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Sequential High-Resolution Wind Profile Measurements

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SEQUENTIAL HIGH-RESOLUTION WIND PROFILE MEASUREMENTS

I. INTRODUCTION

A. Background

Acquisition of high-resolution or detailed wind profile measurements within the troposphere and lower stratosphere has been possible during the past decade because of the development of two measurement systems. One is the optical smoke trail technique whereby a three-station camera network is utilized to observe the behavior of the wind-blown smoke trail produced by a rocket as it ascends. The other system involves use of a specially designed constant-volume balloon tracked by a high-precision radar. While both systems produce accurate data, the smoke trail system involves a relatively costly rocket and delivery unit, is restricted to usage during good visual atmospheric conditions, requires an elaborate data reduction scheme, and is more expensive. The constant-volume balloon (or Jimsphere-radar system), however, does not have any of these restrictions. Therefore, the Jimsphere system has been utilized to acquire a very unique set of wind profile measurements. These measurements are the subject of this report and consist of sequential data sets acquired during the last decade at Cape Canaveral, Florida, site of the Eastern Test Range and Point Mugu, California, site of the Pacific Missile Range.

The sequential data sets consist of three or more Jimsphere-radar wind profile measurements made over a period of hours (varying from approximately 6 to 24 h) with time separations of 1.5 to approximately 3 h. Horizontal wind speed and direction at 25 m intervals from near the surface to approximately 18 km altitude were acquired. This system allows wind measurement throughout the troposphere and lower stratosphere. Additional information regarding the vertical wind component can also be derived from variations in the vertical rise rate of the Jimsphere balloon. Although not available with the data sets described in this report, there are high-resolution temperature profile data, measured simultaneously with the wind speed and direction profile data, taken during selected measurement programs that used the Jimsonde balloon system.

This report contains a selection of sequential Jimsphere-radar wind profiles for the Cape Canaveral, Florida, and Point Mugu, California, measurement sites. Table 1 provides an inventory of currently available sequential Jimsphere wind profile sets. The data presented in Appendix A do not constitute all the available sequential data sets, but do provide a sample which exhibits the principal features discussed in this report.

TABLE 1. SEQUENTIAL JIMSPHERE WIND PROFILE DATA SET INVENTORY

Cape Canaveral, Florida	173
Point Mugu, California	31
Wallops Island, Virginia	18
White Sands, New Mexico	23
Green River, Utah	30
Vandenberg AFB, California	13

These data sets are indeed unique and provide the basis for studies of both an engineering and disciplinary nature into the mesoscale characteristics of the wind flow structure in the troposphere and lower stratosphere. Inquiries concerning the availability of magnetic data tape copies of these data sets should be directed to the Atmospheric Sciences Division of the Space Sciences Laboratory, NASA, Marshall Space Flight Center, Alabama 35812.

B. Purpose

This report is directed to two groups of investigators: those involved in engineering studies concerning aerospace vehicles (rockets, space vehicles, and aircraft) and those involved in disciplinary studies concerning mesoscale characteristics of the wind flow in the troposphere and lower stratosphere. Accordingly, the three appendices of this report have been prepared to provide both groups with pertinent data records applicable to their respective interests and interface areas of concern. In addition, the report will provide some discussion of the data sets to bring the reader's attention to various characteristics of the wind profile structure and associated data in the appendices.

1. Engineering. Although these unique data sets contain a wealth of information applicable to a number of disciplinary investigations, the original use for which these data were acquired, and the use for which they continue to provide important inputs, is in the aerospace vehicle engineering area. All near vertically rising vehicles have one point in common: the susceptibility or vulnerability of their structural and control systems to the wind profile characteristics through which they must perform. Therefore, their performance

under operational conditions is directly proportional to the design ability of the systems relative to the wind characteristics measured and specified for the vehicle development.

A multitude of vehicle responses are affected by the forces produced as a result of the wind profile. These are especially critical during the higher dynamic pressure portion of the flight path or trajectory. Furthermore, these responses are a function of trajectory shaping, control system gains, structural damping, vehicle configuration, operational characteristics, etc. In addition, the wind flow within the troposphere and stratosphere (the major area of concern to the design of an aerospace vehicle) is such that no two wind profile measurements are exactly alike. The wind flow is a highly variable environment in space and time. As a result of these two situations, it is essentially impossible to develop either a single vehicle analytical model from which all wind response related design calculations can be accomplished or a single wind profile model from which all wind input characteristics related to design calculations can be obtained to insure operational integrity.

One important purpose of this report, from an engineering viewpoint, is the desire on the part of the authors to provide those engineers concerned with wind inputs a selected set of accurate wind profile measurements from which they can gain an appreciation of the behavior of the wind structure through which the vehicles they are designing must perform. This appreciation of the wind behavior cannot be obtained from wind models ordinarily used with analytical vehicle design models. Accordingly, the engineering oriented investigator will find Appendix A, Cape Canaveral and Point Mugu sequential wind speed and direction plots, of primary interest. However, the reader is cautioned to remember that the data sets provided do not constitute a valid statistical sample from the viewpoint of representativeness of all possible wind shear, gust, and profile characteristics. Additional efforts are being made to acquire a larger data sample.

2. <u>Disciplinary</u>. Investigations regarding wave structure, propagation within the atmosphere, and influence of the waves on the wind flow characteristics are a prime area which can benefit from these data sets. Studies of the behavior of the mesoscale features versus the turbulent and larger scale flow character as a function of altitude and time is another obvious area of application. The search for triggering mechanisms which produce the various mesoscale features and the role of these features in, perhaps, triggering other atmospheric processes is another research area to which the data sets can be applied. Comparative analyses of wind profile features, their change with time, and association with other observable atmospheric processes as revealed by rawinsonde and satellite observations and synoptic map analyses is an area of potential research value.

It is with these and other considerations in mind that the authors have provided Appendices B and C. Appendix B contains plots of the available temperature profiles acquired by rawinsonde measurements during the period when the sequential Jimsphere wind profile measurements were made. Appendix C provides copies of the surface synoptic charts and 200 mb charts during the same time periods.

C. Measurement System and Data Reduction

The measurement system consists of a 2 m diameter, 0.5 mil mylar (aluminized), constant-volume balloon. The balloon itself weighs approximately 400 gm and contains 398 conical protrusions, equally distributed over the surface, each of which is 7.5 cm in base diameter and 8 cm in height (Fig. 1). A valve in the balloon maintains in excess of 5 mb overpressure. The tracking radar is an AN/FPS-16 or equivalent high-precision radar system and provides space position (range, azimuth, and elevation) data each 0.1 s of flight for the Jimsphere balloon, which rises at a rate of approximately 300 m/min with a floating altitude near 18 km. The radar tracking accuracy (RMS) is 4.6 m in range and 0.01 deg in angular measurement (azimuth and elevation angle). The scheme as utilized in acquisition of data for prelaunch monitorship of aerospace vehicle launches is illustrated in Figure 2.

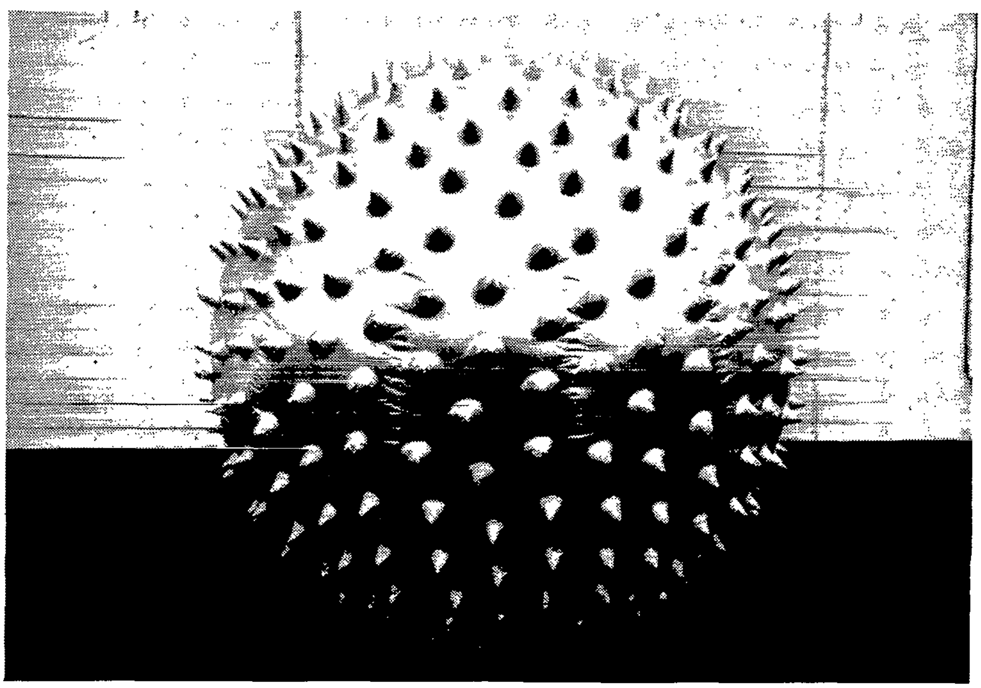

Figure 1. The Jimsphere balloon configuration. (Note the conical roughness elements.)

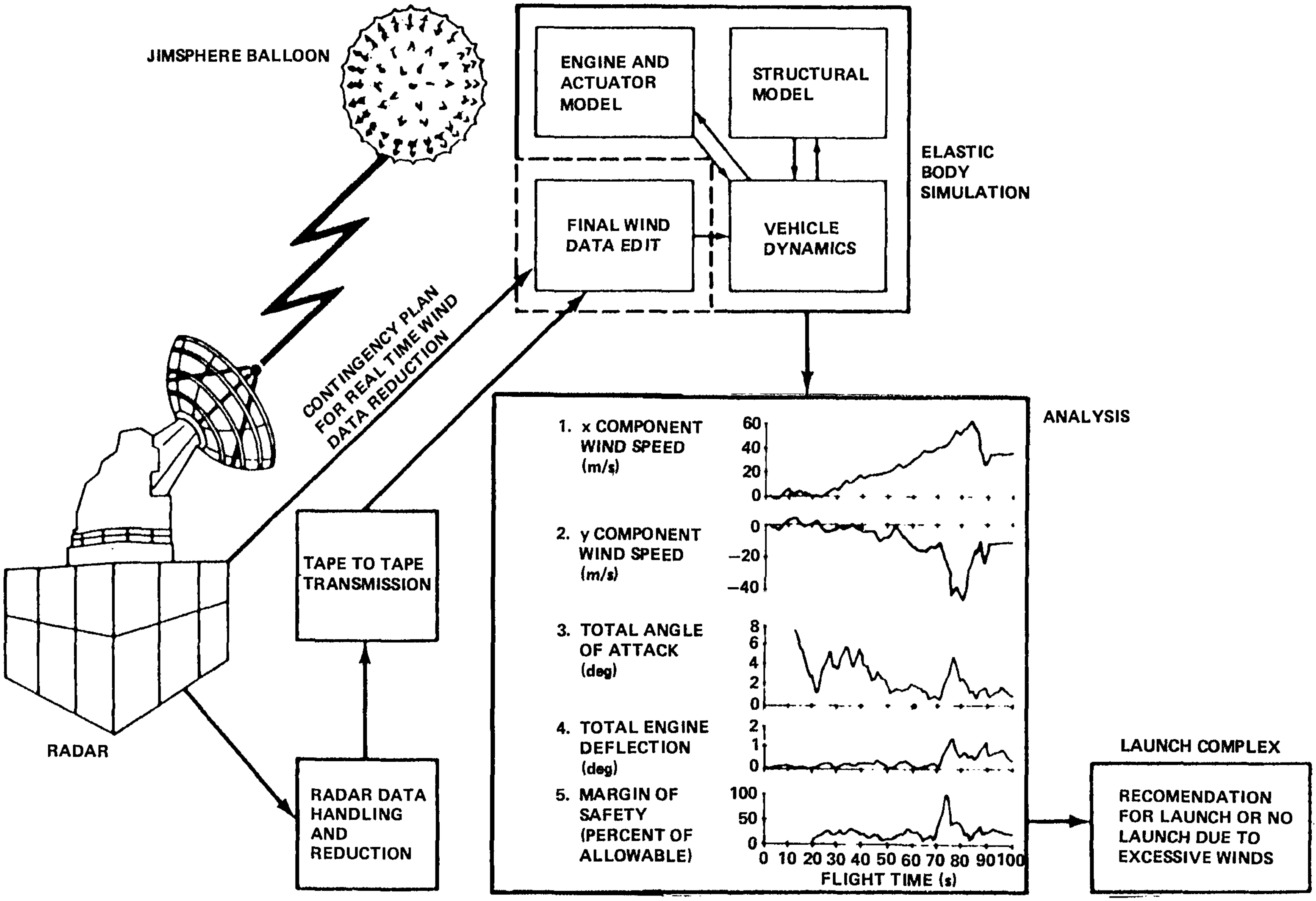

Figure 2. Operation of the FPS-16 radar/Jimsphere system.

Data reduction is accomplished by a smoothing routine over the position data to eliminate spurious tracking errors. The smoothing routine is applied to the reduced X, Y, and Z position data over a 25 m interval. The resulting data are differenced over 50 m intervals to produce wind profile data points. Figure 3 provides an error analysis result which illustrates the accuracy of the wind profile data points. Figure 4 provides a plot which demonstrates the relative frequency resolution in the Jimsphere relative to that of the conventional rawinsonde wind profile measurement system.

A multitude of studies and reports have been prepared concerning the Jimsphere-radar measurement system, data reduction scheme, system performance, and Jimsphere performance and design. The reader is invited to consult the bibliography for appropriate reports or articles on this subject.

In summary, the Jimsphere-radar system provides a wind profile measurement from the surface to an altitude of 18 km in slightly less than 1 h with a vertical spatial frequency resolution of 1 cycle/100 m and an RMS error of approximately 0.5 m/s or less for wind velocities averaged over 50 m intervals. This provides better than an order-of-magnitude accuracy improvement over the conventional rawinsonde wind profile measuring system.

II. DATA DESCRIPTION

A. Specific Characteristics

The most significant features of the wind profile are wind speed and direction fluctuations which persist, often throughout the whole series, at approximately the same altitude. One way of viewing the nature and characteristics of these fluctuations is by considering perturbations about a mean wind profile which should remain constant — or nearly constant — throughout the period of observation. Even a brief review of the profiles given in Appendix A reveals the various scales of perturbations that may exist in the atmosphere and their persistence or lack of persistence. Specifically, the following categories of wind speed perturbations may be recognized:

1) Large-scale (jet stream) perturbations having a vertical wavelength generally greater than approximately 5 km and an amplitude greater than 20 m/s and usually persisting unchanged throughout the series. The sequential series No. 8 is a good example which shows this macroscale feature.

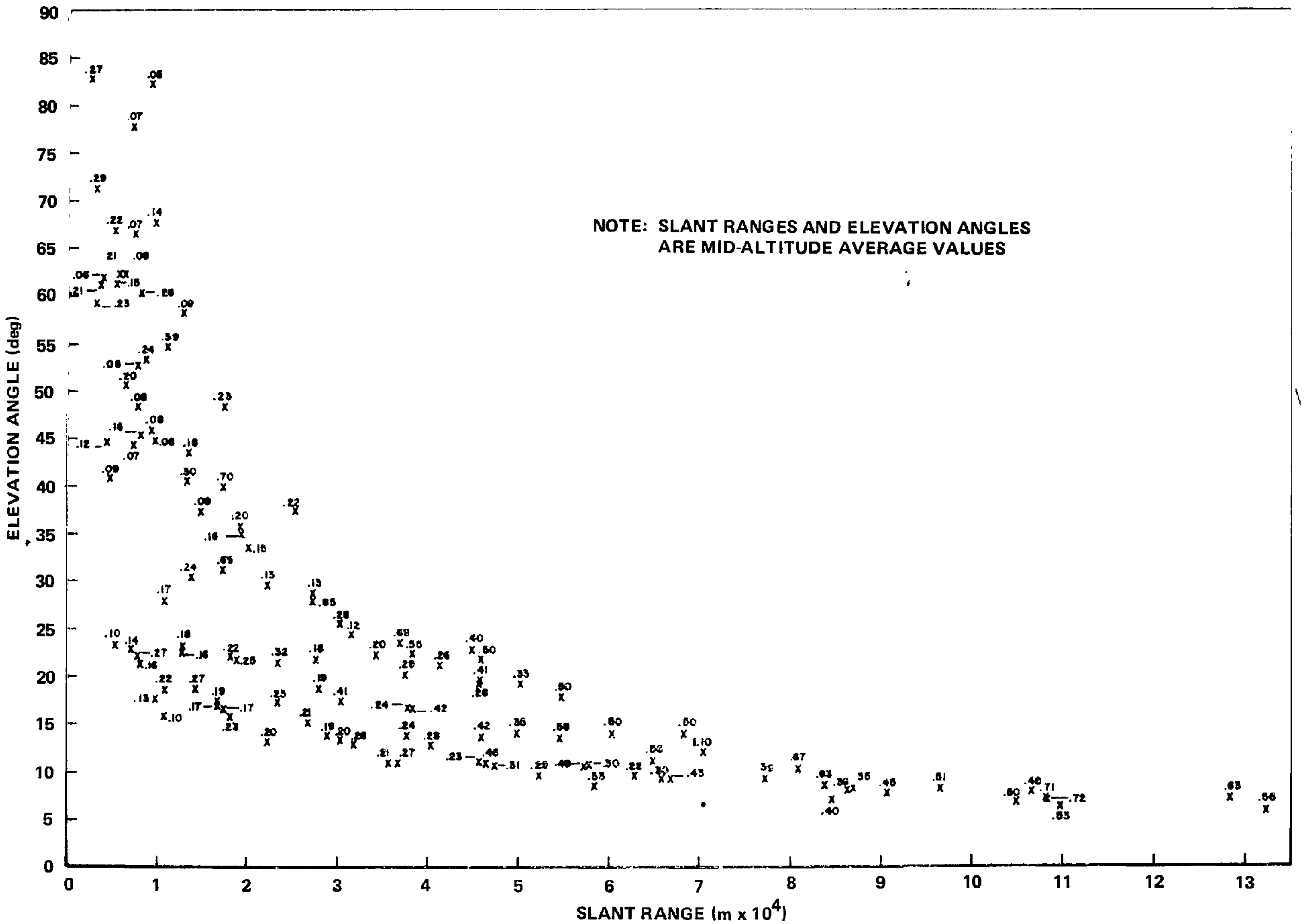

Figure 3. RMS errors of wind speed (V) as a function of slant range (R) versus elevation angle (θ) for dual FPS-16 radar/Jimsphere tracking at Cape Canaveral, Florida.

NOTE: R represents the fraction of amplitude of wind variation included in rawinsonde measurements as function of wavelength.

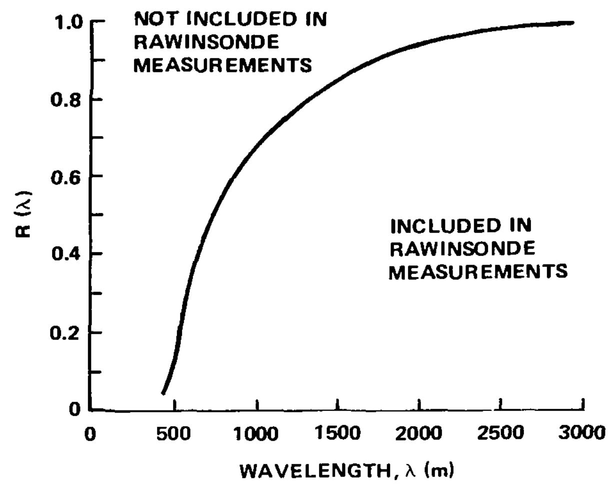

Figure 4. Approximate response function for rawinsonde (GMD-1B) system based on standard rawinsonde reduction techniques.

2) Mesoscale perturbations having a vertical wavelength from approximately 0.2 to 2 km and an amplitude up to approximately 15 m/s. Individual wind speed maximums from these perturbations persist from several hours to a time period longer than that over which the sequential measurements were taken. Often the amplitude and occasionally the vertical wavelength of the perturbations change considerably from one profile to the next so that successive perturbations are not exact replicas of each other yet can still be identified as the same feature rather easily. The sequential profile set No. 23 is an excellent example of this feature.

3) Small-scale (turbulence) perturbations having a vertical wavelength less than approximately 500 m and an amplitude up to approximately 6 m/s. These oscillations differ from the small mesoscale features principally because of their highly transient nature. They are common perturbations on a given profile but lack continuity in time. The profiles given in series No. 47 demonstrate these turbulent (microscale) perturbations.

Several examples of specific profiles may help in developing a frame of reference for the specific wind profile features such as (1) jet stream winds and associated wind shear, (2) sinusoidal variation in wind with altitude, (3) high winds over a broad altitude range, (4) light winds throughout the troposphere, and (5) discrete gusts. Jet stream winds (Fig. 5) are quite common during the winter months and can reach magnitudes in excess of 100 m/s. These winds often occur over a limited altitude range and produce large wind shears over several kilometers. Directional variations in the profile are usually at a minimum. Figure 6 depicts a wind profile with sinusoidal behavior. These sinusoidal features vary in amplitude, wavelength, and cycles. They are especially noticeable in the portion of the wind profile measurement that extends into the relatively stable layered structure of the stratosphere where the persistence of buoyancy or internal gravity waves is most evident. Figure 7 is an excellent example of high winds over a large altitude range. Notice that the wind speeds exceeded 50 m/s for over 10 km in altitude. Figure 8 shows a wind profile with speeds less than 15 m/s and is typical of the summer season. Figure 9 shows two examples of single discrete mesoscale gust features that may occur at any altitude and speed of the wind profile.

Although three categories of wind speed perturbations were identified earlier in this section, it should be noted that a spectra study based on a sample of profiles did not show any preferred frequencies that correspond to the terminology "large-scale," "mesoscale," or "small-scale." There appears to be no clear-cut, natural separation between the different scales of motion. Instead, as far as spectrum shape is concerned, divisions between scales or categories may be selected on an arbitrary basis. The mesoscale category of wind speed perturbation has a significant interest to both engineering and disciplinary studies. Figure 10 provides an example of some common changes in mesoscale perturbations.

B. Discussion

1. Engineering Application. The various features of the wind profiles and their behavior as a function of time and altitude are of considerable importance in the design and operation of aerospace vehicles. The recent advent of high-rate-of-climb aircraft adds another vehicle to the existing important class of vertically rising rockets and space vehicles. The influence of low frequency or mean wind profile features can often be accommodated by wind biasing or trajectory shaping techniques. Conceptually, this can be employed on relatively short time notice prior to actual flight. At least in theory this could eliminate a considerable portion of the forcing function created on the structural and control system due to this category of wind speed perturbation where demanded by a particular vehicle's development limitations and operational requirements. However, the two other categories of the wind profile perturbations must be

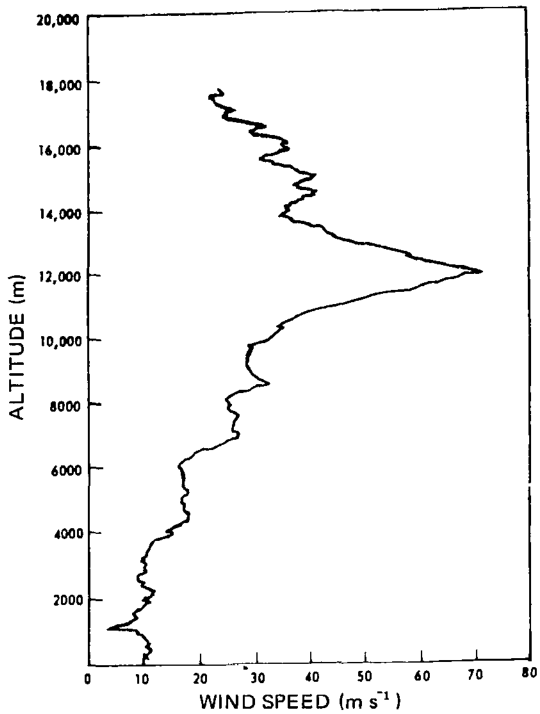

Figure 5. Example of jet stream winds.

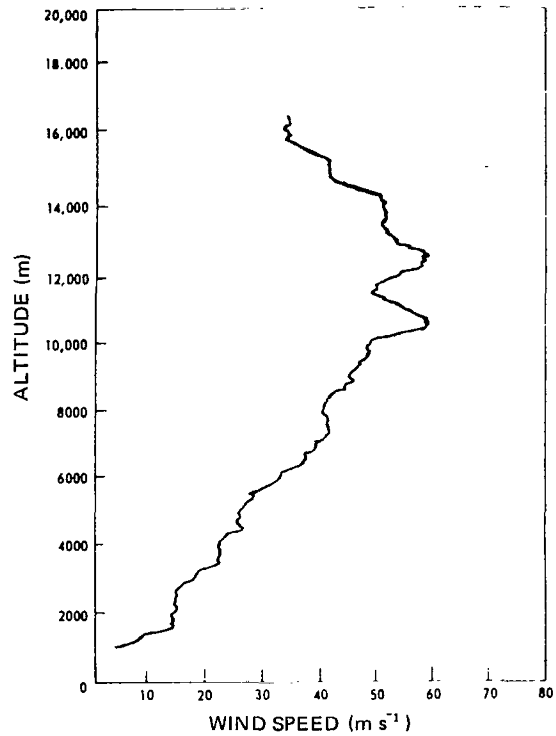

Figure 6. Example of sine wave flow in the 10 to 14 km altitude region.

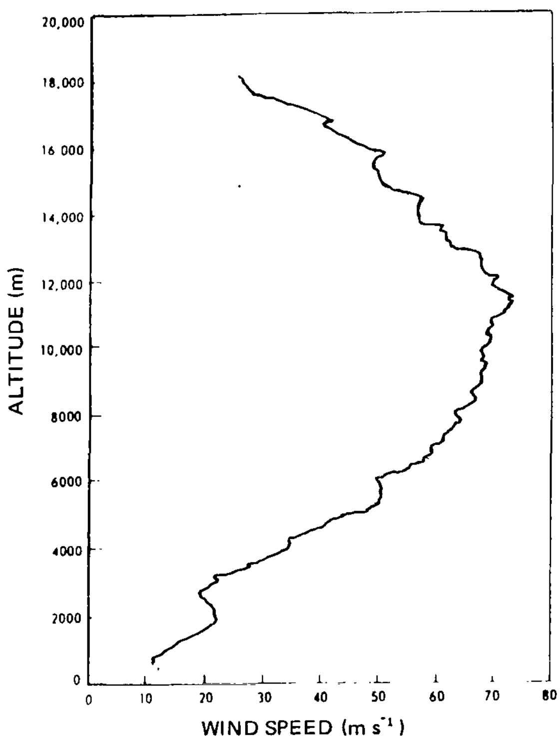

Figure 7. Example of high wind speeds over a deep altitude layer.

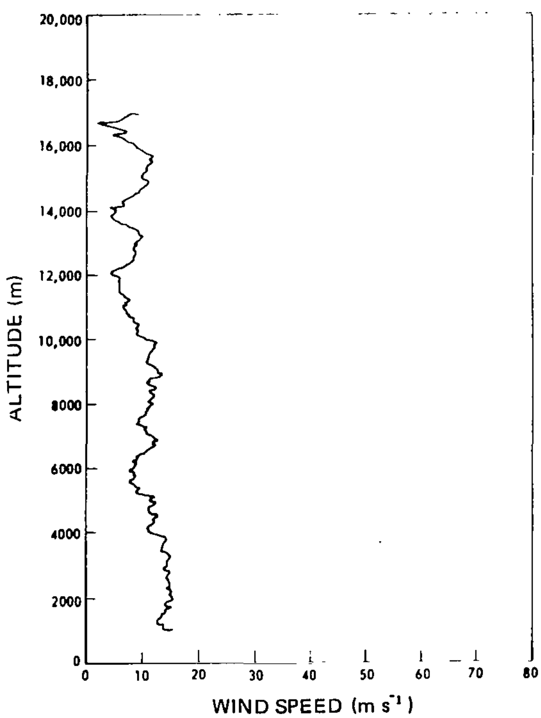

Figure 8. Example of low wind speeds.

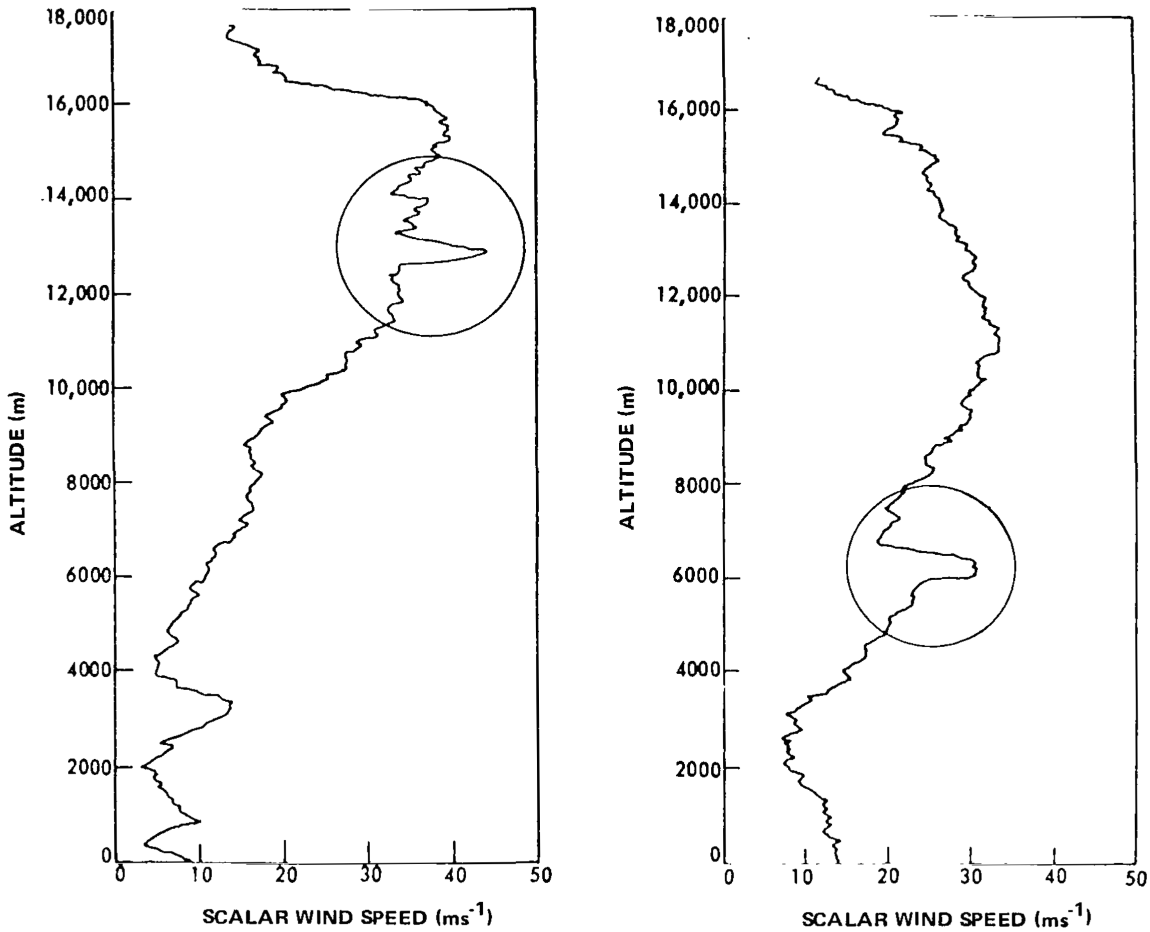

Figure 9. Examples of discrete gusts.

accounted for within the design of the vehicle system or avoided if possible during operations. There is no way to avoid the small-scale or turbulent category of the wind profile; therefore, it must be incorporated into the design at a minimum risk level and allowed for in any prelaunch monitorship simulation since it cannot be predicted in a deterministic manner for expected launch inflight winds. This leaves the mesoscale category of wind profile features. It is this category that contains the frequencies of most concern to structural and control system responses.

A number of attempts have been made to represent the mesoscale category of the wind profile in a suitable form for use in vehicle engineering studies. Most attempts have resulted in descriptions that could be used for specific

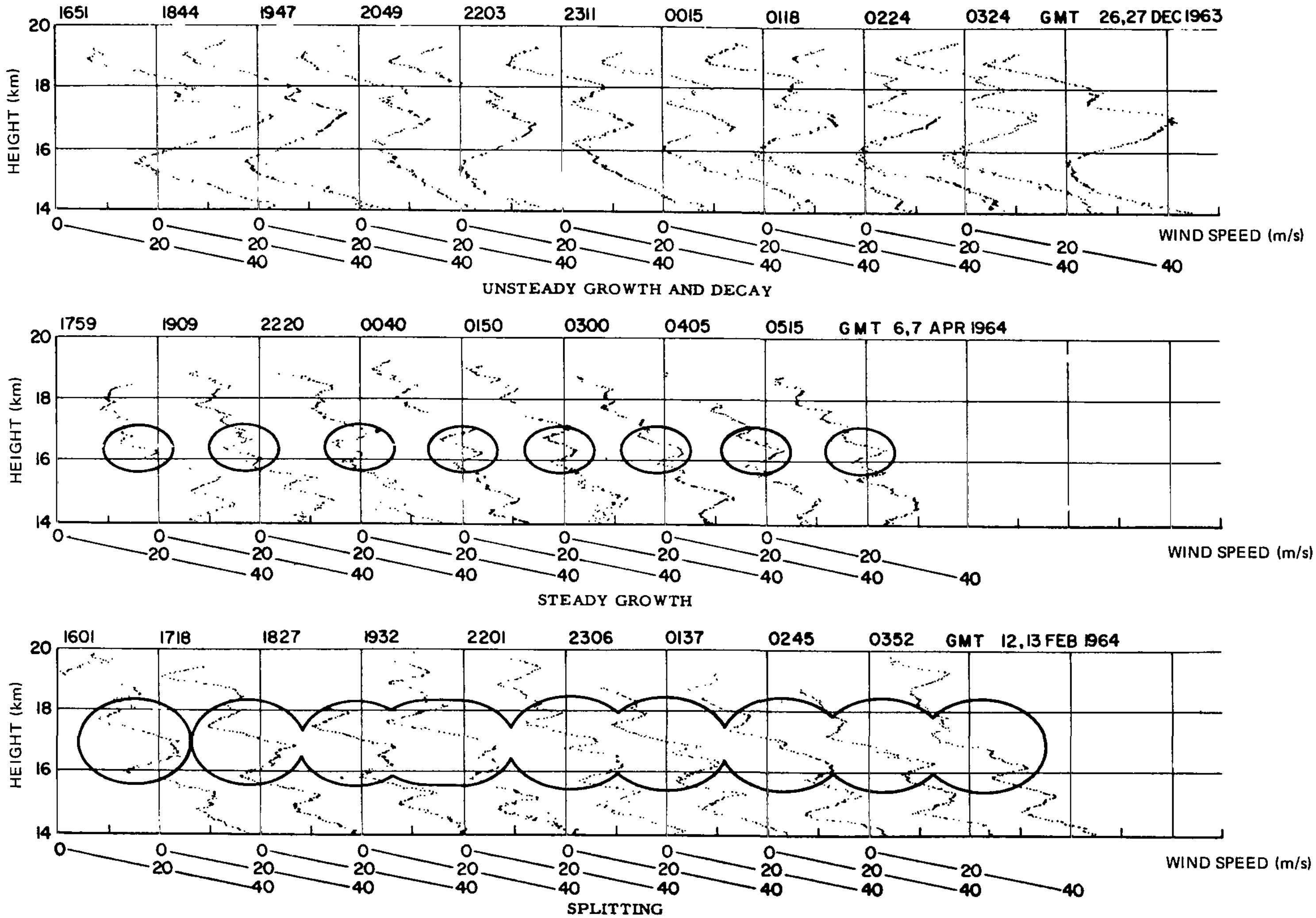

Figure 10. Common changes in mesoscale perturbations.

applications, but, to date, no universal representation has been formulated. Discrete and continuous mesoscale wind structure representations have been given. The discrete representations take the form of relatively well-defined, sharp-edged, and repeated sinusoidal characteristics. Sharp-edge discrete mesoscale features represented by a quasi-square wave with an amplitude of approximately 9 m/s is one representation. These are often referred to as embedded jets or singularities in the vehicle wind profile and may be observed to develop and persist in the sequential profile measurements given in Appendix A. Figure 9 gives excellent examples of this discrete feature in the wind profile. Another form of discrete mesoscale features that has been observed is approximately sinusoidal in nature. An analysis concentrating on this feature resulted in the data given in Figure 11. This figure illustrates the approximate number and amplitude of consecutive sinusoidal-type features that may occur for aerospace vehicle engineering analysis purposes. It is very important to recognize that oscillations in the vertical wind profile structure having a pure sinusoidal representation are rarely, if ever, observed in nature.

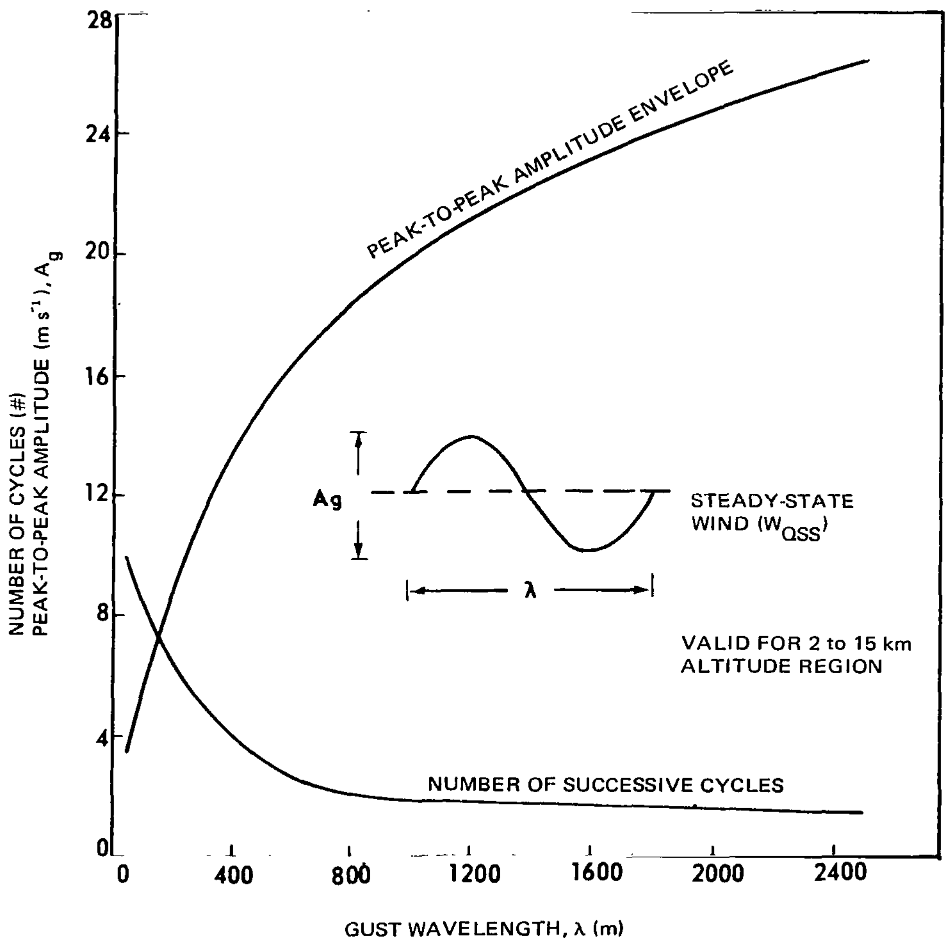

Figure 11. Best estimate of expected gust amplitude and number of cycles as a function of gust wavelengths.

The continuous mesoscale feature representations take the form of spectra. In general, the smaller-scale motions associated with vertical detailed wind profiles are characterized by a superposition of discrete gusts and many random frequency components. Spectral methods have been employed to specify the characteristics of this superposition. Spectra have been computed, and Figure 12 provides one result from this analysis, applicable to the 4 to 16 km altitude range. It has been shown that the energy of the small-scale motions is not vertically homogeneous and may be larger than shown for limited altitude intervals and frequency bands.

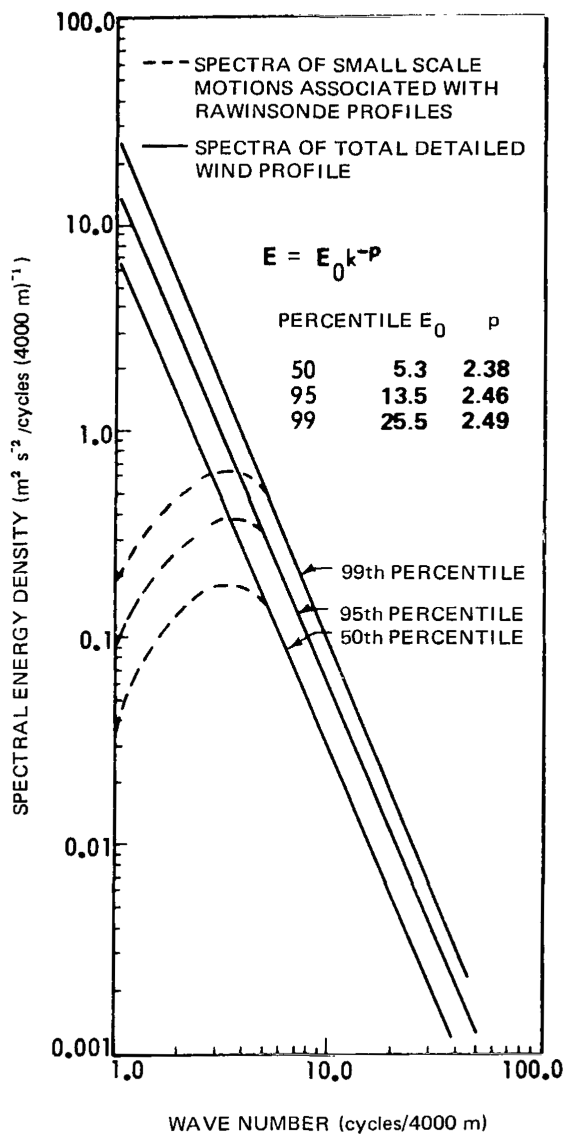

Figure 12. Spectra of detailed wind profiles.

Use of continuous or power spectrum methods in dynamic response calculations was an important step forward over the existing discrete gust method because it took account of the correct variation of energy with wavelength. However, by incorporating the variation of intensity with gradient distance in the discrete gust method, one can equally include the correct scaling with respect to wavelength. The power spectrum model is concerned with average energy in relatively long patches of wind perturbations and its distribution with wavelength. The discrete gust method is concerned with large local energy concentrations as represented by a localized gradient in the spatial distribution of the wind perturbation. In any particular engineering design situation the choice of an appropriate wind perturbation model will depend upon the application. In the case of aircraft, for example, the discrete gust method is well suited to treatment of rigid body modes relevant to assessment of control and handling qualities, since these modes need to be well damped. The power spectrum method, however, is appropriate in the case of loads at points in the structure where the dominant response is from a lightly damped structural mode.

The mesoscale perturbations shown by the sequential wind profile measurements in this report are of a frequency that affects the performance and response of vertically rising aerospace vehicles. It is important that they be included in the design and that the vehicle be capable of performing under their influence. It is also important to anticipate for major launch operations the magnitude and characteristics of such oscillations, at least within the range of wavelengths which might trigger response frequencies in the rising vehicle. This would call for highly sophisticated forecasting procedures which, without knowledge of the physical nature of these oscillations, would have to be based entirely on statistical findings. A large data base would be required. Even though some of the observed oscillations persist for several hours, we do not yet know what causes their appearance or disappearance in any specific sequence of measurements, nor what maintains them while they are observed. Therefore, based upon the available data analyses and evidence of physical processes responsible for the observed oscillations, only short-term forecasts, not to exceed 1 to 3 h, could be issued. From a single sounding there is no indication available on what possible development the measured mesoscale perturbations might undergo. This is readily evident by observing the behavior of the sequential data sets provided in Appendix A.

2. Disciplinary Application. The observed mesoscale oscillations must be associated with ageostrophic flow, since the observed detailed shears cannot be accounted for quantitatively by the thermal wind equation through the levels in question. The limitations of the measurements due to (a) single site representations, (b) lack of comparable high-resolution temperature profile data, and

(c) the fact that they are in a quasi-Eulerian coordinate system make model development or verifications tentative. The apparent simplicity of the flows at the stable levels of the atmosphere, as is especially evident in the stratosphere portion of profile measurements, suggests the dominant influence of buoyancy or internal gravity waves. Within the troposphere the complex flow structure and evident interactions due to convective activity make identification of sources for the mesoscale features difficult and cause a relatively high degree of variation in persistence, development, and decoy. A brief study based on comparative (time-wise) lower resolution radiosonde temperature profile data indicates that the mesoscale features exhibit identifiable and persistent characteristics when stable layers exist. The spectra of deviations between successive profiles were very similar for several sequences studied in depth. This indicates, but not conclusively, that seasonal and synoptic influences may not be large. A comparison of the rate-of-rise profiles indicates some correlation between this maxima and minima and the horizontal speed and direction perturbations. Also, the strongest speed shears in individual cases typically occur in or near stable layers. The mesoscale features for the wind profiles measured at Point Mugu, California, and Cape Canaveral, Florida, display similar characteristics. The data presented in Appendices B and C are intended to provide the potential investigator with an opportunity to study, at least qualitatively, the available time-correlated temperature profile structure, associated surface synoptic, and 200 mb conditions. It is obvious from a disciplinary viewpoint that knowledge of what physical cause results in the triggering of these distinctive mesoscale features, what promotes their subsequent behavior and eventual dissipation, and whether these features, in turn, trigger more significant synoptic-scale phenomena are important links in understanding the atmosphere and predicting its future.

Some preliminary studies have been sponsored and consideration given toward developing a better understanding of the observed mesoscale features as revealed by the Jimsphere-radar system. Earlier studies by investigators using carefully measured rawinsonde, etc., profiles and optimum data handling and reduction techniques have noted the existence of an organized mesoscale structure in the tropospheric and stratospheric flow. The existence of laminar structures or layers over relatively large horizontal areas (but limited in altitude) has also been noted. More recently, remote sensing using radar-acoustic and laser techniques has also produced similar observational conclusions about the troposphere. The reader may consult the bibliography for references applicable to these and other studies.

As with all free atmosphere measurement programs, the data acquired, while perhaps providing an answer to the immediate question of concern, frequently raise additional questions for which the data do not allow a decisive choice of an answer. This program is certainly not unique in that respect.

Three mesoscale circulation models have been suggested to explain the observations. The models are:

a) Quasi-horizontal stacked layers of alternating inertial oscillations

b) Phase differences in stationary internal gravity-type waves contained within stacked layers

c) Paired longitudinal vortices (helicane).

The available data appear to reflect attributes of each model, but do not provide one with an absolute choice as to which, if any, is the correct one to explain the observed perturbations. Further study of these data may well produce added insight. Future mesoscale measurement programs should certainly be designed with the goal of producing adequate data to permit a physical understanding of these mesoscale features.

III. DESCRIPTION OF CORRELATIVE METEOROLOGICAL DATA

A. Introduction

This section presents some observations and comments concerning the Jimsphere sequential wind profiles of Appendix A with respect to the associated temperature profiles and synoptic weather charts of Appendices B and C, respectively. Because this report presents all the associative material under one cover, it gives the disciplinarian reader most of the tools needed for further wave studies. No in-depth statistical correlation studies were done on the sequential series presented in this report. As the title of this section indicates, only a cursory examination of the profile sequences was made, and any distinguishing profile features or appropriate comments were subjectively noted.

B. Data Used

The data presented in Appendices A, B, and C were obtained from different sources. The sequential Jimsphere wind speed/direction vertical profiles as presented in Appendix A for Cape Canaveral, Florida, and Point Mugu, California, were obtained from magnetic tapes that contain data for all Marshall Space Flight Center Jimspheres released at both sites. The magnetic tapes were processed on a Hewlett-Packard 21MX computer, and all sequential wind profiles were plotted on the auxiliary HP7210A plotter. Initially, there were 87 sequential Jimsphere sounding sets for Cape Canaveral and 31 sets for Point Mugu. These amounts were reduced to 70 and 24 sets,[1] respectively, because sets were eliminated if sequences contained incomplete profiles or if the sequence time interval between soundings was longer than 3 h. The sequential wind profiles were subjected to a standard 6 point smoothing program, and a filtering (edit) program was also applied to detect and eliminate any stray inaccurate data points.

The temperature profiles contained in Appendix B for Cape Canaveral and Point Mugu were constructed from mandatory and significant level radiosonde data obtained from the NOAA National Climatic Center in Asheville, North Carolina. Because the Point Mugu data contained only mandatory level information, the associative complete Vandenberg AFB, California, radiosonde temperature data are also included in Appendix B. Vandenberg AFB is also a California Pacific Ocean coastal site, located approximately 145 km (90 mi) northwest of Point Mugu. Totals of 49 and 17 temperature profile cases are presented for Cape Canaveral and Point Mugu, respectively, only for sequential cases in which 5 or more wind profiles were taken during the sequential observing period.

The surface and 200 mb synoptic maps, as presented in Appendix C, were also prepared by the NOAA National Climatic Center for the same criteria as used with the previously mentioned temperature profiles. Note that after the April 19, 1977, sequential Jimsphere series, the 200 mb maps are presented in a smaller, less detailed format. The 200 mb map is presented here as a representation of the upper air flow patterns at approximately 12 000 m, near the region of profile maximum wind speed.

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1. These sequential sets were initially published for internal use at the Marshall Space Flight Center [see Johnson and Alexander (1976a and 1976b)].

The appendices give the basic information needed by the disciplinarian reader. That is, the Jimsphere wind profiles as well as the associative temperature profiles and upper-air and surface synoptic maps are presented. Meteorological satellite cloud photographs taken during the sequential periods were not received in time for inclusion in this report.

C. Sequential Numbering System Used

The wind profile sequence numbering system used in this report (Appendices A, B, and C) presents the 70 Cape Canaveral sequential series experiments as numbers 1 through 70, while the 24 Point Mugu sequential experiments are numbered 101 through 124. Vandenberg AFB temperature profiles (Appendix B) are also numbered 101 through 124. These 94 Jimsphere profile sequences were numbered in this manner to prevent any misunderstanding as to the sequence number being discussed. The appropriate figures (with sequence numbers) should be consulted in the appendices as the selected sequences are discussed.

D. Observational Analysis

This section presents a general observational evaluation that deals with all profile sequences; no in-depth study was done on individual sequences and their supporting data. This task is left to future studies/investigations.

It was noticed that at times certain sequential profiles displayed two differing sets of wind speed conditions aloft. It appeared as if a standing wave pattern of one frequency was above one of a greater frequency. This condition was observed 24 times, to differing degrees, throughout the sequential series. Of the 24 times this condition was observed, 19 (or 79 percent) were directly related to the height of the tropopause (or level of upper-air temperature profile inversion base). Some profile examples which show this type of structure are No. 23 for the Cape Canaveral area and No. 107 for the Point Mugu area. A complete listing of profile sequences which indicate this piggyback-type of correlative vertical wave structure, to differing degrees, is given in Table 2.

1. Case Studies.

a. Sequence No. 23. Large vertical wavelength oscillations on the order of approximately 1 km were noticed starting at the 12 to 13 km level and extending upwards to higher altitudes on the 1214Z April 16, 1967, wind profile. Later soundings indicated the level to be at approximately 13 km. Below this level, wavelengths on the order of 0.5 km or smaller were observed.

TABLE 2. JIMSPHERE SEQUENTIAL SERIES WHICH EXHIBIT A DUAL-FREQUENCY STRUCTURE

Sequence No.	Tropopause/Inversion Level (km)	Profile/Inversion Level Correlation
3	12	Yes
6	NA	No
9	11	Yes
17	11-12	Yes
18	12-13	Yes
22	12-13	Yes
23	13	Yes
25	13	Yes
29	14	Yes
32	14	Yes
35	NA	No
49	NA	No
50	NA	No
51	15	Yes
60	11-12	Yes
103	10	Yes
106	10	Yes
107	9	Yes
109	12	Yes
111	12	Yes
112	NA	No
113	10-11	Yes
115	16	Yes
116	12	Yes

The temperature profiles for this period, as given in Appendix B, indicate a 13 km inversion base on the 1200Z April 16, 1967, profile while by 1200Z April 17, 1967, the first isothermal or inversion begins at the 15 km level. The associated wind speed profile also indicates a breakdown of the two separate wave fields at 13 km by 0721Z. The entire wind profile at this time appears chaotic except possibly above 15 km. This example may indicate how important the tropopause (or any high-level temperature inversion, isothermal region, etc.) may be in the establishment of standing wave patterns, or slowly moving gravity waves, on either side of it. This inversion level may be behaving as a reflective wall for different atmospheric waves, such as gravity waves, which are trapped and therefore oscillate between inversion levels. The reader is referred to publications by Hines (1972) and Gossard and Hooke (1975) for an explanation of the generation and propagation of gravity waves in the atmosphere. Further power spectrum studies of the wind region above the tropopause as compared with the region below are needed.

The argument is that wind profiles measured at high altitudes (12 to 18 km) can be unreliable because of possible low elevation angles measured at the time the balloon reaches these upper altitudes. However, the fact that the detail observed in the structure of the wind speed profiles is very repeatable for up to 12 to 24 h later is indeed a good indication that the wind features measured are actually there. Feature repeatability is an important characteristic when observing these highly detailed Jimsphere measured wind profile sequences.

Wind directions for sequence No. 23 also indicate that the wind is not changing much in direction between 7 and 12 km, where a smooth profile is observed between these levels on the earlier soundings of sequence No. 23. By the time the last directional profile was taken (0721Z), the structure appears chaotic just as the associated speed plot did when the inversion moved up beyond the 15 km level.

The synoptic situation at the surface for series No. 23 can be seen in Appendix C. The Cape Canaveral area was under the influence of a high pressure system located out in the Atlantic, east of Cape Canaveral. The nearest low pressure area was a storm system moving into the Great Lakes area. The 200 mb flow aloft shows a NNW flow changing to a NW flow throughout the sequence.

b. Sequence No. 107. An example of a Point Mugu sequence showing the dual wave structure is sequence No. 107, taken March 15-16, 1965. Here the wavelength amplitude above 8 to 8.5 km altitude appears larger than observed amplitudes below this level. Point Mugu temperature profiles were missing for this case, but the Vandenberg temperature structure does indicate the beginning of a temperature inversion at approximately 9 km on the Vandenberg 0Z March 16, 1965, sounding. A 200 mb trough aloft also existed over the area during the sequence.

c. Sequence No. 109. Point Mugu sequence No. 109 indicates a small-frequency/low-amplitude wave pattern existing below 12 km altitude. Above this level a more chaotic, larger frequency, larger amplitude wave structure existed. The associated temperature profile, again, indicates a sharp temperature inversion present at 12 km altitude. This sharp feature is inherent on both the Point Mugu and Vandenberg temperature profiles. The synoptic conditions show a surface trough through southern California on the 12Z March 16, 1970, surface chart, while a cold front is pushing into northern California by the 0Z March 17, 1970, analysis, with no sign of the earlier trough. The wind direction profiles for this sequence also show a less variable, smoother directional profile below 12 km altitude.

d. Sequence No. 113. Sequence No. 113 at Point Mugu, taken during August 16-17, 1965, indicates a small temperature inversion at 11 km on the 12Z August 16 sounding, which then drops to 10 km 12 h later (by 0Z August 17). The tropopause inversion occurs above 15 km altitude. A small wind increase of approximately 10 m/s occurs at approximately 12 km altitude throughout the sequence. One feature of interest noticed is that the lull in speed at the base of this wind increase area (at approximately 11.5 km on the 1633Z temperature profile) also appears to drop more than 1 km during 10 h (to approximately 10 km at 0129Z August 17). The descent of this profile feature appears to be correlated with the drop of the temperature inversion level. Again, from 6 to approximately 10 km altitude there is a completely different wave structure from that noticed above the inversion or tropopause level.

e. Sequence No. 103. Point Mugu sequence No. 103 is unique in that it contains many different features. The temperature inversion begins at approximately 11 km on the 12Z February 18, 1965, sounding. Vandenberg sounding data indicate a drop of the inversion base to approximately 9.5 km by 0Z February 19, 1965. There is almost a 1 km drop (from 10 to 9.25 km) in the lull at the base of the strong wind shear layer. The obvious feature is the very strong wind increase (shear) area above 10 km altitude. An increase of more than 40 m/s/2 km is observed. Synoptically, a surface trough area from out of Mexico is progressing across southern California during the sequence. At 200 mb there are very strong winds coming from out of the northwestern states. Again, the wave structure (in terms of wavelength and amplitude) above 11 km is different from that below this level, indicating a possible connection with the vertical temperature structure of the profile.

f. Sequence No. 101. An interesting feature occurred during Point Mugu sequence No. 101 on January 18-19, 1965. The wind speed lull (at approximately 10 km) and peak (at approximately 8.5 km) features on the 1756Z January 18, 1965, profile drop vertically more than 2 km (to 6.5 and 6 km, respectively) during this sequential series ending at 0526Z January 19, 1965. A vertical drop rate of 0.3 and 0.2 km/h existed, with the lull feature apparently moving faster than the peak. Vandenberg temperature data also indicated decreases in the level of two temperature inversions which are apparently correlated with these wind features. Two small inversions were located at approximately 7.5 and 6 km altitude on the 0Z January 19, 1965, temperature profile. At this same time, the lull and peak in the wind speed profile, as mentioned earlier, were located approximately between 7 and 8 km for the lull and between 6 and 7 km for the peak. By 12Z January 19, 1965, the temperature profile shows the two inversions almost together, with the upper inversion base at approximately 5.5 km and the lower inversion base at 5 km. The vertical drop rates over these 12 h for the upper and lower inversions are 0.2 and 0.1 km/h, respectively. During this 12 h radiosonde period, the wind speed profile features also dropped. Values of 0.2 and 0.1 km/h are realistic for wind feature vertical drop rates from 0Z January 19 on. Therefore, the levels of wind speed features (lull and peak) do drop in altitude/time corresponding to the temperature inversion drop. Also, the wind speed features aloft (or inversions aloft) descend faster than lower ones. The synoptic situation throughout the sequence indicates a weak surface level trough through southern California from out of Mexico and a Pacific frontal system working its way toward the north California coast, arriving by 12Z January 19, 1965. Incidentally, the Jimsphere measured wind profile peak (at approximately 12 km) decreased in magnitude by approximately 12 m/s (from 38 to 26 m/s) throughout the sequence.

g. Sequence No. 28. This Cape Canaveral sequence indicates a sudden increase in wind speed of approximately 15 m/s (from 25 to 40 m/s) at approximately 13 km altitude. This peak speed developed sometime after the 0440Z May 30, 1966, Jimsphere measurement. Even though a strong temperature inversion (stable layer) existed at 0Z May 30, 1966, which diminished to a near isothermal layer by 12Z May 30, 1966, it is believed that this sudden increase in speed is probably due to the meandering of the jet stream flow shown in southern Florida on the 200 mb maps of Appendix C.

h. Sequence No. 17. The Cape Canaveral March 3, 1969, sequential series No. 17 probably offers the most correlative type comments. The five wind profiles span slightly more than 10 h, from 0225Z to 1245Z. The most dramatic event noted is the sudden increase in wind speed at approximately 11 km altitude between the 0225Z and 0446Z profiles. Within this 2 h 20 min time interval the winds increased approximately 20 m/s (from 50 to 70 m/s) at this level. A total increase of 25 m/s is also seen by the 0701Z profile. This strong peak wind also produced a strong wind shear in excess of 20 m/s/km ($> 0.02 \text{ s}^{-1}$) during the sequence.[2] Winds were also strong prior to the 0225Z

2. This sequence was taken just prior to the launch of Apollo 9 (AS-504) at 1600Z on March 3, 1969. The wind conditions during this launch were the most extreme, in terms of speed (76.2 m/s) and 1 km wind shear in the max Q region (0.0248 pitch and 0.0254 yaw shear), experienced during the launch of any Saturn, Saturn IB, or Saturn V vehicle [see Johnson (1973)].

release; rawinsonde balloon measurements taken at 1610Z and 1812Z on March 2, 1969, indicate peak winds of 75 m/s (at 10.75 km) and 76 m/s (at 10.50 km). However, the March 3 rawinsonde release of 0240Z, taken 15 min after the calmer 0225Z Jimsphere profile, indicated a smaller magnitude peak wind of 65 m/s (at 11.50 km). Therefore, it is believed that the lull experienced at 0225Z was there and was being replaced by stronger winds even within 15 min of its measurement. The 200 mb isotach analysis on the 0Z March 3, 1969, map does indicate a zone of >120 kn (>62 m/s) winds hear Cape Canaveral at this time. Immediately west of this isotach area can be seen a region of calmer winds over the eastern Gulf of Mexico, probably due to the meandering jet stream. It is possible that this lull area affected the Cape Canaveral upper winds by 0225Z, resulting in the approximately 50 m/s peak winds. The 200 mb analysis chart of 12Z March 3, 1969, did not have an isotach analysis; therefore, it was not possible to check the Gulf and Florida wind conditions at this later time to see if stronger winds were again over east-central Florida.

The features on these five wind speed profiles do indicate a slight upward movement (at a rate of approximately 0.09 km/h) of most features above 10 km altitude. A strong temperature base is located at 11 km altitude on the 0Z March 3, 1969, temperature sounding. Twelve hours later (12Z) the inversion base was located at approximately 12 km altitude. This 0.08 km/h upward rate corresponds closely to the feature movement rate as stated previously. Large amplitude wavelengths, approximately 2 km and greater, in the wind speed profile above the inversion level were set up, suggesting the presence of gravity waves. Much smaller wavelength patterns are indicated at altitudes below the inversion. Wave activity is also prevalent in the wind direction plots above the 11 to 12 km inversion base. The last three directional plots do indicate two wave peaks just above 12 and 14 km on the 0701Z plot. Again, the peaks are approximately 2 km apart and do ascend in altitude as did their counterpart speed plot features.

The question that now arises is whether the wave-type features noted in both the speed and directional plots are caused by waves moving upward or whether they are established standing wave patterns that ascend vertically as the inversion base/tropopause ascends. It is believed that in this case the features are indeed tied to the upward movement of the temperature inversions. This can be seen, to a small degree, in the 200 mb maps for this day. The 12Z March 3, 1969, 200 mb map does indeed indicate slightly higher contour (iso-height) lines throughout Florida than does the 0Z 200 mb map of 12 h earlier. Therefore, it is believed that the general large-scale circulation pattern did influence the movement of the wind profile features in this case.

The microbarograph trace for March 3, 1969, indicates pressure oscillations possibly due to the passage of wave activity. These oscillations begin at approximately 1:00 a.m. LST (0600Z) March 3, 1969, and extend throughout the remainder of the day. In the early morning hours the wave frequency of these pressure oscillations varied between 0.5 and 0.7 cycles/h. This pressure trace was the only one of all the Cape Canaveral sequential series in which oscillations of this type were noted. This indicates that the pressure fluctuations could have been so large that they even appeared clearly on this standard microbarograph instrument on which pen-drag is generally a factor in suppressing fluctuations of this type. Figure 13 presents this Cape Canaveral pressure chart.

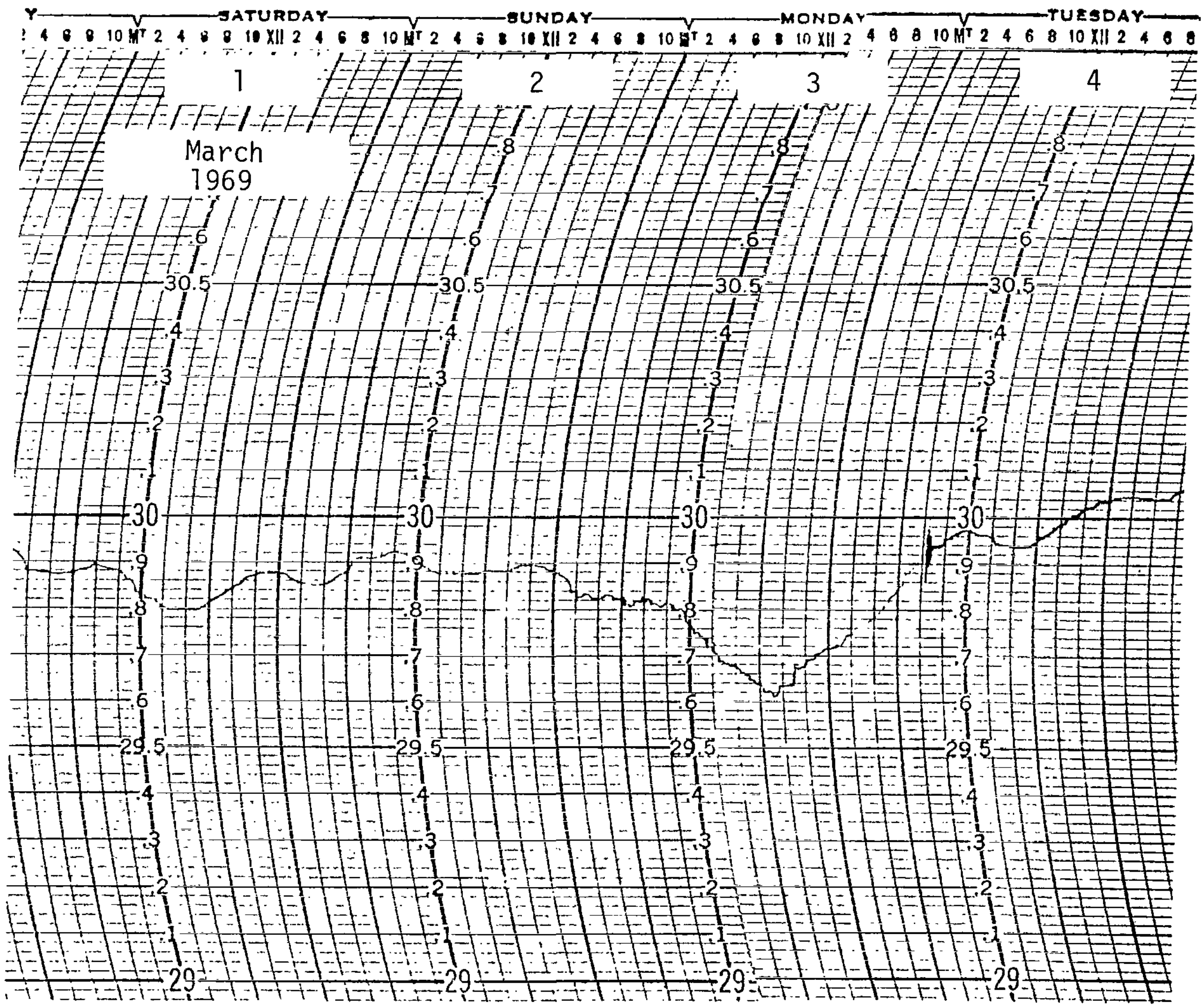


Figure 13. Cape Canaveral, Florida, microbarograph trace during March 2-3, 1969.

The synoptic surface conditions show that a cold front, from out of a low-pressure area located in South Carolina, passed through the Cape Canaveral area sometime after 12Z on March 1, 1969. High pressure is shown pushing over the southeastern United States from the 12Z March 2 through the 0Z March 3 surface maps. The 12Z March 3 map indicates a changing situation. A stationary front with a low-pressure area along it was located in the eastern Gulf of Mexico, with frontogenesis occurring between Florida and Cuba. This situation produced rain shower activity over the southern tip of Florida by this map time. Between 12Z March 3 and 12Z March 4, this low-pressure area developed into a tight cyclonic warm-cold frontal system, moved across southern Florida, and located itself N-S in the Atlantic Ocean approximately 550 km (300 n.mi.) east of Florida. This left Florida under the influence of high pressure. Most all of Florida, consequently, received rainfall, amounting to over 1.27 cm (0.5 in.) in certain areas, from storm activity. It is thought that the inferred gravity wave activity for March 3 could have been triggered by the passage of this storm system.

i. Sequence No. 13. It should be mentioned that the directional plots for the February 11, 1969, series indicate a rising feature, initially just less than 12 km, together with a descending feature just above 5 km altitude. It appears as if a disturbance was generated at approximately 9 km, with propagation being measured vertically in both directions. This peculiar activity can also be seen in the wind speed profile plots at approximately the same altitudes. Notice the ascending wind speed peak located just below 12 km near the strong wind shear area. Likewise, note the descending peak speed bulge at approximately 5 km on the 0300Z profile. Both speed and directional features appear to have a vertical propagation rate of ≥ 70 m/h

Over central Florida the 200 mb map shows contour heights dropping from 12 120 m to 12 000 m between 0Z and 12Z (a 10 m/h rate of drop). Likewise, the 500 mb map contours indicate a drop from 5720 to 5690 m between 12Z February 10 and 12Z February 11 (a 1.3 m/h rate of drop). It is therefore believed that the local profile vertical movements are not connected with the general large-scale circulation pattern throughout this sequence, since the rates are completely different and the direction of feature movement upward is completely opposite that of the downward movement of the contour height pattern at approximately 12 km altitude. Therefore, it appears that in this case wave activity is probably present which may be causing the wind profile features to move differently from what the general circulation dictates.

j. Sequence No. 18. Cape Canaveral series No. 18 indicates a good change in wavelength/amplitude above 12 to 13 km altitude in the wind speed profiles. This also can be seen to a lesser degree in the directional plots. In the April 13, 1965, case the temperature profile for 12Z indicates a very small temperature inversion base at approximately 13 km, with the main tropopause at approximately 17 km. This small inversion is still present at 13 km on the 0Z April 14, 1965, sounding as well. The surface synoptic situation reveals a dry cold frontal passage during the sequence. The 12Z April 13, 1965, map indicates the E-W oriented cold front location to be in southern Georgia near the Florida state line. By 0Z April 14, 1965, it had moved through the Cape Canaveral area and was located halfway between Cape Canaveral and Miami. Could this frontal passage have been a trigger mechanism for wave propagation as revealed above 13 km altitude during this sequence?

k. Sequence No. 25. The April 4, 1968, series No. 25 also indicates a more wavy wind speed profile above 13 km than below it. This is evident to a lesser degree in the directional profiles. Once again, the temperature structure indicates the tropopause (isothermal conditions) starting at 13 km, which correlates well with the wavy wind speed profile above this level. On April 3 a stationary front was located E-W along the Georgia-Florida border. The synoptic surface maps for April 4 indicate this frontal activity being further north, leading out of an intense low-pressure system centered in Iowa and moving across the east-central part of the country, producing much shower/thunderstorm activity. Could this system be triggering the waves measured above 13 km at Cape Canaveral?

l. Sequence No. 30. The Cape Canaveral temperature structure observed during sequence No. 30 shows an inversion base at approximately 11 km altitude (the tropopause being located much higher) on the 0Z May 5, 1969, sounding. This inversion is shown to have dropped to between 9 and 10 km by 12Z on the same day. This correlates well with the general dropping of the higher wind speed area as shown in the associative speed plots. The base altitude of the wind speed bulge on the 2346Z May 4, 1969, speed plot is located at 11 km, and this level also drops to slightly less than 10 km by the 1339Z May 5 wind speed profile. The May 5, 1969, 200 mb level maps do not show any drastic changes in the general flow patterns at this level (approximately 12 180 m) between 0Z and 12Z. This may imply that this dropping characteristic is too fine a feature to be shown on these larger-scale 200 mb maps. The 200 mb maps do, however, indicate the end of a peak wind (isotach) line near the Cape Canaveral area at 0Z, while undoubtedly lesser winds would prevail at 12Z. This is shown to occur in the wind speed plots where 45 m/s peak speeds at 2345Z do decrease in intensity to 25 m/s peak by 1049Z.

m. Sequence No. 36. Cape Canaveral sequence No. 36, taken July 2, 1965, indicates a very wavy structure in the vertical (from the ground up through 16 km) of approximately 2 km wavelength, with the tropopause being located above 15 km altitude. This sequence was taken while a cold front was pushing south through northern Florida, becoming stationary across central Florida on July 3 and then dissipating.

n. Sequence No. 60. The November 10, 1965, Cape Canaveral sequence No. 60, again, shows good correlation between the inversion height and the wind speed structure about this level. Wavelengths of 1.5 to 2 km exist above the 12 km tropospheric inversion height, with much smaller wavelengths below. The synoptic conditions during this time indicate a surface cold front moving south and becoming stationary over northern Florida. The 200 mb pattern shows generally zonal flow at this level, with bands of very strong winds blowing over Florida.

o. Sequence No. 63. The November 9, 1967, Cape Canaveral directional plots indicate a northerly bulge appearing at approximately 5 km altitude. The wind direction at this level switched from westerly through the north to northeasterly throughout the sequence. Two small temperature inversions also existed, at 2 to 3 km and 5 to 6 km altitude, on either side of this directional bulge. The synoptic surface and 200 mb maps do not show any significant changes during this period. However, the 500 mb map on 0Z November 8, 1967, does show westerly flow, while the 0Z November 9 map indicates northwesterly flow due to a trough aloft passing between map times, with Cape Canaveral being west of the trough line on the later map.

Other variations which occur with the wind speed profiles, in addition to those mentioned previously, are listed in Table 3.

2. Sequence Summary. Table 4 gives a summary of all pertinent wind profile features and supplemental information. This includes a summary of profile features, synoptic conditions, temperature inversions, and changes in wind conditions observed for Cape Canaveral and Point Mugu. Although it may not be the most complete or accurate correlative listing of all measurable data assembled during these sequences, it should help the investigator who studies them. The purpose of this section has been not to explain all features present on the profiles but to observe the profiles and bring some of these features to the reader's attention. It should be remembered that these observational comments are preliminary, quick-look, subjective, and sometimes speculative in nature.

TABLE 3. WIND FEATURES OBSERVED IN SEQUENTIAL JIMSPHERE PROFILE SETS

Sequence No.	Date	Wind Speed (WS) Variations
5	1/20-21/69	A discrete gust develops at approximately 11 km during sequence
8	2/7/66	High WS region exists over a large altitude interval
9	2/25-26/66	Double WS peak observed
16	3/28-29/66	Two WS peaks develop into one peak
17	3/3/69	WS increases over a large altitude region
19	4/4/66	Sharp WS peak develops
28	5/29-30/66	Sharp WS peak develops
55	10/19-20/65	One WS peak develops
62	11/4/67	High WS region exists over a large altitude interval
106	3/2-3/65	Double WS peak develops
111	5/12-13/69	One broad WS peak develops
112	6/1/65	WS peak intensifies
121	10/4-5/67	WS peak intensifies and broadens vertically
123	12/21/65	Strong double WS peak that deintensifies into smaller single peak

TABLE 4. KENNEDY SPACE CENTER AND POINT MUGU JIMSPHERE SEQUENCE CORRELATIVE SUMMARY

Atmospheric Event Present	Jimsphere Sequence No.
1. Wind profile features rise with time[a]	5, 13, 17, 24, 51, 59, 60, 64, 66, 68, 70, 103, 115
2. Wind profile features fall with time[a]	2, 6, 9, 13, 14, 20, 22, 24, 33, 51, 52, 55, 57, 59, 63, 101, 109, 110, 113, 115
3. Nonideal synoptic conditions (fronts, troughs, hurricanes, etc. near)	4, 6, 14, 17, 18, 20, 24, 36, 51, 52, 54, 55, 57, 59, 60, 70, 101, 103, 107, 109, 112, 113, 114, 115, 119, 121, 122
4. Temperature inversions	1, 3, 5, 6, 9, 10, 12, 13, 14, 17, 18, 20, 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, 45, 60, 63, 67, 70, 101, 103, 109, 112, 113, 116, 117, 119, 122, 123
5. Change in WS in time	13, 16, 17, 22, 28, 30, 38, 55, 60, 101, 103, 105, 112, 113, 121, 123, 124
6. Strong wind shear existing or developing	4, 5, 6, 8, 9, 10, 13, 16, 17, 19, 26, 27, 28, 30, 31, 32, 35, 45, 49, 57, 60, 66, 68, 69, 101, 103, 106, 109, 110, 112, 113, 115, 123, 124
7. Two different wave frequencies noticed in wind profile and temperature correlated	3, 9, 17, 18, 22, 23, 25, 29, 32, 51, 60, 103, 106, 107, 108, 111, 113, 115, 116
8. No. 7 sequences which do not correlate with the height of the tropopause/inversion base	6, 35, 49, 50, 112
9. Microbarograph oscillation	17
10. Exhibits good wave structure throughout WS profile	34, 36, 58, 60, 64, 107, 109, 124

a. Very subjective conclusion

IV. SUMMARY REMARKS

The intent of this report has been to provide both the engineering and disciplinary oriented reader with a better insight into the behavior of the mesoscale flow in the troposphere and lower stratosphere. While some discussion of the measurements and associated atmospheric observations has been given relative to both the engineering and disciplinary areas, this has been done primarily to focus the reader's attention and, hopefully, motivate his further interest in the subject. Future measurement programs will be designed with both types of investigators in mind.

It is readily apparent that organized mesoscale flow patterns exist in the troposphere as well as the more stable environment of the stratosphere. These flows persist in a dramatic manner and, while restricted to relatively thin layers of a few kilometers, appear to extend over horizontal distances of many kilometers. Determination of the physical mechanism(s) behind the observed mesoscale processes in order to permit the forecasting of future changes or deviations is an obvious goal which would benefit both engineering and disciplinary oriented users. In this report many wind profile features, including wave structure, are mentioned and discussed subjectively. The cause and effect of these observed mesoscale features have yet to be definitively established. While considerable insight has been achieved during the past decade, added capabilities of analysis would greatly enhance our means of estimating the persistence, the predictability, and the general physical nature of the atmospheric mesostructure. Supplemental data consisting of associated temperature profiles and surface/aloft synoptic maps are also included in this report.

BIBLIOGRAPHY

Adelfang, S. I.: Analysis of Jimsphere Wind Profiles Viewed in the Flight Time Domain of a Saturn Vehicle. Journal of Spacecraft and Rockets, Vol. 7, No. 9, 1970, pp. 1146-1149.

Avsec, D.: Thermoconvective Eddies in Air, Application to Meteorology. Sci. and Tech. Publ. of Air Ministry Works, Institute of Fluid Mechanics, Fac. of Sci., Paris, No. 155, Translated from French by C. Ronne, Woods Hole Ocean. Inst., Woods Hole, Mass., 1939.

Camp, Dennis W. and Scoggins, James R.: Some Practical Accuracy Considerations of Smoke Trail Wind Profile Data. NASA TM X-53261, 1965.

Camp, Dennis W. and Vaughan, William W.: High Resolution System for Tropospheric Wind and Temperature Profile Measurements. Journal of Geophysical Research, Vol. 80, No. 27, 1975, pp. 3797-3800.

Daniels, Glenn E. (Ed.): Terrestrial Environment (Climatic) Criteria Guidelines for Use in Aerospace Vehicle Development. 1973 Revision. NASA TM X-64757, 1973.

Danielsen, E. F.: The Laminar Structure of the Atmosphere and Its Relation to the Concept of a Tropopause. Arch. Meteorol. Geophysics, Bioklimatol, Series A: Meteorologic and Geophysoik, Bond II, 3, Heft, 1959.

Danielsen, E. F. and Duguet, R. T.: A Comparison of FPS-16 and GMD-1 Measurements and Methods for Processing Wind Data. NASA CR-61158, 1966.

DeMandel, R. E. and Krivo, S. J.: Capability of the FPS-16 Radar/Jimsphere System for Direct Measurement of Vertical Air Motions. NASA CR-61232, 1968.

DeMandel, R. E. and Krivo, S. J.: Radar/Balloon Measurements of Vertical Air Motions Between the Surface and 15 km. Journal of Applied Meteorology, Vol. 10, 1971, pp. 313-319.

Dutton, John A.: The Ceaseless Wind. New York, McGraw-Hill, Inc., 1976.

BIBLIOGRAPHY (Continued)

Endlich, R. M., Singleton, R. C., Drexhage, K. A., and Mancuso, R. L.: Studies of Vertical Wind Profiles at Cape Kennedy, Florida. NASA CR-61263, 1969.

Fichtl, George H.: The Responses of Rising or Falling Spherical Wind Sensors to Atmospheric Wind Perturbations. Journal of Applied Meteorology, Vol. 10, 1971, pp. 1275-1284.

Fichtl, George H., DeMandel, R. E., and Krivo, S. J.: Aerodynamics Properties of Spherical Balloon Wind Sensors. Journal of Applied Meteorology, Vol. II, No. 3, 1972, pp. 472-481.

Gossard, Earl E., and Hooke, William H.: Waves in the Atmosphere. New York, Elsevier Scientific Publishing Company, 1975.

Hines, C. O.: Internal Atmospheric Gravity Waves at Ionospheric Heights. Canadian Journal of Physics, Vol. 38, 1960, pp. 1441-1481.

Hines, C. O.: Gravity Waves in the Atmosphere. Nature, September 8, 1972, pp. 73-78.

Johnson, D. L.: Summary of Atmospheric Data Observations for 155 Flights of MSFC/ABMA Related Aerospace Vehicles. NASA TM X-64796, December 5, 1973.

Johnson, Dale and Alexander, Margaret: 70 Sequential Jimsphere Wind Profile Data Sets for Eastern Test Range (Cape Kennedy, Florida) December 1964-July 1970. Doc. No. NASA/MSFC-ES41, August 1976a.

Johnson, Dale and Alexander, Margaret: 24 Sequential Jimsphere Wind Profile Data Sets for Pacific Missile Range (Point Mugu, California) January 1965-April 1970. Doc. No. NASA/MSFC-ES41, August 1976b.

Jones, J. C.: A Unified Discrete Gust and Power Spectrum Treatment of Atmospheric Turbulence. International Conference on Atmospheric Turbulence, London, England, May 1971. AIAA Reprint No. A71-29790.

Luers, James K. and MacArthur, Charles D.: The Limitations of Wind Measurement Accuracy for Balloon Systems. Journal of Applied Meteorology, Vol. 13, 1974, pp. 168-173.

BIBLIOGRAPHY (Concluded)

Ryan, Robert S. and King, Alberta: The Influential Aspects of Atmospheric Disturbances on Space Vehicle Design Using Statistical Approaches for Analysis. NASA TN D-4963, 1969.

Scoggins, James R.: Spherical Balloon Wind Sensor Behavior. Journal of Applied Meteorology, Vol. 4, No. 1, 1965, pp. 139-145.

Stinson, Robert, Weinstein, A. I., and Reiter, E. R.: Details of Wind Structure from High Resolution Balloon Soundings. NASA TM X-53115, 1964.

Susko, Michael and Vaughan, William W.: Accuracy of Wind Data Obtained by Tracking a Jimsphere Wind Sensor Simultaneously with Two FPS-16 Radars. NASA TM X-53752, 1968.

Vaughan, William W.: New Wind Monitoring System Protects R& D Launches. Astronautics and Aeronautics, Vol. 6, No. 12, 1968, pp. 41-43.

Vaughan, William W.: An Investigation of the Temporal Character of Mesoscale Perturbations in the Troposphere and Stratosphere. NASA TN D-8445, 1977.

Weinstein, A. I. and Reiter, E. R.: Mesoscale Structure of 11-20 km Winds. NASA CR-61080, 1965.

APPENDIX A

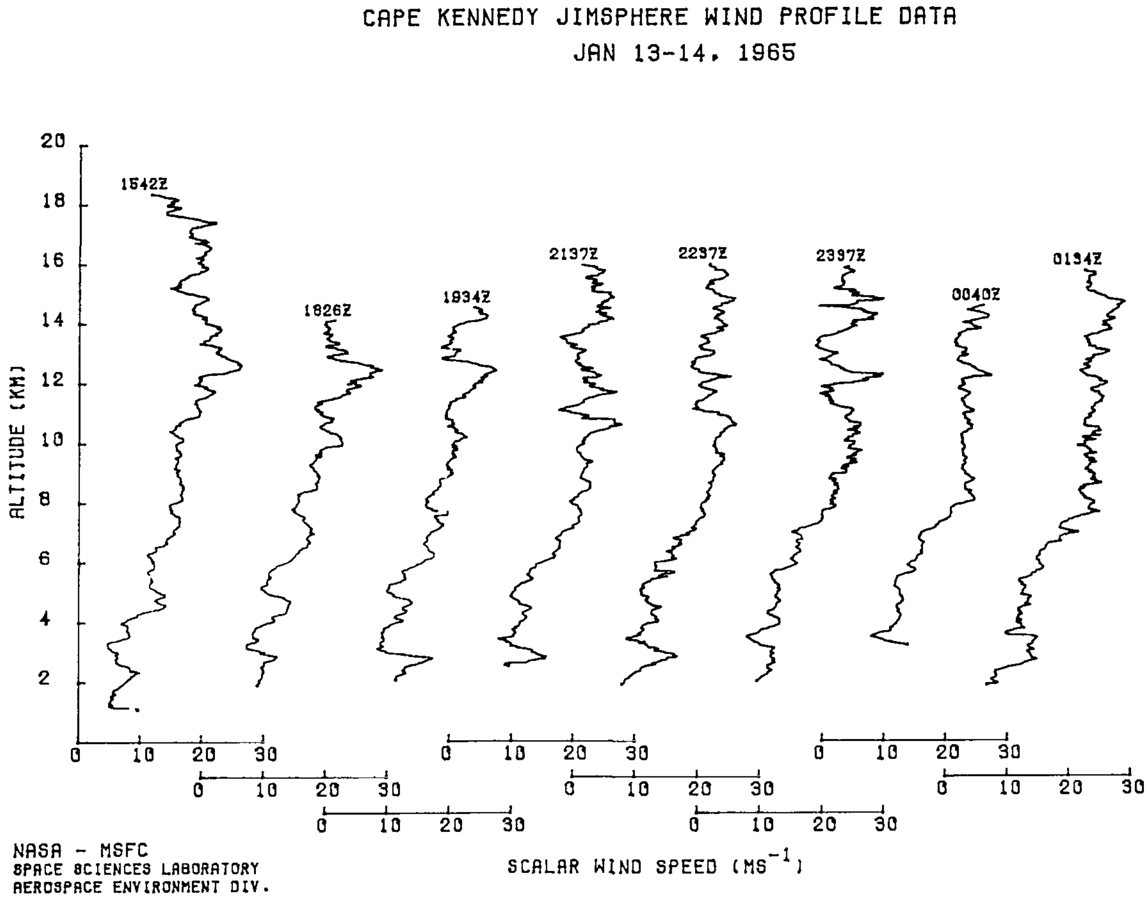
JIMSPHERE WIND PROFILE DATA

70 Sequential Jimsphere Wind Profile Data Sets For

Cape Canaveral (Cape Kennedy), Florida

December 1964 – July 1970

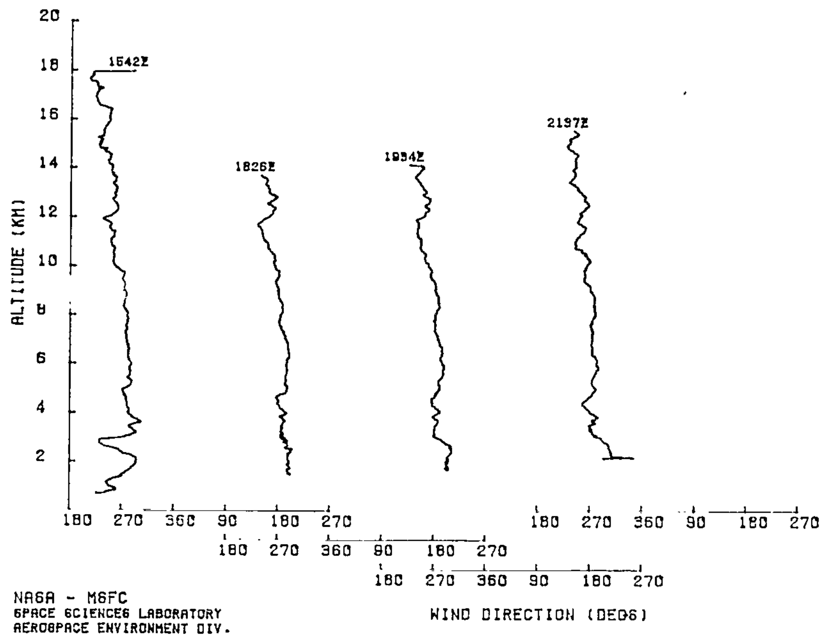
1



CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JAN 13-14, 1965
ALTITUDE (KM)
1542Z
1826Z
1934Z
2137Z
2237Z
2337Z
0040Z
0134Z
SCALAR WIND SPEED (MS⁻¹)
NASA - MSFC
SPACE SCIENCES LABORATORY
AEROSPACE ENVIRONMENT DIV.

1

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JAN 13-14, 1965



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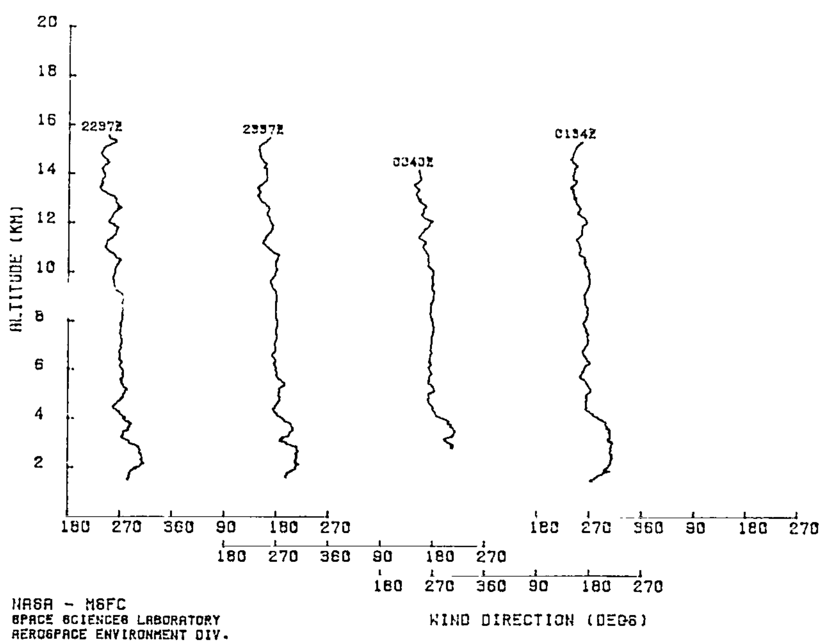

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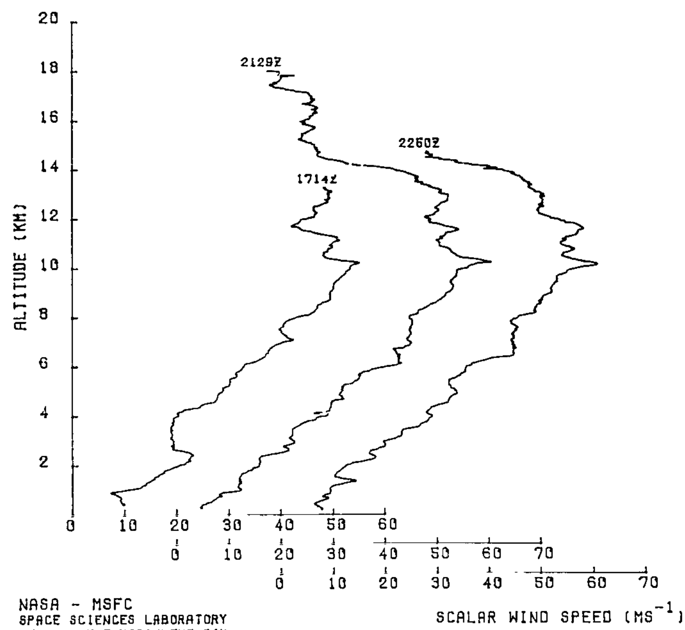
2

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JAN 27, 1965



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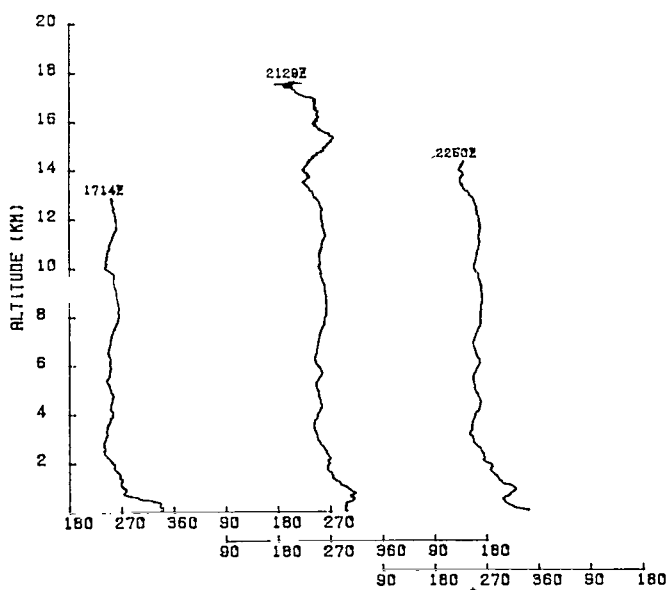
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JAN 27, 1965



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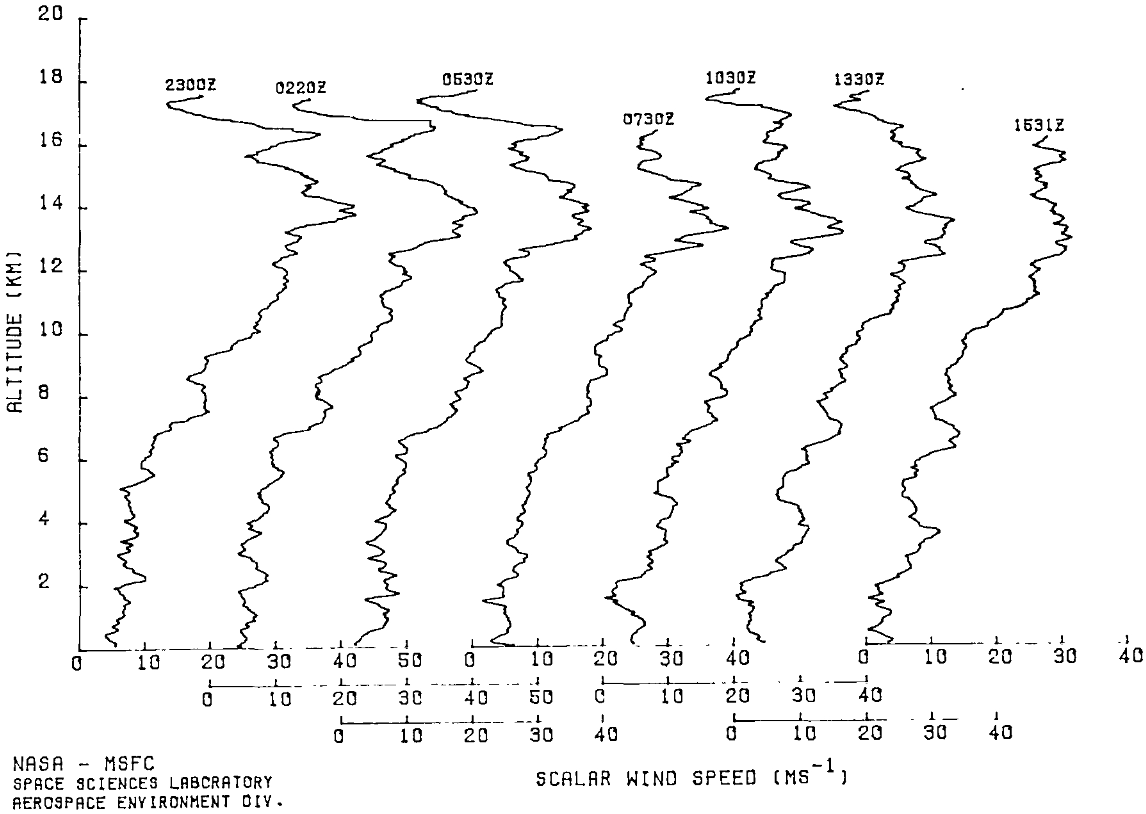
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JAN 21-22, 1968



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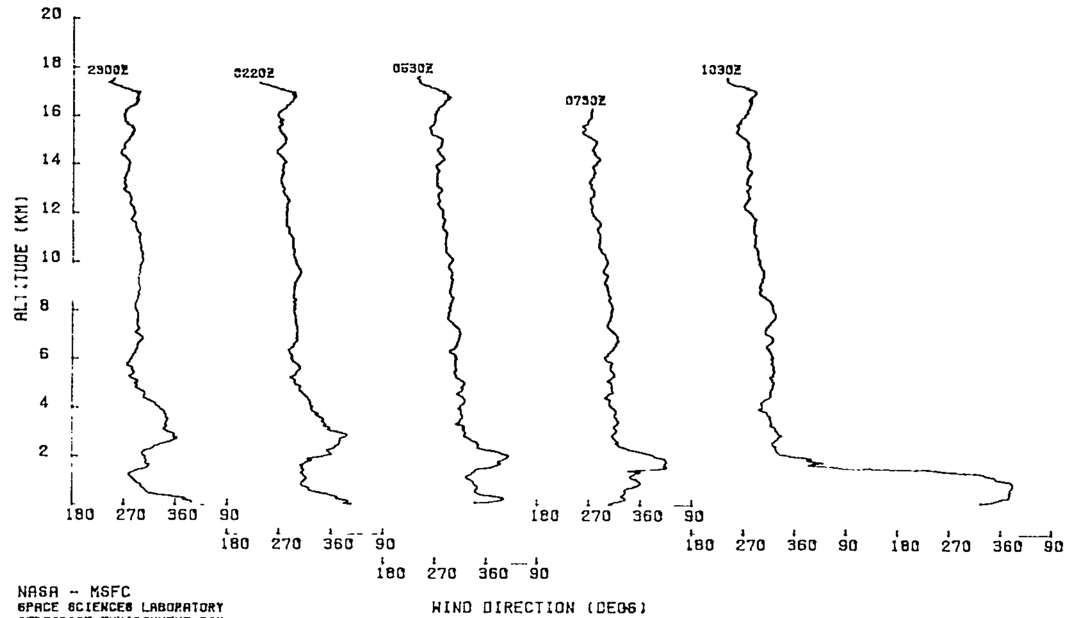
JAN 21-22, 1968



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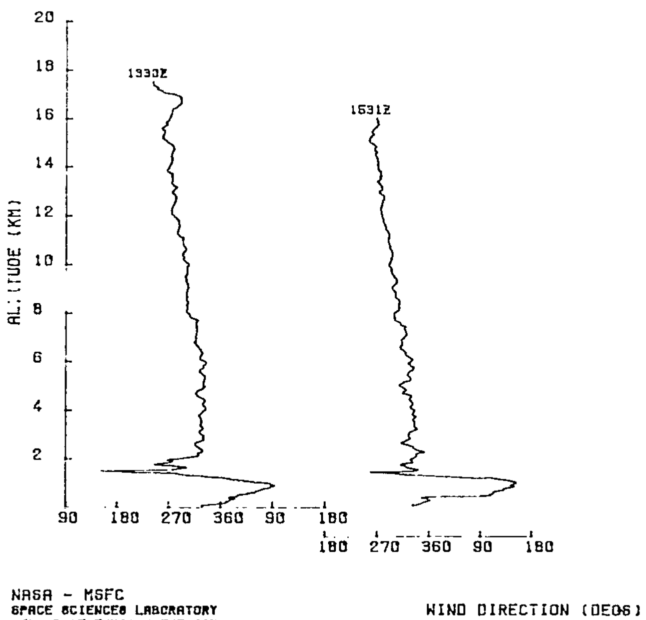
AEROSPACE ENVIRONMENT DIV.

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JAN 21-22, 1968



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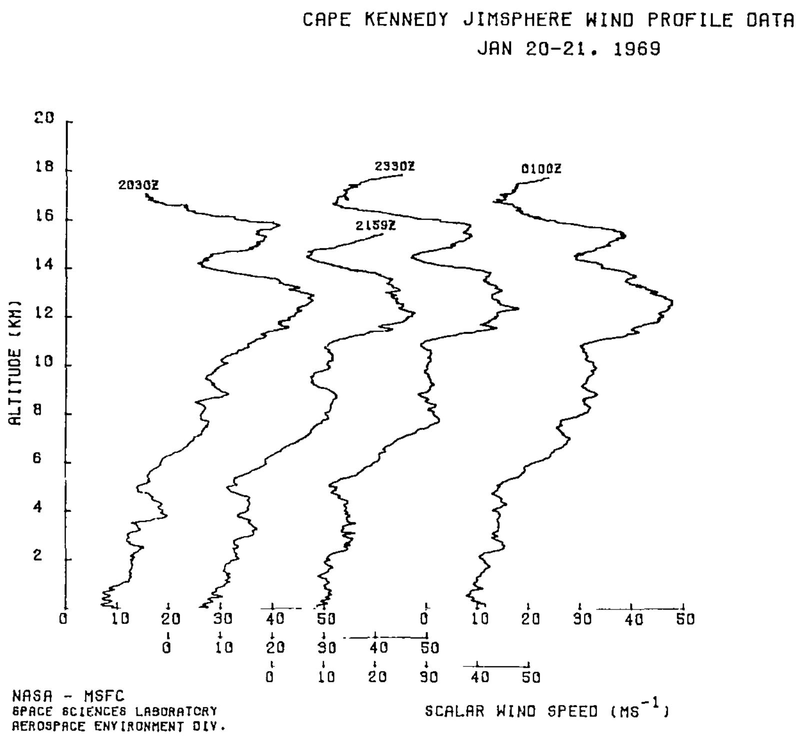
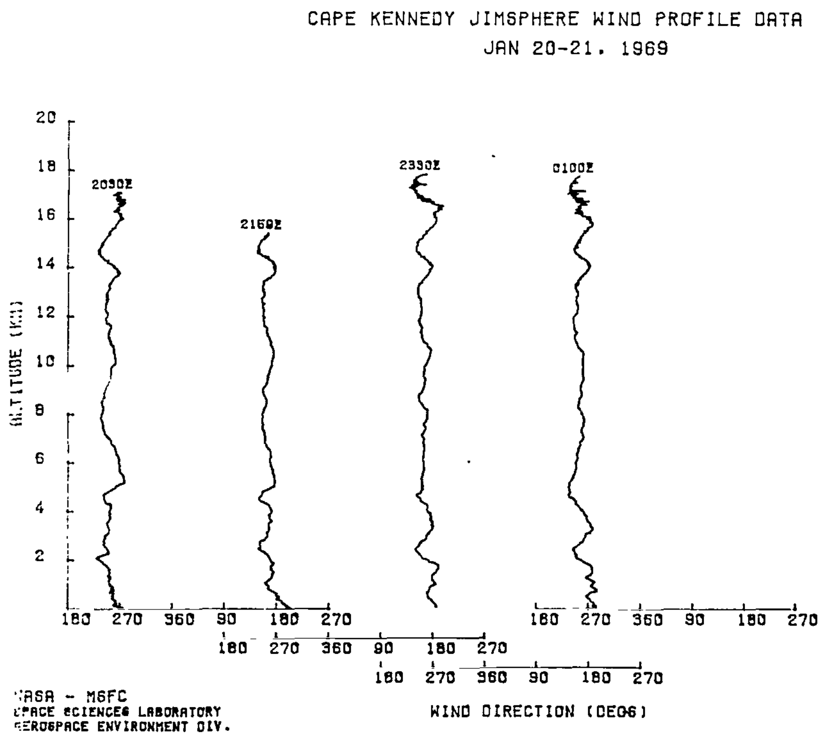

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JAN 20-21. 1969
ALTITUDE (KM)
2030Z
2159Z
2330Z
0100Z
SCALAR WIND SPEED (MS^-1)
NASA - MSFC
SPACE SCIENCES LABORATORY
AEROSPACE ENVIRONMENT DIV.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JAN 20-21. 1969
ALTITUDE (KM)
2030Z
2159Z
2330Z
0100Z
WIND DIRECTION (DEGS)
NASA - MSFC
SPACE SCIENCES LABORATORY
AEROSPACE ENVIRONMENT DIV.

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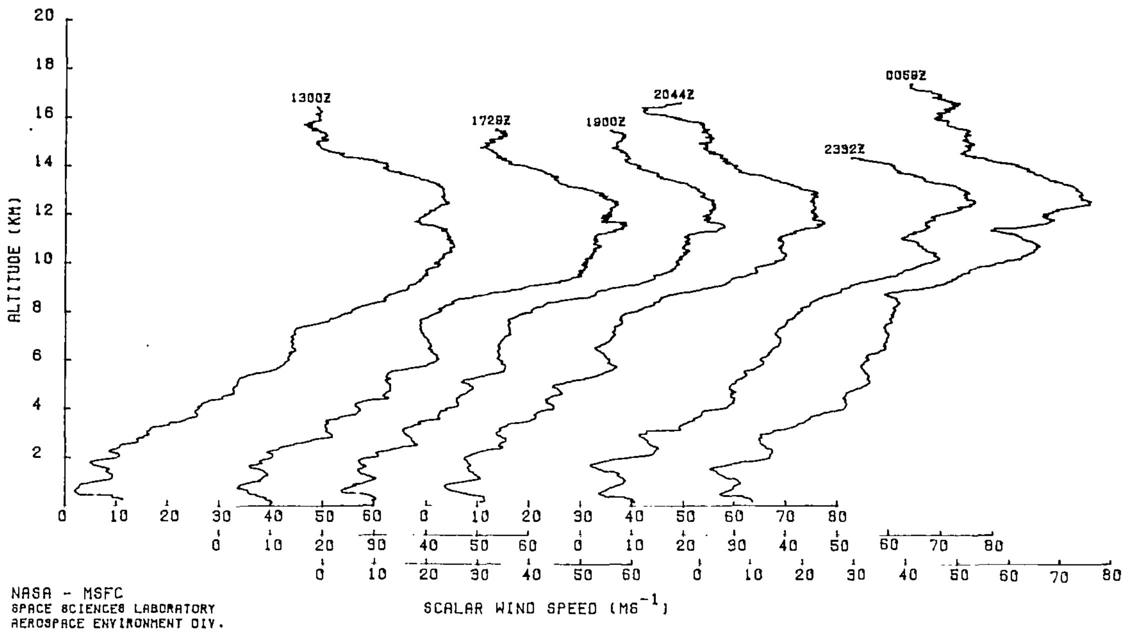

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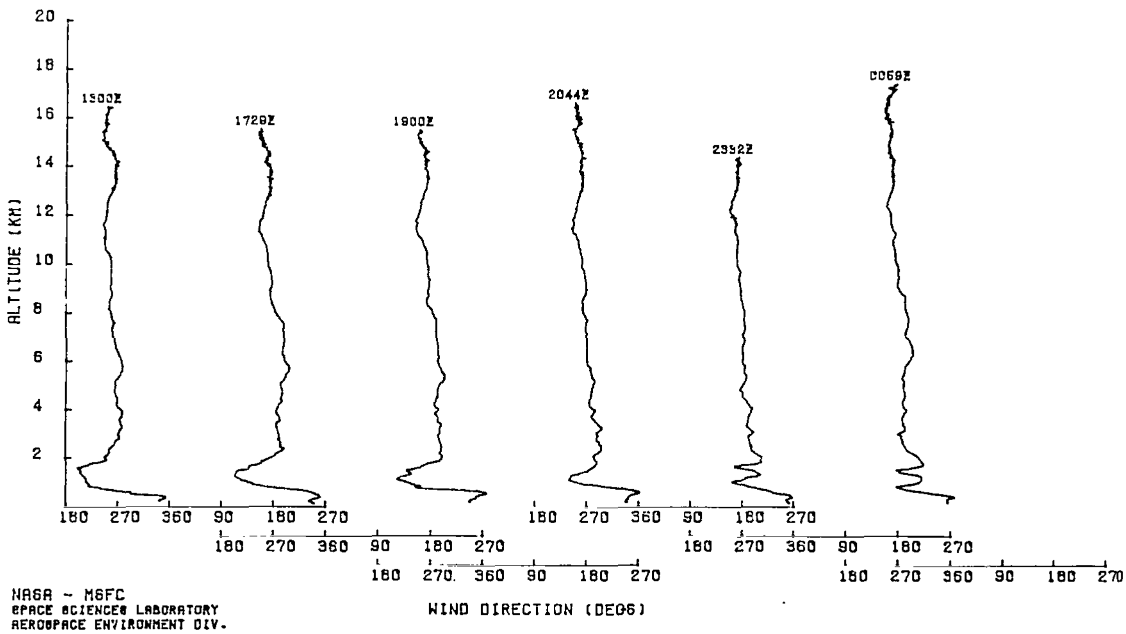

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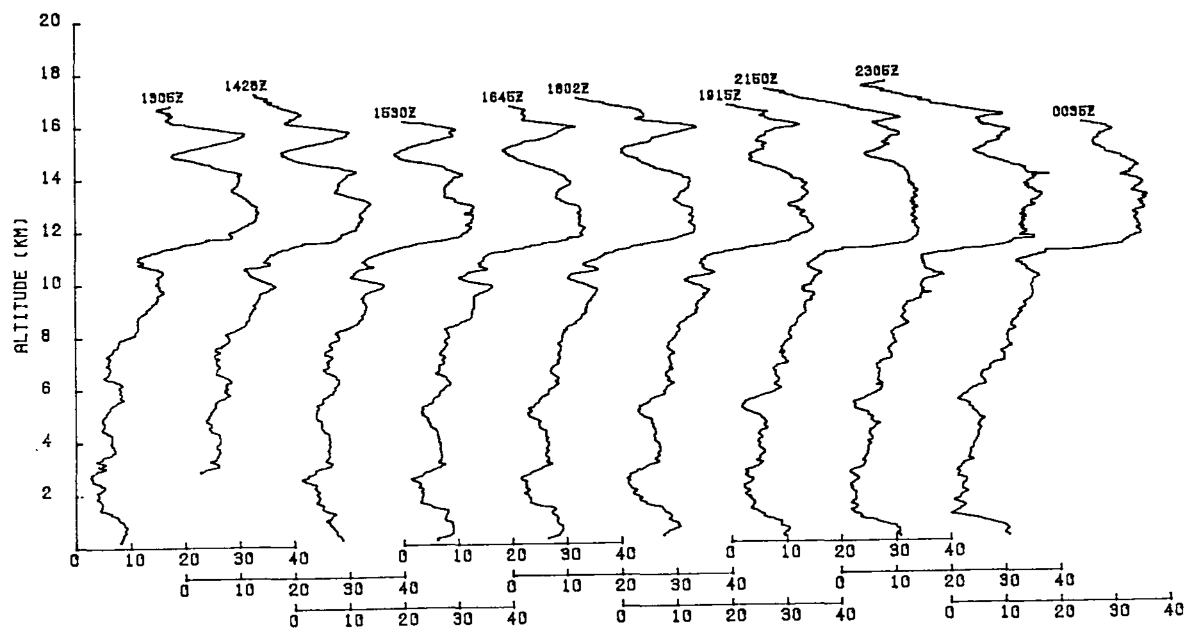
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
FEB 10-11, 1965



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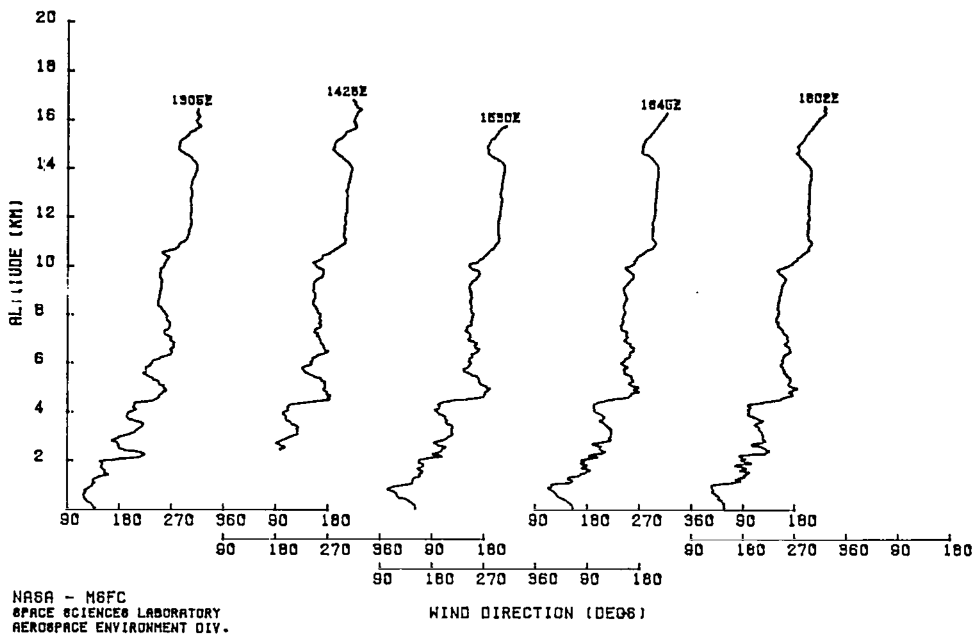

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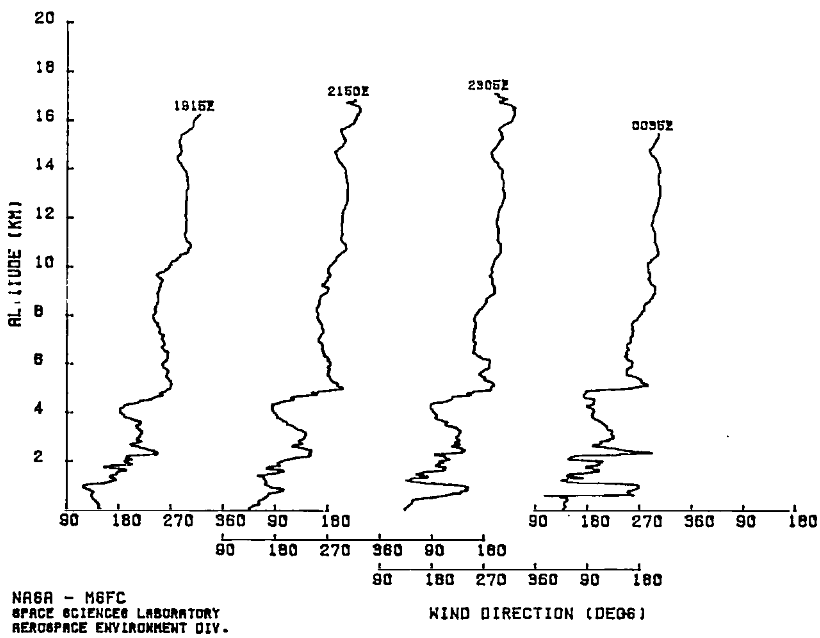

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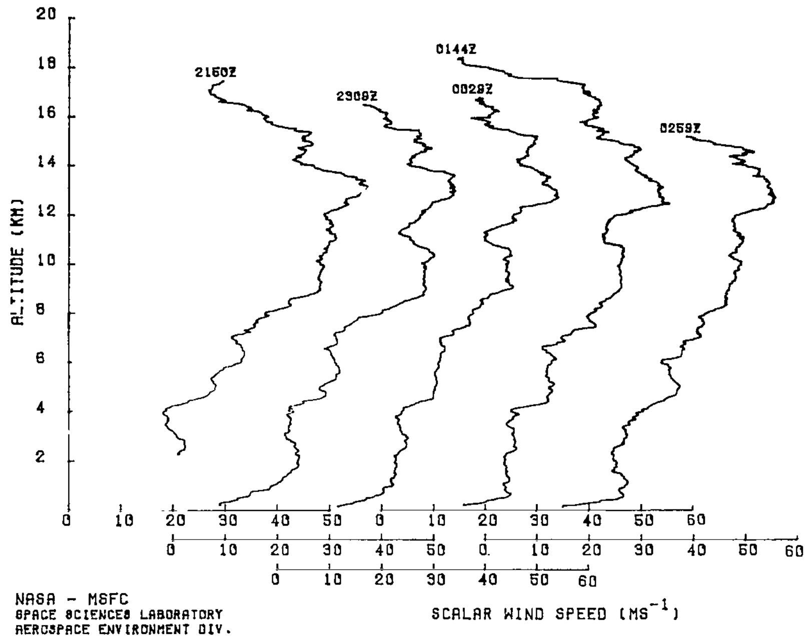
FEB 24-25. 1965



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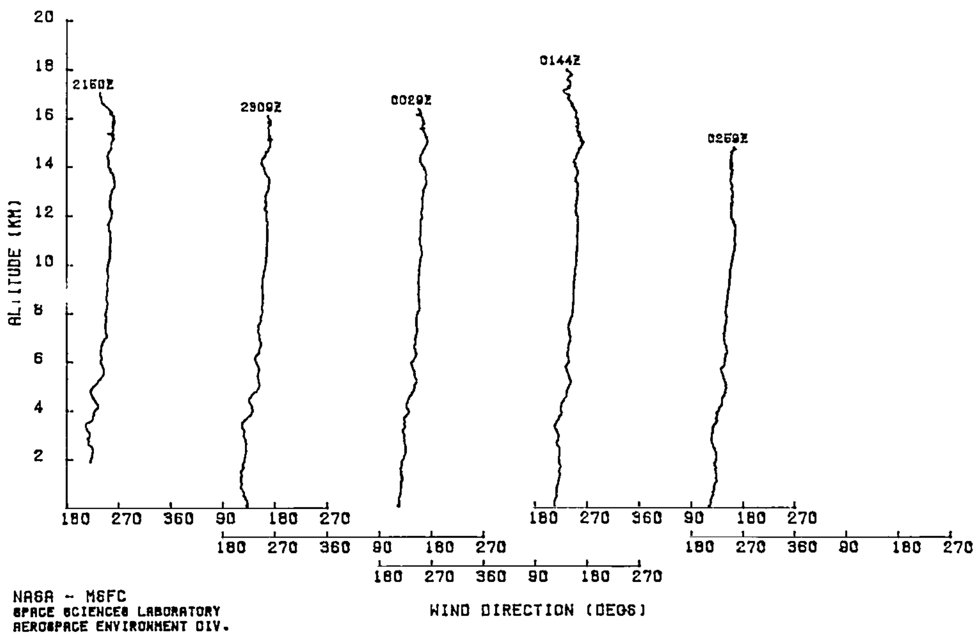

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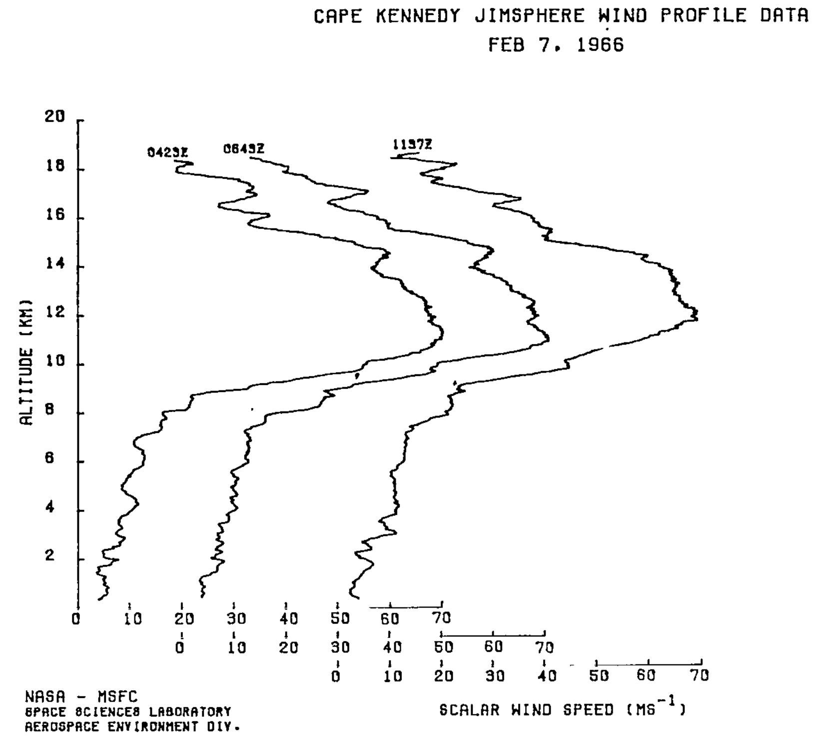
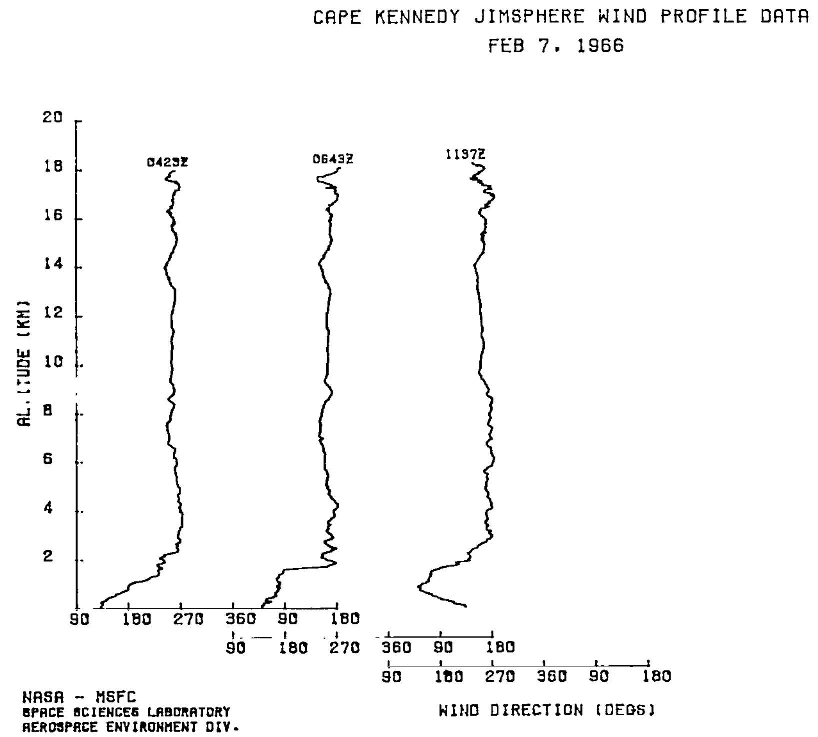


CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
FEB 7, 1966
0423Z
0643Z
1137Z
ALTITUDE (KM)
20
18
16
14
12
10
8
6
4
2
0 10 20 30 40 50 60 70
0 10 20 30 40 50 60 70
0 10 20 30 40 50 60 70
NASA - MSFC
SPACE SCIENCES LABORATORY
AEROSPACE ENVIRONMENT DIV.
SCALAR WIND SPEED (MS^{-1})



CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
FEB 7, 1966
0423Z
0643Z
1137Z
ALTITUDE (KM)
20
18
16
14
12
10
8
6
4
2
90 180 270 360 90 180
90 180 270 360 90 180
90 180 270 360 90 180
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AEROSPACE ENVIRONMENT DIV.
WIND DIRECTION (DEGS)

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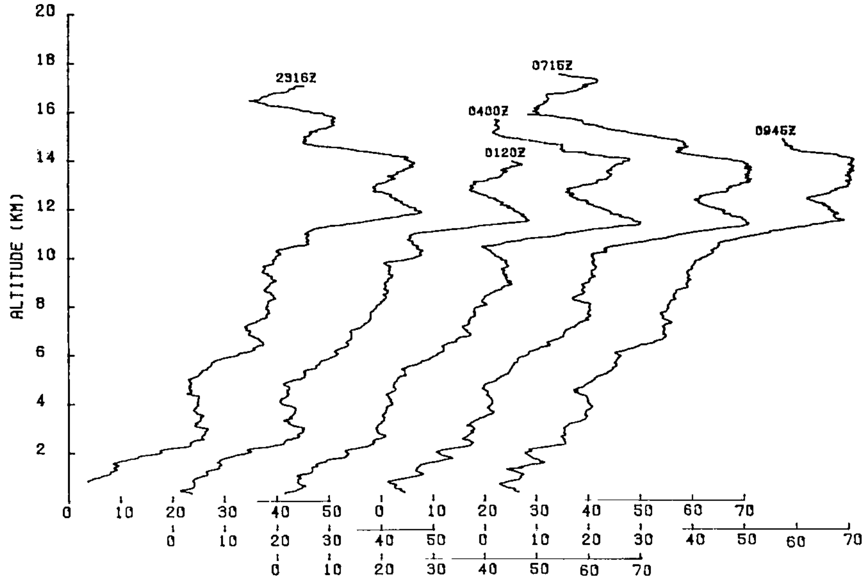
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
FEB 25-26. 1966



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CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
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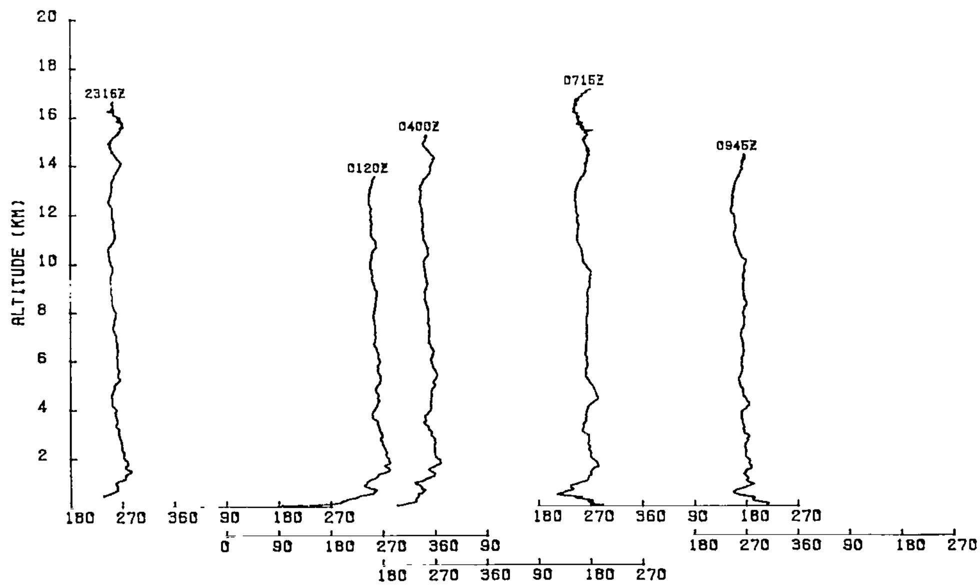

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CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
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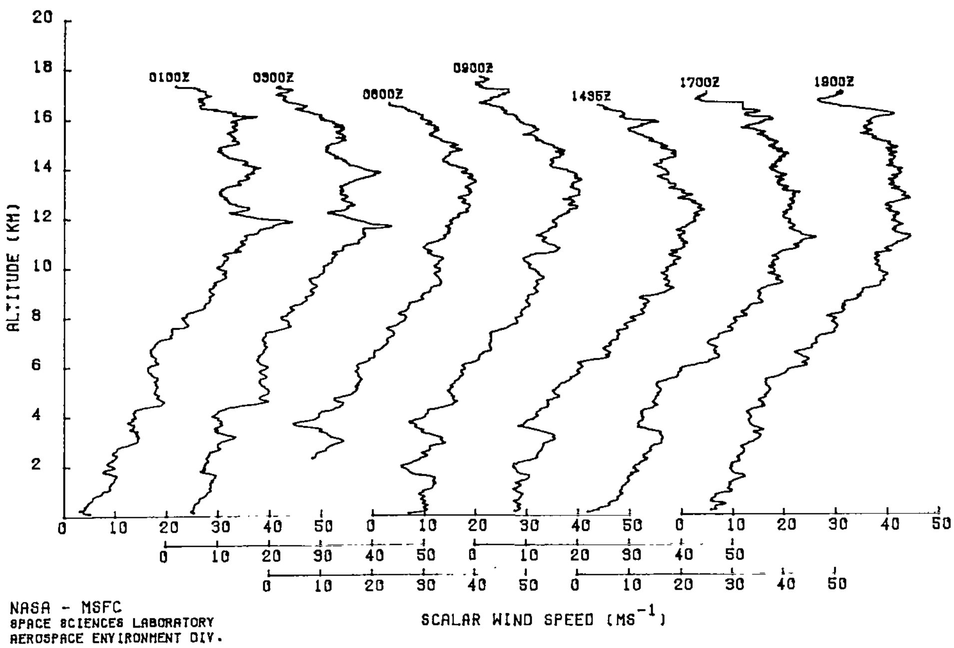

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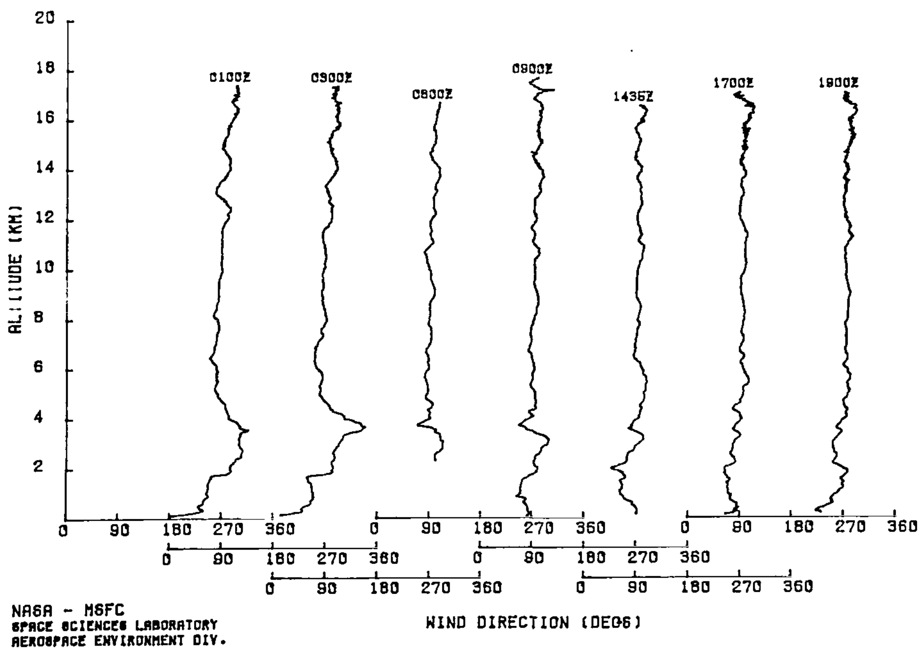

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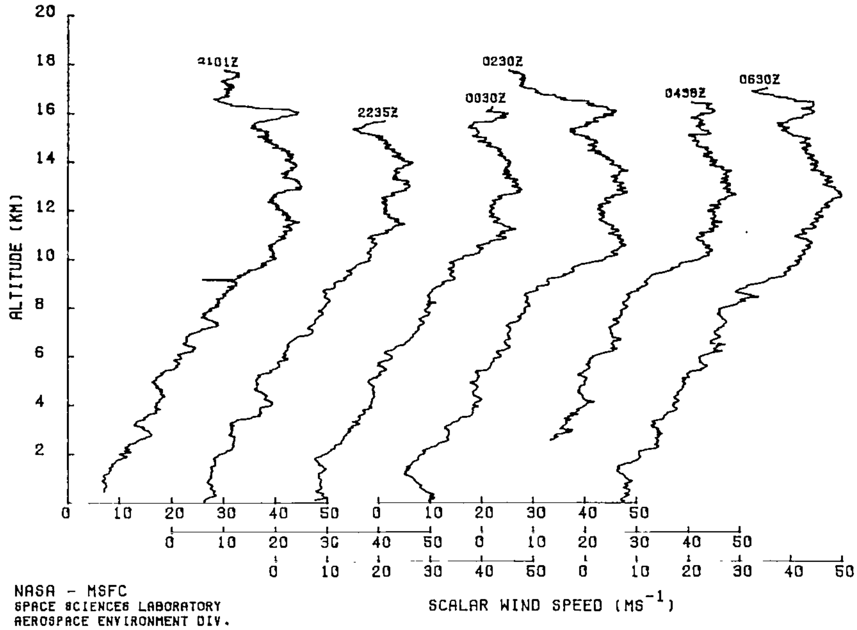

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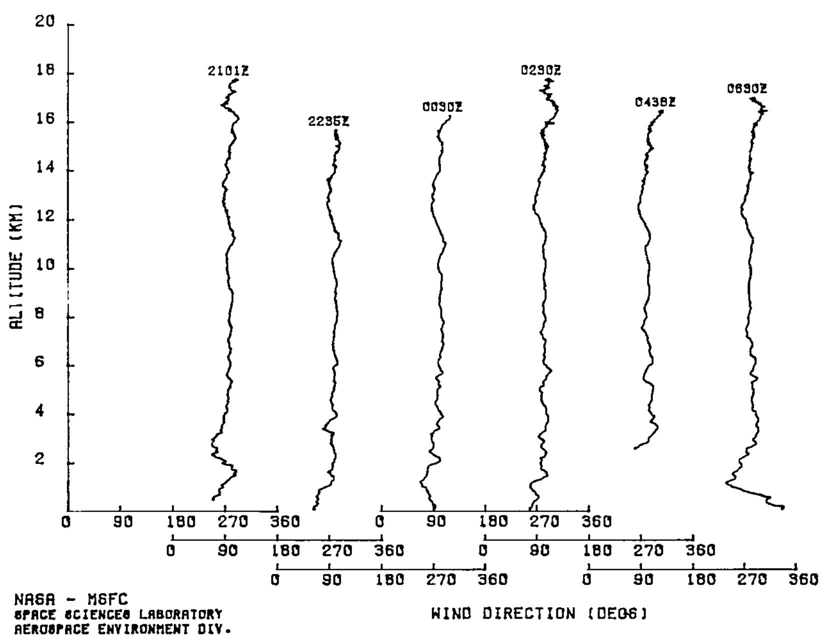

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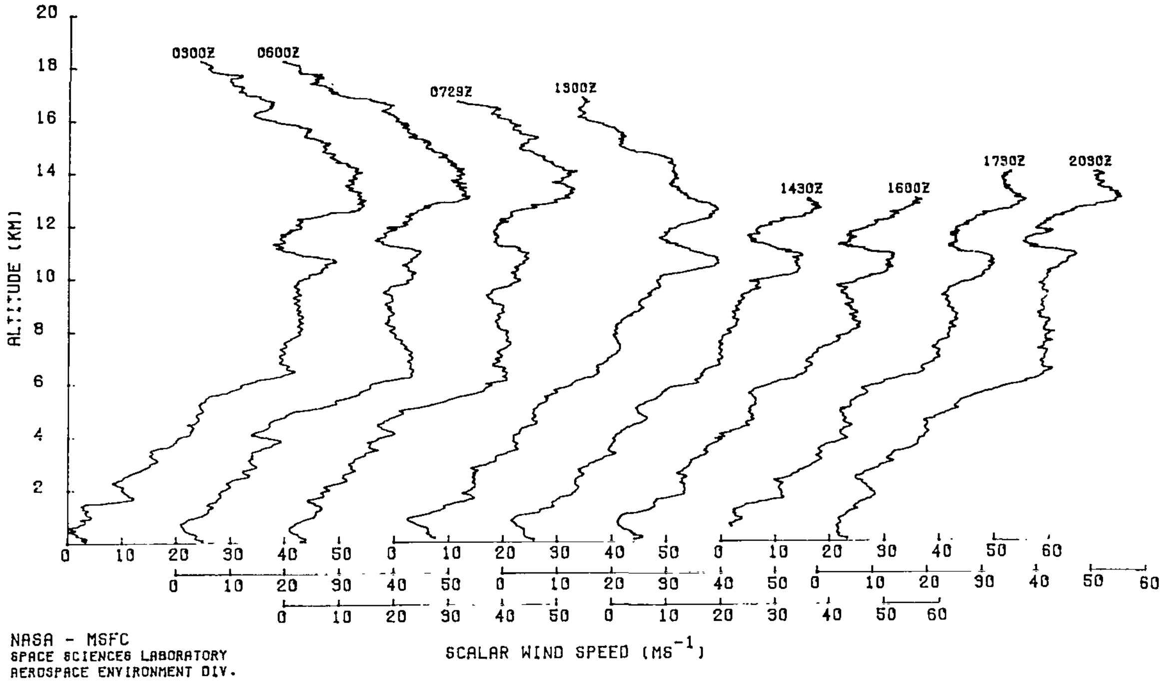
FEB 14. 1968



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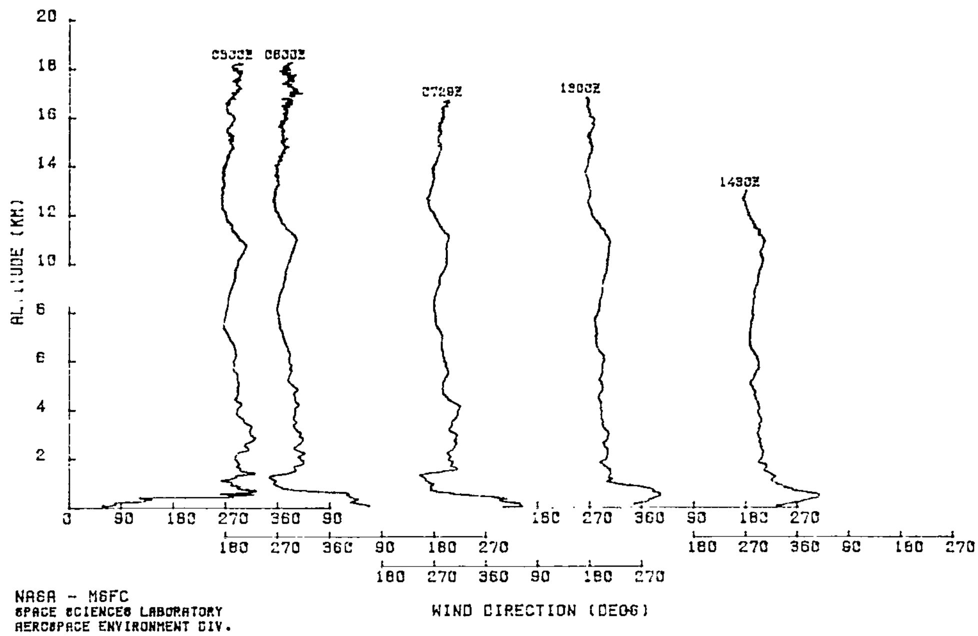

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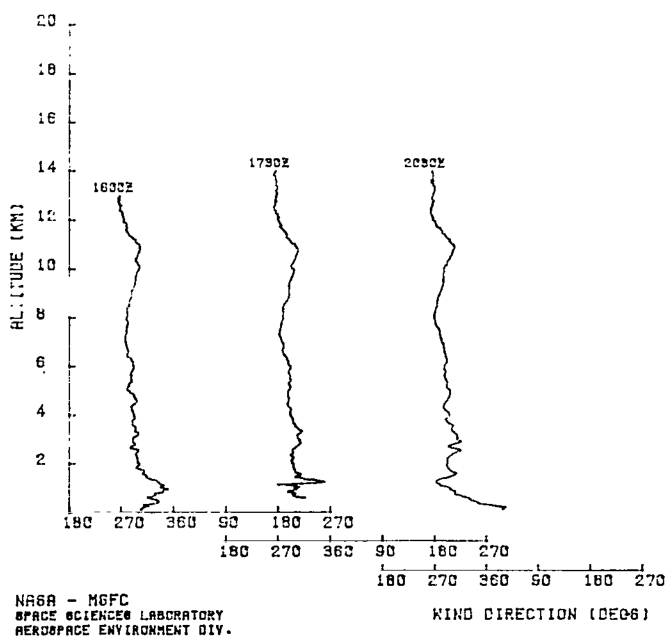

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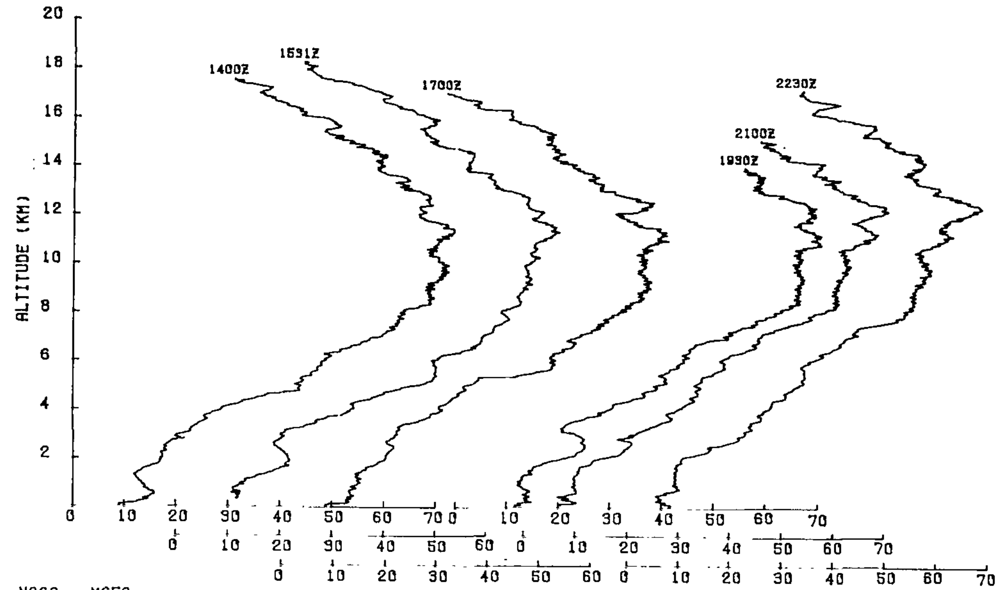
12

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
FEB 27 1968



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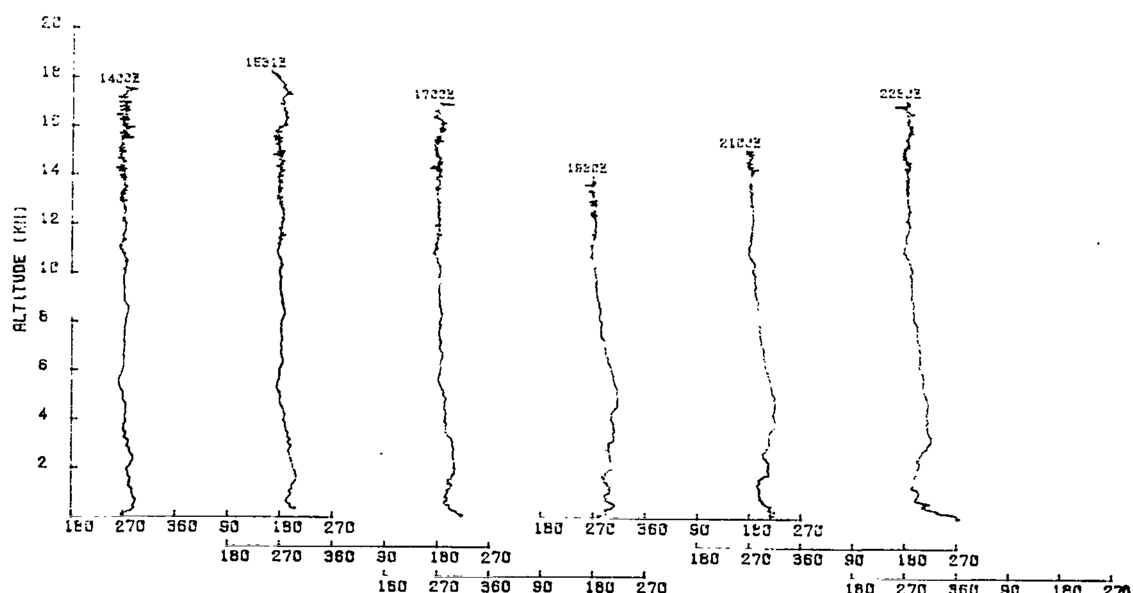
AEROSPACE ENVIRONMENT DIV.

SCALAR WIND SPEED (MS^{-1})

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
FEB 27 1968



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AEROSPACE ENVIRONMENT DIV.

WIND DIRECTION (DEGS)

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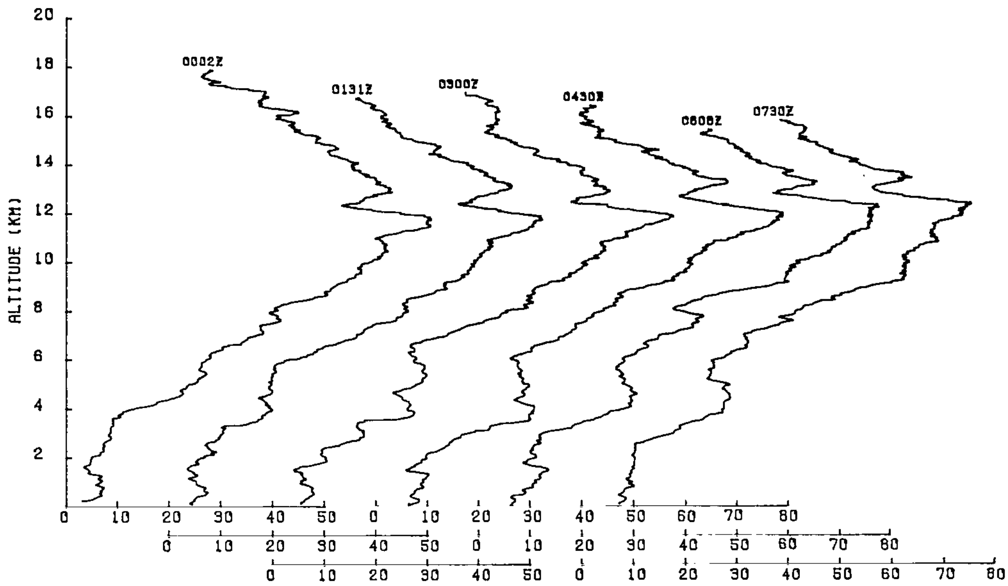
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
FEB 11, 1969



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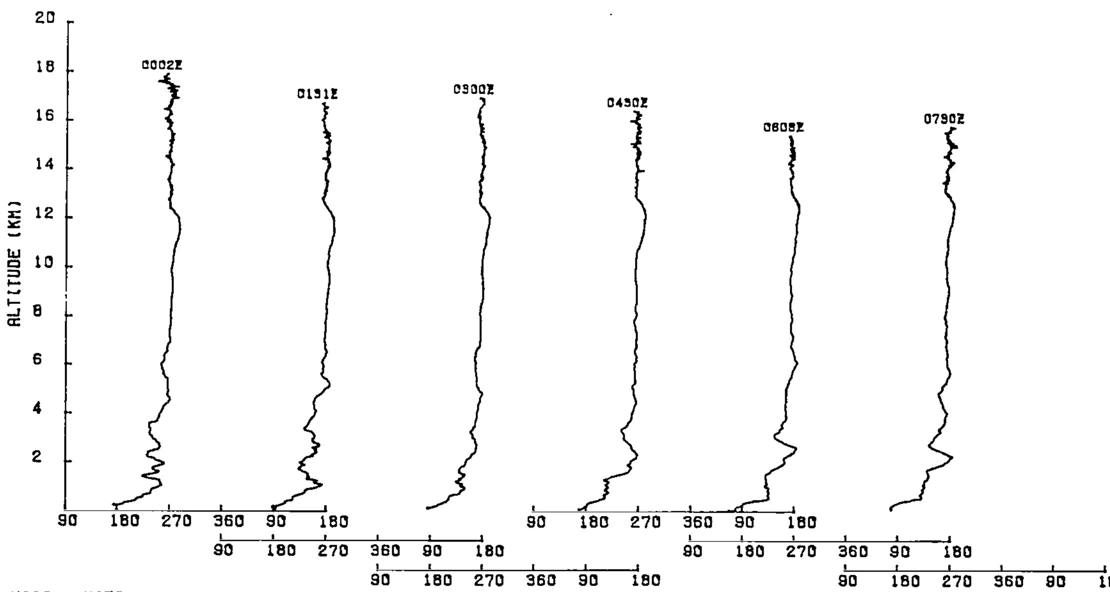
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
FEB 11, 1969



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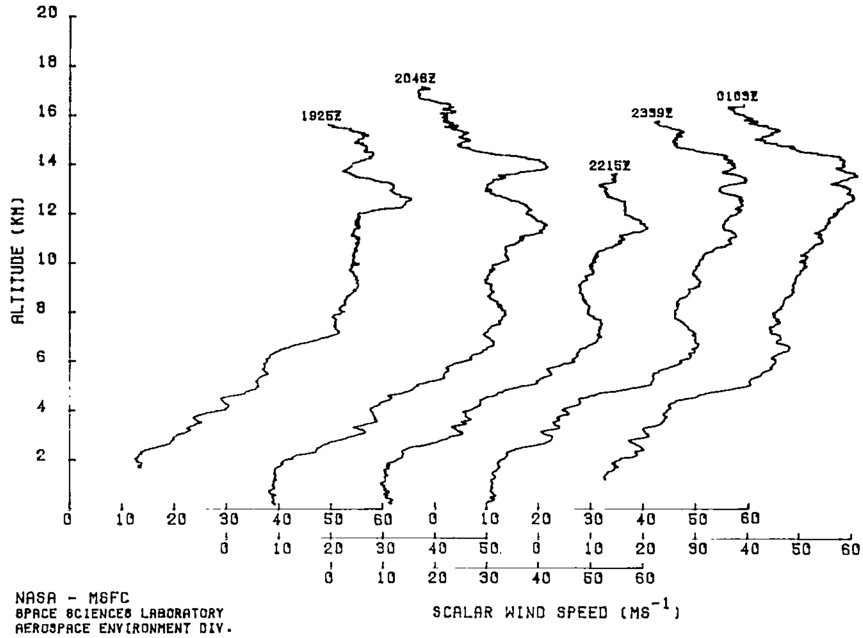
14

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
MAR 10-11. 1965



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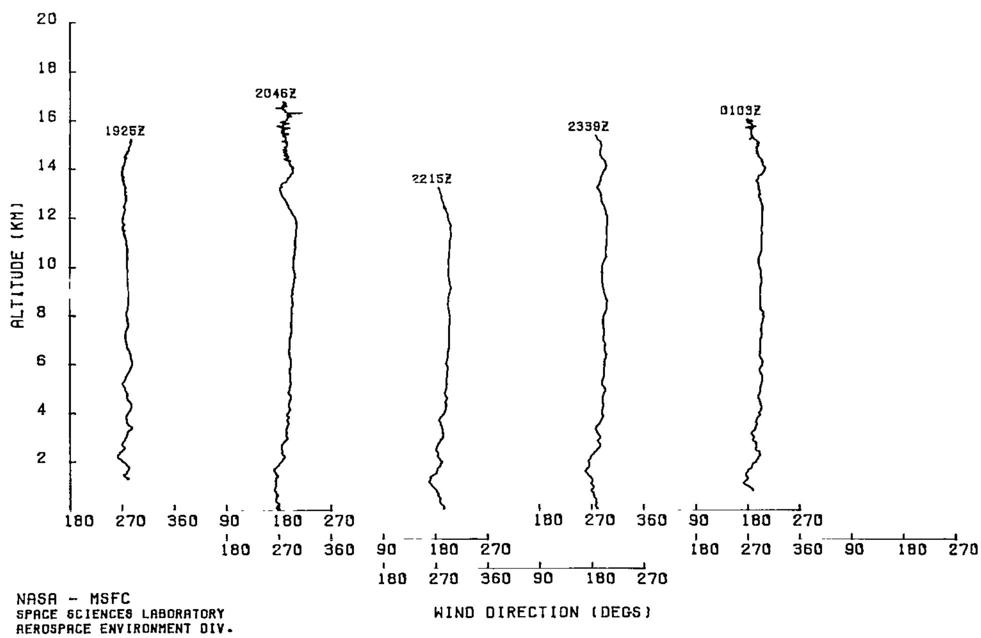
MAR 10-11. 1965



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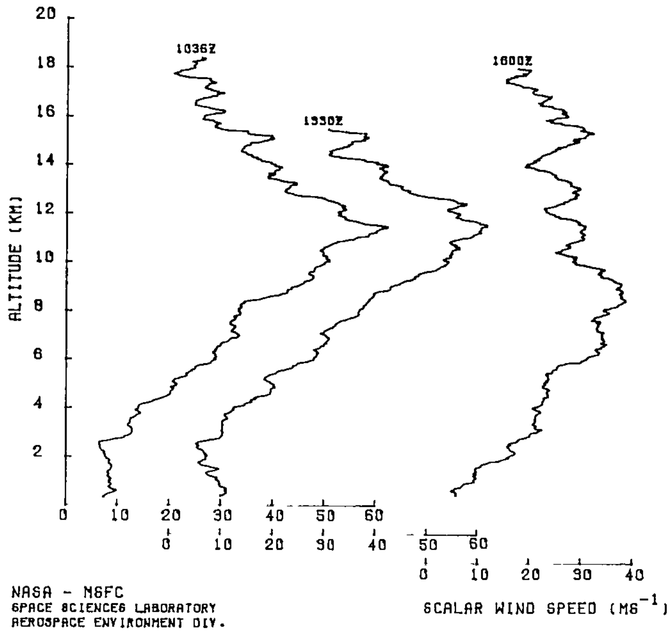
MAR 15. 1966



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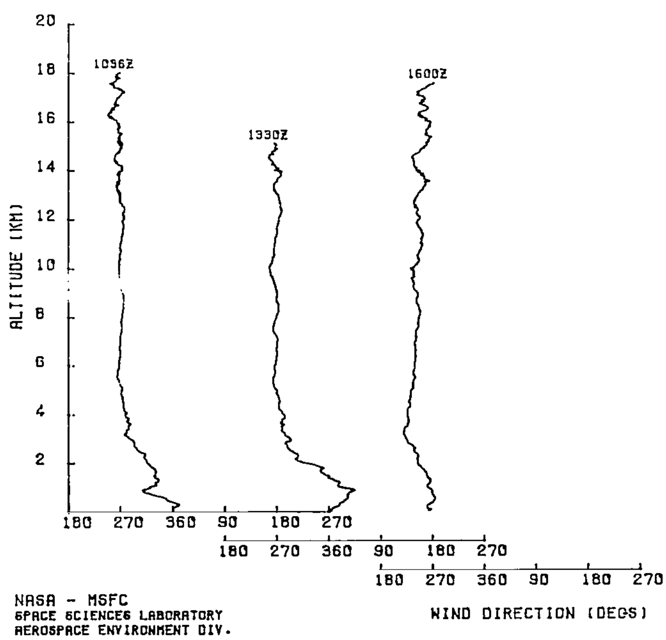
MAR 15. 1966



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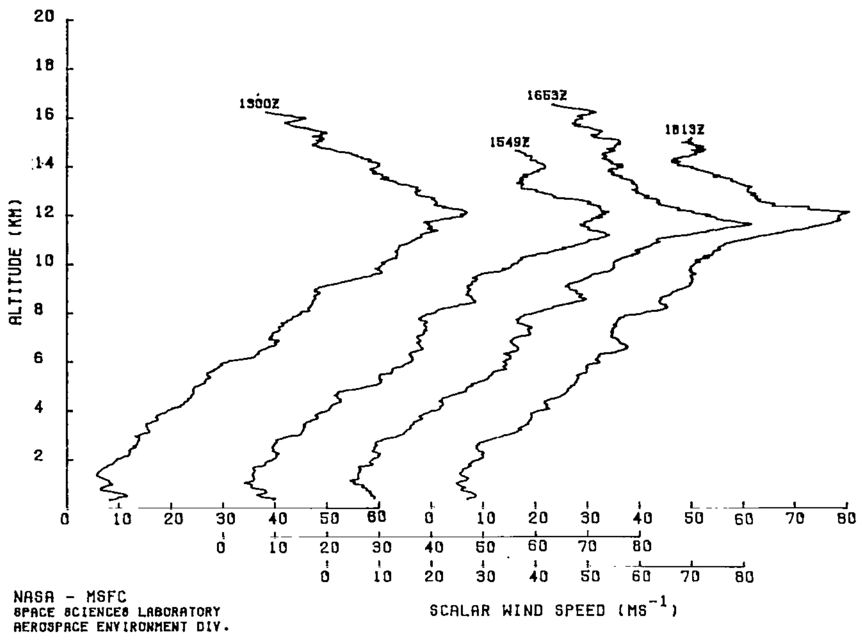
MAR 28-29. 1966



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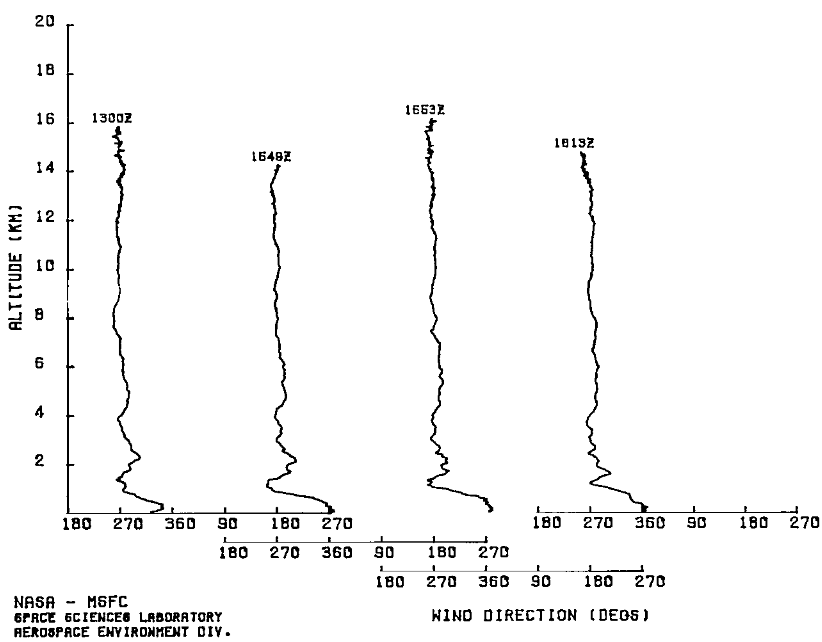
MAR 28-29. 1966



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17

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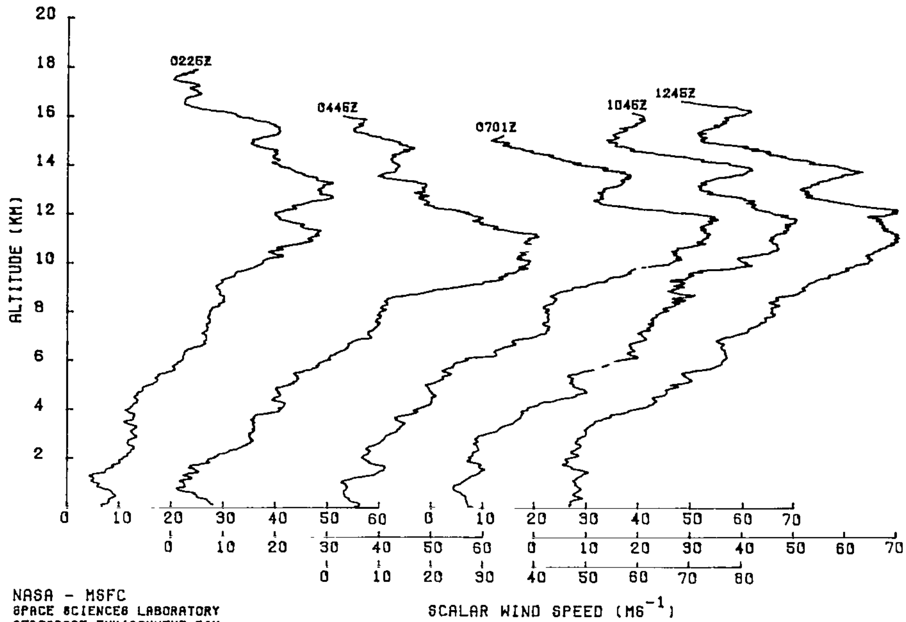
MAR 3, 1969



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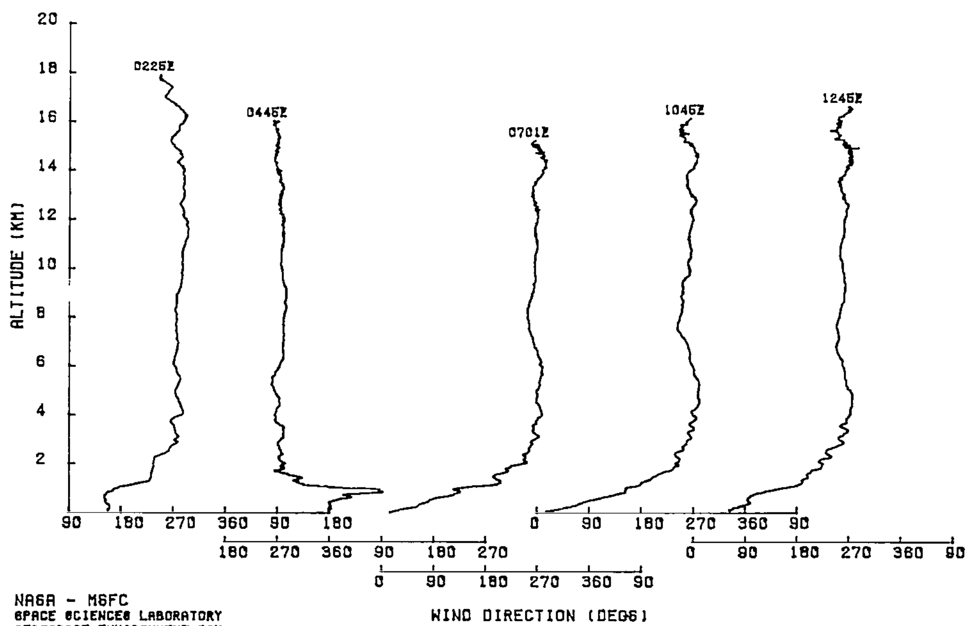
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
MAR 3, 1969



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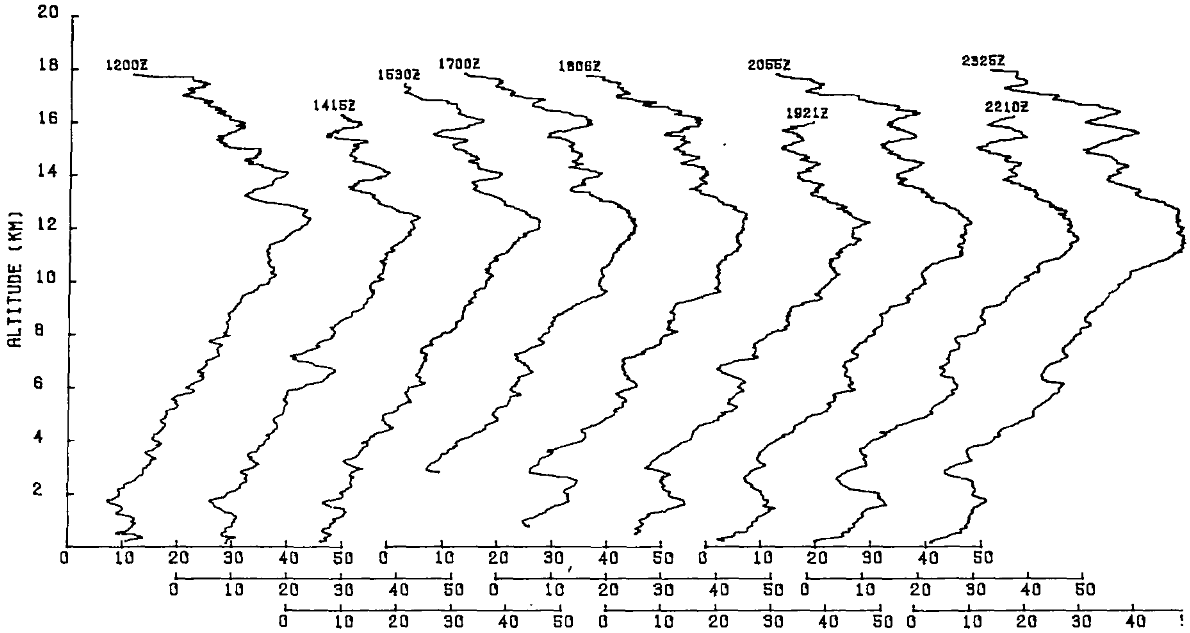
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 13, 1965



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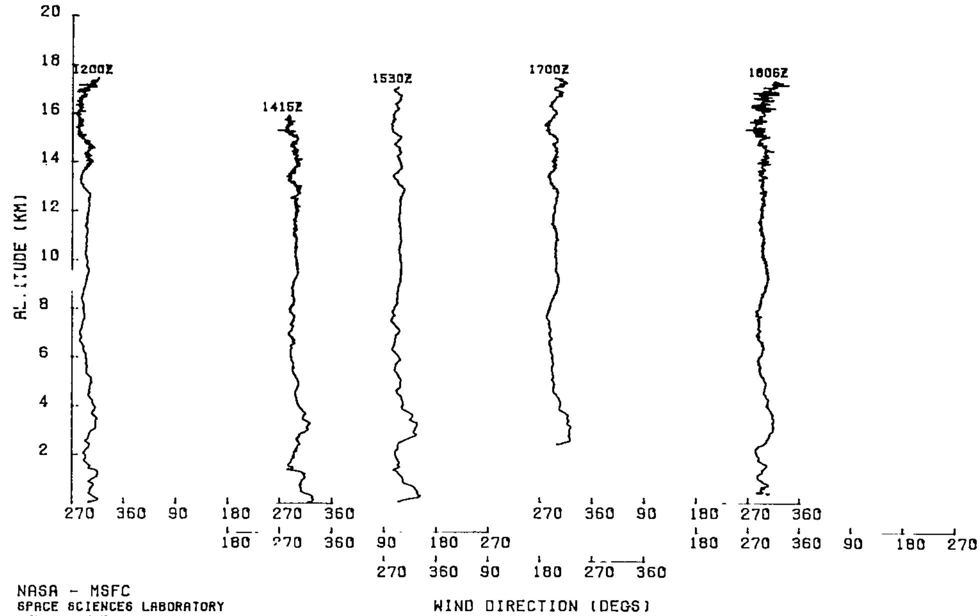
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 13. 1965



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AEROSPACE ENVIRONMENT DIV.

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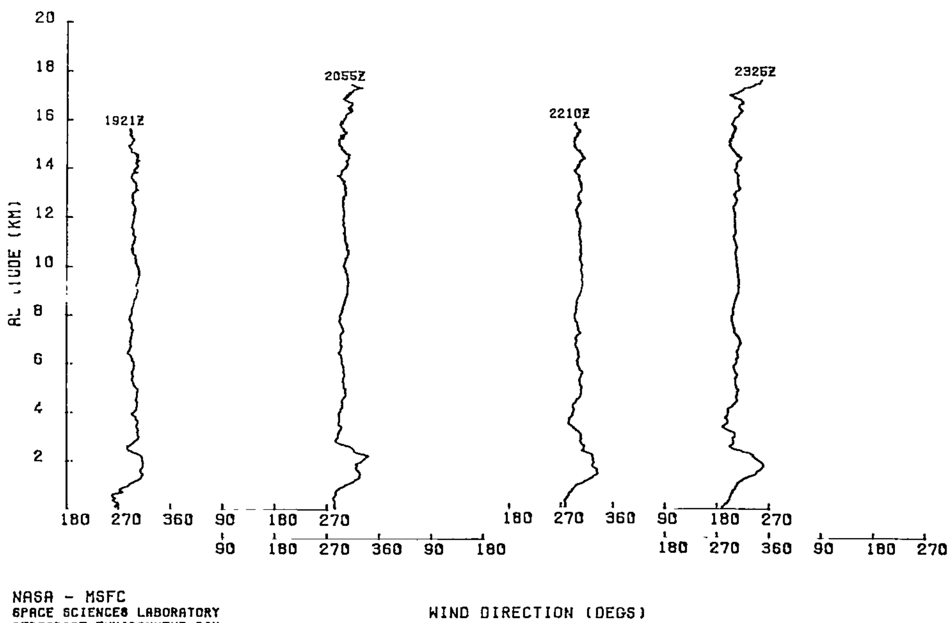

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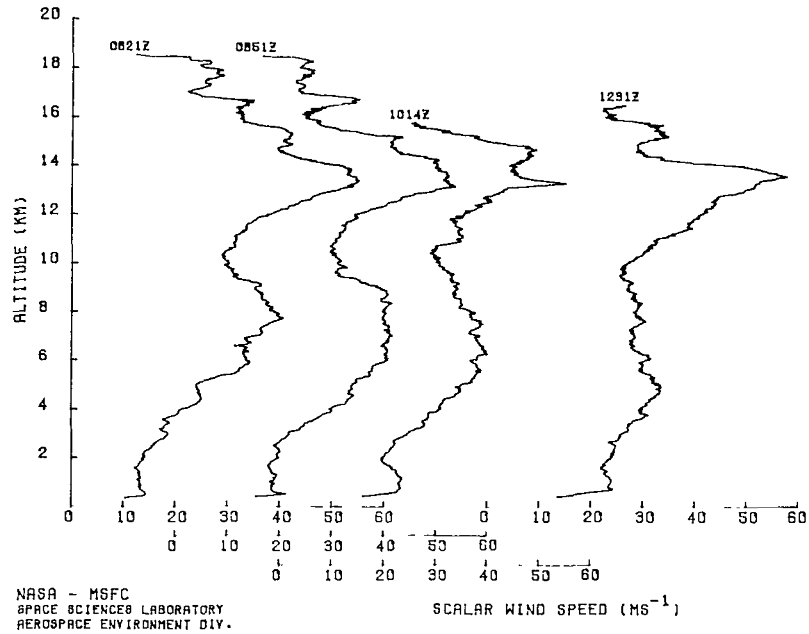
APR 4, 1966



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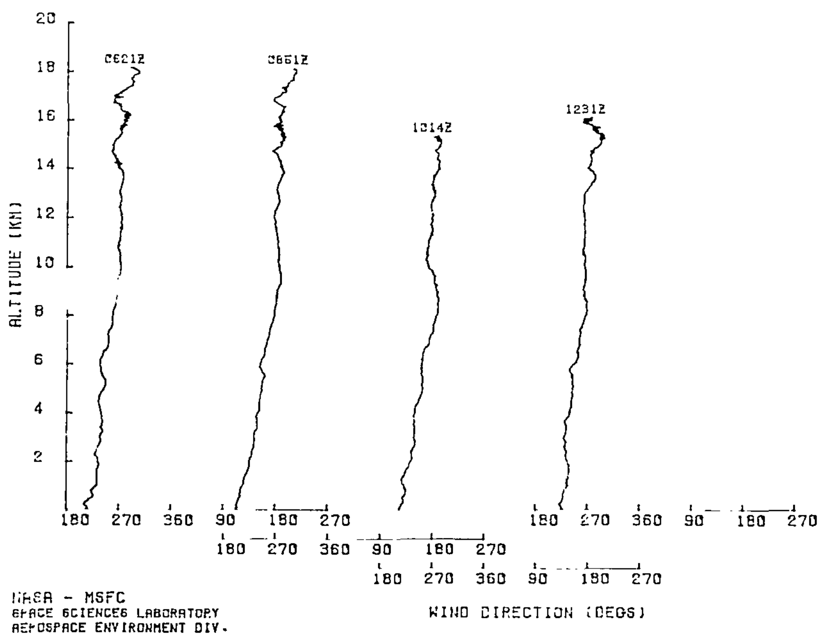
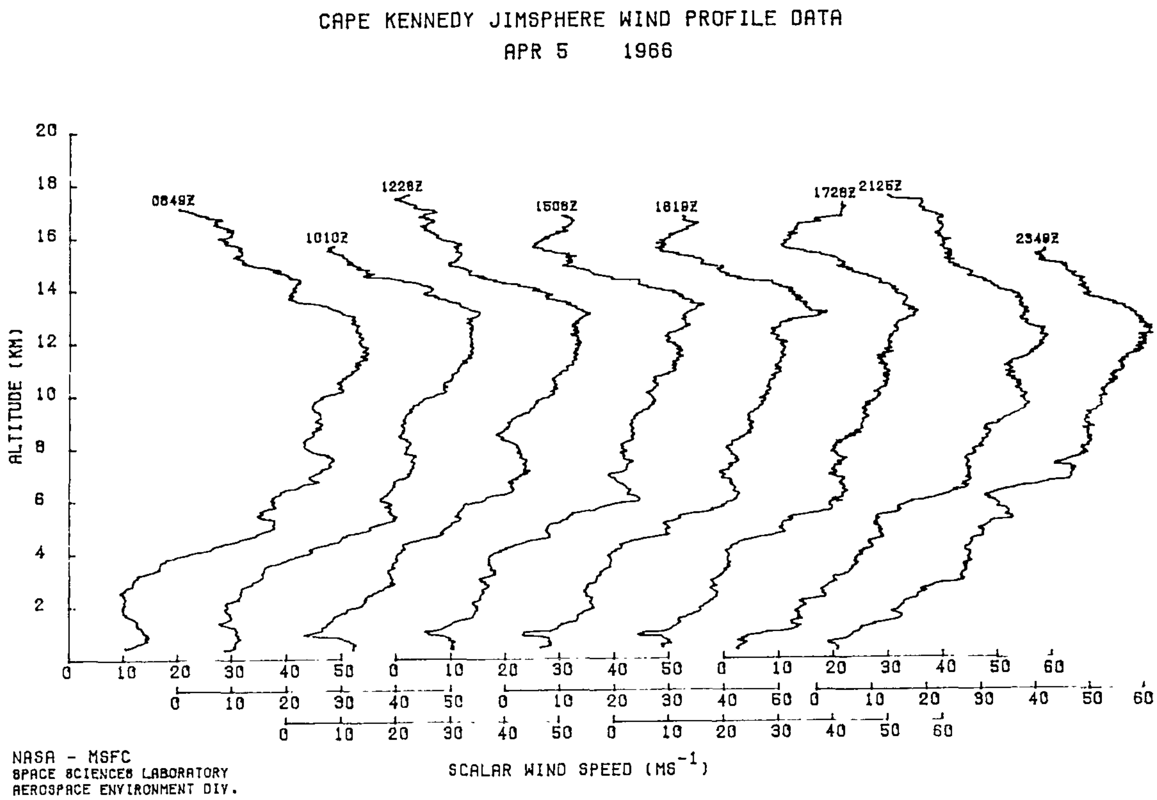
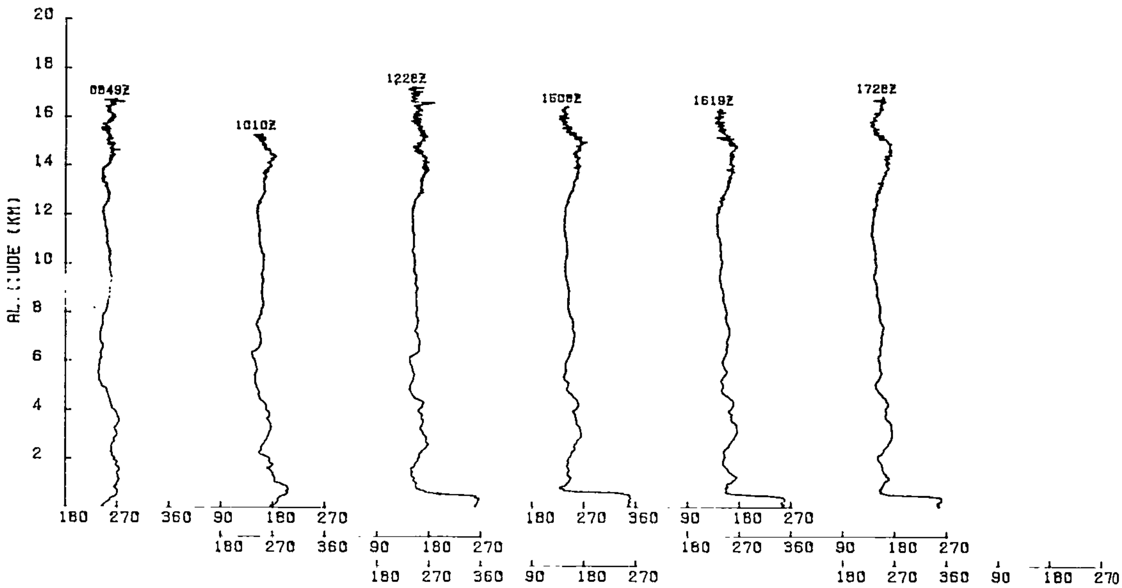
APR 4, 1966




CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 5 1966
ALTITUDE (KM)
0849Z
1010Z
1228Z
1508Z
1818Z
1728Z
2126Z
2349Z
NASA - MSFC
SPACE SCIENCES LABORATORY
AEROSPACE ENVIRONMENT DIV.
SCALAR WIND SPEED (MS⁻¹)

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 5 1966



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AEROSPACE ENVIRONMENT DIV.

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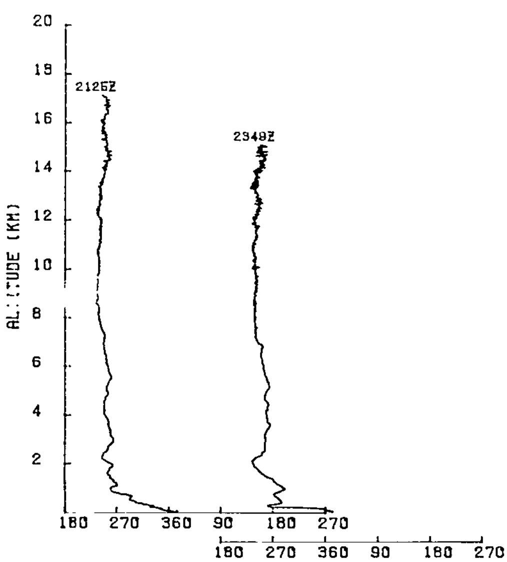

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AEROSPACE ENVIRONMENT DIV.

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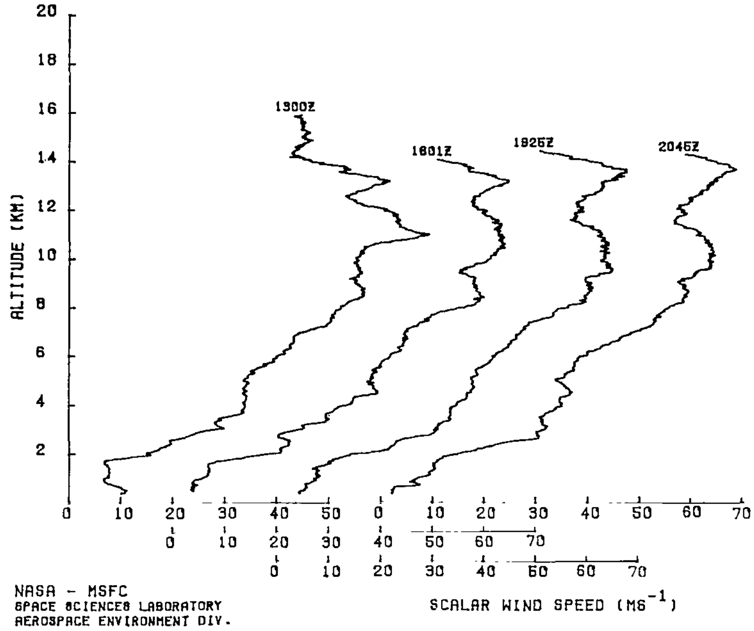
APR 6, 1966



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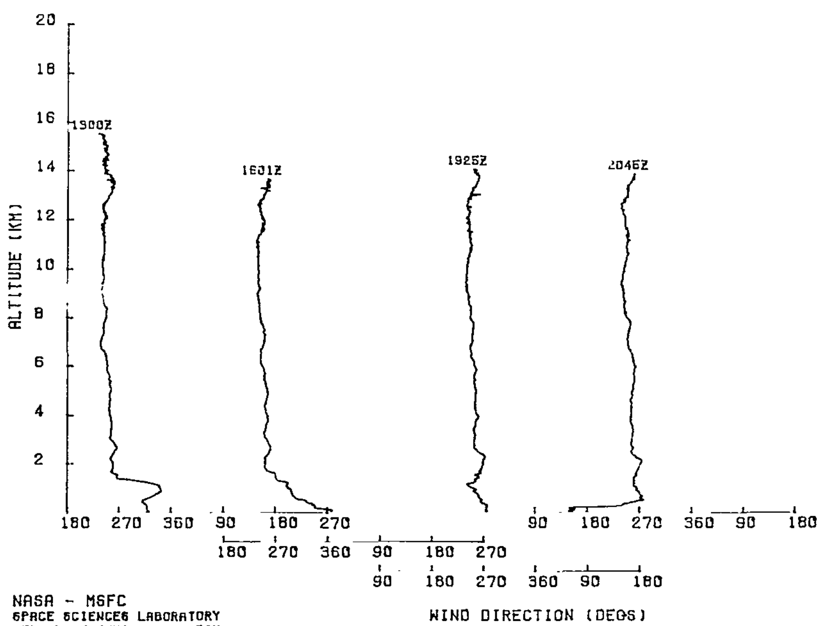
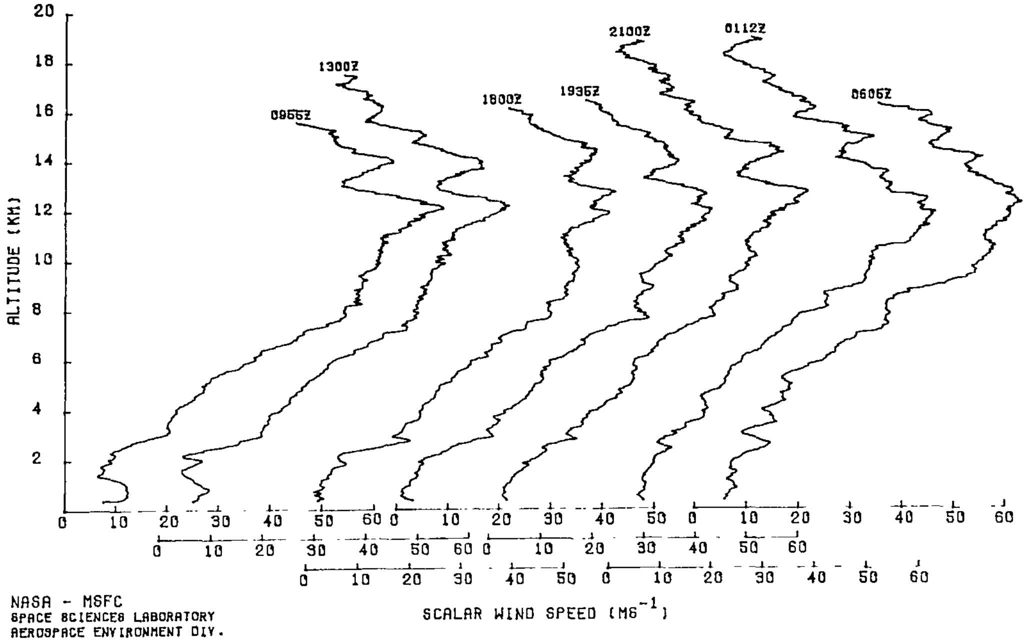


22

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 7-8. 1966



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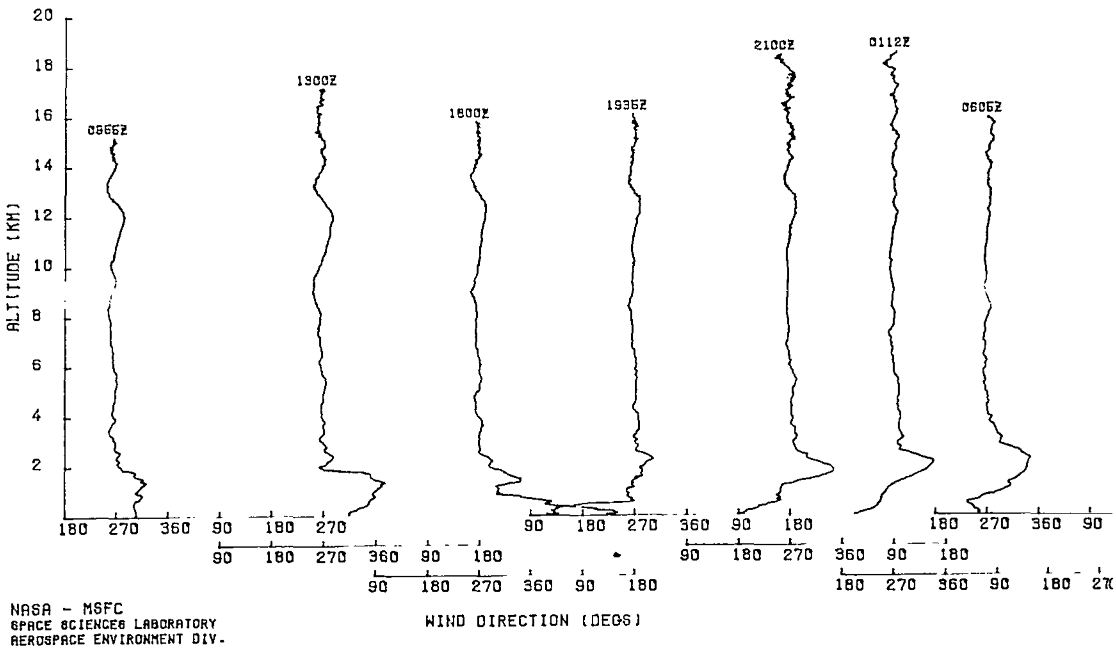
APR 7-8. 1966



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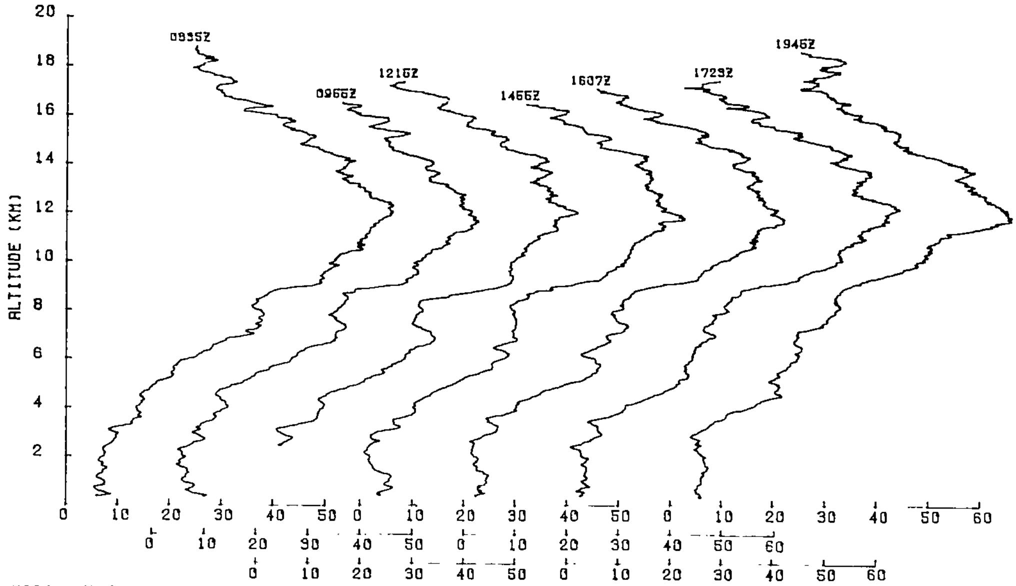
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 7-8, 1966



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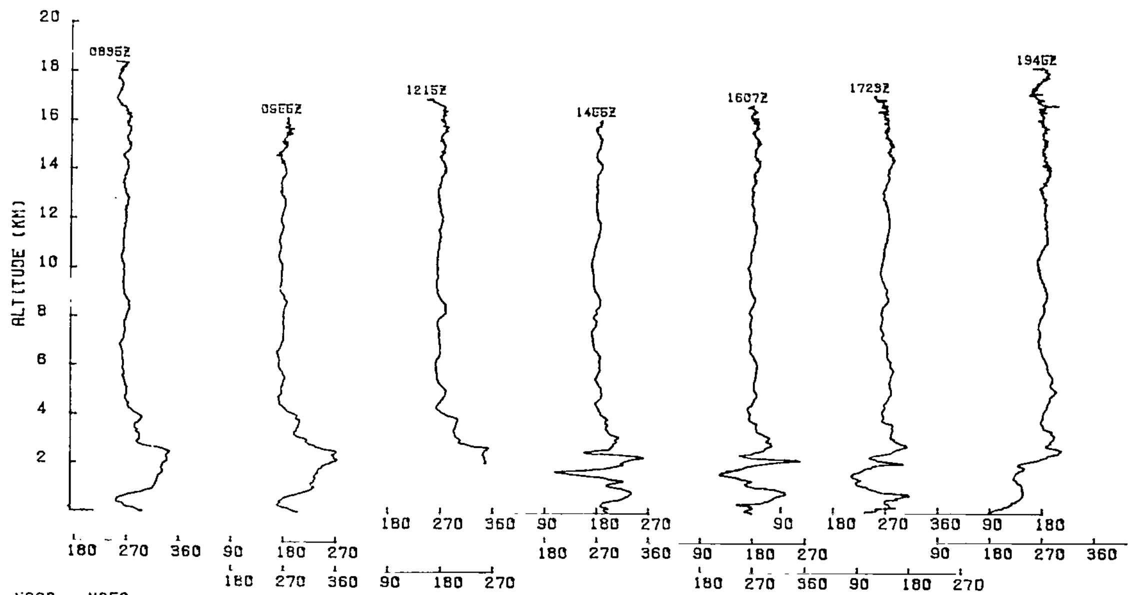
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 7-8, 1966



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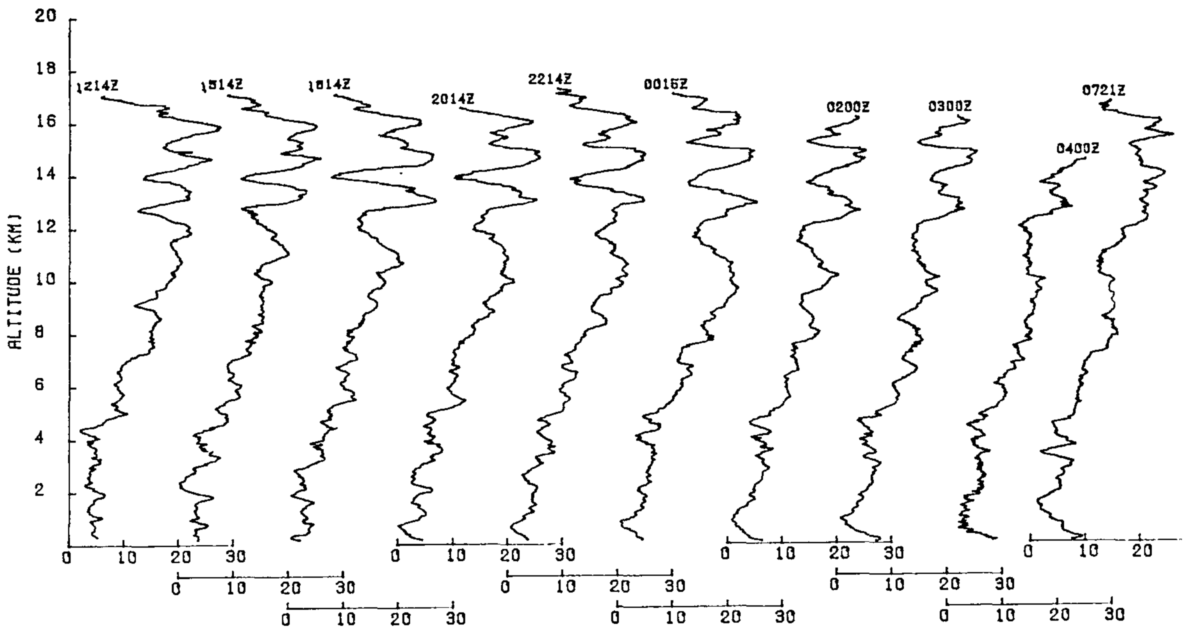
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 16-17, 1967



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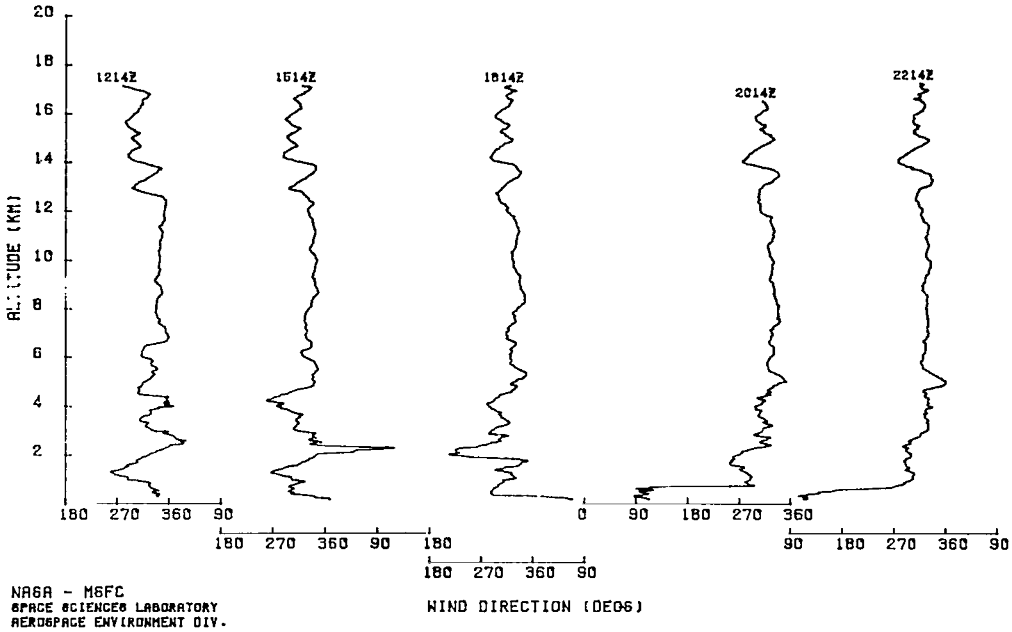
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 16-17. 1967



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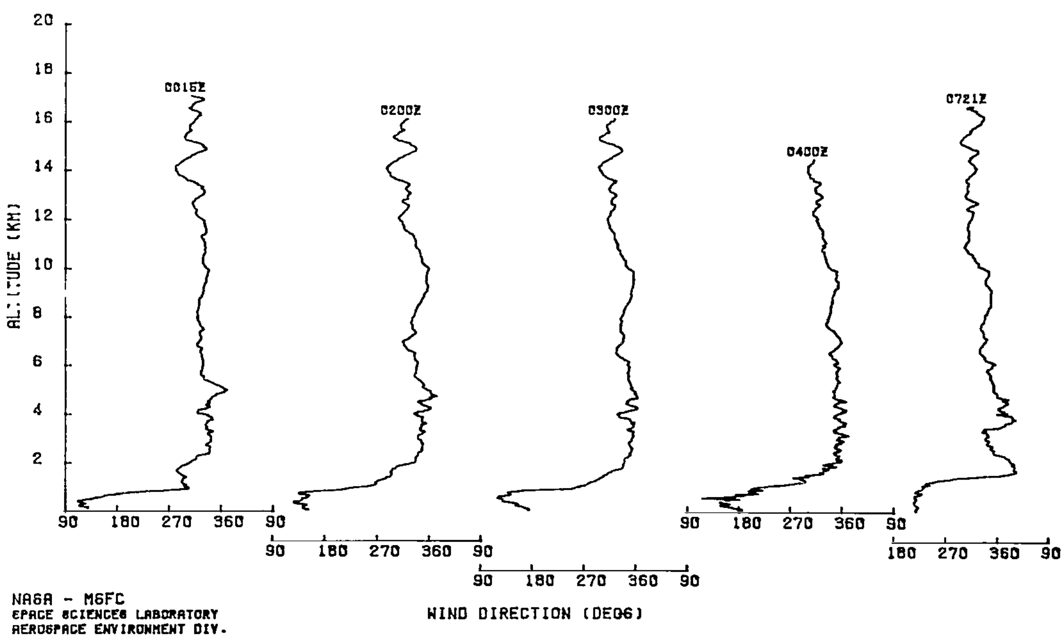
APR 16-17. 1967



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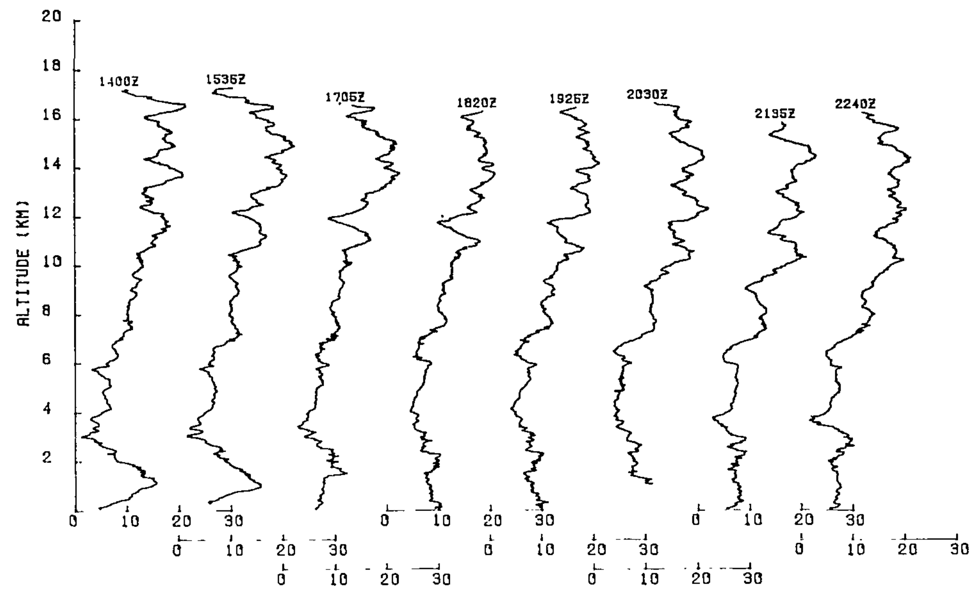
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 18, 1967



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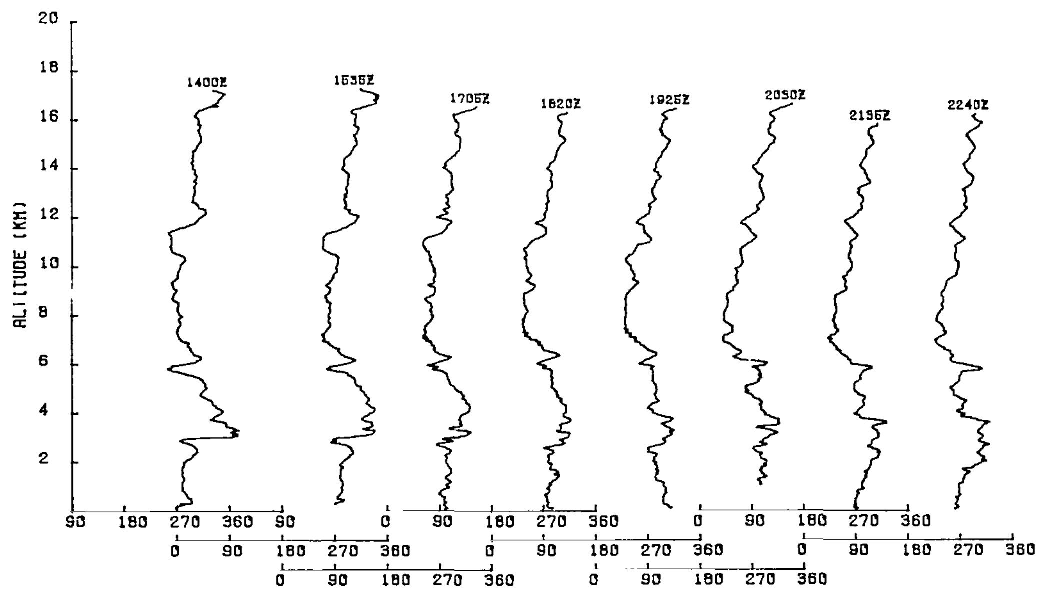
AEROSPACE ENVIRONMENT DIV.

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 18, 1967



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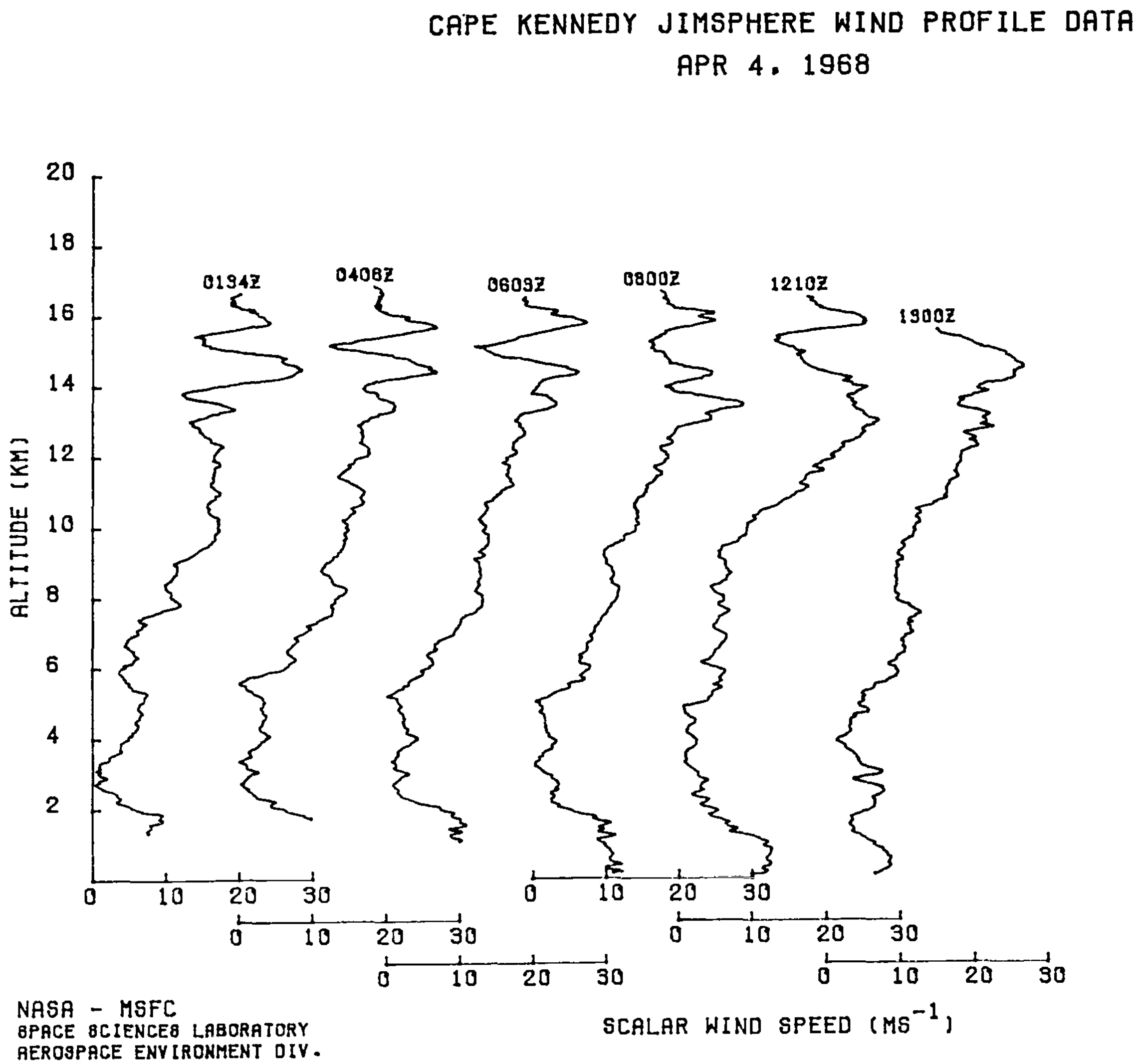

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 4, 1968
0134Z
0408Z
0603Z
0800Z
1210Z
1900Z
ALTITUDE (KM)
20
18
16
14
12
10
8
6
4
2
0
10
20
30
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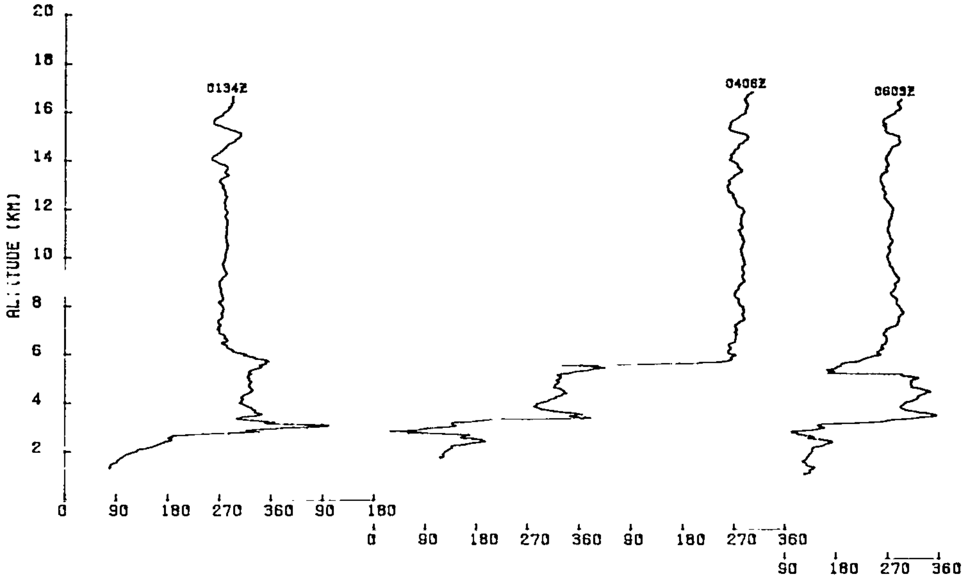
AEROSPACE ENVIRONMENT DIV.
SCALAR WIND SPEED (MS-1)

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 4. 1968



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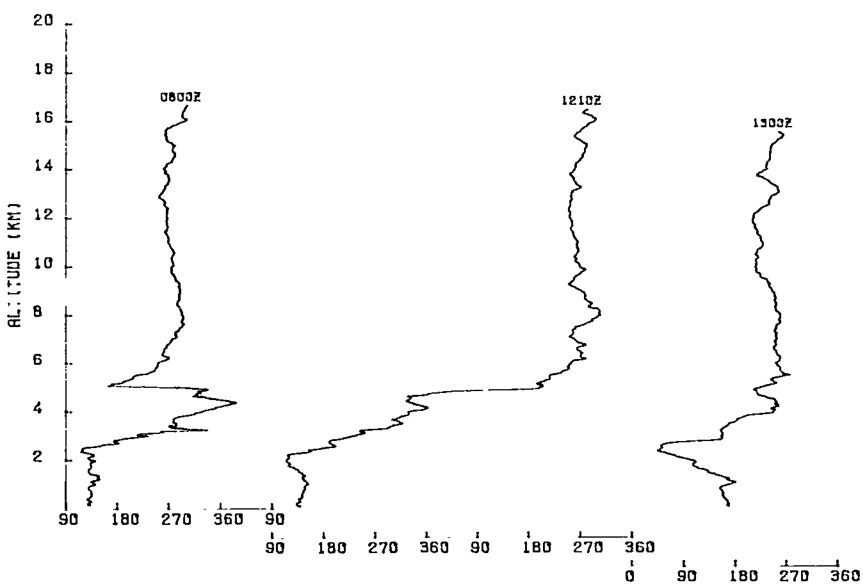
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 4. 1968



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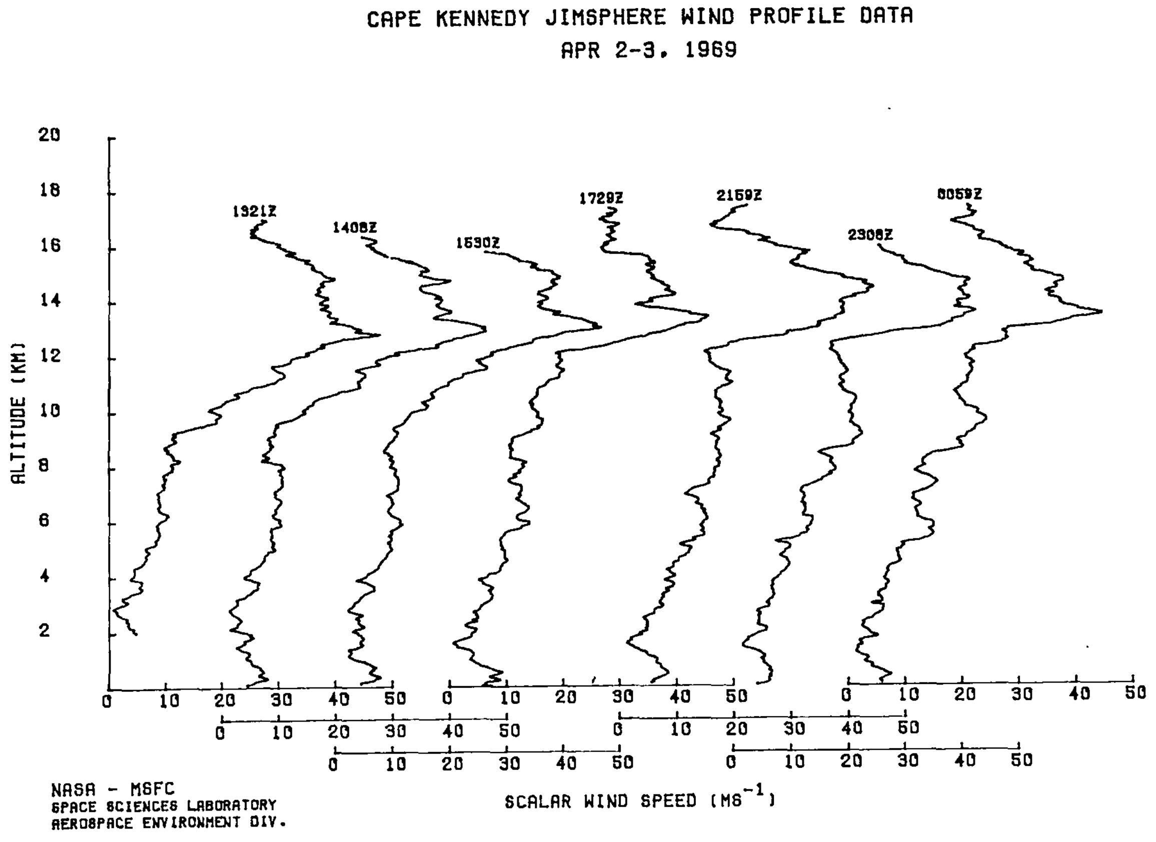
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 2-3, 1969
ALTITUDE (KM)
1921Z
1408Z
1530Z
1729Z
2159Z
2308Z
0059Z
SCALAR WIND SPEED (MS^{-1})
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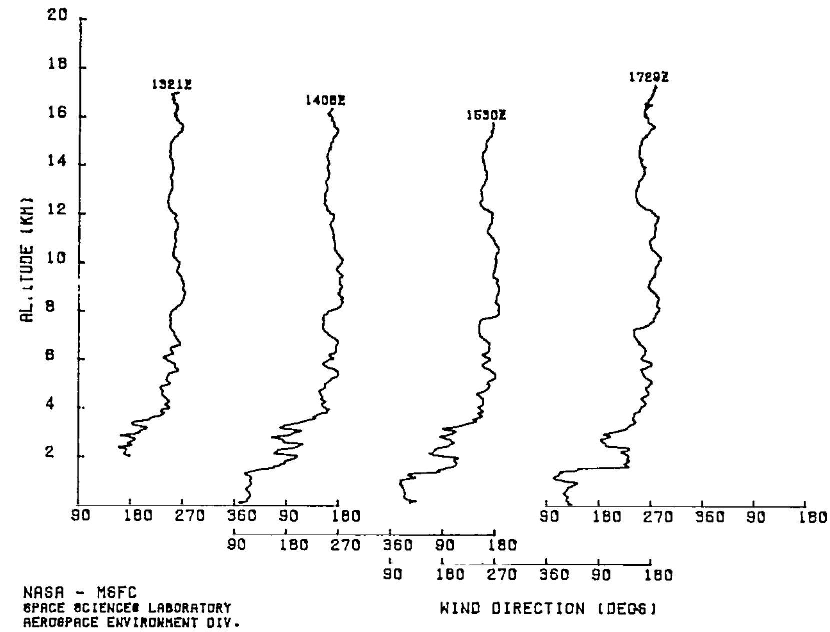
AEROSPACE ENVIRONMENT DIV.

26

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
APR 2-3, 1969



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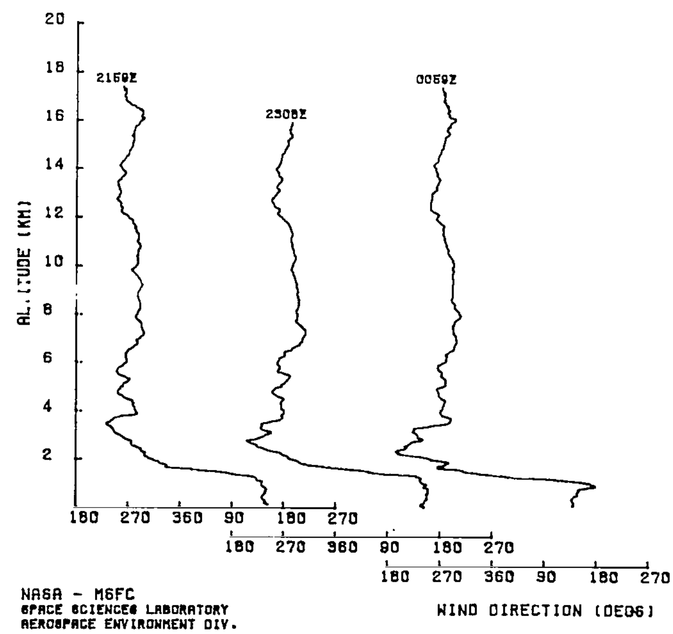

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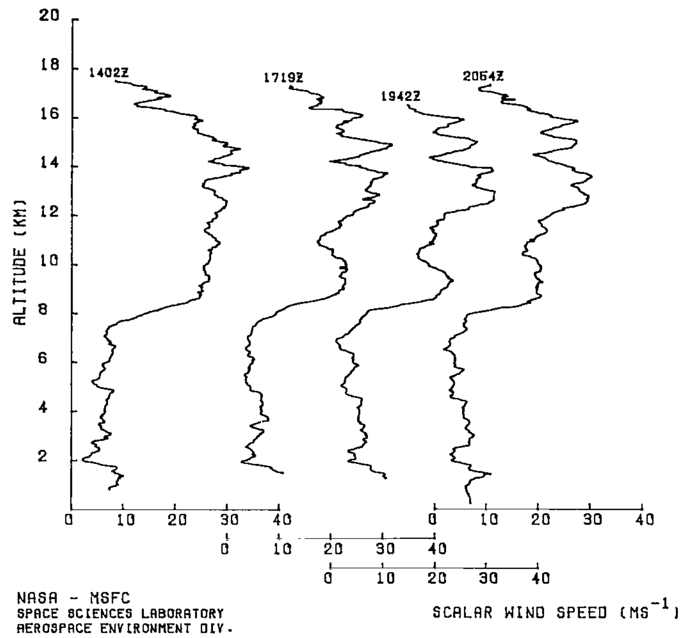
MAY 14-15, 1965



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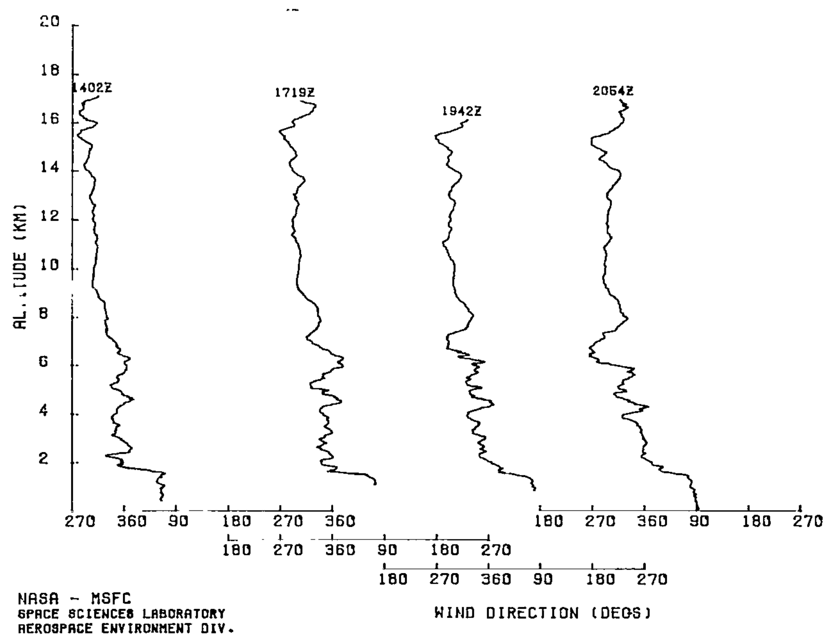

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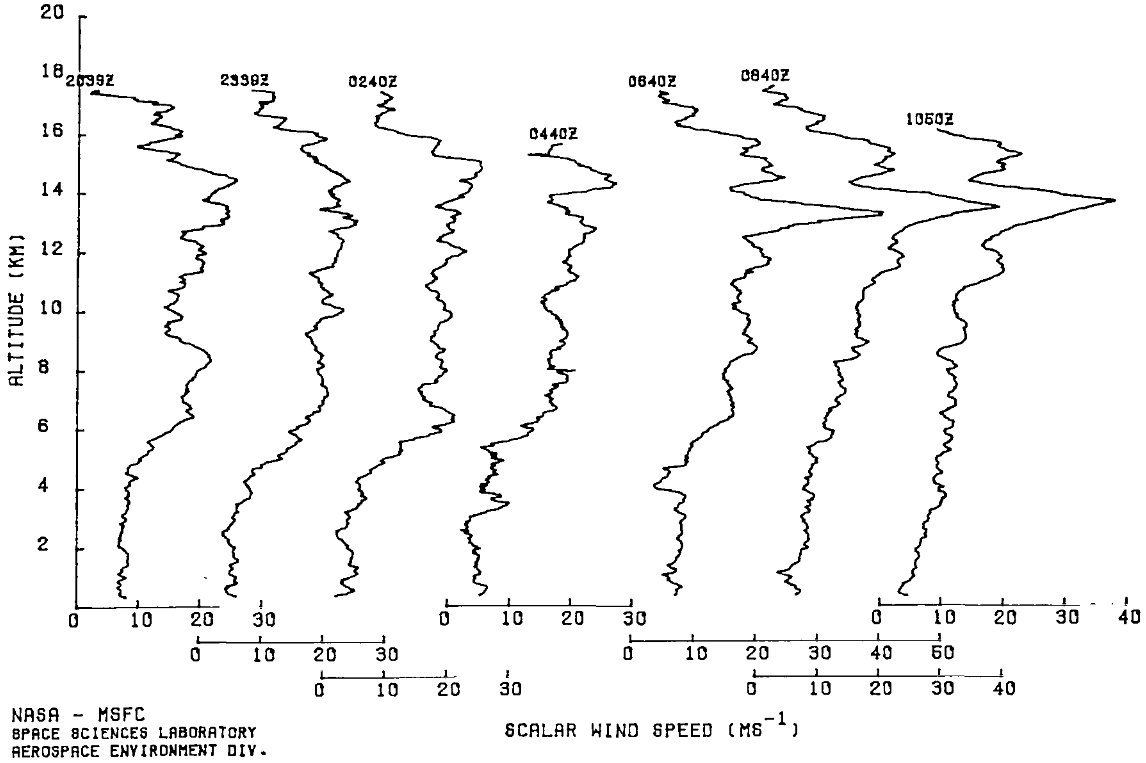
MAY 29-30, 1966



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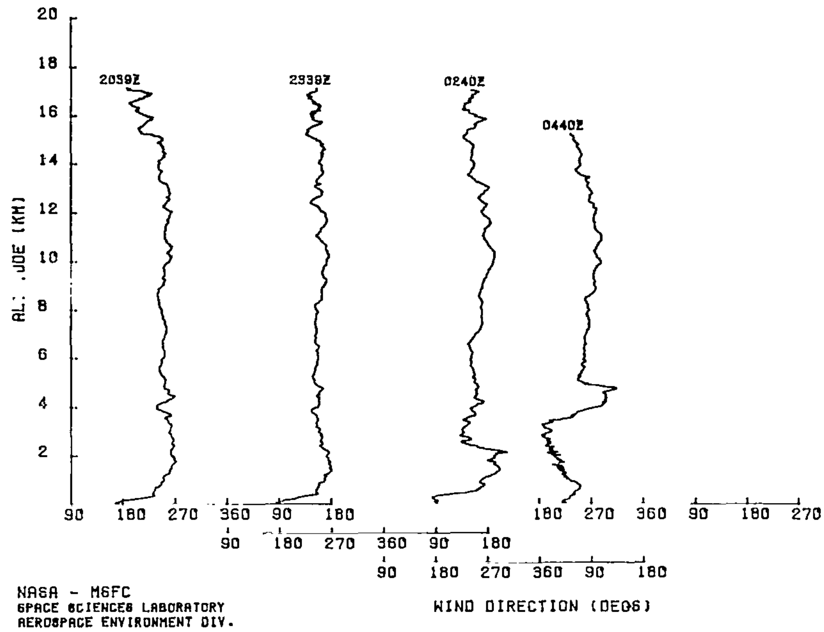

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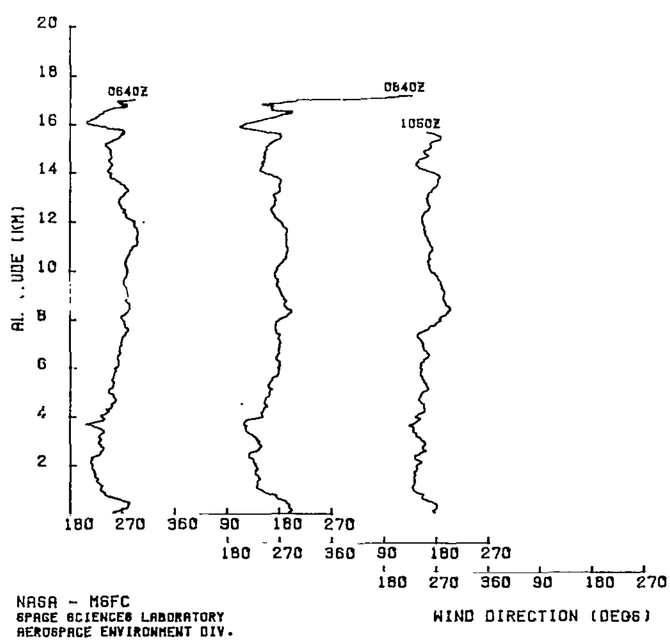

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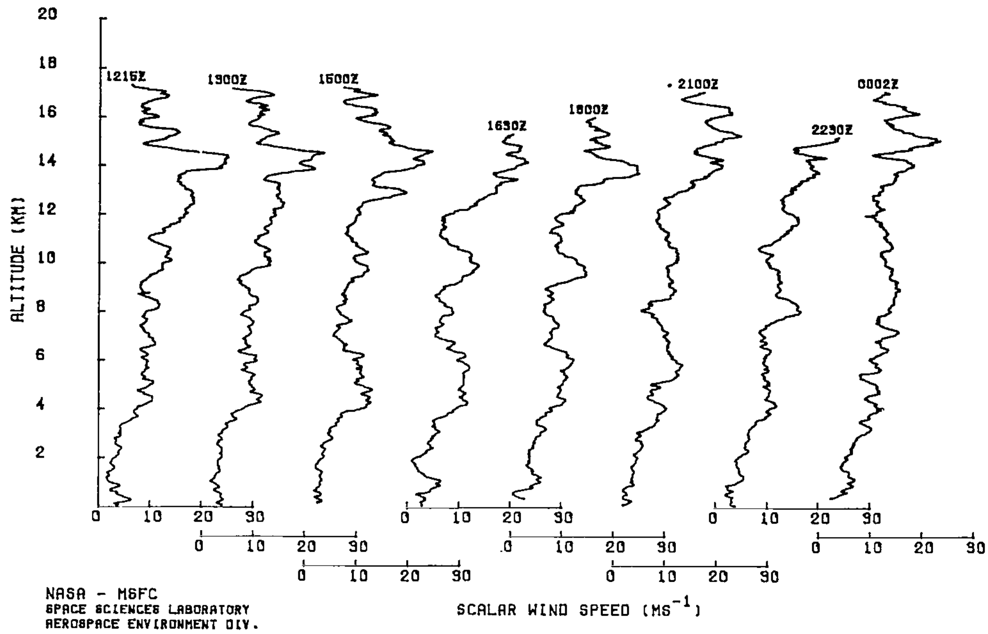
MAY 15-16. 1968



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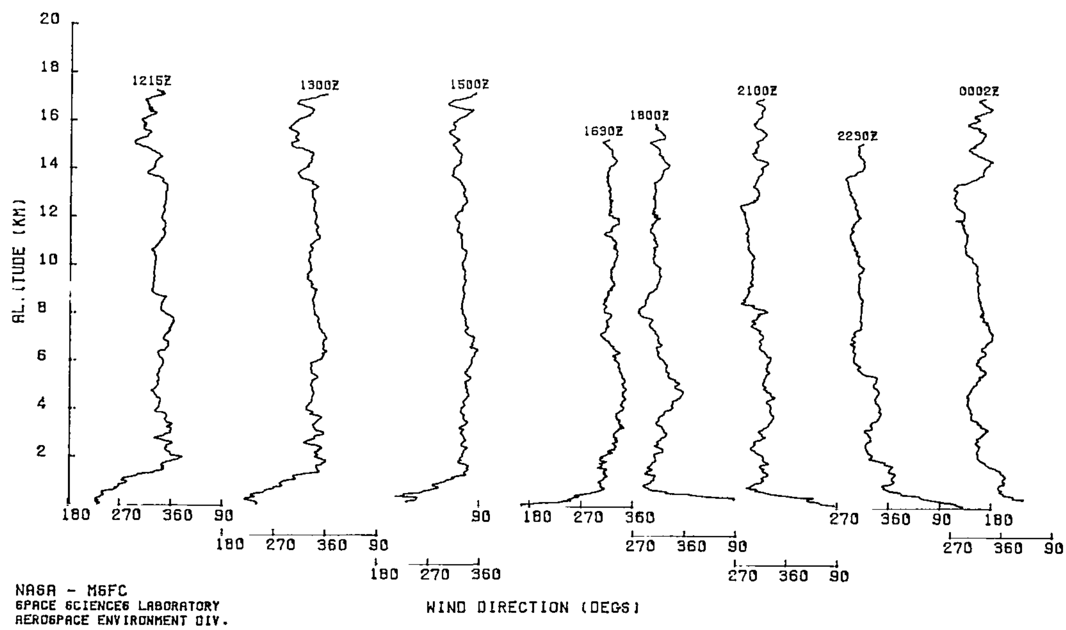
MAY 15-16. 1968



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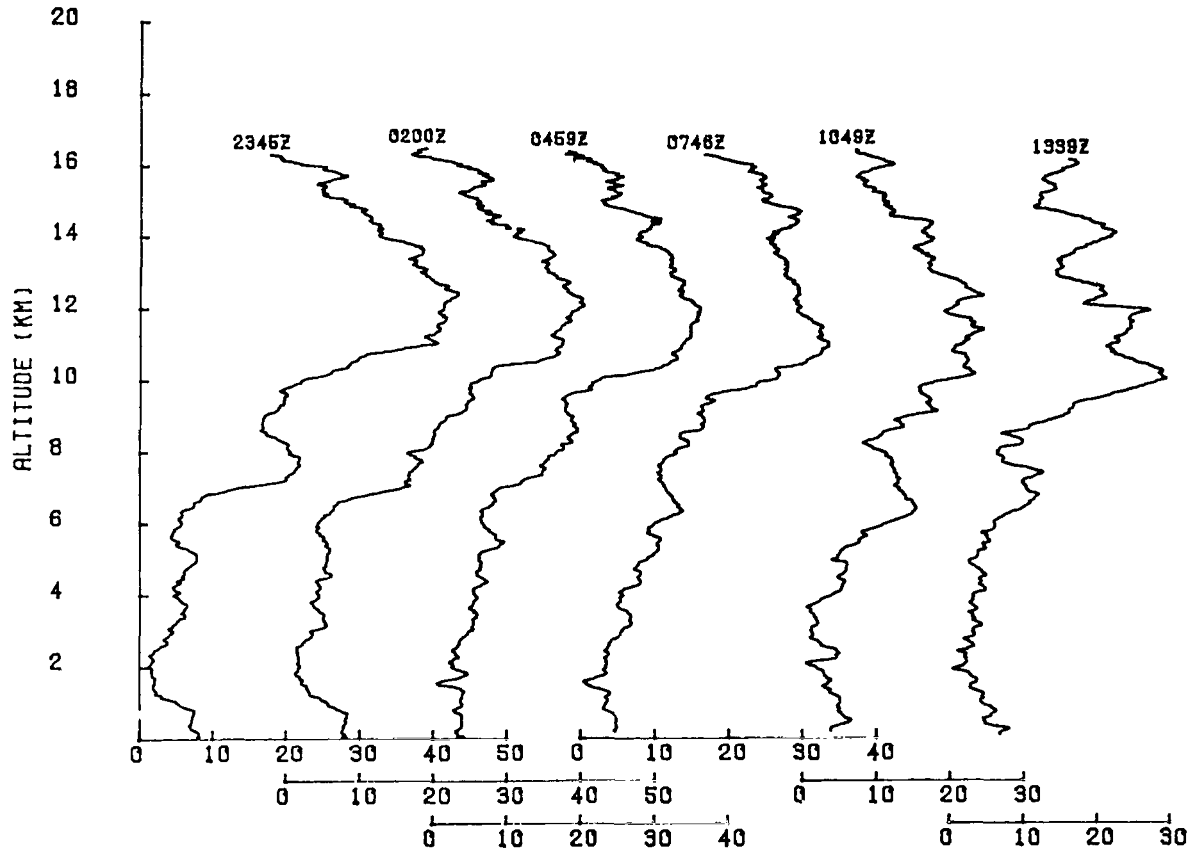
MAY 4-5, 1969



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SCALAR WIND SPEED (MS^{-1})

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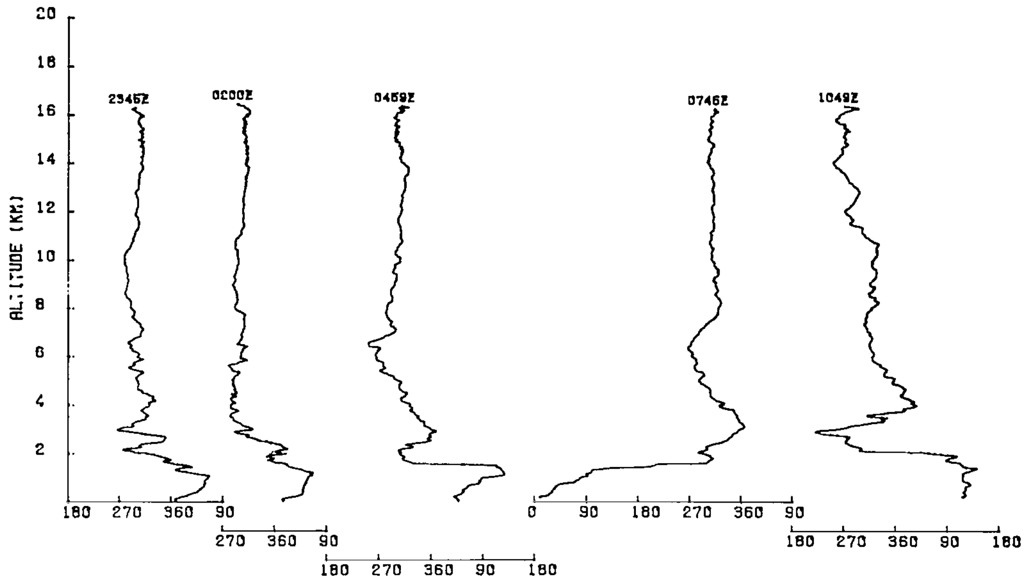
MAY 4-5, 1969



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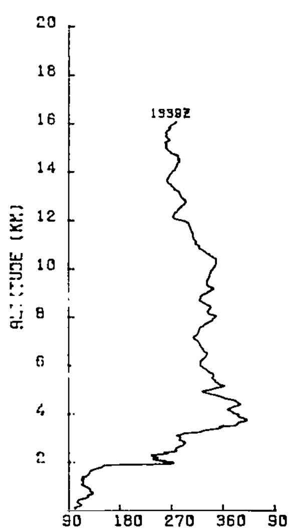
MAY 4-5, 1969



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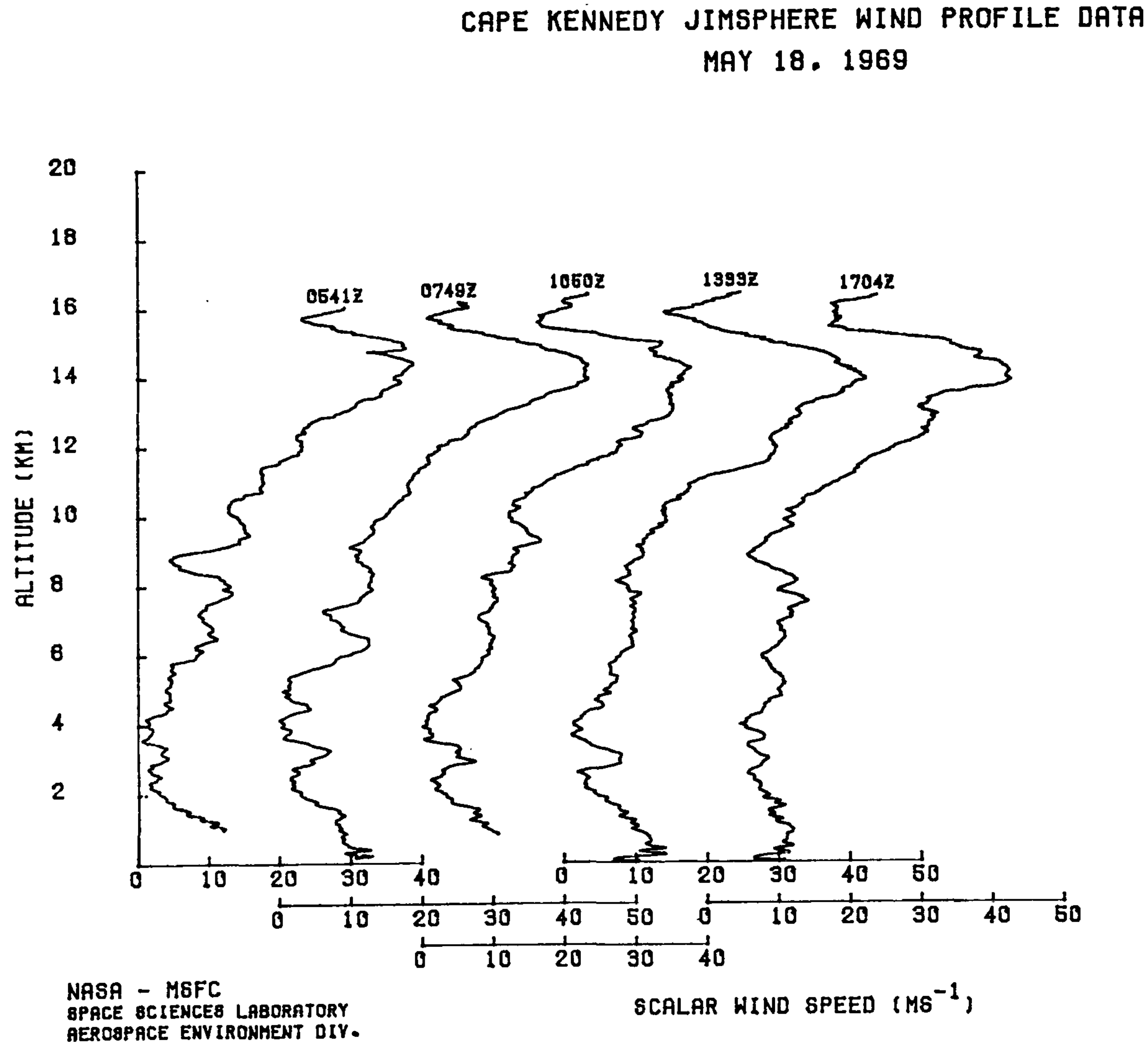

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
MAY 18, 1969
ALTITUDE (KM)
0541Z
0749Z
1050Z
1333Z
1704Z
SCALAR WIND SPEED (MS^{-1})
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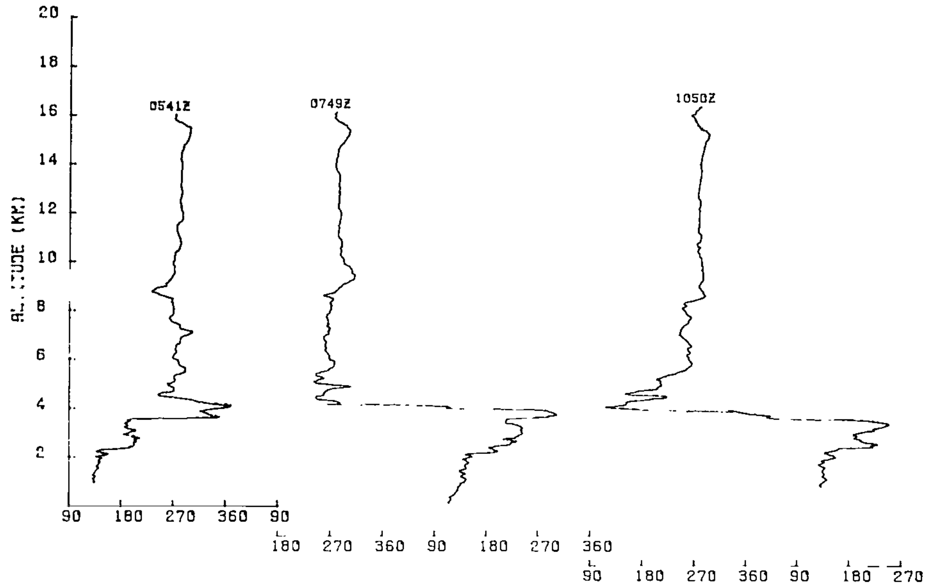
AEROSPACE ENVIRONMENT DIV.

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
MAY 18, 1969



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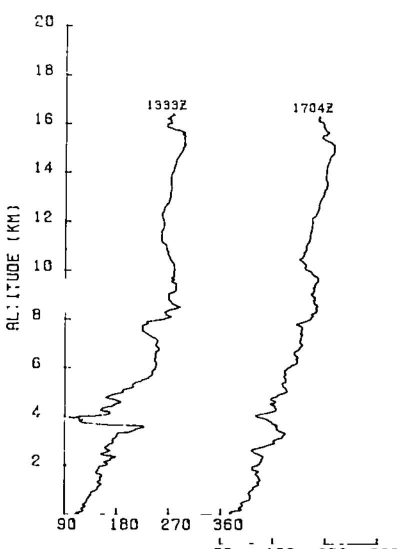
AEROSPACE ENVIRONMENT DIV.

WIND DIRECTION (DEGS)

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
MAY 18, 1969



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WIND DIRECTION (DEGS)

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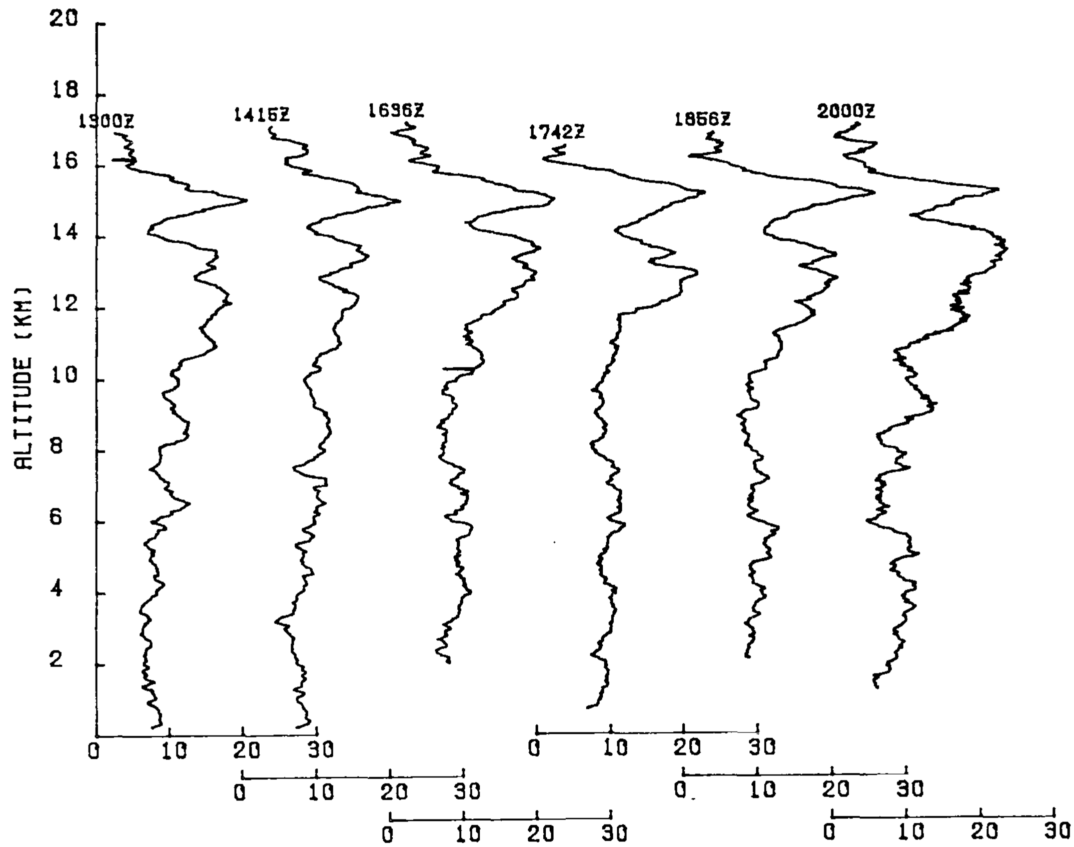
JUN 14 1965



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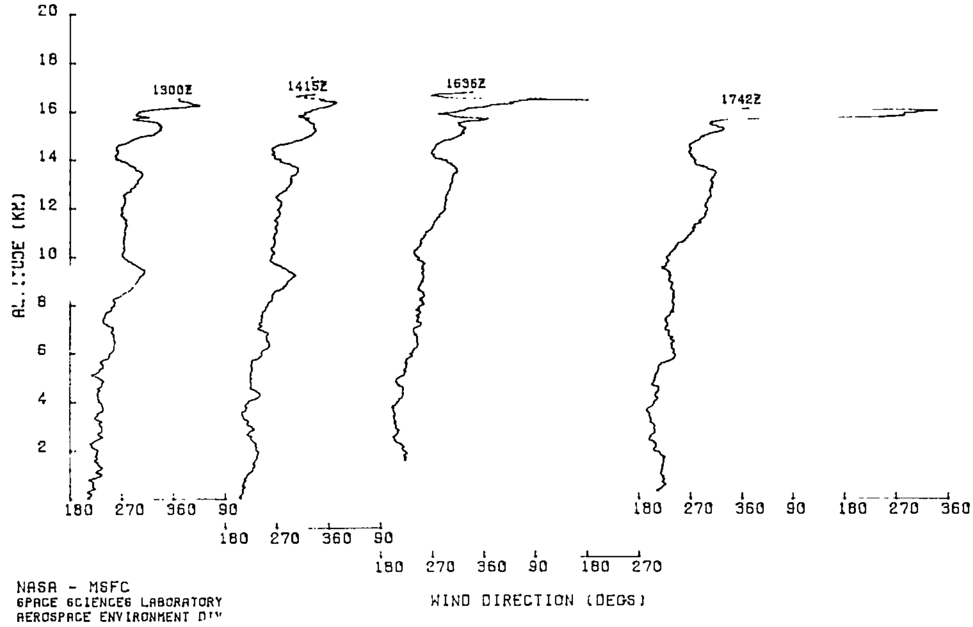
JUN 14 1965



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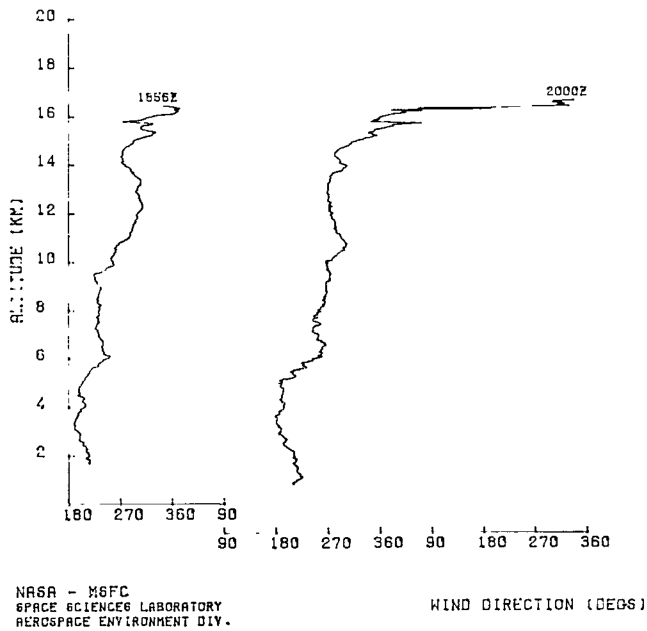

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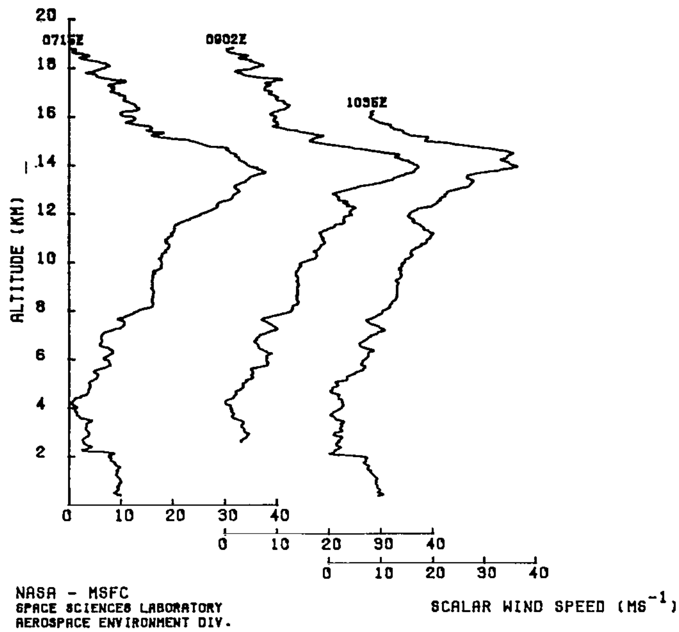
JUN 3, 1966



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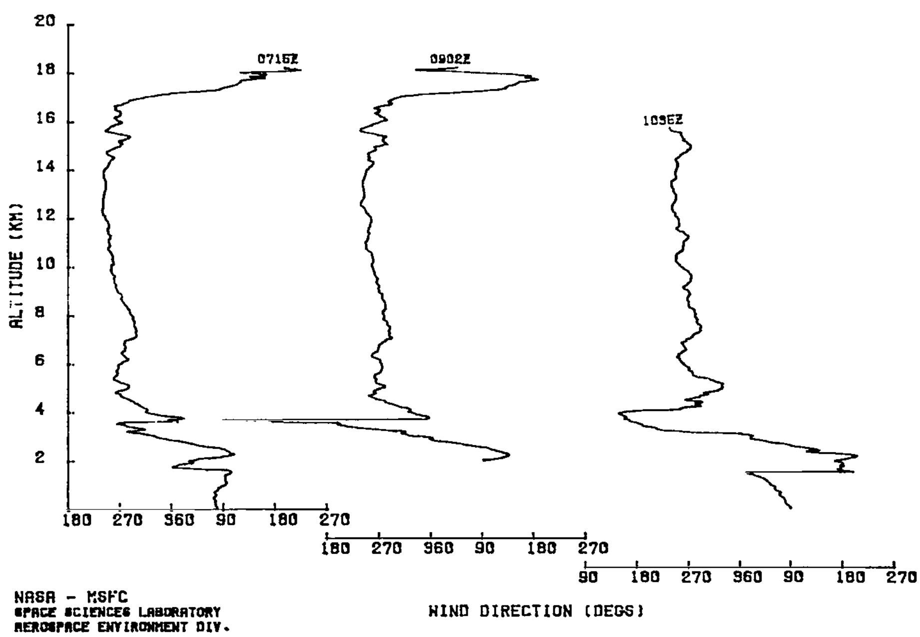
JUN 3, 1966



34

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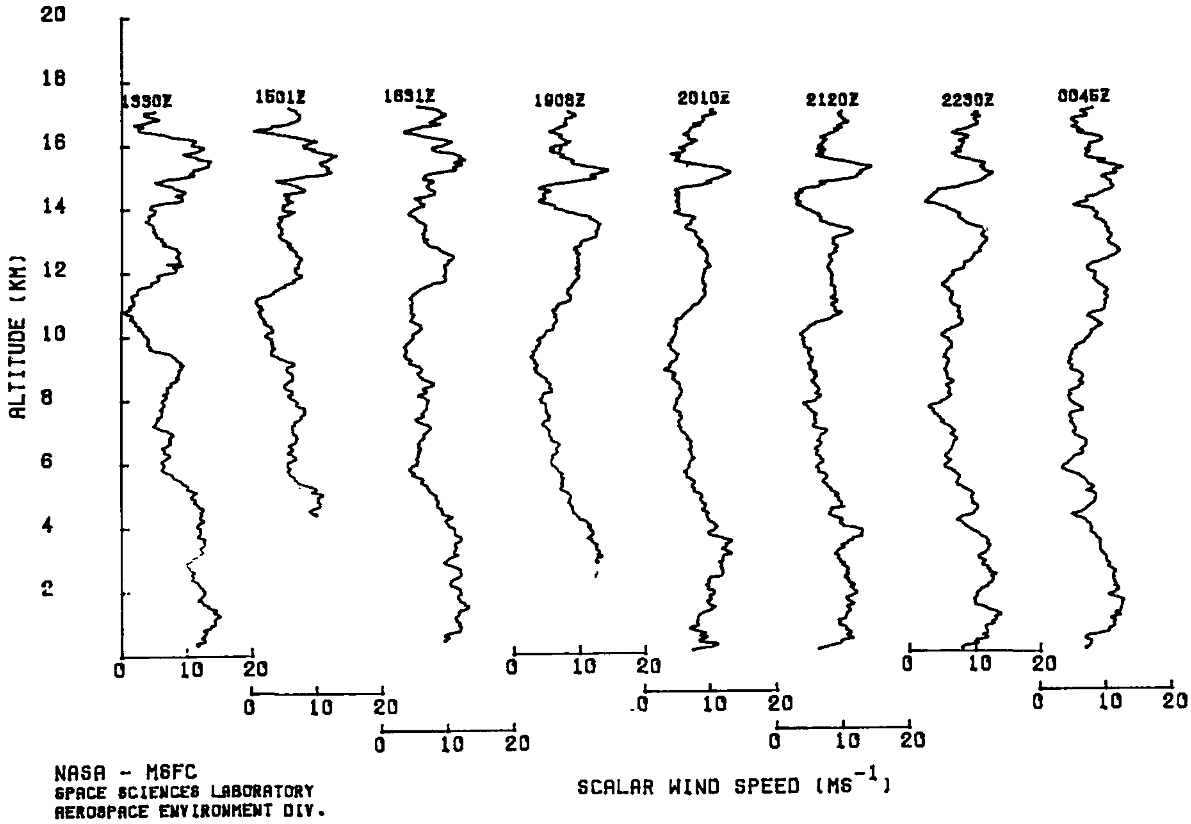
JUN 20-21, 1968



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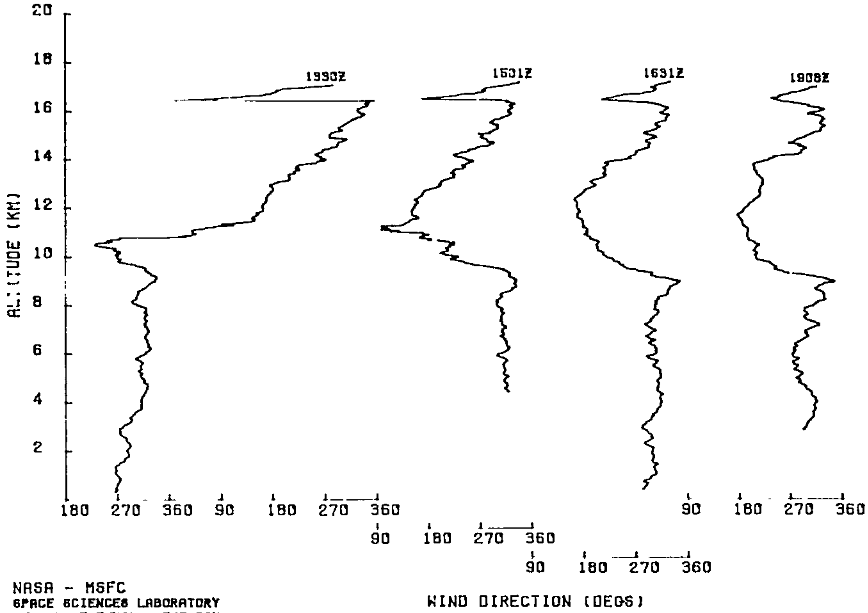
JUN 20-21, 1968



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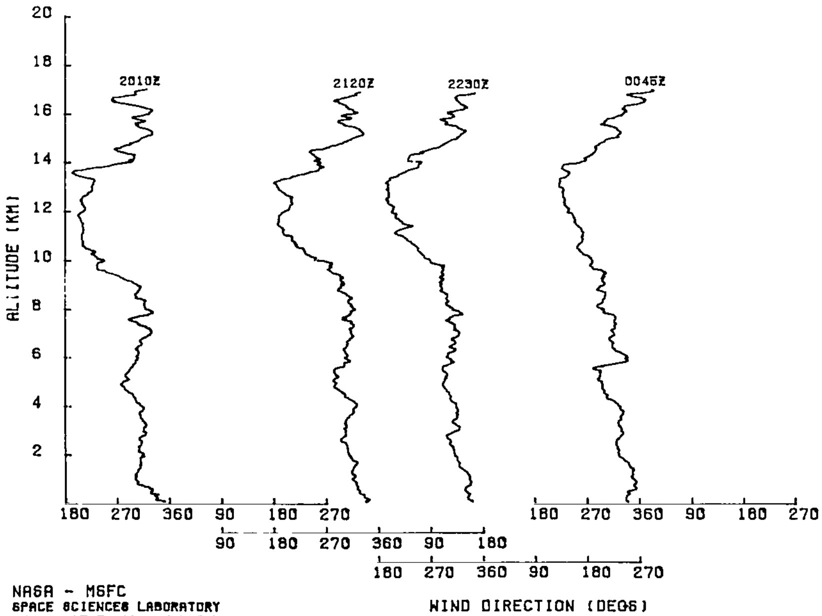
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JUN 20-21, 1968



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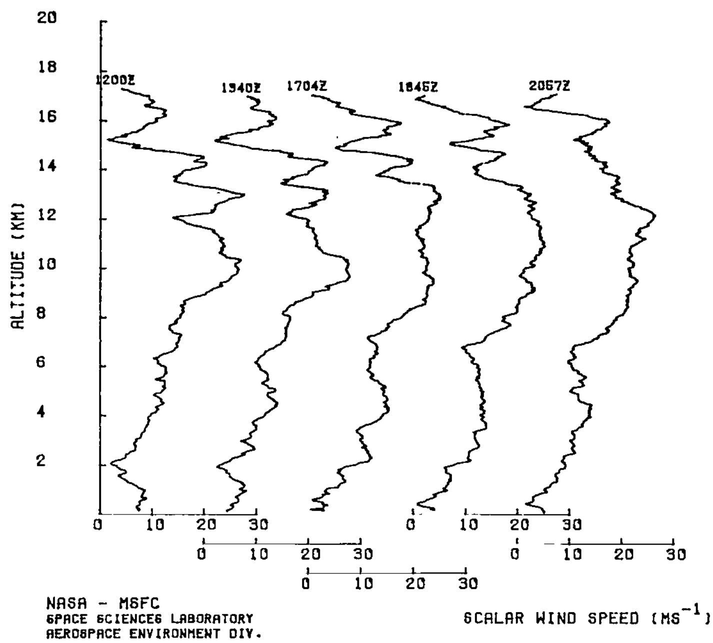
JUN 12, 1970



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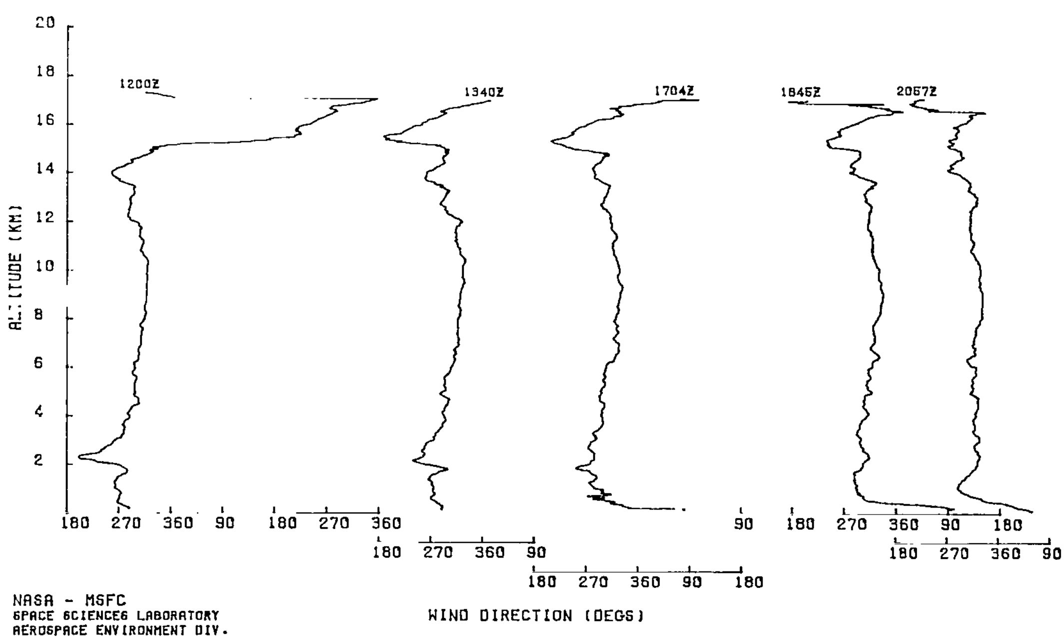

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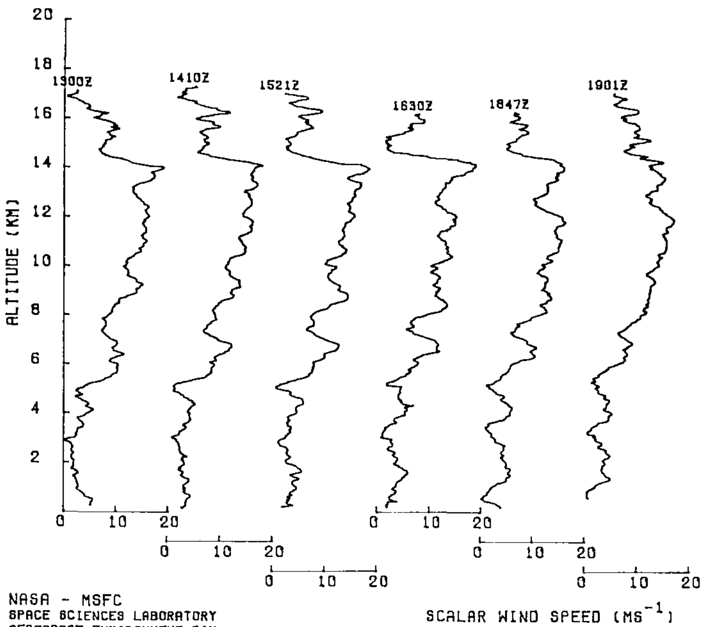
JUL 2, 1965



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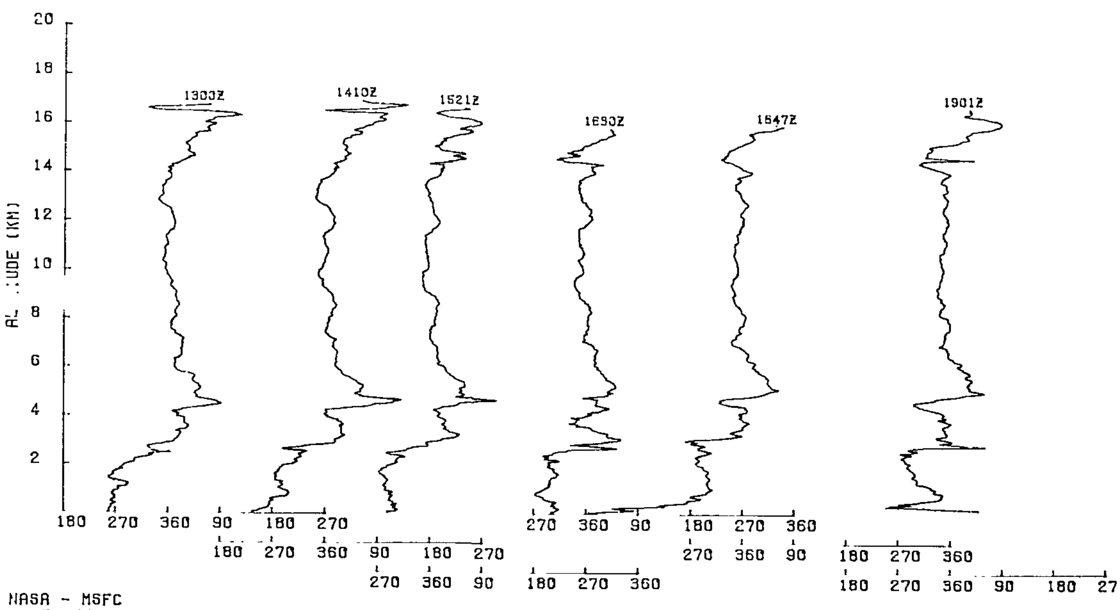
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JUL. 2, 1965



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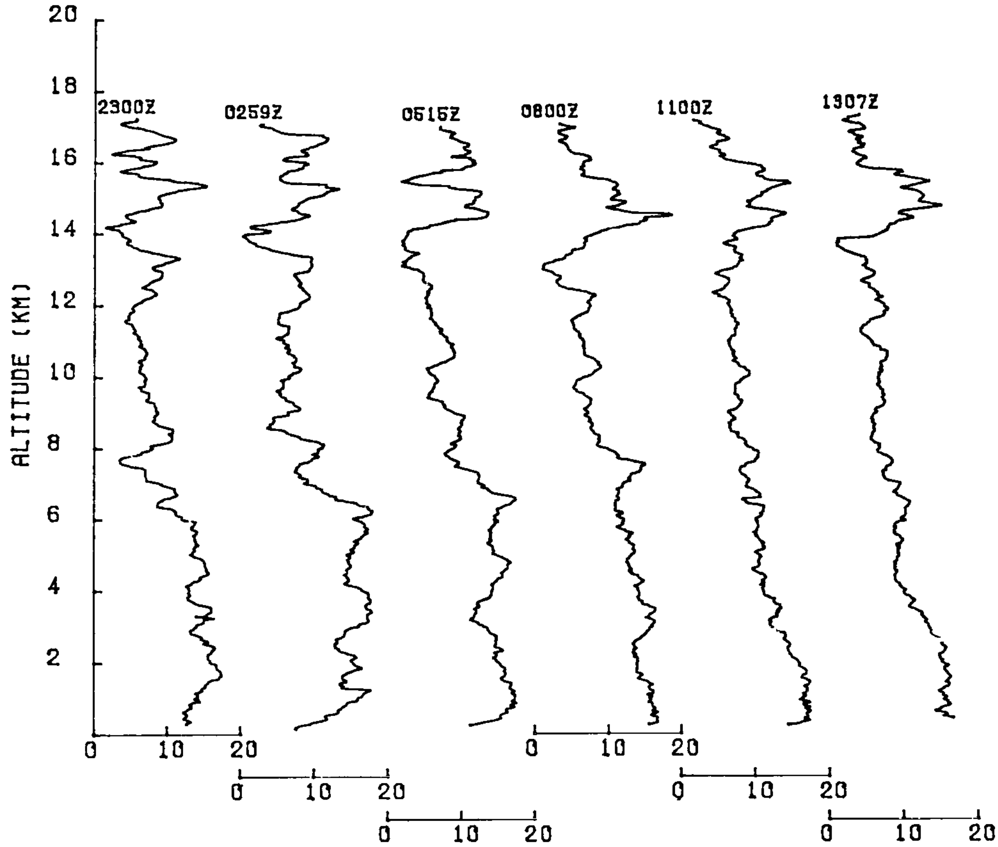
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JUL 29-30, 1965



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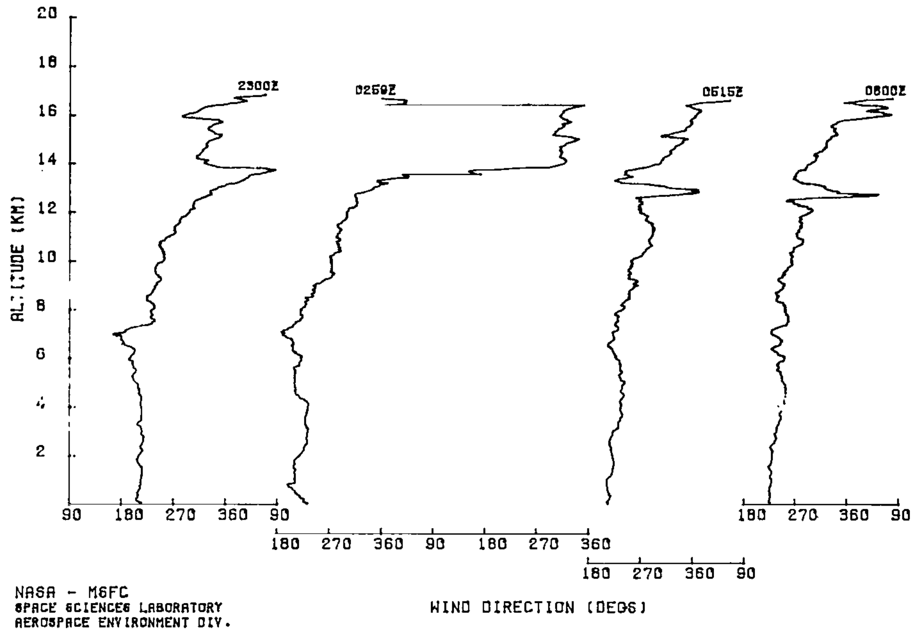
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JUL 29-30, 1965



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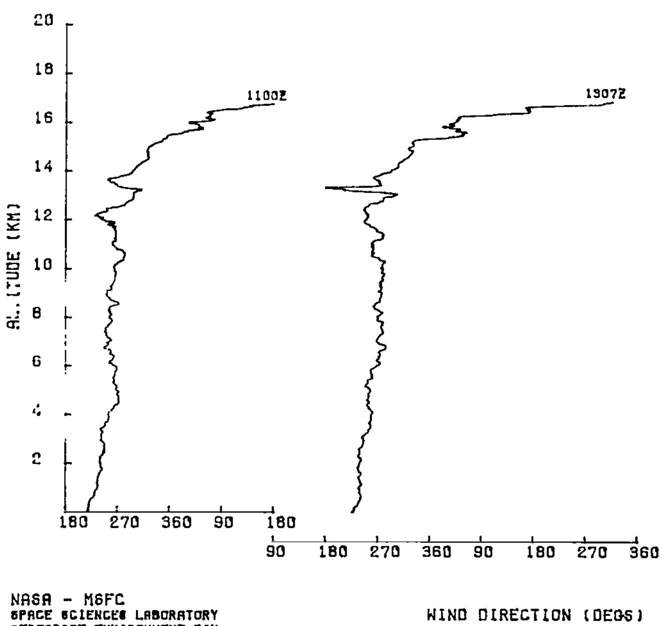

38

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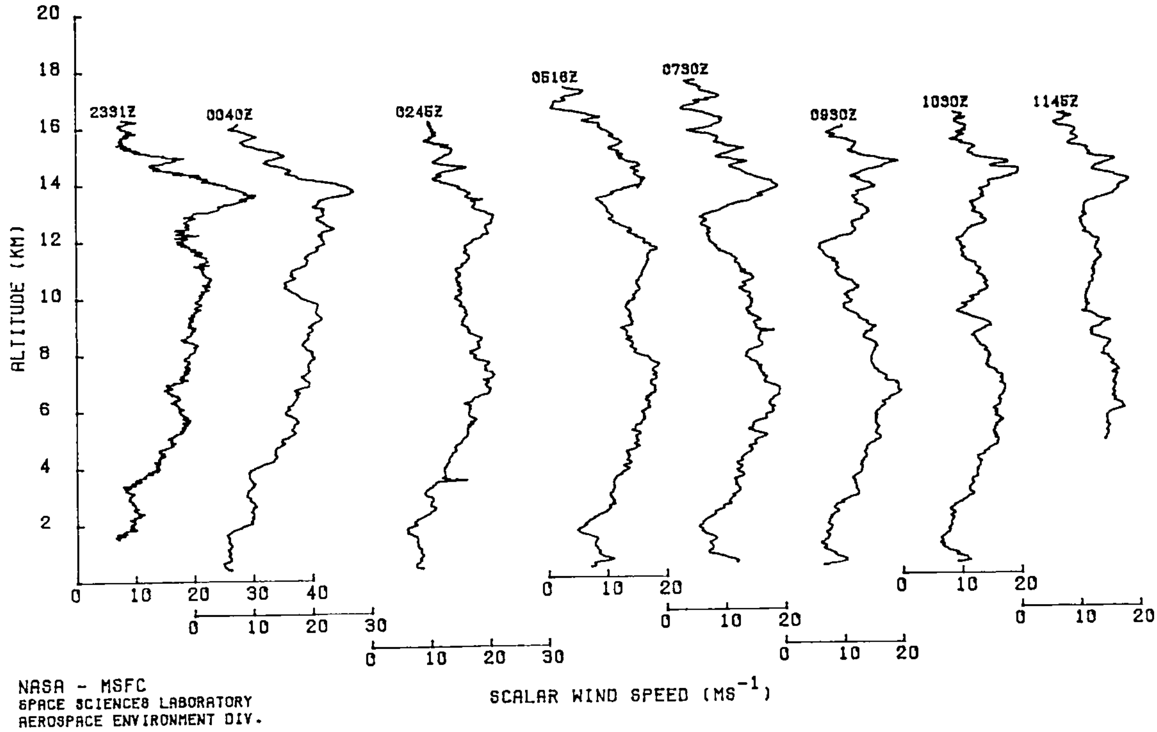
JUL 4-5, 1966



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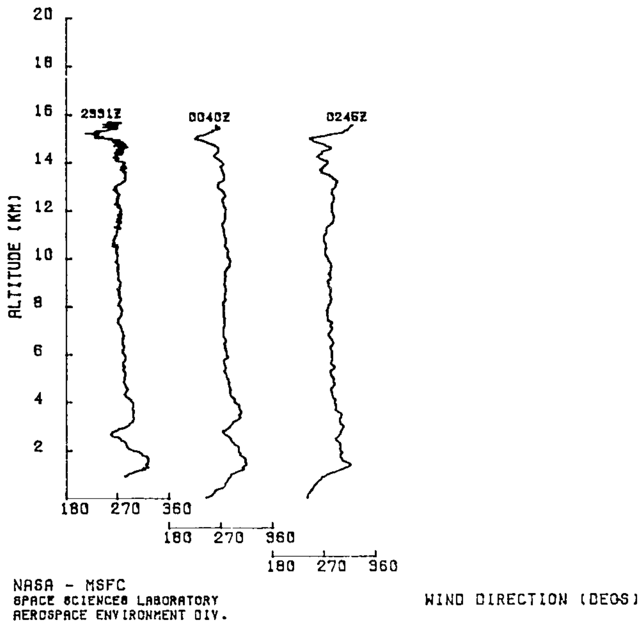
JUL 4-5, 1966



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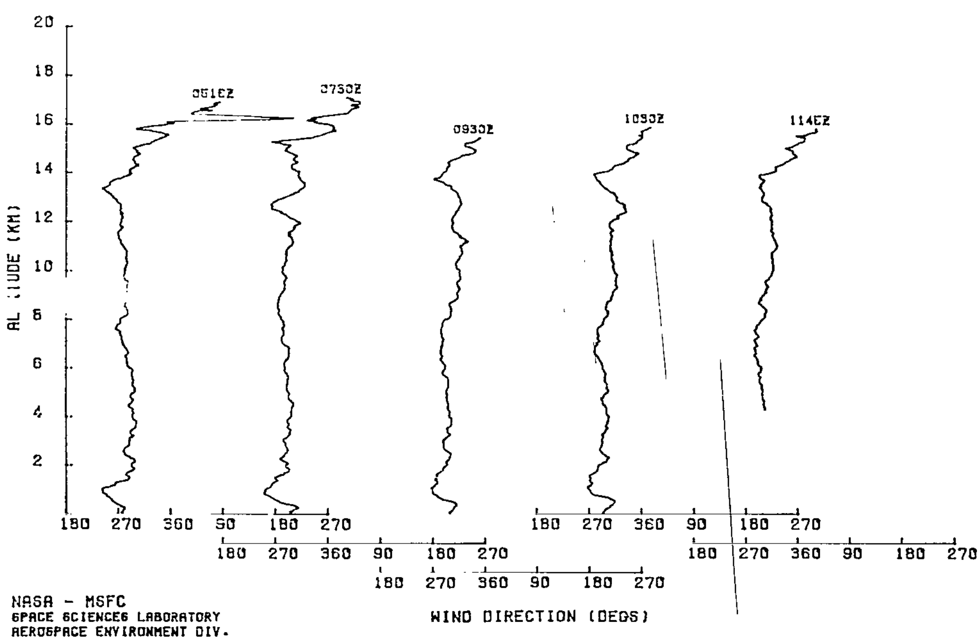
JUL 4-5, 1966



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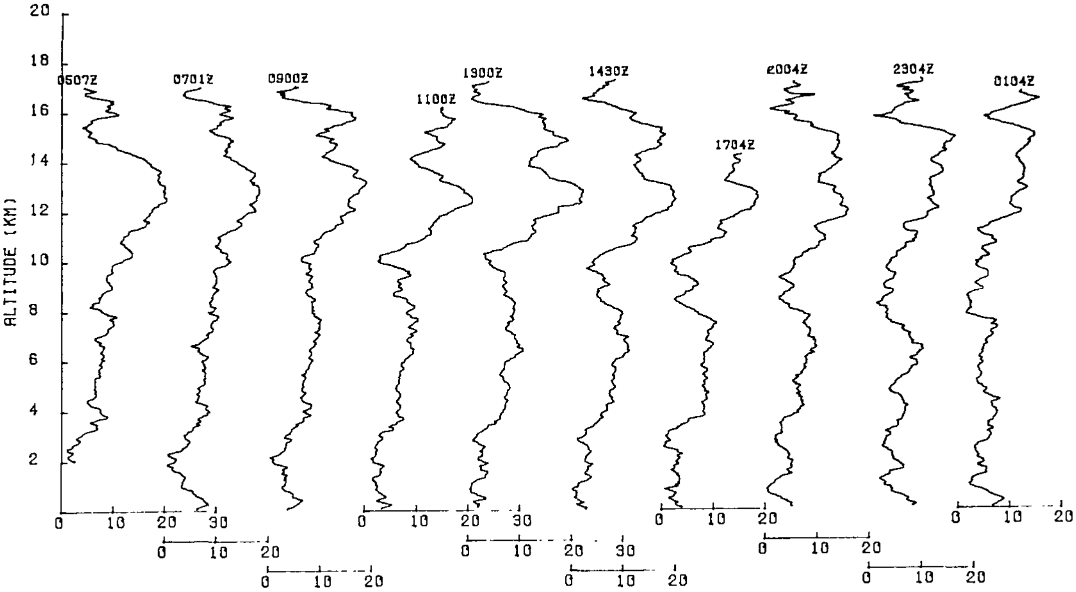
JUL 12-13, 1967



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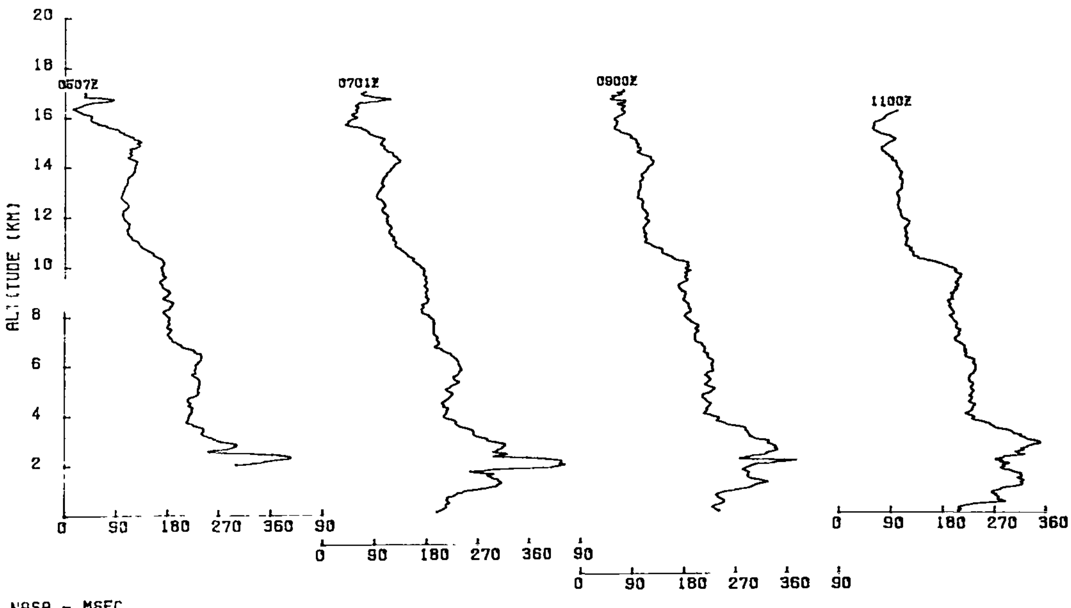
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JUL 12-13, 1967



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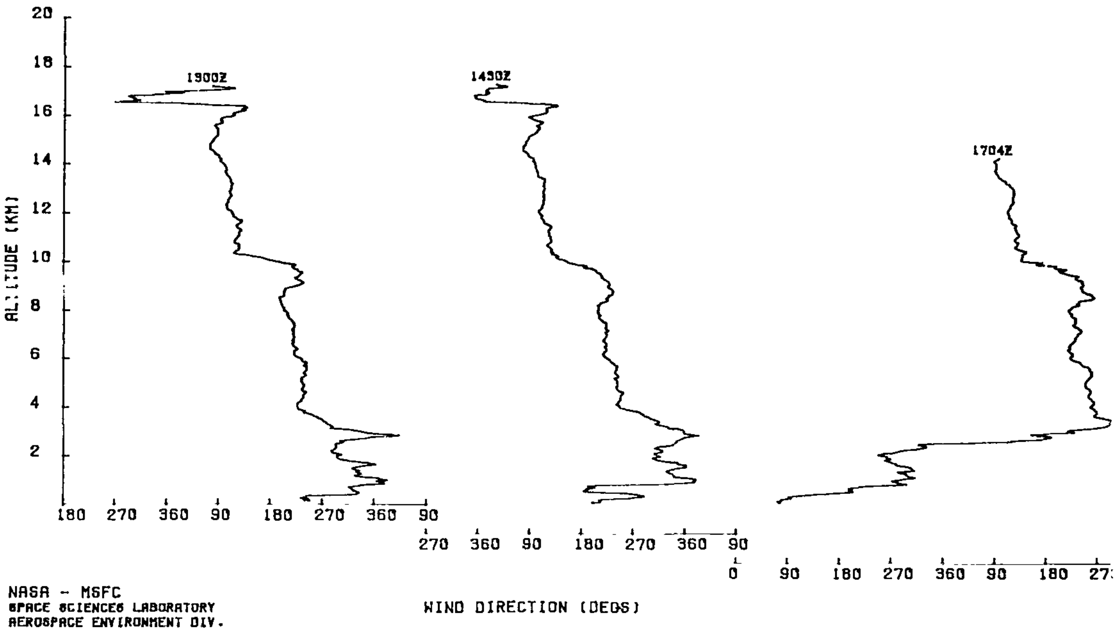

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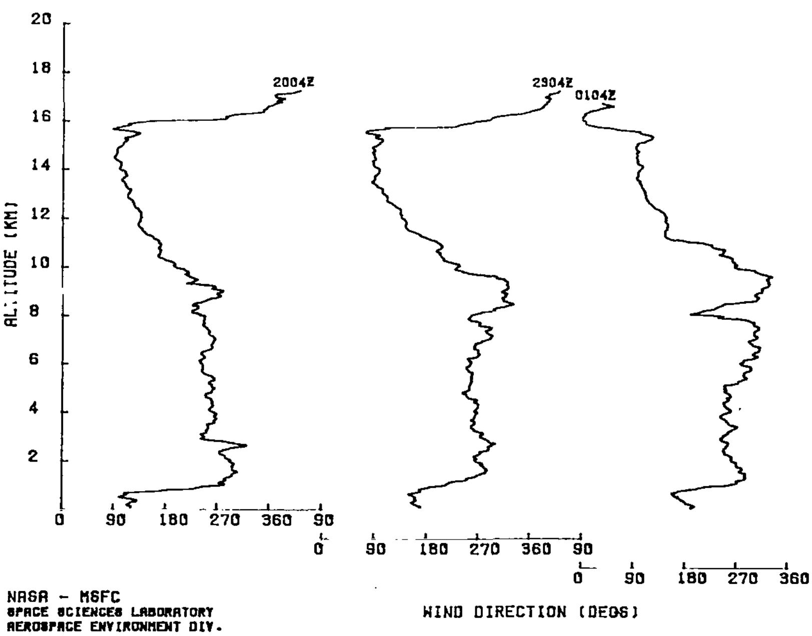

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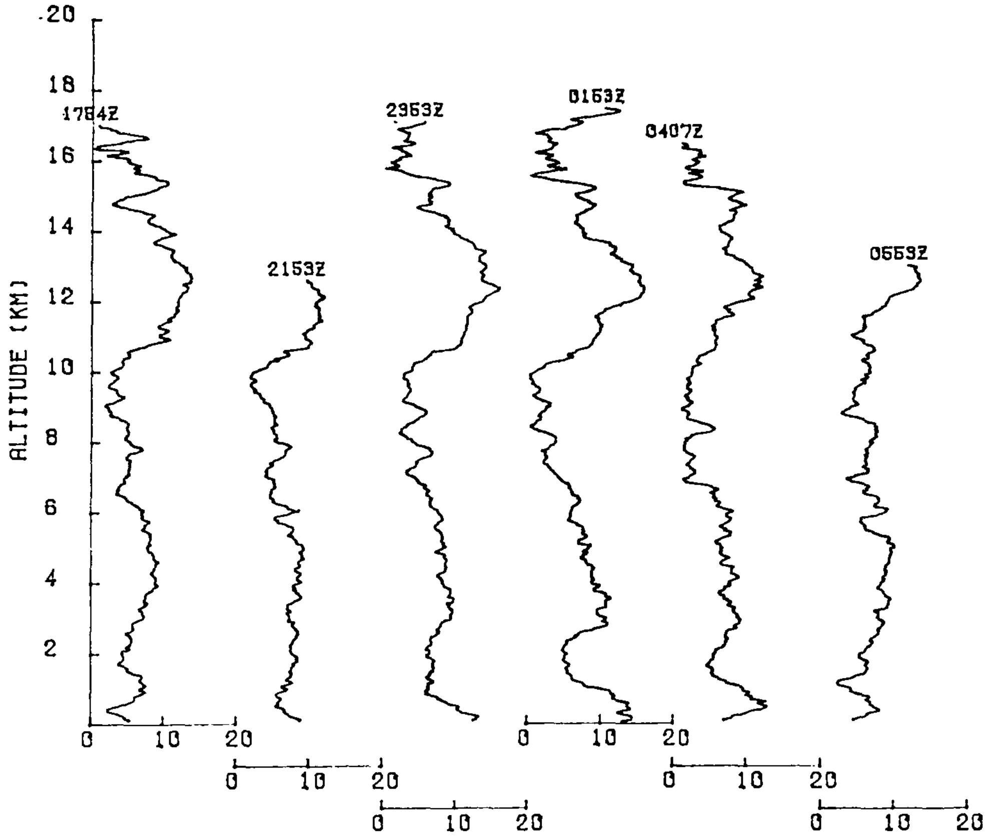

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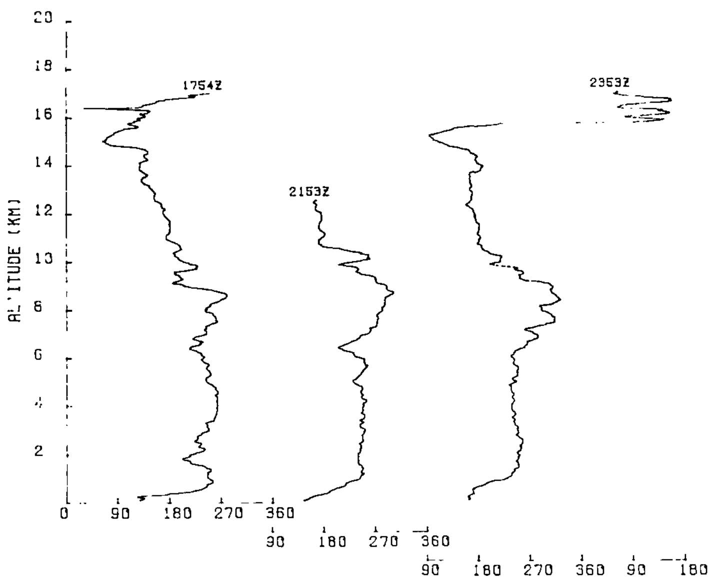
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JUL. 13-14. 1967



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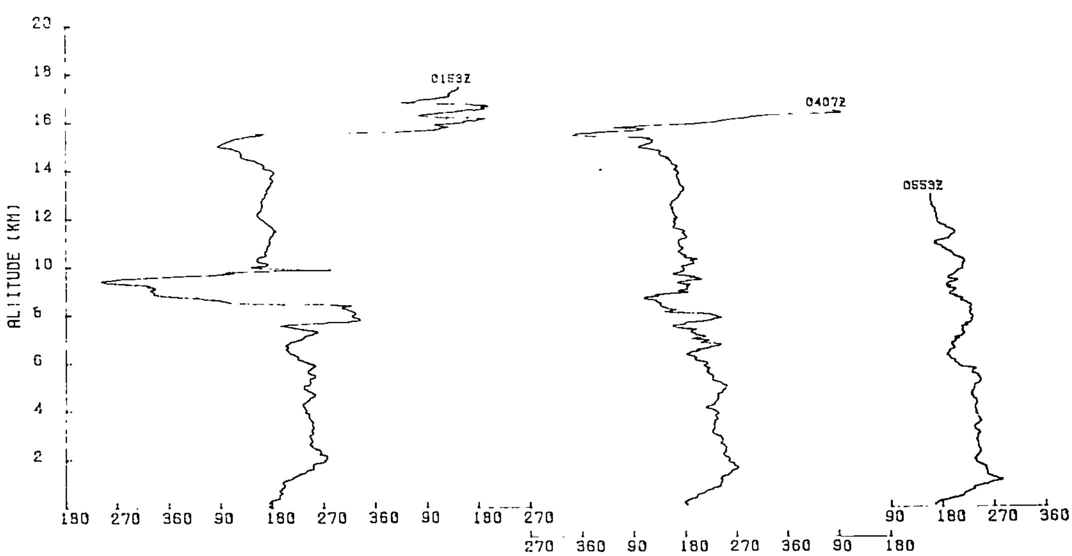
WIND DIRECTION (DEGS)

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JUL 13-14. 1967



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WIND DIRECTION (DEGS)

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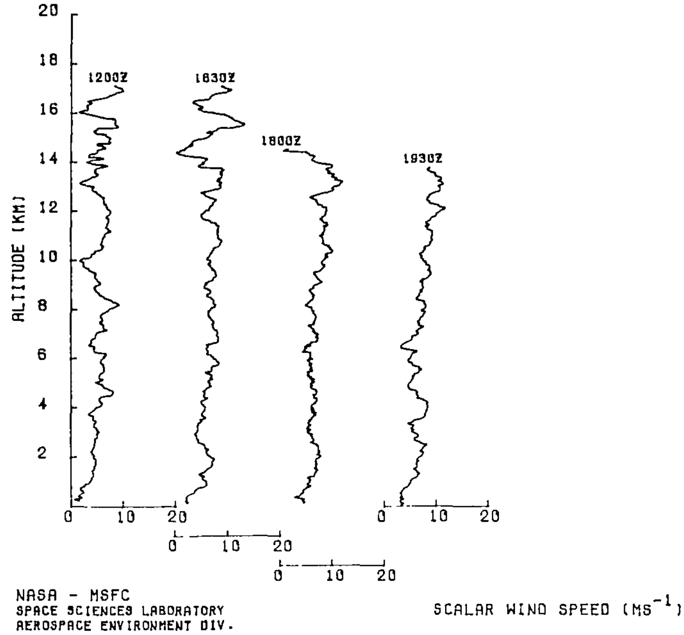
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JUL 24, 1967



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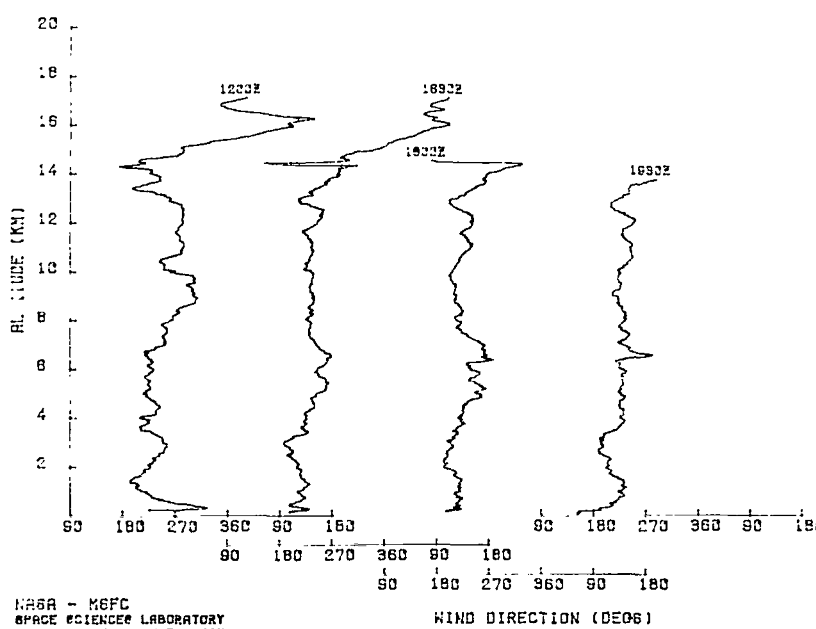
JUL 24, 1967



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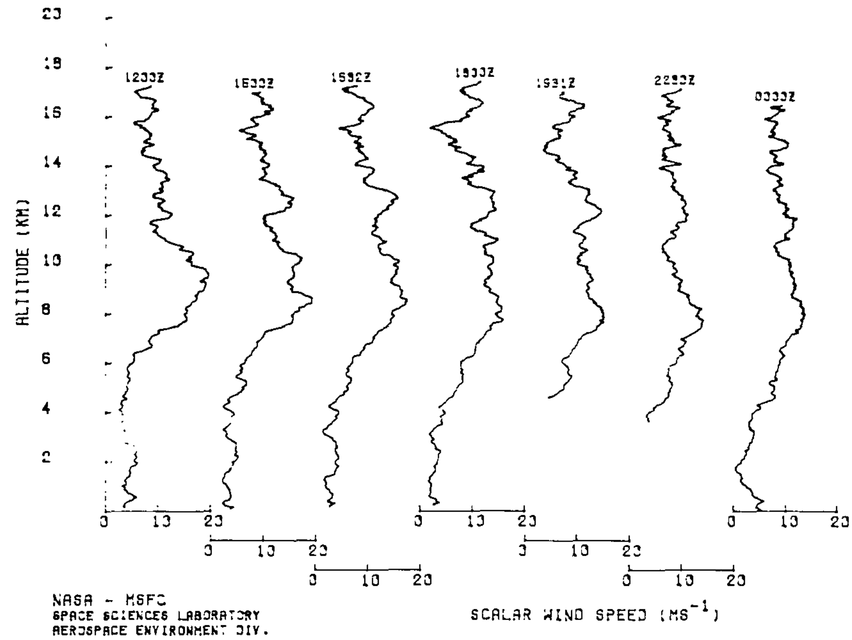
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JUL 25-26, 1968



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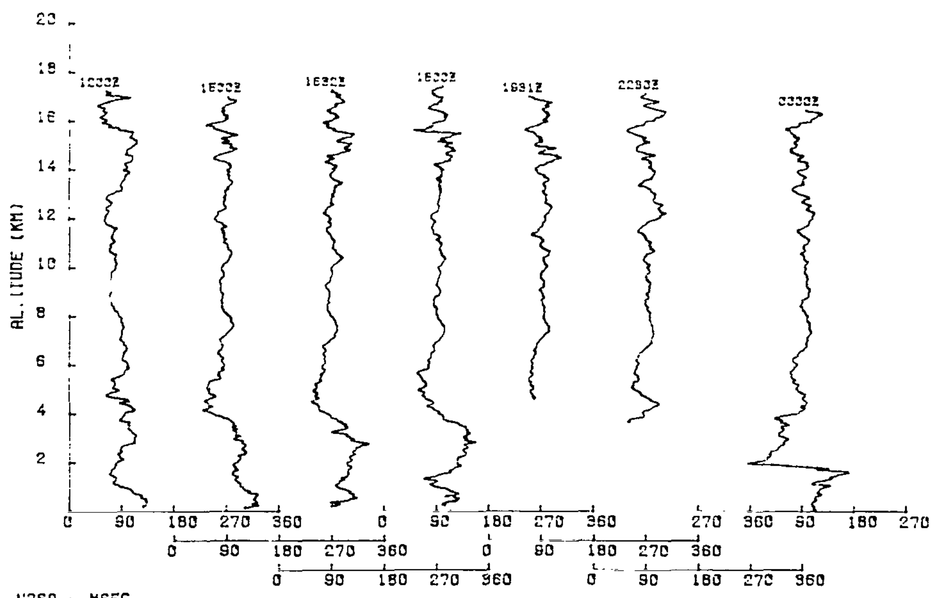
JUL 25-26, 1968



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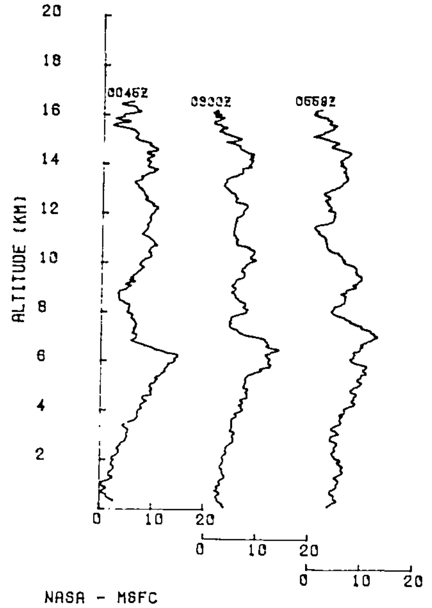

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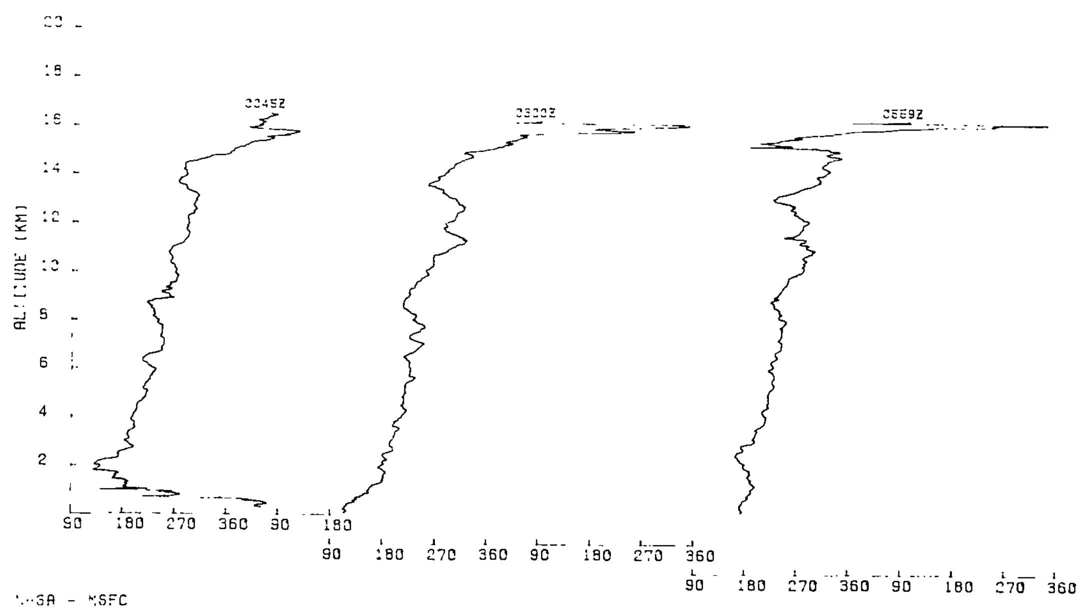
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JUL 16, 1969



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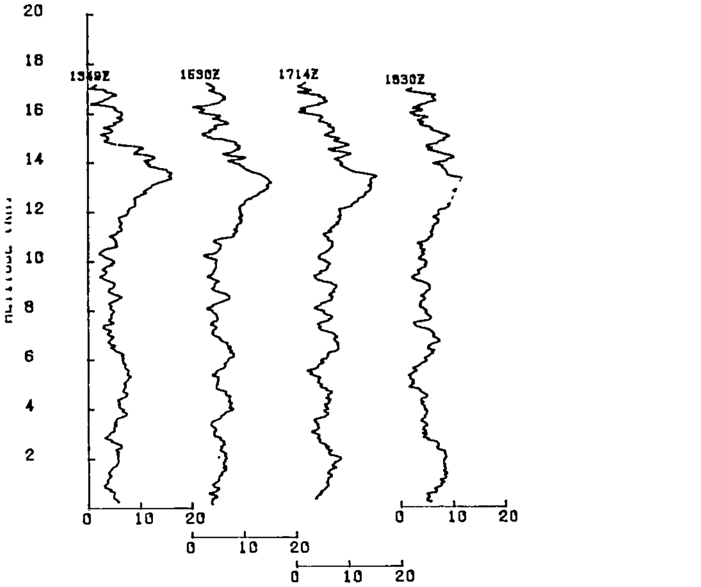
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JUL 17, 1970



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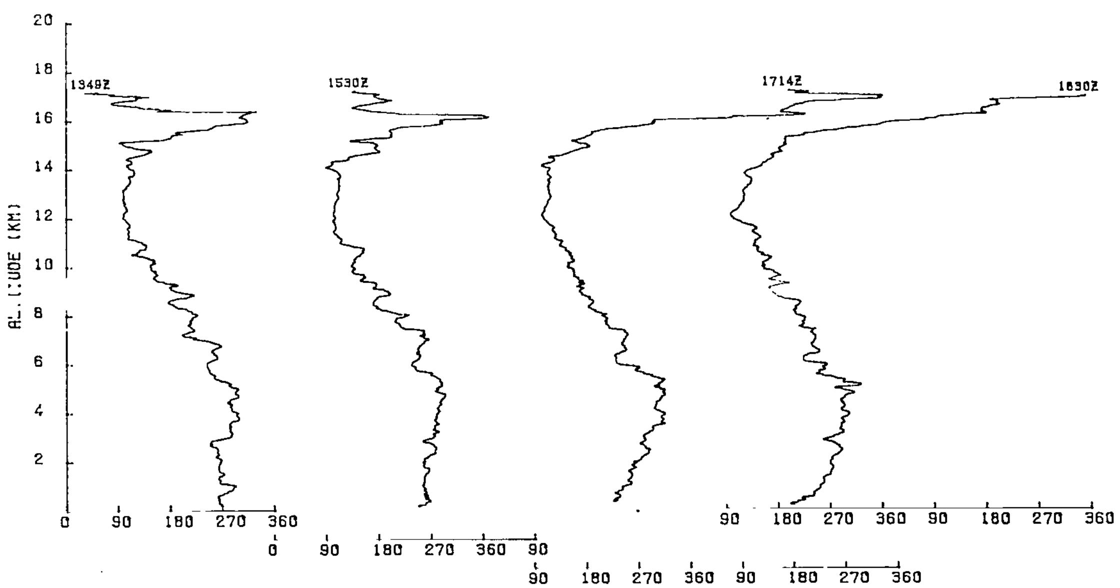
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
JUL 17, 1970



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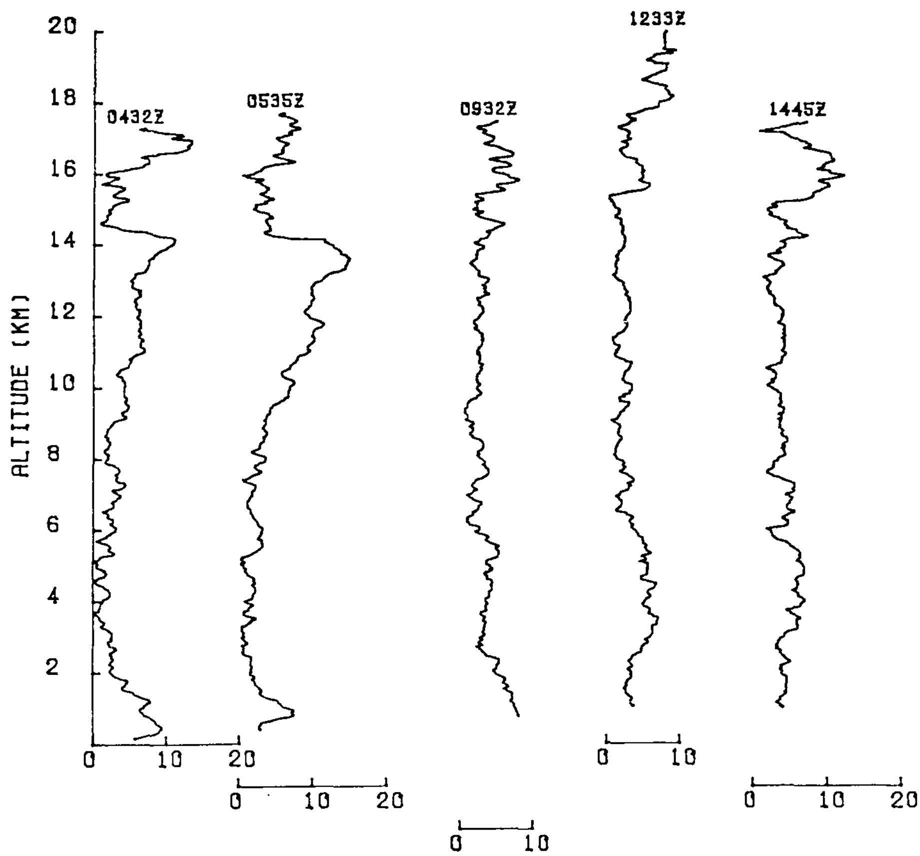
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
AUG 11, 1965



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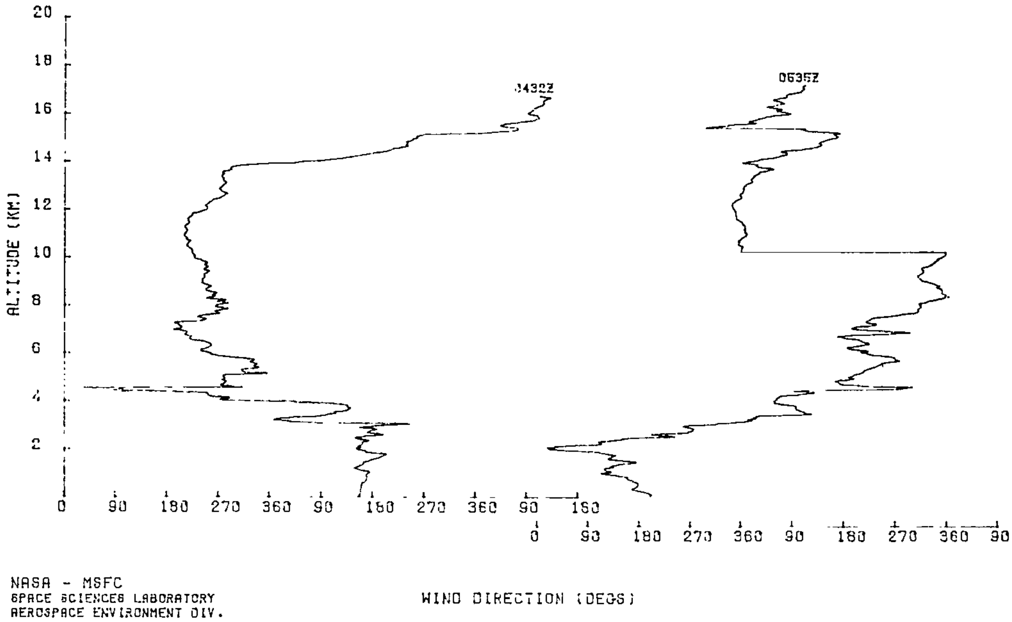
SCALAR WIND SPEED (MS^{-1})

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
AUG 11, 1965



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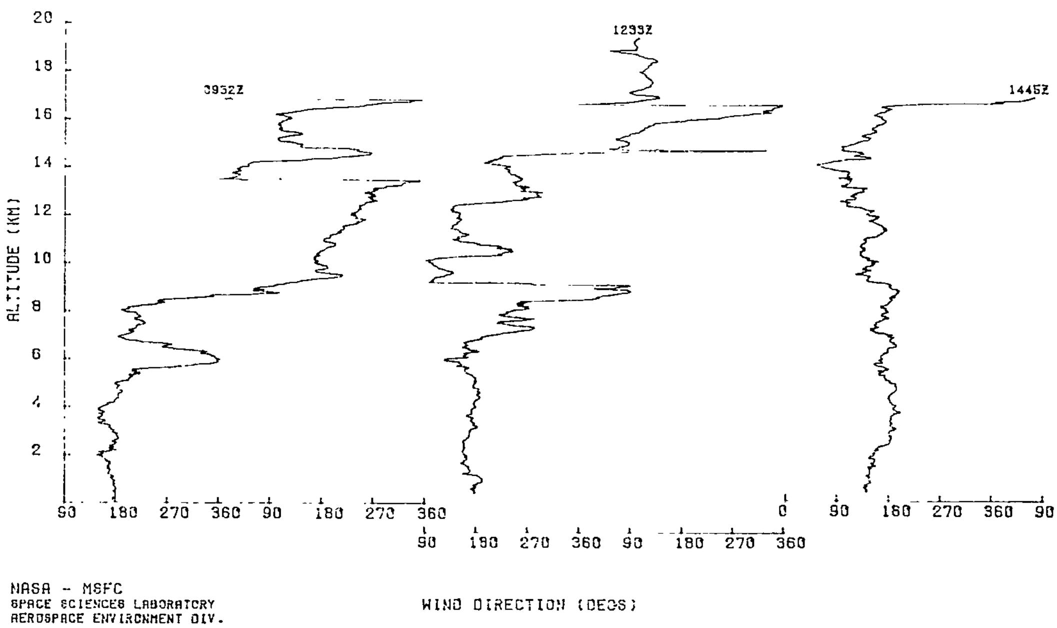
AUG 11, 1965



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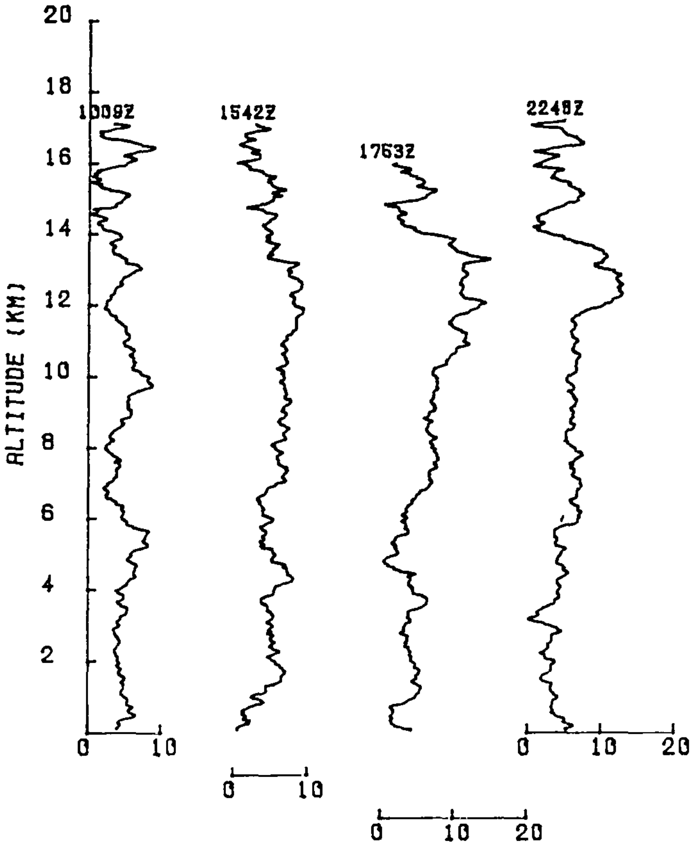
AUG 1, 1967



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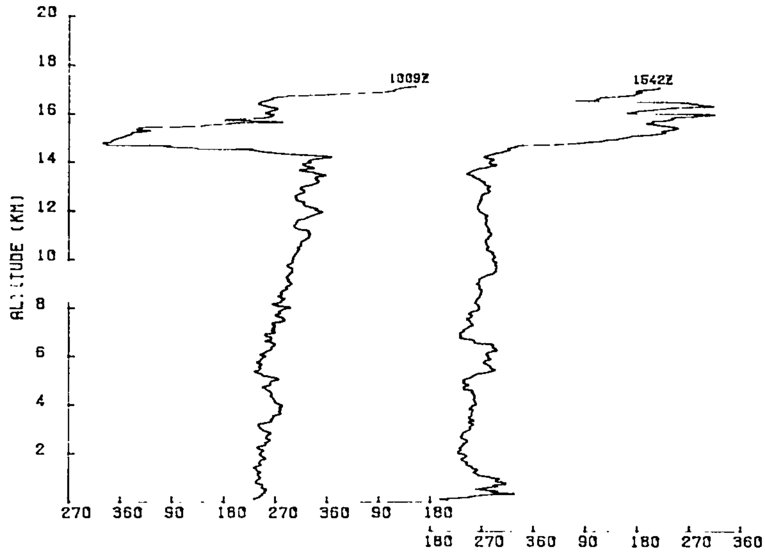
SCALAR WIND SPEED (MS^{-1})

46

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
AUG 1, 1967



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WIND DIRECTION (DEGS)

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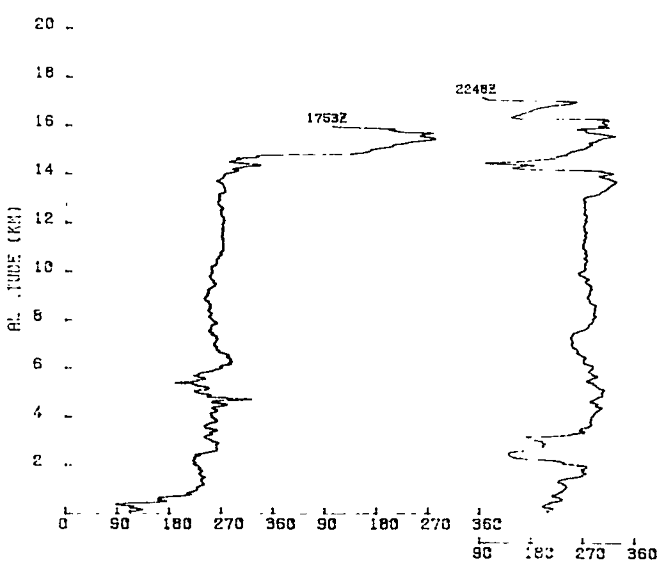
AUG 1, 1967



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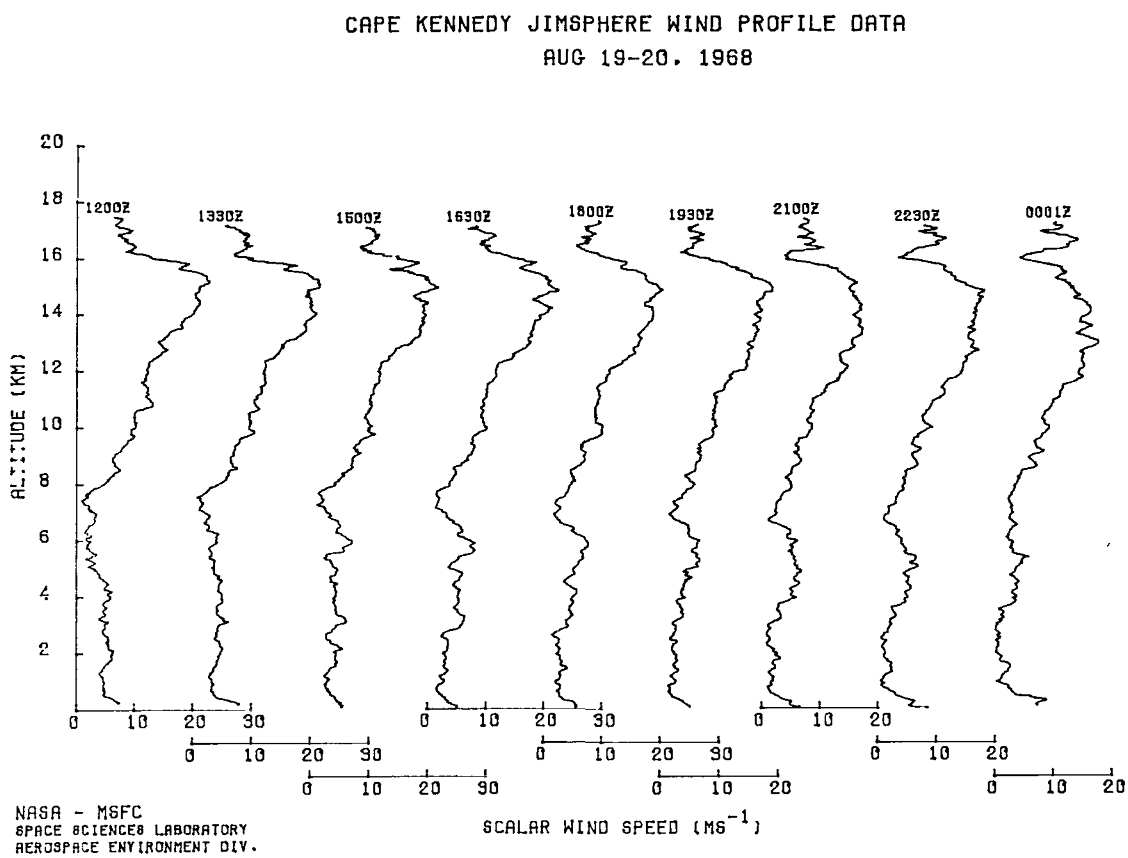
WIND DIRECTION (DEGS)


CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
AUG 19-20, 1968
ALTITUDE (KM)
20
18
16
14
12
10
8
6
4
2
1200Z
1330Z
1500Z
1630Z
1800Z
1930Z
2100Z
2230Z
0001Z
0 10 20 30
0 10 20 30
0 10 20 30
0 10 20 30
0 10 20 30
0 10 20
0 10 20
0 10 20
0 10 20
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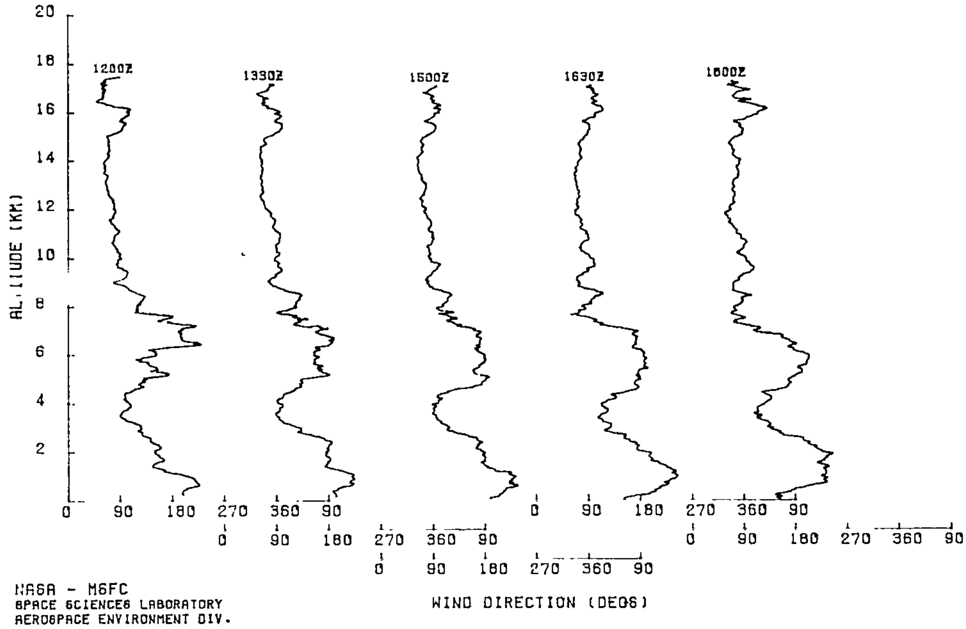
AEROSPACE ENVIRONMENT DIV.
SCALAR WIND SPEED (MS⁻¹)

47

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
AUG 19-20, 1968



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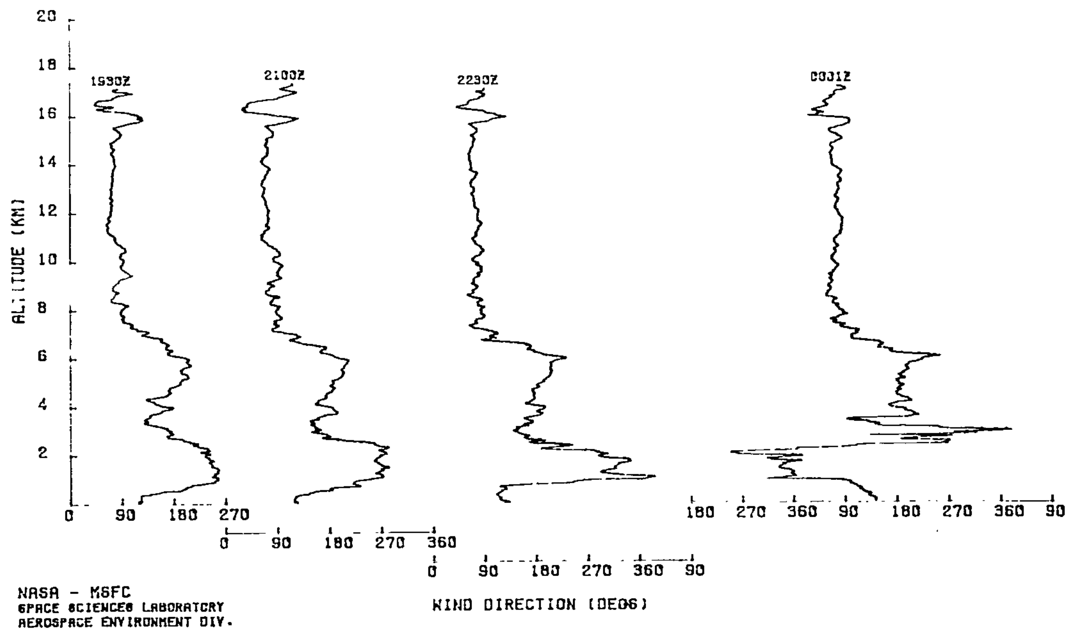
AUG 19-20, 1968



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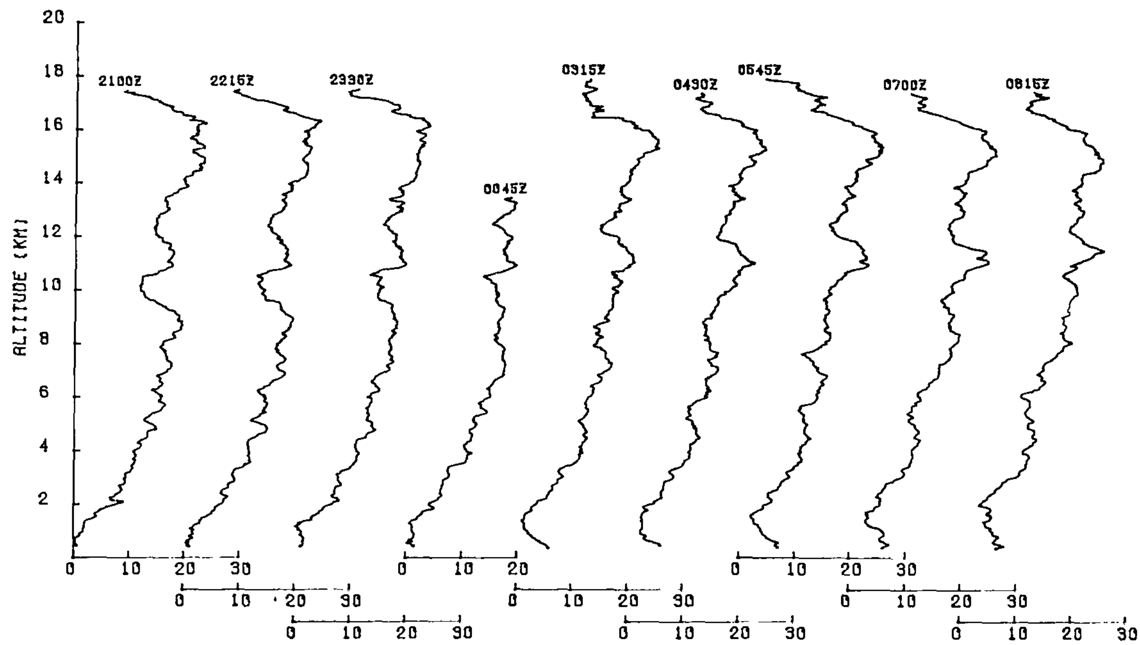
SEPT 13-14, 1965



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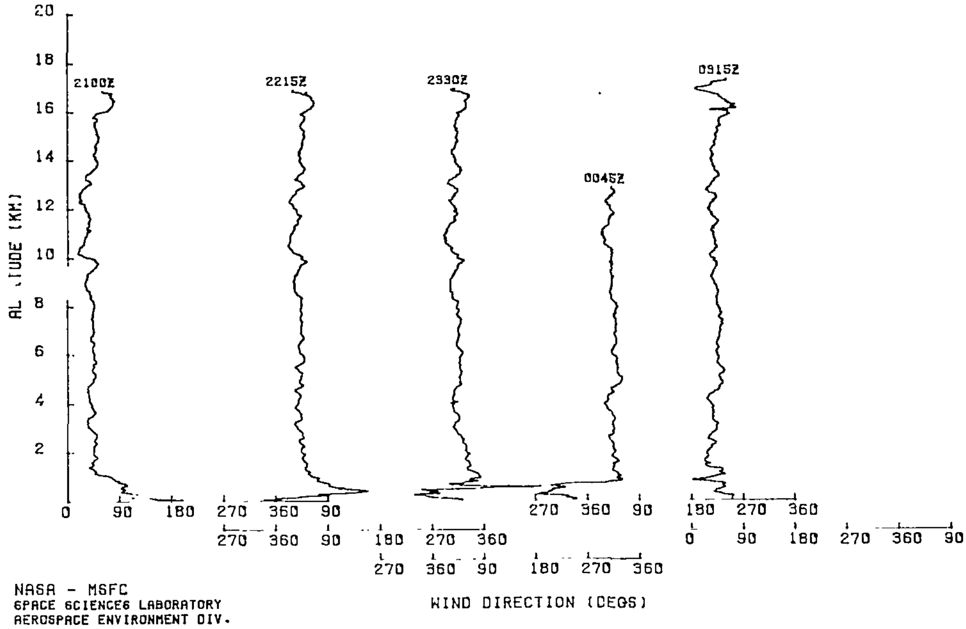
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
SEPT 13-14, 1965



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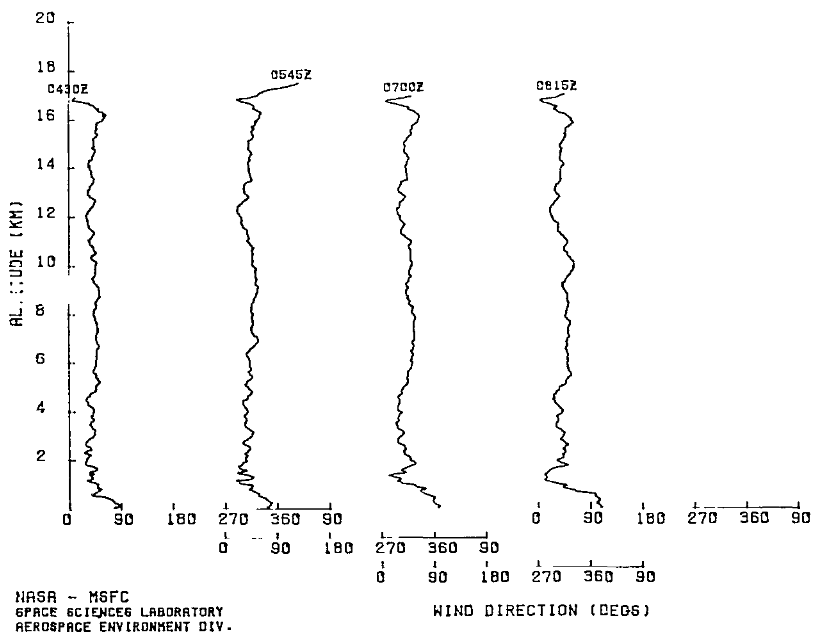
SEPT 13-14, 1965



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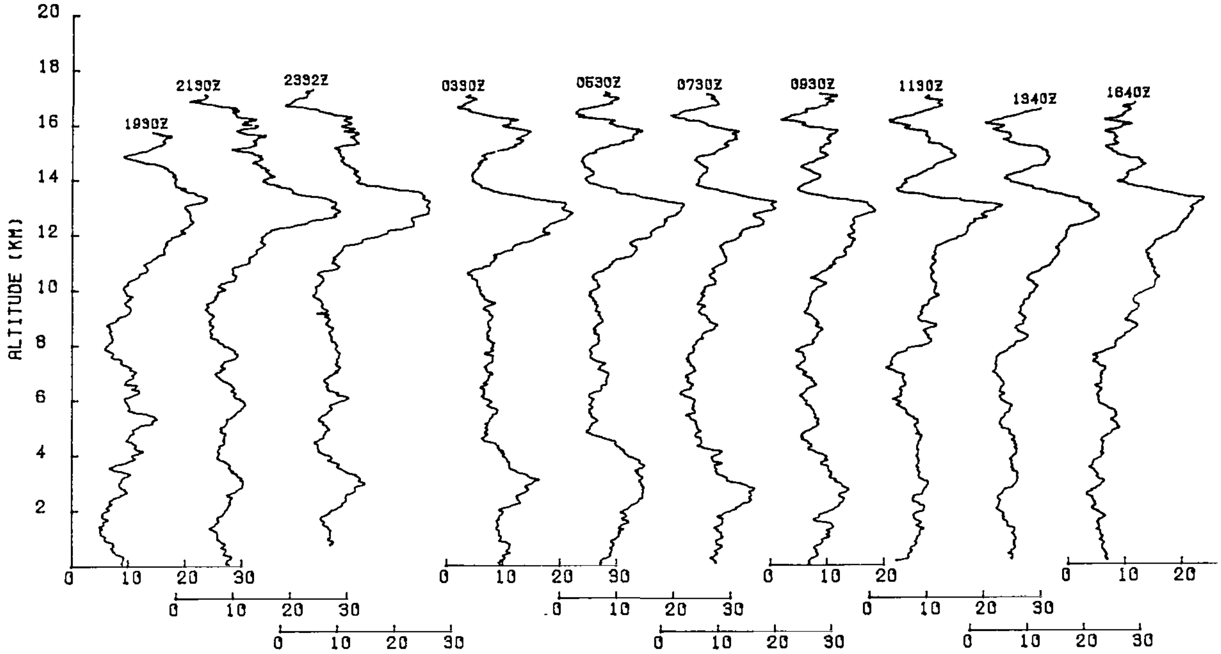
SEPT 6-7, 1967



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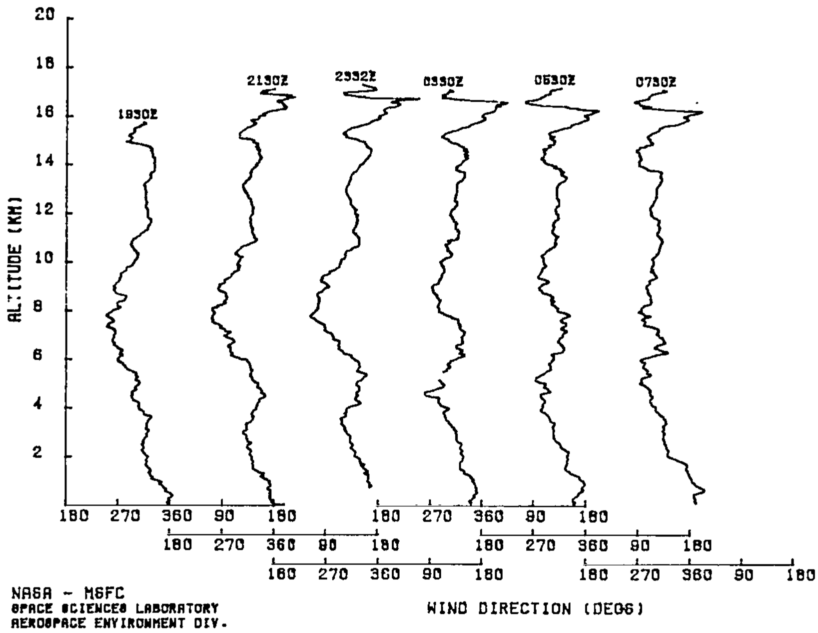
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
SEPT 6-7, 1967



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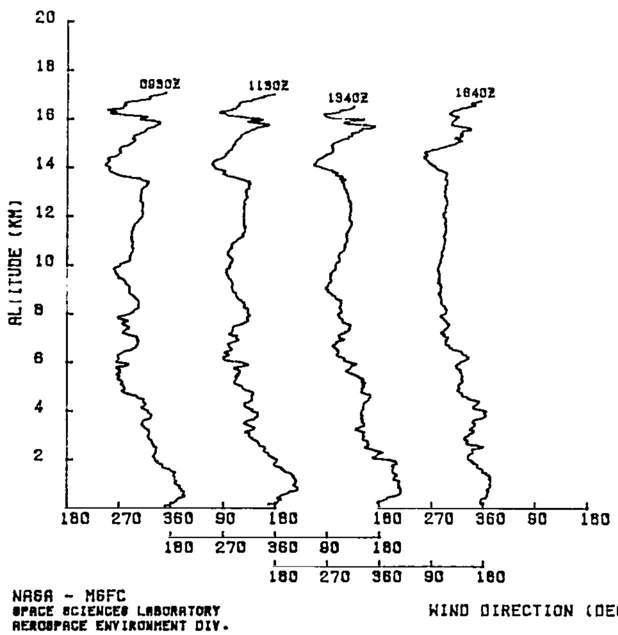
SEPT 6-7, 1967



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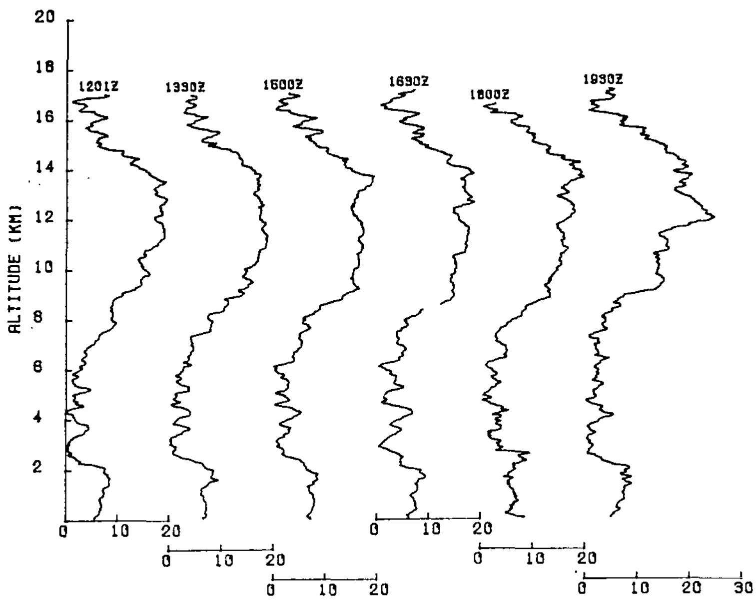
SEPT 14, 1967



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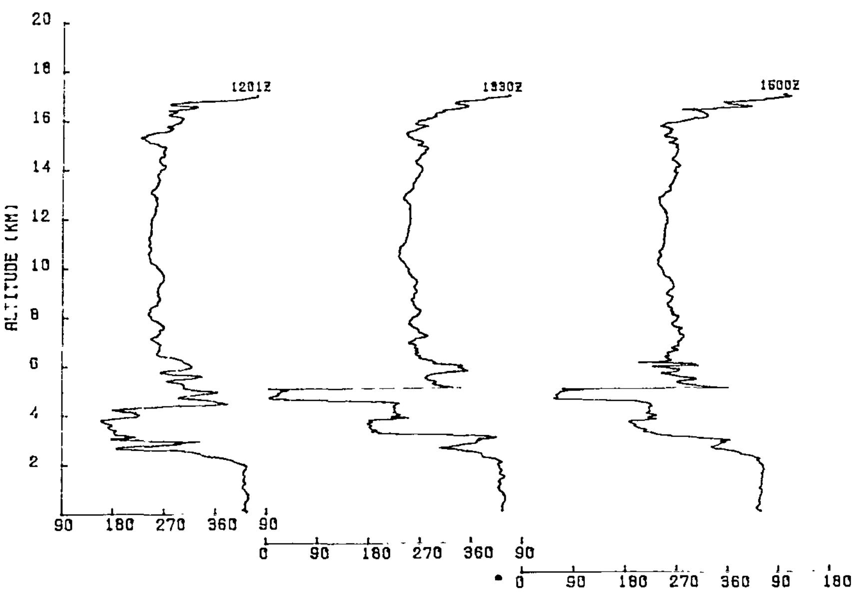
SEPT 14, 1967



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50

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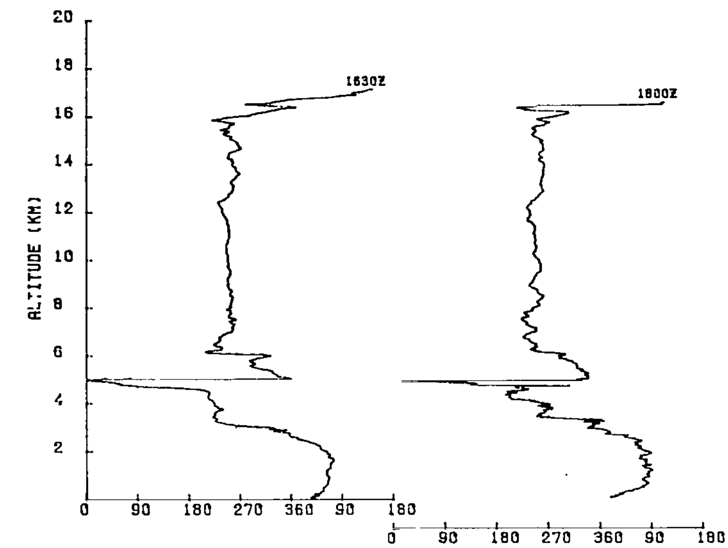
SEPT 14. 1967



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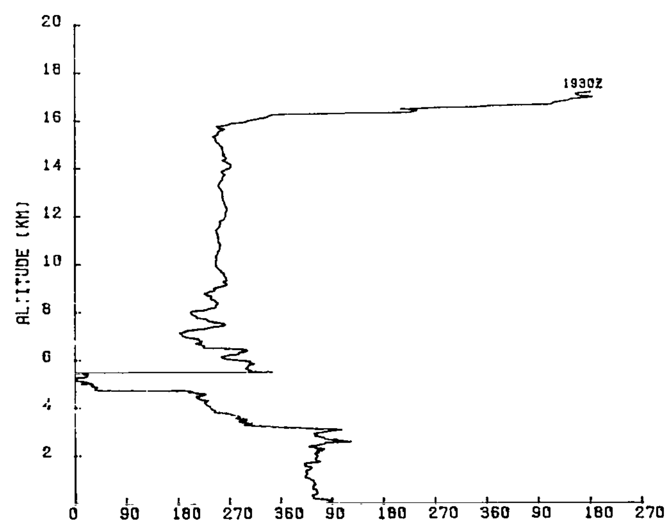
WIND DIRECTION (DEGS)

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
SEPT 14. 1967



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WIND DIRECTION (DEGS)

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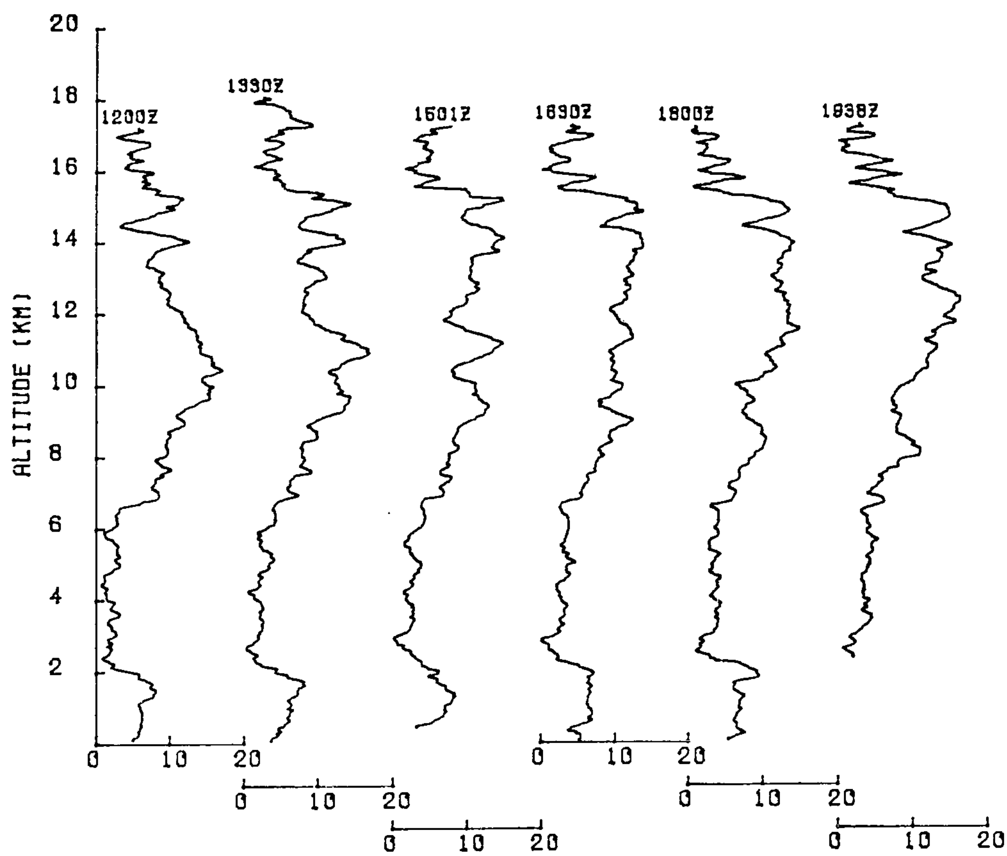
SEPT 15, 1967



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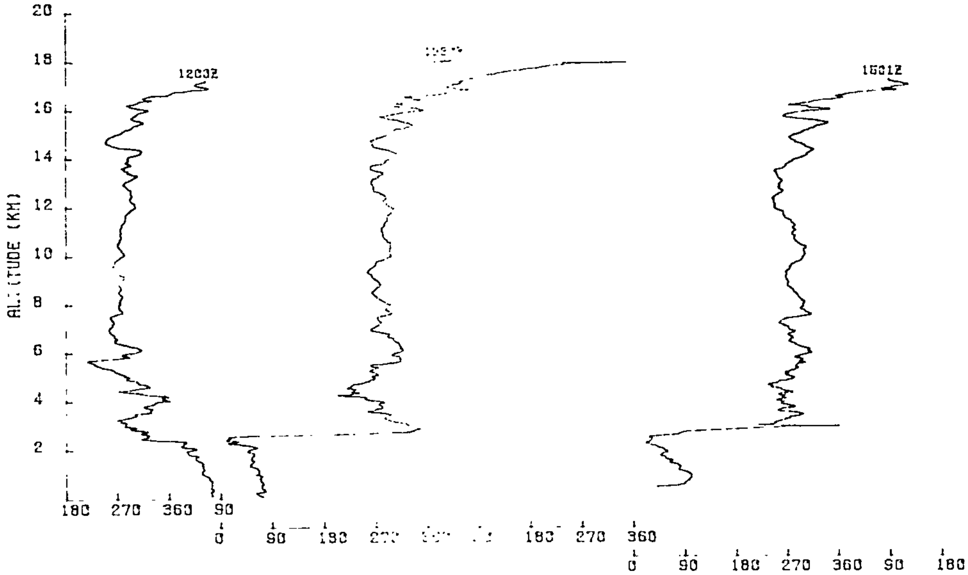
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
SEPT 15. 1967



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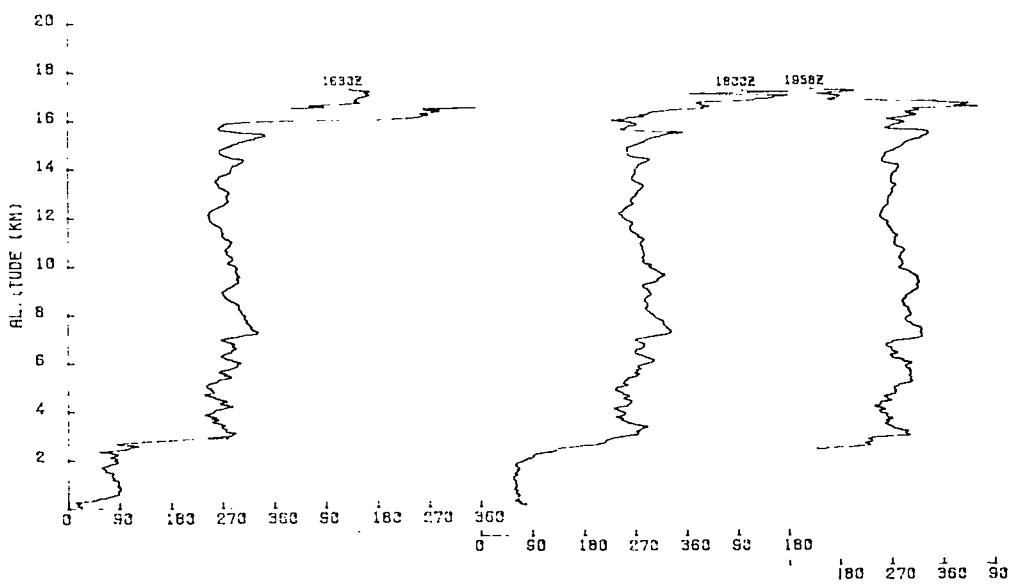
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
SEPT 15. 1967



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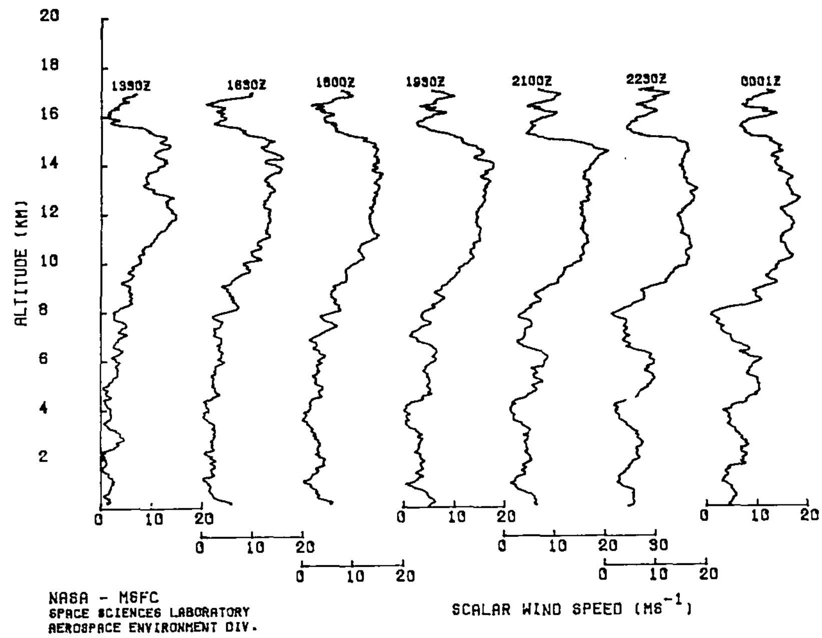
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
SEPT 19-20, 1968



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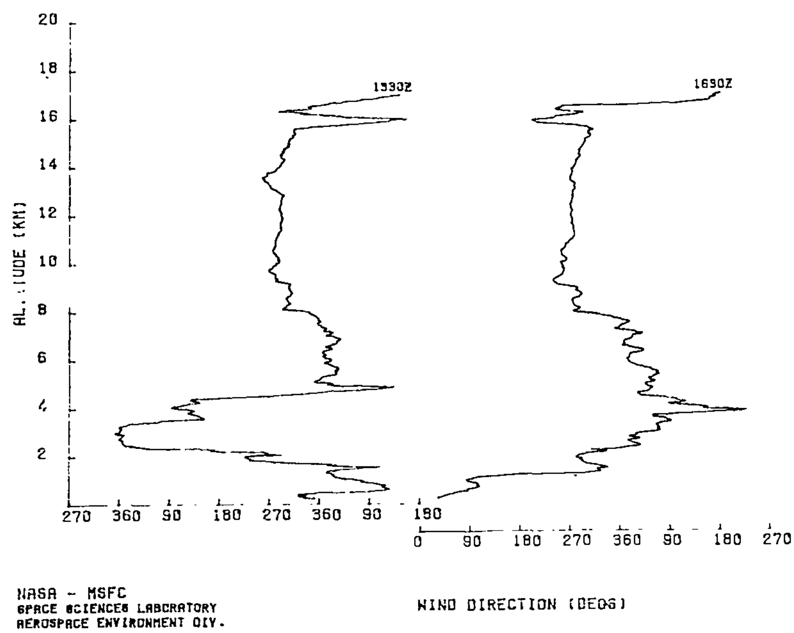

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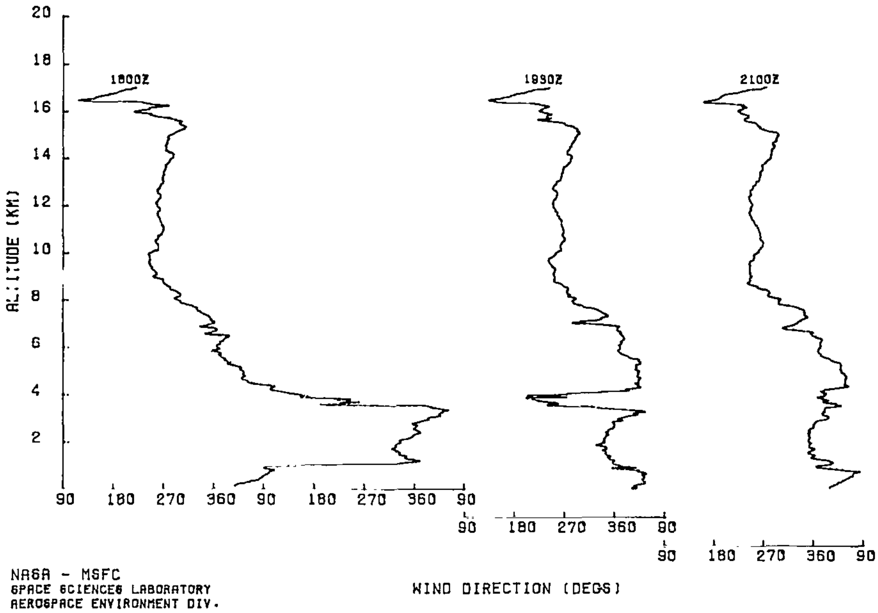

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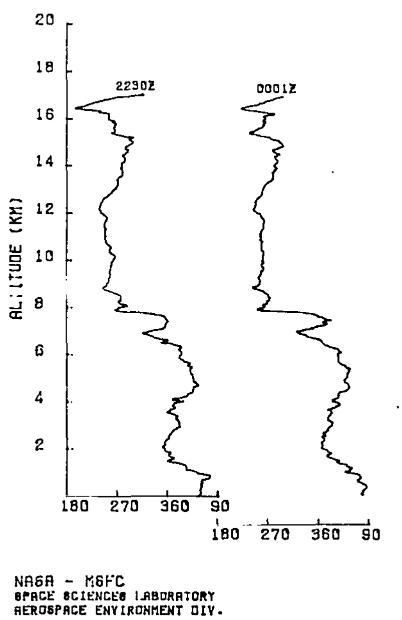

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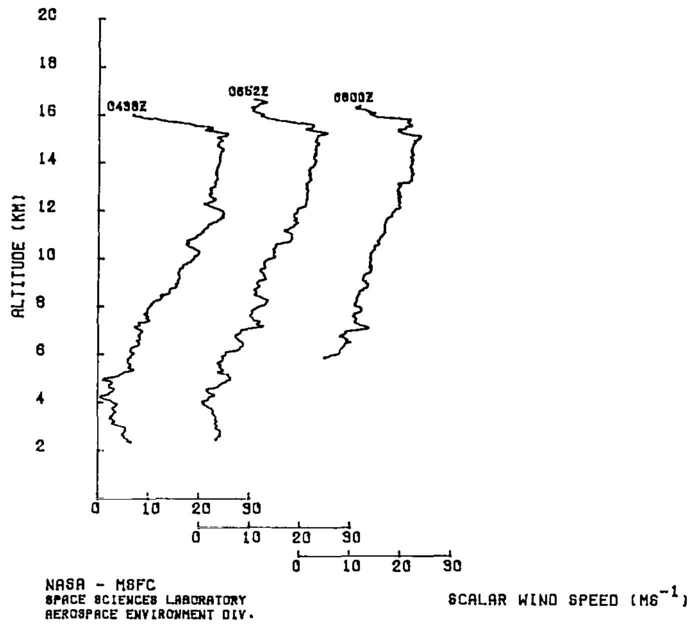
SEPT 27. 1968



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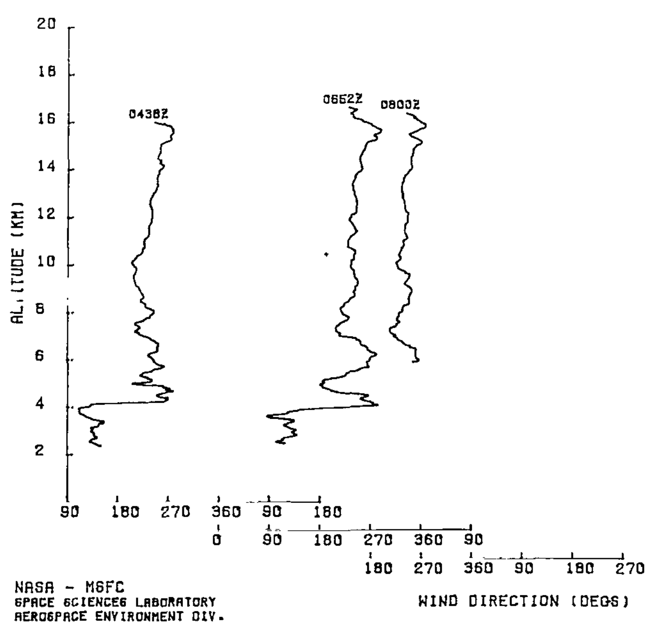
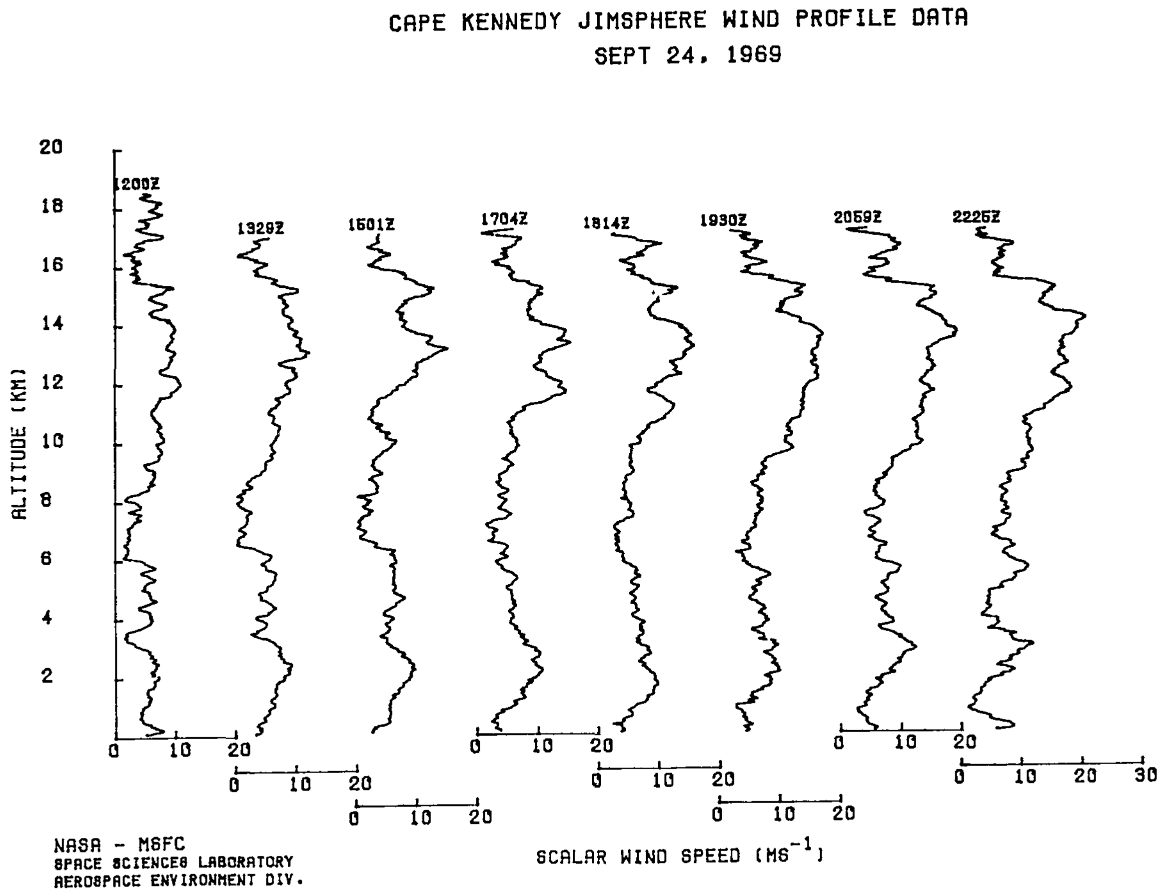
SEPT 27. 1968




CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
SEPT 24, 1969
ALTITUDE (KM)
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16
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12
10
8
6
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2
1200Z
1329Z
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1704Z
1814Z
1930Z
2059Z
2225Z
0 10 20
0 10 20
0 10 20
0 10 20
0 10 20
0 10 20
0 10 20
0 10 20 30
SCALAR WIND SPEED (MS^{-1})
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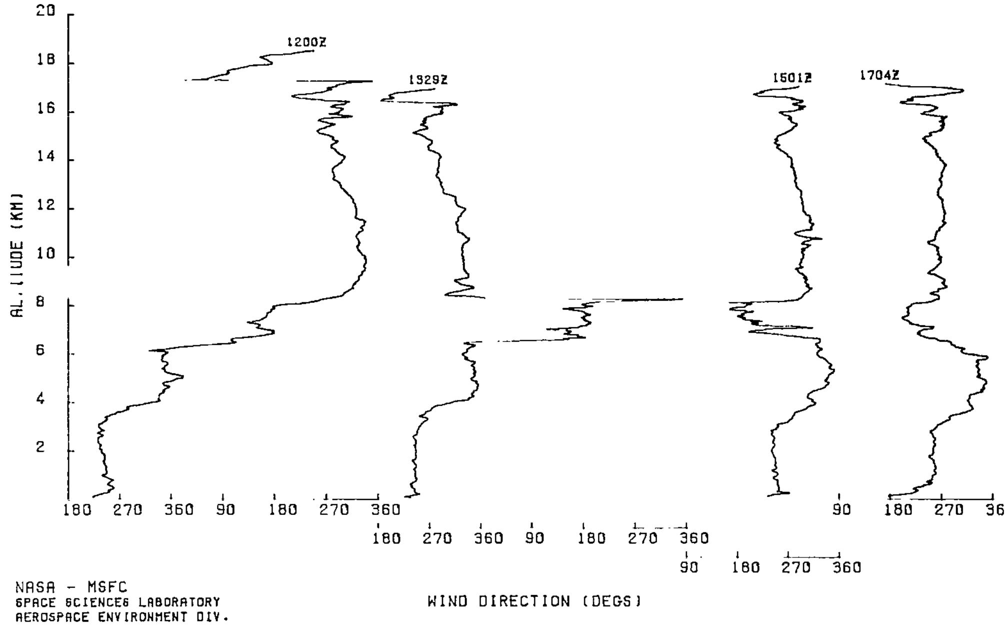
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
SEPT 24. 1969



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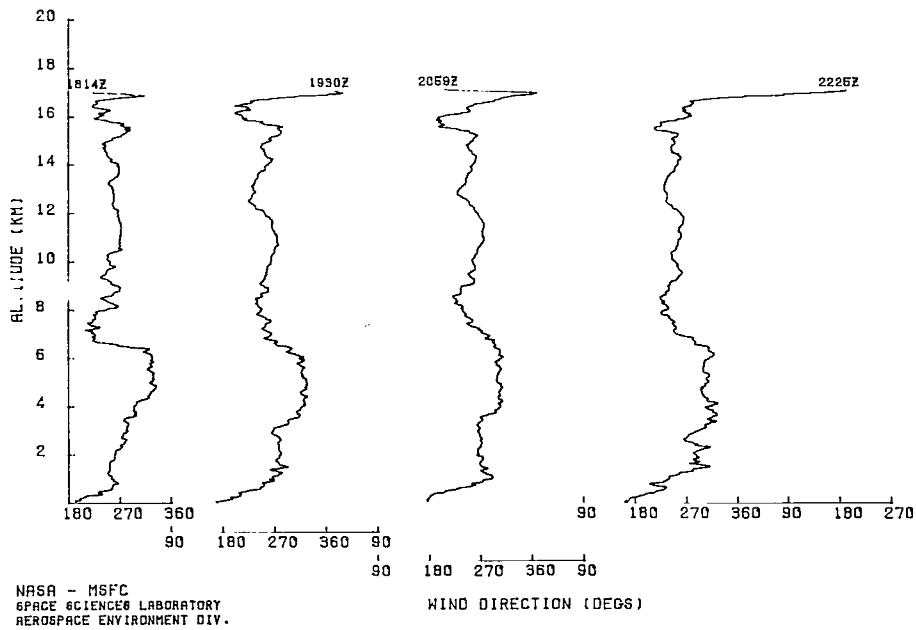

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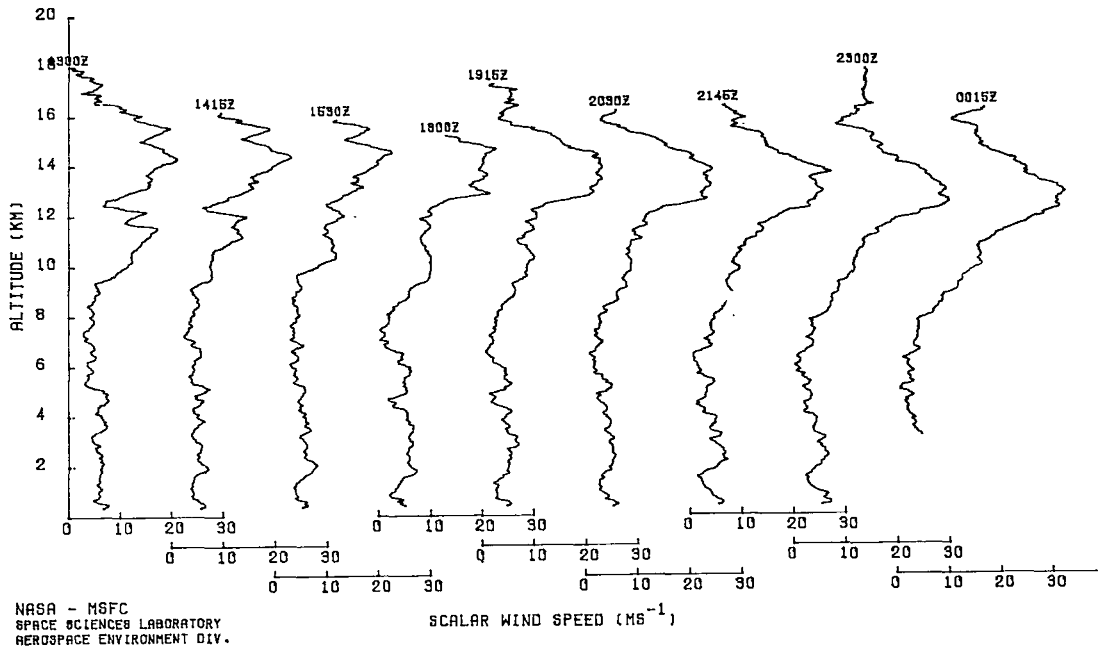
OCT 19-20, 1965



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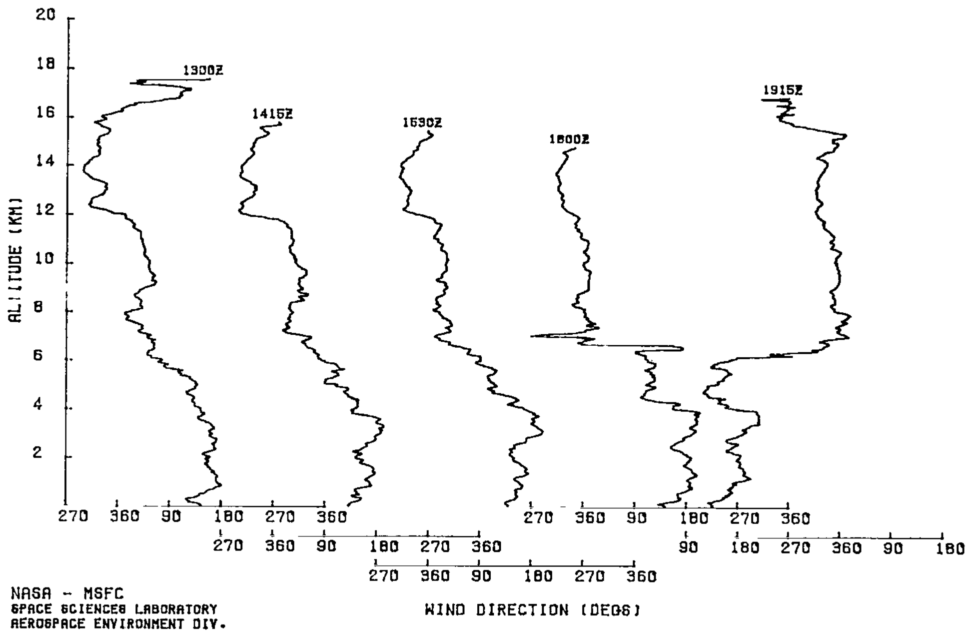
OCT 19-20. 1965



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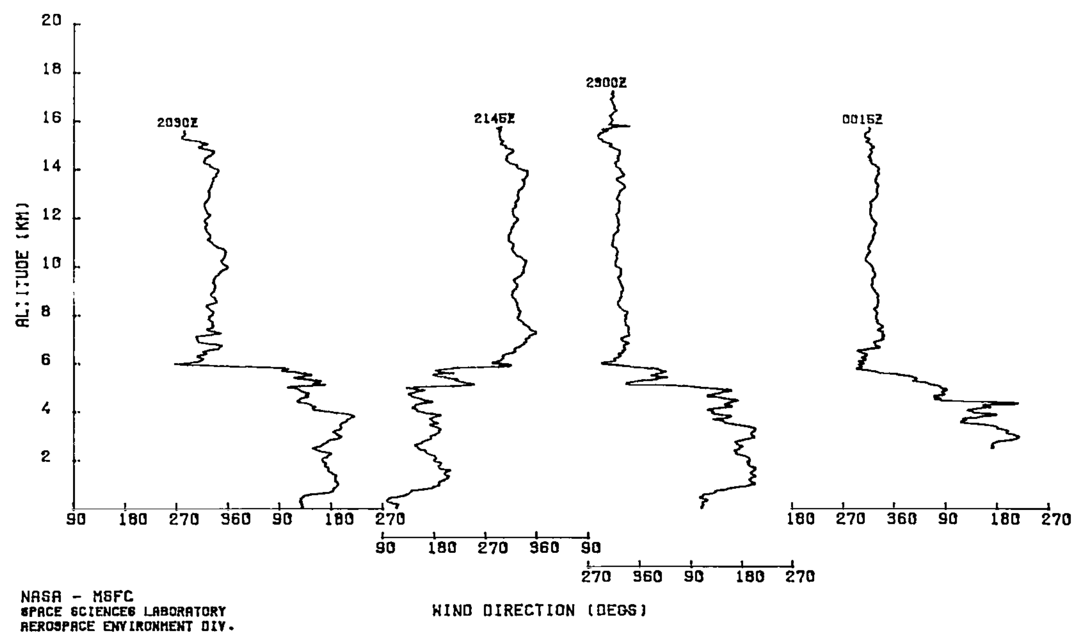
OCT 19-20. 1965



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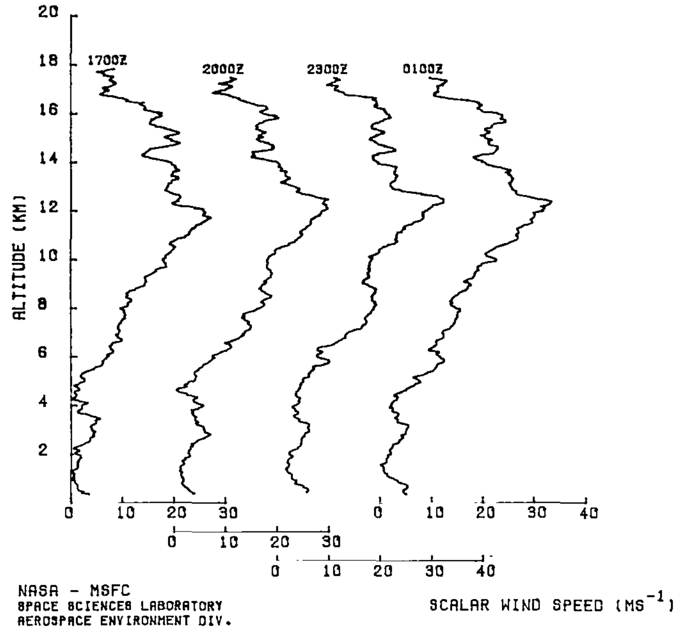
OCT 24-25, 1966



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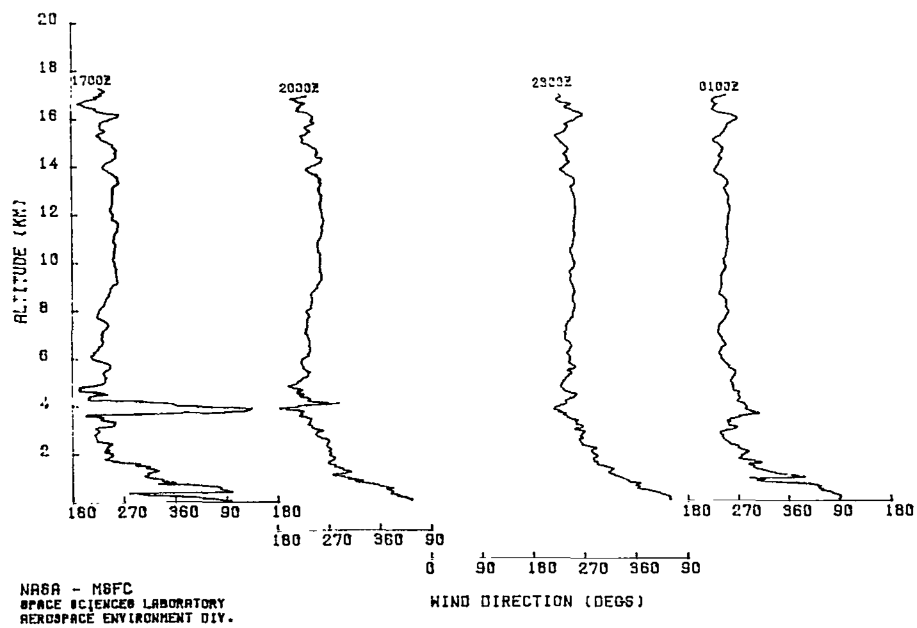
OCT 24-25, 1966



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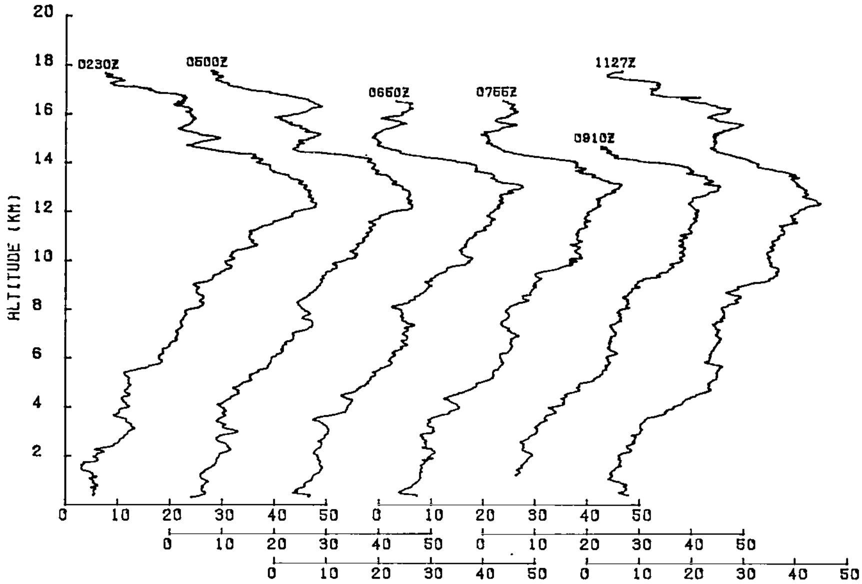
OCT 26. 1966



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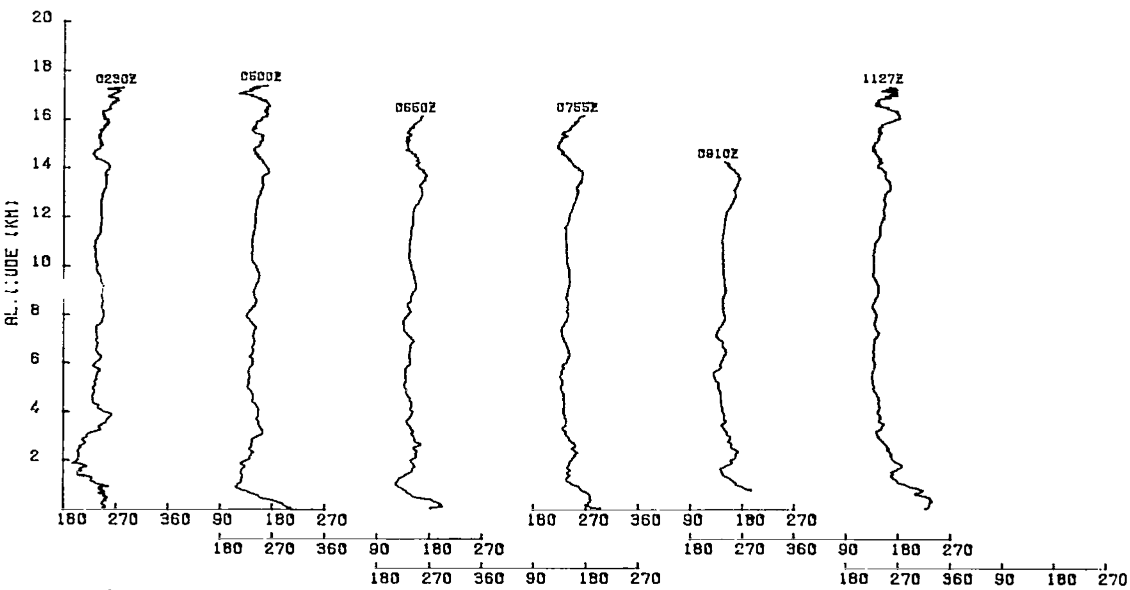
AEROSPACE ENVIRONMENT DIV.

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
OCT 26. 1966



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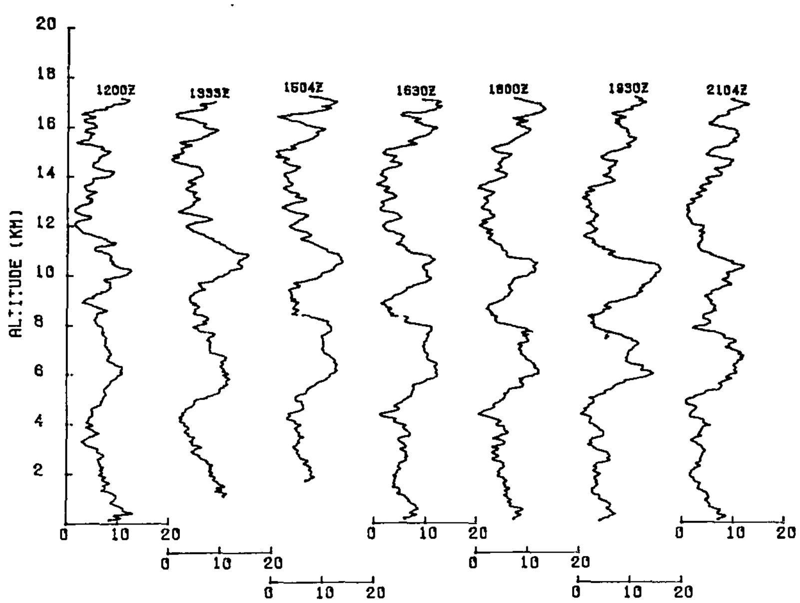
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
OCT 16. 1967



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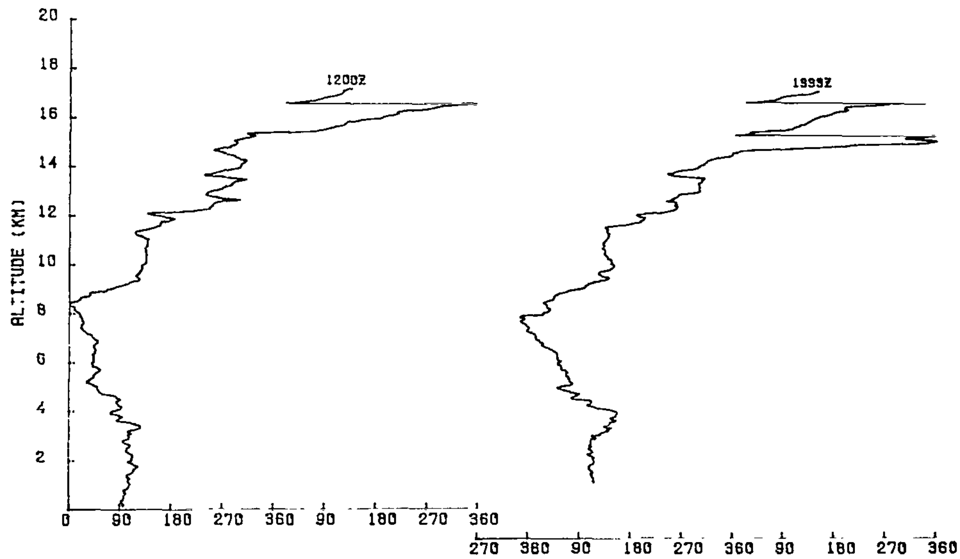

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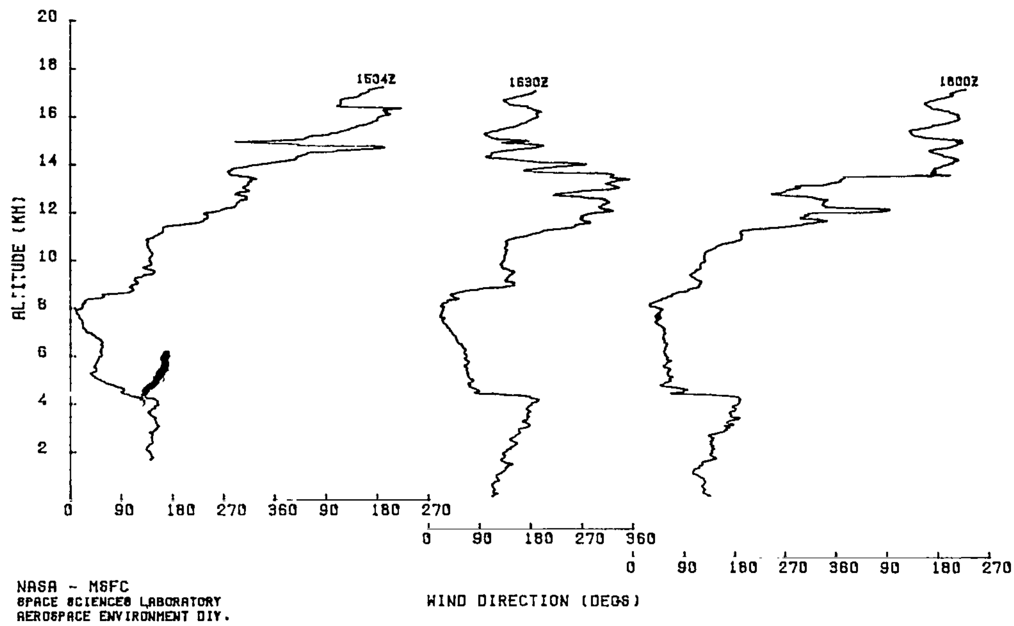
OCT 16. 1967



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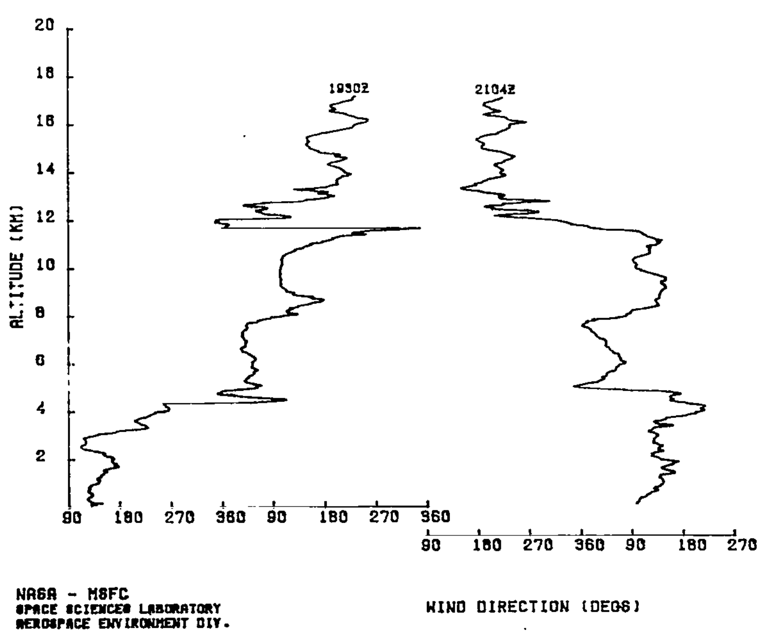

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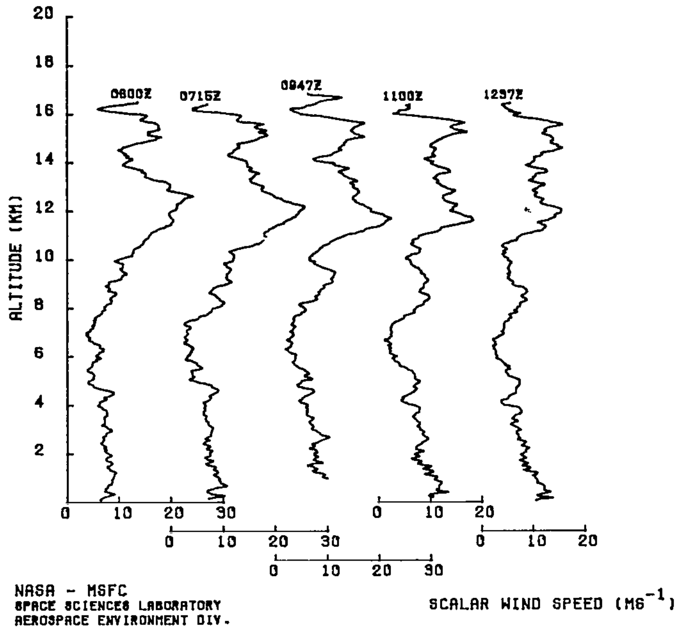
OCT 11, 1968



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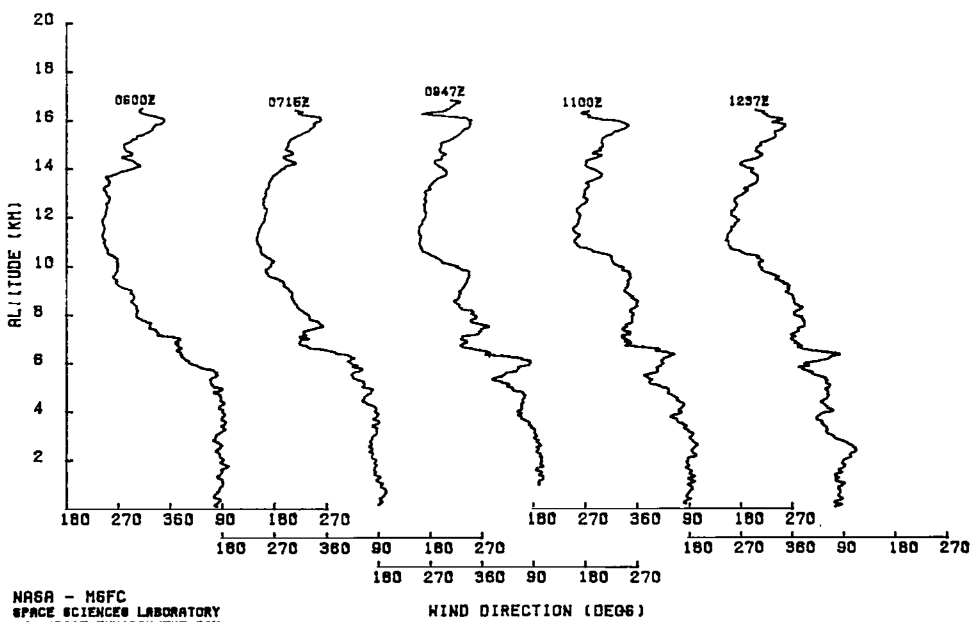
OCT 11, 1968



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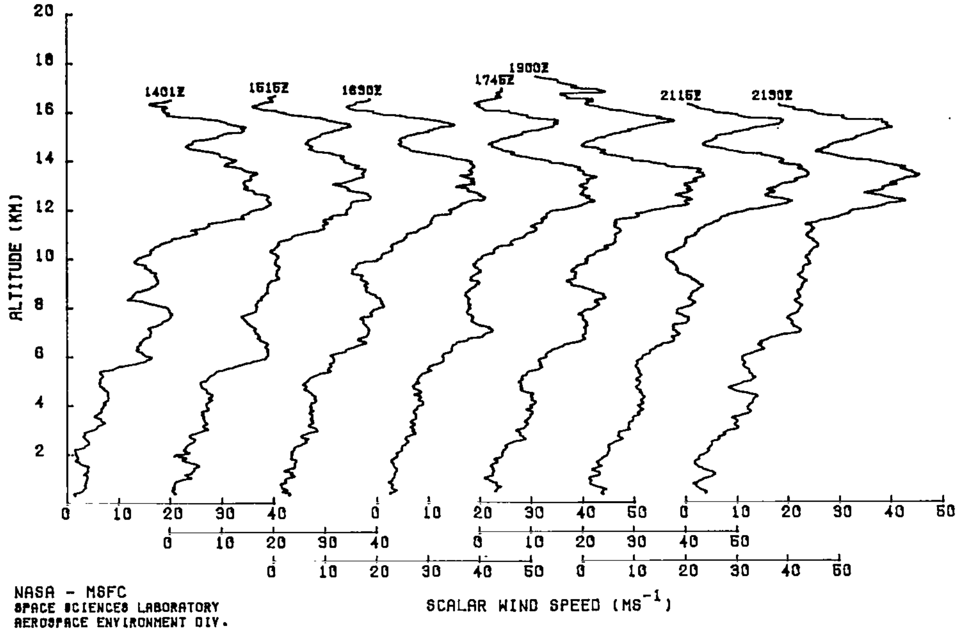
NOV 10, 1965



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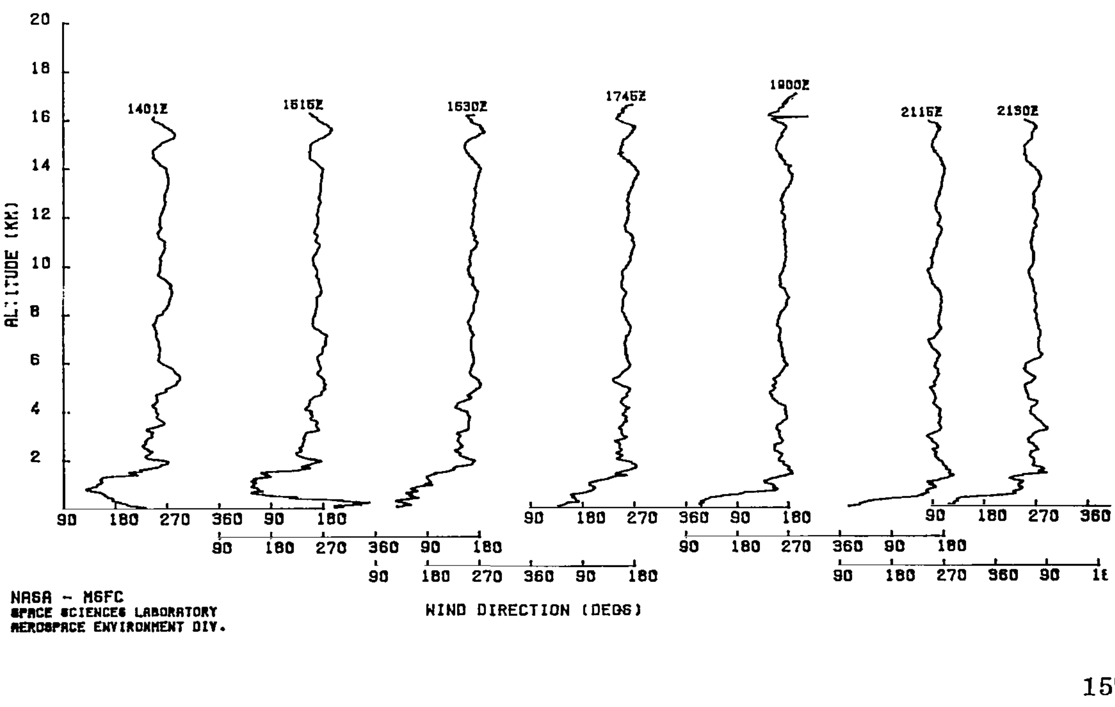
NOV 10, 1965



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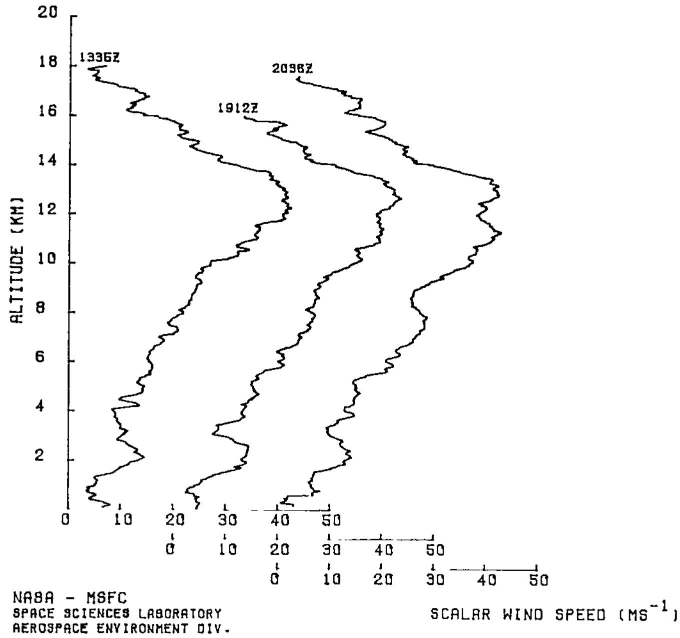
NOV 3, 1967



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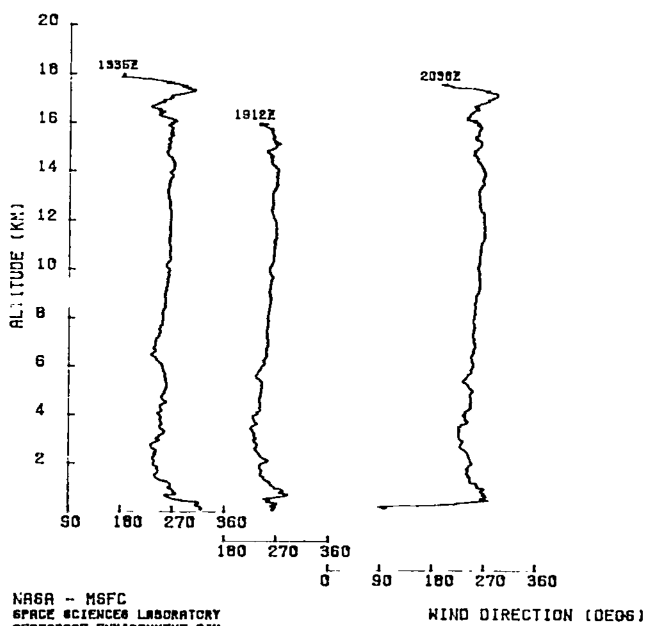

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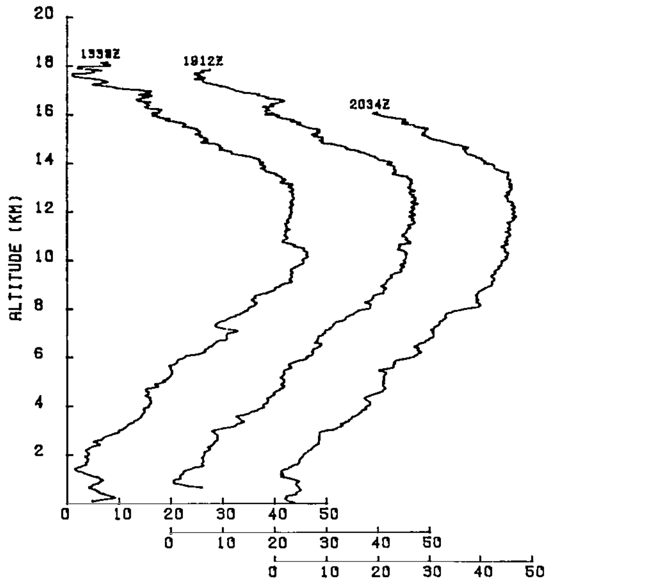
NOV 4. 1967



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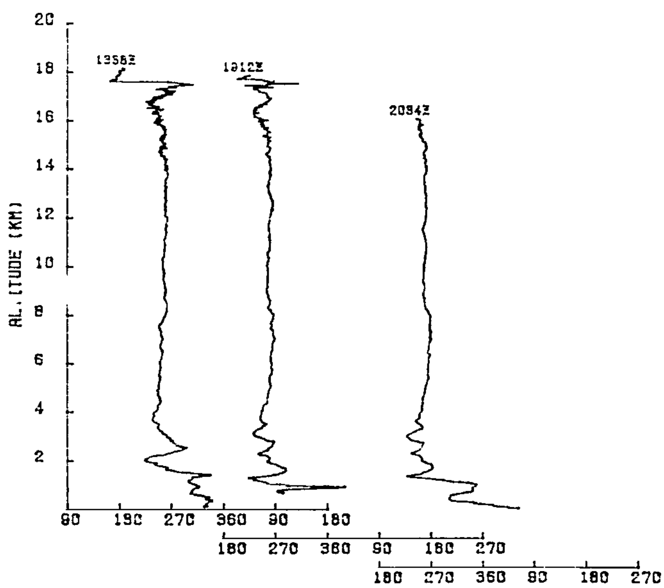
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
NOV 4. 1967



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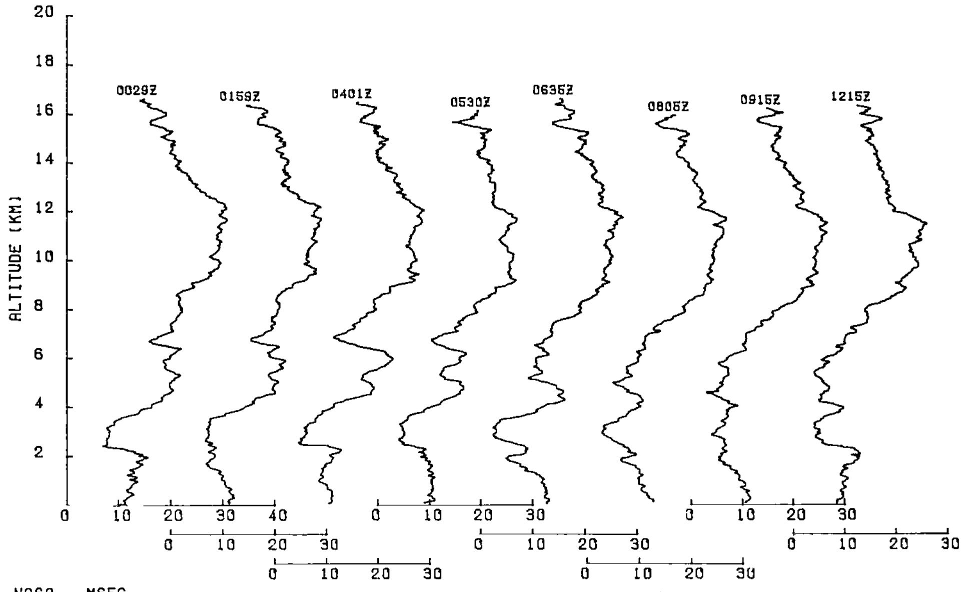
NOV 9, 1967



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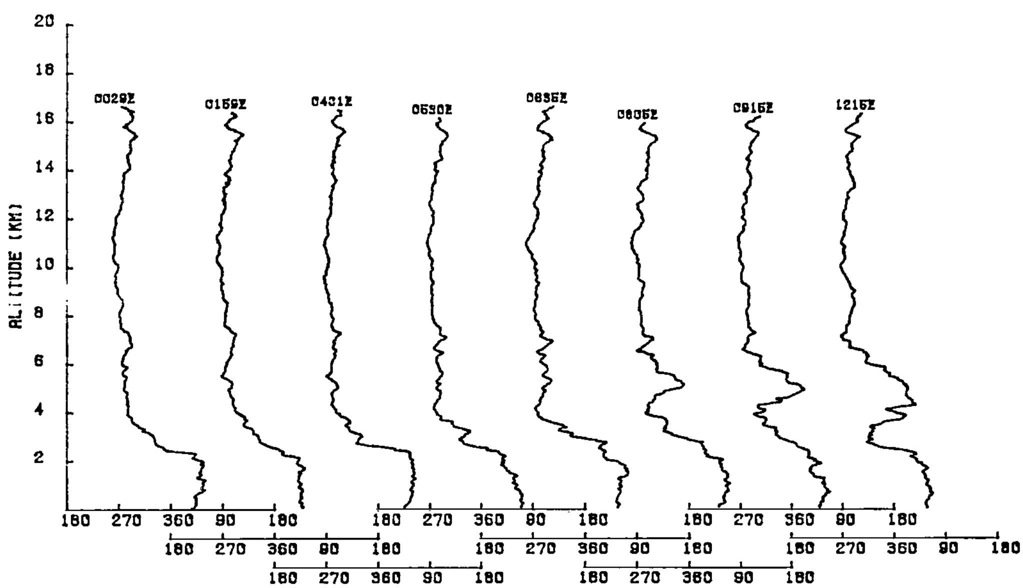
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
NOV 9, 1967



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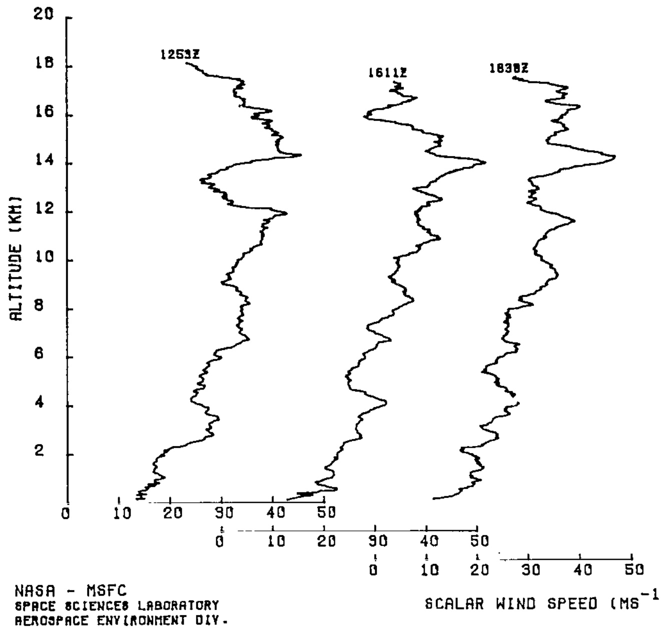
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
NOV 14, 1969



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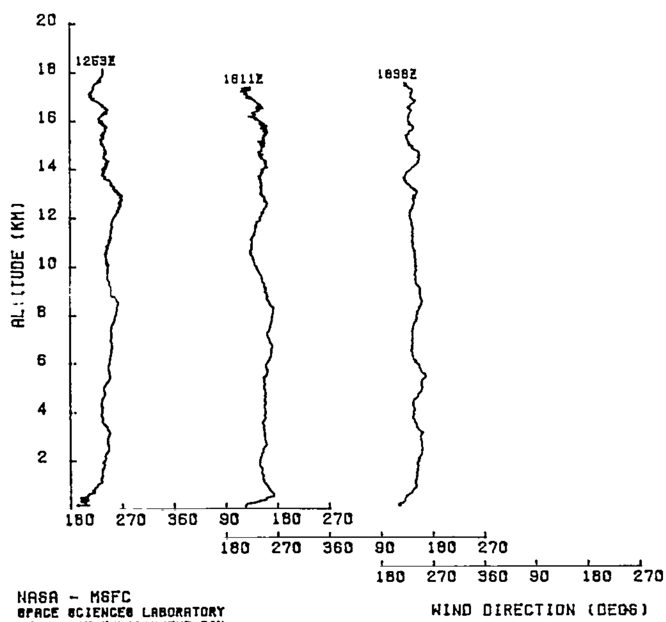
NOV 14, 1969



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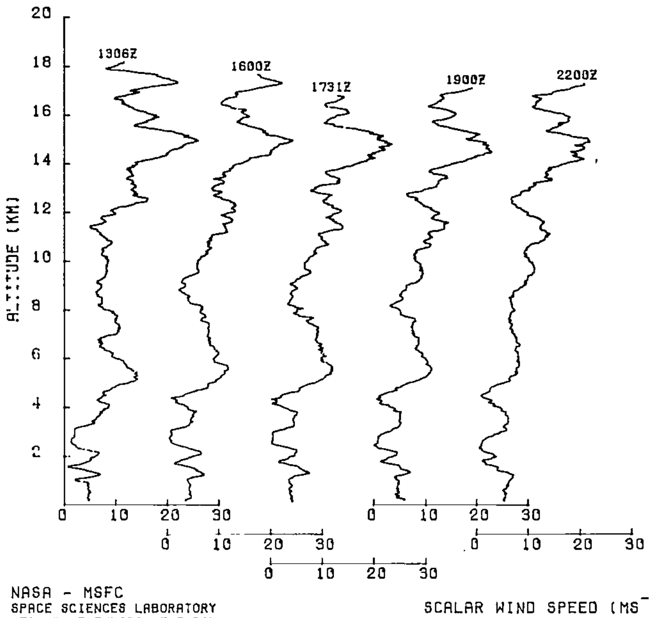
DEC 29, 1964



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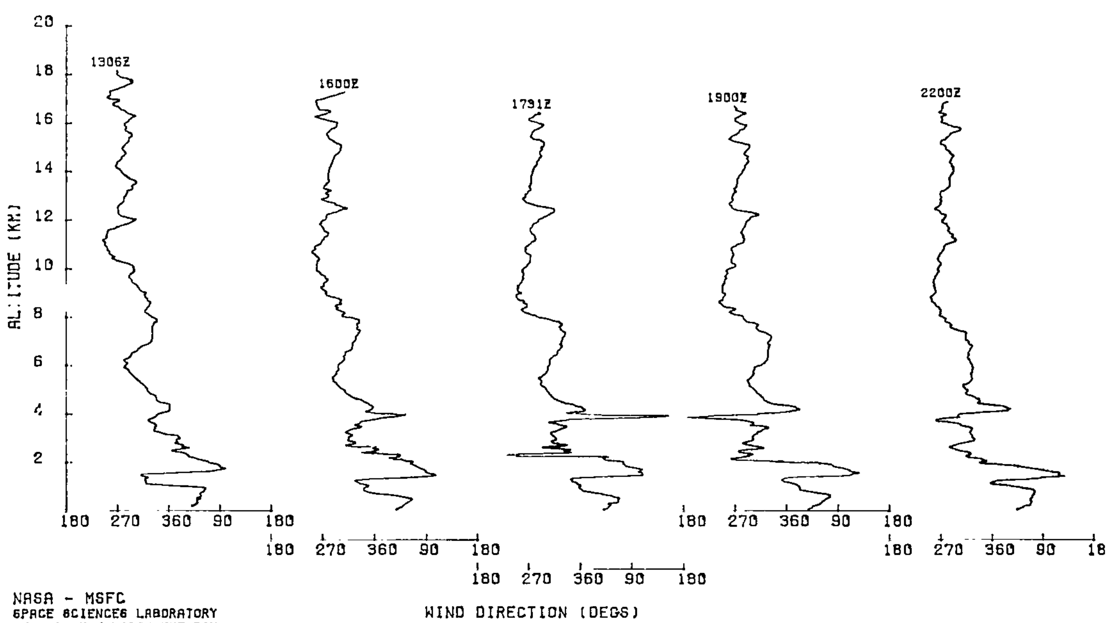
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
DEC 29, 1964



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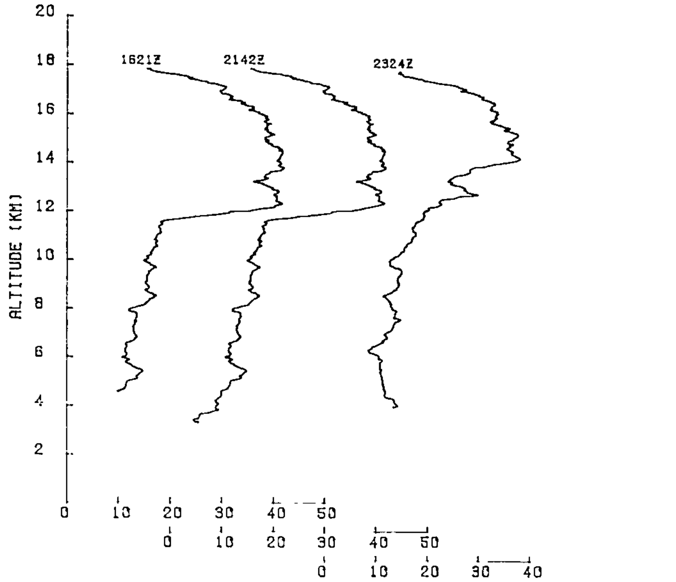
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
DEC 6, 1966



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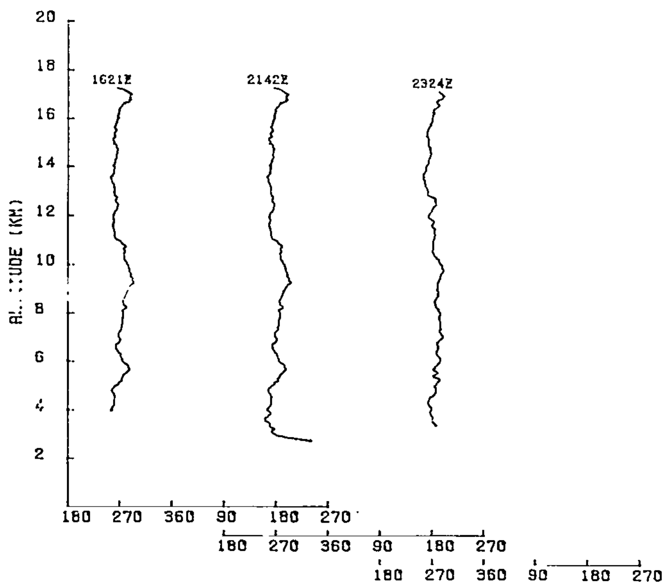
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
DEC 6, 1966



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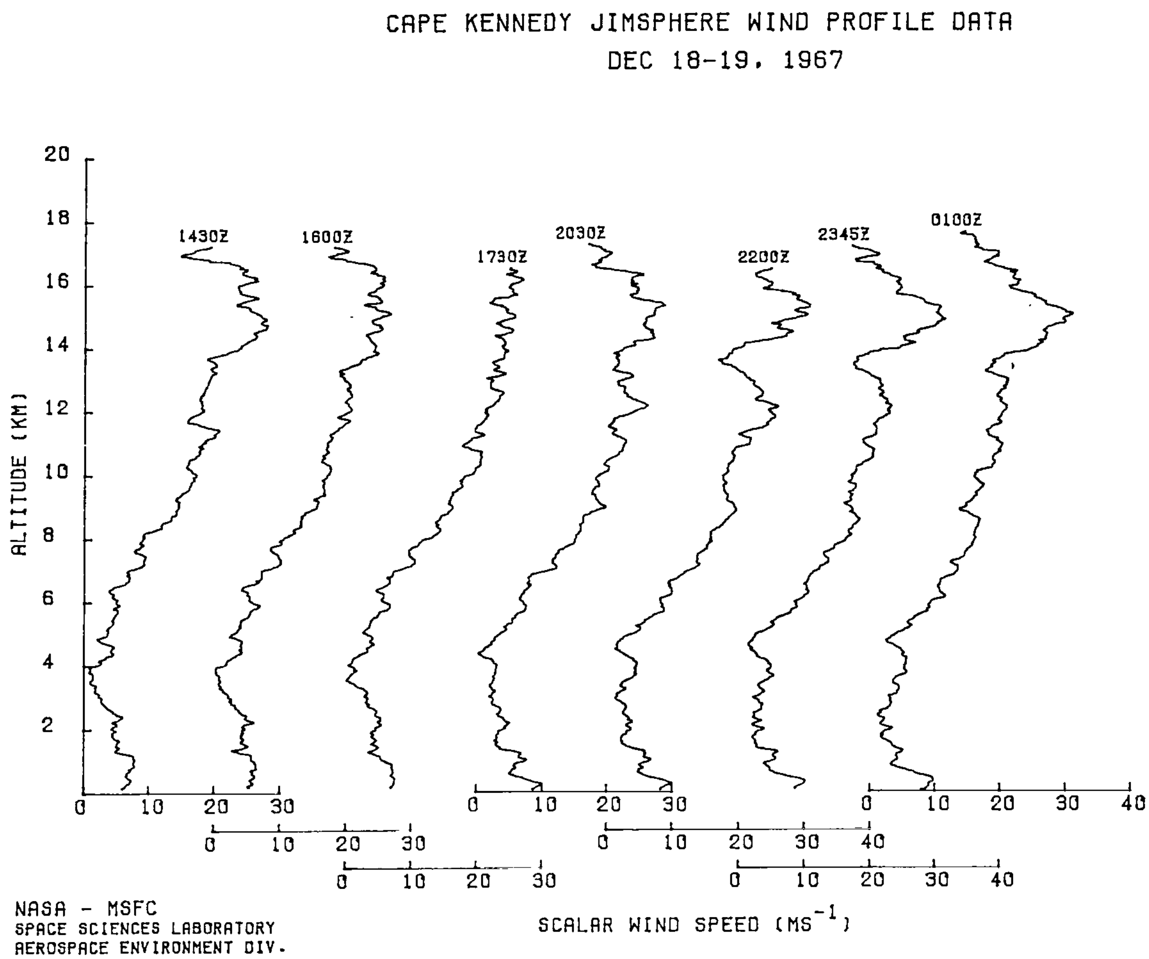
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
DEC 18-19, 1967
ALTITUDE (KM)
1430Z
1600Z
1730Z
2030Z
2200Z
2345Z
0100Z
SCALAR WIND SPEED (MS-1)
NASA - MSFC
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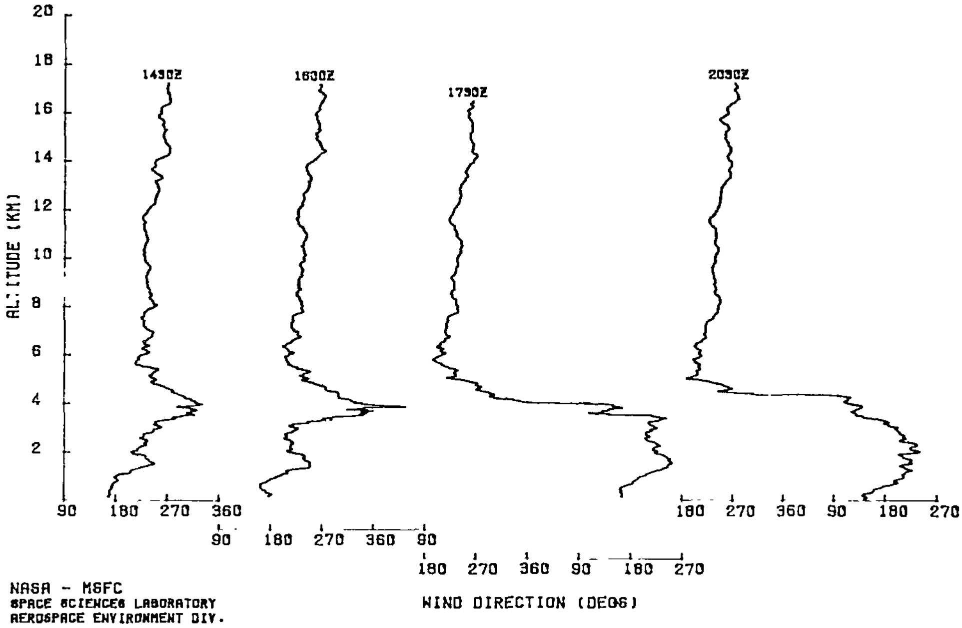
AEROSPACE ENVIRONMENT DIV.

CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
DEC 18-19, 1967



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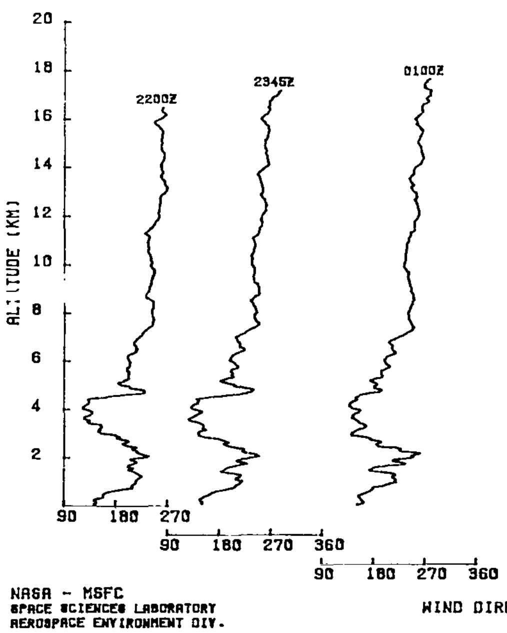

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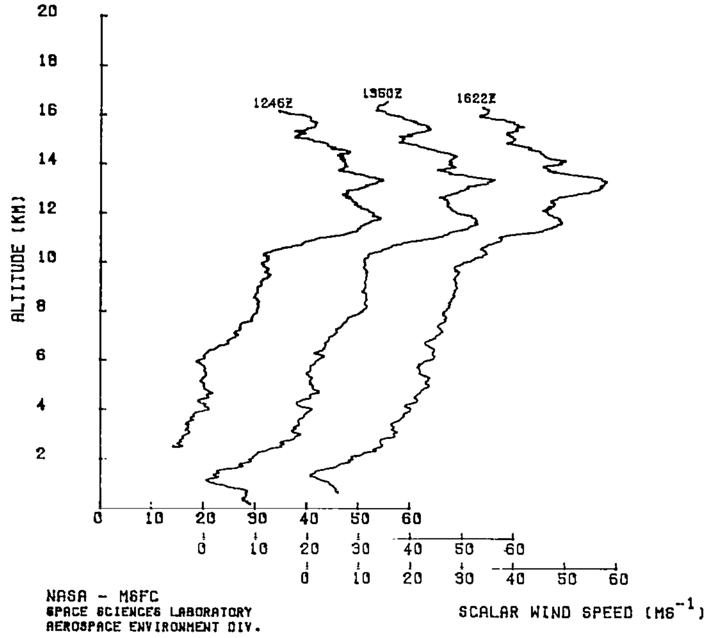
DEC 9. 1968



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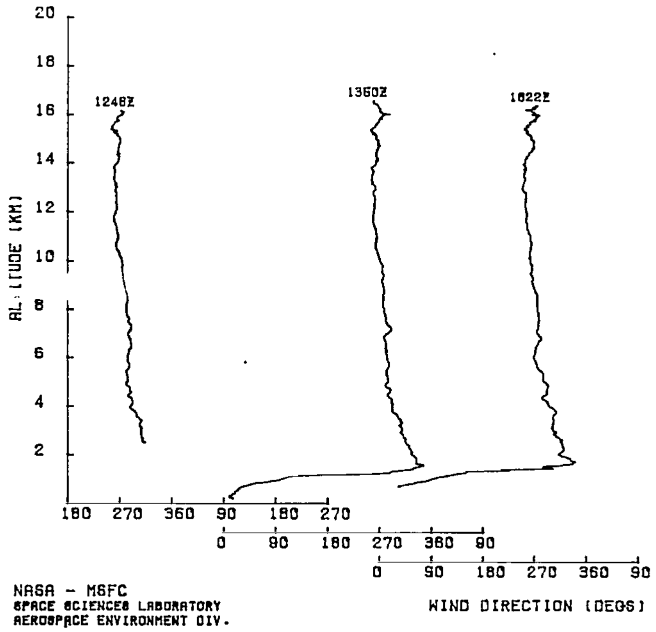
DEC 9. 1968



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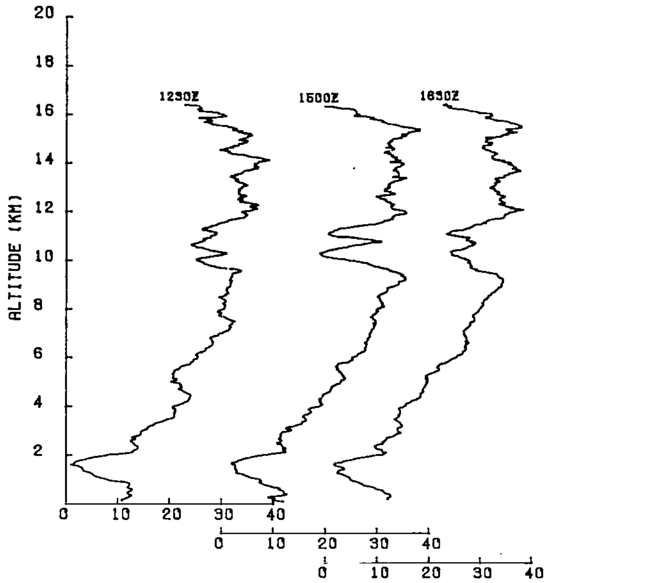
DEC 11, 1968



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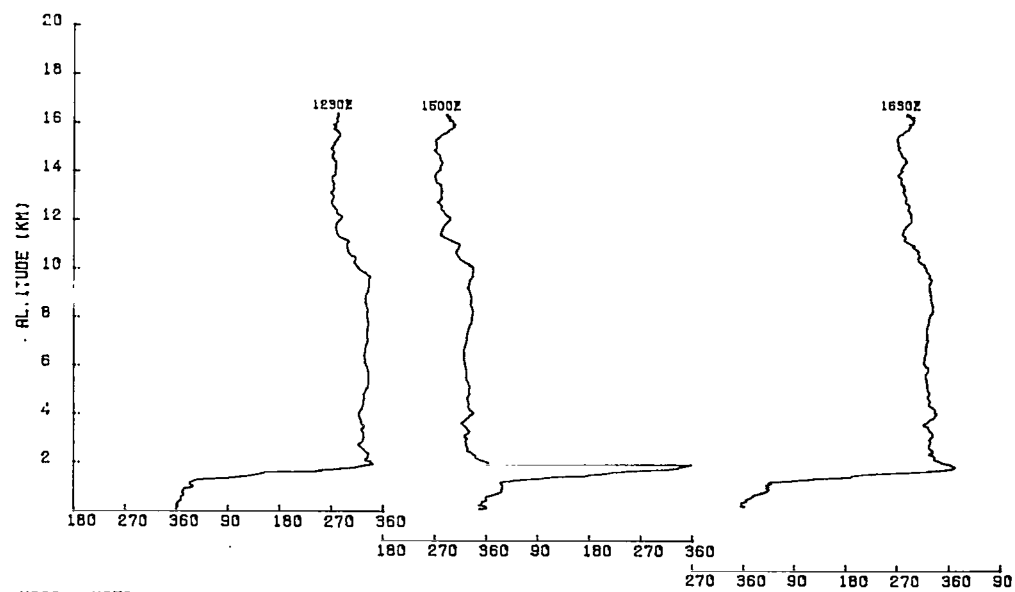
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
DEC 11, 1968



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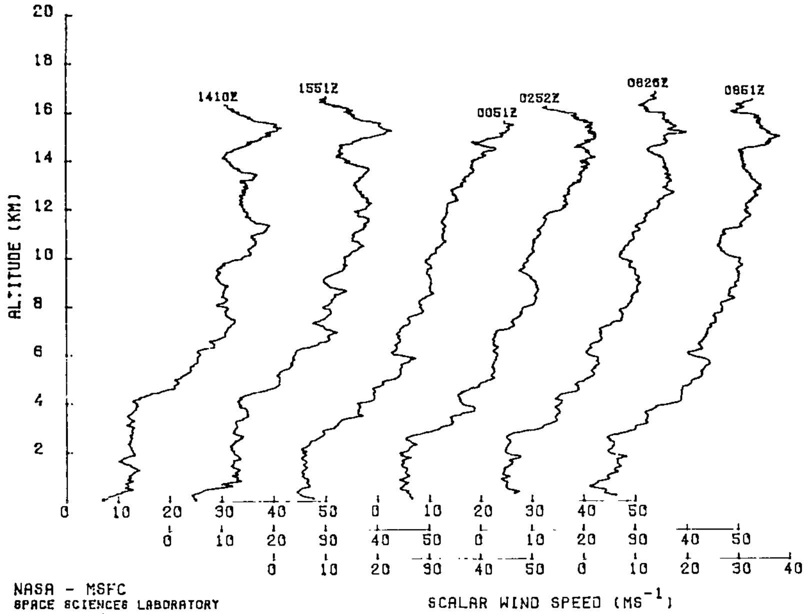
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
DEC 20-21, 1968



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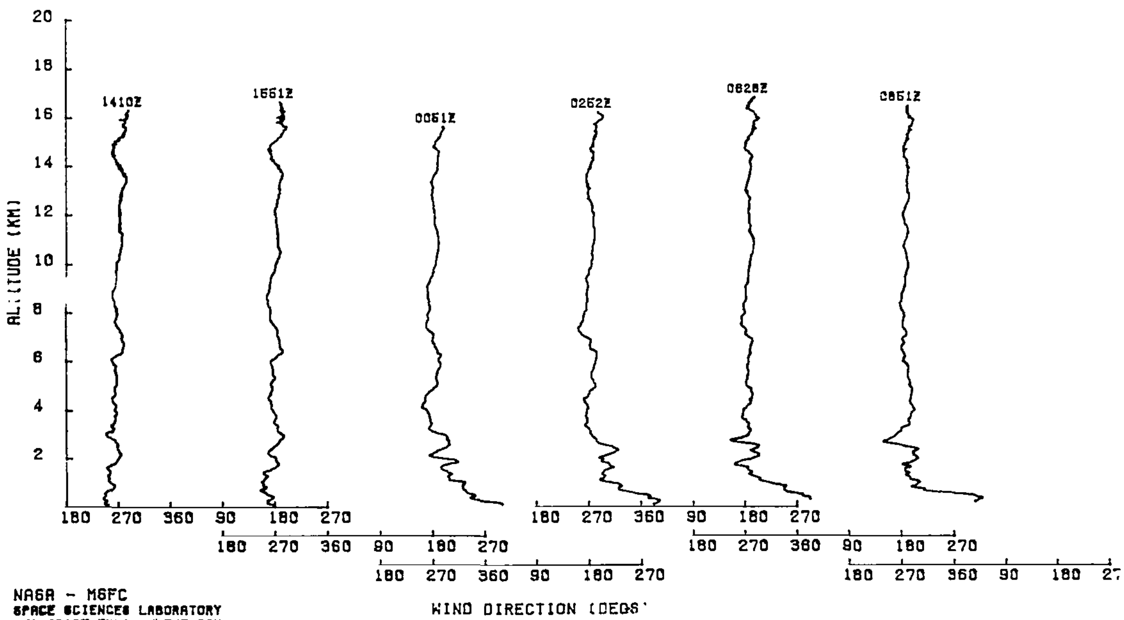
CAPE KENNEDY JIMSPHERE WIND PROFILE DATA
DEC 20-21, 1968



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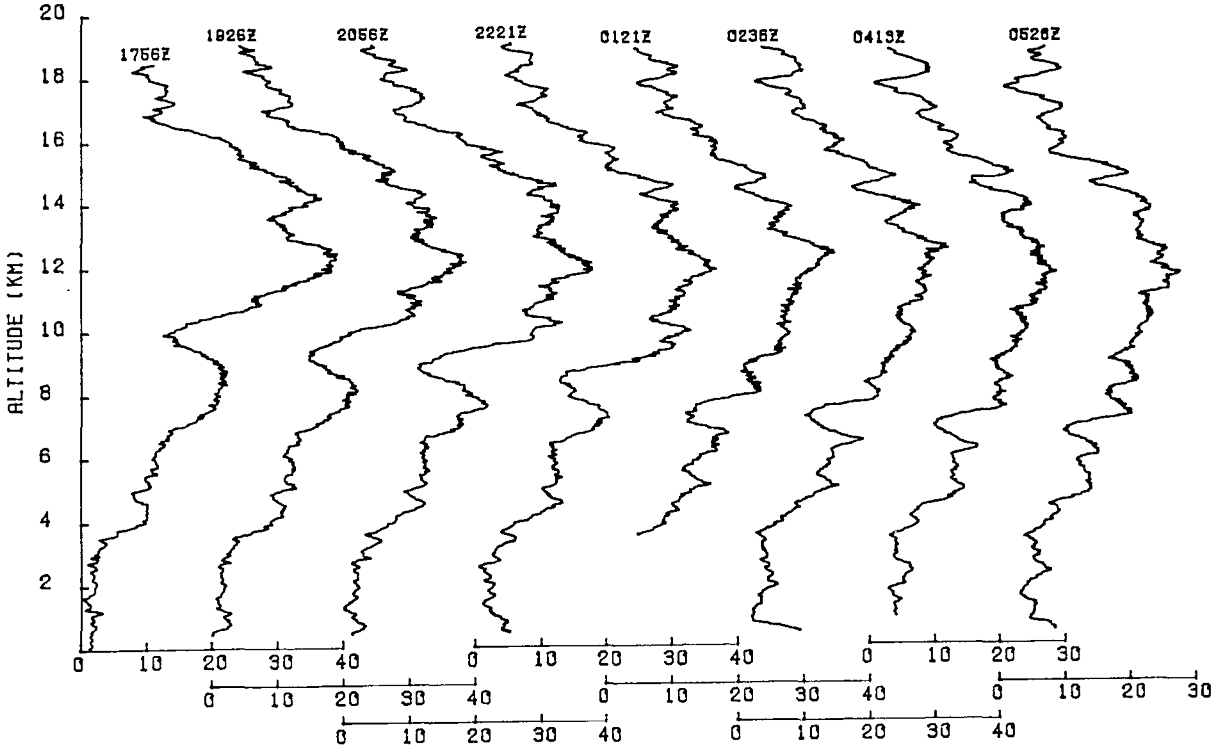
24 Sequential Jimsphere Wind Profile Data Sets For Point Mugu, California January 1965 – April 1970

101

POINT MUGU JIMSPHERE WIND PROFILE DATA
JAN 18-19, 1965



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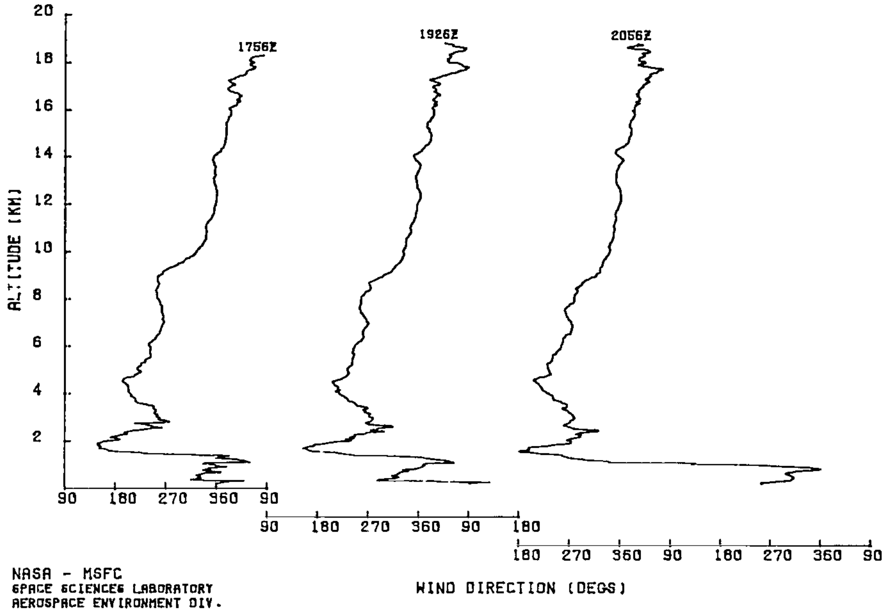
101

POINT MUGU JIMSPHERE WIND PROFILE DATA
JAN 18-19. 1965



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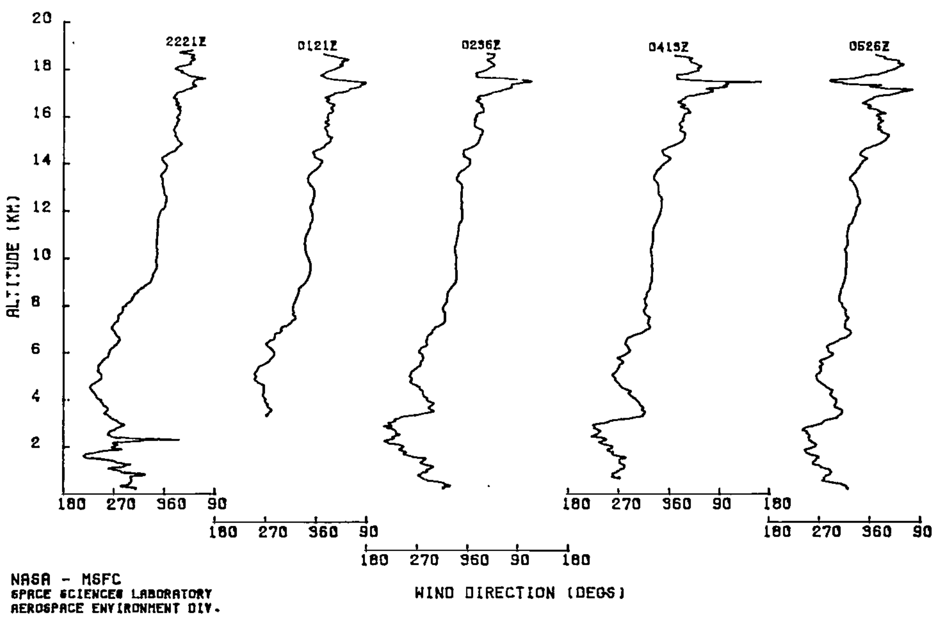
JAN 18-19. 1965



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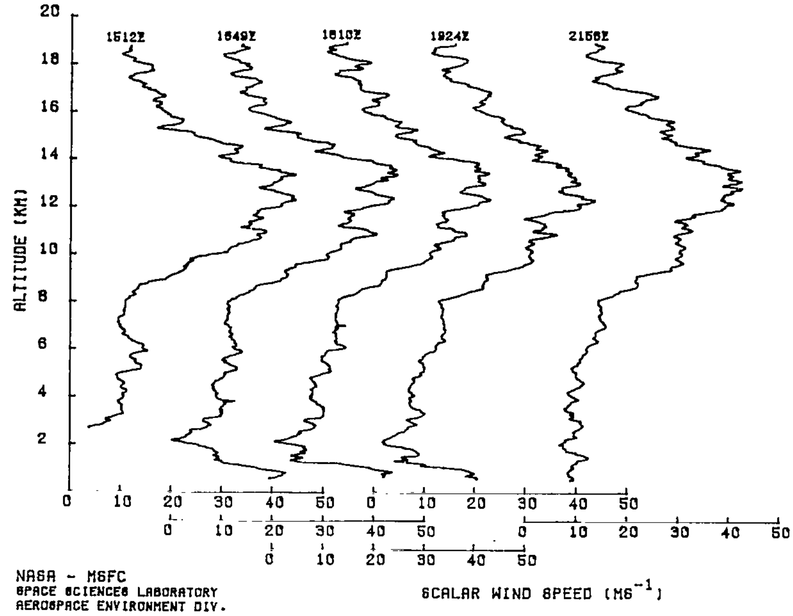
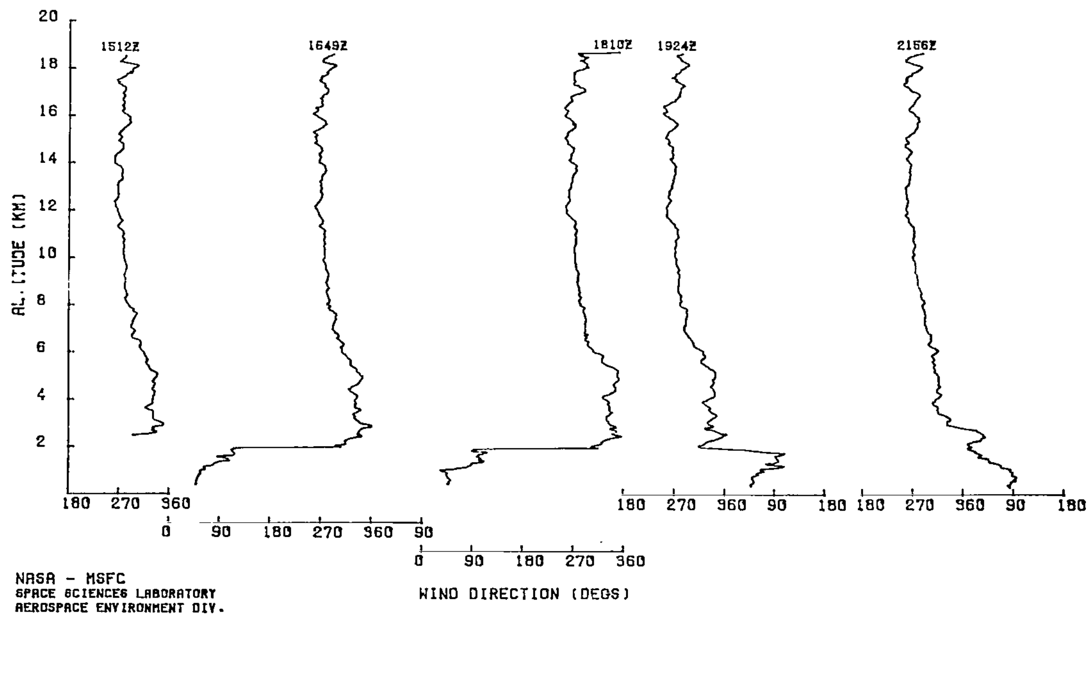
POINT MUGU JIMSPHERE WIND PROFILE DATA
JAN 2 1970



POINT MUGU JIMSPHERE WIND PROFILE DATA
JAN 2 1970



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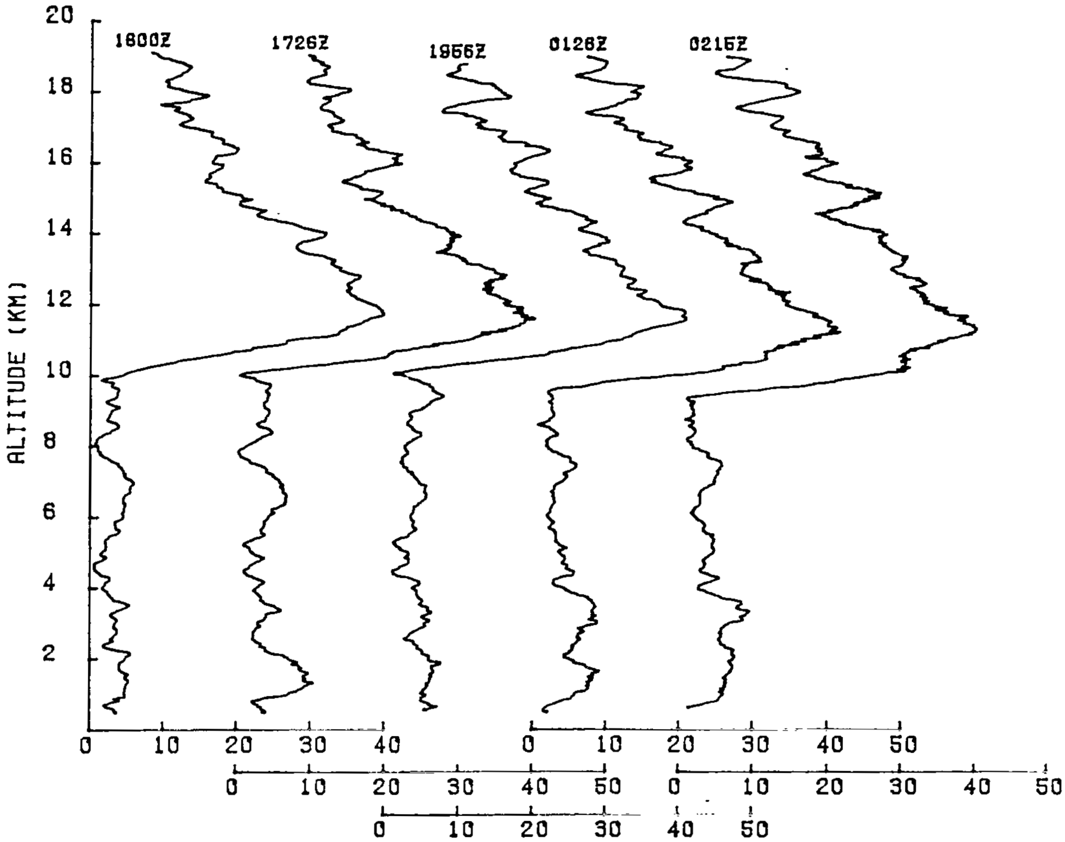
FEB 18-19, 1965



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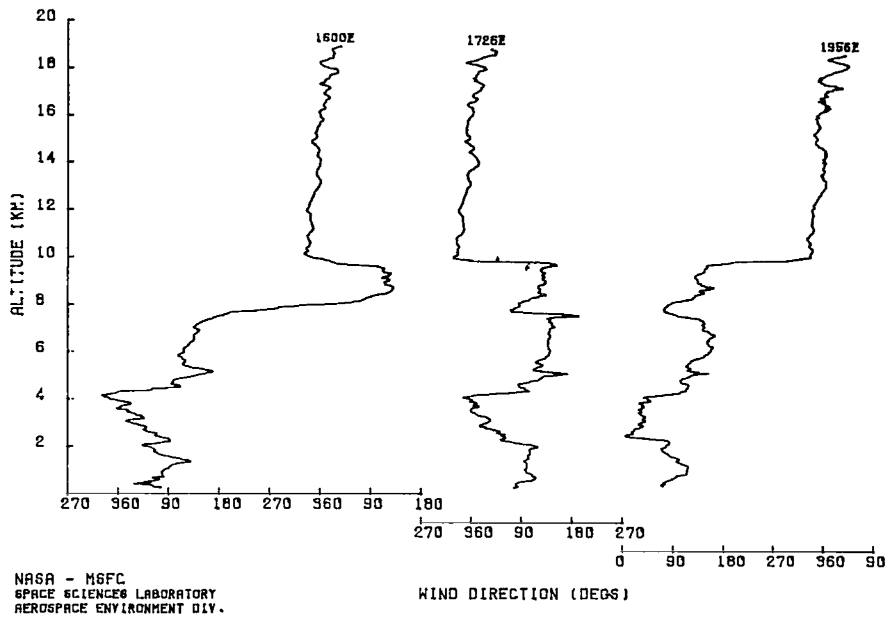
SCALAR WIND SPEED (MS^{-1})

POINT MUGU JIMSPHERE WIND PROFILE DATA
FEB 18-19. 1965



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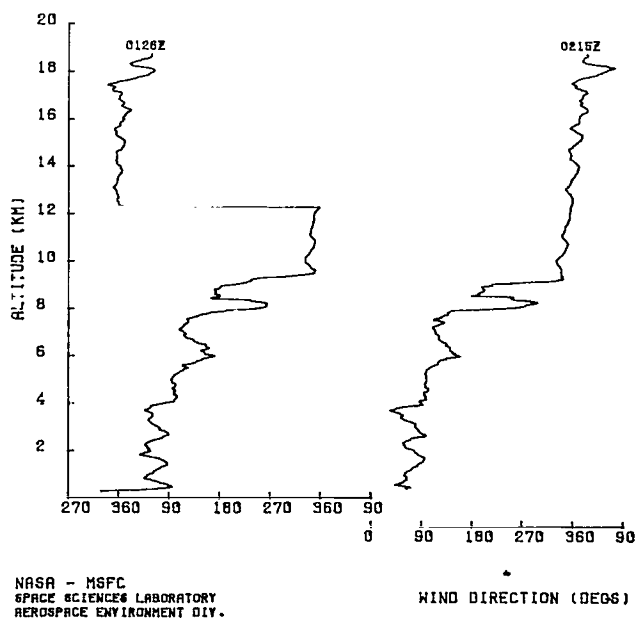
FEB 18-19. 1965



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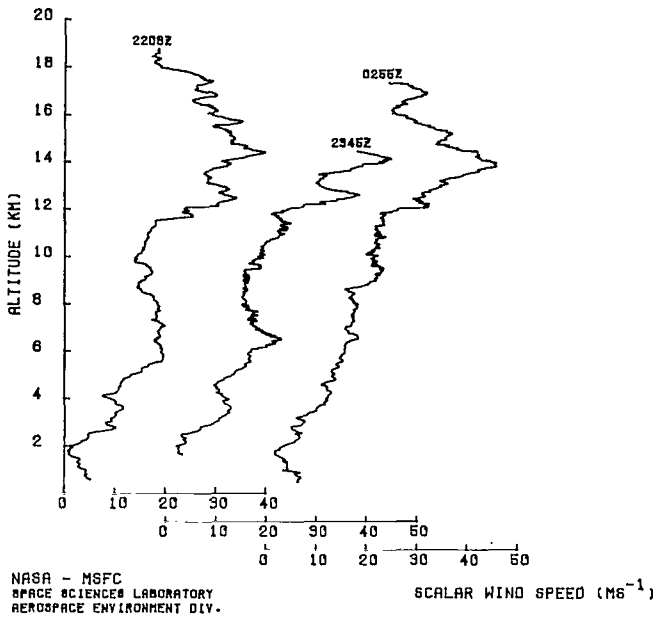
FEB 28-29. 1966



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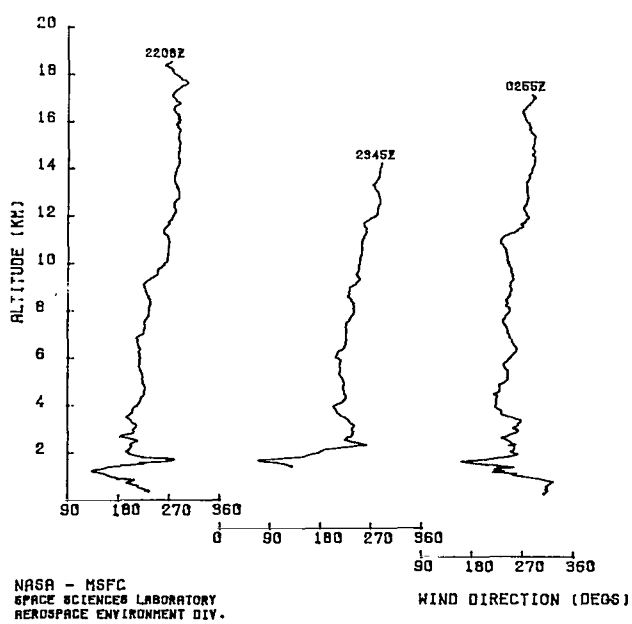
FEB 28-29. 1966



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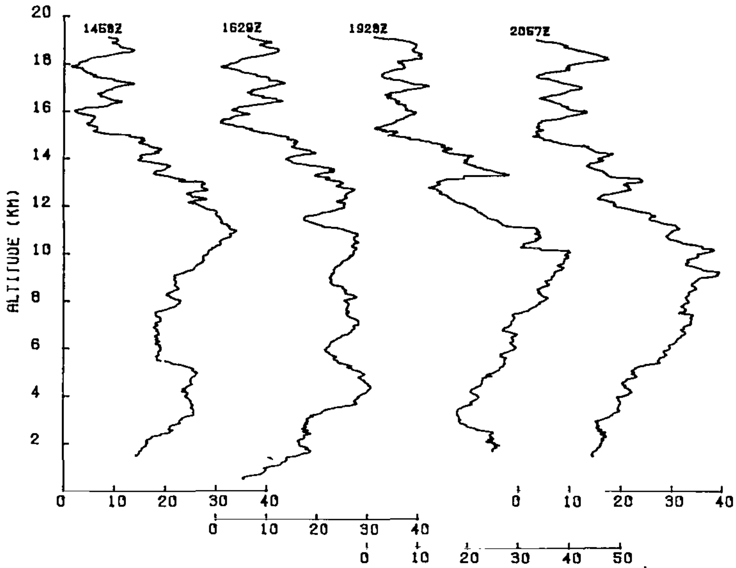
FEB 9, 1970



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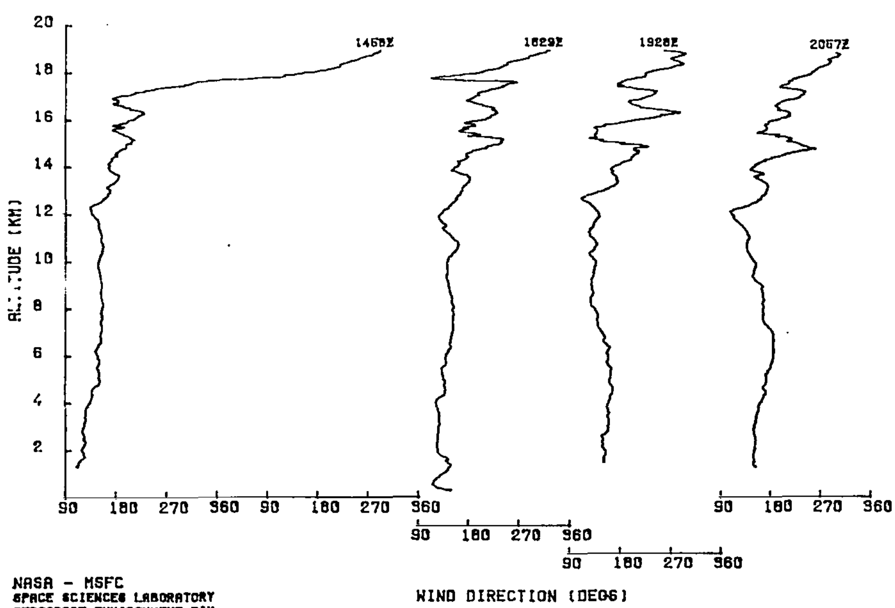
POINT MUGU JIMSPHERE WIND PROFILE DATA
FEB 9, 1970



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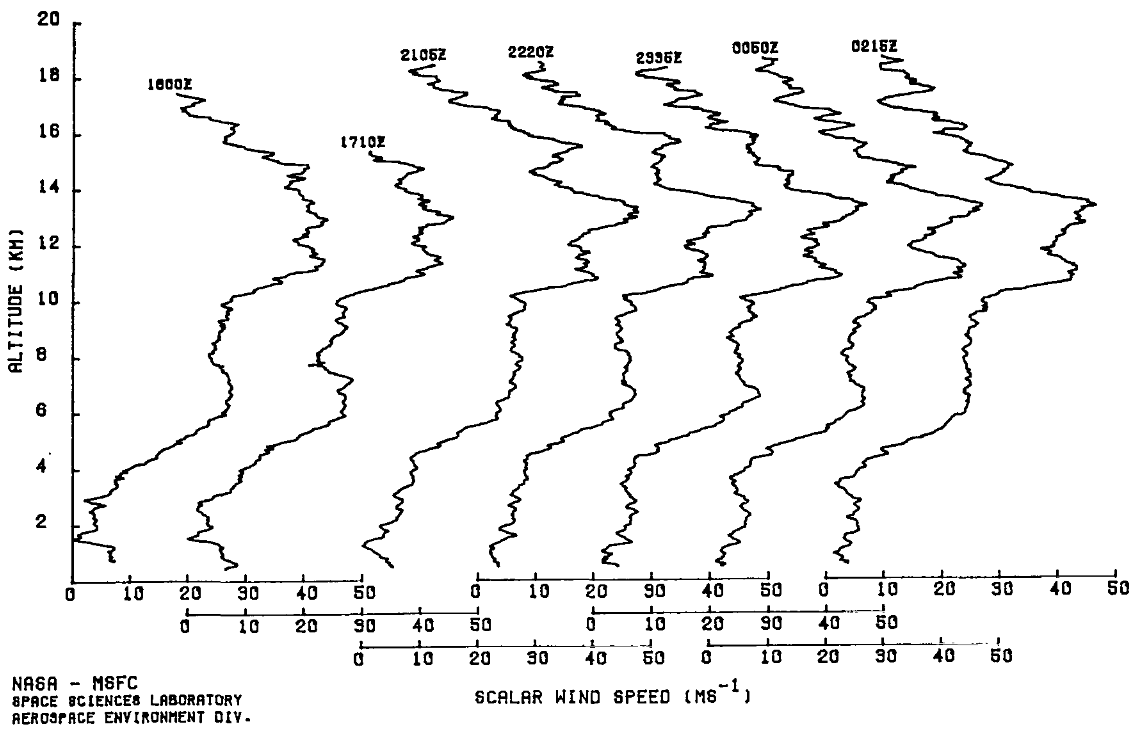
POINT MUGU JIMSPHERE WIND PROFILE DATA
MAR 2-3, 1965



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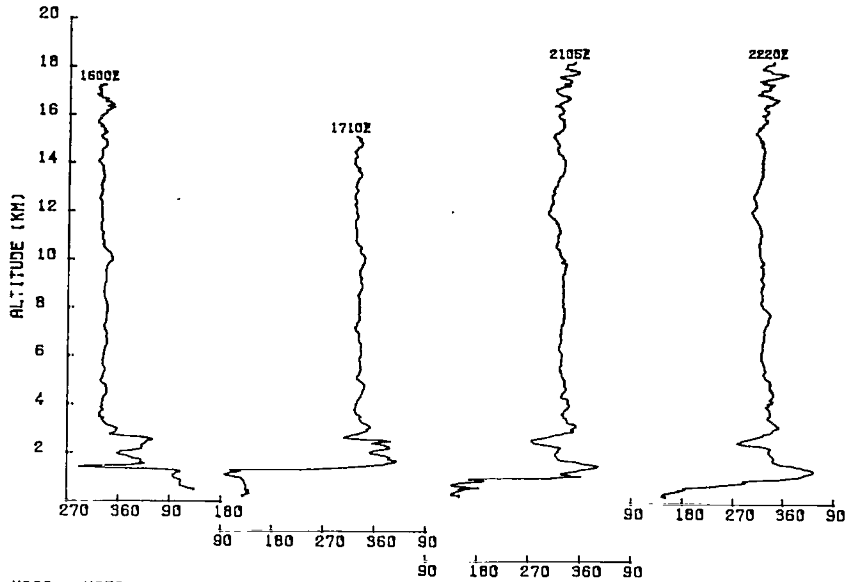
MAR 2-3. 1965



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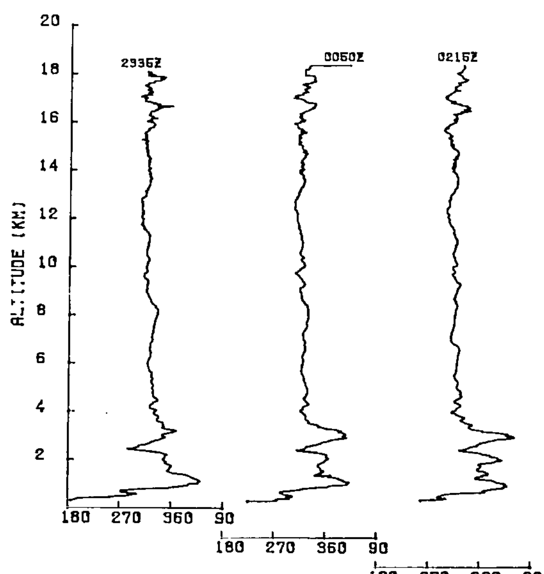
WIND DIRECTION (DEGS)

POINT MUGU JIMSPHERE WIND PROFILE DATA
MAR 2-3. 1965



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WIND DIRECTION (DEGS)

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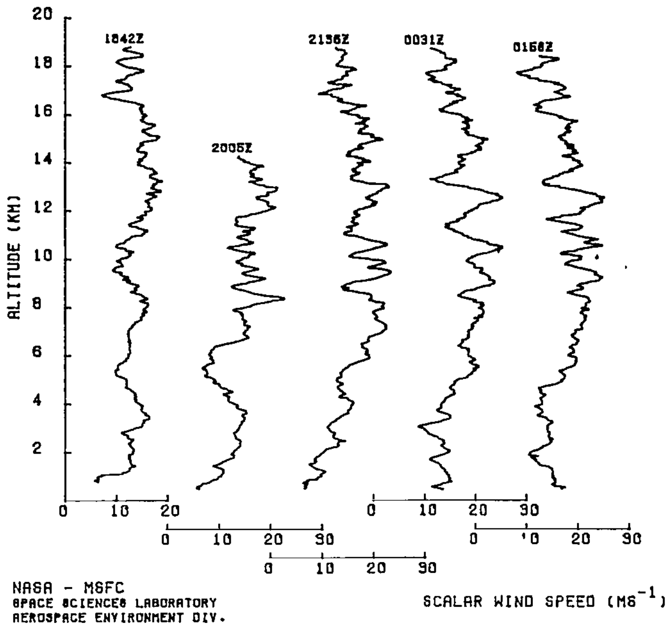
POINT MUGU JIMSPHERE WIND PROFILE DATA
MAR 15-16. 1965



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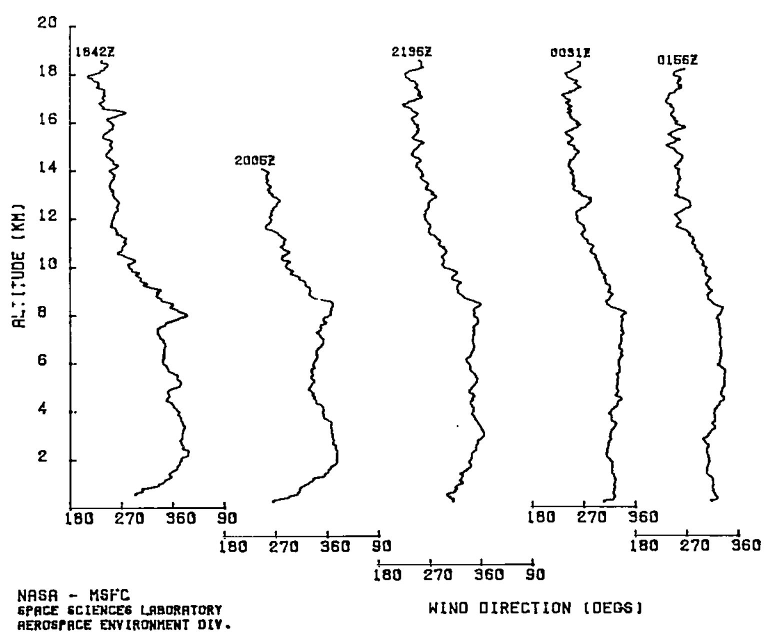
MAR 15-16. 1965



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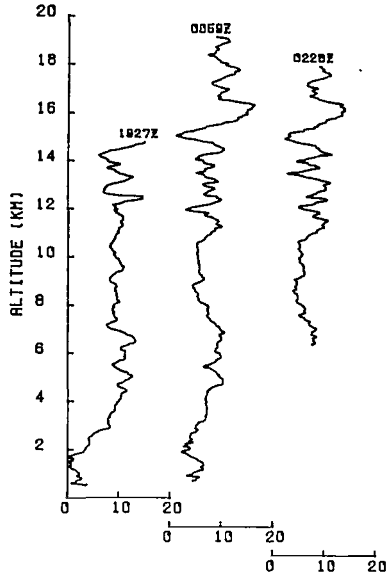
MAR 28-29, 1966



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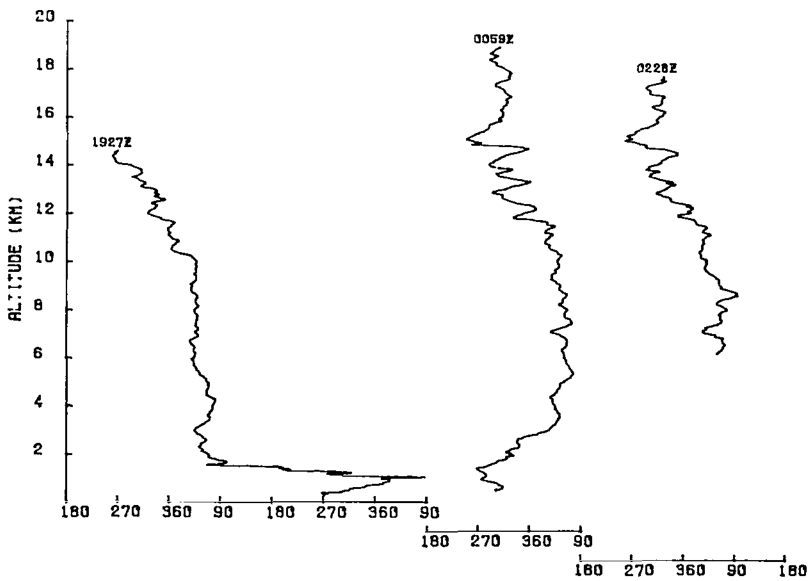
AEROSPACE ENVIRONMENT DIV.

SCALAR WIND SPEED (MS^{-1})

POINT MUGU JIMSPHERE WIND PROFILE DATA
MAR 28-29, 1966



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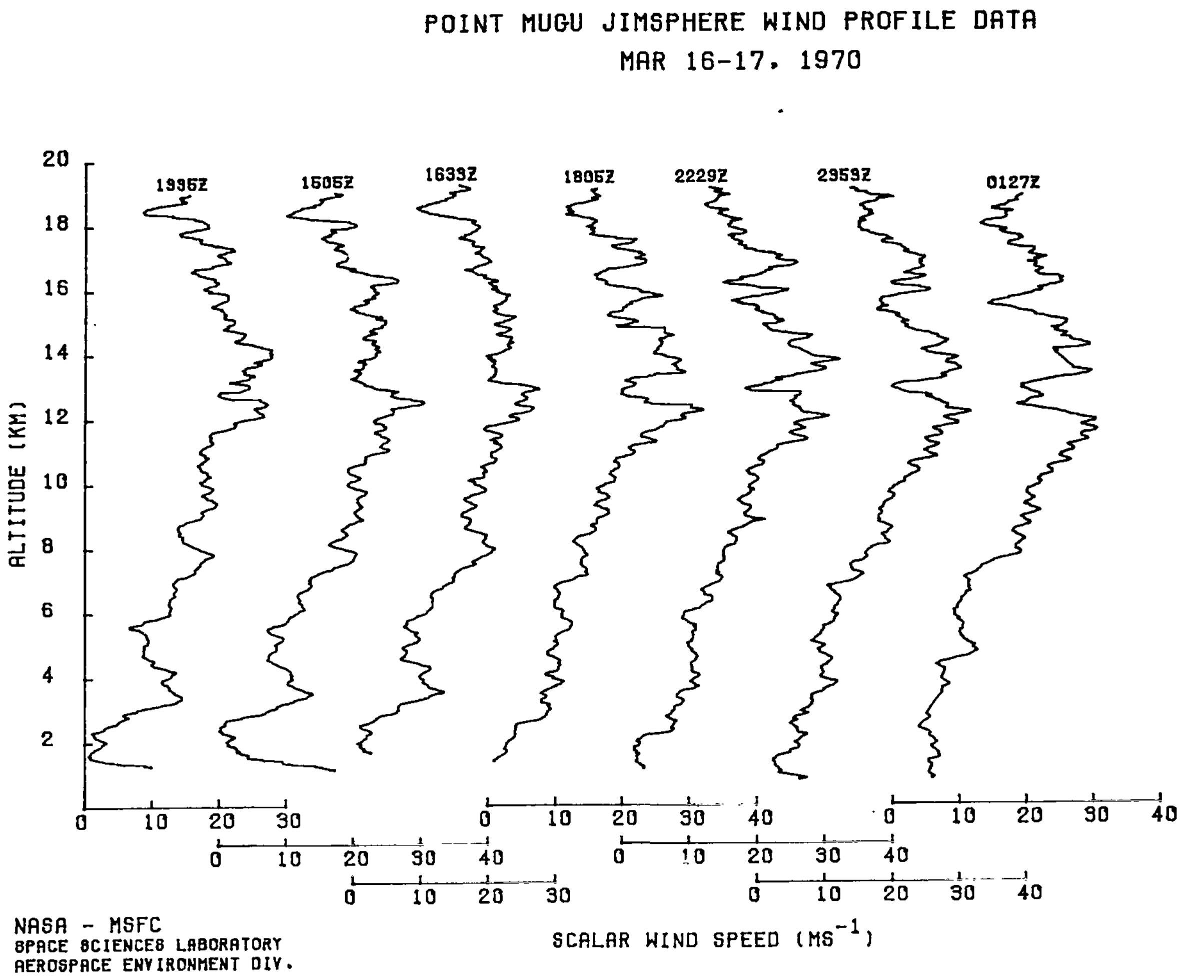
WIND DIRECTION (DEGS)


POINT MUGU JIMSPHERE WIND PROFILE DATA
MAR 16-17, 1970
ALTITUDE (KM)
20
18
16
14
12
10
8
6
4
2
1335Z
1505Z
1633Z
1805Z
2229Z
2359Z
0127Z
0 10 20 30
0 10 20 30 40
0 10 20 30
0 10 20 30 40
0 10 20 30 40
0 10 20 30 40
0 10 20 30 40
SCALAR WIND SPEED (MS-1)
NASA - MSFC
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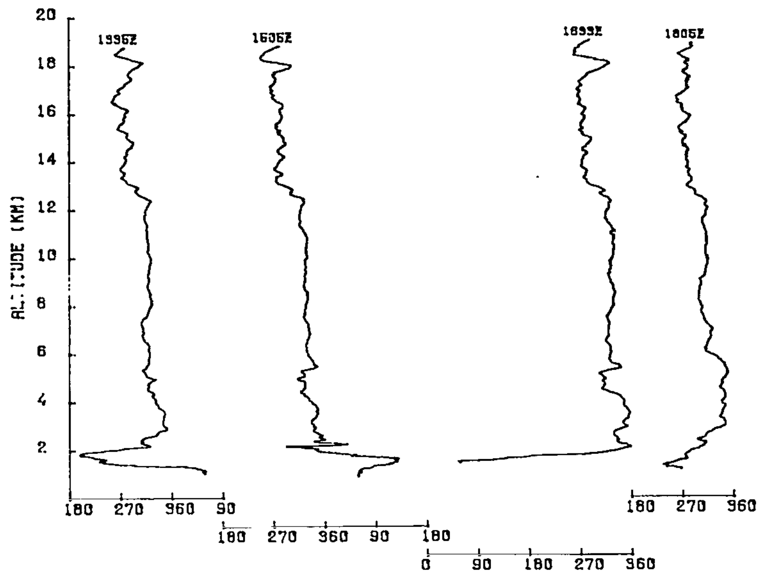
AEROSPACE ENVIRONMENT DIV.

POINT MUGU JIMSPHERE WIND PROFILE DATA
MAR 16-17. 1970



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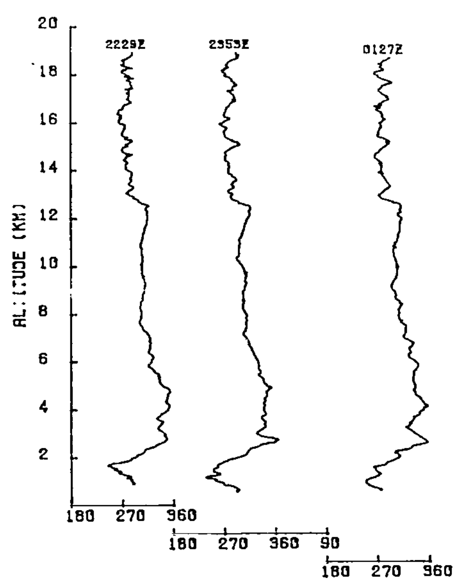
WIND DIRECTION (DEGS)

POINT MUGU JIMSPHERE WIND PROFILE DATA
MAR 16-17. 1970



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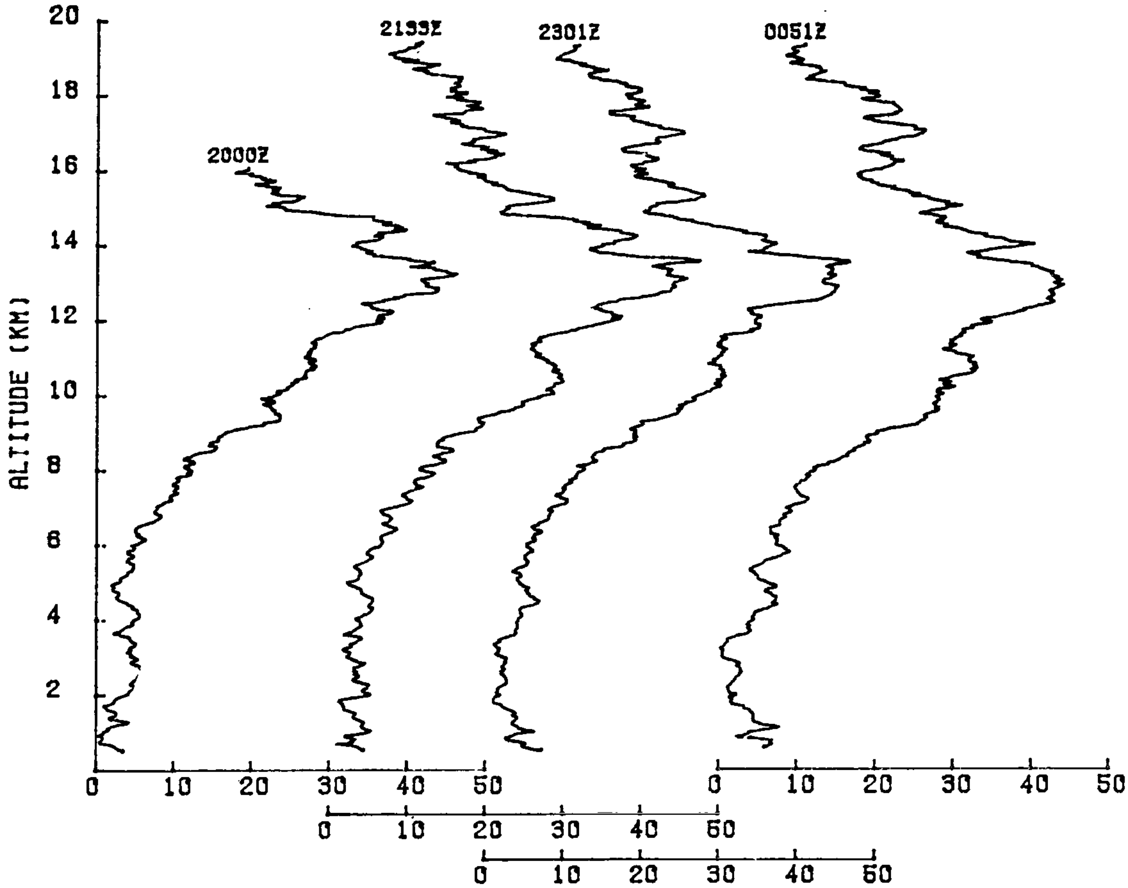
WIND DIRECTION (DEGS)

POINT MUGU JIMSPHERE WIND PROFILE DATA
MAY 13-14, 1966



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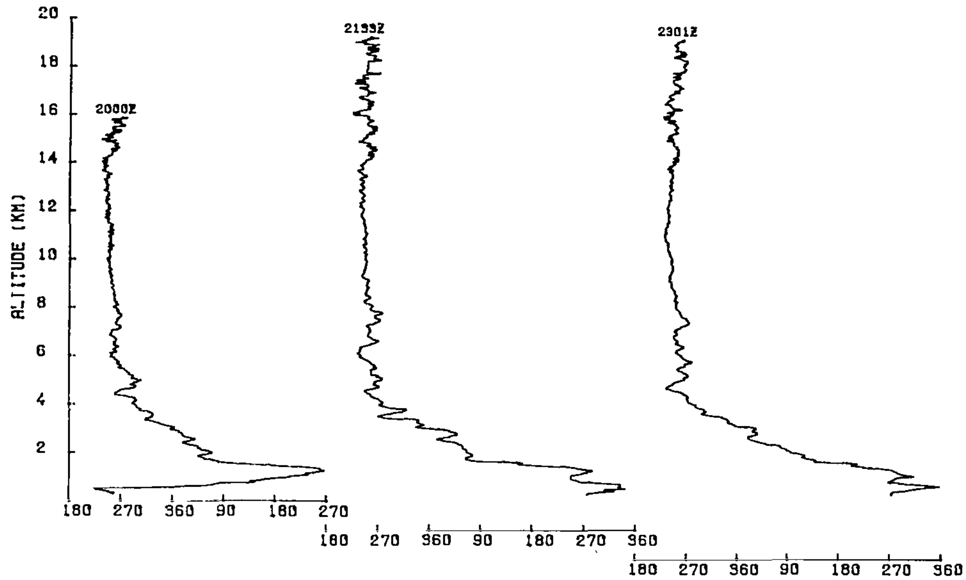
POINT MUGU JIMSPHERE WIND PROFILE DATA
MAY 13-14. 1966



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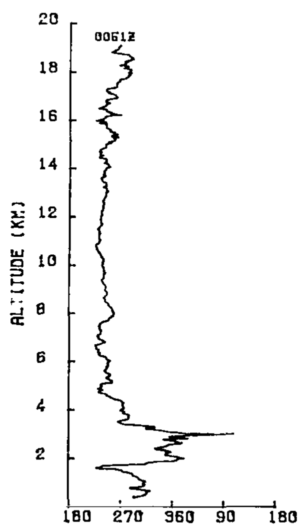
AEROSPACE ENVIRONMENT DIV.

WIND DIRECTION (DEGS)

POINT MUGU JIMSPHERE WIND PROFILE DATA
MAY 13-14. 1966



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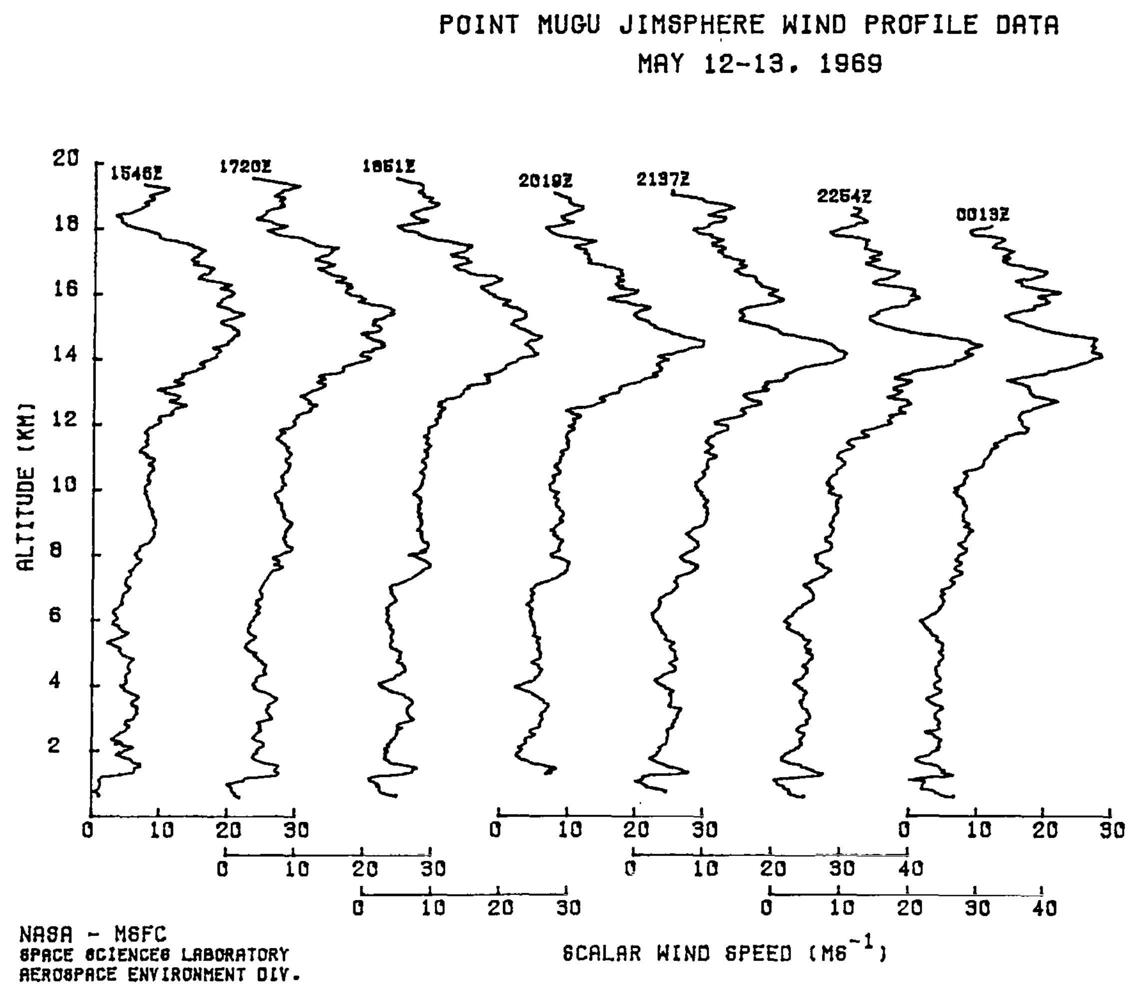
WIND DIRECTION (DEGS)


POINT MUGU JIMSPHERE WIND PROFILE DATA
MAY 12-13, 1969
1546Z
1720Z
1851Z
2019Z
2137Z
2254Z
0013Z
ALTITUDE (KM)
20
18
16
14
12
10
8
6
4
2
0 10 20 30
0 10 20 30
0 10 20 30
0 10 20 30
0 10 20 30 40
0 10 20 30 40
0 10 20 30
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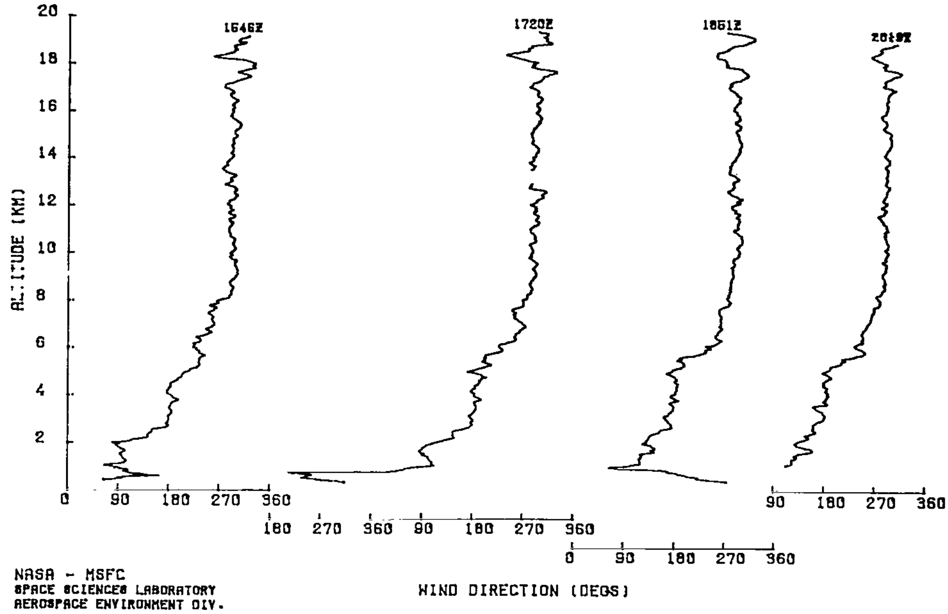
AEROSPACE ENVIRONMENT DIV.
SCALAR WIND SPEED (MS^{-1})

POINT MUGU JIMSPHERE WIND PROFILE DATA
MAY 12-13. 1969



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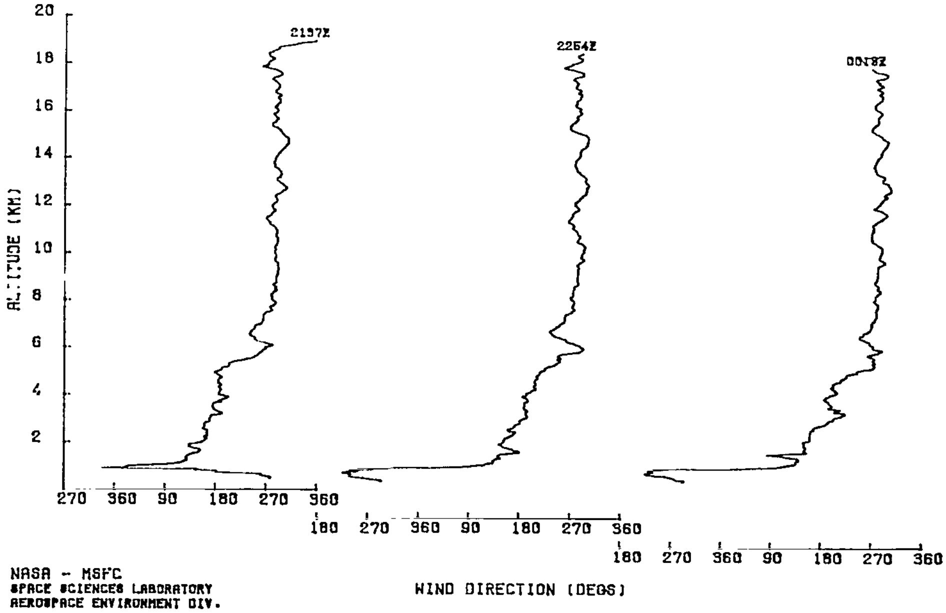

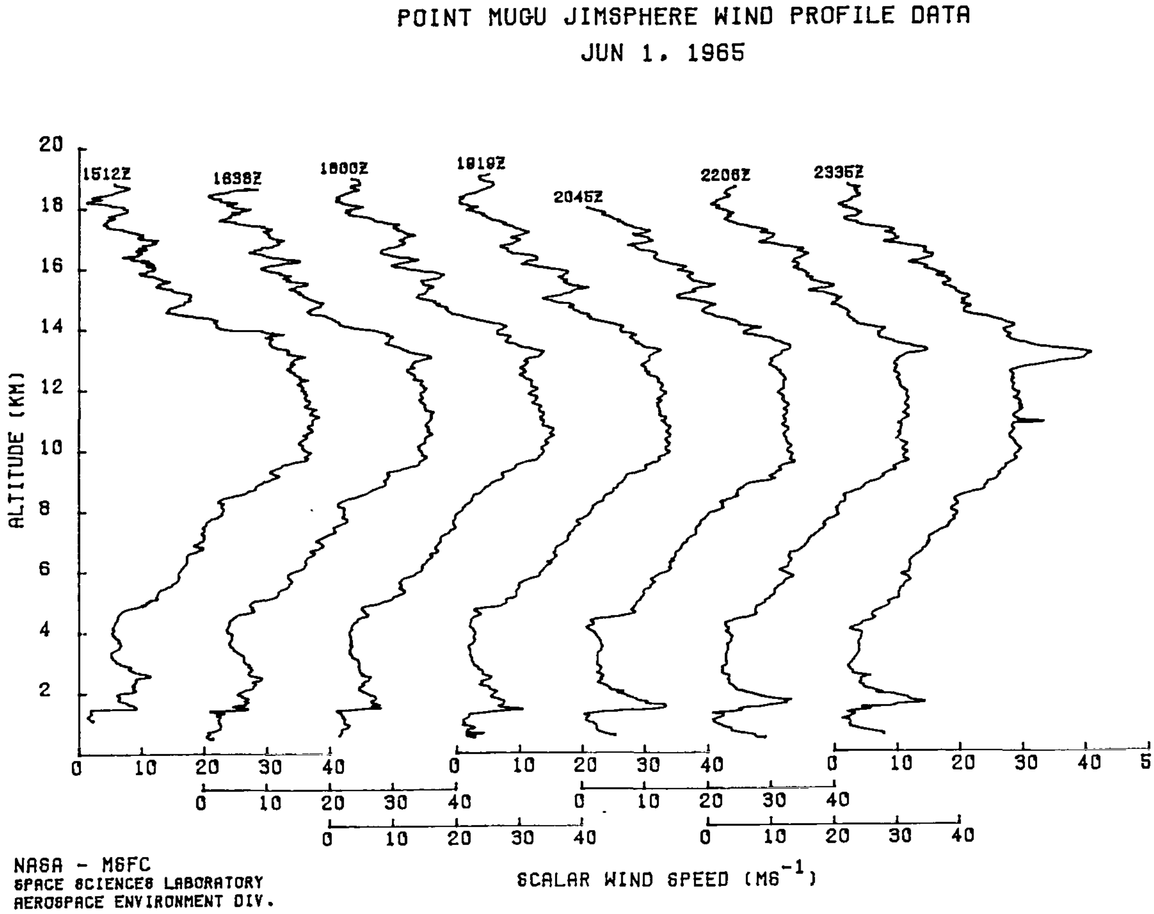
POINT MUGU JIMSPHERE WIND PROFILE DATA
JUN 1, 1965
ALTITUDE (KM)
1512Z
1638Z
1800Z
1919Z
2045Z
2206Z
2335Z
SCALAR WIND SPEED (MS^{-1})
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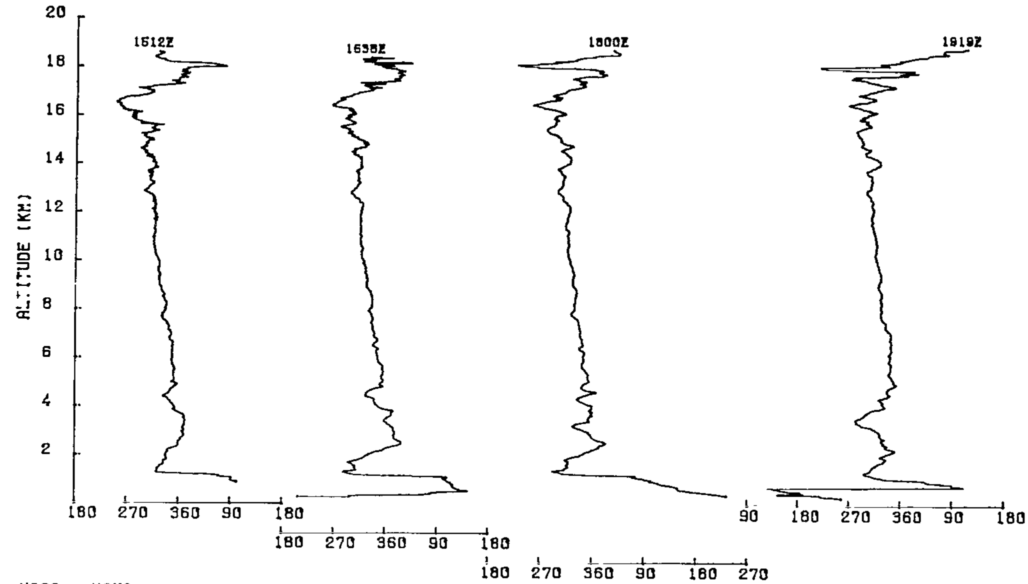
AEROSPACE ENVIRONMENT DIV.

POINT MUGU JIMSPHERE WIND PROFILE DATA
JUN 1. 1965



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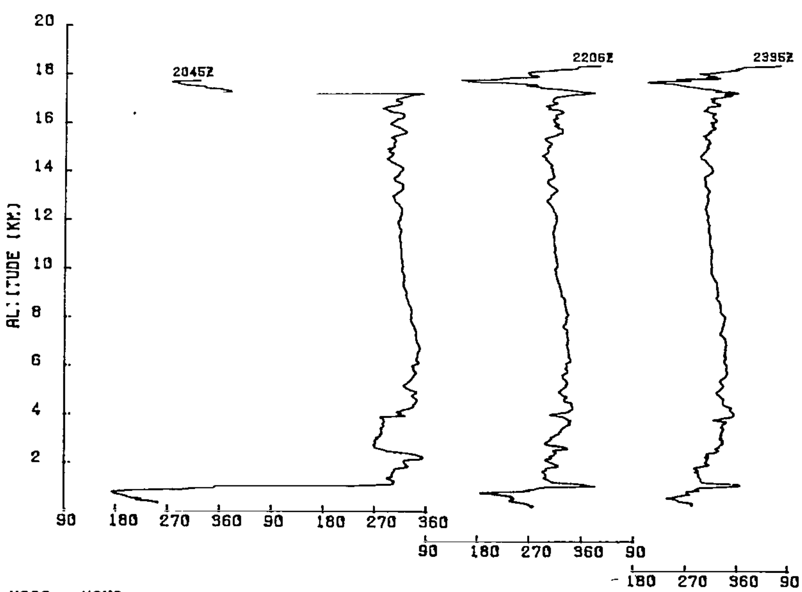
POINT MUGU JIMSPHERE WIND PROFILE DATA
JUN 1. 1965



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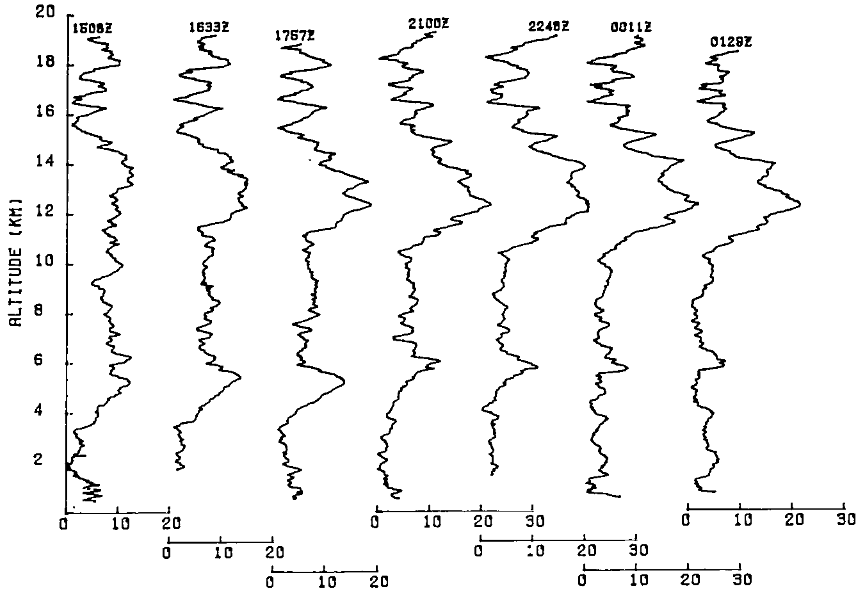
POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 16-17. 1965



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POINT MUGU JIMSPHERE WIND PROFILE DATA
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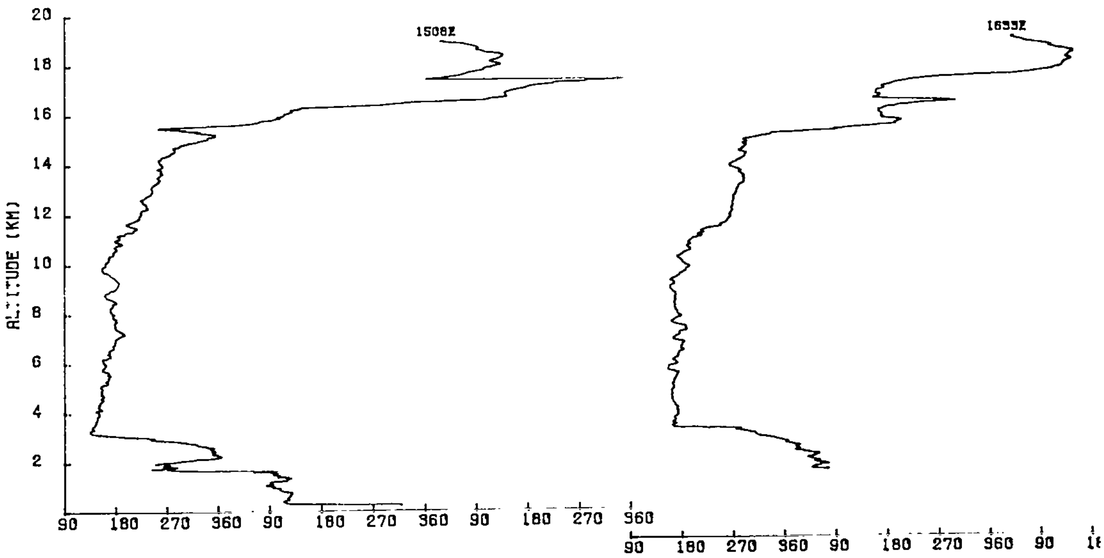

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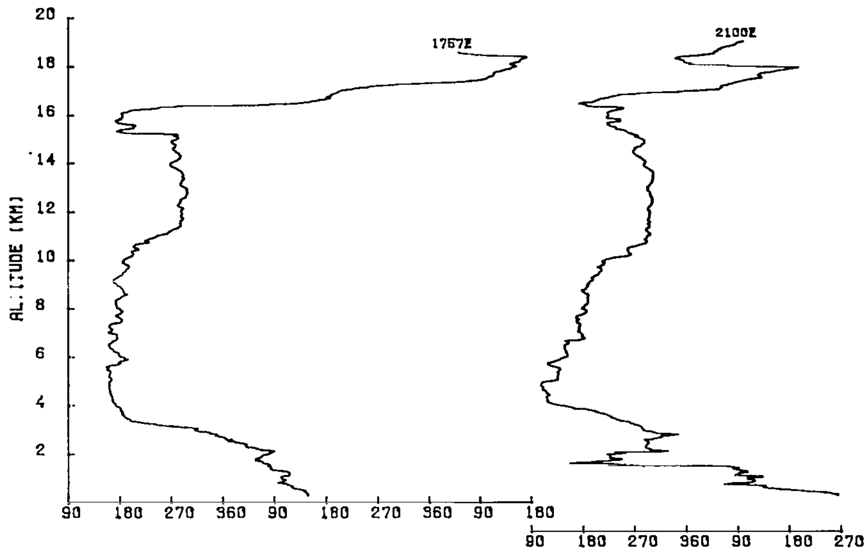
POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 16-17. 1965



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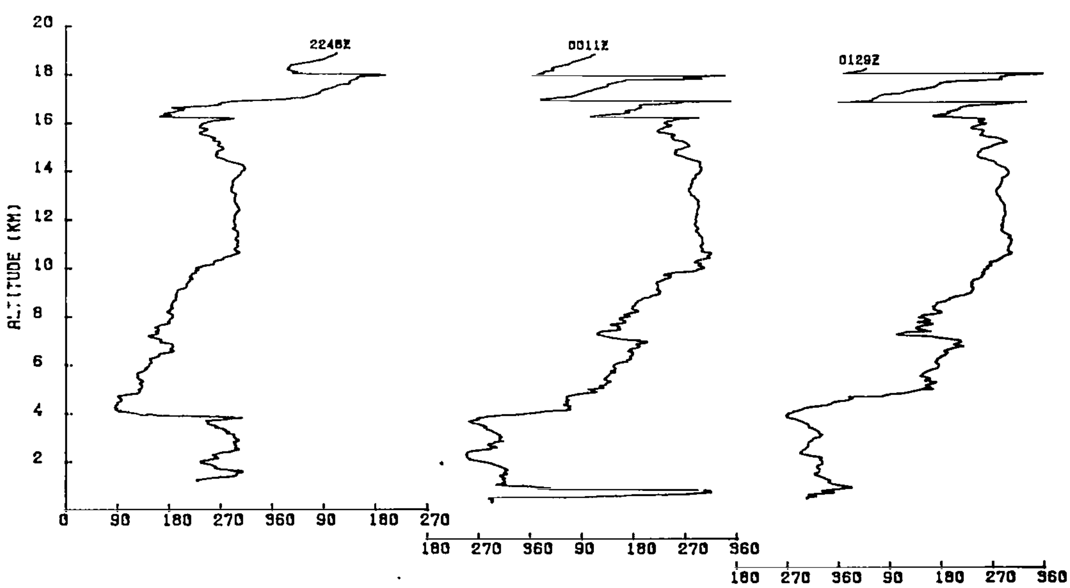
WIND DIRECTION (DEGS)

POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 16-17. 1965



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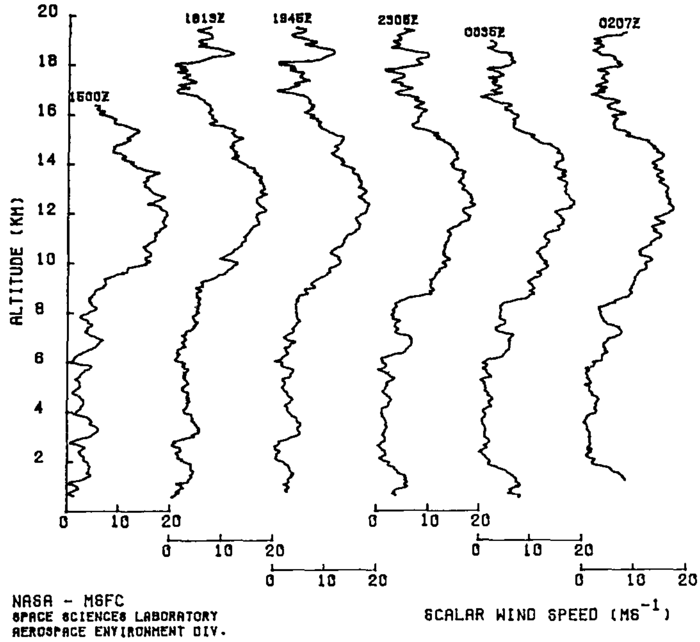
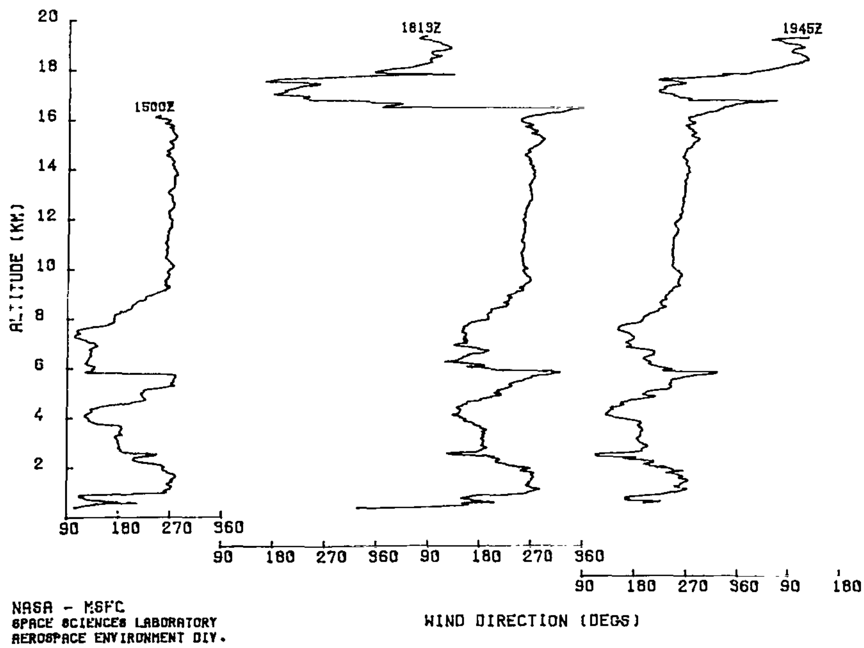
WIND DIRECTION (DEGS)

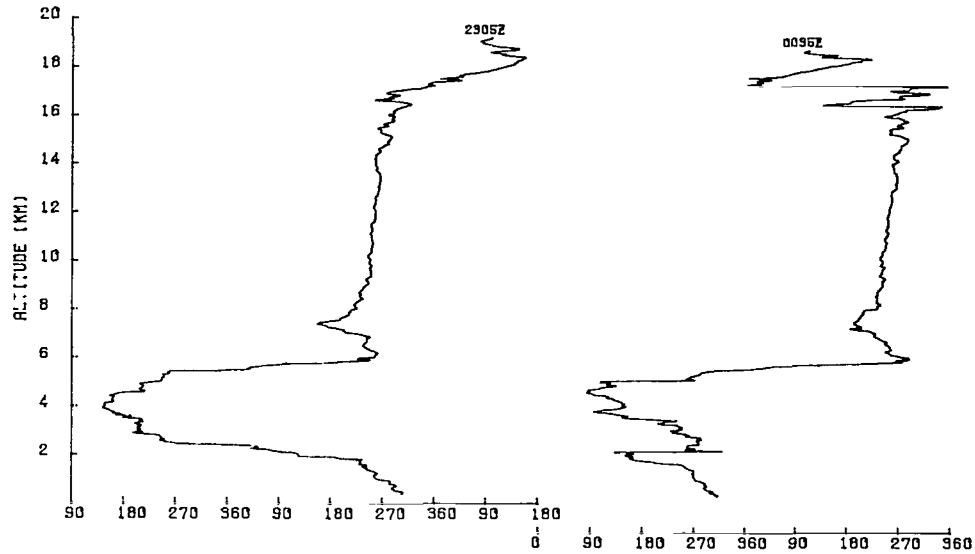
POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 15-16. 1966



POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 15-16. 1966



POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 15-16, 1966



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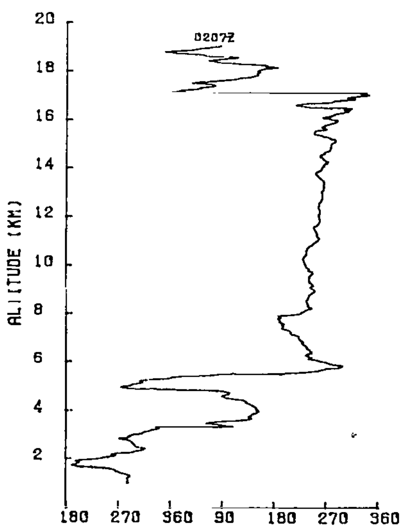
AEROSPACE ENVIRONMENT DIV.

WIND DIRECTION (DEGS)

POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 15-16, 1966



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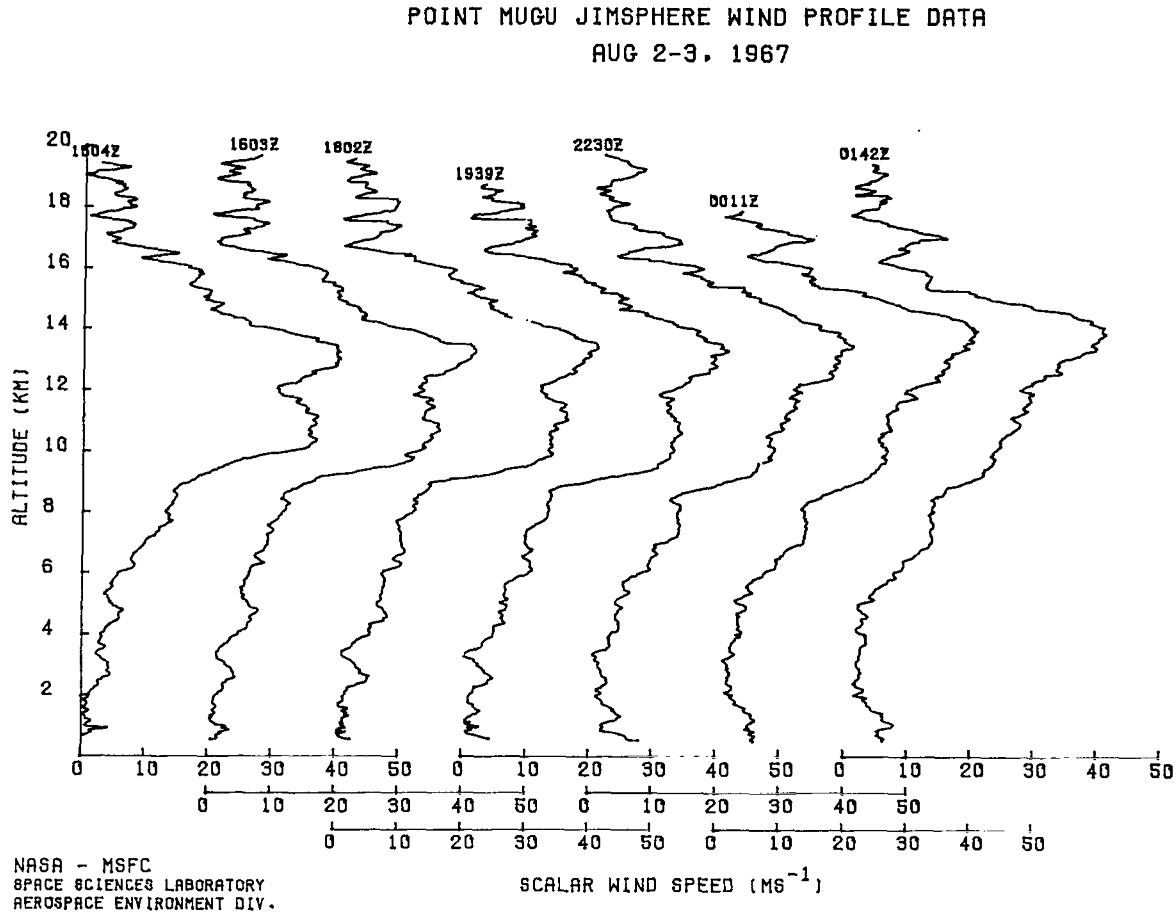
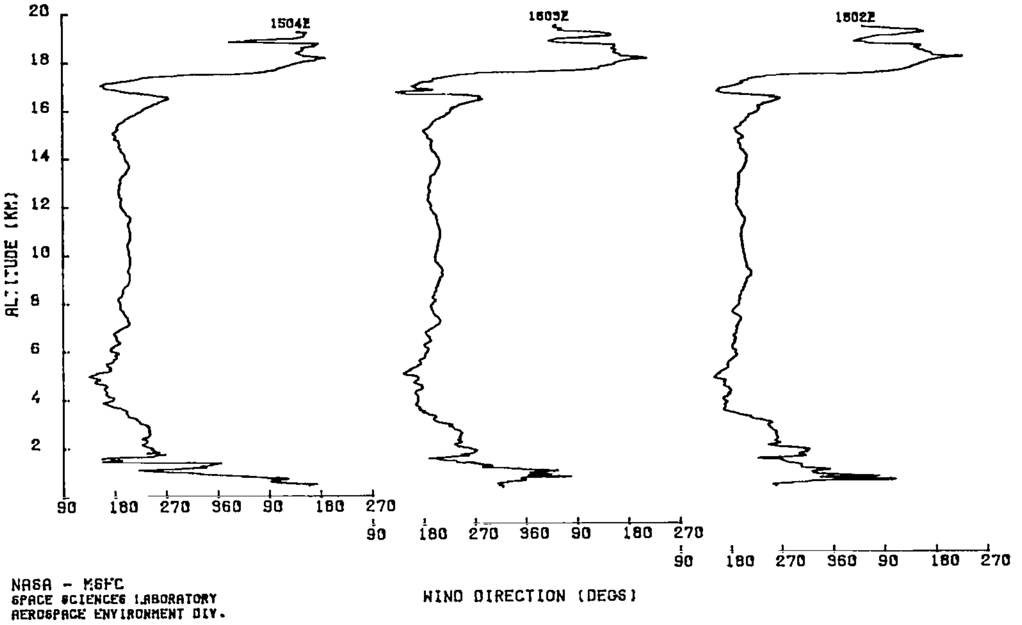
SPACE SCIENCES LABORATORY
AEROSPACE ENVIRONMENT DIV.

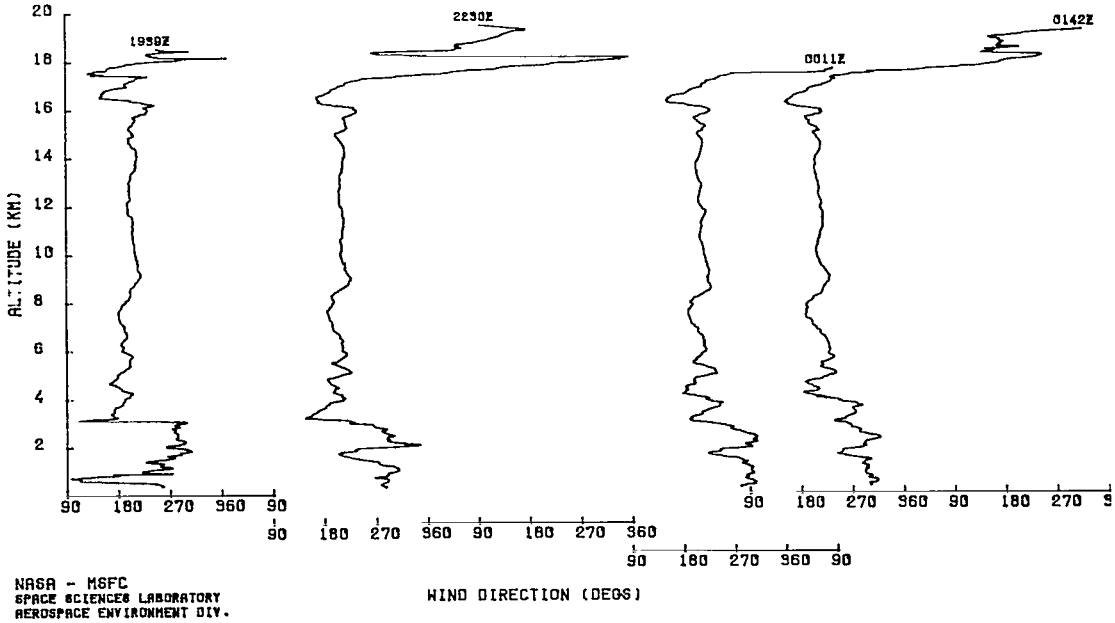
WIND DIRECTION (DEGS)


POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 2-3, 1967
1504Z
1603Z
1802Z
1939Z
2230Z
0011Z
0142Z
ALTITUDE (KM)
0 10 20 30 40 50
SCALAR WIND SPEED (MS⁻¹)
NASA - MSFC
SPACE SCIENCES LABORATORY
AEROSPACE ENVIRONMENT DIV.

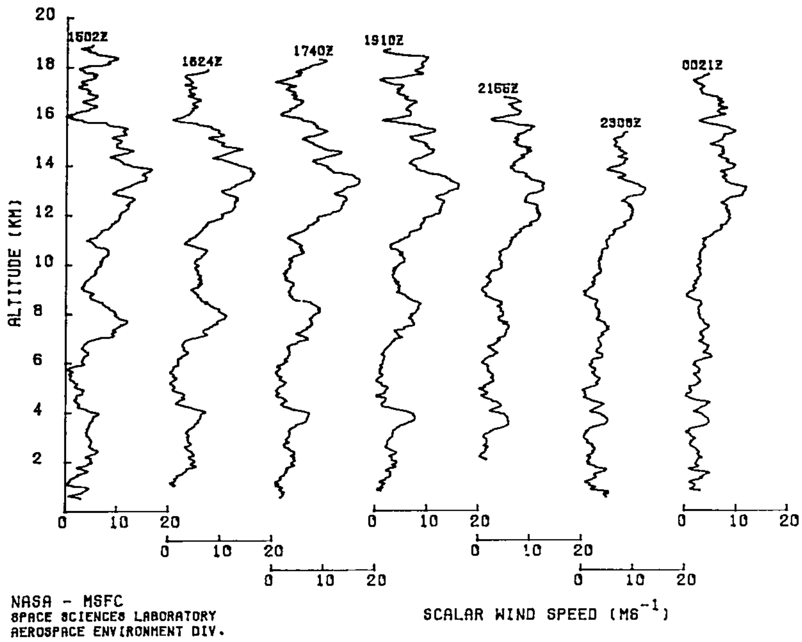
POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 2-3. 1967



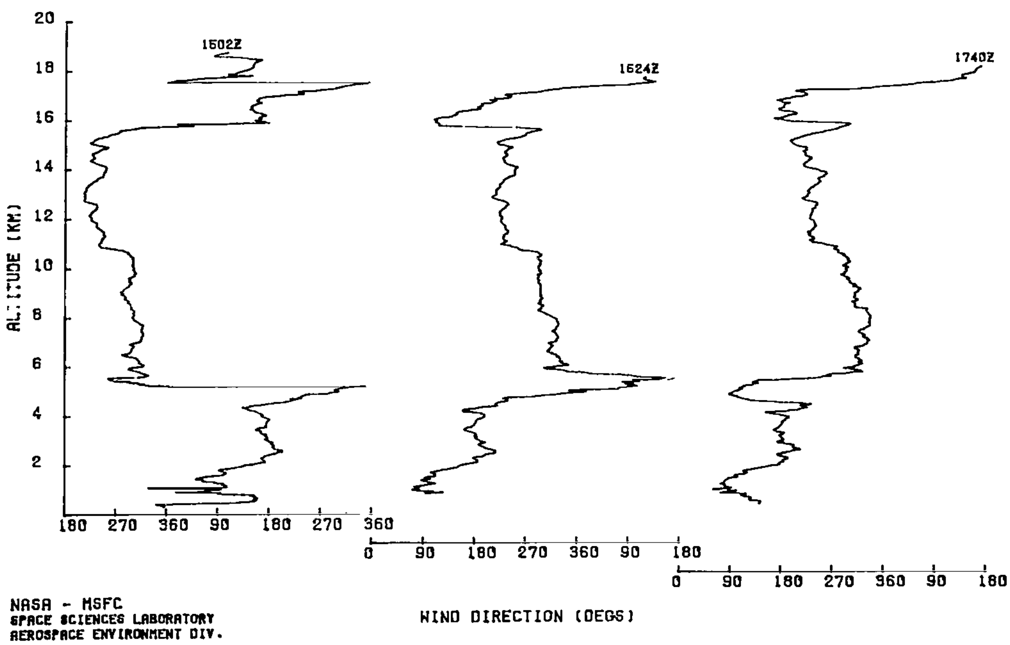
POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 2-3. 1967



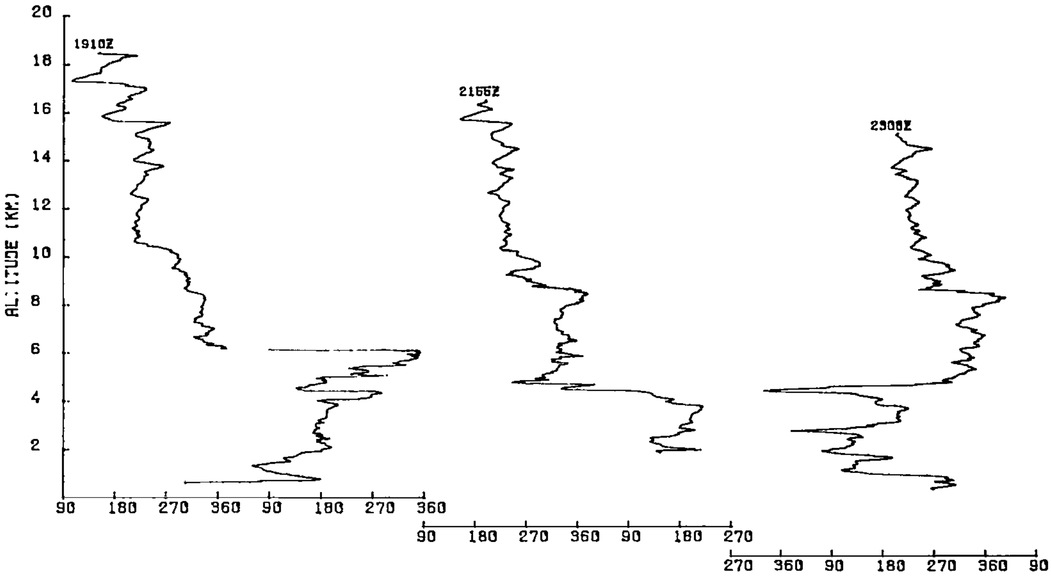
POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 5-6, 1968



POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 5-6, 1968



POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 5-6. 1968



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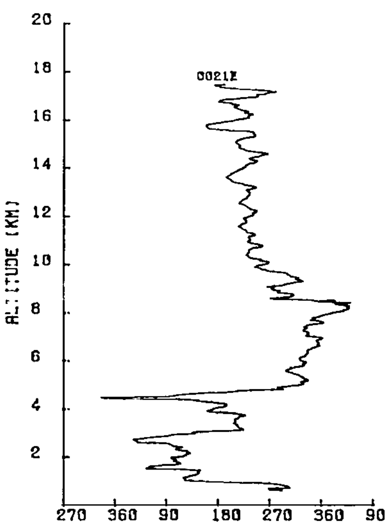
WIND DIRECTION (DEGS)

POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 5-6. 1968



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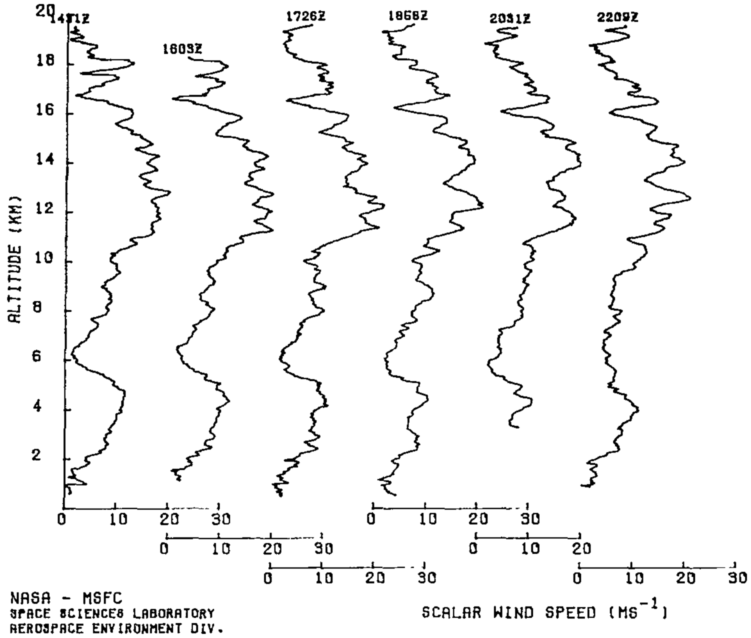
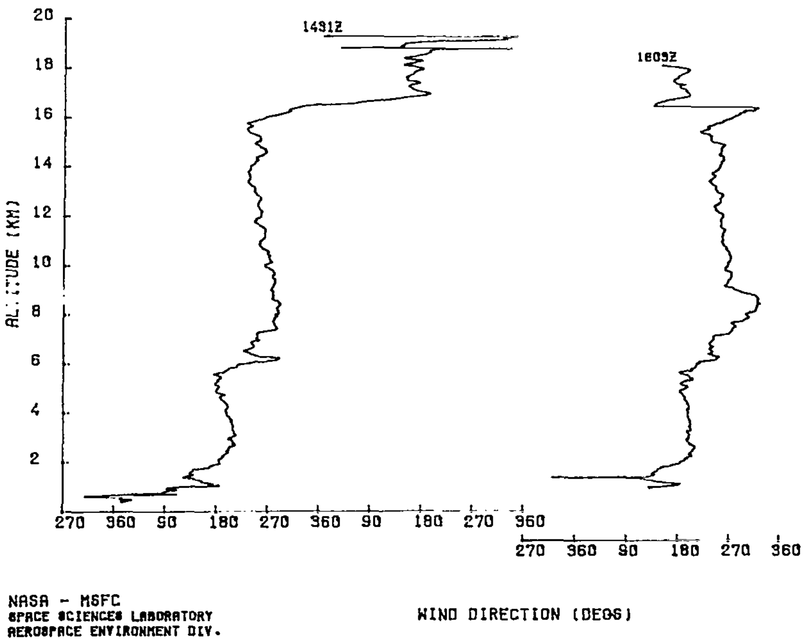
SPACE SCIENCES LABORATORY
AEROSPACE ENVIRONMENT DIV.

WIND DIRECTION (DEGS)

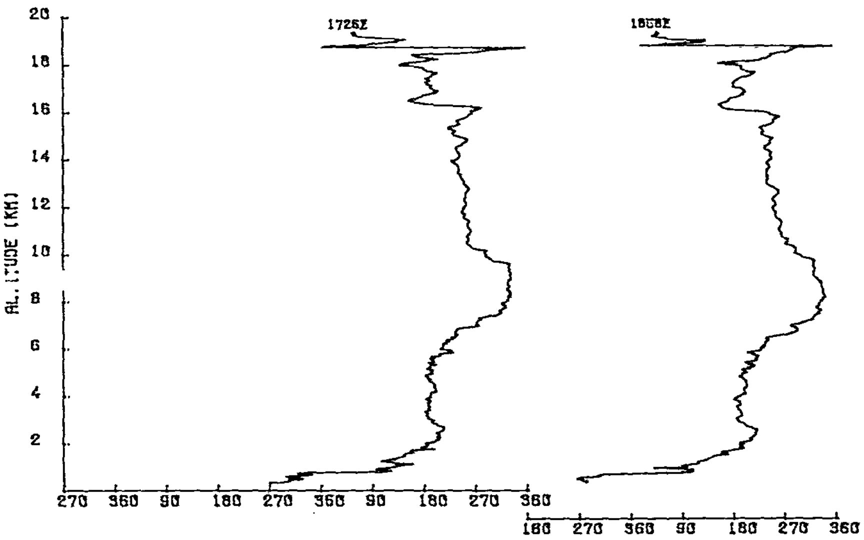
POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 18. 1969



POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 18. 1969



POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 18, 1969



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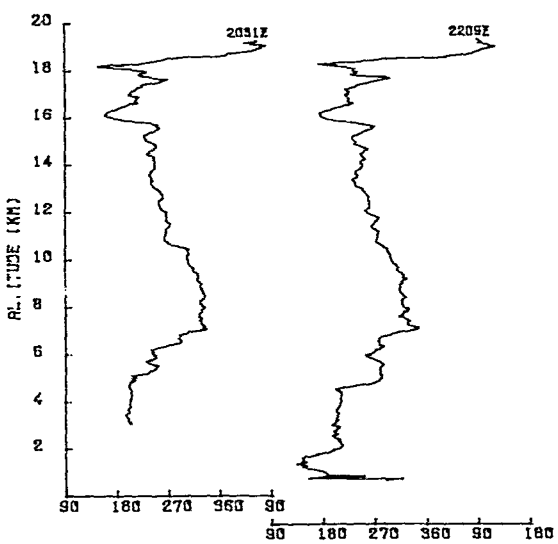
AEROSPACE ENVIRONMENT DIV.

WIND DIRECTION (DEGS)

POINT MUGU JIMSPHERE WIND PROFILE DATA
AUG 18, 1969



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AEROSPACE ENVIRONMENT DIV.

WIND DIRECTION (DEGS)

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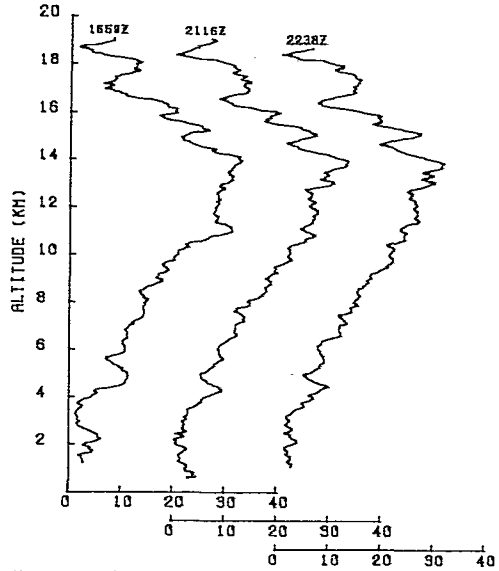
POINT MUGU JIMSPHERE WIND PROFILE DATA
SEPT 8, 1965



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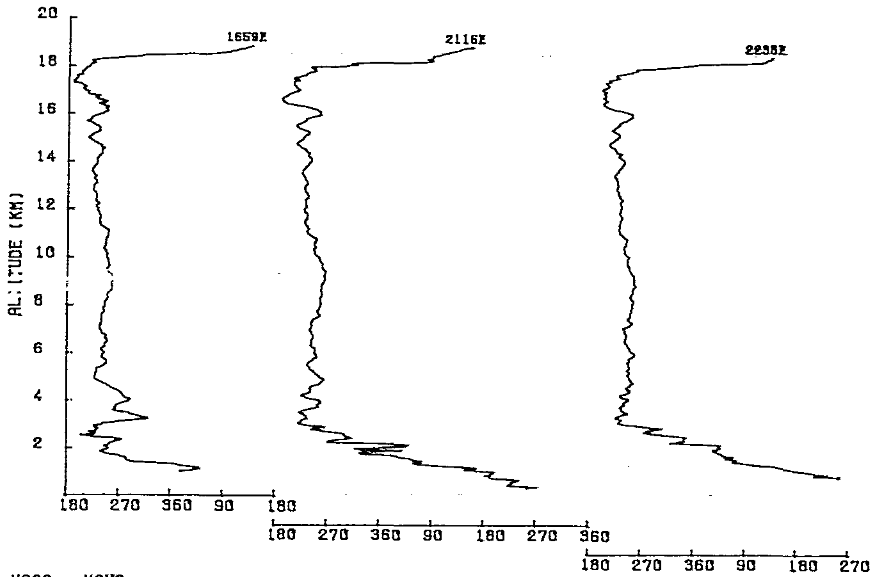
AEROSPACE ENVIRONMENT DIV.

SCALAR WIND SPEED (MS^{-1})

POINT MUGU JIMSPHERE WIND PROFILE DATA
SEPT 8, 1965



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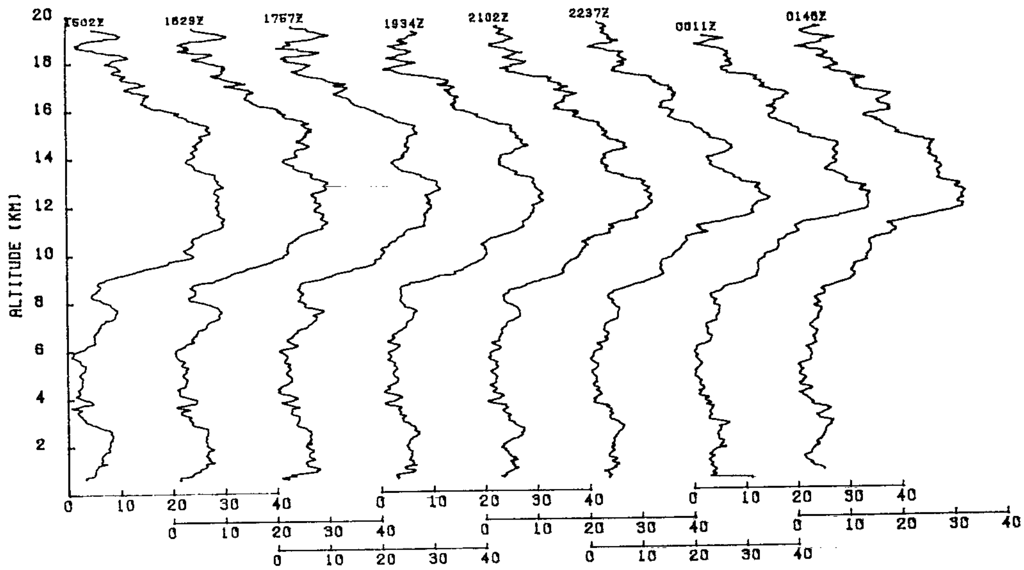
AEROSPACE ENVIRONMENT DIV.

WIND DIRECTION (DEGS)

POINT MUGU JIMSPHERE WIND PROFILE DATA
SEPT 16-17, 1966



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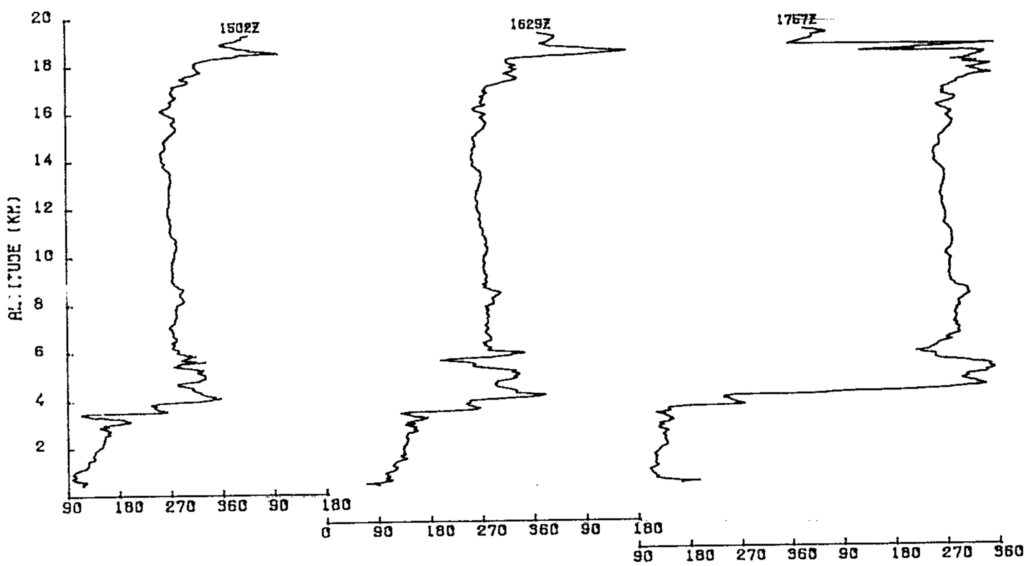
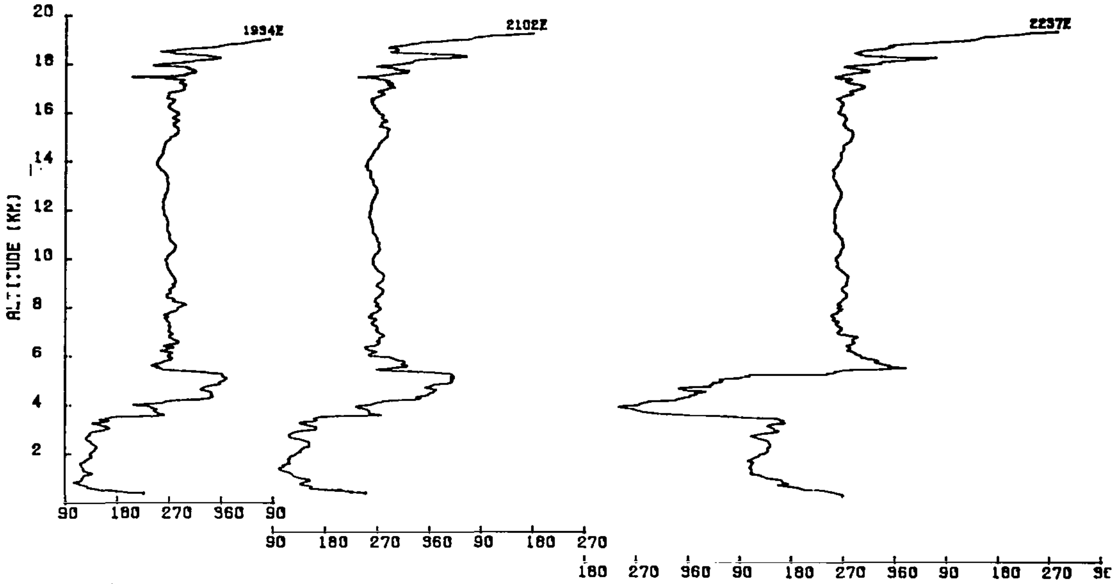
SPACE SCIENCES LABORATORY
AEROSPACE ENVIRONMENT DIV.

POINT MUGU JIMSPHERE WIND PROFILE DATA
SEPT 16-17, 1966



NASA - MSFC
SPACE SCIENCES LABORATORY
AEROSPACE ENVIRONMENT DIV.

POINT MUGU JIMSPHERE WIND PROFILE DATA
SEPT 16-17, 1966



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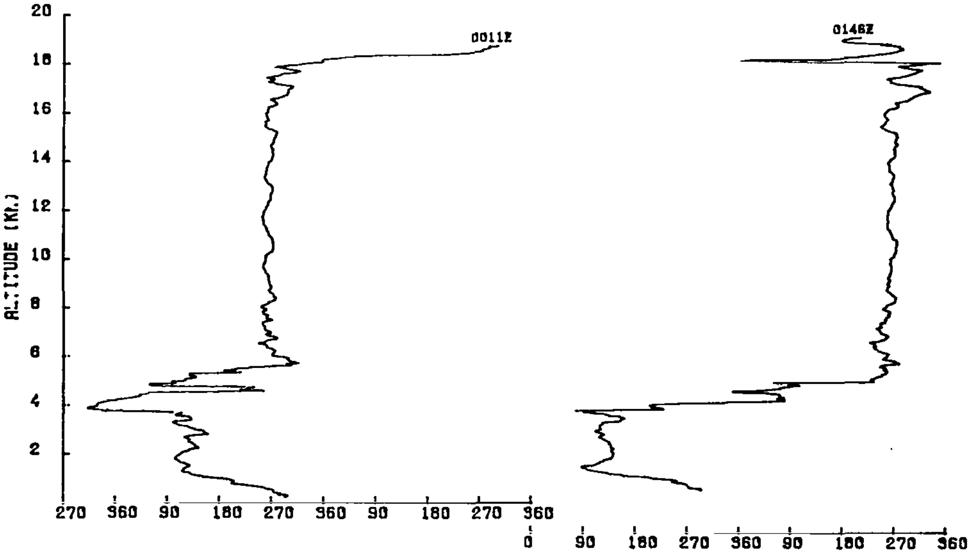
AEROSPACE ENVIRONMENT DIV.

WIND DIRECTION (DEGS)

POINT MUGU JIMSPHERE WIND PROFILE DATA
SEPT 16-17, 1966



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AEROSPACE ENVIRONMENT DIV.

WIND DIRECTION (DEGS)

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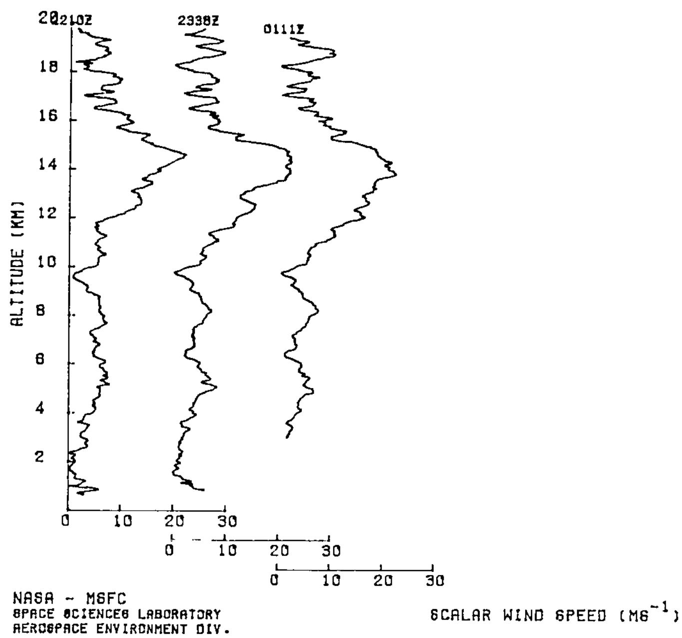
POINT MUGU JIMSPHERE WIND PROFILE DATA
SEPT 5-6, 1967



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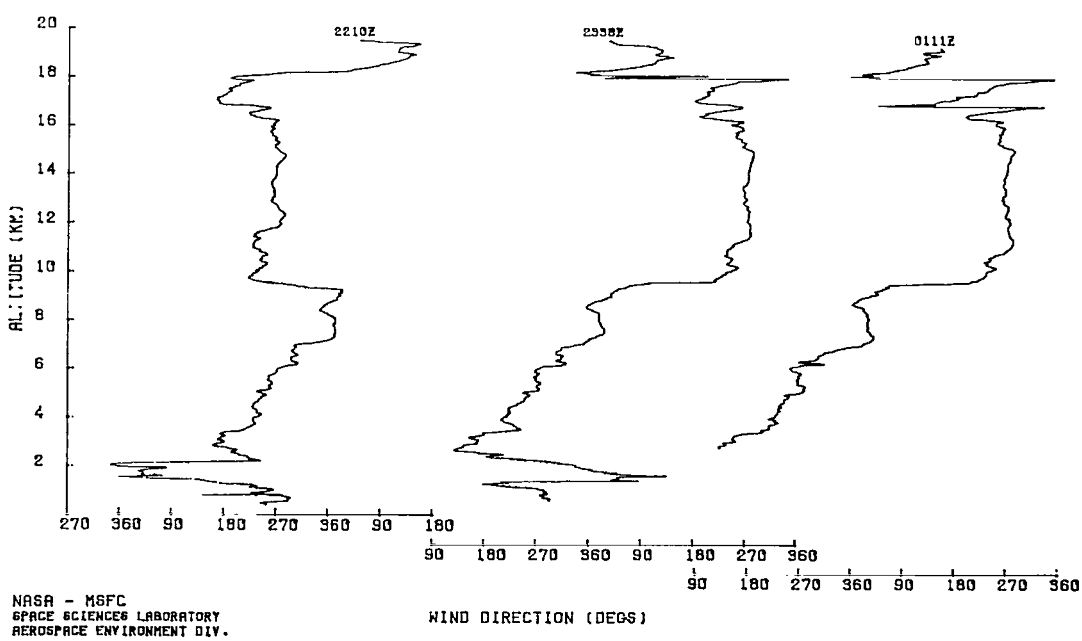
SEPT 5-6, 1967



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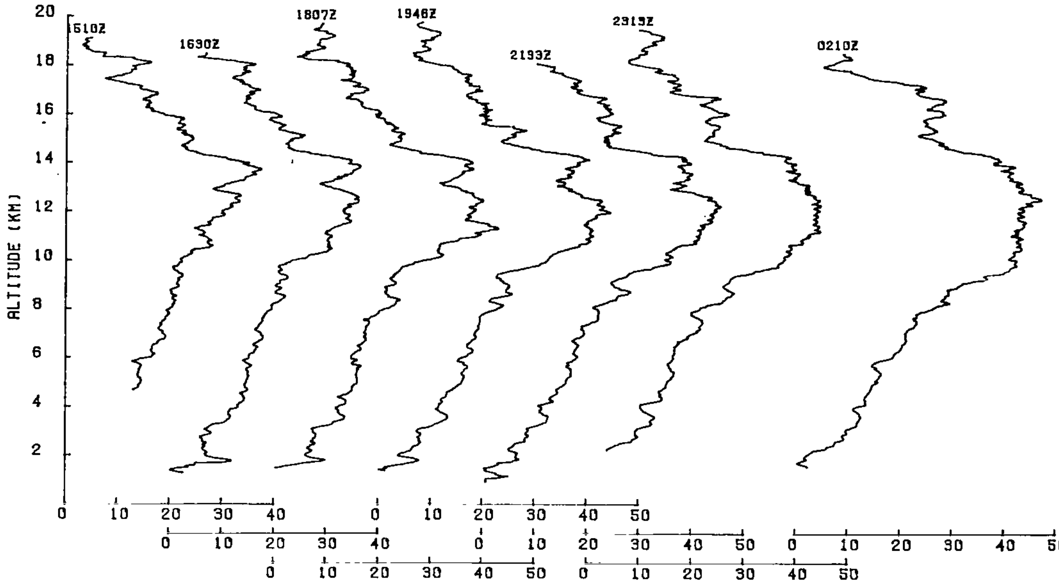
POINT MUGU JIMSPHERE WIND PROFILE DATA
OCT 4-5. 1967



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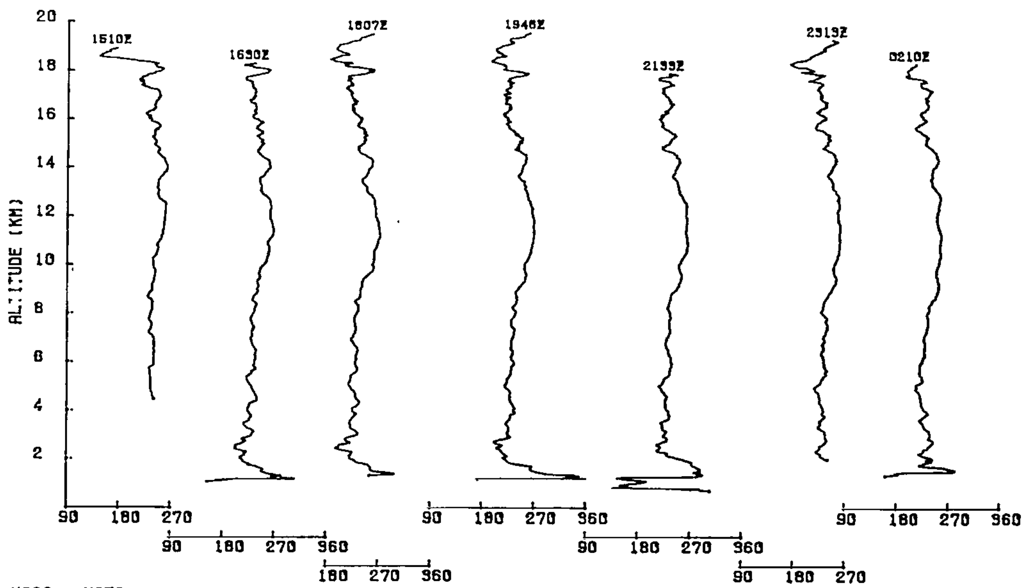
AEROSPACE ENVIRONMENT DIV.

POINT MUGU JIMSPHERE WIND PROFILE DATA
OCT 4-5. 1967



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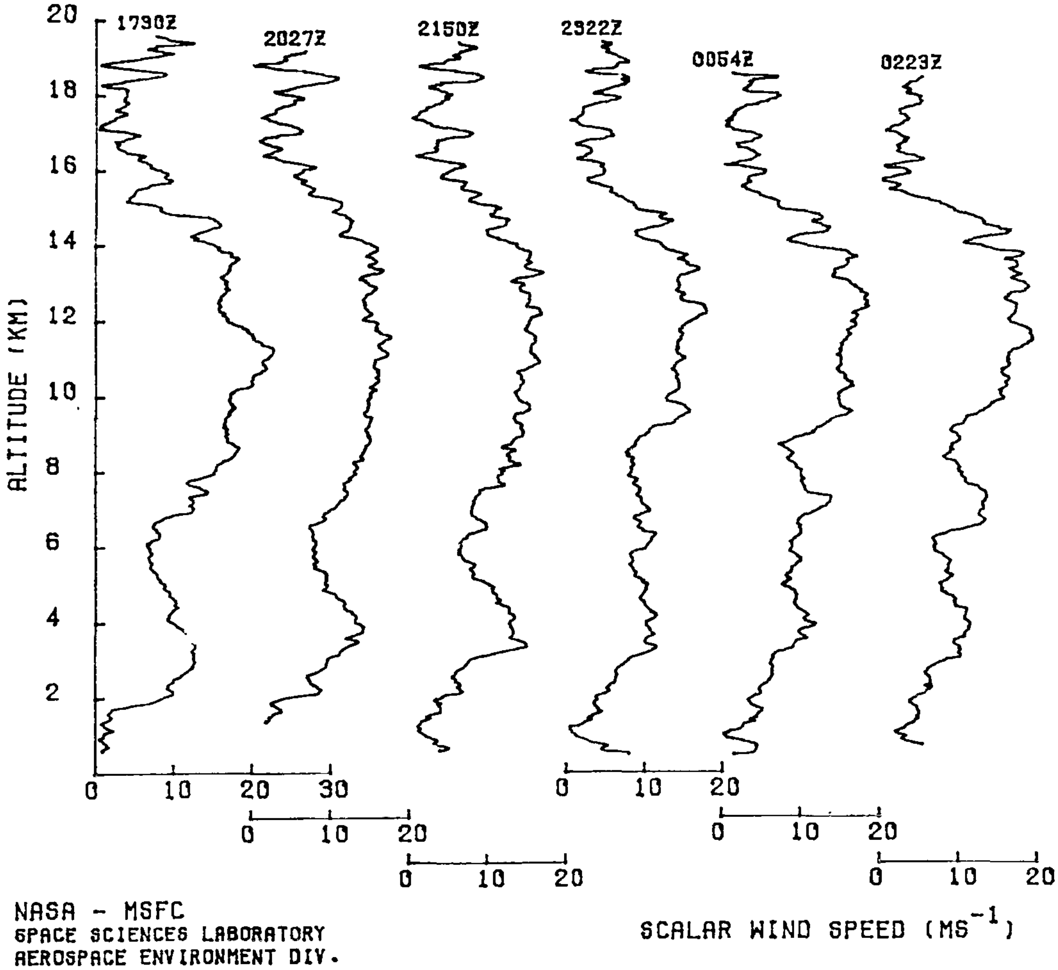
AEROSPACE ENVIRONMENT DIV.

POINT MUGU JIMSPHERE WIND PROFILE DATA
NOV 16-17, 1967



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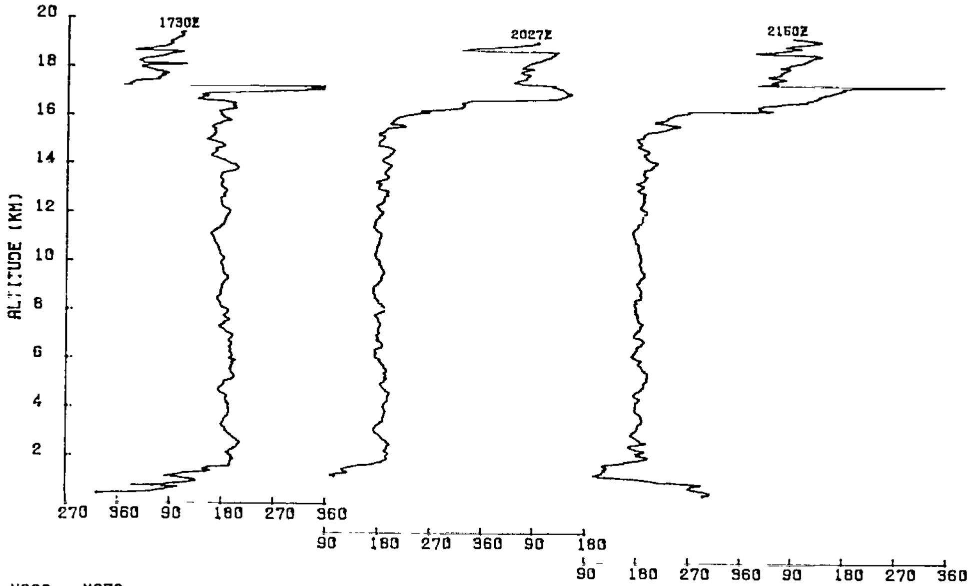
NOV 16-17. 1967



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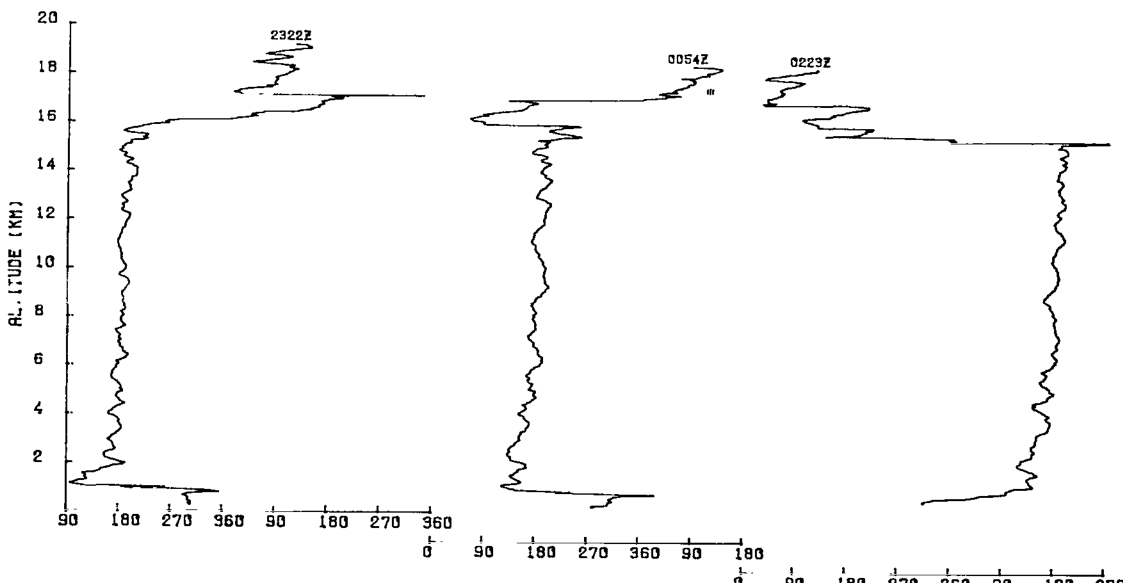
AEROSPACE ENVIRONMENT DIV.

WIND DIRECTION (DEGS)

POINT MUGU JIMSPHERE WIND PROFILE DATA
NOV 16-17. 1967



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AEROSPACE ENVIRONMENT DIV.

WIND DIRECTION (DEGS)

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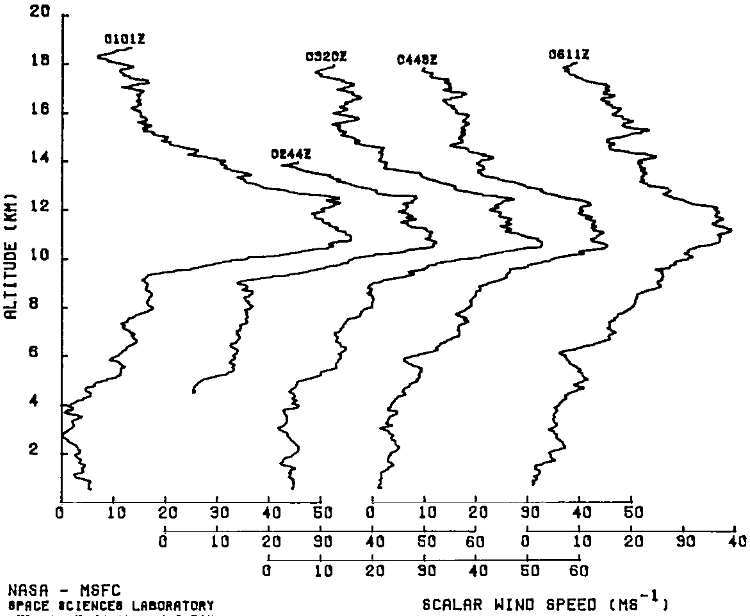
POINT MUGU JIMSPHERE WIND PROFILE DATA
DEC 21, 1965



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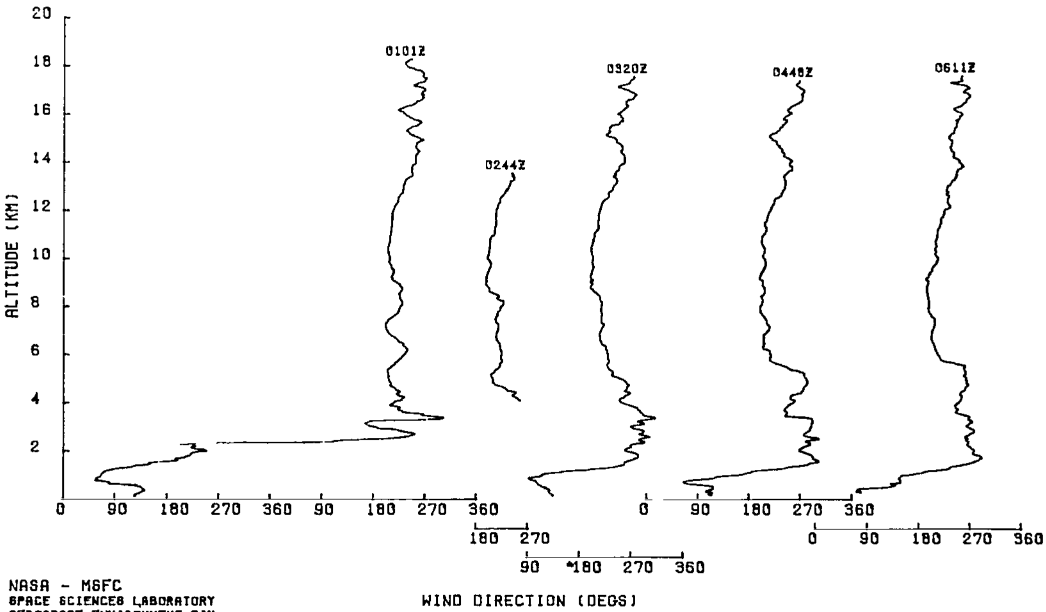
AEROSPACE ENVIRONMENT DIV.

POINT MUGU JIMSPHERE WIND PROFILE DATA
DEC 21, 1965



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AEROSPACE ENVIRONMENT DIV.

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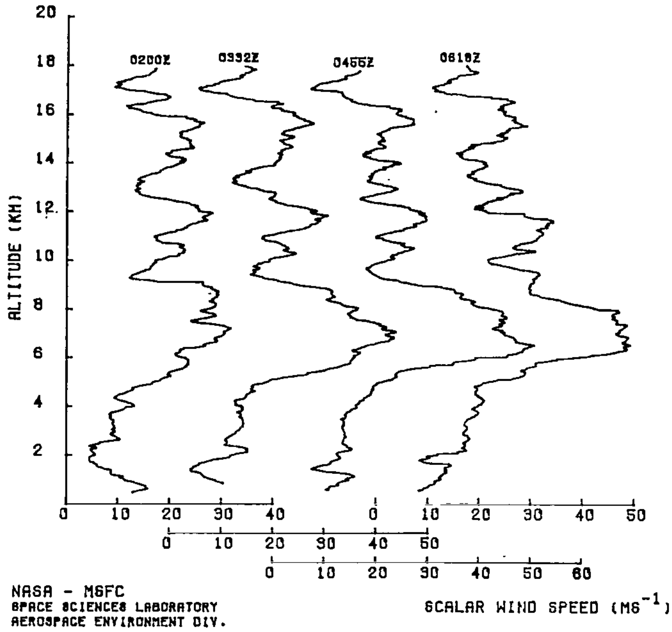
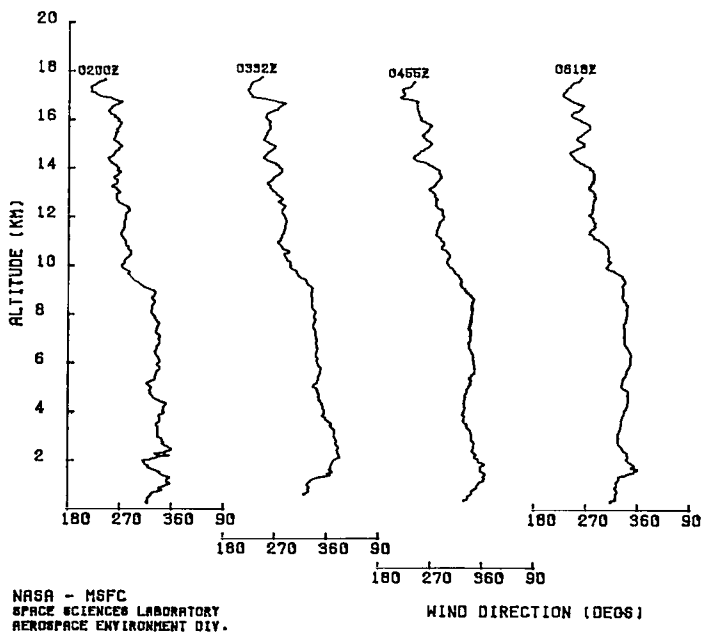
POINT MUGU JIMSPHERE WIND PROFILE DATA
DEC 22. 1965



POINT MUGU JIMSPHERE WIND PROFILE DATA
DEC 22. 1965

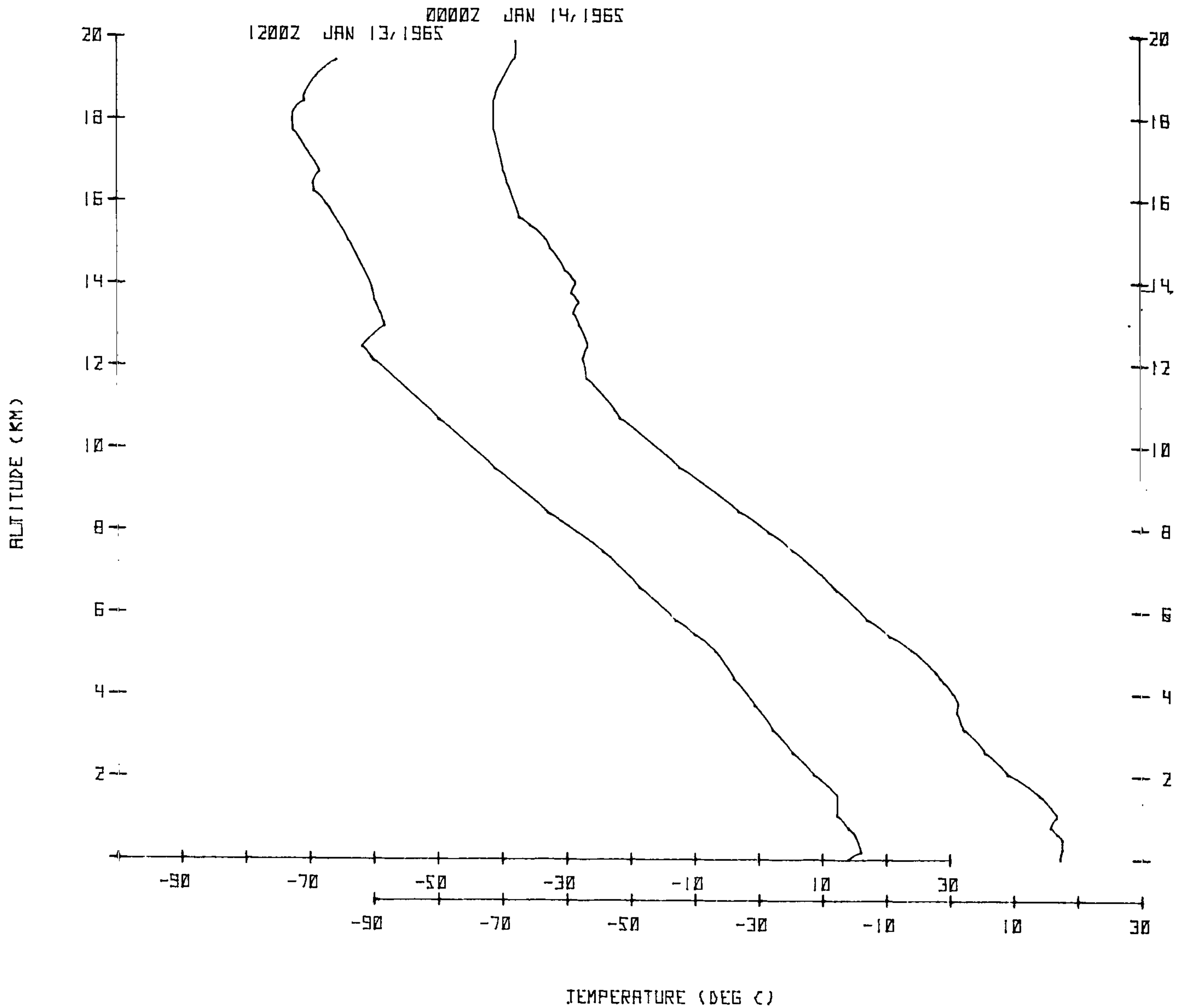


APPENDIX B

RADIOSONDE TEMPERATURE PROFILE DATA

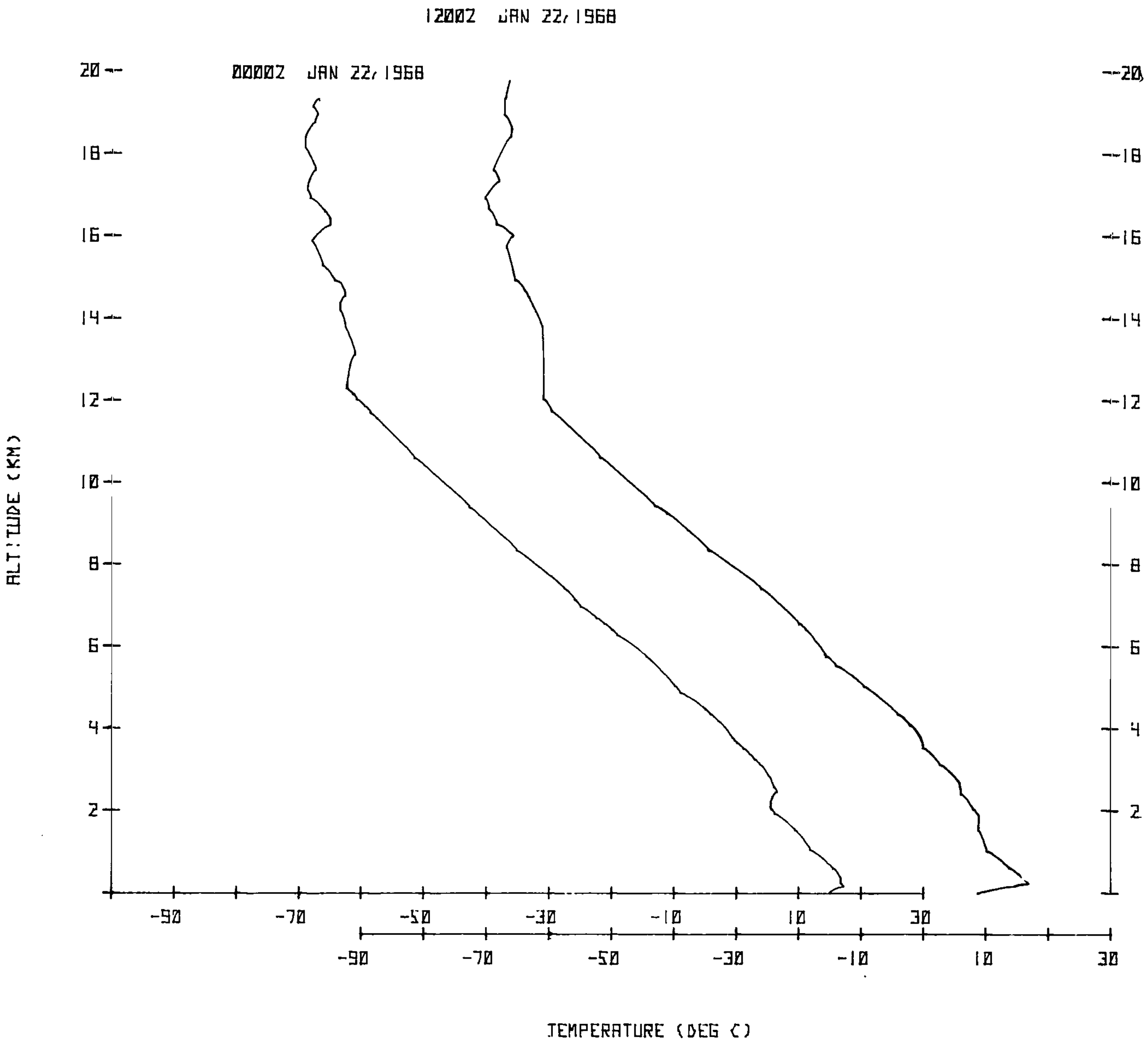
Cape Canaveral (Cape Kennedy), Florida Radiosonde
Temperature Profile Data

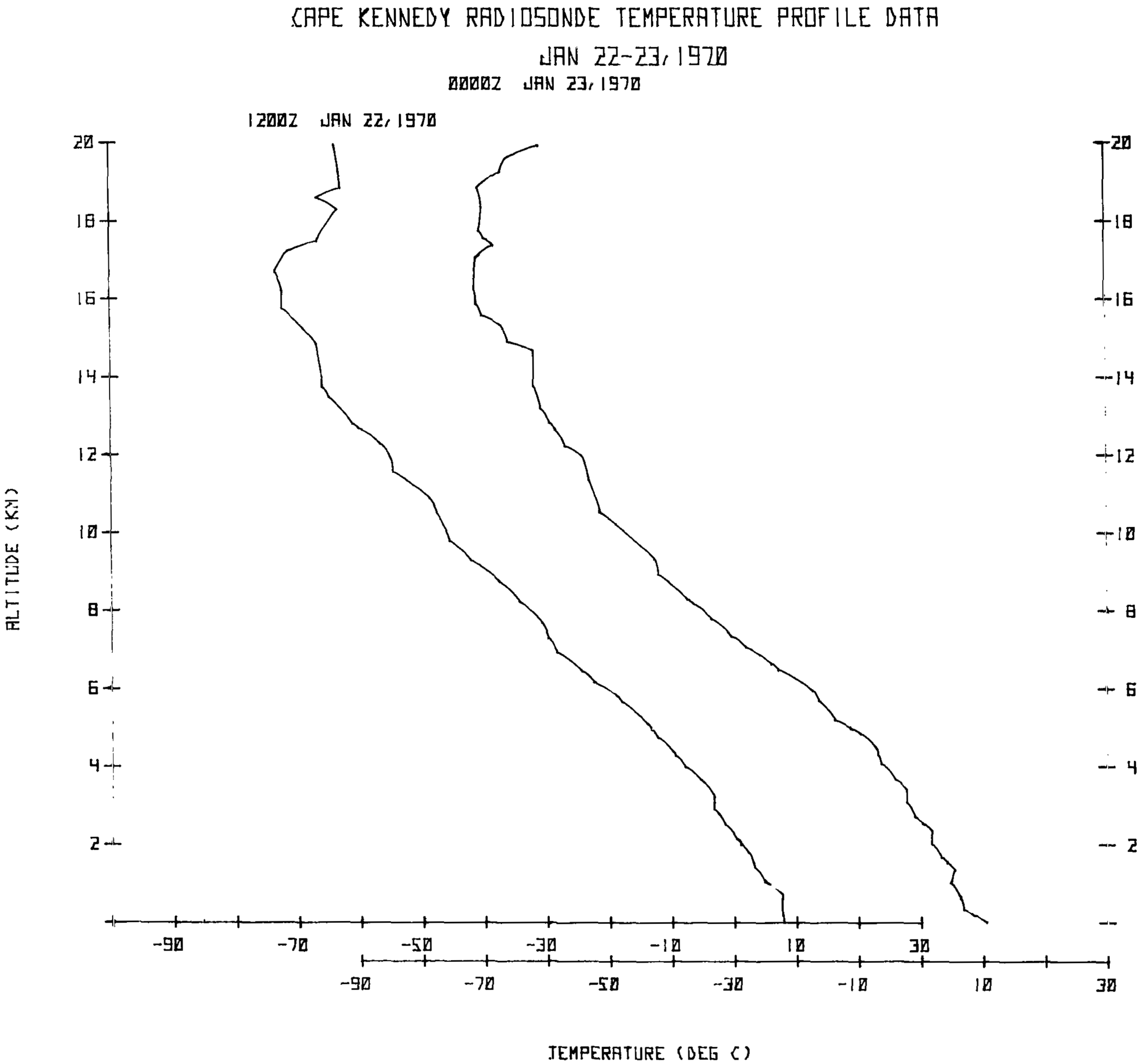
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA
JAN 13-14, 1965



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

JAN 22, 1968

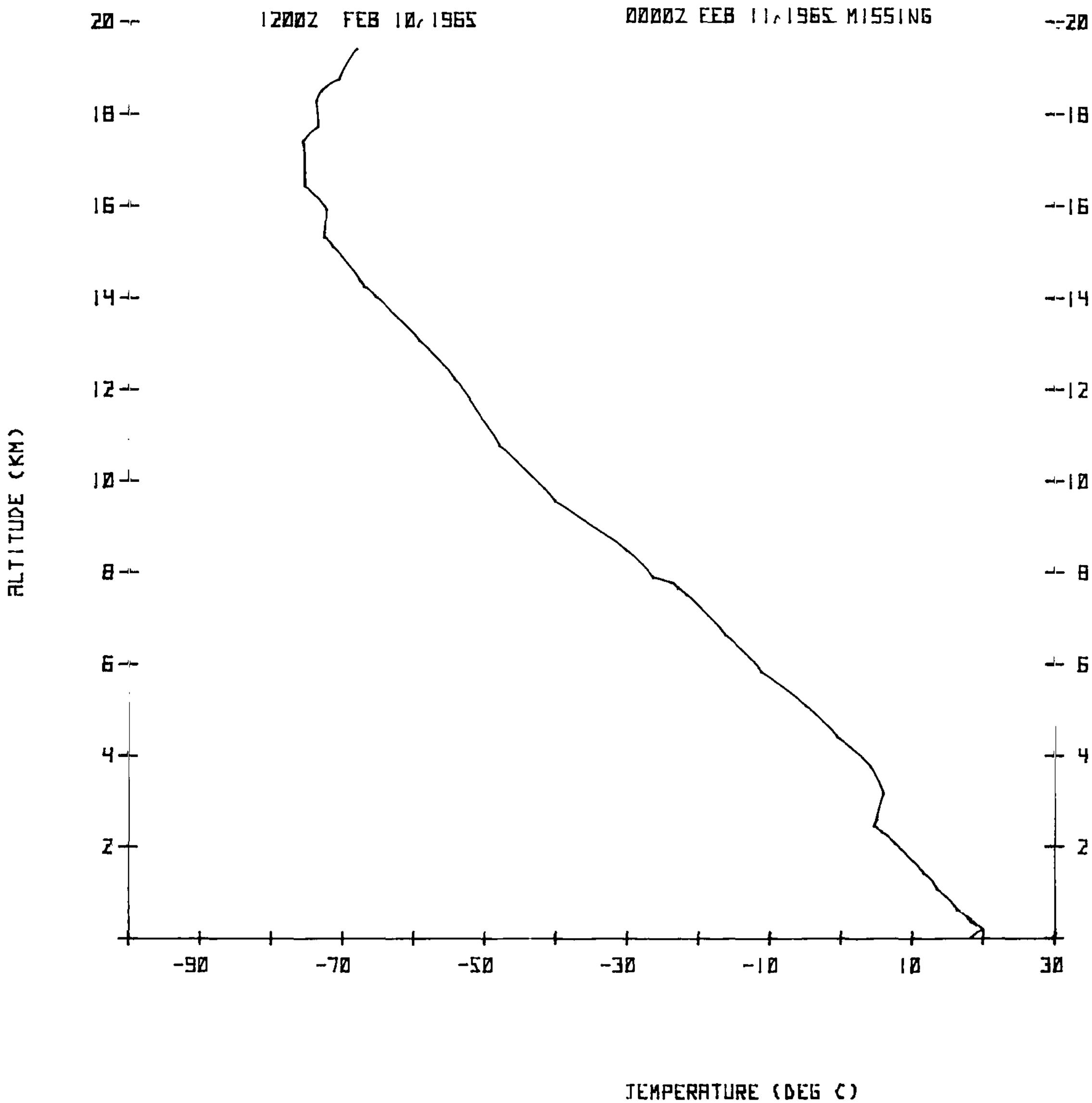



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA
JAN 22-23, 1970
0000Z JAN 23, 1970
1200Z JAN 22, 1970
ALTITUDE (KM)
20
18
16
14
12
10
8
6
4
2
-90
-70
-50
-30
-10
10
30
TEMPERATURE (DEG C)

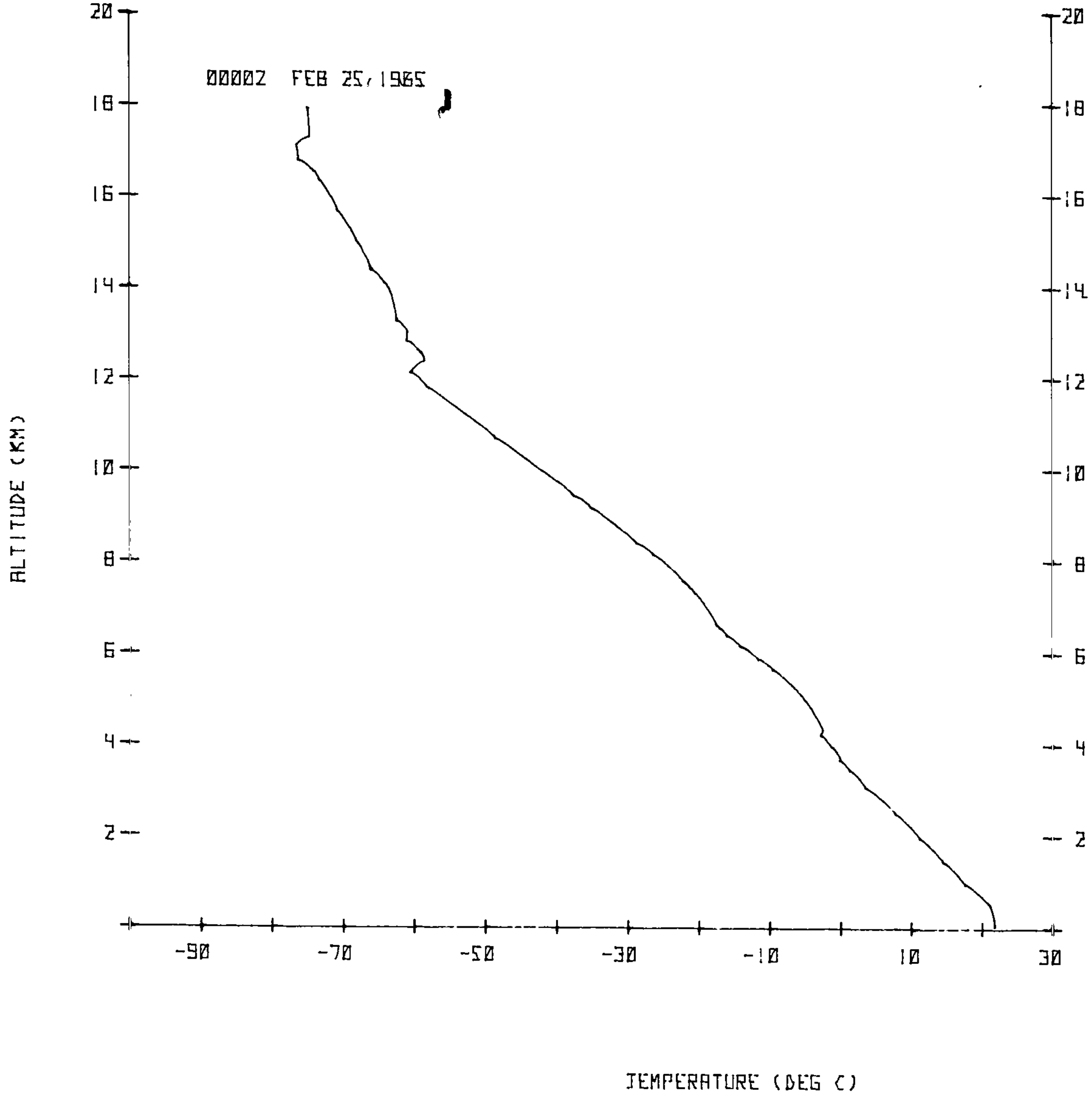
5

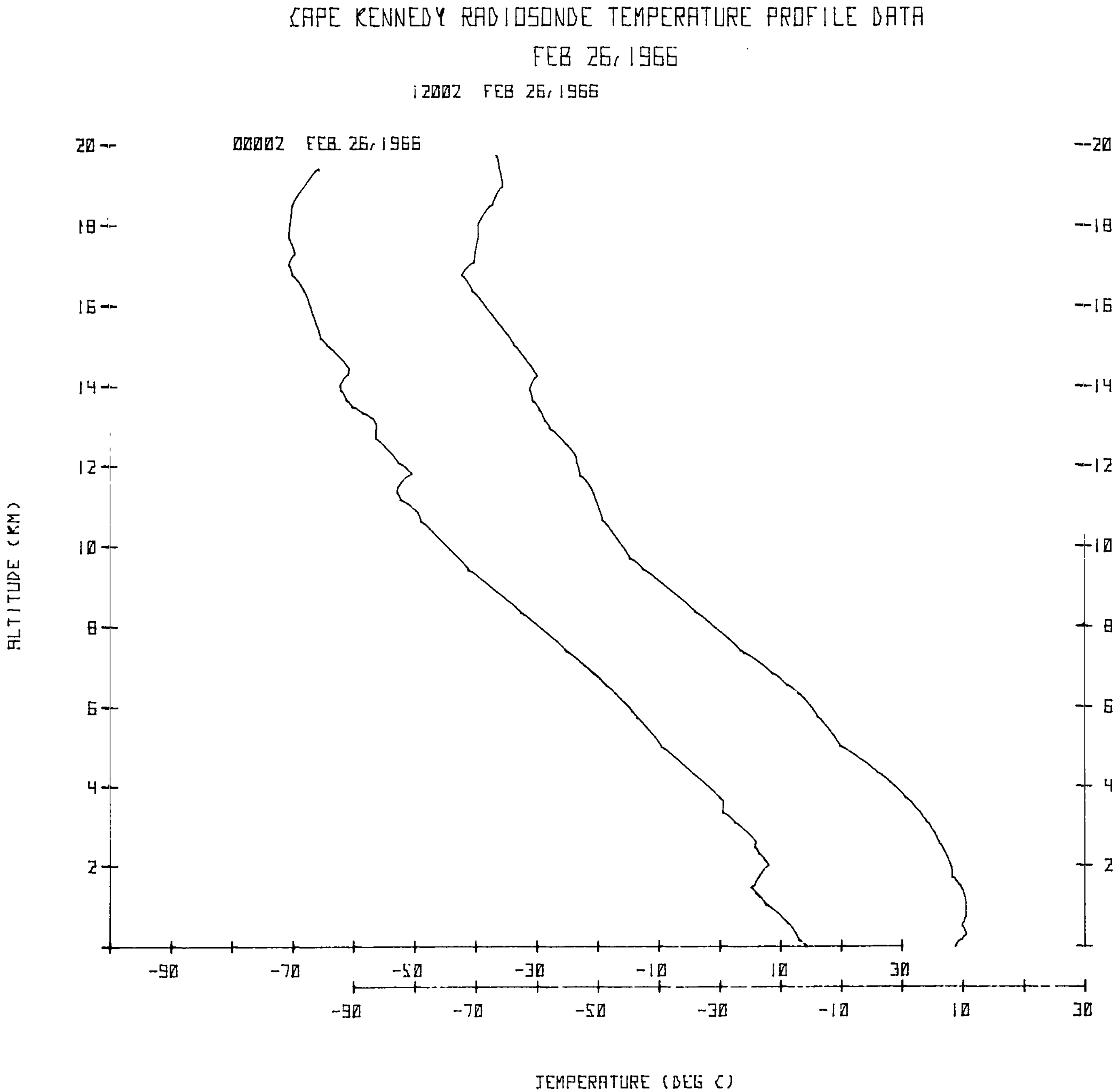
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

FEB 10-11, 1965



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA
FEB 25, 1965

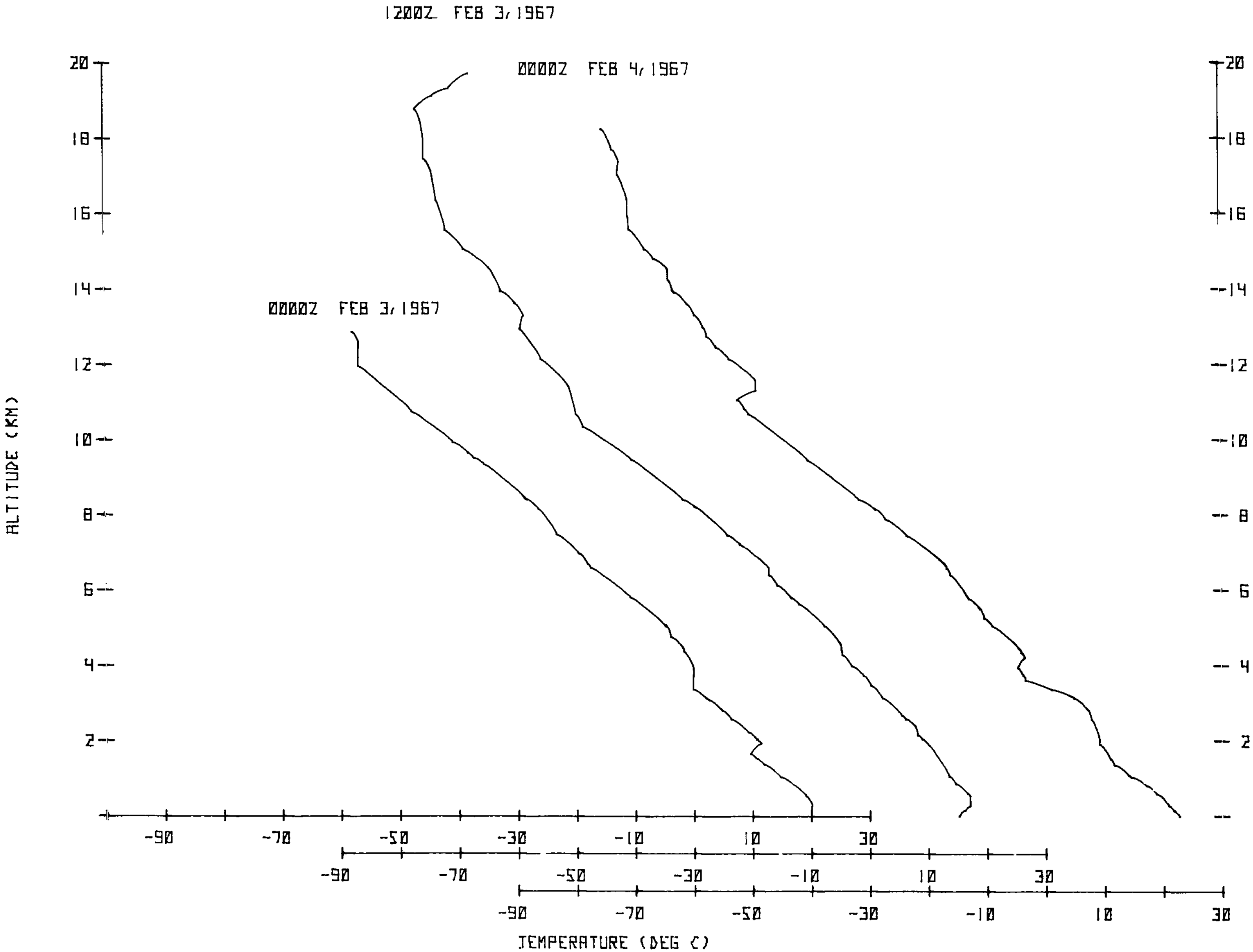




CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA
FEB 26, 1966
1200Z FEB 26, 1966
0000Z FEB. 26, 1966
ALTITUDE (KM)
TEMPERATURE (DEG C)

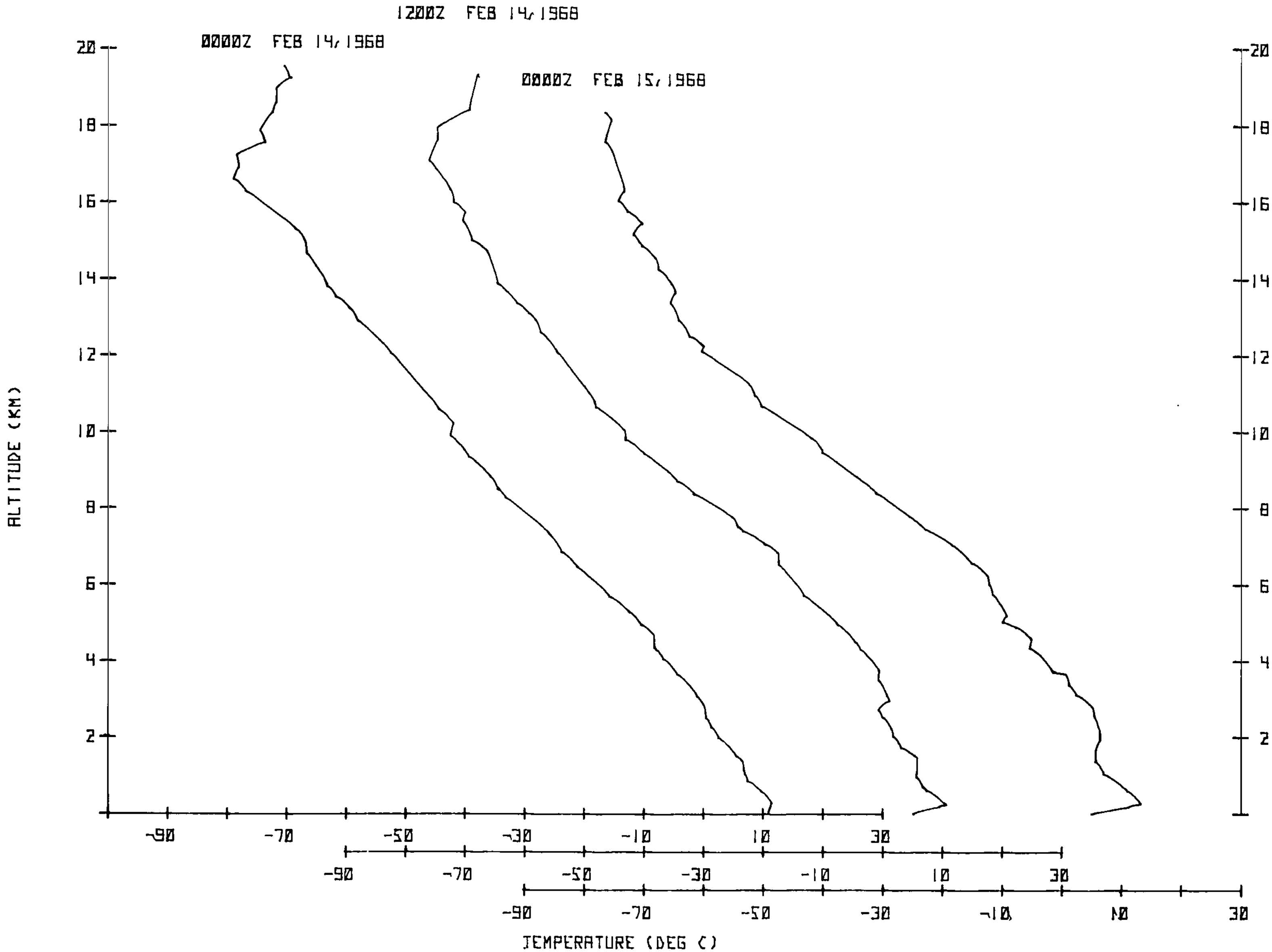
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

FEB 3-4, 1967



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

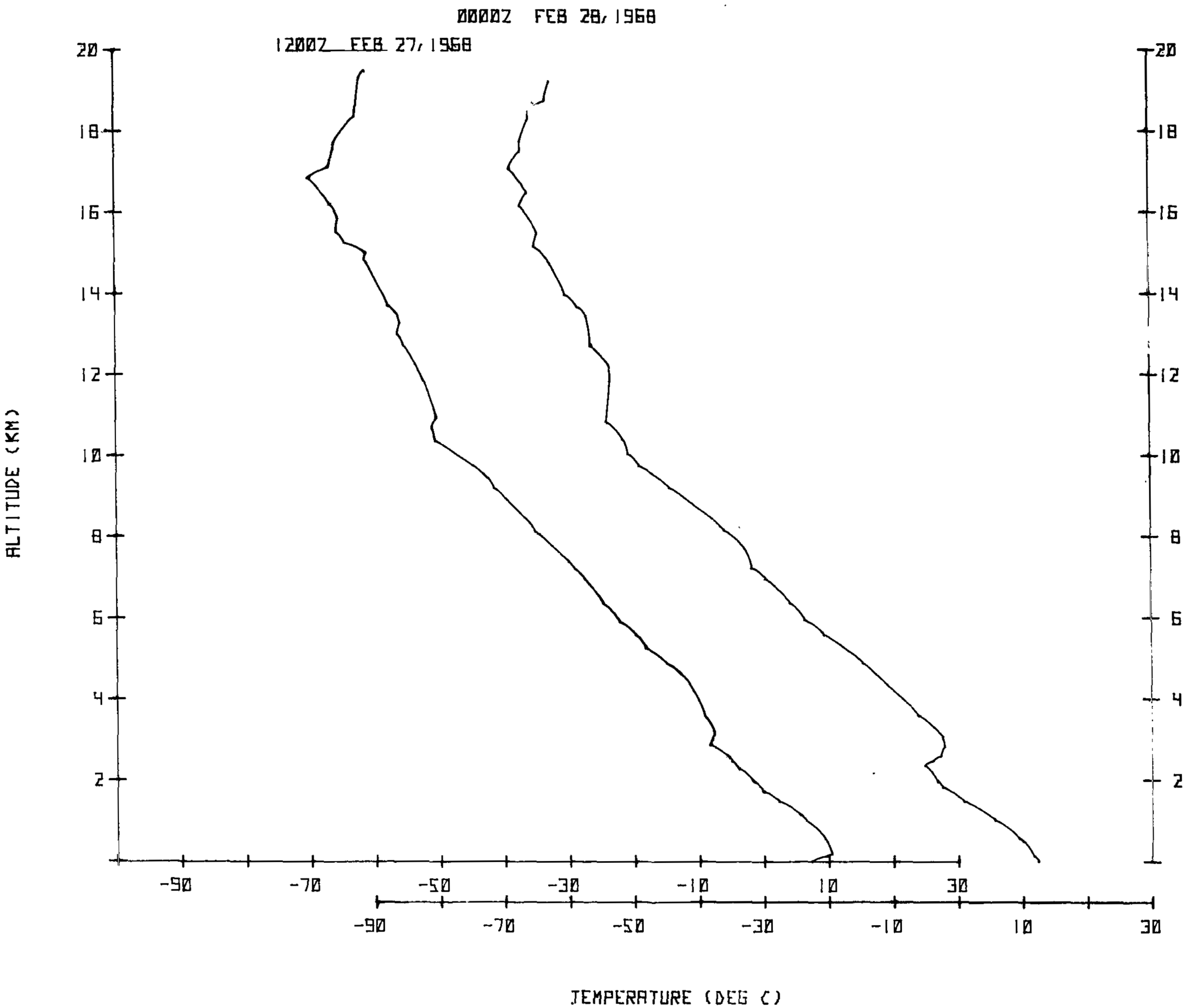
FEB 14-15, 1968



11

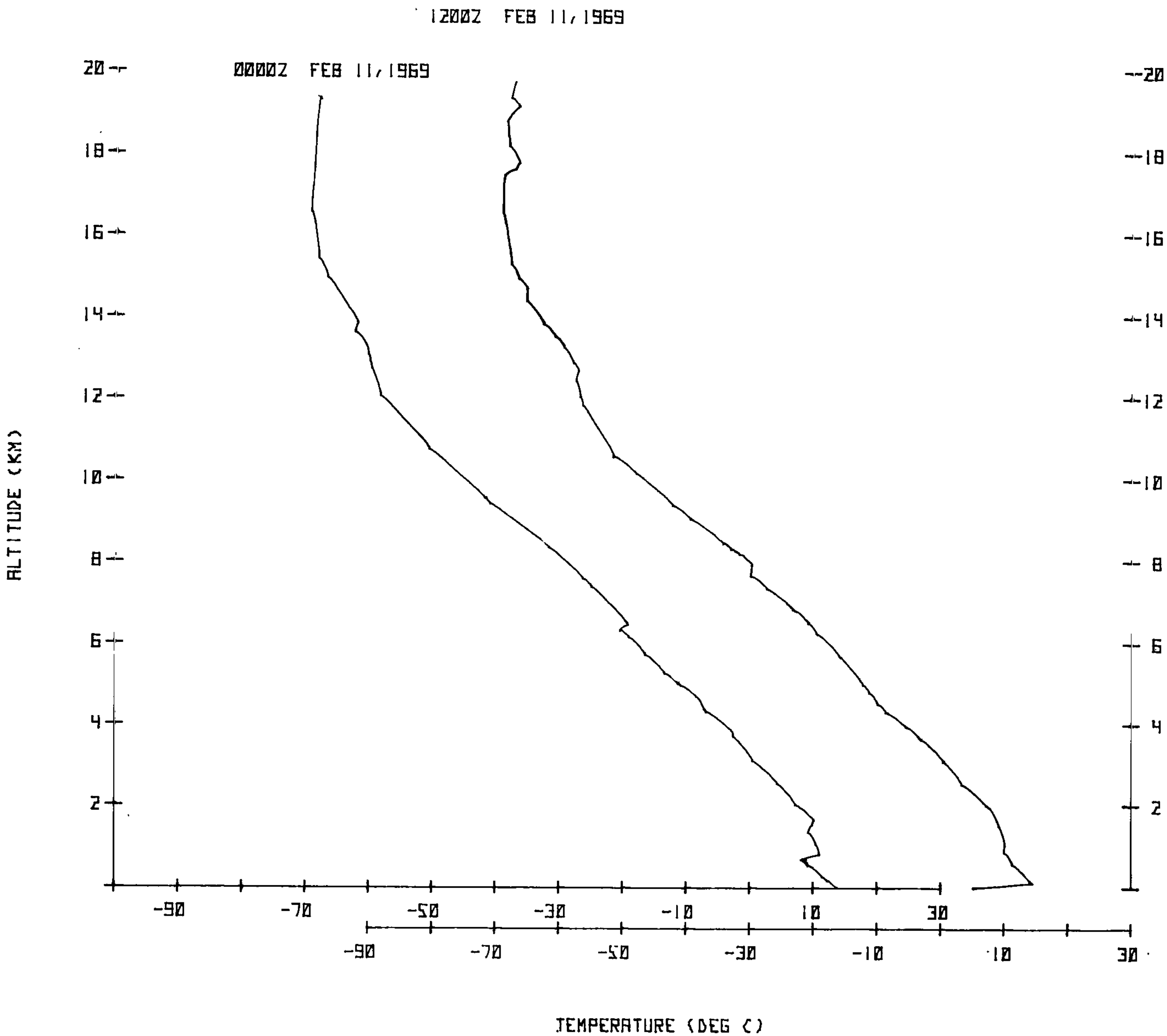
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

FEB 27-28, 1968



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

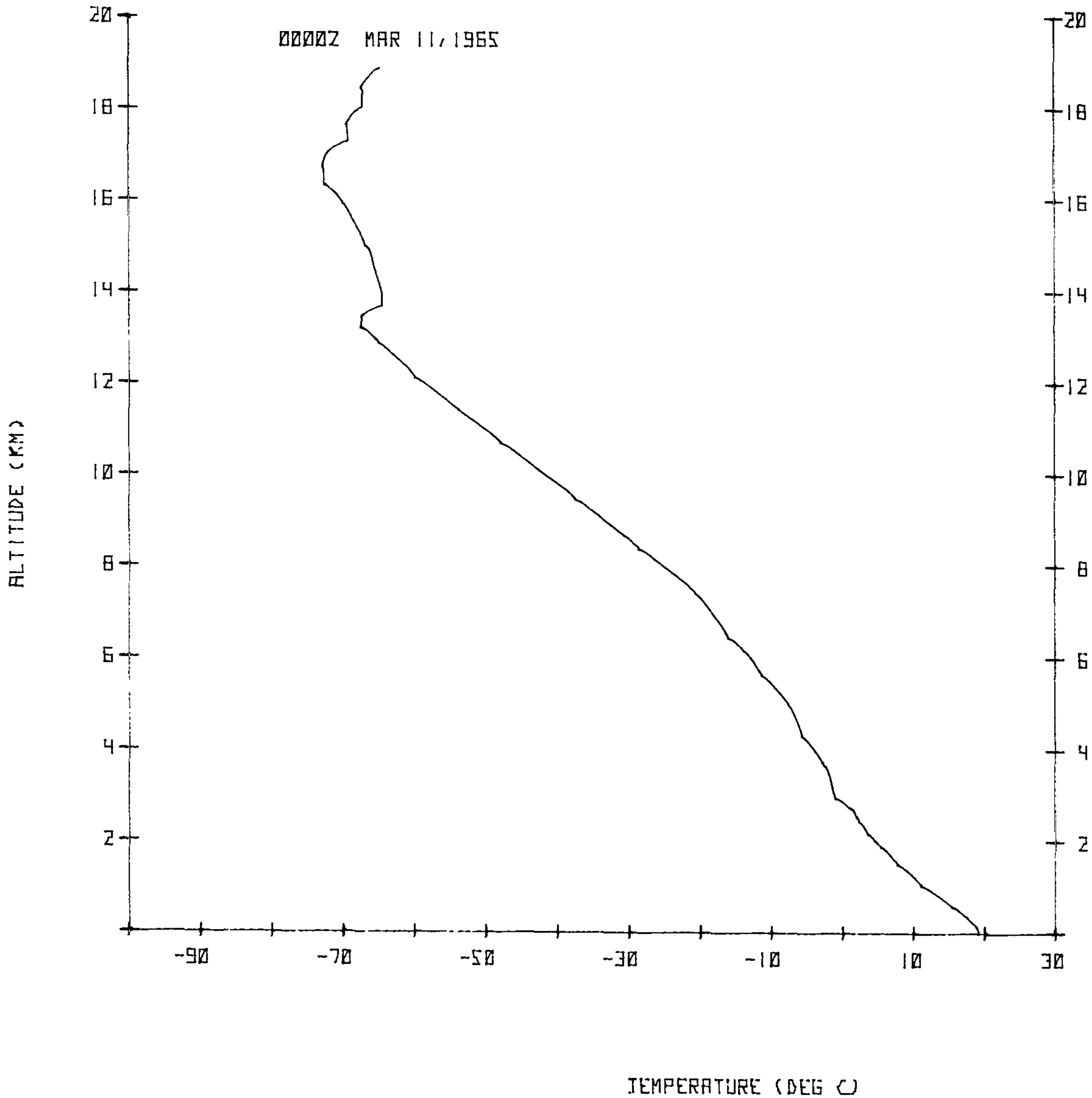
FEB 11, 1969



13

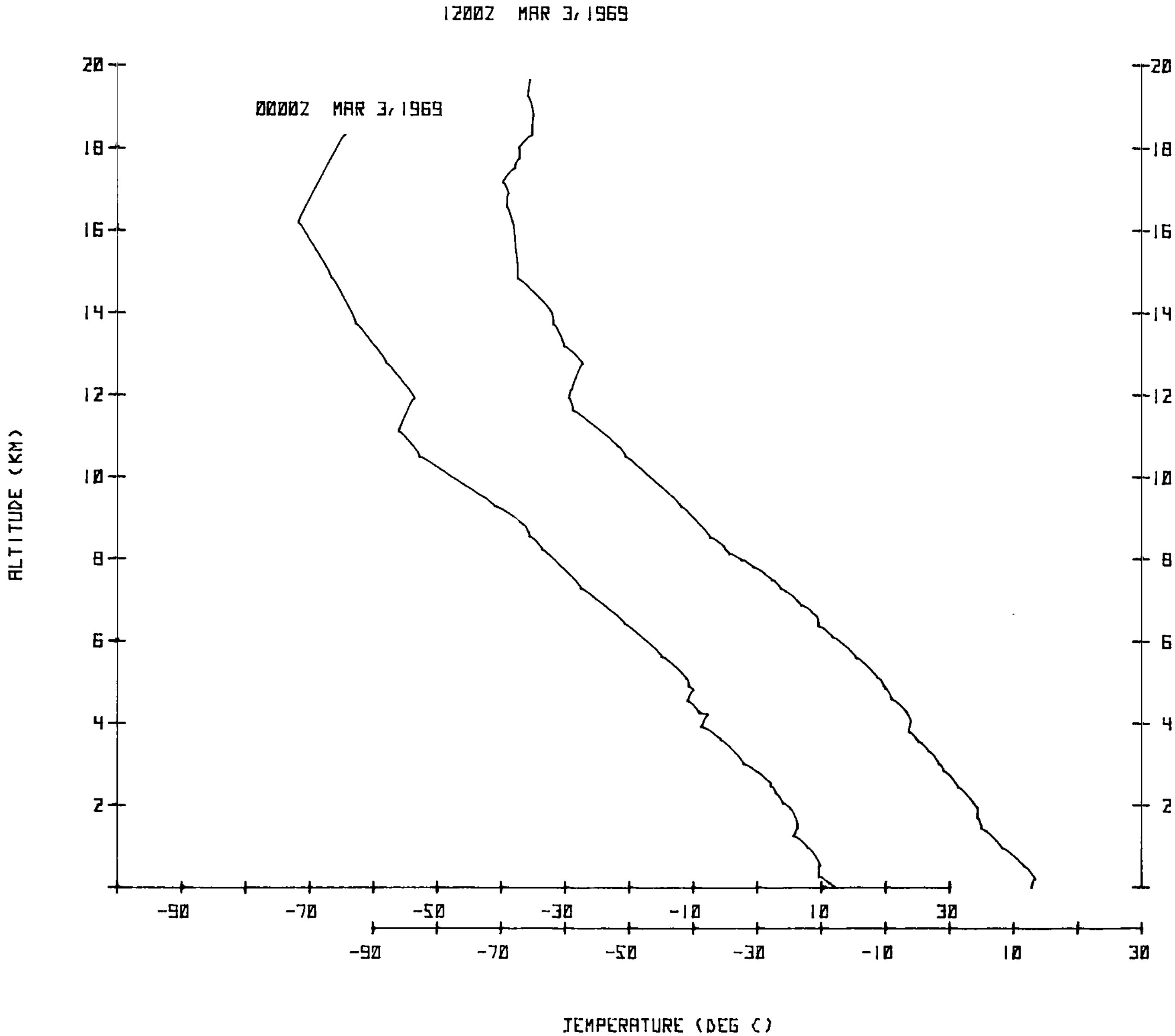
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

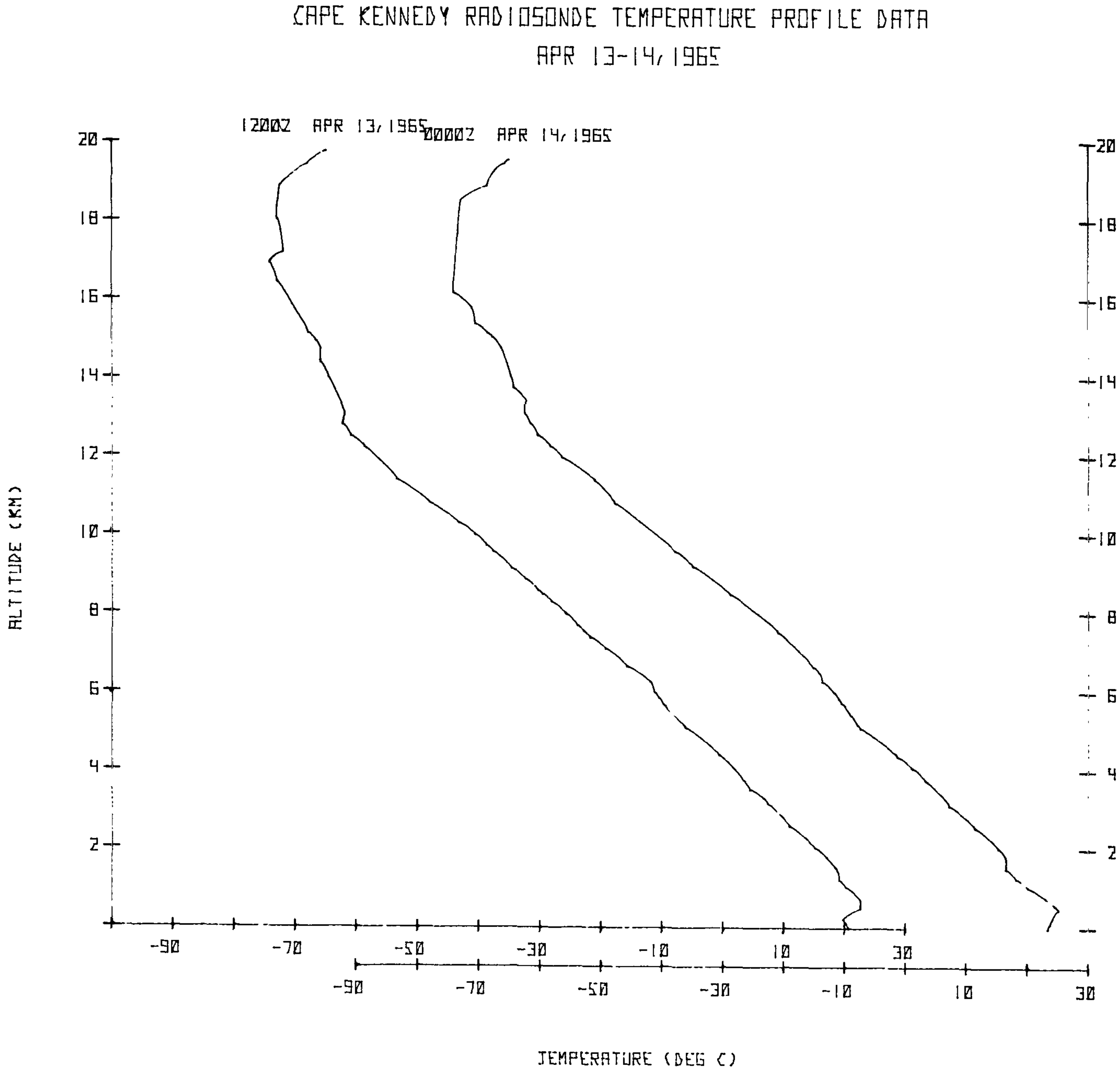
MAR 11, 1965



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

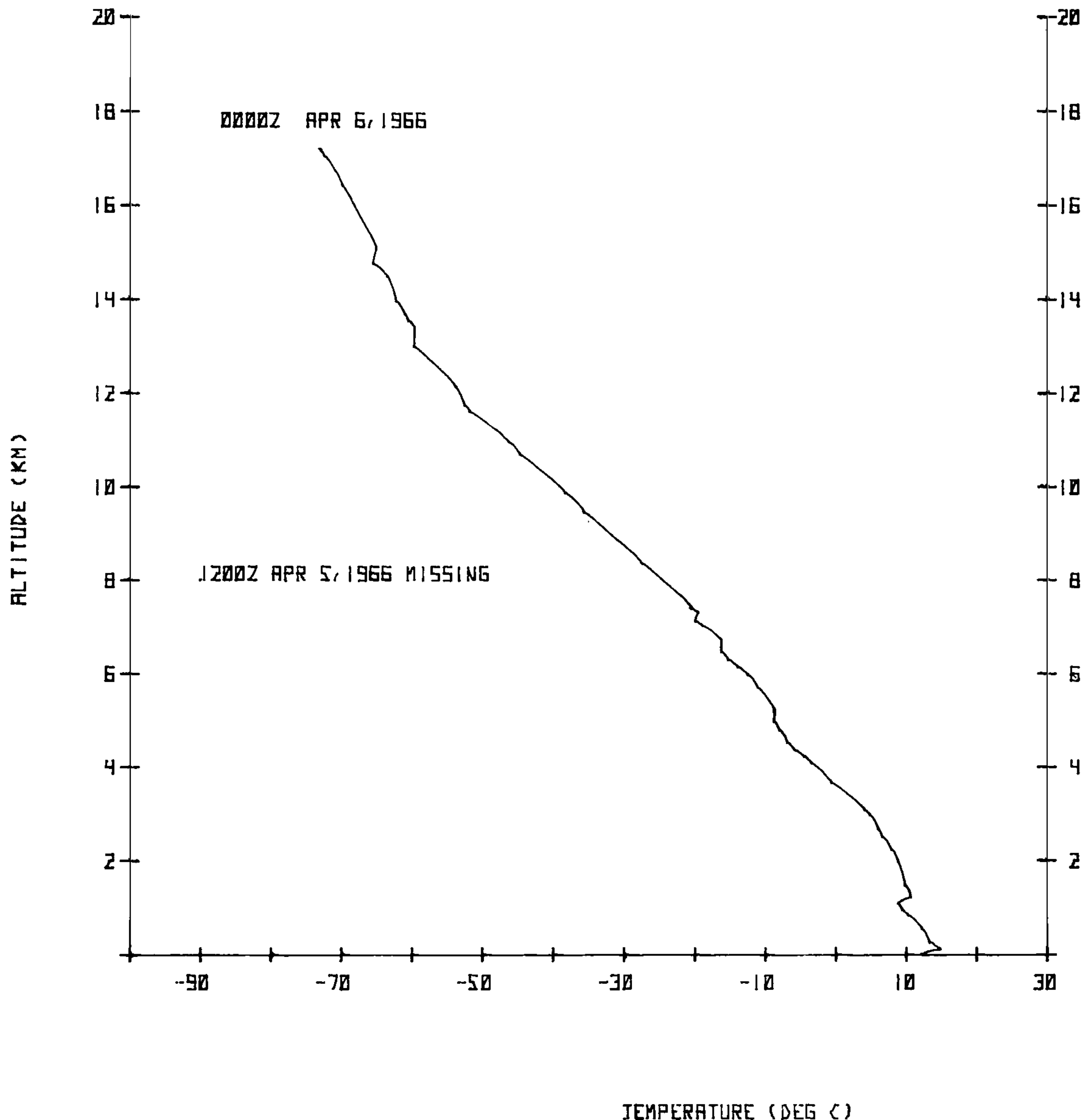
MAR 3, 1969



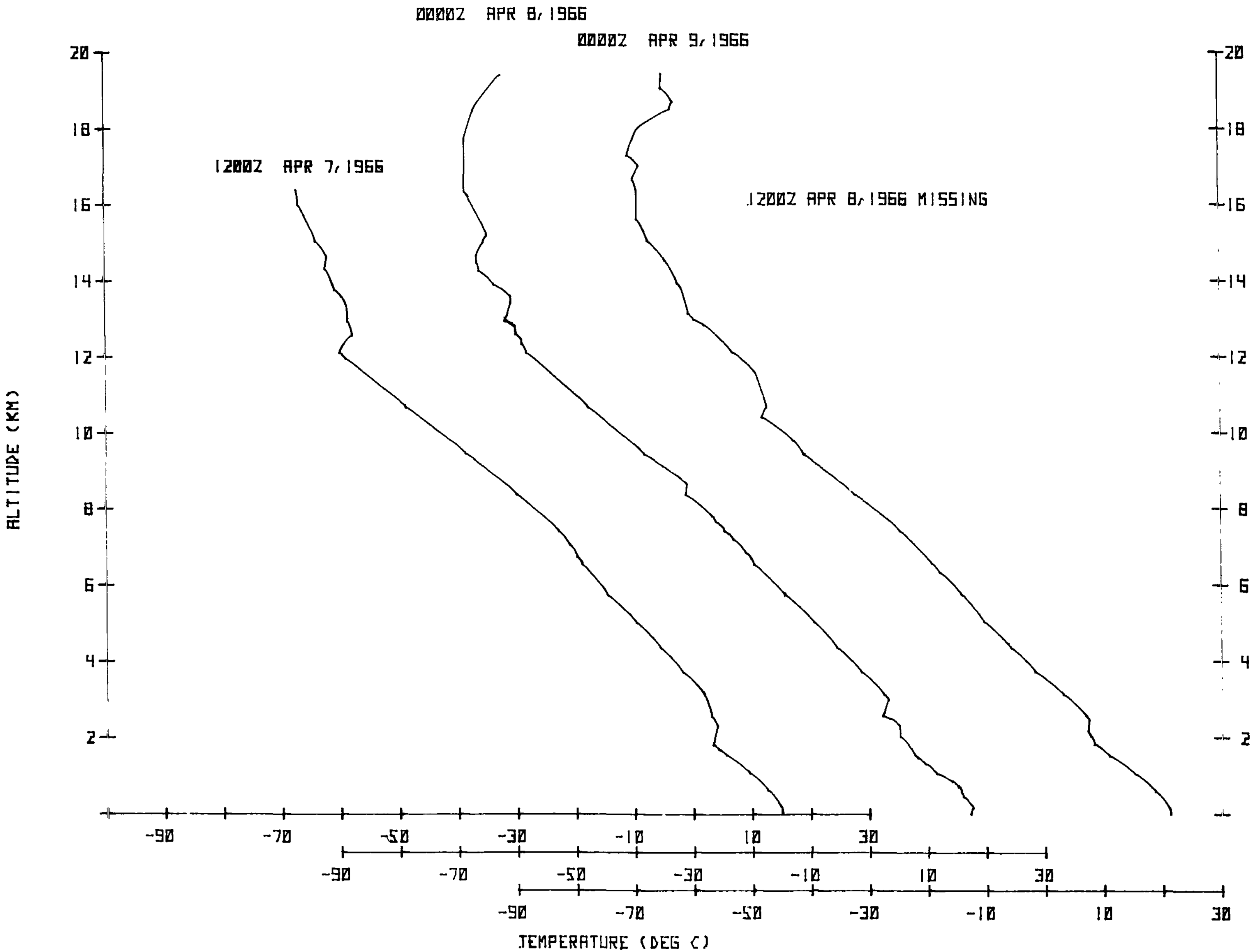


CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA
APR 13-14, 1965
1200Z APR 13, 1965
0000Z APR 14, 1965
ALTITUDE (KM)
20
18
16
14
12
10
8
6
4
2
-90
-70
-50
-30
-10
10
30
TEMPERATURE (DEG C)

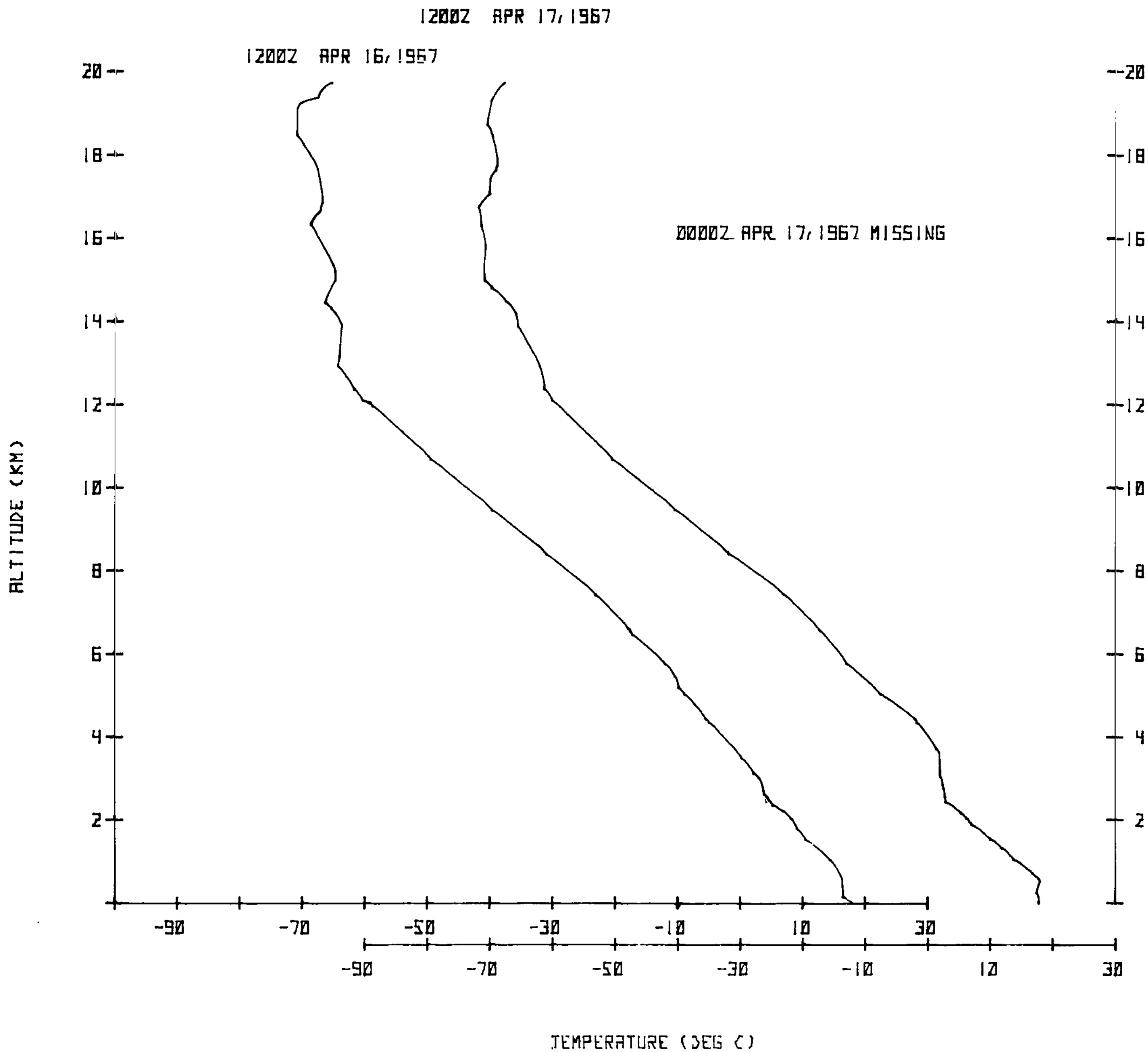
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA
APR 5-6, 1966



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA
APR 7-9, 1966

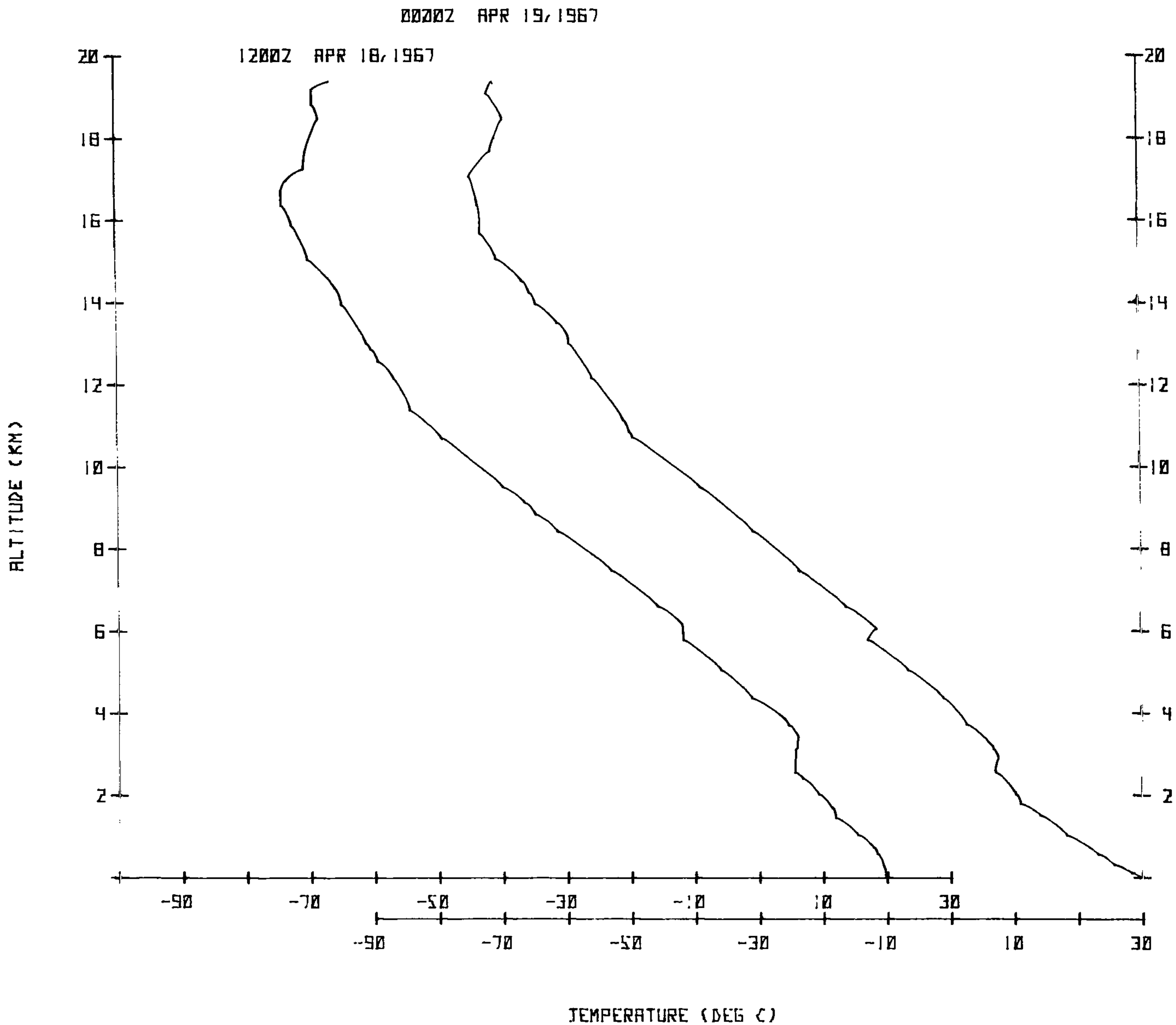


CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA
APR 16-17, 1967



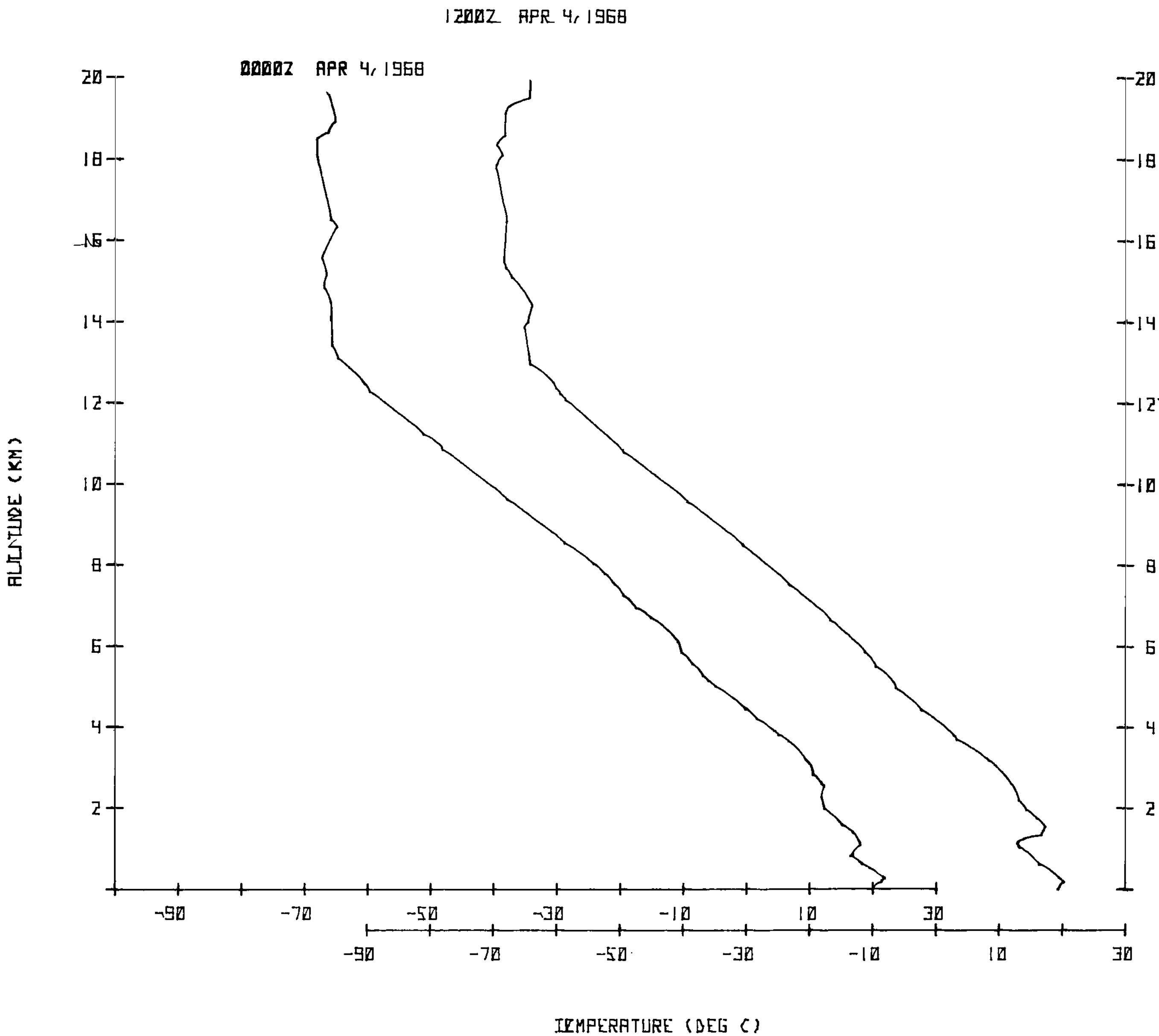
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

APR 18-19, 1967



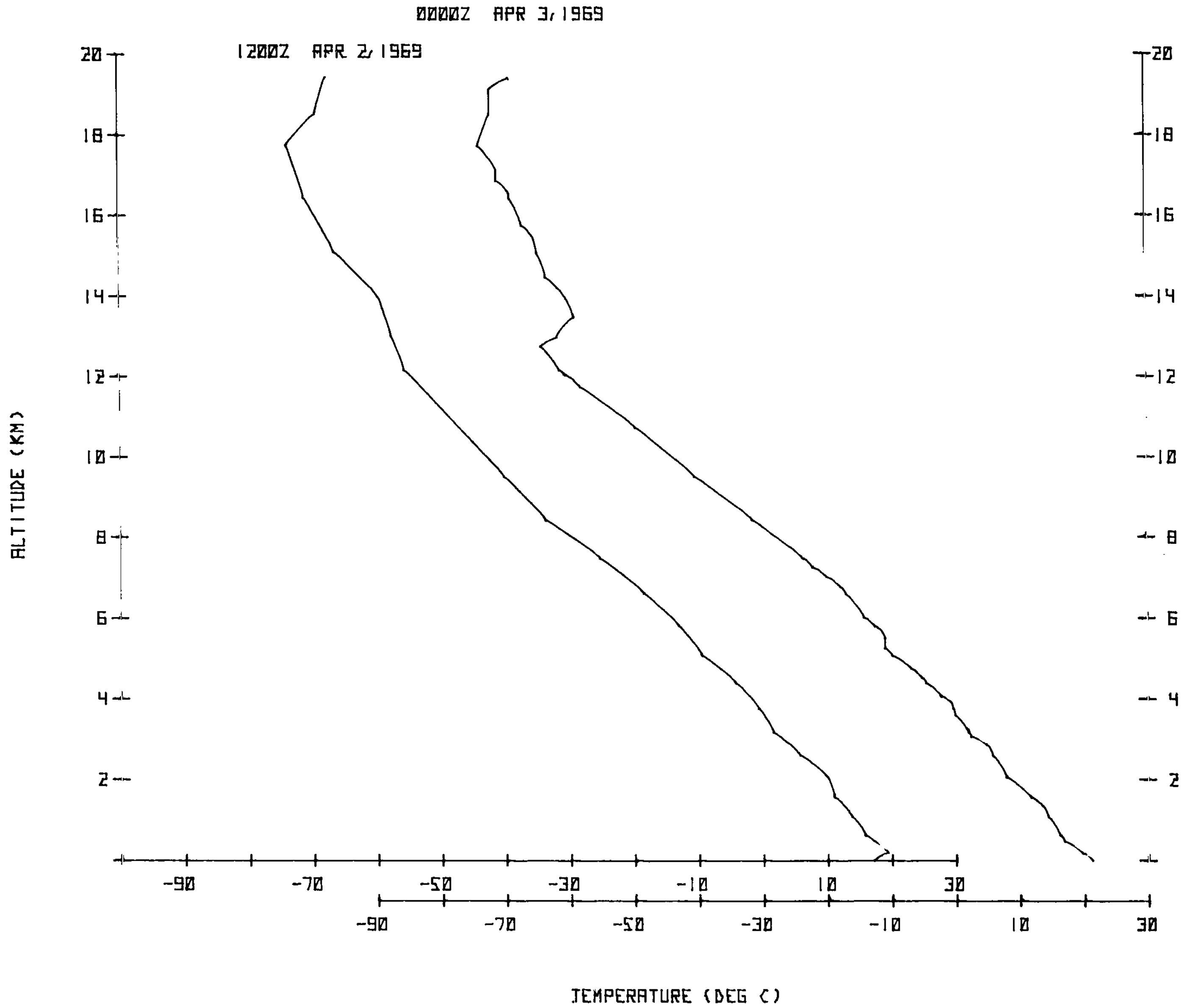
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

APR 4, 1968

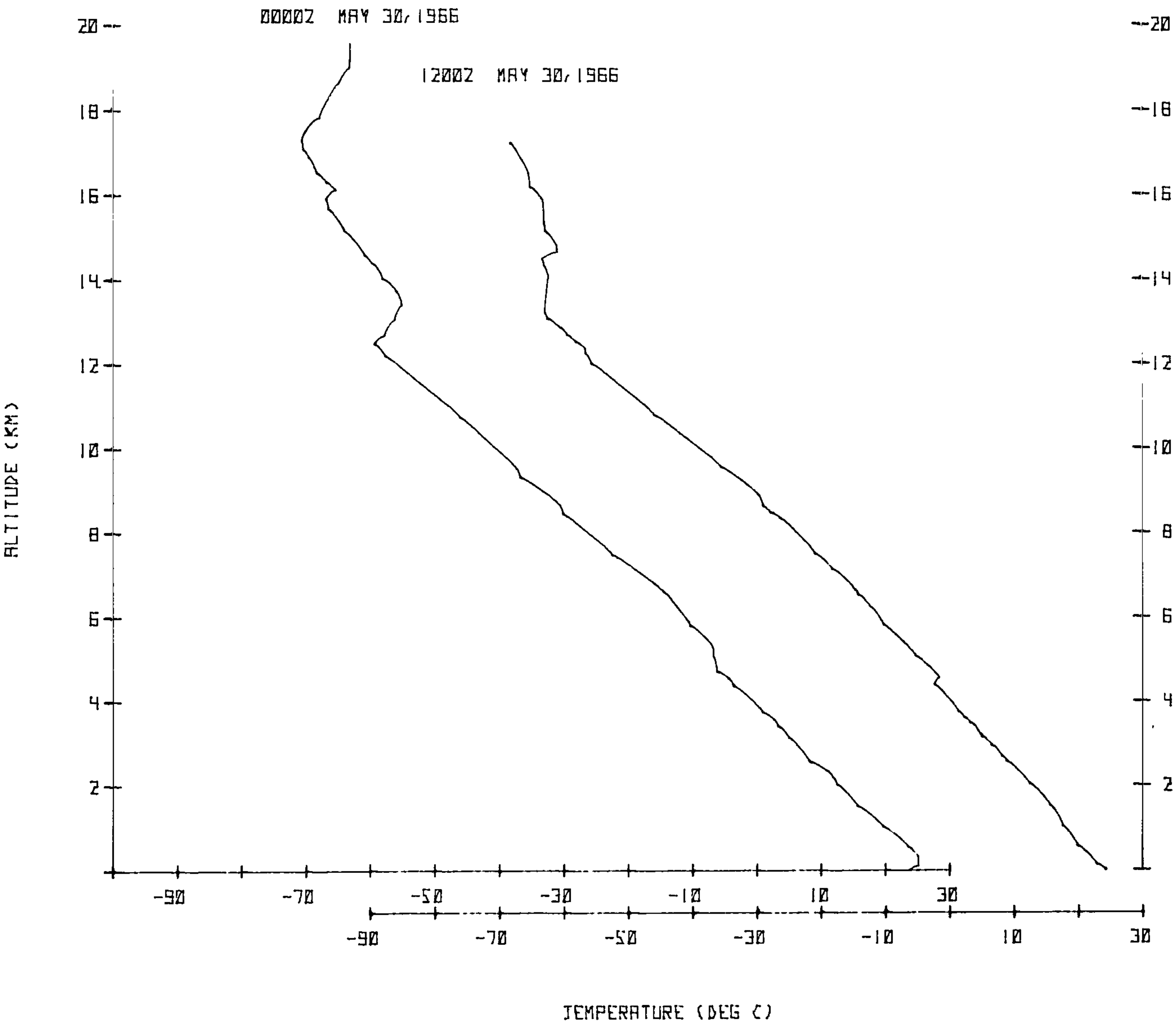


CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

APR 2-3, 1969

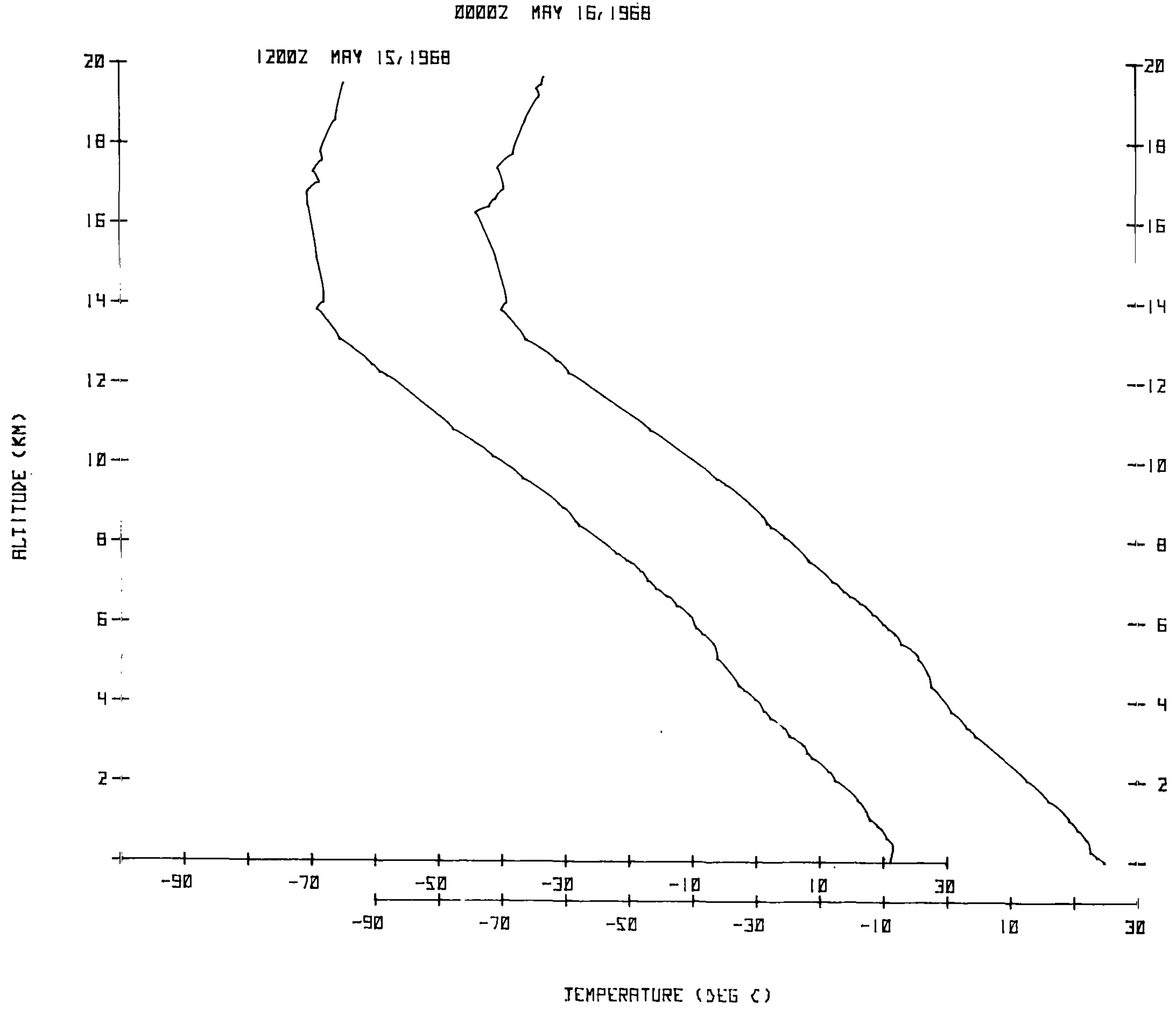


CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA
MAY 30, 1966



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

MAY 15-16, 1968



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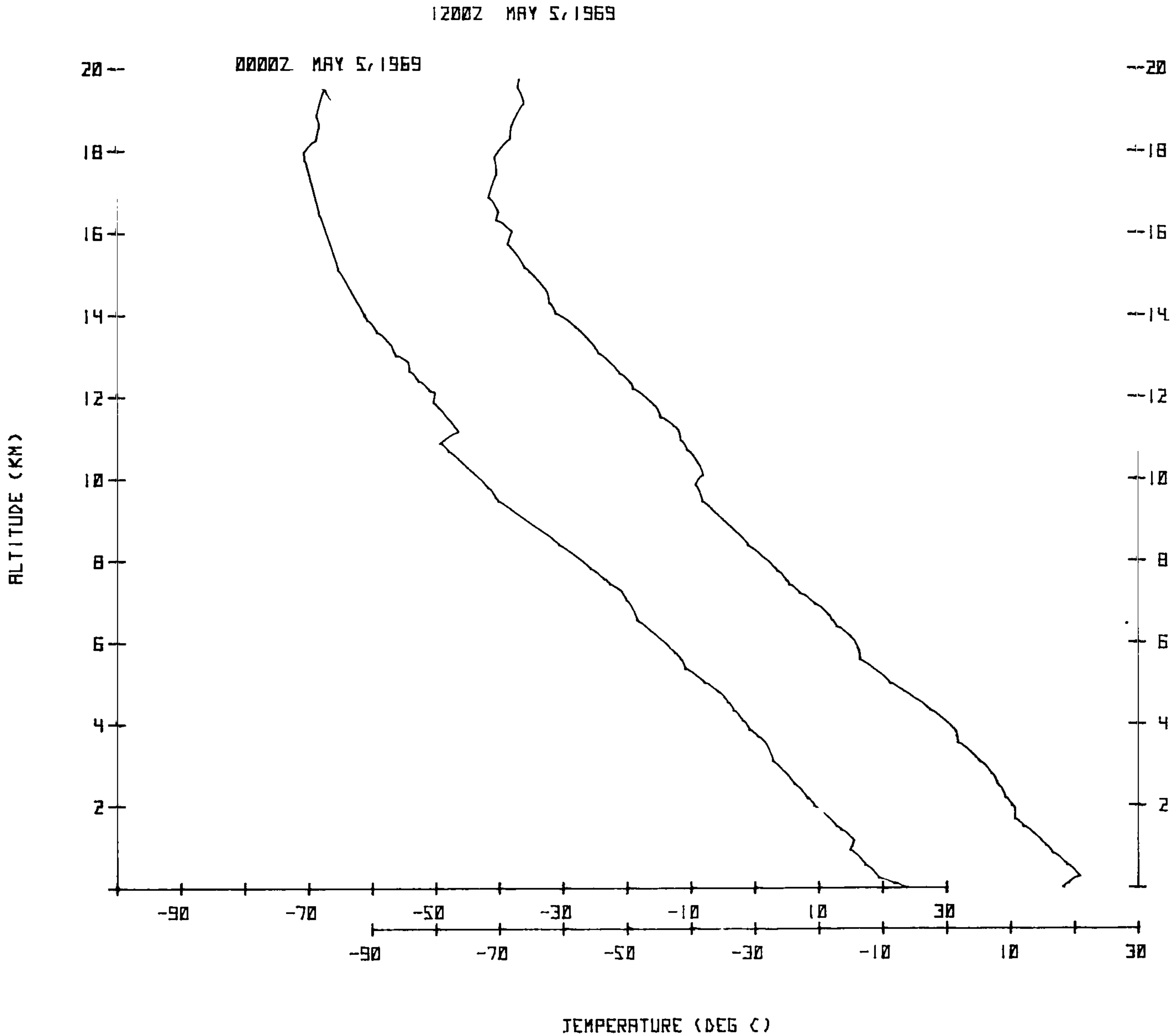
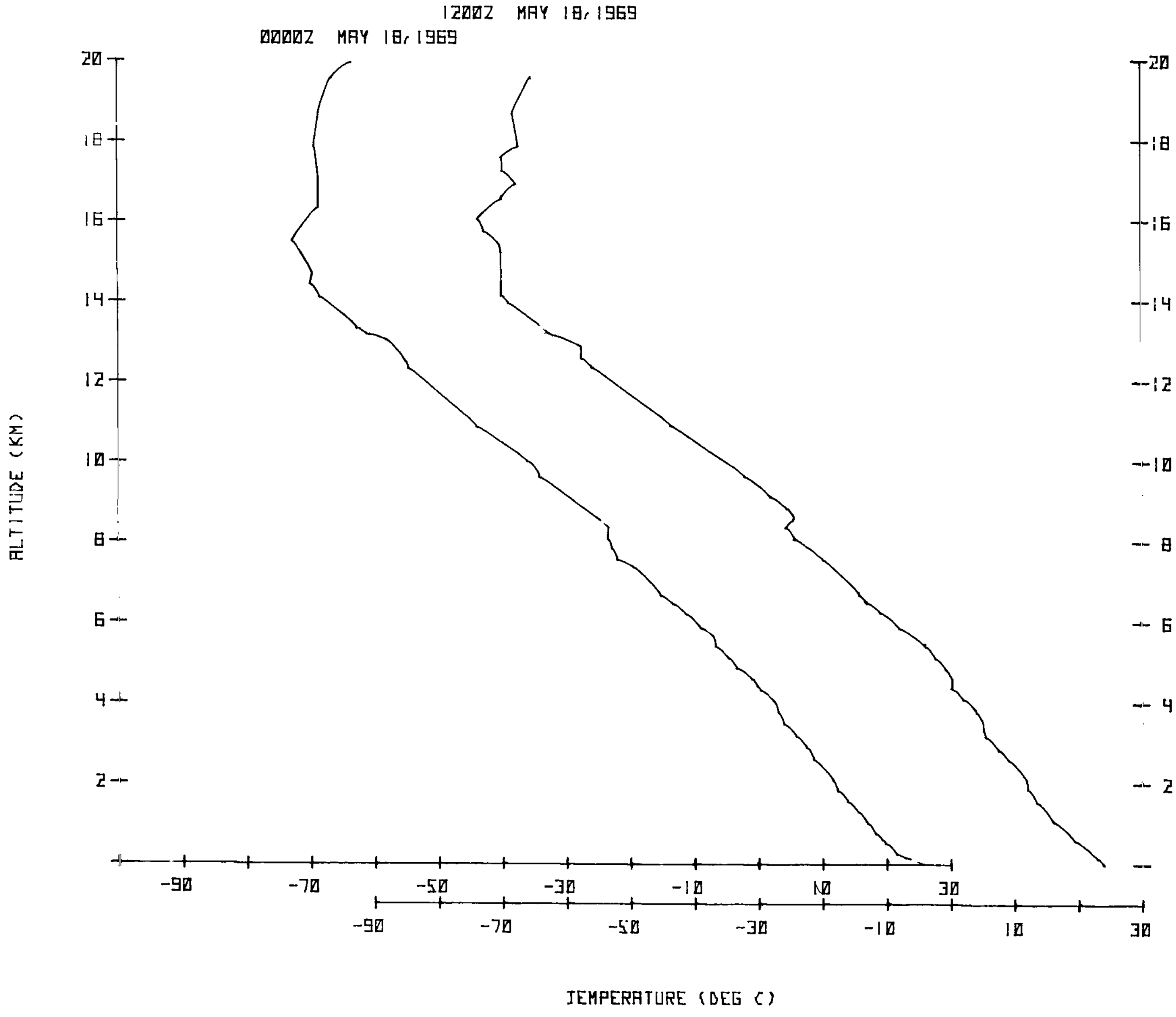
MAY 5, 1969



30

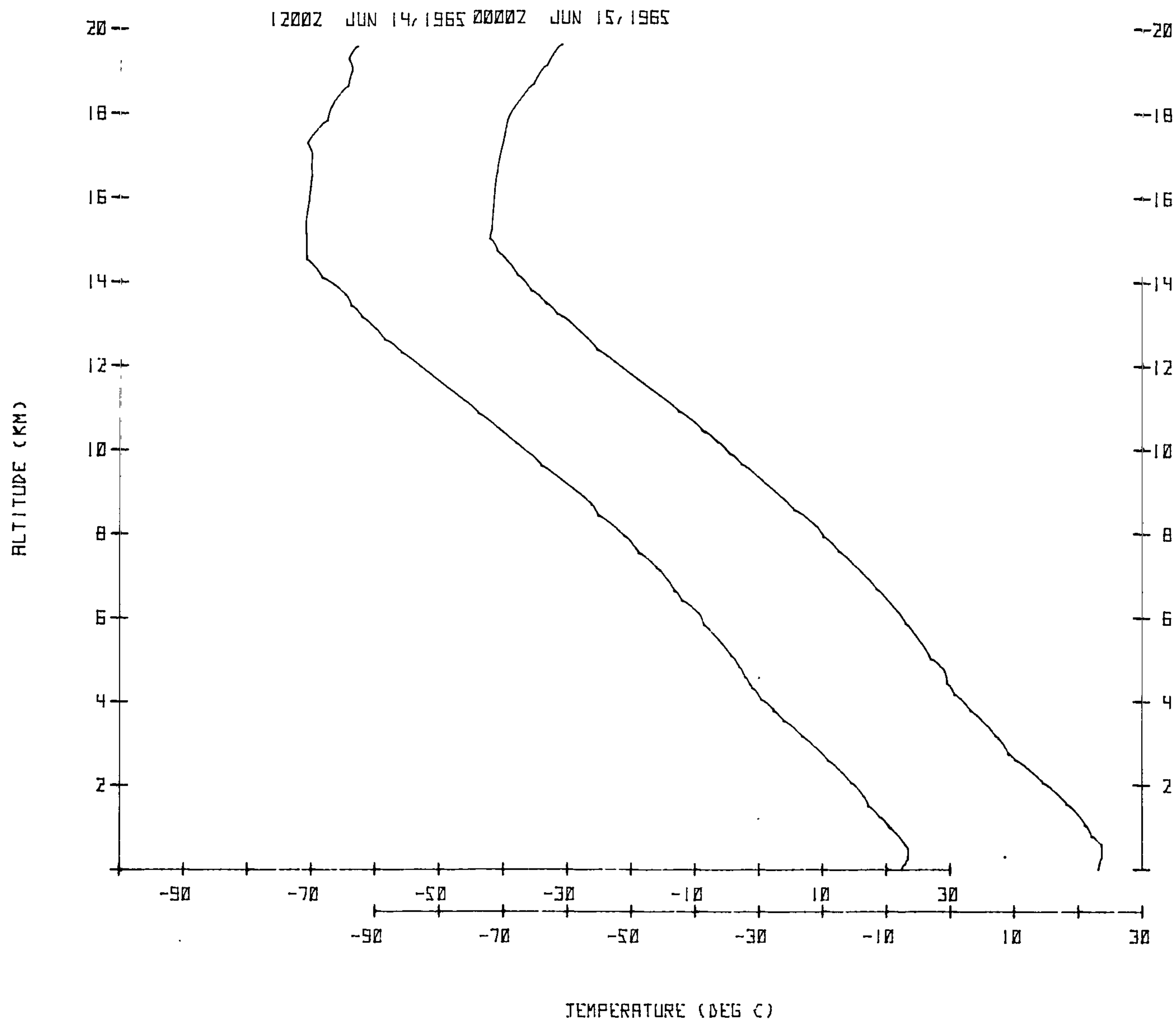
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

MAY 18, 1969



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

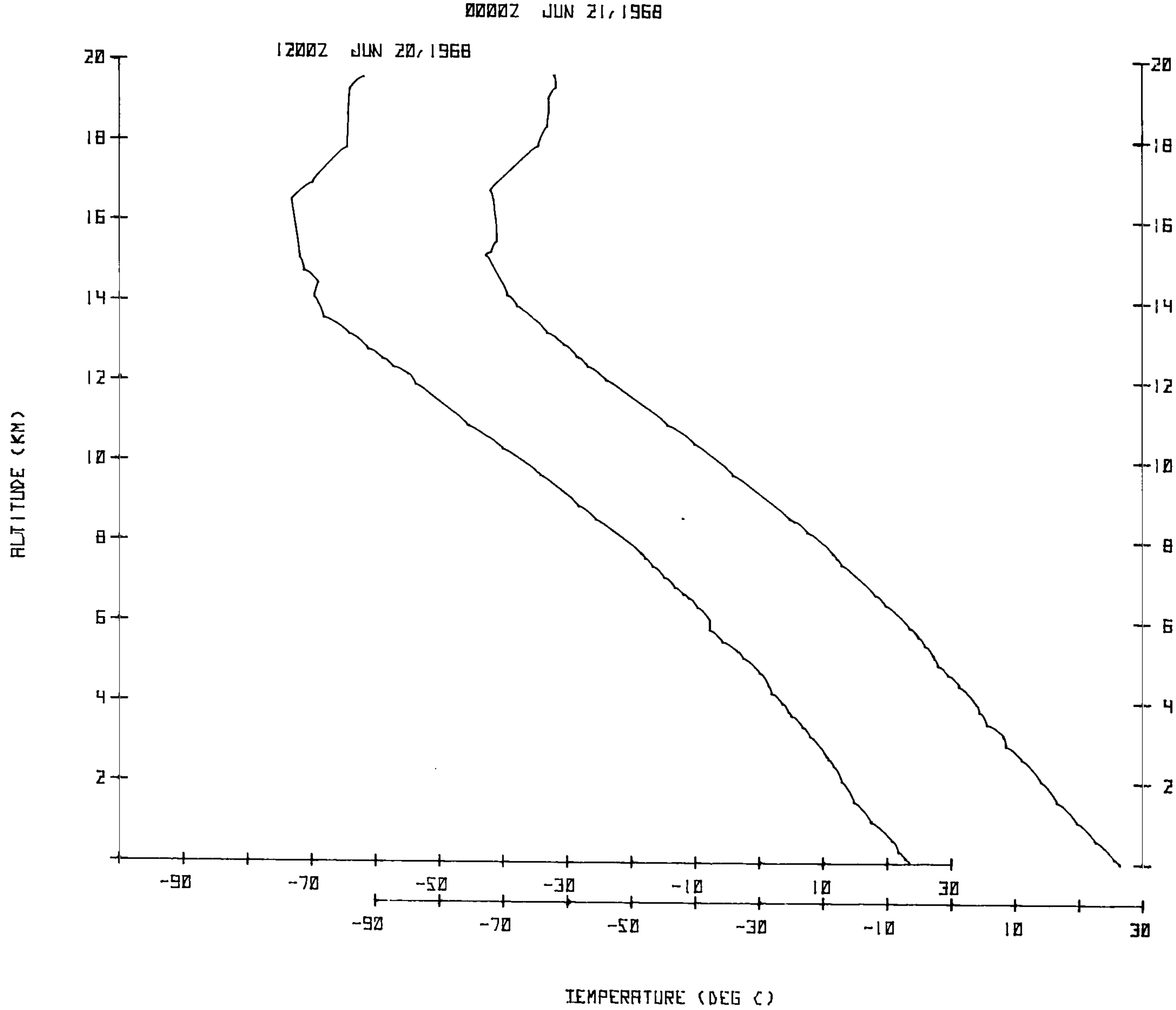
JUN 14-15, 1965



32

CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

JUN 20-21, 1968



256

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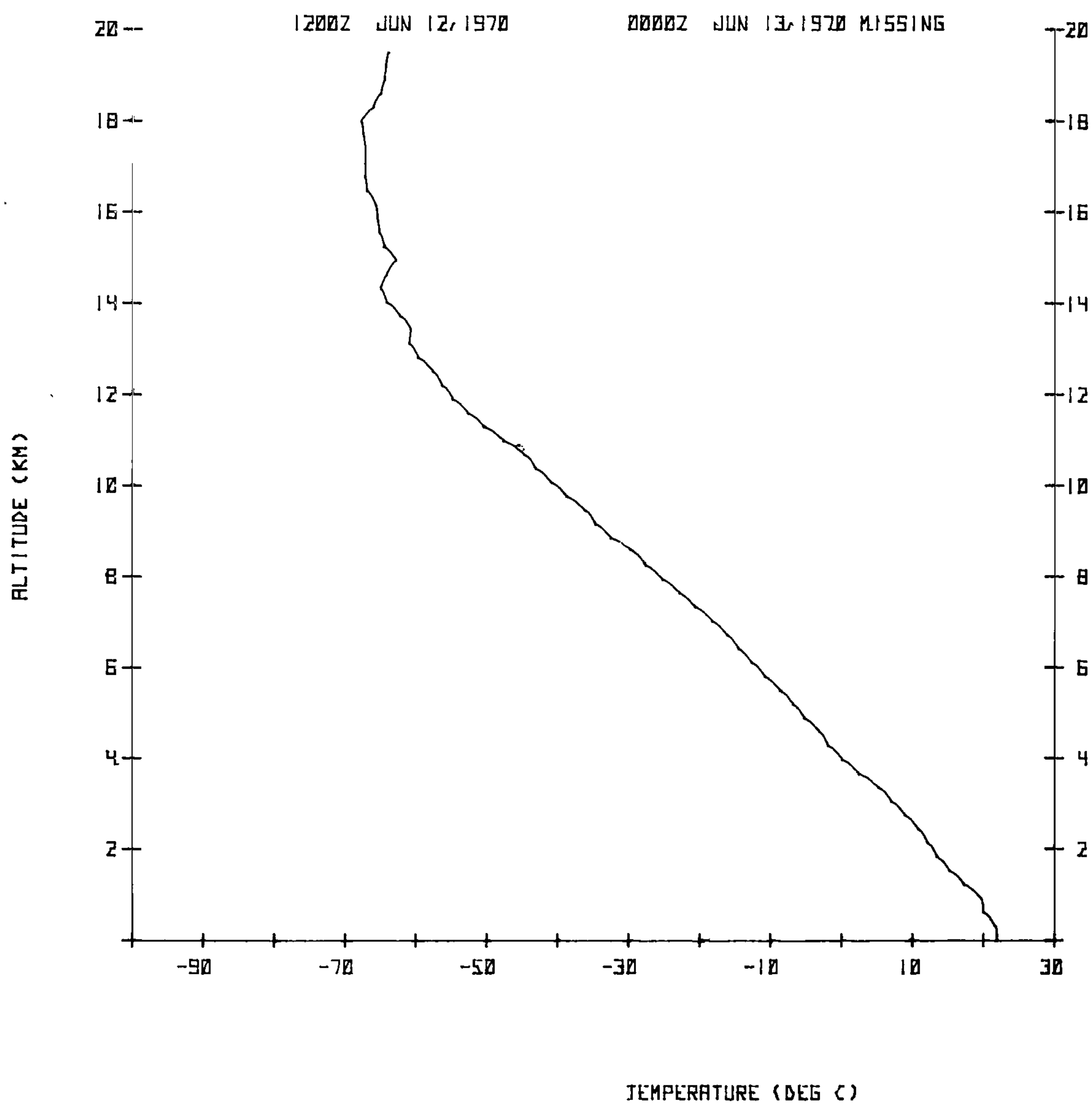
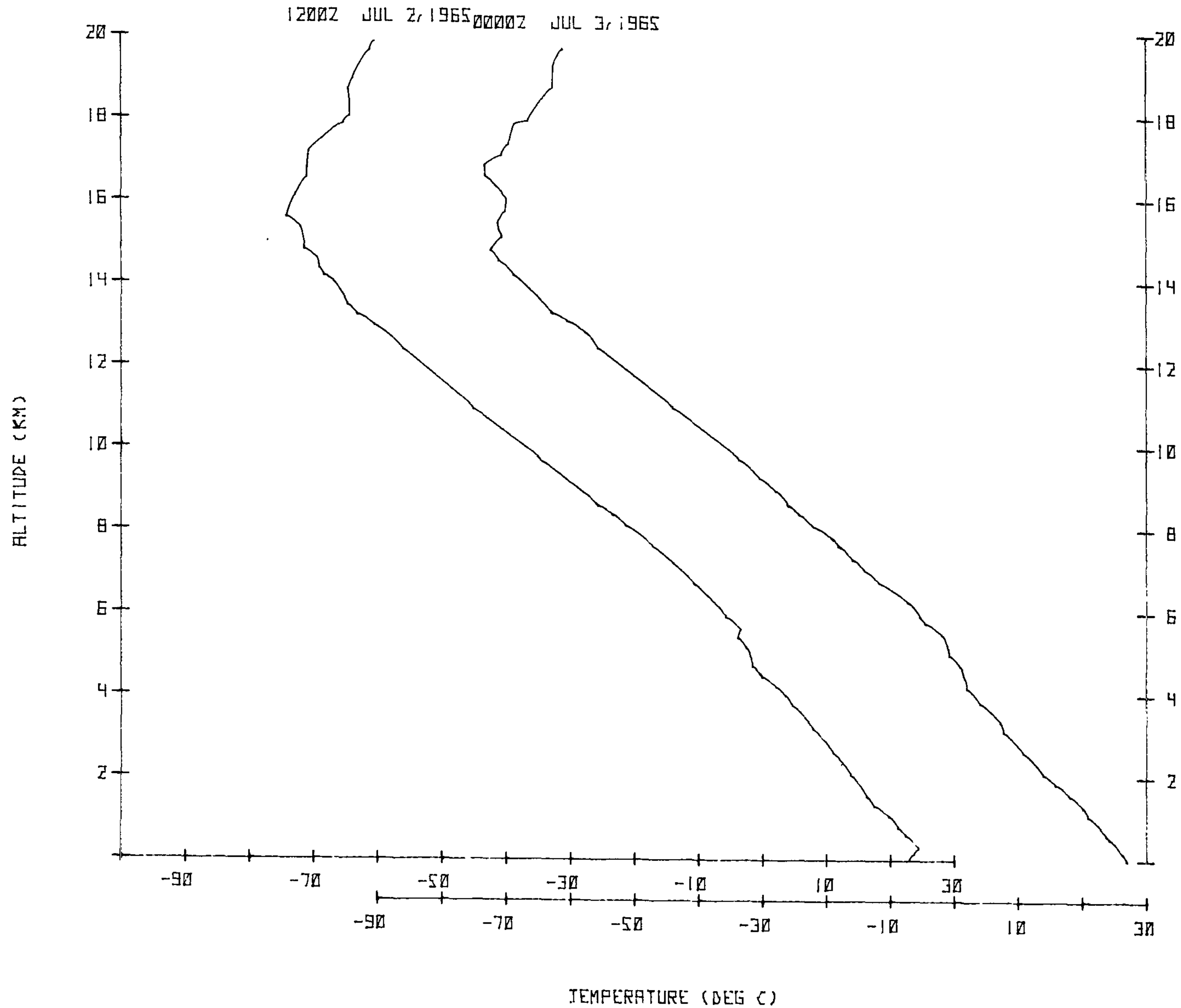
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA
JUN 12-13, 1970



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

JUL 2-3, 1965



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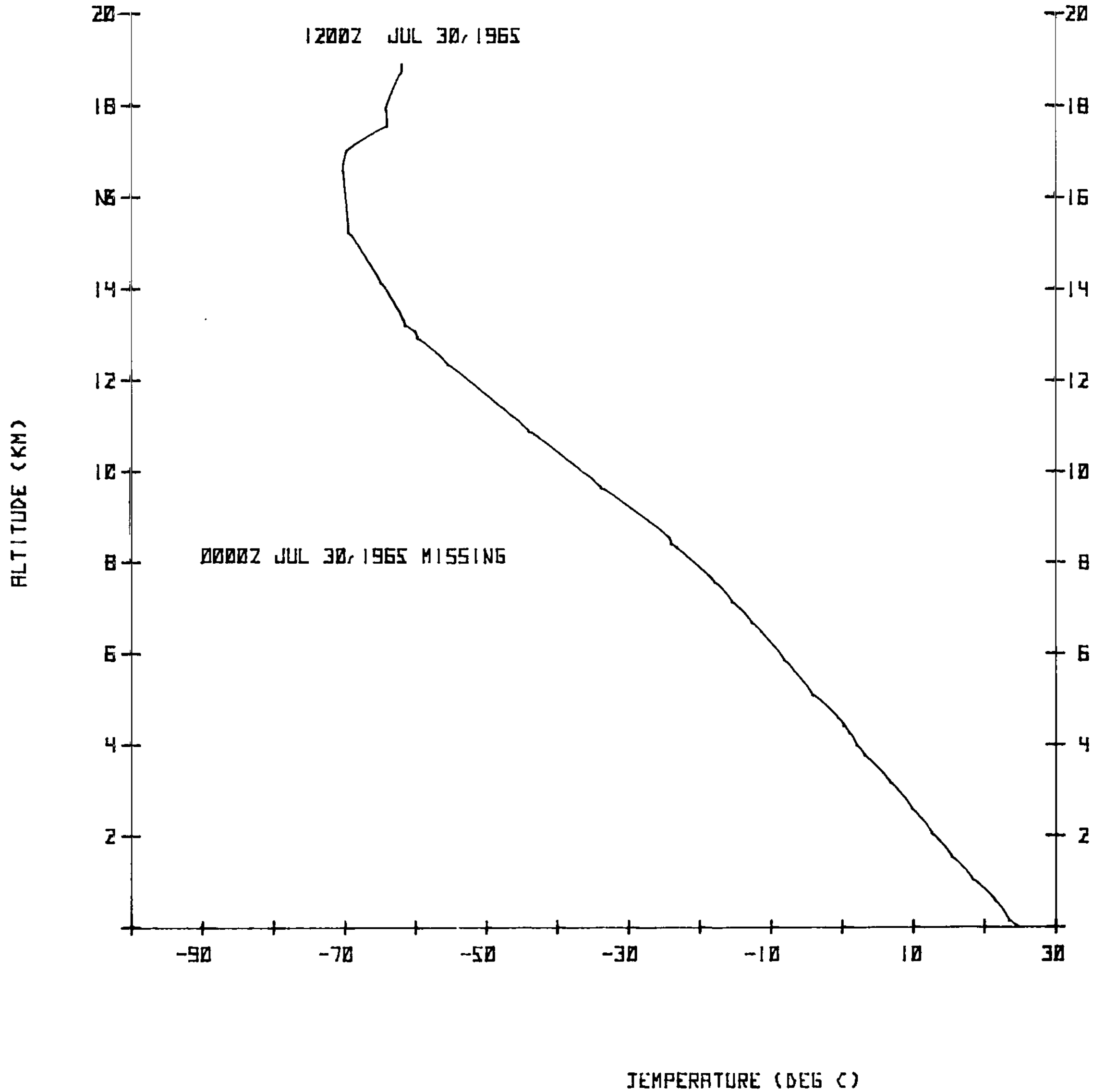
JUL 30, 1965



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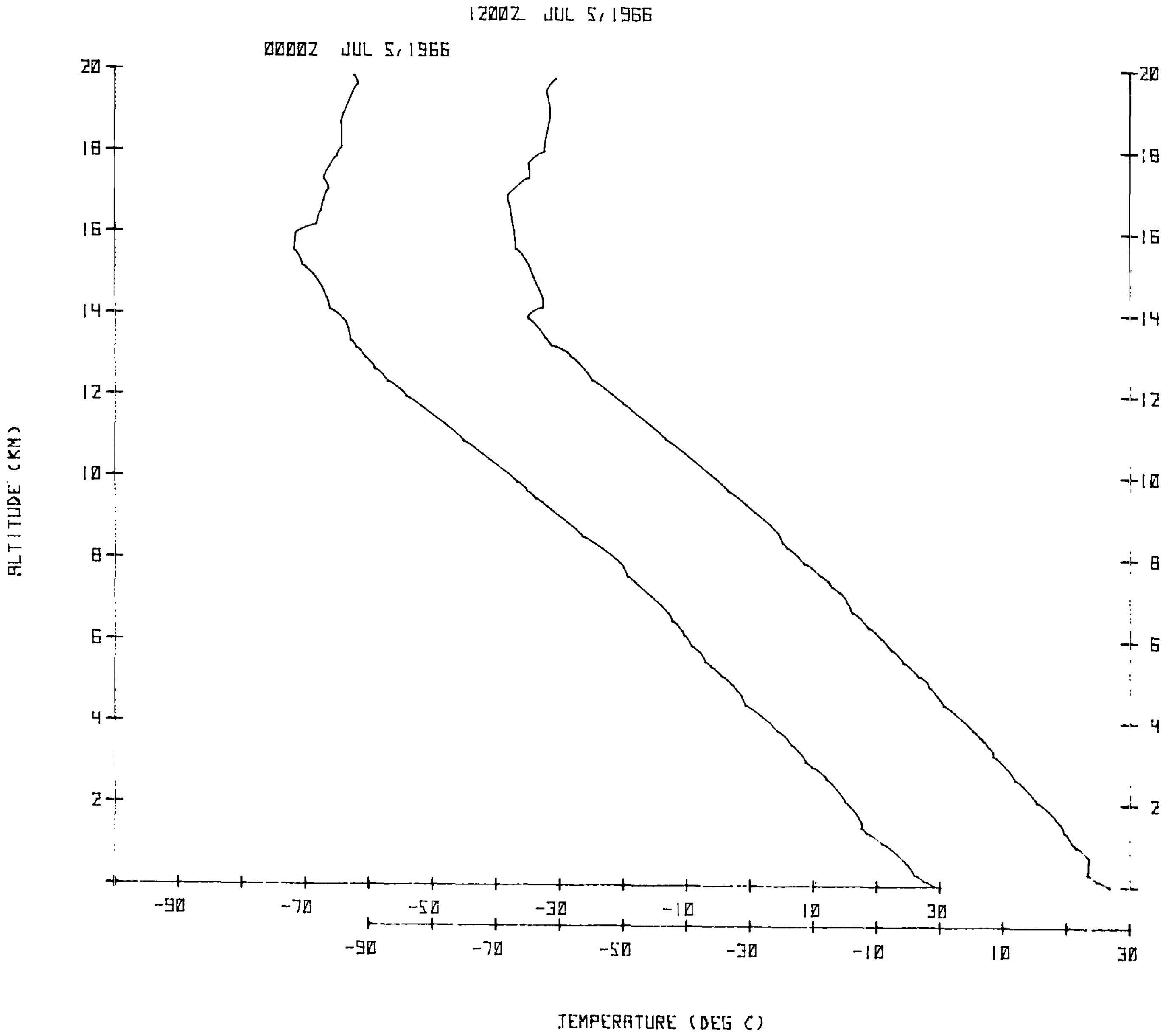
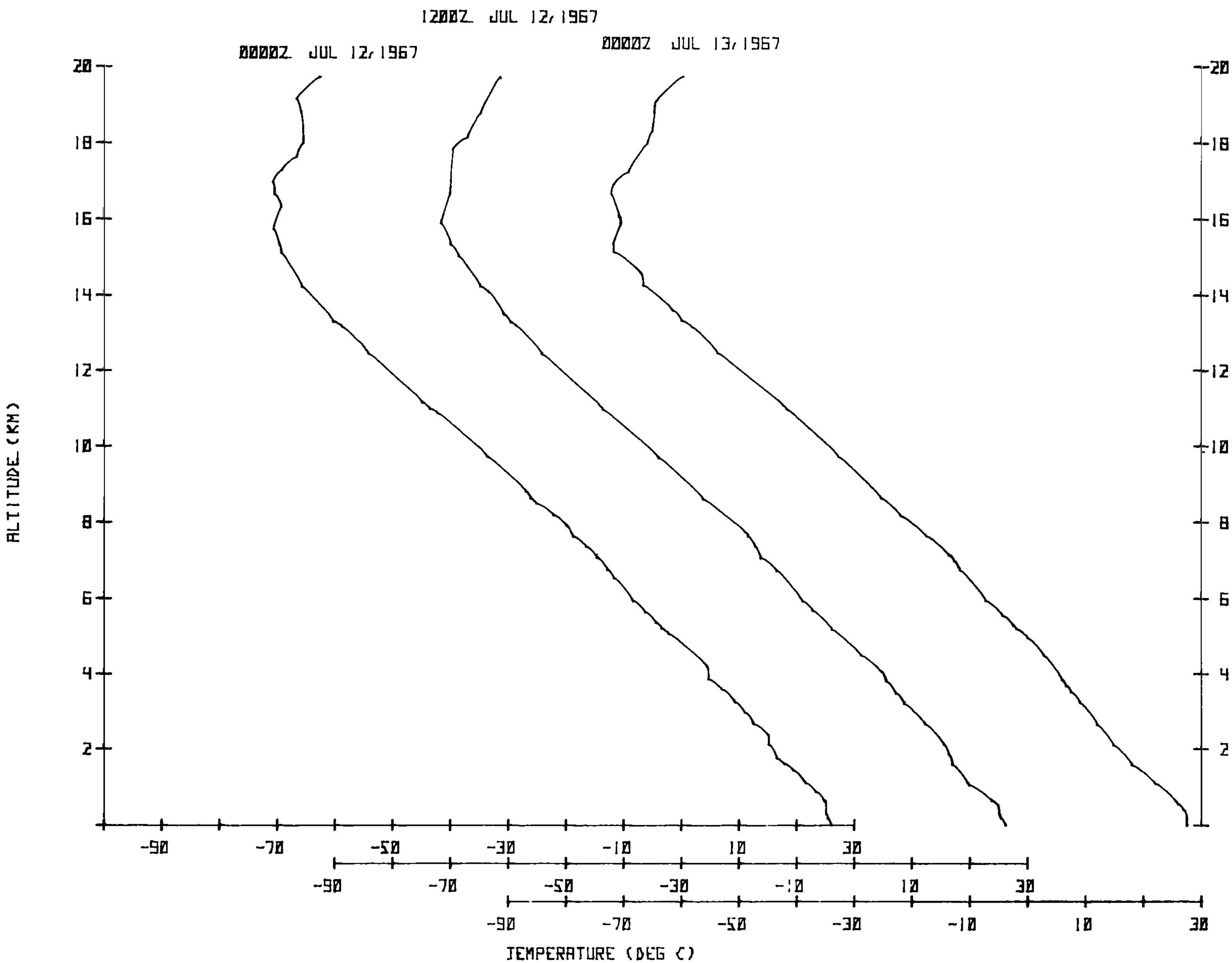
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

JUL 5, 1966



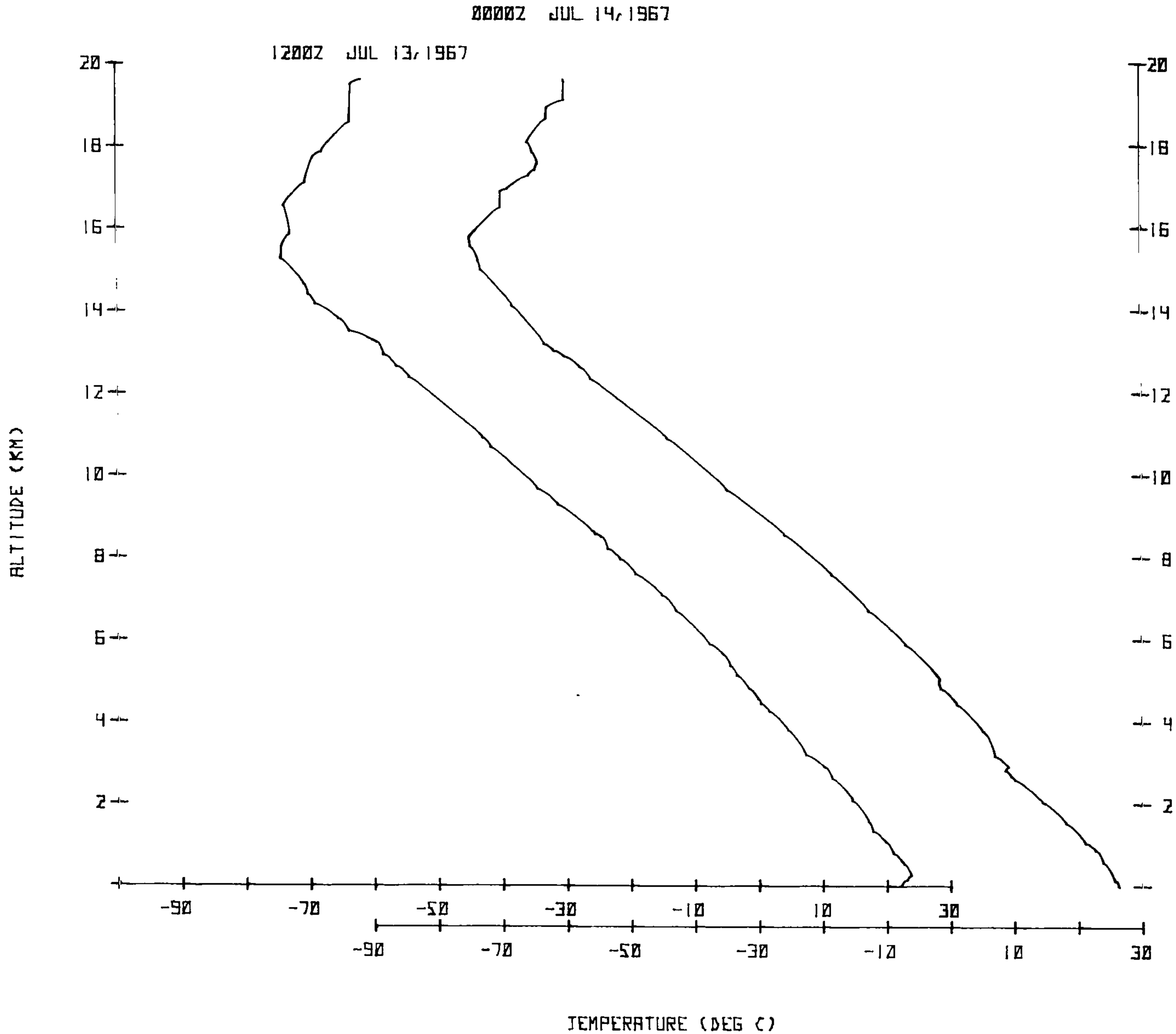
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

JUL 12-13, 1967



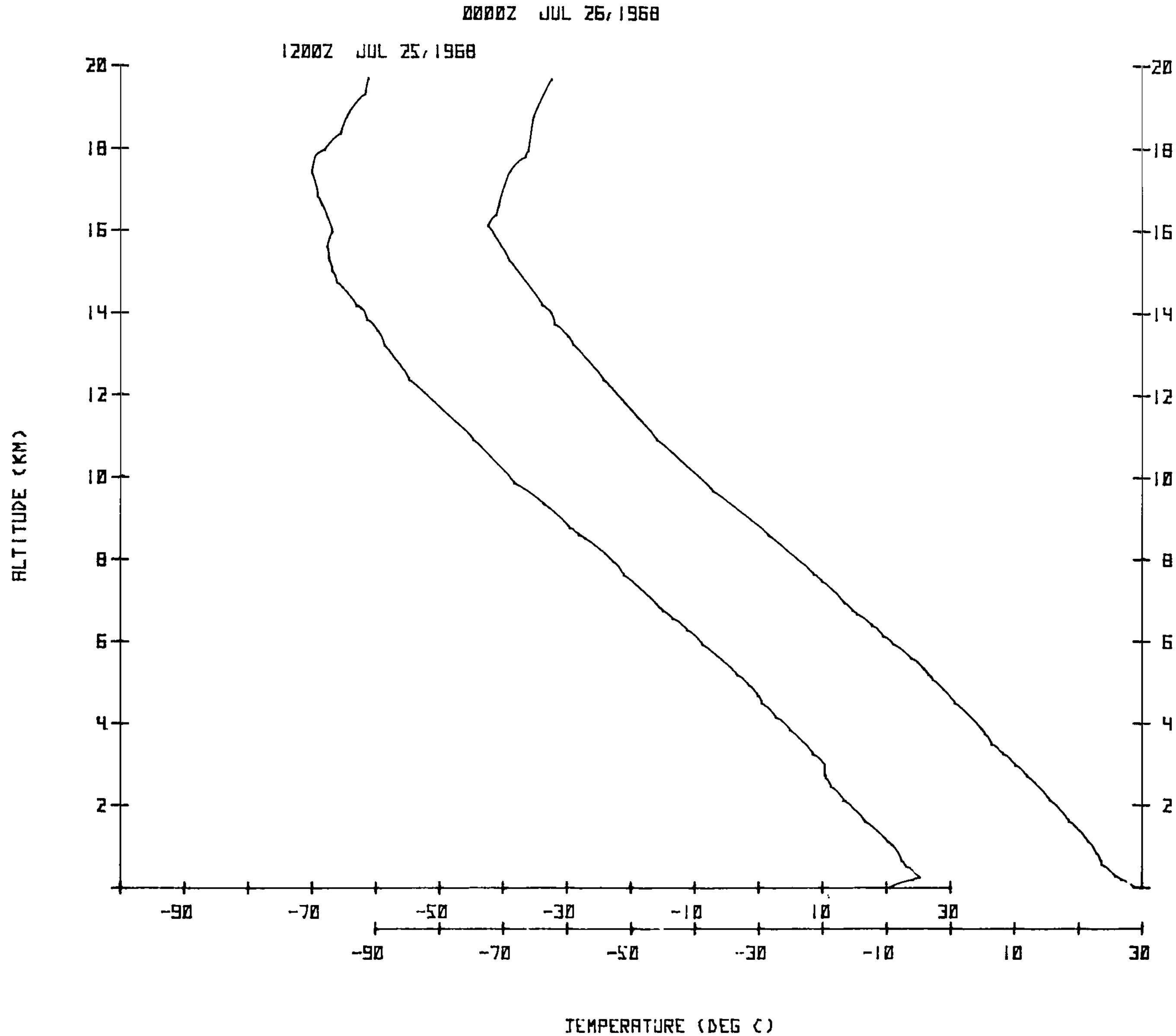
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

JUL 13-14, 1967



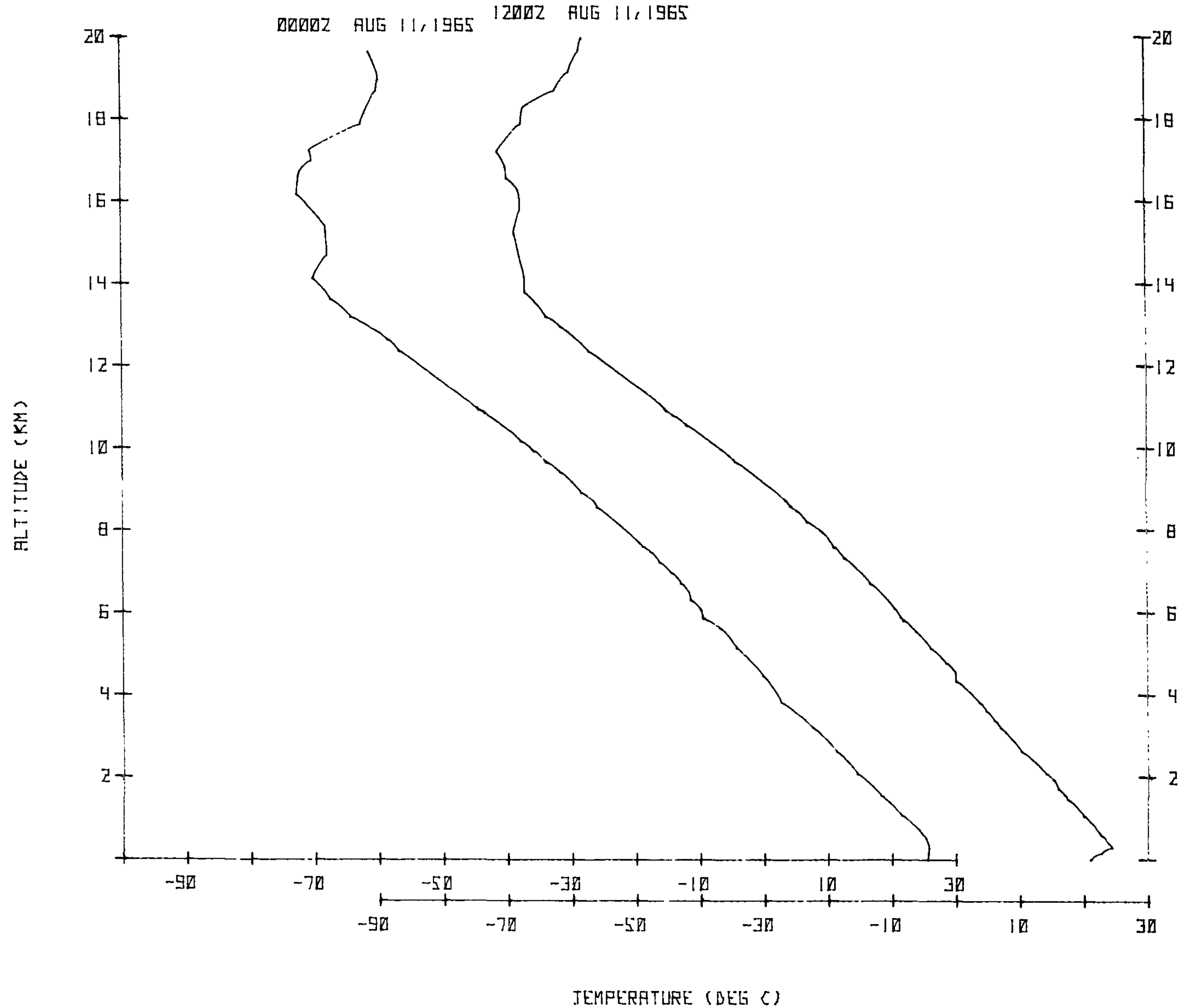
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

JUL 25-26, 1968



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

AUG 11, 1965



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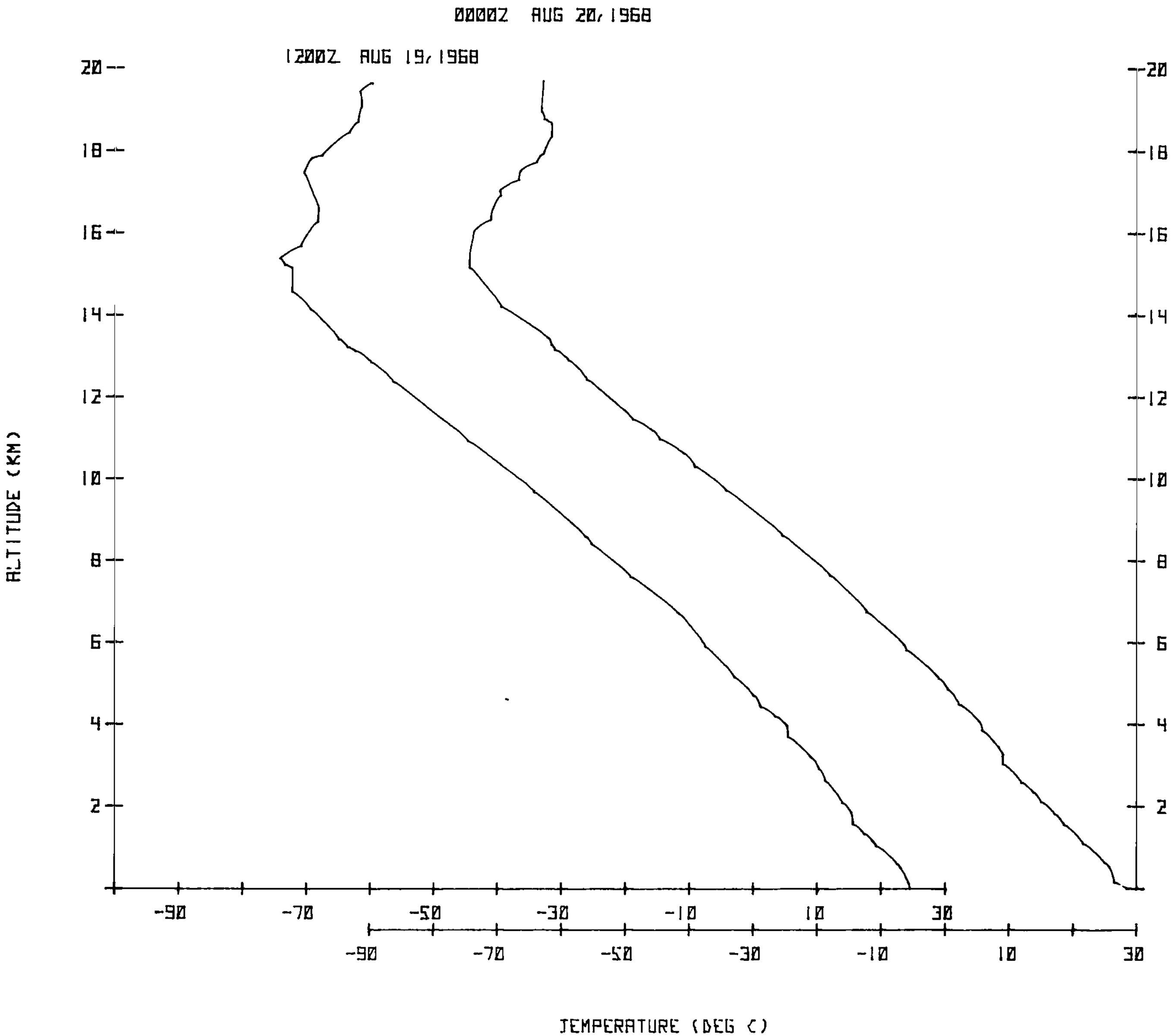
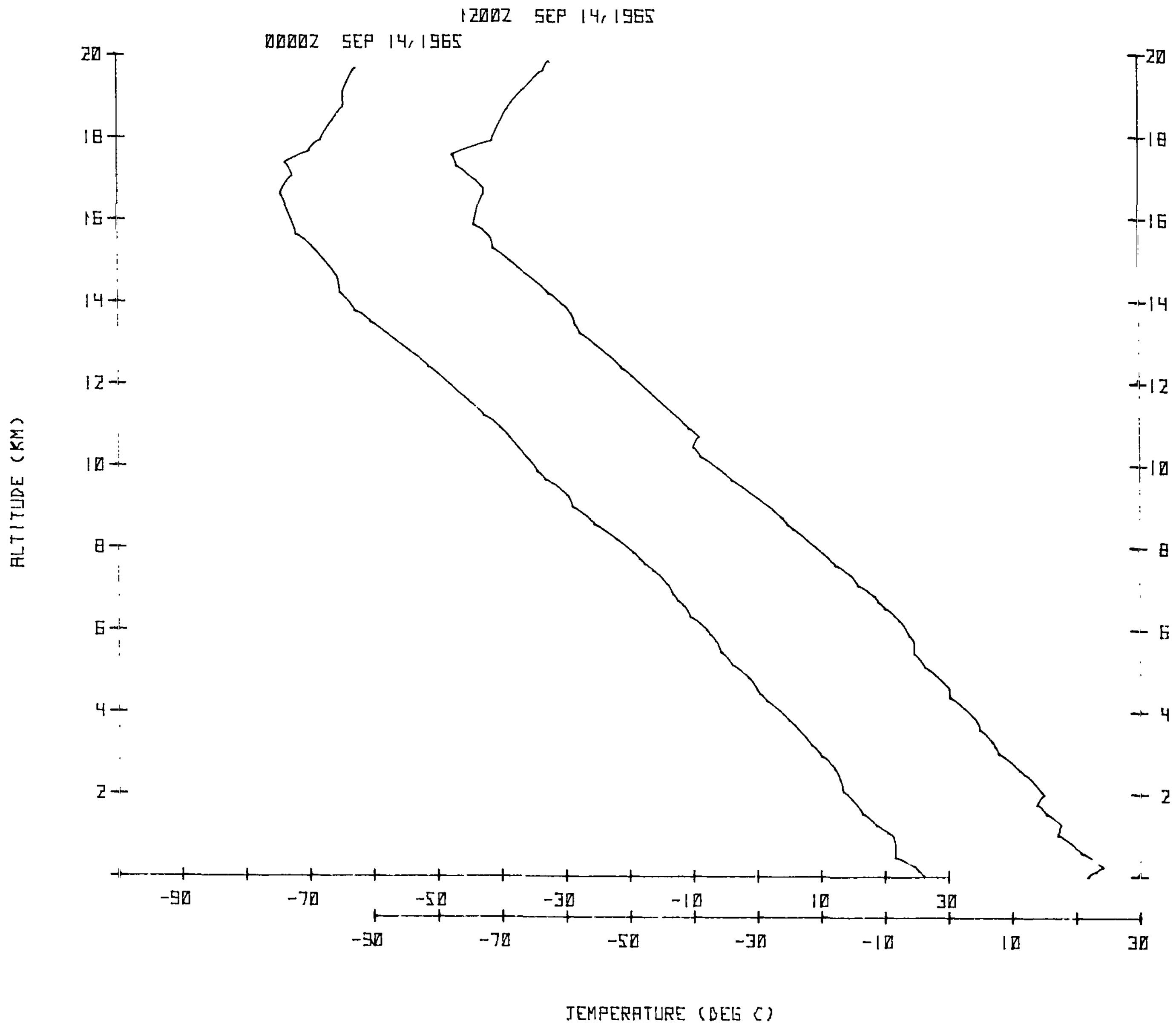
AUG 19-20, 1968



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

SEP 14, 1965



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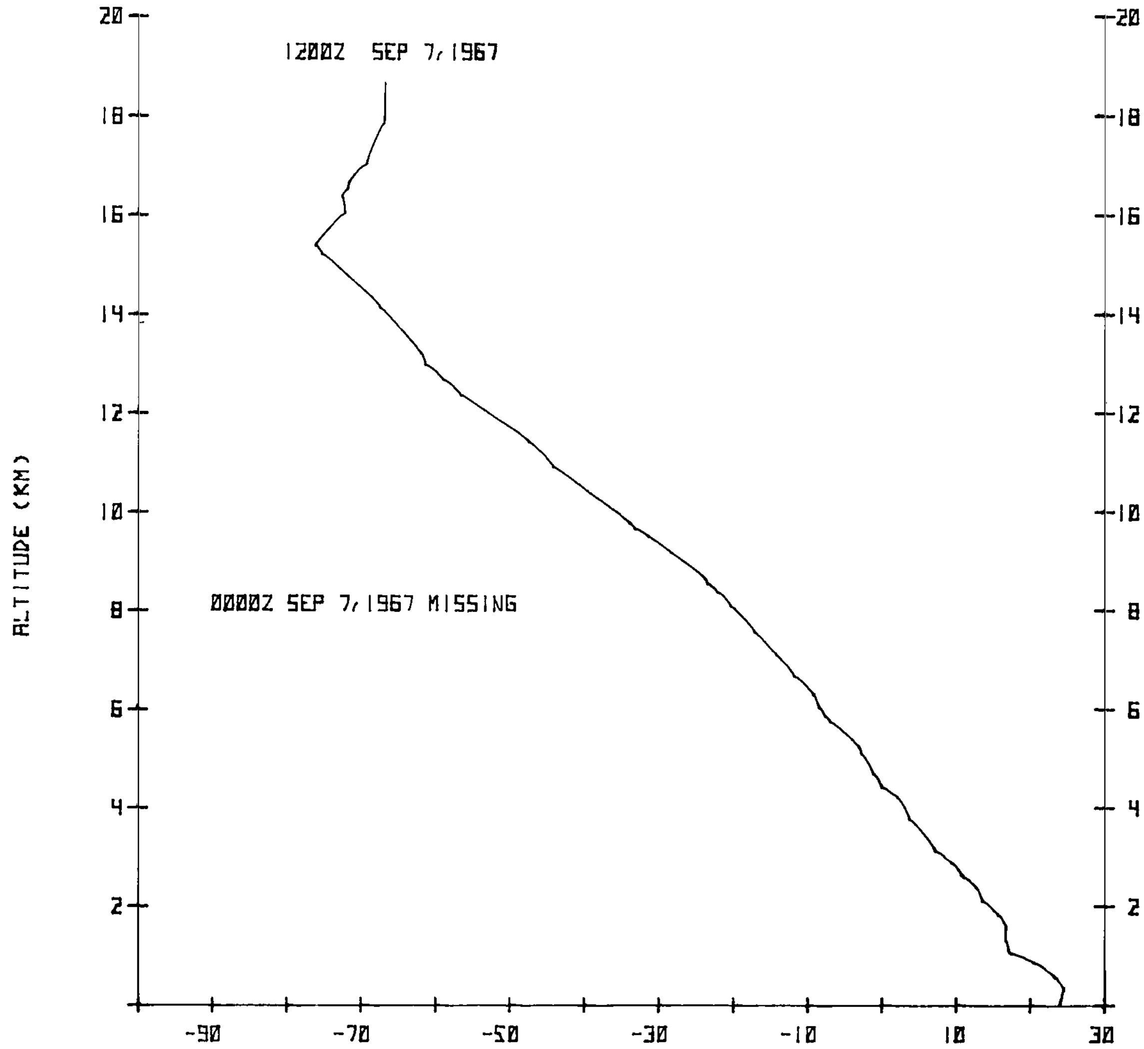
SEP 7, 1967



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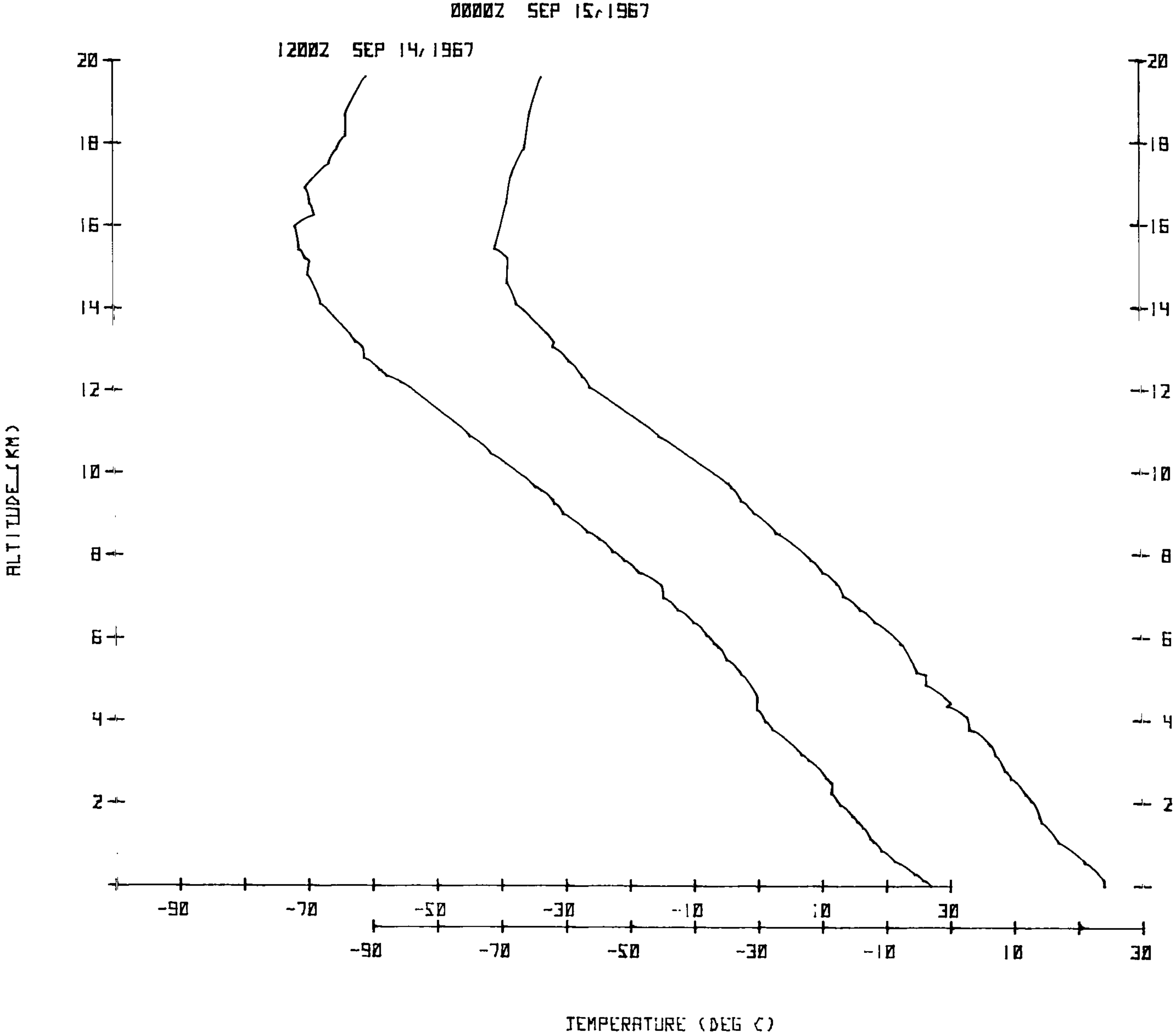
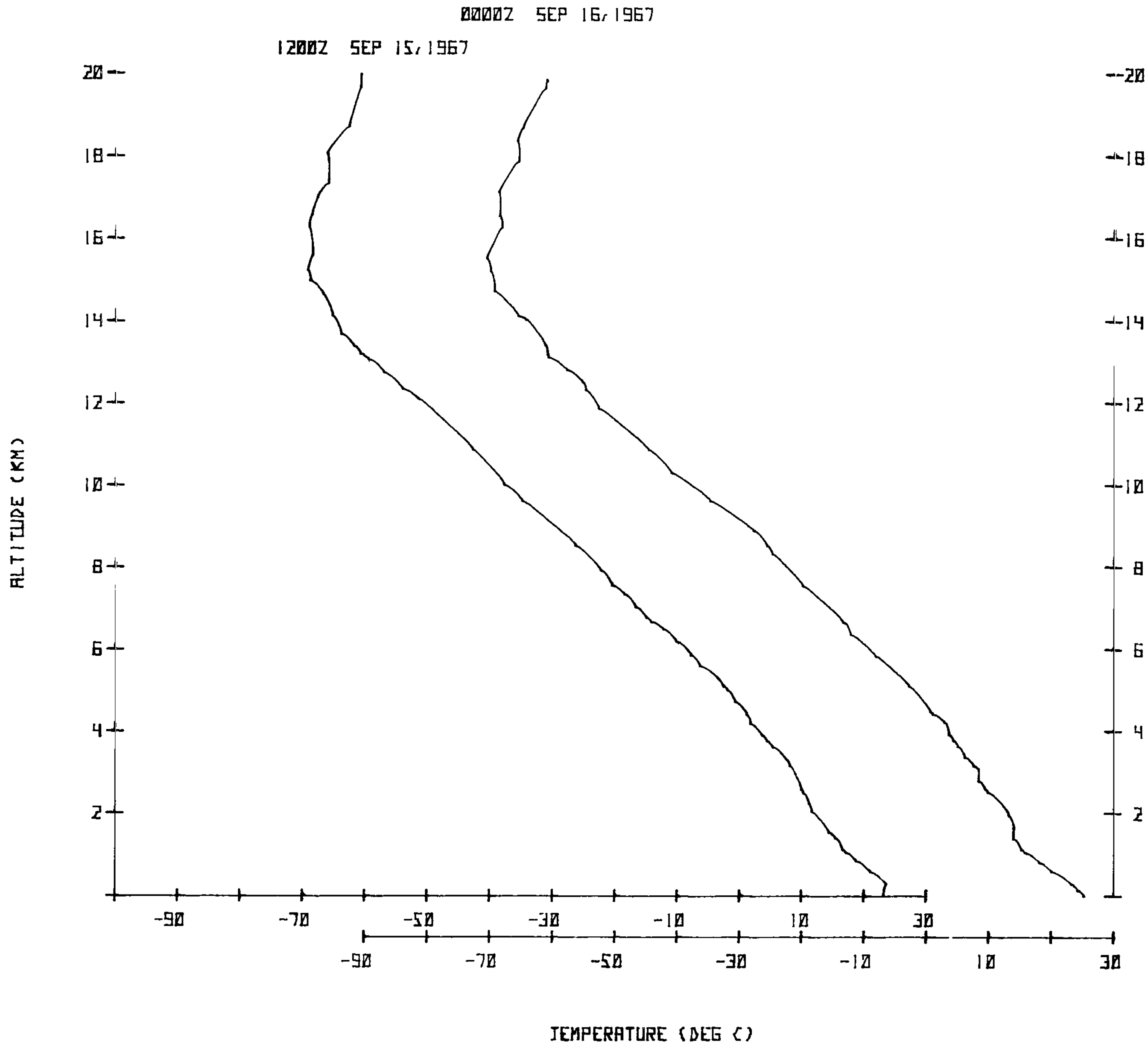


50

CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

SEP 15-16, 1967



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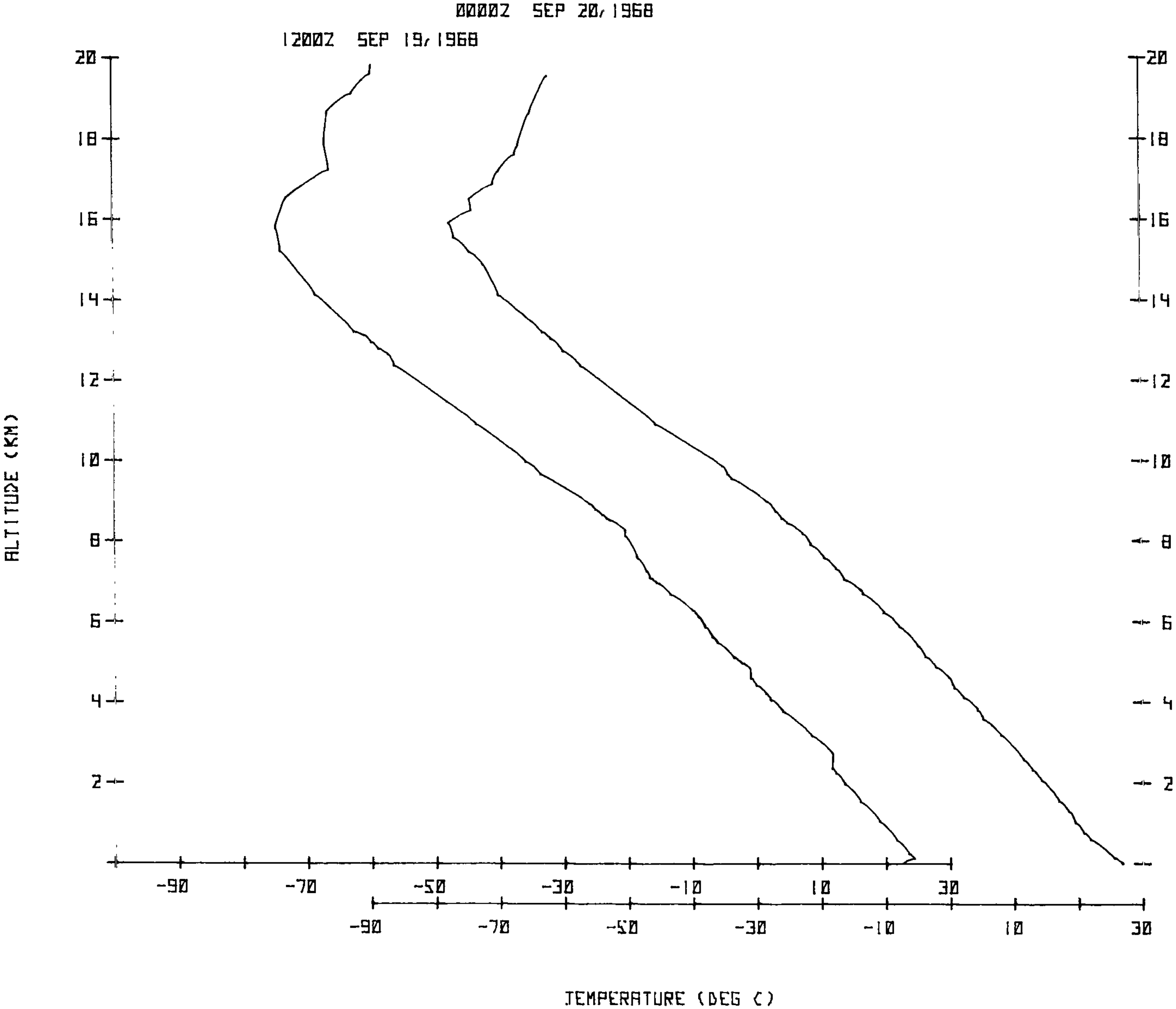

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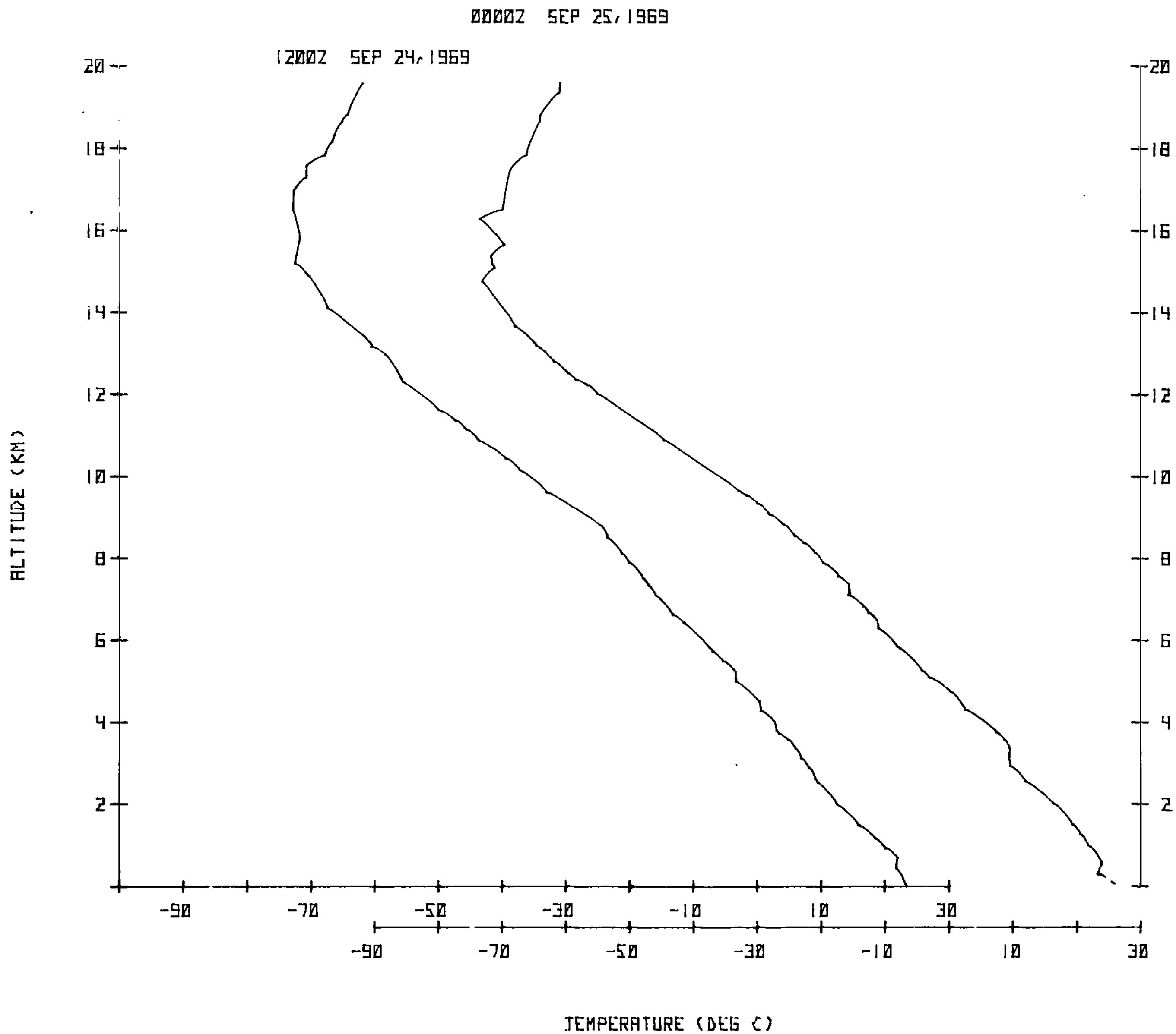
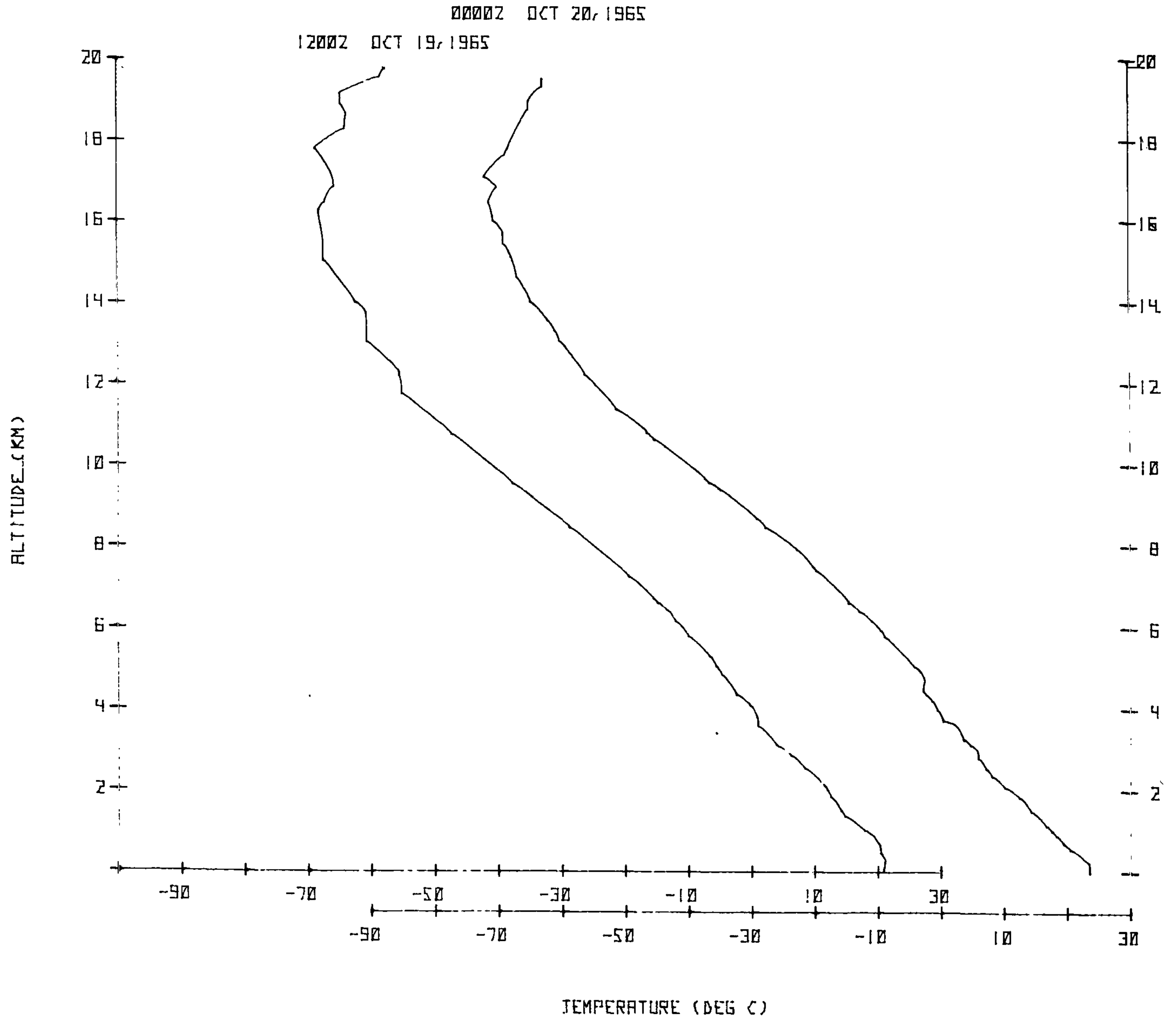
SEP 24-25, 1969



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

OCT 19-20, 1965



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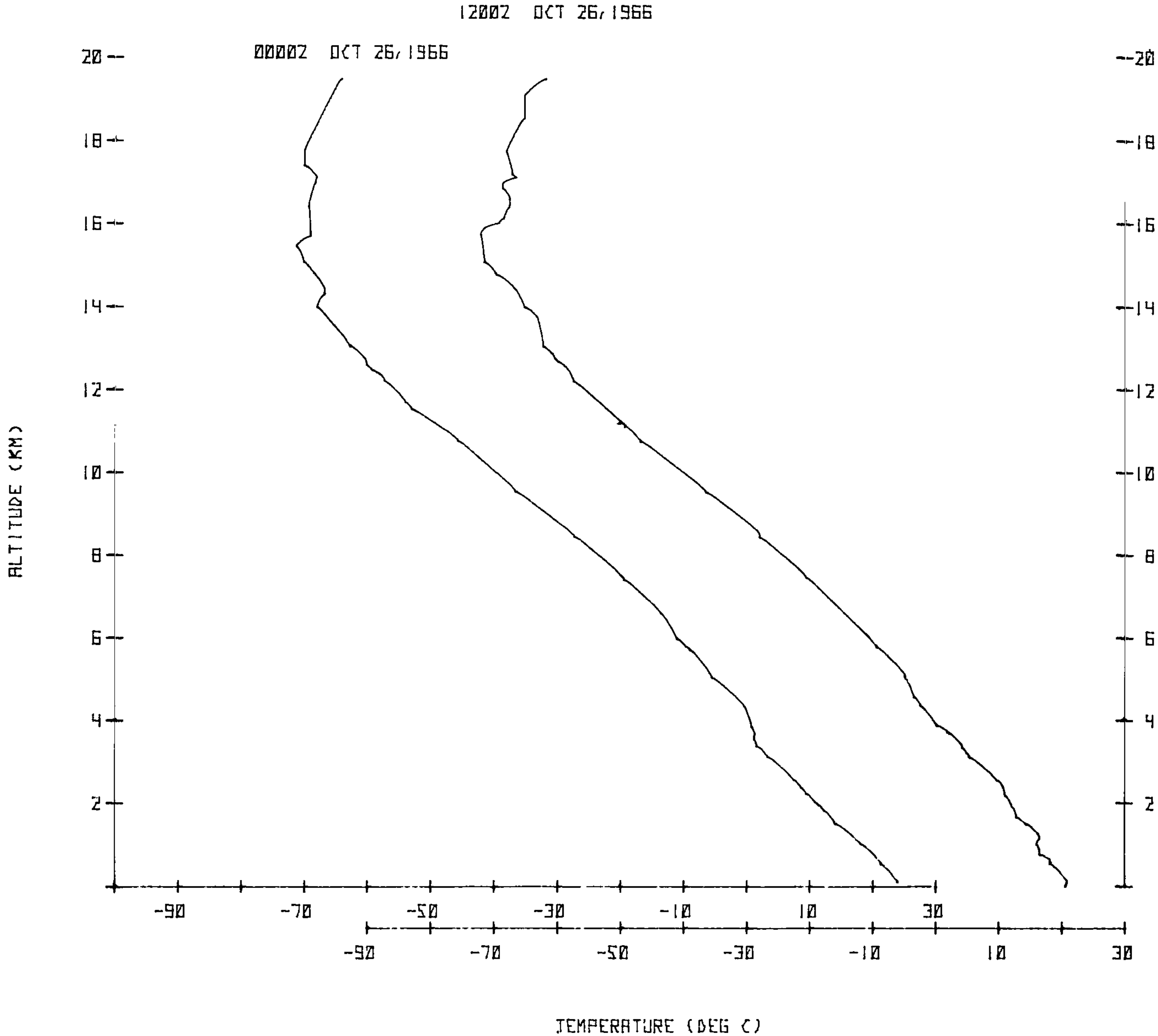
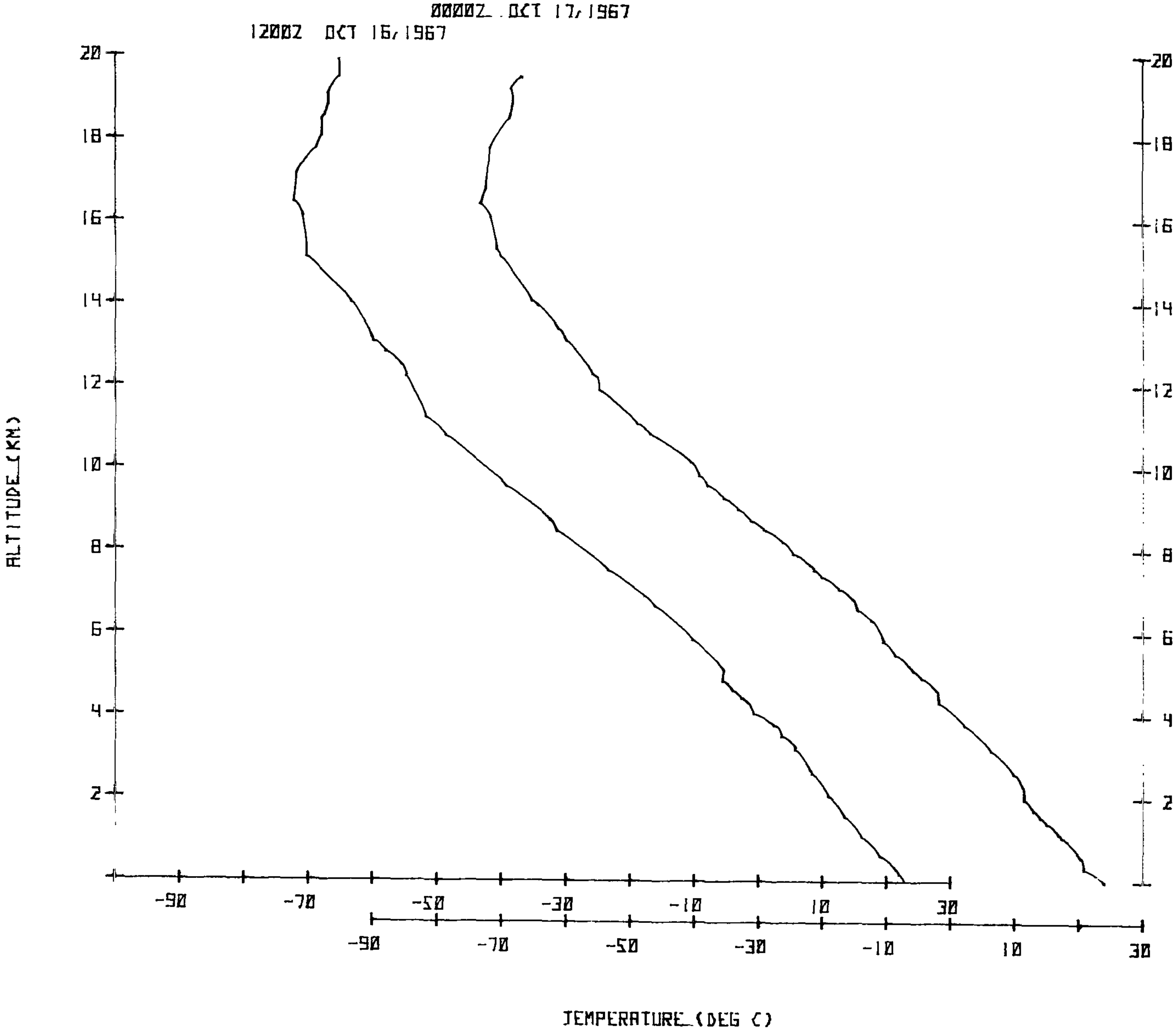
OCT 26, 1966



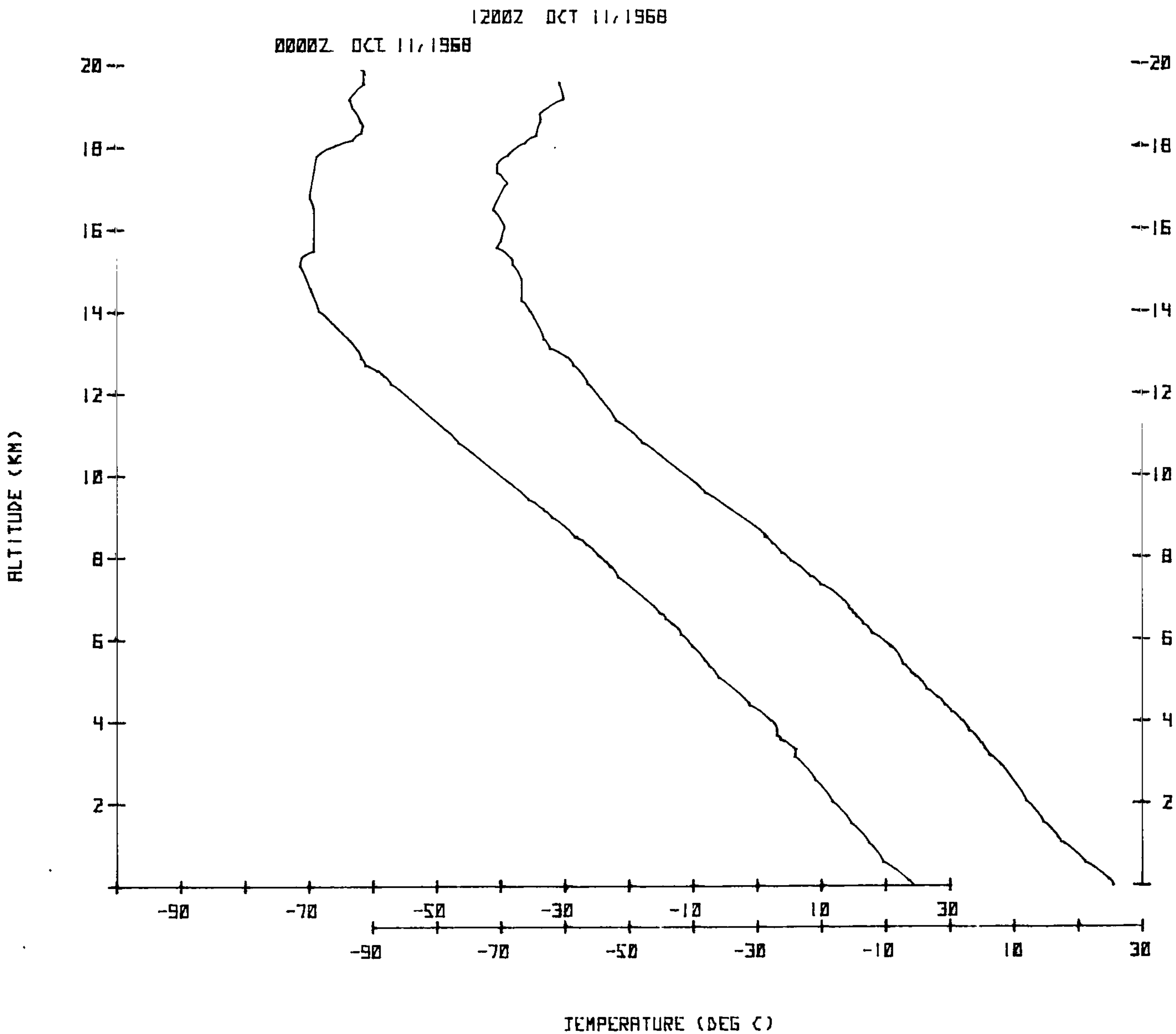
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

OCT 16-17, 1967



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

OCT 11, 1968



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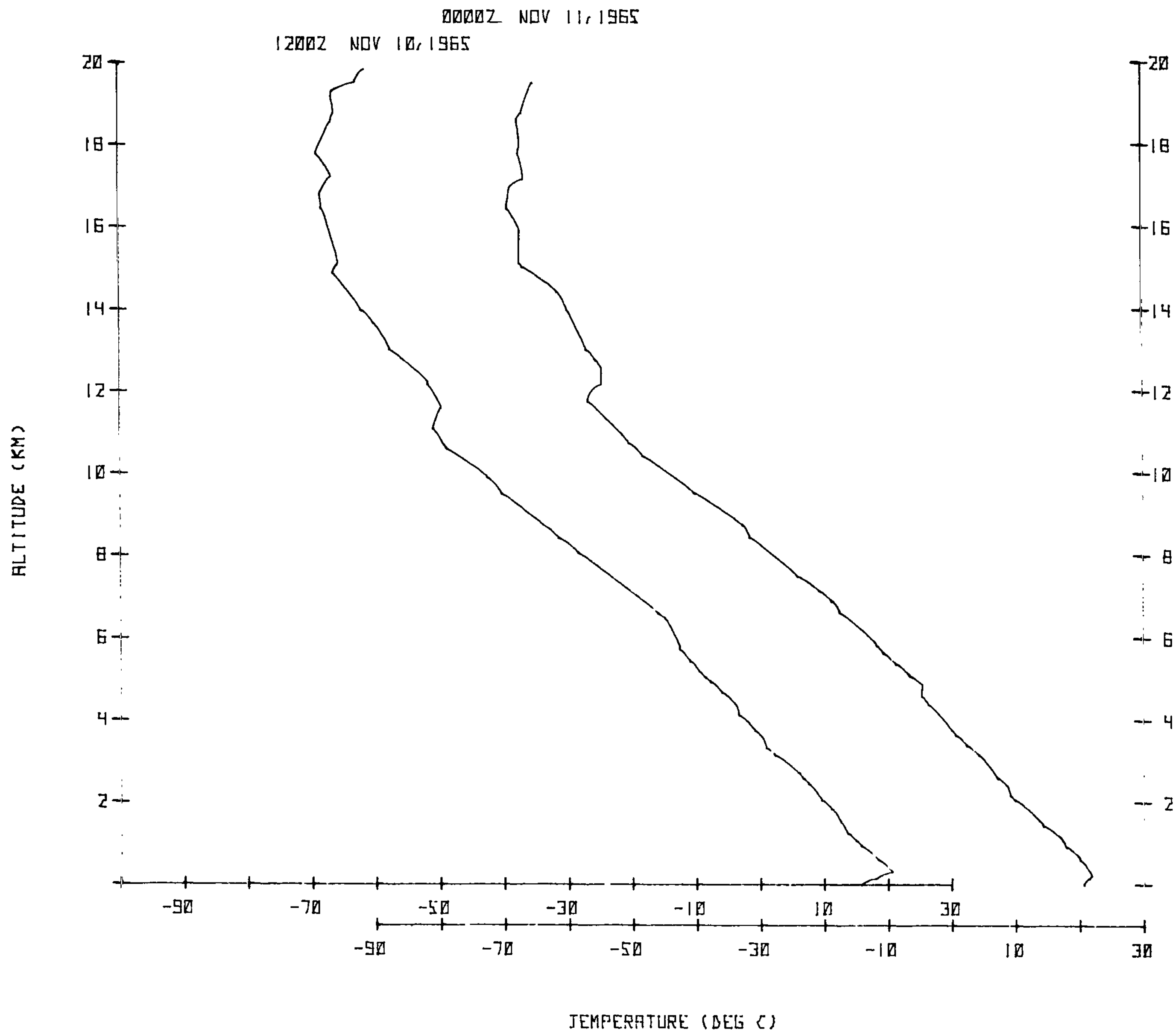
NOV 10-11, 1965



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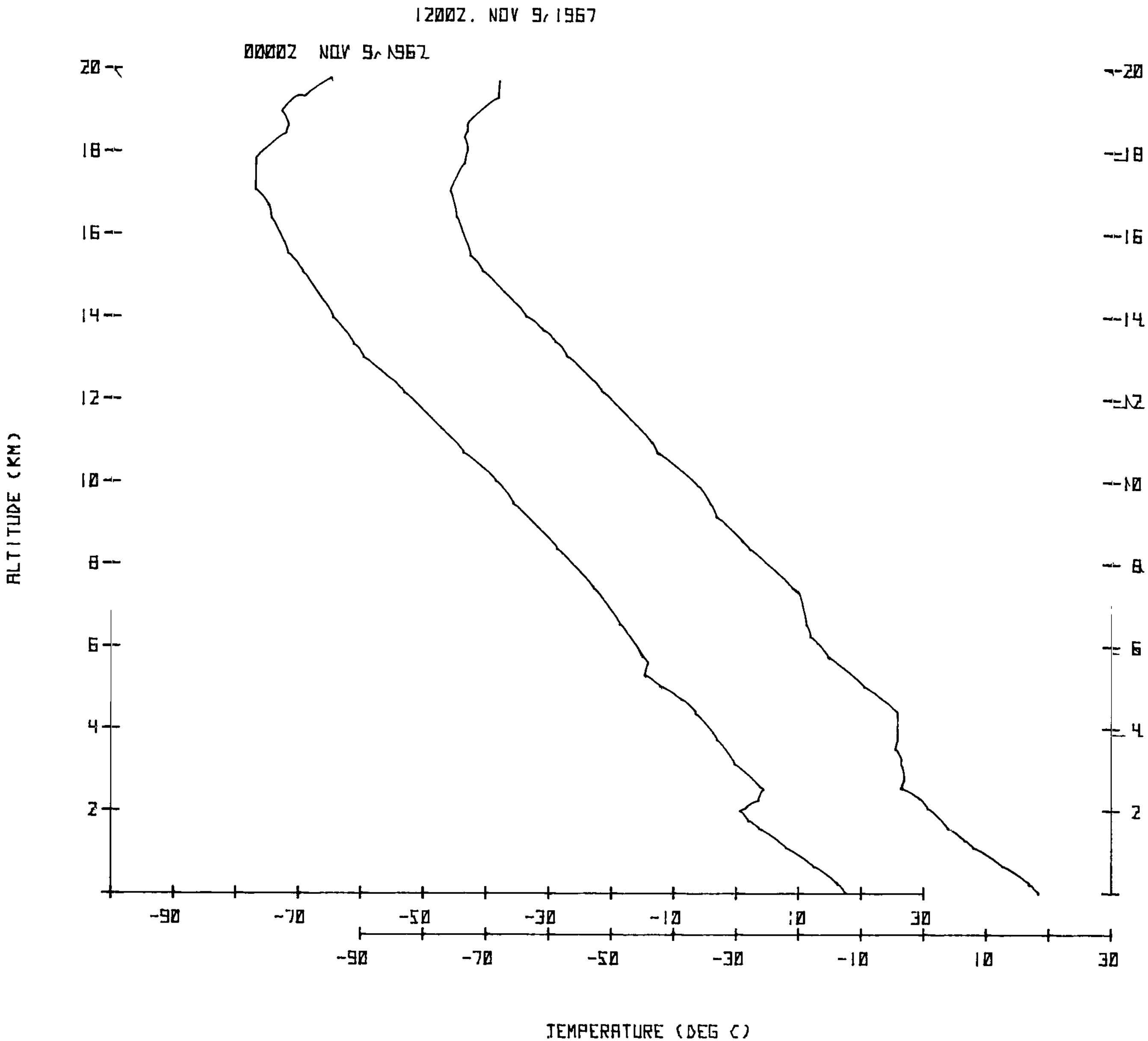

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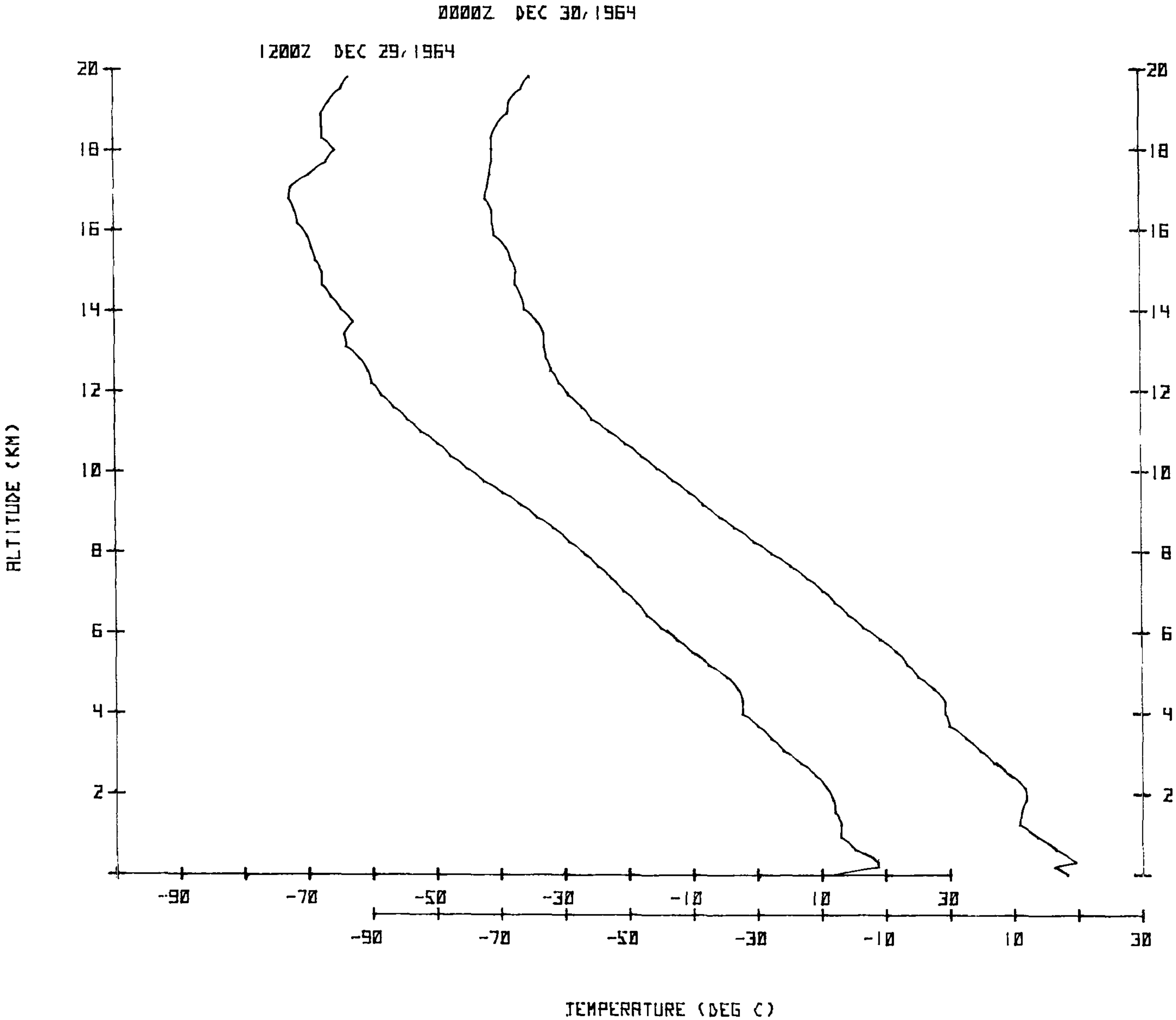
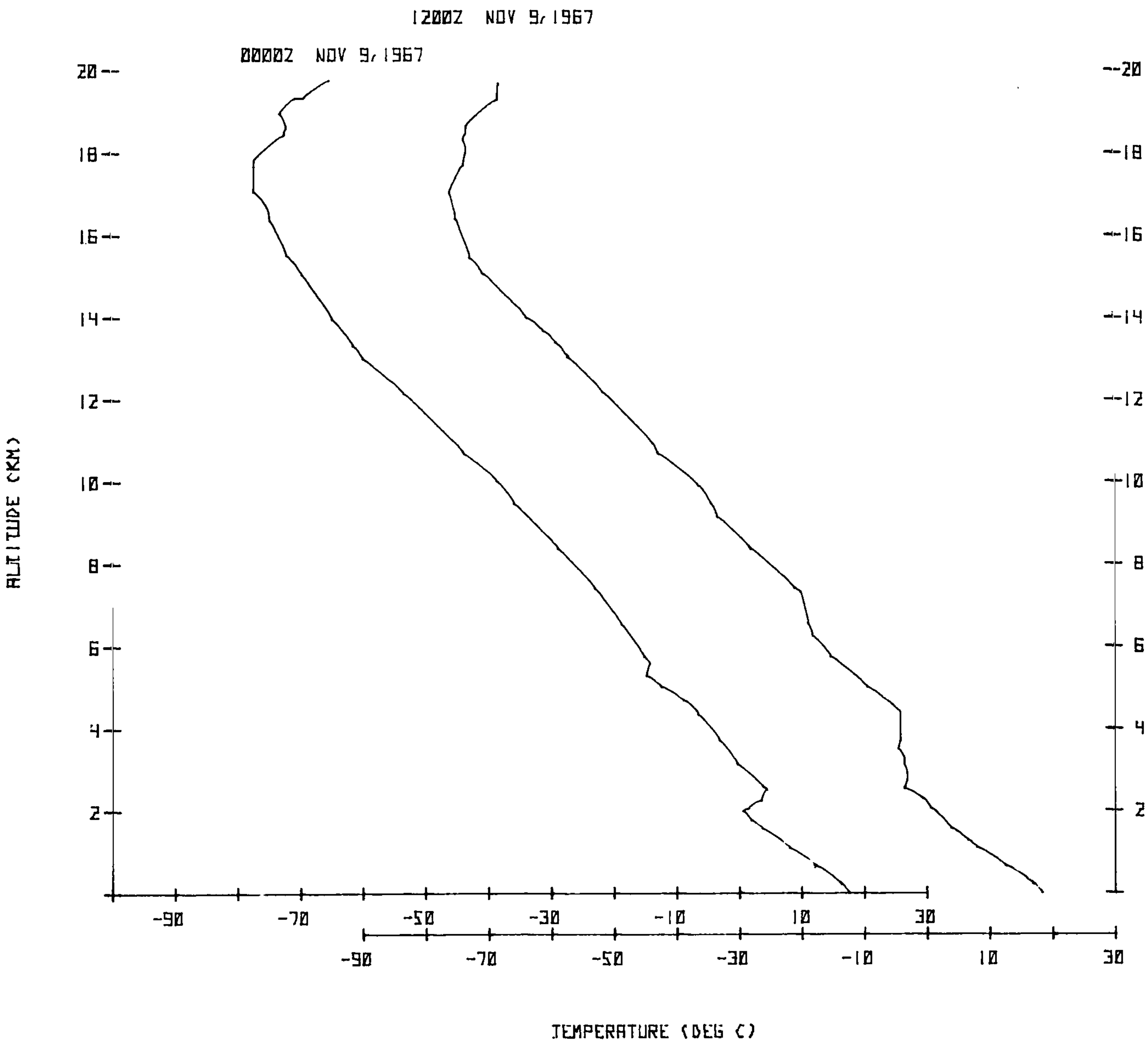
DEC 29-30, 1964



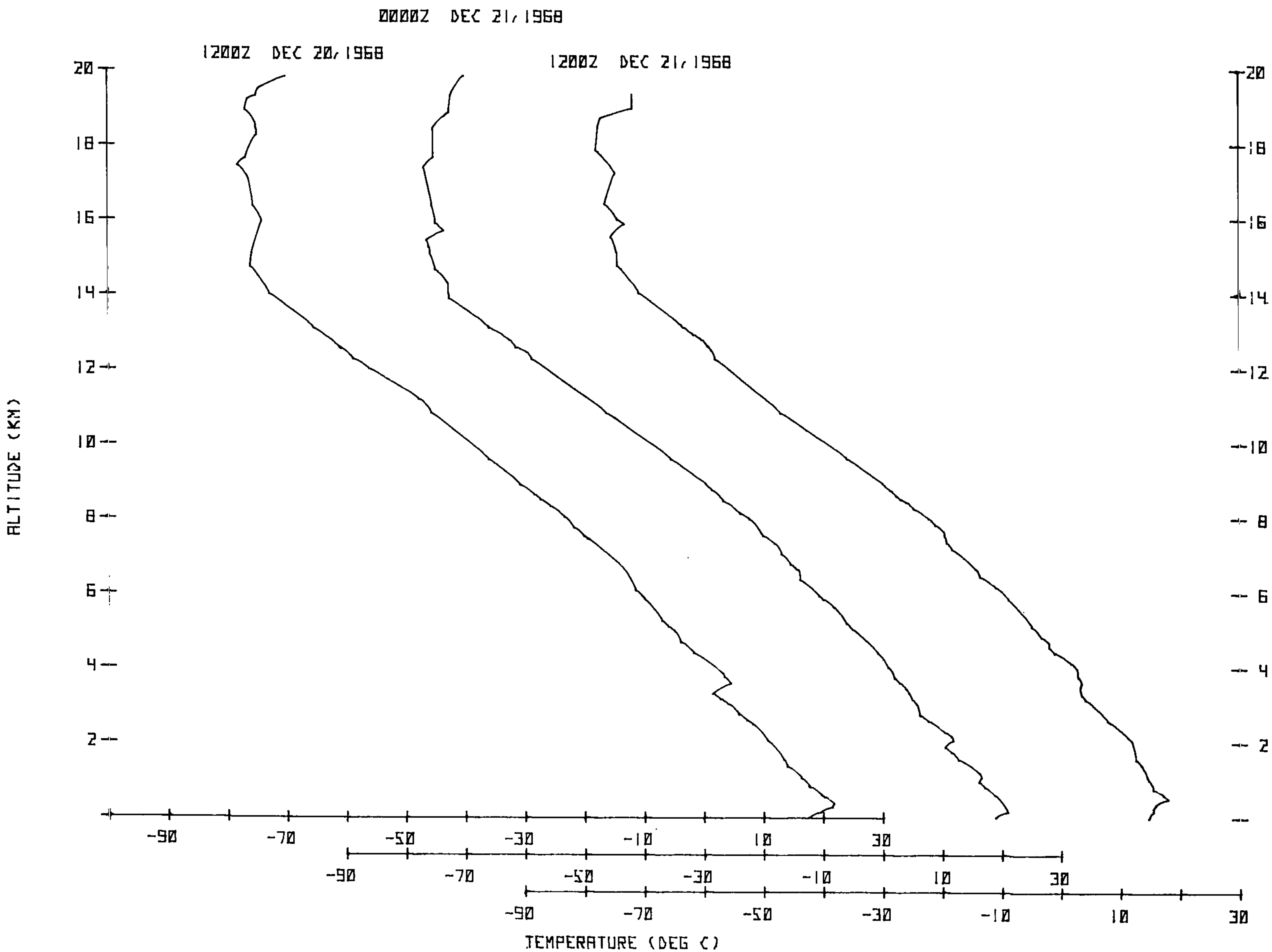
CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

DEC 18-19, 1967



CAPE KENNEDY RADIOSONDE TEMPERATURE PROFILE DATA

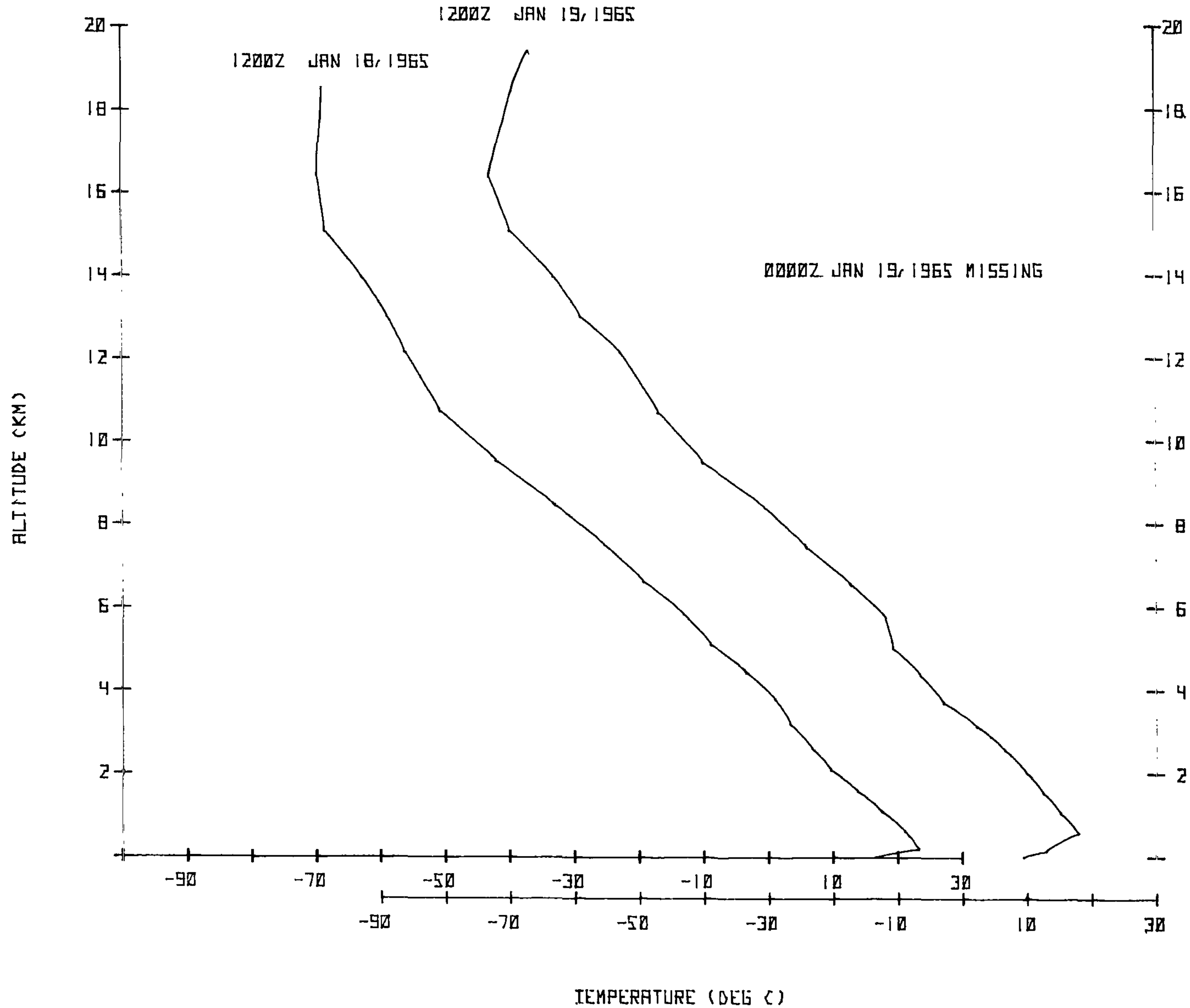
DEC 20-21, 1968



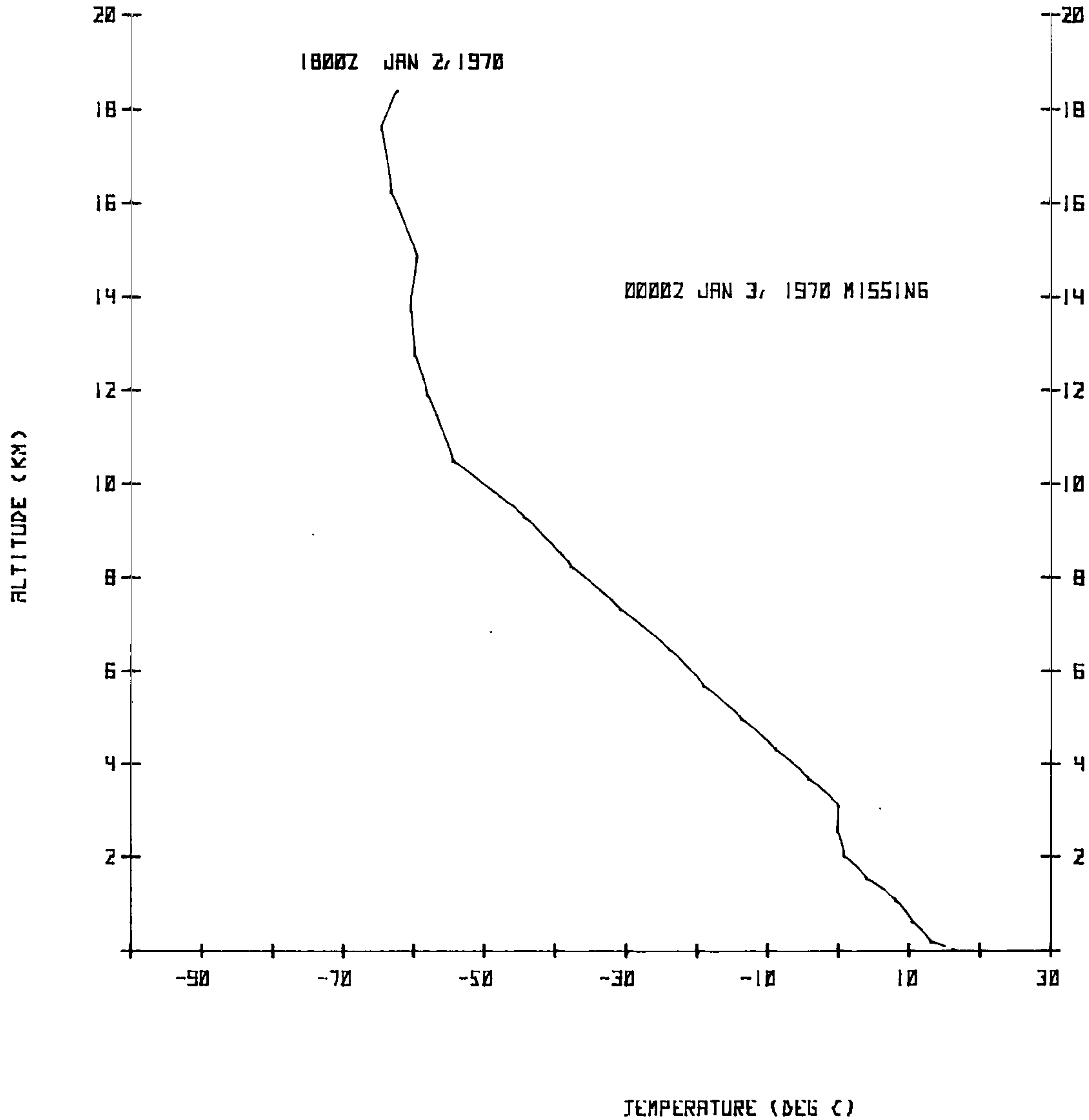
Point Mugu, California Radiosonde Temperature Profile Data

PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA

JAN 18-19, 1965



PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA
JAN 2-3, 1970



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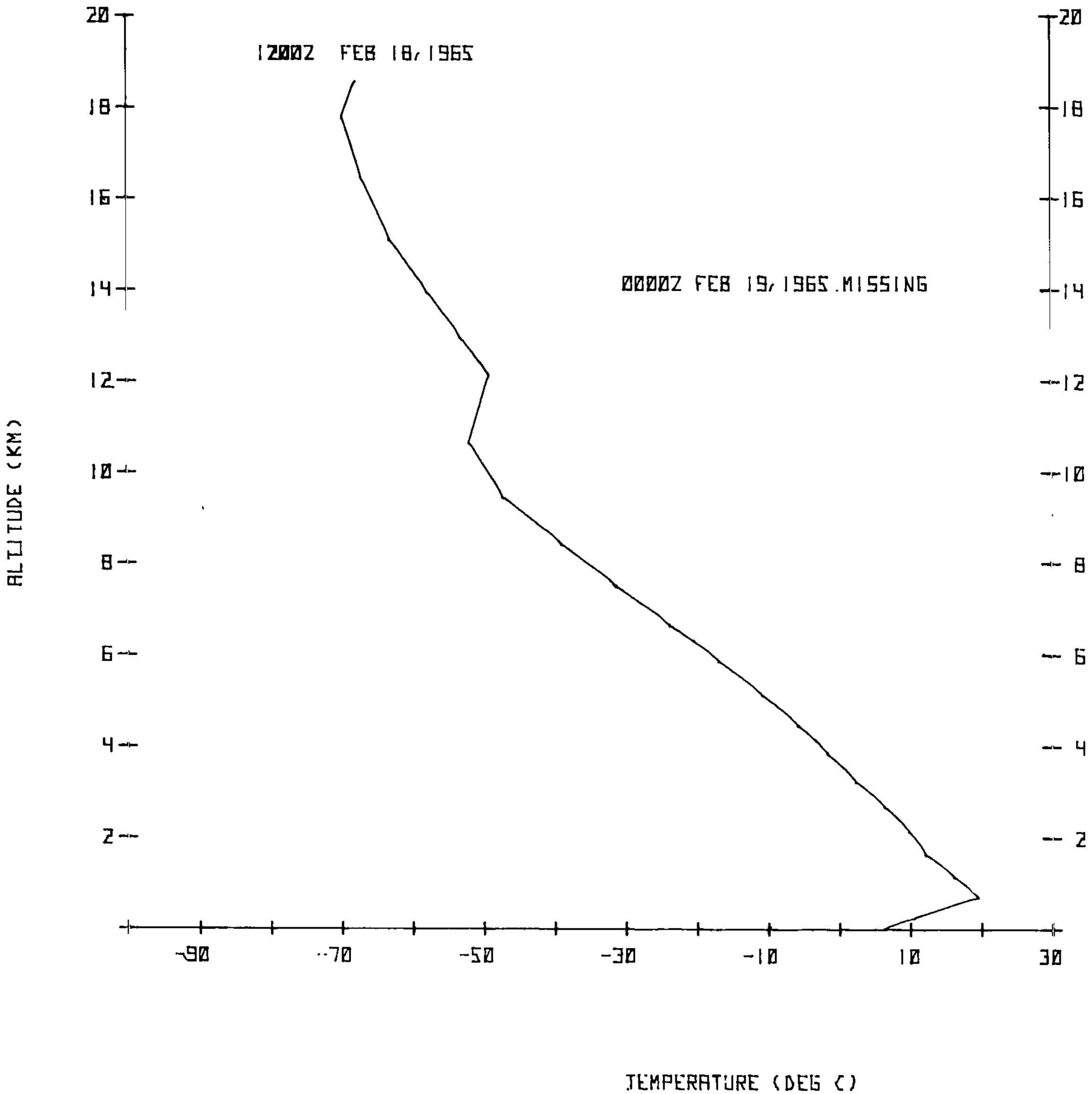
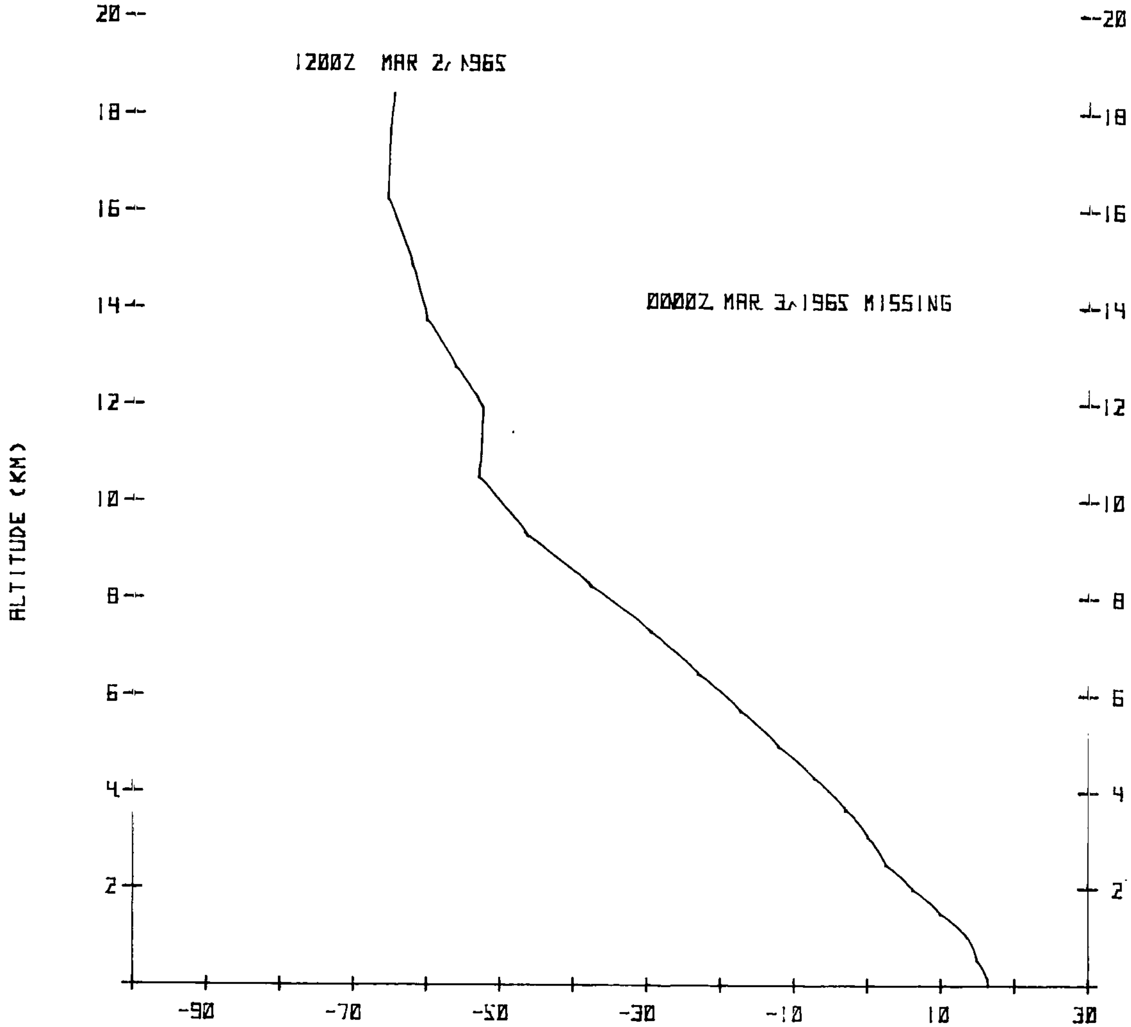
PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA

FEB 18-19, 1965



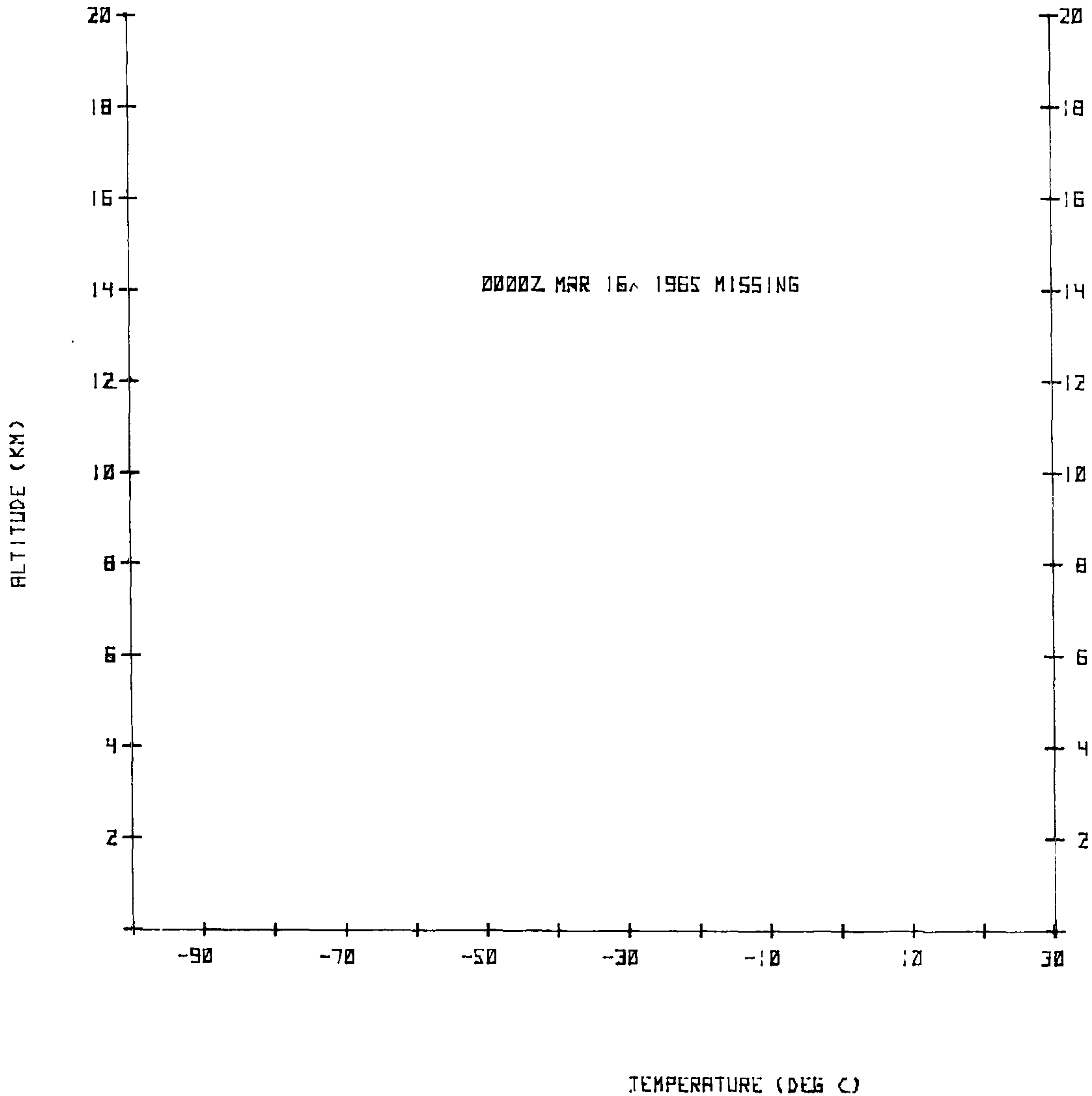
PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA

MAR 2-3, 1965



PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA

MAR 16, 1965



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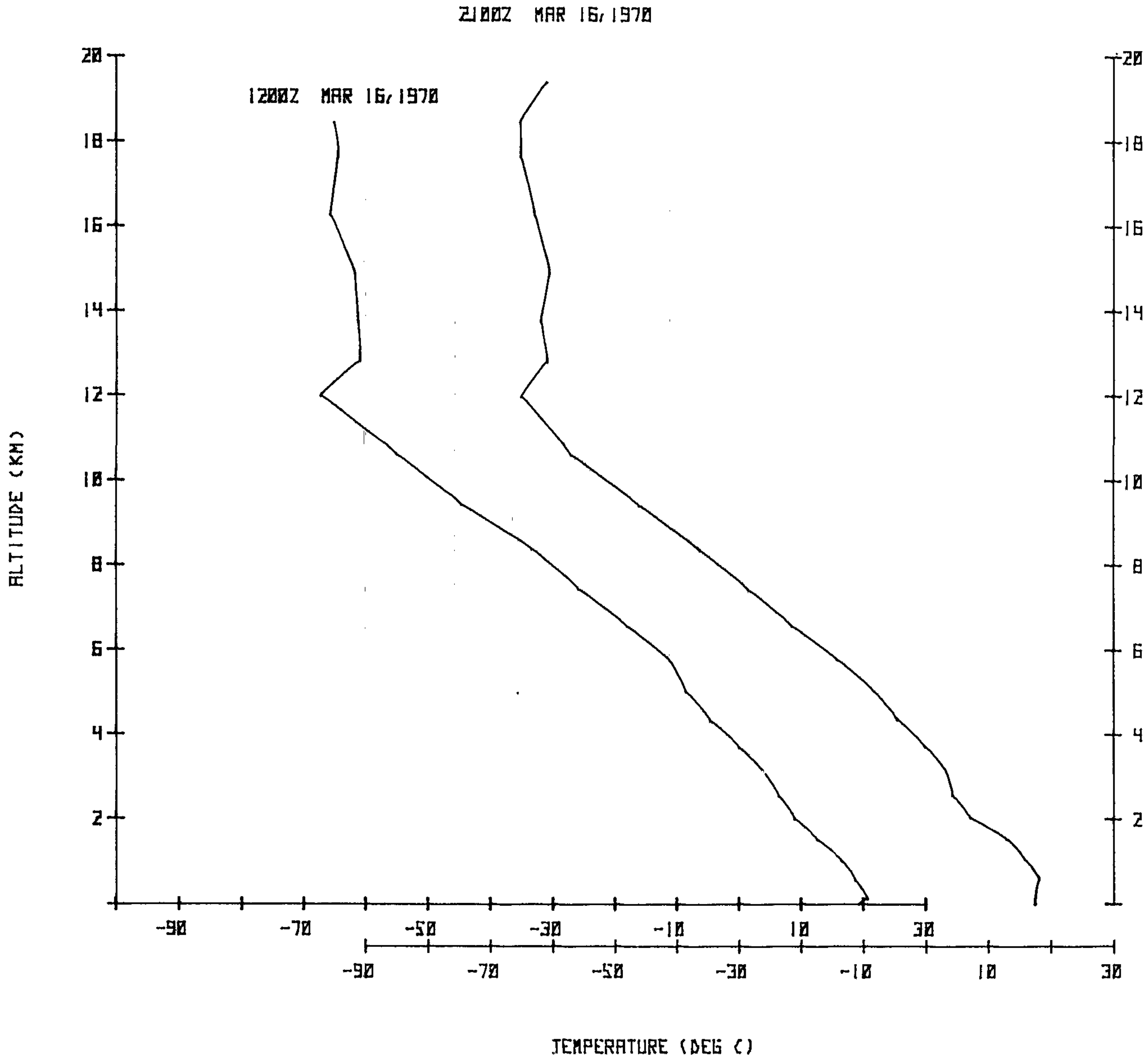
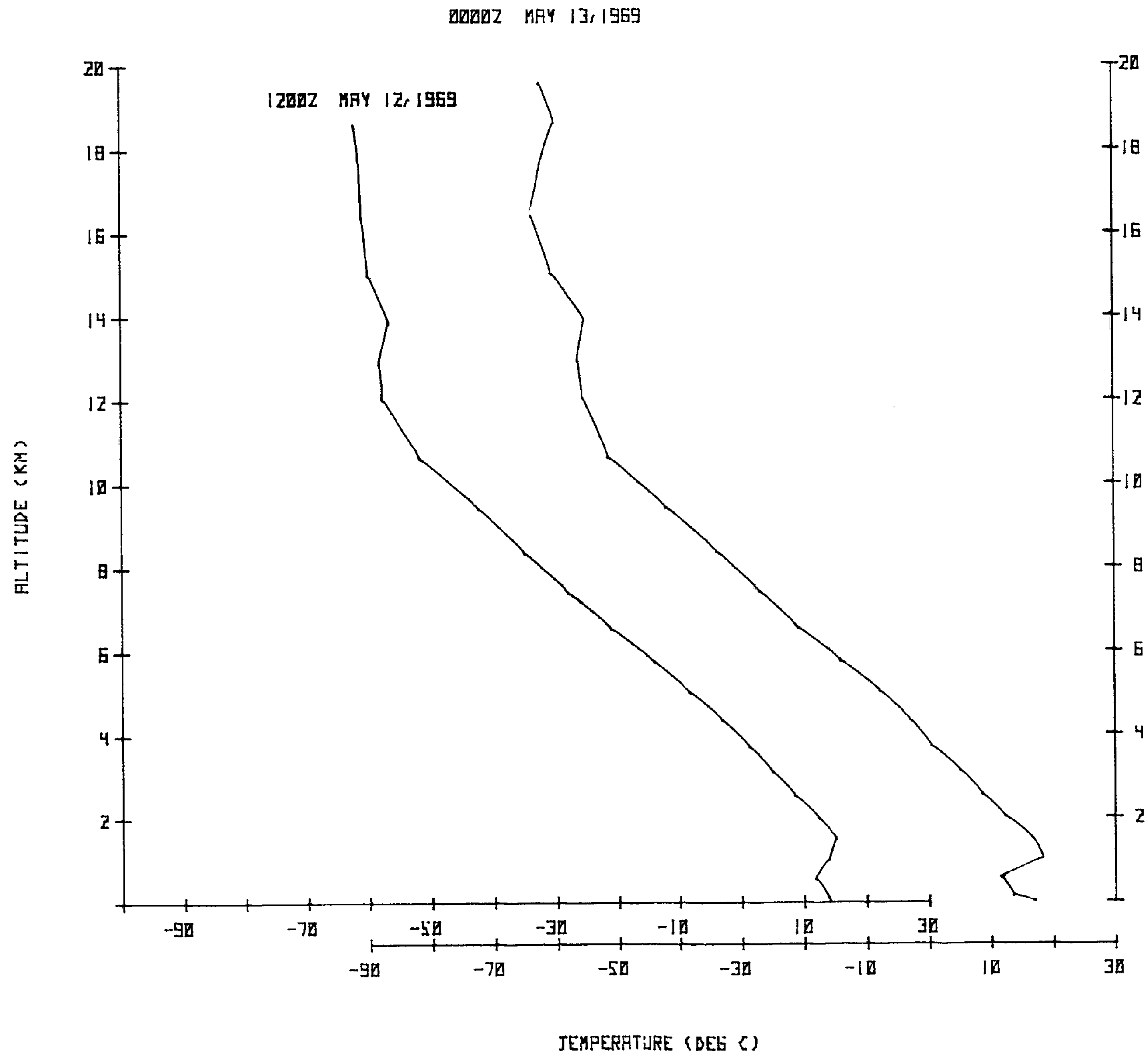
MAR 16-17, 1970



PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA
MAY 12-13, 1969



PT. MUGU RADIOSONDE TEMPERATURE PROFILE DATA
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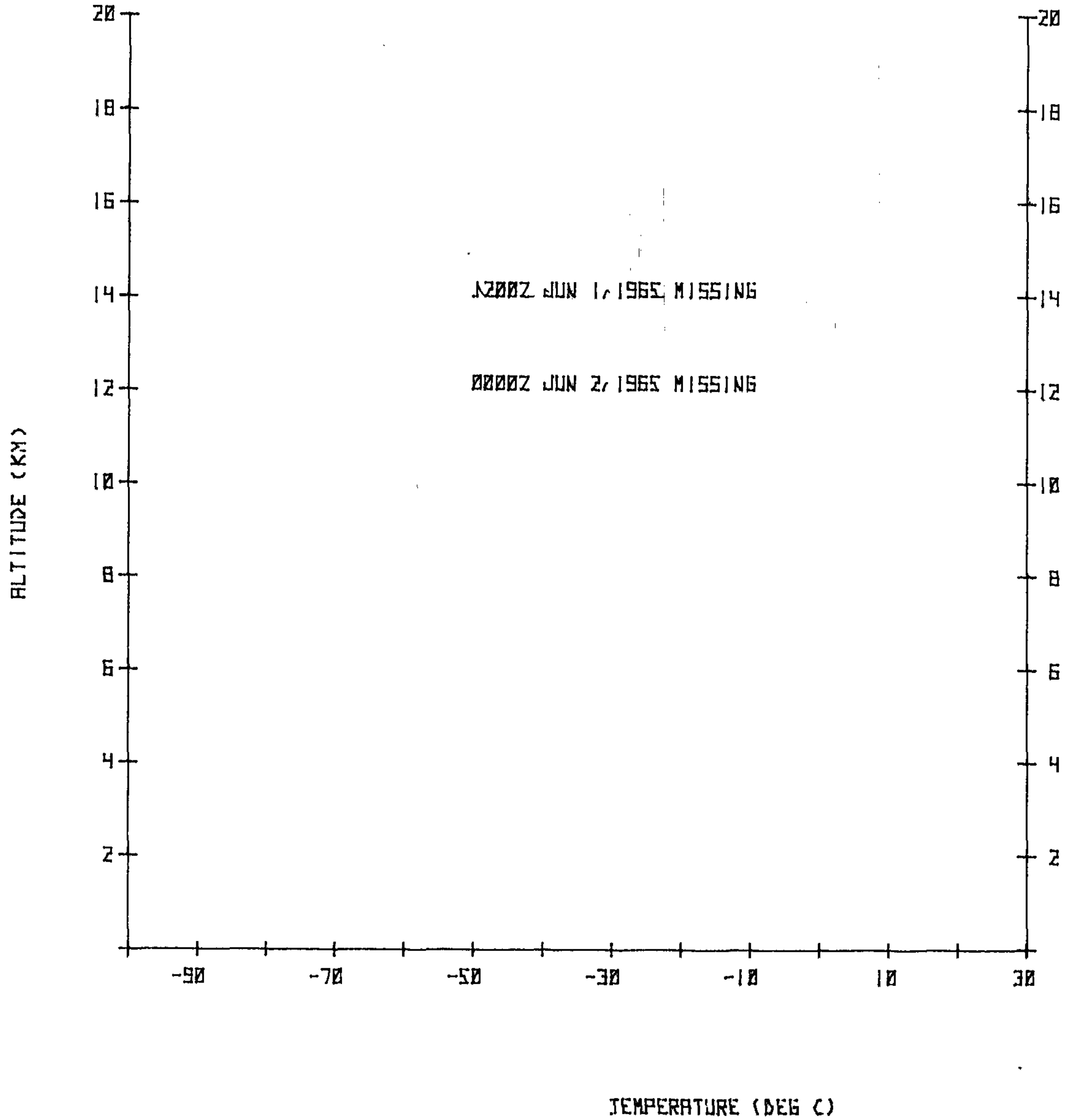
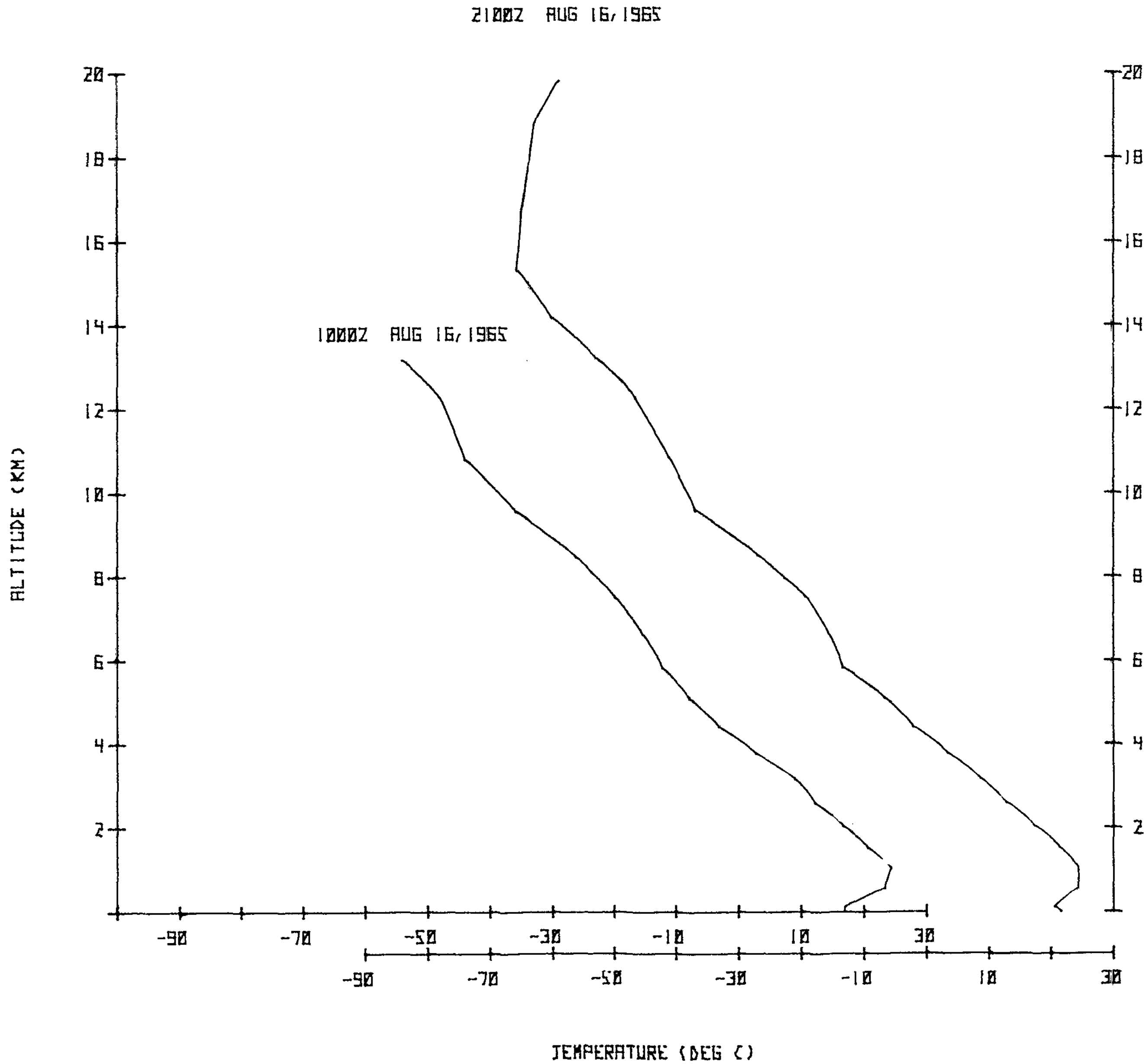


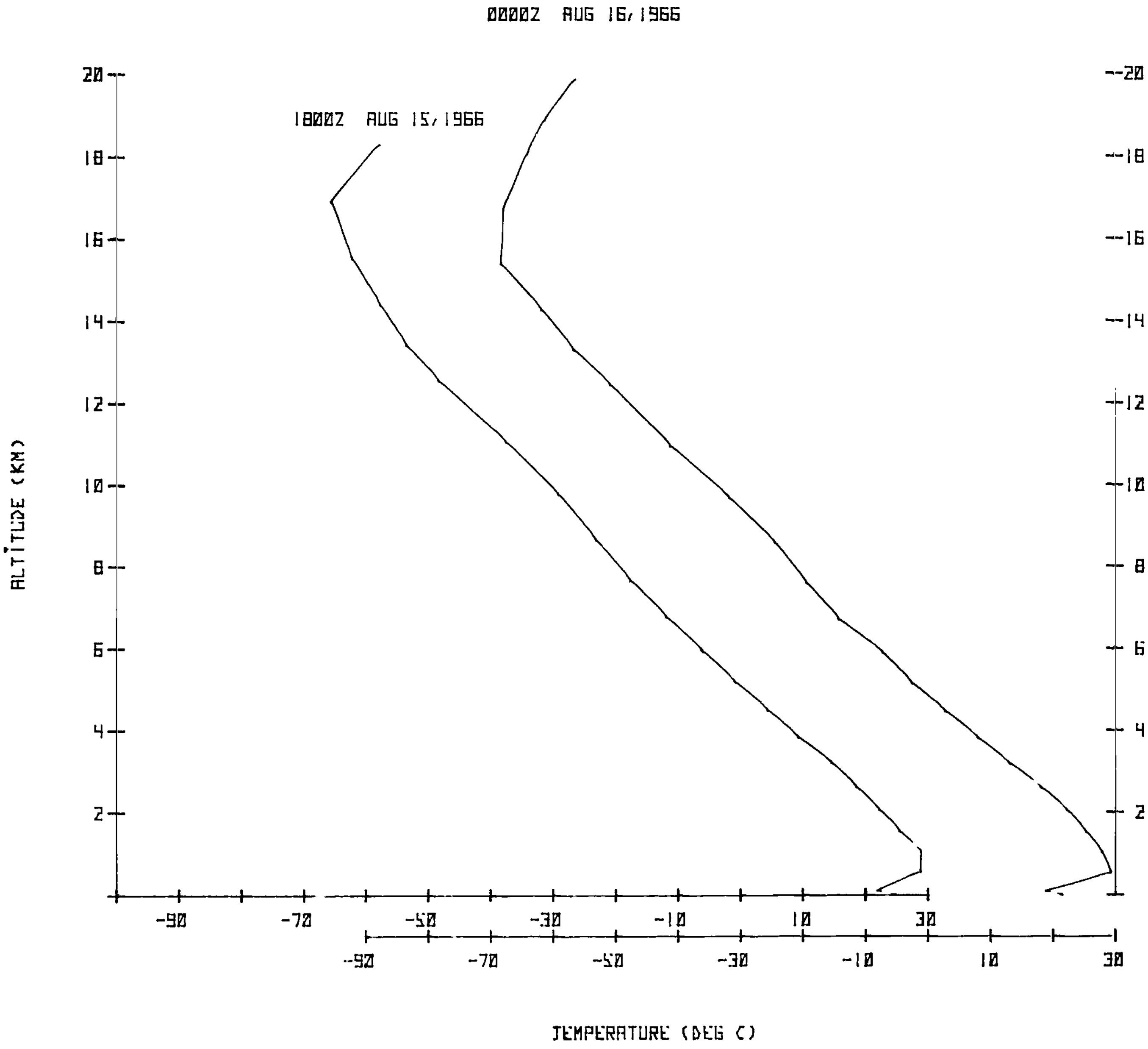
PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA

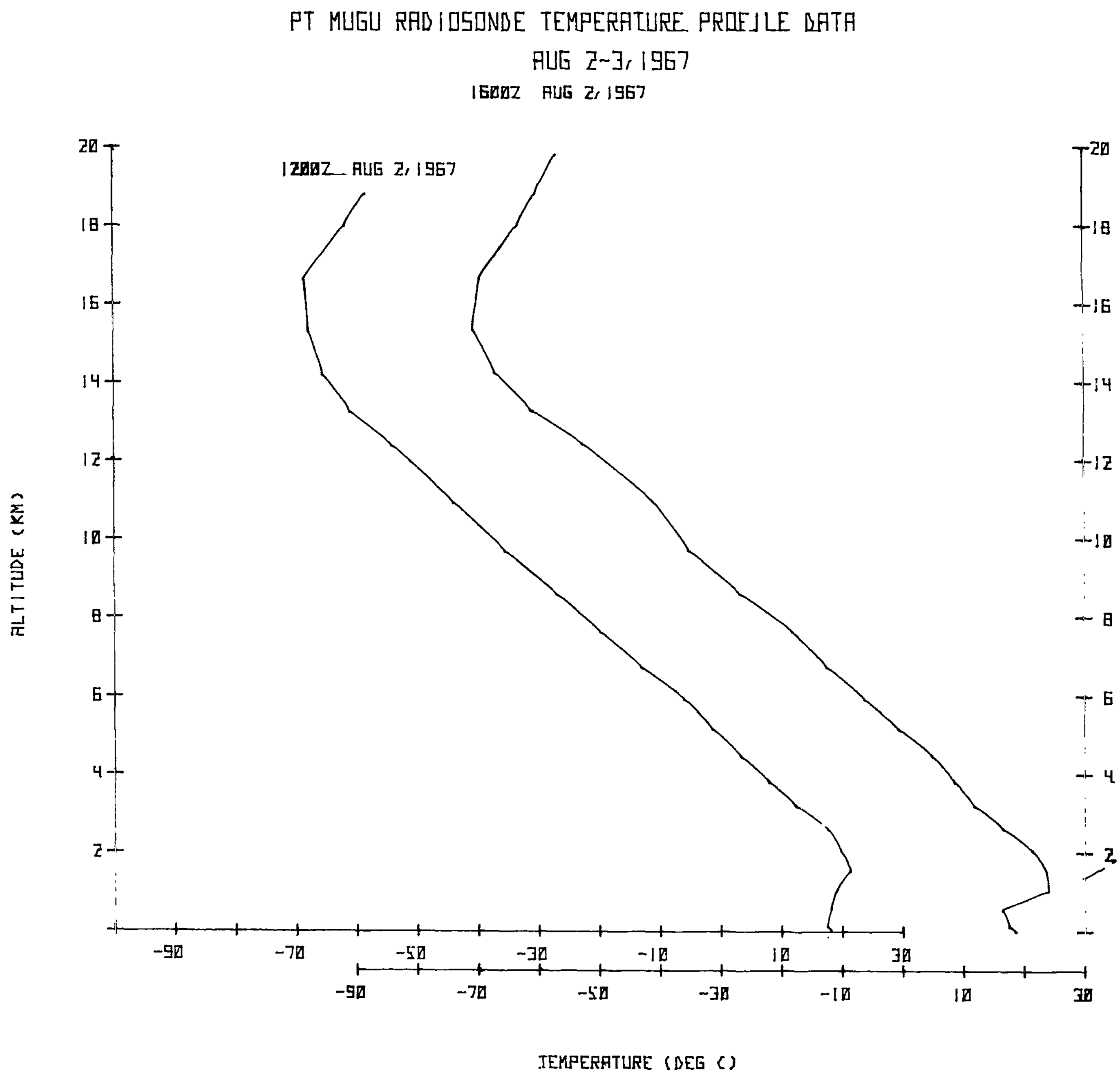
AUG 16-17, 1965



PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA

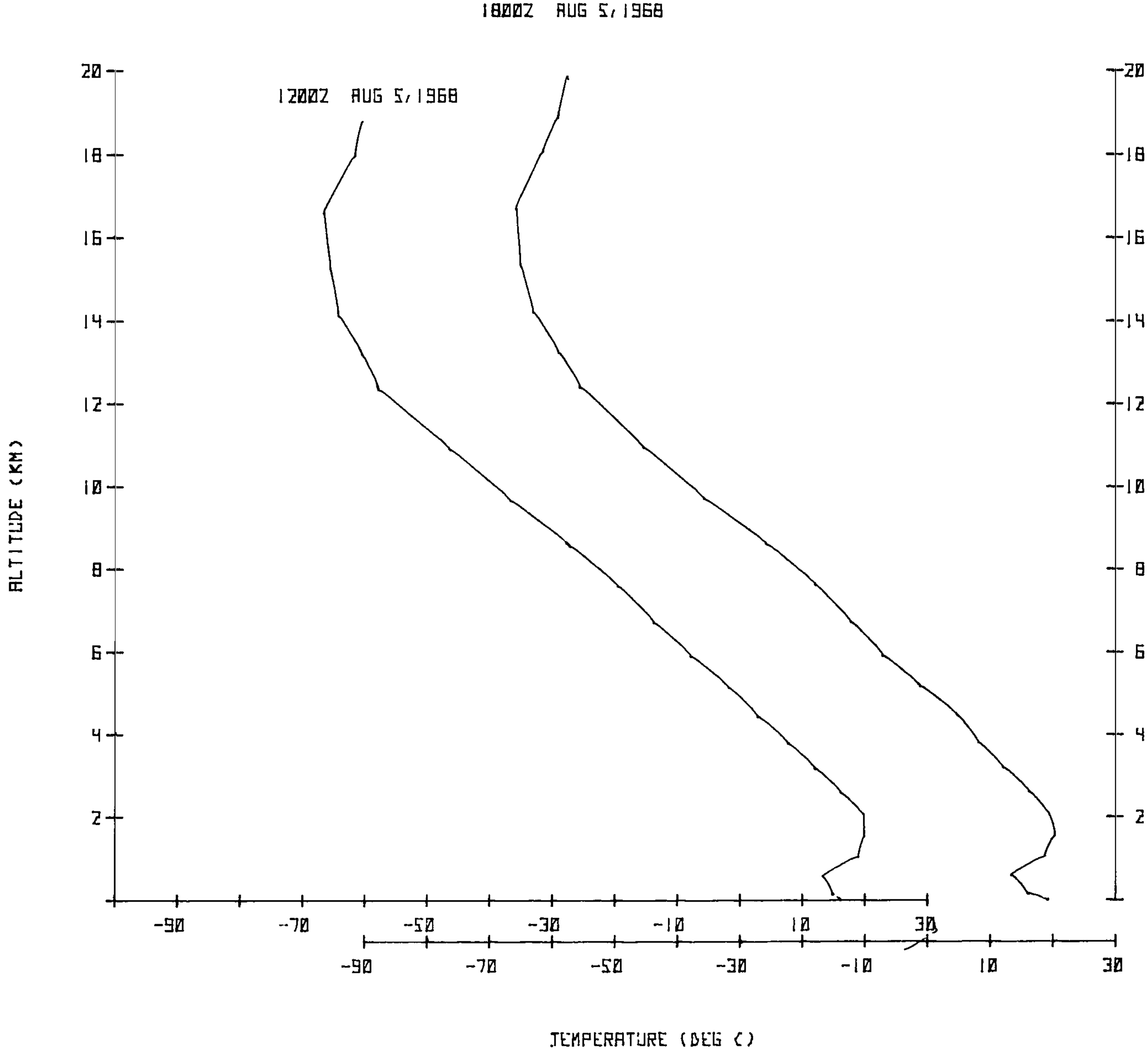
AUG 15-16, 1966




PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA
AUG 2-3, 1967
1600Z AUG 2, 1967
1200Z AUG 2, 1967
ALTITUDE (KM)
20
18
16
14
12
10
8
6
4
2
-90
-70
-50
-30
-10
10
30
TEMPERATURE (DEG C)

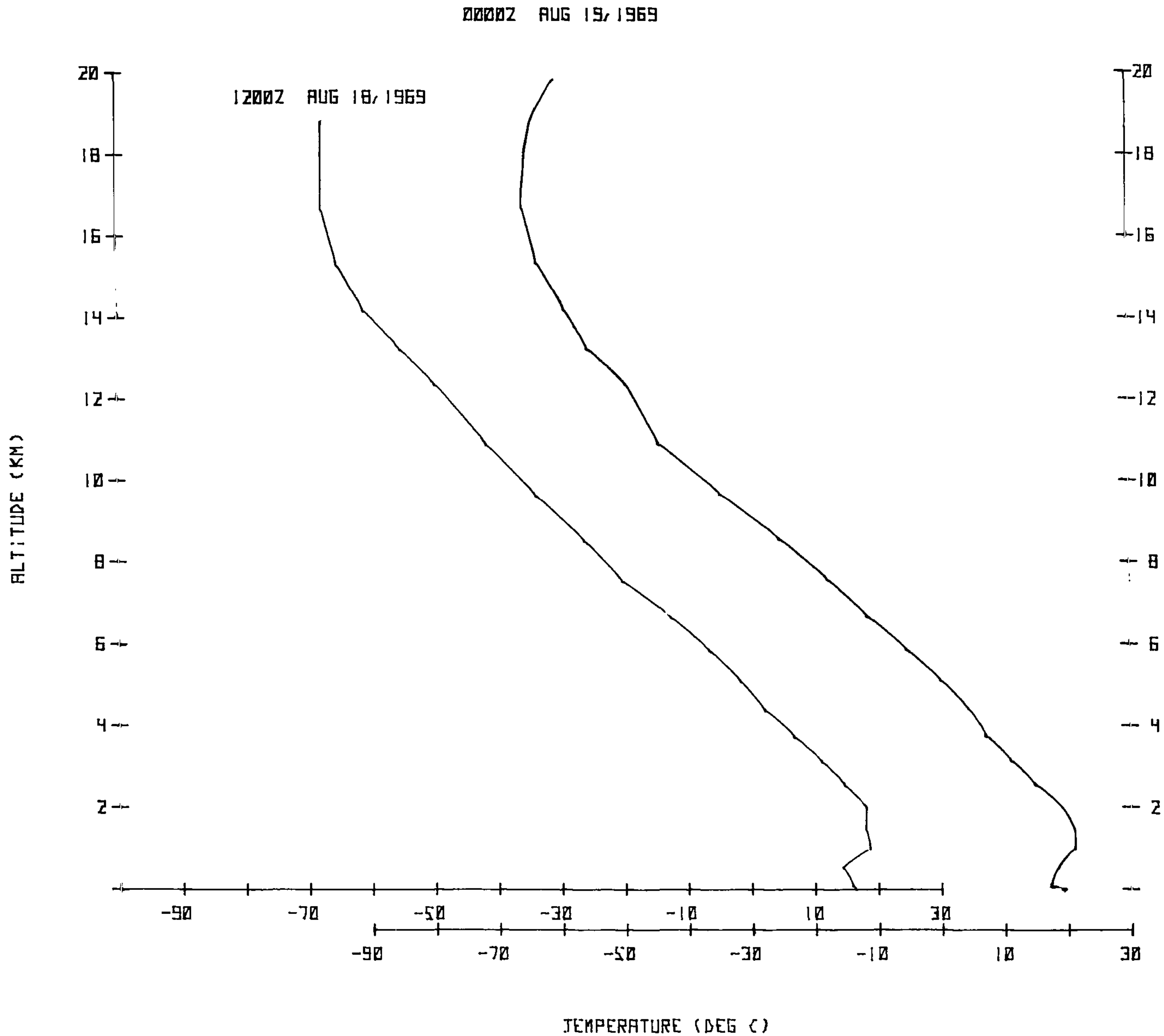
PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA

AUG 5-6, 1968



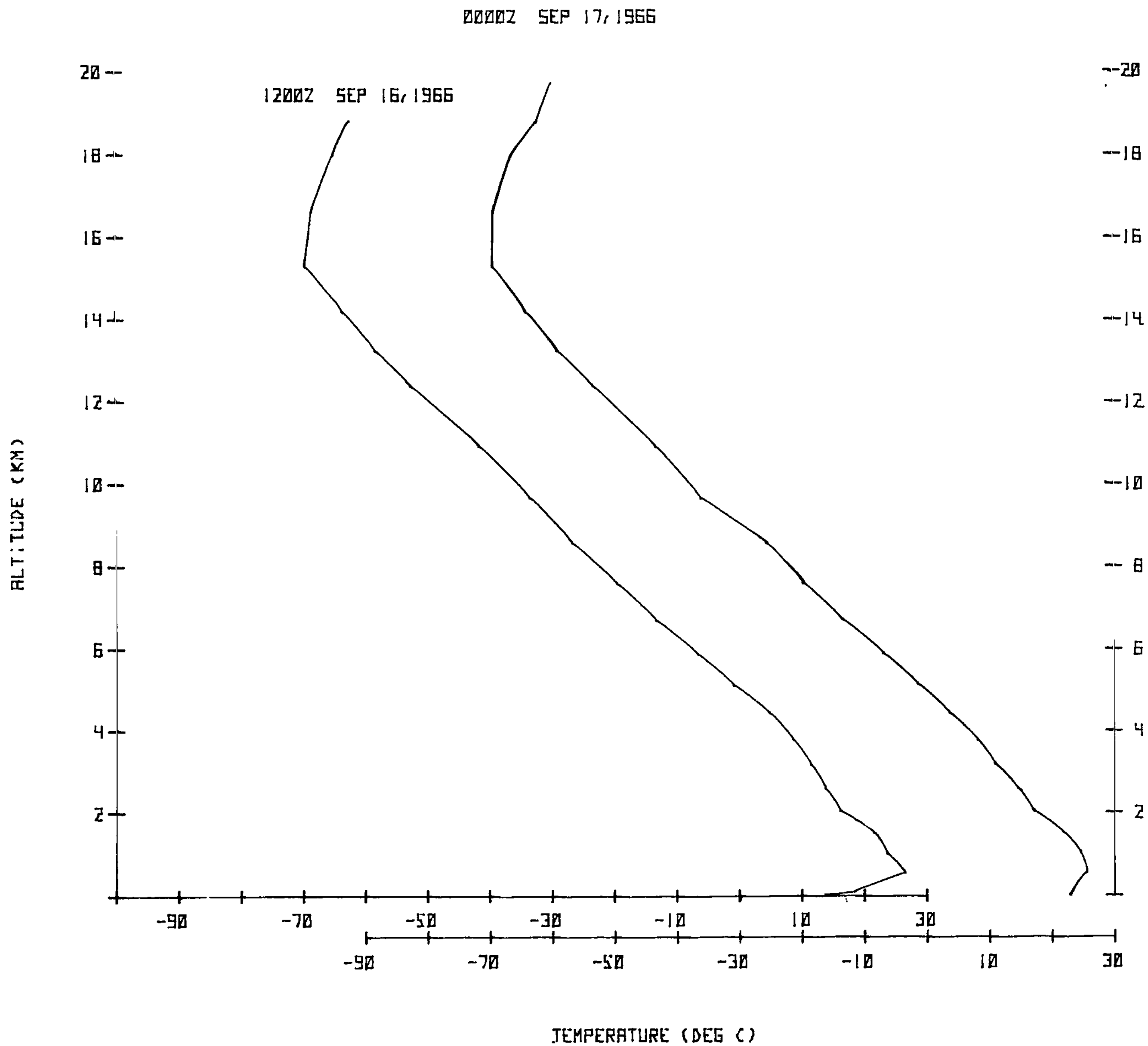
PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA

AUG 18-19, 1969



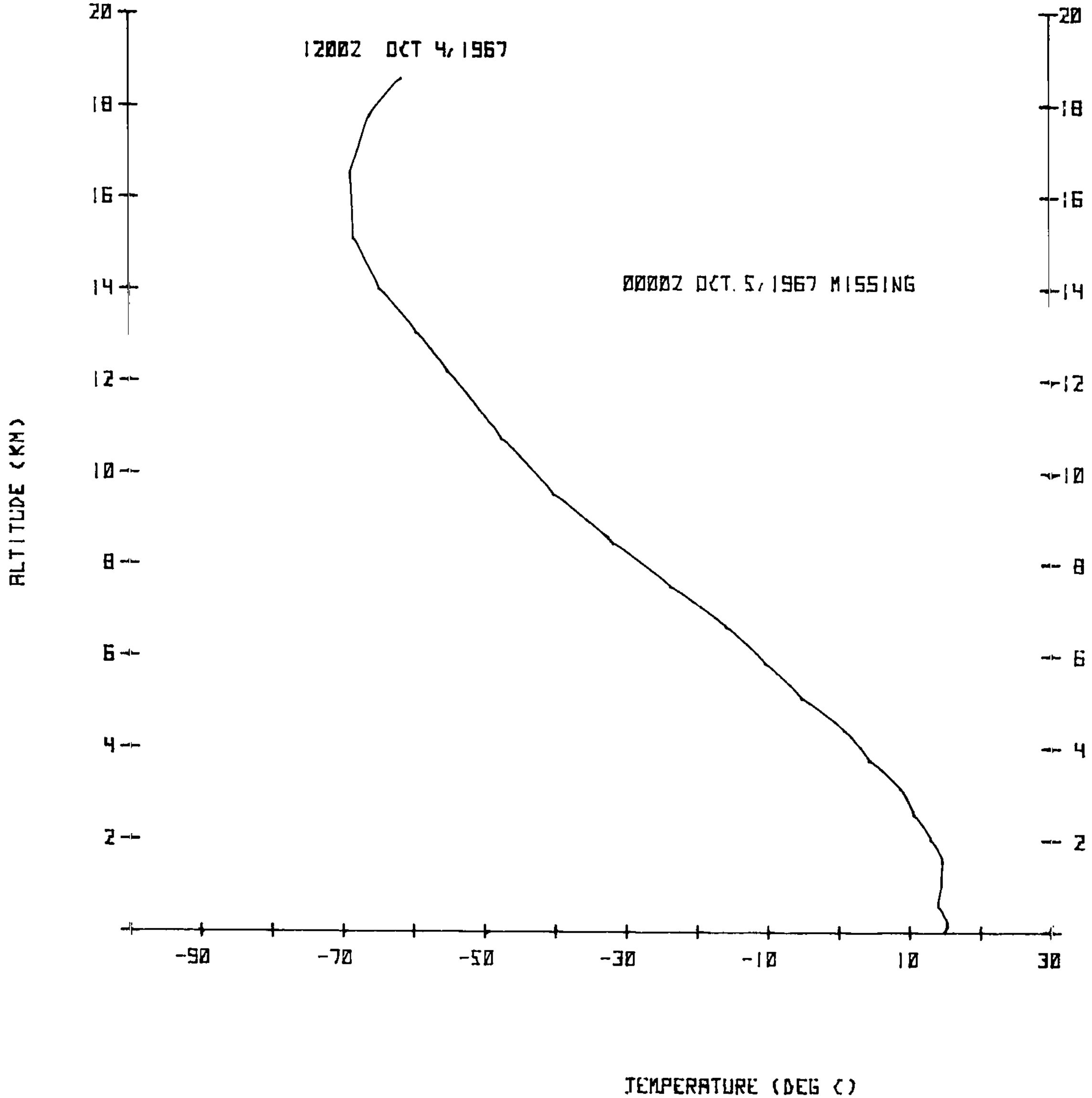
PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA

SEP 16-17, 1966



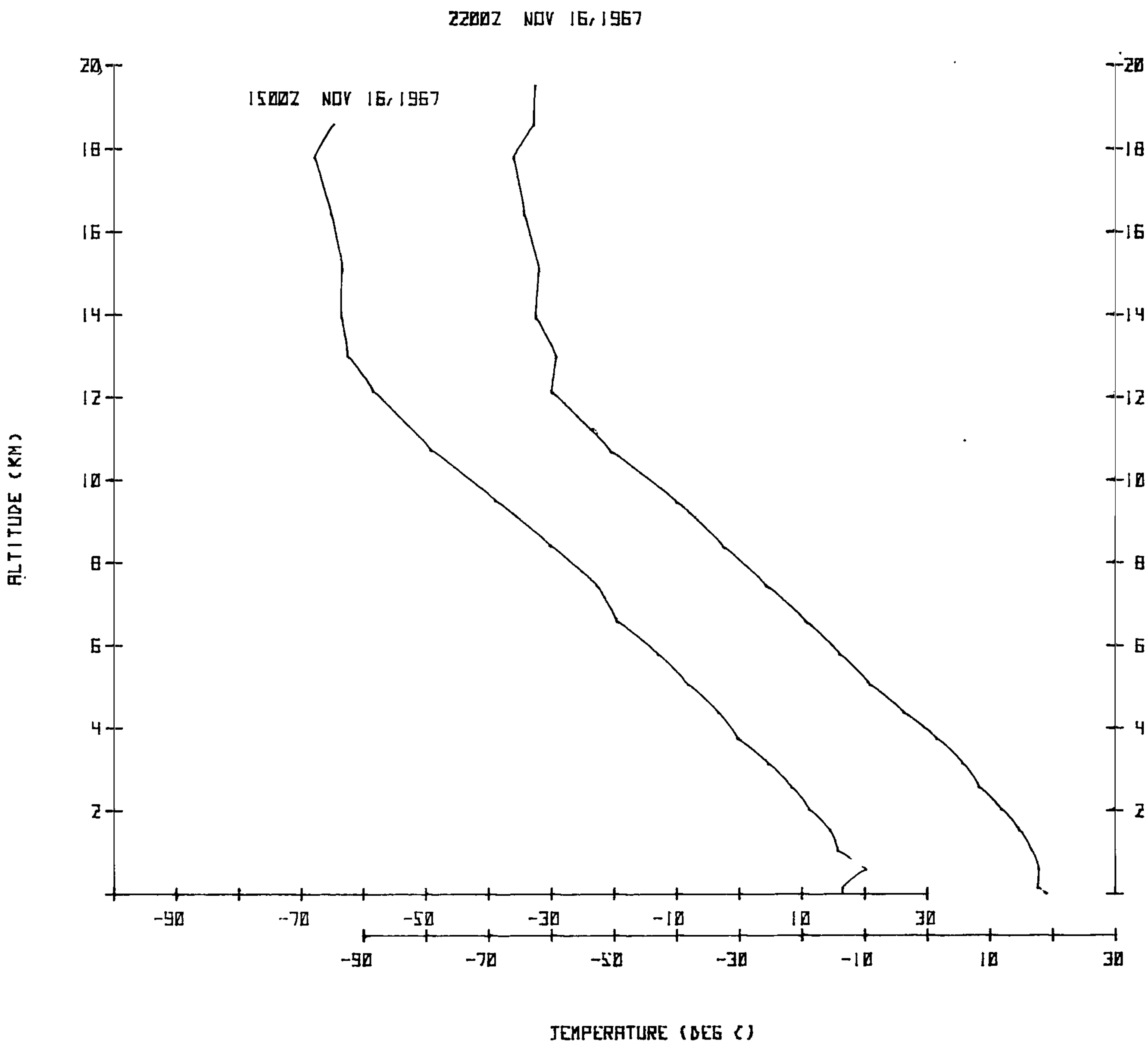
PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA

OCT 4-5, 1967



PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA

NOV 16-17, 1967



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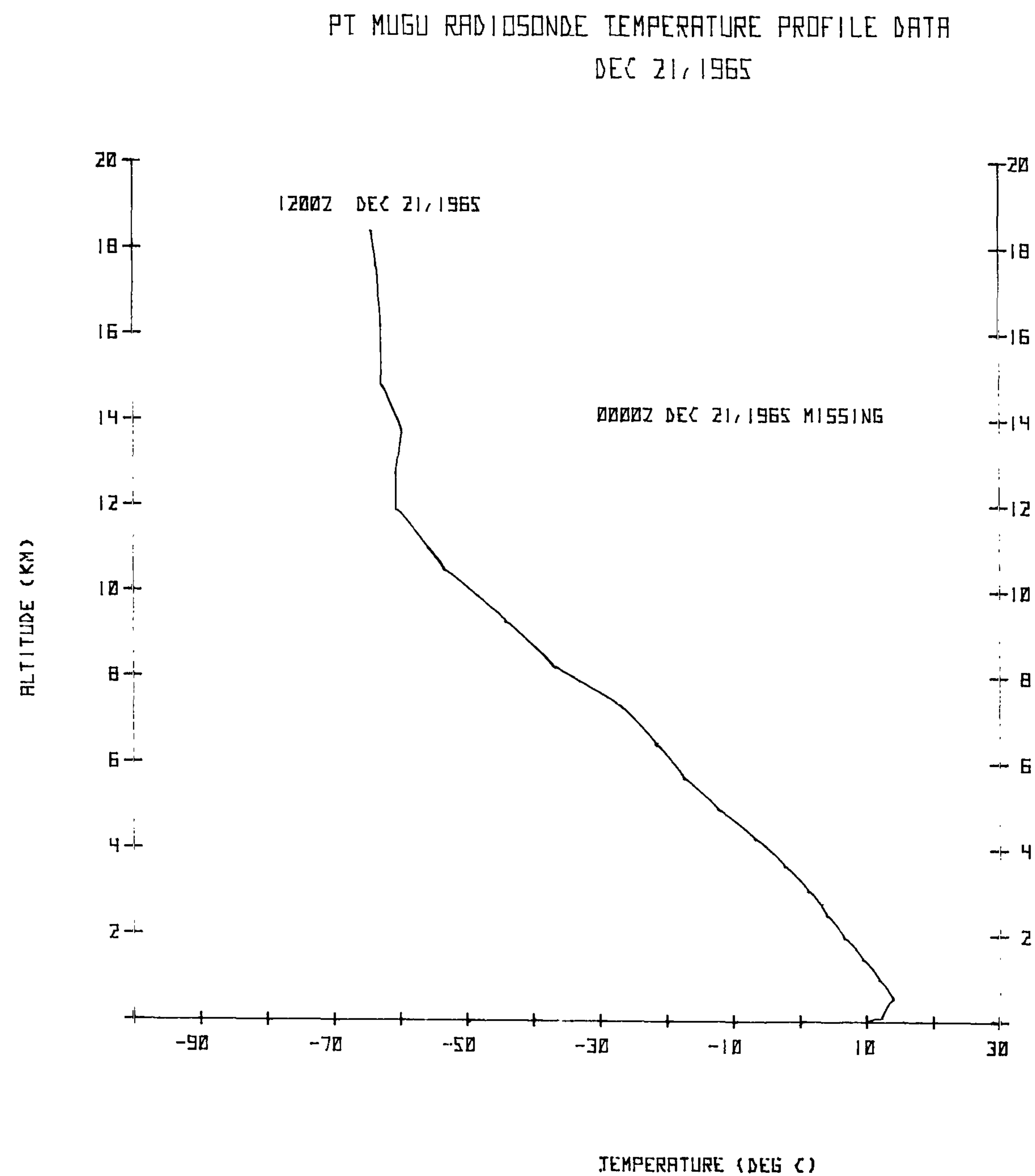
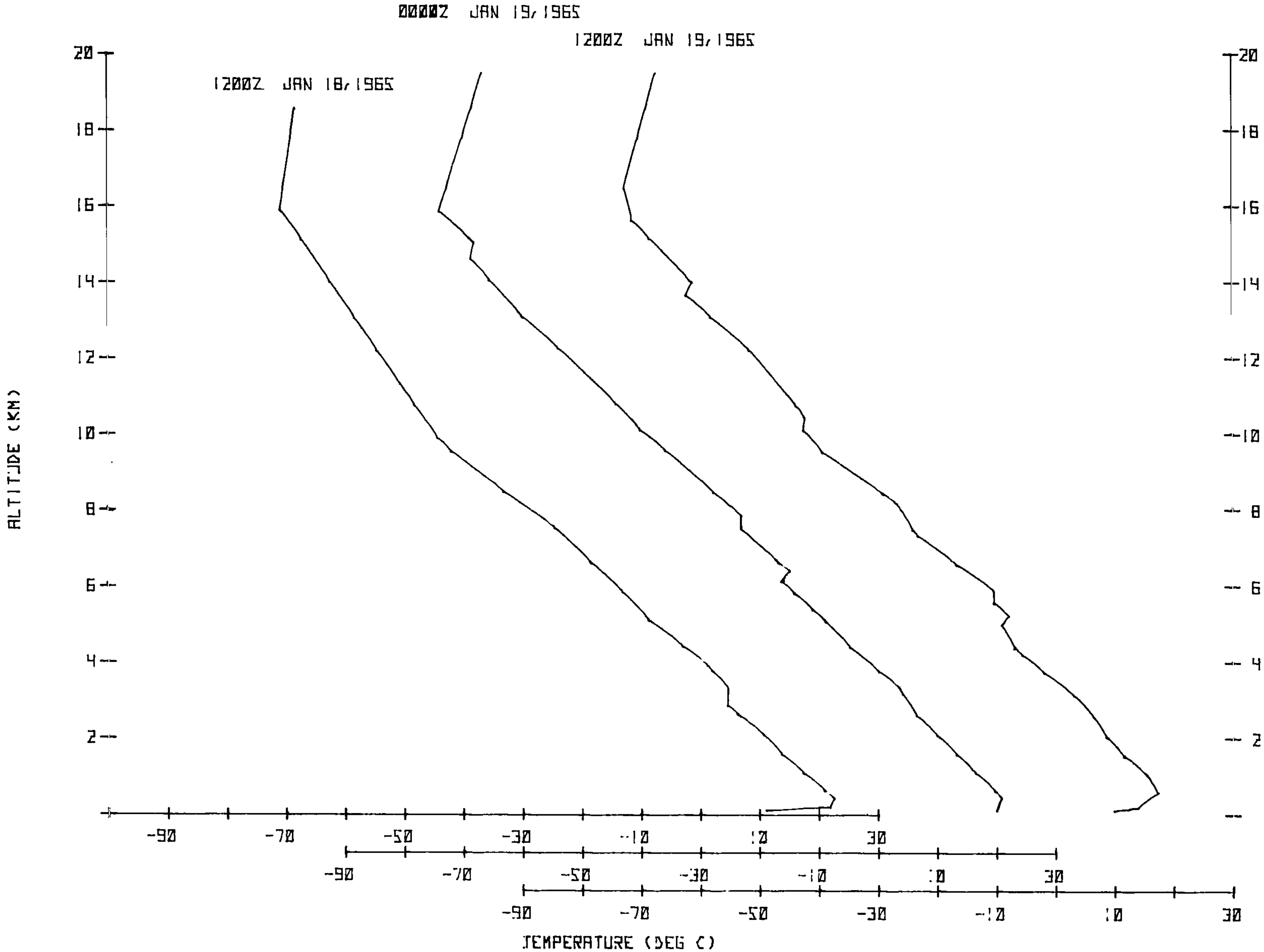

PT MUGU RADIOSONDE TEMPERATURE PROFILE DATA
DEC 21, 1965
1200Z DEC 21, 1965
0000Z DEC 21, 1965 MISSING
ALTITUDE (KM)
TEMPERATURE (DEG C)
20
18
16
14
12
10
8
6
4
2
-90
-70
-50
-30
-10
10
30

Vandenberg AFB, California Radiosonde
Temperature Profile Data

VANDENBERG RADIOSONDE TEMPERATURE PROFILE DATA

JAN 18-19, 1965



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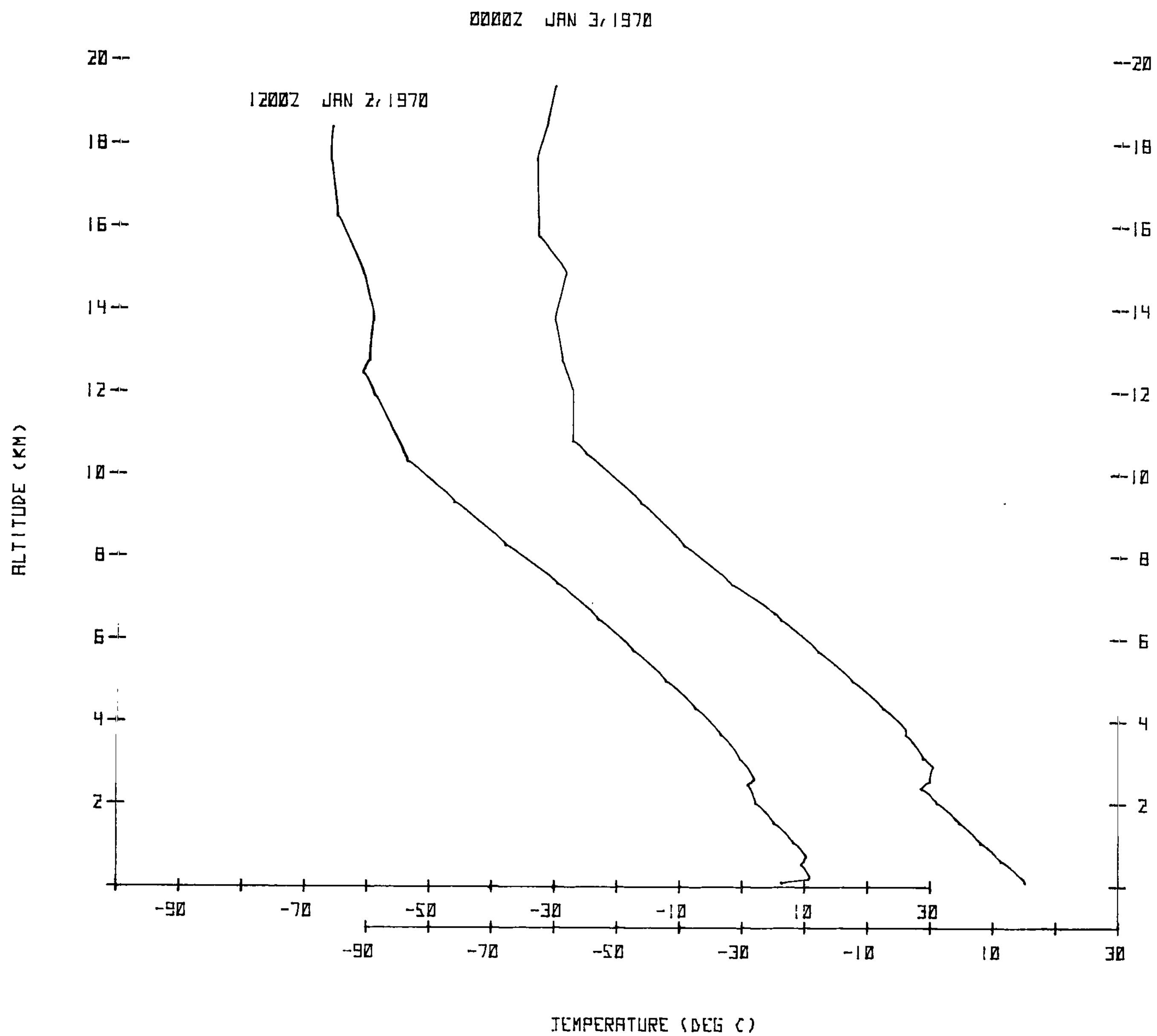
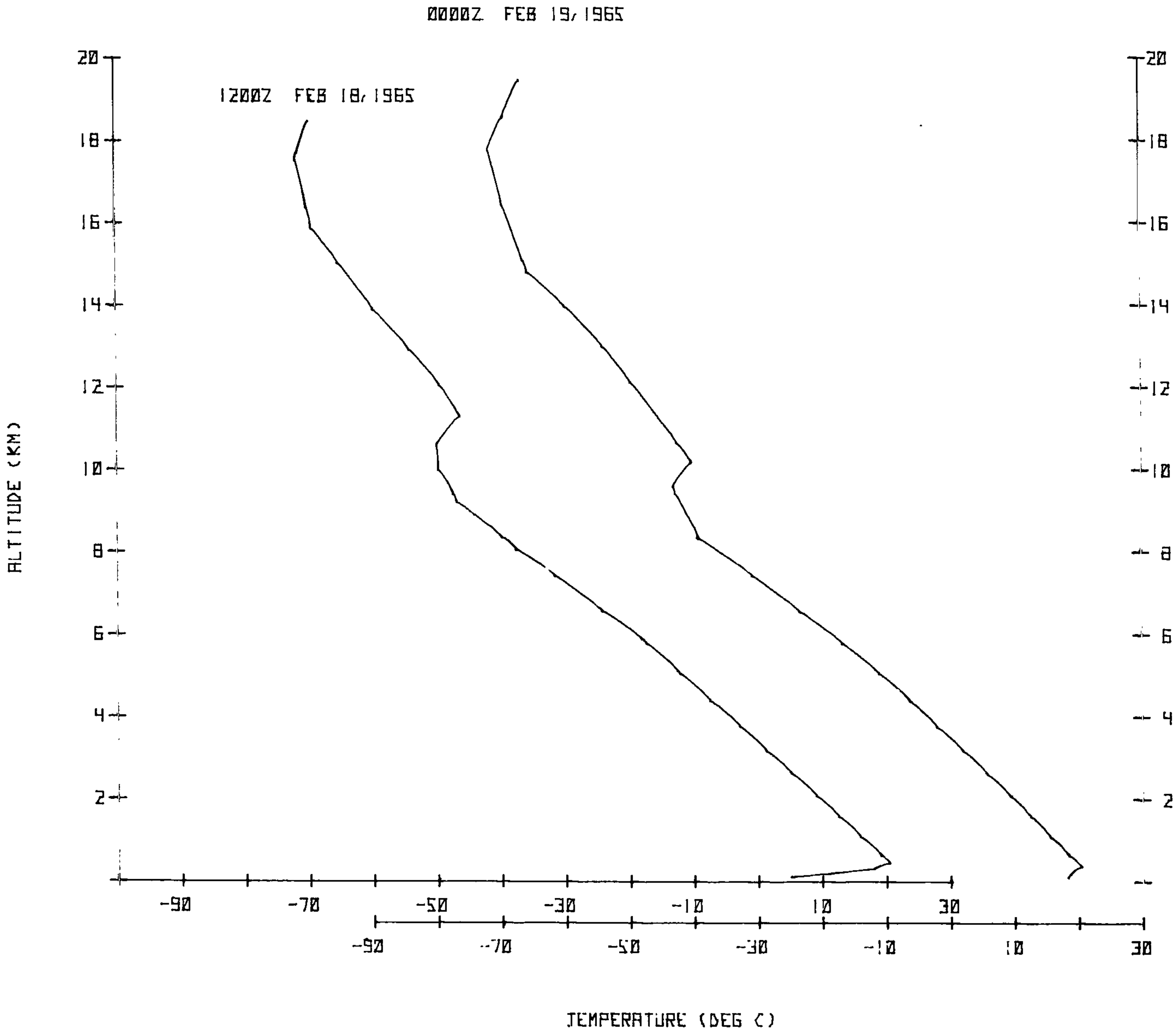
JAN 2-3, 1970



VANDENBERG RADIOSONDE TEMPERATURE PROFILE DATA

FEB 18-19, 1965



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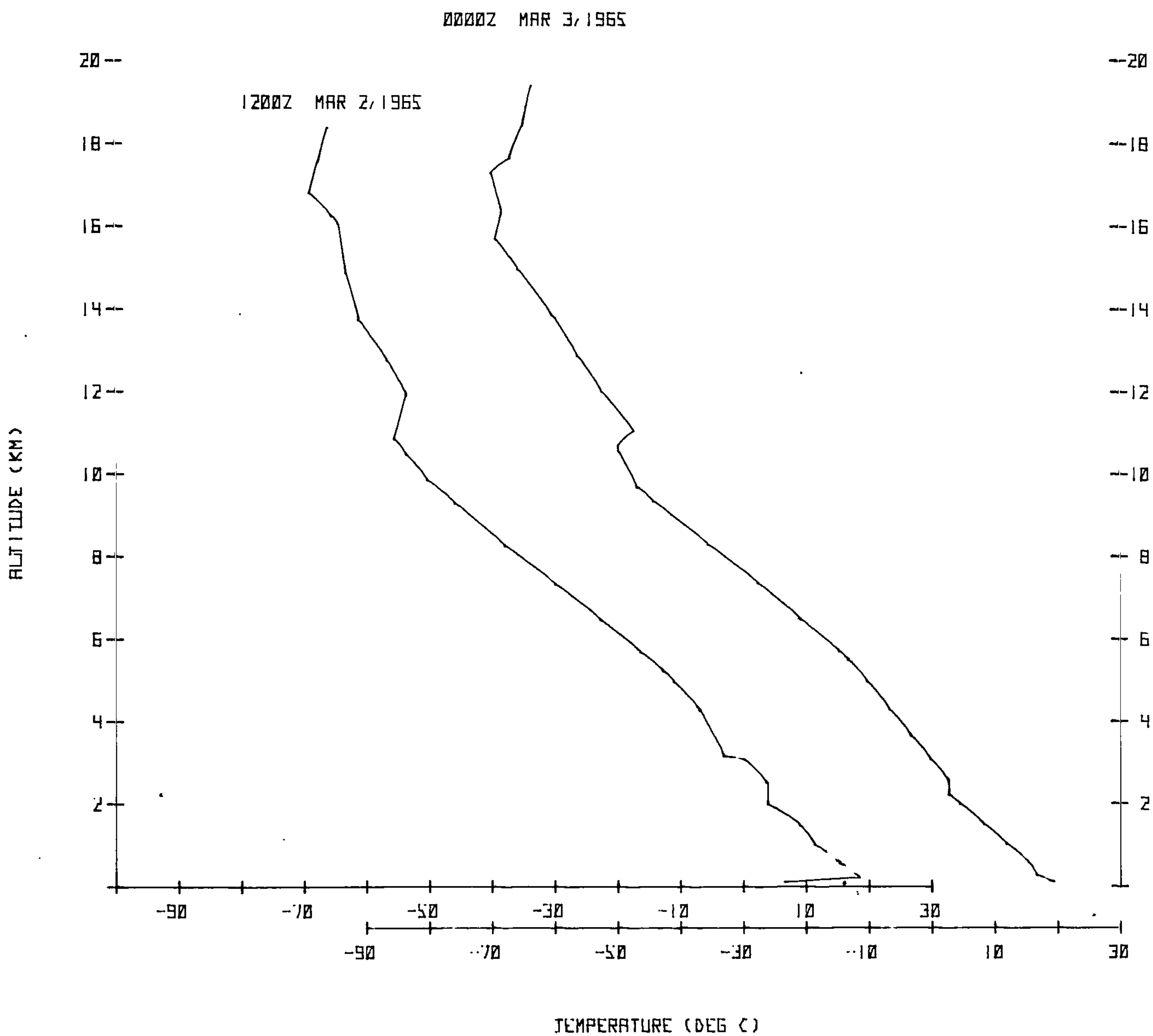
MAR 2-3, 1965



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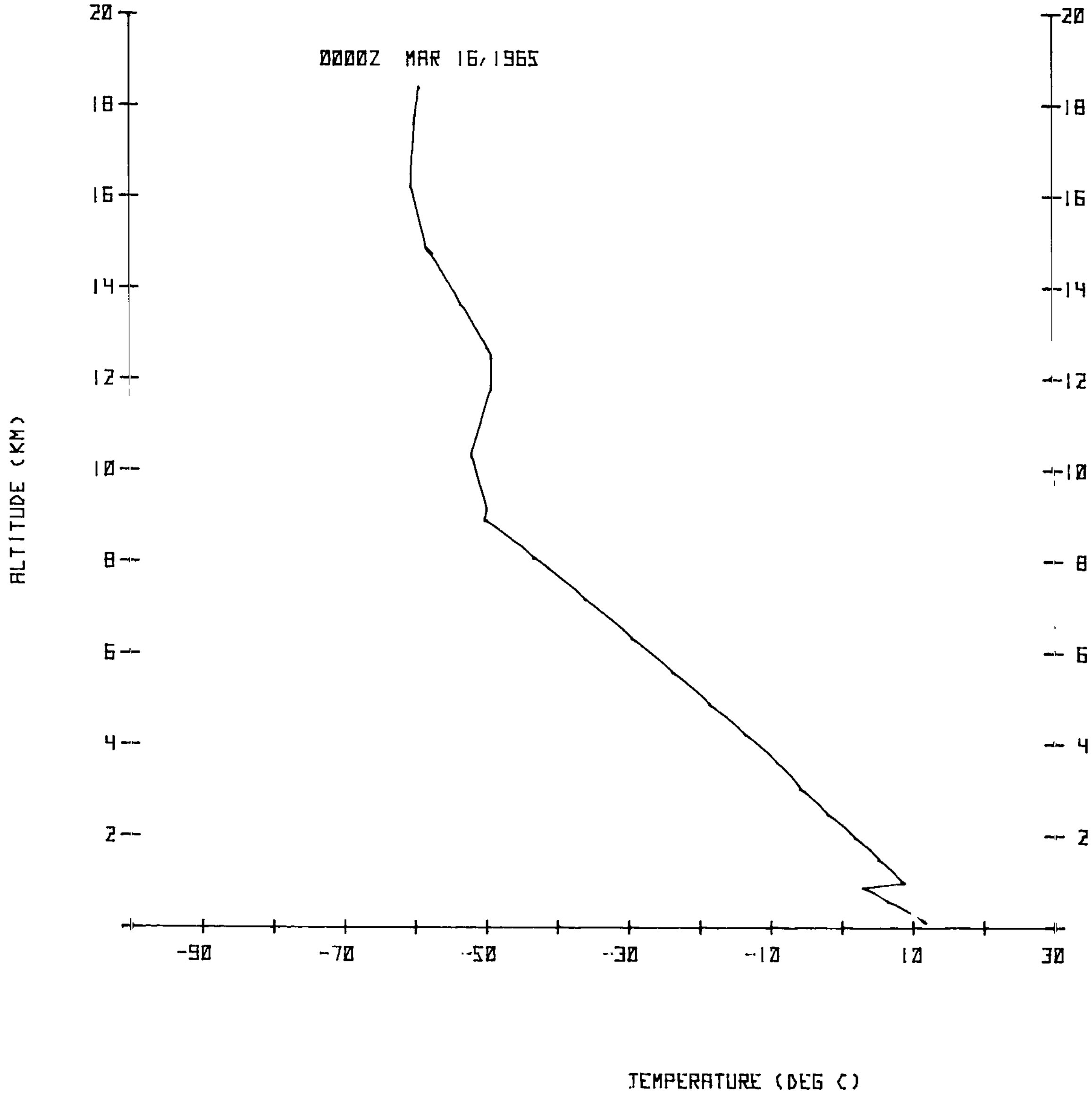
MAR 16, 1965



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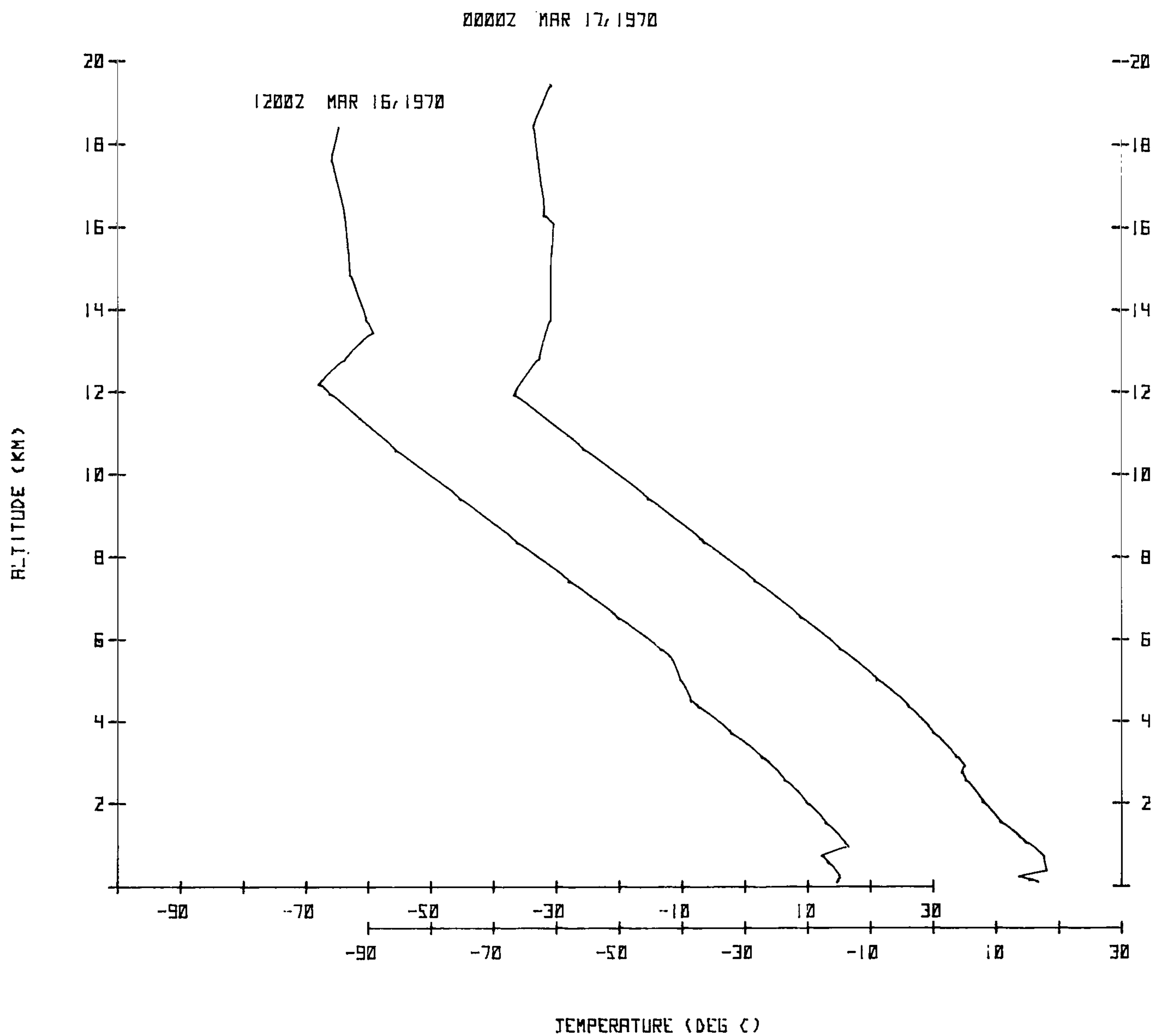
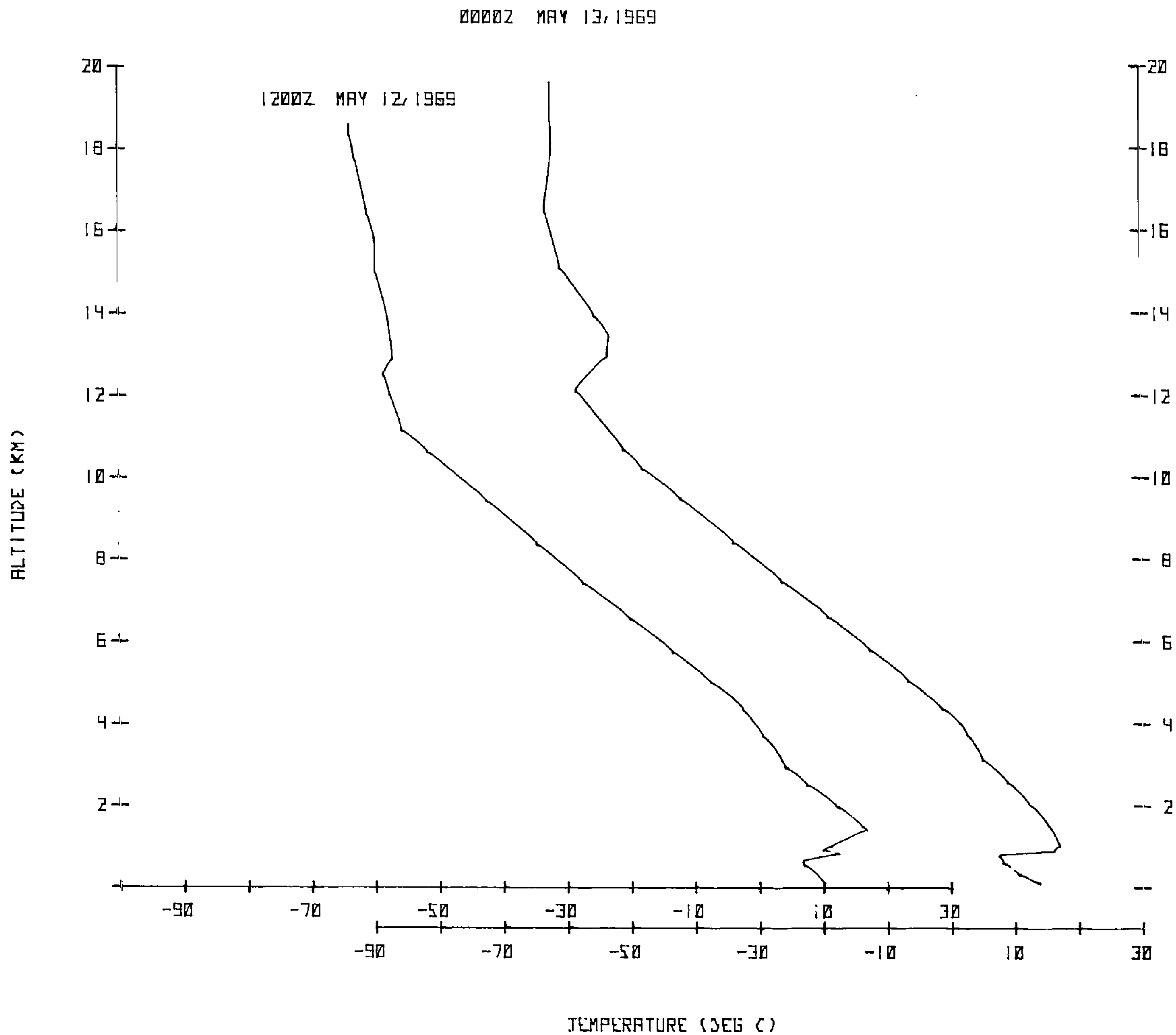
MAR 16-17, 1970



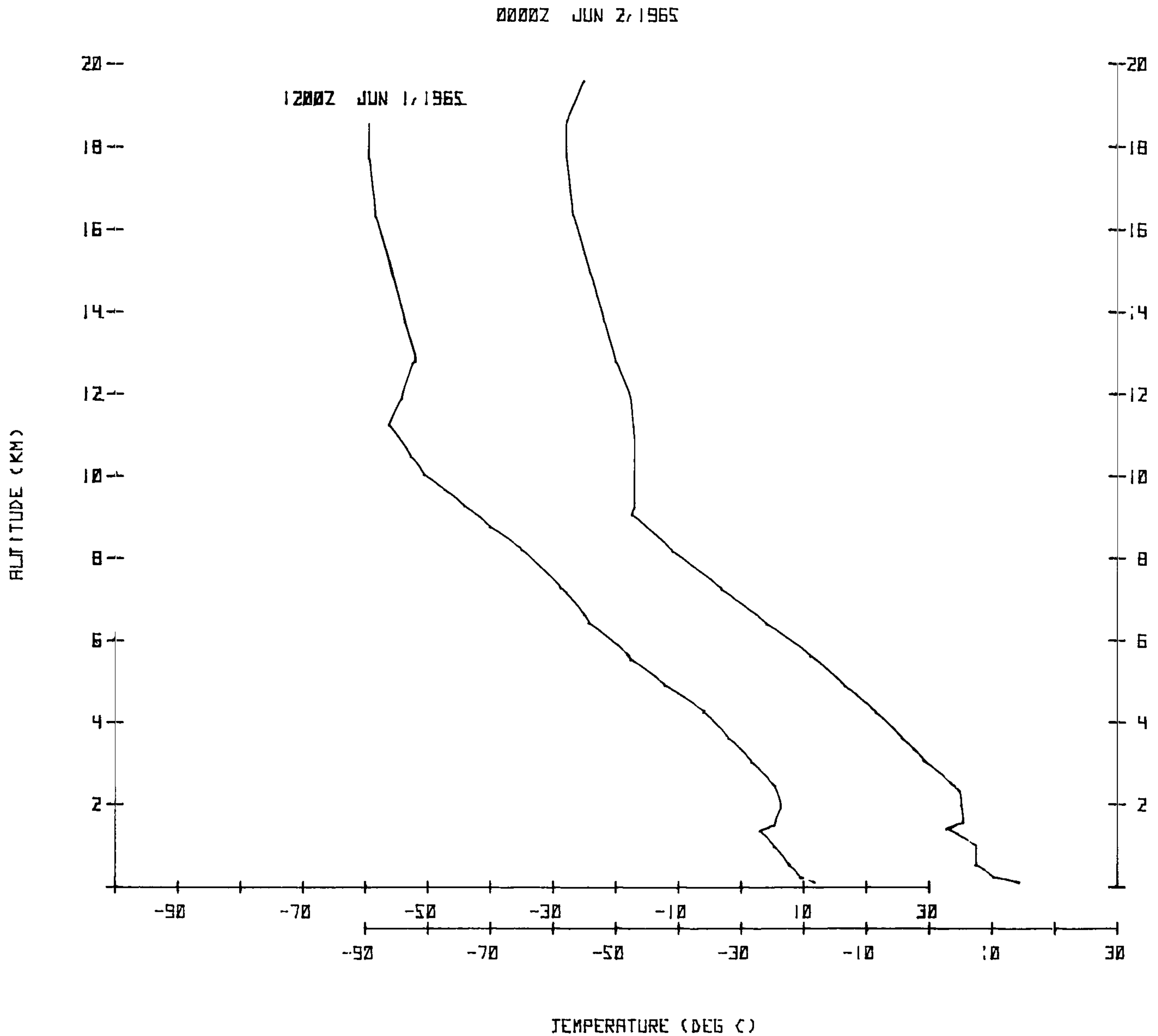
VANDENBERG RADIOSONDE TEMPERATURE PROFILE DATA

MAY 12-13, 1969



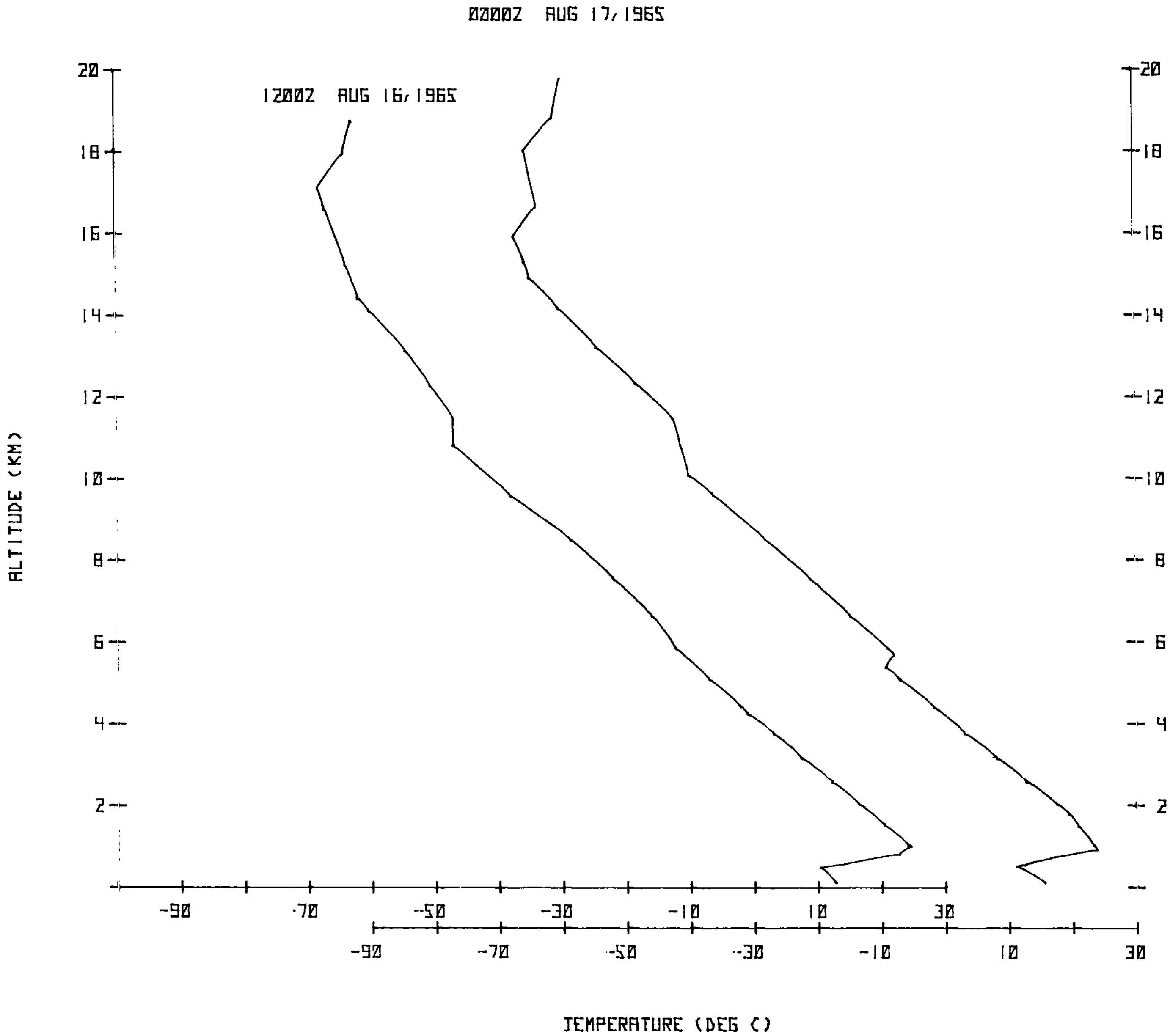
VANDENBERG RADIOSONDE TEMPERATURE PROFILE DATA

JUN 1-2, 1965

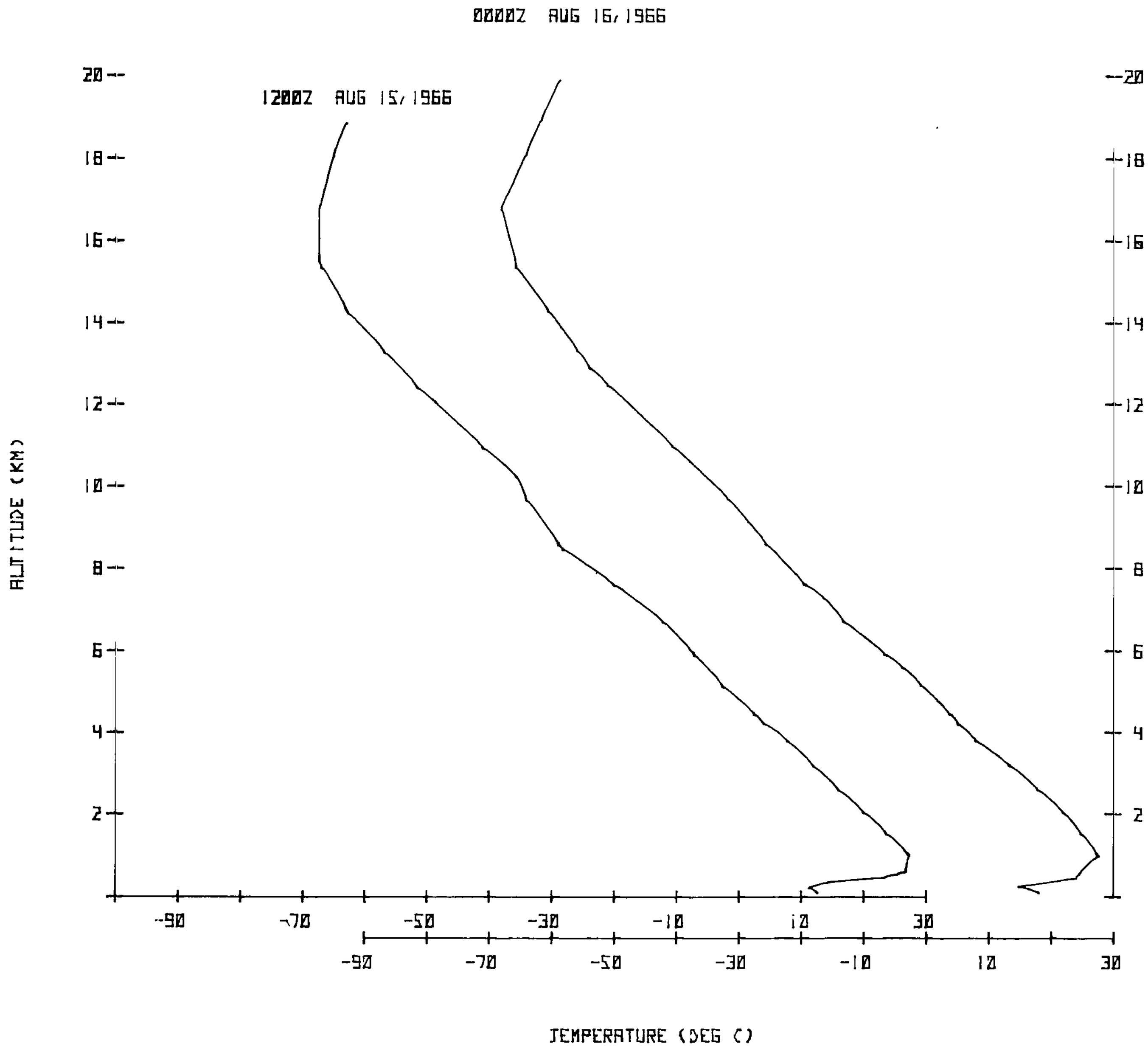


VANDENBERG RADIOSONDE TEMPERATURE PROFILE DATA

AUG 16-17, 1965



VANDENBERG RADIOSONDE TEMPERATURE PROFILE DATA
AUG 15-16, 1966



VANDENBERG RADIOSONDE TEMPERATURE PROFILE DATA

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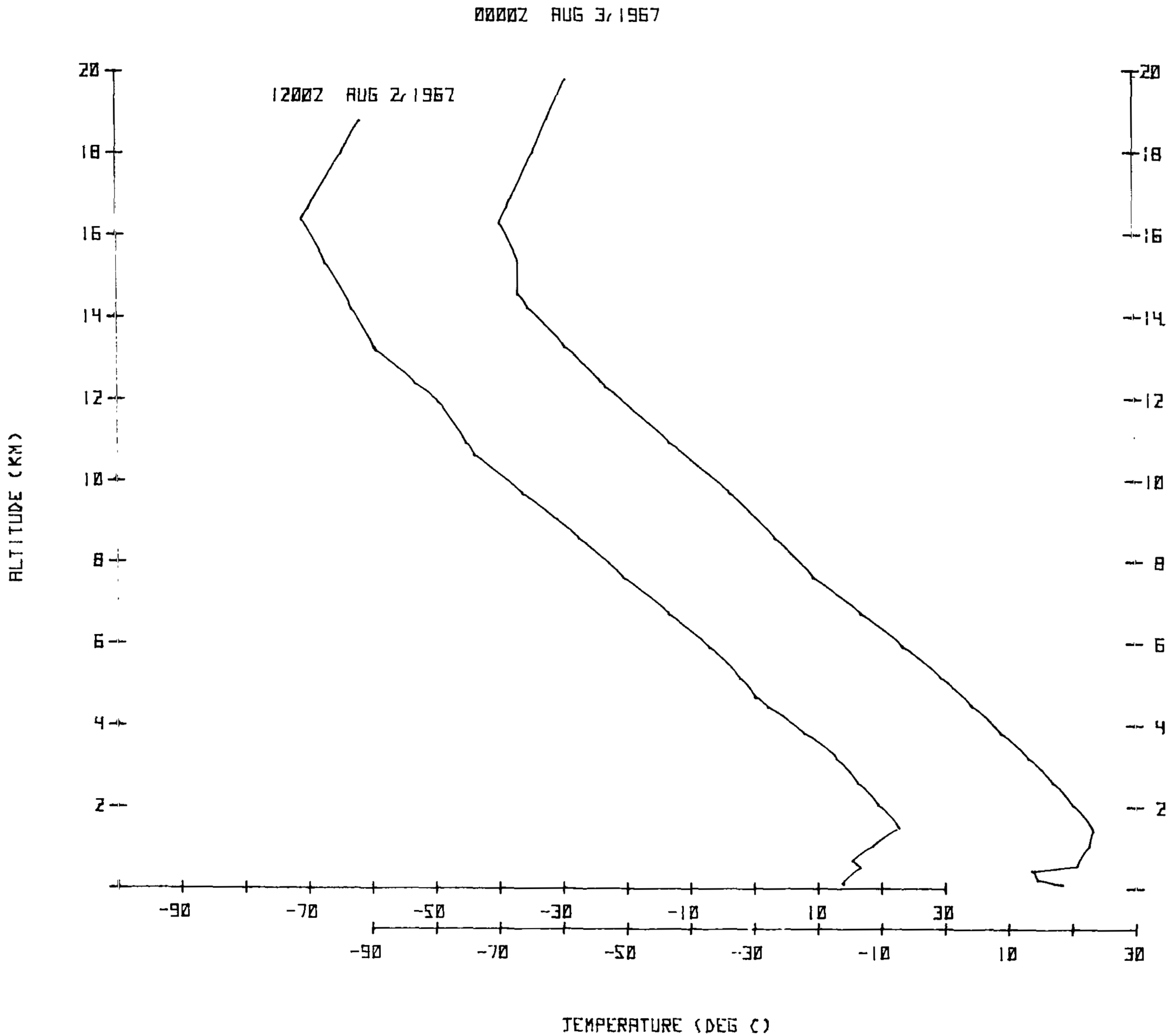
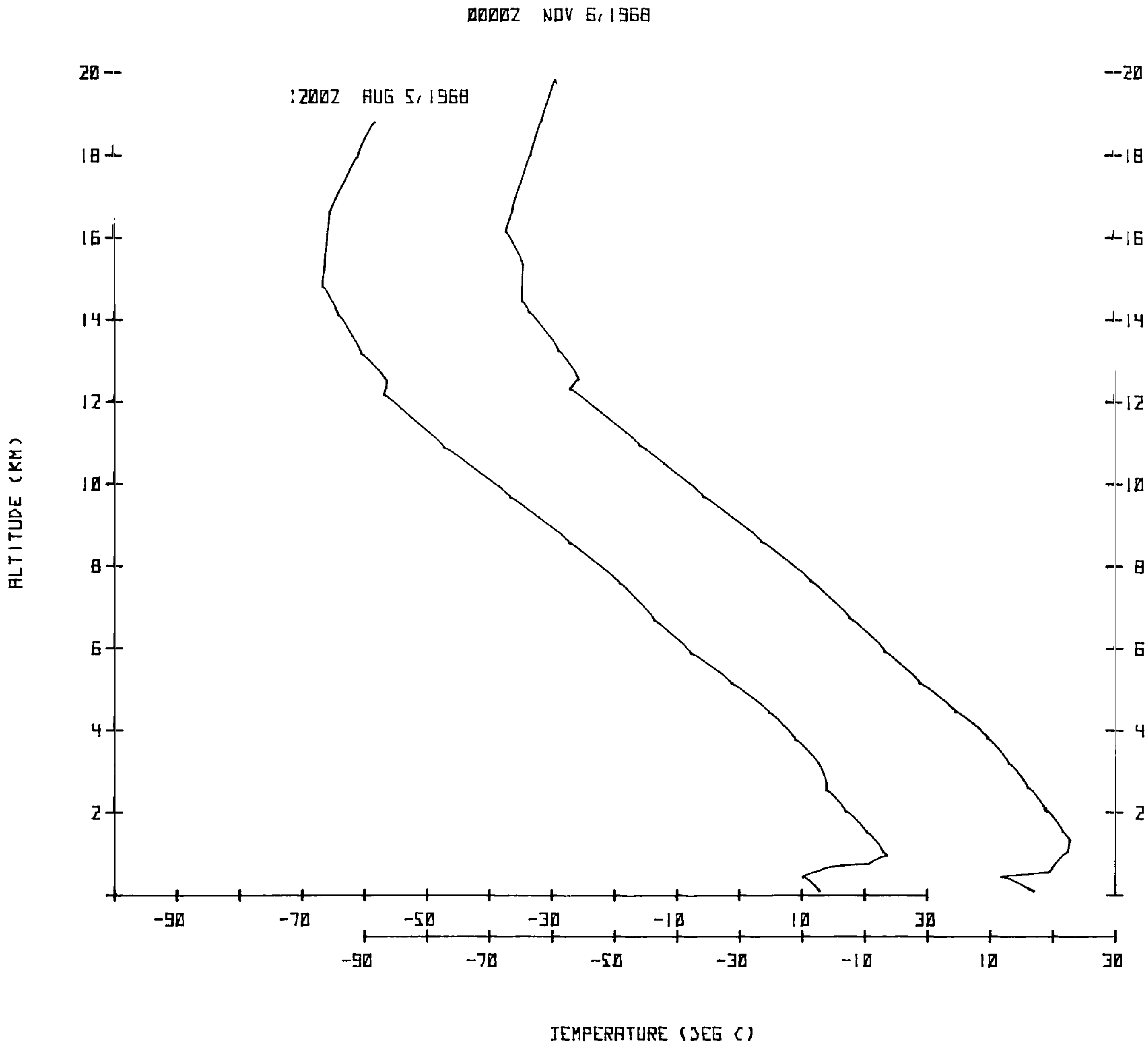


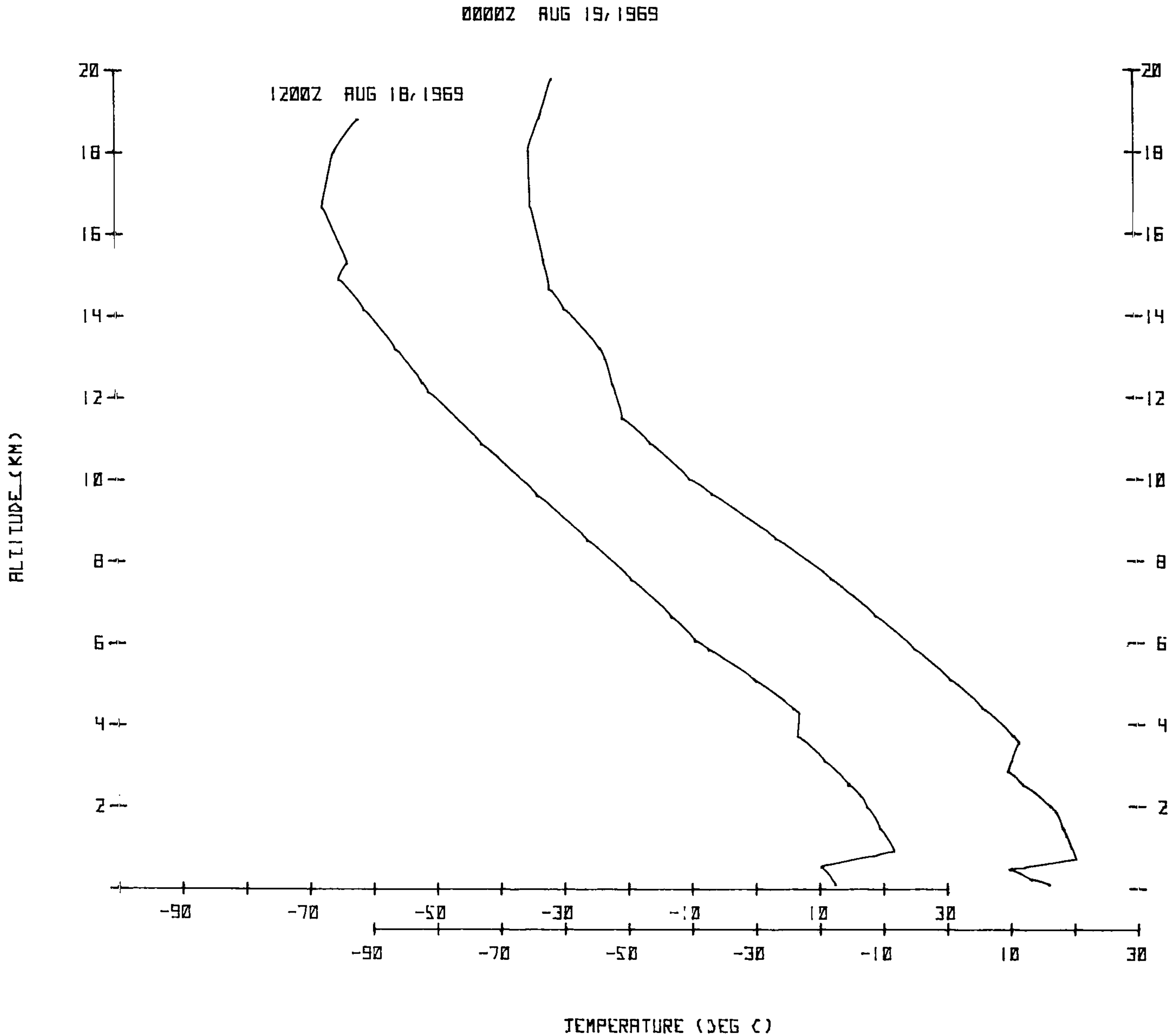
VANDENBERG RADIOSONDE TEMPERATURE PROFILE DATA

AUG 5-6, 1968



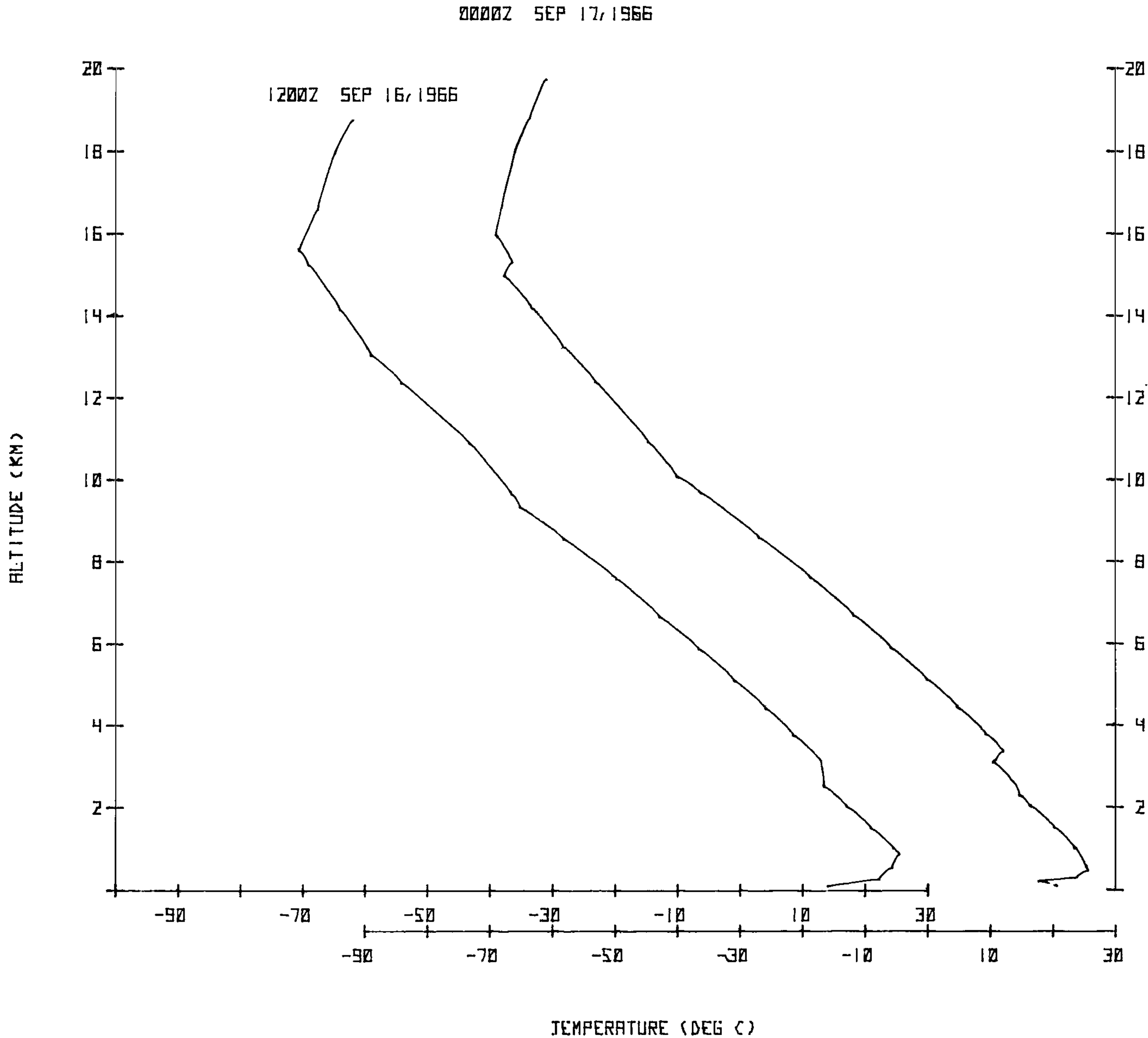
VANDENBERG RADIOSONDE TEMPERATURE PROFILE DATA

AUG 18-19, 1969



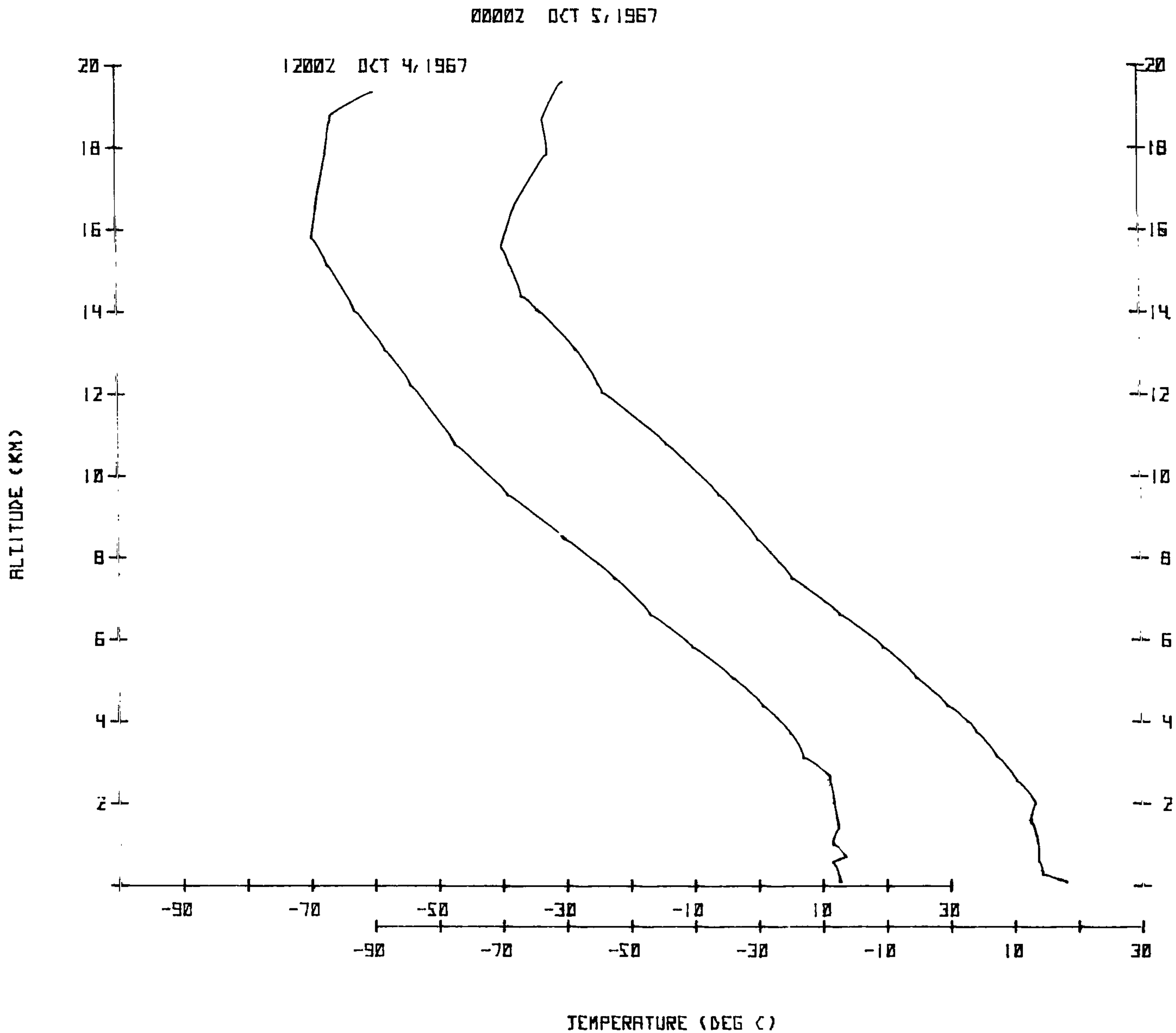
VANDENBERG RADIOSONDE TEMPERATURE PROFILE DATA

SEP 16-17, 1966

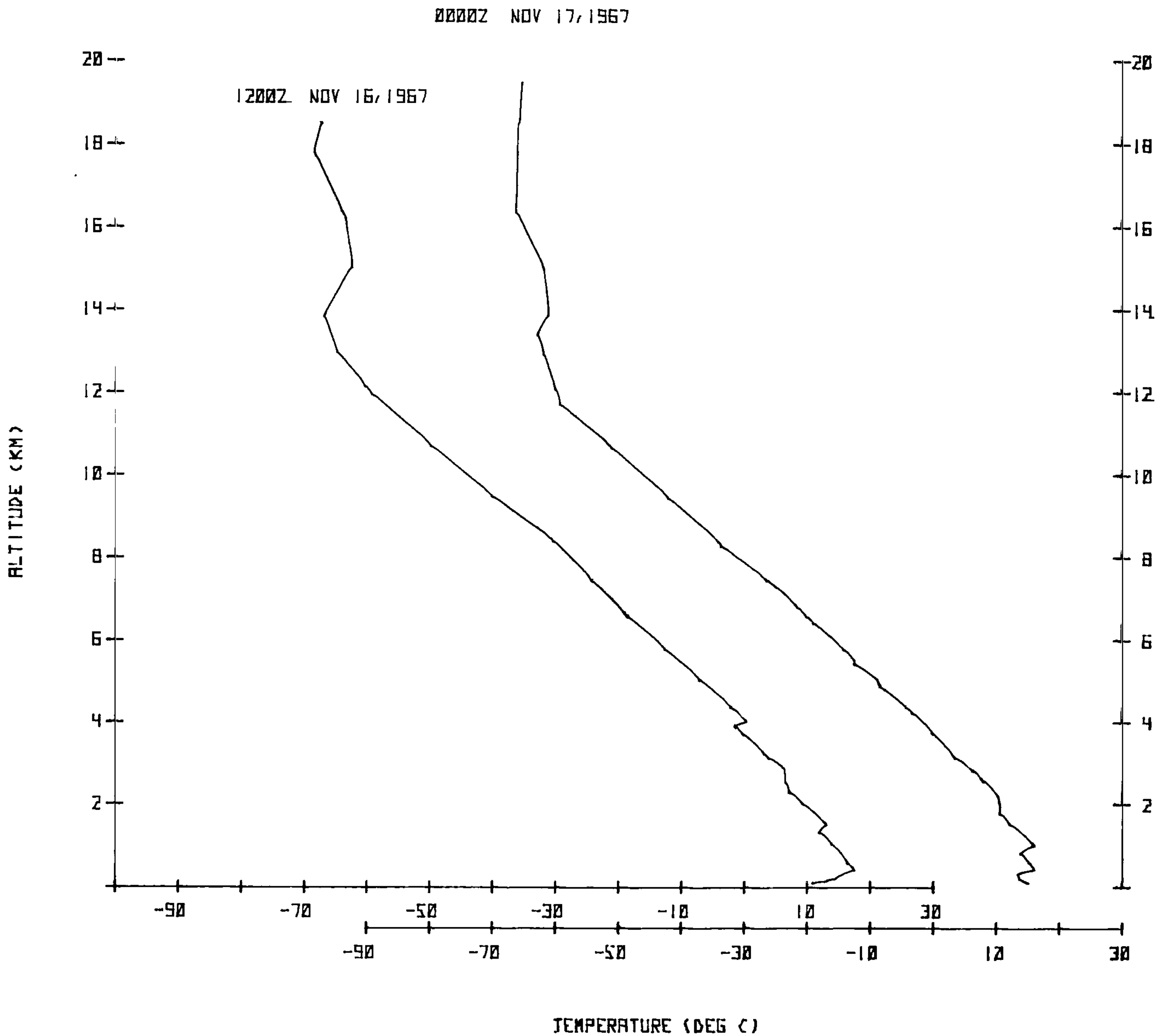


VANDENBERG RADIOSONDE TEMPERATURE PROFILE DATA

OCT 4-5, 1967



VANDENBERG RADIOSONDE TEMPERATURE PROFILE DATA
NOV 16-17, 1967



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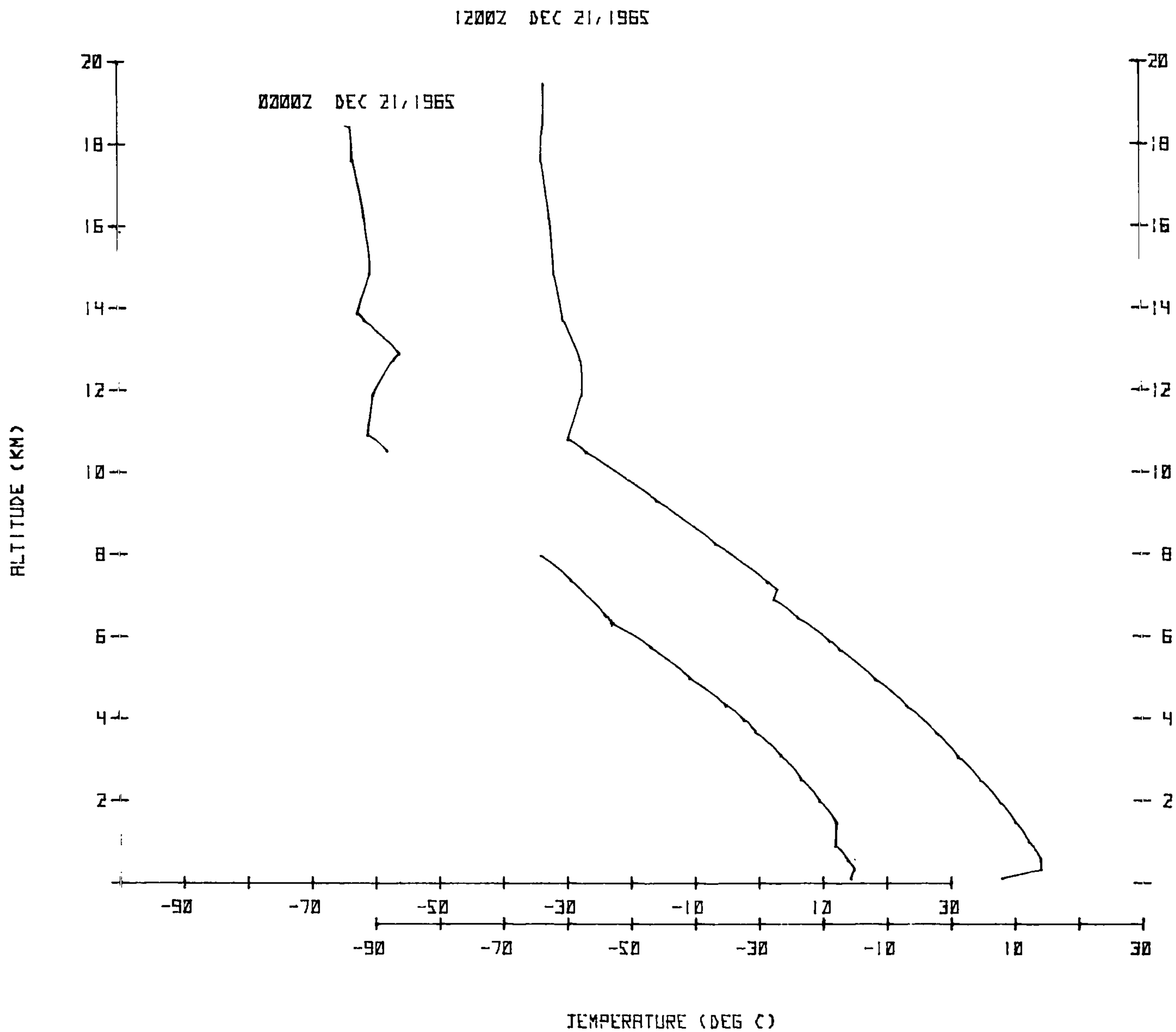
DEC 21, 1965



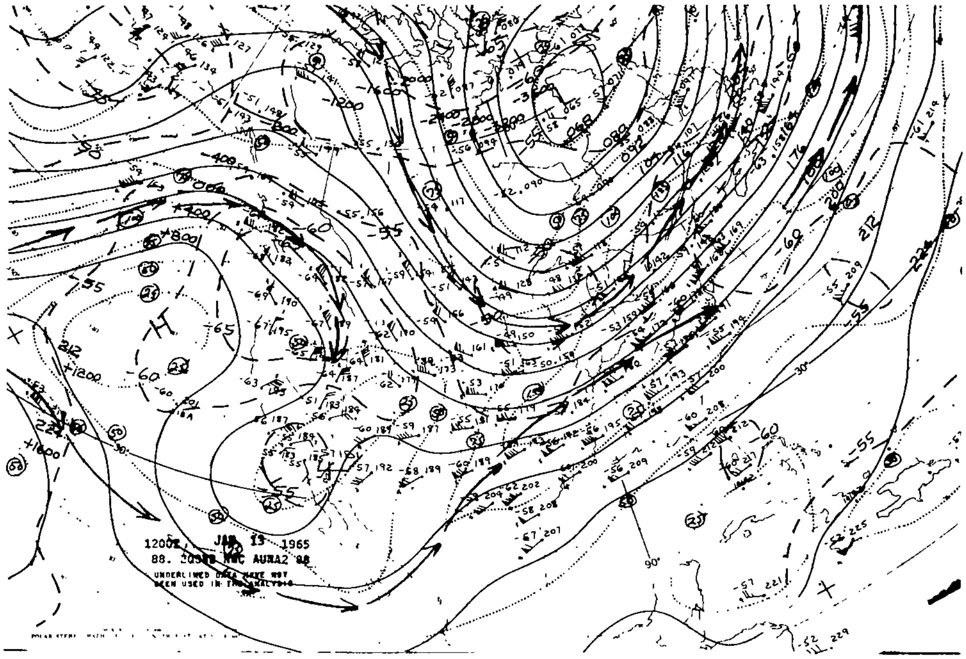
APPENDIX C

200-mb AND SURFACE SYNOPTIC WEATHER MAPS

200-mb and Surface Synoptic Weather Maps

Apply for Cape Canaveral, Florida Sequentials

1



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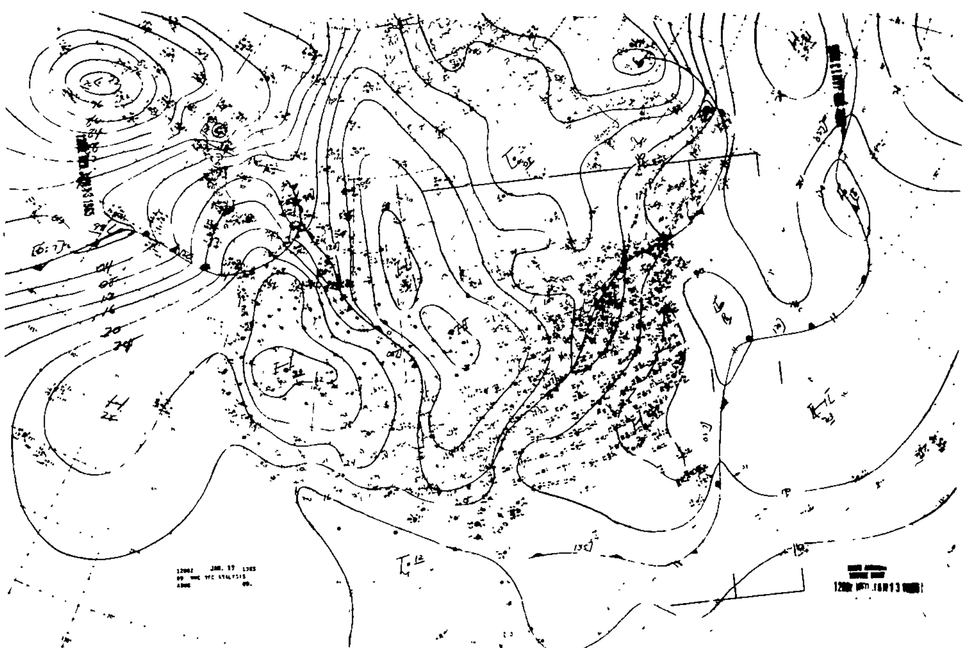

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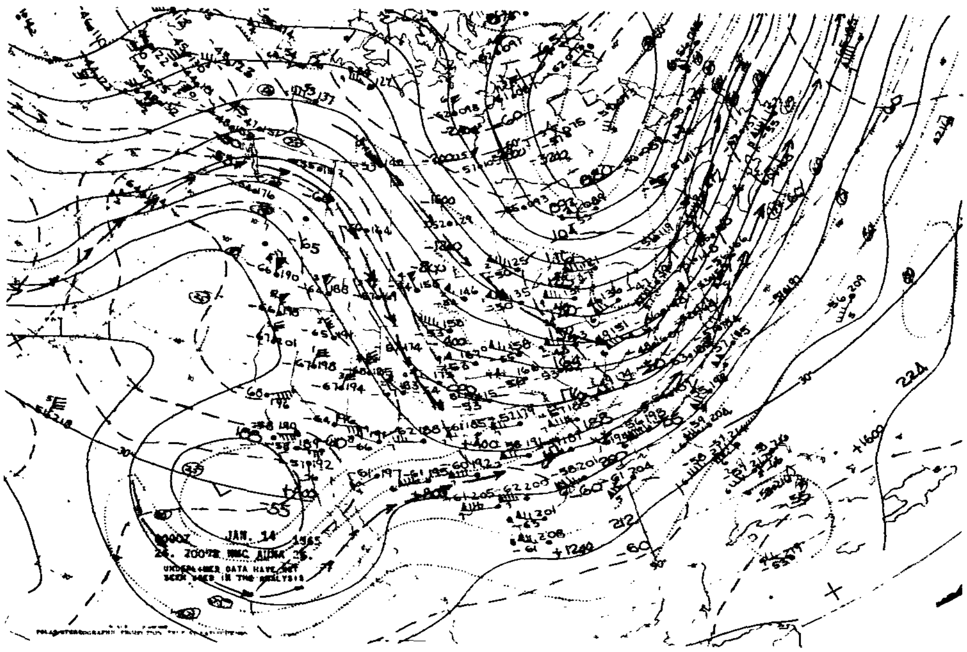

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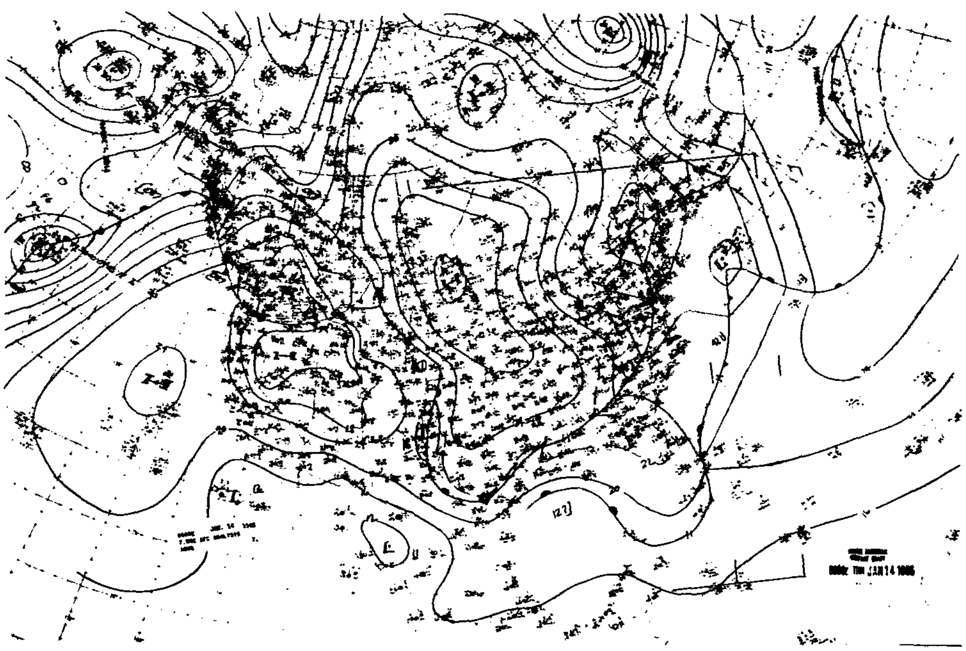

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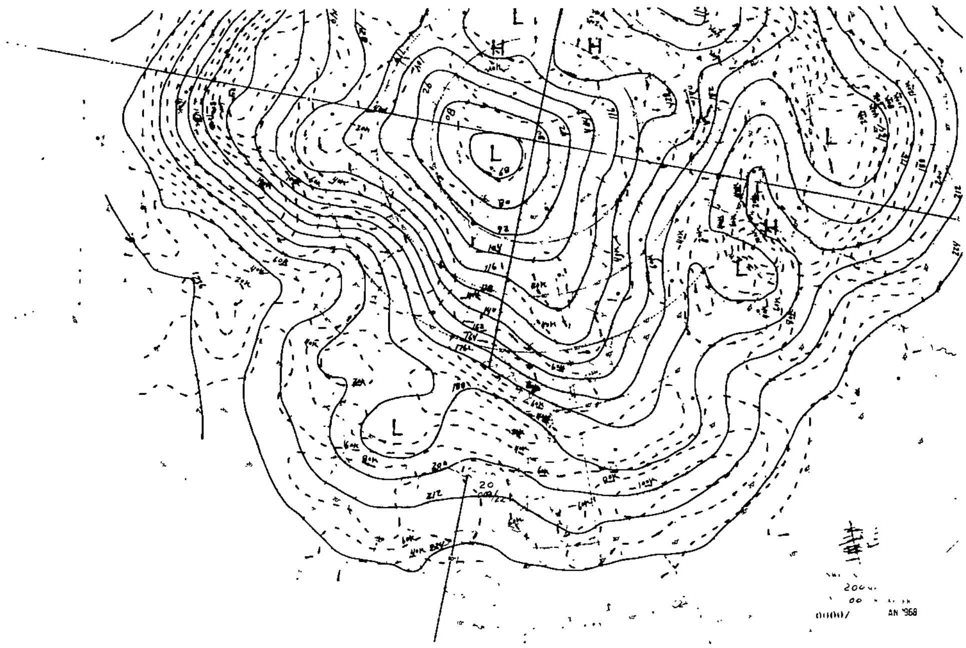

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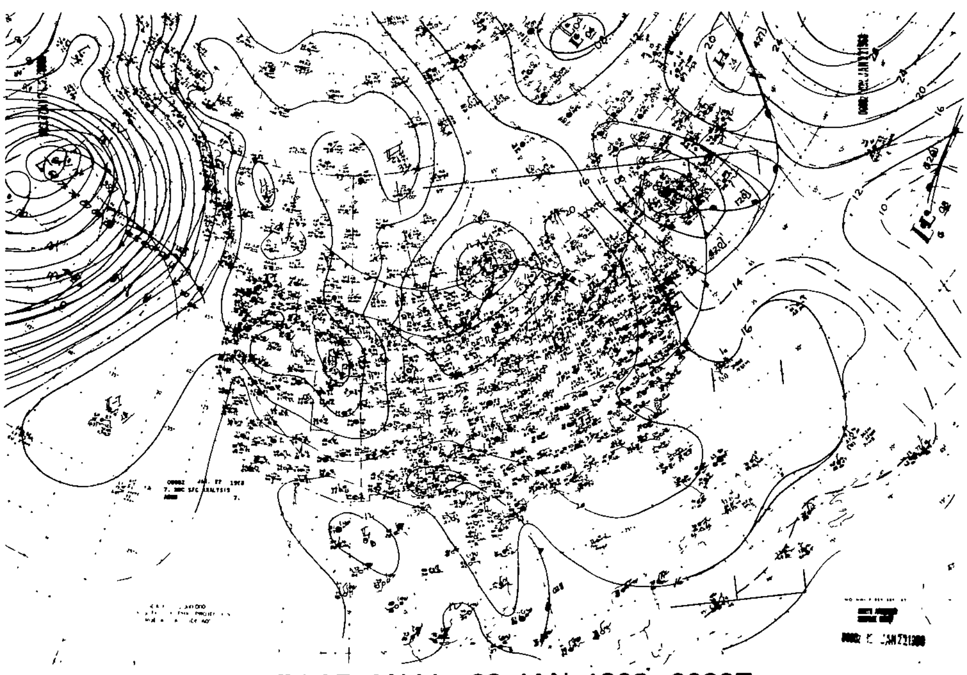

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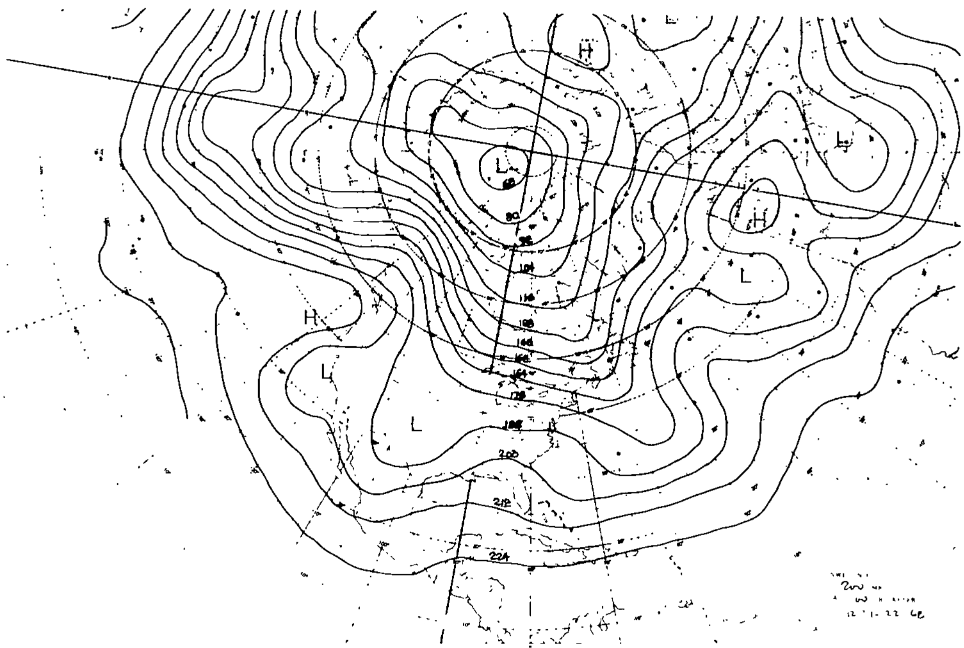

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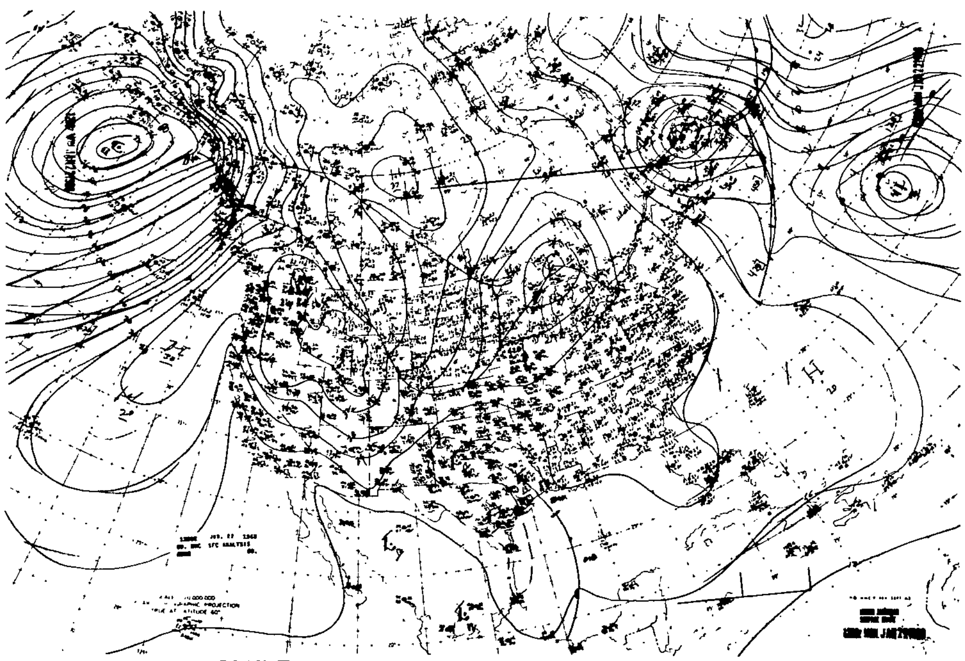

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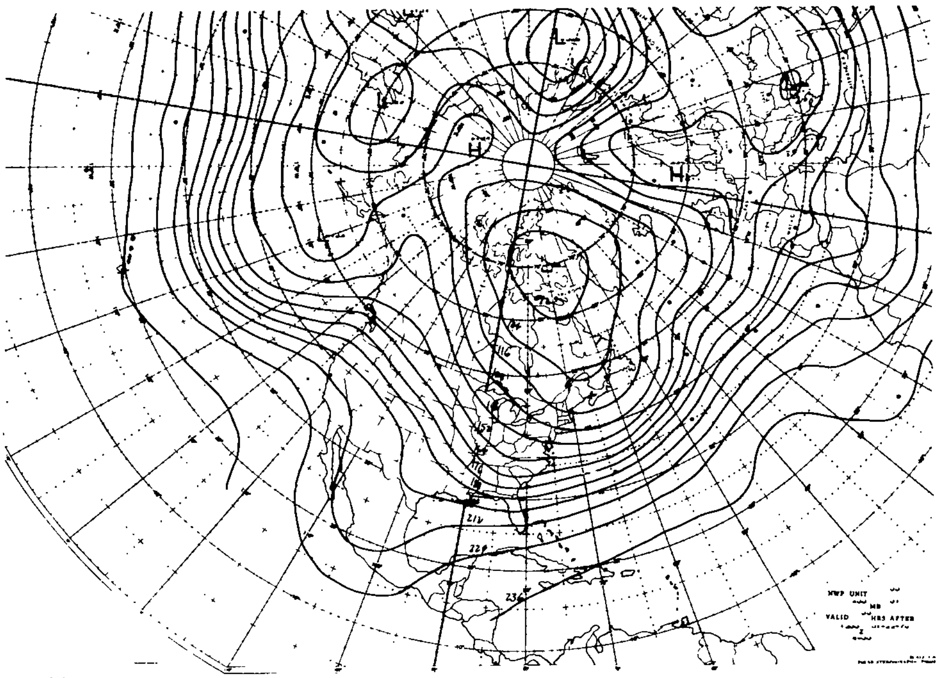

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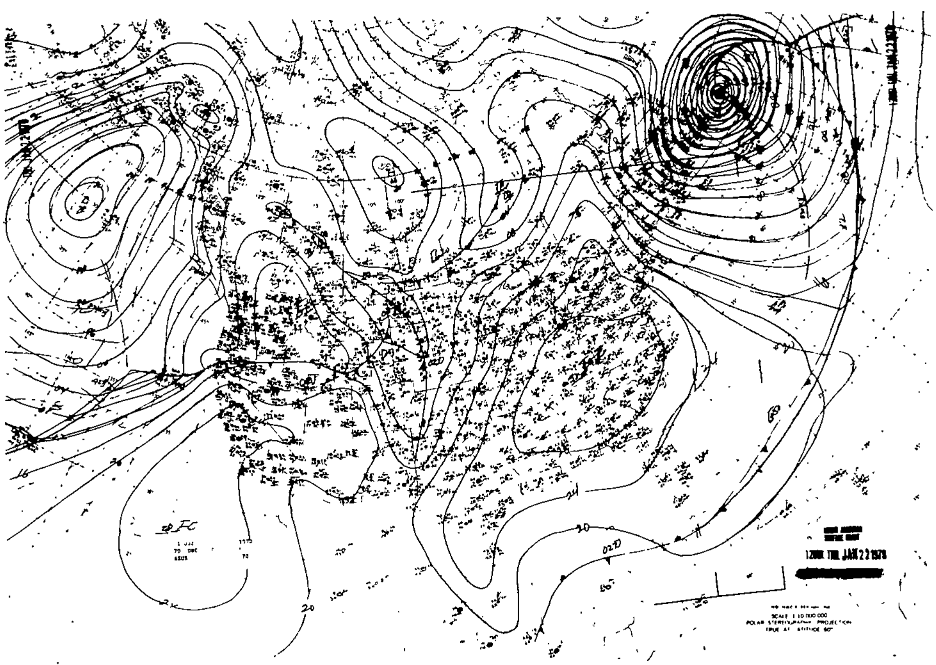

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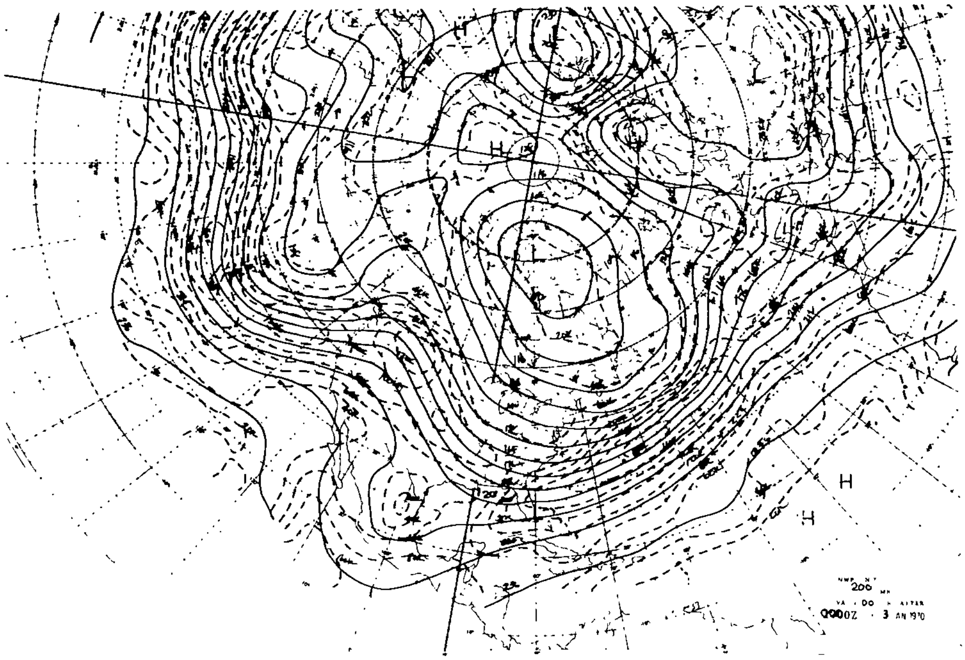

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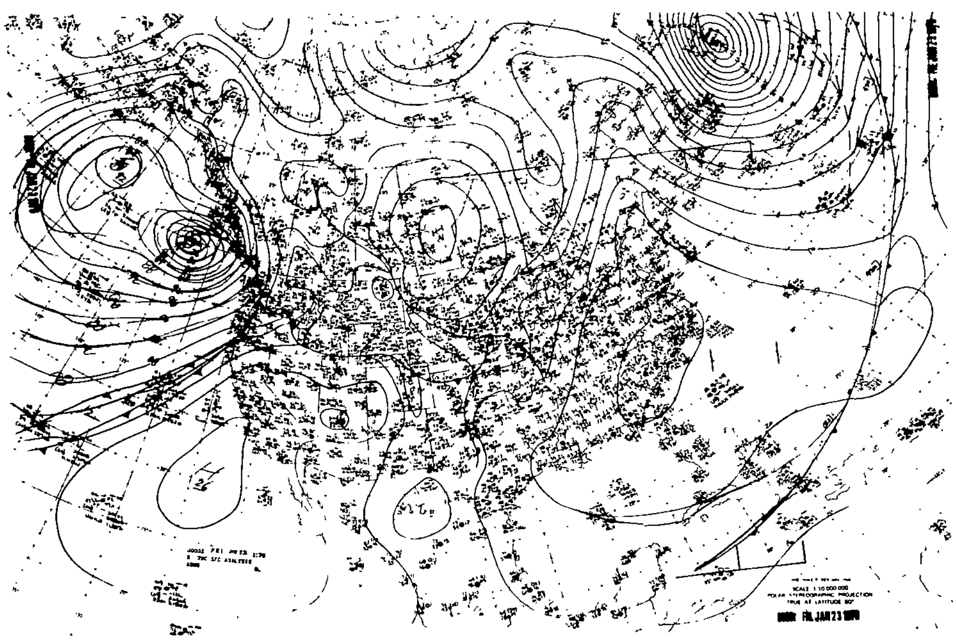

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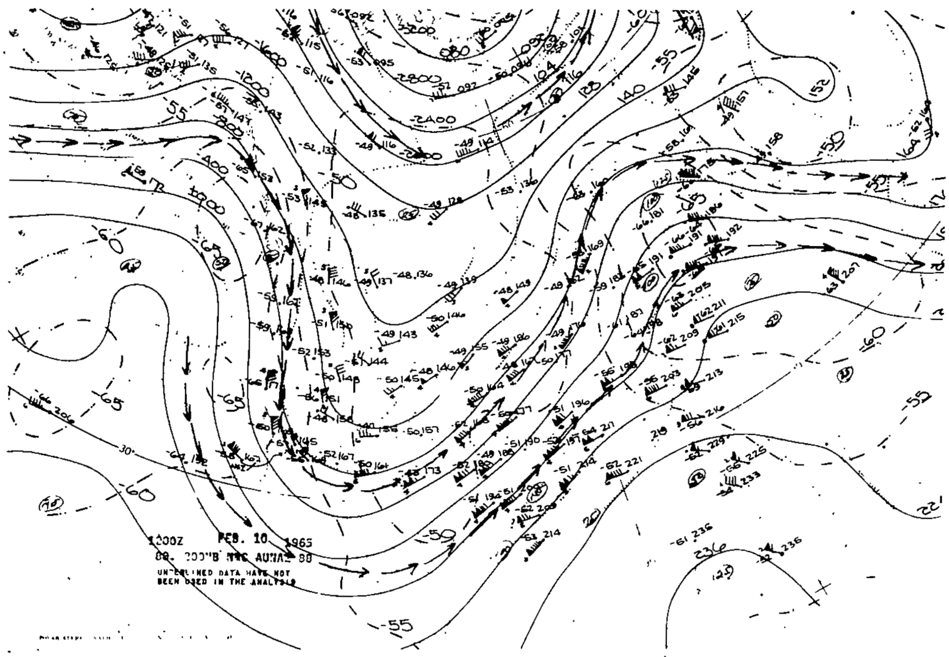

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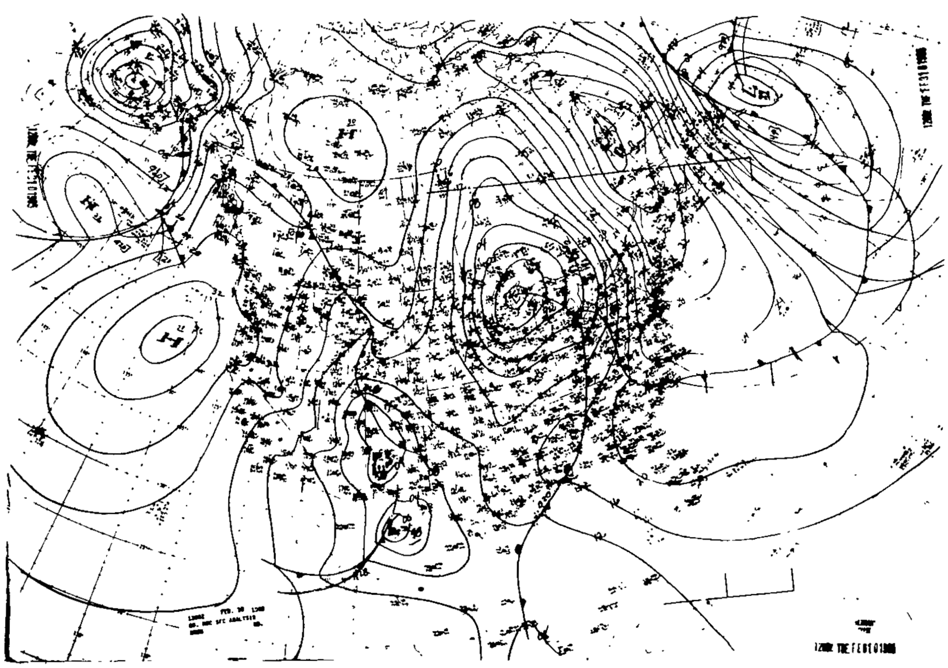

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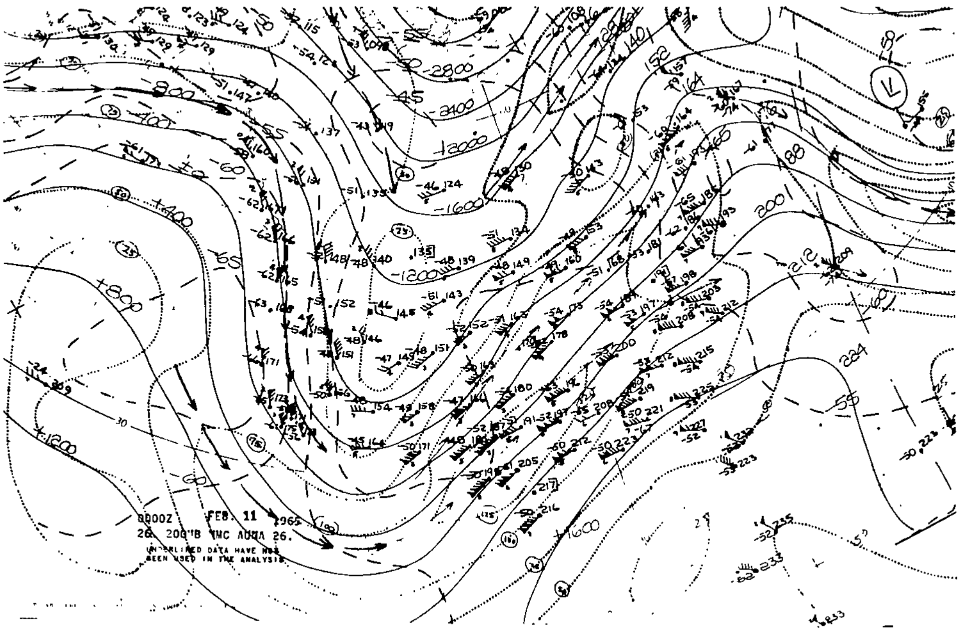

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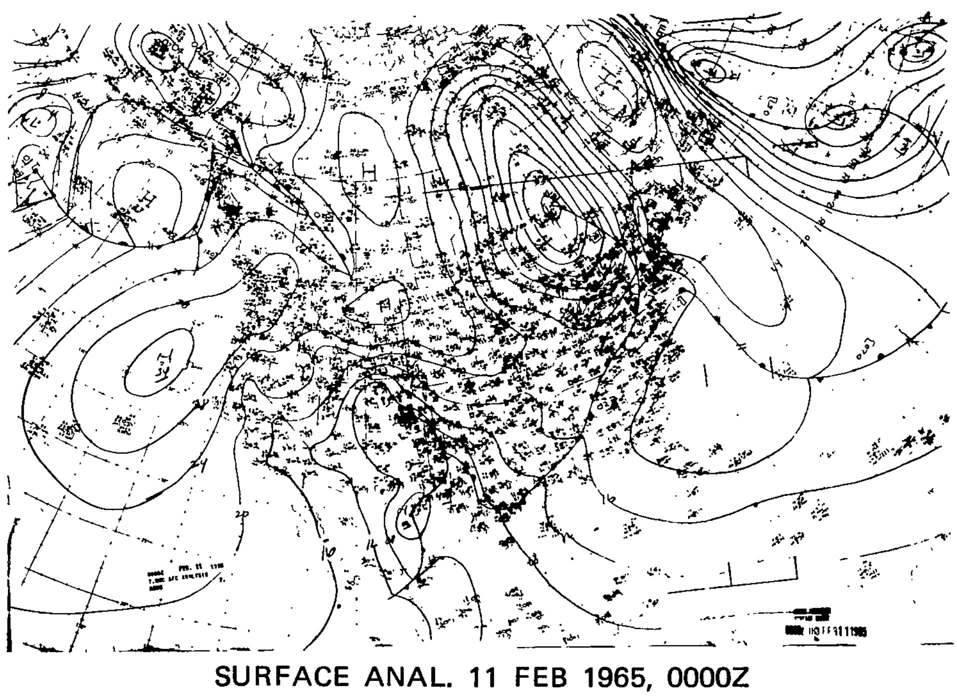

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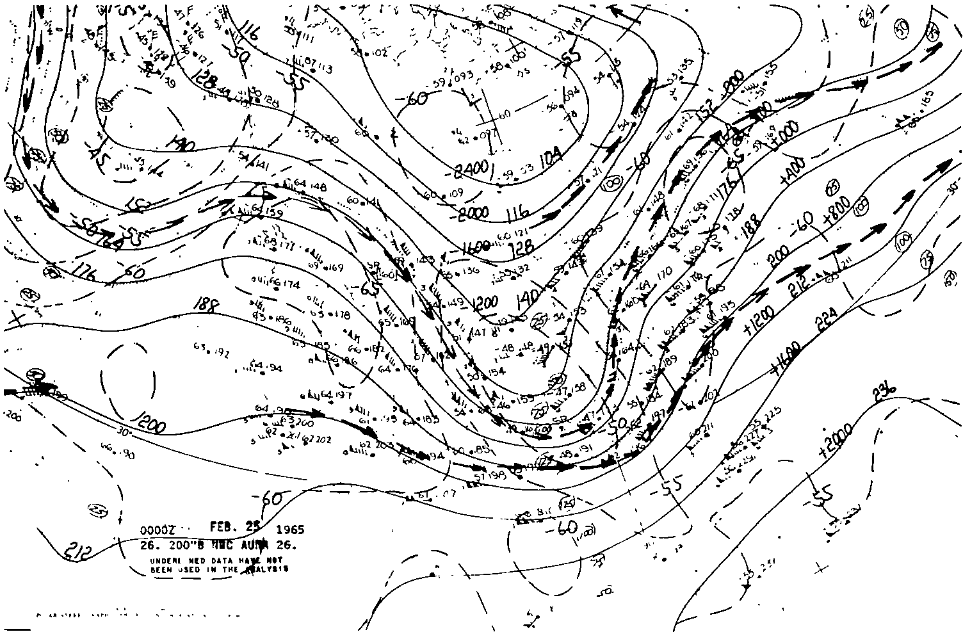

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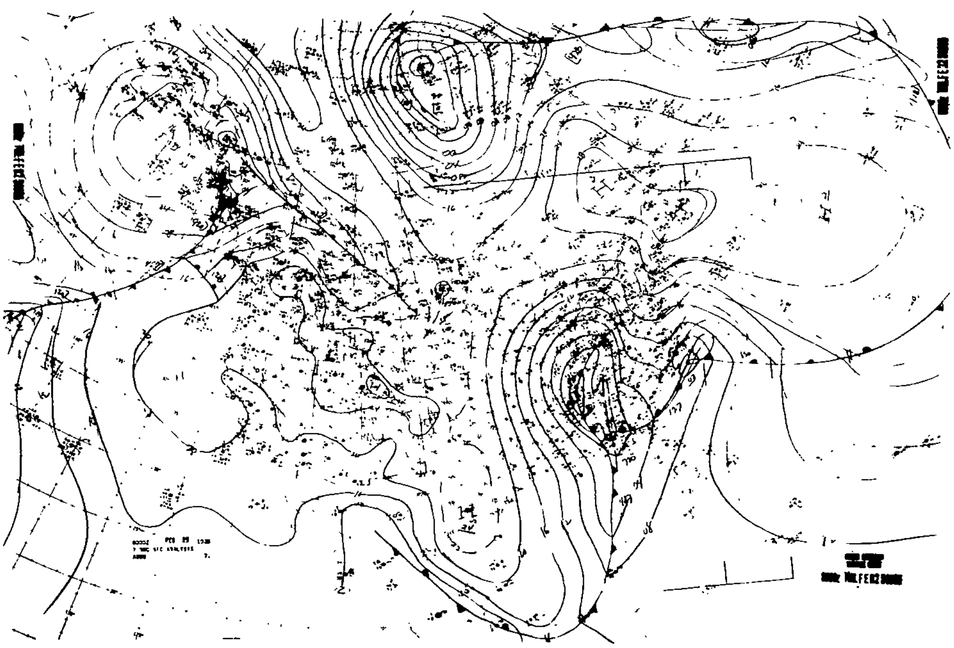

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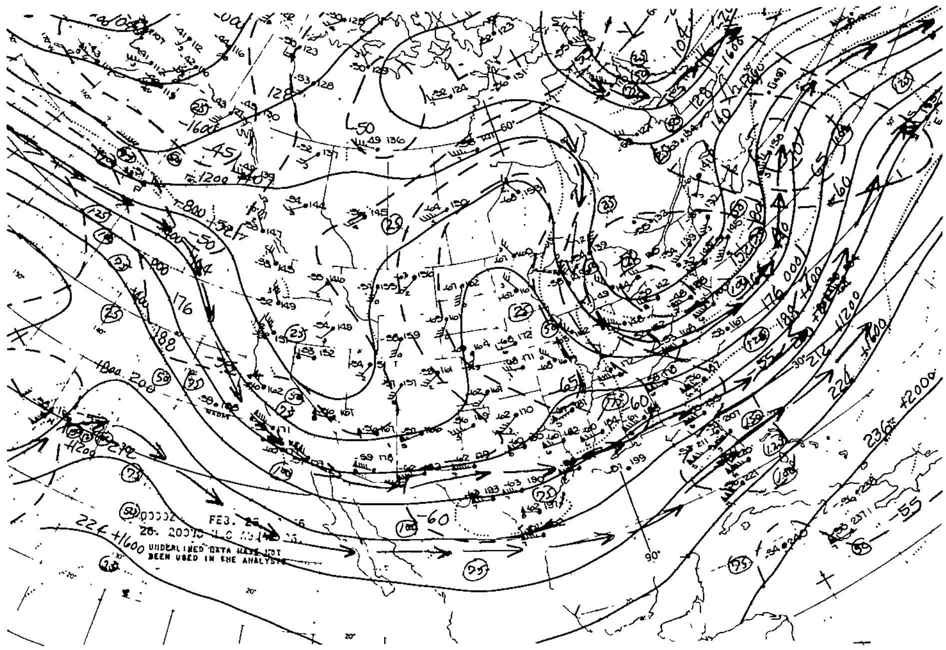

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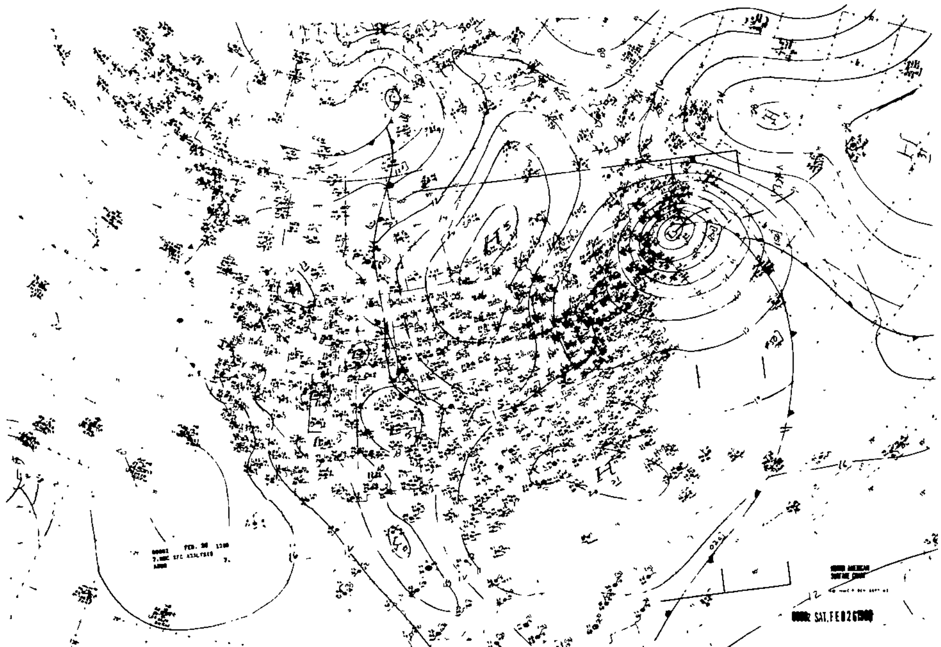

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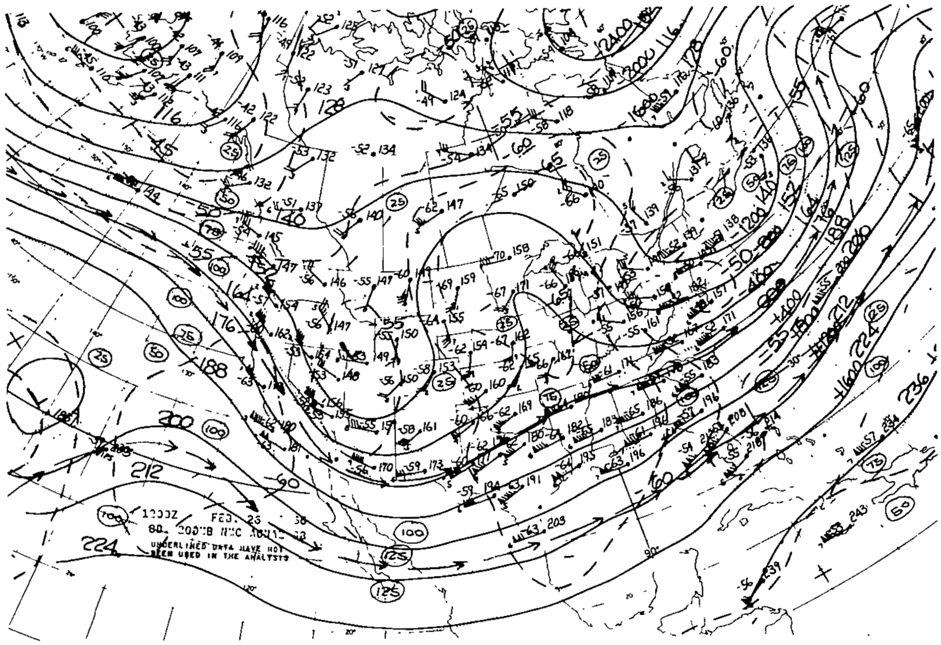

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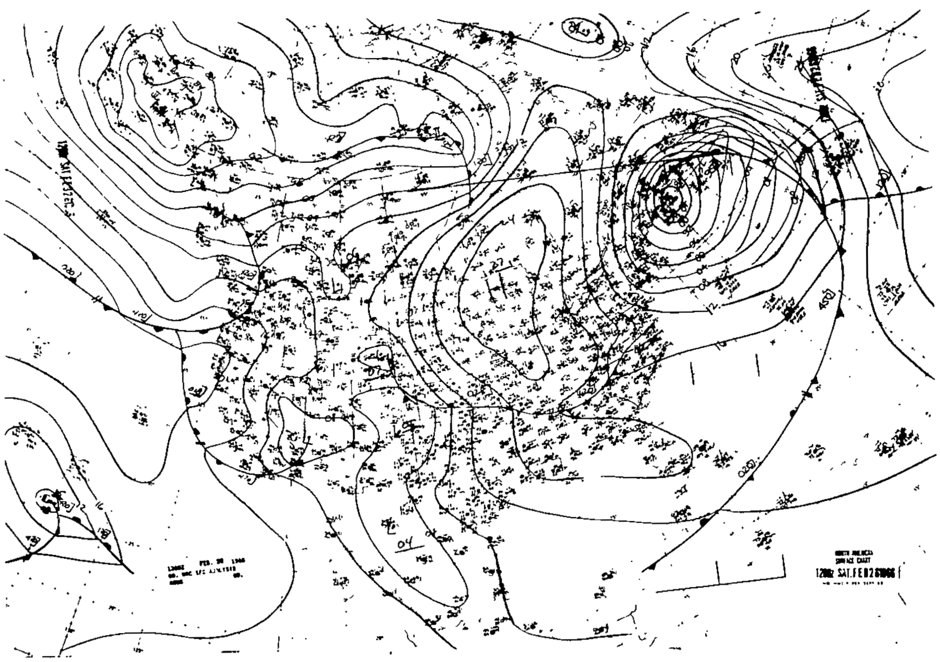

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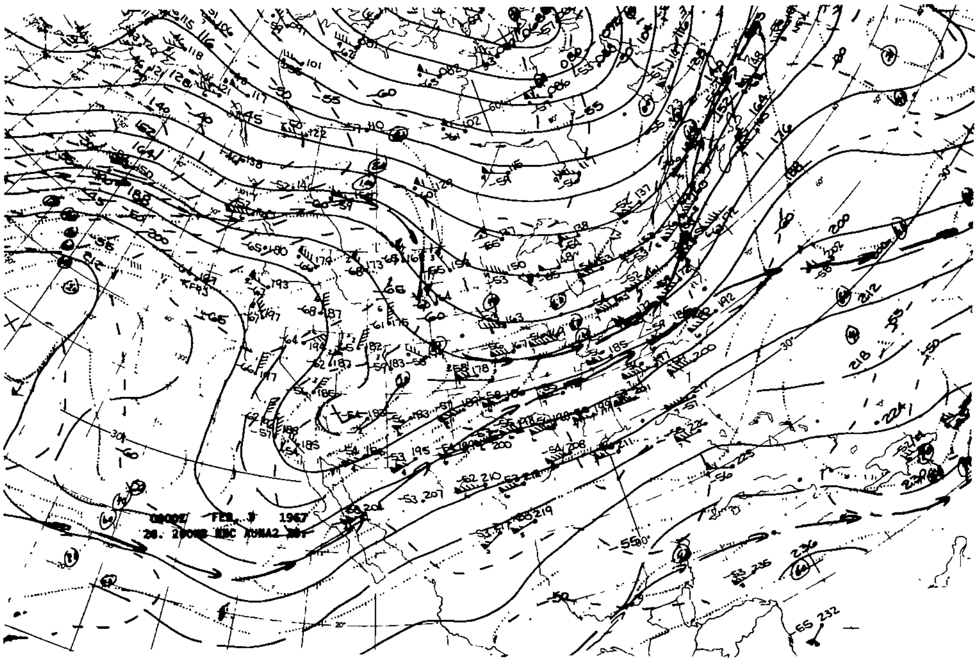

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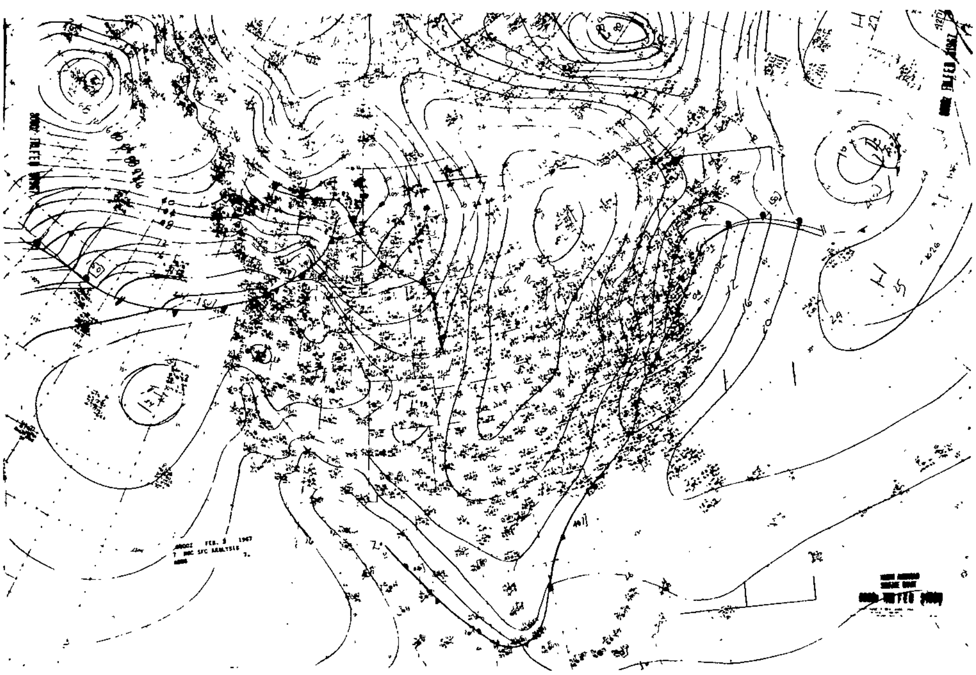

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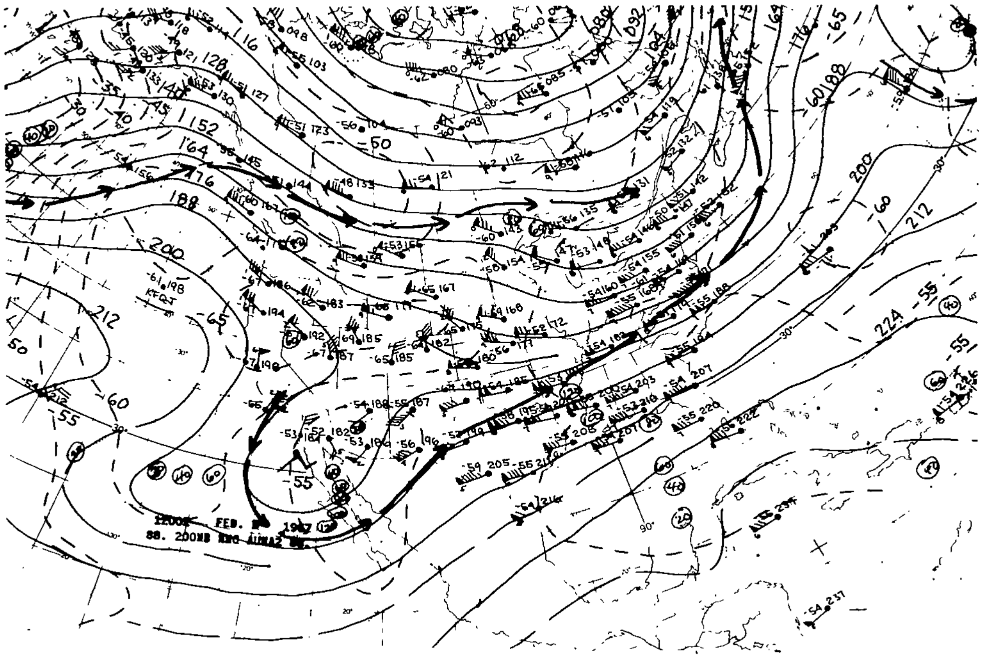

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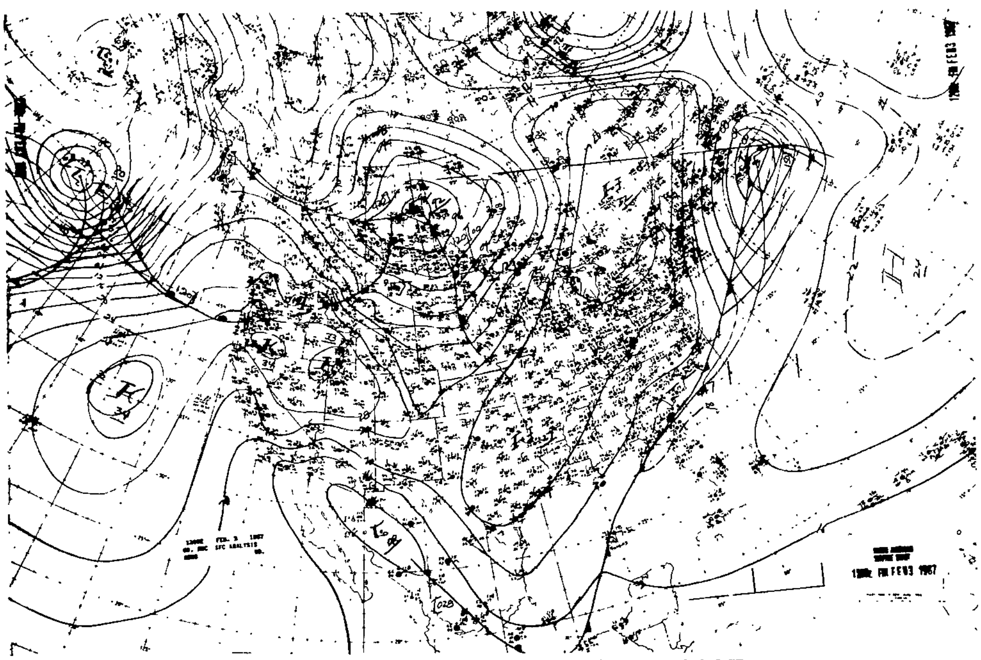

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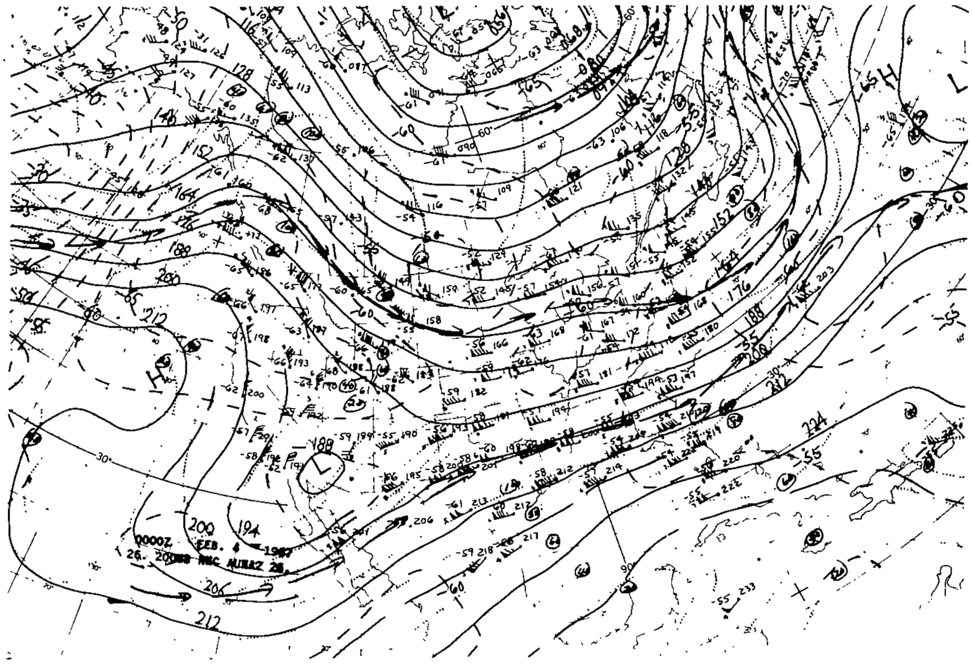

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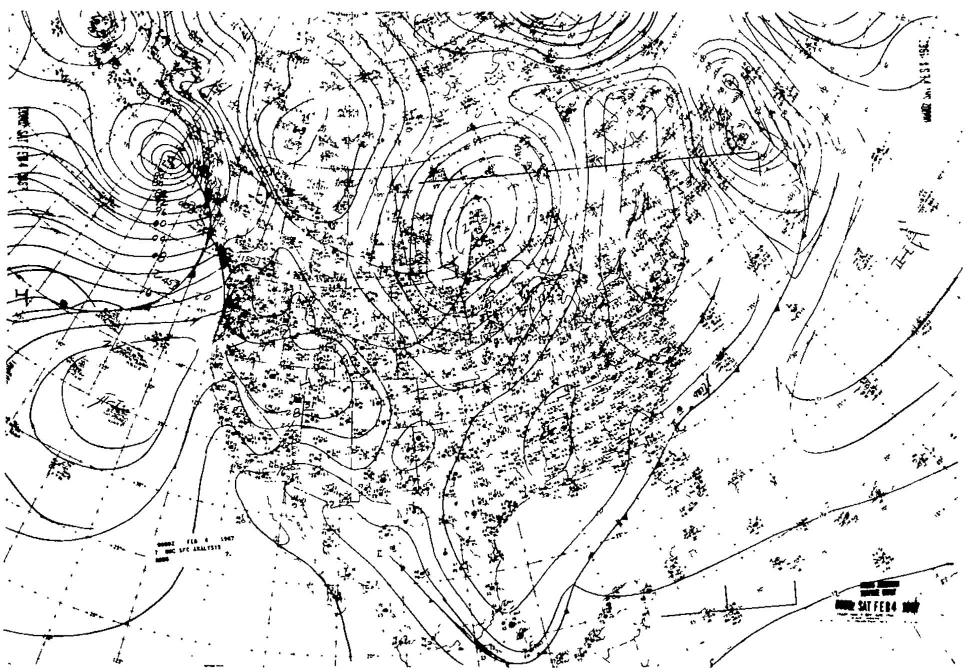

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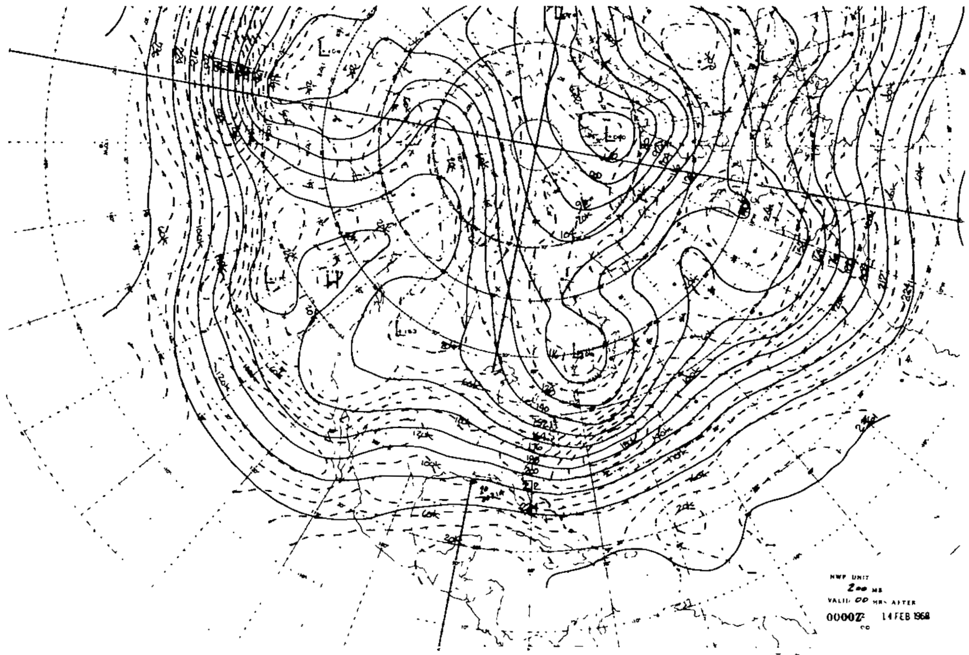

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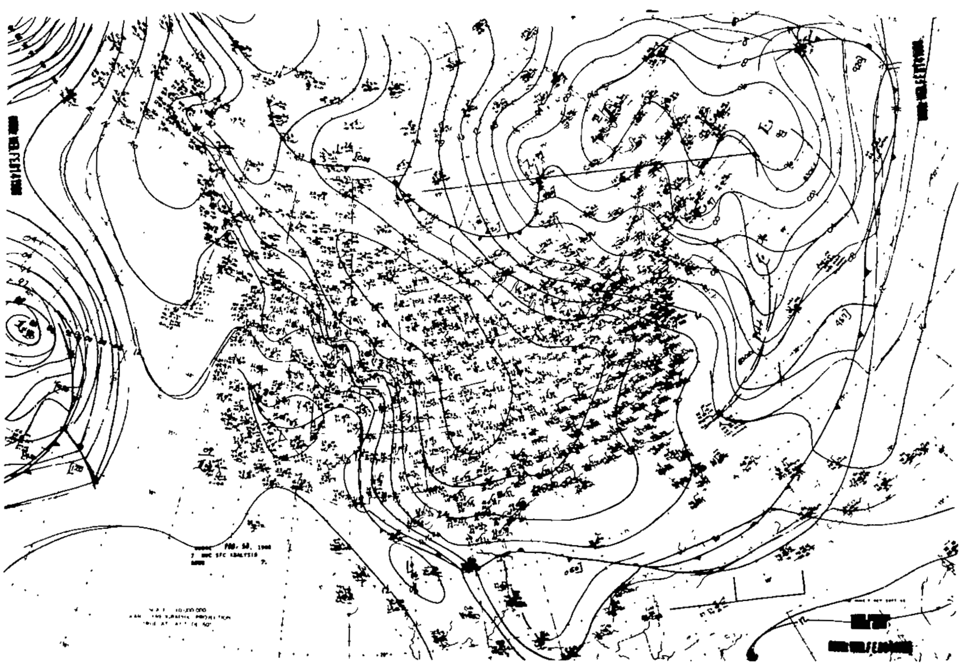

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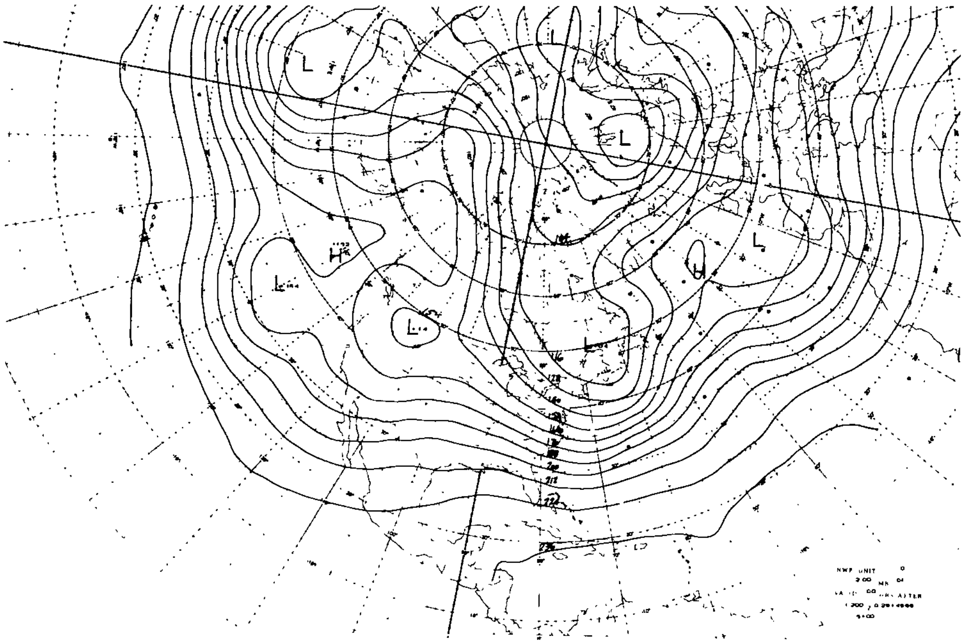

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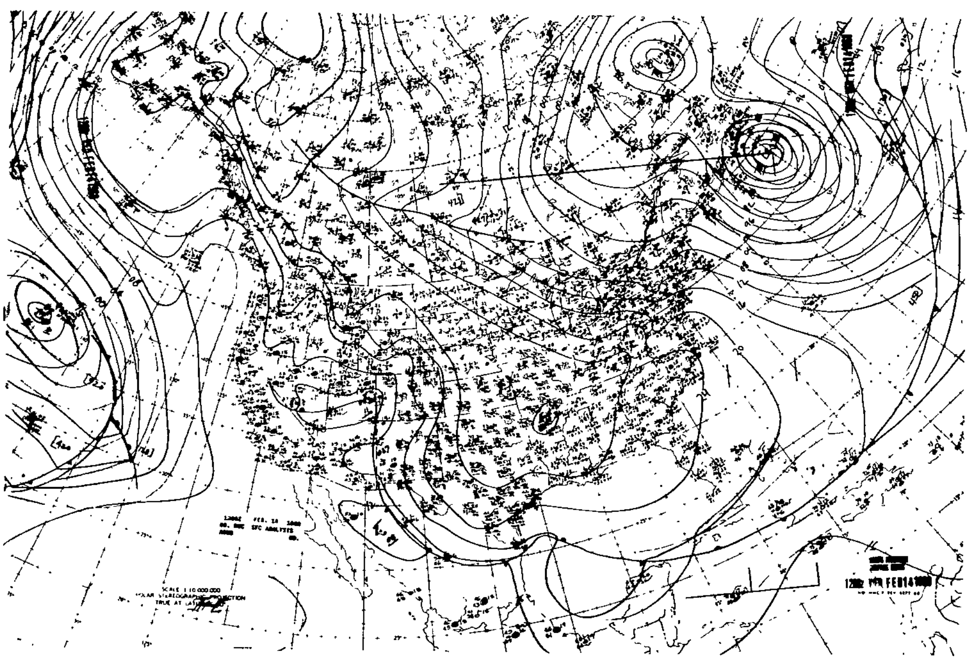

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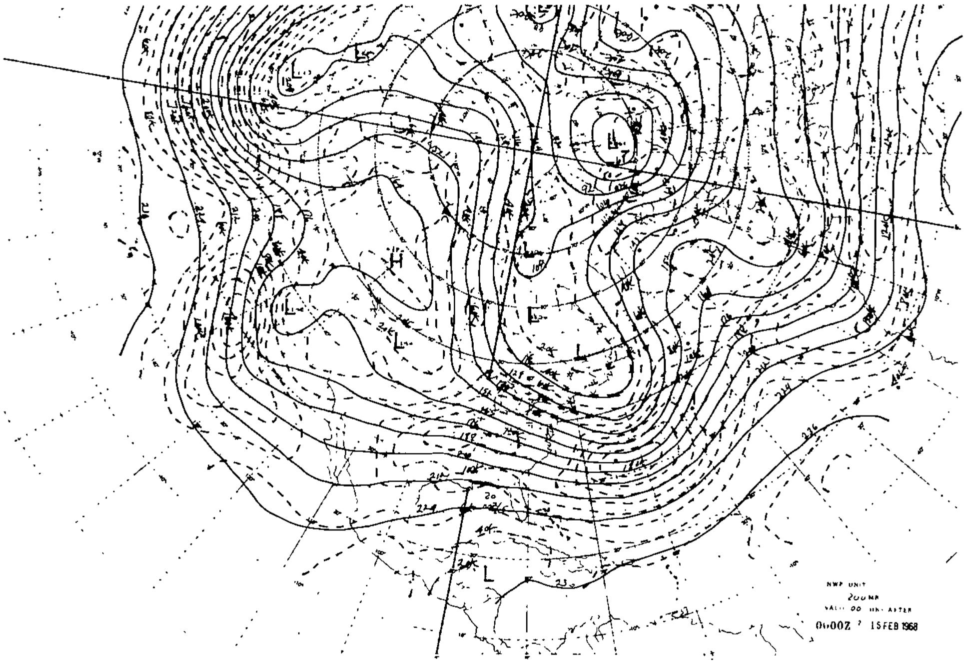

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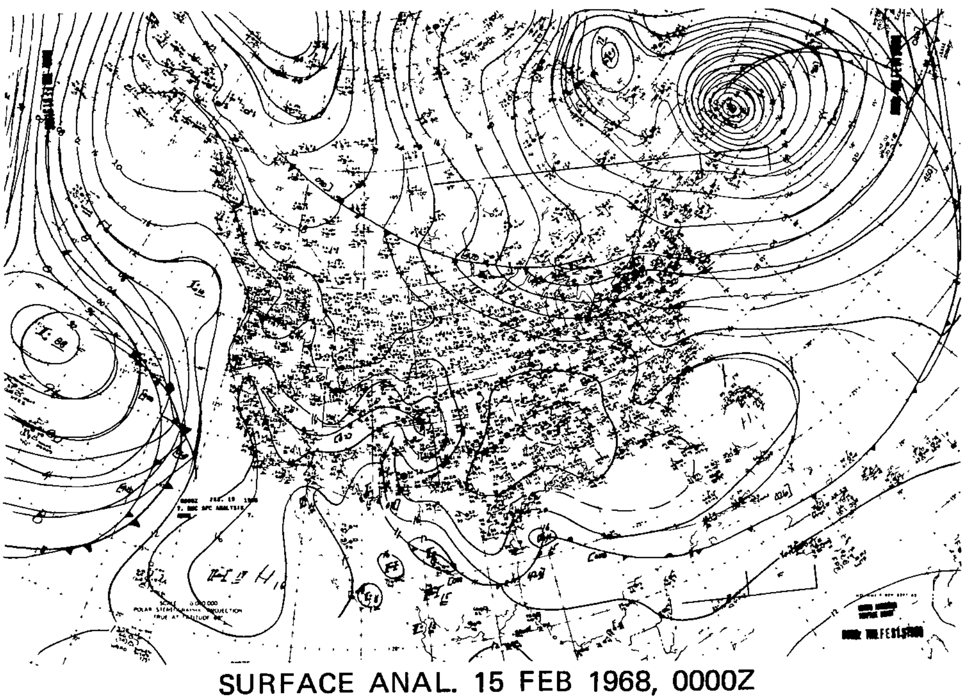

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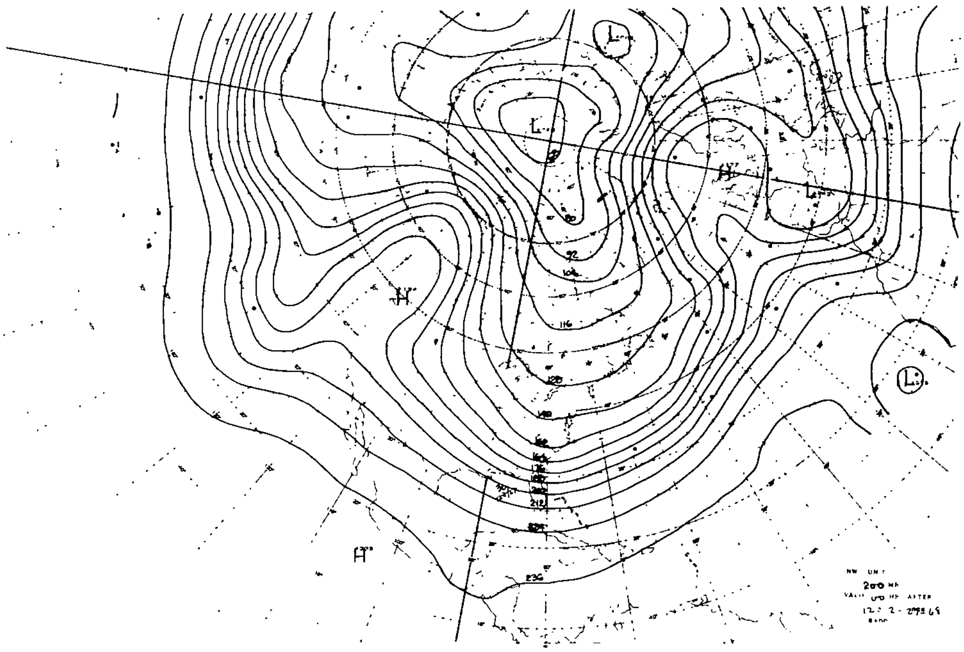

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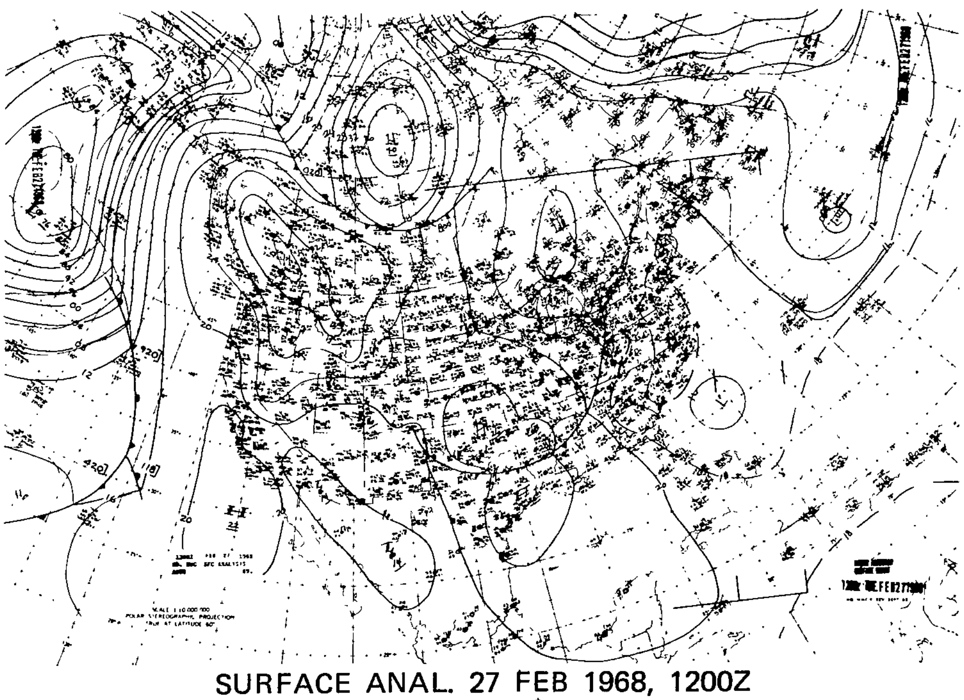

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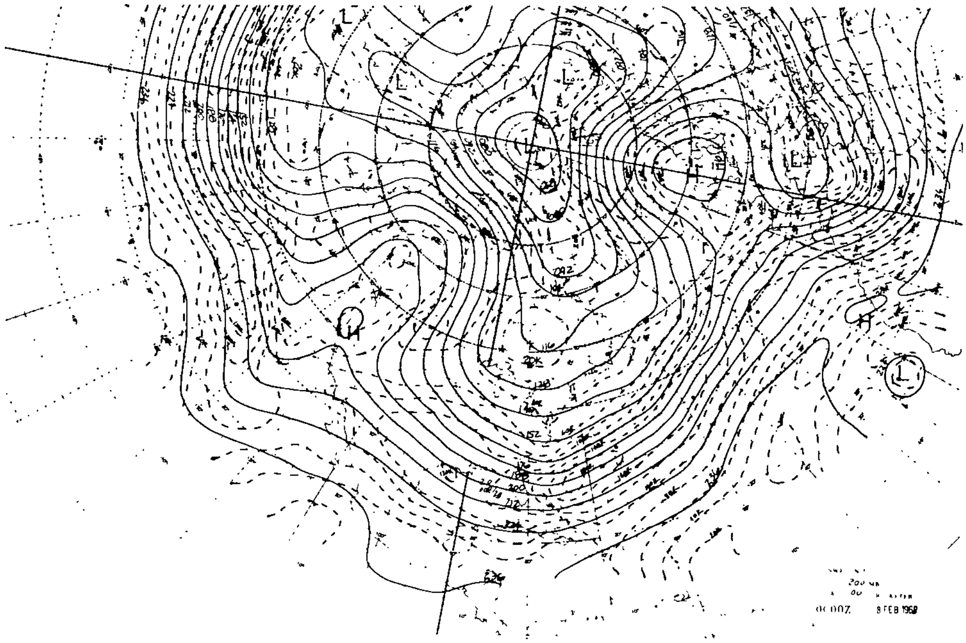

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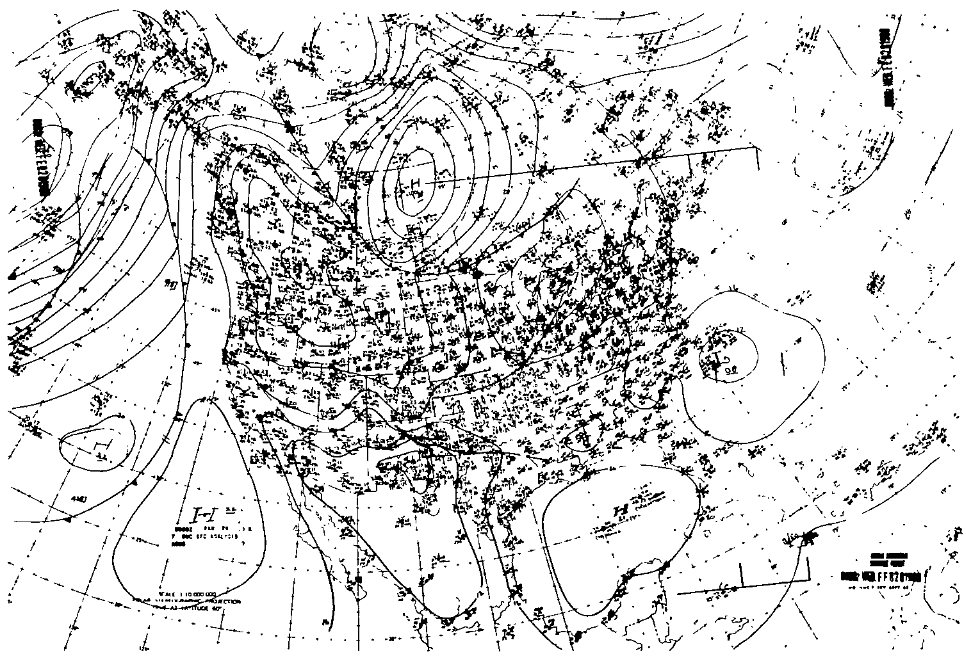

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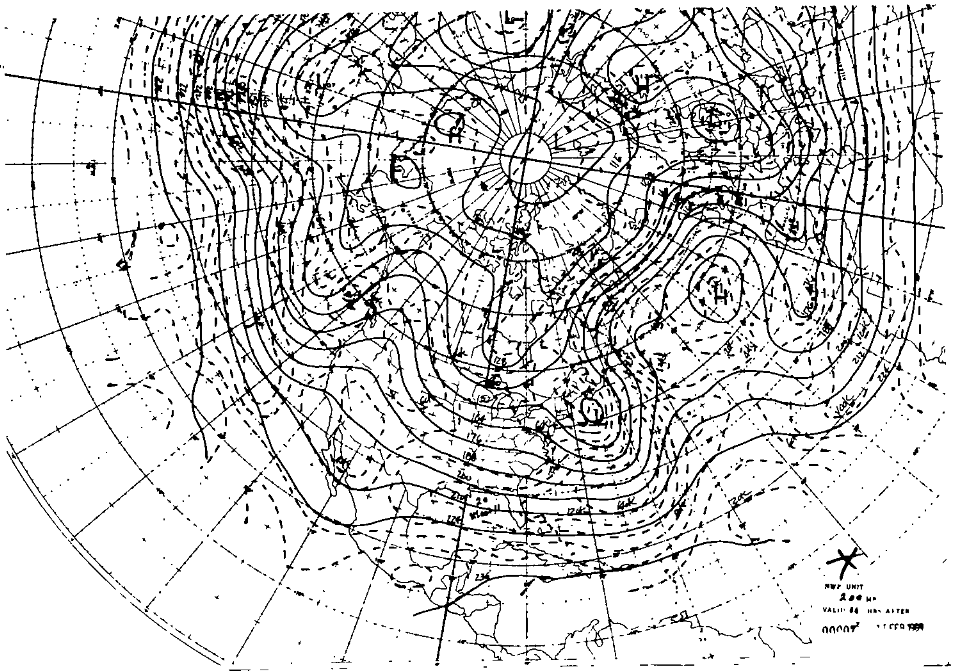

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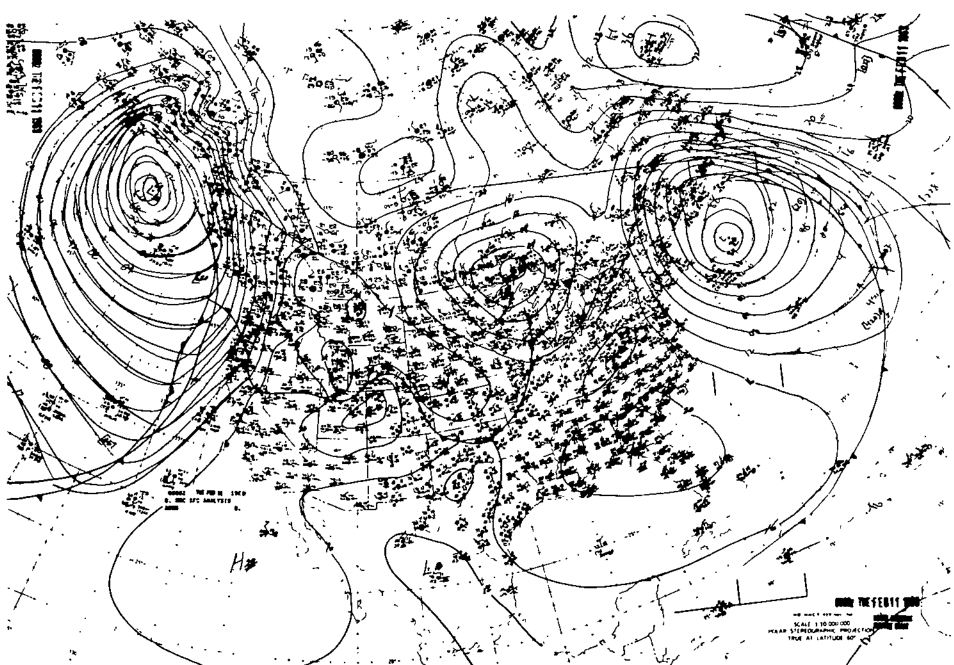

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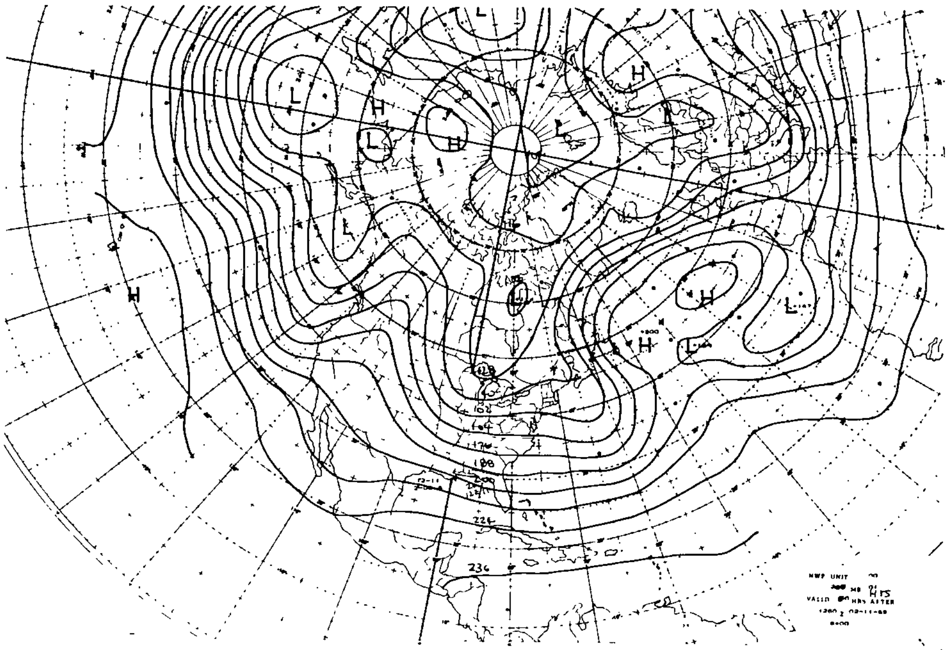

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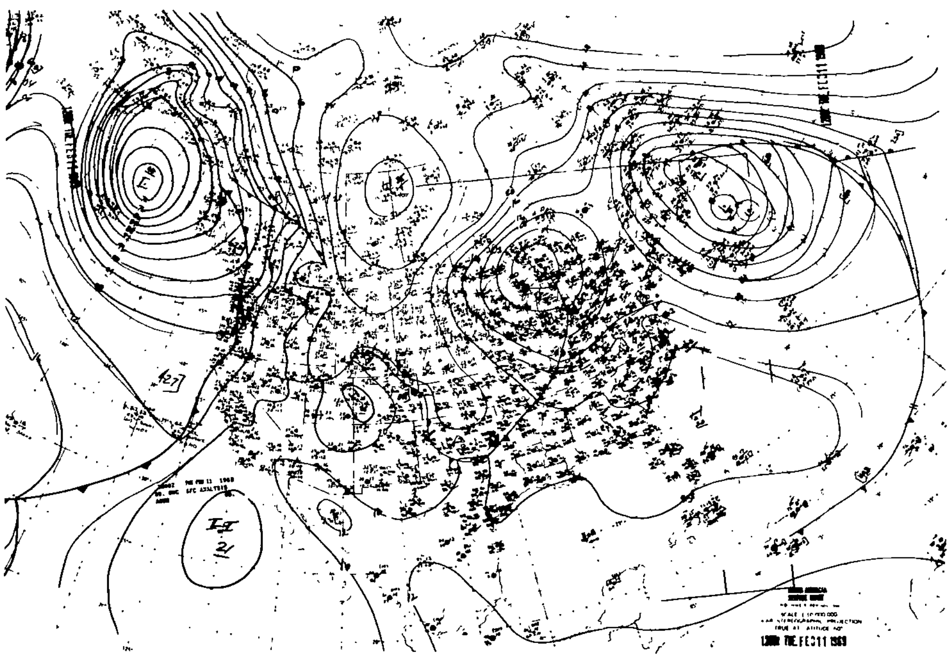

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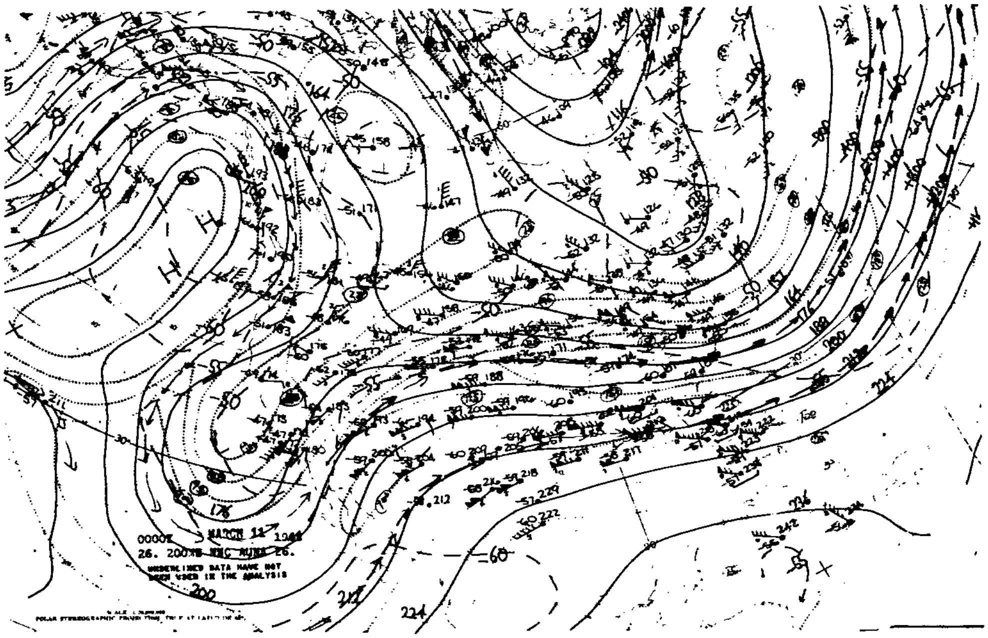

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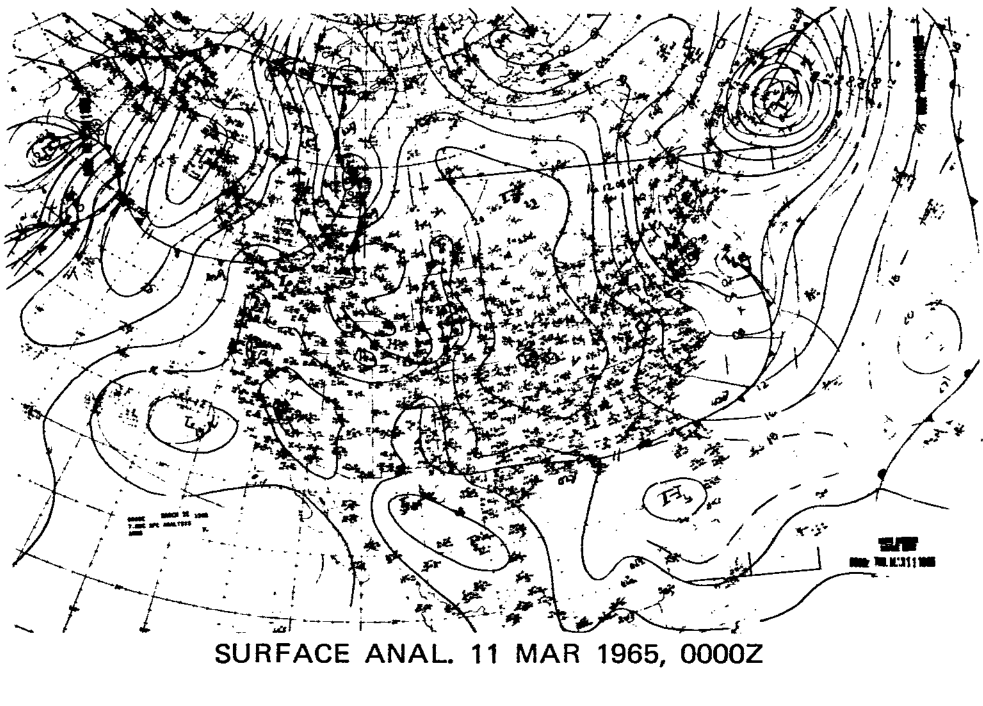

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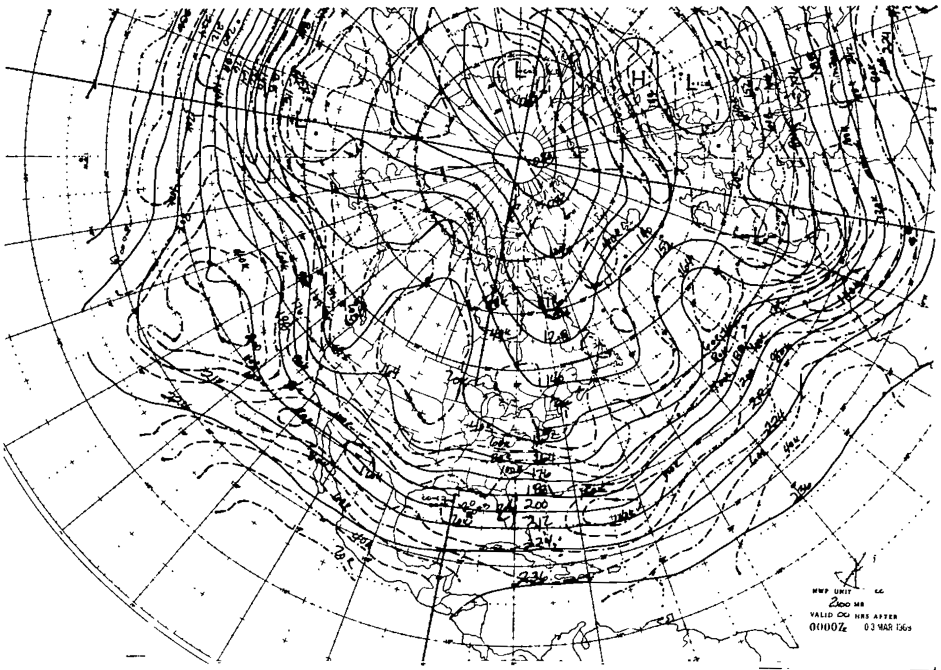

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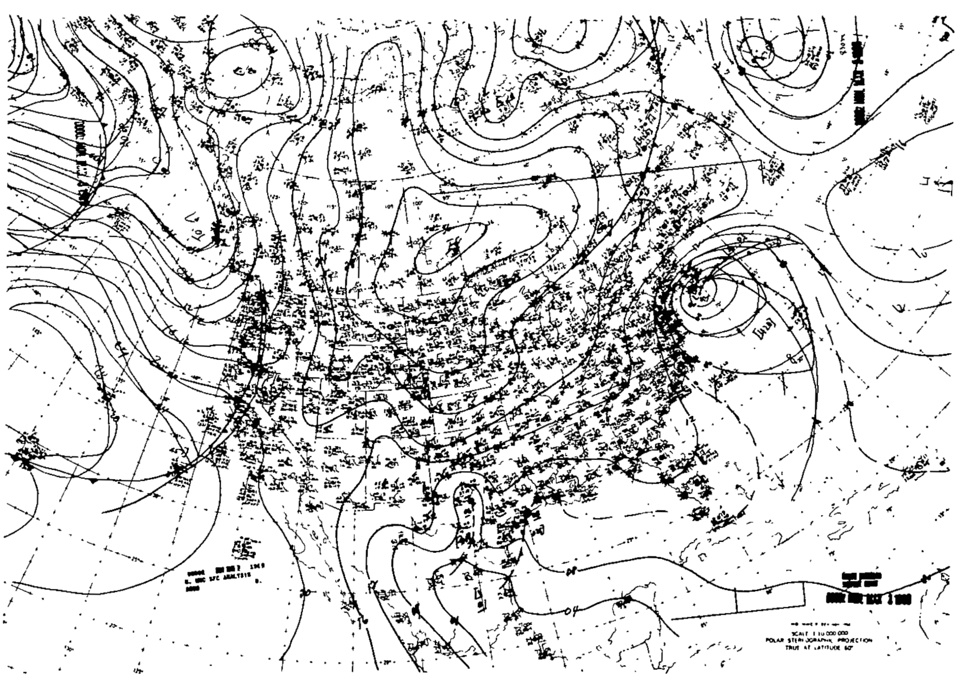

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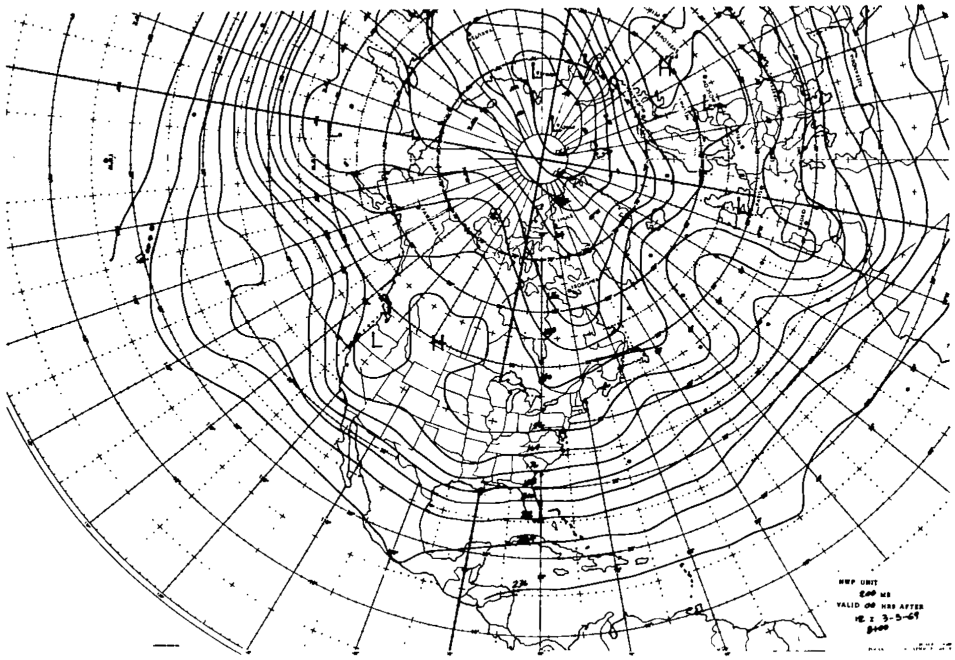

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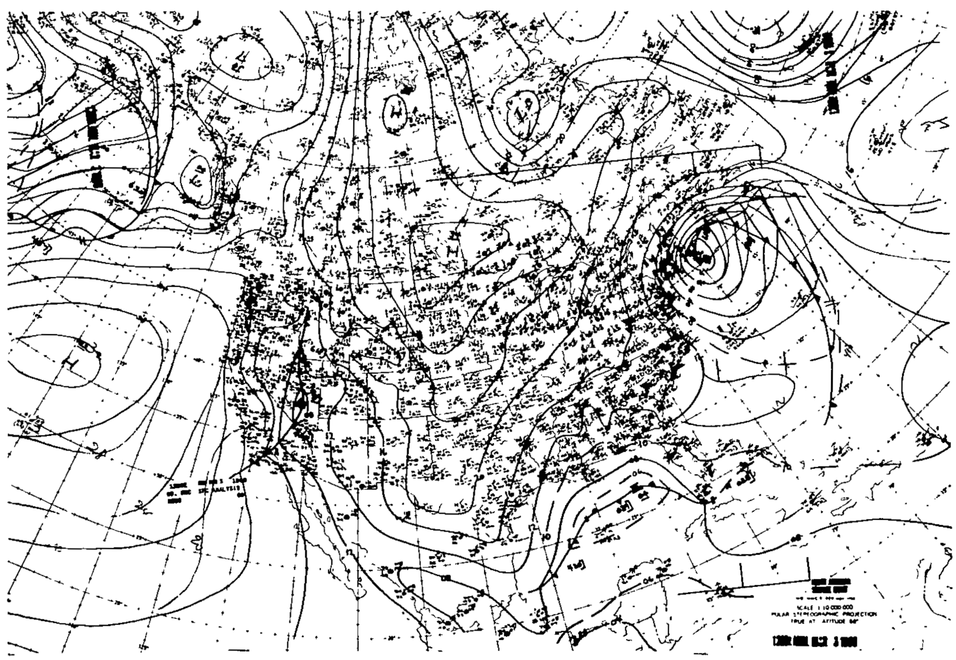

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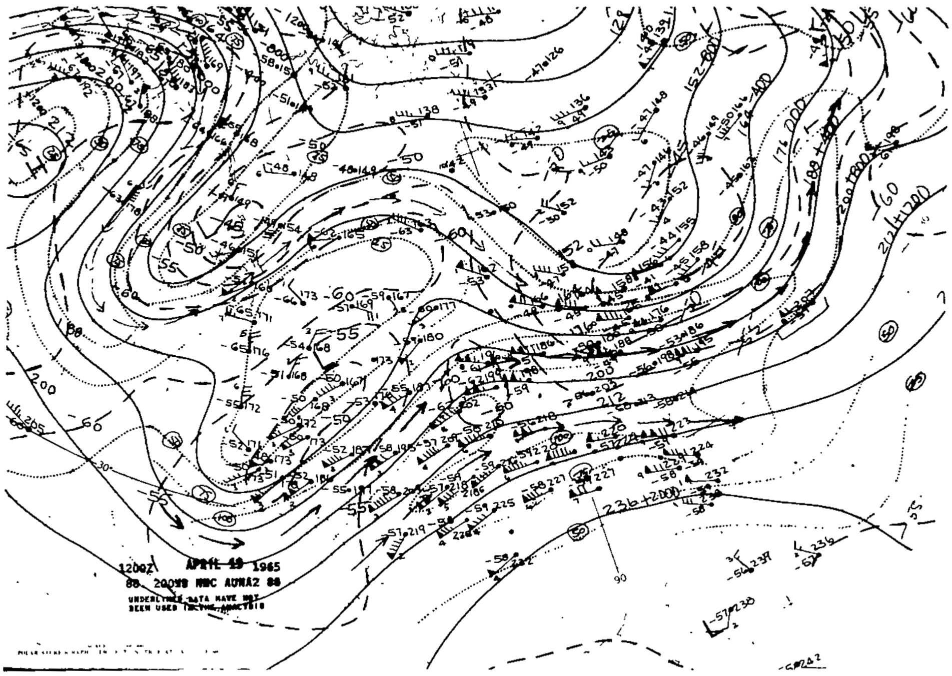

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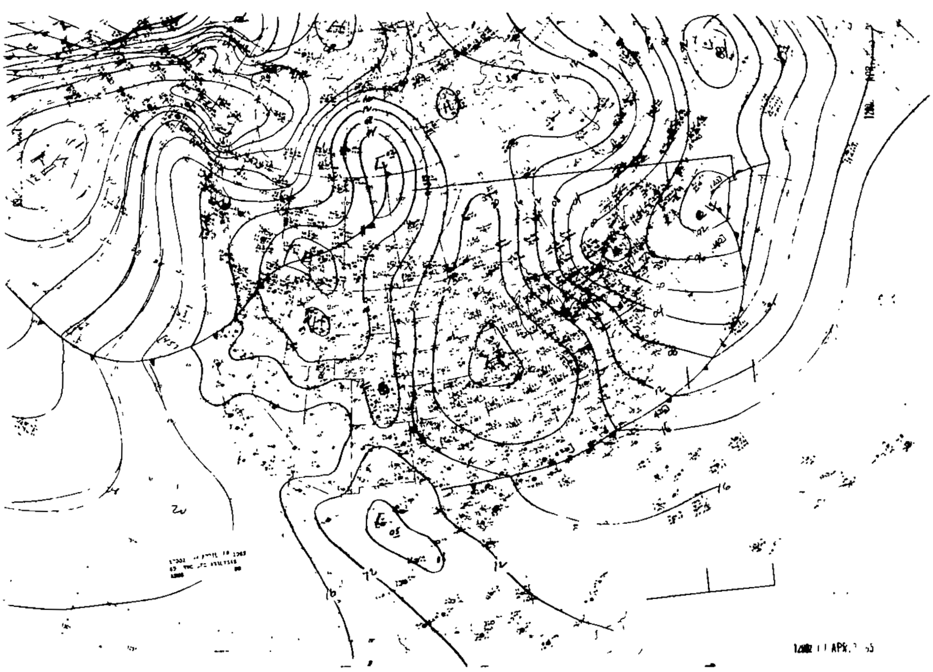

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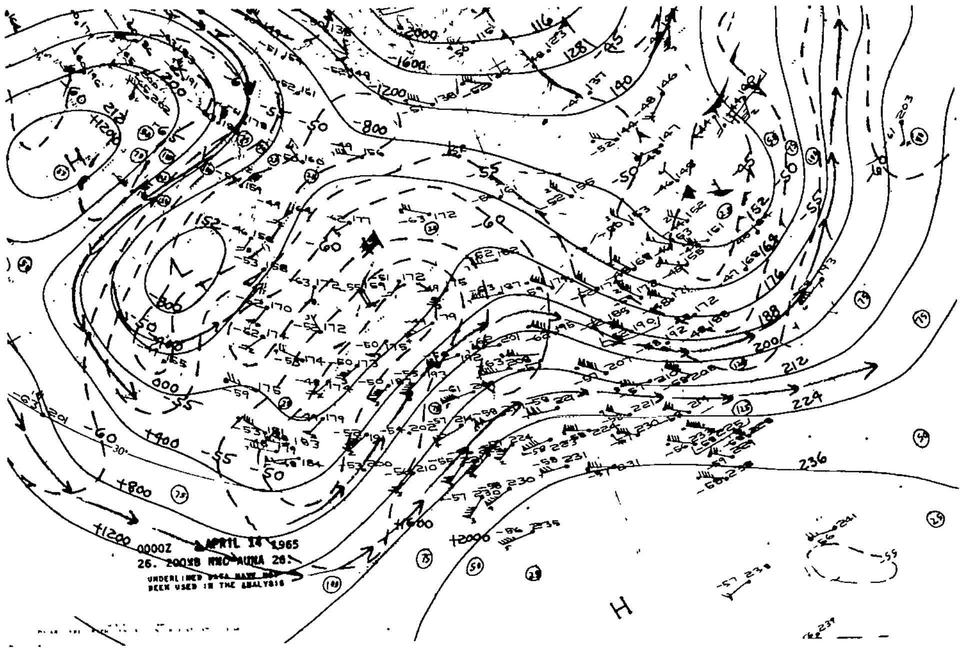

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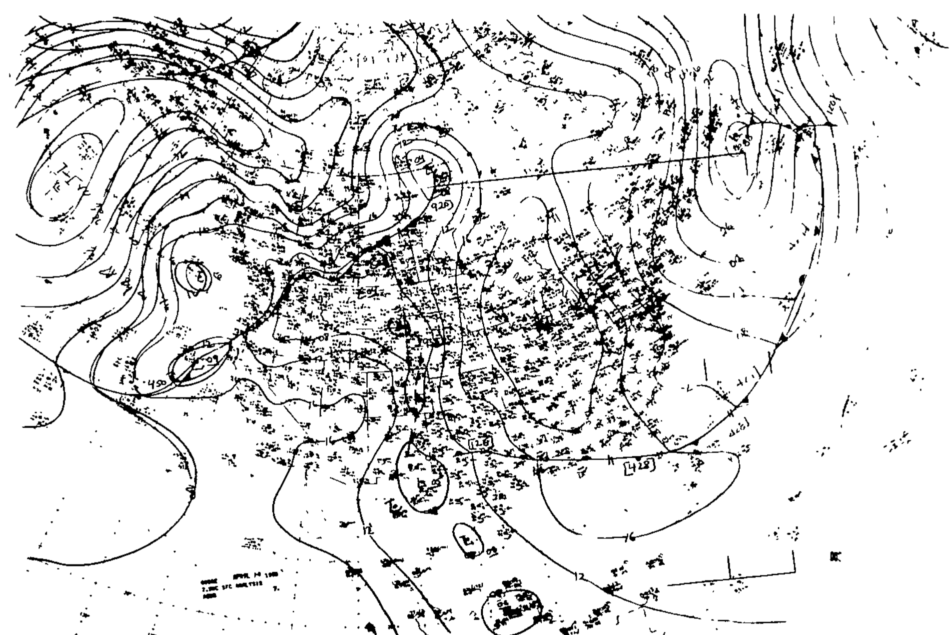

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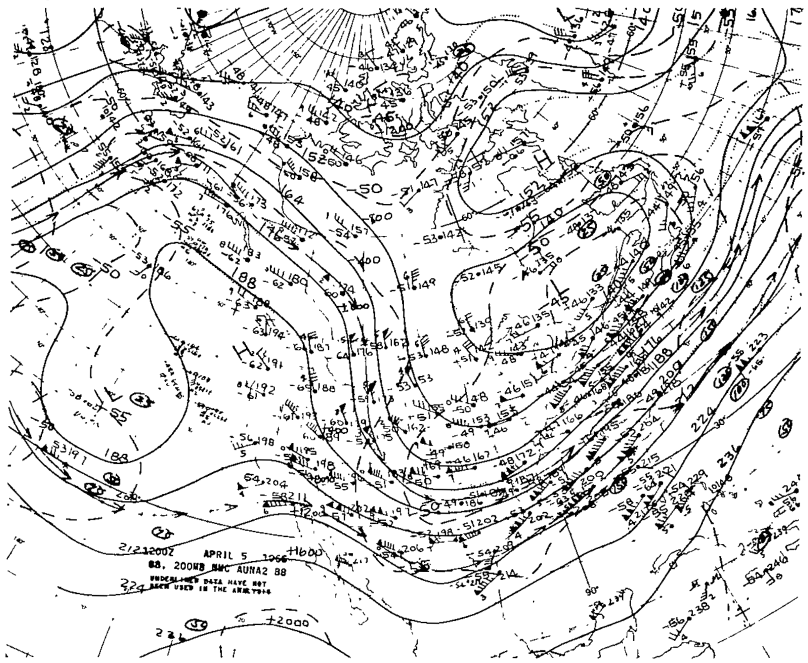

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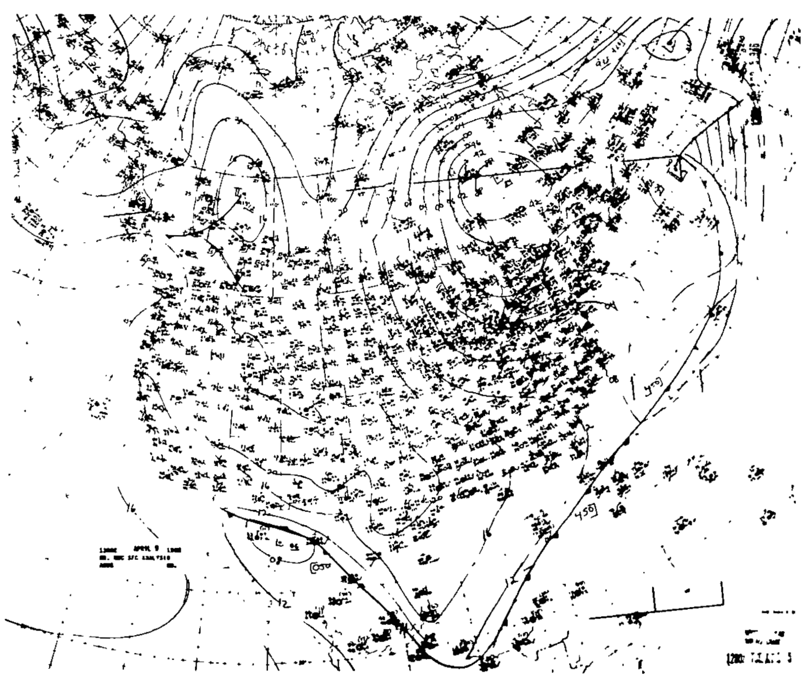

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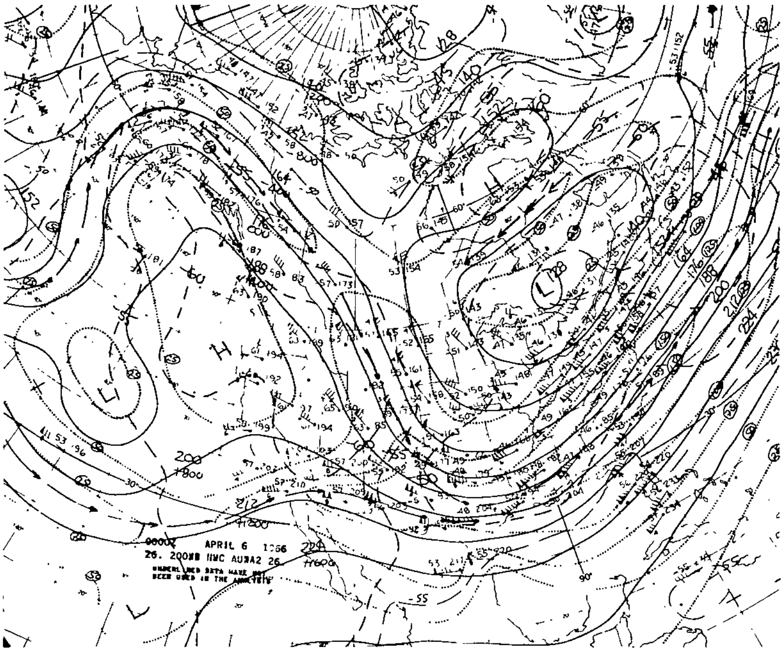

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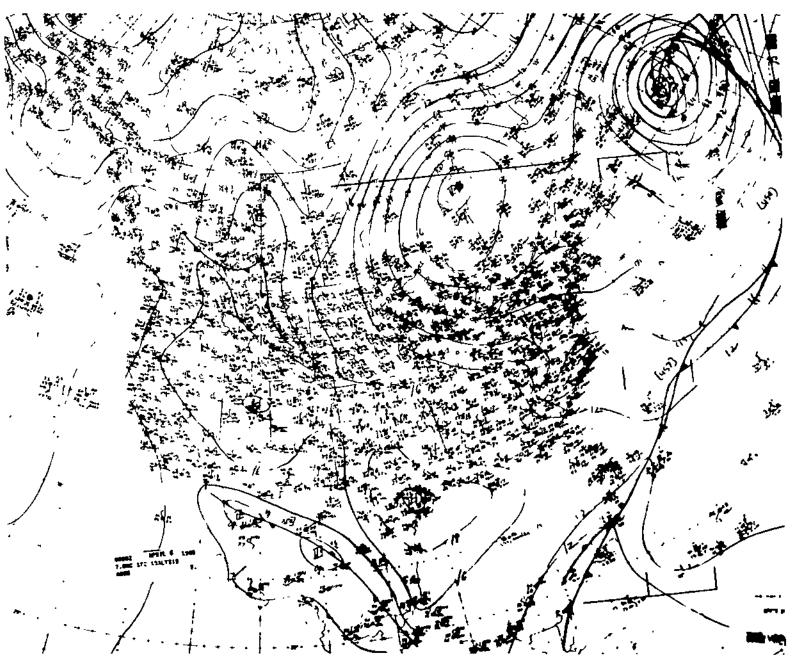

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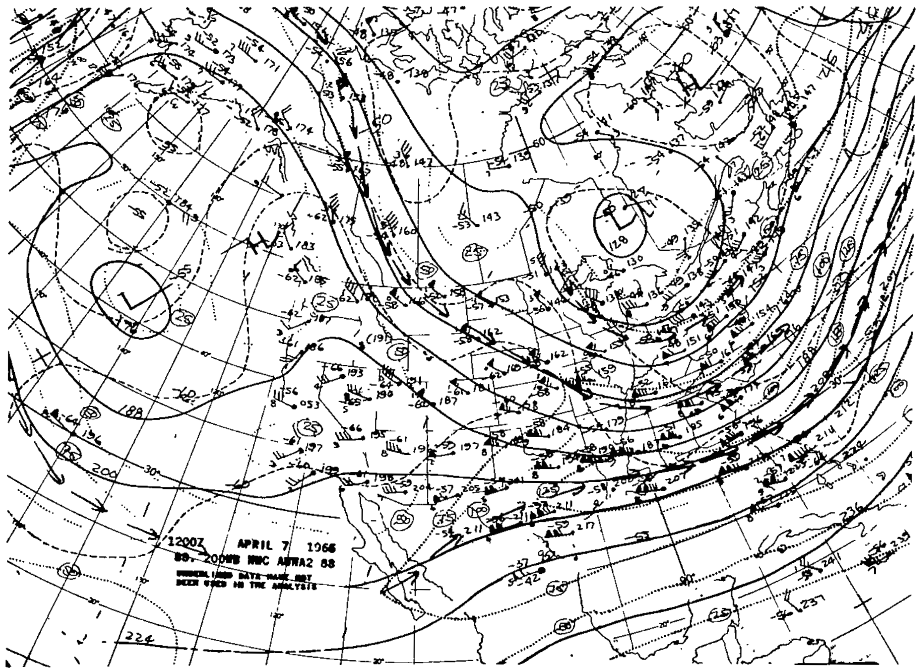

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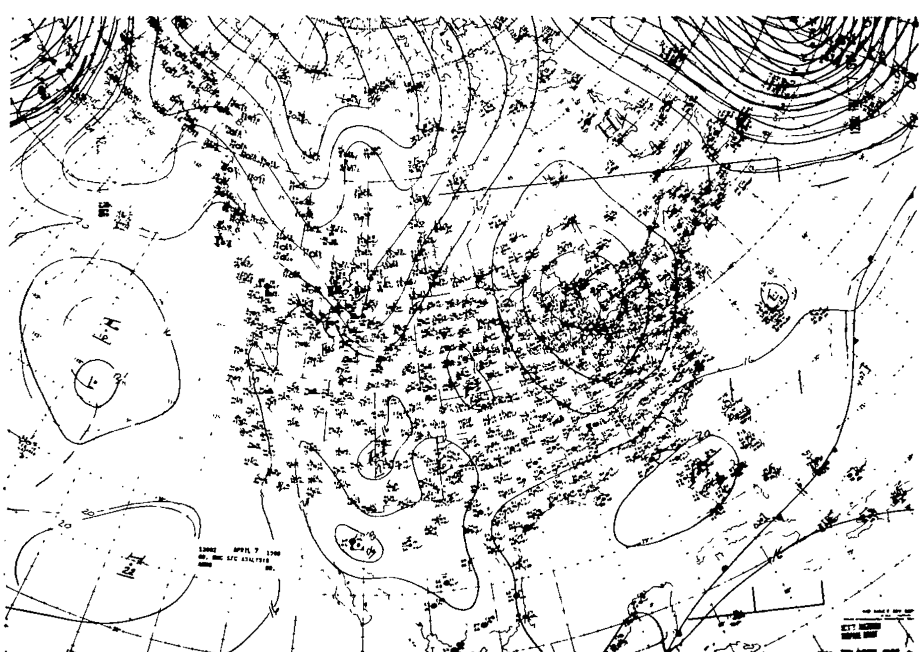

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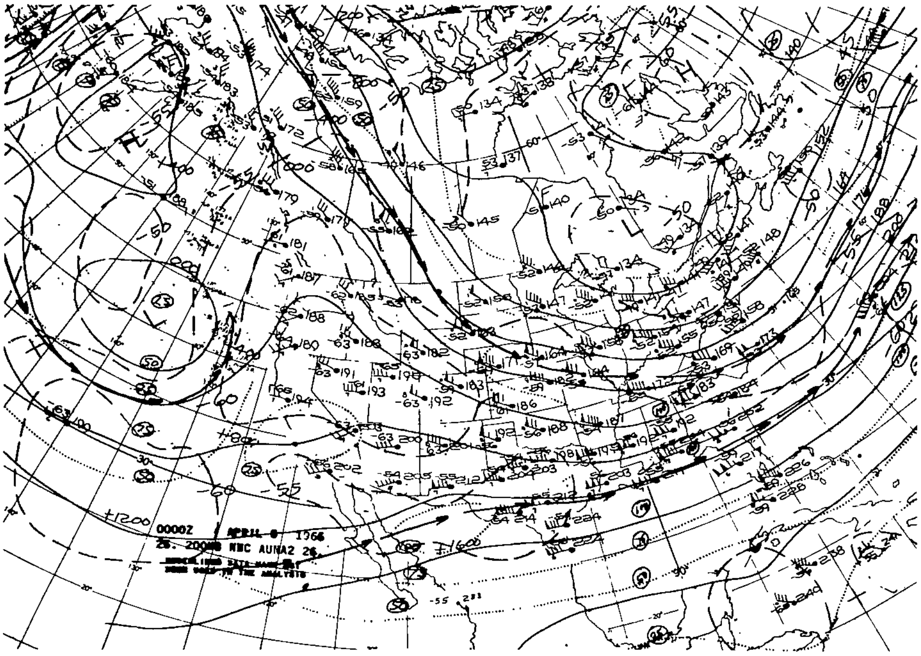

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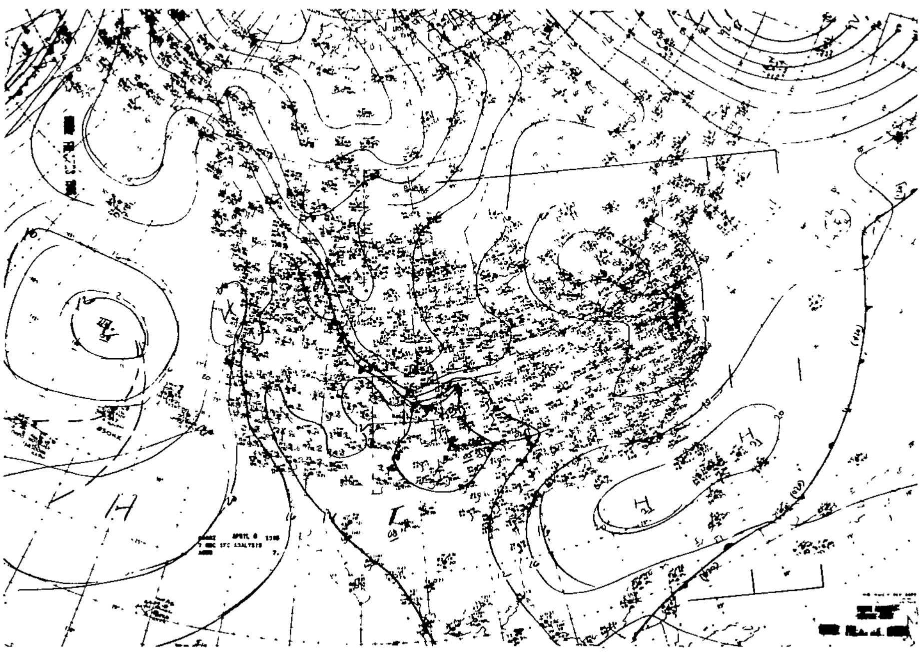

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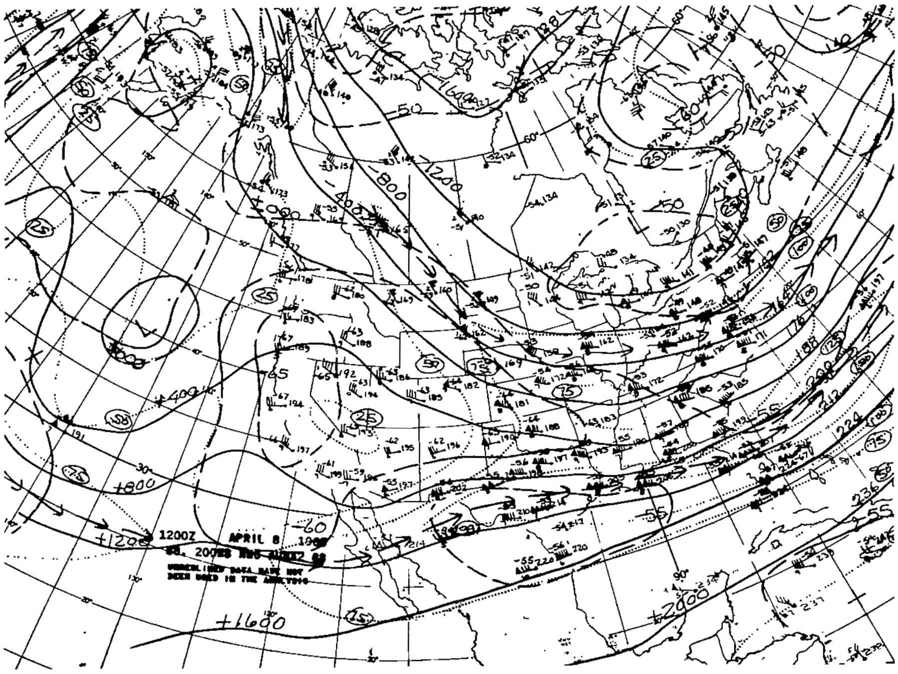

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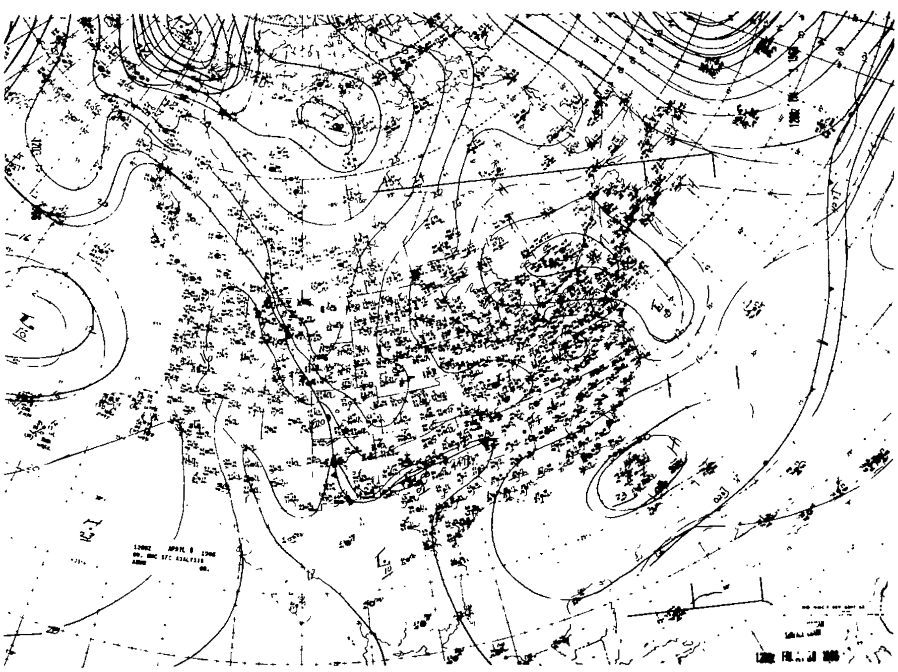

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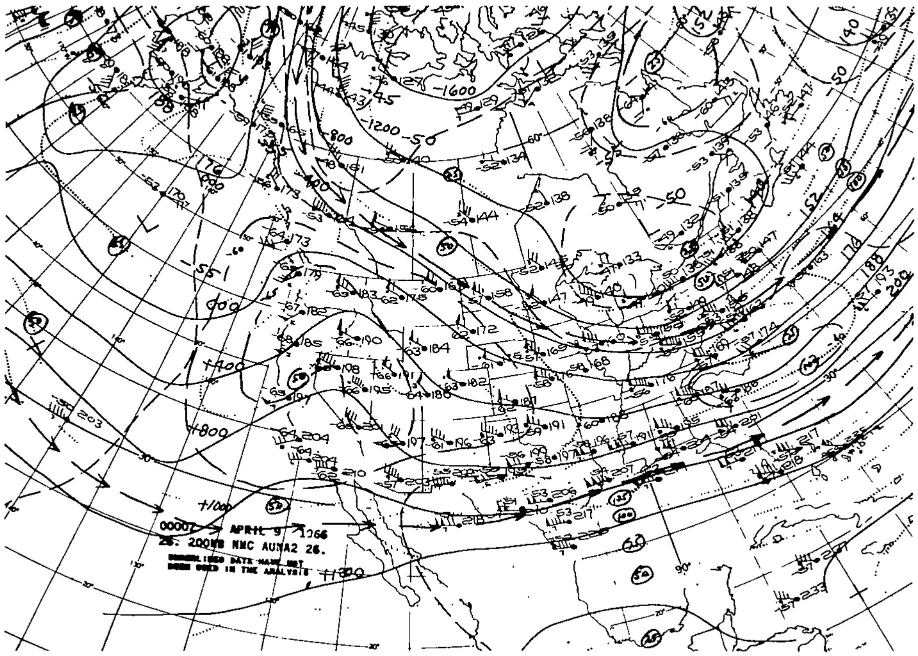

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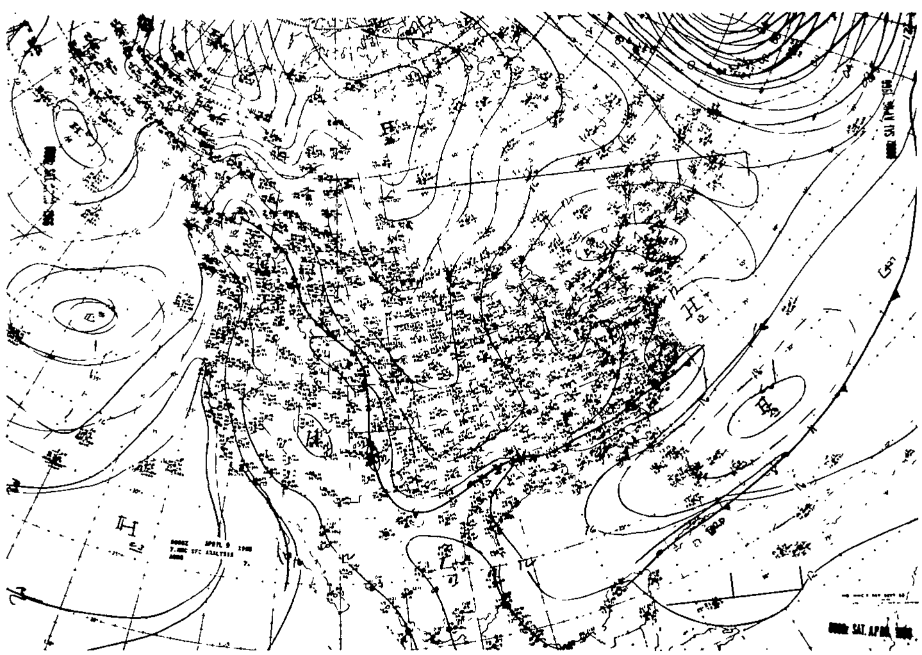
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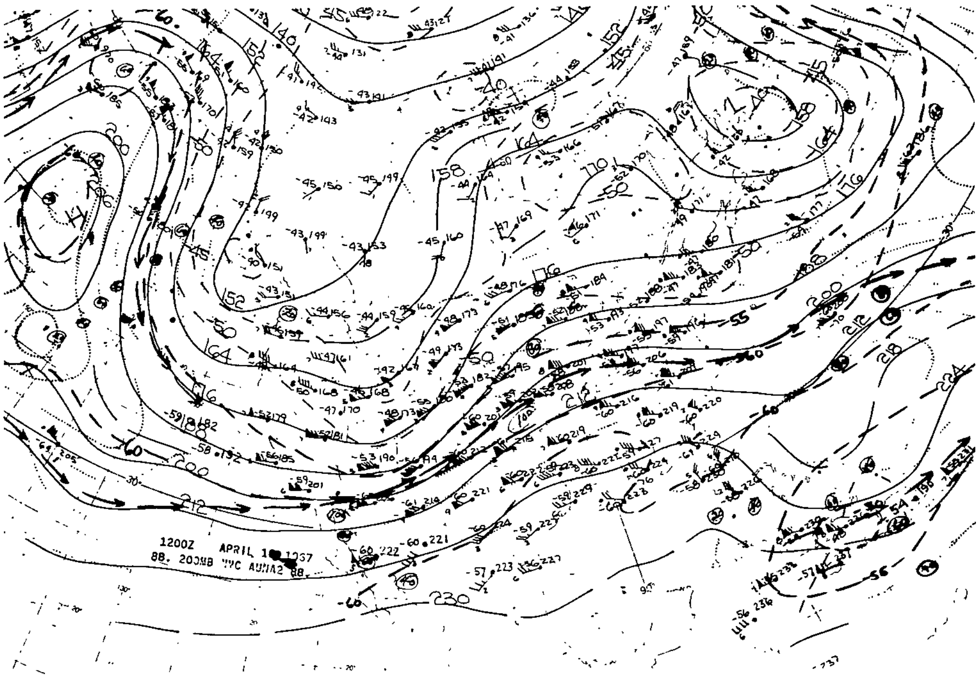

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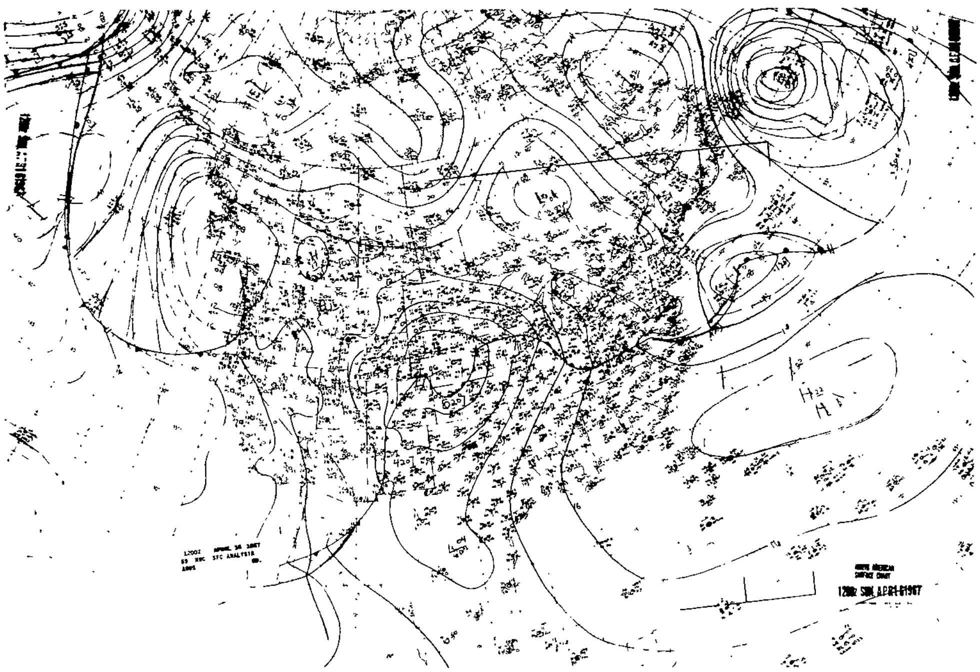

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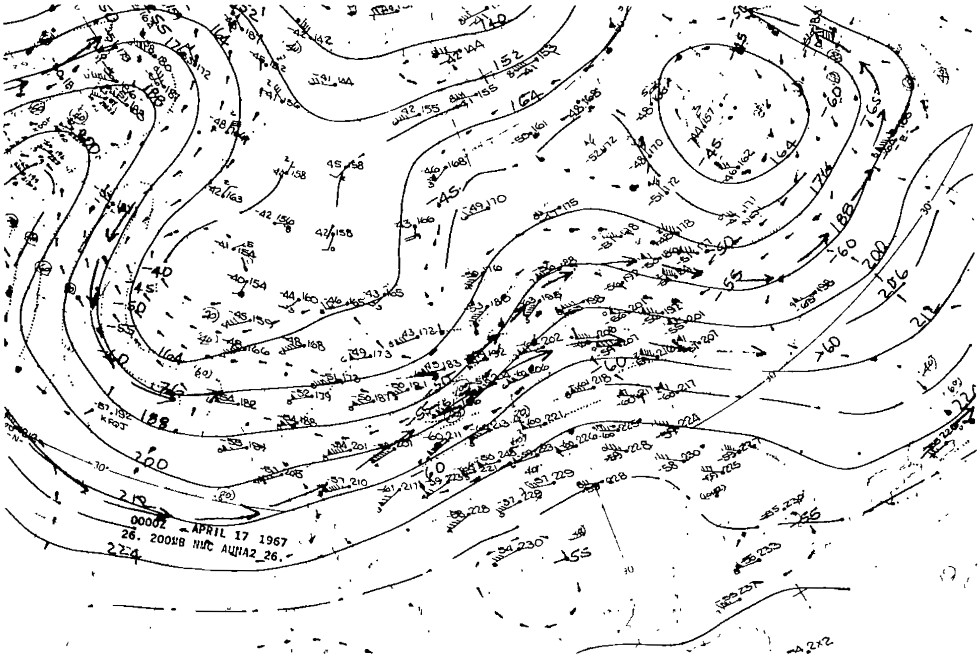

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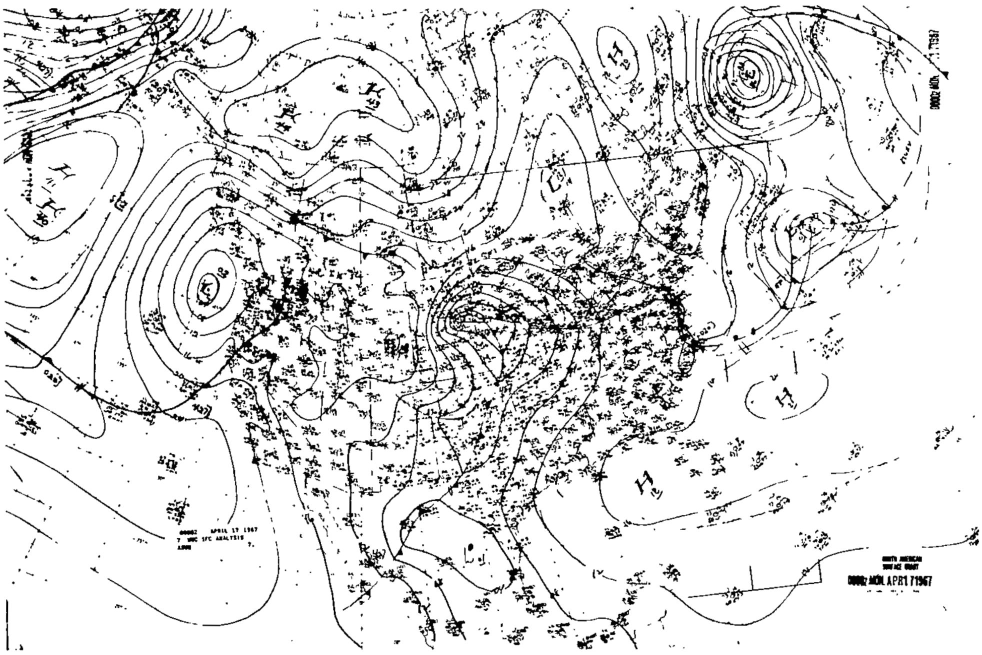

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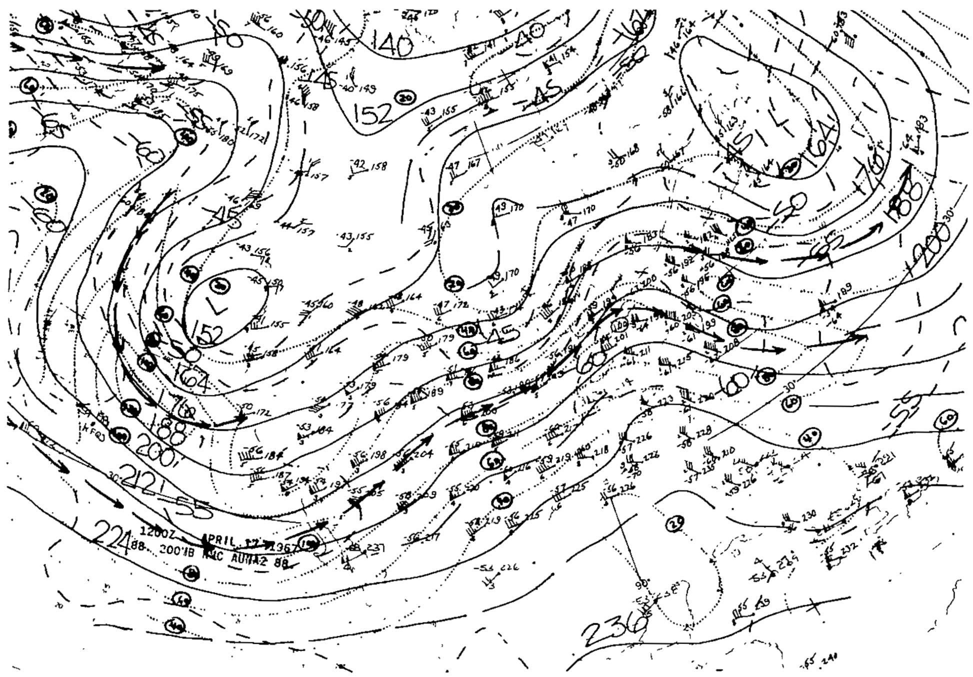

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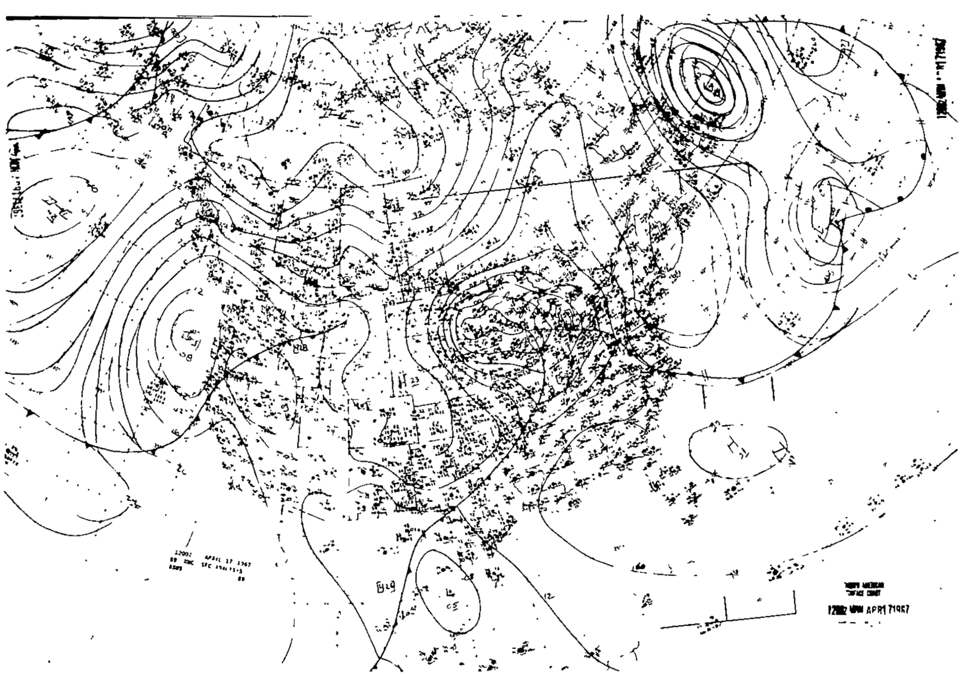

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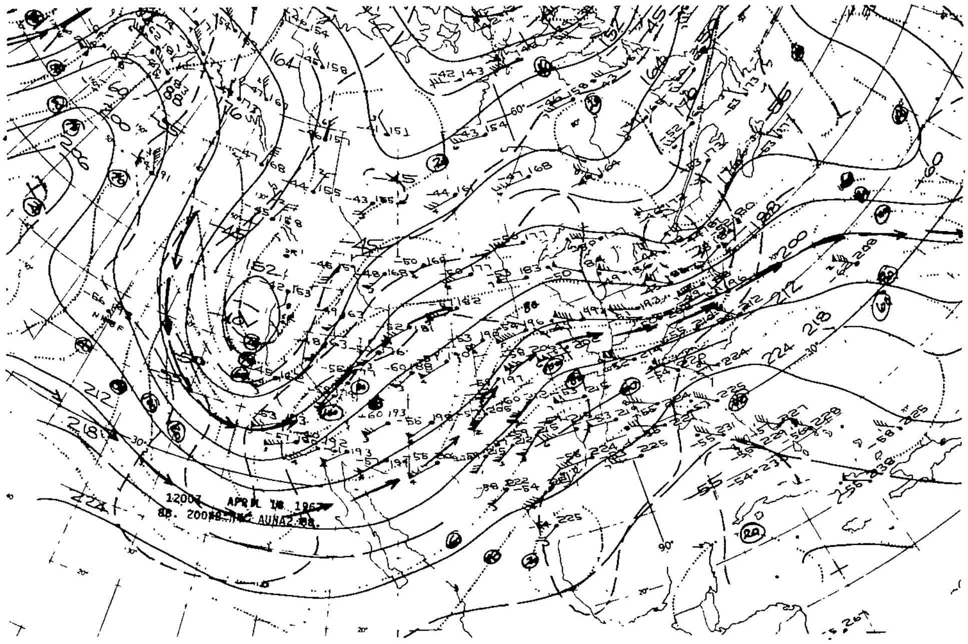

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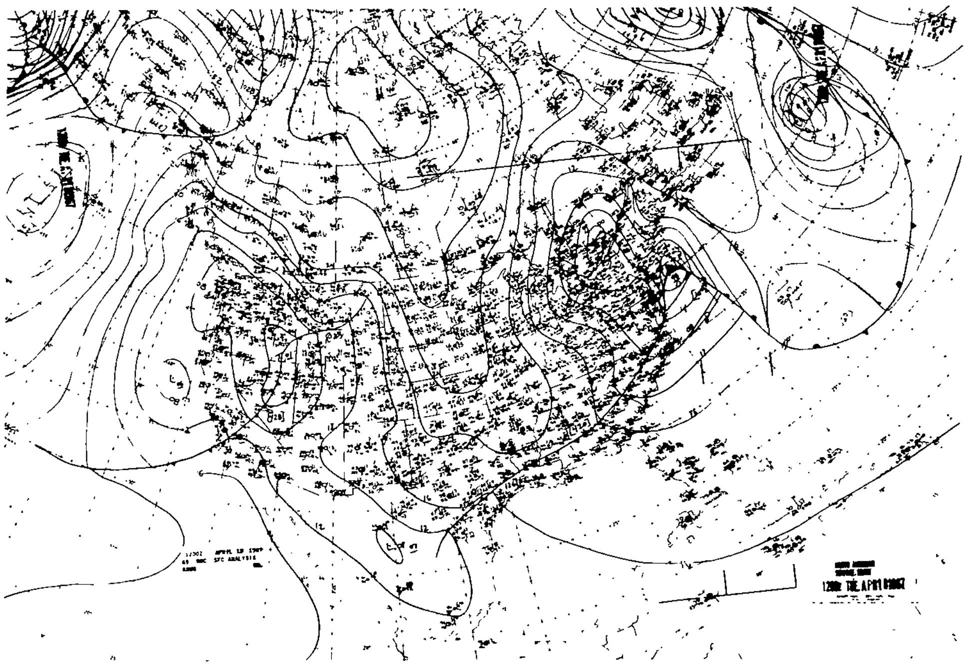

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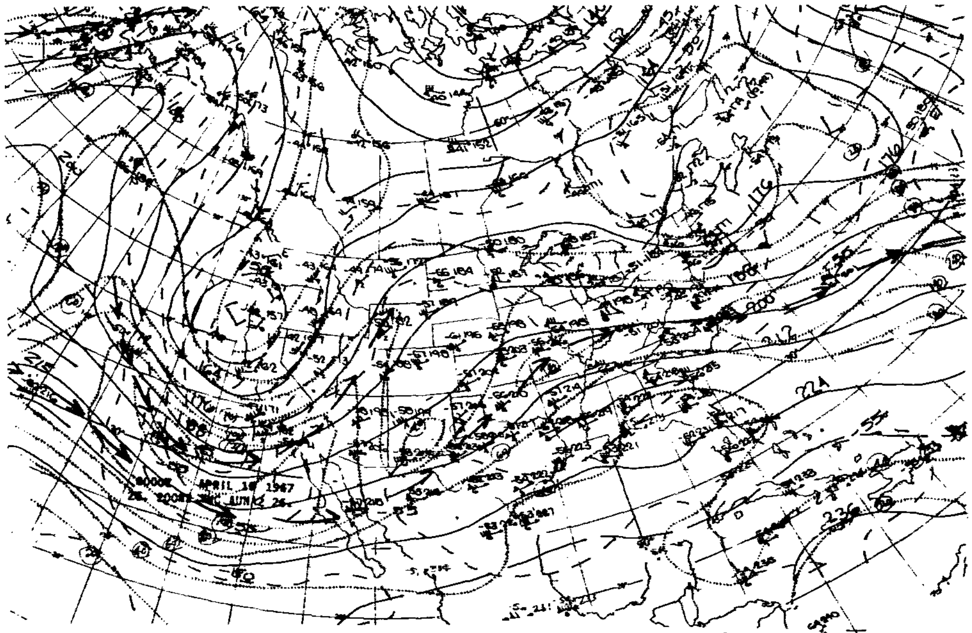

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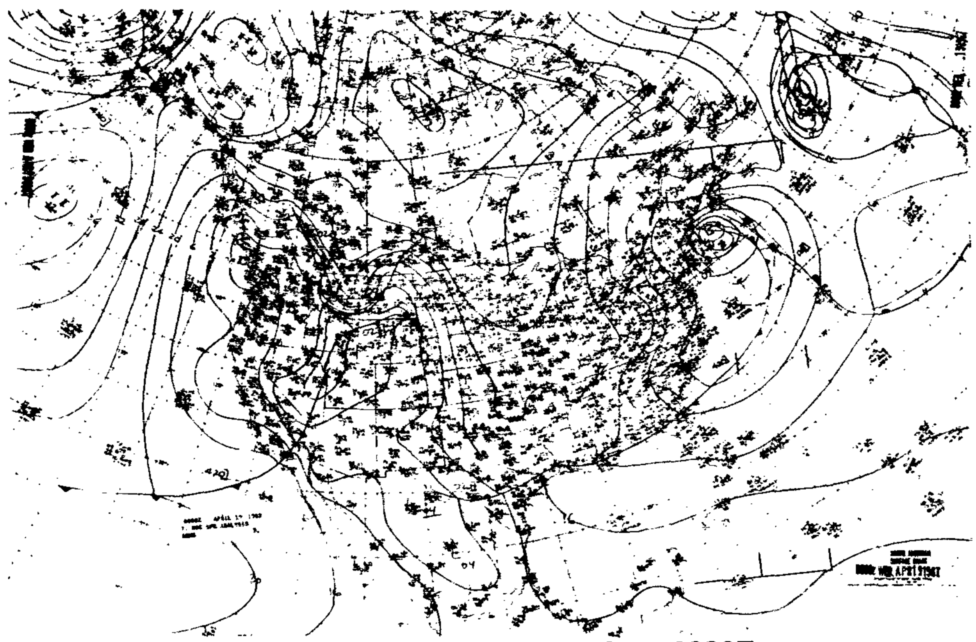

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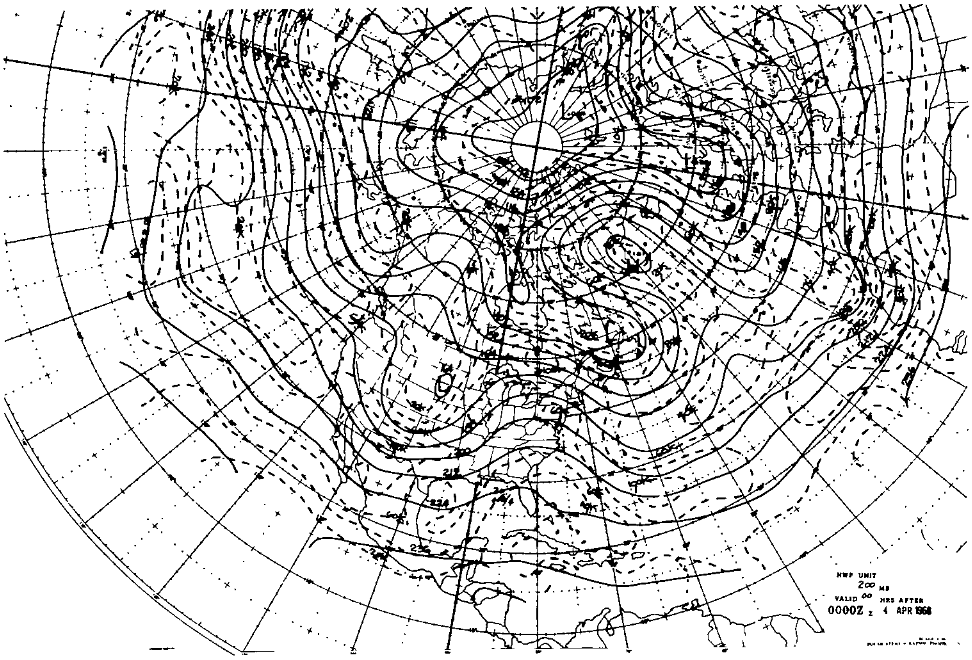

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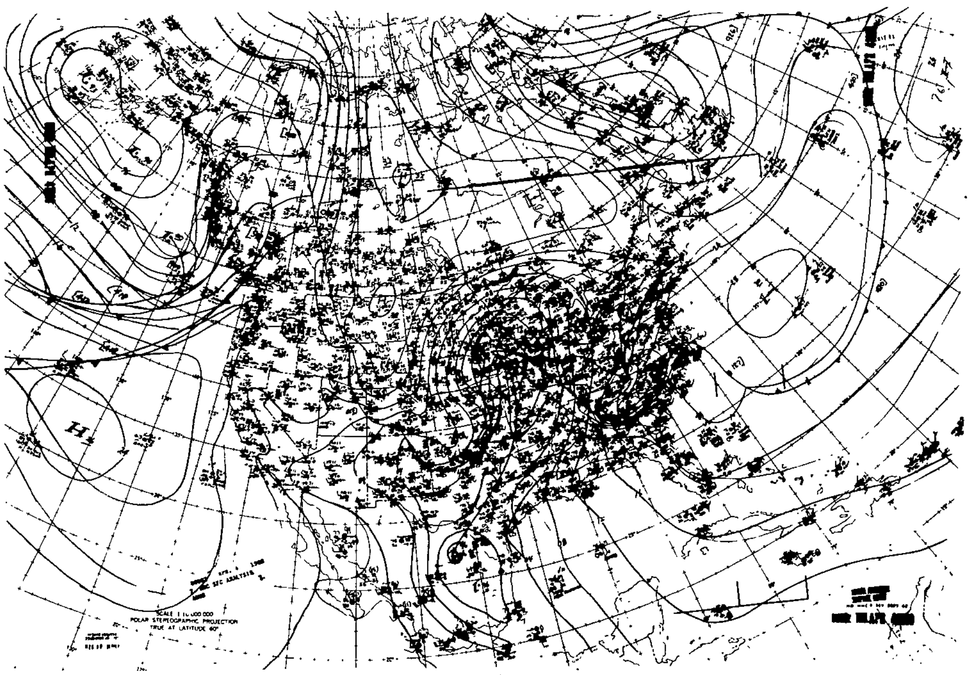

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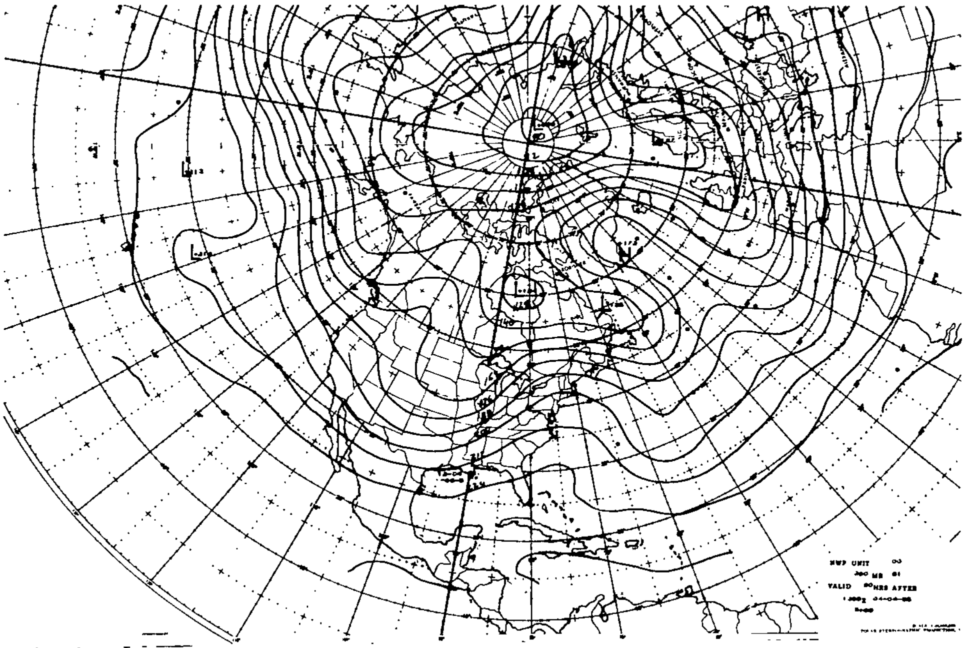

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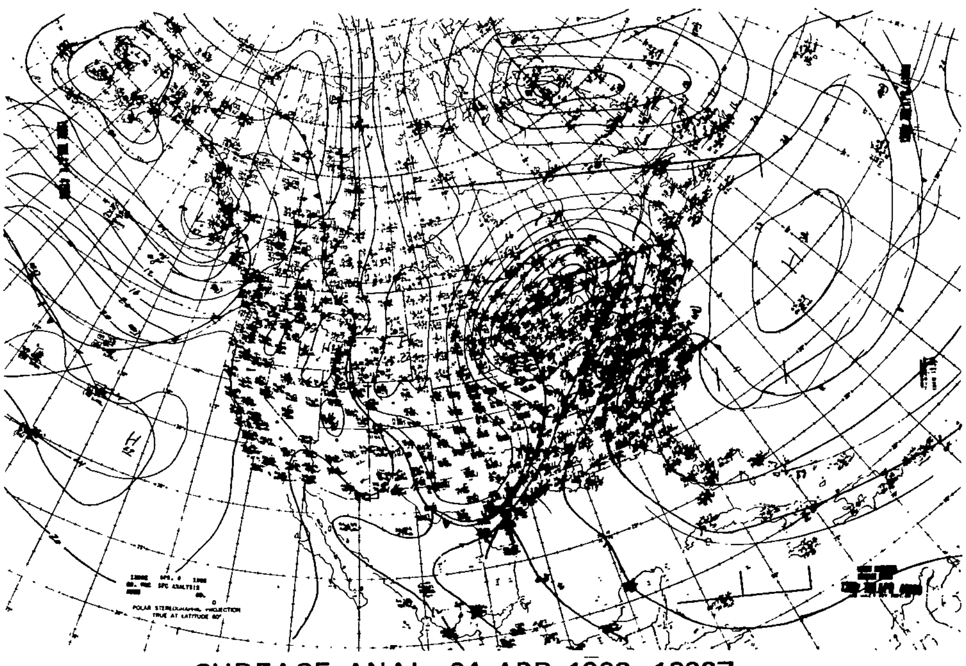

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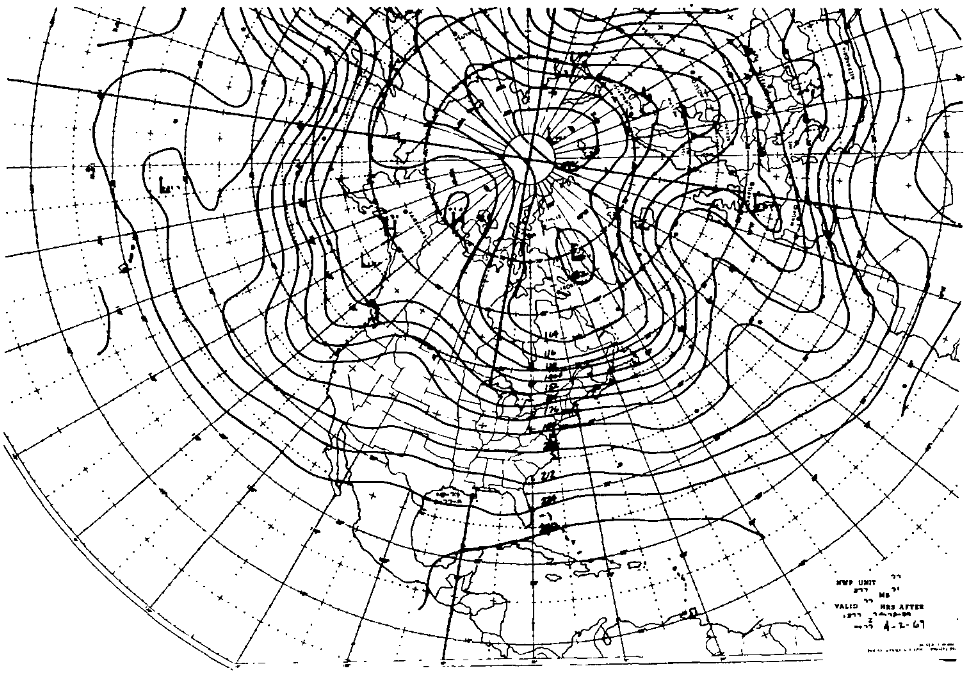

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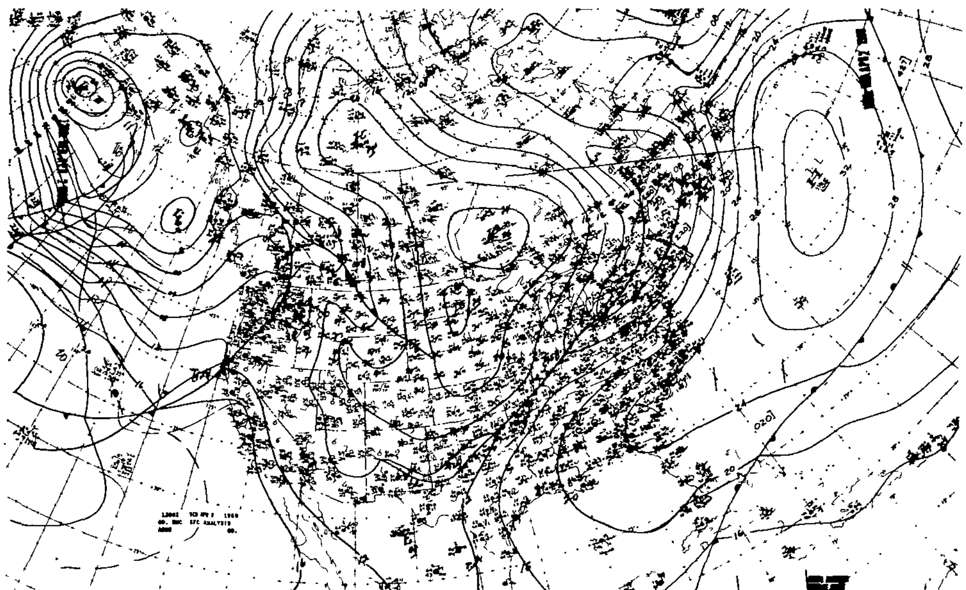

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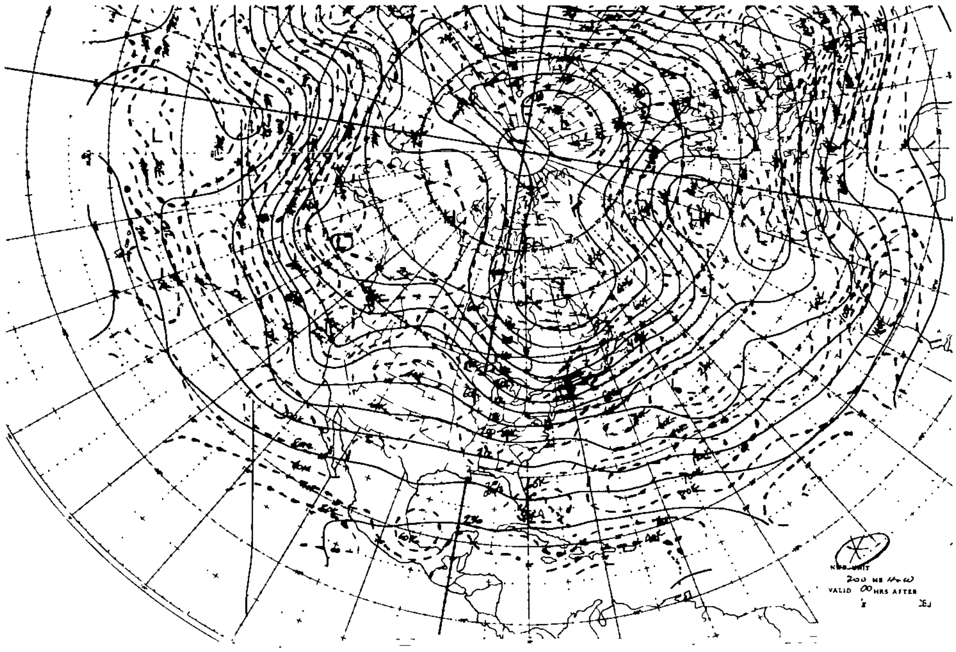

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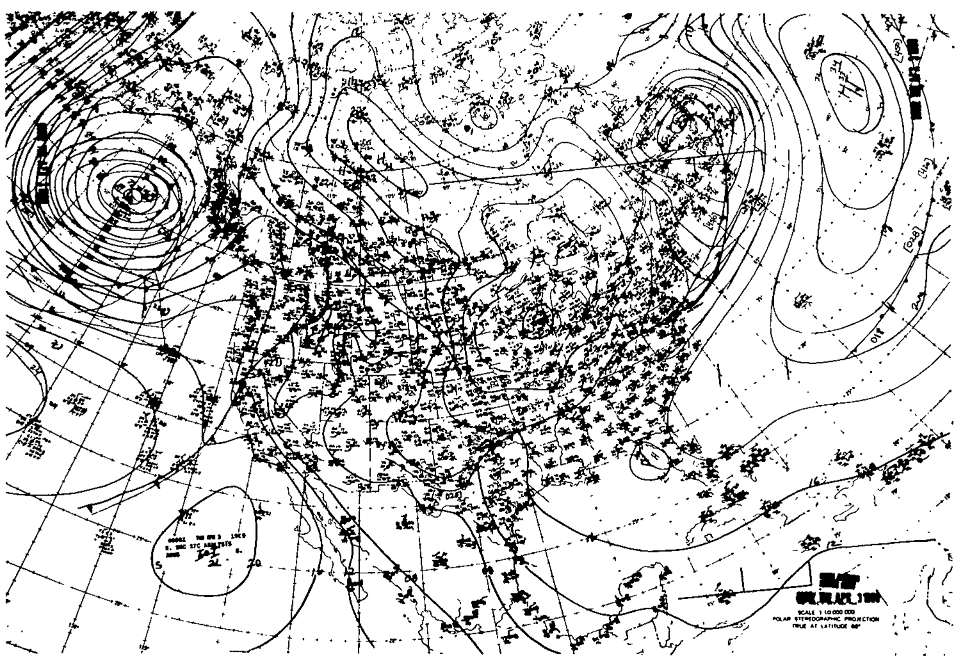

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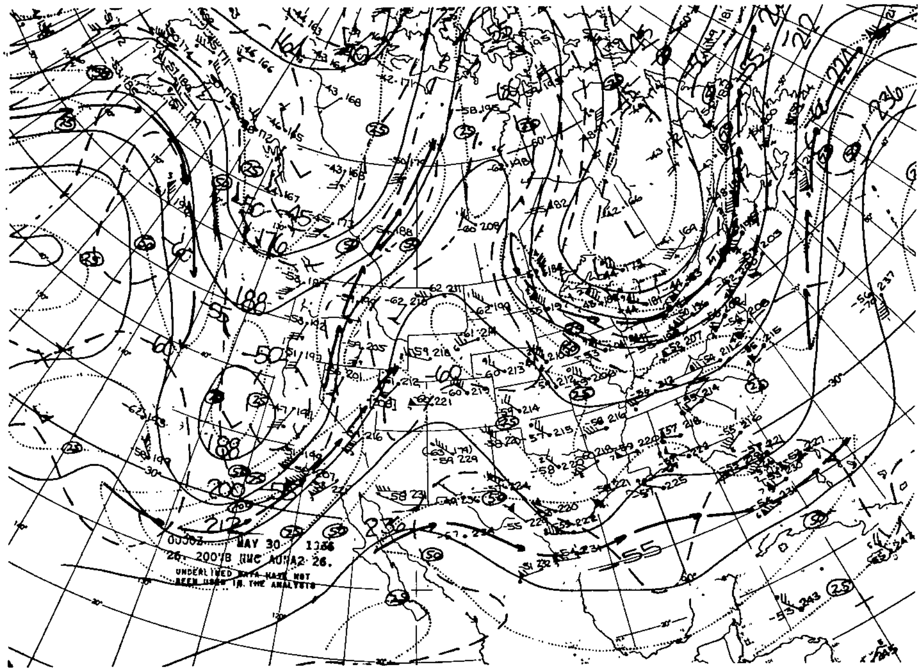

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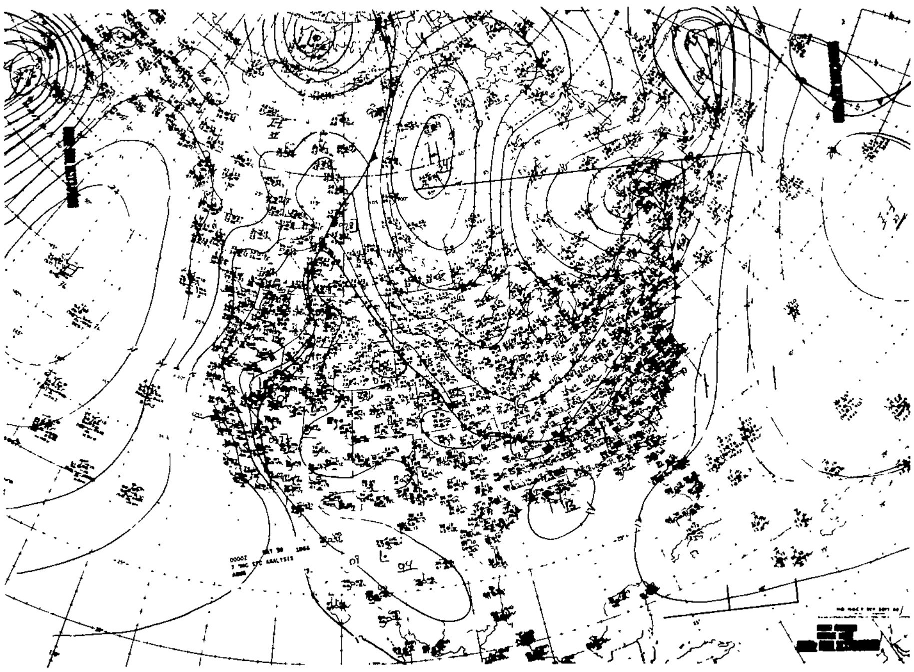

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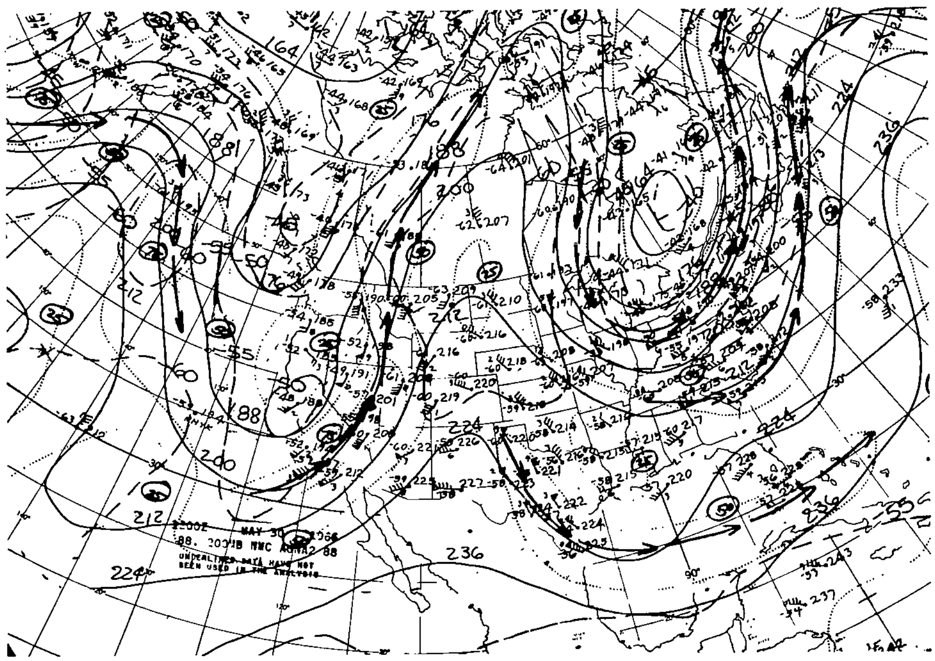

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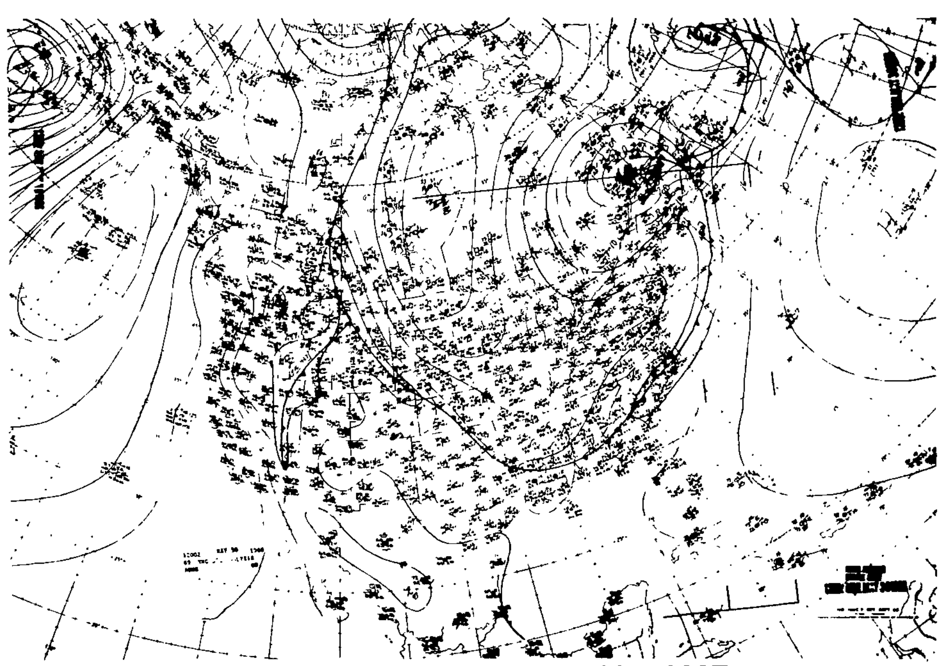

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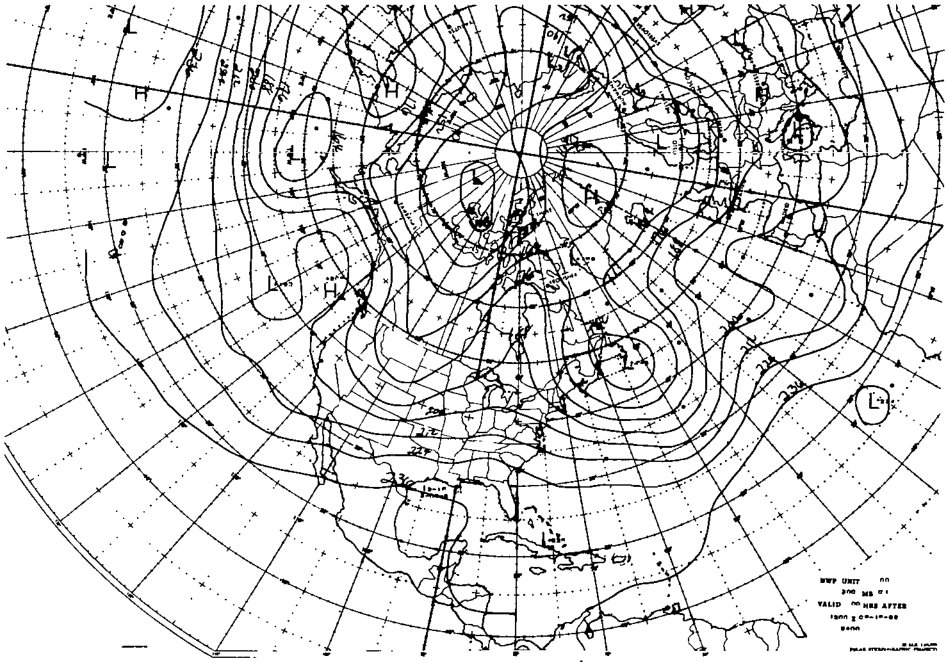

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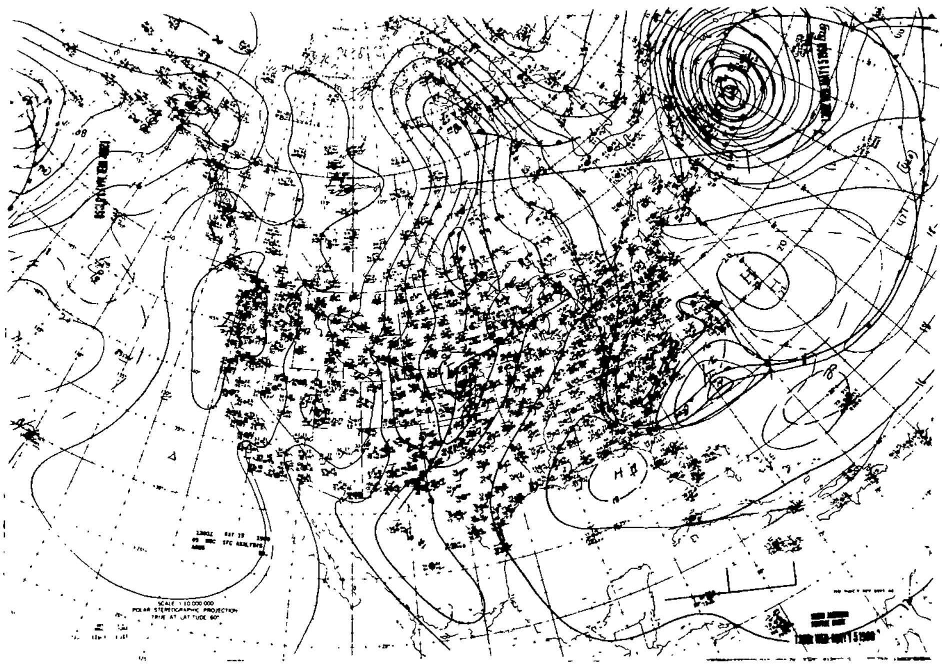

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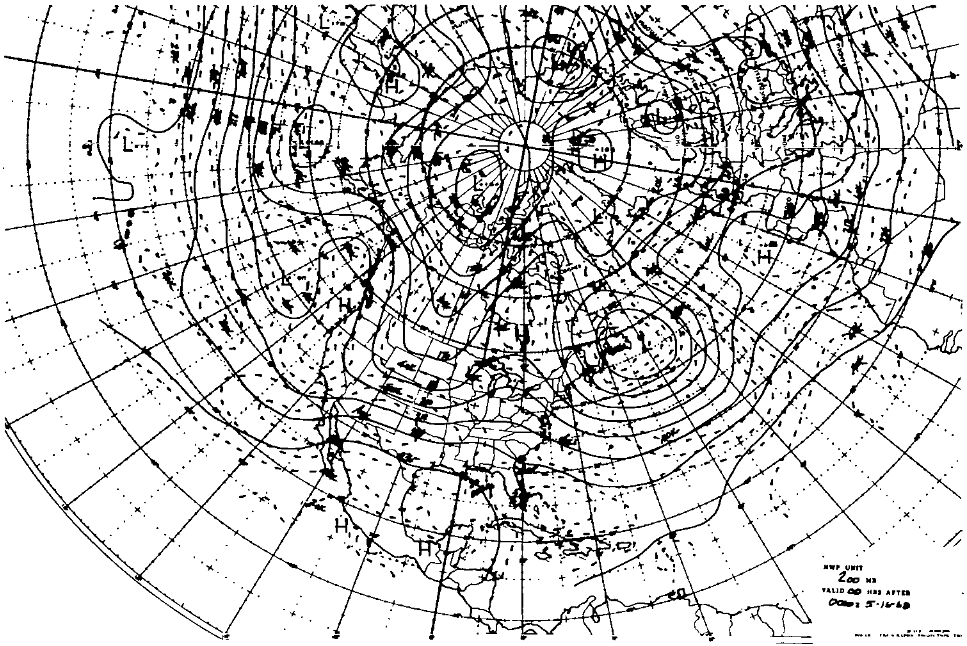

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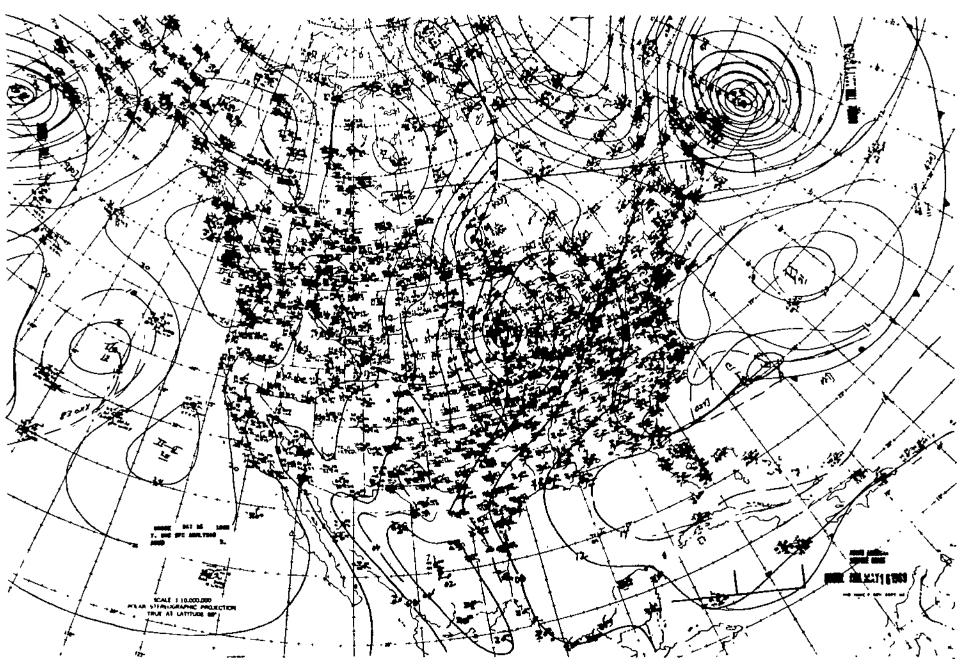

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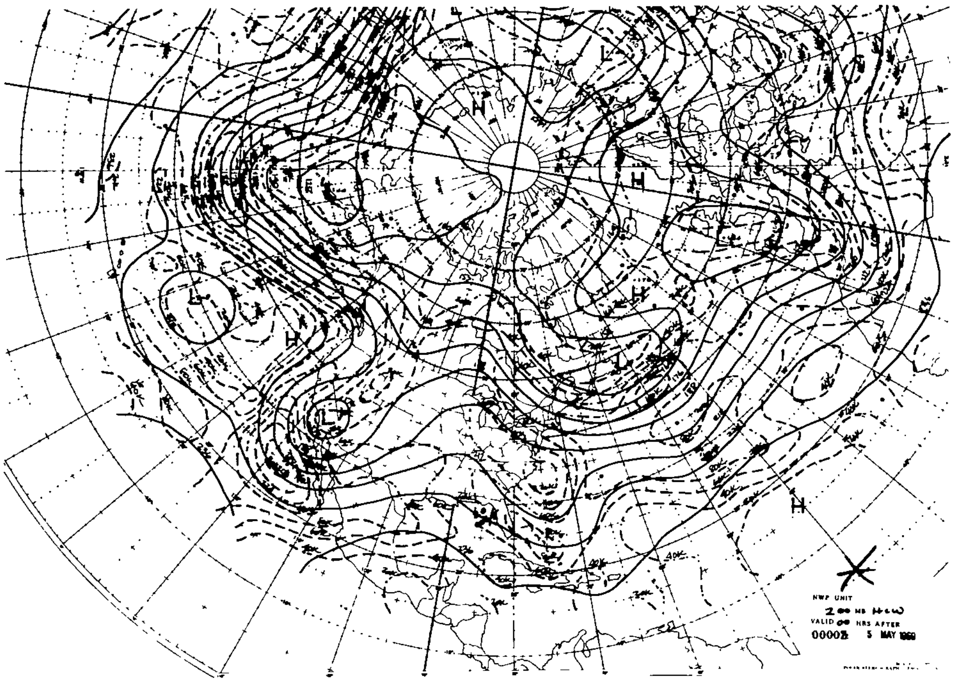

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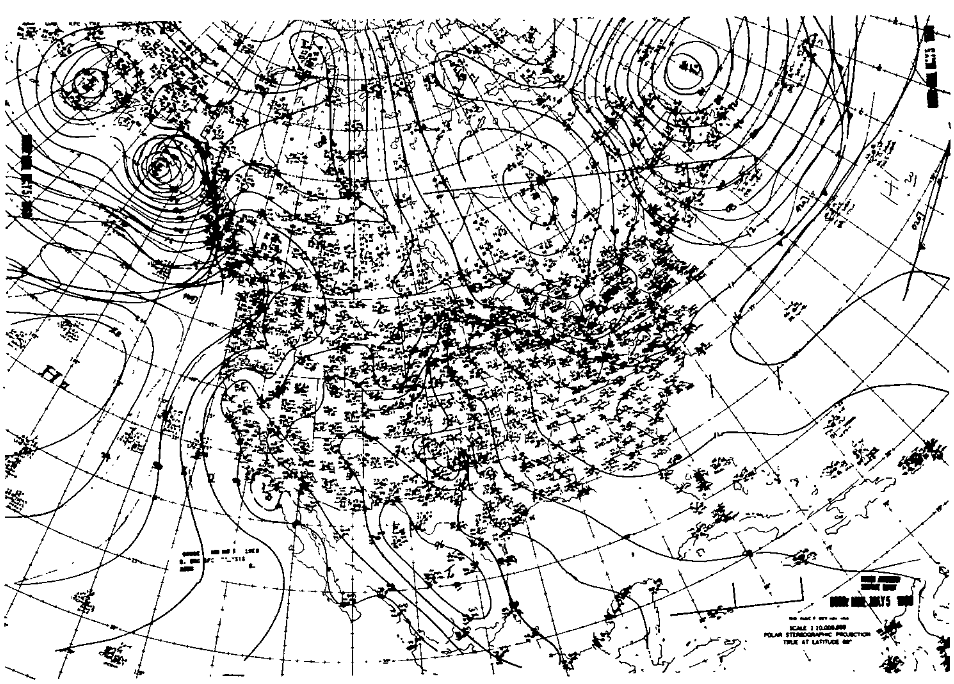

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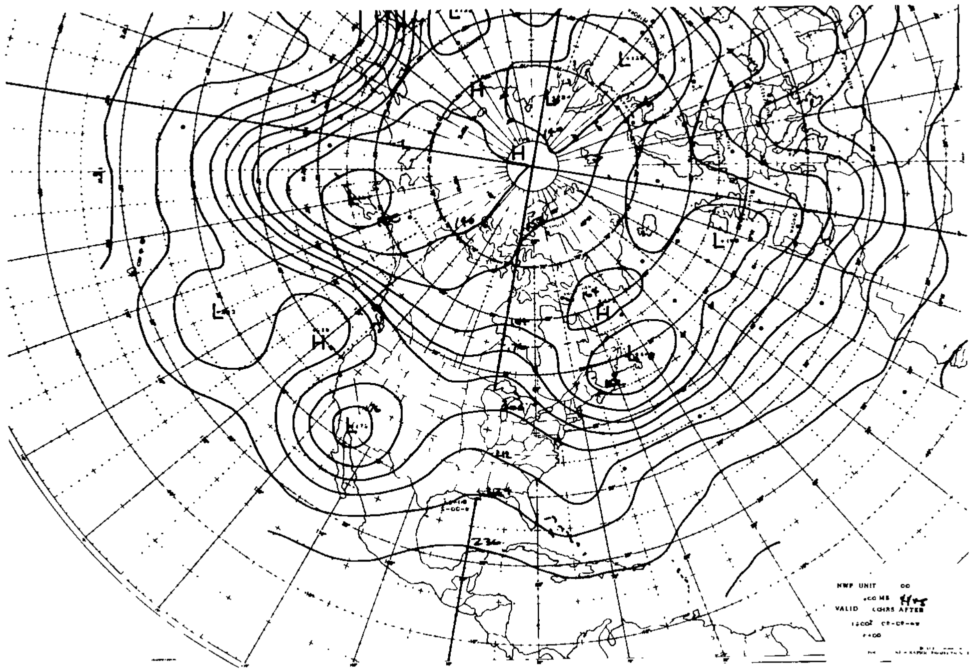

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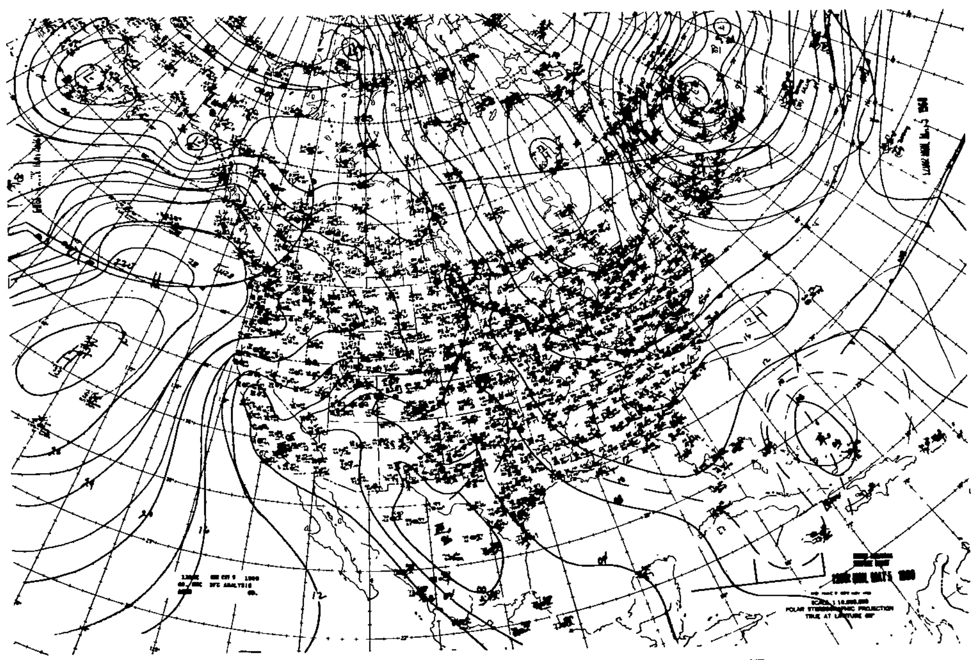

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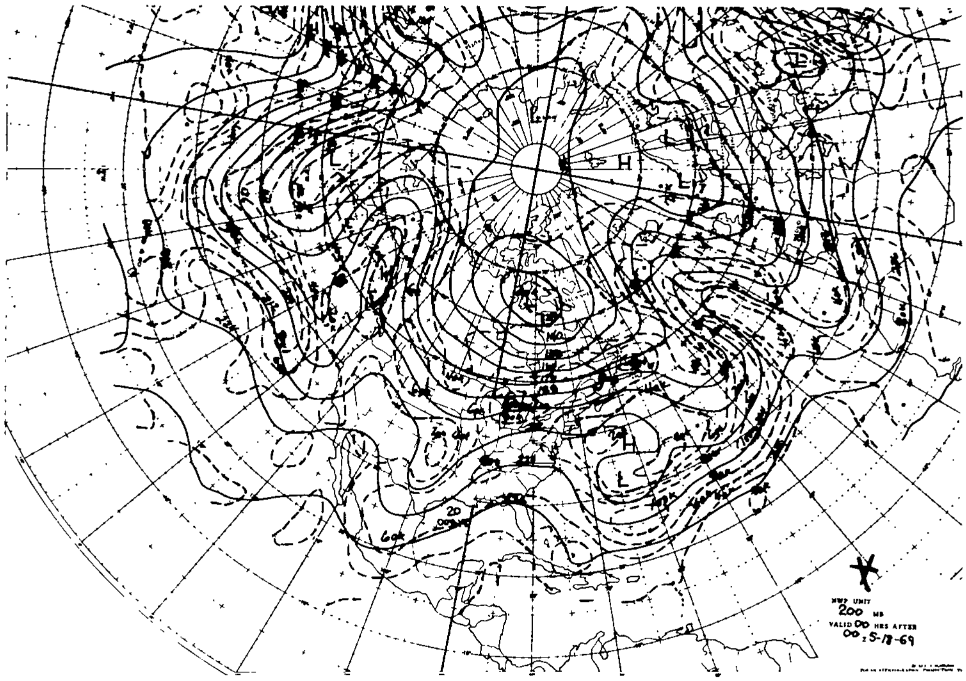

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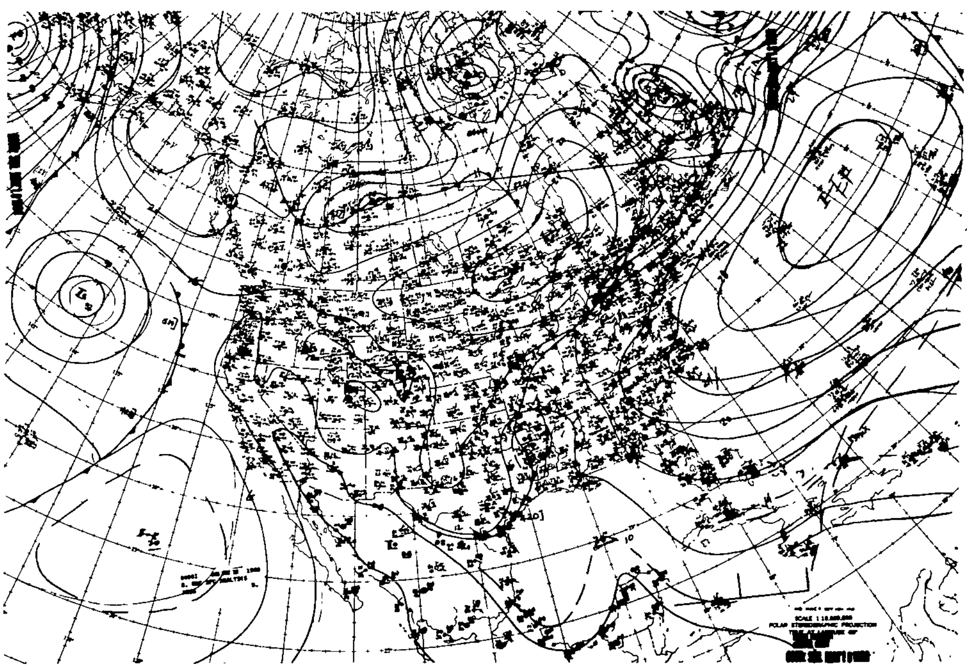

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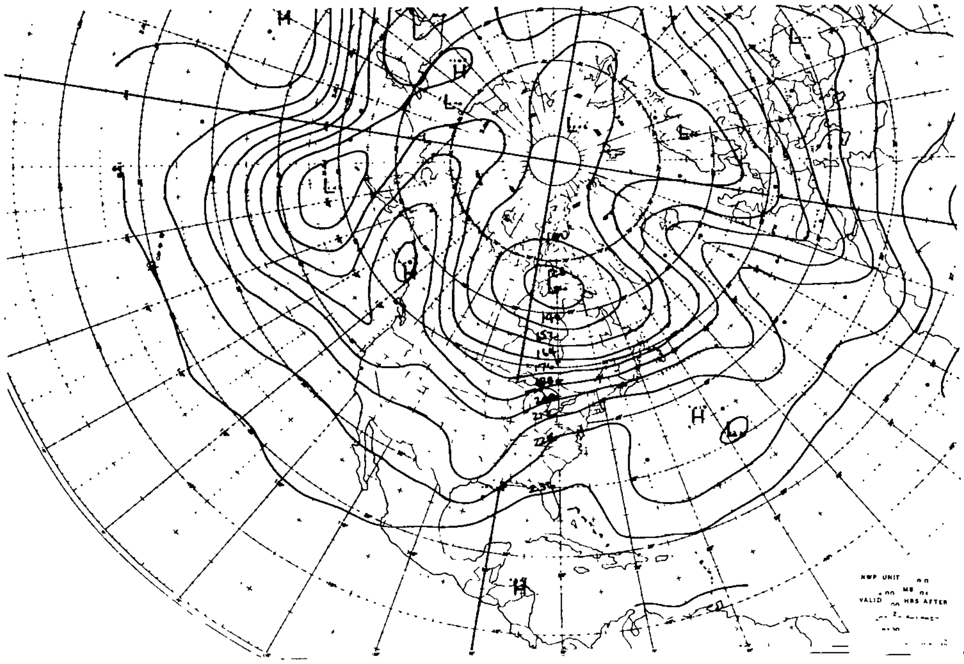

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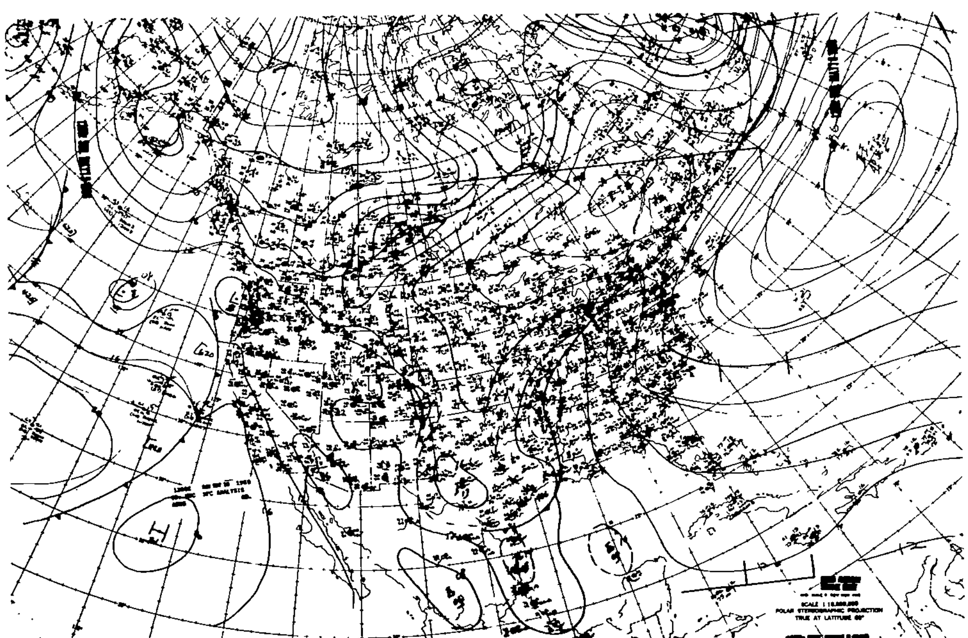

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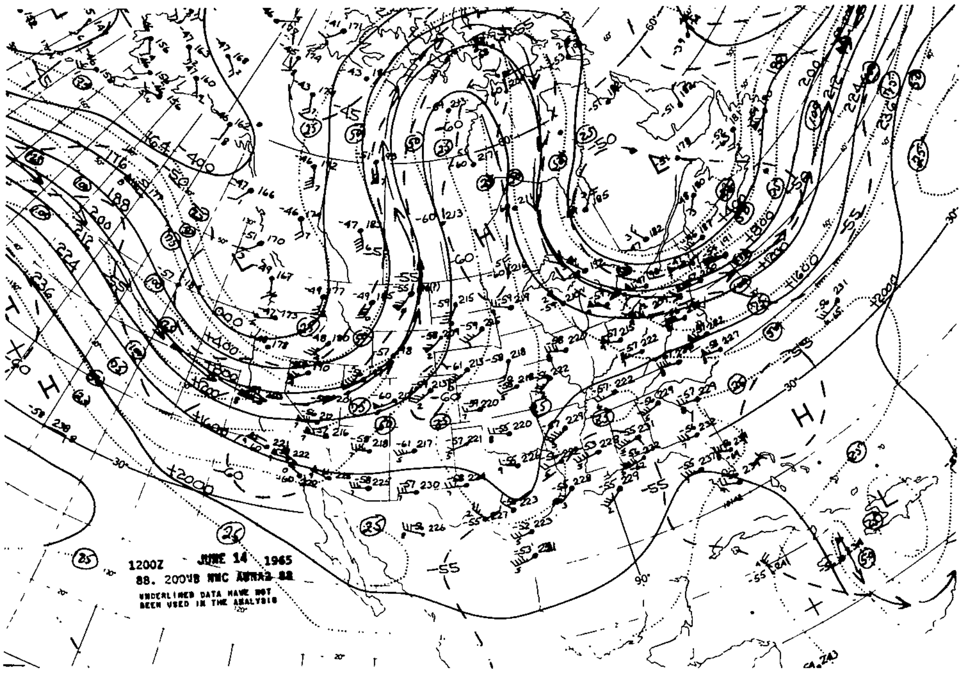

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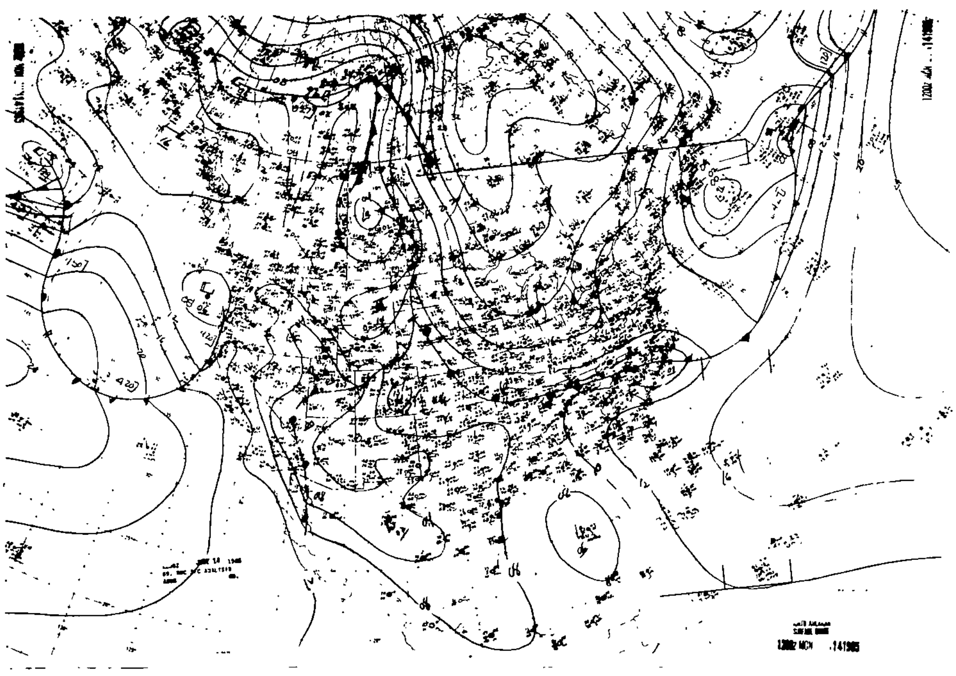

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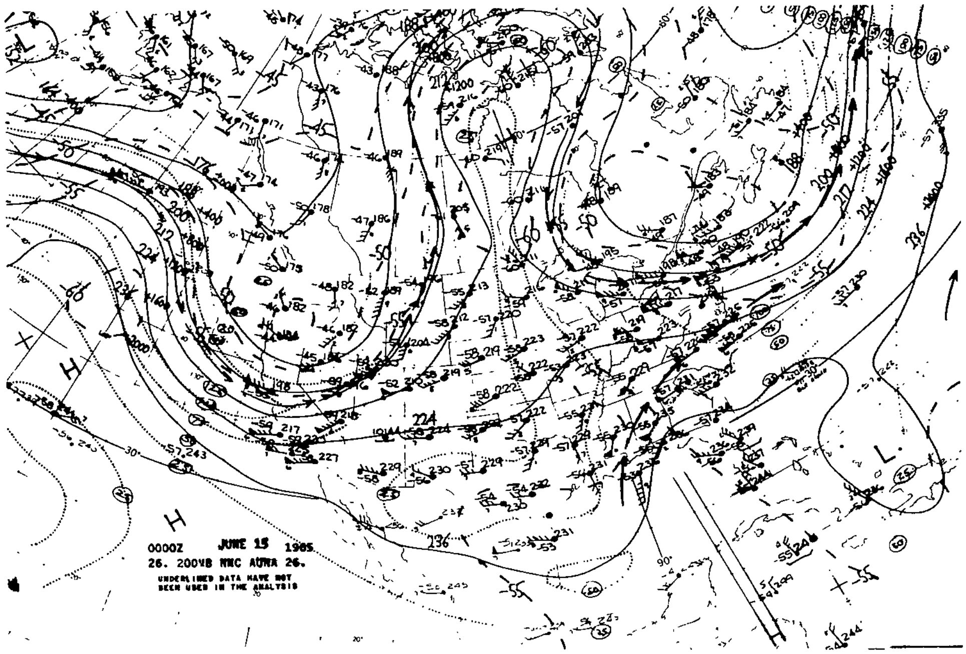

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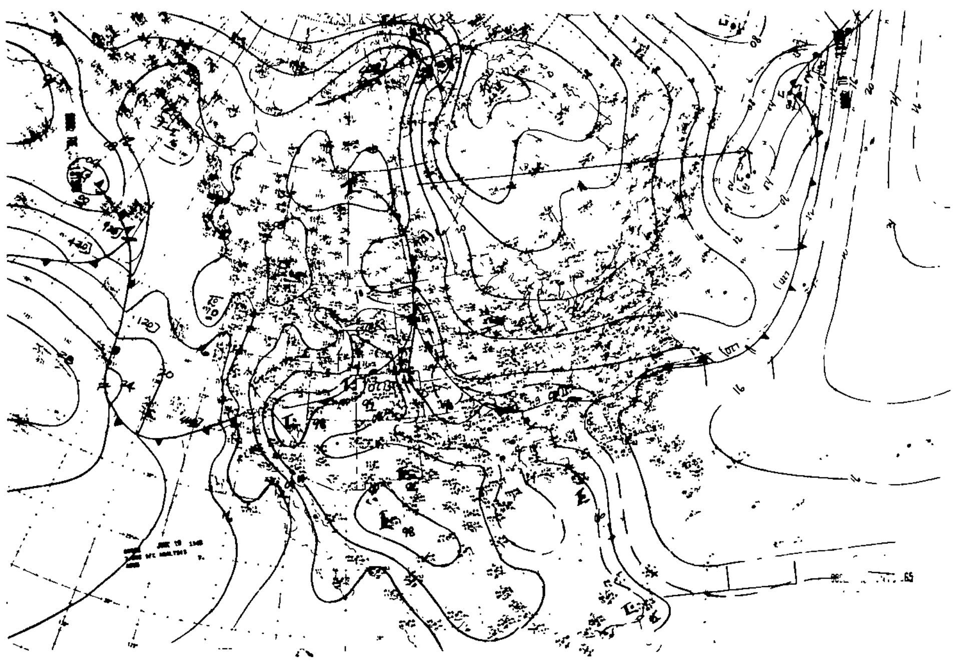

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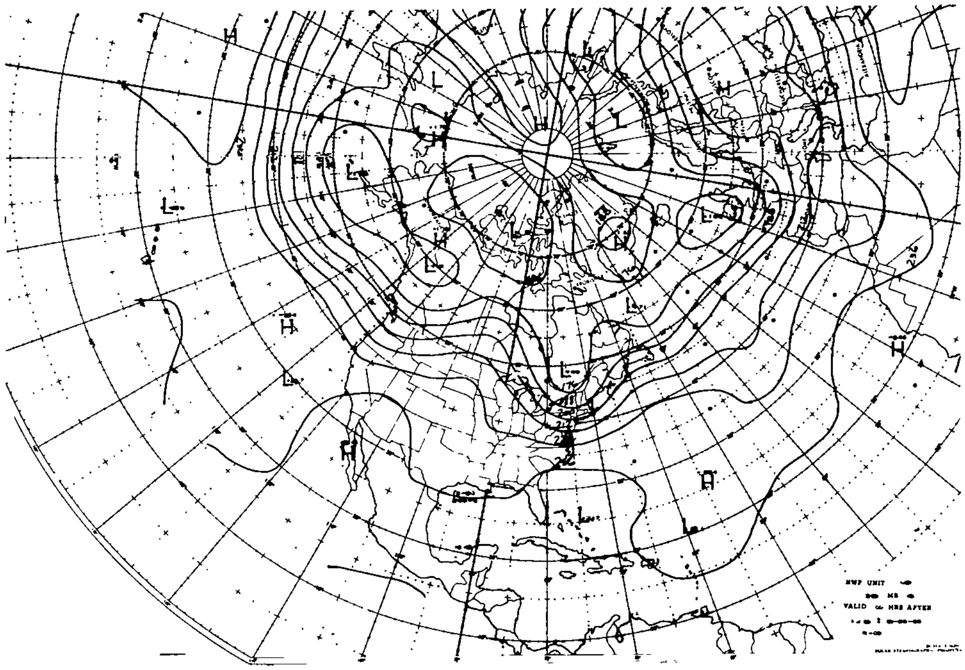

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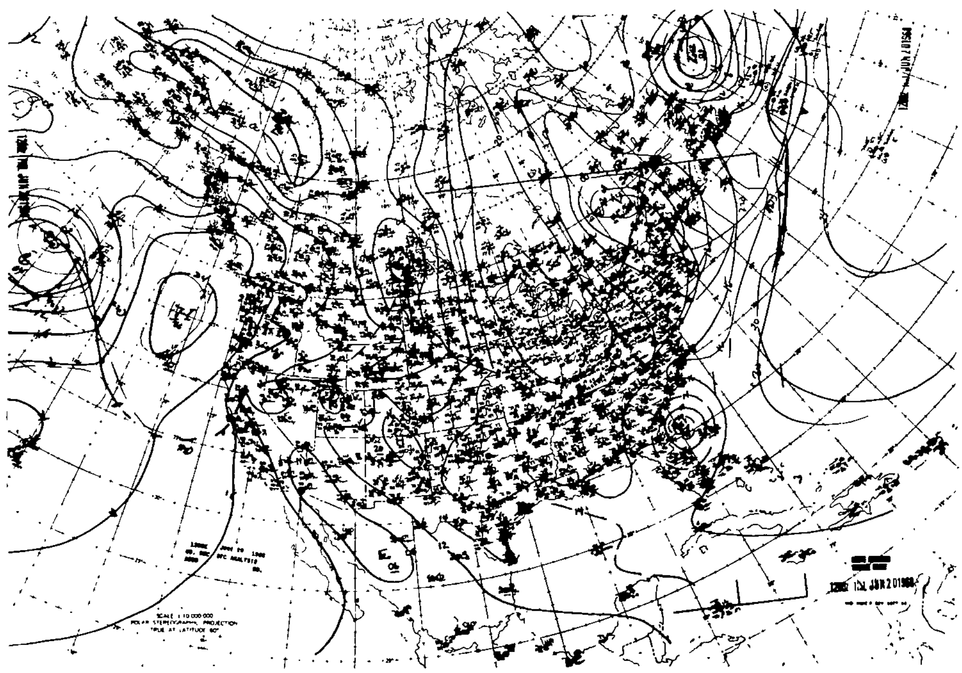

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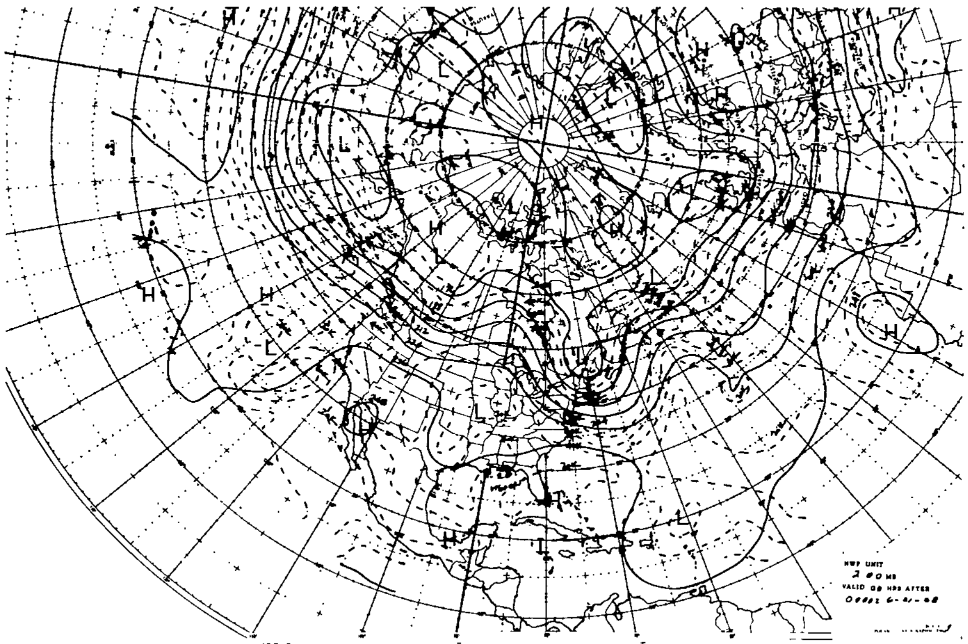

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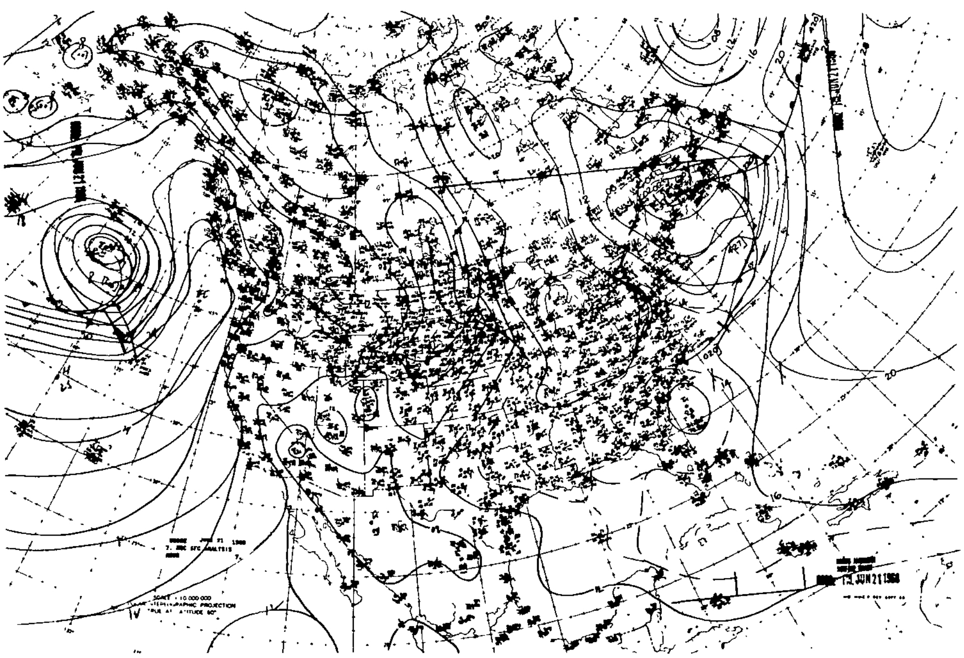

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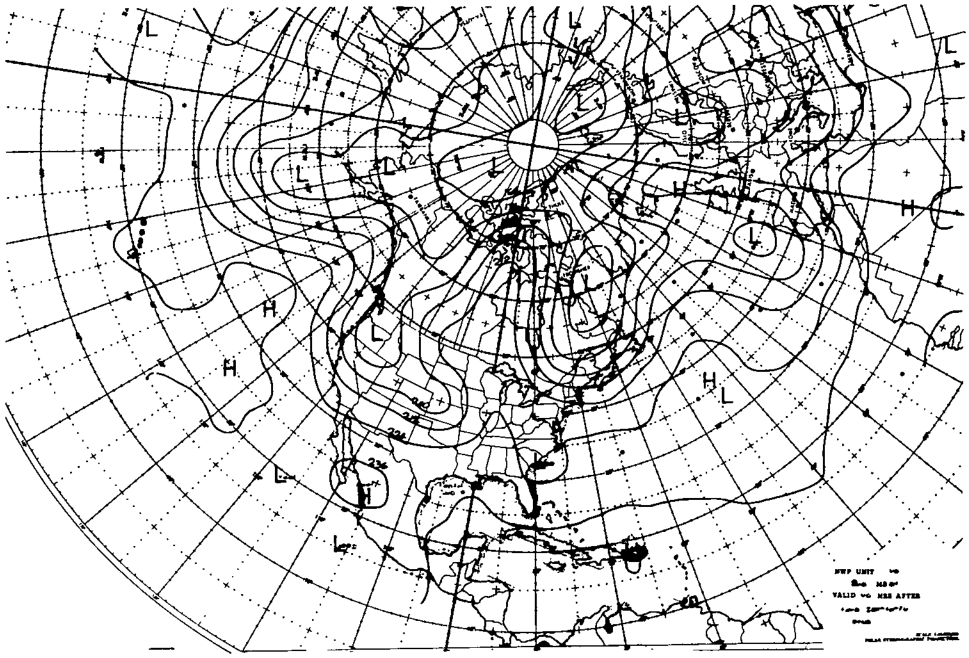

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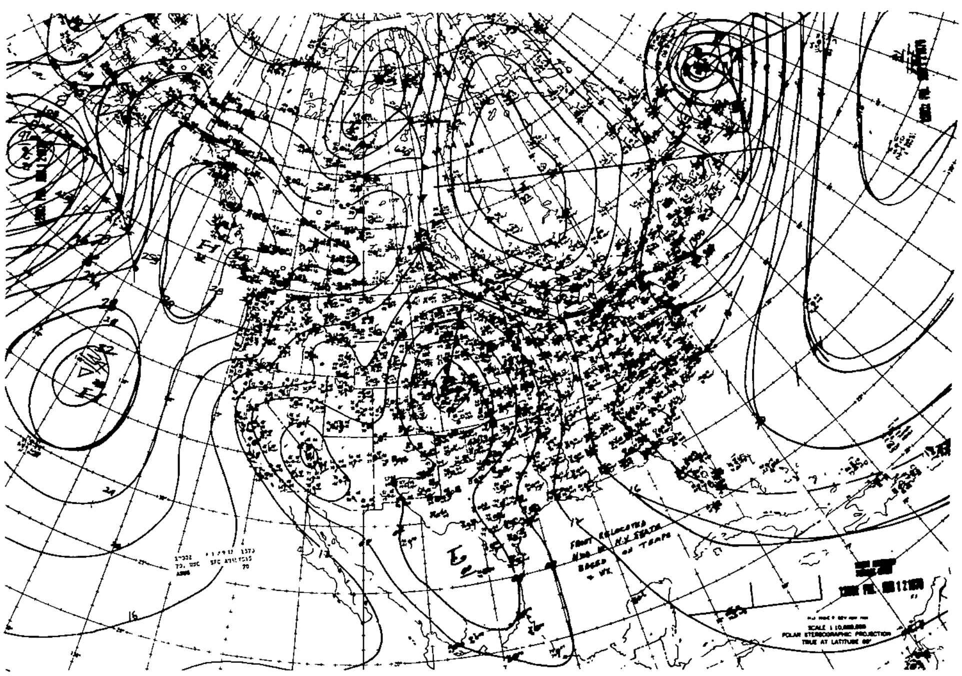

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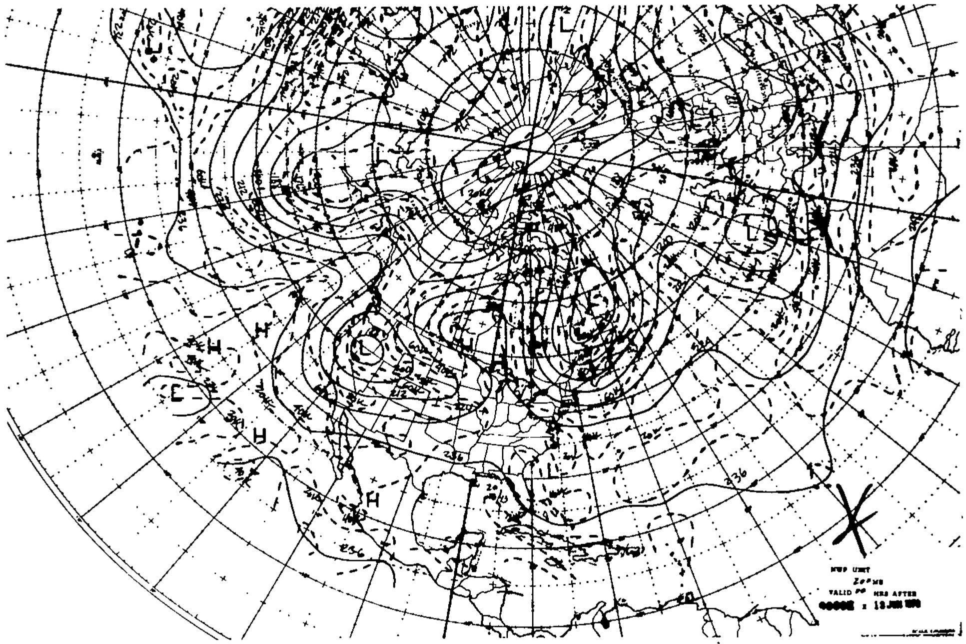

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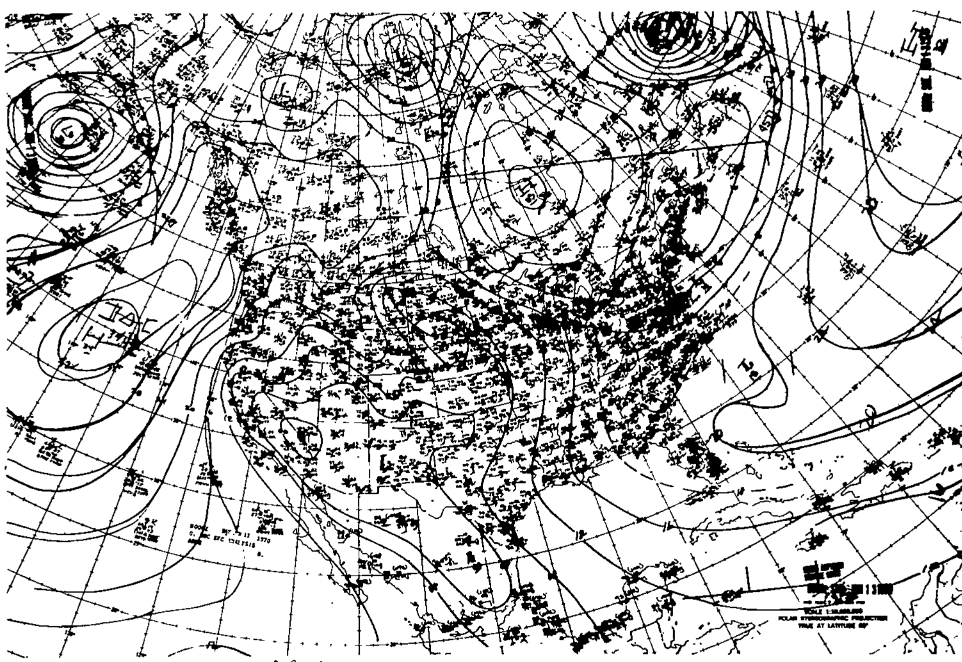

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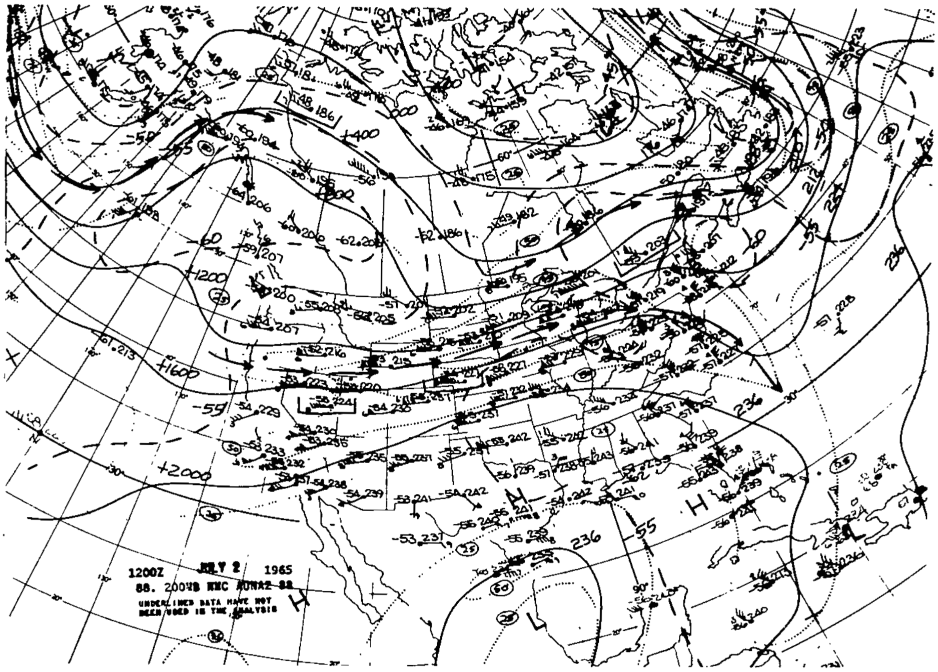

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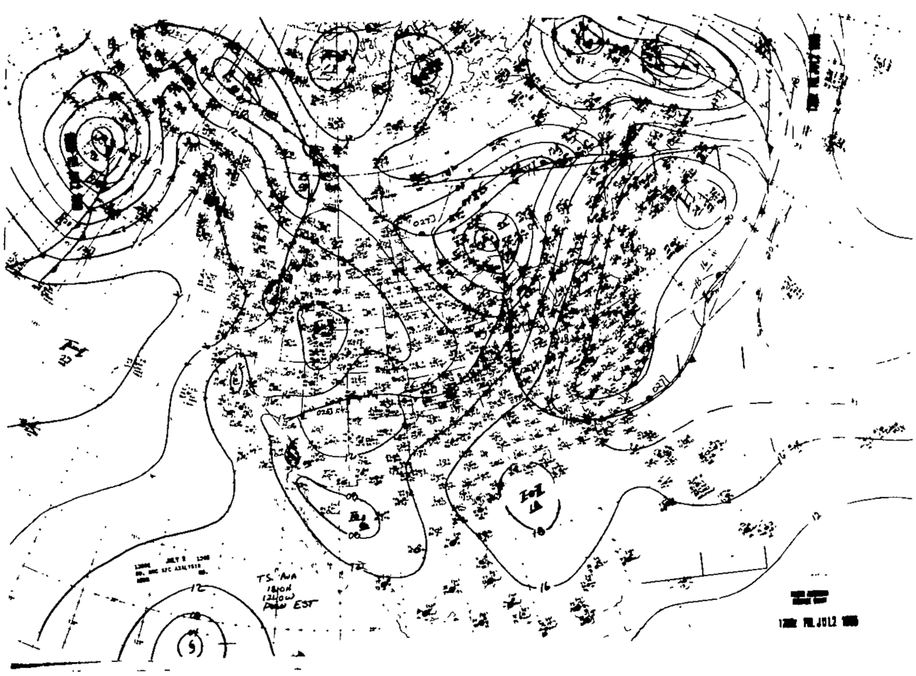

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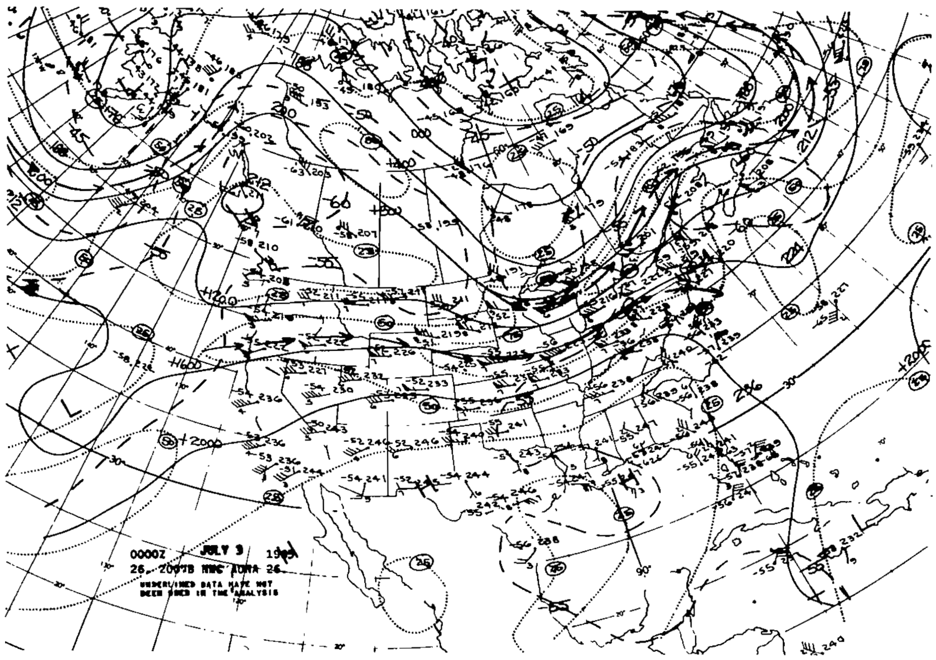

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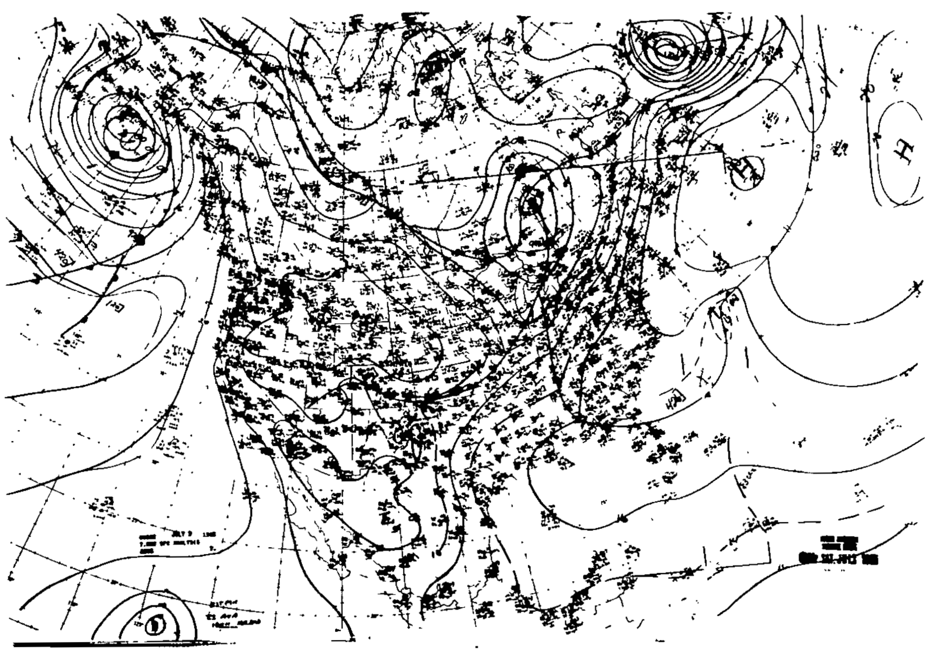

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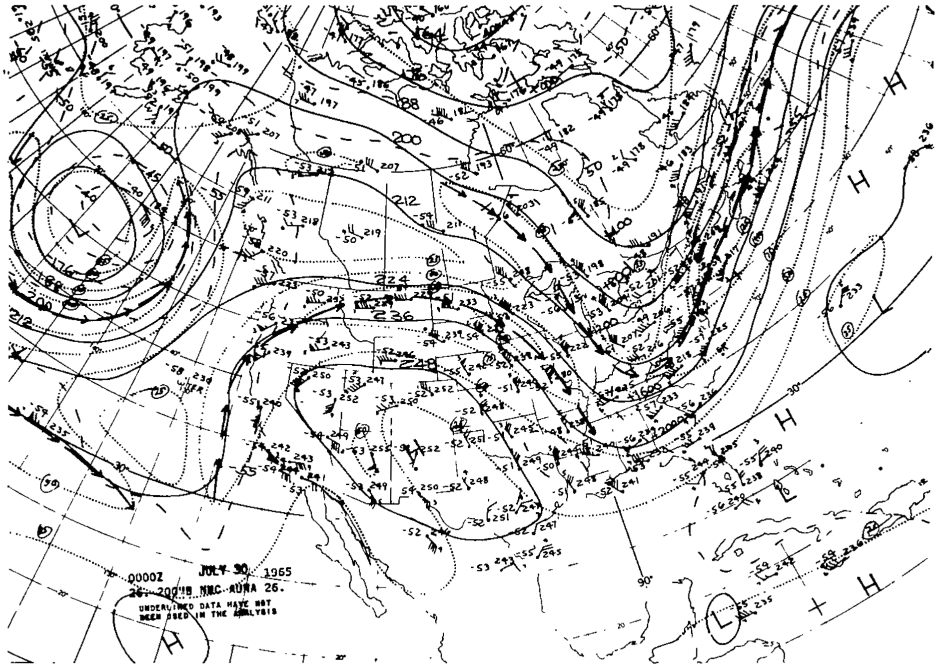

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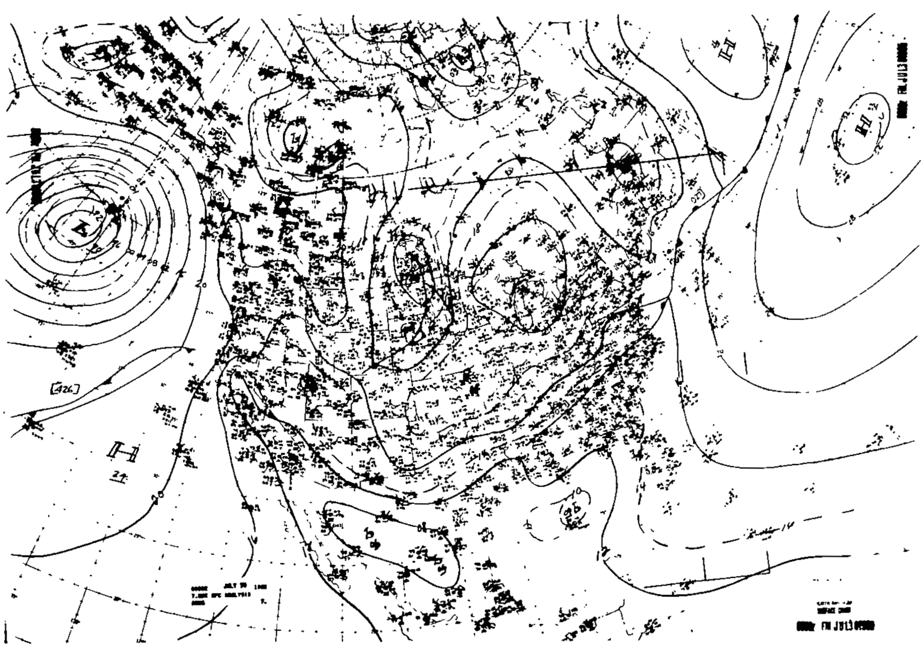

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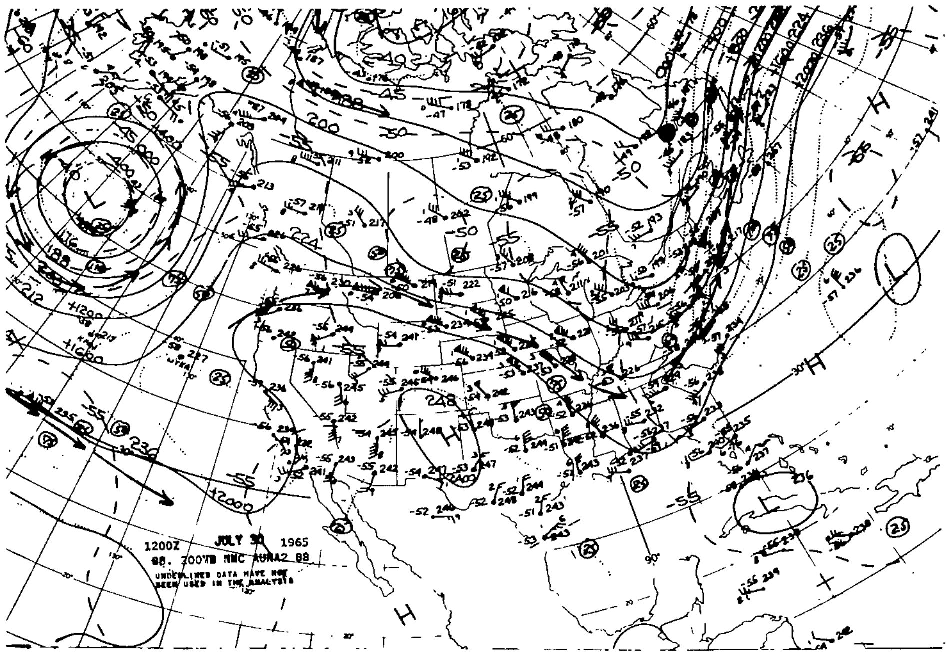

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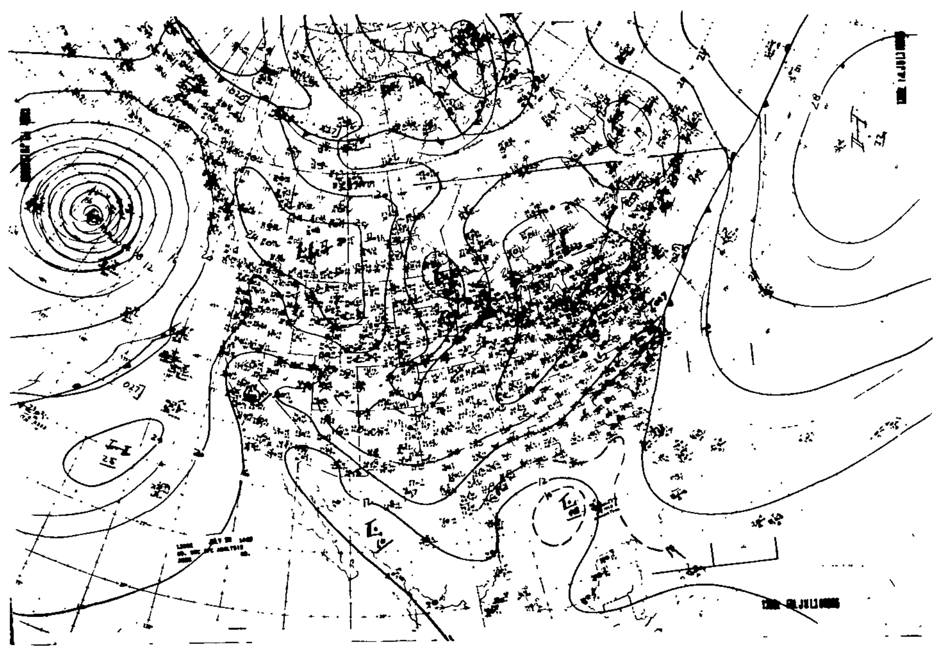

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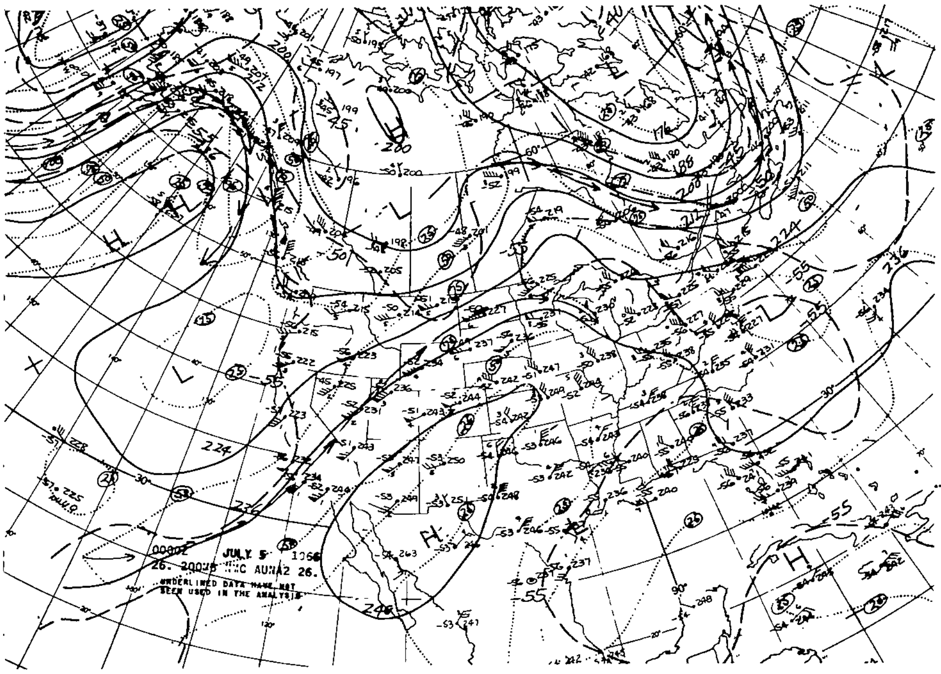

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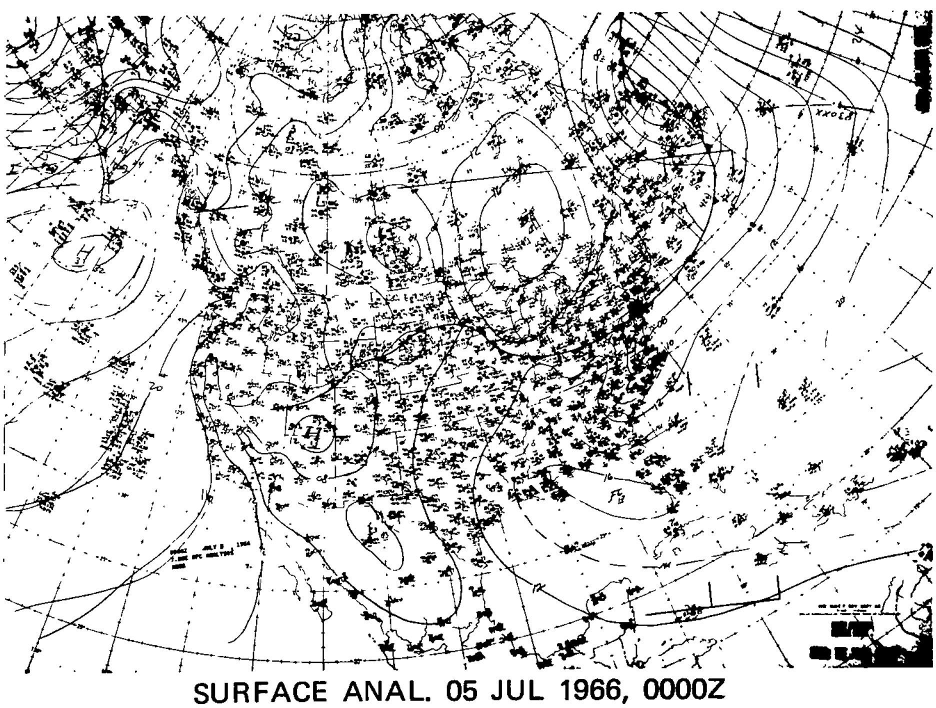

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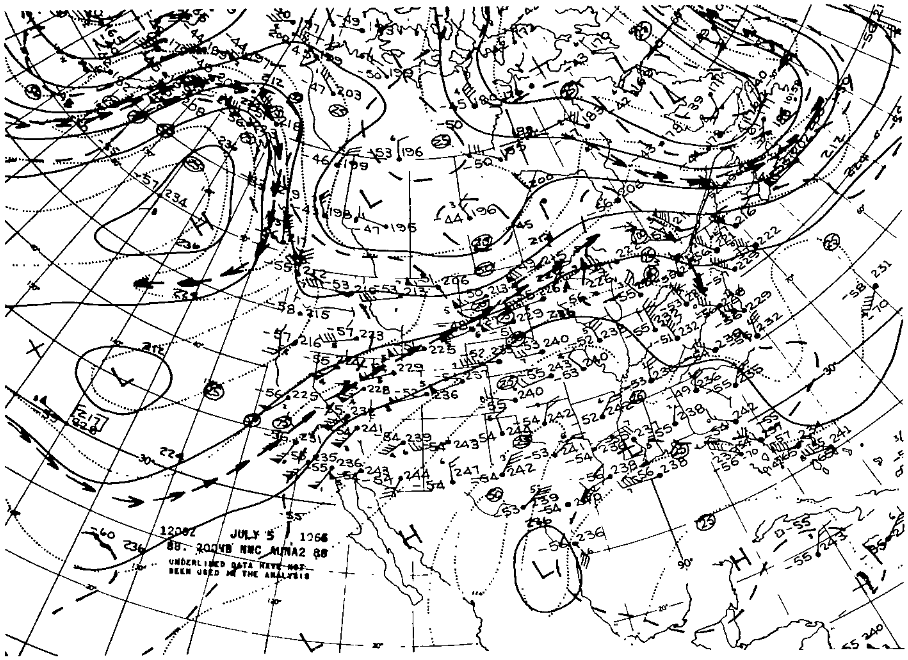

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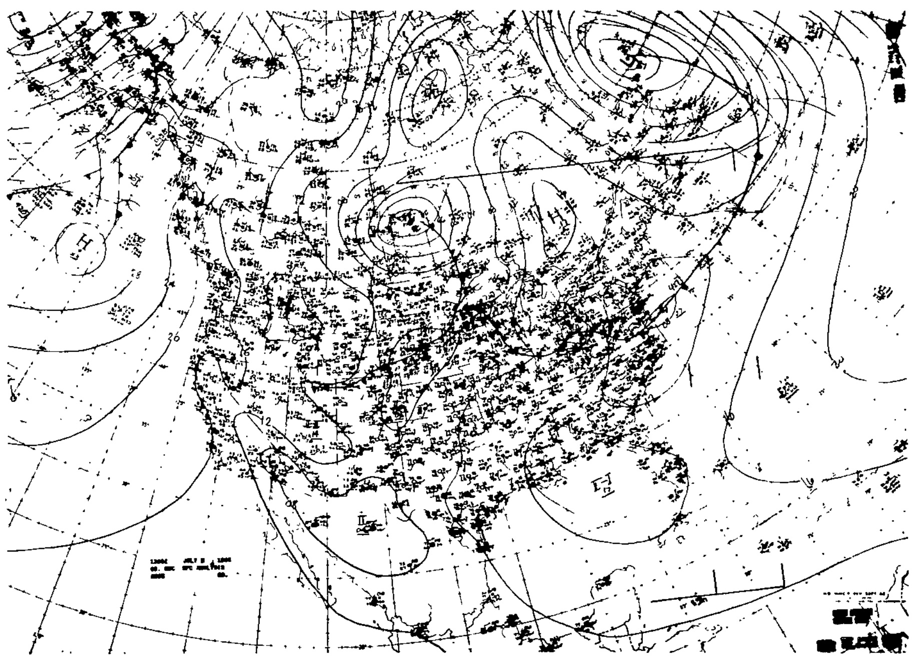

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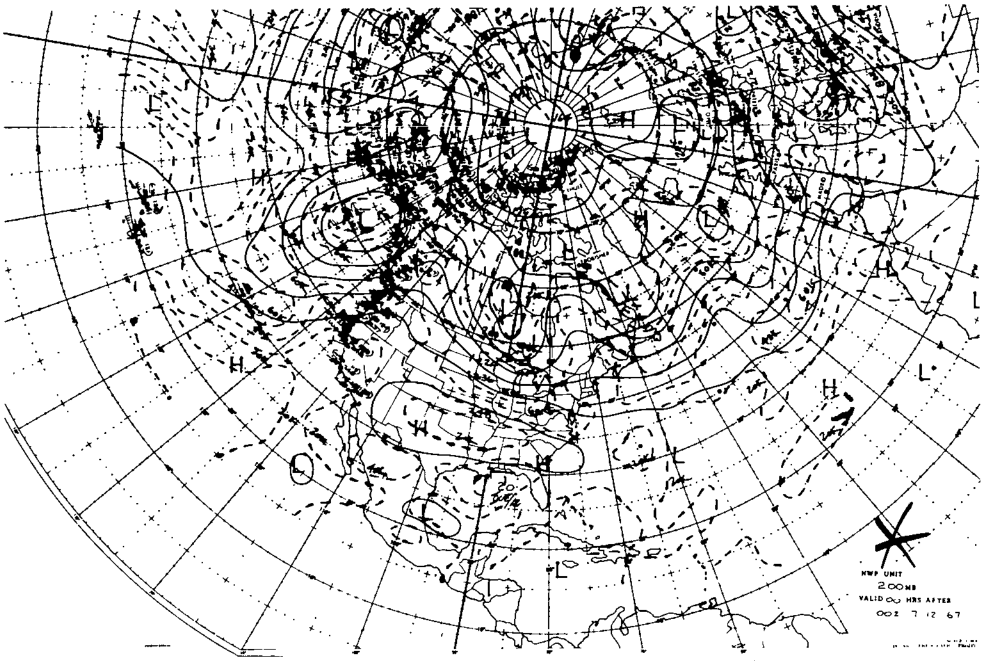

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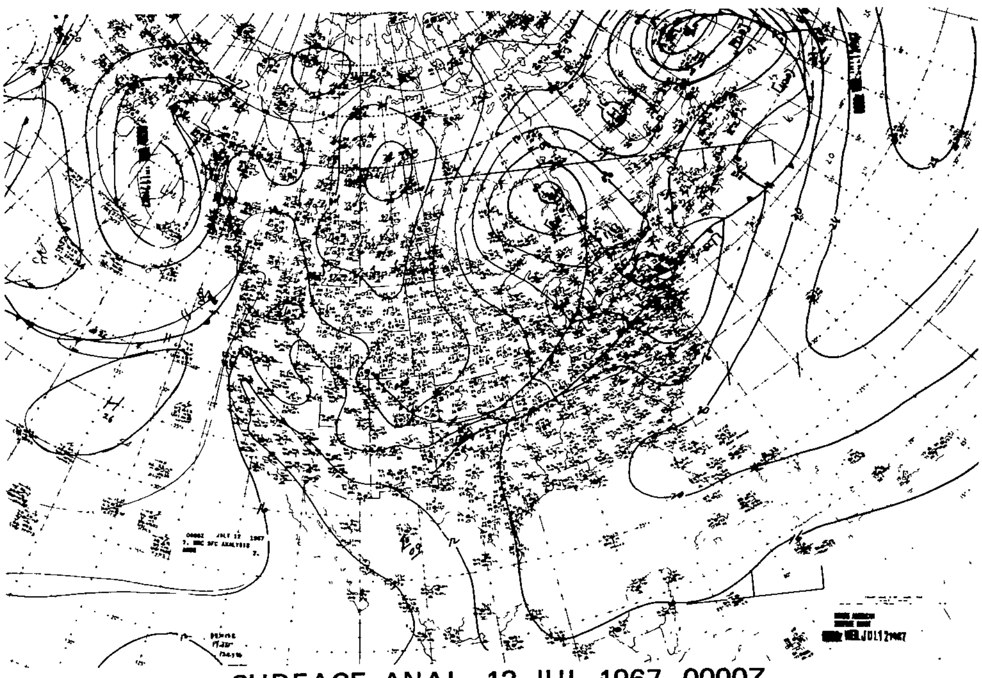

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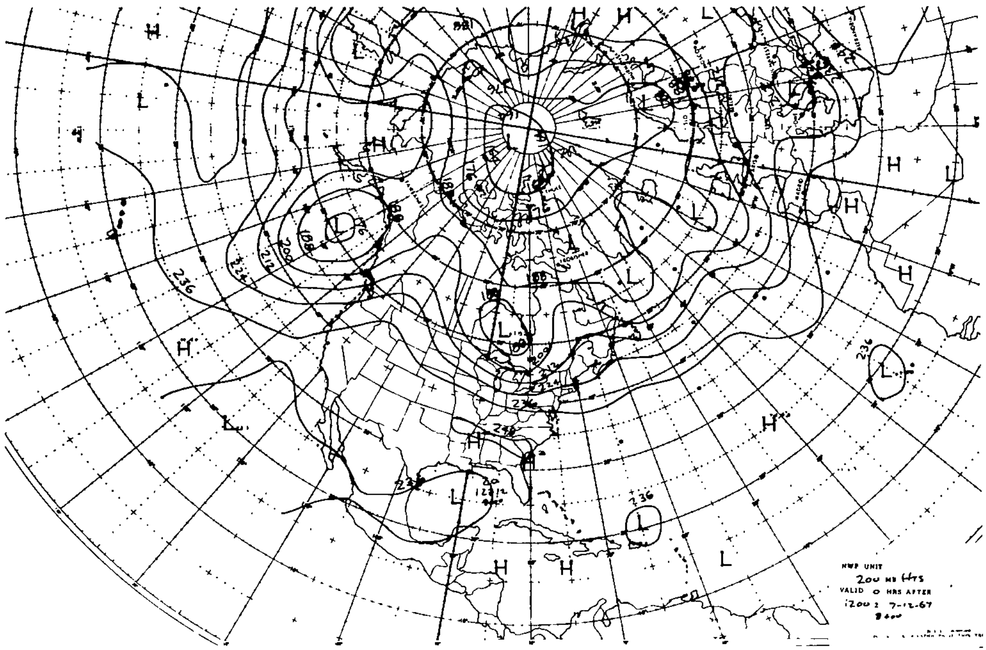

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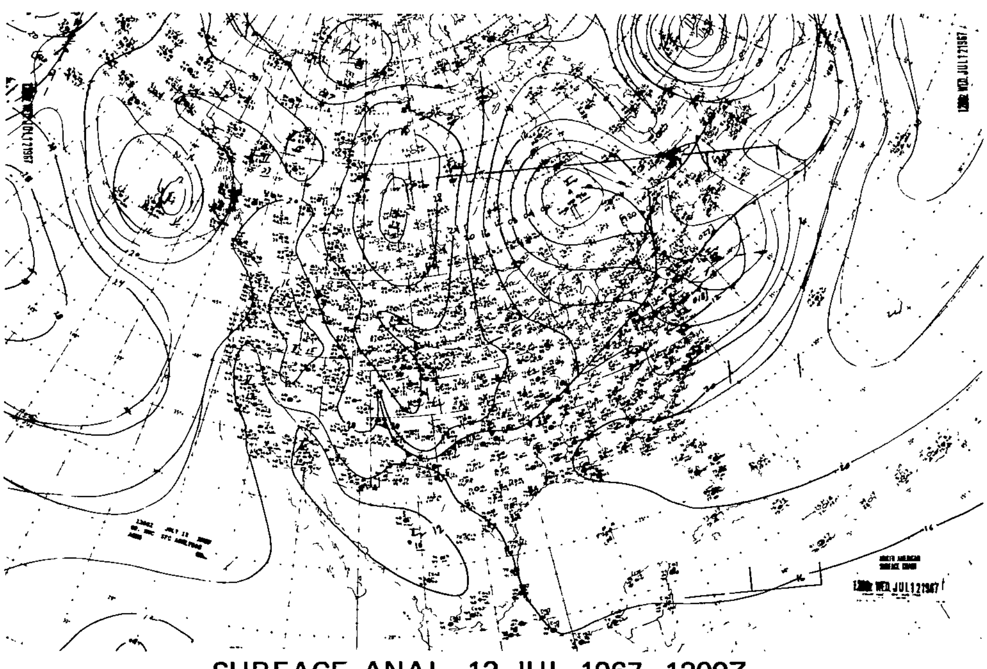

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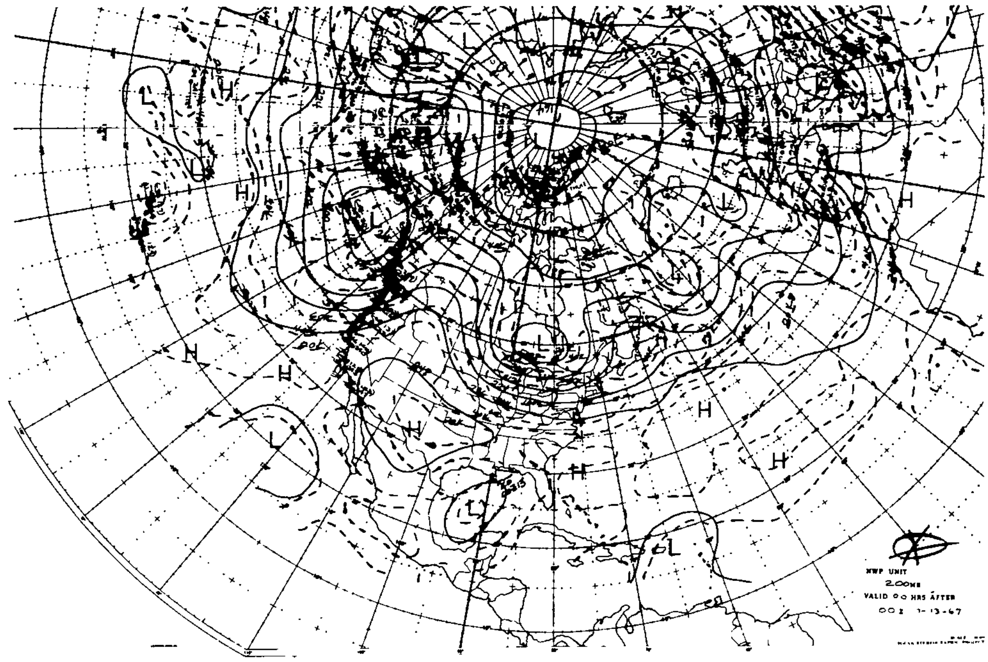

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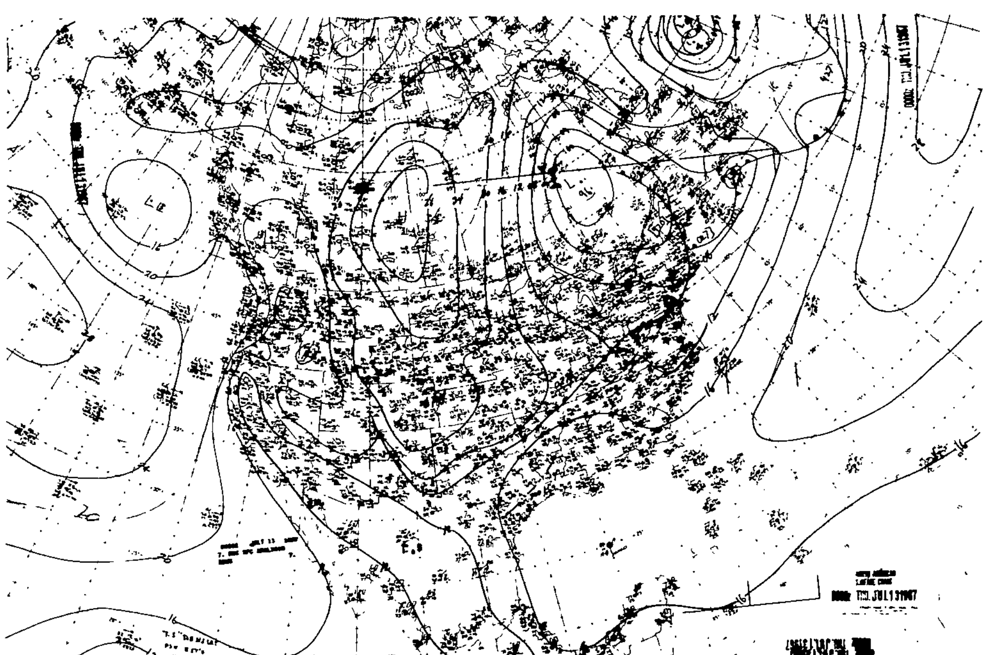

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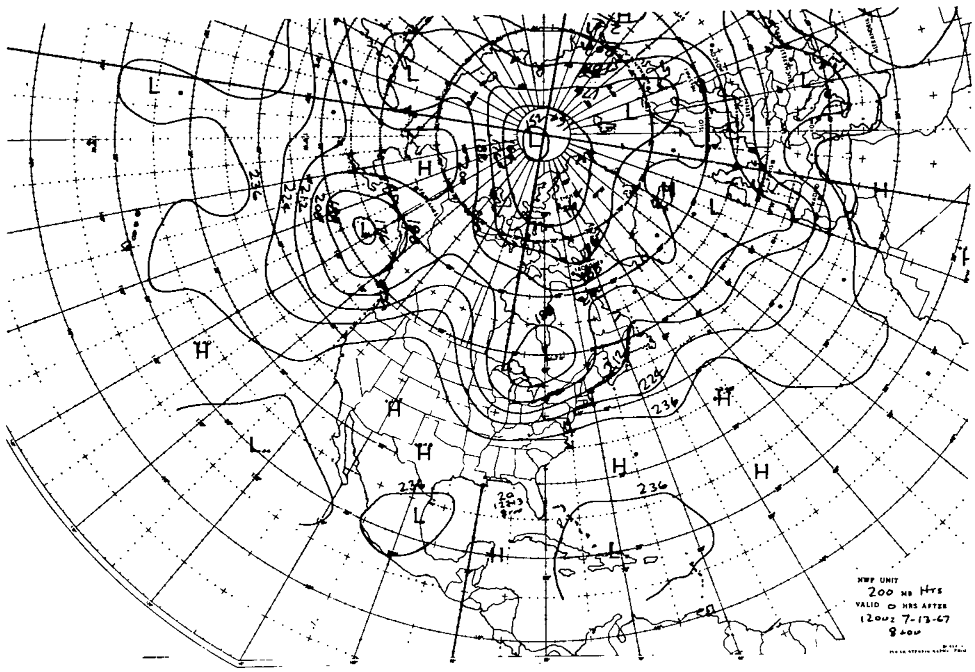

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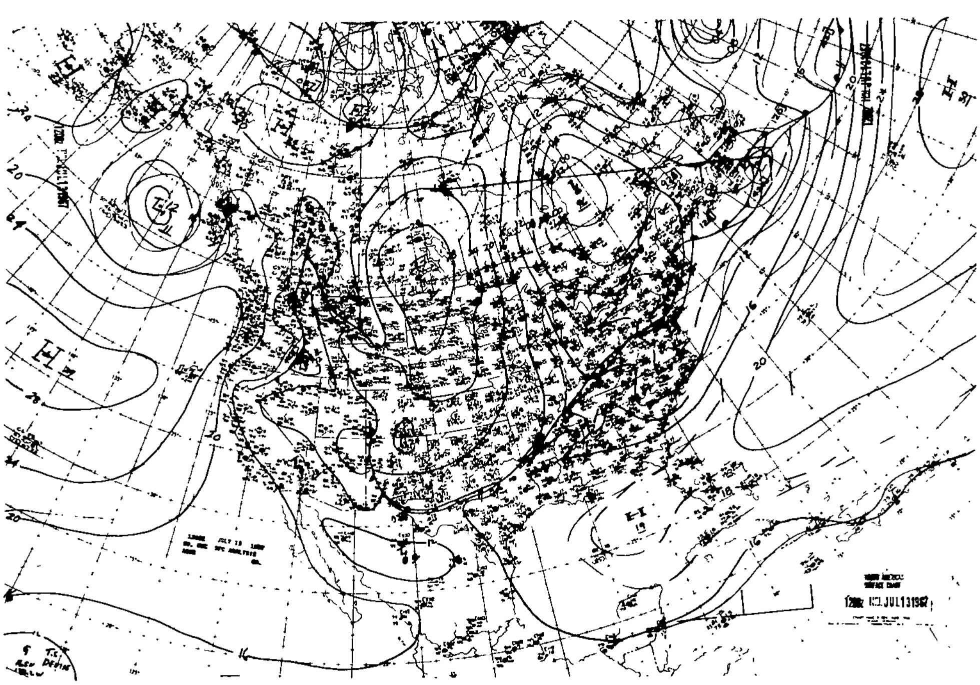

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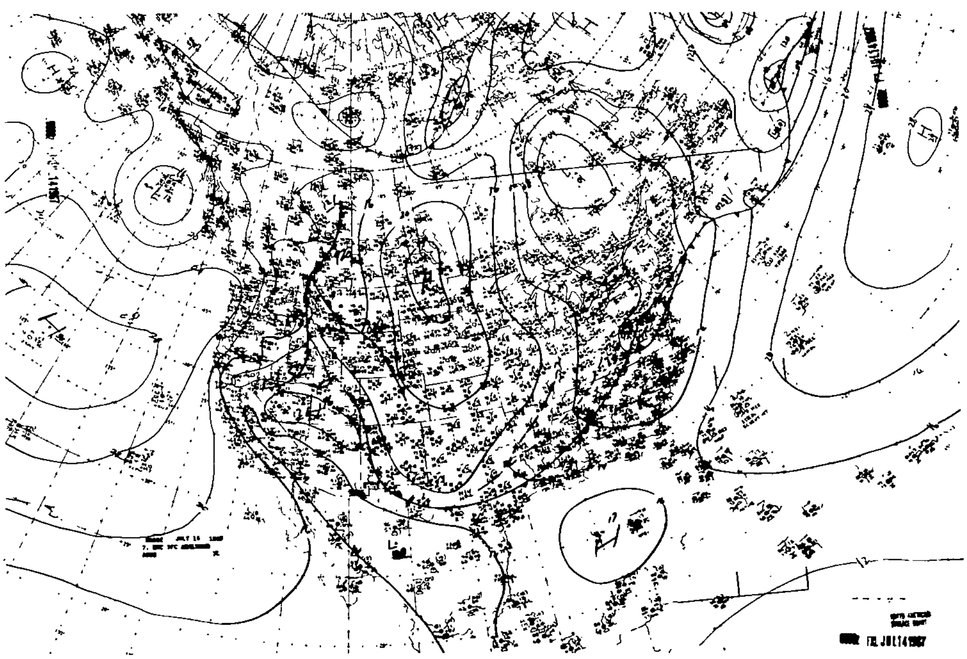

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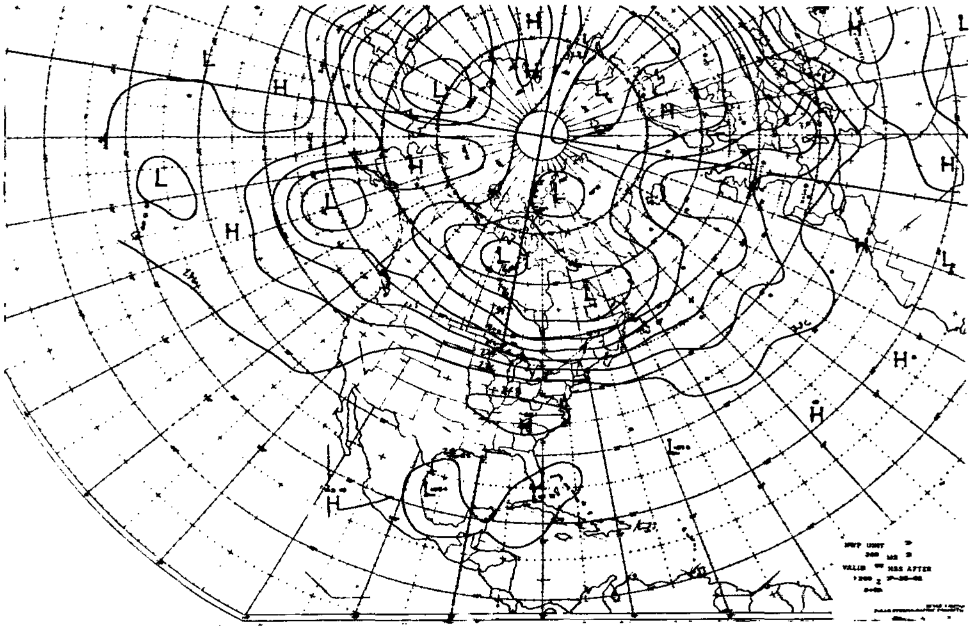

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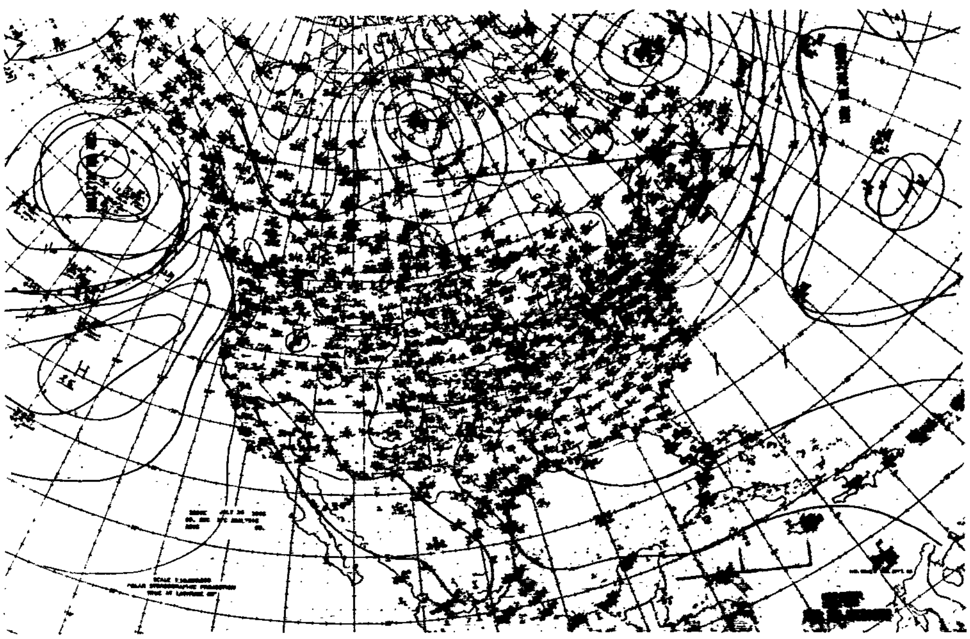

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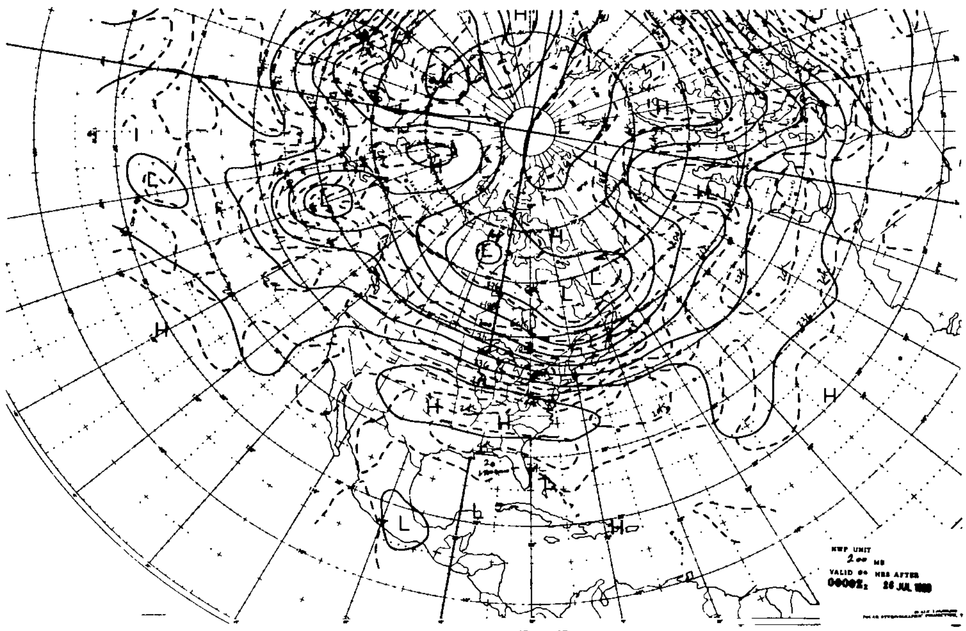

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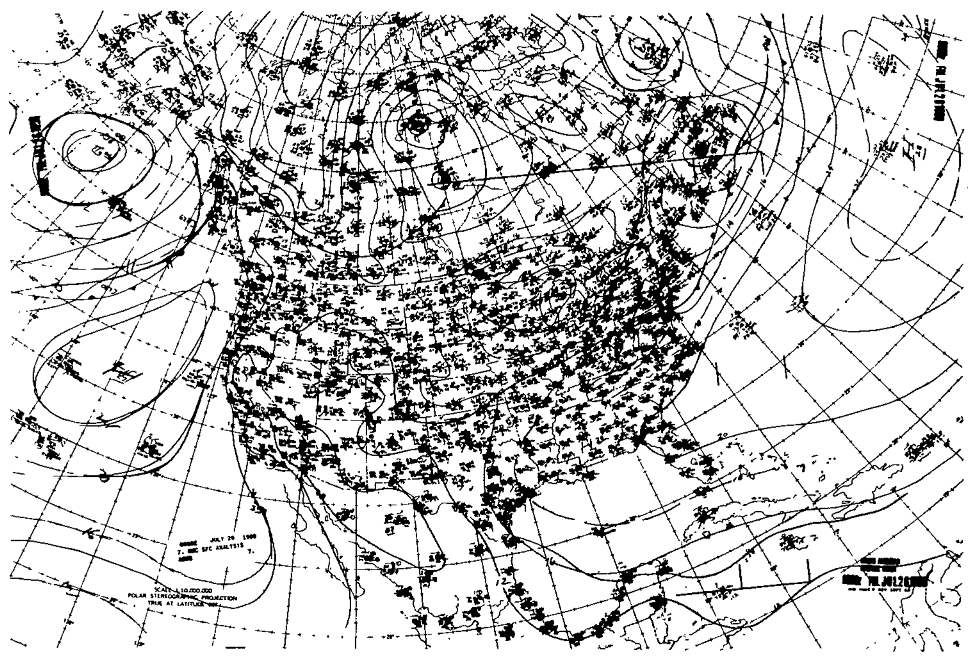

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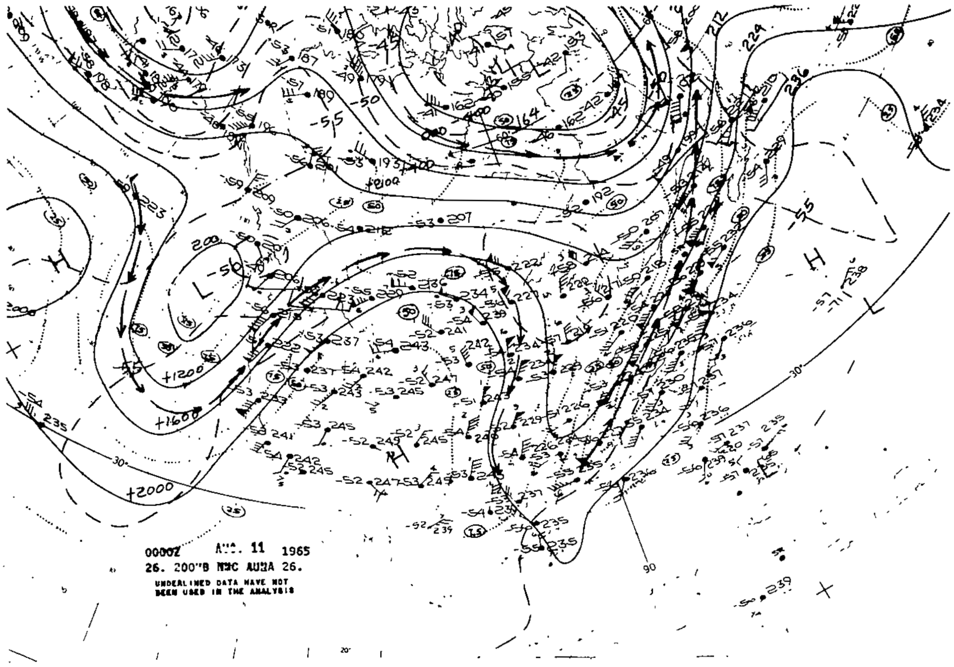

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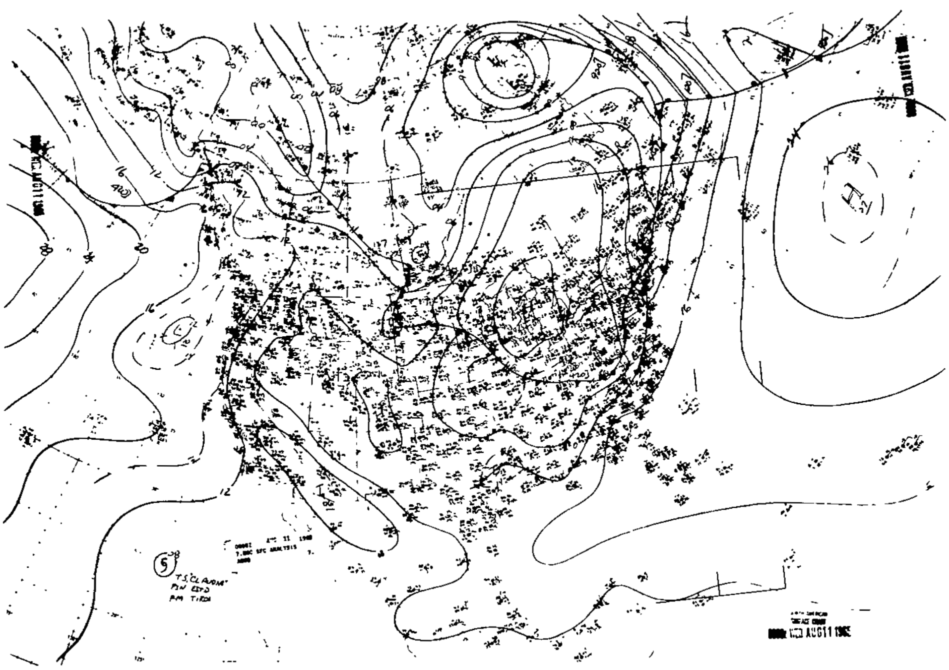

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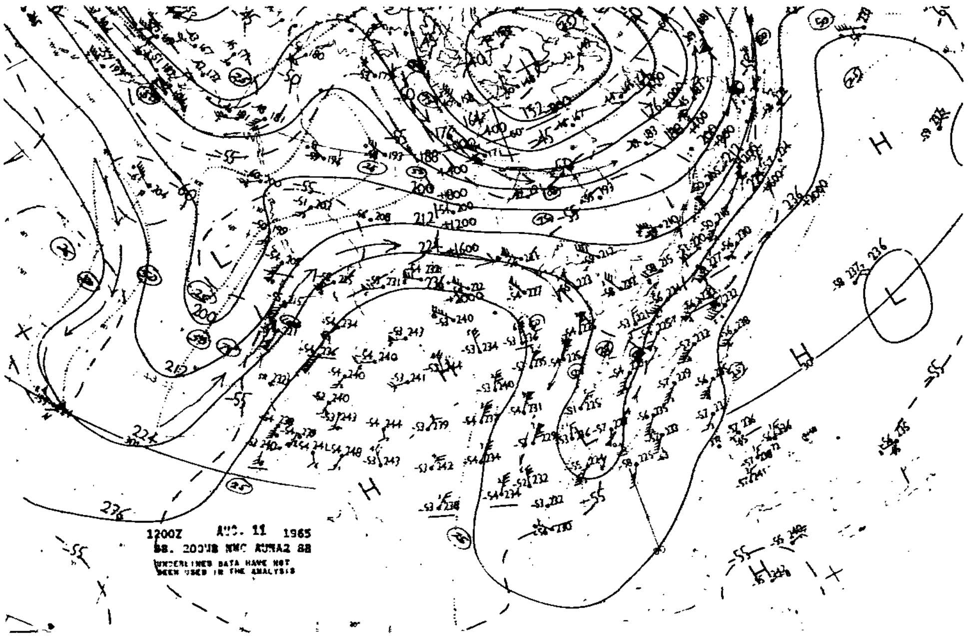

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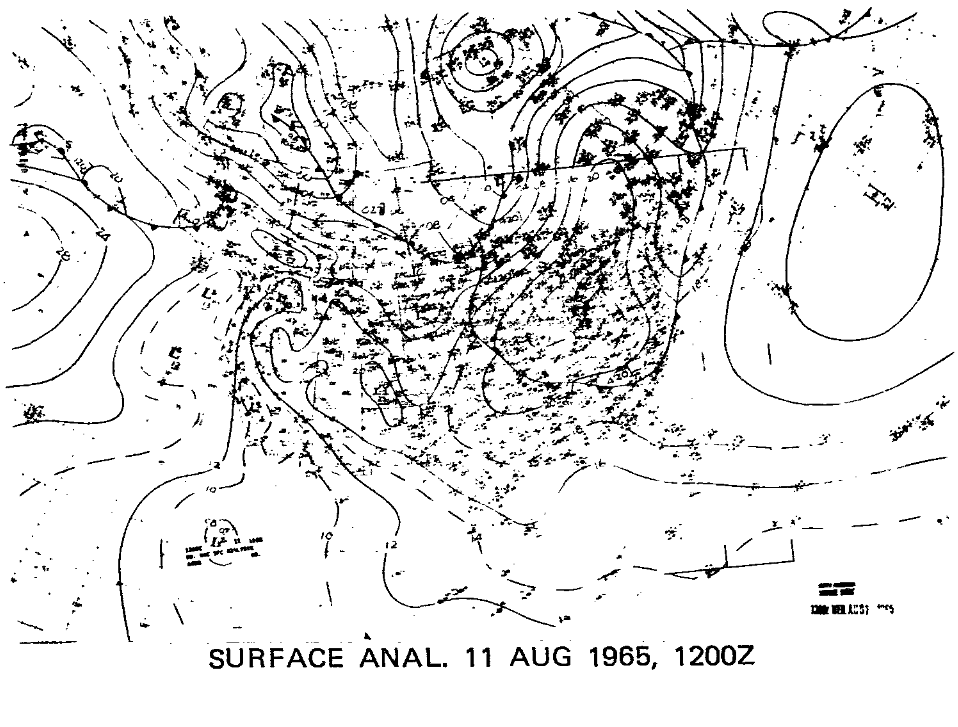

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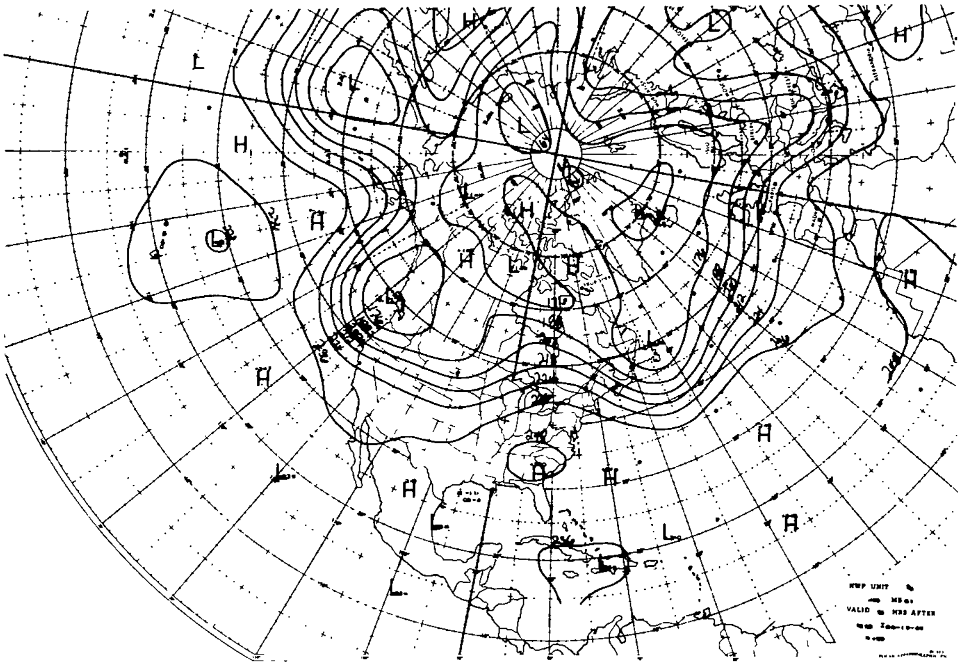

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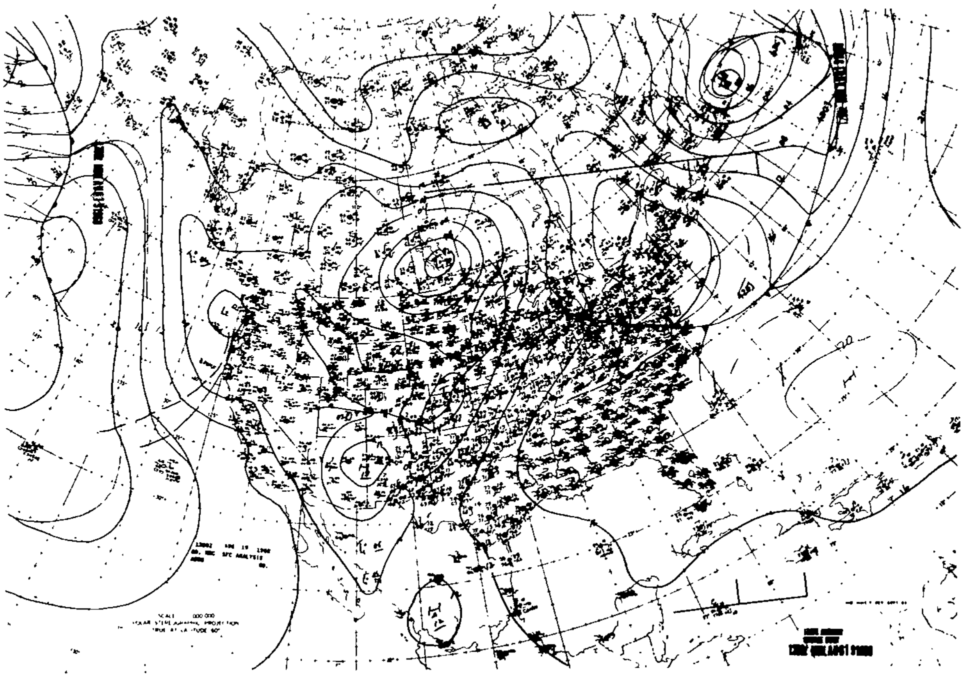

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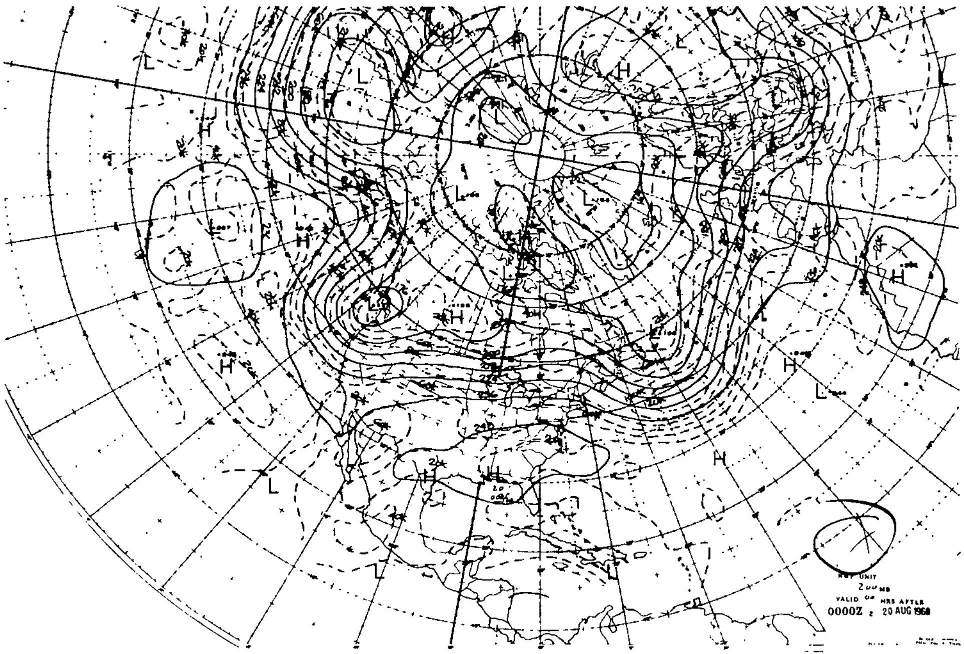

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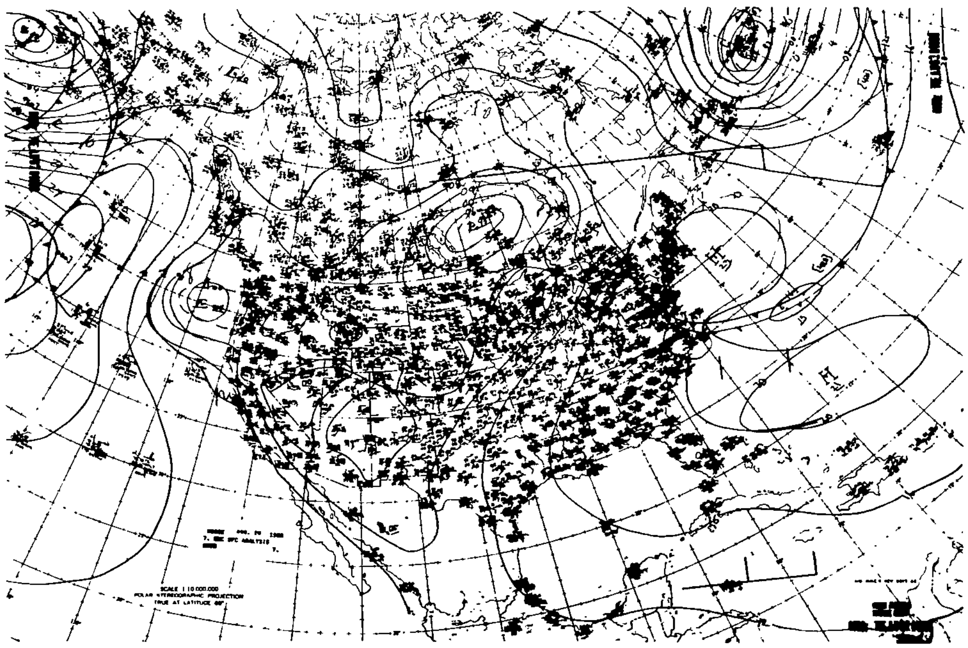

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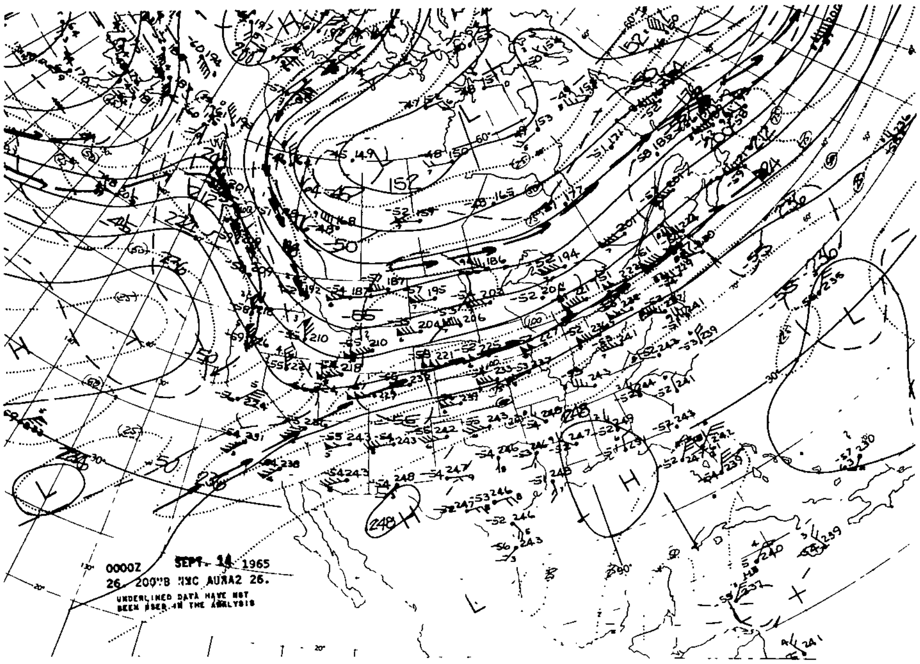

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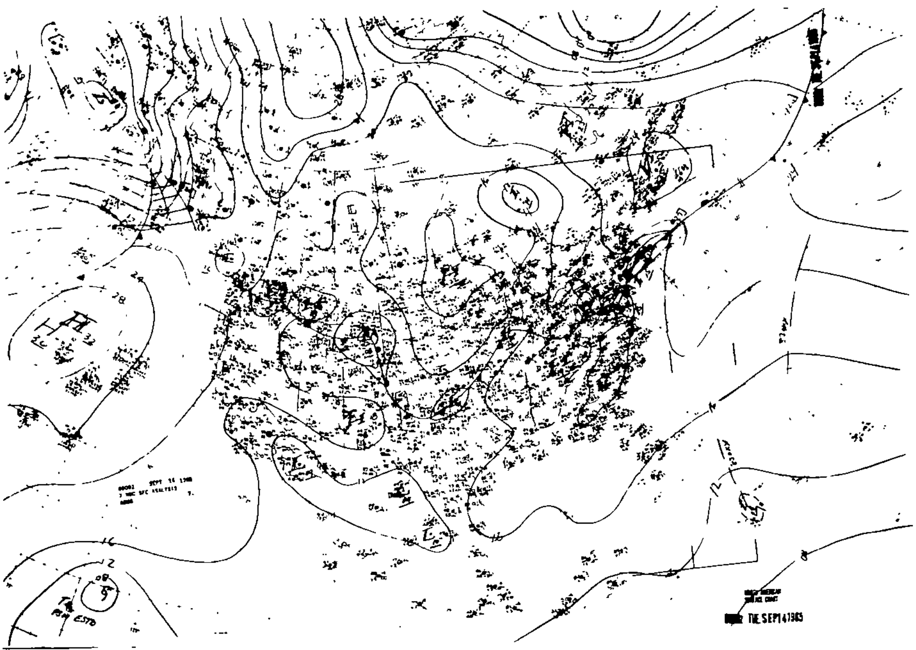

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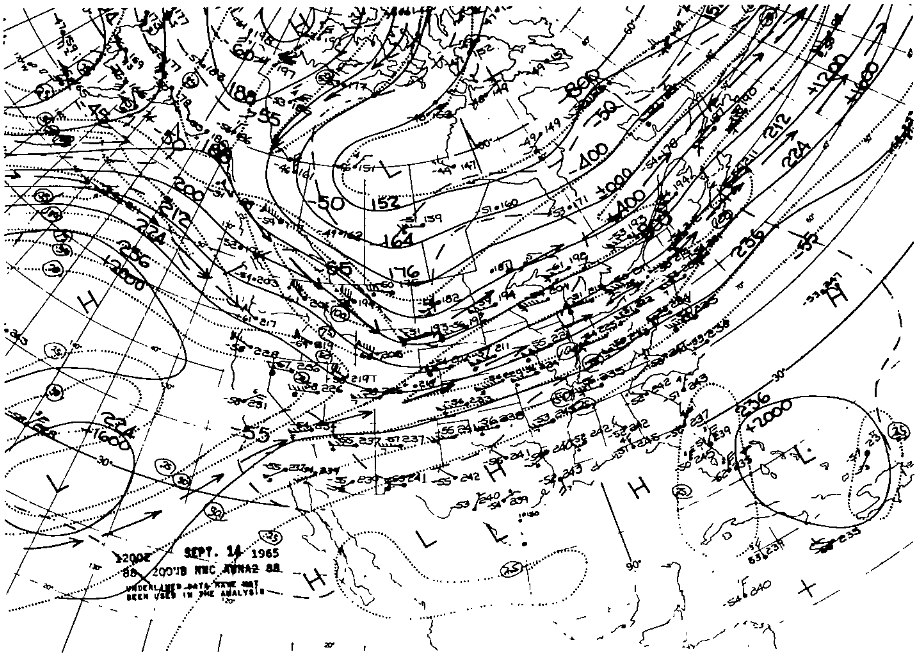

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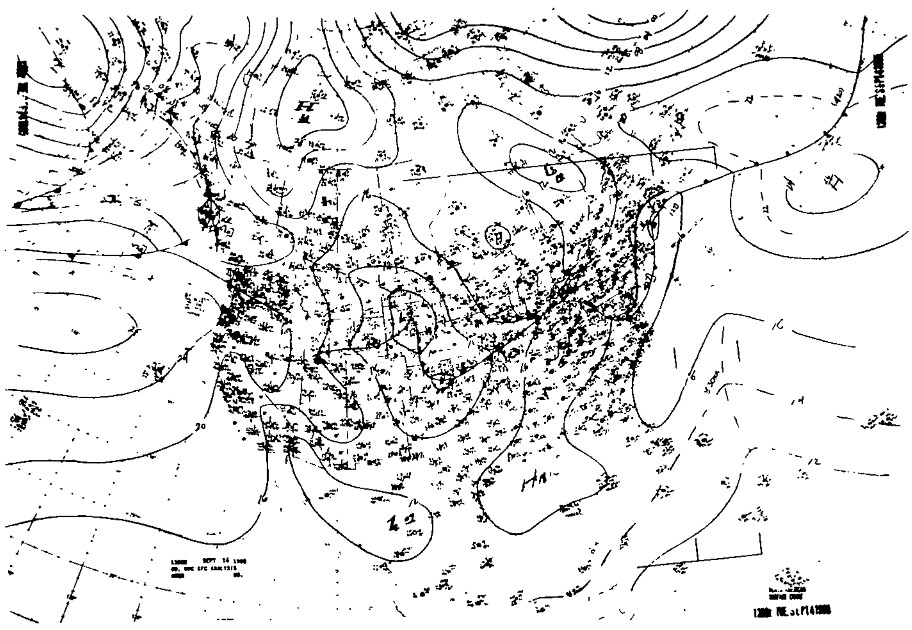

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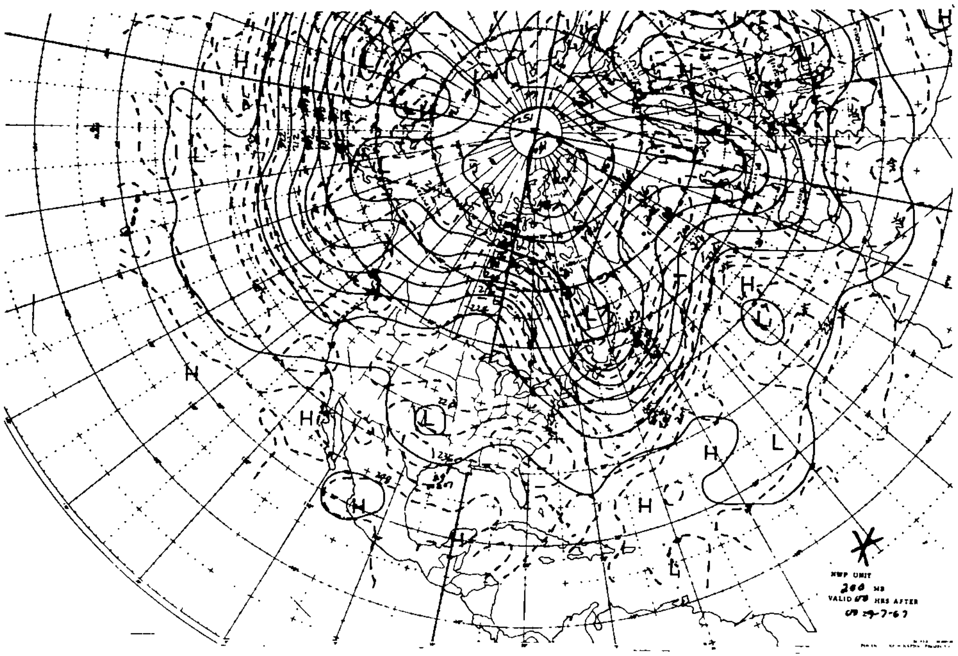

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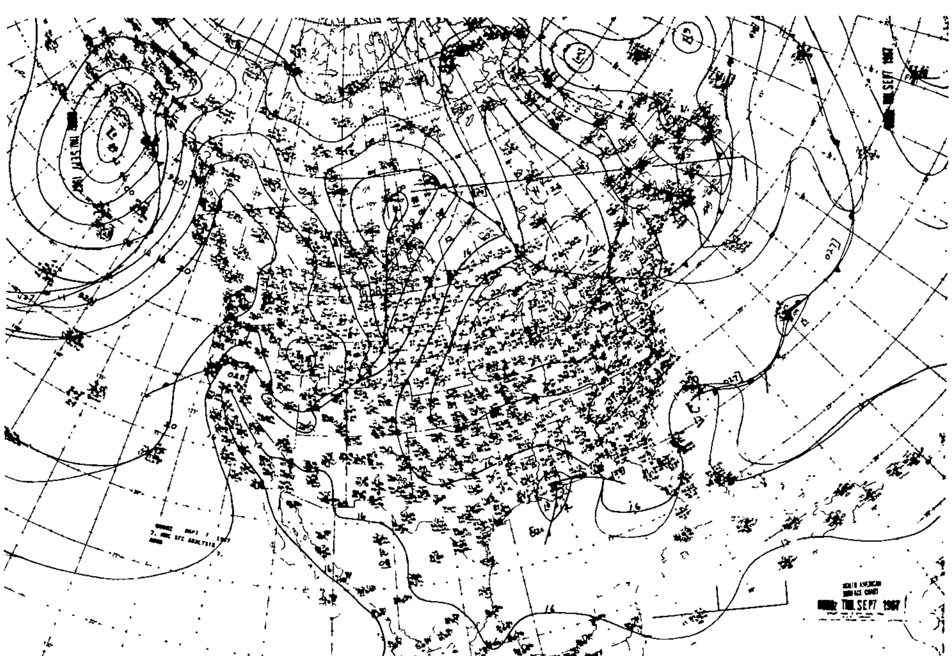

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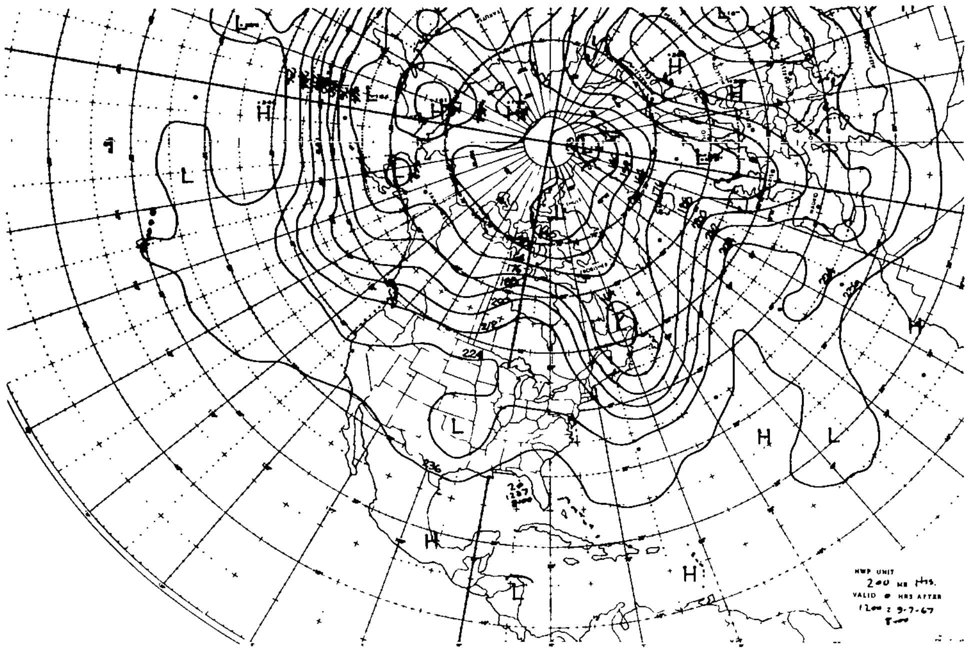

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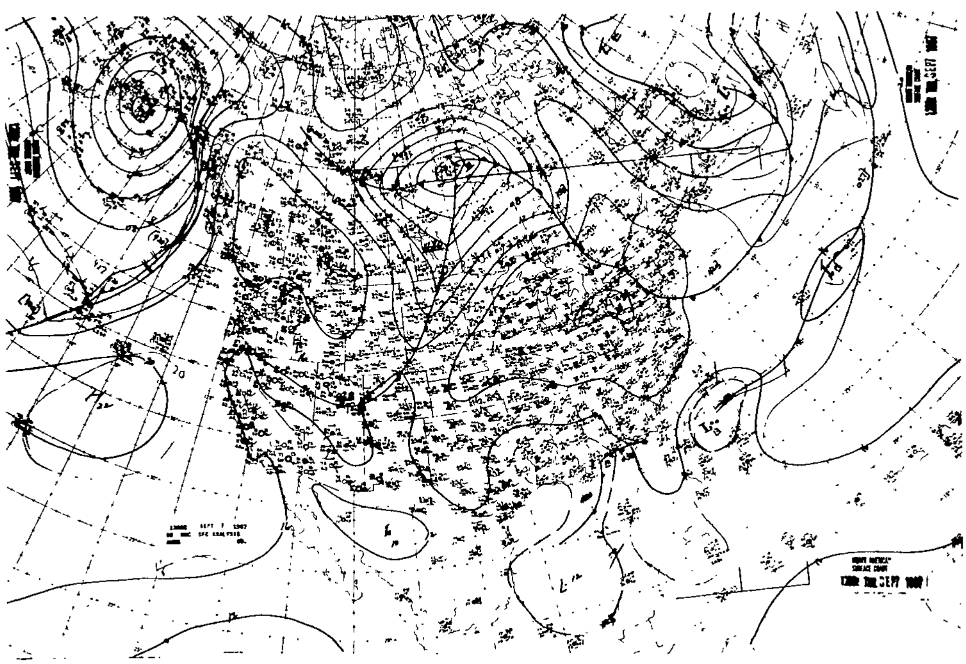

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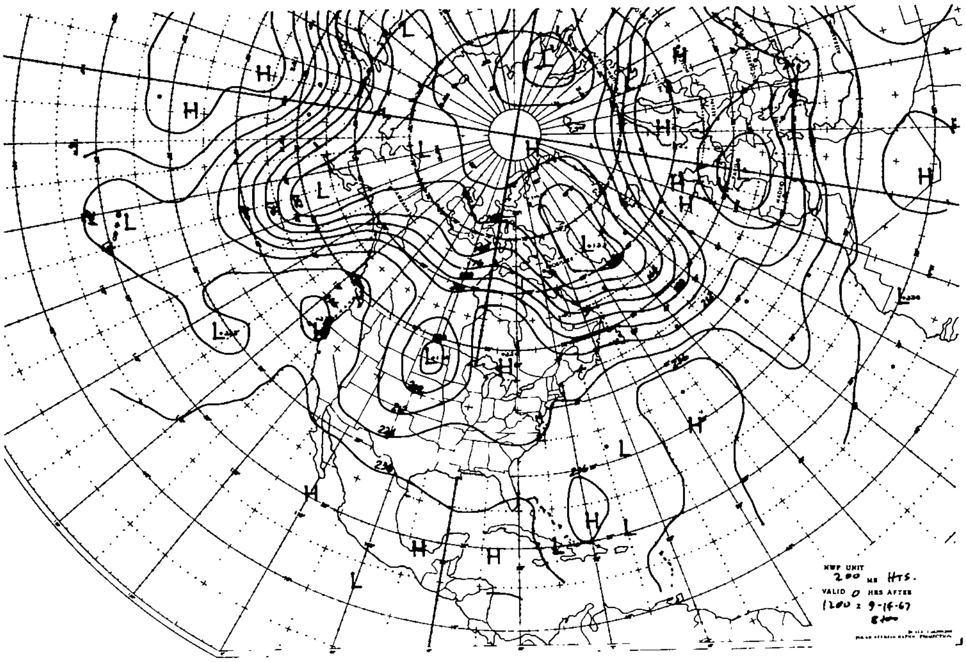

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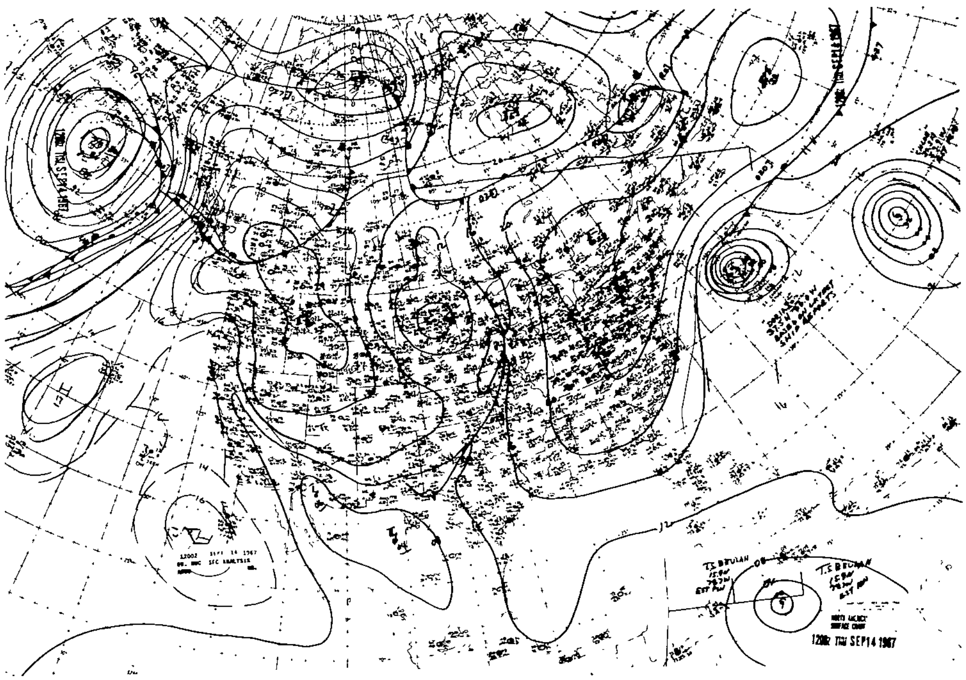

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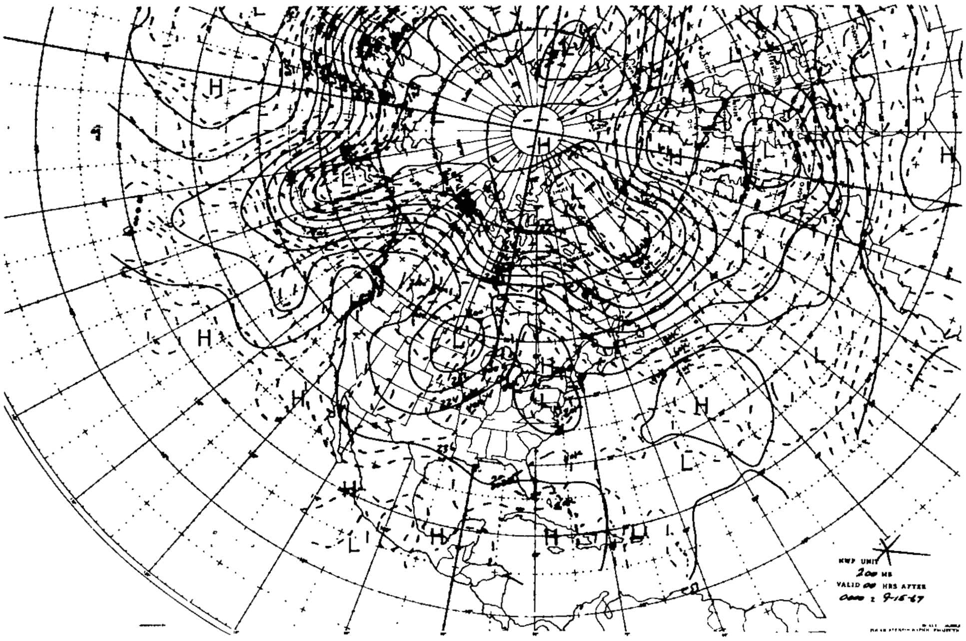

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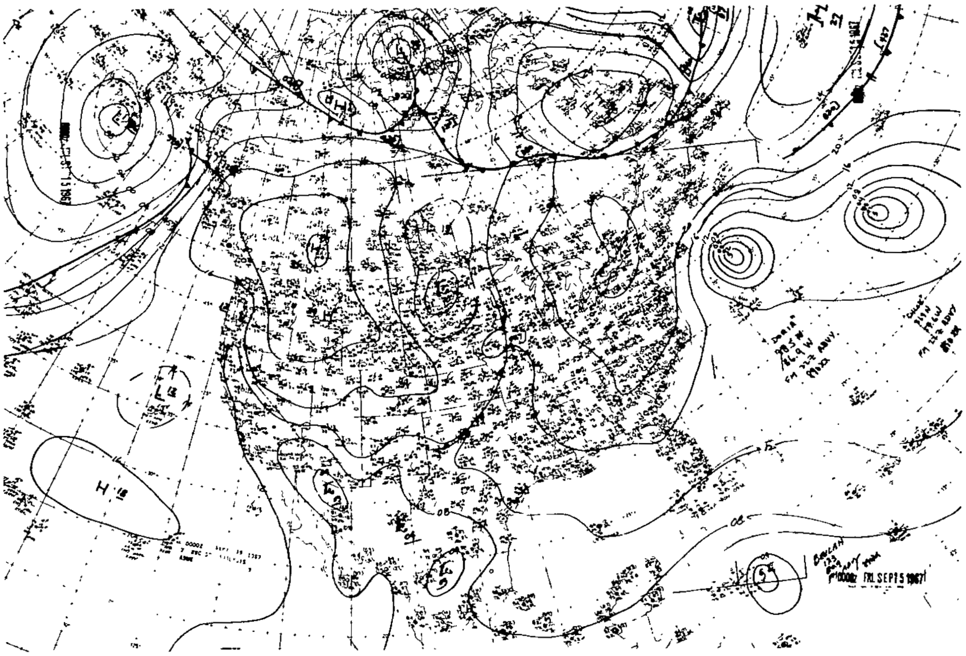

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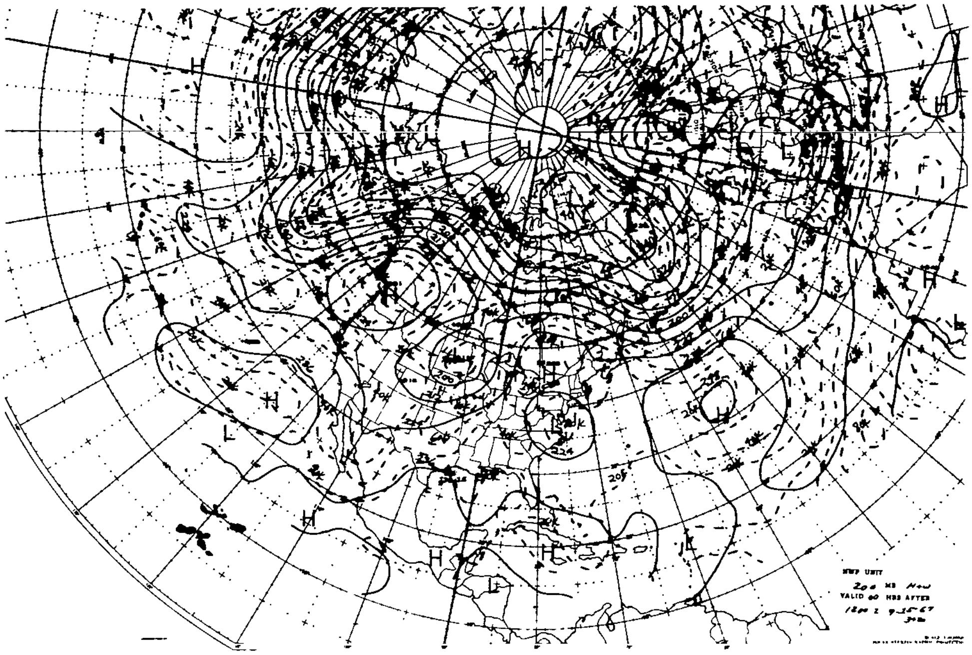

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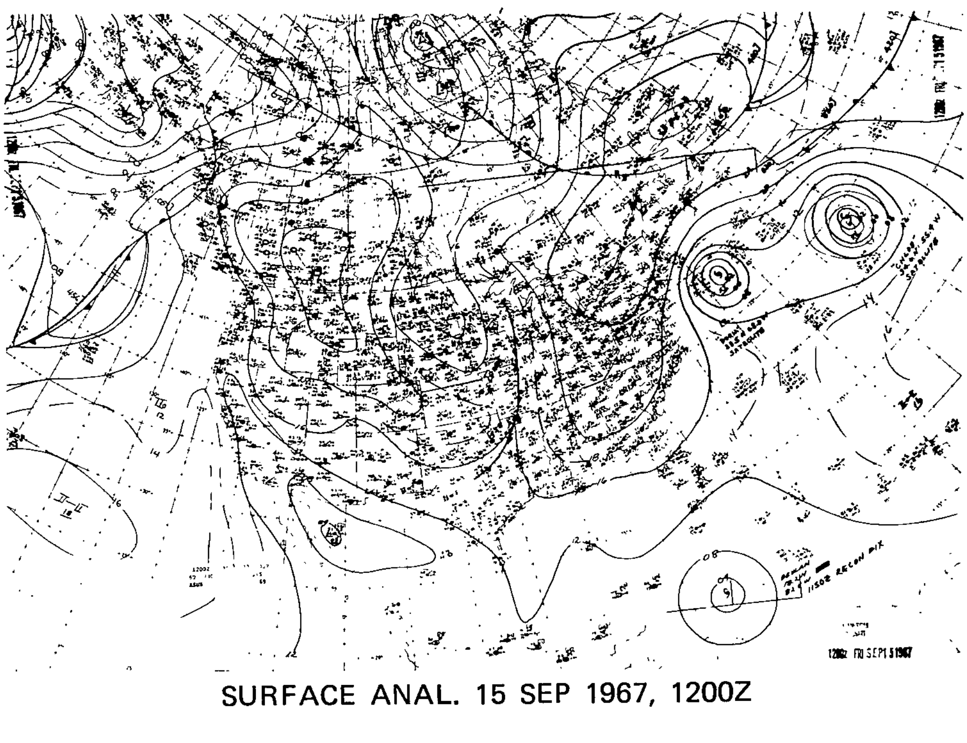

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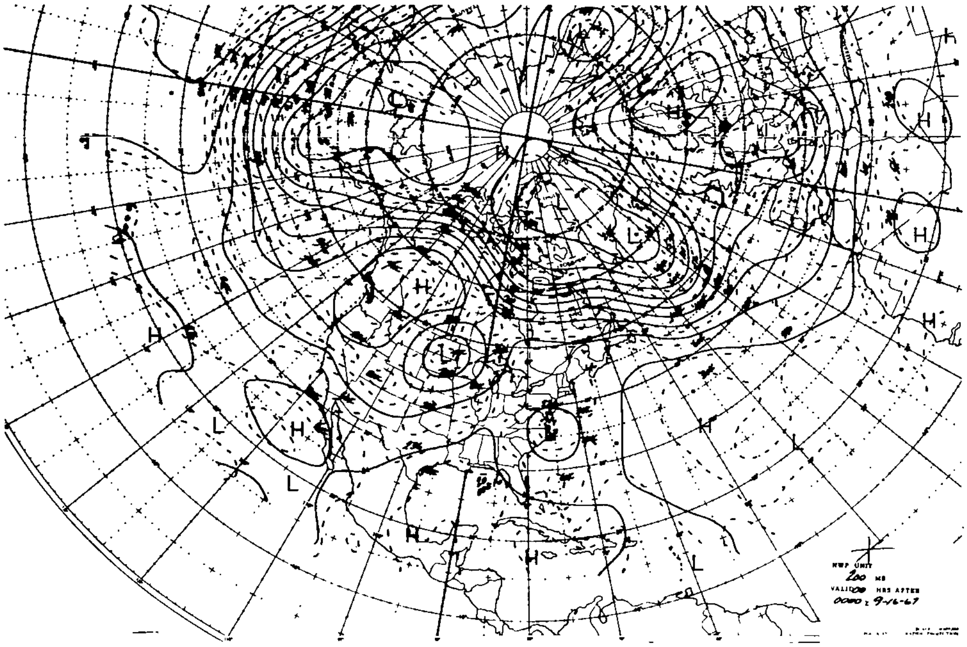

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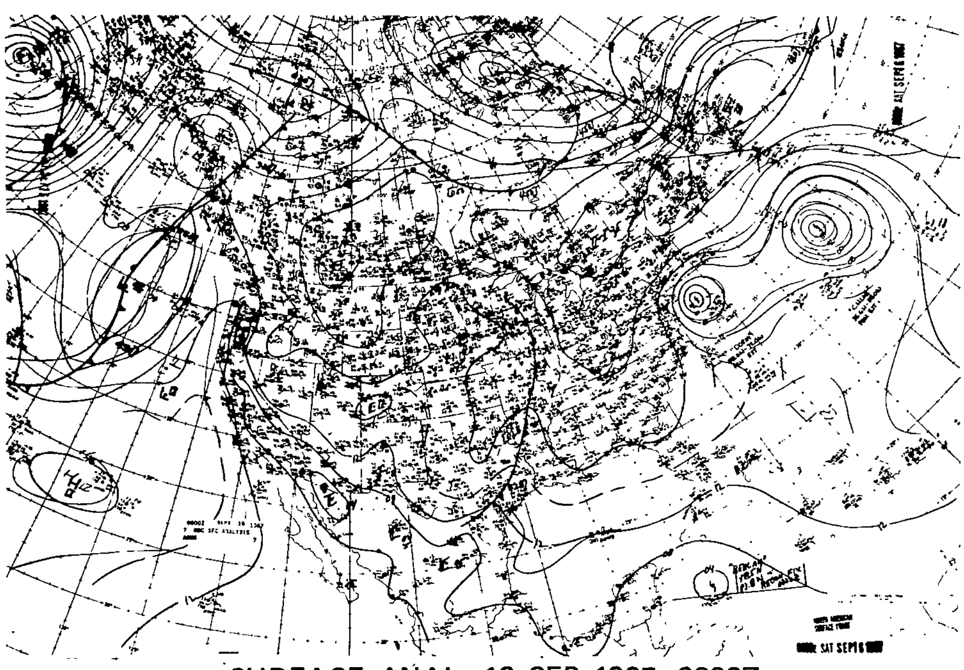

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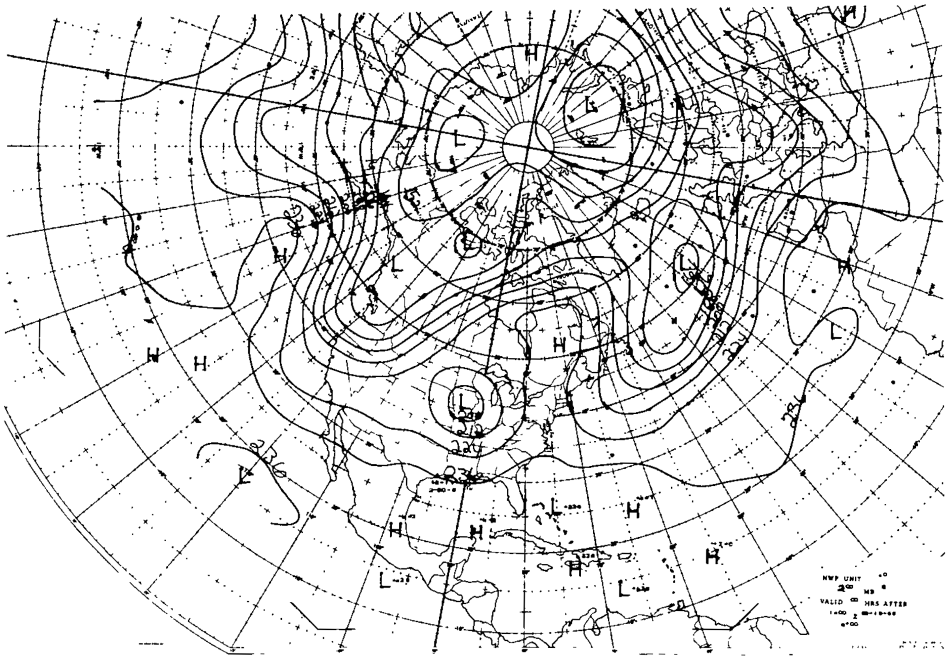

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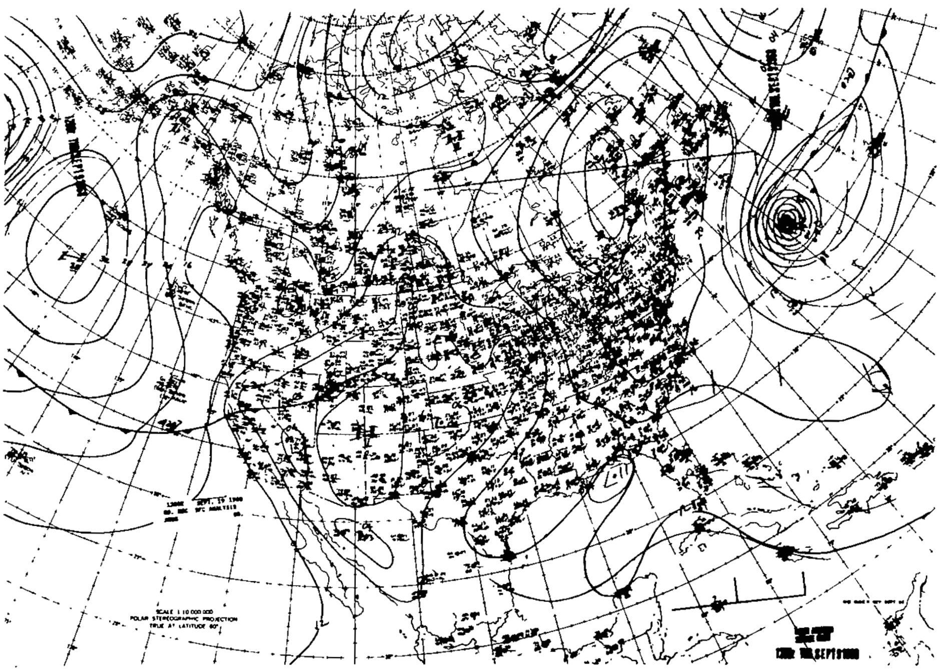

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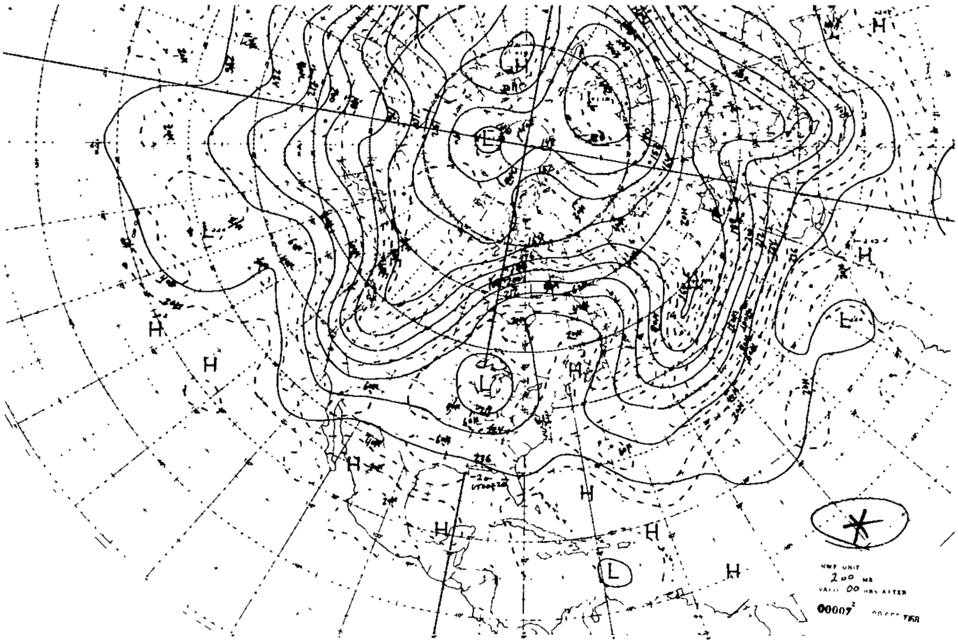

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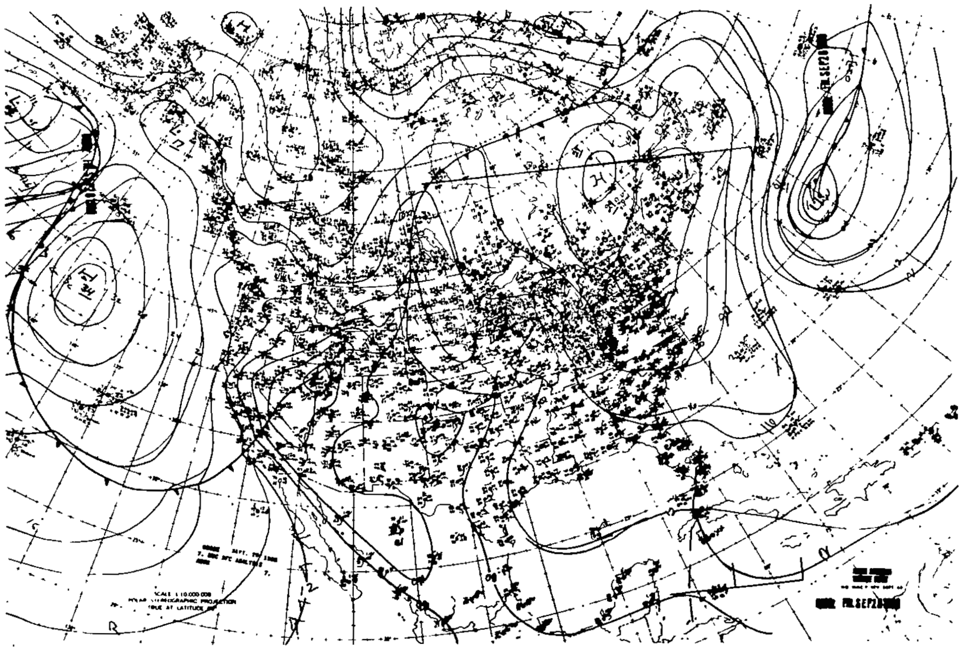

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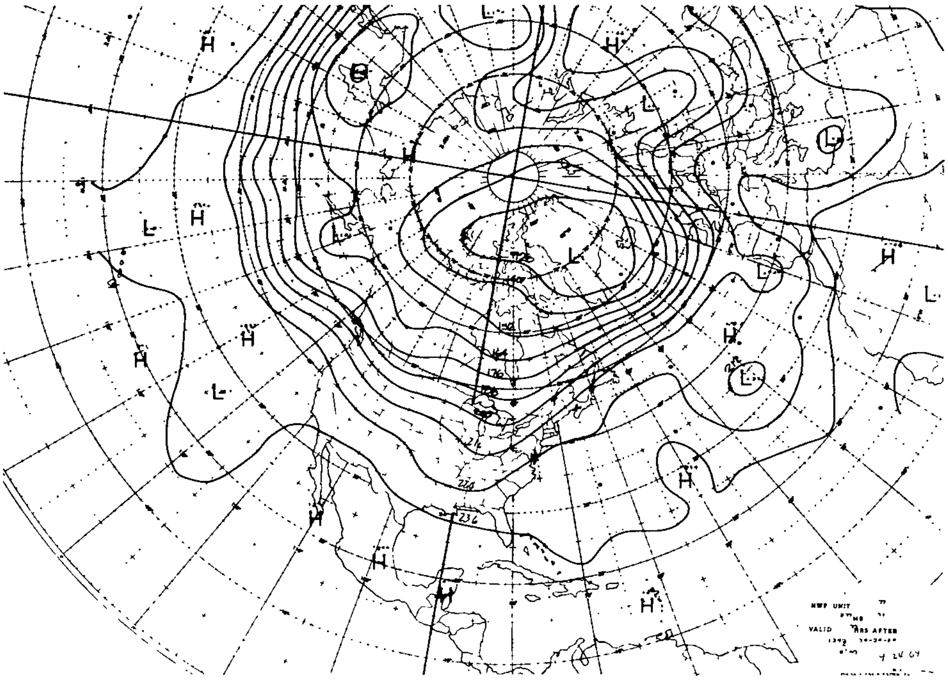

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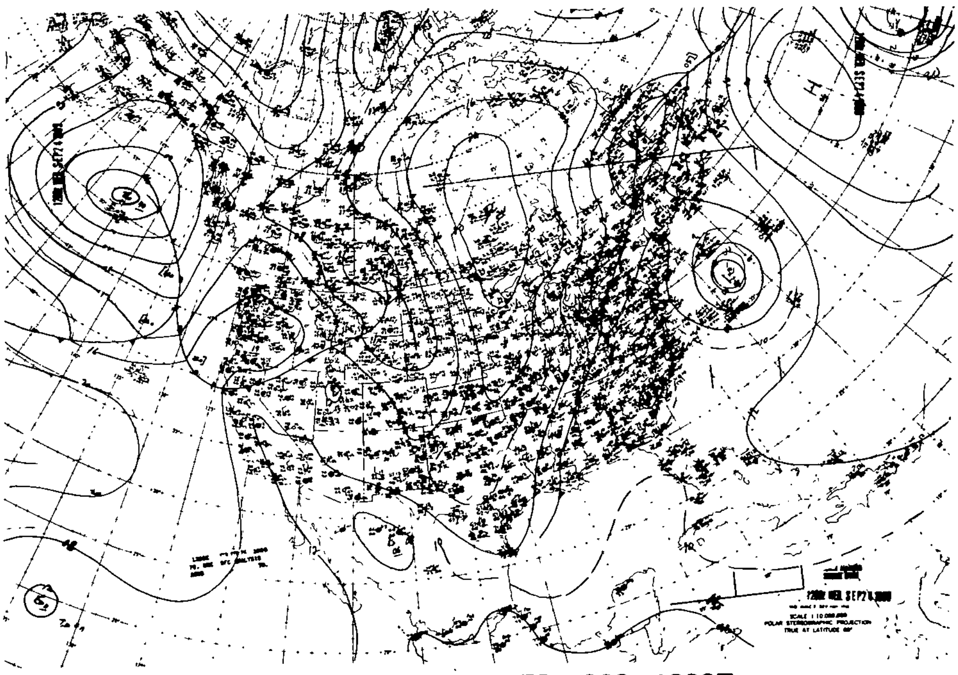

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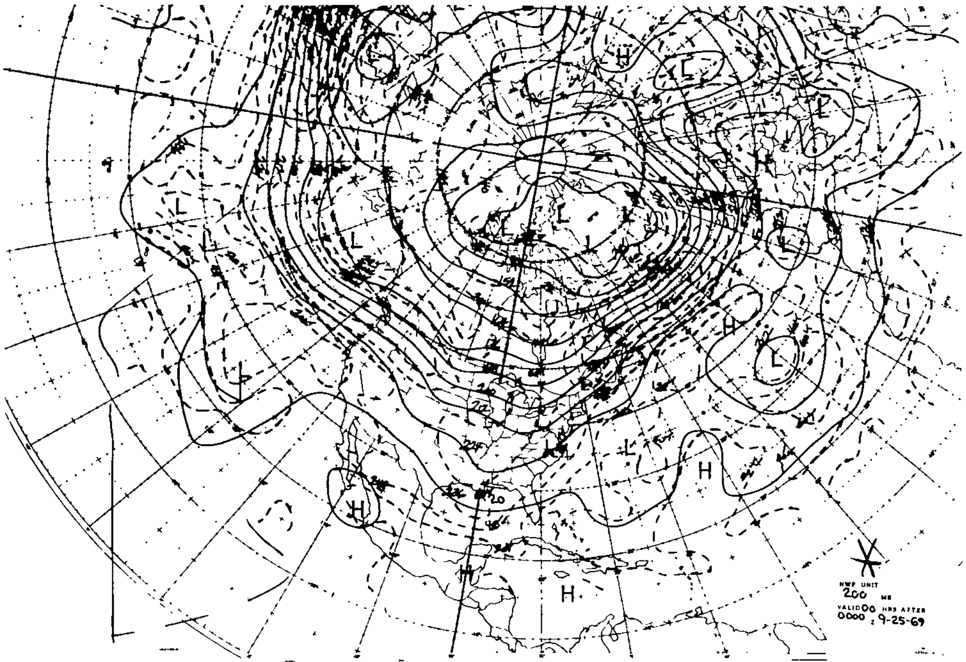

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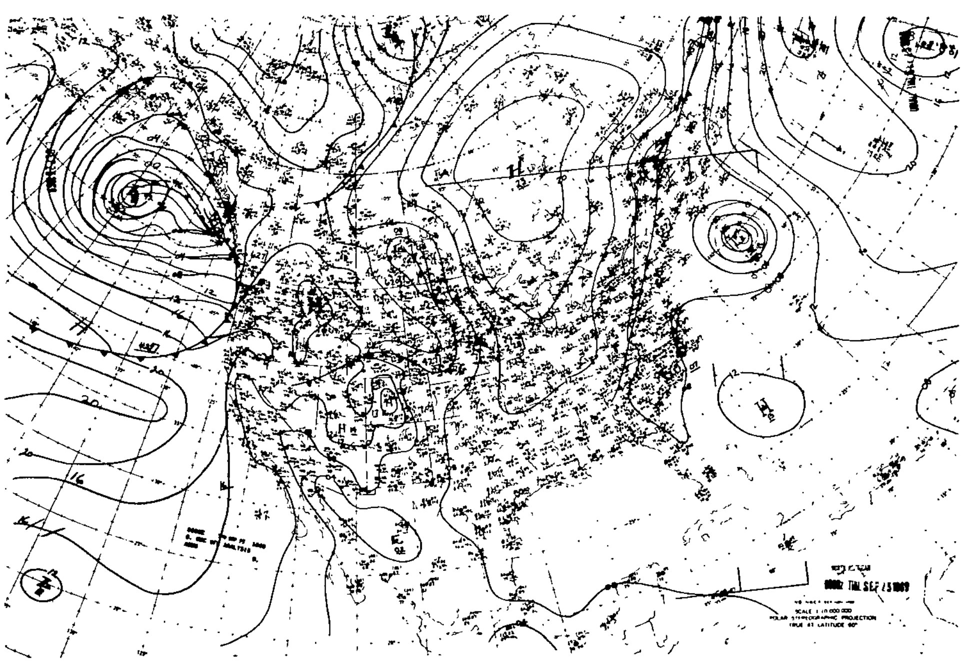

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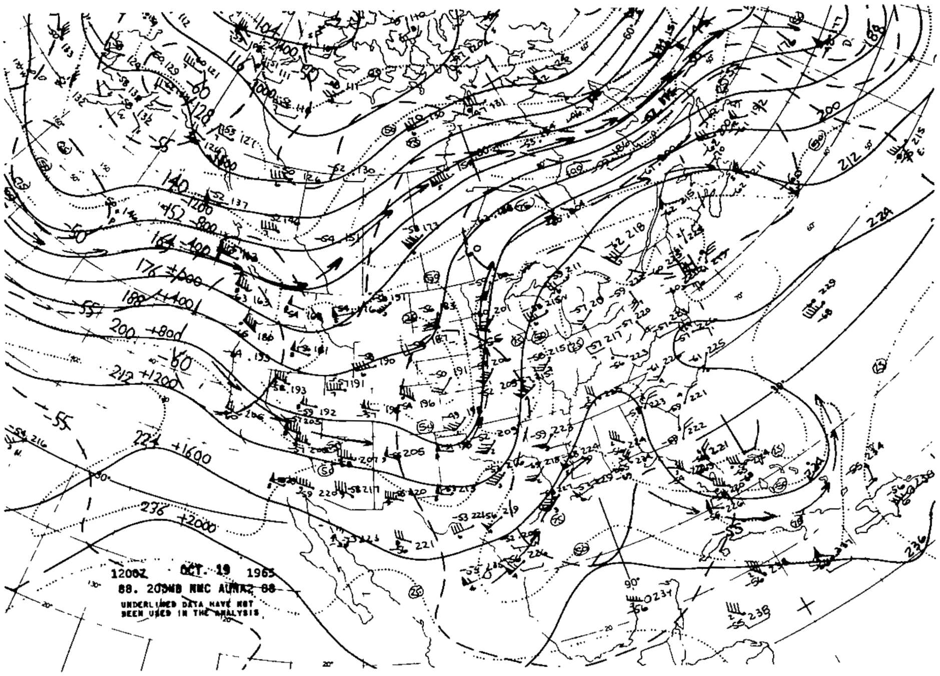

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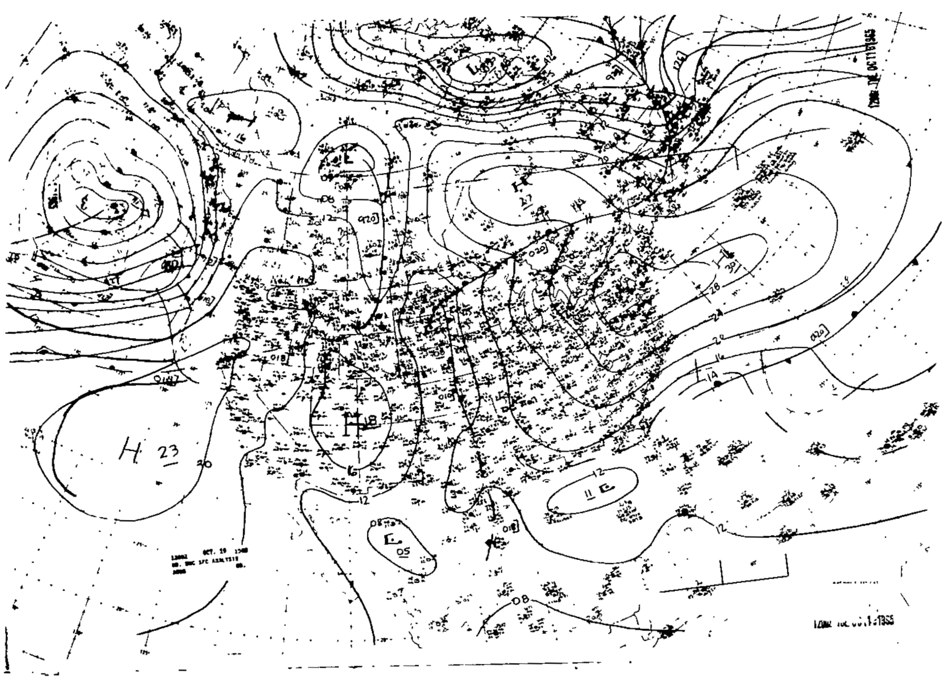

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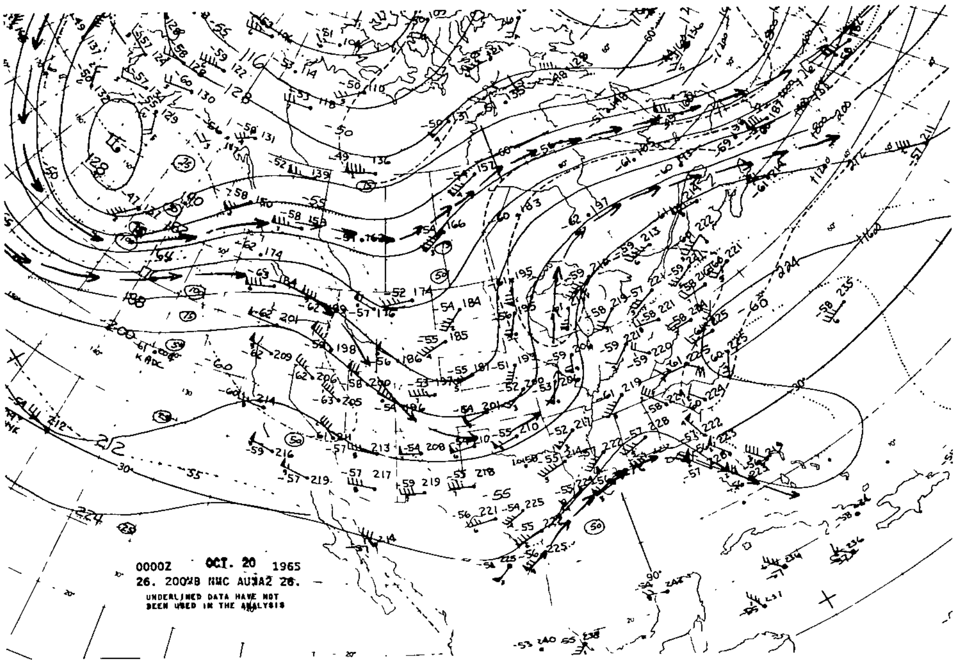

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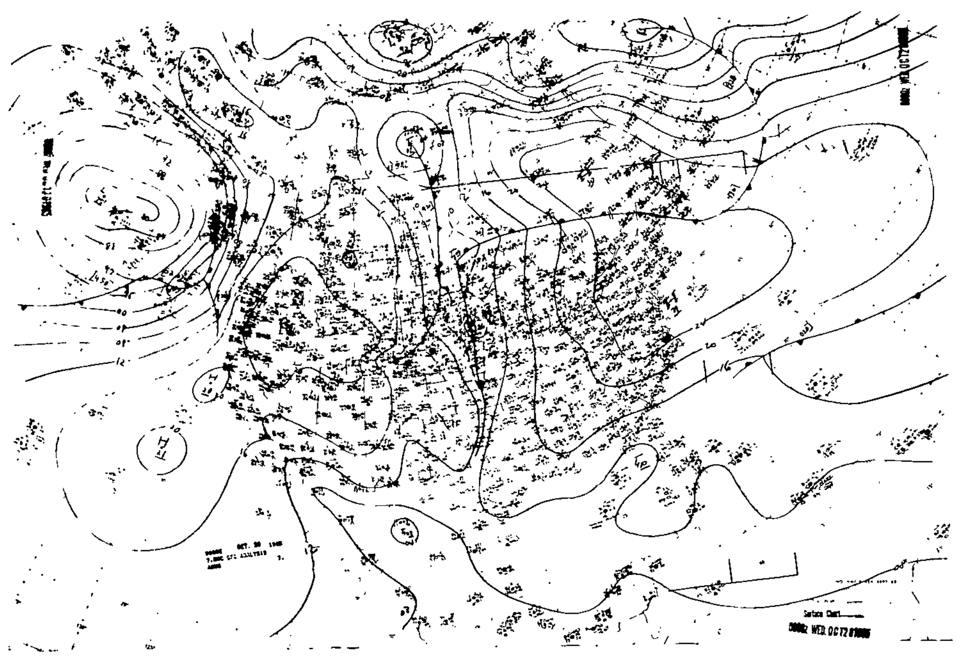

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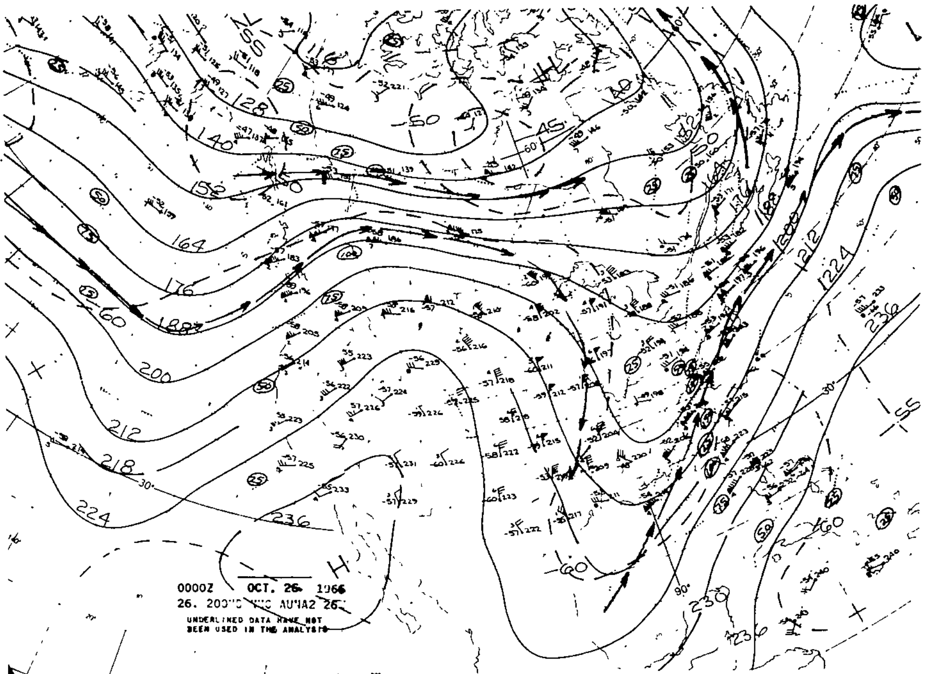

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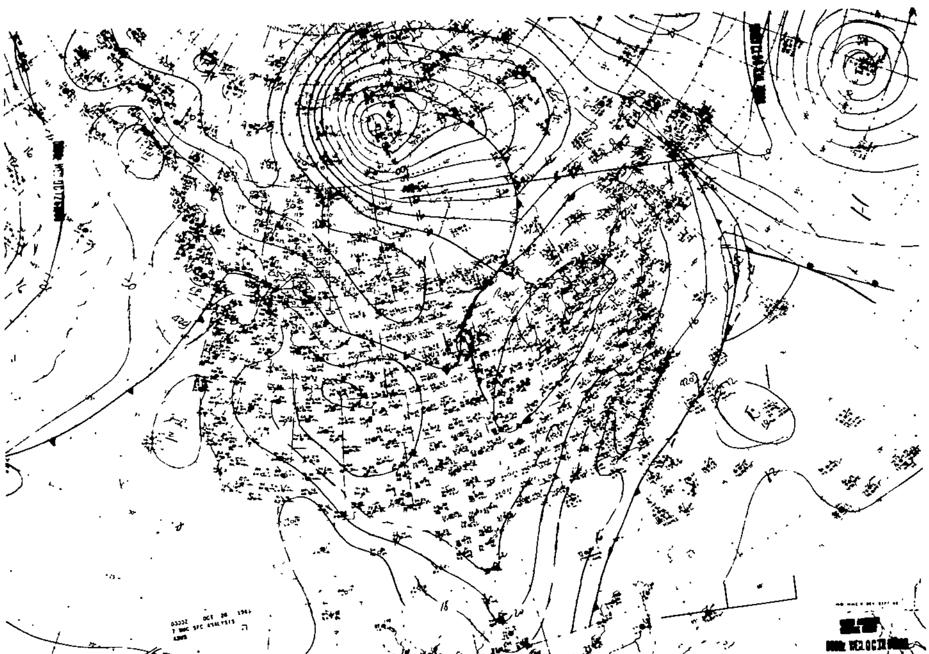

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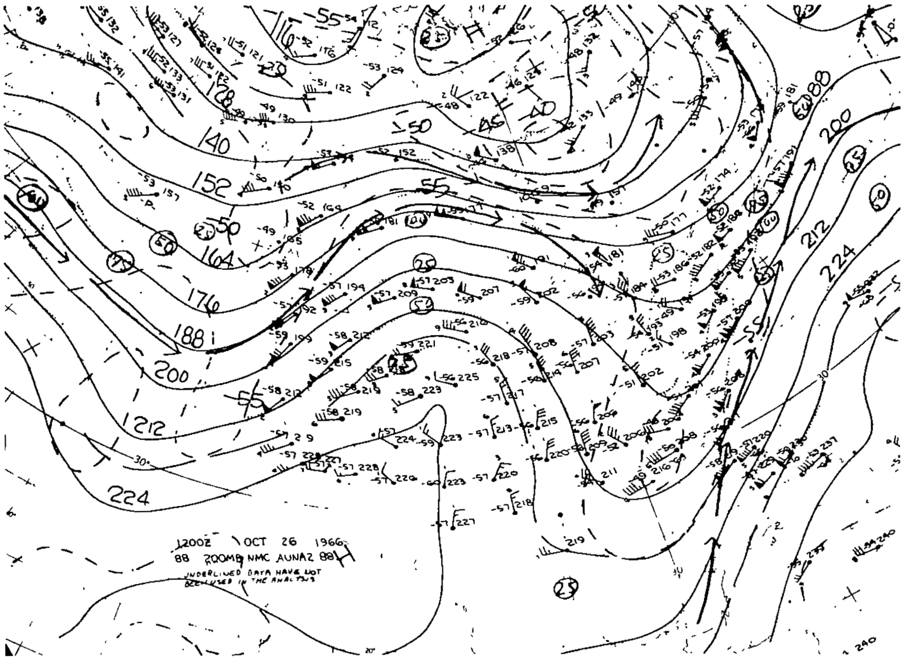

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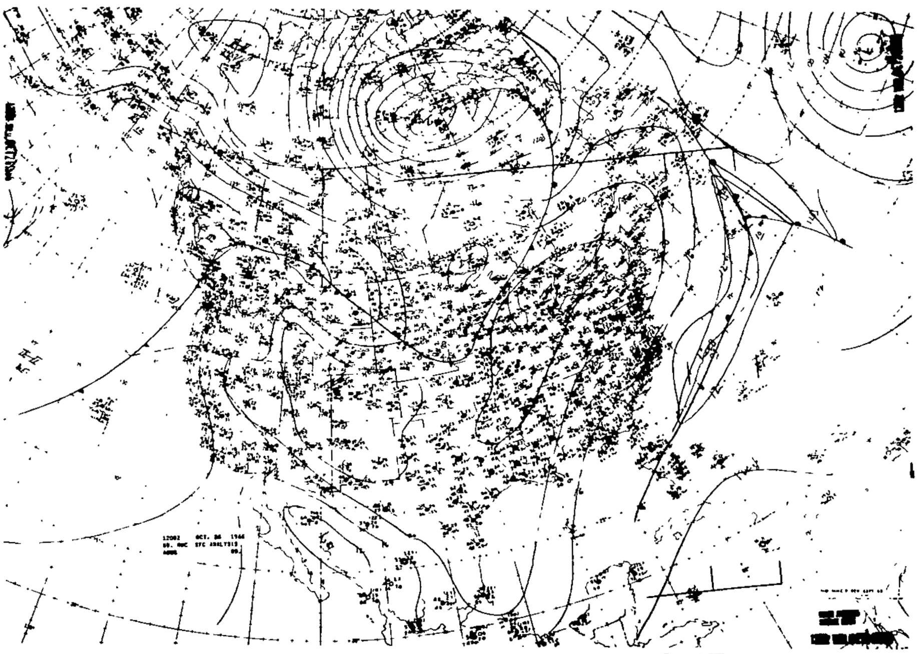

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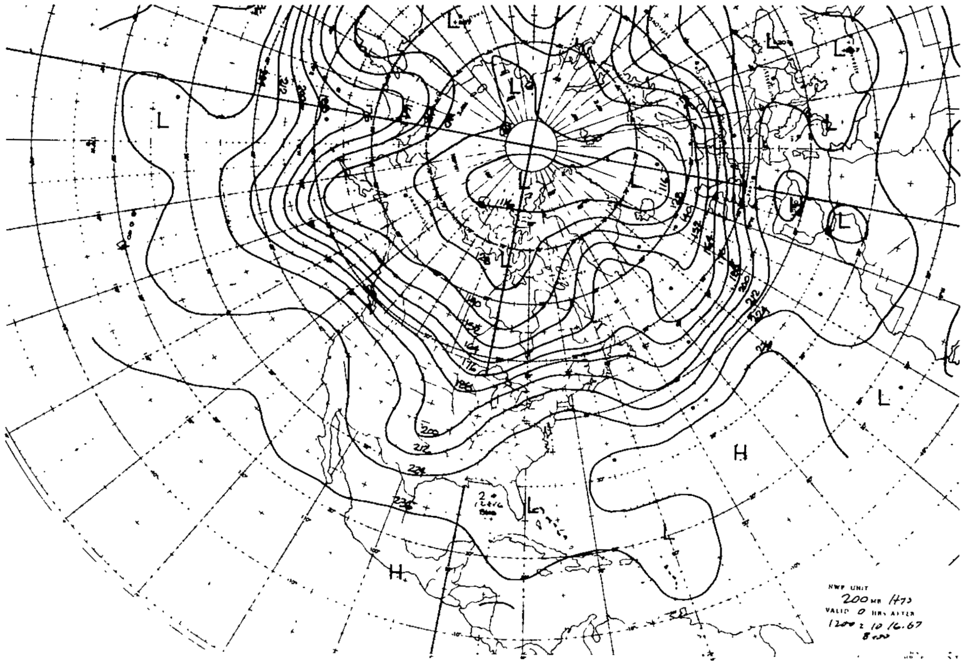

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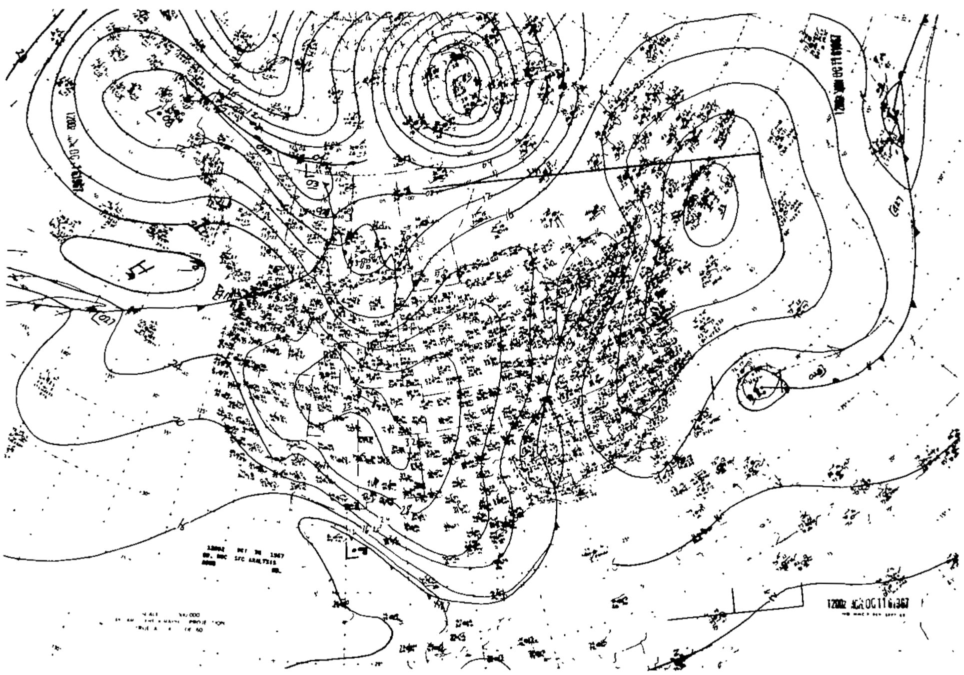

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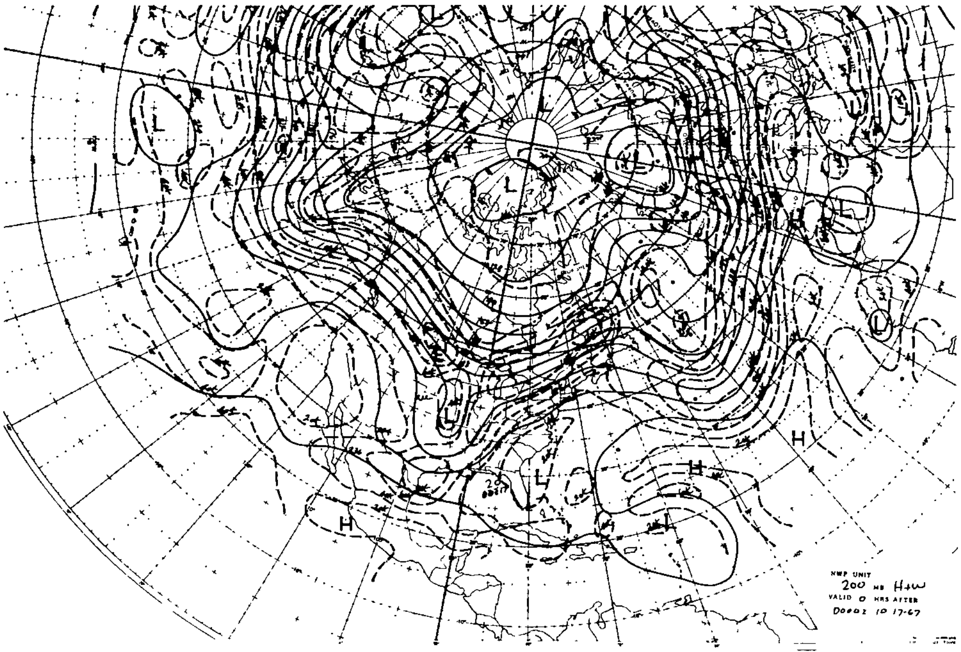

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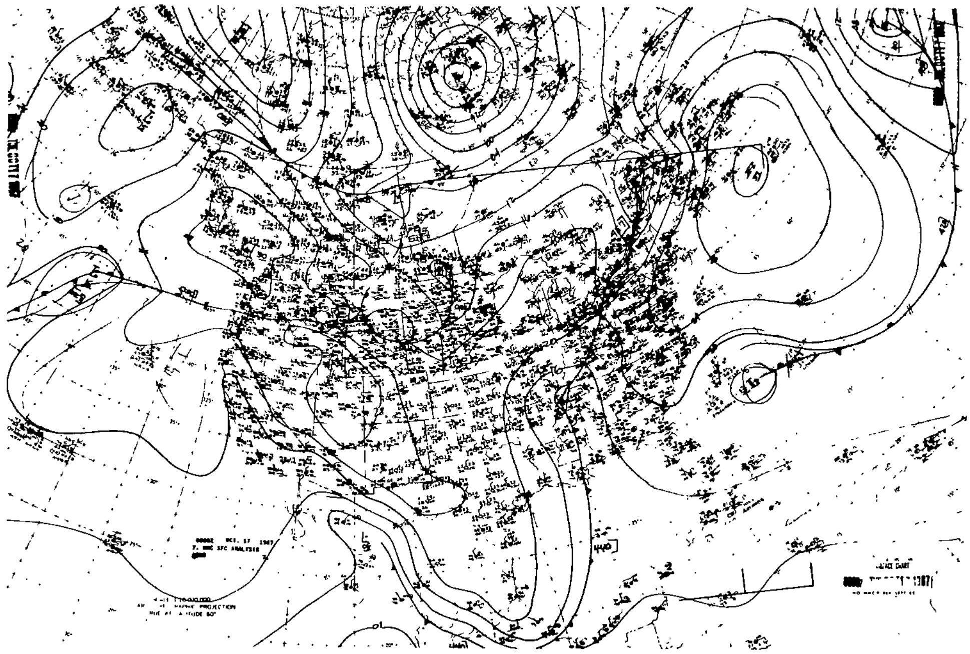

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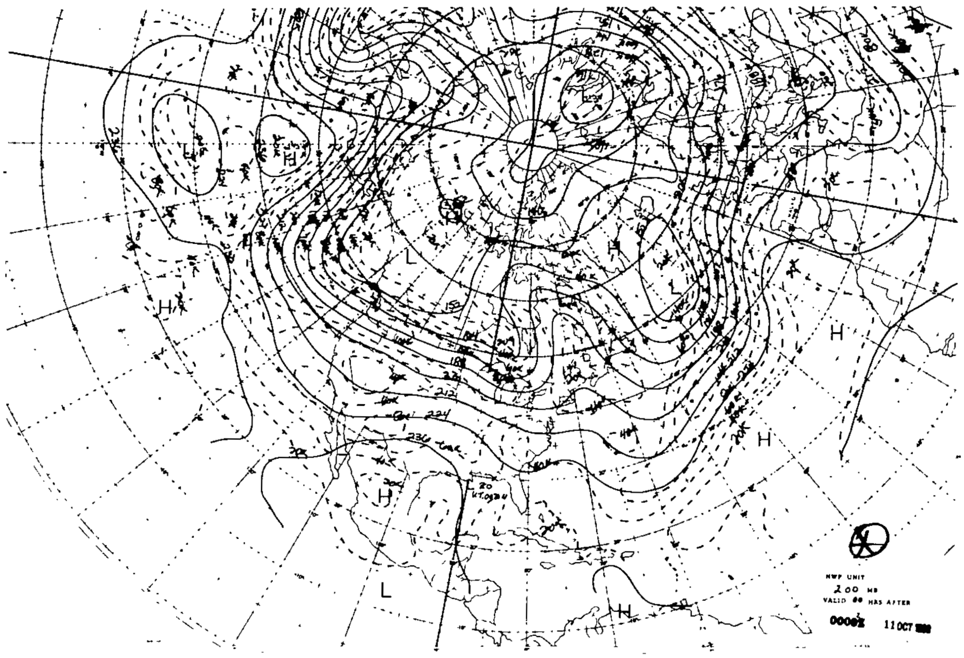

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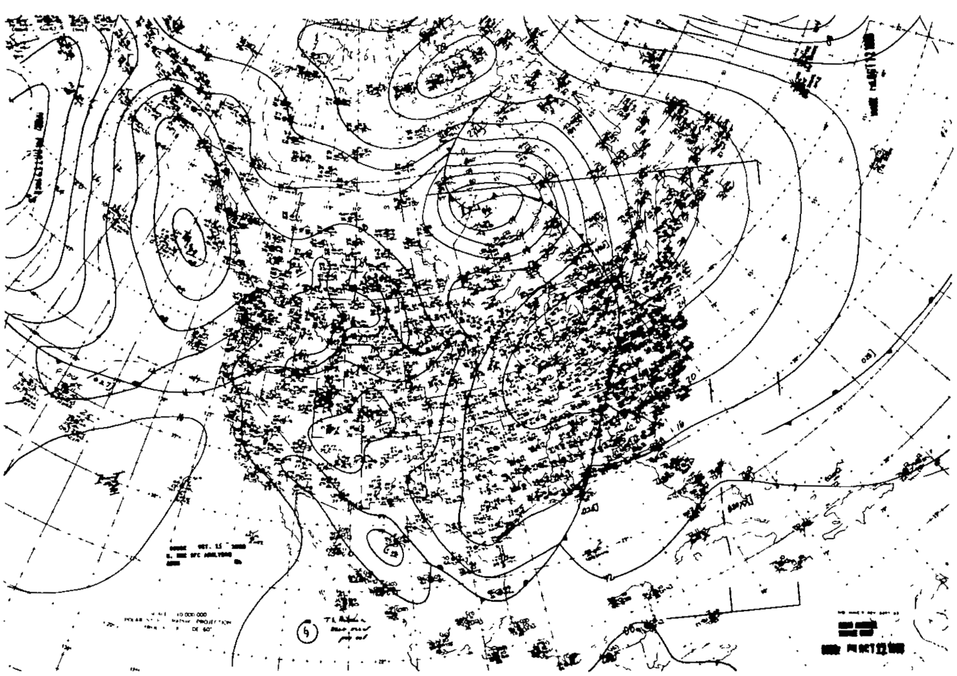

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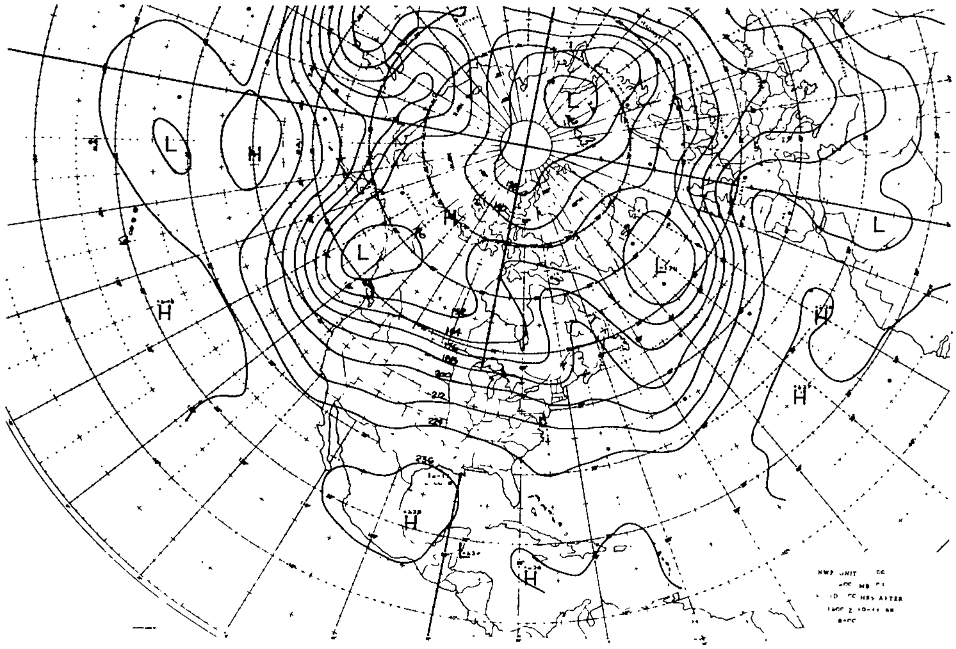

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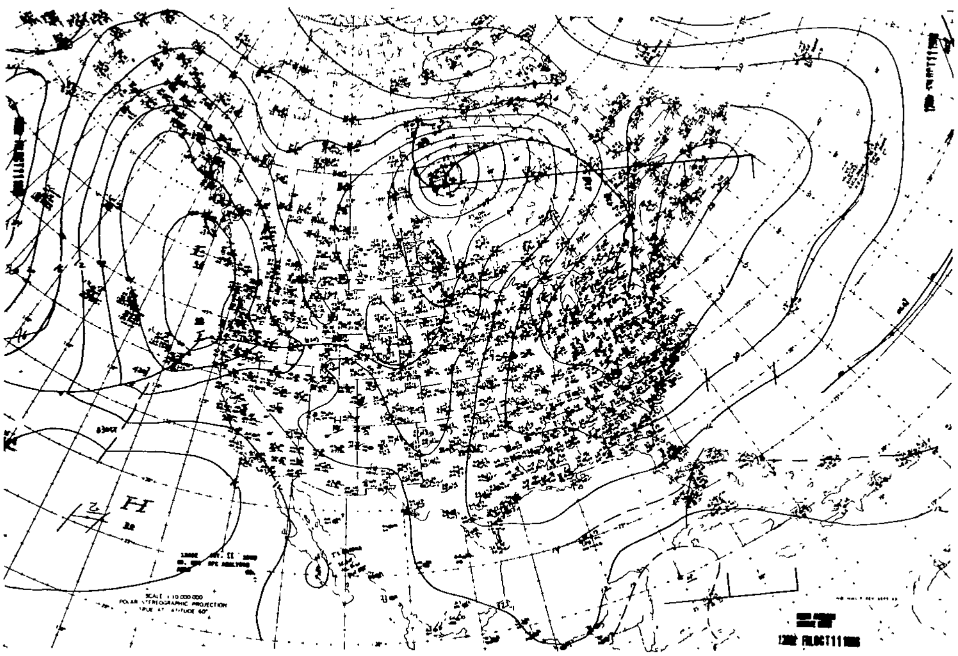

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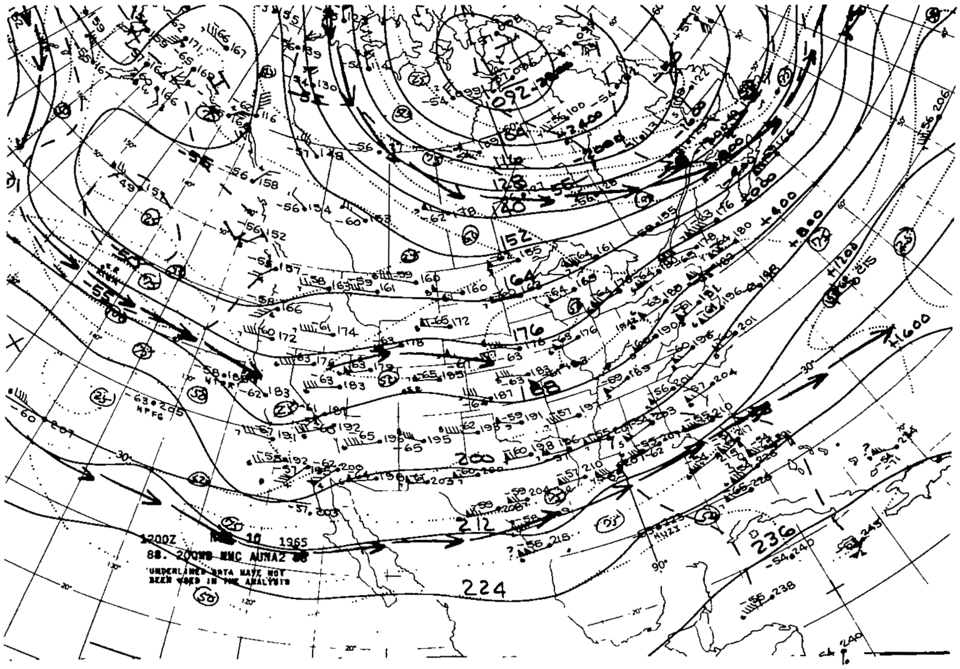

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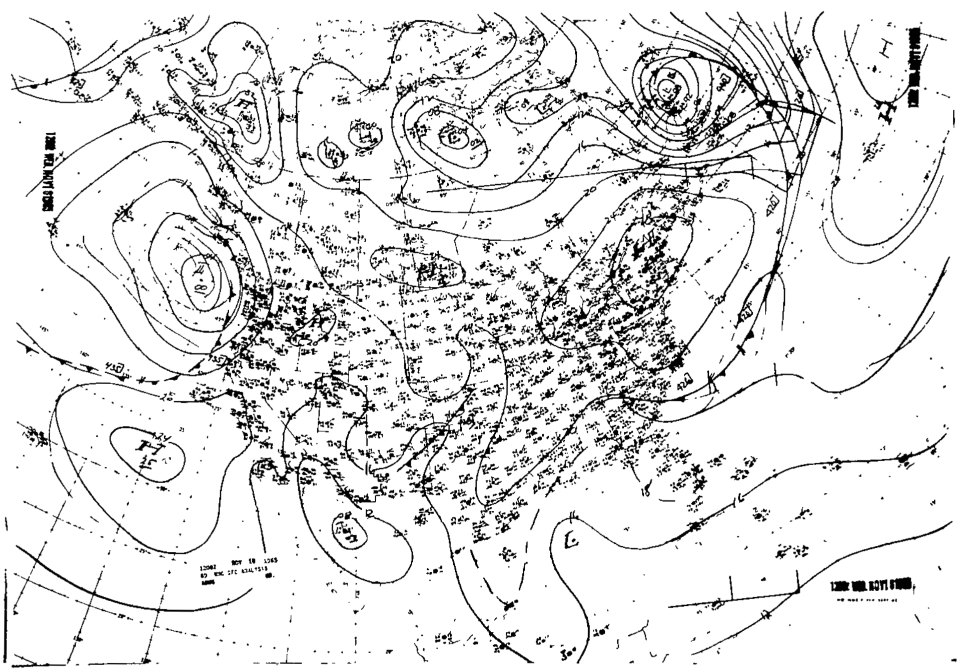

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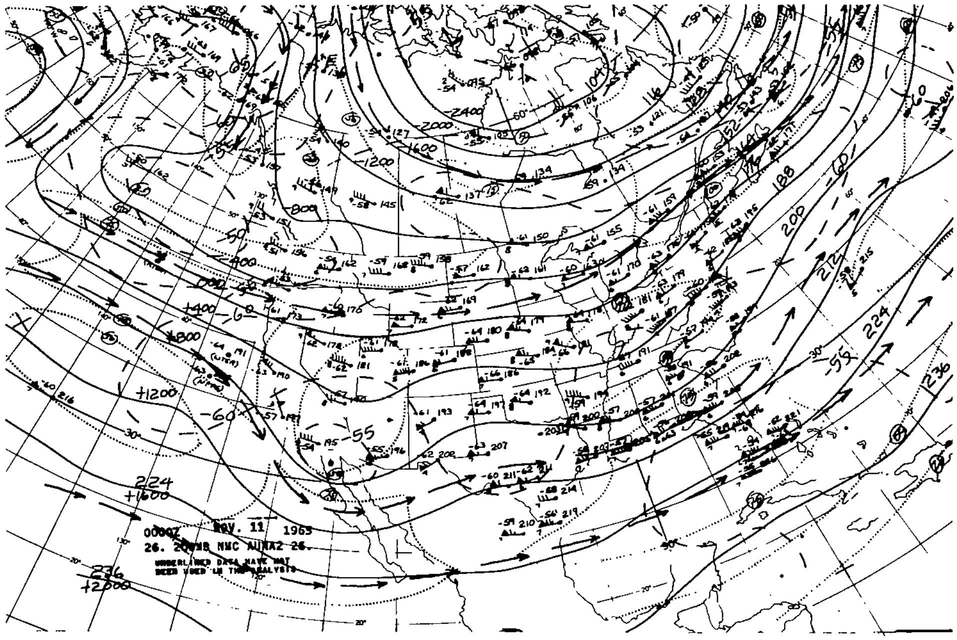

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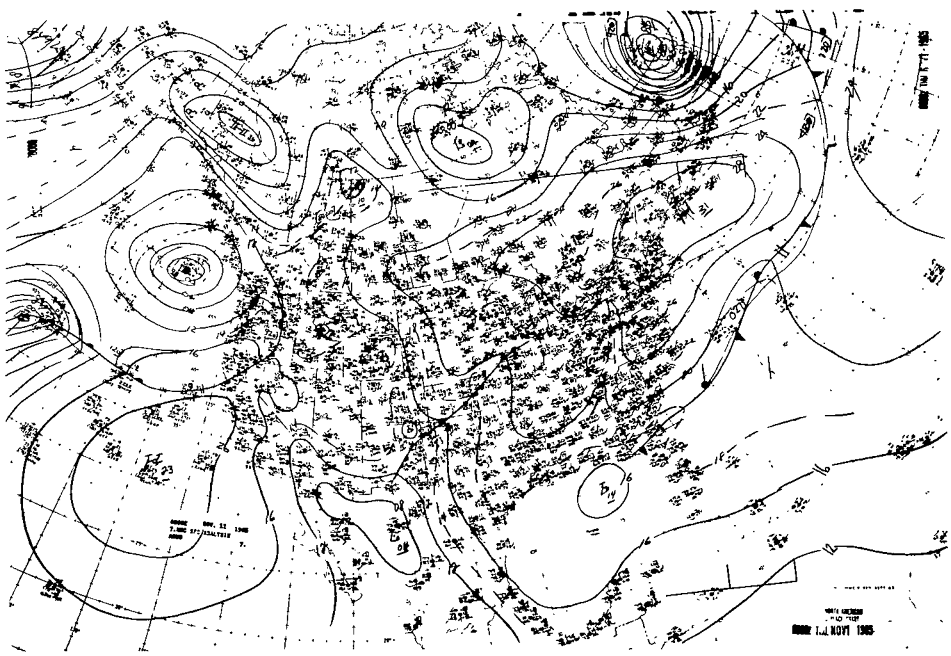

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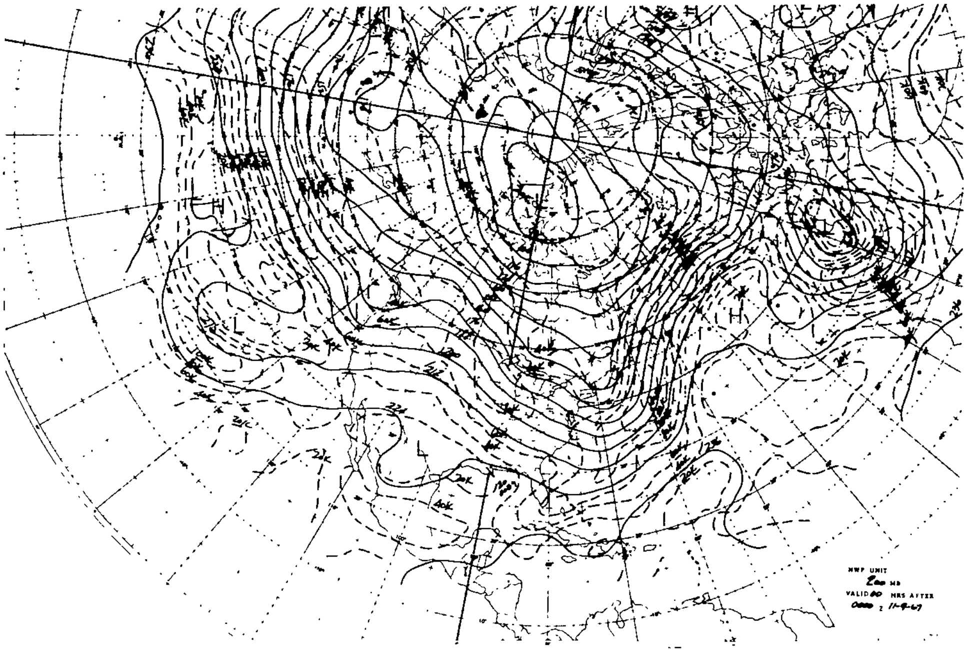

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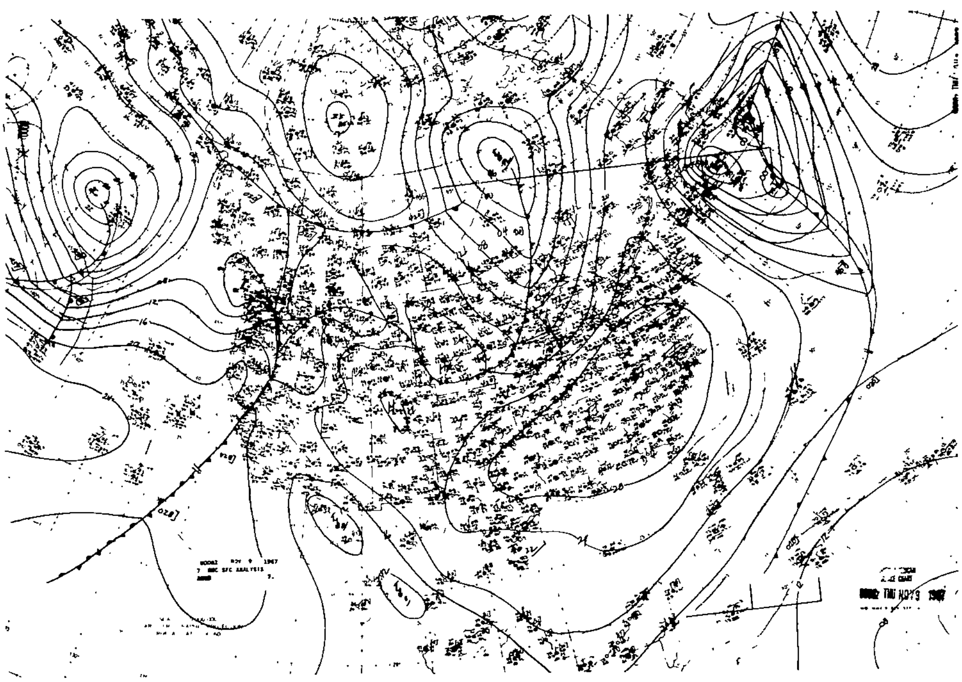

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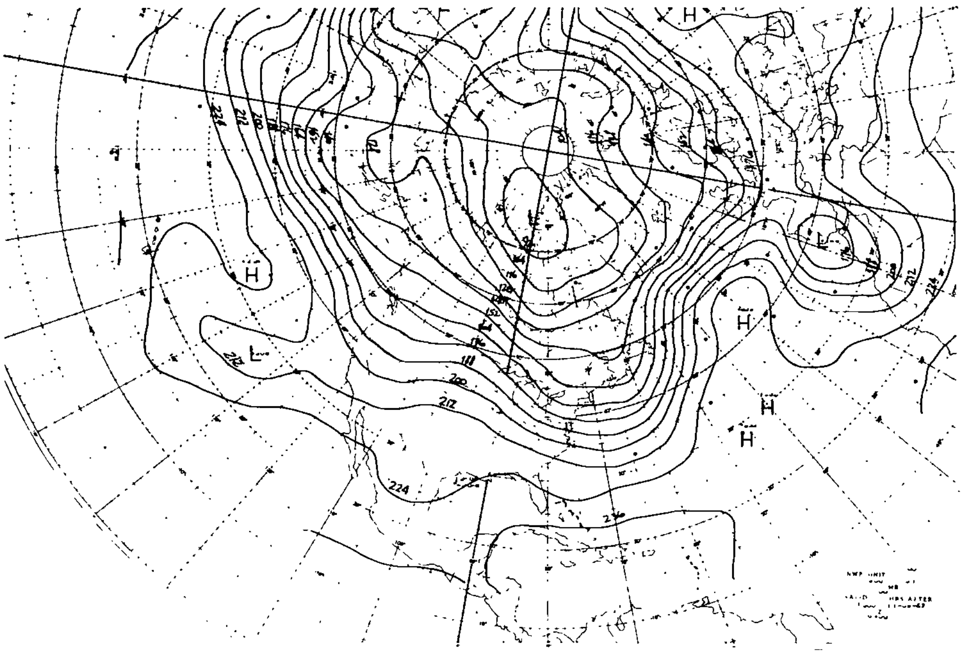

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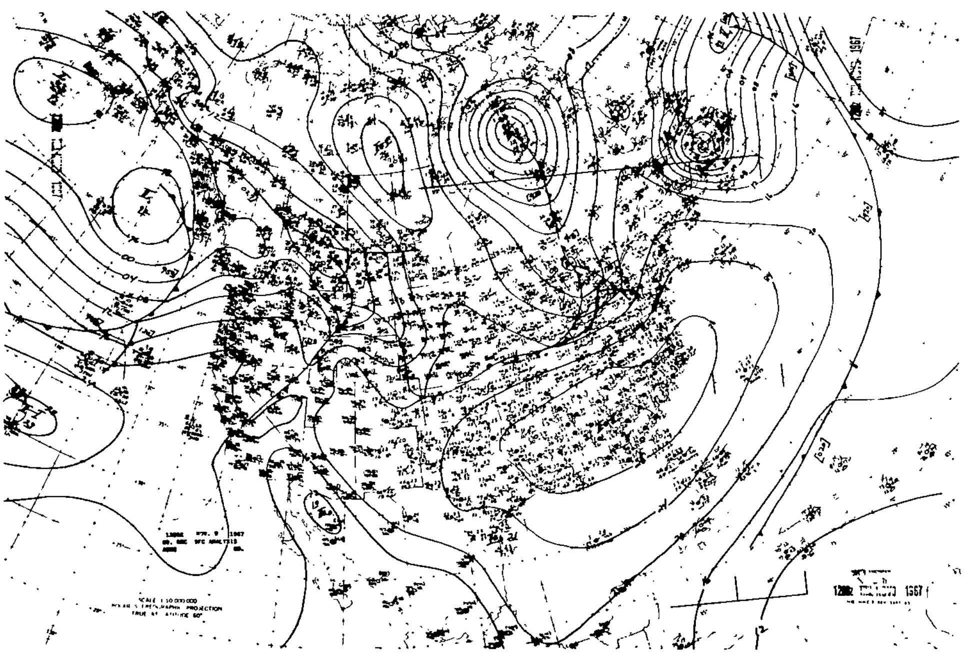

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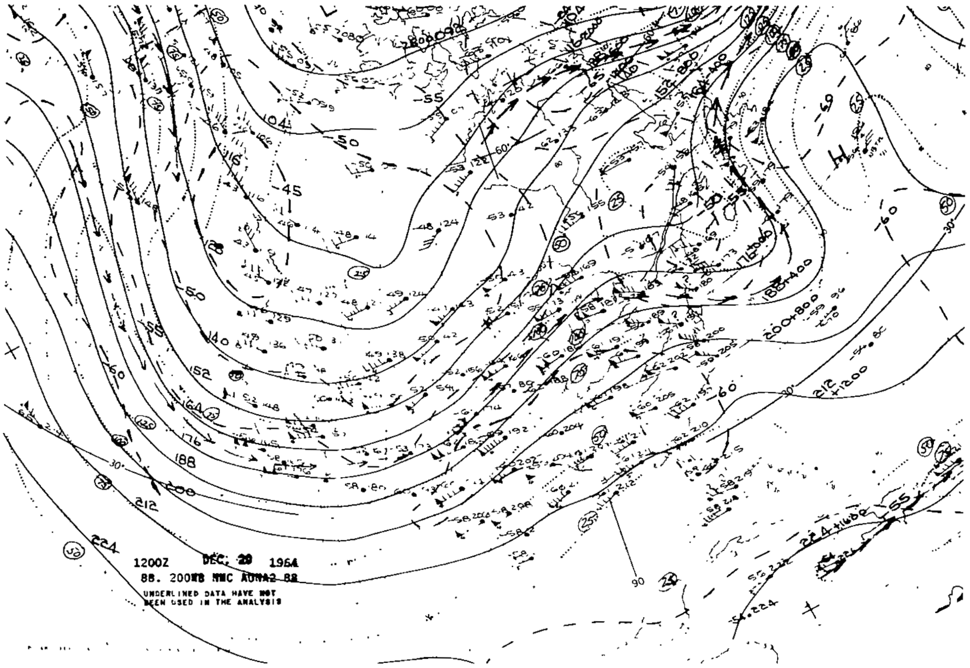

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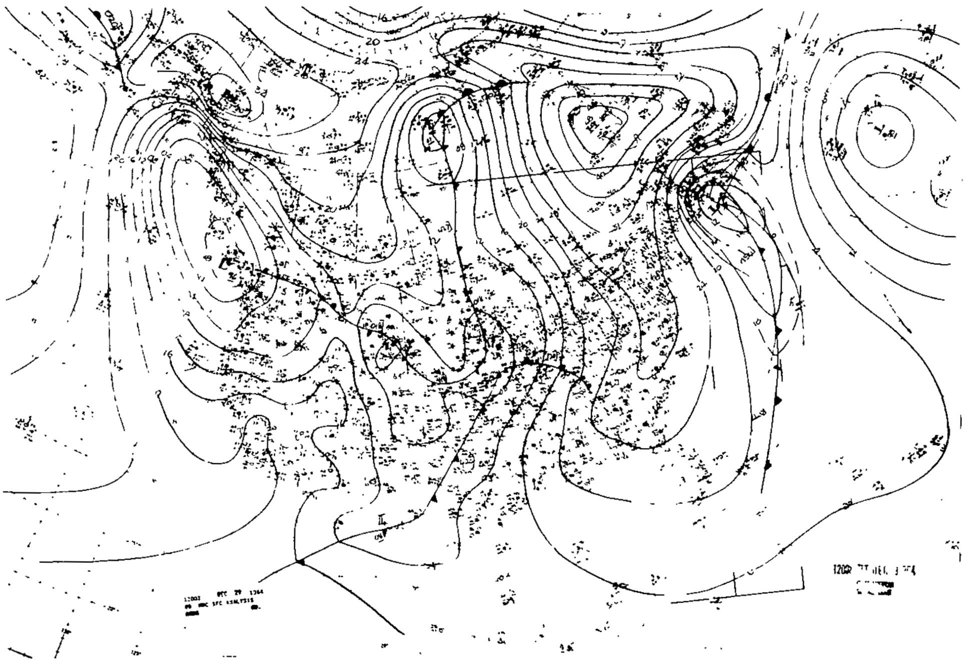

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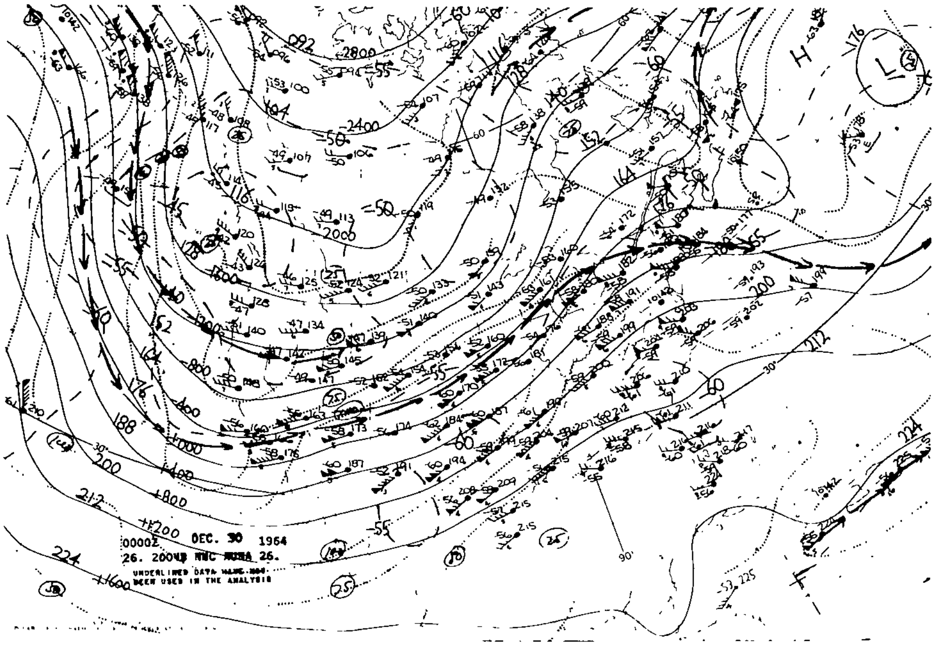

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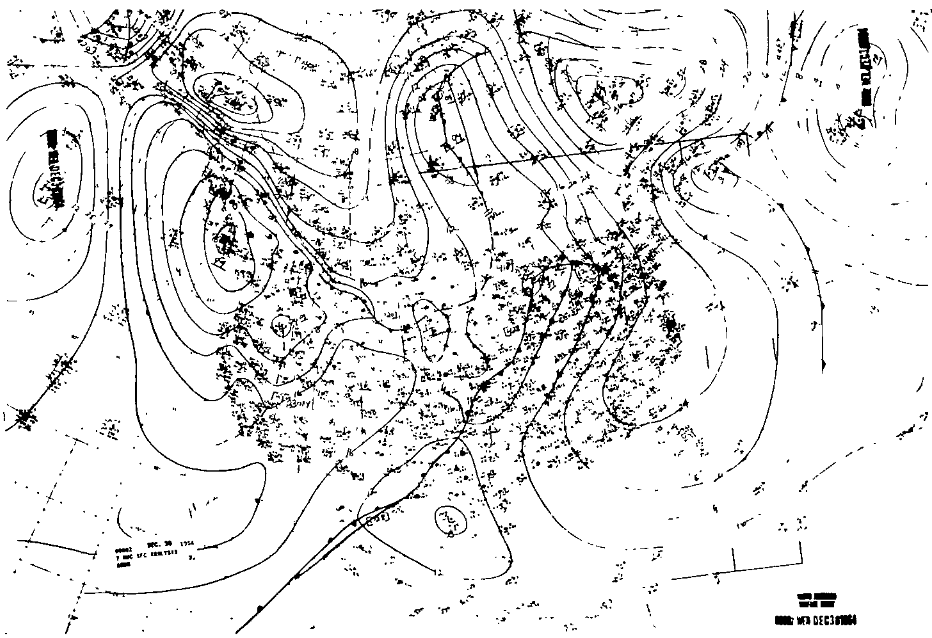

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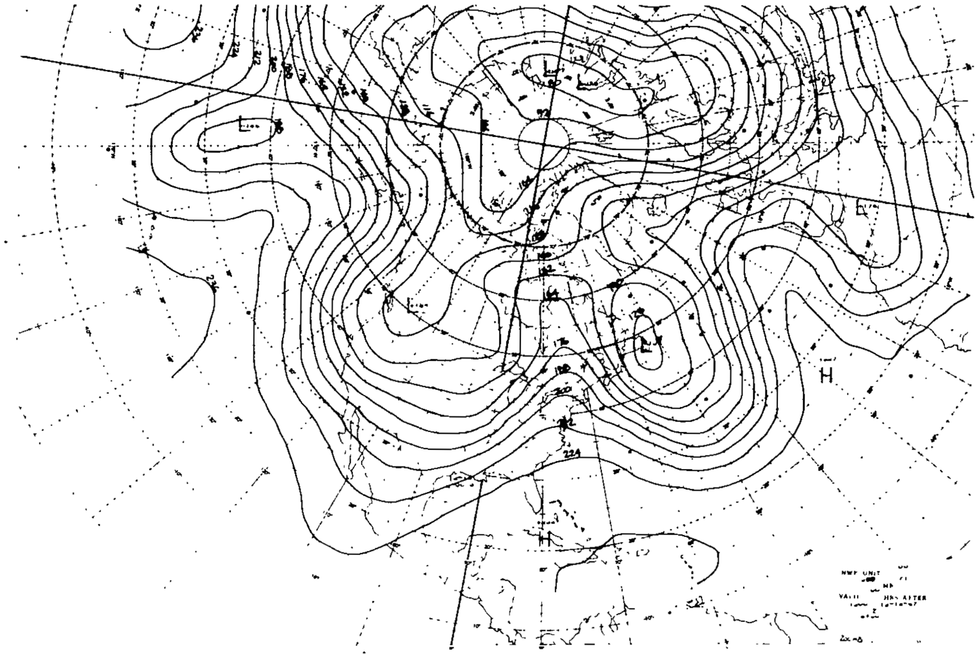

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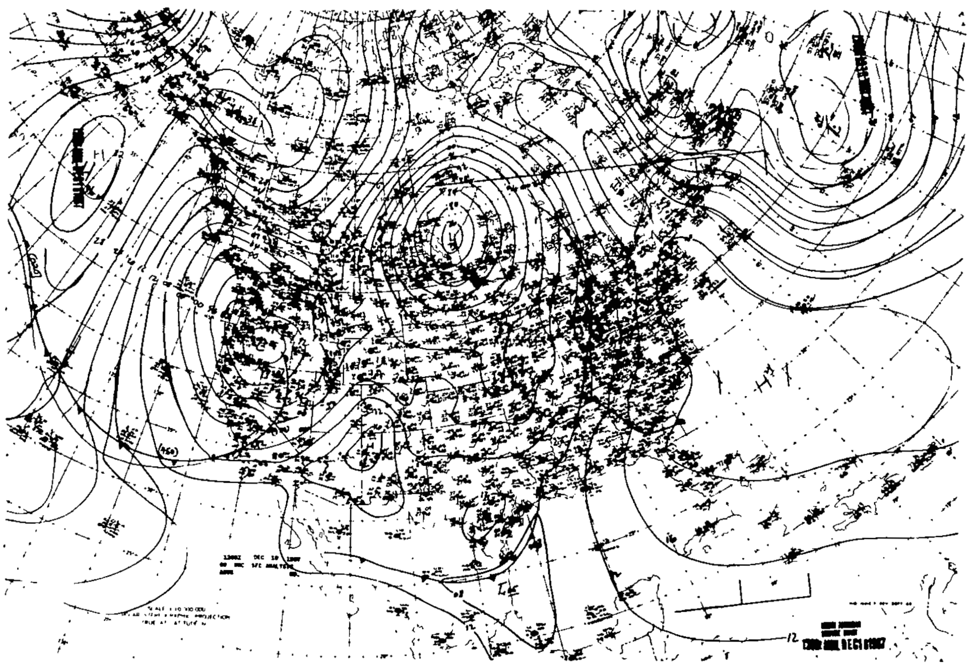

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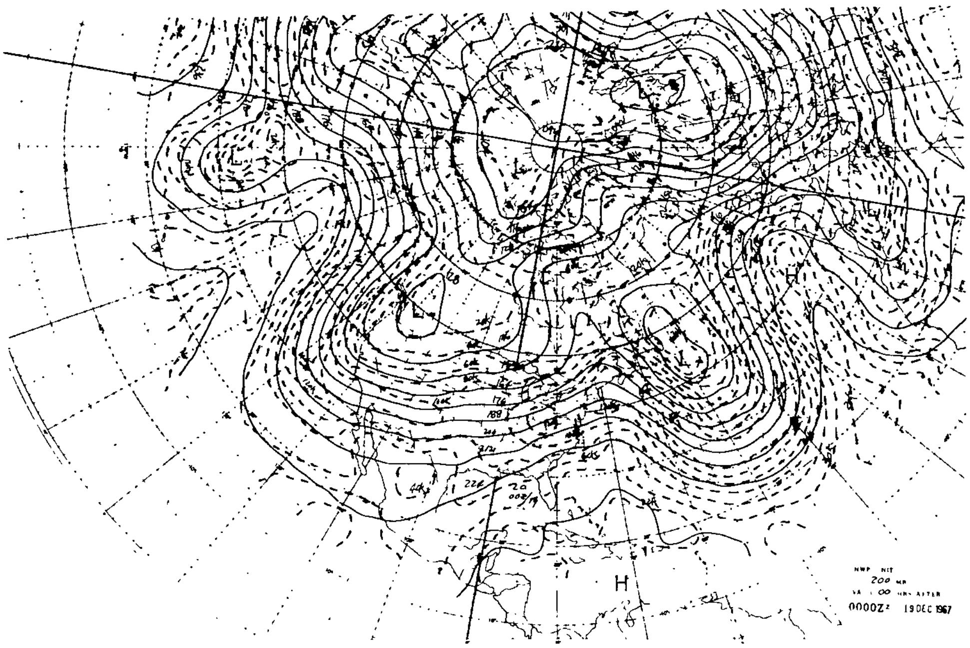

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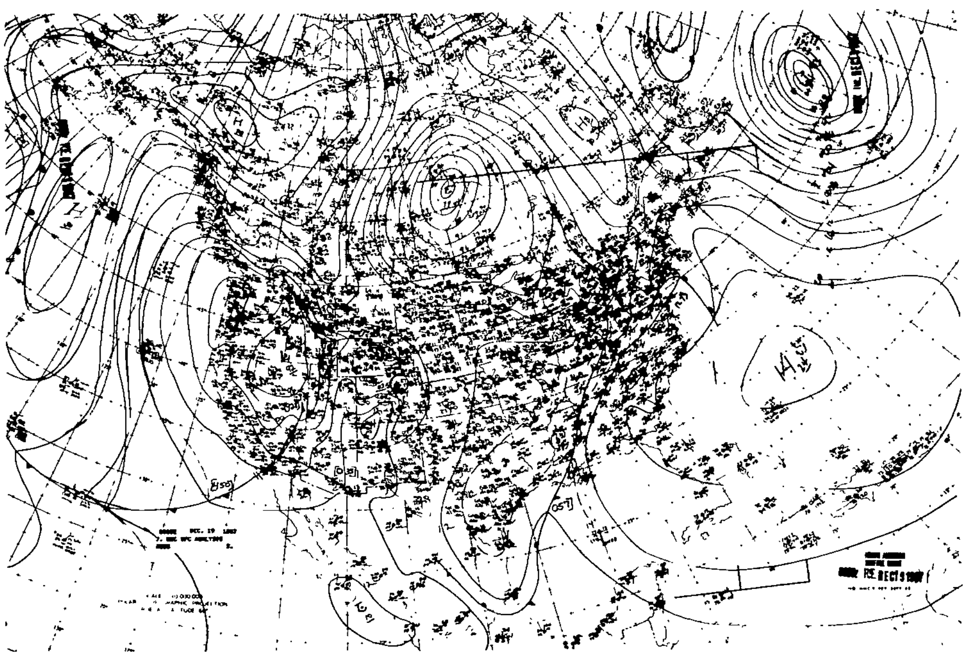

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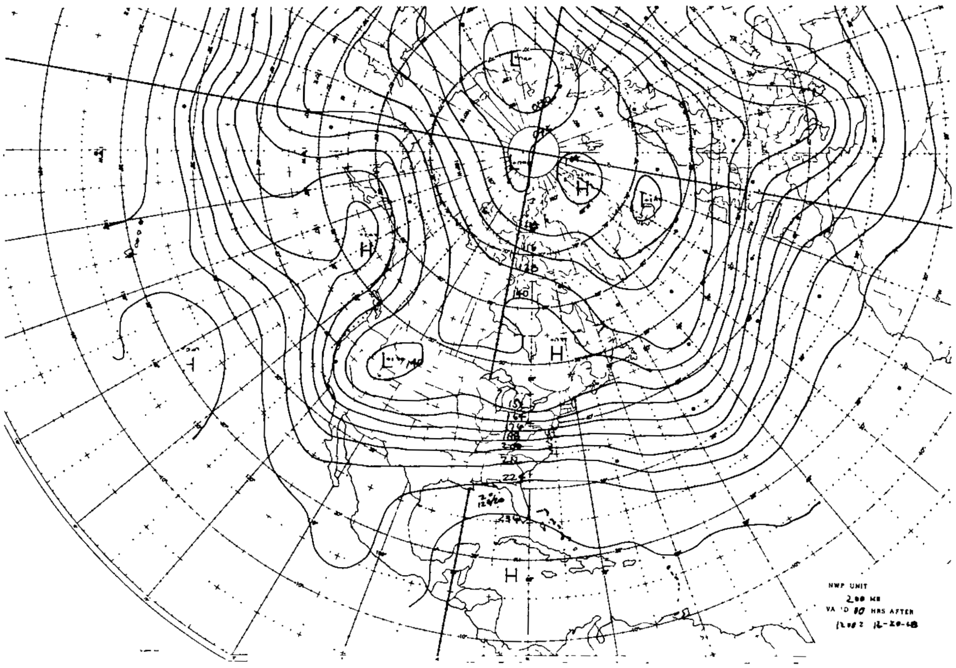

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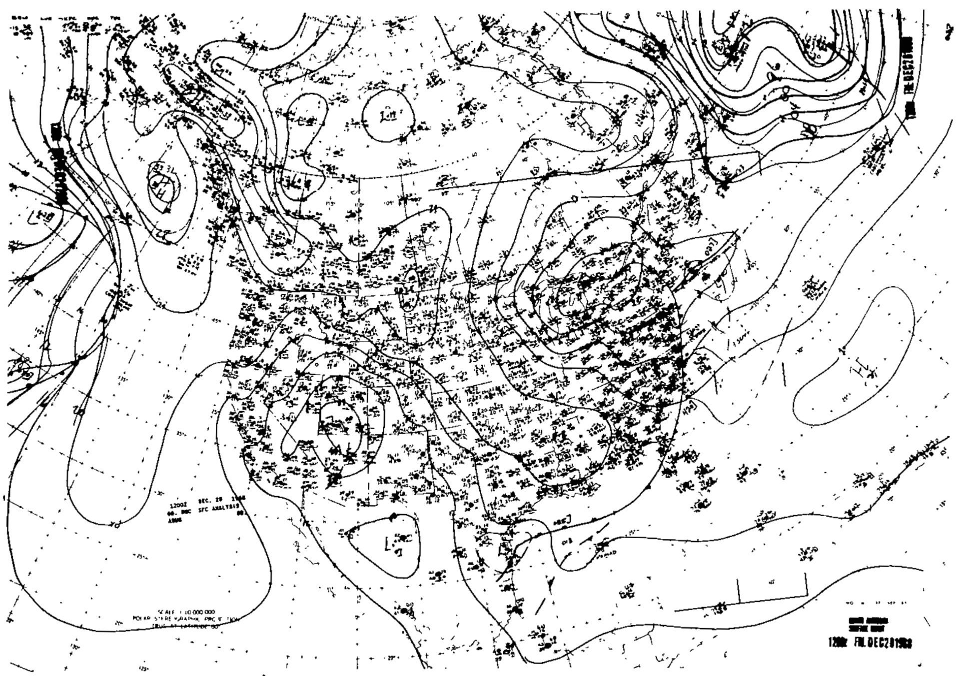

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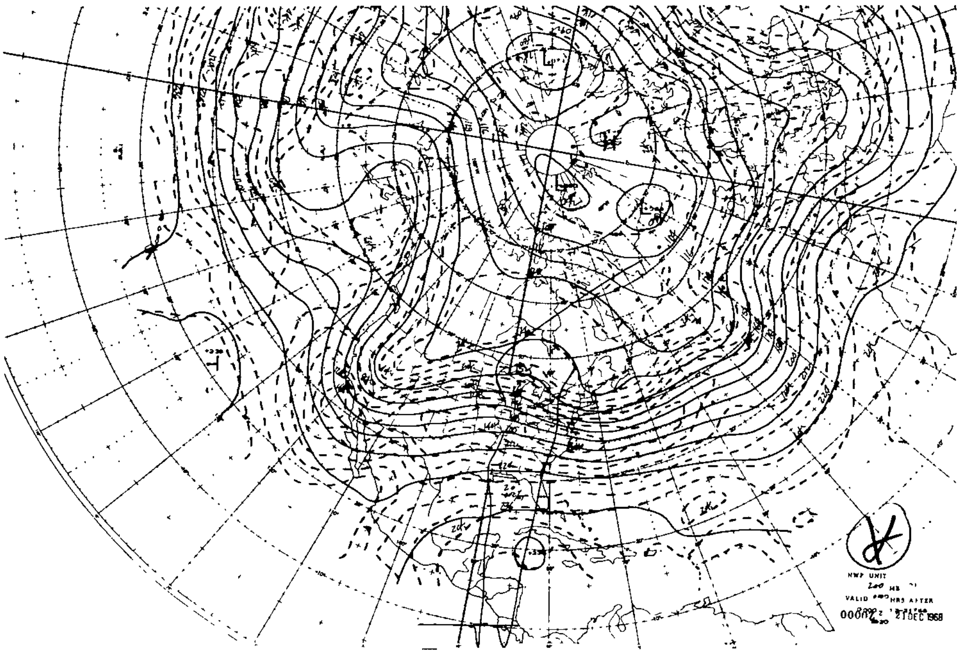

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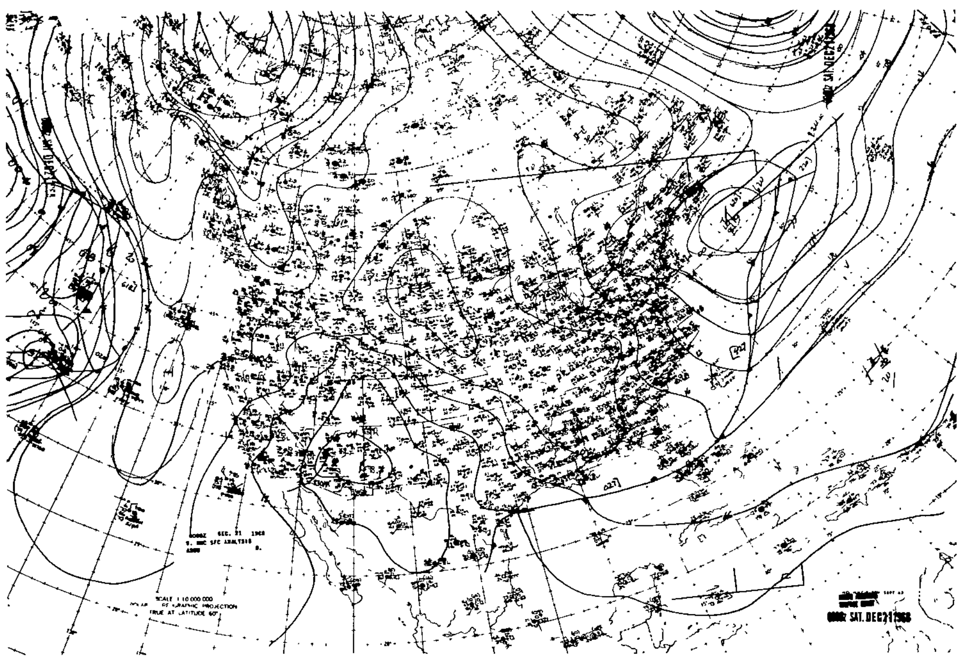

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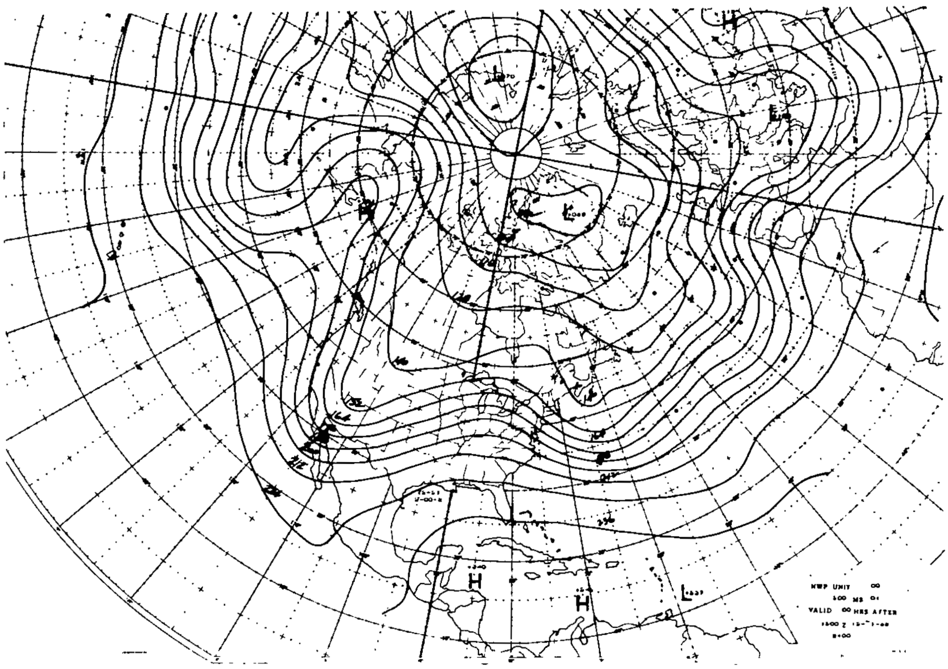

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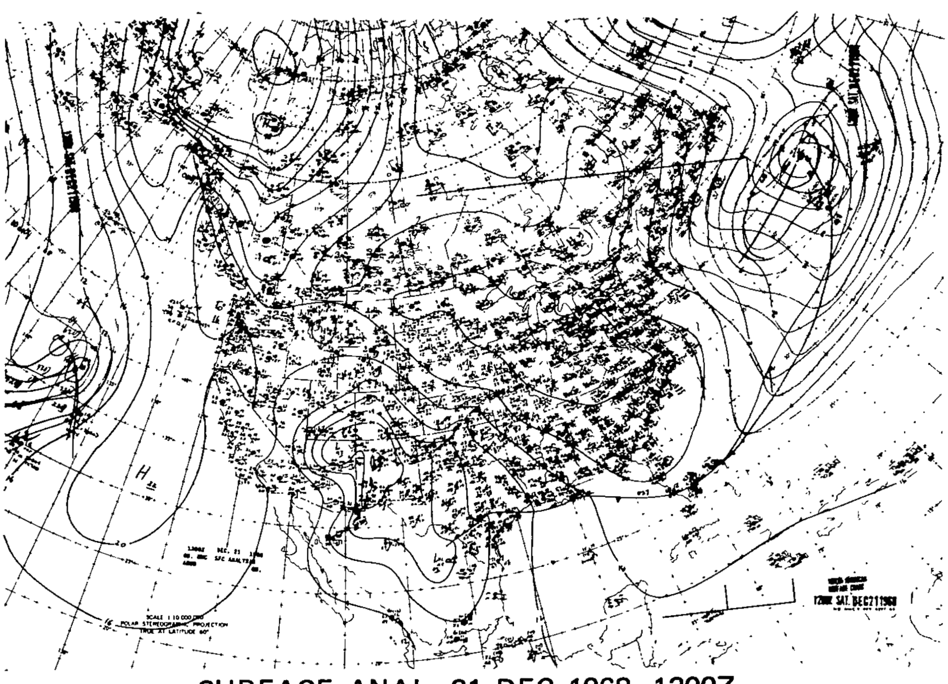

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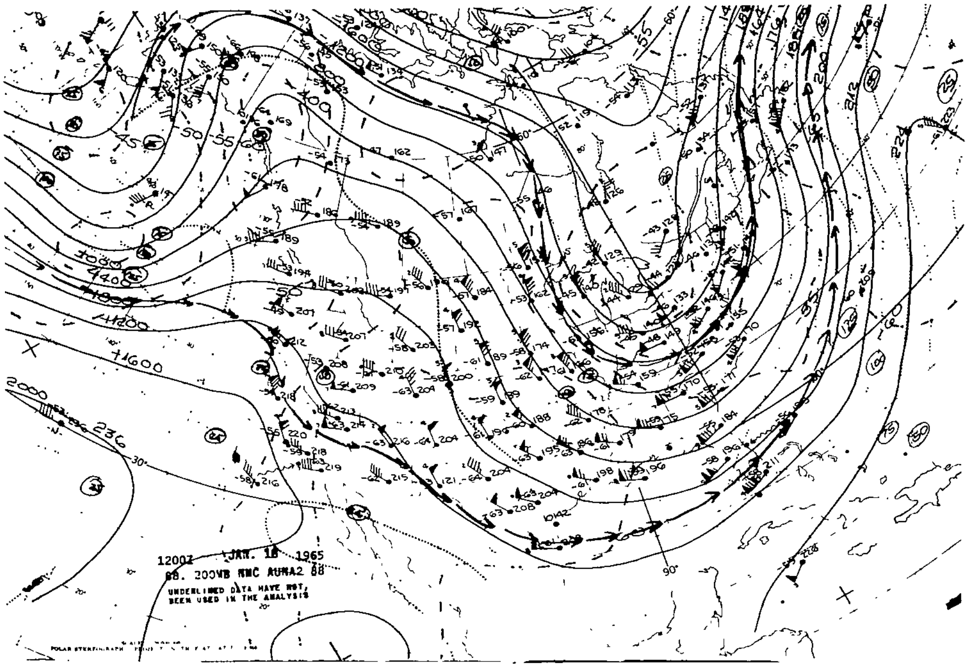

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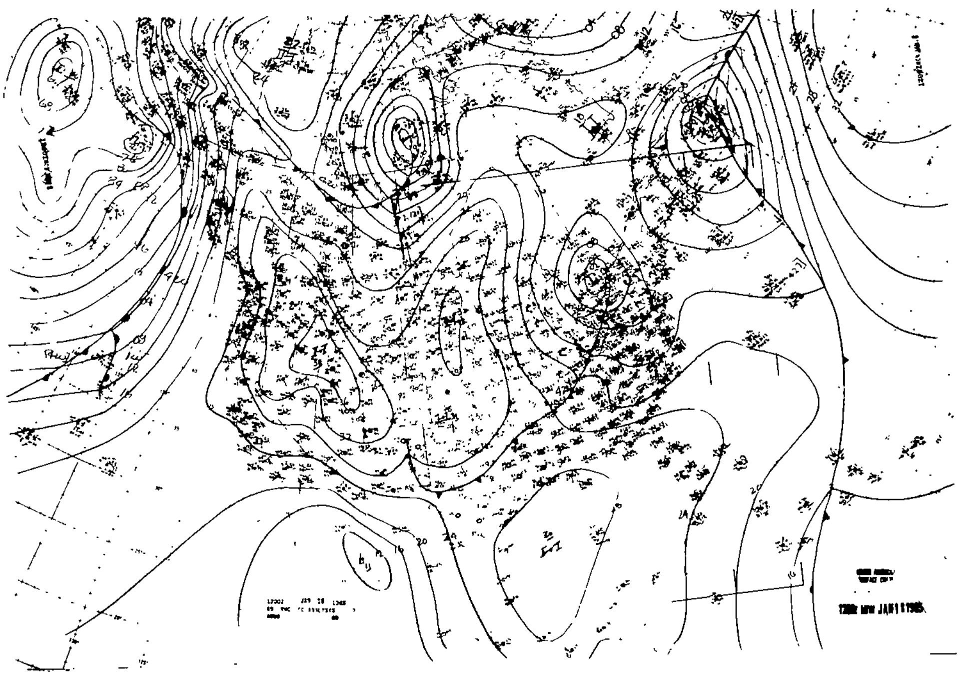

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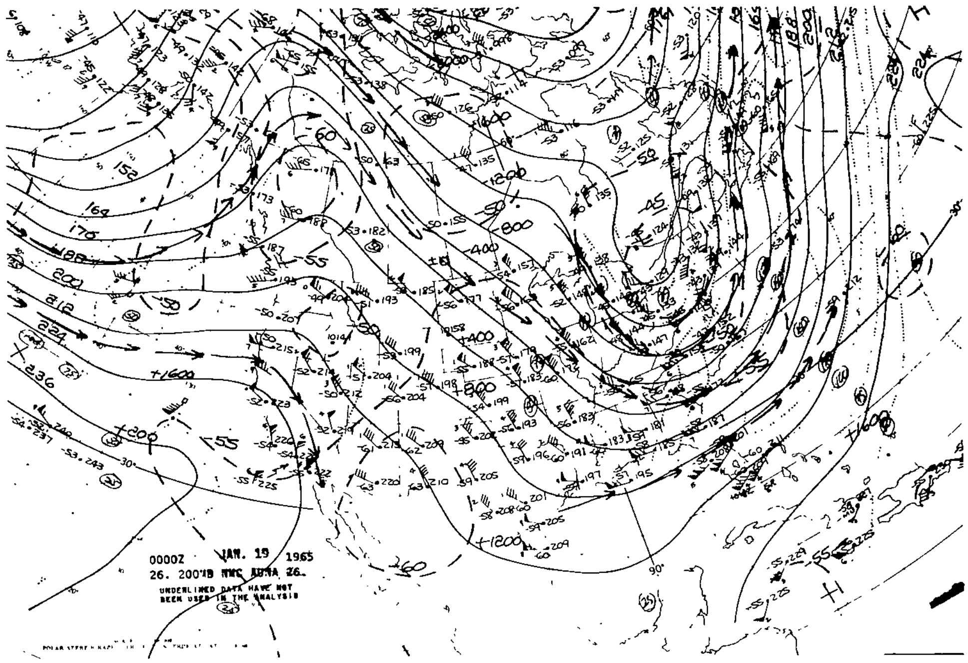

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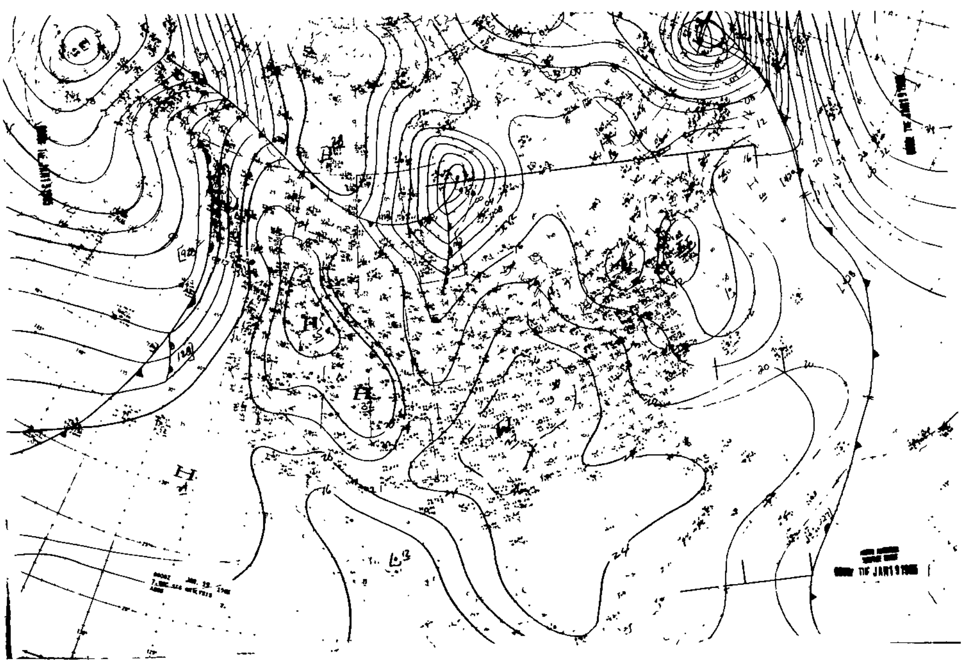

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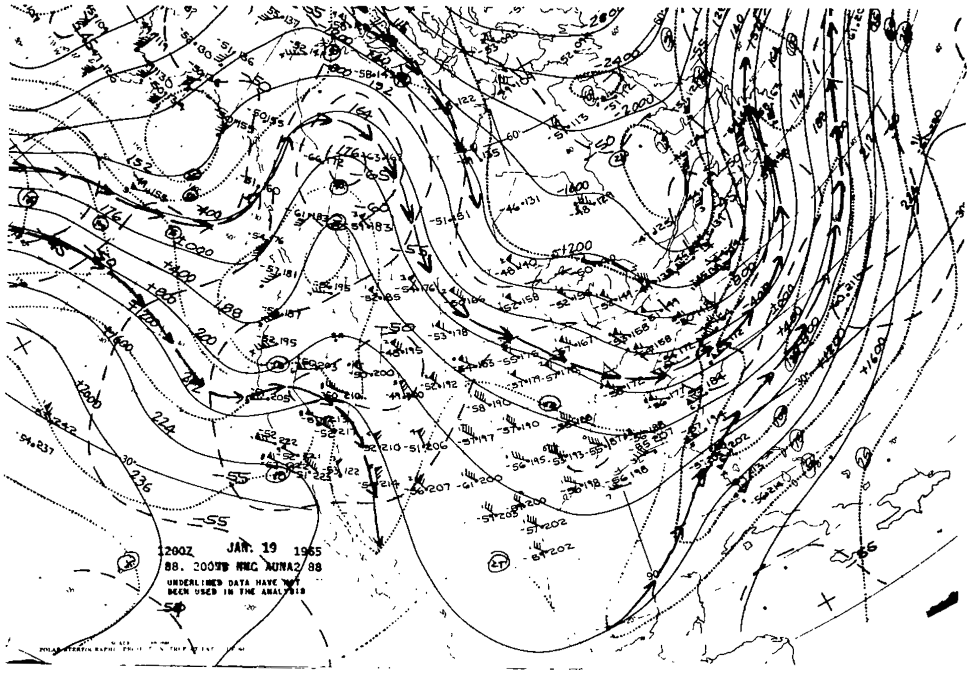

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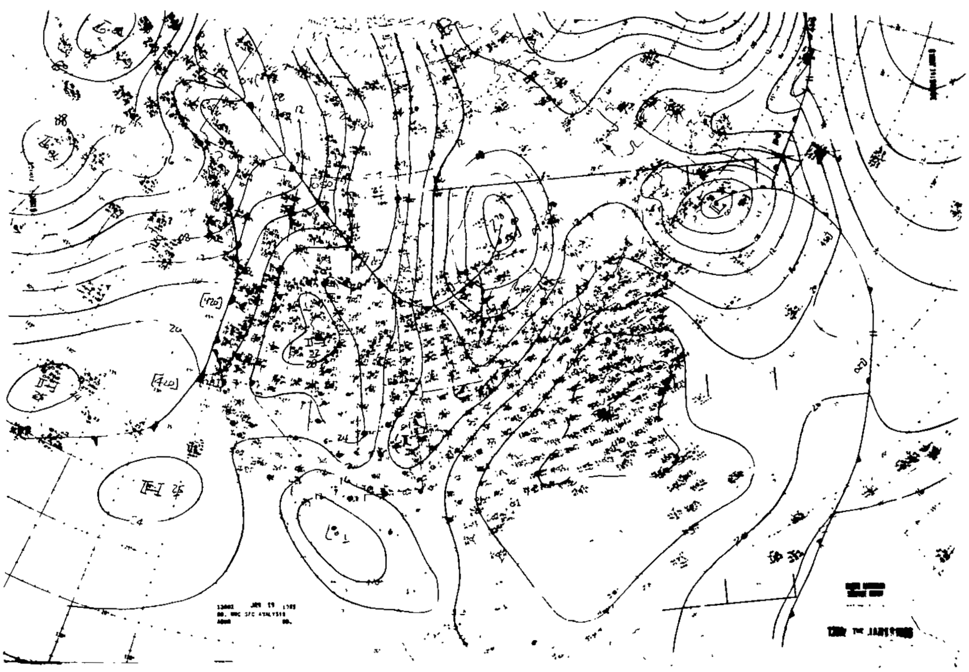

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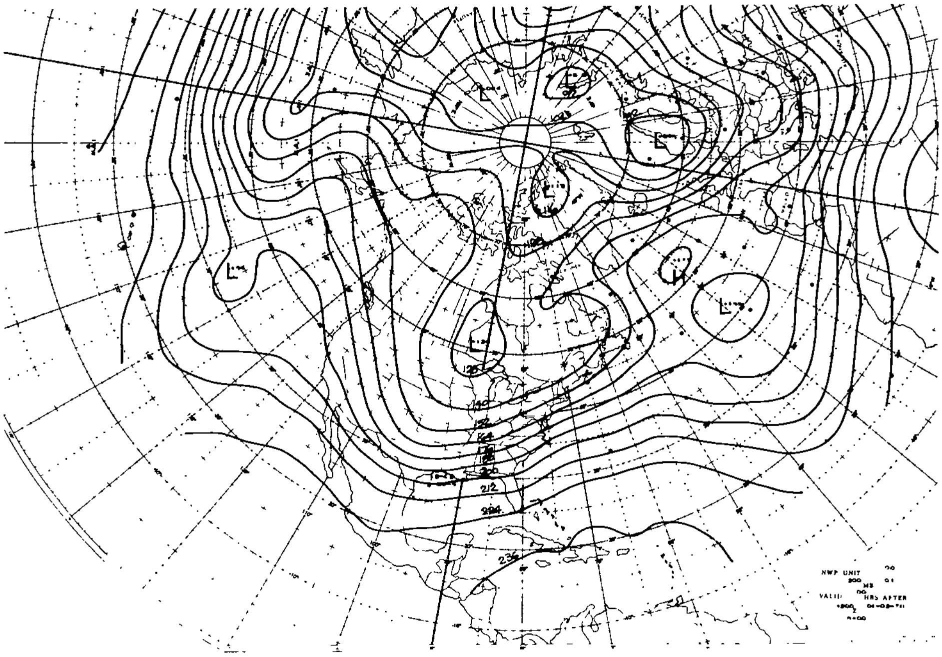

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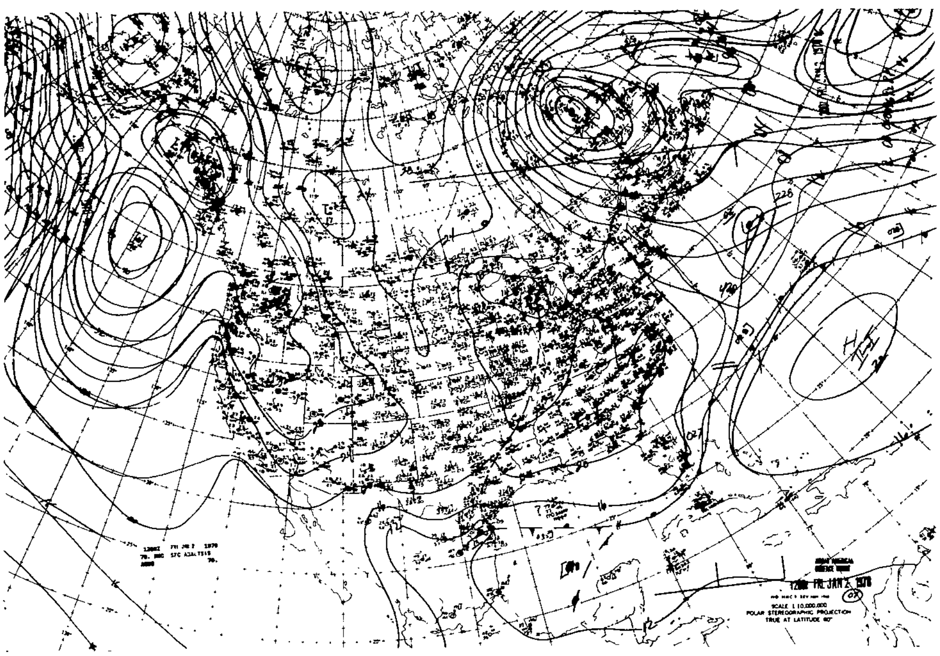

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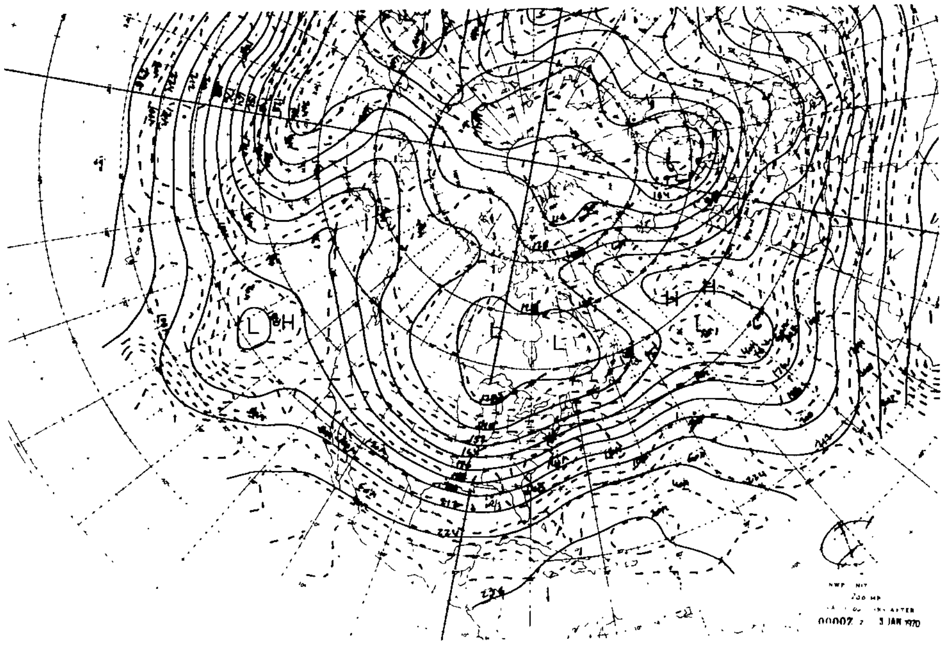

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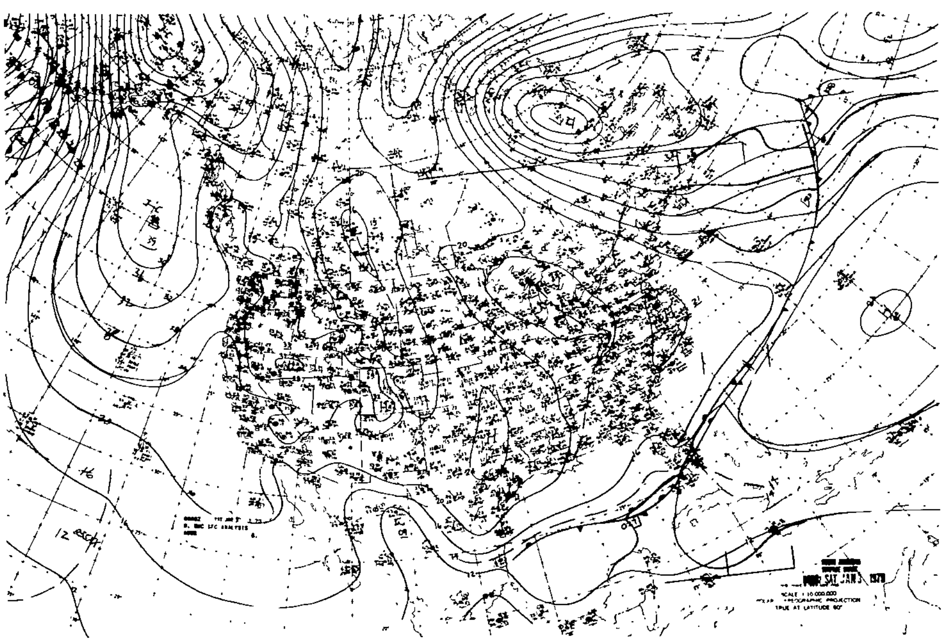

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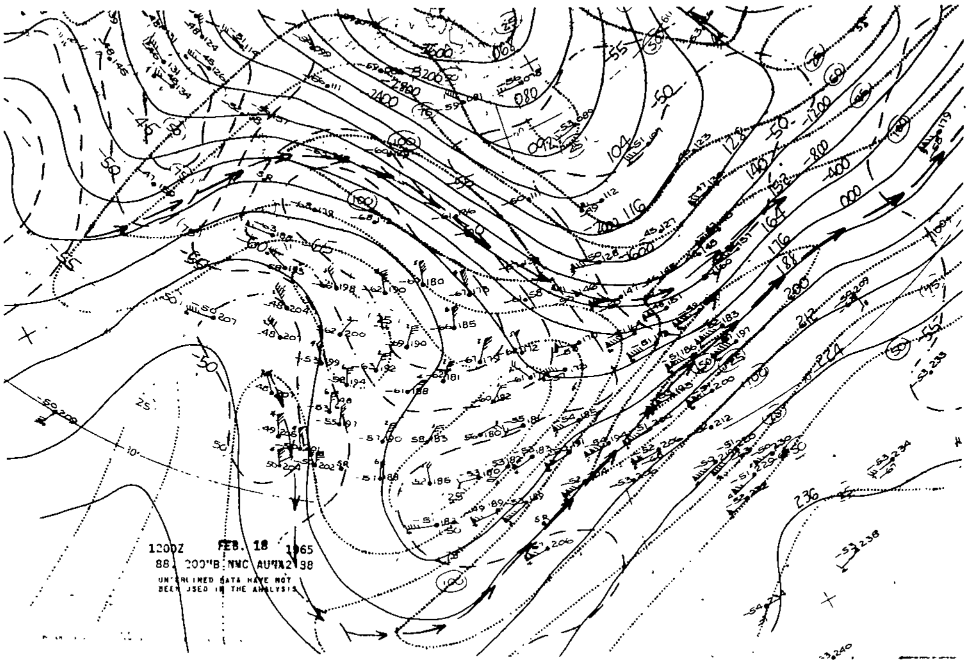

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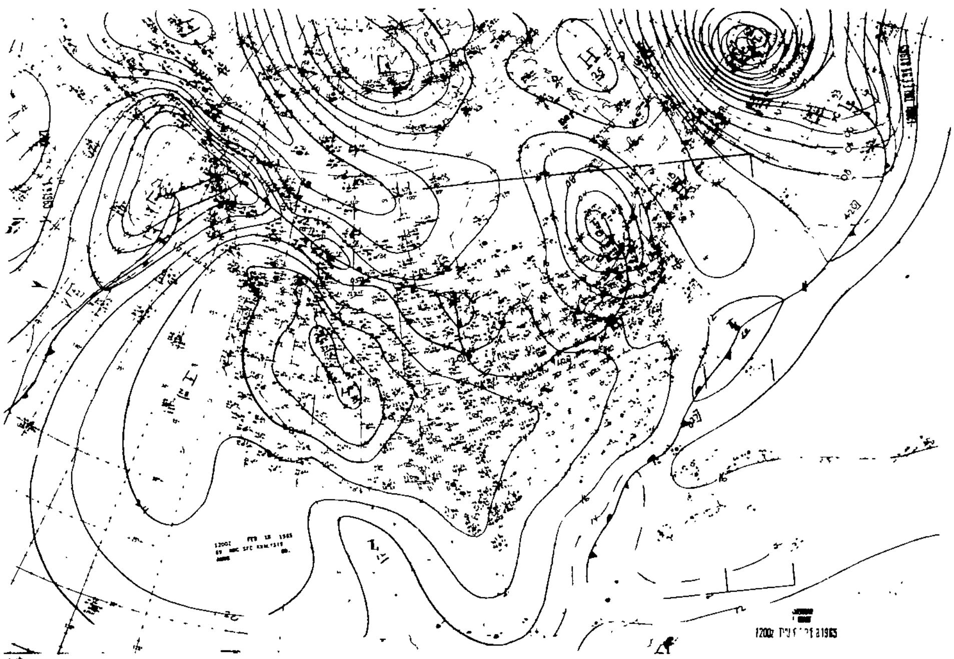

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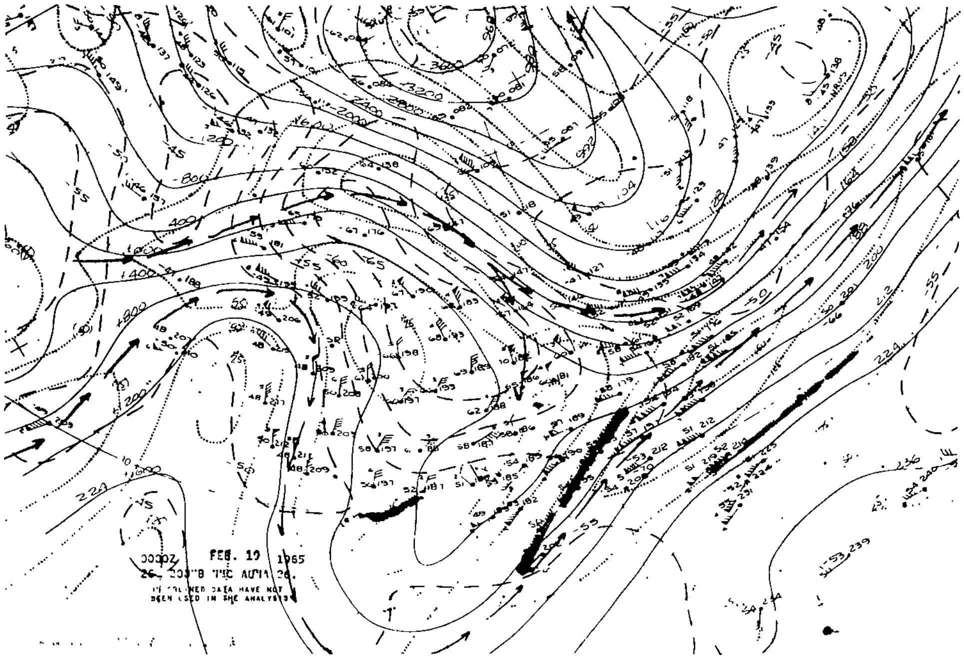

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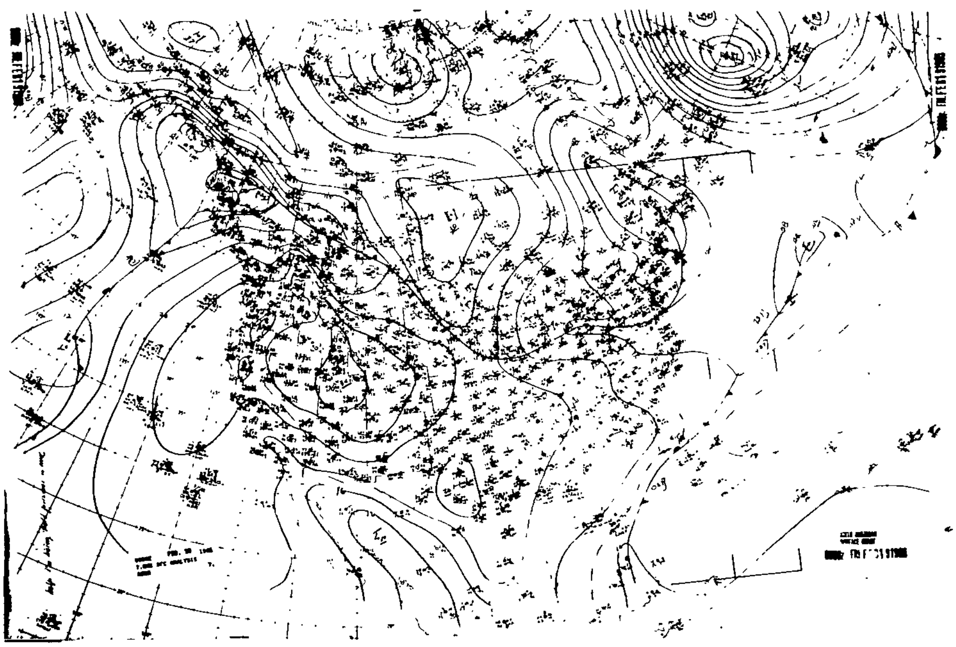

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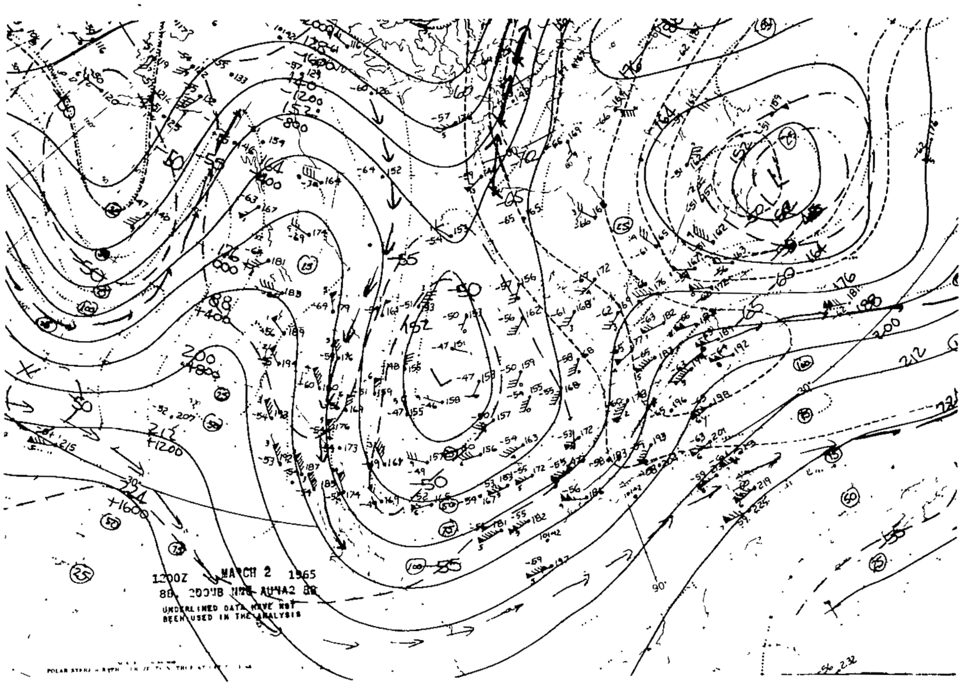

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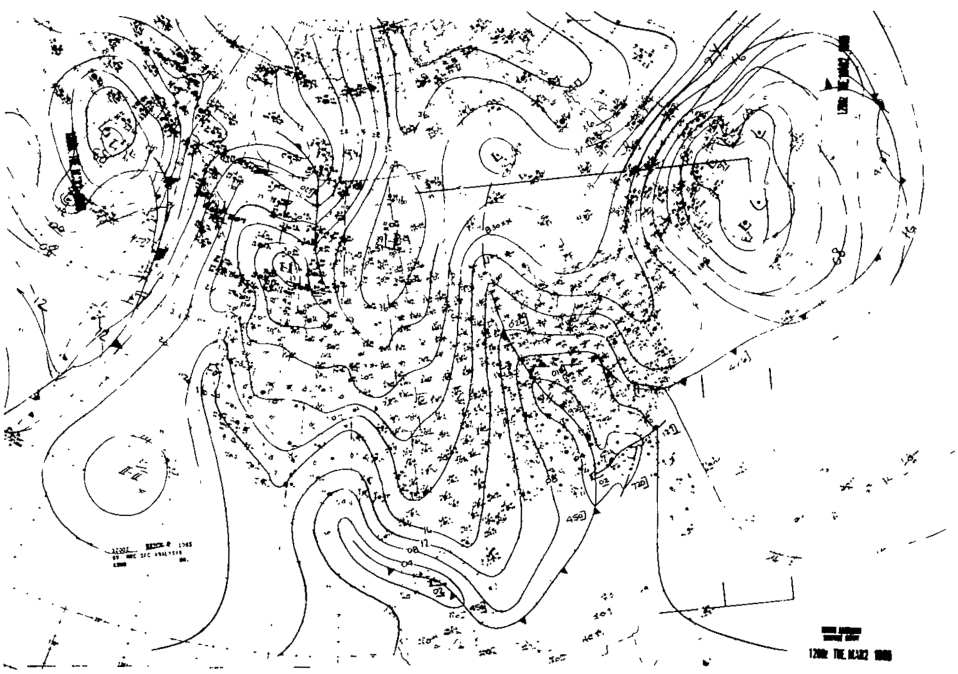

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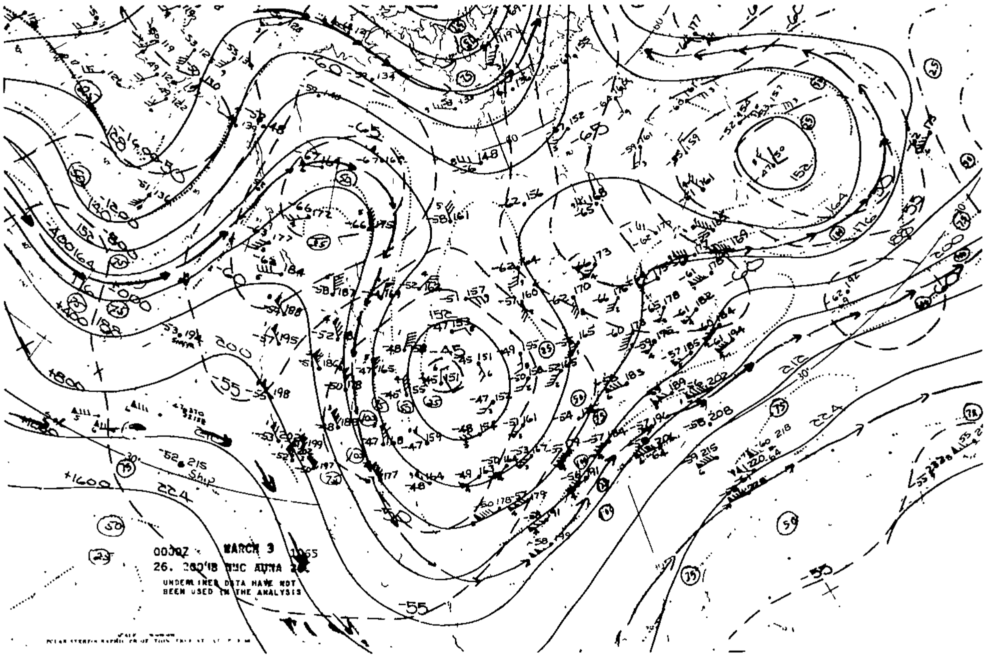

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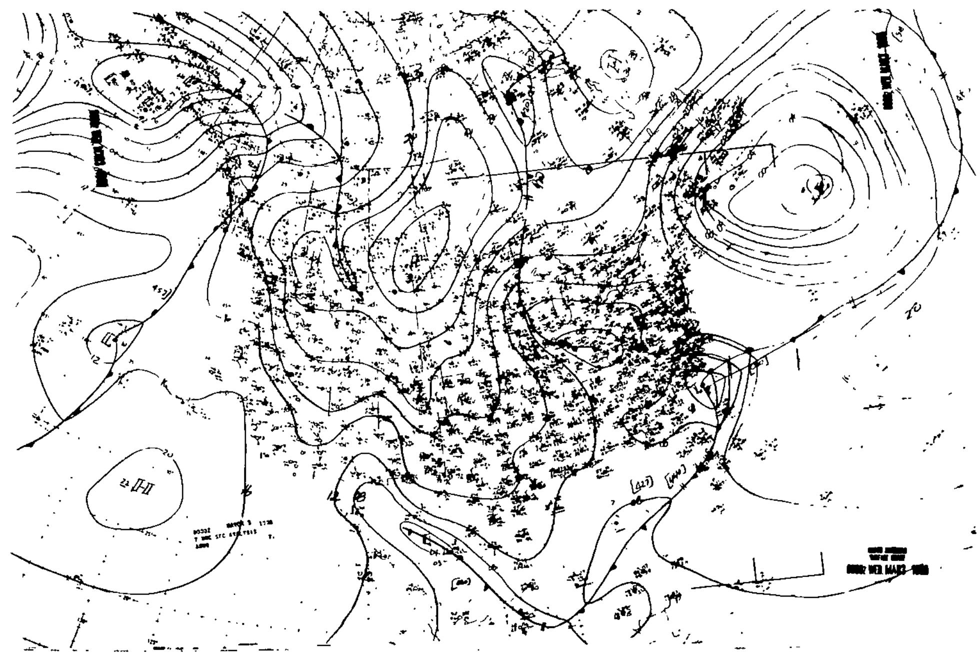

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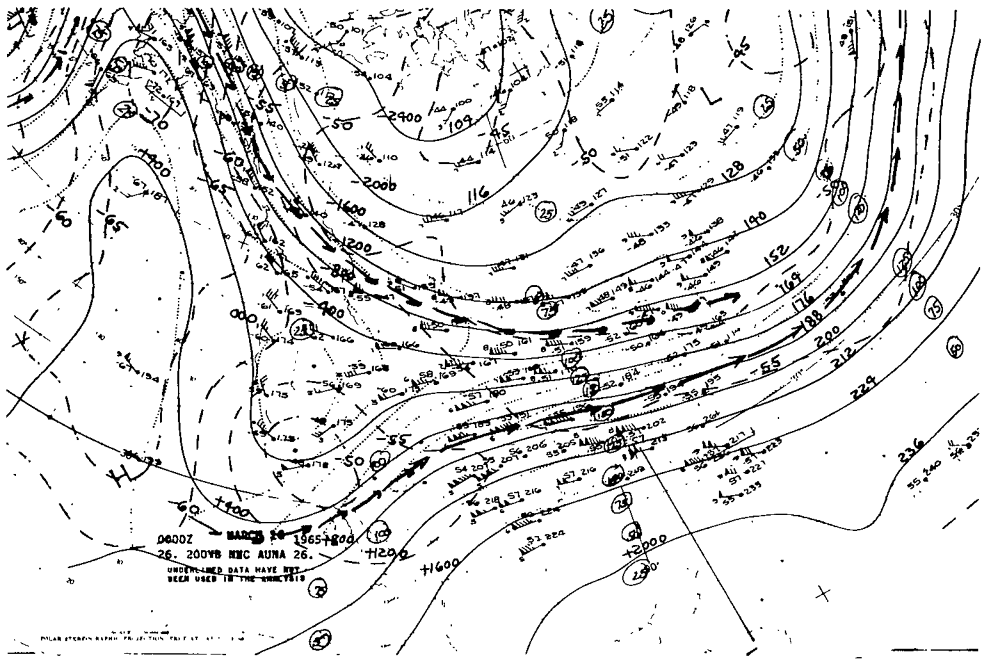

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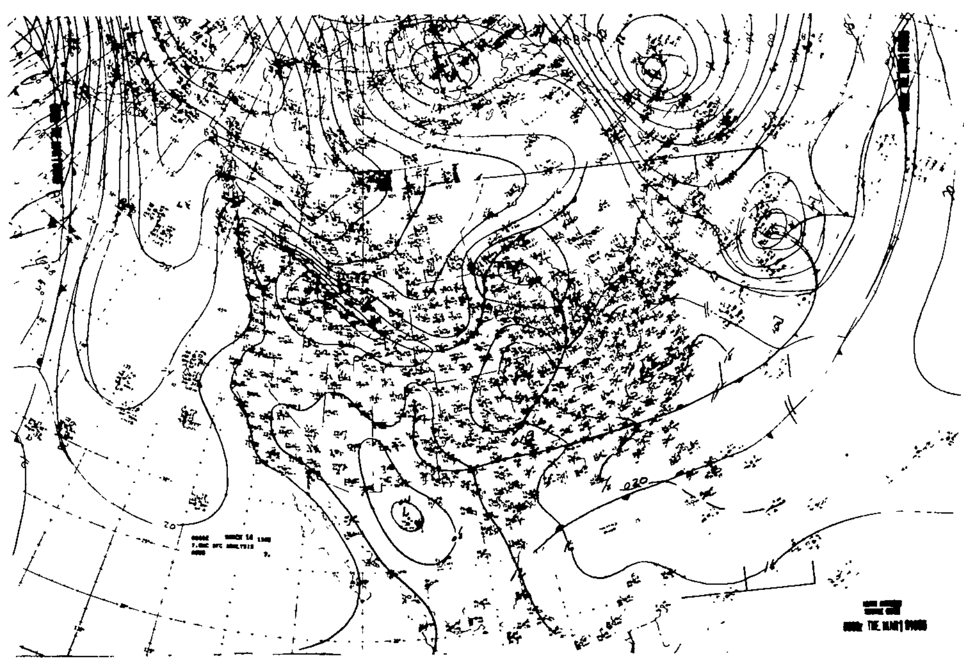

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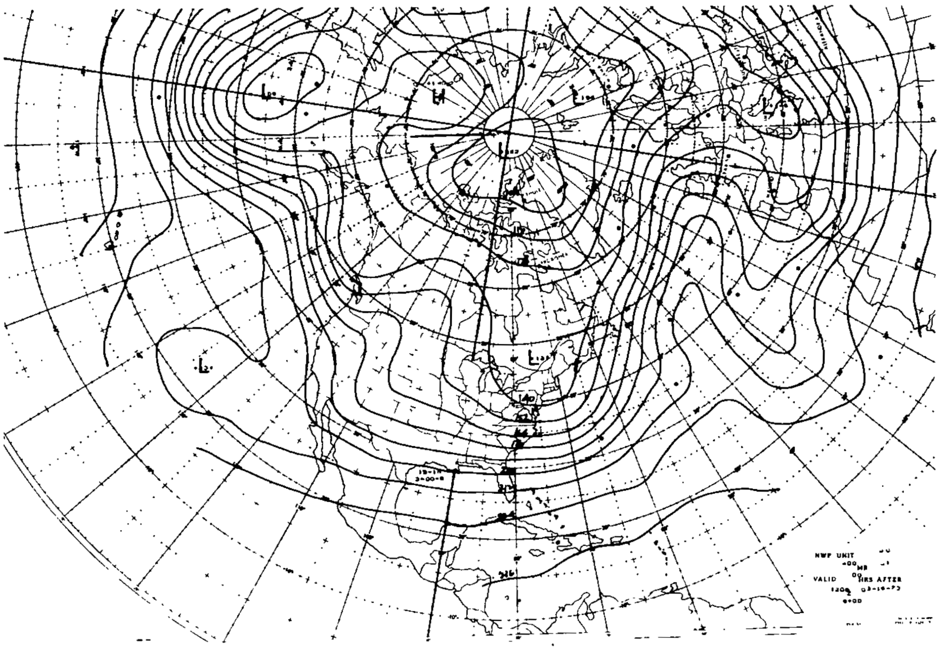

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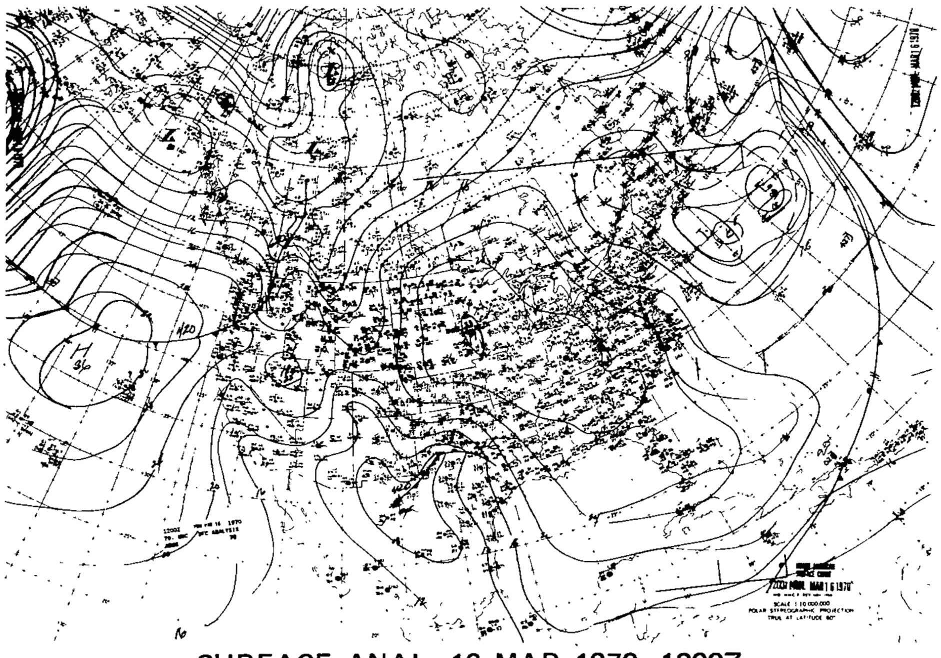

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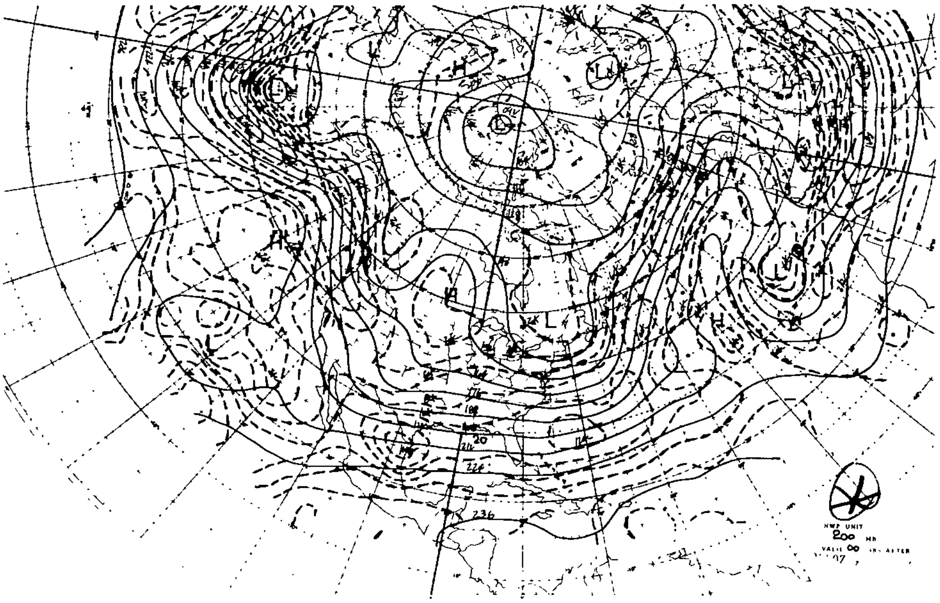

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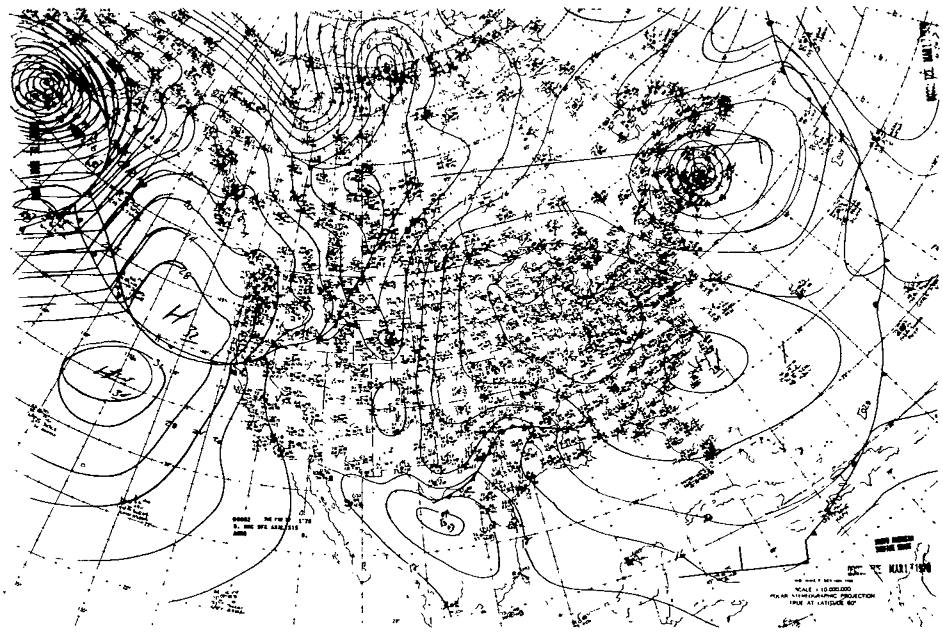

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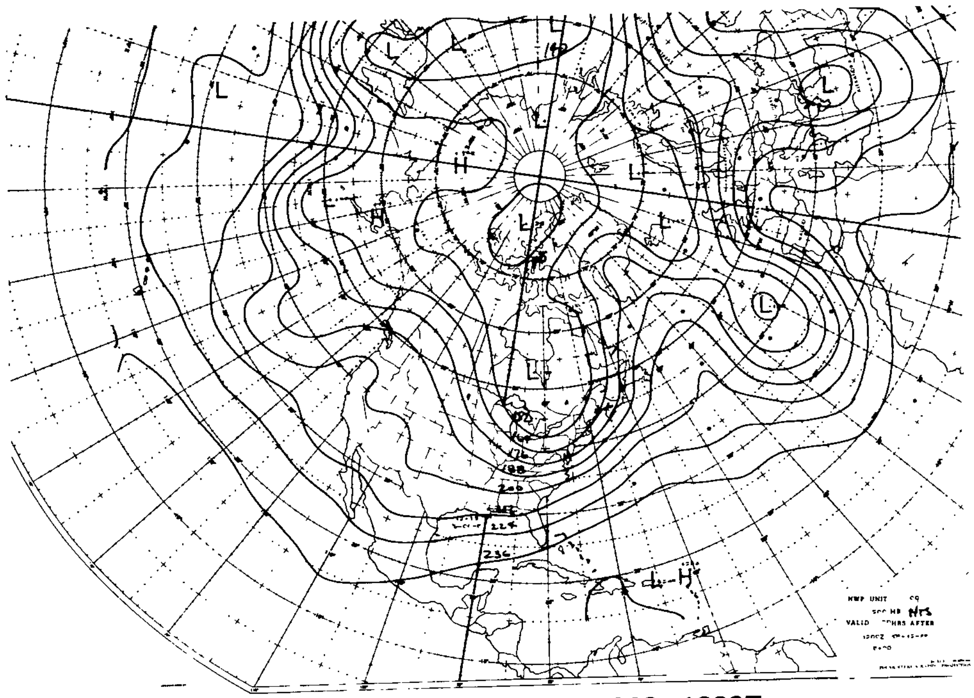

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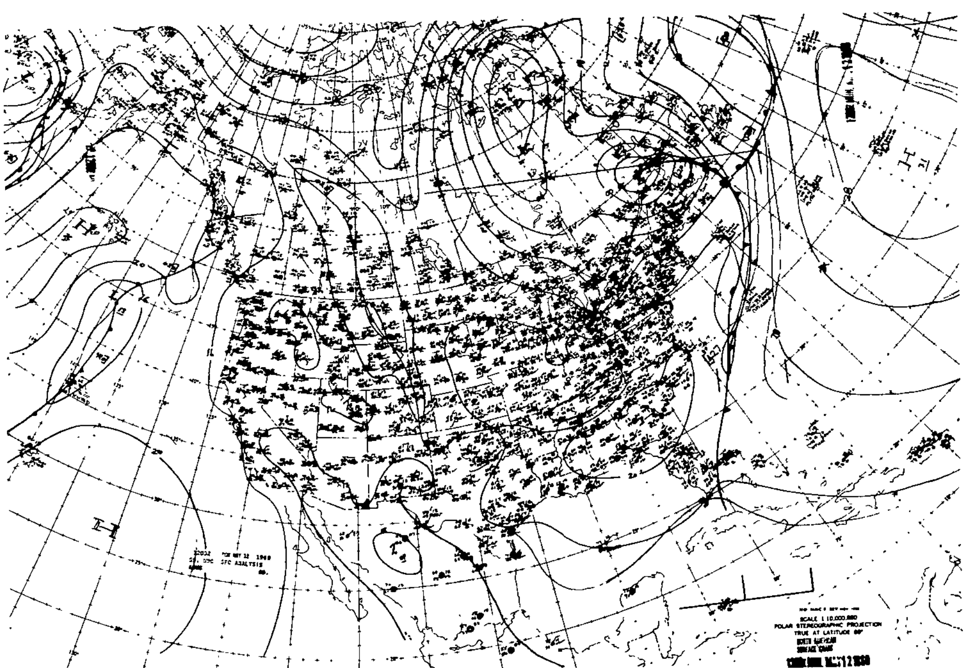

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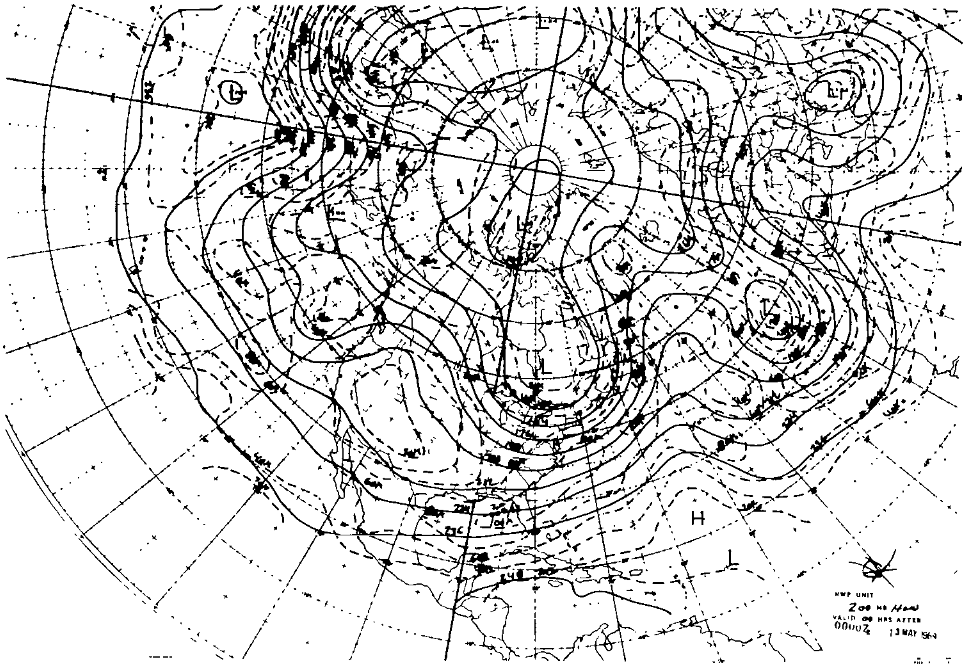

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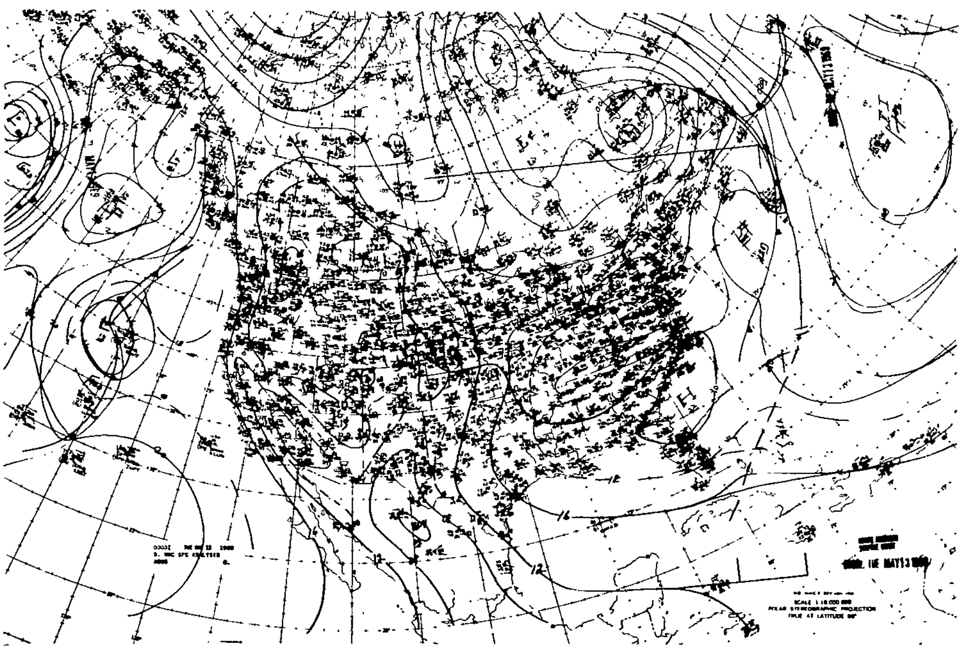

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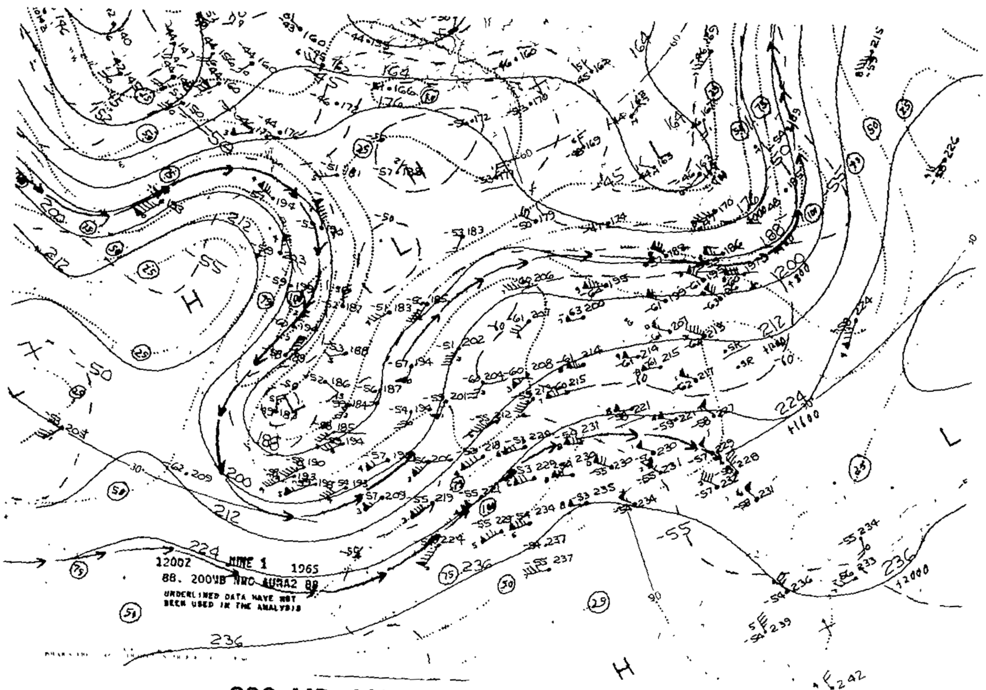

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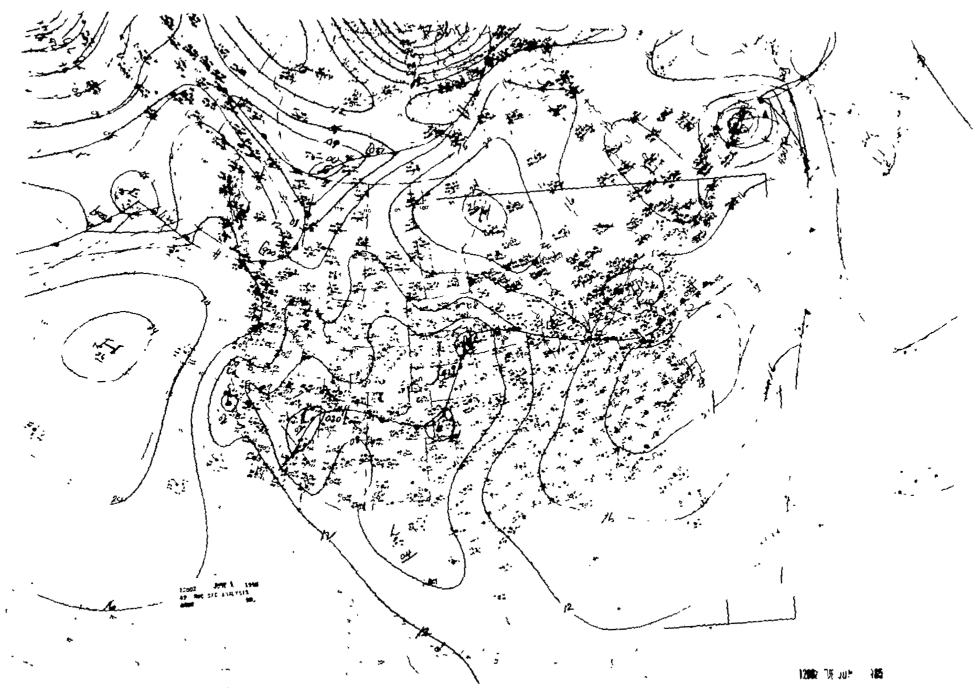

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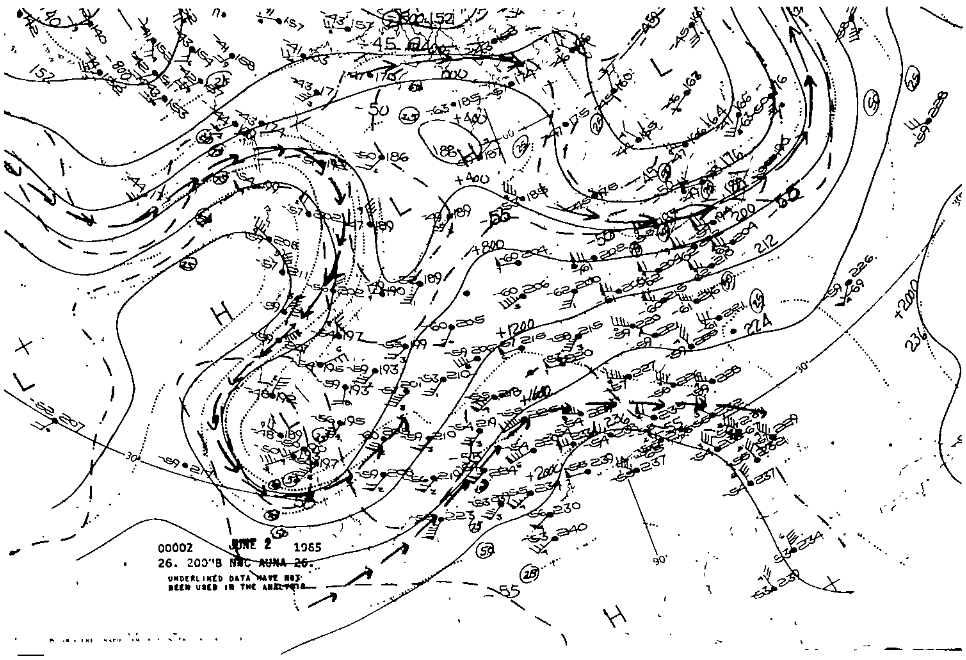

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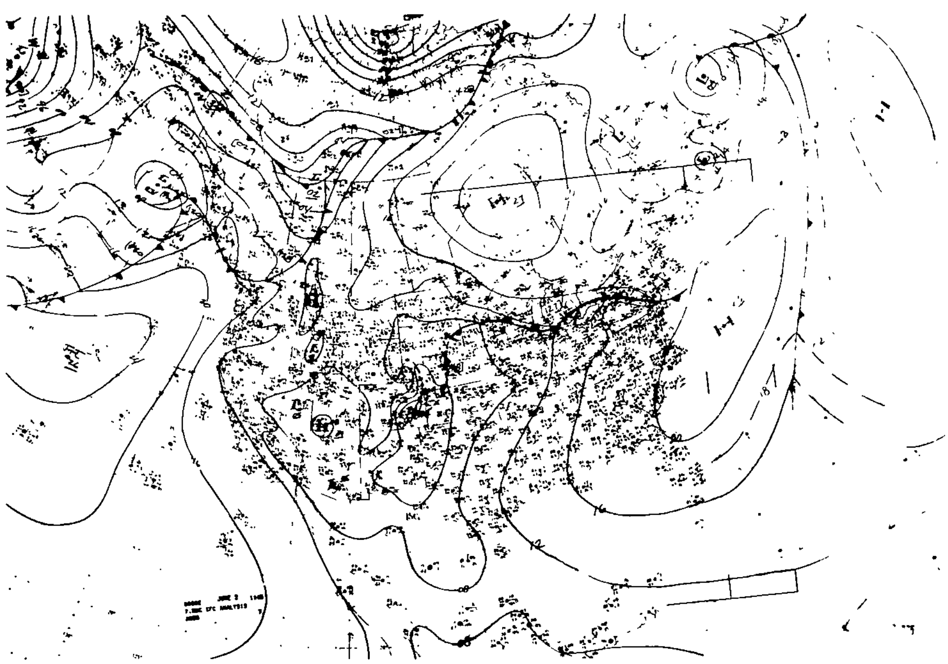

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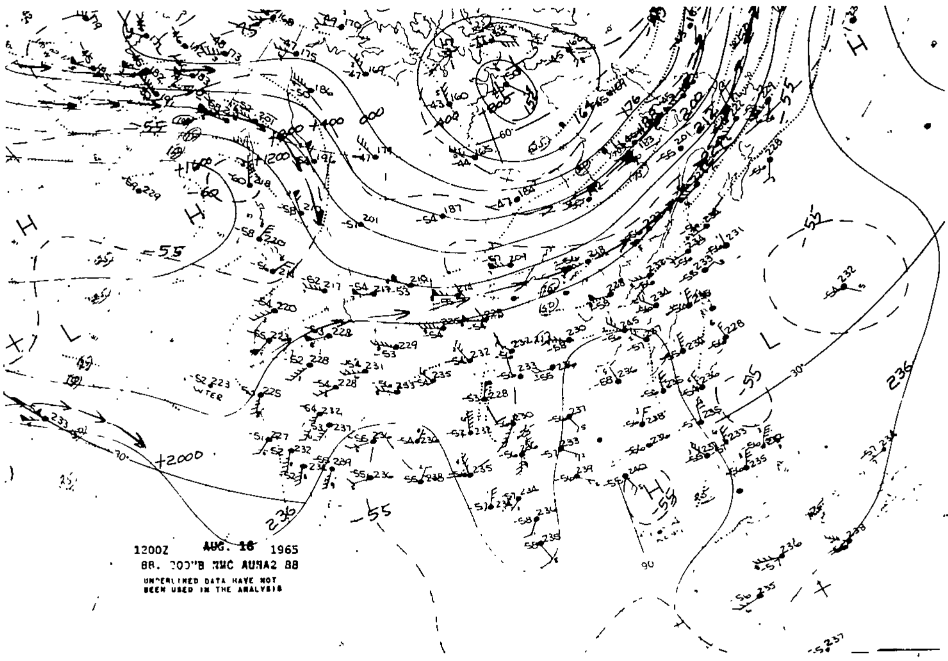

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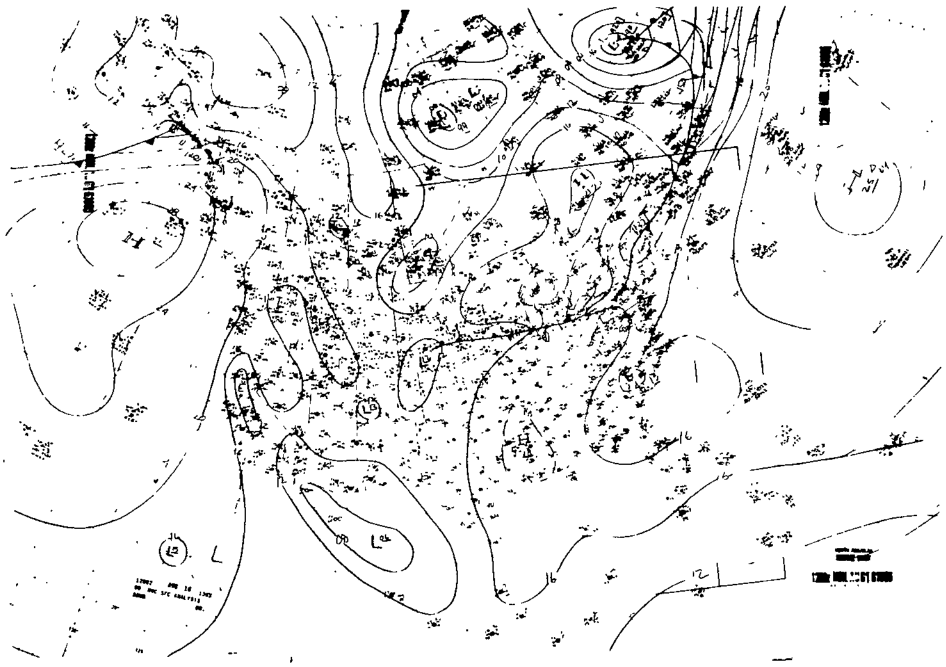

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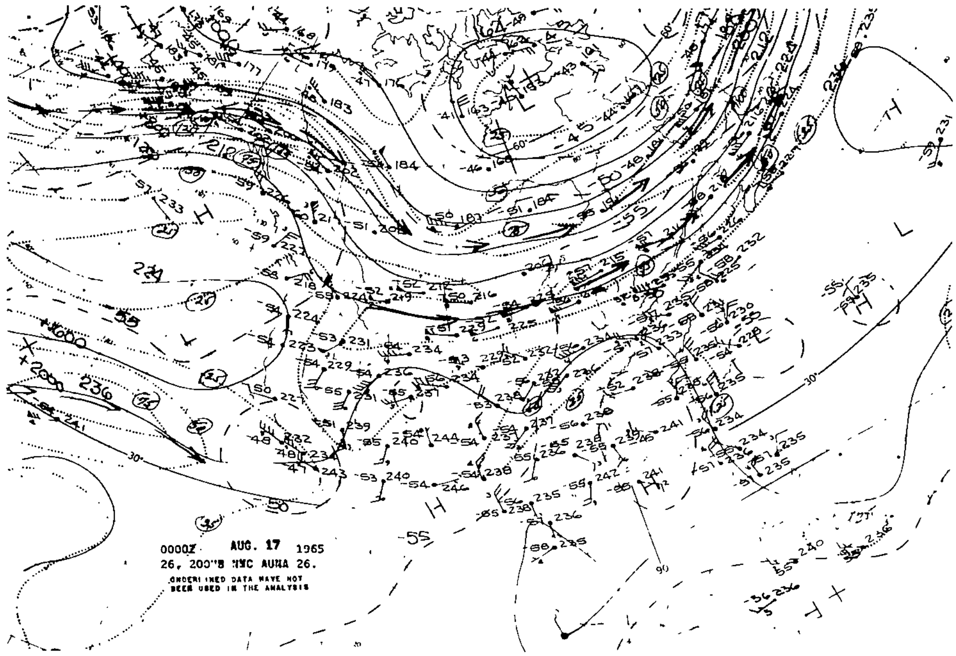

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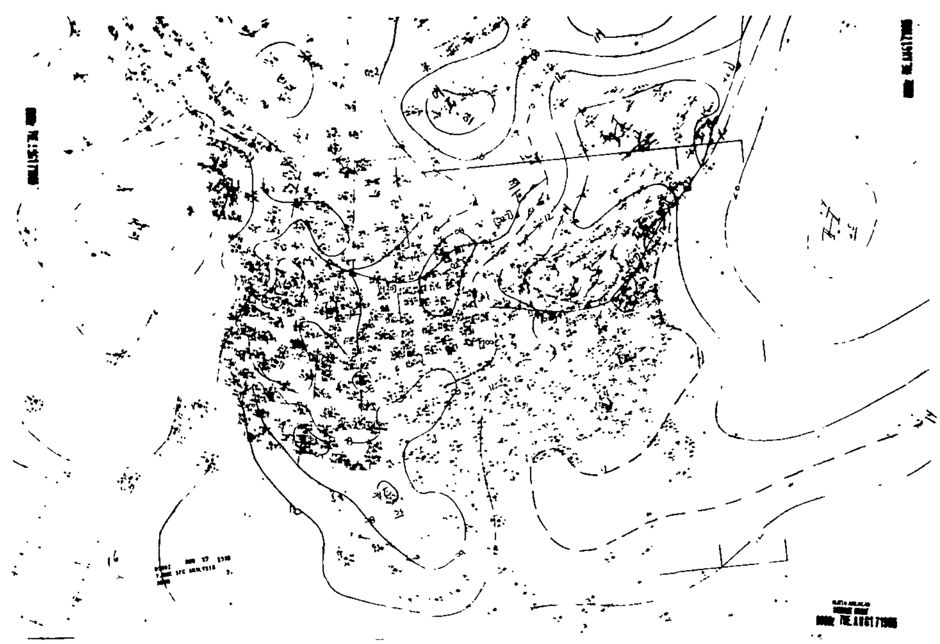

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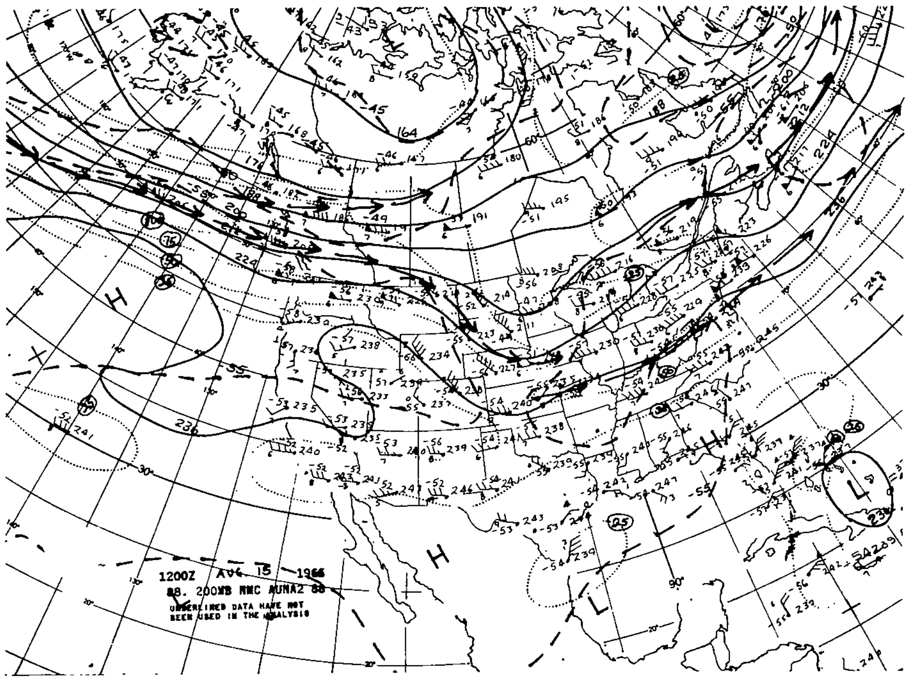

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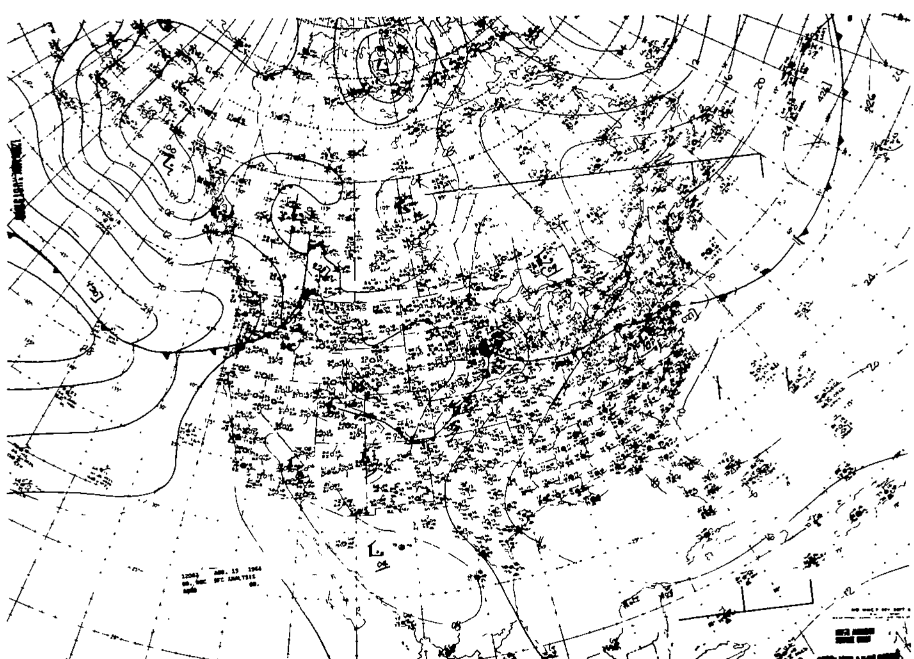

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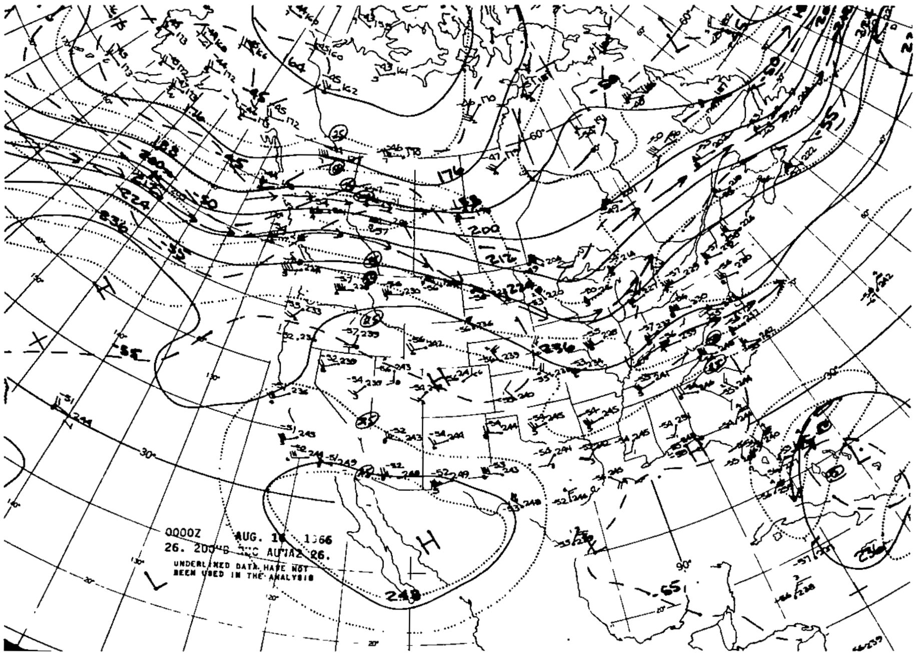

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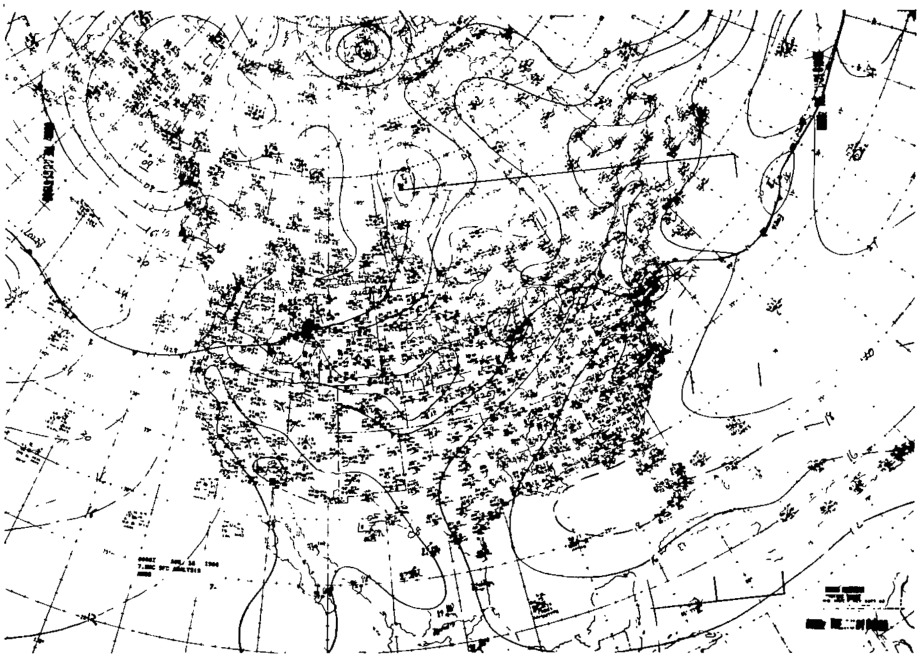

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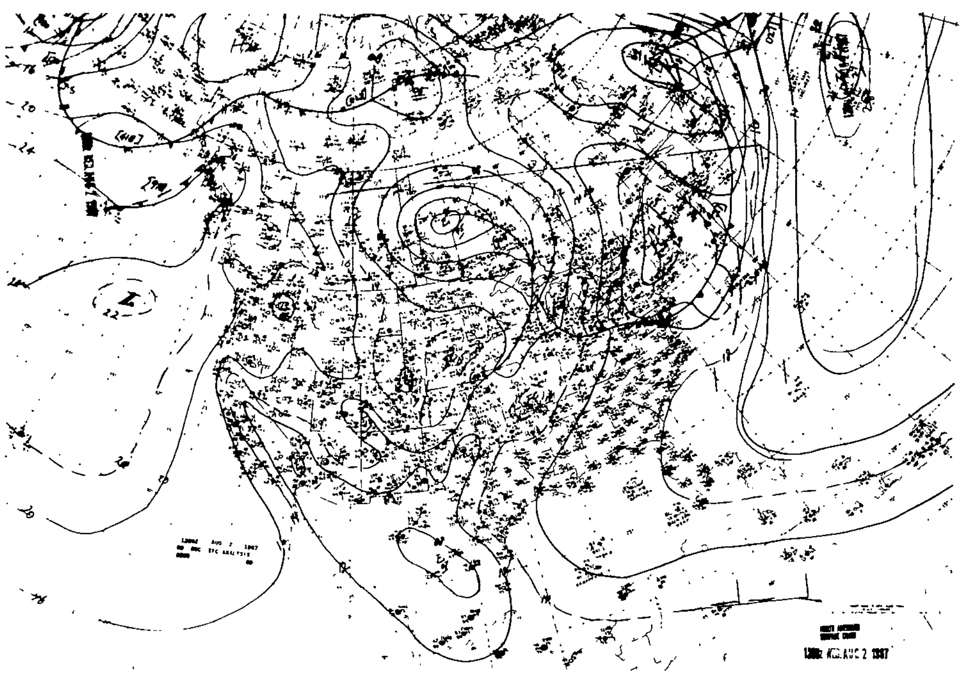

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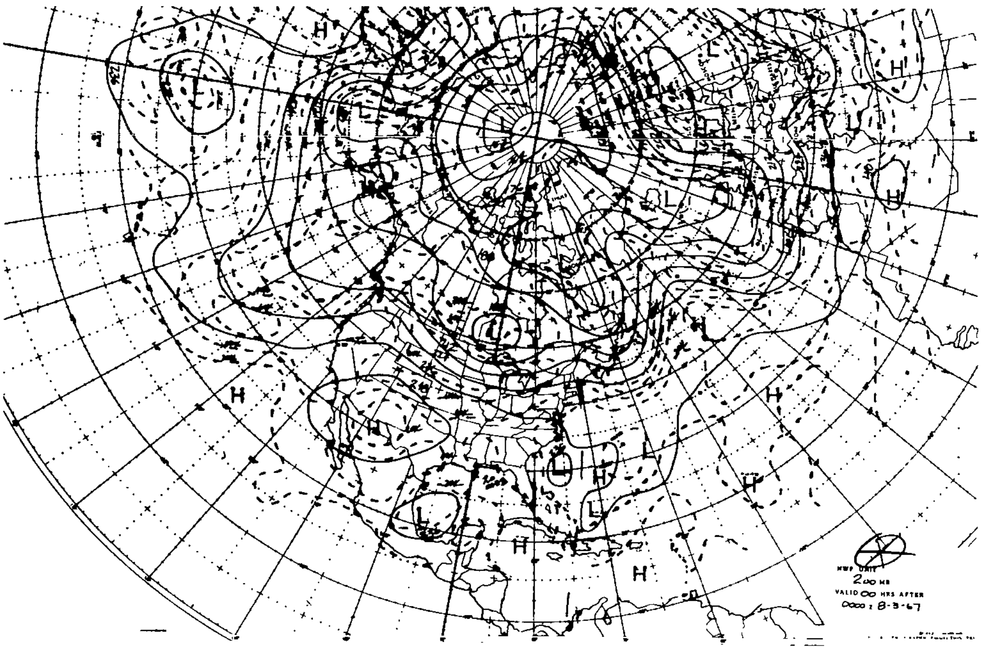

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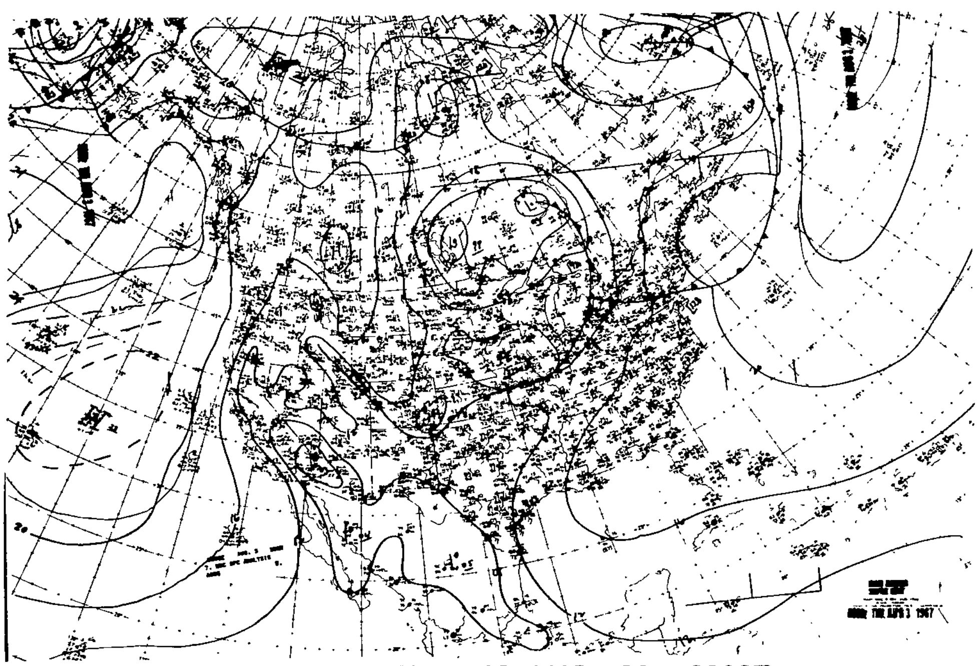

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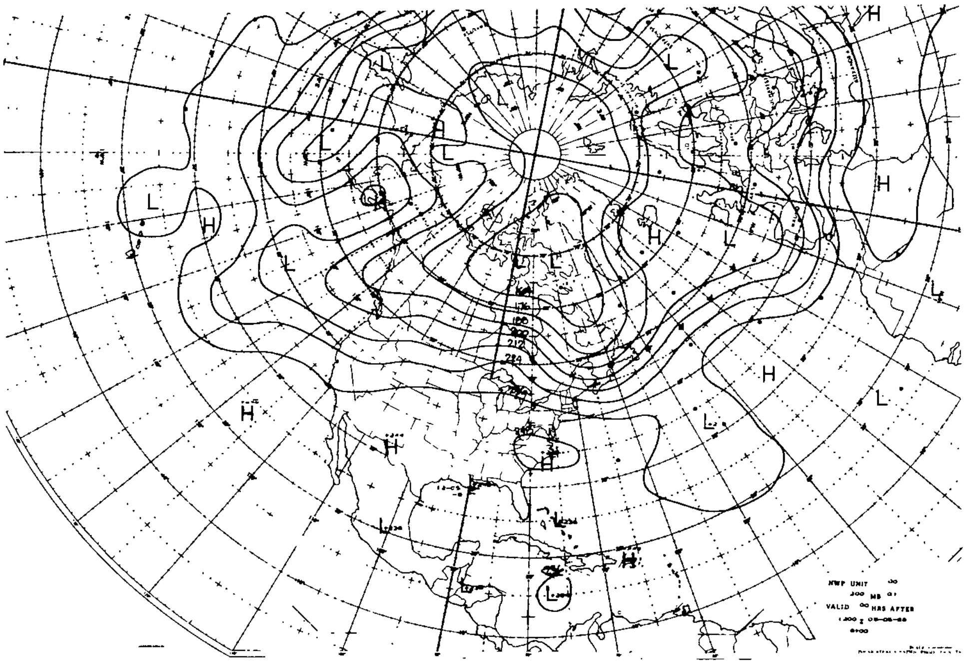

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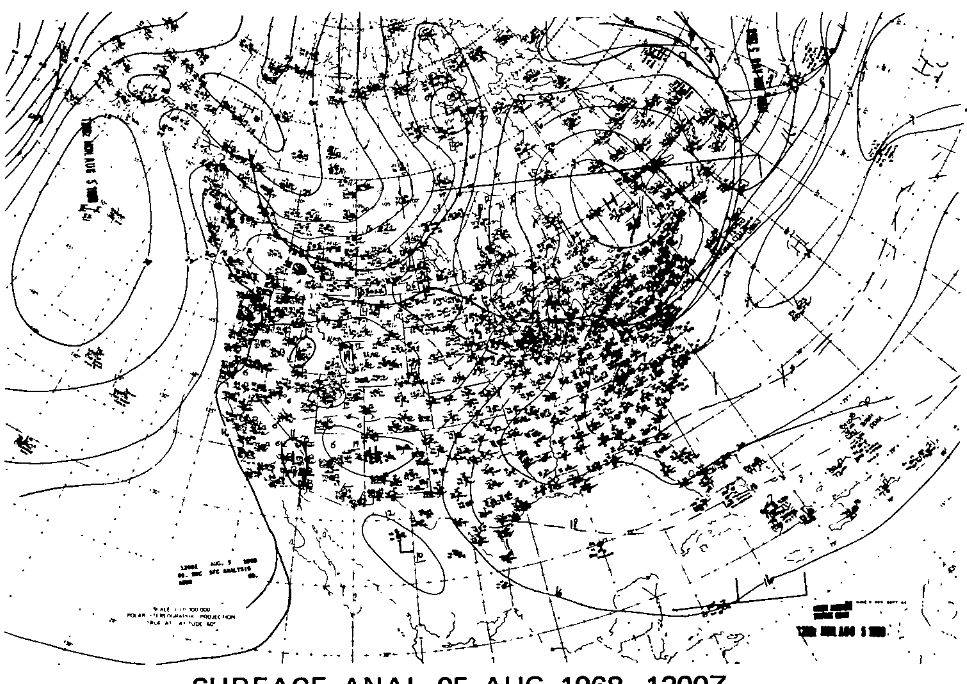

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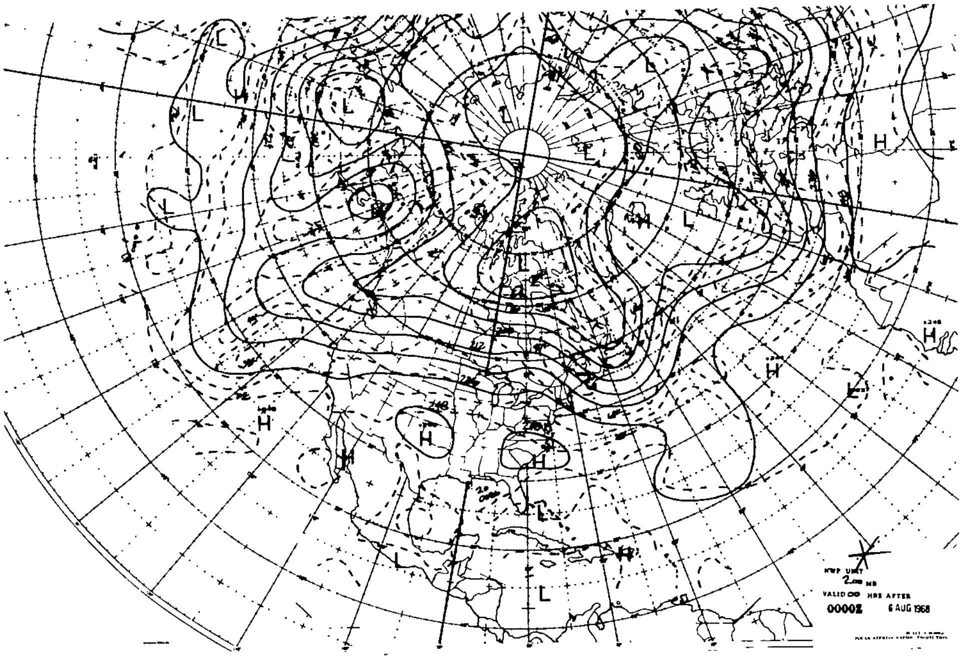

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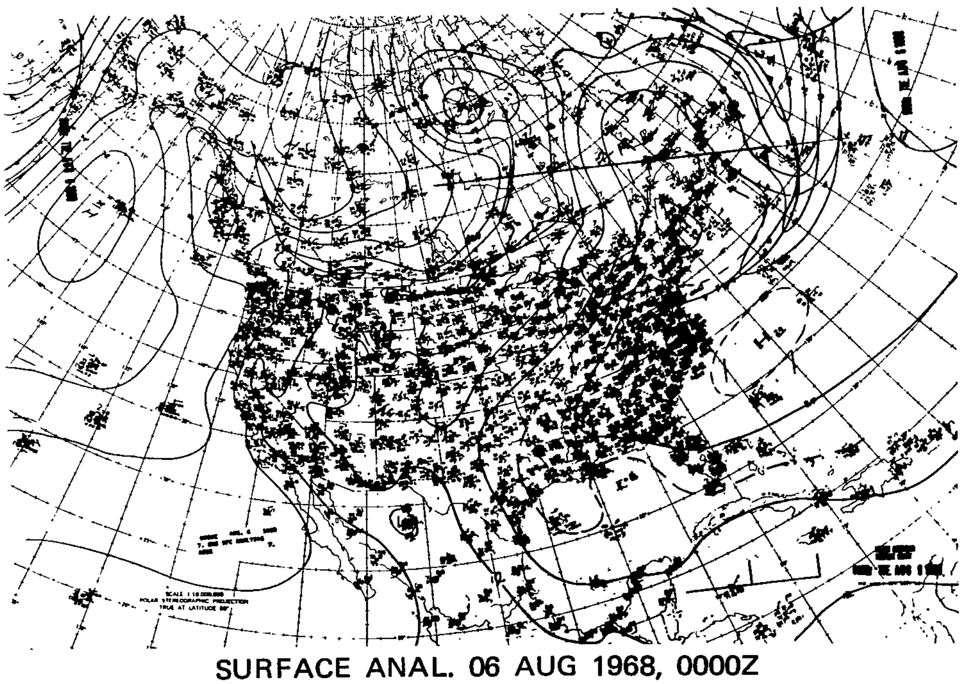

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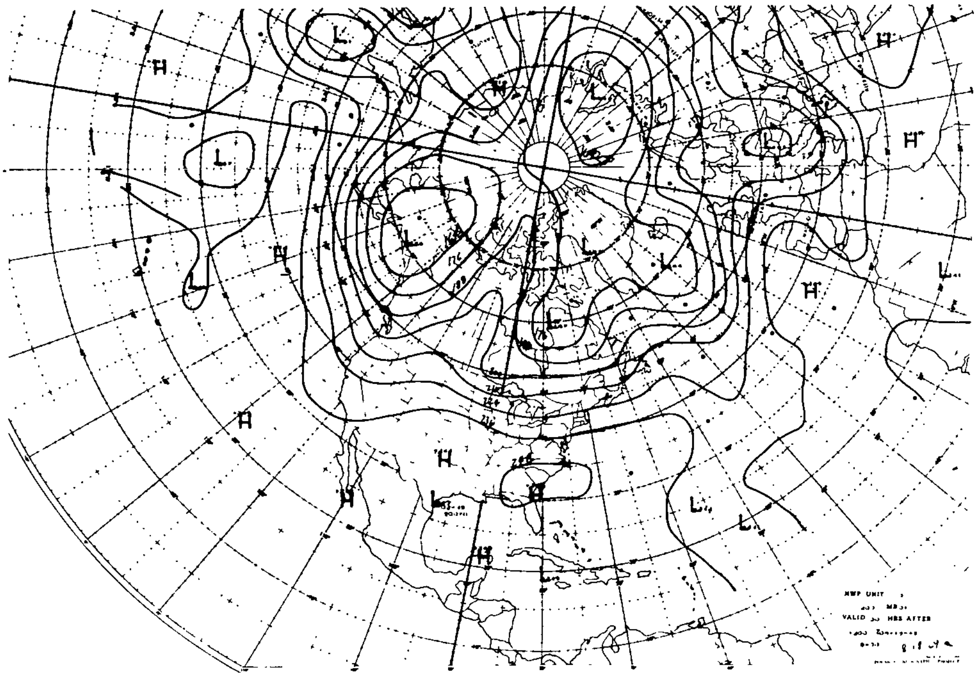

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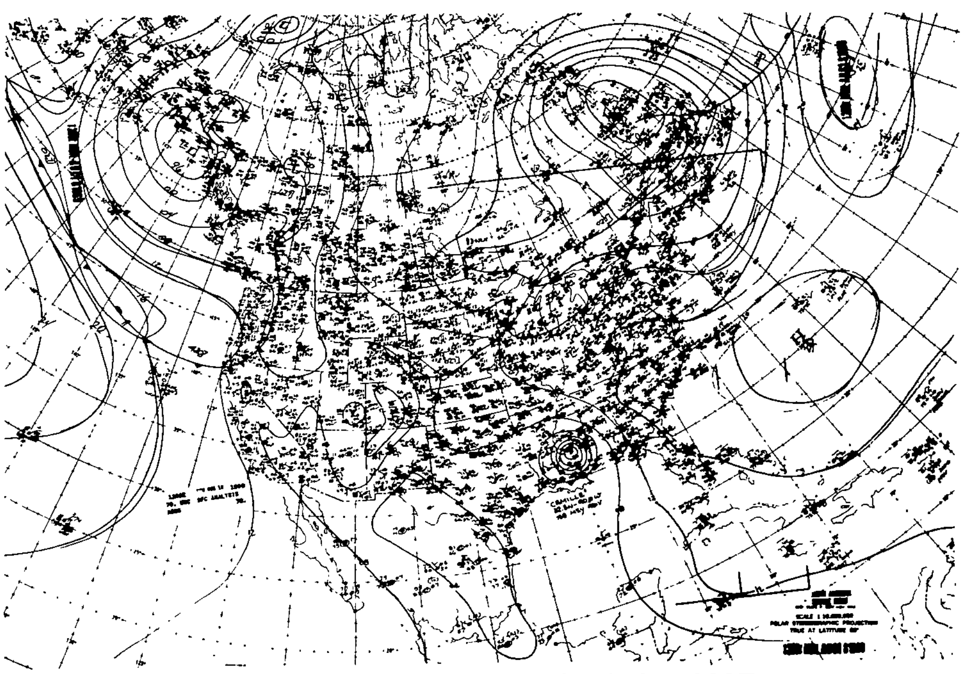

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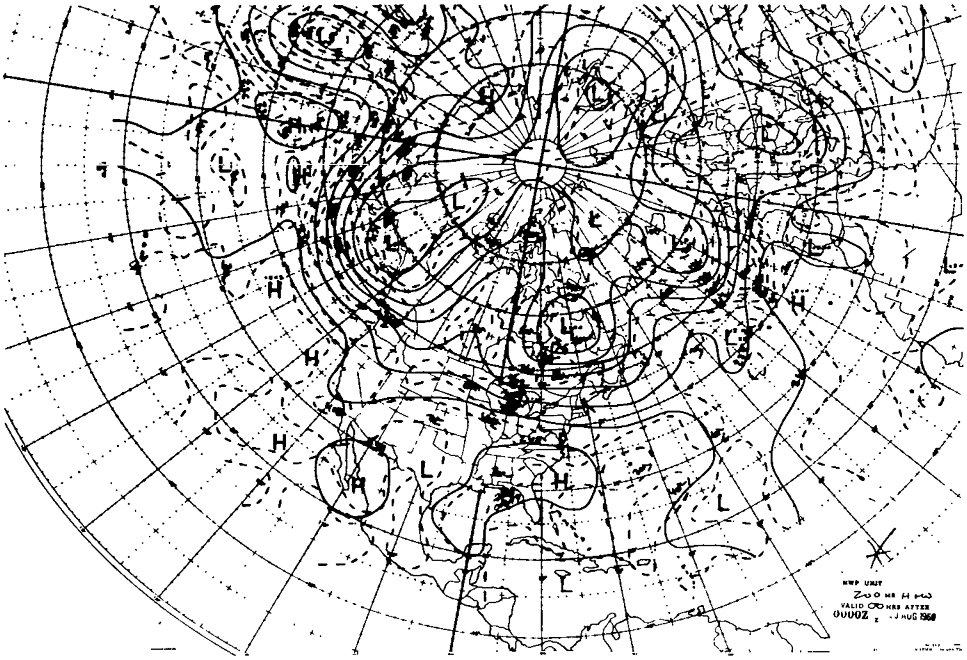

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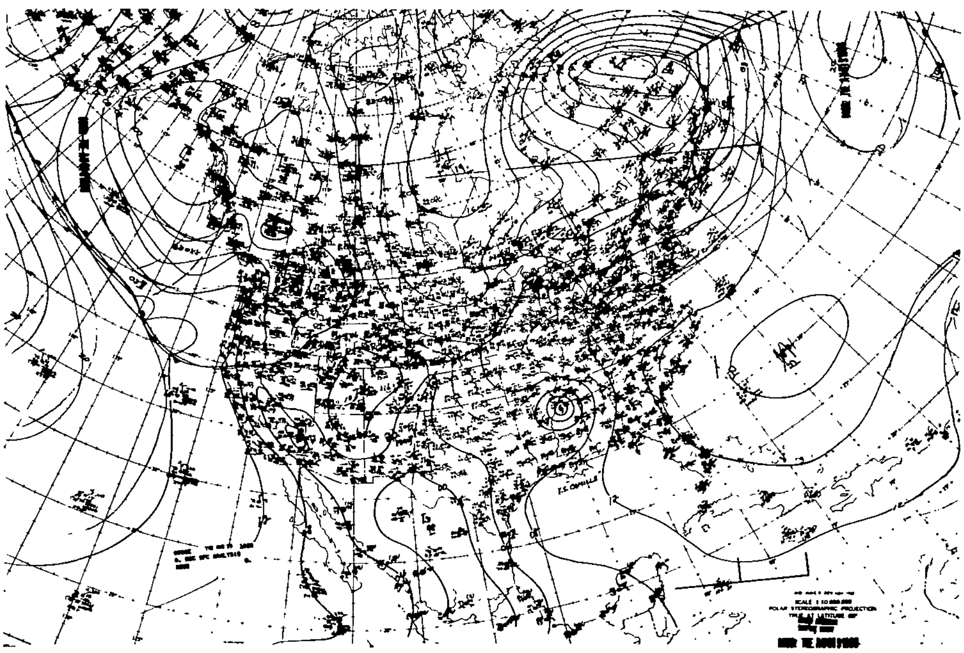

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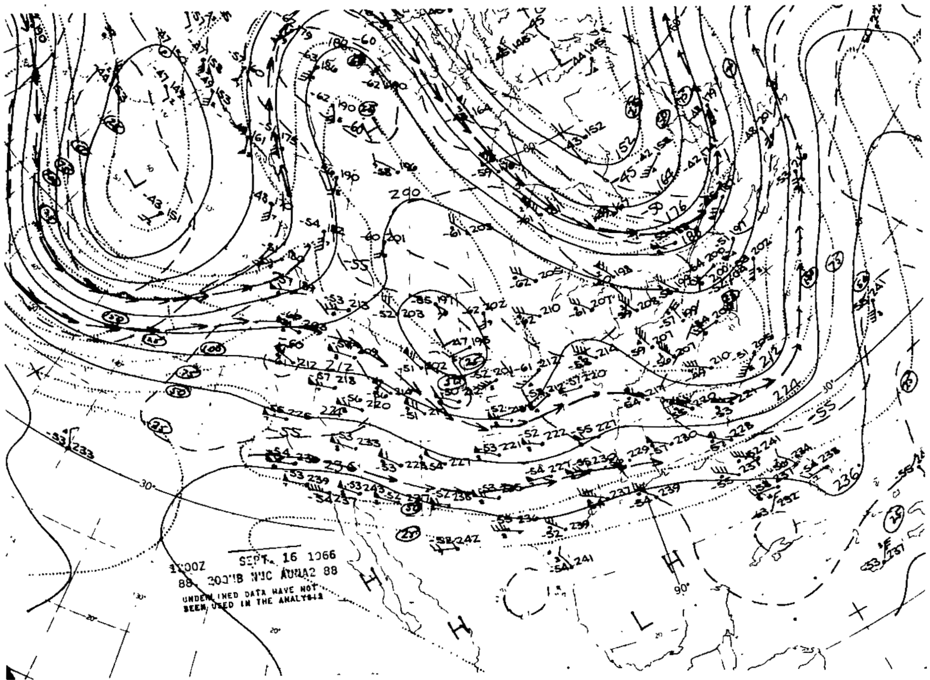

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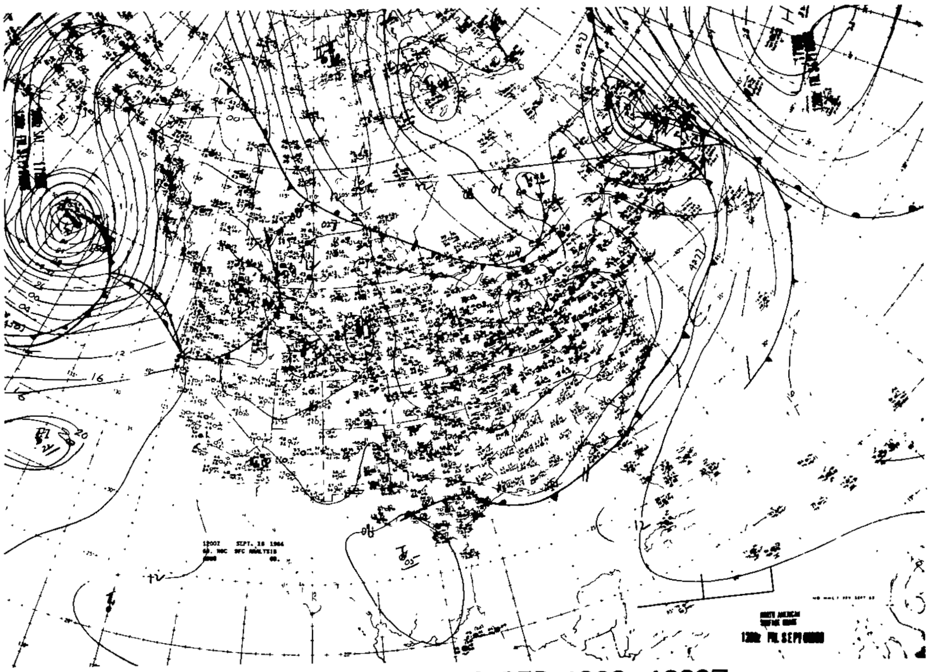

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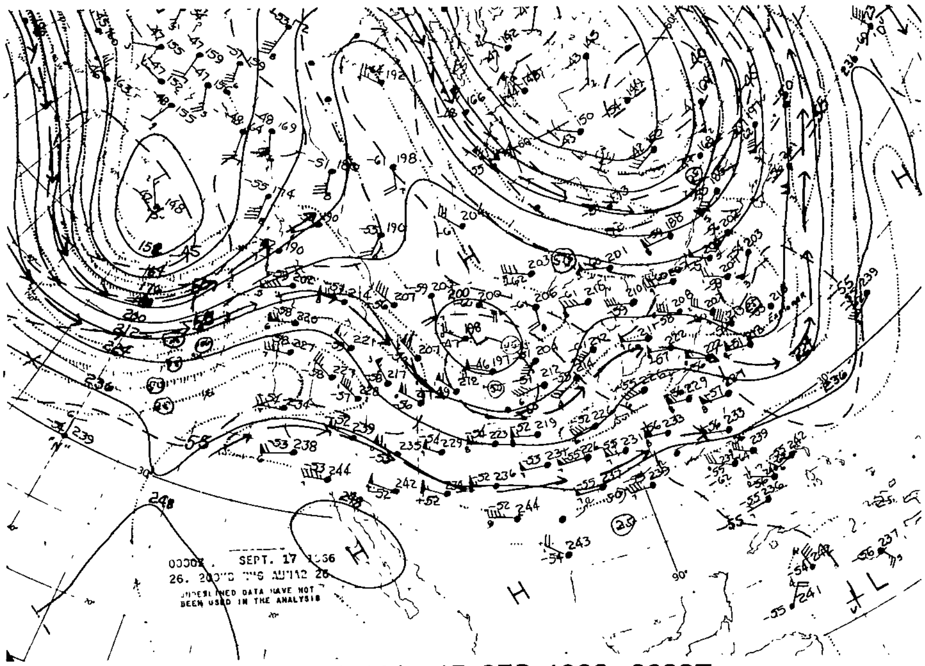

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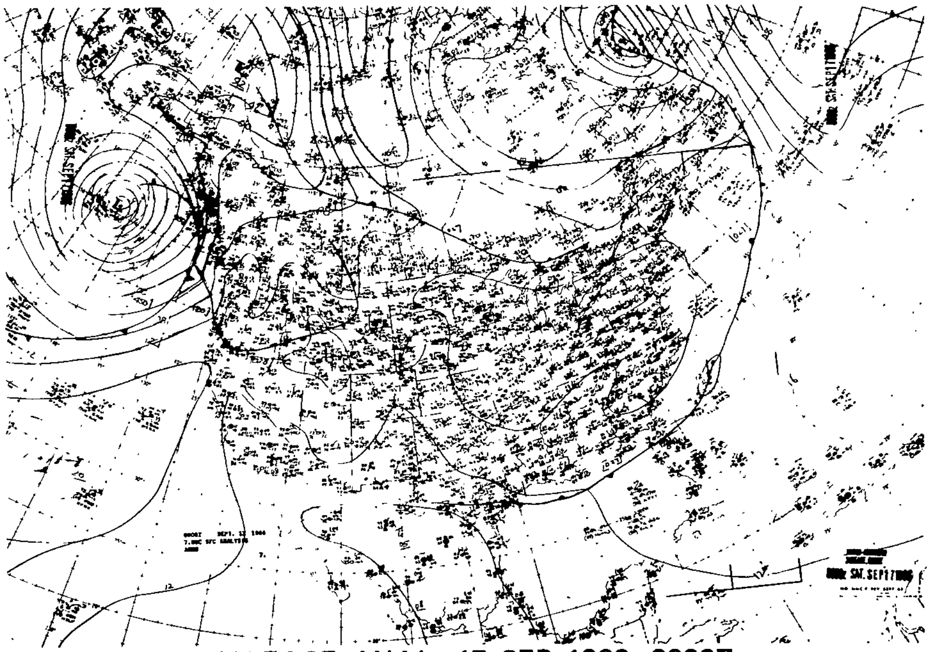

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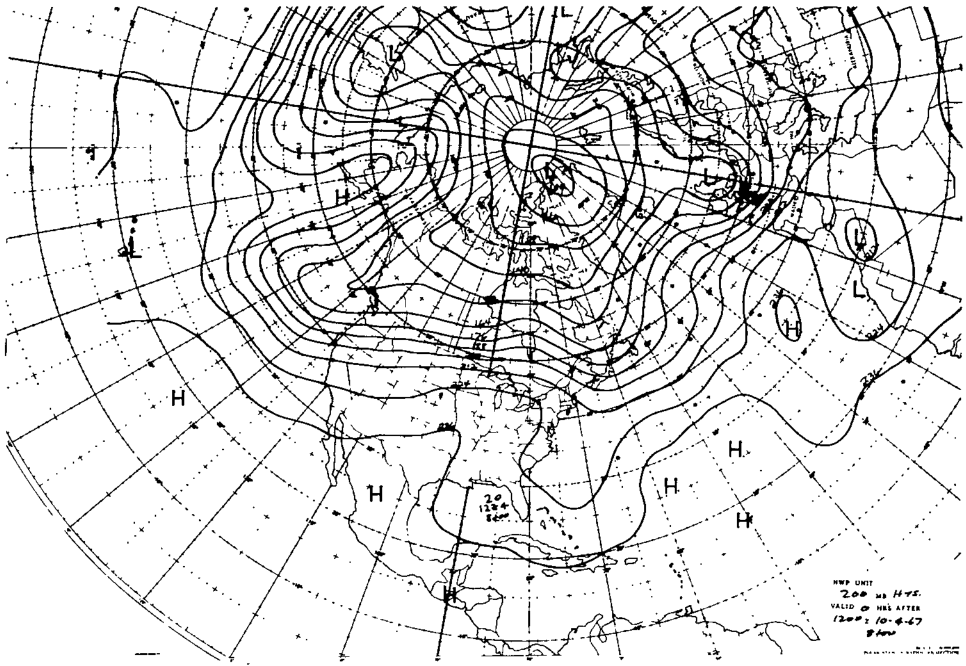

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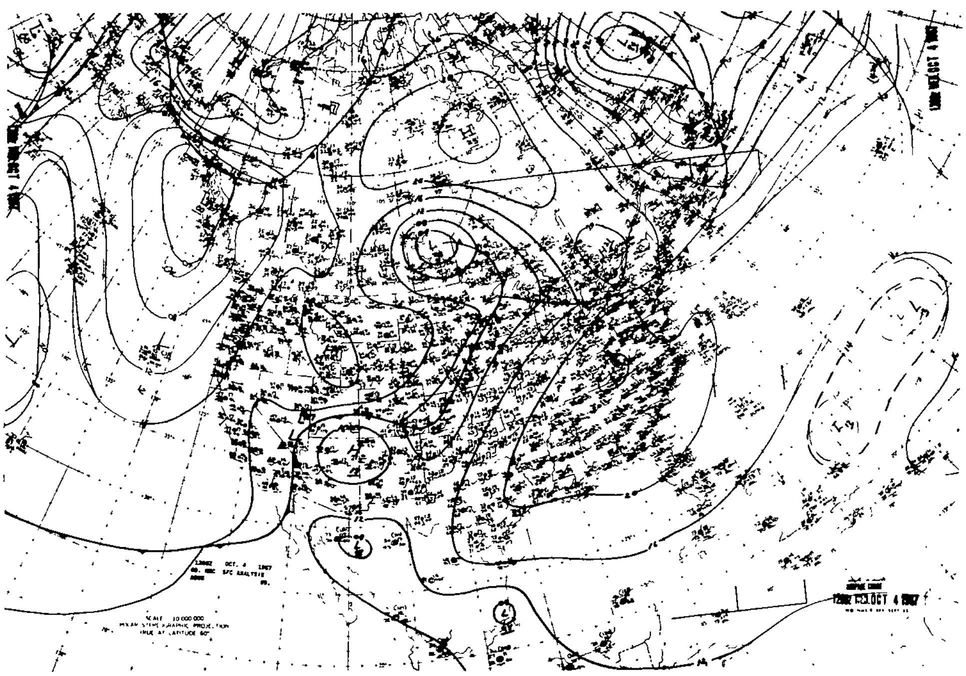

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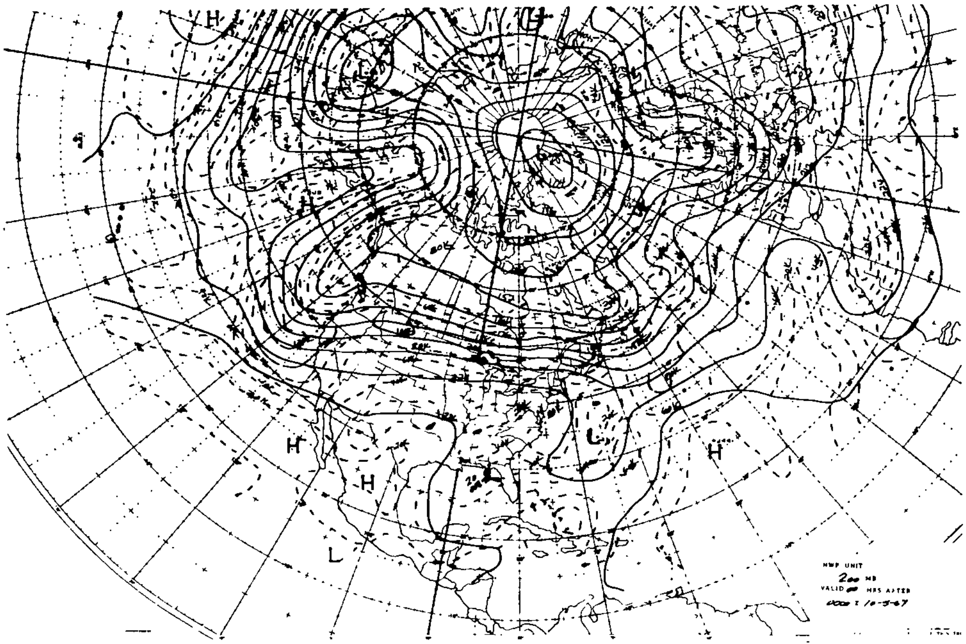

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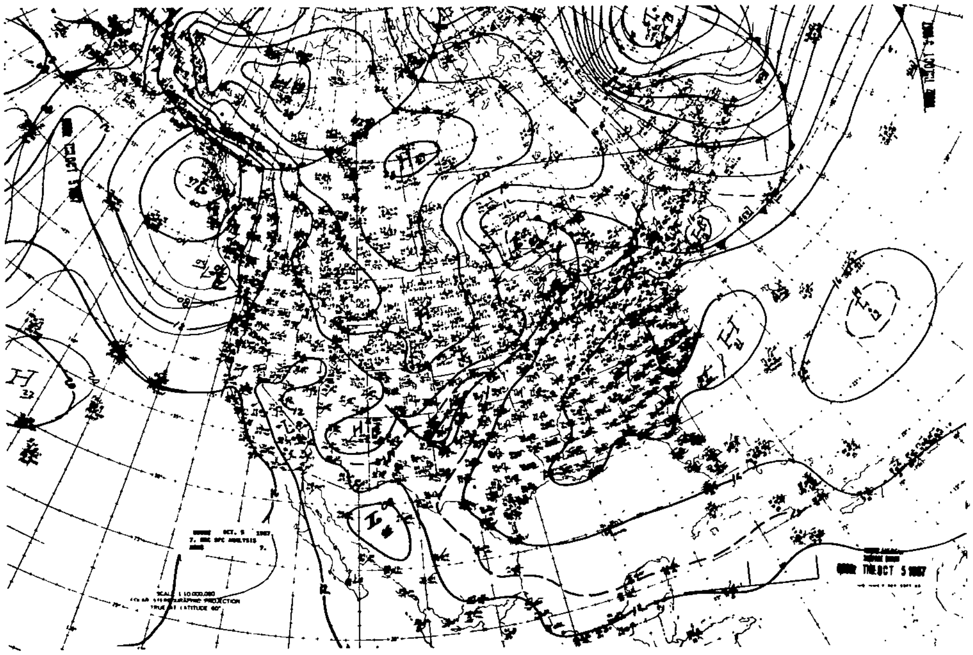

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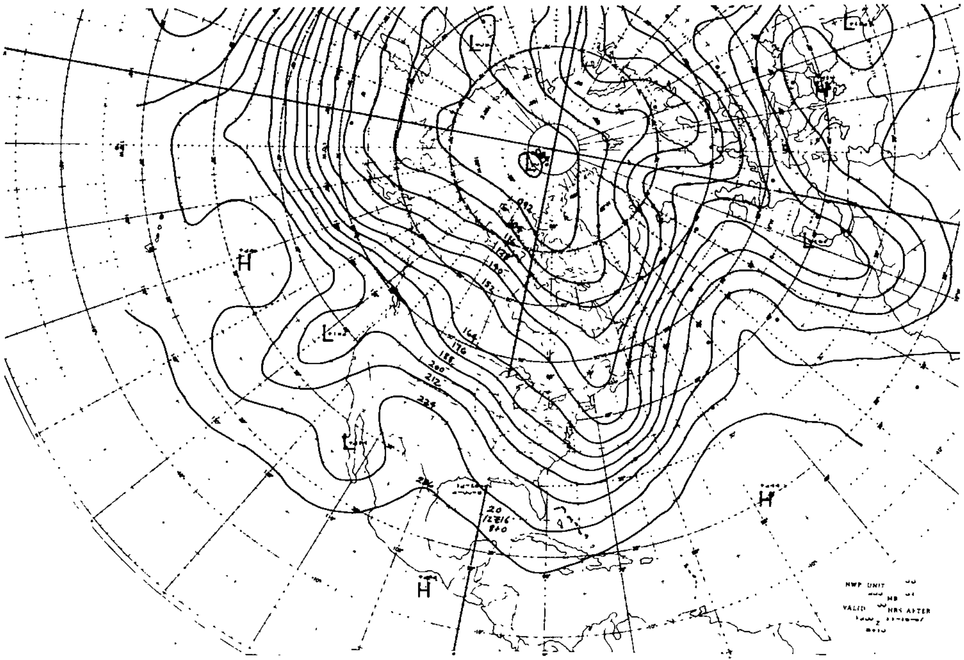

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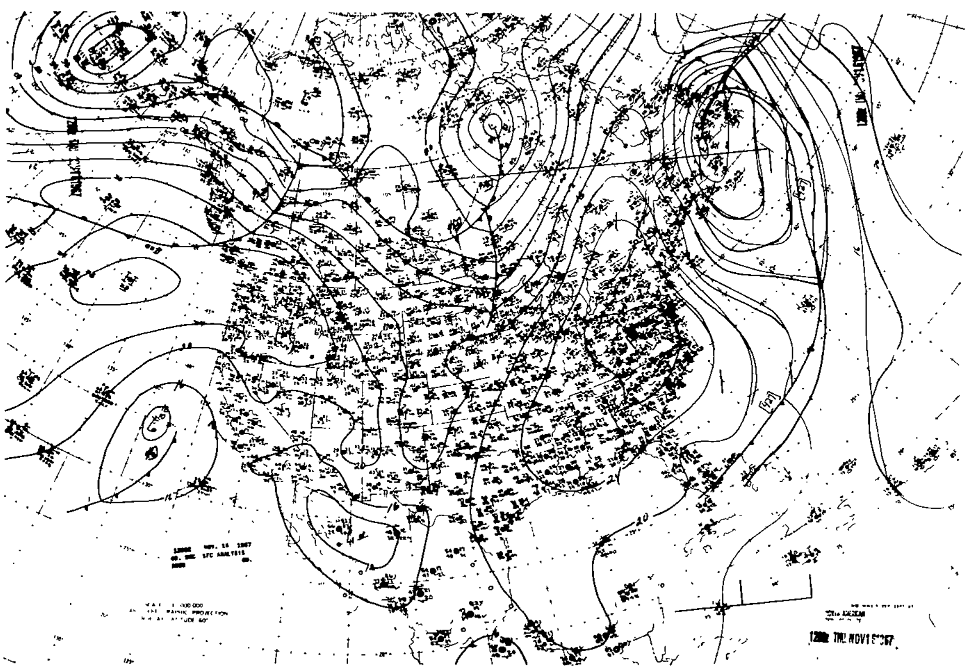

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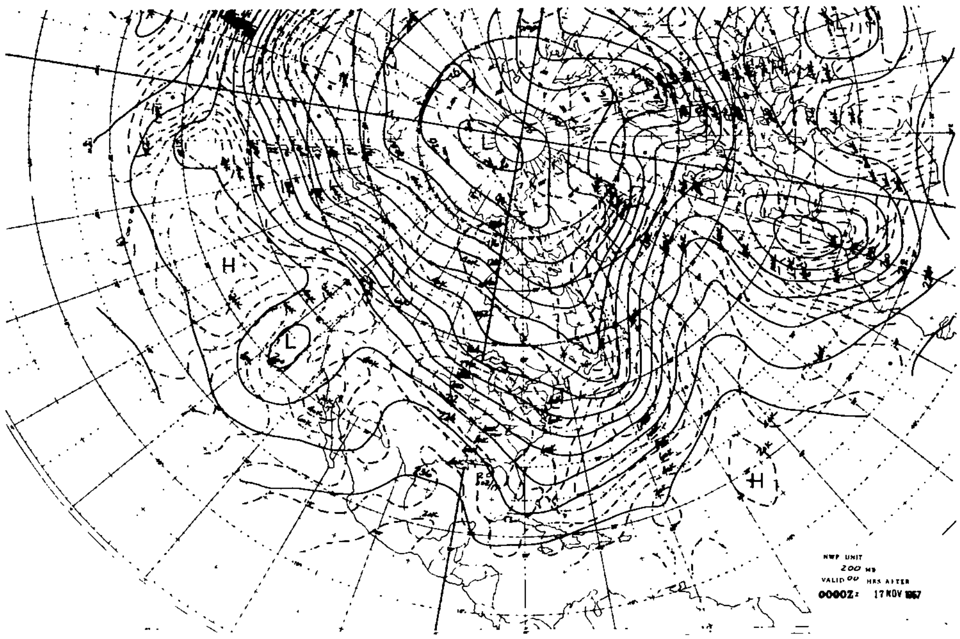

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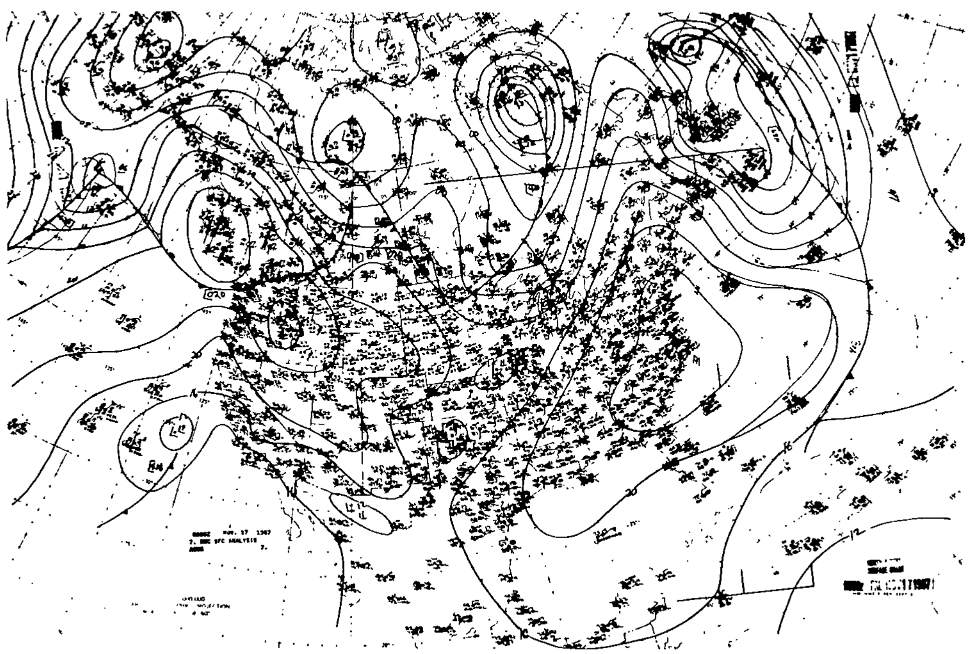

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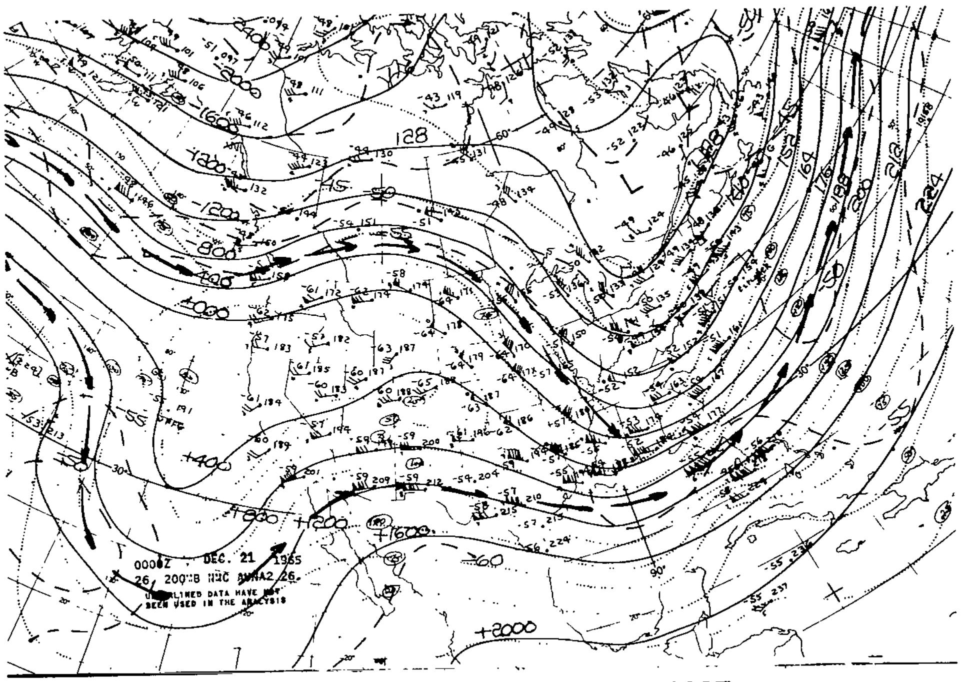

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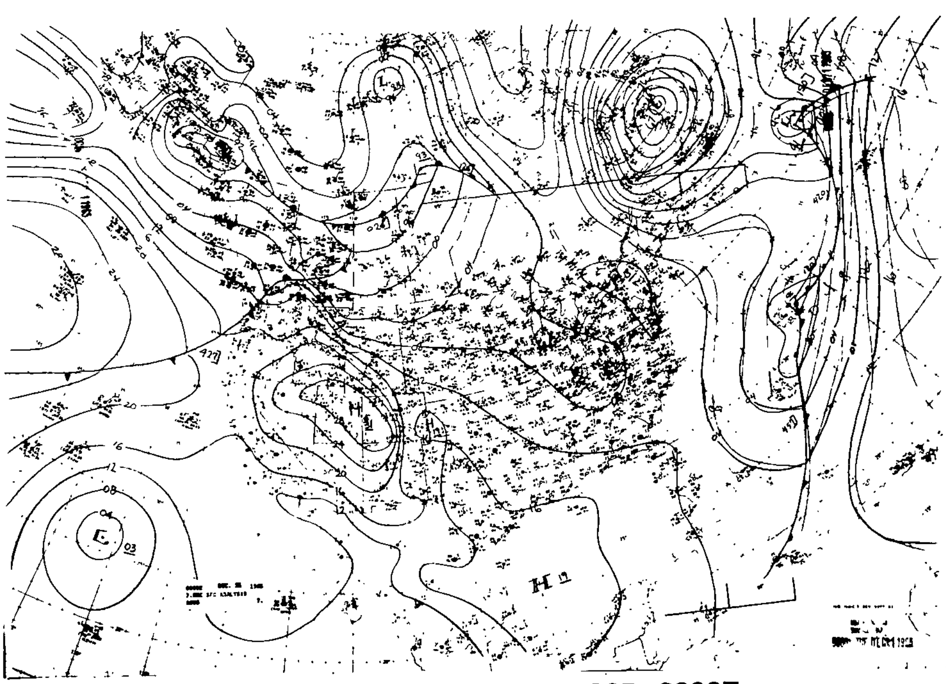

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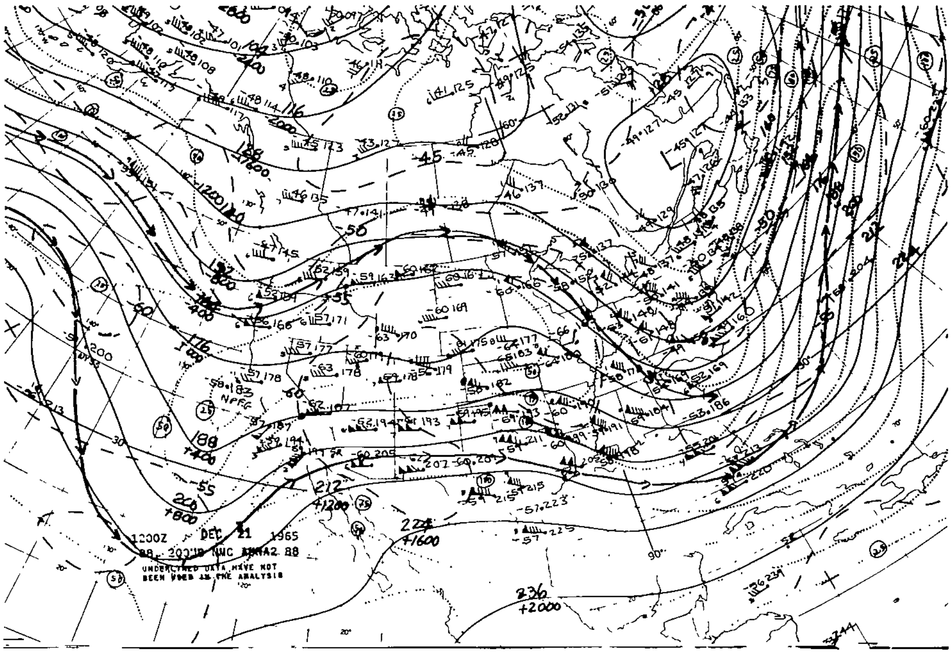

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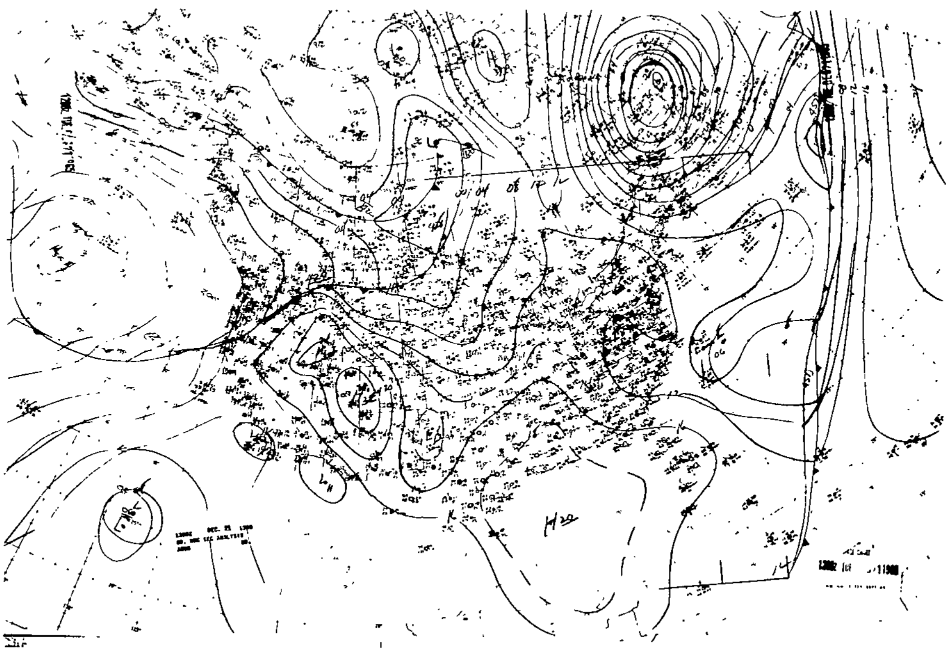

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16. ABSTRACT

Tropospheric flow and lower stratospheric flow as measured by 94 sequences of high-resolution Jimsphere balloon data are presented and discussed. The 70 and 24 sequential series are presented for the Kennedy Space Center, Florida, and Point Mugu, California, areas, respectively. Supplemental data, consisting of the associative temperature profiles and the surface and 200 mb synoptic maps, are also presented. The measurements are discussed relative to both the engineering and disciplinary areas. An initial subjective analysis of mesoscale features observed on some sequences is presented.

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