be possible.

The field work will be located in Europe (N. Italy), because of logistical requirements associated with long-term continuous measurement of fluxes, and the need for frequent sampling of air and soil for transport to laboratories in the Partners’ home countries for manipulations and analysis. However, the characteristics of CH4 emission from paddy soils of this region have been shown previously to be typical of those prevailing in major rice-growing regions of the world, and the applicability of the results will be global. The proposed work will bring together 6 groups that have already been successfully involved in the investigation of rice paddies, methane flux measurements, isotope studies and microbial pathways and processes for methane production and oxidation, and modelling.

Verwandte Informationen

Berichtsübersichtsberichte: Measurements of seasonal and diurnal cycles in 13C/12C and D/H ratios of methane emissions from rice fields
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Fachgebiete
Environmental Protection - Forecasting - Measurement Methods - Meteorology

Zuletzt geändert am 1998-10-08
Abgerufen am 2018-09-05

Permalink: https://cordis.europa.eu/project/rcn/39022_en.html
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