

Seasonal changes of greenhouse gases in the upper troposphere/lower stratosphere observed by commercial airliner

SAWA, Yousuke^{1*} ; MACHIDA, Toshinobu² ; MATSUEDA, Hidekazu¹ ; NIWA, Yosuke¹ ; TSUBOI, Kazuhiro¹ ; MURAYAMA, Shohei³ ; MORIMOTO, Shinji⁴ ; AOKI, Shuji⁴

¹Meteorological Research Institute, ²National Institute for Environmental Studies, ³National Institute of Advanced Industrial Science and Technology, ⁴Tohoku University

Atmospheric mixing ratios of greenhouse gases at about 11 km altitude were analyzed from monthly air sampling aboard commercial airliner during the flights between Europe and Japan from April 2012 to August 2013. Compared to the subtropic, higher CH₄ and SF₆ mixing ratios, similar values of N₂O, and larger seasonal changes of CO₂ were found in the upper troposphere. CH₄, N₂O and SF₆ in the lower stratosphere, above the tropopause up to 30 K in potential temperature, showed simultaneous increases from June to October, and faster decreases at higher altitudes from January to March. Mean age of the air in the lower stratosphere was estimated based on SF₆ mixing ratios to be about 2 years in late spring and 1 year in autumn, suggesting stronger influences on the mixing ratios in the stratosphere from troposphere in summer.

Keywords: Atmospheric Chemistry, Greenhouse Gas, Upper Troposphere/Lower Stratosphere