

Temporal variation of CH₄ vertical profile over Tsukuba derived from ground-based infrared spectra

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Tropospheric CH₄ is regarded as the second most important greenhouse gas after CO₂. On the other hand, stratospheric CH₄ is lately drawing attention as well. For example, some of the recent studies have indicated that chemical reactions in the stratosphere have a larger contribution to CH₄ loss process than those in the troposphere. These stratospheric reactions provide stratosphere with H₂O through CH₄ oxidation. However, it is thought to be difficult to understand the above processes quantitatively as there is little research published on the analysis of long-term variations of CH₄ in the stratosphere.

In this study we have analyzed long-term variations in the vertical profiles of CH₄ retrieved from solar spectra, which were measured with ground-based Fourier Transform InfraRed Spectrometer (FTIR) from 2001 at Tsukuba, Japan (36°N). In order to retrieve CH₄ vertical profile, we applied spectra fitting program called SFIT2, which is originally based on the Rodgers's method [Rodgers et al., 1976, Rinsland et al., 1998, 1999, 2000].

Through the analysis of the retrieved data we detected some specific features of CH₄ seasonal variations in the lower stratosphere:

- (1) CH₄ in the lower stratosphere increases during the summer-fall season and decreases during the winter-spring season.
- (2) Day-to-day variation of CH₄ concentration is relatively larger during the winter period than during other seasons.

The former could be caused by a large-scale stratospheric transport brought about by Brewer-Dobson circulation. The latter could be the result of polar vortex movement in the lower stratosphere.