

タグ付きモデル計算から推定される西太平洋上部対流圏における一酸化二窒素およびメタン変動中の放出源の影響

Source signals in N₂O and CH₄ variability in the upper troposphere over the western Pacific derived by model simulations

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Multiple greenhouse gases simulations with tagged-tracers are performed to mainly understand surface-source influences on latitudinal-temporal variabilities of nitrous oxide (N₂O) and methane (CH₄) in the upper troposphere (UT) over the western Pacific observed by the Automatic air Sampling Equipment (ASE) included in the CONTRAIL project. We use greenhouse gases concentration data, which have been obtained almost fortnightly in the altitude range of 9-11 km between Sydney or Brisbane, Australia and Tokyo, Japan for the period Dec 2005 - Mar 2009. An atmospheric general circulation model-based chemistry transport model (ACTM), which is nudged toward the Japanese 25 year ReAnalysis data from the Japan Meteorological Agency (JMA) (JRA-25), is used in this study. Dynamical structure in the tropical UT region in ACTM is reasonably validated by the fact that ACTM simulation of mean latitudinal SF₆ gradient for the observation period is almost perfectly consistent with the observation within 0.03ppt, which is much smaller than the measurement precision. For tracing the origins of N₂O and CH₄ in model, the globe is separated into more than ten of emission regions so that each region emission affects the corresponding tagged-tracers concentration variation on the globe through the atmospheric transport. The tracers simulation results and observation results are detrended, and their seasonal or shorter eventual concentration variabilities are compared. In case of N₂O, concentration values around 30N and 30S are largely fluctuated by stratospheric intrusions, which lower N₂O concentration in the UT, but some surface source signals can be still detectable especially around 30N by removing data highly affected by the stratosphere. That indicates that N₂O around 20-30N seems to be most affected by Middle East and South Asia region, and secondly by East and Southeast Asia region mainly in summer. It is possible that monsoon and Tibetan Plateau work to transport N₂O emitted from South Asia to this region in the UT over the western Pacific. Around 10S, N₂O seems to be relatively dominated by emissions from Australia, but the degree is not so prominent compared to above two Asian regions for 20-30N. CH₄ shows slightly different features of affecting source regions from those of N₂O. It is indicated that China and India affect 26-30N region in the UT over the western Pacific in summer and fall, respectively. Meanwhile, region around 10S is dominantly affected by Malaysia-Indonesia-Papua New Guinea emission region. It might be necessary to take into account CH₄ loss by OH enhanced in the tropics and transport of CH₄ through the region to the UT for better understanding the different emission region affecting around 10S between N₂O and CH₄.

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