Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AAS21-17 Room:201B Time:May 28 12:00-12:15

Atmospheric methane measurement by open-path laser methane instrument at paddy fields in India

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Methane is the second important greenhouse gas after carbon dioxide, and increasing importance to the Earth's radiative budget. To better quantify methane emissions, their regional and temporal distribution, and attribution to the different methane sources is needed.Satellite observations offer the possibility of sensing methane globally and retrieving methane abundances in remote areas and can help with interpretation of sparse ground based measurement. In southeast and south Asia, the previous satellite observations suggest that the emission from rice paddies is significant and important source of methane during rainy season. However, there are large uncertainties in quantitative estimation of methane emission in these areas and there are needs for more certification between satellite and ground based measurements. In remote areas with insufficient infrastructure, air sampling and subsequently analysis are typical and reliable method for gas analysis. We developed the methane concentration measurement system which can make a continuous observation to interpolate the data of sampled air between each sampling period and we have operated the developed system at rural area in India.

The developed measurement system consists of gas sensor, power supply, data logger, remote control instruments and telecommunication equipment. The methane gas sensor is used a laser methane measurement instrument (LaserMethane, ANRITSU CORPORATION) which is a portable detector with low electric consumption, easy maintenance, and outdoor use. Remote sensing of methane is accomplished by means of infrared absorption spectroscopy with near-IR diode laser using reflected light from a reflector located at several tens meters away from the detector. High sensitivity is achieved by the second-harmonic detection of wavelength modulation spectroscopy. It can quickly and selectively detect the integral methane concentration on the optical path of the laser beam. To measure the methane concentration at paddy field in India, the methane measurement system was installed at rural area (Sonepat, Haryanea) on the north of Delhi and has been operated since the winter of 2014. The air sampling along with our measurement has been carried out once a weak currently. The methane concentration from the laser instrument can be corrected with the more precise value of the sampled air. To establish how to correct the data and calibrate the system, we performed both of laboratory experiment and field measurement. We will present about the development of the open-path laser methane measurement system and the recent results of field measurement in India.

Keywords: methane, open-path laser spectroscopy, paddy field, India