

Validations of global CH₄ data observed by SCIAMACHY onboard ENVISAT

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Methane (CH₄) is the second most important anthropogenic greenhouse gas after carbon dioxide (CO₂). The concentration has been doubled since the industrial revolution, because of the human activities. Recently, SCIAMACHY onboard ENVISAT (Environmental Satellite) enabled us to know global CH₄ distribution from space.

This study validates SCIAMACHY (SCIA) data by comparing with aircraft data and surface observation data to clarify global CH₄ distribution.

We analyze three kinds of data; firstly, SCIA data include vertical column densities (VCD) of CH₄, which is retrieved by IMAP-DOAS algorithm. In order to correct the air mass factor of the data, we use CO₂ data simultaneously observed with CH₄ [1]. Secondly, aircraft data are the vertical profiles of volume mixing ratio (VMR) of CH₄ and CO₂ observed at three stations of Siberia and Sagami. Thirdly, surface observation data of CH₄ and CO₂ VMR at 52 stations from WDCGG (World Data Centre for Greenhouse Gases) were downloaded from their web sites.

SCIA measures VCD data that are converted to column averaged mixing ratio. If the vertical profile of VMR is constant, the column-averaged VMR should be consistent with the surface VMR data. However, CH₄ sources are on the ground and its sinks are in the air. Therefore, vertical distribution of CH₄ should depend on altitude slightly; the higher the altitude is, the less the CH₄ VMR should be. The aircraft measurements indicate that vertical distributions of CH₄ are not uniform and significantly affected by CH₄ sources. It is expected that there must be bias between SCIA data and surface observation data near when and where those effects are not negligible. Comparison of satellite data and surface data shows the ratios CH₄/CO₂ observed from satellite are smaller than those at surface at almost all latitudes. Especially, the difference is large at northern mid- and high-latitudes where there are many CH₄ sources, while it is small at northern low- latitude and in southern hemisphere where there are less sources. When all surface observation data are divided into source-area data and non-source-area data and compared with SCIA data, the difference of SCIA and surface data for both groups. The difference between the two datasets has seasonal variation, demonstrating the effect of CH₄ source activity.

[1] C. Frankenberg et al., J. Geophys. Res, 2006, Vol.111, D07303