



Stratospheric methane: Time series from ground-based Fourier transform infrared spectrometry

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Partial column densities of stratospheric methane (defined here in the layer between 19 km to ~ 100 km) were retrieved using ground based infrared spectrometry. The measurements were retrieved from stations in Europe as part of the project UFTIR. We report for the first time, seasonal cycles of stratospheric CH₄ measured from the ground. The measurements were compared with a two-dimensional chemistry-transport model of the middle atmosphere. The seasonal variations of CH₄ measurements in the Arctic and high latitude regions are reproduced very well by the model. However, there are large discrepancies in the mid-latitude regions. The total methane in the atmosphere varies by about 1.6%-1.97%. Our measurements show that stratospheric methane can vary by about $\pm 13\%$. Since about 4% of the total methane in the atmosphere can be found from 19km up, the stratospheric methane variation could account for $\sim 30\%$ of the variation of the total columns of atmospheric methane. Furthermore, the seasonal cycle of stratospheric methane is approximately 6 months out of phase with the variation of tropospheric methane. We believe that this accounts for most of the discrepancies in comparisons of methane from surface in-situ measurements and ground based FTIR, since the retrieval of methane total columns and column averaged volume mixing ratios could be influenced by stratospheric methane.