

2.7. AIRCRAFT PROGRAM

Flights over Carr, Colorado (40.9°N, 104.8°W), to collect atmospheric samples as vertical profiles continued on a weekly basis as they have for the past few years. The Carr flights have also served as a testing facility for the initial flights of new sampling instruments after their construction at CMDL. The Carr vertical profiles were also integrated into the NASA Earth Observing System (EOS) validation experiments of the CCGG where the in situ data from those flights are used to validate the remote sensing data retrievals.

With funding from the NASA Earth Science Enterprise Experiment, CO and CH₄ in the lower and middle troposphere were measured. In collaboration with the Measurement Of Pollution In The Troposphere (MOPITT) science team, four locations were chosen for study. These sites, their three-letter site codes and locations are: Poker Flats, Alaska (PFA, 65.1°N 147.5°W), Harvard Forest, Massachusetts (HFM, 42.5°N 71.2°W), and Molokai, Hawaii (HAA, 21.4°N 157.2°W). Using portable automated sampling equipment, measurements from chartered, turboprop aircraft began at these sites during 1999. Original plans called for flights above SMO, but problems with the charter service required that the program be moved to Rarotonga in the Cook Islands (RTA, 21.2°S 159.8°W), and the first flights were made in April 2000. Sampling typically extends to an altitude of about 8 km (25,000 ft), except for RTA (7 km).

The equipment consists of two suitcases, one with 17-20 sampling flasks and a controller, and one with batteries and

compressors. Only a clean air inlet and a place to stow the suitcases on the aircraft are needed. Usually a sampling inlet is created on a modified storm window. These samplers are then shipped back to NOAA for automated analysis through the flask analysis system, in which not only CO and CH₄, but also CO₂, H₂, N₂O, and SF₆ are being measured. Recently isotopic analysis of CO₂ in these samples was started through mass spectrometry by INSTAAR. A second analytical system is being readied at NOAA to absorb the increase in aircraft profile analysis.

In addition to these sites CMDL has flown the automated sampler at several experimental sites such as the WLEF tower in Wisconsin and onboard a Citation aircraft as part of the CO₂ Budget and Rectification Airborne (COBRA) campaign. Aircraft sites were also prepared at two locations in Brazil for the Large Scale Biosphere Atmosphere (LBA) experiment; one site is in the Amazon Basin and one is off of the East Brazilian coast. Intensive flights will also occur in Southern Africa in 2000 during the NASA EOS validation flights as part of the Southern African Fire-Atmosphere Research Initiative (SAFARI) 2000 campaign. In addition, NCAR test flights recently used the NOAA sampler onboard the DOE Citation aircraft.

The first attempts at shipping the sampling equipment between Boulder and the sites led to considerable damage to the units. Over the past 2 years, significant effort has been devoted to improving the design for greater ruggedness and a corresponding increase in successful analysis. An example of mixing ratios determined from these aircraft programs is shown in Figure 2.24.

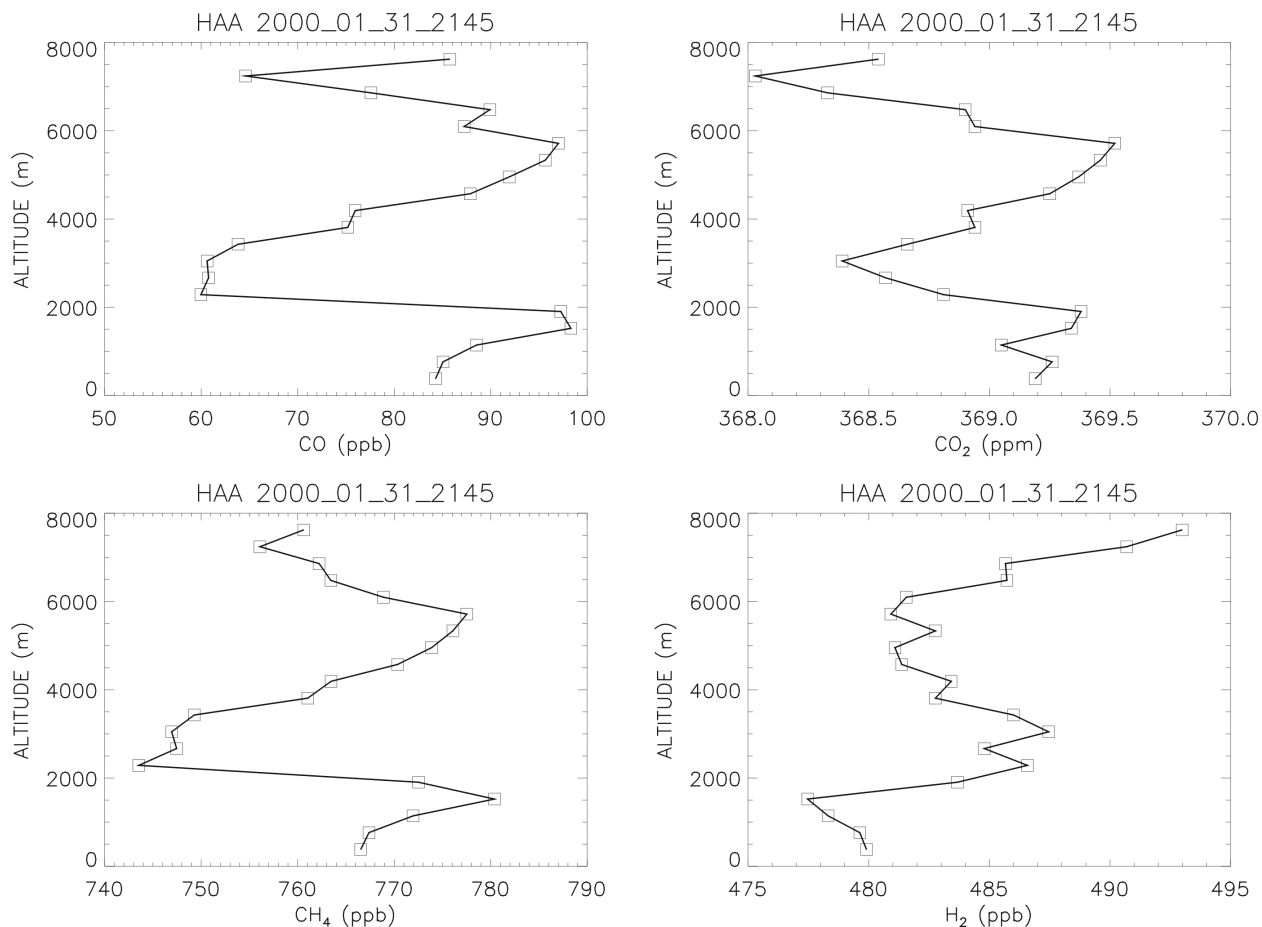


Fig. 2.24. Example of vertical profile results collected as part of the MOPITT calibration program at Molokai, Hawaii, on January 31, 2000. CO has been corrected to the 1999 gravimetric scale (section 2.4.2).