

Three-dimensional Behaviors of Atmospheric CO₂ Revealed by the Comprehensive Observation Network for Trace Gases by Airliner (CONTRAIL) Project

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Frequent measurements of atmospheric CO₂ using Continuous CO₂ Measuring Equipment (CME) as well as other greenhouse gases by Automatic Air Sampling Equipment onboard the commercial airliners under the CONTRAIL Project brought us huge numbers of CO₂ data in upper air and revealed latitudinal, longitudinal and vertical difference in CO₂ variation worldwide. The CONTRAIL Project has been conducted since 2005 using 6 aircraft operated by Japan Airlines. Until 2012, more than 7,000 of CME flights were made between Japan and Europe, South Asia, Southeast Asia, East Asia, Australia, Hawaii and North America, and 13,000 vertical profiles have been obtained there (Figure 1).

In the Northern Hemisphere, large seasonal changes of CO₂ in the upper troposphere are found from spring through summer at northern mid-to-high latitudes with significant longitudinal differences; seasonally low CO₂ mixing ratios are vertically transported from the surface over the Eurasian continent and then transported eastward to the North Pacific. In the Southern Hemisphere, the CO₂ in the upper troposphere increases rapidly from April to June, indicating clearly the inter-hemispheric transport of high CO₂ from the Northern Hemisphere winter. The rapid increase in the upper southern lower latitudes is equivalent to about 0.2 Pg increase in carbon.

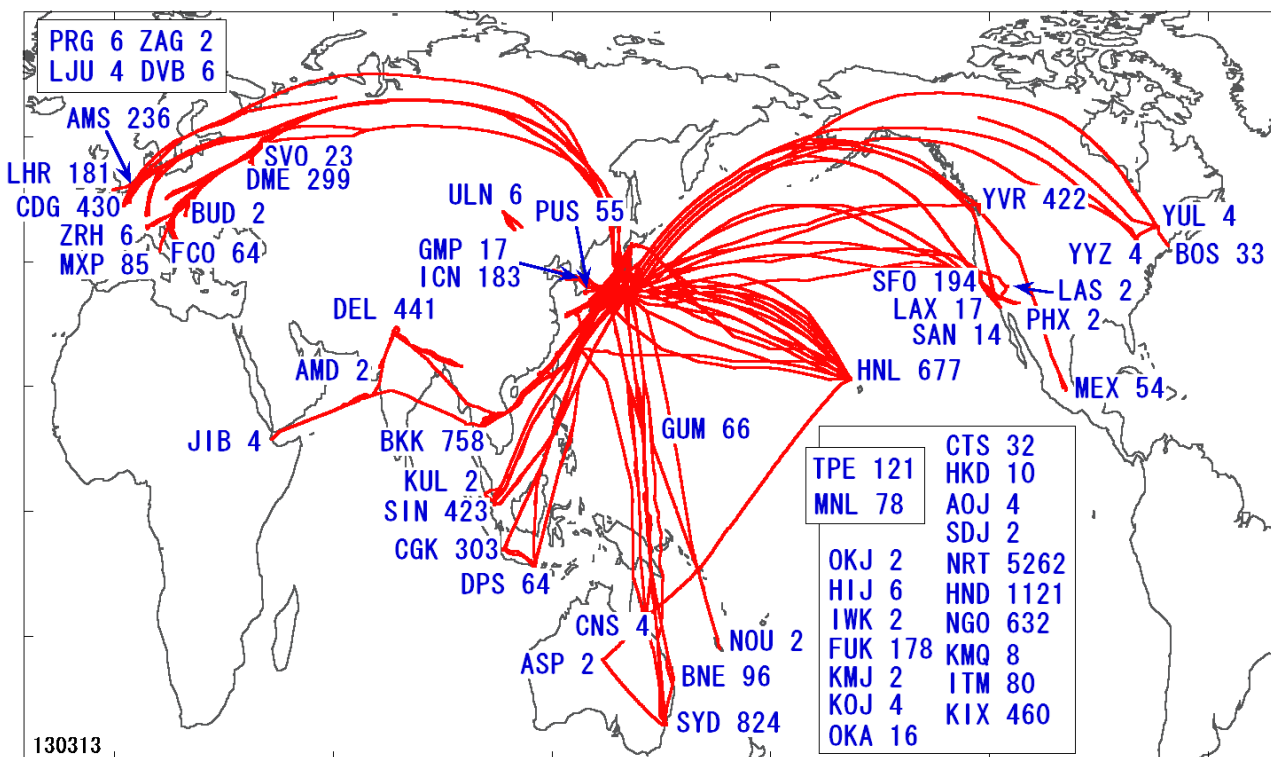


Figure 1. Flight routes of CME observation and numbers of vertical profiles over the airports.