

^{13}C Isotopic Composition of CO_2 in the Tropopause Region as Measured by CARIBIC

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The Civil Aircraft for the Regular Investigation of the atmosphere Based on an Instrumented Container (CARIBIC) project (www.caribic-atmospheric.com) used an automatic instrument container (1.2 ton) on board a Boeing 767 aircraft for monthly flights from Europe to Male/Sri Lanka, southern Africa, and the Caribbean for the period 1998-May 2002. Halocarbons, non-methane hydrocarbons, N_2O , SF_6 , CH_4 , and CO_2 were measured by gas chromatography. For each of the 12 air samples (0.3 m^3) collected, ^{13}CO , ^{14}CO , C^{18}O , $^{13}\text{CO}_2$, and C^{18}OO were also measured by accelerator mass spectrometry (AMS) and isotope ratio mass spectrometry (IRMS). Flights resumed in winter 2003 with a new Lufthansa A340-600 aircraft to be used for a period of 10 years.

The CARIBIC $\delta^{13}\text{C}$ and CO_2 values shown in the top two frames of Figure 1 display a well-defined seasonal cycle, with some deviations due to contributions of tropical and southern hemisphere air (latitude $<15^\circ\text{N}$) and of stratospheric air. When we plot only northern hemisphere tropospheric CO_2 mixing ratios and $\delta^{13}\text{C}$ values, the data resemble those from selected remote stations of the NOAA/CMDL network (bottom two frames of Figure 1).

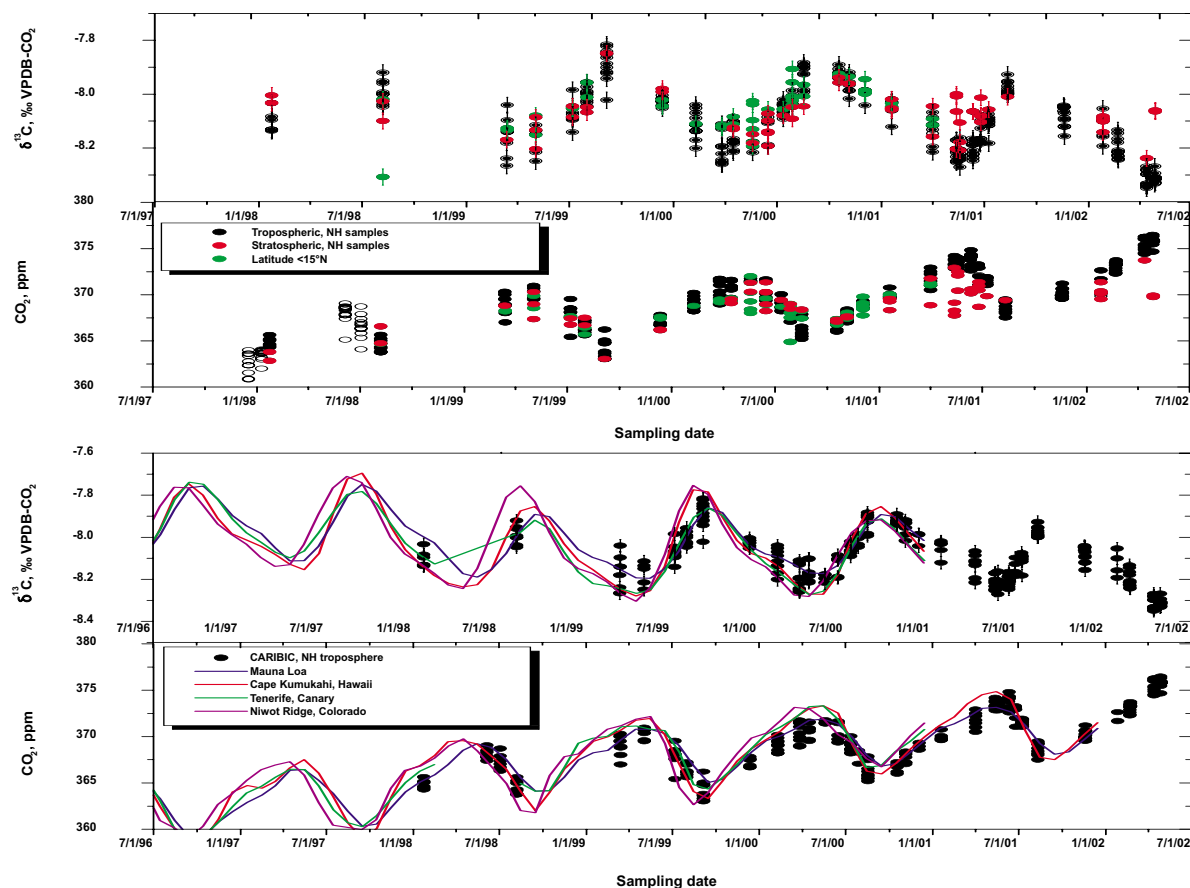


Figure 1. The mixing ratio and $\delta^{13}\text{C}$ of CO_2 in air collected by the CARIBIC aircraft on flights to mainly Male, Sri Lanka, and Cuba. After removing data for air collected in the lowermost stratosphere, a comparison with the NOAA/CMDL data for selected stations is shown in the lower frame: Mauna Loa, Hawaii, United States, 19.53°N , -155.58°W , 3397 m above sea level; Cape Kumukahi, Hawaii, United States, 19.52°N , -154.82°W , 3 m above sea level; Tenerife (Izaña), Canary Islands, Spain, 28.30°N , -16.48°W , 2360 m above sea level; Niwot Ridge, Colorado, United States, 40.05°N , -105.58°W , 3475 m above sea level.