Development of A Gas Sensor for Monitoring of Methane and Nitrous Oxide from Rice-based Agroecosystem

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Abstracts

A portable real time high precision diode laser DFG gas sensor is being developed for field measurements of methane and nitrous oxide fluxes using the eddy correlation method.

A 50mw fixed-wavelength 1083nm distributed-feedback diode laser and a 100mw tunable-wavelength 815nm or 875nm diode laser were mixed in PPLN to generate about $0.5\,\mu$w of power at $3.29\,\mu$w and $4.55\,\mu$w wavelength respectively. These two wavelength are carefully chosen to avoid possibly over lapping absorption line and interference from other molecular spices, and atmosphere perturbations as it is used to monitor gas through open-path (20m) configuration at atmosphere pressure. The wavelengh modulation signal-sawtooth is generated in 50-100 discrete steps with a 200kHz digital to analogue convert broad, thus the absorption line and base line are acquired continuously at a rate of 2-5kHz. 2 % of the duty scale of laser current is dropped below the lasing threshold to provide a precise measurement of dark current intensity. A 12-bit ADC provide a numerical representative of the signal amplitude from the infrared detector. A computer program control the data acquisition and information process using directly absorption method to provide advantage to retain the convenience of absolute concentration retrieval. The limiting noise source is caused by a base line signal which varies with optical alignment. The gas sensor is designed to provide 10 Hz data 1 % accuracy (20ppb) for ambient methane and nitrous oxide. A three-dimension sonic-anemometer and thermometer are used to measure wind speed and direction, air temperature, relative humility and ground temperature. The combination permits rapid response with sufficient sensitivity for eddy- correlation flux measurements over a wide range of meteorological condition.