学 位 論 文 要 旨

The Comparison of greenhouse gases emission by closed chamber and eddy covariance technique in paddy rice field in Japan

クローズドチャンバー法と渦相関法による日本の水田からの温室効果ガス

排出の比較

生物生産科学専攻　生物制御科学大講座

Nongpat Chaichana

The global is being dramatically affected by environmental changes such as alterations to the composition of the atmosphere, associated shifts in climate and reductions in biological diversity. The increase of greenhouse gases in the atmosphere plays a prominent role in global warming. In addition to carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are also potent greenhouse gases, accounting for an estimate 19% and 7% of global warming, respectively. The problem is caused by anthropogenic activities like industrial process and burning of fossil fuels. The management of agricultural can also increase atmospheric greenhouse gases. Rice is the most important agricultural staple for more than half of the world's population and is grown in 114 countries over a total area of around 153 million ha. However, rice cropping systems are considered to be among the major anthropogenic sources of GHGs. Although the study of GHGs emissions from soil to atmosphere, it is still difficult to measure it accurately because of its great temporal and spatial variability and dependence on many environmental characteristics. A variety greenhouse gases measurement strategies exist, each with their own strengths and weaknesses. So, the accurate measurement, supporting well-inform the pattern tendency of such landscape-based emission is critical in order to understand the driver of climate change as well as to identify mitigation opportunities.

The goal of the present study is to understand the GHHs flux pattern in rice paddy field. Compare by using the widely used method, closed chamber (CC) method and eddy covariance (EC) method. The second objective was to find out the relationship between GHGs production mechanism in soil and environmental factors for the emission. Futhermore, to combine the output form CC and EC method for a more detail description for upscaling point data to large area and longer time series of GHGs emission.

In this study, greenhouse gas flux was conducted by CC and EC technique in flooded rice paddy field during June to November, 2014. Intensive monitoring using conducted at 30, 60, 90 days after transplanting (DAT) and after harvest (AHV). The EC method was conducted GHGs flux continuous measurements during the rice cropping season. It was found that spatial-temporal variation in GHGs flux among rice growing stage was observed. The variation of CH_4 flux pattern was similar for all growing stage. Methane flux was lower in early growing stage (30 DAT) and became highest in 60 DAT. Due to the increased of environmental factors including net radiation, air temperature and soil temperature. Diurnal variation of CH_4 flux from CC and EC method showed similar emission pattern for all growing stage. The CC method resulted in CH_4 flux average that were 58%, 81%, 94%, and 57% higher than those measured by the EC method at 30, 60, 90 DAT and AHV, respectively. The results found that, depending on the particular atmosphere condition make the over or underestimated by both methods. The overestimate by CC method due to the inclusion of optimally grown rice plants at high temperature for flux measurements, and the EC method aggregated different sourced and masked the individual process behind the fluxes at each point. With the analysis of continuous measurements that show the general trend of a large area and homogeneous terrain, the EC method has a strong advantage. The different strengths and weakness of the CC and EC methods can complement each other, and the use of both methods together leads to more understanding of GHGs emissions from paddy fields.