

Measurement of Atmospheric CO₂ Column Density with a Fabry Perot Interferometer and a Fiber Etalon

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GOSAT is launched successfully and will start to measure column densities of atmospheric CO₂ and CH₄ within a couple of months. On the ground the column density of CO₂ in the air has been measured by use of a Fourier Transform Infrared Spectrometer (FT-IR). The FT-IR gives spectra with a high resolution but needs a skilled operator and an air-conditioned room. The FT-IR is thus expensive and it is not easy to set it up on the place desired such as on a mountain or in tropical regions with severe climate conditions.

We have developed an apparatus to monitor the atmospheric CO₂ column density by a periodical controlling the temperature of a Fabry-Perot interferometer, the usefulness of which has been reported by Wilson et al. [1]. The apparatus is small, cheap and controlled remotely. A system measuring the CO₂ column density has been set up on the top of a building of Ryugasaki City Hall in Ibaragi prefecture. We have monitored the atmospheric CO₂ column density more than 3 months. The column density deduced is consistent with ones reported at the Wisconsin Tall Tower site [2] and a value calculated theoretically by assuming 380 ppm of CO₂ on the ground level [3]. The estimated errors at noon in Ryugasaki city are less than 0.5 %, being within the requirement in GOSAT. The details of the monitoring system and results obtained will be presented.

A Fiber-Etalon, which has been developed in optical fiber communications, has the similar character with a Fabry-Perot interferometer. The size of the fiber-etalon is about 10 mm long; 1 mm diameter and thus has a quite small heat capacity, being desirable for a rapid temperature control. The measuring system is composed of a fiber-circulator, a fiber Bragg grating; 2 coupler and a fiber-etalon. All components are put in a box with 10 x10x20 cm. The optical fiber elements are mass-produced and easy to handle. Basic figures of the system will also be presented.

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