NDP-007
DOI: 10.3334/CDIAC/atg.ndp007

CDIC NUMERIC DATA COLLECTION

Atmospheric CO_2 Concentrations—The CSIRO (Australia) Monitoring Program from Aircraft for 1972-1981

Information Resources Organization at Oak Ridge National Laboratory
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NDP-007

ATMOSPHERIC CO_2 CONCENTRATIONS

THE CSIRO (AUSTRALIA) MONITORING PROGRAM from AIRCRAFT

1972 - 1981

Contributed by
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September 1984

Prepared by the
Carbon Dioxide Information Center
Information Division
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
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for the
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ABSTRACT

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1. NUMERIC DATA PACKAGE NAME

Atmospheric CO_2 Concentrations - The CSIRO (Australia) Monitoring Program from Aircraft for 1972-1981

2. CONTRIBUTOR(S)

D. J. Beardsmore and G. I. Pearman, Division of Atmospheric Research, Commonwealth Scientific and Industrial Research Organization (CSIRO), Mordialloc, Victoria AUSTRALIA

3. HISTORICAL BACKGROUND INFORMATION

Atmospheric CO_2 concentrations were measured in the troposphere and lower stratosphere over the Australia-New Zealand region and as far south as Antarctica for the period 1972-1981. The samples were collected from aircraft over a large range of latitudes and altitudes. The sampling program has been based on the cooperation of the Australia Department of Transport, Quantas Airways, Trans Australia Airlines, the United States, New Zealand and Australian Air Forces and occasional chartering of light aircraft for special purposes.

4. SOURCE AND SCOPE OF THE DATA

The degree of natural variability of CO_2 concentration at various levels of the troposphere and lower stratosphere is described based on 3519 individual samples. The average rate of CO_2 increase in the mid-troposphere over the period 1972-1981 is 1.3 ppmv per year. The annual variation of the CO_2 concentration in the mid-troposphere has an amplitude of 1.2 ppmv peak-to-peak with the maximum occurring in October and the minimum in April. Vertical gradients through the middle and upper troposphere are generally of order 0.4 ppmv per 10 km with lower concentrations at lower altitudes throughout most of the year. In the lower troposphere (below 2 km), gradients of up to 4 ppmv per km may occur when air has transversed vegetated land. The data are presented in the WMO 1981 CO_2 Calibration Scale.

The variations shown for the Southern Hemisphere are similar in magnitude and phase to concentrations measured at the South Pole. The mid-tropospheric data indicates a fossil fuel airborne fraction of 0.57 over the period January 1973 to January 1981. These results compare well with estimates of approximately 0.55 based on data obtained from several other monitoring stations (Pearman and Beardsmore 1984).

5. APPLICATIONS OF THE DATA

The data taken from aircraft are unselected and therefore free of potential biases due to the selection procedures used. The record also spans a decade, such that significant conclusions can be made concerning the large-scale trends of CO_2 concentration in the atmosphere.

The data are also the first published record of CO_2 concentrations in the Southern Hemisphere expressed in the WMO 1981 CO_2 Calibration Scale and with relevant corrections for NDIR gas analyzer carrier-gas errors applied. The data form the basis for on-going studies to determine the relative importance of transport, and oceanic or biospheric CO_2 exchange in determining the seasonal variation in CO_2 concentration in the Southern Hemisphere, and when compared to high quality data from other monitoring stations, a description of the meridional concentration distribution which, combined with atmospheric transport models, can be used to make quantitative estimates of the meridional fluxes and surface exchanges. The data can also be used to obtain a precise description of the airborne fraction against which the performance of global carbon cycle models are gauged. The variability of CO_2 on all time scales can also be used to develop rational selection criteria for surface monitoring stations in order to ensure that unbiased datasets are prepared which relate to definable space-scales (Pearman and Beardsmore 1984).

6. LIMITATIONS/RESTRICTIONS

The estimated precision of measurement of individual samples collected in glass flasks is better than 0.2 ppmv, while the accuracy with respect to the international standards is better than 0.3 ppmv. For the steel samplers operated by TAA, precision of individual samples is thought to be better than 0.5 ppmv.

7. DESCRIPTION OF VARIABLES AND FORMATS

A data retrieval and output routine is written in

FORTRAN IV.

The descriptive information and CO_2 concentration data files are written in EBCDIC as card images.

File 2 contains general information about the dataset and can be read with a (20A4) format. File 3 contains the CO_2 concentration data in EBCDIC card images. The data are formatted as IDAYS, MONS, IYRS, AIRTYP, FLIGHT, FLASK, ITIME, ISECT, IDIST, IDIR, IDME, ALT, TR, IDAYA, MONA, IYRA, IPRES, HISPAN, LOSPAN, ANAL, CONC, (COM(I),I=1,3) where IDAYS, MONS, IYRS are the sampling dates, AIRTYP is the type of aircraft, FLIGHT is the flight number, FLASK is the identification of the flask used for collecting the sample, ITIME is the time in G.M.T., ISECT is the geographical sector, IDIST is the distance in km from the listed DME station, IDME is the station number of radio navigation distance measuring equipment, ALT is the altitude of the aircraft above M.S.L., TR is an indicator of the origin of the sample, IDAYA, MONA, IYRA is the date of analysis, IPRES is the pressure of the sample in flask and manifold at the beginning of the analysis, HISPAN and LOSPAN are designations of the two teritary standards used for the analysis, ANAL is the identification of the NDIR gas analyzer used, CONC is the carbon dioxide concentration computed, COM is an array containing general comments pertinent to a given sample. A detailed description of each of the variables is included in the DESCRIPTIVE INFORMATION section of this data package document.

The format is:

```
 FORMAT(3I3,1X,A5,1X,A4,1X,A3,1X,A4,1X,I2,1X,A4,1X,I2,
1 1X,I3,1X,F5.2,1X,A2,1X,3I3,1X,I4,1X,A2,1X,A2,1X,A3,
2 1X,F5.1,1X,3A4)
```

Missing data are noted by blanks.

8. KEYWORDS

CARBON DIOXIDE CONCENTRATIONS, ATMOSPHERIC; MONITORING NETWORK; SECULAR TRENDS; AIRCRAFT SAMPLING; SOUTHERN HEMISPHERE

9. REFERENCES

Pearman, G. I., Beardsmore, D. J., and O'Brien, R. C. 1983. The CSIRO (Australia) Atmospheric Carbon Dioxide Monitoring Program: Ten Years of Aircraft Data, Division of Atmospheric Physics Technical Paper No. 45, Commonwealth Scientific and Industrial Research Organization, Australia.

Pearman, G. I. and Beardsmore, D. J. 1984. "Atmospheric Carbon Dioxide Measurements in the Australian Region: Ten Years of Aircraft Data," Tellus 36B:1-24.

10. CONTENTS OF THE DATA PACKAGE

The package contains three files of information written in EBCDIC onto magnetic tape as card images: Retrieval Code, Descriptive Comments, CO_2 Concentrations data. Total records = 3873.

The following Critical Documents are also included.

Beardsmore, D. J., Pearman, G. I., Fraser, P. J. B., and O'Toole, J. G. 1978. The CSIRO (Australia) Atmospheric Carbon Dioxde Monitoring Program: The First Six Years of Data. Division of Atmospheric Research Technical Paper No. 35, Commonwealth Scientific and Industrial Research Organization, Australia. 71 pp.

Pearman, G. I., Beardsmore, D. J., and O'Brien, R. C. 1983. The CSIRO (Australia) Atmospheric Carbon Dioxide Monitoring Program: Ten Years of Aircraft Data, Division of Atmospheric Physics Technical Report No. 45, Commonwealth Scientific and Industrial Research Organization, Australia, 113 pp.

Pearman, G. I. and Beardsmore, D. J. 1984. "Atmospheric Carbon Dioxide Measurements in the Australian Region: Ten Years of Aircraft Data," Tellus 36B:1-24.

11. OTHER BACKGROUND REFERENCES

Beardsmore, D. J. 1980. "Atmospheric Carbon Dioxide Monitoring at Australian Stations," pp. 41-47 in G. I. Pearman, ed., Carbon Dioxide and Climate: Australian Research. Australian Academy of Science, Canberra.

Beardsmore, D. J., Pearman, G. I., Fraser, P. J. B., and O'Toole, J. G. 1978. The CSIRO (Australia) Atmospheric Carbon Dioxide Monitoring Program: The First Six Years of Data, Division of Atmospheric Physics Technical Paper No. 35, Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia.

Fraser, P. J., Pearman, G. I., and Hyson, P. 1983. "The Global Distribution of Atmospheric Carbon Dioxide:

2. A Review of Provisional Background Observations, 1978-1980," Journal of Geophysical Research 88(C6):3591-3598.

12. HOW TO OBTAIN THE PACKAGE

The documentation of NDP-007 contains a sample printed listing of the data retrieved via the retrieval routine. A complete listing of the data set is enclosed on microfische. Requests for computerized data files should be accompanied by a reel of magnetic tape and special instructions for transmitting the data. Requests should be addressed to:

Carbon Dioxide Information Center
Oak Ridge National Laboratory
Post Office Box X
Oak Ridge, Tennessee 37831-2008 USA

13. PREPARATION OF THE PACKAGE

This data package was prepared by J. A. Watts, and B. F. Jacobs of the Carbon Dioxide Information Center.

14. DATE OF ABSTRACT

September 1984.

TAPE CONTENTS

Tape Identification _____
Density _____ 9 Track

Package: NDP-007
Date Packaged: 09-24-84
Most Recent Update:

Description	Mode	Logical Records	DCB Parameters
File 1. Descriptive Information	EBCDIC	291	FB 8000 80
File 2. Retrieval Program	EBCDIC	63	FB 8000 80
File 3. Atmospheric CO_2 Concentrations for SH Data	EBCDIC	3519	FB 8000 100
	Total	3873	

A listing of the retrieval and output program and descriptive information is included. Tabular listings of the data file (file 3) are given as Table 1.

RETRIEVAL AND OUTPUT PROGRAM LISTING

```
            DIMENSION A(20), COM(3)
          REAL*8 AIRTYP,FLIGHT
            N1=20
            N6=6
C
C  READ AND PRINT FILE CONTAINIGN DESCRIPTIVE INFORMATION
C      ABOUT THE DATASET - FILE 2 ON TAPE
C
            WRITE(N6,5)
5           FORMAT(1H1)
7           READ(N1,10,END=999) A
10          FORMAT(20A4)
            WRITE(N6,20) A
20          FORMAT(1H ,20A4)
            GO TO 7
C
C      READ AND PRINT FILE CONTAINING CO2 MEASUREMENTS FROM THE
C         AIRCRAFT MONITORING PROGRAM - FILE 3 ON TAPE
C
1         CONTINUE
         READ(N1,100,END=99) IDAYS,MONS,IYRS,AIRTYP,FLIGHT,FLASK,ITIME,
     1  ISECT,IDIST,IDIR,IDME,ALT,TR,IDAYA,MONA,IYRA,IPRES,HISPAN,
     2  LOSPAN,ANAL,CONC,(COM(I),I=1,3)
100        FORMAT(3I3,3X,A5,1X,A5,1X,A3,2X,A4,2X,I2,2X,A4,1X,
     1  I2,1X,I3,2X,F5.2,2X,A2,3I3,I4,3X,A2,4X,A2,3X,A3,3X,F5.1,3A4)
            WRITE(N6,200) IDAYS,MONS,IYRS,AIRTYP,FLIGHT,FLASK,ITIME,
     1  ISECT,IDIST,IDIR,IDME,ALT,TR,IDAYA,MONA,IYRA,IPRES,HISPAN,
     2  LOSPAN,ANAL,CONC,(COM(I),I=1,3)
200         FORMAT(3I3,1X,A5,1X,A4,1X,A3,1X,A4,1X,I2,1X,A4,1X,I2,1X,
     1  I3,1X,F5.2,1X,A2,1X,3I3,1X,I4,1X,A2,1X,A2,1X,A3,1X,F5.1
     1  1X,3A4)
             GO TO 1
99           CONTINUE
             STOP
             END
```

DESCRIPTIVE INFORMATION

CDIC/NDP-007

DATASET TITLE: ATMOSPHERIC CO2 CONCENTRATIONS - THE CSIRO (AUSTRALIA) MONITORING PROGRAM FROM AIRCRAFT FOR 1972-1981

CONTRIBUTORS: D. J. BEARDSMORE AND G. I. PEARMAN, DIVISION OF ATMOSPHERIC RESEARCH, COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION (CSIRO), MORDIALLOC, VICTORIA AUSTRALIA

SCOPE OF THE DATA:

THE FOLLOWING DATA SET COMPRISES TEN YEARS OF DATA OBTAINED FROM THE CSIRO (AUSTRALIA) CARBON DIOXIDE MONITORING PROGRAM FROM AIRCRAFT IN THE AUSTRALIAN REGION. THE KEY TO THE DETAILS IN THE TABULATION FOLLOWS. DETAILS OF SAMPLING AND ANALYSIS PROCEDURES, SELECTION CRITERIA AND CORRECTION CAN BE FOUND IN :

BEARDSMORE, D.J, G.I. PEARMAN,P.J.B. FRASER AND J.G. O'TOOLE (1978). THE CSIRO (AUSTRALIA) ATMOSPHERIC CARBON DIOXIDE MONITORING PROGRAM: THE FIRST SIX YEARS OF DATA. CSIRO DIVISION OF ATMOSPHERIC PHYSICS TECH. PAPER NO. 35. 71 PP.

PEARMAN, G.I., D.J. BEARDSMORE AND R.C. O'BRIEN (1983). THE CSIRO (AUSTRALIAN) ATMOSPHERIC CARBON DIOXIDE MONITORING PROGRAM: TEN YEARS OF AIRCRAFT DATA. CSIRO DIVISION OF ATMOSPHERIC PHYSICS TECH. PAPER NO. 45. 113 PP.

DATA FORMAT:

KEY TO SAMPLE COLLECTION DETAILS OF THE DATA SET-

1. DATE
   DAY, MONTH AND YEAR OF SAMPLE COLLECTION.

2. AIRCRAFT
   TYPE OF AIRCRAFT FROM WHICH SAMPLE WAS COLLECTED:

B50	BEECHCRAFT B50, "BONANZA"
B55	BEECHCRAFT B55, "BARON"
B707	BOEING 707-338C
B727	BOEING 727, VARIOUS SERIES
B747	BOEING 747B
C130	LOCKHEED C130, "HERCULES"
C141	LOCKHEED C141, "STARLIFTER"
C310	CESSNA 310
CV990	CONVAIR 990
DC9	DOUGLAS DC9
F27	FOKKER F27, "FRIENDSHIP"
F28	FOKKER F28, "FELLOWSHIP"
ME2B	SWEARINGEN, "MERLIN 2B", "MERLIN 3"

PA30 PIPER "COMANCHE" OR "AZTEC"

3. FLIGHT
FLIGHT NUMBER BY THE COOPERATING AGENCY. ALPHABETIC DESIGNATOR INDICATES METHOD OF SAMPLING AND COOPERATING AGENCY.

A MANUAL SAMPLING BY RAAF OR ANTARCTIC DIVISION OF NEW ZEALAND DSIR FROM USAF AIRCRAFT.

B AUTOMATIC SAMPLING FROM AIRCRAFT OF TRANS AUSTRALIA AIRLINES.

C MANUAL SAMPLING FROM CHARTERED LIGHT AIRCRAFT.

D MANUAL SAMPLING FROM AIRCRAFT OF AUSTRALIAN DEPARTMENT OF TRANSPORT, AIR TRANSPORT GROUP.

M MANUAL SAMPLING FROM COMMERCIAL PASSENGER AIRCRAFT. NO PUMP USED. SAMPLES COLLECTED AT CABIN PRESSURE AFTER LONG FLUSHING TIME AND TAPS FIRMLY CLOSED.

N MANUAL SAMPLING FROM AIRCRAFT FLOWN BY THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION.

Q MANUAL SAMPLING FROM AIRCRAFT OF QANTAS AIRWAYS LTD.

4. FLASK
IDENTIFICATION NUMBER OF THE FLASK IN WHICH THE SAMPLE WAS COLLECTED.

5. TIME
TIME IN G.M.T. AT WHICH SAMPLE WAS COLLECTED. ON OCCASIONS THE SAME TIME (AND DISTANCE) ARE GIVEN FOR MORE THAN ONE SAMPLE TAKEN OVER THE TASMAN SEA (SECTOR 3). IT IS ASSUMED THAT IN THESE INSTANCES THE QANTAS AIRCREW CONCERNED COLLECTED THE SAMPLES CONSECUTIVELY, COMMENCING AT THE TIME STARTED.

6. LOCATION

(A) SECT.
GEOGRAPHICAL SECTOR IN WHICH SAMPLES WERE COLLECTED.

1. SOUTHERN VICTORIA, BASS STRAIT AND TASMANIA.
2. INLAND SOUTH-EASTERN AUSTRALIA.
3. TASMAN SEA.
4. NEW ZEALAND TO ANTARCTICA.
5. FLIGHTS OVER GREAT AUSTRALIAN BIGHT.
6. SUB-TROPICAL FLIGHTS SAMPLING BETWEEN LATITUDES 15 deg. AND 24 deg. S.

(B) DIST.

DISTANCE IN KILOMETERS FROM THE DME STATION FOR ALL EXCEPT SECTOR 4. DISTANCES IN KILOMETERS x 0.1 FROM THE LISTED DME STATION FOR SECTOR 4.

(C) DIR.

DIRECTION FROM LISTED DME STATIONS TO EIGHT CARDINAL POINTS:
E.G. NORTH, 1; NORTH-EAST, 2; EAST, 3; ETC.

(D) DME

STATION NUMBER OF RADIO NAVIGATION DISTANCE MEASURING EQUIPMENT (DME) TO WHICH DISTANCES AND DIRECTIONS ARE RELATED. DURING THE COURSE OF THE PROGRAM SOME ASSIGNED DME STATION NUMBERS HAVE CHANGED. HOWEVER, FOR CONSISTENCY WE HAVE RETAINED THE ORIGINAL STATION NUMBERS THROUGHOUT.

SECTOR 1

1. WYNYARD (TAS.)
3. FLINDERS ISLAND (TAS.)
7. MELBOURNE (VIC.)
16. KING ISLAND (TAS.)
34. HOBART (TAS.)
38. STRAHAN (TAS.)
42. WONTHAGGI (VIC.)
44. LAUNCESTON (TAS.)
47. DEVONPORT (TAS.)

SECTOR 2

1. LEIGH CREEK (S.A.)
2. CORRYONG (VIC.)
3. LAKE ALBERT (S.A.)
4. MILDURA (VIC.)
5. SYDNEY (N.S.W.)
6. MERIMBULA (N.S.W.)
7. MELBOURNE (VIC.)
8. HOLBROOK (N.S.W.)
9. ADELAIDE (S.A.)
10. NHILL (VIC.)
11. MANGALORE (VIC.)
12. MT. GAMBIER (S.A.)
13. WAGGA (N.S.W.)
21. WILLIAMSDALE (N.S.W.)
23. WEE JASPER (N.S.W.)
26. MT. WILLIAM (VIC.)
35. ALBURY (N.S.W.)
40. CANBERRA (A.C.T.)
41. RUGBY (N.S.W.)

SECTOR 3

3. FLINDERS ISLAND (AUST.)
5. SYDNEY (AUST.)
7. MELBOURNE (AUST.)
42. WONTHAGGI (AUST.)
58. CHRISTCHURCH (N.Z.)
72. AUCKLAND (N.Z.)

SECTOR 4

0. ASSIGNED TO SOUTH POLE FOR IDENTIFICATION PURPOSES.
58. CHRISTCHURCH (N.Z.)

SECTOR 5

2. PERTH (W.A.)
7. MELBOURNE (VIC.)
9. ADELAIDE (S.A.)

SECTOR 6

2. PERTH (W.A.)
5. DARWIN (N.T.)
9. ADELAIDE (S.A.)

7. ALT.
ALTITUDE (IN KILOMETERS) ABOVE M.S.L.

8. TR/STR
INDICATION OF ORIGIN OF THE AIR SAMPLE.

TR SAMPLED BELOW THE TROPOPAUSE
ST SAMPLED ABOVE THE TROPOPAUSE.
T? UNCERTAIN (PROBABLY SAMPLED BELOW TROPOPAUSE).
S? UNCERTAIN (PROBABLY SAMPLED ABOVE TROPOPAUSE).
?? UNCERTAIN (NO ESTIMATION OF THE SAMPLE ORIGIN POSSIBLE).

KEY TO SAMPLE ANALYSIS DETAILS-

1. DATE
DAY, MONTH AND YEAR OF SAMPLE ANALYSIS.

2. FLASK PRESS
PRESSURE (kPa ABOVE ATMOSPHERIC) OF SAMPLE IN FLASK(S) AND MANIFOLD AT COMMENCEMENT OF CO_2 ANALYSIS. NEGATIVE FIGURES INDICATE PARTIAL VACUUM. ALL AUTOMATIC SAMPLER ANALYSES FROM B-PREFIXED FLIGHTS ARE GIVEN A VALUE OF 3 kPa, AS THIS IS APPROXIMATELY THE POSITIVE PRESSURE AT WHICH THE SAMPLE IS ALLOWED TO FLOW THROUGH THE ANALYZER.

3. HISPAN AND

4. LOSPAN
DESIGNATIONS OF THE TWO TERITIARY STANDARDS USED FOR ANALYSIS.
PREFIX A INDICATES CO_2/AIR MIXTURE.
PREFIX N INDICATES CO_2/N_2 MIXTURE.

5. ANAL'R
IDENTIFICATION OF THE NDIR GAS ANALYZER USED IN ANALYSIS.

U1 UNOR 2 (S/NO. 631478)
U2 UNOR 2 (S/NO. 631693)
U3 URAS 2 (S/NO. 6933216)

6. CO2

THE COMPUTED CONCENTRATION OF CARBON DIOXIDE IN THE SAMPLE EXPRESSED AS PPMV ON THE WMO 1981 CO2 CALIBRATION SCALE. ALL DATA HAVE BEEN CORRECTED FOR THE APPROPRIATE CARRIER-GAS ERRORS. IN THE CASE OF B-PREFIXED FLIGHTS THE VALUE GIVEN IS THE MEAN OF THE COMPUTED CONCENTRATIONS OF BETWEEN ONE AND SIX SEPARATE DETERMINATIONS OBTAINED FROM THE ONE LARGE AIR SAMPLE. PRIOR TO APRIL 1980 THE CONCENTRATION ASSIGNED TO THESE SAMPLES REFERS TO THEIR CONCENTRATION AS INDICATED BY THE ANALYSER WITHOUT DRYING. FROM APRIL 1980 SAMPLES WERE CHEMICALLY DRIED BEFORE ANALYSIS.

7. COMMENTS

(A) GENERAL COMMENTS

F11 THE SAMPLE WAS ANALYSED BY GAS CHROMATOGRAPHY FOR SELECTED CARBON COMPOUNDS AND/OR HALOCARBONS BEFORE CO2 ANALYSIS.

N20 THE SAMPLE WAS ANALYSED BY GAS CHROMATOGRAPHY FOR SELECTED NITROGEN COMPOUNDS BEFORE CO2 ANALYSIS.

TASMAN SEA FLIGHT LEG IDENTIFICATION (E.G. S-C INDICATES THE FLIGHT LEG FROM SYDNEY TO CHRISTCHURCH, A-M INDICATES AUCKLAND TO MELBOURNE, ETC.)

A	AUCKLAND (N.Z.)	M	MELBOURNE (AUST.)
B	BRISBANE (AUST.)	S	SYDNEY (AUST.)
C	CHRISTCHURCH (N.Z.)		

(B) OTHER COMMENTS

1972

A/C-DRY SAMPLE WAS DRIED, AS USUAL, DURING SAMPLING IN AIRCRAFT.

LAB-DRY SAMPLE WAS NOT DRIED IN AIRCRAFT, BUT IN THE LABORATORY BEFORE ANALYSIS.

1973

AV HT MEAN ALTITUDE-SAMPLE TAKEN DURING DESCENT FROM 9.15 TO 6.71 KM.

1974

TEMP INL TEMPORARY POLYTHENE HOSE USED TO INTAKE OF PUMP.

15M PUMP WEAK. SAMPLE TOOK 15 MIN TO COLLECT BETWEEN 0715 AND 0730 HOURS G.M.T. TIME AND DISTANCE ARE MEAN VALUES.

1975

AV HT MEAN ALTITUDE-SAMPLE TAKEN DURING CLIMB FROM SURFACE TO 2.08 KM.

1977

PUMP?	FLASKS COULD NO BE FULLY PRESSURIZED DUE TO A LEAK IN THE OUTLET TUBE OF THE PUMP.
LAB-DRY	SAMPLE WAS NOT DRIED IN AIRCRAFT, BUT IN THE LABORATORY BEFORE ANALYSIS.
DISP AN.	SAMPLE RECEIVED AT VERY LOW OVER-PRESSURE. PART OF THE SAMPLE TRANSFERRED TO A PRE-EVACUATED 1/2 LITRE GLASS FLASK AND ANALYSIS PERFORMED BY MERCURY DISPLACEMENT METHOD.

1978

LAB DRY	SAMPLE WAS NOT DRIED IN AIRCRAFT, BUT IN THE LABORATORY BEFORE ANALYSIS.
EST ALT	SAMPLE COLLECTED ON A COMMERCIAL PASSENGER FLIGHT. ALTITUDE OF COLLECTION WAS ESTIMATED.
C.PT) W1,etc) E1,etc)	A NUMBER OF SAMPLES WERE COLLECTED ON A TRAVERSE AT CONSTANT HEIGHT. SAMPLING POINTS ARE AT APPROXIMATELY 18-20 KM INTERVALS EAST NORTH EAST (E) AND WEST SOUTH WEST (W) FROM THE CENTRE POINT (C.PT) OF THE TRAVERSE.

1979

LAB DRY	SAMPLE WAS NOT DRIED IN AIRCRAFT, BUT IN THE LABORATORY BEFORE ANALYSIS.
LPC L/D	LOW PRESSURE COLLECTION, SIMILAR TO M FLIGHTS, DUE TO PUMP FAILURE. CARE TAKEN IN FLUSHING AND SEALING OF FLASKS SO THAT RESULTS CAN BE TAKEN AS VALID. SAMPLE DRIED IN.

1980

LAB-DRY	SAMPLE WAS NOT DRIED IN AIRCRAFT, BUT IN THE LABORATORY BEFORE ANALYSIS.
LPC L/D	LOW PRESSURE COLLECTION. CONDITIONS AS FOR LPC L/D FLASKS IN 1979.
CP) W1,etc) E1,etc)	SAMPLES COLLECTED ON A HORIZONTAL TRAVERSE. SAMPLING POINT DEFINITION IS THE SAME AS C.PT FLASKS IN 1978.

1981

L/P COL	LOW PRESSURE COLLECTION. CONDITIONS AS FOR LPC L/D

DIR/IN SAMPLE COLLECTED THROUGH A P.T.F.E. TUBE FROM A SPECIALLY FITTED AIR INLET DIRECTLY TO OUTSIDE THE AIRCRAFT RATHER THAN VIA THE NORMAL BUTYL-RUBBER TUBE FROM THE AIRCONDITIONING SYSTEM.

S/S IN SAMPLE COLLECTED THROUGH A SPECIAL STAINLESS STEEL INLET TUBE COMMUNICATING DIRECTLY WITH THE OUTSIDE OF THE AIRCRAFT, RATHER THAN VIA THE NORMAL BUTYL-RUBBER TUBE FROM THE AIRCONDITIONING SYSTEM.

Table 1. Selected Atmospheric CO_2 Concentrations for the CSIRO Aircraft Monitoring Program
(units = ppmv)

DETAILS OF SAMPLE COLLECTION												DETAILS OF SAMPLE ANALYSIS						REMARKS
DATE DA MO YR	AIRCRAFT	FLIGHT	FLASK	TIME GMT	SECT	DIST	DIR	DME	ALT. (KM)	TR/ STR	DATE DA MO YR	FLASK PRESS	HISPAN	LOSPAN	ANAL'R	CO2 (PPMV)	
20 3 72	F27	D 1	16	2339	1	84	4	42	3.98	TR	17 4 72	120	AH	AE	U3	327.2	
20 3 72	F27	D 1	14	2342	1	99	4	42	3.98	TR	17 4 72	123	AH	AE	U3	327.2	
20 3 72	F27	D 1	13	2349	1	158	1	47	3.98	TR	17 4 72	126	AH	AE	U3	327.3	
21 3 72	F27	D 1	2	0410	1	123	4	42	3.68	TR	20 4 72	136	AH	AN	U3	326.0	
3 4 72	F27	D 2	5	2325	1	119	4	42	4.12	TR	20 4 72	0	AH	AN	U3	325.5	
3 4 72	F27	D 2	19	2327	1	128	4	42	4.12	TR	20 4 72	107	AH	AN	U3	325.2	
4 4 72	F27	D 2	20	0442	1	117	2	1	2.59	TR	19 4 72	0	AH	AN	U3	325.1	
4 4 72	F27	D 2	21	0445	1	130	2	1	2.59	TR	20 4 72	107	AH	AN	U3	324.7	
4 4 72	F27	D 2	22	0447	1	139	2	1	2.59	TR	20 4 72	104	AH	AN	U3	324.8	
18 4 72	F27	D 3	8	0056	1	127	1	1	3.99	TR	20 4 72	91	AH	AN	U3	326.1	
18 4 72	F27	D 3	9	0058	1	117	1	1	3.99	TR	21 4 72	83	AH	AN	U3	325.4	
18 4 72	F27	D 3	10	0059	1	112	1	1	3.99	TR	21 4 72	53	AH	AN	U3	325.9	
18 4 72	F27	D 3	11	0101	1	97	1	1	3.99	TR	21 4 72	99	AH	AN	U3	325.8	
18 4 72	F27	D 3	12	0458	1	172	5	42	3.69	TR	21 4 72	88	AH	AN	U3	326.1	
18 4 72	F27	D 3	13	0500	1	161	5	42	3.69	TR	21 4 72	79	AH	AN	U3	326.1	
18 4 72	F27	D 3	14	0501	1	150	5	42	3.69	TR	21 4 72	77	AH	AN	U3	326.3	
18 4 72	F27	D 3	16	0503	1	138	5	42	3.69	TR	21 4 72	142	AH	AN	U3	326.5	
18 4 72	F27	D 3	17	0505	1	127	5	42	3.69	TR	21 4 72	142	AH	AN	U3	327.2	
24 4 72	F27	D 4	8	0027	1	114	2	16	3.62	TR	26 4 72	3	AH	AN	U3	325.7	
24 4 72	F27	D 4	9	0031	1	92	2	16	3.62	TR	26 4 72	5	AH	AN	U3	326.2	
24 4 72	F27	D 4	10	0034	1	77	2	16	3.62	TR	26 4 72	4	AH	AN	U3	325.5	
24 4 72	F27	D 4	11	0036	1	62	2	16	3.01	TR	26 4 72	139	AH	AN	U3	325.4	
24 4 72	F27	D 4	12	0039	1	44	2	16	2.10	TR	26 4 72	174	AH	AN	U3	325.3	
24 4 72	F27	D 4	13	0531	1	55	4	16	2.86	TR	26 4 72	174	AH	AN	U3	325.4	
24 4 72	F27	D 4	14	0605	1	61	2	16	3.47	TR	26 4 72	152	AH	AN	U3	325.4	

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