

AIRCRAFT CARBON DIOXIDE PROJECT

FINAL REPORT

1 JANUARY 1968

Prepared By

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A summary of measurements of samples of air collected at 300, 500,
and 700 millibars by the Air Weather Service of the U. S. Air Force.

American Documentation Institute
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*Financial support from the Atmospheric Sciences Section of the U. S.
National Science Foundation under grants Y/211/302, Y/901/132,
G-8748, and G-19168.

I. Introduction.

This report presents the results of a program to measure the concentration of atmospheric carbon dioxide over the Northern Pacific and Arctic Oceans from April 1958 through December 1961. Samples of air were collected by personnel of the 55th Weather Reconnaissance Squadron of the U. S. Air Force and were analyzed in the Scripps laboratory. The experimental method is described and the results interpreted in an article by Keeling, Harris, and Wilkins [1967].

The data were originally calculated as "index values" proportional to concentration. In 1959 it was established provisionally at Scripps that the true concentration (mixing ratio) in parts per million of dry air by volume (ppm) is given by the relationship:

$$\text{Manometric Concentration} = (C - 311.51) 1.2188 + 311.51$$

where C is the index value. This relationship has been used to determine all concentrations in this report. (It was also applied to other data obtained at Scripps and published by Pales and Keeling [1965], Brown and Keeling [1965], and Keeling et al. [1965].)

In Table 1 manometric concentrations are presented in chronological order of sampling. In Tables 2 - 6 work sheets are presented to show the basis for calculating summaries of the data which appear in Bolin and Keeling [1963] and in Keeling, Harris, and Wilkins [1968].

II. Full List of Data - Table 1.

This table presents the original data, listed in the order of date of sampling. The table supplies the flight name, observer, date, time of sampling, pressure height, geographic coordinates, and CO₂ concentration in ppm. These data are copied from a more detailed table on file at Scripps which lists in addition to these entries: index values, flask numbers, and sheet numbers of Flask Sample Laboratory Data Sheets. The latter constitute the original laboratory record of flask analyses at Scripps. The field information in columns 1 to 7 of Table 1 was copied from Aircraft Project Flight Data Sheets which list the information logged by an Air Force meteorologist on each flight. Figure 1 shows a facsimile of one of these sheets.

Fig. 1

Column 2 identifies the sample-taker by a three-letter code as indicated below:

<u>Designation</u>	<u>Rank</u>	<u>Name</u>
BAN	Lt.	Banks
BOR	Lt.	Borton
BRE	Capt.	Brett
BUR	Capt.	Burwell
CAR	CWO	Carney
COM	Lt.	Commons
COO	Lt.	Cooley
COR	Capt.	Corcoran
FRA	-	France

(continued)

<u>Designation</u>	<u>Rank</u>	<u>Name</u>
FRE	Lt.	Freeman
FRO	Lt.	Fromer
FUK	Capt.	Fukuda
HAN	CWO	Hansen
HAR	Capt.	Harrell
HAY	Lt.	Haywood
HUB	Capt.	Huber
MAR	Lt.	Martinenko
MOS	M/Sgt	Mosher
NAG	Lt.	Nagle
PER	-	Perrin
POL	M/Sgt	Polittle
SHA	Capt.	Sharp
SKI	Lt.	Skillman
SMJ	Capt.	Smurro
STR	Lt.	Streeter
WIL	CWO	Williamson
YEL	Lt.	Yelton

A single asterisk in column 8 indicates that the sample is omitted from the compilations in Tables 2 - 5 because the sample was judged to have been contaminated during sampling. A double asterisk in the same column denotes additional samples omitted from compilations of Loon K flights labeled Revised in Table 3, as discussed in the next section.

III. Zonal Monthly Averages - Tables 2 and 3

These tables show the basis for determining zonal monthly average concentrations of the 500 mb portions of Lark flights (Table 2) and 700 mb portions of Loon flights (Table 3) from the data of Table 1. In each Table the data have been sorted by month and zone. The zones are designated in the headings by specific latitudes which generally lie at the center of the zones. Thus the 12.5°N zone applies to data collected between 10.0° and 15.0°N, the 17.5°N zone between 15.1° and 20.0°N, and so on to 32.5°N. The 40.0°N zone, however, applies to data collected between 35.1 and 41.0°N. The 500 mb data for zone 40.0°N and all of the 700 mb data have been subdivided into subzones for purposes of computing adjustments as discussed below. In Table 2, zone 40.0°N, A refers to 35.1-39.4°N, B to 39.5-39.9°N, C to 40.0-41.0°N. In Table 3, A refers to the southern half, B to the northern half of each zone. Thus A under 12.5°N refers to 10.0-12.5°N, B to 12.6-15.0°N.

In the body of the Table under the name of the month are first listed the dates of all flights during that month and the number of flasks per zone for each flight. This information aids in locating the original data in Table 1. The average latitudes and dates, giving equal weight to each flask, are listed next. Average latitude and date adjustments in ppm

<u>Designation</u>	<u>Rank</u>	<u>Name</u>
FRE	Lt.	Freeman
FRO	Lt.	Fromer
FUK	Capt.	Fukuda
HAN	CWO	Hansen
HAR	Capt.	Harrell
HAY	Lt.	Haywood
HUB	Capt.	Huber
MAR	Lt.	Martinenko
MOS	M/Sgt	Mosher
NAG	Lt.	Nagle
PER	-	Perrin
POL	M/Sgt	Polittle
SHA	Capt.	Sharp
SKI	Lt.	Skillman
SMU	Capt.	Smurro
STR	Lt.	Streeter
WIL	CWO	Williamson
YEL	Lt.	Yelton

A single asterisk in column 8 indicates that the sample is omitted from the compilations in Tables 2 - 5 because the sample was judged to have been contaminated during sampling. A double asterisk in the same column denotes additional samples omitted from compilations of Loon K flights labeled Revised in Table 3, as discussed in the next section.

were determined as described in the next paragraph. The total number of flasks is the sum of the numbers for each flight. The (zonal monthly) average concentration gives equal weight to each flask. The concentration of each flask (before averaging) was referred to a datum of January 1960 by the formula:

$$\begin{array}{l} \text{concentration (ppm)} \\ \text{referred to Jan. 1960} \end{array} = \begin{array}{l} \text{manometric} \\ \text{concentration (ppm)} \end{array} - .72x(\Delta M/12)$$

where ΔM is the number of months between the datum and the flight date, positive if the flight occurs after the datum. The figure 0.72 is the average rate of increase in atmospheric CO_2 in ppm yr^{-1} according to Bolin and Keeling [1963, p. 390]. A more recent figure of Pales and Keeling [1965] is slightly lower (0.68 ppm), but the former value is used here so that the results of this report agree exactly with the former article. The adjusted zonal monthly average concentrations which appear on the last line is the sum of the average concentration and both adjustments. The adjusted concentration is thus an estimate of the concentration expected to occur on the fifteenth of the month in question and at the specific plotting latitude listed in the headings.

To determine the adjustments, the (unadjusted) zonal monthly average concentrations of Table 2 and 3 were first plotted versus latitude and month, using the coordinates listed in the table headings (12.5°N, 17.5°N, etc.) as plotting

latitudes. Monthly averages of Stork and Ptarmigan flights, taken from Table 4, were added to the plots versus latitude, using as plotting latitudes the average latitude of each track: 78°N for Ptarmigan flights and 50°N for Stork flights. The Stork and Ptarmigan monthly average had been adjusted to apply to the 15th of each month beforehand (see Section IV) and were not altered when the other data were subsequently adjusted. On both the latitudinal and the monthly plots, smoothed curves were drawn with the constraint that the two modes of plotting be consistent. Preliminary latitude and date adjustments were then read from these smoothed curves and used to determine preliminary adjusted concentrations for the Lark and Loon flights. Revised curves were then drawn to conform to the adjusted concentrations. In a few cases the adjustments themselves were now altered to conform better with the revised curves and the whole process repeated. After the second revision, no further adjustments appeared necessary. The values in Tables 2 and 3 are consistent with the final version of the smoothed curves. Smoothed curves of concentration versus latitude for all months of the year and some of the smoothed curves versus season appear in Bolin and Keeling [1963]. The complete series versus season (including Ptarmigan and Stork flights, see Section IV) appears in this report as Figures 2 - 12. The

figures also show as solid dots, for the Lark and Loon flights, the adjusted zonal monthly average concentrations, and for the Ptarmigan and Stork flights, the unadjusted monthly averages.

The revised entries in Table 3 are consistent with a reevaluation of the Loon K flights by Pales and Keeling [1963] in which the authors rejected as contaminated several concentrations accepted in the compilation of Bolin and Keeling [1963]. Figures 9 - 12 reflect the revised values. The open and solid squares in Figures 3 - 14 of Bolin and Keeling [1963], plotted from the adjusted concentrations listed in Tables 2 to 4, however, include values in Table 3 without these revisions. The revisions do not significantly affect the smoothed latitudinal plots in Bolin and Keeling [1963], and corrected versions of the latitudinal plots have not been prepared for inclusion in this report.

IV. Flight Track Monthly Averages - Tables 4 and 5.

These tables give monthly summaries of data not included in Tables 2 and 3. The data are summarized for each track and pressure height but are not differentiated latitudinally within the tracks. For the Stork and Ptarmigan flights, the data show no systematic latitudinal variation within the tracks. For the other tracks the data are too few to investigate latitudinal

variations. The table includes those portions of Lark flights at 700 mb; those portions of Loon H flights at 500 mb; all Stork flights (at 500 mb); all Ptarmigan flights (500 and 700 mb). For Stork and Ptarmigan flights, date adjustments were read directly from smoothed curves based on the unadjusted track average concentrations versus month (Figures 2, 3, and 8). For Lark, 700 mb, the smoothed plot for Lark, 500 mb, 40-41°N, was used to estimate the adjustments.

The Loon H flights at 500 mb extended over such a wide range of latitudes that the date adjustments themselves had to be considered as a function of latitude. Table 5 lists individual adjustments for each latitude zone and weighted averages of these used to determine the adjusted values in Table 4. For zones centered at 27.5°N to 42.5°N, the individual adjustments were read from smoothed plots of Lark flights at 500 mb at 27.5°N, 32.5°N, 37.5°N, and 40.0°N. For zones centered 47.5°N to 57.5°N, they were read from the smoothed plots of the Stork flights.

No summary is given of 5 samples each collected on September 28, 1959 and April 7, 1960 on Lark U flights at 30,000 feet above sea level (300 mb). From Table 1 it may be seen that the data show no significant departures from data on the same flights at 500 mb.

Also, no summary is given of 6 samples collected on June 20, 1959 at 700 mb on a Stork G flight and 23 samples on two Lark I flights on April 6 and April 12, 1958. These last two flights, which initiated the aircraft sampling program, gave good data, but were on a track which cannot be readily compared with data from any other track. *Also, no summary is given of 10 samples on a special Stork flight over Canada, November, 1958.*

V. Smoothed Values of the CO₂ Concentration - Table 6.

In this table are copied values of concentration which correspond to the smoothed curves in Figures 2 - 12 for the fifteenth of each month. Values for latitudes 32.5°-78.0°N at 500 mb and 12.5°-17.5°N for 700 mb appear in Bolin and Keeling [1963, Table 3, p. 3911]. For latitudes 22.5°-27.5°N where data are available at both 500 and 700 mb, Bolin and Keeling prepared composite smoothed curves (see p. 3909 of their article) which yielded values lying between those at the separate levels. These composite values are not shown in Table 6, but appear in Table 3 of Bolin and Keeling [1963].

VI. Duplicate Samples - Table 7

This table lists the individual analyses, averages, and differences between analyses for nineteen samples run in duplicate during the course of the project. Samples were analyzed

in duplicate in the laboratory only when the first analysis was suspected to be in error. If we omit the measurements on Stork G at 2243, June 20, 1959, where the first analysis is clearly faulty, the average difference is 0.56 ppm. Individual differences are distributed rather evenly over the range 0.00 - 1.00 ppm. Duplicate analyses of samples collected in 5-liter flasks at the South Pole yield an average difference of only 0.2 ppm [Brown and Keeling, 1965, p. 6082]. These facts taken together suggest that the duplicate analyses of the aircraft samples, owing to the special selection of samples for rerun, did not reflect the average analytical error or the normal distribution of errors. Nevertheless, the errors, even if they were typical for the aircraft data, are not so large as to invalidate the conclusions reached by Keeling, Harris, and Wilkins [1968].

REFERENCES

- Bolin, B., and C. D. Keeling [1963] Large-scale atmospheric mixing as deduced from the seasonal and meridional variations of carbon dioxide. J. Geophys. Res., 68, 3899-3920.
- Brown, C. W., and C. D. Keeling [1965] The concentration of atmospheric carbon dioxide in Antarctica. J. Geophys. Res., 70, 6077-6085.
- Keeling, C. D., T. B. Harris, and E. M. Wilkins [1968] The concentration of atmospheric carbon dioxide at 500 and 700 millibars. J. Geophys. Res., in press.
- Pales, J. C., and C. D. Keeling [1965] The concentration of atmospheric carbon dioxide in Hawaii. J. Geophys. Res., 70, 6053-6076.

FIGURES

Figure 1. Copy of an Aircraft Project Flight Data Sheet. The entries are information logged by the U. S. Air Force observer during flight.

Figures 2 - 12. The concentration of atmospheric CO₂ at various altitudes and latitudes as a function of month of the year. January through June (months 1 through 6) are plotted twice to reveal the seasonal pattern more fully. Solid dots are monthly average concentrations taken from Tables 2 - 4. In Figures 2, 3, and 8 unadjusted concentrations are plotted versus the average date of sampling as listed in Table 4. In Figures 4 - 7 and 9 - 12 adjusted values are plotted versus the fifteenth of the month. Solid curves are smoothed plots consistent with the latitudinal plots of Bolin and Keeling [1963, Figures 3 to 14, pp. 3903-3909]. Concentrations corresponding to the smoothed curves are given in Table 6.

LARK YANKEE REVERSE

OBSERVER 1/LT BURWELL

				Time (GCT)	Altitude (ft.)	Air Speed (knots)	No. of turns of valve	Flow Rate (LPM)	Is Cabin Pressurized?	Remarks (Icing conditions, turbulence, condition of stopcock, etc.)
<u>DATA BEFORE SAMPLING BEGINS</u>						IAS				
				1649	2000	164	1/4	1	NO	—
				1710	5000	172	1/4	1	NO	—
				1724	10000	169	1/4	1	NO	—
				1735	18000	188	1/4	1	YES	—
<u>DATA DURING SAMPLING</u>						TAS				
Flask No.	Position									
No.	No.	Lat.	Long.							
119	14	25.3	156.0	1812	19440	238	1/4	1	YES	—
120	13	27.3	154.4	1847	19410	250	1/4	1	"	LIGHT RIME ICING, LIGHT TURBULENCE, GOOD FLOW
118	12	29.3	152.7	1926	19430	240	1/4	1	"	CLEARED ICING FROM TUBE IN CLEAR AIR
117	11	31.4	151.1	2001	19430	241	1/4	1	"	—
143	10	33.4	149.4	2038	19400	242	1/4	1	"	—
142	9	35.4	147.6	2120	19440	242	1/4	1	"	—
144	8	37.5	145.8	2157	19460	244	1/4	1	"	—
141	7	39.5	144.0	2229	19500	244	1/4	1	"	—
135	6	39.5	140.7	2256	19450	244	1/4	1	"	—
136	5	39.5	137.5	2336	19450	245	1/4	1	"	—
133	4	39.5	134.3	0024	19510	242	1/4	1	"	STOPCOCK MAY HAVE LEAKED

FIG. 1

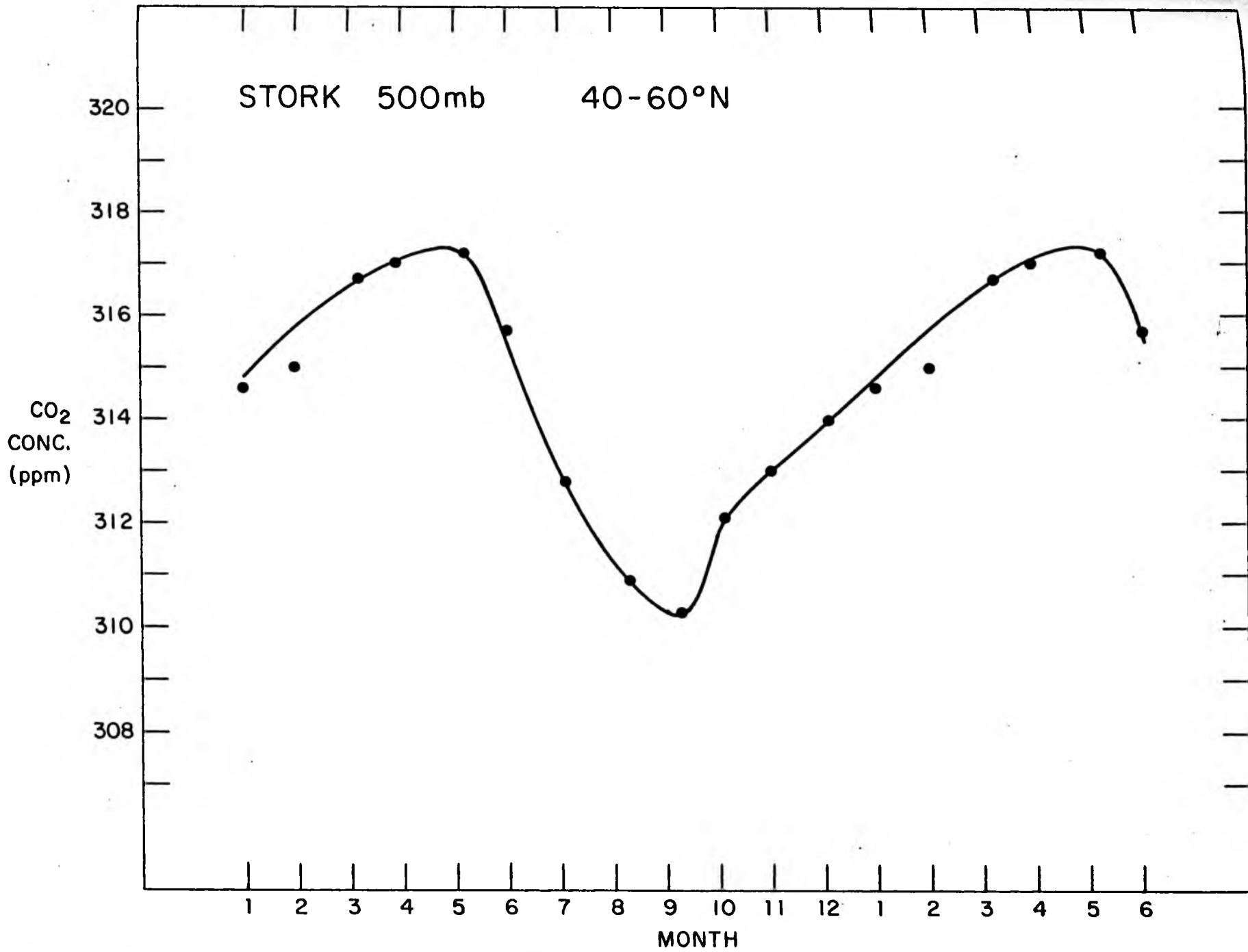


FIG. 2

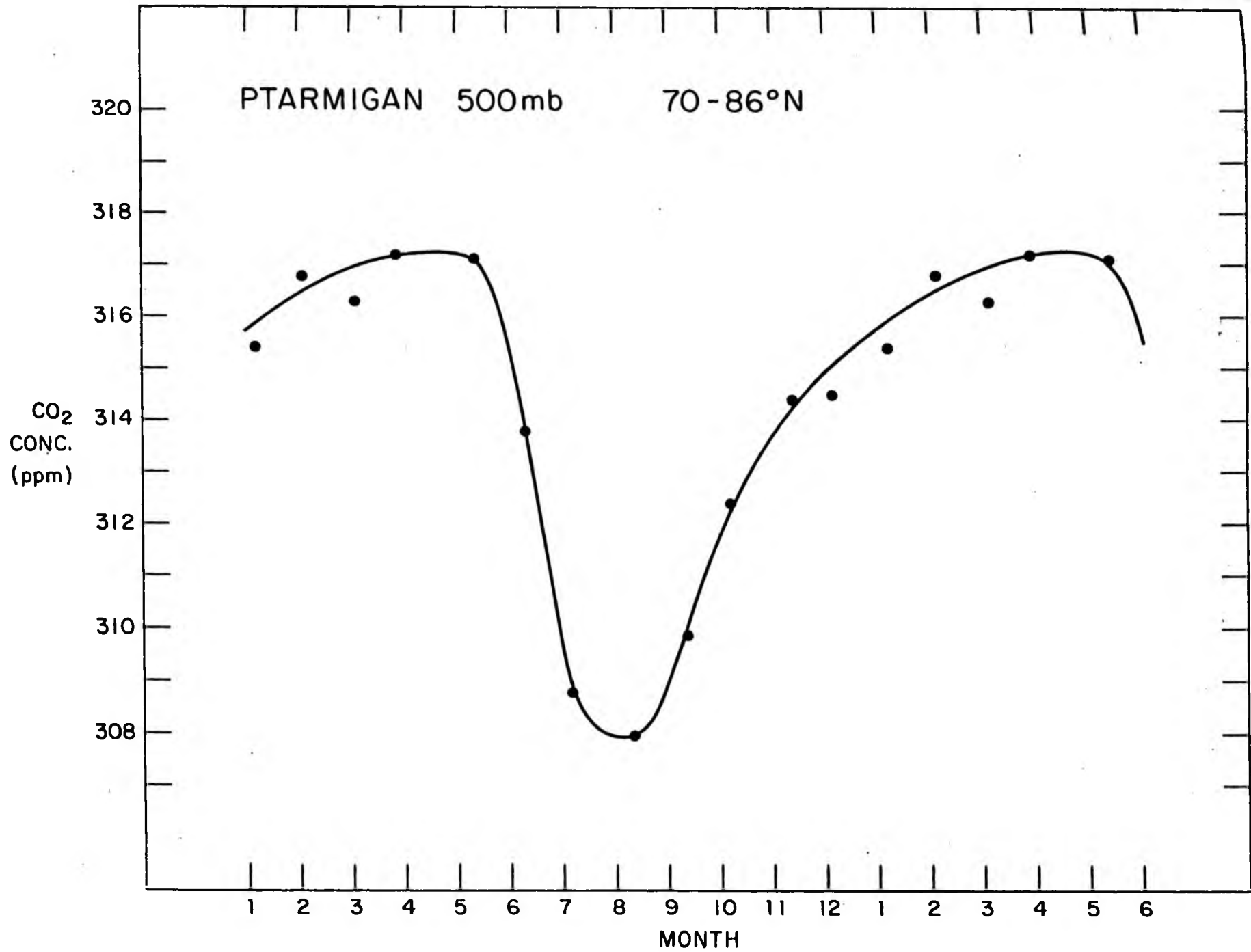


FIG. 3

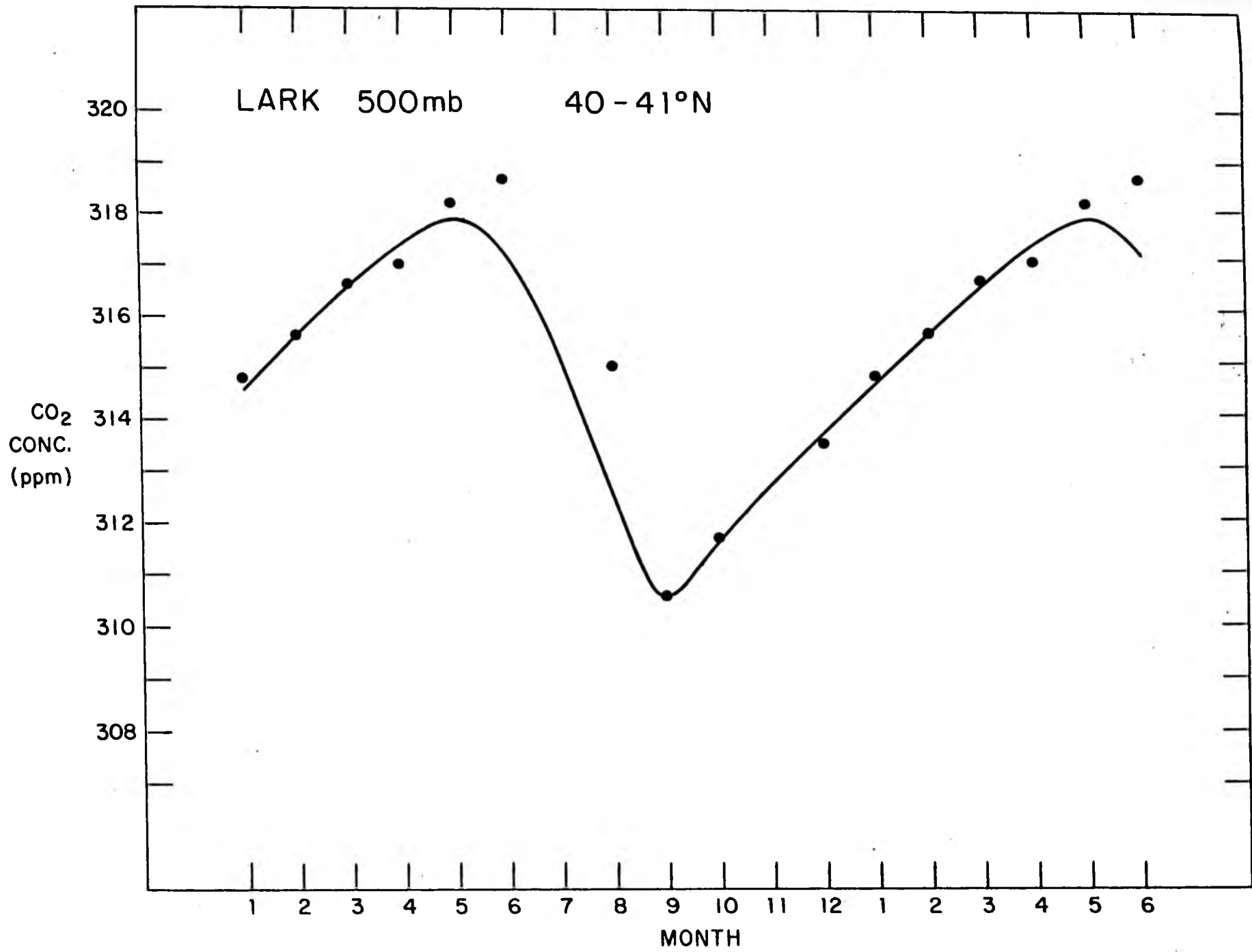


FIG. 4

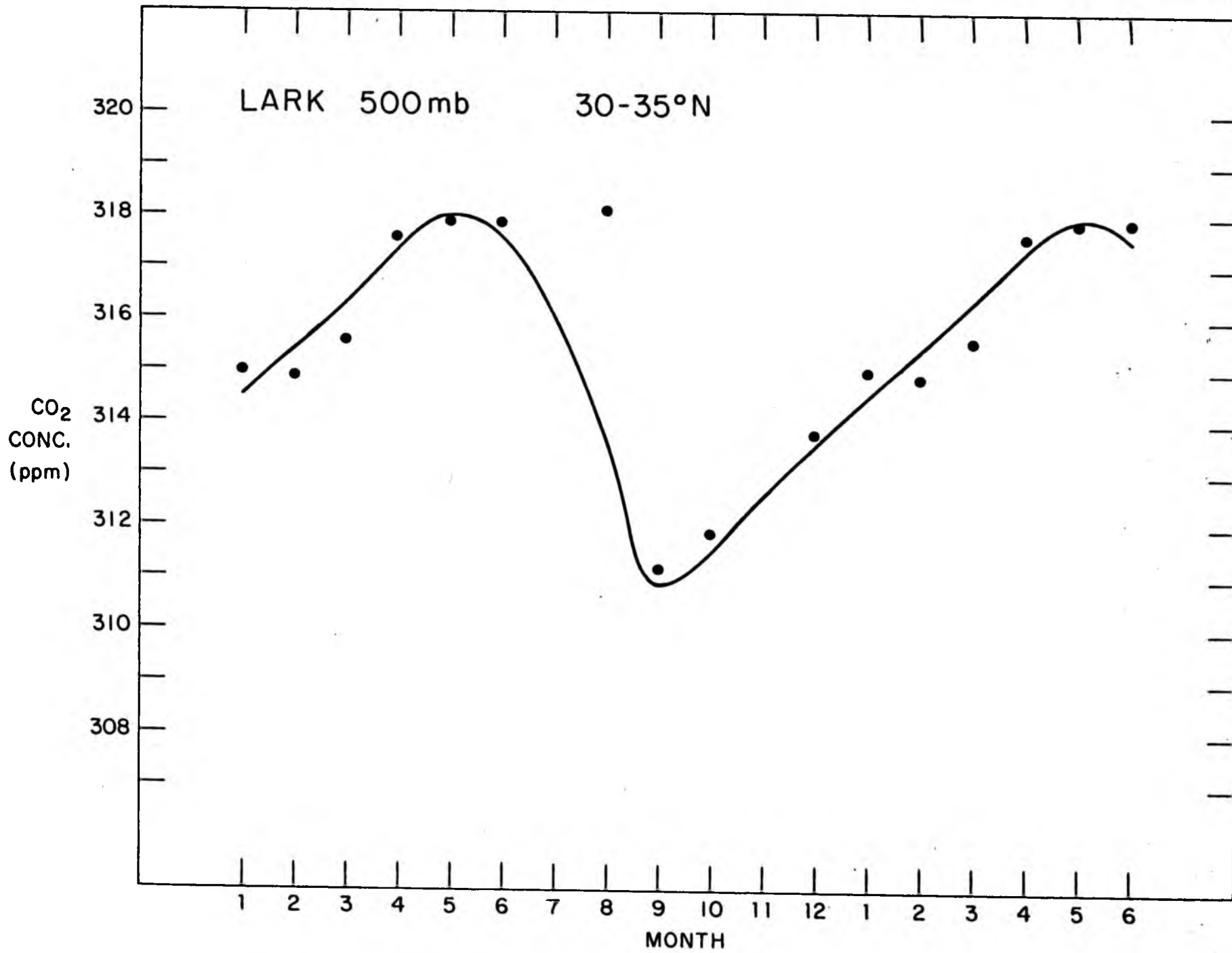


FIG. 5

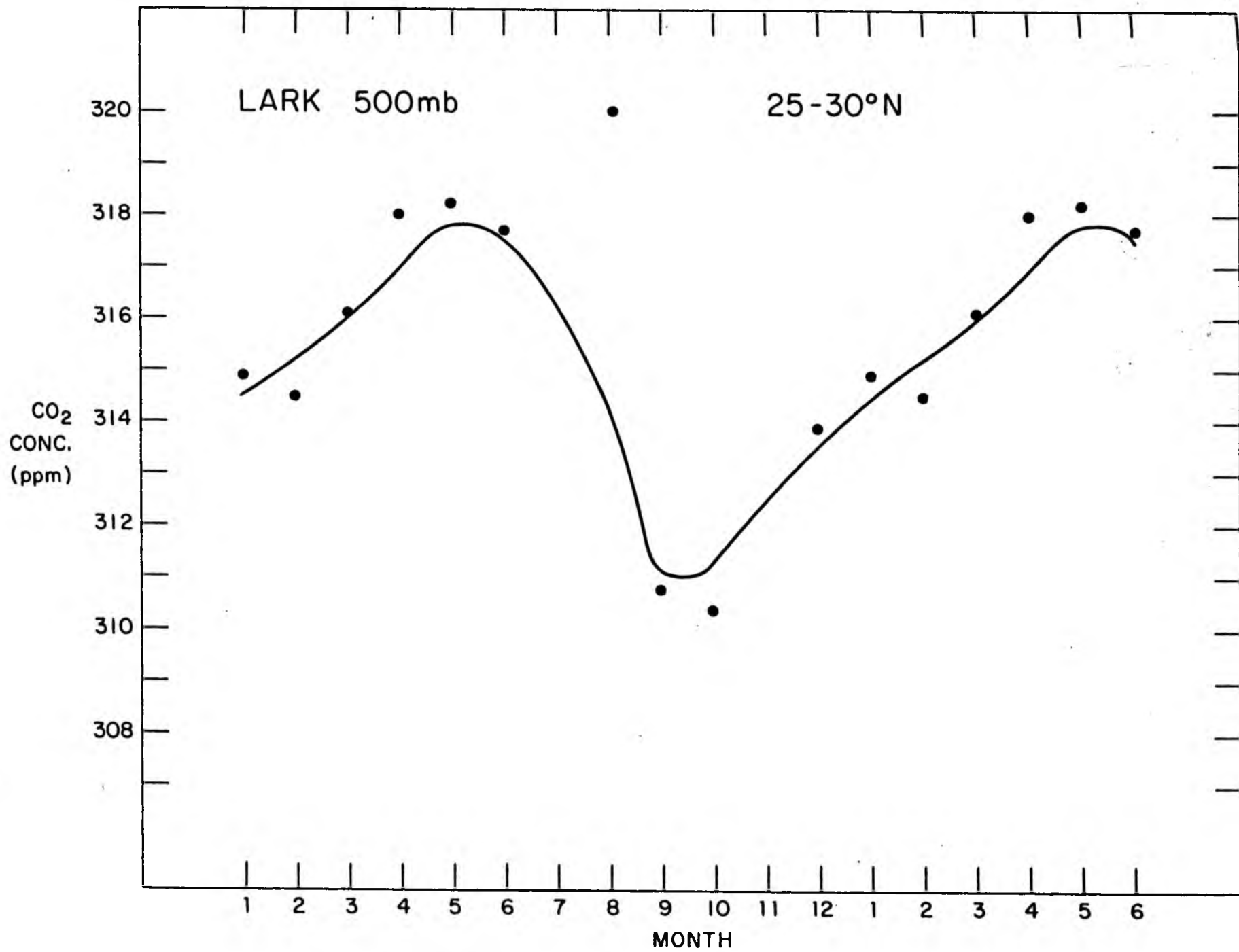


FIG. 6

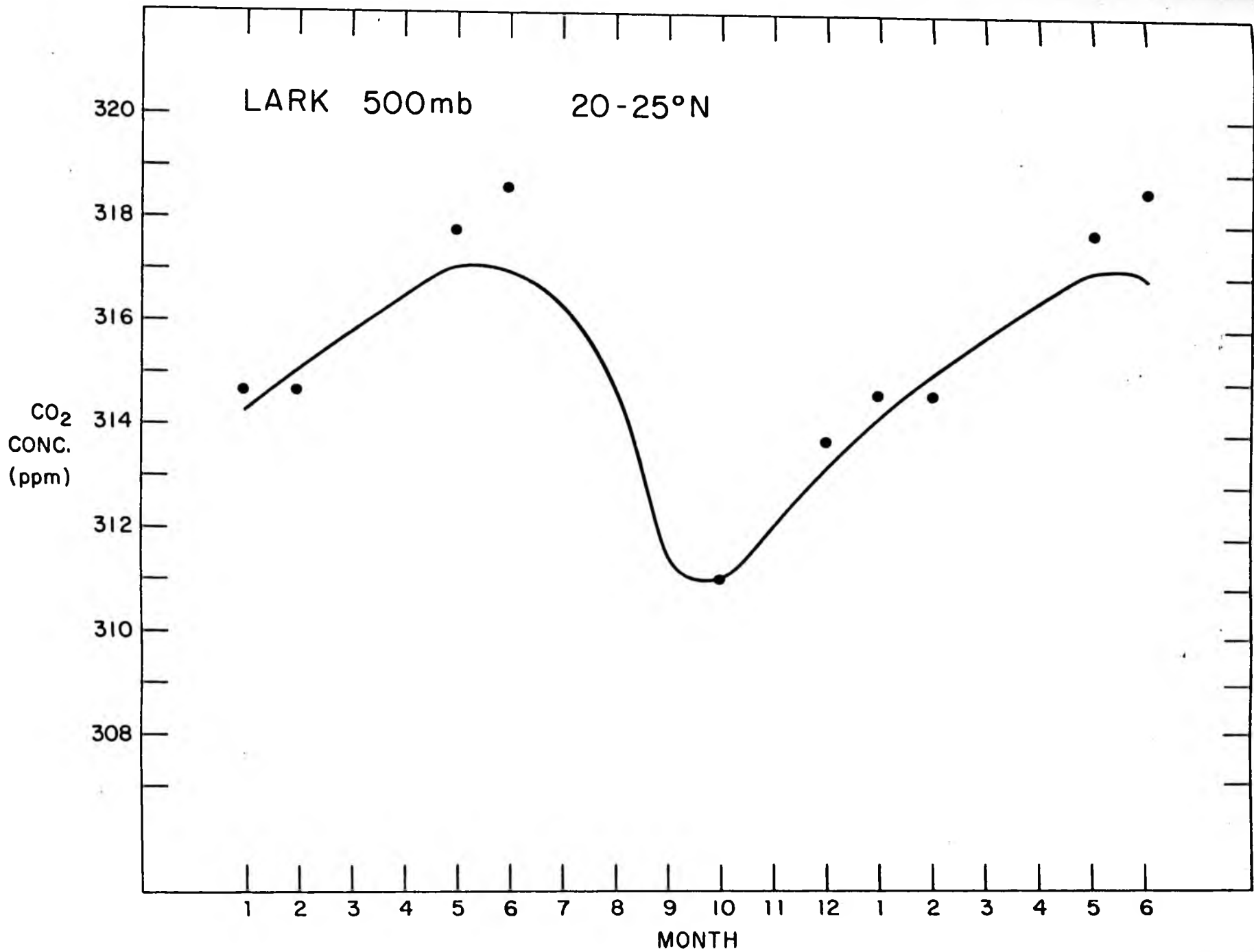


FIG. 7

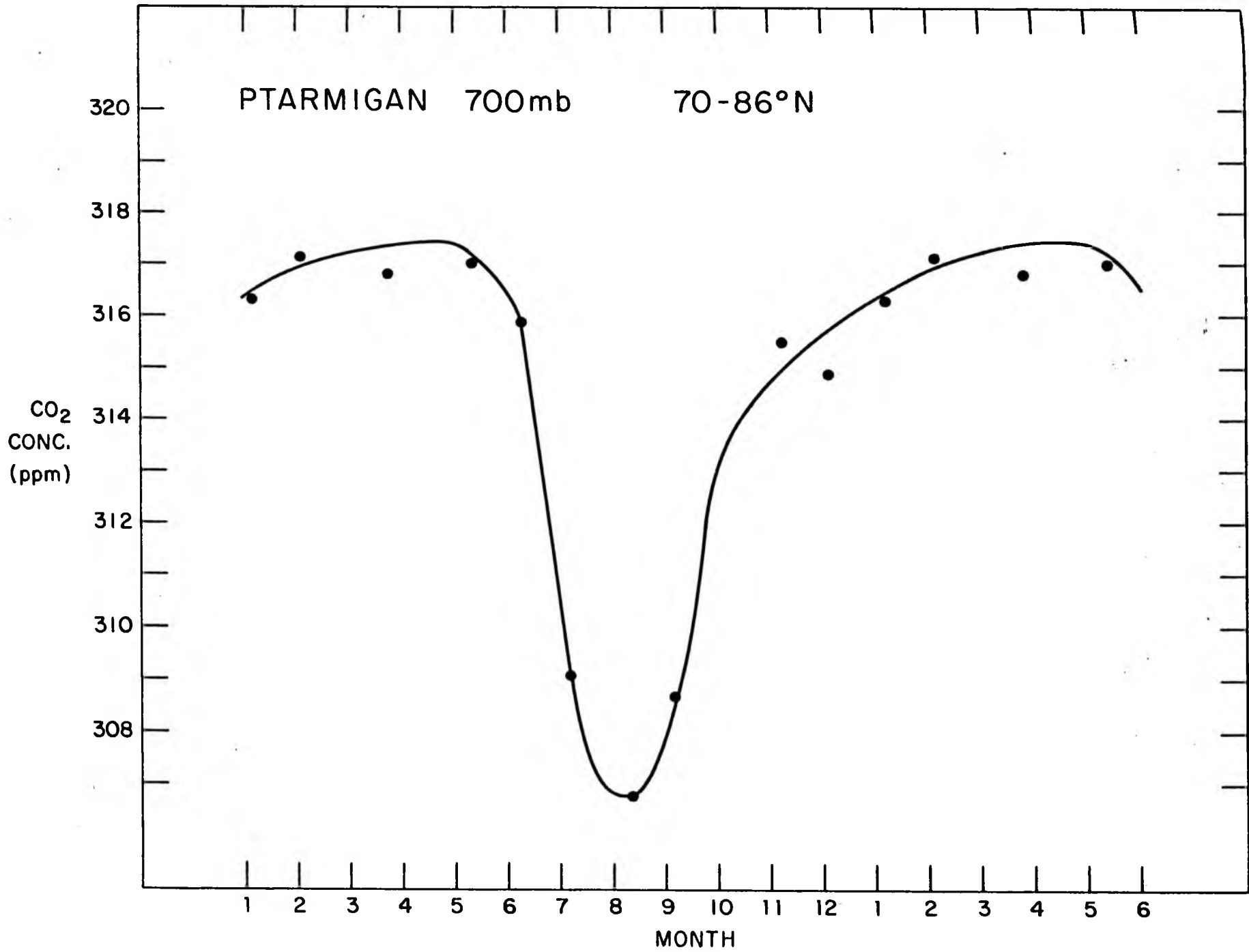


FIG. 8

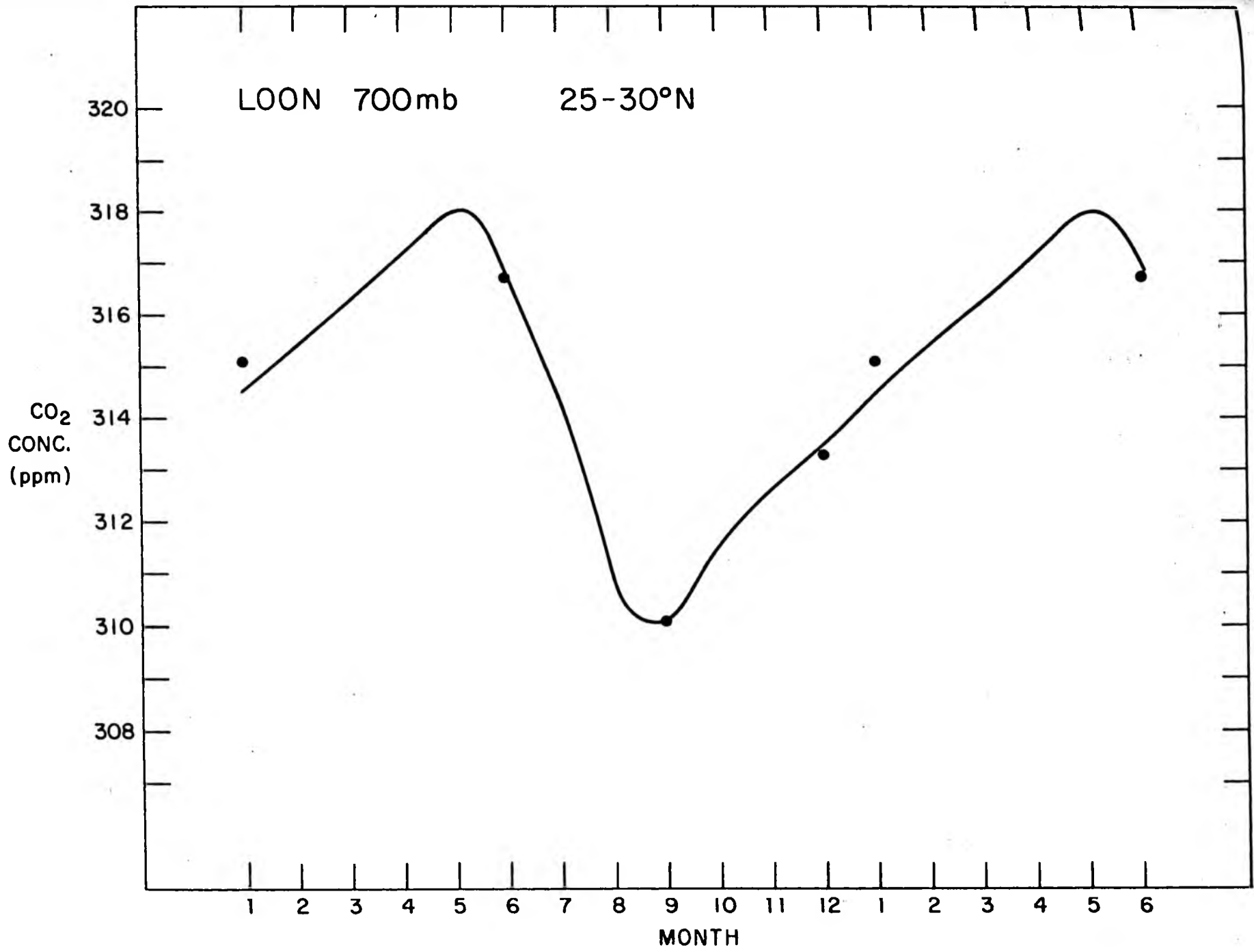


FIG. 9

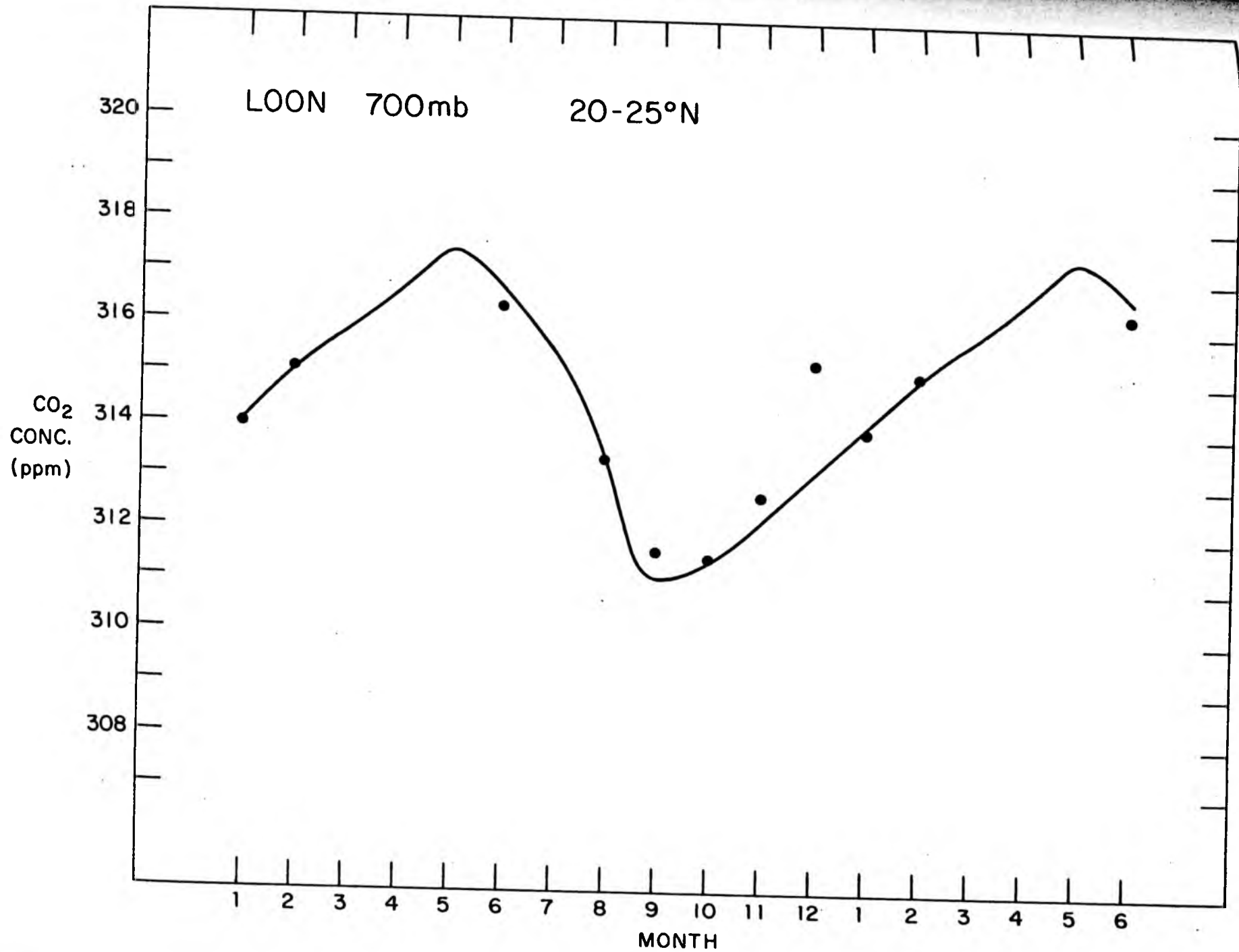


FIG. 10

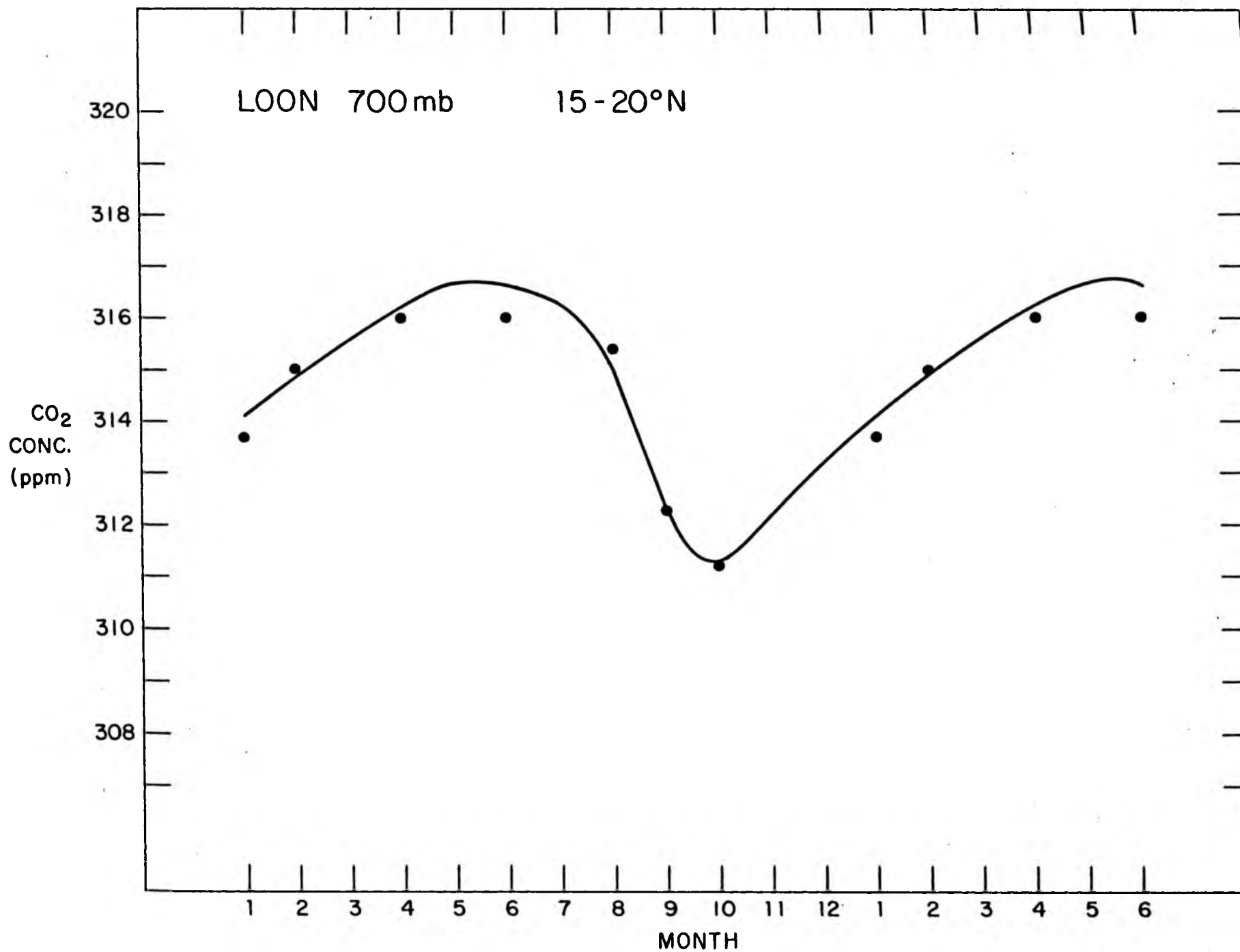


FIG. 11

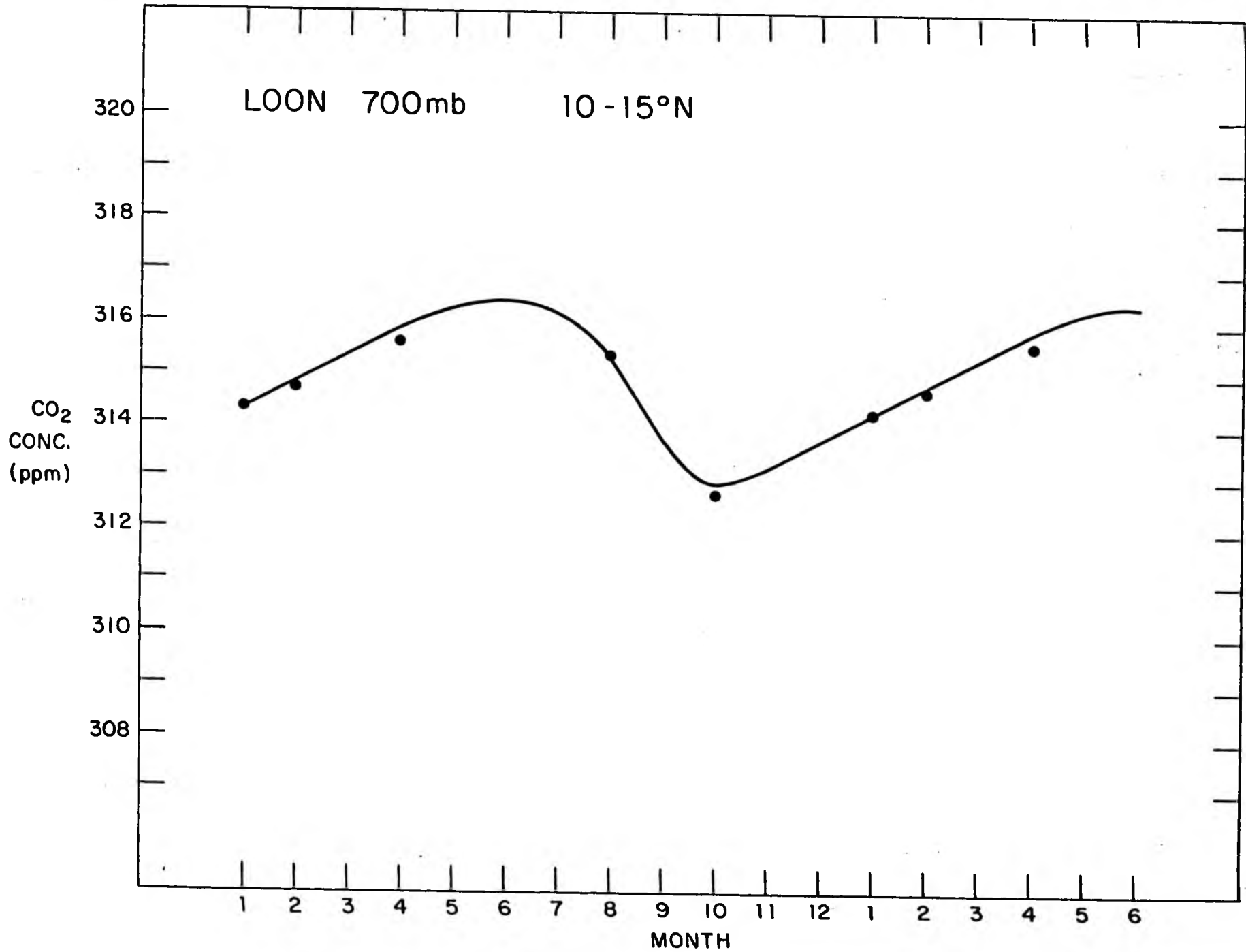


FIG. 12

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7	8						
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat. Long.	CO ₂ Concentration (ppm)						
Lark I	NAG	1958 Apr.	6	1658	500	41.0	125.0	314.1					
				1740		42.9	127.1	314.3					
				1903		46.9	131.5	314.2					
				1940		48.8	133.8	314.3					
				2108		52.7	138.6	314.6					
				2152		54.7	141.3	315.4					
			7	2318		49.7	141.8	313.8					
				0003		47.2	142.1	315.9					
				0126		42.2	142.6	316.7					
				0200		42.0	139.2	314.7					
				0315		41.5	132.6	314.9					
				Lark I		NAG	Apr.	12	1710	500	41.0	125.0	313.8
									1742		42.9	127.1	314.0
									1901		46.9	131.5	315.5
									1933		48.8	133.8	314.9
2046	52.7	138.6	315.9										
2120	54.7	141.3	317.1										
2322	49.7	141.8	315.4										
2318	47.2	142.1	314.1										
13	0023	42.2	142.6		314.6								
	0050	42.0	139.2		314.0								
	0157	41.5	132.6	316.7									
	0235	41.3	129.3	316.6									

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Col: 1	2	3	4	5	6	7		8			
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)			
Stork A	NAG	<u>1958</u> Jun.	8	1730	500	40.9	127.3	314.6			
				1810		41.5	129.7	315.6			
		1858		42.2		133.0	314.6				
		1933		43.0		136.2	314.9				
		2055		44.4		142.8	315.4				
		2135		45.2		146.2	313.5				
		2217		46.0		149.6	314.9				
		2347		47.5		156.5	315.4				
		9	0032	48.3	160.0	315.4					
			0151	53.0	162.9	315.7					
			0305	57.6	166.2	316.4					
			0344	59.6	163.3	315.3					
			Stork B	NAG	Jun.	11	2001	500	55.1	154.7	316.3
							2046		52.8	156.5	314.9
2220	48.3	160.0			315.8						
2253	47.5	156.5			313.5						
2327	46.8	153.0			314.3						
2358	46.0	149.6			313.6						
12	0031	45.2			146.2		314.6				
	0104	44.4			142.8		313.0				
	0209	43.0			136.2	314.9					
	0241	42.2			133.0	319.0*					
	0315	41.5	129.7	327.6*							

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)
Ptarmigan	SMJ	<u>1958</u> Sept.	29	0130	500	84.9	164.5	308.3
				0145		85.9	166.2	309.9
				0205		85.9	144.4	307.6
				0218		85.6	132.1	312.1*
				0243		84.8	115.7	309.3
				0257		85.6	132.1	307.4
				0416		86.3	135.0	307.4
				0548		83.5	161.5	307.9
				0626		81.0	159.5	309.9
				0710		78.5	158.3	306.7
				0753		76.0	157.5	306.5
				0826		73.5	157.0	307.8
				Stork C		HAY	Sept.	29
2242	52.8	162.2	308.2					
2328	50.4	161.1	309.5					
30	0012	48.0	160.0		310.9			
	0042	48.0	156.3		310.5			
	0109	48.0	152.6		-			
	0137	48.0	148.9		309.2			
	0212	48.0	145.1		-			
	0246	48.0	141.4		308.4			
	0321	48.0	137.7		317.0*			
	0354	48.0	133.9		309.0			
	0429	48.0	130.2		309.4			

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7	8		
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat. Long.	CO ₂ Concentration (ppm)		
Stork C	HAY	<u>1958</u> Oct.	24	2141	500	52.8	162.3	310.6	
				2221		50.4	161.1	310.2	
				2303		48.0	160.0	311.3	
				2333		48.0	156.3	316.9*	
			25	0001		48.0	152.6	313.1*	
				0034		48.0	148.8	311.3	
				0107		48.0	145.1	311.4	
				0137		48.0	141.4	310.6	
				0213		48.0	137.7	310.3	
				0253		48.0	133.9	310.3	
				0327		48.0	130.2	310.5	
Stork S	SMJ	Nov.	1	1730	500	65.8	143.5	314.8	
				1830		67.7	134.4	314.2	
				1930		69.2	122.8	311.9	
				2030		69.9	110.1	313.6	
				2130		68.9	101.3	-	
				2230		65.3	105.3	311.0	
				2330		61.7	108.6	310.6	
				0030		59.9	107.3	-	
				2		0130	58.2	108.6	310.6
						0230	55.3	112.0	310.6
						0330	52.3	116.0	311.1
						0430	49.9	119.6	310.3

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7	8						
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat. Long.	CO ₂ Concentration (ppm)						
Petralark F	CAR	<u>1958</u>	28	1716	500	40.9	124.1	312.2					
		Dec.		1759		40.8	127.3	316.6*					
		1907		40.6		132.2	312.5						
		2026		40.5		137.1	312.7						
		2130		40.3		142.0	312.7						
		2244		40.6		146.9	313.1						
		29		0005		38.7	150.4	313.1					
				0120		35.0	150.7	316.6*					
				0235		31.0	151.1	313.1					
				0244		27.6	151.5	312.5					
				0455		25.3	154.7	312.5					
				Petralark F		FUK	<u>1959</u>	7	1713	500	40.9	124.1	313.7
							Jan.		1800		40.8	127.3	313.1
		1920					40.8		132.5		313.4		
2035	40.5	137.1	314.2										
2155	40.1	142.1	313.1										
2306	40.1	146.9	313.1										
8	0015	38.9	150.3		313.4								
	0116	35.0	150.7		313.8								
	0215	31.1	151.1		313.8								
	0312	27.6	151.5		313.1								
	0430	25.0	155.0	313.1									
0529	23.0	158.0	313.0										

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8			
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)			
Stork C	PER	<u>1959</u> Jan.	7	1948	500	55.9	163.8	313.0			
				2027		52.8	162.3	312.8			
		2054		50.4		161.1	313.3				
		2121		48.0		160.0	312.8				
		2200		48.0		156.3	312.6				
		2242		48.0		152.6	313.0				
		2322		48.0		148.8	-				
		8	0002	48.0	145.1	312.7					
			0037	48.0	141.4	314.7*					
			0117	48.0	137.7	316.7*					
			0156	48.0	133.9	316.7*					
			0235	48.0	130.2	317.9*					
			Stork C	---	Feb.	7	0038	500	55.9	163.8	315.4
							0134		52.8	162.3	315.0
							0220		50.4	161.1	314.0
0300	48.8	160.0					313.2				
0336	48.0	156.3					313.0				
0413	48.0	152.6					313.8				
0444	48.0	148.8					313.8				
0517	48.0	145.1					314.1				
0559	48.0	141.4					314.0				
0626	48.0	137.7					314.2				
0708	48.0	133.9	314.4								
0745	48.0	130.2	313.8								

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)
Stork C	HAY	<u>1959</u>	17	0325	500	56.1	164.2	322.1*
		Apr.		0433		52.8	162.3	322.4*
				0519		50.4	161.1	316.9
				0604		48.0	160.0	317.6
				0646		48.0	156.3	326.1*
				0729		48.0	152.6	316.7
				0812		48.0	148.8	315.9
				0855		48.0	145.1	317.8
				0932		48.0	141.4	316.3
				1009		48.0	137.7	316.5
				1044		48.0	133.9	316.0
	1110	48.0	130.2	316.0				
Ptarmigan	HAN	Apr.	17	0220	500	84.5	163.0	317.5
				0242		85.9	166.2	316.7
				0315		85.6	132.1	316.3
				0340		84.4	114.0	316.4
				0410		83.2	115.2	316.1
				0432		82.2	122.3	316.6
				0500		80.3	129.2	316.6
				0530		78.4	133.2	317.8
				0600		76.6	136.4	317.0
				0630		75.1	139.3	317.2
				0700		73.1	140.6	317.3
0730	71.3	142.2	315.2					

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8			
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)			
Petralark F	MOS	1959 Apr.	17	2036	500	26.0	153.7	316.7			
				2107		27.6	151.5	317.0			
		2142		30.0		151.2	318.0				
		2219		32.5		151.0	317.3				
		2256		35.0		150.7	316.9				
		2335		37.5		150.5	316.8				
		0011		40.0		150.2	316.6				
		18	0046	40.1	146.9	316.9					
			0124	40.2	143.7	316.7					
			0239	40.5	137.1	317.0					
			0317	40.6	133.9	315.9					
			0433	40.8	127.3	316.6					
			Lark	MOS	May	20	2035	500	40.3	140.5	317.1
							2114		40.1	143.8	318.0
2156	40.0	147.1					319.1				
2238	39.9	150.3					317.2				
2321	37.4	150.6					317.1				
21	0009	34.9			150.8	317.3					
	0054	32.4			151.0	317.5					
	0136	29.9			151.2	317.9					
	0214	27.4			151.3	317.8					
	0254	26.0			153.6	322.8*					
	0339	24.5			155.8	317.5					

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)
Stork G	POL	<u>1959</u>	20	2320	500	48.4	156.6	317.5
		May		2358		43.9	157.8	317.3
			21	0032		44.9	155.4	317.7
		0107		45.8		151.1	317.2	
		0142		46.7		147.8	317.0	
		0218		47.7		144.4	316.7	
		0254		48.6		141.4	317.3	
		0328		45.9		137.5	317.2	
		0404		47.8		134.7	317.2	
		0439		46.2		132.0	316.6	
		0511		44.5		129.3	316.9	
		0546		42.8		126.8	317.4	
		Loon H***	HAR	May		22	0508	500
0557	57.5				163.0		317.1	

***Four more samples were run, and found to be grossly contaminated. No record was kept of the condition of the remaining six flasks.

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7	8		
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat. Long.	CO ₂ Concentration (ppm)		
Loon H	HAY	<u>1959</u> Jun.	20	2200	500	32.5 163.0	316.6		
				2242		35.0 163.0	313.3		
		21	2321	37.5 163.0	314.6				
			0016	40.0 163.0	315.8				
			0056	42.5 163.0	314.2				
			0137	45.0 163.0	314.4				
			0228	47.5 163.0	314.6				
			0309	50.0 163.0	314.4				
			0351	52.5 163.0	314.8				
			0433	55.0 163.0	314.2				
			0517	57.5 163.0	313.1				
			0559	60.0 162.4	313.9				
		Stork G	FUK	Jun.	20	1706	700	63.8 149.0	314.2
						1800		60.8 150.0	314.2
21	1915			56.4 150.8	314.4				
	2030			51.9 153.1	314.0				
	2145			47.6 155.4	314.4				
	2243			500 46.3 156.3	314.0				
	0001			45.8 151.1	313.7				
	0112			47.7 140.4	315.0				
	0222			49.5 137.5	314.6				
	0339			46.2 132.0	313.4				
	0456			42.8 126.8	316.3*				
	0603			700 40.1 122.2	316.9*				

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8		
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)		
Lark	STR	1959 Jun.	20	1500	700	40.6	125.2	318.0*		
				1600		40.4	129.5	315.2		
		1700		40.4		133.5	316.0			
		1750		40.2		137.1	315.8			
		1900		500		40.1	142.1	318.0		
		2000				40.0	146.1	317.7		
		2100				39.4	150.2	317.0		
		2210				36.0	150.4	319.3		
		21		2300		32.4	150.6	318.6		
				0000		29.4	151.2	318.0		
			0100	26.2	152.5	318.6				
				20.1	155.6	318.0				
		Stork G	HAR	Jul.	18	1552	500	42.8	126.8	315.4
						1629		44.5	129.3	315.9
1710	46.2					132.0		319.4*		
1748	47.8					134.7		313.8		
1826	49.5					137.5		315.1		
1920	48.6					141.0		325.9*		
2003	47.7					144.4		315.3		
2113	49.0					149.4		312.7		
2223	53.3					152.6		310.8		

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)
Ptarmigan	FUK	<u>1959</u> Aug.	23	1940	700	66.9	151.5	307.6
				2340		80.3	158.0	308.2
		24	0025	500	83.2	160.0	307.9	
			0108		85.9	166.2	309.2	
			0142		85.8	132.1	308.0	
			0217		84.2	108.7	308.4	
			0300		82.4	122.8	307.7	
			0345		79.1	133.5	308.2	
			0430		76.2	138.2	307.8	
			0515		73.6	141.0	309.6	
			0600		70.8	143.0	307.2	
			0645		68.0	145.2	307.0	
Stork I	FUK	Aug.	25	1745	500	61.8	150.0	309.0
				2009		53.5	152.0	311.9
				2109		49.7	152.0	311.5
				2203		46.0	152.0	311.9
				2253		47.7	147.8	311.5
				2347		49.2	143.5	309.7
			26	0040	51.0	138.9	310.5	
				0125	48.4	135.6	309.7	
				0210	45.8	132.3	311.5	
				0305	43.3	129.5	311.1	
				0405	41.1	125.4	310.2	

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8	
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)	
Lark V	FUK	1959 Sept.	28	1310	500	37.4	123.4	311.1	
				1350		36.0	126.0	311.3	
				1430		34.4	128.6	311.7	
				1515		32.6	131.7	310.6	
				1600		31.2	135.2	311.1	
				1645		29.8	138.6	311.2	
				1800		300	27.1	144.2	311.3
				1835			26.0	147.3	311.7
				1910			25.1	149.8	312.8
				1950			23.9	152.6	314.2*
				2040			22.1	155.8	-
Ptarmigan	SHA	Sept.	30	0118	500	85.9	166.2	310.2	
				0136		85.8	149.1	309.8	
				0156		85.6	132.1	310.6	
				0213		84.9	120.0	309.4	
				0230		84.2	108.7	310.3	
				0245		83.2	114.0	310.2	
				0303		82.2	122.3	310.2	
				0336		80.1	130.2	310.7	
				0415		77.8	135.3	310.3	
				0453		75.3	138.8	310.5	
				0532		73.0	141.3	310.7	
0620	70.1	143.6	311.1						

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8				
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)				
Loon H	FUK	<u>1959</u> Oct.	1	1925	700	23.0	158.0	311.0				
				2020		24.4	161.0	310.9				
				2115		26.9	163.0	388.1*				
				2210	500	30.0	163.0	311.1				
				2258		33.7	162.9	310.5				
				2354		37.5	163.0	311.1				
				0052		41.2	163.0	311.2				
			2	0153	45.0	163.0	312.4					
				0300	48.8	163.0	314.1					
				0400	52.5	163.0	314.3					
				0510	56.2	163.0	314.1					
				0624	60.0	162.4	311.2					
				Stork I	SHA	Oct.	2	1847	500	58.0	149.5	311.2
								2004		53.5	152.0	310.9
								2041		51.0	152.0	310.3
2118	48.5	152.0	310.7									
2154	46.0	152.0	310.7									
2221	47.3	148.8	311.3									
2257	48.5	145.6	311.3									
2329***	49.7	142.4	-									
3	0034	49.1	136.4					310.3				
	0109	47.2	134.0					311.0				
	0146	45.2	131.7					311.1				
	0222	43.3	129.5					310.7				

***Samples at 2257 and 2329 were combined to yield a single analysis.

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8		
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)		
Lark U	STR	<u>1959</u> Oct.	20	1745	700	40.9	125.1	312.7		
				1845		40.9	129.2	315.9*		
		1943		40.8		133.2	316.2*			
		2042		40.5		136.6	315.9*			
		2146		500		40.3	140.0	315.9*		
		2244				40.1	144.8	318.8*		
		2347				40.0	148.7	-		
		21	0037	38.1	150.4	319.9*				
			0148	34.0	150.8	318.1*				
			0243	30.5	151.3	312.7				
			0343	26.8	152.4	326.9*				
			0444	24.3	156.1	316.0*				
		Ptarmigan	SHA	Oct.	22	0047	500	85.9	166.2	313.8*
						0109		85.7	149.2	314.2*
0128	85.6					137.1		335.7*		
0150	84.9					120.4		316.5*		
0209	84.2					108.7		317.4*		
0235	83.2					115.4		-		
0259	82.2					122.3		-		
0338	80.1					130.2		360.4*		
0419	77.8					135.3		316.5*		
0502	75.3					138.8		318.4*		
0540	73.0					141.3		312.3		
0626	70.1					143.6		312.1		

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8				
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)				
Stork I	SHA	<u>1959</u>	23	1854	500	58.0	149.5	311.7				
		2013		53.5		152.0	312.4					
		2054		51.0		152.0	312.7					
		2213		46.0		152.0	312.2					
		2320		48.5		145.6	317.5*					
		24		0028		51.0	138.9	313.1				
		0111		49.1		136.4	312.5					
		0150		47.2		134.0	311.7					
		0231		45.2		131.7	311.4					
		0310		43.3		129.5	311.4					
		0349		41.4		127.3	311.7					
		Loon H		STR		Oct.	24	1819	700	22.7	158.0	316.0*
								1914		24.2	160.4	311.5
2015	26.8		162.8		314.7*							
2115	500		30.4		162.9			317.8*				
2215	33.9		162.8		314.6*							
2312	37.1		162.6		314.6*							
25	0013		40.5		162.8			316.2*				
0113	43.8		163.0		315.4*							
0212	47.1		162.8		315.7*							
0315	50.9		162.9		312.1							
0420	52.2		163.0		318.9*							
0513	58.5		162.8		319.0*							

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8				
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)				
Ptarmigan	FUK	<u>1959</u> Nov.	24	1932	700	66.8	153.6	314.5				
				2010		69.4	152.2	313.9				
		2052		71.3		156.6	315.0					
		2211		76.0		157.5	315.0					
		2329		81.0		159.5	315.3					
		25	0042	500	85.9	166.2	314.6					
			0202		84.2	108.7	313.0					
			0317		80.1	130.2	314.6					
			0446		75.3	138.8	315.0					
			0635		70.1	143.6	314.0					
			0712		68.2	145.5	314.0					
			Stork I		FUK	Nov.	26	1833	500	59.7	151.5	313.6
								1937		57.0	150.8	313.4
2051	53.5	152.0		314.0								
2200	49.8	152.0		313.9								
2310	48.5	152.0		313.7								
27	0020	47.8		147.4			314.4					
	0113	49.7		142.4			312.8					
	0146	51.0		138.9			313.2					
	0303	48.0		135.2			312.3					
	0415	45.2		131.7			312.8					
	0520	42.0		128.4			312.3					
	0600	41.2		125.6			312.3					

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Lat.	Long.	CO ₂ Concentration (ppm)
Loon H	FRE	1959 Nov.	26	1929	700	24.5	161.8	313.0
				2138	500	31.2	163.0	315.2*
		2215			33.7	163.0	312.3	
		2255			36.2	163.0	312.7	
		2335			38.7	163.0	313.0	
		27	0045		42.5	163.0	323.1*	
			0135		46.2	163.0	313.2	
			0215		48.7	163.0	314.5	
			0300		51.2	163.0	317.0 ←	
Lark U	BOR	Dec.	17	1730	700	40.8	127.5	333.9*
				1844		40.6	132.3	315.8
				1953		40.4	137.2	314.9
				2054	500	40.3	140.5	314.9
				2144		40.1	143.8	312.9
				2307		40.0	148.7	313.1
			18	0015		37.4	150.6	313.5
				0059		34.9	150.8	313.1
				0203		31.2	151.1	313.6
				0303		27.4	151.3	314.9
				0345		26.0	153.6	313.8
				0450		23.7	156.9	314.0

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8				
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)				
Ptarmigan	BRE	<u>1959</u> Dec.	17	2052	700	71.3	156.6	316.0				
				2216		76.0	157.5	315.5				
		2339		81.0		159.5	316.4					
		18	0054	500	85.9	166.2	314.5					
			0128		85.6	132.1	316.6					
			0202		84.2	108.7	316.4					
			0242		82.2	122.3	315.0					
			0327		80.1	130.2	315.4					
			0415		77.8	135.3	315.5					
			0502		75.3	138.8	316.8					
			0546		73.0	141.3	313.6					
			0641		70.1	143.6	332.5*					
			Stork I		BRE	Dec.	19	1912	500	58.0	149.5	314.3
								1954		56.0	152.0	314.1
2038	53.5	152.0		314.1								
2119	51.0	152.0		314.3								
2158	48.5	152.0		315.3								
2240	46.0	152.0		313.8								
2343	48.5	145.6		314.1								
20	0049	51.0		138.9			339.6*					
	0123	49.1		136.4			313.7					
	0159	47.2		134.0			314.0					
	0232	45.2		131.7			313.6					
	0352	41.4		127.3			313.7					

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8			
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)			
Loon H	BOR	<u>1959</u> Dec.	19	1829	700	23.0	158.0	315.8			
				1928		24.5	161.7	315.1			
						2033		27.5	163.0	313.3	
						2116	500	30.0	163.0	314.5	
						2222		33.7	163.0	314.0	
						2311		37.5	163.0	314.0	
				20		0014		41.2	163.0	314.9	
					0108		45.0	163.0	314.5		
					0210		48.7	163.0	315.8		
					0319		52.5	163.0	315.9		
					0428		56.2	163.0	316.8		
					0542		60.0	162.4	316.0		
		Ptarmigan	POL		<u>1960</u> Jan.	20	2200	500	68.9	144.6	315.8
							0300		71.7	142.3	315.5
				21		0400		76.0	138.0	314.3	
					0500		79.8	130.7	314.2		
					0700		85.6	125.0	316.2		
					0751		85.9	166.2	315.6		
					0900		81.4	161.3	315.8		
					1000		77.8	158.0	316.7		
					1100		74.2	157.0	317.3		
					1147		71.3	156.6	315.5		
					1210		500	70.2	154.2	316.4	

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8		
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)		
Lark U	SHA	1960 Jan.	22	1949	700	40.5	134.0	315.8		
				2037	500	40.3	140.5	315.6		
					2114		40.1	143.8	316.4	
					2155		40.0	147.1	314.5	
					2312		37.4	150.6	314.7	
					2348		34.9	150.8	315.1	
				23	0025		32.4	151.0	314.8	
					0100		29.9	151.2	315.5	
					0138		27.4	151.3	316.1	
					0212		26.0	153.6	315.9	
					0250		24.5	155.8	316.4	
					0333		23.0	158.0	315.5	
		Stork	POL	Jan.	22	1800	500	61.0	150.2	342.4*
						1900		58.0	149.5	315.3
					2000		54.2	152.0	315.3	
					2100		50.6	152.1	315.3	
					2200		46.6	152.0	315.1	
					2300		47.6	148.5	314.8	
				23	0000		49.6	143.1	314.9	
					0100		50.4	138.2	315.6	
					0200		47.5	134.3	315.5	
					0248		45.2	131.7	315.9	
					0325		43.3	129.5	314.5	
					0402		41.4	127.3	314.5	

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8		
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)		
Loon H	SHA	<u>1960</u> Jan.	27	1958	700	24.0	160.5	314.5		
				2122		27.5	163.0	315.5		
						2251	500	32.5	163.0	314.9
						2330		35.0	163.0	316.4
					28	0008		37.5	163.0	316.9
						0050		40.0	163.0	317.5
						0127		42.5	163.0	319.6
						0205		45.0	163.0	319.9
						0240		47.5	163.0	318.5
						0316		50.0	163.0	319.3
						0354		52.5	163.0	316.9
						0432		55.0	163.0	316.8

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8		
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)		
Stork	COM	1960 Feb.	19	1912	500	43.3	129.5	315.1		
				2041		47.2	134.0	315.1		
		2124	49.1	136.4	315.0					
		2256	49.7	142.4	314.8					
		2353	48.5	145.6	315.1					
		20	0050	47.3	148.8	317.4*				
			0222	48.5	152.0	315.0				
			0305	51.0	152.0	315.0				
			0433	56.0	152.0	315.8				
			0515	58.0	149.5	315.6				
			0548	59.7	151.6	315.5				
			0916	61.2	149.8	315.9				
		Lark U	COR	Feb.	21	2147	500	40.3	140.5	315.6
						2220		40.1	143.8	315.1
				2255	40.0	147.1	315.3			
22	2326			39.9	150.3	316.7				
	0008			37.4	150.6	316.3				
	0048			34.9	150.8	314.8				
	0128			32.4	151.0	314.9				
	0205			29.9	151.2	315.1				
	0243			27.4	151.3	314.8				
	0322			26.0	153.6	314.6				
0403	24.5			155.8	315.1					
0443	23.0			158.0	314.7					

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8				
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)				
Ptarmigan	COM	<u>1960</u> Feb.	24	2000	700	68.4	152.0	316.2				
				2100		72.0	157.8	316.1				
		2200		76.0		157.5	316.7					
		2300		80.0		159.5	318.5					
		25	0000	500	83.9	161.7	317.4					
			0100		85.0	136.0	315.5					
			0200		82.9	118.4	316.2					
			0300		79.4	130.7	317.4					
			0400		76.0	135.0	316.2					
			0430		74.1	139.9	315.9					
			0500		72.2	142.2	314.8					
			0600		68.7	145.0	316.7					
			Stork J		WIL	Apr.	5	1554	500	39.8	126.0	316.4
								1627		41.7	127.9	315.9
1702	43.7	130.0		317.6								
1739	45.7	132.1		316.8								
1816	47.7	134.3		316.8								
1853	49.7	136.6		316.7								
2022	47.7	143.3		316.8								
2203	45.5	150.0		318.6								
2253	50.5	150.0		316.8								
6	0004	55.5		150.0				316.4				
	0100	59.7		151.5				317.2				
	0125	61.3		149.8				318.9				

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8	
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Lat.	Long.	CO ₂ Concentration (ppm)	
Lark V	HUB	<u>1960</u> Apr.	7	1700	500	36.0	126.0	320.9*	
				1730		34.5	129.0	317.0	
		1810		33.3	131.0	316.4			
		1840		32.5	132.5	319.4			
		1930		31.3	135.0	317.2			
		2015		30.0	137.8	318.9			
		2105		300	29.0	140.5	316.6		
		2140			28.0	142.5	316.7		
		2215			27.0	145.0	317.2		
		2250			26.0	148.0	317.2		
		2320			25.0	150.3	320.1*		
		2355			23.5	153.0	320.3*		
		Loon K		HUB	Apr.	8	1900	700	19.5
1940	19.0		152.0				315.5		
2030	17.5		149.0				315.5		
2120	16.5		150.5				315.9		
2220	15.0		154.0				316.9		
2315	14.5		156.5				316.0		
9	0005		15.5				159.5		317.0
	0100		14.5				162.5		315.7
	0155		12.0			166.0	315.2		
	0245		15.0			166.0	315.2		
	0340		18.0			165.0	319.6*		
	0435		20.0			162.0	319.6*		

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8				
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)				
Ptarmigan	WIL	1960 Apr.	8	1945	700	66.9	150.7	317.3				
				2101		70.6	159.9	316.8				
		2222		75.6		159.9	316.2					
		2345		80.6		159.9	317.6					
		0026		83.1		159.9	-					
		9	0104	500	85.6	159.9	316.8					
			0214		81.6	132.0	316.7					
			0248		79.3	126.7	318.2					
			0329		77.2	132.9	318.8					
			0446		72.6	140.8	316.6					
			0537		70.1	143.6	317.2					
			0608		68.1	145.5	316.7					
			Stork J		SKI	Jun.	3	1640	500	41.7	127.9	318.3
								1717		43.7	130.0	318.1
1759	45.7	132.1		318.4								
1847	47.7	134.3		318.2								
2005	48.7	139.9		320.6								
2133	46.6	146.7		317.8								
2207	45.5	150.0		317.8								
2248	48.0	150.0		318.6								
2327	50.5	150.0		317.8								
4	0008	53.0		150.0				317.3				
	0050	55.5		150.0				317.0				
	0128	58.0		150.0				317.2				

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8					
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Lat.	Long.	CO ₂ Concentration (ppm)					
Stork J	SKI	<u>1960</u> Jun.	17	1636	500	41.7	127.9	-					
				1718		43.7	130.0	314.8					
		1800		45.7		132.1	315.0						
		1840		47.7		134.3	315.1						
		2010		48.7		139.9	316.2						
		2057		47.7		143.3	326.3*						
		2145		46.6		146.7	318.2						
		2230		45.5		150.0	315.3						
		2355		50.5		150.0	315.2						
		18		0042		53.0	150.0	314.9					
				0122		55.5	150.0	316.1					
				0201		58.0	150.0	316.4					
				Ptarmigan		SKI	Jun.	19	2011	500	70.1	143.6	315.0
									2049		72.6	140.8	-
		2123							74.9		137.4	315.9	
2154	77.2	132.9	315.1										
2225	79.3	126.7	-										
2300	81.6	132.0	319.2*										
2333	83.8	141.4	314.6										
20	0007	85.6	159.9		313.1								
	0124	700	80.6		159.9				317.6				
	0208	78.1	159.9		318.0								
	0250	75.6	159.9	353.0*									
	0332	73.1	159.9	317.4									

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8	
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)	
Lark Y	HUB	<u>1960</u> Jun.	21	1745	500	39.5	124.6	316.4	
				1830		39.5	127.8	321.7	
		1915		39.5		131.1	320.3		
		1950		39.5		134.3	316.4		
		2030		39.5		137.5	318.7		
		2110		39.5		140.7	319.1		
		2150		38.5		144.2	319.2		
		2230		36.5		146.2	319.0		
		2340		33.0		150.0	318.0		
		22		0015		31.0	151.5	316.7	
				0050		29.0	153.0	316.5	
				0125		27.0	155.0	316.6	
		Loon K		HUB		Jun.	26	1935	700
2005	17.5		155.7		316.9				
2030	18.0		157.3		316.5				
2055	18.5		159.0		316.1				
2125	19.0		160.7		315.4				
2155	19.5		162.4		314.9				
2220	20.0		164.0		316.2				
2240	21.7		164.0		316.2				
2305	23.3		164.0		316.2				
2335	25.0		164.0		316.1				
27	0000		26.7		164.0			316.2	
	0020		28.3		164.0			316.2	

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Lat.	Long.	CO ₂ Concentration (ppm)
Stork	COO	1960 Jul	18	1630	500	41.7	127.9	314.9
				1705		43.7	130.0	314.2
		1745		45.7		132.1	311.7	
		1820		47.7		134.3	315.2	
		1940		48.7		139.9	309.7	
		2030		47.7		143.3	308.6	
		2115		46.6		146.7	309.1	
		2155		45.5		150.0	308.1	
		2305		50.5		150.0	311.2	
		2340		53.0		150.0	311.8	
		19		0025		55.5	150.0	312.1
		0105		58.0		150.0	311.4	
		Ptarmigan		COO		Jul.	20	2135
2220	75.6		159.9		308.6			
2310	78.1		159.9		308.9			
21	0005		500		80.6		159.9	309.6
	0055				83.1		159.9	310.1
	0135				85.6		159.9	311.4
	0210				83.8		141.4	307.8
	0245				81.6		132.0	308.4
	0355				77.2		132.9	309.3
	0430				74.9		137.4	309.5
	0505				72.6		140.8	308.9

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8			
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)			
Loon K	BUR	<u>1960</u> Aug.	4	1821	700	19.3	152.9	316.2			
				2015		18.1	149.6	316.4			
		2106		17.0		149.6	316.5				
		2152		16.0		152.9	316.4				
		2240		14.9		156.2	316.7				
		2328		13.9		159.5	319.4*				
		0016		12.9		162.8	316.5				
		5	0103	11.9	166.0	315.5					
			0151	15.2	166.0	318.0**					
			0243	17.8	164.6	317.7**					
			0336	19.6	161.7	317.1**					
			0400	20.6	160.2	315.4					
			Lark Y	BUR	Aug.	12	1812	500	25.3	156.0	319.4
							1847		27.3	154.4	-
1926	29.3	152.7					321.9				
2001	31.4	151.1					317.7				
2038	33.4	149.4					320.0				
2120	35.4	147.6					315.9				
2157	37.5	145.8					315.3				
2229	39.5	144.0					310.8				
2256	39.5	140.7					310.6				
2336	39.5	137.5					322.4				
13	0024	39.5					134.3		320.1		
	0101	39.5					131.1		325.2*		

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8			
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)			
Stork	COO	1960 Aug.	23	1625	500	39.8	126.0	307.2			
				1710		41.7	127.9	307.8			
		1755		43.7		130.0	309.5				
		1850		45.7		132.1	310.4				
		2030		49.7		136.6	309.6				
		2115		48.7		139.9	311.5				
		2155		47.7		143.3	312.3				
		2245		46.6		146.7	313.1				
		24	0000	48.0	150.0	314.5					
			0035	50.5	150.0	313.4					
			0115	53.0	150.0	312.7					
			0200	55.5	150.0	311.5					
			Ptarmigan	COO	Aug.	25	2135	700	73.1	159.9	304.2
							2210		75.6	159.9	305.4
2250	78.1	159.9			305.8						
2330	80.6	159.9			306.7						
26	0010	83.1			159.9	307.3					
	0050	500			85.6	159.9	308.9				
	0125	83.8			141.4	308.4					
	0200	81.6			132.0	308.0					
0240	79.3	126.7	309.1								
0320	77.2	132.9	309.2								
0355	74.9	137.4	308.0								
0440	72.6	140.8	307.7								

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8		
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)		
Loon K	COO	1960 Sept.	11	1945	700	17.0	154.0	312.9		
				2010		17.5	155.7	312.9		
		2040		18.0		157.3	312.7			
		2135		19.0		160.7	312.5			
		2225		20.0		164.0	312.4			
		2320		23.3		164.0	312.1			
		12		0015		26.7	164.0	310.4		
			0110	27.9	162.2	310.4				
			0200	27.1	158.6	310.2				
			0250	25.3	157.9	311.8				
			0315	24.0	159.0	311.9				
			0340	22.6	158.0	311.8				
			Lark Y	COO	Sept.	15	1800	500	25.3	156.0
		1845					27.3		154.4	311.4
1930	29.3	152.7					311.2			
2005	31.4	151.1					311.0			
2120	35.4	147.6					311.0			
2200	37.5	145.8					311.2			
2235	39.5	144.0					311.1			
16	2310	39.5				140.7	311.0			
	0015	39.5				134.3	309.9			
	0055	39.5				131.1	311.2			
	0125	39.5				127.8	311.1			
	0200	39.5				124.6	310.8			

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8	
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)	
Stork J	COR	1960 Sept.	21	1550	500	39.8	126.0	311.1	
				1635		41.7	127.9	311.6	
		1720		43.7		130.0	310.8		
		1810		45.7		132.1	311.0		
		1930		49.7		136.6	308.5		
		2010		48.7		139.9	311.0		
		2225		45.5		150.0	311.8		
		2330		48.0		150.0	312.1		
		22		0005		50.5	150.0	370.4*	
				0045		53.0	150.0	310.1	
				0200		58.0	150.0	310.2	
		Ptarmigan		MAR		Sept.	22	2053	700
2138	73.1		159.9		308.7				
2222	75.6		159.9		309.3				
2303	78.1		159.9		308.4				
2341	80.6		159.9		308.3				
23	0024		83.1		159.9	310.5			
	0104		500		85.6	159.9		311.8	
	0217		81.6		132.0	310.2			
	0254		79.3		126.7	310.3			
	0335		77.2		132.9	311.4			
	0451		72.6		140.8	309.7			

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8	
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)	
Lark Y	COR	1960 Oct.	19	1726	500	39.5	127.8	311.8	
				1807		39.5	131.1	312.7	
		1845		39.5		134.3	312.3		
		1928		39.5		137.5	312.5		
		2009		39.5		140.7	312.3		
		2054		39.5		144.0	312.6		
		2140		37.5		145.8	311.9		
		2231		35.4		147.6	312.3		
		2322		33.4		149.4	312.5		
		20		0006		31.4	151.1	312.1	
				0140		27.3	154.4	311.1	
				0314		23.2	157.6	311.8	
		Stork J		HUB		Oct.	19	1715	500
1800	45.7		132.1		314.0				
1845	47.7		134.3		314.4				
1915	49.7		136.6		315.8				
2000	48.7		139.9		312.7				
2045	47.7		143.3		313.8				
2120	46.6		146.7		315.2				
2202	45.5		150.0		313.2				
2240	48.0		150.0		313.7				
2320	50.5		150.0		315.7				
20	0000		53.0		150.0			313.0	
	0040		55.5		150.0			312.5	

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8			
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)			
Loon K	COR	<u>1960</u> Oct.	21	1926	700	19.3	152.9	312.0			
				2016		18.1	149.6	311.0			
		2107		17.0		149.6	311.4				
		2200		16.0		152.9	311.7				
		2248		14.9		156.2	312.3				
		2340		13.9		159.5	312.4				
		0034		12.9		162.8	313.2				
		22	0059	12.4	164.4	315.3**					
			0123	11.9	166.0	313.4					
			0213	15.2	166.0	313.2					
			0306	17.8	164.6	312.6					
			0356	19.6	161.7	312.1					
			Ptarmigan	FRO	Nov.	14	2208	700	73.1	159.9	316.3
							2248		75.6	159.9	334.7*
2326	78.1	159.9					317.1				
15	0009	80.6			159.9	315.4					
	0056	500			80.6	159.9	-				
	0135	78.1			159.9	328.4*					
	0214	75.6			159.9	339.3*					
	0251	73.1			159.9	-					

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8				
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)				
Stork J	COR	1960 Dec.	16	1617	500	39.8	126.0	319.3*				
				1812		45.7	132.1	314.5				
		1852		47.7		134.3	315.1					
		1924		49.7		136.6	314.2					
		1957		48.7		139.9	314.4					
		2030		47.7		143.3	314.3					
		2108		46.6		146.7	347.6*					
		2144		45.5		150.0	315.7					
		2211		48.0		150.0	318.0*					
		2241		50.5		150.0	314.4					
		2312		53.0		150.0	314.4					
		0018		58.0		150.0	313.2					
		Ptarmigan		COR		Dec.	18	2228	700	70.6	159.9	313.7
								2310		73.1	159.9	314.9
19	2349				75.6		159.9	313.9				
	0027				78.1		159.9	314.6				
	0104				80.6		159.9	314.9				
	0218		500		85.6		159.9	314.8				
	0244				83.8		141.4	314.8				
	0314				81.6		132.0	313.9				
	0343				79.3		126.7	313.9				
	0415				77.2		132.9	314.0				
	0450				74.9		137.4	313.9				
	0603				70.1		143.6	314.5				

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8				
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)				
Lark Y	FRO	<u>1961</u>	15	1731	500	39.5	128.8	316.2				
		Jan.		1819		39.5	131.1	335.0*				
				1911		39.5	134.3	315.7				
				2005		39.5	137.5	316.2				
				2056		39.5	140.7	338.2*				
				2150		39.5	144.0	321.1*				
				16		0055	32.5	150.2	316.4			
				0130		31.4	151.1	316.3				
				0200		30.1	152.1	314.9				
				0228		29.3	152.7	314.9				
				0304		27.3	154.4	315.1				
				0347		25.3	156.0	315.1				
		Stork J		BAN		Jan.	19	1621	500	43.7	130.0	315.7
								1734		45.7	132.1	315.4
								1803		47.7	134.3	314.5
1832	49.7		136.6		314.9							
1916	48.7		139.9		316.8							
2000	47.7		143.3		317.6							
2115	45.5		150.0		314.4							
2151	48.0		150.0		317.1							
2255	53.0		150.0		316.2							
2326	55.5		150.0		317.0							
2356	58.0		150.0		316.1							

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8			
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)			
Loon K	HUB	1961 Jan.	25	2030	700	17.5	148.0	366.2*			
				2100		17.0	149.6	314.7			
		2125		16.5		151.3	314.5				
		2155		16.0		152.9	316.4**				
		2220		15.5		154.6	314.8				
		2250		14.9		156.2	317.5*				
		2345		13.9		159.5	315.2				
		26	0045	12.9	162.8	316.8*					
			0135	11.9	166.0	315.2					
			0250	16.9	166.0	315.8**					
			0335	18.7	163.2	315.8**					
			Ptarmigan	HAN	Feb.	12	2120	700	71.0	160.0	317.0
							2155		74.0	160.0	317.5
					2245		76.5		160.0	317.0	
2320	78.5	160.0			318.1						
13	0000	81.0			160.0	318.2					
	0045	83.5			160.0	320.6					
	0125	500			85.6	160.0	319.9				
	0200	83.7			141.2	321.2					
	0231	81.5			132.0	358.0*					
	0310	79.0			127.0	317.9					
0345	77.0	133.0	316.1								
0425	74.3	138.5	316.4								

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8				
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)				
Loon K	HUB	<u>1961</u> Feb.	18	1930	700	22.2	150.0	316.0				
				2000		20.3	150.0	315.8				
		2030		18.5		150.0	315.5					
		2100		16.7		150.0	316.2					
		2130		14.8		150.0	316.0					
		2200		13.0		150.0	315.6					
		2235		13.0		152.0	315.8					
		2310		13.0		154.0	315.3					
		2345		13.0		156.0	315.4					
		19		0025		13.0	158.0	315.7				
				0055		13.0	160.0	315.7				
		Lark Y		BAN		Feb.	19	1815	500	25.3	156.0	315.1
								1935		29.3	152.7	315.7
2017	31.4		151.1		316.0							
2056	33.4		149.4		316.0							
2133	35.4		147.6		315.8							
2206	37.5		145.8		316.1							
2307	39.5		140.7		316.6							
2341	39.5		137.5		316.2							
20	0014		39.5		134.3			316.6				
	0047		39.5		131.1			316.7				
	0120		39.5		127.8			316.7				

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8			
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)			
Ptarmigan	SMJ	<u>1961</u> Mar.	19	2322	500	80.6	159.9	317.4			
			20	0000		83.1	159.9	317.5			
			0040	85.6		159.9	317.0				
			0057	84.7		148.0	317.3				
			0116	83.8		141.4	316.5				
			0149	81.6		132.0	316.1				
			0207	81.0		130.0	317.8				
			0223	79.3		126.7	316.9				
			0257	77.2		132.9	340.9*				
			0332	74.9		137.4	316.9				
			0410	72.6		140.8	317.4				
			0445	70.1		143.6	317.6				
		Stork	COR	Mar.		20	1824	500	59.7	151.5	317.8
							1853		58.0	150.0	317.0
1934	55.5				150.0		316.6				
2015	53.0				150.0		317.1				
2055	50.5				150.0		317.0				
2135	48.0				150.0		317.6				
2215	45.5				150.0		317.4				
2334	47.7				143.3		318.5				
21	0046				49.7		136.6		323.6*		
0123	47.7				134.3		317.2				
0203	45.7				132.1		318.8				
0318	41.7				127.9		338.0*				

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8				
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)				
Lark Y	BAN	<u>1961</u> Mar.	22	1633	500	39.5	124.6	318.8				
				1723		39.5	127.8	317.0				
		1810		39.5		131.1	318.2					
		1852		39.5		134.3	318.3					
		1935		39.5		137.5	317.0					
		2019		39.5		140.7	317.4					
		2108		39.5		144.0	317.5					
		2144		37.5		147.6	318.3					
		2223		35.4		147.6	316.6					
		2300		33.4		149.4	316.9					
		2334		31.4		151.1	316.4					
		23		0010		29.3	152.7	316.2				
		Stork J		BAN		May	24	1553	500	39.8	126.0	317.5
								1630		41.7	127.9	316.9
1710	43.7		130.0		317.5							
1746	45.7		132.1		318.9							
1821	47.7		134.3		317.6							
1854	49.7		136.6		318.2							
1929	48.7		139.9		317.9							
2005	47.7		143.3		318.6							
2044	46.6		146.7		318.0							
2119	45.5		150.0		317.6							
2210	48.0		150.0		316.7							
2253	50.5		150.0		321.8*							

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8			
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)			
Ptarmigan	BAN	<u>1961</u> May	26	2053	700	70.6	159.9	318.2			
				2135		73.1	159.9	317.9			
		2214		75.6		159.9	317.6				
		2252		78.1		159.9	317.3				
		2330		80.6		159.9	318.0				
		27	0007	83.1	159.9	318.5					
			0045	85.6	159.9	318.0					
			0122	83.8	141.4	318.2					
			0308	77.2	132.9	317.3					
			0348	74.9	137.4	318.9					
			Stork J	COR	Jun.	24	1626	500	41.7	127.9	316.9
							1707		43.7	130.0	316.8
							1742		45.7	132.1	314.6
1819	47.7	134.3					315.8				
1858	49.7	136.6					313.9				
1942	48.7	139.9					314.9				
2030	47.7	143.3					315.1				
2156	45.5	150.0					314.0				
2308	50.5	150.0					311.9				
2344	53.0	150.0					312.0				
25	0027	55.5					150.0		315.9		
	0109	58.0					150.0		314.9		

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8		
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)		
Ptarmigan	YEL	<u>1961</u> Aug	29	2138	700	73.1	159.9	308.3		
				2220		75.6	159.9	307.8		
					30	0011	500	83.1	159.9	308.3
				0056	85.6	159.9		309.9		
				0130	83.8	141.4		308.4		
				0206	81.6	132.0		308.8		
				0238	79.3	126.7		309.0		
				0313	77.2	132.9		306.5		
				0347	74.9	137.4		309.0		
				0424	72.6	140.8		309.6		

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8		
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Lat.	Long.	CO ₂ Concentration (ppm)		
Ptarmigan	HAN	<u>1961</u> Nov.	29	2130	700	68.2	154.2	316.6		
				2200		70.0	158.3	328.9*		
		2250	73.1	159.9	317.4					
		2330	75.6	159.9	319.8					
		0045	80.6	159.9	315.7					
		0148	500	85.6	159.9	316.8				
		0226		83.8	141.4	316.8				
		0310	81.6	132.0	316.1					
		0355	79.3	126.7	315.4					
		0442	77.2	132.9	315.7					
		0529	74.9	137.4	315.0					
		0615	72.5	141.0	314.7					
		Stork J	FRA	Nov.	30	1835	500	59.1	151.0	383.5*
						1900		58.0	150.0	327.5*
1934	55.3					150.0		358.5*		
2010	53.0					150.0		328.6*		
2046	50.3					150.0		327.7*		
2123	48.0					150.0		328.6*		
2155	45.3					150.0		330.6*		
2234	46.3					147.1		336.1*		
2325	47.4					143.4		-		
0006	48.4					139.6		-		
0043	49.5					136.6		327.0*		
0118	47.5					134.2		329.9*		

Table 1. The Concentration of Carbon Dioxide in Air Samples Collected by Aircraft

Col: 1	2	3	4	5	6	7		8
Flight Name	Observer	Month	Day	Time (GMT)	Altitude (Millibars)	Position Lat.	Long.	CO ₂ Concentration (ppm)
Lark Y	BUR	<u>1961</u>	7	1803	500	39.5	131.1	314.5
		Dec		1838		39.5	134.3	314.4
		1915		39.5		137.5	314.9	
		1952		39.5		140.7	315.1	
		2026		39.5		144.0	315.2	
		2108		37.5		145.8	314.2	
		2145		35.4		147.6	314.9	
		2226		33.4		149.4	315.6	
		2308		31.4		151.1	315.3	
		2350		29.3		152.7	315.2	
		0031		27.3		154.4	315.3	
		0107		25.3		156.0	315.3	
		Lark Y		BUR		Dec.	16	1906
1942	27.3		154.4		314.9			
2019	29.3		152.7		315.3			
2056	31.4		151.1		-			
2136	33.4		149.4		315.1			
2211	35.4		147.6		315.0			
2247	37.5		145.8		315.0			
2322	39.5		144.0		314.9			
2349	39.5		140.7		314.9			
0015	39.5		137.5		314.9			
0045	39.5		134.3		-			
0115	39.5		131.1		315.6			

Table 2. Work Sheets for the Zonal Monthly Average Concentration of Atmospheric Carbon Dioxide (ppm) at 500 mb Referred to a Constant Datum (January 1960)

Zone:	22.5°N	27.5°N	32.5°N	40.0°N			40.0°N
				A	B	C	
<u>JAN.</u>							
Lark 7 Jan'59, no. of flasks	2	1	2	1	0	6	
Lark 22 Jan'60, no. of flasks	2	3	2	1	0	3	
Lark 15 Jan'61, no. of flasks	0	3	3	0	3	0	
av. latitude	23.9	27.5	32.5	38.2	39.5	40.4	
av. date	15	17	12	14	15	12	13
latitude adjustment	-.1	.0	.0	.0	.0	.0	
date adjustment	.0	.0	.1	.0	.0	.1	
total no. of flasks	4	7	7				14
av. concentration	314.8	314.9	314.9				314.7
av. adjusted concentration	314.7	314.9	315.0				314.8
<u>FEB.</u>							
Lark 21 Feb'60, no. of flasks	2	3	2	1	1	3	
Lark 19 Feb'61, no. of flasks		2	2	2	5		
av. latitude	23.8	27.6	33.0	36.8	39.5	40.1	
av. date	22	21	20	20	19	21	20
latitude adjustment	.0	.0	.0	.1	.0	.0	
date adjustment	-.2	-.2	-.1	-.1	-.1	-.2	
total no. of flasks	2	5	4				12
av. concentration	314.9	314.7	315.0				315.7
av. adjusted concentration	314.7	314.5	314.9				315.6
<u>MAR.</u>							
Lark 22 Mar'61, no. of flasks		1	2	2	7		
av. latitude		29.3	32.4	36.4	39.5		
av. date		22	22	22	22		22
latitude adjustment		-.1	.0	.0	.0		
date adjustment		-.2	-.2	-.2	-.2		
total no. of flasks		1	2				9
av. concentration		315.4	315.8				316.8
av. adjusted concentration		315.1	315.6				316.6

Table 2 . Work Sheets for the Zonal Monthly Average Concentration of Atmospheric Carbon Dioxide (ppm) at 500 mb Referred to a Constant Datum (January 1960)

Zone:	22.5°N	27.5°N	32.5°N	40.0°N			40.0°N
				A	B	C	
<u>APRIL</u>							
Lark	17 Apr'59, no. of flasks		3	2	1		6
Lark	7 Apr'60, no. of flasks		1	4			
	av. latitude		28.4	33.2	37.5		40.4
	av. date		15	10	18		18
	latitude adjustment		.0	.0	-.1		.0
	date adjustment		.0	.2	-.1		-.1
	total no. of flasks		4	6			7
	av. concentration		318.0	317.4			317.2
	av. adjusted concentration		318.0	317.6			317.0
<u>MAY</u>							
Lark	20 May'59, no. of flasks	1	2	2	1	1	3
	av. latitude	24.5	28.6	33.6	37.4	39.9	40.1
	av. date	20	20	20	20	20	20
	latitude adjustment	-.2	-.1	.0	-.1	.0	.0
	date adjustment	.0	.0	.0	.0	.0	.0
	total no. of flasks	1	2	2			5
	av. concentration	318.0	318.3	317.9			318.2
	av. adjusted concentration	317.8	318.2	317.9			318.2
<u>JUNE</u>							
Lark	20 Jun'59, no. of flasks	1	2	1	2		2
Lark	21 Jun'60, no. of flasks		2	2	2	6	
	av. latitude	20.1	27.9	32.1	37.6	39.5	40.0
	av. date	20	20	20	20	21	20
	latitude adjustment	.0	.0	.0	-.2	.0	.0
	date adjustment	.2	.2	.2	.2	.2	.2
	total no. of flasks	1	4	3			12
	av. concentration	318.4	317.5	317.7			318.5
	av. adjusted concentration	318.6	317.7	317.9			318.7

Table 2. Work Sheets for the Zonal Monthly Average Concentration of Atmospheric Carbon Dioxide (ppm) at 500 mb Referred to a Constant Datum (January 1960)

Zone:		22.5°N	27.5°N	32.5°N	40.0°N			40.0°N
					A	B	C	
<u>AUGUST</u>								
Lark	12 Aug'60, no. of flasks		2	2	2	4		
	av. latitude		27.3	32.4	36.4	39.5		
	av. date		12	12	12	12		12
	latitude adjustment		.0	.0	-.6	.0		
	date adjustment		-.2	-.3	-.3	-.3		
	total no. of flasks		2	2				6
	av. concentration		320.2	318.4				315.4
	av. adjusted concentration		320.0	318.1				315.0
<u>SEPTEMBER</u>								
Lark	28 Sep'59, no. of flasks		1	3	2			
Lark	15 Sep'60, no. of flasks		3	1	2	6		
	av. latitude		27.9	32.4	36.6	39.5		
	av. date		18	25	22	15		18
	latitude adjustment		.0	.0	-.1	.0		
	date adjustment		.0	.0	.0	.0		
	total no. of flasks		4	4				10
	av. concentration		310.8	311.2				310.6
	av. adjusted concentration		310.8	311.2				310.6
<u>OCTOBER</u>								
Lark	21 Oct'59, no. of flasks			1				
Lark	19 Oct'60, no. of flasks	1	1	2	2	6		
	av. latitude	23.2	27.3	31.8	36.4	39.5		
	av. date	19	19	20	19	19		19
	latitude adjustment	.0	.0	.0	.1	.0		
	date adjustment	-.1	-.1	-.2	-.1	-.1		
	total no. of flasks	1	1	3				8
	av. concentration	311.2	310.5	312.1				311.8
	av. adjusted concentration	311.1	310.4	311.9				311.7

Table 2. Work Sheets for the Zonal Monthly Average Concentration of Atmospheric Carbon Dioxide (ppm) at 500 mb Referred to a Constant Datum (January 1960)

	Zone:	22.5°N	27.5°N	32.5°N	40.0°N			40.0°N
					A	B	C	
<u>DECEMBER</u>								
Lark	28 Dec '58, no. of flasks		2	1	1		5	
Lark	17 Dec '59, no. of flasks	1	2	2	1		3	
Lark	7 Dec '61, no. of flasks		3	2	2	5		
Lark	16 Dec '61, no. of flasks		3	1	2	4		
	av. latitude	23.7	27.0	32.6	37.0	39.5	40.4	
	av. date	17	16	16	15	11	24	17
	latitude adjustment	-.1	.0	.0	.0	.0	.0	
	date adjustment	-.1	.0	.0	.0	.1	-.3	
	total no. of flasks	1	10	6				23
	av. concentration	314.0	313.9	313.8				313.6
	av. adjusted concentration	313.8	313.9	313.8				313.5

Table 3 . Work Sheets for the Zonal Monthly Average Concentration of Atmospheric Carbon Dioxide (ppm) at 700 mb Referred to a Constant Datum (January 1960)

Zone:	12.5°N		17.5°N		22.5°N		27.5°N	
	A	B	A	B	A	B	A	B
<u>JANUARY</u>								
Loon H	27 Jan'60, no. of flasks				1		1	
Loon K	25 Jan'61, no. of flasks		1	1	5	1		
	av. latitude		11.9	13.9	16.4	18.7	24.0	27.5
	av. date		25	25	25	25	27	27
	latitude adjustment		.0	.0	.0	.0	-.1	.0
	date adjustment		-.2	-.2	-.3	-.3	-.4	-.4
	total no. of flasks		2		6		1	
	av. concentration		314.5		314.6		314.5	
	av. adjusted concentration		314.3		314.3		314.0	
<u>Revised</u>								
Loon H	27 Jan'60, no. of flasks		unchanged		unchanged		unchanged	
Loon K	25 Jan'61, no. of flasks		↓		3	↓		↓
	av. latitude				16.3			
	av. date				25			
	latitude adjustment				.0			
	date adjustment				-.3			
	total no. of flasks				3			
	av. concentration				314.0			
	av. adjusted concentration				313.7			
<u>FEBRUARY</u>								
Loon K	18 Feb'61, no. of flasks		7		1	1	2	
	av. latitude		13.2		16.7	18.5	21.2	
	av. date		18		18	18	18	
	latitude adjustment		.0		.0	.0	.1	
	date adjustment		-.1		-.1	-.1	-.1	
	total no. of flasks		7		2		2	
	av. concentration		314.8		315.1		315.1	
	av. adjusted concentration		314.7		315.0		315.1	

Table 3 . Work Sheets for the Zonal Monthly Average Concentration of Atmospheric Carbon Dioxide (ppm) at 700 mb Referred to a Constant Datum (January 1960)

Zone:		12.5°N		17.5°N		22.5°N		27.5°N	
		A	B	A	B	A	B	A	B
<u>APRIL</u>									
Loon K	9 Apr 60, no. of flasks	1	4	3	2				
	av. latitude	12.0	14.8	16.5	19.2				
	av. date	9	9	9	9				
	latitude adjustment	.0	-.2	.1	-.2				
	date adjustment	.1	.1	.1	.1				
	total no. of flasks	5		5					
	av. concentration	315.6		315.9					
	av. adjusted concentration	315.6		316.0					
<u>JUNE</u>									
Loon K	26 Jun 60, no. of flasks			2	5	1	2	1	1
	av. latitude			17.2	19.0	21.7	24.2	26.7	28.3
	av. date			26	26	26	26	26	26
	latitude adjustment			0	0	0	0	.1	-.1
	date adjustment			.1	.1	.4	.4	.8	.8
	total no. of flasks			7		3		2	
	av. concentration			315.9		315.9		315.9	
	av. adjusted concentration			316.0		316.3		316.7	
<u>AUGUST</u>									
Loon K	4 Aug 60, no. of flasks	1	2	3	4	1			
	av. latitude	11.9	13.9	16.1	18.7	20.6			
	av. date	4	4	4	4	4			
	latitude adjustment	0	0	-.1	.2	-.6			
	date adjustment	-.4	-.4	-.6	-.6	-1.0			
	total no. of flasks	3		7		1			
	av. concentration	315.8		316.5		315.0			
	av. adjusted concentration	315.4		316.0		313.4			

Table 3 . Work Sheets for the Zonal Monthly Average Concentration of Atmospheric Carbon Dioxide (ppm) at 700 mb Referred to a Constant Datum (January 1960)

Zone:	12.5°N		17.5°N		22.5°N		27.5°N	
	A	B	A	B	A	B	A	B
<u>Revised</u>								
Loon K	4 Aug 60, no. of flasks		unchanged		2 2		unchanged	
	av. latitude		↓		16.5 18.7		↓	
	av. date				4 4			
	latitude adjustment				-.1 .2			
	date adjustment				-.6 -.6			
	total no. of flasks				4			
	av. concentration				316.0			
	av. adjusted concentration		↓		315.4		↓	
<u>SEPTEMBER</u>								
Loon K	12 Sep 60, no. of flasks		2 3		3 3		3 1	
	av. latitude		17.2 19.0		23.3		26.4 27.9	
	av. date		12 12		12		12 12	
	latitude adjustment		-.1 .3		.2		-.1 .0	
	date adjustment		-.1 -.1		-.1		.0 .0	
	total no. of flasks		5		3		4	
	av. concentration		312.2		311.5		310.1	
	av. adjusted concentration		312.3		311.6		310.1	
<u>OCTOBER</u>								
Loon H	1 Oct 59, no. of flasks				2			
Loon H	24 Oct 59, no. of flasks				1			
Loon K	21 Oct 60, no. of flasks		2 3		3 4			
	av. latitude		12.2 13.9		16.1 18.7		23.9	
	av. date		21 21		21 21		9	
	latitude adjustment		-.1 .7		-.2 .0		.0	
	date adjustment		-.1 -.1		-.2 -.2		.2	
	total no. of flasks		5		7		3	
	av. concentration		312.8		311.5		311.4	
	av. adjusted concentration		313.1		311.2		311.5	

Table 3 . Work Sheets for the Zonal Monthly Average Concentration of Atmospheric Carbon Dioxide (ppm) at 700 mb Referred to a Constant Datum (January 1960)

	Zone: 12.5°N		17.5°N		22.5°N		27.5°N	
	A	B	A	B	A	B	A	B
<u>Revised</u>								
Loon H 1 Oct 59, no. of flasks					unchanged		unchanged	
Loon H 24 Oct 59, no. of flasks					↓		↓	
Loon K 21 Oct 60, no. of flasks	1	3						
av. latitude	11.9	13.9						
av. date	21	21						
latitude adjustment	-.1	.7						
date adjustment	-.1	-.1						
total no. of flasks		4						
av. concentration		312.3						
av. adjusted concentration		312.7						
<u>NOVEMBER</u>								
Loon H 26 Nov 59, no. of flasks							1	
av. latitude							24.5	
av. date							26	
latitude adjustment							-.1	
date adjustment							-.4	
total no. of flasks							1	
av. concentration							313.2	
av. adjusted concentration							312.7	
<u>DECEMBER</u>								
Loon H 19 Dec 59, no. of flasks							2	1
av. latitude							23.8	27.5
av. date							19	19
latitude adjustment							-.1	.0
date adjustment							-.1	-.1
total no. of flasks							2	1
av. concentration							315.5	313.4
av. adjusted concentration							315.3	313.3

Table 4. Work Sheets for the Flight Track Monthly Average Concentration of Atmospheric Carbon Dioxide (ppm) at Various Levels Referred to a Constant Datum (January 1960)

	Lark (40-41°N) 700 mb		Loon (20-60°N) 500 mb		Stork (40-60°N) 500 mb		Ptarmigan (70-80°N) 700 mb		500 mb	
<u>JANUARY</u>										
day, year, no. of flasks	22nd '60	1	28th '60	10	7th '59	7	21st '60	4	20th '60	7
					22nd '60	11				
					19th '61	11				
av. date	22		28		16		21		20	
date adjustment	-.2		-.5		.0		-.1		-.1	
total no. of flasks	1		10		29		4		7	
av. concentration	315.8		317.6		314.6		316.3		315.4	
av. adjusted concentration	315.6		317.1		314.6		316.2		315.3	
<u>FEBRUARY</u>										
day, year, no. of flasks					8th '59	12	24th '60	5	25th '60	7
					19th '60	11	12th '61	6	13th '61	5
av. date					14		18		19	
date adjustment					.0		-.1		-.1	
total no. of flasks					23		11		12	
av. concentration					315.0		317.1		316.8	
av. adjusted concentration					315.0		317.0		316.7	
<u>MARCH</u>										
day, year, no. of flasks					20th '61	10			19th '61	11
av. date					20				19	
date adjustment					-.2				-.1	
total no. of flasks					10				11	
av. concentration					316.7				316.3	
av. adjusted concentration					316.5				316.2	

Table 4. Work Sheets for the Flight Track Monthly Average Concentration of Atmospheric Carbon Dioxide (ppm) at Various Levels Referred to a Constant Datum (January 1960)

	Lark (40-41°N) 700 mb	Loon (20-60°N) 500 mb	Stork (40-60°N) 500 mb	Ptarmigan (70-80°N) 700 mb	500 mb
<u>APRIL</u>					
day, year, no. of flasks			17th '59 9 5th '60 12	8th '60 4	17th '59 12 9th '60 7
av. date			11	8	13
date adjustment			.1	.1	.0
total no. of flasks			21	4	21
av. concentration			317.0	316.8	317.2
av. adjusted concentration			317.1	316.9	317.2
<u>MAY</u>					
day, year, no. of flasks		22nd '59 2	20th '59 12 24th '61 11	26th '61 6	27th '61 4
av. date		22	22	26	27
date adjustment		.2	.1	.2	.1
total no. of flasks		2	23	6	4
av. concentration		317.7	317.2	317.0	317.1
av. adjusted concentration		317.9	317.3	317.2	317.2
<u>JUNE</u>					
day, year, no. of flasks	20th '59 3	21st '59 12	8th '58 12 11th '58 9 20th '59 5 3rd '60 12 17th '60 10 24th '61 12	20th '60 3 26th '61 4	19th '60 5 27th '61 6
av. date	20	21	14	23	23
date adjustment	.3	.3	.0	.6	1.7
total no. of flasks	3	12	60	7	11
av. concentration	316.1	314.9	315.7	315.9	313.8
av. adjusted concentration	316.4	315.2	315.7	316.5	315.5

Table 4. Work Sheets for the Flight Track Monthly Average Concentration of Atmospheric Carbon Dioxide (ppm) at Various Levels Referred to a Constant Datum (January 1960)

	Lark (40-41°N) 700 mb	Loon (20-60°N) 500 mb	Stork (40-60°N) 500 mb	Ptarmigan (70-80°N) 700 mb	500 mb
<u>JULY</u>					
day, year, no. of flasks			18th '59 7 18th '60 12	21st '60 5	21st '60 6
av. date			18	21	21
date adjustment			.2	1.7	1.0
total no. of flasks			19	5	6
av. concentration			312.8	309.1	308.9
av. adjusted concentration			313.0	310.8	309.9
<u>AUGUST</u>					
day, year, no. of flasks			25th 11 23rd 12	23rd 3 25th 5 29th 5	24th 9 26th 7 30th 7
av. date			24	26	27
date adjustment			.3	.0*	.0*
total no. of flasks			23	13	23
av. concentration			310.9	306.8	308.0
av. adjusted concentration			311.2	306.8	308.0
<u>SEPTEMBER</u>					
day, year, no. of flasks			29th '58 9 21st '60 10	22nd '60 6	29th '58 11 30th '59 12 23rd '60 5
av. date			25	22	27
date adjustment			.0*	-.7	-1.1
total no. of flasks			19	6	28
av. concentration			310.3	308.7	309.9
av. adjusted concentration			310.3	308.0	308.8

*No correction is applied because there is no basis for determining rate of change in concentration near the minimum. This evidently occurs close to the time of these data, but the exact date and concentration cannot be established.

Table 4. Work Sheets for the Flight Track Monthly Average Concentration of Atmospheric Carbon Dioxide (ppm) at Various Levels Referred to a Constant Datum (January 1960)

	Lark (40-41°N) 700 mb		Loon (20-60°N) 500 mb		Stork (40-60°N) 500 mb		Ptarmigan (70-80°N) 700 mb 500 mb			
<u>OCTOBER</u>										
day, year, no. of flasks	20th '59	1	2nd '59	9	24th '58	9		22nd '59	2	
			25th '59	1	2nd '59	11				
					23rd '59	10				
					19th '60	12				
av. date	20		4		17			22		
date adjustment	-.2		.5		-.2			-.6		
total no. of flasks	1		10		42			2		
av. concentration	312.8		312.4		312.1			312.4		
av. adjusted concentration	312.6		312.9		311.9			311.8		
<u>NOVEMBER</u>										
day, year, no. of flasks			20th '59	7	1st '58	10	24th '59	3	25th '59	6
					26th '59	12	14th '60	3	29th '61	7
							29th '61	4		
av. date			26		14		22		27	
date adjustment			-.5		.0		-.3		-.4	
total no. of flasks			7		22		12		13	
av. concentration			314.1		313.0		315.5		314.4	
av. adjusted concentration			313.6		313.0		315.2		314.0	
<u>DECEMBER</u>										
day, year, no. of flasks	17th '59	2	20th '59	9	19th '59	11	17th '59	3	18th '59	8
					16th '60	9	18th '60	5	19th '60	7
av. date	17		20		18		18		18	
date adjustment	-.1		-.2		-.1		-.1		-.1	
total no. of flasks	2		9		20		8		15	
av. concentration	315.4		315.2		314.0		314.9		314.5	
av. adjusted concentration	315.3		315.0		313.9		314.8		314.4	

Table 5. Work Sheet for Computing Weighted Average Date Adjustments for Loon H Flights*

5° Zone	May 22, 1959	June 20, 1959	Oct. 1, 1959	Oct. 25, 1959	Nov. 26, 1959	Dec. 19, 1959	Jan. 27, 1960
27.5°N			.3 (1)			-.2 (1)	
32.5°N		.2 (2)	.4 (1)		-.5 (2)	-.2 (1)	-.4 (2)
37.5°N		.3 (2)	.6 (1)		-.6 (2)	-.2 (1)	-.5 (2)
42.5°N		.3 (2)	.6 (2)			-.2 (2)	-.5 (2)
47.5°N		.4 (2)	.8 (1)		-.5 (2)	-.2 (1)	-.5 (2)
52.5°N	.2 (1)	.4 (2)	.8 (1)	-.5 (1)	-.5 (1)	-.2 (1)	-.5 (2)
57.5°N	.2 (1)	.4 (2)	.8 (2)			-.2 (2)	
Weighted av.	.2 (2)	.3 (12)	.5 (10)		-.5 (7)	-.2 (9)	-.5 (10)

*Adjustments appear to the nearest 0.1 ppm; the number of flasks per zone is shown in parentheses.

Table 6. Smoothed Values of the CO₂ Concentration (in ppm) by Latitude and Month

Latitude	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						500 mb						
78.0°N	315.7	316.4	316.9	317.2	317.2	315.5	309.9	308.0	308.8	311.8	313.7	315.0
50.0°N	314.8	315.7	316.5	317.1	317.3	315.5	313.0	311.2	310.3	311.9	313.0	313.9
40.0°N	314.6	315.6	316.5	317.3	317.9	317.1	315.2	312.6	310.6	311.7	312.7	313.7
32.5°N	314.5	315.4	316.3	317.3	318.0	317.6	316.0	313.7	310.9	311.5	312.6	313.6
27.5°N	314.5	315.2	316.0	317.0	317.8	317.5	316.3	314.3	311.1	311.3	312.5	313.5
22.5°N	314.3	315.1	315.8	316.5	317.1	317.0	316.4	314.8	311.5	311.1	312.2	313.3
						700 mb						
78.0°N	316.3	316.9	317.2	317.4	317.4	316.5	310.8	306.8	308.0	313.0	314.7	315.7
27.5°N	314.5	315.4	316.2	317.1	318.0	316.8	314.4	311.0	310.1	311.6	312.6	313.5
22.5°N	314.1	315.1	315.8	316.6	317.4	316.6	315.5	313.4	311.1	311.4	312.3	313.2
17.5°N	314.1	314.9	315.6	316.2	316.7	316.6	316.3	315.1	312.3	311.3	312.2	313.2
12.5°N	314.3	314.8	315.4	315.9	316.3	316.4	316.2	315.4	313.7	312.9	313.2	313.8

Table 7. The Concentration of Atmospheric Carbon Dioxide (ppm) in Samples Run in Duplicate

Flight Name	Date	Time (GMT)	CO ₂ Concentration (ppm)			Difference
			1st Analysis	2nd Analysis	Av. Conc.	
Stork C	Apr. 17, 1959	0325	321.65	322.51	322.08	.86
		0646	326.23	326.04	326.14	-.19
		0812	316.41	315.41	315.91	-1.00
		0855	318.21	317.30	317.76	-.91
Ptarmigan	Apr. 17, 1959	0220	317.71	317.30	317.50	-.41
		0730	315.15	315.18	315.16	.03
Loon H	Jun. 20, 1959	2200	317.09	316.12	316.60	-.97
		2242	313.64	313.05	313.35	-.59
Stork G	Jun. 20, 1959	2030	314.28	314.51	314.40	.23
		2243	317.20*	314.00	314.00	-
	Jun. 21, 1959	0001	313.80	313.52	313.66	-.28
		0112	315.31	314.76	315.04	-.55
		0222	315.21	314.00	314.60	-1.21
		0339	313.24	313.48	313.36	.24
		0456	316.26	316.32	316.29	.06
		0603	317.49	316.32	316.90	-1.17
Lark U	Oct. 20, 1959	1845	315.82	316.02	315.92	.20
Ptarmigan	Feb. 24, 1960	2200	316.73	316.64	316.69	-.09
		2300	318.30	318.77	318.54	.47
					Average	.53 (18 samples)

*Omitted from average