

Seasonal variations of CO₂ mixing ratios in the tropopause region based on frequent observations by commercial airliners

Y. Sawa (1), T. Machida (2), and H. Matsueda (1)

(1)Geochemical Research Department, Meteorological Research Institute, (2)Center for Global Environmental Research, National Institute for Environmental Studies

This study focuses on the upper troposphere/lowermost stratosphere (UT/LS) transport processes based on variations of carbon dioxide (CO₂) mixing ratios in the tropopause region. Frequent airborne measurements between Japan and Europe were made from November 2005 in the CONTRAIL program using JAL airliners. The CO₂ in the UT shows a strong seasonal cycle with a maximum in spring and a minimum in July. In the LS region, a different seasonal pattern with a sharp CO₂ increase in summer and following very slow decrease was found at higher altitudes above 30 K from tropopause. The seasonal amplitude in the LS slightly enlarged with increasing distance from tropopause. We also analyzed the CO₂ distributions using equivalent latitude and potential temperature coordinates. The CO₂ isopleths follow local tropopause during winter and spring, but they follow potential temperature surfaces crossing local tropopause in summer. These results demonstrate that the CO₂ seasonal cycle observed in the LS is mainly caused by a combination with fast meridional intrusion of air from tropical upper troposphere in summer and active subsidence from higher altitudes in spring driven by Brewer-Dobson circulation.