Estimation of scalar source patches for methane emissions from paddy fields using remote sensing flux footprint technique: case studies with paddy grown in the Eastern India.

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Abstract:

This work focuses on the development of a remote sensing micrometeorological technique, based on the footprints of methane fluxes from paddy fields. This method estimates the emission fluxes, probable size and location of the pertinent source areas of methane emissions from paddy fields.

This micrometeorological model is based on the analytical solution of the Eulerian advection-diffusion equation for a line source and then extrapolated to the case of an area source for cases of shorter downwind distances as compared to the infinite crosswind stretch. Diffusion in the lateral direction is commonly assumed to be Gaussian.The approach includes calculation of a factor $\int K \cdot dx$ with standard surface layer scaling parameters and meteorological data and measurement of trace gas concentration at a certain height. Then the source areas are computed with the SAM-2 (Schmid, 1994)model. Ultimately the trace gas fluxes, in g $m^{-2}s^{-1}$ are multiplied with the source areas in m^2 to give the odour emission rates in g s^{-1}, which are used in any dispersion models or predictive models for global climate change.

Flux chambers, which are generally used for measuring methane fluxes from agricultural sources directly, has different shortcomings. They cannot replicate the real world atmospheric conditions. The results obtained from the chambers also are not very authentic due to leakage along the piping and at fittings, especially when these chambers are used over a relatively rough surface like an agricultural field or a wetland.

A field experiment has been designed to measure different micrometeorological parameters like wind direction, wind speed, temperature, and relative humidity of air at two different heights of a meteorological mast. Simultaneously methane concentration was measured continuously at one of the levels using flame ionization detection technique.

The fluxes obtained from this model are also compared with the data obtained from direct chamber method experimentation. The results are obtained for previous two consecutive years for both **post monsoon** and **boro** variety of paddy. Obtained results

from these experiments are in good agreement with each other. Along with the fluxes the dimensions of all possible scalar source areas of methane emissions have been determined.

Reference

1. Schmid, H. P. (1994). “Source Areas For Scalars and Scalar Fluxes”, *Boundary-Layer Meteorology*. , **67**, pp. 293-318.