Development of a low-cost in-situ methane observation system and results of field observation at a paddy field in India

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Methane (CH_4) is the second most prevalent greenhouse gas next to carbon dioxide (CO_2). The atmospheric concentration of methane tends to increase year by year, and it is important to obtain detail information on the source of methane and seasonal variation of its concentration. Since there are many unclear points about the regional differences and seasonal variations of the methane concentration, further ground-based observations are needed to investigate them in detail. Previous studies suggest that the emissions of methane from farmlands in Southeast and South Asia have significant contribution to the methane concentrations. But, there are many difficulties to conduct observations in such farmlands. At the paddy field in north India where we plan to observe methane, electric power are available for only 2-3 hours a day at night and the duration of power supply is not stable. In addition, the place where we can set the measurement instrument is nothing but a barn in the farmland, and we must manage to prevent bad influences on instruments by rain, dust, bugs, and rats. Thus, it is difficult to use existing commercial instruments, which are typically operated in a clean laboratory. Therefore, we developed a low-cost measurement system of methane to use at rural and remote area. Moreover, we have conducted the methane measurement using the developed system at the paddy field in India.

In this study, we used LaserMethane(ANRITSU Co. Ltd.) to measure the atmospheric concentrations of methane. LaserMethane is the portable instrument with low electricity consumption, which can measure methane concentrations in real time. LaserMethane is an open-path laser spectroscopic instrument which can measure methane selectively by tunable diode laser absorption spectroscopy. We developed a power supply, a data logging, and a remote control equipment for continuous operation of LaserMethane at remote area. We have conducted the methane observation at Sonipat, Haryana in India which is located at north of Delhi since the end of 2014 using the developed system. Along with LaserMethane, we have also obtained methane concentrations from the off-line analyses of ambient air, which have been sampled typically once a week, using gas chromatography. The concentration data of LaserMethane are calibrated by the air sampling data and meteorological data. In this presentation, we will present the introduction of the developed system and the measurement results which were obtained in 2015 at the paddy field in Sonipat, India. It showed that the concentrations of methane increased in monsoon season and winter. This characteristic enhancement of methane concentrations observed in monsoon season is considered to be due to the large methane emission from paddy field during rice cultivation. In addition, the real-time measurements indicated that the large variation of methane concentrations between day and night often appeared. We will also discuss the sources of the observed seasonal and diurnal variations.

Reference

Matsumi et al., Measuring methane with a simple open-path gas sensor, SPIE Newsroom, doi: 101117/2.1201601.006283, 2016

http://spie.org/newsroom/technical-articles/6283-measuring-methane-with-a-simple-open-path-gas-sensor

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