

Technical Report 197

U. S. DEPARTMENT OF DEFENSE
OFFICE OF
NATIONAL WEATHER SERVICE
LELAND

AD-661979



SUMMARIES OF PRESSURE, TEMPERATURE, AND DENSITY OVER CAPE KENNEDY AFS, INCLUDING PERIODIC DENSITY VARIATIONS

By

Major Edward V. Von Gohren
6th WEATHER WING

This Document
Has Been Approved For Public Release and Sale;
Its Distribution is Unlimited.

PUBLISHED BY
AIR WEATHER SERVICE (MAC)
UNITED STATES AIR FORCE
AUGUST 1967

556
.U5
T44
NO.197

661979

PREFACE

Periodic variations of density at geometric altitudes in the stratosphere and mesosphere are of concern to meteorologists supporting military operations at or through these altitudes, and to those people who plan future operations in these regions of the upper atmosphere. During 1964, 1965, and 1966, nearly 500 meteorological rockets were launched at Cape Kennedy Air Force Station (CKAFS) in support of major missile and space vehicle tests, and/or to provide synoptic and climatological data for the Air Force Environmental Rocket Sounding System. Thermodynamic data reduced from 379 PWN-6A launches are tabulated, giving means, standard deviations, and extremes of temperature, pressure, and density between 80,000 and 220,000 feet. Inferences on the annual periodicity of temperature at 160,000 feet and at the stratopause are discussed. Seasonal variations in the height of the stratopause are considered. The density data at 160,000 feet are then arranged in a table according to hour and month. A nomogram of density is developed from this table. This work is considered applicable to subtropical atmospheres and is geophysically significant.

The original data were reduced on the meteorological computer at Patrick Air Force Base, Florida. The summaries were processed on this same computer using a program prepared by Captain John Pohle, USAF. The individual efforts of the members of the Data Section, Detachment 11, 6th Weather Wing, who prepared these data for processing and applied local quality control, are gratefully acknowledged. Thanks, also go to the members of the Meteorological Data Reduction Section and to Mr. O. H. Daniel of the Range Division Meteorological Office (PAA) for their programming and data reduction efforts.

EDWARD V. VON GOHREN, Major, USAF
Aerospace Environmental Consultant
Hq 6th Weather Wing (6V)
Andrews AFB, Maryland 20331
31 August 1967

DISTRIBUTION: (page 11)

This document has been approved for public release
and sale; its distribution is unlimited.

DISTRIBUTION:

HQ AWS	5
Wings	17
except 7 Wea Wg	25
ETAC	1
Squadrons	1
Forecasting Detachments	1
Special	

TABLE OF CONTENTS

	Page
Section A Introduction	1
Section B Discussion of the Data	1
Section C Summaries of Pressure, Temperature, and Density	2
Annual	2
Seasonal	2
Monthly	3
Section D Annual Temperature Variations at 160,000 Feet and at the Stratopause	3
Section E Density Variations at 160,000 Feet	3
Annual and Diurnal	3
Interdiurnal	6
Section F Summary and Recommendations for Further Investigation	9
REFERENCES	10

LIST OF ILLUSTRATIONS

Figure 1 Cape Kennedy ARCASONDE 1A Temperatures, December, January, February, March, 1964-1966	4
Figure 2 Cape Kennedy ARCASONDE 1A Temperatures, June, July, August, September, 1964-1966	5
Figure 3 Cape Kennedy Annual and Diurnal Variations of Density at 160,000 Feet, 1964-1966	7
Figure 4 Cape Kennedy Interdiurnal Variations of Density at 160,000 Feet, 1966	8

LIST OF TABLES

Table 1 Cape Kennedy Summary, January through December 1964-1966, 1300Z to 0000Z	12
Table 2 Cape Kennedy Summary, January through December 1964-1966, 0000Z to 1300Z	13
Table 3 Cape Kennedy, Winter Summary	14
Table 4 Cape Kennedy, Summer Summary	14
Table 5 Cape Kennedy Summary, January 1964-1966, 1300Z to 0000Z	15

		Page
Table 6	Cape Kennedy Summary, February 1964-1966, 1300Z to 0000Z. . .	16
Table 7	Cape Kennedy Summary, March 1964-1966, 1300Z to 0000Z . . .	17
Table 8	Cape Kennedy Summary, April 1964-1966, 1300Z to 0000Z . . .	18
Table 9	Cape Kennedy Summary, May 1964-1966, 1300Z to 0000Z	19
Table 10	Cape Kennedy Summary, June 1964-1966, 1300Z to 0000Z. . . .	20
Table 11	Cape Kennedy Summary, July 1964-1966, 1300Z to 0000Z. . . .	21
Table 12	Cape Kennedy Summary, August 1964-1966, 1300Z to 0000Z. . .	22
Table 13	Cape Kennedy Summary, September 1964-1966, 1300Z to 0000Z .	23
Table 14	Cape Kennedy Summary, October 1964-1966, 1300Z to 0000Z . .	24
Table 15	Cape Kennedy Summary, November 1964-1966, 1300Z to 0000Z. .	25
Table 16	Cape Kennedy Summary, December 1964-1966, 1300Z to 0000Z. .	26
Table 17	Mean Monthly Temperatures at 160,000 Feet and at the Strato- pause	27
Table 18	Cape Kennedy Distribution of Observations of Density at 160,000 Feet, 1964-1966	27
Table 19	Cape Kennedy Mean Densities, 160,000 Feet, 1964-1966. . . .	28
Table 20	Frequency Distribution of Interdiurnal Density Changes. . .	29

SUMMARIES OF PRESSURE, TEMPERATURE, AND DENSITY OVER CAPE KENNEDY AFS,
INCLUDING PERIODIC DENSITY VARIATIONS

SECTION A — INTRODUCTION

Atmospheric data at altitudes above 100,000 feet have become increasingly important as the various Air Force and NASA aerospace programs move toward hypervelocity re-entry programs. Providing forecasts of insertion altitude density and profiles of density along the flight trajectory for the USAF ASSET and START/PRIME Programs, and the need for increased quality control of the meteorological rocket data has emphasized the importance of defining the periodic variations of density at geometric altitudes. Increased knowledge of these periodicities, when coupled with latitudinal variations and actual observations, should assist in defining the density regime along the flight profile to the desired accuracy. These variations have been investigated at satellite and rawinsonde altitudes [1], [6], and in the upper stratosphere and mesosphere [3], [4], [5], [7], [9], [10], [11], [12], [13], [14], [16], [17]. Most investigations in the upper stratosphere and mesosphere have been restricted to the analysis of data collected using a variety of sounding systems at several locations. Others have inferred results from a limited number of soundings spaced rather far apart. More recently, there have been various attempts to determine diurnal periodicity by launching at frequent intervals over a 48-hour period [8]. Now, for the first time, data from a single station are available in sufficient quantity and quality to attempt a more definitive evaluation of these periodic variations by statistical or climatological methods. This report is designed to present annual, seasonal, and monthly summaries of temperature, pressure, and density between 80,000 and 220,000 feet at Cape Kennedy Air Force Station (CKAFS), and to present mean annual, diurnal, and interdiurnal periodicities of density at 160,000 feet. The mean monthly temperatures at 160,000 feet and at the stratopause are discussed along with seasonal variations in the height of the stratopause.

SECTION B — DISCUSSION OF THE DATA

Temperature profiles with increased accuracy and detail were obtained at CKAFS starting in January 1964. The system used is the PWN-6A. This is an ARCAS motor and the ARCASONDE 1A payload. The payload is tracked by precision radar to obtain space position data, and the temperature data is recorded on

the AN/TMQ-5 recorder record as received through the AN/GMD receiver. An altitude versus temperature profile is calculated from the radar and AN/TMQ-5 data. Temperatures are neither corrected nor adjusted to coincide with rawinsonde temperatures in the region of overlap. In general, the temperatures in the lower overlap region are comparable to rawinsonde temperatures. Above 85,000 feet, the rawinsonde temperatures become gradually colder than rocketsonde temperatures but this is to be expected, considering the long-wave radiational error in the rod thermistor used in the rawinsonde observations. A vertical pressure profile is computed hydrostatically using the conjugate raob pressure at 80,000 feet as the base pressure. A density profile may then be constructed using the equation of state. The technique follows the method of hydrostatic integration described in AWS Technical Report 175 [14].

The original profiles of pressure and density were reduced by the contractor-operated Meteorological Data Reduction Section at the Air Force Eastern Test Range, Patrick AFB, Florida. The summaries were processed in this same facility using a program prepared by Captain John Pohle, USAF. The mean values of density used to derive the 160,000-foot annual and diurnal periodicity nomogram (refer to Figure 3) were computed on a machine calculator by the author. A total of 379 rocket thermistor observations have been used. These were acquired between January 1964 and the end of December 1966. The summaries are for each 10,000-foot interval from 80,000 to 220,000 feet. Altitudes are geometric and are expressed in English units because this is convention to the aeronautical engineer.

SECTION C — SUMMARIES OF PRESSURE, TEMPERATURE, AND DENSITY

Annual

Annual summaries of pressure, temperature, and density over CKAFS are presented in Tables 1 and 2. Table 1 is the summary of data acquired between 1300Z and 0000Z (0800 EST and 1900 EST). Table 2 summarizes data acquired between 0000Z and 1300Z. Mean values and extremes are shown. A comparison of these two tables show the strong diurnal character of the data.

Seasonal

Seasonal summaries of mean values, standard deviations and extremes of pressure, temperature, and density for "winter" and "summer" are listed in Tables 3 and 4, respectively. Again, the summaries are for the hours between 1300Z and 0000Z. "Winter" refers to the months December through March; "summer" denotes the months June through September. These periods can reasonably be considered as representative of the general thermodynamic features

which occur with the respective westerly and easterly stratospheric wind regimes. Figures 1 and 2 display the seasonal temperature summaries and compare the results to the applicable AFCRL 1962 Supplemental Atmosphere for 30°N.

Monthly

Monthly summaries of mean values and extremes of pressure, temperature, and density are tabulated in Tables 5 through 17 for the hours between 1300Z and 0000Z.

SECTION D — ANNUAL TEMPERATURE VARIATIONS AT 160,000 FEET (48.8 km) AND AT THE STRATOPAUSE

Batten [2] shows double maxima at 30°N at a height of 50 km (164,000 feet) (April and September-October). Tóth [18], in an independent analysis of Meteorological Rocket Network (MRN) temperatures, shows double maxima at 30°N at 50 km (164,000 feet) (May and October). Quiroz, et al. [14] states that the lowest temperature generally occurs in December-January, implying also at a height of 164,000 feet. CKAFS (28°N) temperatures at 160,000 feet show maxima in May, September-October, and December-January (Table 17). In fact, the absolute maximum monthly mean temperature at 160,000 feet occurs in December. This feature was totally unexpected but is confirmed by J. E. Morris (paper presented at the AMS Conference on High Altitude Meteorology and Space Weather, 29-31 March 1967, Houston, Texas). This finding merits further study.

These data do not permit a resolution of the mean stratopause height nearer than 10,000 feet (3.28 km). Nevertheless, the level of mean maximum temperature can be seen (Table 17) to vary throughout the year, reaching the maximum height in October. The mean monthly temperature at the mean stratopause height follows the same triple maxima found at 160,000 feet.

SECTION E — DENSITY VARIATIONS AT 160,000 FEET (48.8 km)

Annual and Diurnal

The distribution of observations by hour and by month is shown in Table 18. It is obvious that the distribution is not ideal; however, inspection of the available data indicates that the density in the upper stratosphere is strongly dependent upon time of day and day of the year. Mean values of density were calculated for each time period that had an observation. These mean values are shown in Table 19. These means were assigned to the midpoint of

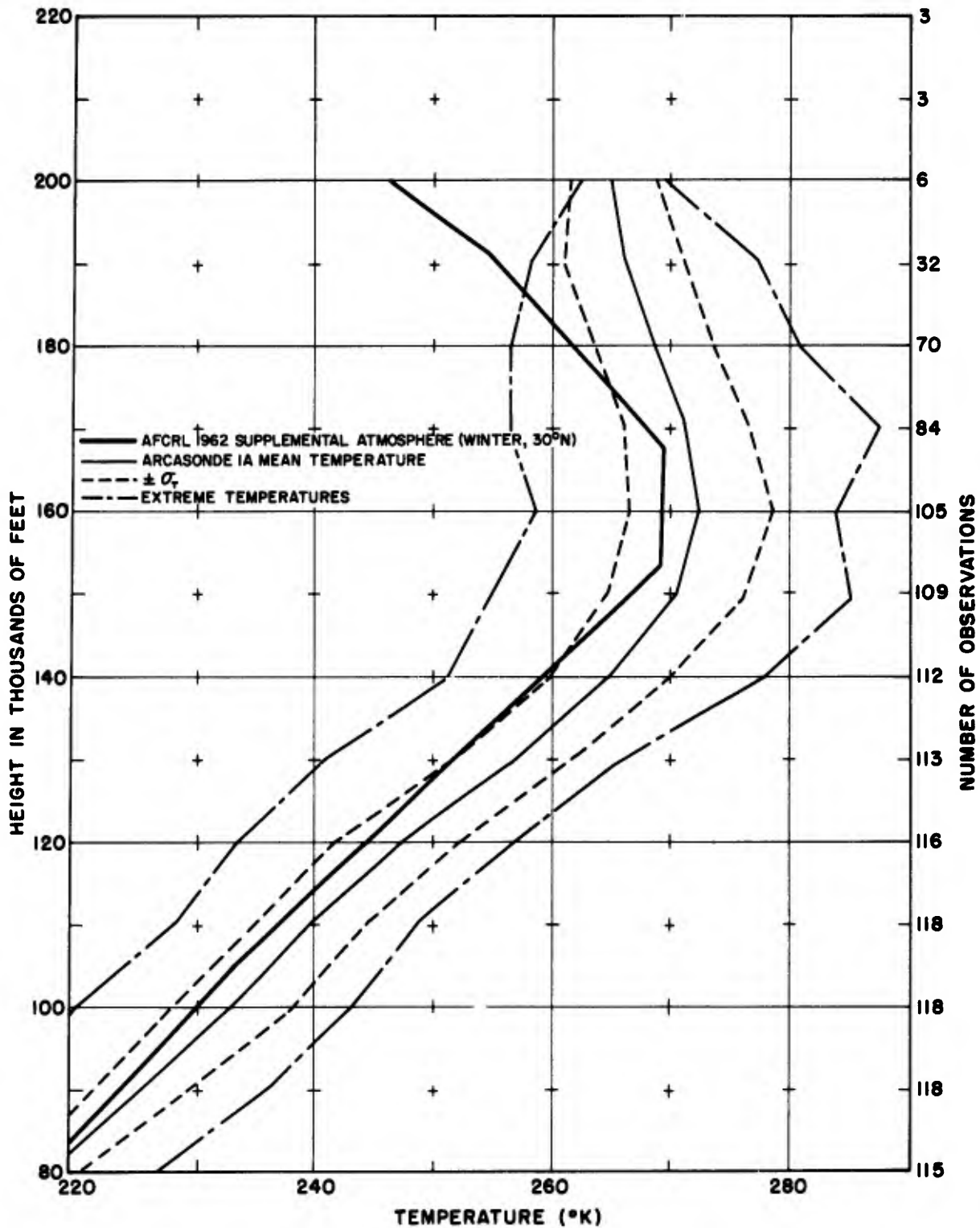


Figure 1. Cape Kennedy ARCASONDE 1A Temperatures, December, January, February, March, 1964-1966.

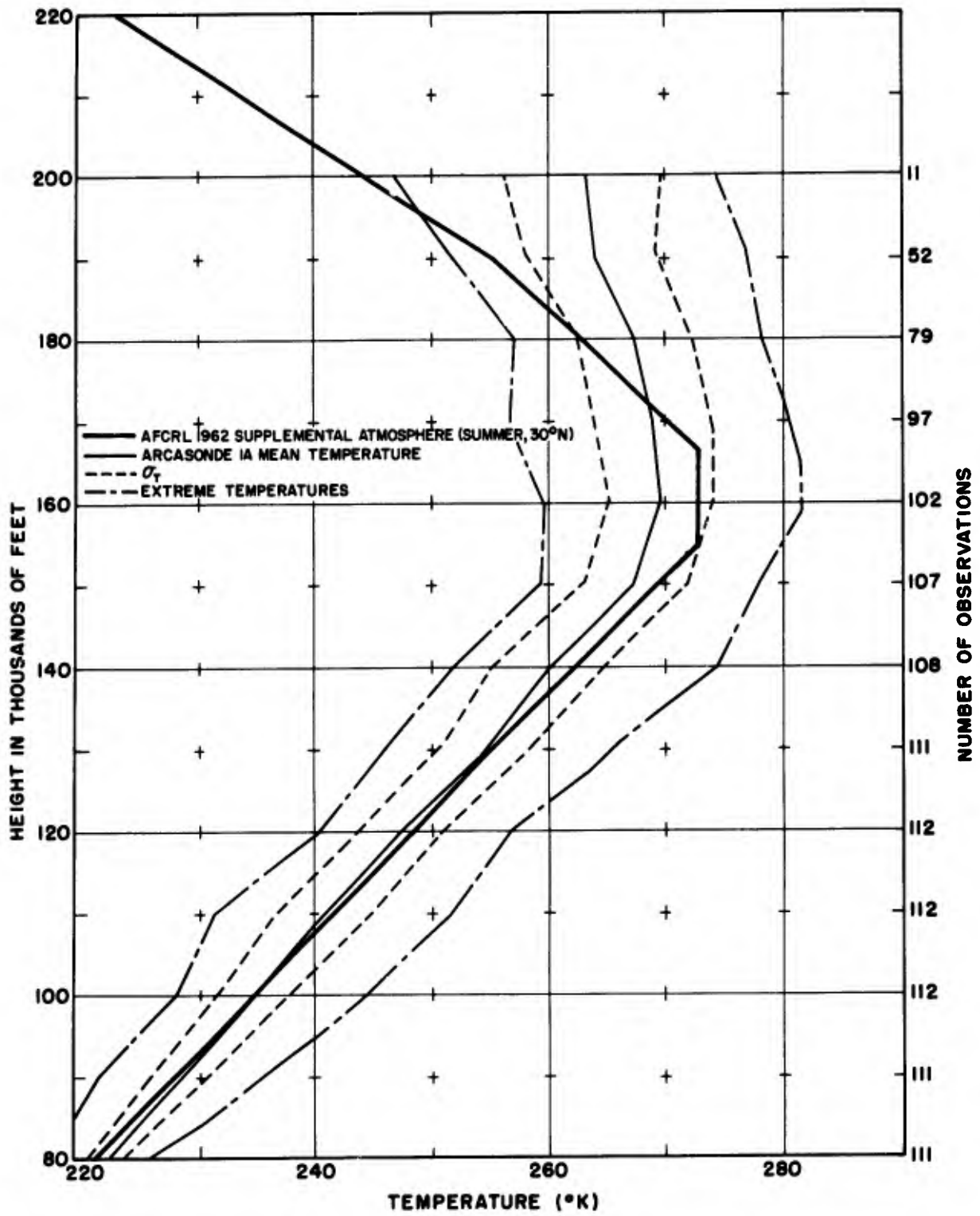


Figure 2. Cape Kennedy ARCASONDE 1A Temperatures, June, July, August, September, 1964-1966.

the period and the resulting grid was analyzed for isopleths of density. Figure 3 is the nomogram developed from this analysis.

The major features of this nomogram are:

- a. Minimum annual densities occur during December and January nights.
- b. Maximum annual densities occur during June and July, with a tendency for nearly equal diurnal maxima near 1000 EST and again in the midafternoon.
- c. Maximum diurnal densities from October through March occur about 1300 EST.
- d. There is evidence of multiple periodicities in the diurnal density during May, June, July, and August.
- e. There is a hint of multiple periodicities during other months of the year.
- f. Simple calculations from the nomogram show that for a given hour the June-July density is about 15% higher than the December-January value. Similarly, the diurnal variation of density ranges from about 10% in January and February to about 7 or 8% in June and July. These values are in agreement with Cole and Kantor's [5] tentative assessment of the diurnal variability at about the same latitude (Eglin ROBIN density observations, 9-10 May 1961 and 12 October 1962).
- g. The nomogram has been used to predict density at 160,000 feet at CKAFS on an independent data sample. Preliminary results, based on 67 rocket soundings made during the first five months of 1967, indicate that density can be predicted to an accuracy of 3% with a standard deviation of $\pm 1\%$. The sample will be extended to one year and reported on in a following report.

Interdiurnal

The interdiurnal variation of density at 160,000 feet was investigated using the 1966 data. The analysis follows Quiroz, et al. [14]. The mean differences in density observed from one to ten days apart were calculated. Only observations that occurred within multiples of 24 hours of each other were considered. A leeway of plus-or-minus one hour was allowed. This ensured a minimum amount of contamination of the results by diurnal variations. The distribution of the data sample is not optimum; therefore, one should recognize that the results could be affected by distribution bias. However, the distribution is the best available and the results should give at least a general indication of interdiurnal variability of density. Results of this analysis are displayed in Figure 4 and a frequency distribution of interdiurnal density changes is provided in Table 20. These results are in accord with the inferences of Quiroz, et al. [14]. Their work has been extended and, for

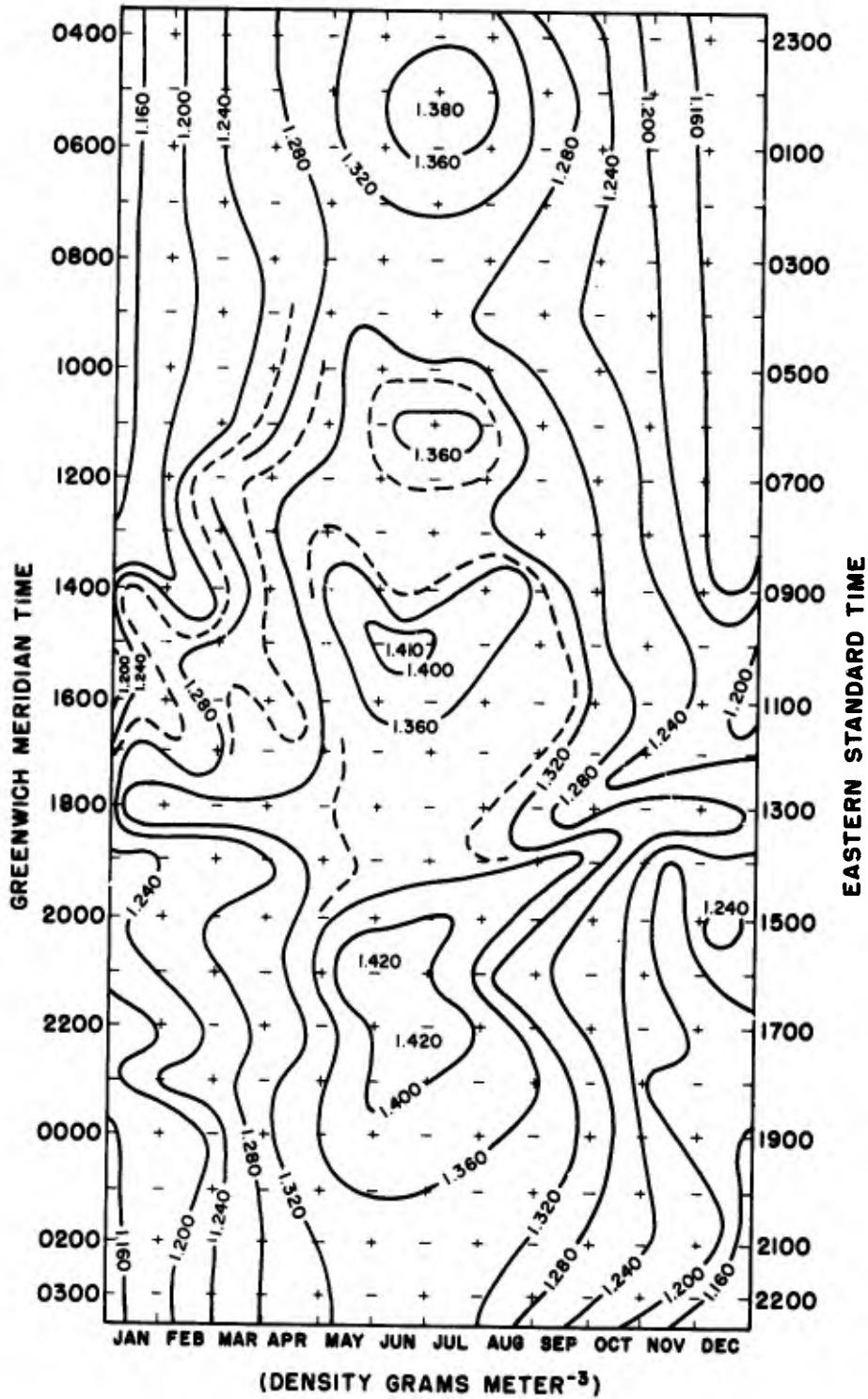


Figure 3. Cape Kennedy Annual and Diurnal Variations of Density at 160,000 Feet, 1964-1966.

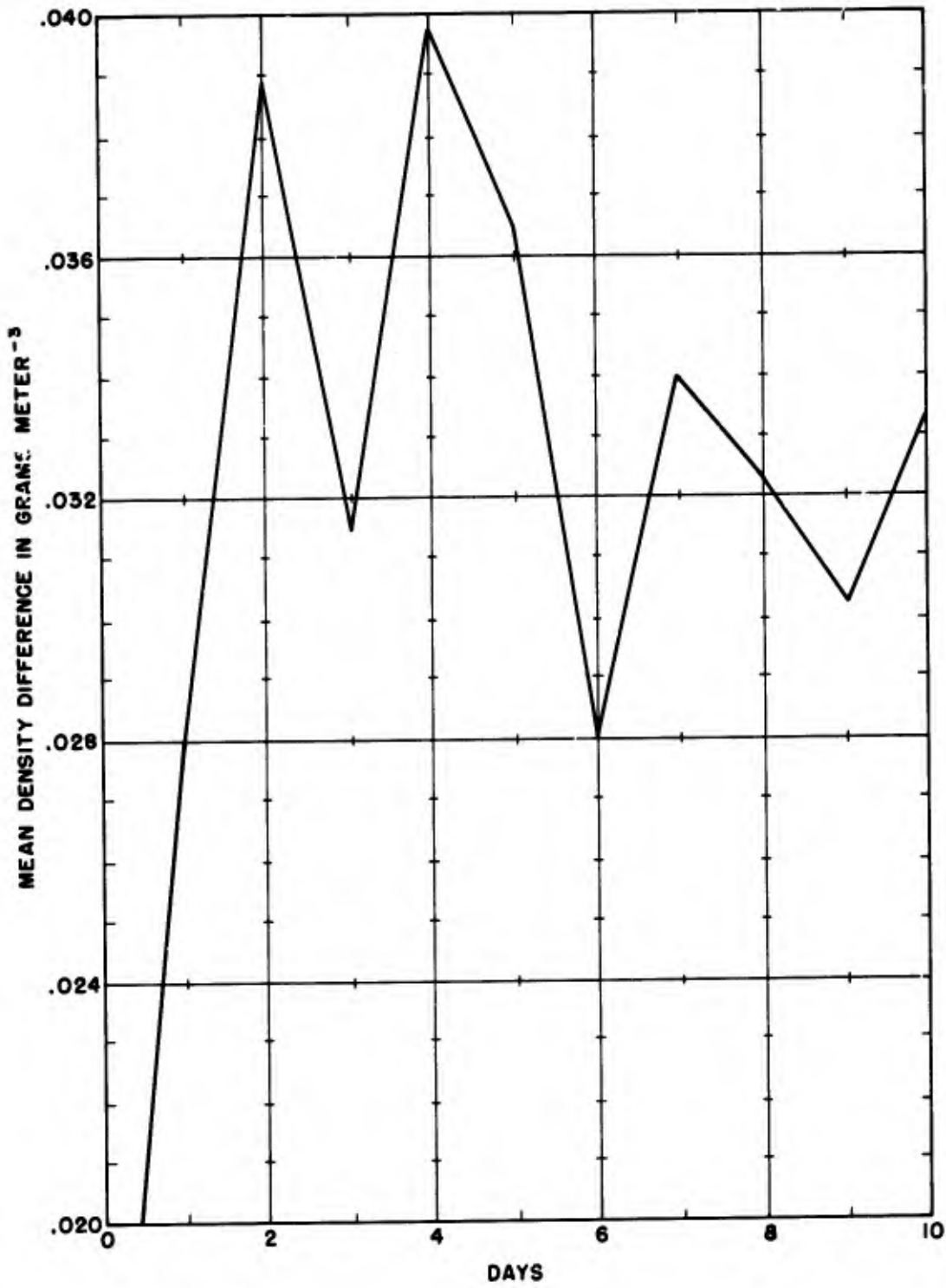


Figure 4. Cane Kennedy Interdiurnal Variations of Density at 160,000 Feet, 1966.

CKAFS, it has been shown that the lower limits of their results (24-hour variability, 2 to 4%; 48-hour variability, 3 to 8%) are applicable at 160,000 feet. A 3-day periodicity is indicated in the interdiurnal changes in density. There is a minimum in the mean change of density after three, six, and nine days. The validity of this observation is purely speculative.

Manual computations are always tedious but sometimes rewarding. The largest interdiurnal changes in density were observed to occur coincidental with the spring and fall stratospheric wind reversals and during mid-December, the time of the year sometimes described as the midwinter storm period. These extreme changes ranged from 7% in 24 hours, 9% in 48 and 72 hours, to 10% in 8 days. This is smaller by a factor of 2 than one would expect based on Cole and Kantor's results [5]. Cole and Kantor recognized that their estimate probably included some diurnal and semidiurnal variations due to solar and lunar effects.

SECTION F -- SUMMARY AND RECOMMENDATIONS FOR FURTHER INVESTIGATION

The summaries indicate that the densities over CKAFS, Florida, between 80,000 feet and 220,000 feet are dependent upon time of day and month of the year. The effect is more noticeable above 100,000 feet than below. The nomogram of densities at 160,000 feet shows further detail of how stratospheric densities vary with time. Seasonal and diurnal variability contribute significantly to the already small standard deviation of density. Mean 24-hour (2%) and 48-hour (3%) variability is small compared to interdiurnal changes which occur near the time of stratospheric wind reversal and during the mid-winter storm period.

The Air Force Environmental Rocket Sounding System should make an effort to gather more data at times other than local noon. These data would confirm or correct the results of this report.

A similar analysis should be made for other locations near the same latitude, and at other latitudes. This must necessarily wait until the data are available in sufficient quantity.

The nomogram has been used in an attempt to predict densities over CKFAS at 160,000 feet (see Section E). It is expected that the regression method of predicting density described in AWS Technical Report 187 [15] and this nomogram can be coupled to yield a more accurate prediction.

Interdiurnal periodicities should be investigated further. The 3-day periodicity shown in CKFAS 1966 data may not be found in the data from other years and other locations. The existence of correlations between observation

sites and also that portion of the interdiurnal change that can be attributed to random instrument error should be investigated.

The effect of the present 11-year solar cycle should be sought. Data from one quarter cycle are now available. This should be sufficient to establish a trend, if such a trend is significant.

REFERENCES

- [1] Alfuth, Werner: "Some Features of Air Density Profiles Up to the Middle Stratosphere," Army Ordnance Missile Command, Redstone Arsenal, Alabama, Report RR-TR-61-4, October 1961, 92 pp.
- [2] Batten, E. S.: "A Model of the Annual Temperature Variations at 30°N and 60°N Between 30 and 50 Km," Rand Corporation RM-3564-PR, March 1963, 32 pp. (AD-299590).
- [3] Champion, K. S. W. and Faire, A. C.: "Falling Sphere Measurements of Atmospheric Density, Temperature, and Pressure, Up to 115 Km," AFCRL, ERP 34, 1964, 27 pp.
- [4] Cole, A. E. and Court, A.: "Density Distribution, Interlevel Correlations and Variation with Wind," AFCRL, AF Surveys in Geophysics No. 151, 1962.
- [5] Cole, A. E. and Kantor, A. J.: "Horizontal and Vertical Distribution of Atmospheric Density, Up to 90 Km," AF Surveys in Geophysics No. 157, June 1964, 23 pp.
- [6] Cole, A. E. and Nee, P. F.: "Correlations of Temperature, Pressure, and Density, to 30 Kilometers," AF Surveys in Geophysics No. 160, 1965, 21 pp.
- [7] Court, A. and Abrahms, G.: "Atmospheric Density Variations with Latitude and Season," Journal of Spacecraft and Rockets, Vol. 2, No. 3, 1965, pp. 472-474.
- [8] Finger, F. G. and Woolf, H. M.: "An Experiment Designed to Determine the Diurnal Temperature and Wind Variation and to Detect Possible Errors in Rocketsonde Temperature Measurement in the Upper Stratosphere," NASA, TMS-1298, November 1966, 19 pp.
- [9] Groves, G. V.: "Seasonal Variations of Temperature, Pressure, Density and Winds to 80 Km Altitude at Woomera, 1957-1963," University College, London, 1965.
- [10] Jones, L. M.: "Upper Air Densities and Temperatures by the Falling Sphere Method, a 1961 Review," University of Michigan, Report O3558-5-T, 1961, 48 pp.
- [11] Peterson, J. W. and McWatters, K. D.: "The Measurement of Upper-Air Density and Temperature by Two Radar-Tracked Falling Spheres," NASA, CR-29, 1964, 41 pp.
- [12] Quiroz, R. S.: "Air Density Profiles for the Atmosphere between 30 and 80 Kilometers," Hq Air Weather Service Technical Report 150, January 1961, 46 pp.

- [13] Quiroz, R. S.: "The High-Latitude Density Regime at Rocket Altitudes Inferred from Observations in Opposite Hemispheres," Journal of Applied Meteorology, Vol. 5, No. 3, 1966, pp. 308-313.
- [14] Quiroz, R. S., Lambert, J. K., and Dutton, J. A.: "Upper-Stratosphere Density and Temperature Variability Determined from Meteorological Rocket Network Results, 1960-1962," Hq Air Weather Service Technical Report 175, December 1963, 44 pp.
- [15] Quiroz, R. S. and Thompson, G. J.: "Regression Equations for Specifying Atmospheric Density Above 30 Km from Observational Data at Radiosonde Altitudes," Hq Air Weather Service Technical Report 187, August 1966, 28 pp.
- [16] Smith, W., et al.: "Temperature, Pressure, Density, and Wind Measurements with the Rocket Grenade Experiment, 1960-1963," NASA, TR R-211, 1964, 46 pp.
- [17] Smith, O. E., McMurray, W., and Crutcher, H. L.: "Cross Sections of Temperature, Pressure, and Density Near the 80th Meridian West," NASA, TN D-1641, 1963, 145 pp.
- [18] Tóth, Jenó: "Über die Temperatur in der Stratosphäre und Mesosphäre," Meteorologische Rundschau, Vol. 16, No. 1, January-February 1963, pp. 16-19.

TABLE 1
Cape Kennedy Summary, January through December 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density ($gm\ m^{-3}$)			Pressure (mb)			Temperature ($^{\circ}K$)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	329	44.656	48.049	41.450	28.323	30.265	26.352	220.9	228.6	212.9	24.4
90	344	27.411	29.259	25.484	17.883	19.102	16.767	227.2	237.5	215.5	27.4
100	346	17.014	18.595	14.491	11.453	12.704	10.552	234.4	248.1	220.5	30.5
110	345	10.760	11.789	9.831	7.423	8.252	6.735	240.3	253.8	228.3	33.5
120	341	6.880	7.649	6.249	4.871	5.444	4.348	246.6	256.9	233.2	36.6
130	337	4.415	4.991	3.960	3.234	3.607	2.855	255.2	265.4	240.5	39.6
140	331	2.885	3.240	2.532	2.177	2.442	1.902	263.0	278.1	246.3	42.7
150	325	1.922	2.128	1.639	1.482	1.682	1.300	268.6	285.0	253.4	45.7
160	306	1.302	1.453	1.107	1.013	1.167	.890	271.1	284.0	258.6	48.8
170	268	.895	1.028	.779	.695	.799	.607	270.2	287.3	256.1	51.8
180	208	.618	.707	.532	.475	.538	.415	268.2	282.2	256.3	54.9
190	106	.428	.481	.366	.326	.370	.286	264.9	276.8	251.6	57.9
200	16	.299	.319	.279	.226	.241	.214	263.7	274.0	247.1	61.0
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 2

Cape Kennedy Summary, January through December 1964-1966, 0000Z to 1300Z.

ALT KFT	N	Density ($gm\ m^{-3}$)			Pressure (mb)			Temperature ($^{\circ}K$)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	32	44.089	46.697	41.969	27.857	29.517	26.692	220.2	227.8	213.9	24.4
90	33	27.062	27.971	25.637	17.564	18.662	16.793	226.1	232.7	218.0	27.4
100	33	16.749	17.889	15.792	11.219	12.015	10.678	233.1	241.9	220.1	30.5
110	33	10.600	11.362	9.872	7.257	7.796	6.894	238.5	248.1	232.6	33.5
120	33	6.718	7.176	6.000	4.741	5.156	4.475	245.2	254.4	234.6	36.6
130	32	4.307	4.638	4.017	3.144	3.465	2.946	254.1	268.1	235.6	39.6
140	30	2.811	2.996	2.578	2.108	2.377	1.947	261.2	276.4	243.2	42.7
150	28	1.876	2.073	1.726	1.436	1.646	1.295	265.0	276.0	255.5	45.7
160	27	1.267	1.430	1.148	.973	1.135	.877	267.3	277.0	258.6	48.8
170	24	.862	.998	.784	.659	.783	.597	266.2	275.5	256.4	51.8
180	19	.590	.649	.552	.444	.487	.402	262.3	271.5	253.8	54.9
190	10	.408	.443	.372	.302	.330	.269	257.6	270.0	249.2	57.9
200	--	--	--	--	--	--	--	--	--	--	--
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 3

Cape Kennedy, Winter Summary (December, January, February, March).

ALT KFT	N	Density						Pressure						Temperature					
		gm m ⁻³			σ	%σ	mb			σ	%σ	°K			σ	%σ	ALT KMS		
		AVG	MAX	MIN			AVG	MAX	MIN			AVG	MAX	MIN					
80	115	43.801	45.277	41.578	.660	1.5	27.492	29.929	26.352	.410	1.5	218.5	226.9	212.9	2.6	1.2	24.4		
90	118	26.736	27.703	25.640	.450	1.7	17.282	17.964	16.791	.239	1.4	225.2	235.8	215.5	3.7	1.6	27.4		
100	118	16.467	17.053	15.566	.298	1.8	11.029	11.636	10.552	.201	1.8	233.2	243.4	220.5	4.9	2.1	30.5		
110	118	10.379	10.860	9.980	.194	1.9	7.137	7.616	6.735	.163	2.3	239.5	248.6	228.3	4.6	1.9	33.5		
120	116	6.614	7.061	6.249	.175	2.6	4.680	5.046	4.348	.133	2.8	246.5	255.9	233.2	5.0	2.0	36.6		
130	113	4.293	4.561	3.960	.128	3.0	3.106	3.384	2.855	.095	3.1	256.2	265.3	241.3	4.7	1.8	39.6		
140	112	2.760	3.032	2.232	.096	3.5	2.096	2.278	1.902	.068	3.3	264.6	278.1	251.5	5.1	1.9	42.7		
150	109	1.843	2.004	1.639	.066	3.6	1.429	1.554	1.300	.049	3.4	270.3	285.0	255.0	5.6	2.1	45.7		
160	105	1.254	1.366	1.107	.047	3.8	.979	1.064	.890	.035	3.6	272.0	284.0	258.6	5.7	2.1	48.8		
170	83	1.861	1.945	.779	.032	3.7	.669	.731	.607	.024	3.6	270.7	287.3	256.1	5.0	1.8	51.8		
180	68	.595	.635	.532	.021	3.5	.458	.501	.415	.017	3.8	268.4	280.9	256.3	4.5	1.7	54.9		
190	29	.411	.430	.366	.014	3.4	.315	.331	.288	.010	3.3	266.5	276.8	258.3	4.6	1.7	57.9		
200	3	.288	.291	.284	.003	1.1	.219	.224	.214	.004	1.9	264.6	269.5	262.1	3.4	1.3	61.0		
210	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
220	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		

TABLE 4

Cape Kennedy, Summer Summary (June, July, August, September).

ALT KFT	N	Density						Pressure						Temperature					
		gm m ⁻³			σ	%σ	mb			σ	%σ	°K			σ	%σ	ALT KMS		
		AVG	MAX	MIN			AVG	MAX	MIN			AVG	MAX	MIN					
80	111	45.844	48.049	43.488	.756	1.6	29.280	30.265	27.629	.471	1.6	222.5	225.5	218.0	4	0.7	24.4		
90	111	28.272	29.259	26.707	.492	1.7	18.543	19.102	17.387	.315	1.7	228.5	235.4	222.0	2.3	1.0	27.4		
100	112	17.634	18.595	14.491	.451	2.6	11.898	12.704	11.136	.235	2.0	234.7	244.3	228.2	3.1	1.3	30.5		
110	112	11.167	11.789	10.456	.215	1.9	7.718	8.252	7.211	.171	2.2	240.8	251.5	231.6	3.8	1.6	33.5		
120	112	7.139	7.649	6.613	.163	2.3	5.063	5.444	4.677	.132	2.6	247.0	256.2	240.3	3.7	1.5	36.6		
130	111	4.599	4.991	4.259	.120	2.6	3.361	3.607	3.087	.100	3.0	254.6	265.3	245.5	3.9	1.5	39.6		
140	108	3.009	3.240	2.749	.089	2.9	2.263	2.440	2.076	.069	3.0	262.1	274.4	251.7	4.5	1.7	42.7		
150	107	2.004	2.128	1.850	.062	3.1	1.538	1.670	1.406	.050	3.2	267.3	277.7	259.3	4.2	1.6	45.7		
160	102	1.357	1.453	1.247	.045	3.3	1.051	1.155	.953	.037	3.5	269.9	281.7	259.7	4.3	1.6	48.8		
170	97	.931	1.028	.836	.034	3.7	.719	.799	.647	.028	3.8	268.9	280.9	256.5	4.8	1.8	51.8		
180	79	.638	.707	.582	.023	3.6	.489	.538	.436	.018	3.7	267.1	277.9	256.8	4.7	1.7	54.9		
190	52	.439	.481	.406	.014	3.2	.332	.370	.301	.011	3.4	263.6	276.4	251.6	5.2	2.0	57.9		
200	11	.303	.319	.291	.008	2.6	.228	.241	.214	.006	2.8	262.7	274.0	247.1	6.4	2.4	61.0		
210	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
220	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		

TABLE 5
Cape Kennedy Summary, January 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density (gm m^{-3})			Pressure (mb)			Temperature ($^{\circ}\text{K}$)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	27	43.792	44.550	42.444	27.405	28.000	26.867	218.0	225.2	212.9	24.4
90	28	26.597	27.244	25.687	17.206	17.601	16.795	225.4	230.2	220.8	27.4
100	28	16.410	17.016	15.566	10.985	11.284	10.713	233.3	243.4	224.3	30.5
110	28	10.307	10.815	10.061	7.112	7.402	6.916	240.4	248.6	228.3	33.5
120	27	6.562	6.808	6.249	4.665	4.911	4.493	247.7	254.0	239.8	36.6
130	27	4.198	4.411	4.030	3.109	3.293	2.971	258.0	265.3	250.0	39.6
140	27	2.751	2.908	2.595	2.103	2.243	2.011	266.3	273.4	258.5	42.7
150	27	1.842	1.930	1.750	1.440	1.542	1.377	272.4	281.4	261.9	45.7
160	26	1.259	1.353	1.191	.988	1.064	.941	273.2	283.4	261.3	48.8
170	23	.874	.945	.819	.677	.731	.638	270.0	279.0	256.1	51.8
180	18	.600	.635	.568	.462	.501	.430	268.3	275.7	260.5	54.9
190	6	.409	.419	.398	.316	.327	.300	269.0	276.5	262.2	57.9
200	--	--	--	--	--	--	--	--	--	--	--
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 6
Cape Kennedy Summary, February 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density (gm m^{-3})			Pressure (mb)			Temperature ($^{\circ}\text{K}$)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	22	44.008	45.178	42.709	27.678	29.929	26.866	218.4	222.5	215.5	24.4
90	22	26.911	27.516	26.320	17.310	17.598	16.842	224.1	229.9	217.8	27.4
100	22	16.518	17.053	15.982	11.029	11.293	10.657	232.6	242.0	224.5	30.5
110	22	10.410	10.726	10.113	7.126	7.349	6.821	238.5	248.3	228.7	33.5
120	22	6.614	6.957	6.252	4.674	4.952	4.414	246.2	254.7	237.0	36.6
130	20	4.192	4.313	3.997	3.091	3.225	2.904	256.8	263.0	251.3	39.6
140	20	2.731	2.844	2.591	2.090	2.191	1.950	266.6	273.3	257.4	42.7
150	19	1.860	1.950	1.724	1.426	1.496	1.321	267.0	278.1	258.2	45.7
160	18	1.263	1.337	1.194	.969	1.019	.898	267.3	275.2	259.6	48.8
170	10	.849	.896	.799	.659	.685	.609	270.3	275.3	262.2	51.8
180	6	.590	.609	.548	.457	.471	.426	270.2	271.4	267.5	54.9
190	1	.413	.413	.413	.312	.312	.312	263.6	263.6	263.6	57.9
200	--	--	--	--	--	--	--	--	--	--	--
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 7
Cape Kennedy Summary, March 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density (gm m ⁻³)			Pressure (mb)			Temperature (°K)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	27	43.731	45.277	41.578	27.605	28.339	26.352	219.9	223.8	215.9	24.4
90	28	26.941	27.611	26.260	17.445	17.964	16.934	225.5	230.6	221.7	27.4
100	28	16.531	17.049	15.947	11.152	11.636	10.766	235.0	241.7	230.2	30.5
110	28	10.398	10.805	10.005	7.252	7.616	6.979	242.9	247.9	236.2	33.5
120	28	6.660	6.911	6.391	4.786	5.046	4.604	250.4	255.9	245.1	36.6
130	27	4.310	4.561	4.118	3.192	3.384	3.055	257.8	262.7	253.6	39.6
140	26	2.853	3.032	2.680	2.160	2.278	2.070	263.7	272.0	258.2	42.7
150	25	1.905	2.004	1.815	1.471	1.554	1.401	269.1	275.3	263.6	45.7
160	23	1.296	1.366	1.242	1.008	1.062	.958	271.0	276.8	265.3	48.8
170	16	.885	.908	.843	.686	.702	.656	270.1	274.3	267.4	51.8
180	14	.609	.632	.591	.468	.480	.448	268.6	275.8	263.2	54.9
190	8	.419	.429	.409	.319	.331	.303	264.8	272.2	258.3	57.9
200	2	.287	.291	.284	.216	.219	.214	262.2	262.3	262.1	61.0
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 8
Cape Kennedy Summary, April 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density (gm m^{-3})			Pressure (mb)			Temperature ($^{\circ}\text{K}$)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	23	44.098	45.175	41.450	28.029	28.939	26.490	221.4	224.7	218.7	24.4
90	28	26.972	27.608	25.484	17.732	18.483	16.767	229.0	233.2	224.4	27.4
100	29	16.764	17.583	16.060	11.394	11.910	10.755	236.8	246.9	231.8	30.5
110	29	10.654	11.123	10.119	7.406	7.763	6.938	242.2	253.8	233.5	33.5
120	29	6.844	7.179	6.378	4.881	5.105	4.539	248.5	255.6	242.7	36.6
130	29	4.412	4.571	4.178	3.249	3.417	3.010	256.5	261.9	251.0	39.6
140	29	2.894	3.059	2.684	2.193	2.312	2.020	264.0	272.5	256.0	42.7
150	29	1.934	2.051	1.788	1.493	1.567	1.375	268.9	274.2	263.5	45.7
160	27	1.308	1.381	1.227	1.023	1.076	.936	272.6	278.6	265.8	48.8
170	27	.899	.958	.826	.703	.744	.640	272.6	279.1	265.1	51.8
180	22	.623	.665	.569	.481	.512	.438	269.4	282.2	263.4	54.9
190	7	.429	.453	.415	.328	.349	.319	266.5	274.4	261.8	57.9
200	--	--	--	--	--	--	--	--	--	--	--
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 9
Cape Kennedy Summary, May 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density (gm m^{-3})			Pressure (mb)			Temperature ($^{\circ}\text{K}$)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	23	44.699	45.670	43.981	28.618	29.025	28.272	223.0	225.2	218.8	24.4
90	29	27.549	28.079	27.012	18.196	18.523	17.897	230.1	233.7	225.1	27.4
100	29	17.204	17.587	16.580	11.719	11.946	11.421	237.3	248.1	231.1	30.5
110	28	10.936	11.237	10.631	7.638	7.930	7.398	243.3	253.4	237.9	33.5
120	27	7.011	7.190	6.738	5.038	5.300	4.865	250.3	256.9	243.5	36.6
130	27	4.536	4.695	4.339	3.366	3.572	3.254	258.4	265.4	252.1	39.6
140	25	2.973	3.111	2.892	2.276	2.442	2.200	266.6	273.5	260.1	42.7
150	25	1.993	2.113	1.907	1.556	1.682	1.505	272.0	277.7	266.6	45.7
160	23	1.361	1.442	1.322	1.069	1.167	1.031	273.7	281.9	268.7	48.8
170	19	.935	.971	.910	.729	.770	.706	271.8	280.0	267.4	51.8
180	15	.649	.681	.622	.501	.530	.482	269.0	277.0	264.4	54.9
190	8	.445	.456	.435	.339	.347	.331	265.0	271.3	258.2	57.9
200	1	.310	.310	.310	.237	.237	.237	266.2	266.2	266.2	61.0
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 10
Cape Kennedy Summary, June 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density (gm m^{-3})			Pressure (mb)			Temperature ($^{\circ}\text{K}$)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	19	45.978	47.710	45.007	29.341	29.951	28.951	222.5	225.5	220.1	24.4
90	19	28.211	28.838	27.456	18.606	19.001	18.290	229.8	235.0	225.8	27.4
100	19	17.669	17.981	17.219	11.950	12.314	11.674	235.6	240.3	230.6	30.5
110	19	11.153	11.364	10.800	7.775	8.064	7.515	242.8	251.5	234.5	33.5
120	19	7.160	7.473	6.886	5.122	5.342	4.903	249.2	254.7	244.4	36.6
130	19	4.629	4.804	4.420	3.415	3.595	3.225	257.0	265.3	247.7	39.6
140	19	3.024	3.168	2.867	2.307	2.440	2.159	265.6	273.4	259.1	42.7
150	19	2.031	2.128	1.917	1.574	1.670	1.468	269.9	277.4	261.1	45.7
160	16	1.388	1.453	1.306	1.081	1.155	1.004	271.4	281.7	262.6	48.8
170	15	.953	1.028	.883	.739	.799	.688	270.5	277.2	261.3	51.8
180	9	.653	.707	.619	.500	.538	.471	266.8	270.6	262.9	54.9
190	6	.448	.459	.440	.336	.342	.318	261.1	267.1	251.6	57.9
200	2	.307	.309	.306	.230	.231	.230	261.2	263.3	259.1	61.0
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 11
Cape Kennedy Summary, July 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density ($gm\ m^{-3}$)			Pressure (mb)			Temperature ($^{\circ}K$)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	33	45.927	47.048	45.065	29.418	29.921	28.794	223.1	224.9	220.5	24.4
90	33	28.449	29.097	27.594	18.636	18.957	18.264	228.2	235.4	224.4	27.4
100	34	17.766	18.595	17.262	11.972	12.704	11.686	234.7	244.3	230.2	30.5
110	34	11.233	11.789	10.929	7.766	8.252	7.543	240.8	245.0	235.3	33.5
120	34	7.182	7.649	6.952	5.094	5.444	4.942	247.1	253.8	240.5	36.6
130	34	4.632	4.991	4.493	3.384	3.607	3.279	254.5	261.8	245.5	39.6
140	34	3.032	3.240	2.858	2.276	2.414	2.184	261.5	274.4	254.9	42.7
150	34	2.017	2.126	1.928	1.544	1.640	1.474	266.7	277.3	259.3	45.7
160	34	1.364	1.437	1.304	1.055	1.128	1.002	269.4	278.5	259.7	48.8
170	31	.938	1.006	.888	.721	.779	.685	267.8	274.2	260.6	51.8
180	27	.643	.675	.607	.490	.538	.468	265.8	277.9	256.8	54.9
190	20	.438	.481	.419	.332	.370	.319	264.1	271.0	253.1	57.9
200	6	.302	.309	.292	.226	.234	.214	260.6	268.0	247.1	61.0
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 12
Cape Kennedy Summary, August 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density ($gm\ m^{-3}$)			Pressure (mb)			Temperature ($^{\circ}K$)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	30	45.992	47.359	43.488	29.354	30.041	27.629	222.3	224.6	219.5	24.4
90	30	28.363	28.971	26.707	18.568	19.102	17.387	228.0	233.8	222.0	27.4
100	30	17.679	18.250	16.497	11.885	12.228	11.136	234.2	240.1	228.2	30.5
110	30	11.158	11.569	10.456	7.707	8.025	7.218	240.6	249.4	235.9	33.5
120	30	7.151	7.439	6.613	5.055	5.330	4.750	246.2	256.2	240.9	36.6
130	29	4.592	4.783	4.259	3.352	3.564	3.167	254.3	263.6	248.3	39.6
140	28	3.004	3.177	2.796	2.252	2.368	2.134	261.2	270.0	253.9	42.7
150	27	2.010	2.110	1.913	1.527	1.614	1.439	264.6	270.6	260.1	45.7
160	27	1.348	1.444	1.251	1.041	1.102	.973	269.0	277.3	260.9	48.8
170	28	.926	.985	.868	.712	.783	.657	267.2	279.6	256.5	51.8
180	25	.633	.662	.597	.484	.515	.445	266.6	276.6	258.3	54.9
190	16	.437	.461	.406	.328	.353	.301	261.7	271.0	252.7	57.9
200	2	.305	.319	.291	.235	.241	.229	268.4	274.0	262.9	61.0
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 13
Cape Kennedy Summary, September 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density (gm m^{-3})			Pressure (mb)			Temperature ($^{\circ}\text{K}$)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	29	45.510	48.049	43.670	29.008	30.265	27.931	222.0	224.9	218.0	24.4
90	29	28.017	29.259	27.191	18.370	19.061	17.760	228.4	234.0	222.4	27.4
100	29	17.412	18.283	14.491	11.789	12.216	11.269	234.5	241.5	229.0	30.5
110	29	11.107	11.580	10.719	7.638	7.910	7.211	239.5	251.3	231.6	33.5
120	29	7.063	7.388	6.685	4.997	5.218	4.677	246.4	256.1	240.3	36.6
130	29	4.548	4.759	4.259	3.308	3.486	3.087	253.3	260.4	246.8	39.6
140	27	2.973	3.149	2.749	2.230	2.360	2.076	261.3	266.9	251.7	42.7
150	27	1.962	2.076	1.850	1.516	1.603	1.406	269.2	277.7	261.9	45.7
160	25	1.336	1.426	1.247	1.038	1.101	.953	270.6	277.3	261.3	48.8
170	23	.913	.974	.836	.711	.760	.647	271.3	280.9	258.0	51.8
180	20	.629	.674	.582	.487	.524	.436	269.6	275.9	261.3	54.9
190	12	.436	.460	.415	.334	.348	.321	266.6	276.4	262.7	57.9
200	1	.300	.300	.300	.229	.229	.229	266.3	266.3	266.3	61.0
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 14
Cape Kennedy Summary, October 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density ($gm\ m^{-3}$)			Pressure (mb)			Temperature ($^{\circ}K$)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	28	44.712	45.674	43.301	28.467	29.019	27.631	221.8	225.6	218.5	24.4
90	29	27.571	28.366	26.536	17.965	18.345	17.152	227.0	237.5	223.3	27.4
100	29	17.107	17.753	16.081	11.494	11.928	10.927	234.1	243.5	227.1	30.5
110	29	10.819	11.240	9.831	7.439	7.792	6.782	239.3	248.8	230.8	33.5
120	28	6.978	7.207	6.750	4.870	5.112	4.683	243.1	250.1	238.2	36.6
130	28	4.440	4.619	4.213	3.217	3.412	3.086	252.3	260.6	247.0	39.6
140	28	2.881	3.046	2.744	2.156	2.307	2.044	260.6	269.2	243.2	42.7
150	27	1.902	2.027	1.814	1.462	1.576	1.367	267.9	276.3	259.3	45.7
160	23	1.285	1.382	1.195	1.000	1.082	.929	270.9	276.6	265.7	48.8
170	20	.881	.937	.845	.685	.740	.657	271.0	276.2	265.5	51.8
180	12	.603	.649	.582	.471	.512	.449	271.8	276.9	262.6	54.9
190	7	.418	.456	.399	.321	.351	.303	268.0	273.8	256.5	57.9
200	1	.279	.279	.279	.217	.217	.217	270.4	270.4	270.4	61.0
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 15
Cape Kennedy Summary, November 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density (gm m ⁻³)			Pressure (mb)			Temperature (°K)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	29	43.859	45.237	42.041	27.809	28.561	27.077	220.9	228.6	216.1	24.4
90	29	37.988	27.742	26.359	17.555	17.975	16.924	226.6	231.3	221.2	27.4
100	29	16.809	17.362	16.254	11.210	11.554	10.711	232.3	242.8	224.0	30.5
110	29	10.616	10.954	10.095	7.241	7.523	6.857	237.6	243.4	231.7	33.5
120	29	6.757	7.104	6.478	4.729	4.913	4.432	243.8	252.5	235.1	36.6
130	29	4.323	4.525	4.038	3.127	3.251	2.914	252.0	261.8	240.5	39.6
140	29	2.824	2.976	2.608	2.092	2.180	1.950	258.2	271.6	246.3	42.7
150	28	1.864	1.972	1.726	1.411	1.491	1.325	263.9	274.6	253.4	45.7
160	26	1.244	1.306	1.172	.959	1.032	.896	268.8	280.5	262.0	48.8
170	22	.845	.915	.789	.653	.692	.611	269.4	279.9	261.4	51.8
180	12	.583	.609	.536	.446	.466	.420	266.9	273.6	257.8	54.9
190	3	.396	.407	.386	.297	.310	.286	261.3	265.1	258.0	57.9
200	--	--	--	--	--	--	--	--	--	--	--
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 16
Cape Kennedy Summary, December 1964-1966, 1300Z to 0000Z.

ALT KFT	N	Density ($gm\ m^{-3}$)			Pressure (mb)			Temperature ($^{\circ}K$)			ALT KMS
		AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	
80	39	43.738	44.978	42.058	27.370	28.042	26.812	218.0	226.9	213.2	24.4
90	40	26.593	27.703	25.640	17.205	17.743	16.791	225.4	235.8	215.5	27.4
100	40	16.434	16.919	15.921	10.973	11.497	10.552	232.6	243.2	220.5	30.5
110	40	10.399	10.860	9.980	7.081	7.471	6.735	237.2	244.7	229.4	33.5
120	39	6.618	7.061	6.271	4.617	4.894	4.348	243.1	252.4	233.2	36.6
130	39	4.197	4.561	3.960	3.053	3.227	2.855	253.5	264.6	241.3	39.6
140	39	2.719	2.861	2.532	2.052	2.176	1.902	263.0	278.1	251.5	42.7
150	38	1.793	1.911	1.639	1.396	1.474	1.300	271.3	285.0	255.0	45.7
160	38	1.221	1.287	1.107	.959	1.015	.890	273.9	284.0	258.6	48.8
170	34	.844	.904	.779	.658	.699	.607	271.7	287.3	262.0	51.8
180	30	.586	.629	.532	.451	.484	.415	268.1	280.9	256.3	54.9
190	14	.408	.430	.366	.312	.328	.288	266.6	276.8	260.1	57.9
200	1	.290	.290	.290	.224	.224	.224	269.5	269.5	269.5	61.0
210	--	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--

TABLE 17

Mean Monthly Temperatures at 160,000 Feet
and at the Stratopause.

Month	Mean Temp (°K) (160,000 ft)	Mean Height of Stratopause (ft)	Mean Temperature at Stratopause (°K)
Jan	273.2	160,000	273.2
Feb	267.3	170,000	270.0
Mar	271.0	160,000	271.0
Apr	272.6	160,000/170,000	272.6
May	273.7	160,000	273.7
Jun	271.4	160,000	271.4
Jul	269.4	160,000	269.4
Aug	269.0	160,000	269.0
Sep	270.6	170,000	271.3
Oct	270.9	180,000	271.8
Nov	268.8	170,000	269.4
Dec	273.9	160,000	273.9

TABLE 18

Cape Kennedy Distribution of Observations of Density
at 160,000 Feet, 1964-1966.

GMT	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	EST
0330-0429	--	--	--	--	--	--	--	--	--	--	--	--	2230-2329
0430-0529	--	--	--	--	--	--	1	--	--	--	--	--	2330-0029
0530-0629	--	--	--	--	--	--	--	--	--	--	--	--	0030-0129
0630-0729	--	--	--	--	--	--	--	--	--	--	--	--	0130-0229
0730-0829	--	--	--	--	1	--	--	--	--	--	--	--	0230-0329
0830-0929	--	--	--	--	2	--	1	--	--	--	--	--	0330-0429
0930-1029	--	--	3	--	--	--	--	--	--	--	--	--	0430-0529
1030-1129	--	1	2	--	--	--	2	--	1	--	--	--	0530-0629
1130-1229	--	2	--	--	--	--	--	1	--	--	--	--	0630-0729
1230-1329	--	4	--	--	--	--	3	--	1	--	--	--	0730-0829
1330-1429	2	1	--	--	1	1	2	1	1	--	--	1	0830-0929
1430-1530	11	5	14	11	7	8	11	11	7	9	7	22	0930-1030
1531-1630	5	3	4	10	9	5	12	9	12	12	11	6	1031-1130
1631-1730	3	1	3	3	4	1	3	3	2	--	3	3	1131-1230
1731-1830	1	1	--	2	--	1	--	1	1	1	1	1	1231-1330
1831-1930	1	1	1	--	--	2	--	--	1	--	1	2	1331-1430
1931-2030	2	--	1	--	--	--	--	--	--	--	--	2	1431-1530
2031-2130	--	--	--	--	1	--	1	1	--	--	1	--	1531-1630
2131-2230	1	--	--	1	--	--	1	1	--	--	1	--	1631-1730
2231-2330	1	3	--	--	--	--	1	--	--	--	1	1	1731-1830
2331-0030	--	2	--	--	2	--	--	--	--	--	--	--	1831-1930
0031-0130	1	--	--	--	--	--	--	--	--	--	--	--	1931-2030
0131-0230	--	--	--	--	--	--	--	--	--	1	--	3	2031-2130
0231-0329	1	--	--	--	2	--	--	--	1	--	--	1	2131-2229

TABLE 19
Cape Kennedy Mean Densities, 160,000 Feet, 1964-1966.

GMT	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	EST
0330-0429	--	--	--	--	--	--	--	--	--	--	--	--	2230-2329
0430-0529	--	--	--	--	--	--	1.380	--	--	--	--	--	2330-0029
0530-0629	--	--	--	--	--	--	--	--	--	--	--	--	0030-0129
0630-0729	--	--	--	--	1.297	--	--	--	--	--	--	--	0130-0229
0730-0829	--	--	--	--	1.311	--	1.287	--	--	--	--	--	0230-0329
0830-0929	--	--	1.240	--	--	--	--	--	--	--	--	--	0330-0429
0930-1029	--	--	1.241	--	--	--	1.364	--	--	--	--	--	0430-0529
1030-1129	--	--	--	--	--	--	--	--	1.295	--	--	--	0530-0629
1130-1229	--	1.261	--	--	--	--	--	--	--	--	--	--	0630-0729
1230-1329	--	1.252	--	--	--	--	1.329	--	--	--	--	--	0730-0829
1330-1429	1.278	1.214	--	--	1.387	1.331	1.358	1.394	1.322	--	--	1.155	0830-0929
1430-1530	1.257	1.275	1.293	1.316	1.363	1.414	1.371	1.355	1.346	1.273	1.258	1.220	0930-1030
1531-1630	1.247	1.274	1.307	1.292	1.358	1.377	1.361	1.337	1.345	1.297	1.253	1.209	1031-1130
1631-1730	1.286	1.265	1.305	1.304	1.343	1.344	1.356	1.357	1.322	--	1.224	1.236	1131-1230
1731-1830	1.353	1.337	--	1.322	--	1.345	--	1.334	1.257	1.282	1.306	1.287	1231-1330
1831-1930	1.227	1.259	1.271	--	--	--	--	--	1.385	--	1.197	1.236	1331-1430
1931-2030	1.246	--	1.293	--	--	--	--	--	--	--	--	1.260	1431-1530
2031-2130	--	--	--	--	1.417	--	1.389	1.305	--	--	--	--	1531-1630
2131-2230	1.191	--	--	1.294	--	--	1.417	1.377	--	--	1.233	--	1631-1730
2231-2330	1.229	1.263	--	--	--	--	1.371	--	--	--	1.178	1.172	1731-1830
2331-0030	--	1.185	--	--	1.392	--	--	--	--	--	--	--	1831-1930
0031-0130	1.189	--	--	--	--	--	--	--	--	--	--	--	1931-2030
0131-0230	--	--	--	--	--	--	--	--	--	1.260	--	1.202	2031-2130
0231-0329	1.179	--	--	--	1.322	--	--	--	1.247	--	--	1.148	2131-2229

TABLE 20

Frequency Distribution of Interdiurnal Density Changes.

Time ±1 Hr	Magnitude of Density Change (%)					Max (%)	Mean (%)	N
	0-1.0	1.1-3.0	3.1-5.0	5.1-10.0	> 10.0			
24	17	12	9	6	--	6.8	2.2	44
48	5	10	10	6	--	6.0	3.0	31
72	8	13	4	2	1	10.1	2.5	28
96	5	16	8	5	1	10.2	3.1	35
120	6	12	9	4	--	8.5	2.8	31
144	11	10	7	4	--	6.9	2.2	32
168	11	19	7	7	--	9.2	2.9	44
192	9	17	6	3	--	10.0	2.6	35
216	7	10	8	2	--	6.8	2.4	27
240	8	12	3	5	--	10.0	2.7	28

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) HQ USAF Environmental Technical Applications Center (MAC), Bldg 159, Navy Yard Annex Washington, D. C. 20333		2a. REPORT SECURITY CLASSIFICATION Unclassified	
		2b. GROUP N/A	
3. REPORT TITLE Summaries of Pressure, Temperature, and Density over Cape Kennedy AFS, Including Periodic Density Variations			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) N/A			
5. AUTHOR(S) (First name, middle initial, last name) Major Edward V. Von Gohren, USAF			
6. REPORT DATE August 1967	7a. TOTAL NO. OF PAGES 32	7b. NO. OF REFS 18	
8a. CONTRACT OR GRANT NO. N/A	9a. ORIGINATOR'S REPORT NUMBER(S) Air Weather Service Technical Report 197		
b. PROJECT NO.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) N/A		
c.			
d.			
10. DISTRIBUTION STATEMENT This document has been approved for public release and sale; its distribution is unlimited.			
11. SUPPLEMENTARY NOTES N/A		12. SPONSORING MILITARY ACTIVITY Hq Air Weather Service (MAC) Scott AFB Illinois 62226	
13. ABSTRACT Summaries of ARCASONDE 1A meteorological rocket thermodynamic data are presented for Cape Kennedy AFS based on data acquired in 1964-1966. Extremes, means, and standard deviations as a function of month and season are shown for altitudes of 80,000 feet through 200,000 feet. The data are statistically treated to provide an estimate of seasonal, diurnal, and interdiurnal periodicities at 160,000 feet over Cape Kennedy AFS. A nomogram of the atmospheric density as a function of local time and month is presented.			

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Density summaries, periodicities Pressure summaries Temperature summaries Meteorological rocket Diurnal density variations Seasonal density variations Atmospheric re-entry						