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WEATHER BUREAU

Weather Bureau Technical Memorandum PR-7

METEOROLOGICAL CHARACTERISTICS
OF THE COLD JANUARY 1969
IN HAWAII

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PACIFIC REGION
TECHNICAL MEMORANDUM PR-7

HONOLULU, HAWAII
November 1969



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1877
The following is a list of the names of the persons who were members of the
Board of Directors of the City of New York, during the year 1877.

1878
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Board of Directors of the City of New York, during the year 1878.

1879
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Board of Directors of the City of New York, during the year 1879.

1880
The following is a list of the names of the persons who were members of the
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1881
The following is a list of the names of the persons who were members of the
Board of Directors of the City of New York, during the year 1881.

1882
The following is a list of the names of the persons who were members of the
Board of Directors of the City of New York, during the year 1882.

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METEOROLOGICAL CHARACTERISTICS
OF THE COLD JANUARY 1969 IN HAWAII

ABSTRACT

A description is presented of the meteorological conditions that attended the unusually chilly weather experienced in Hawaii during January 1969.

INTRODUCTION

One of the most interesting and memorable meteorological characteristics of January 1969 in Hawaii was the occurrence of a prolonged period of abnormally cold weather for Hawaii. Most of the local residents, who are not acclimatized to below 60°F temperatures, shivered for over a week (January 20-27) in morning temperatures ranging in the mid 50's down to the high 40's. The temperature regime for the period is depicted in fig. 1. Most sought relief with extra blankets and quilts. Some rushed out and bought up the limited available supply of portable electric room heaters.

METEOROLOGICAL SITUATION

A succession of surface lows traversed from the northwest to as close as 500 miles of Oahu. Daily positions of significant synoptic features of the period are shown in figs. 2, 3, and 4. Frequent intrusions of cold air depressed the freezing level over Lihue to as low as 7300 feet. Precipitation associated with frontal passages was negligible. Post-frontal subsidence contributed toward stabilizing the lower atmosphere creating relatively cloud free skies. In addition, surface winds were generally light throughout the state. The advection of cold air aloft combined with radiational cooling near the surface caused local surface temperatures to drop to record minimums.

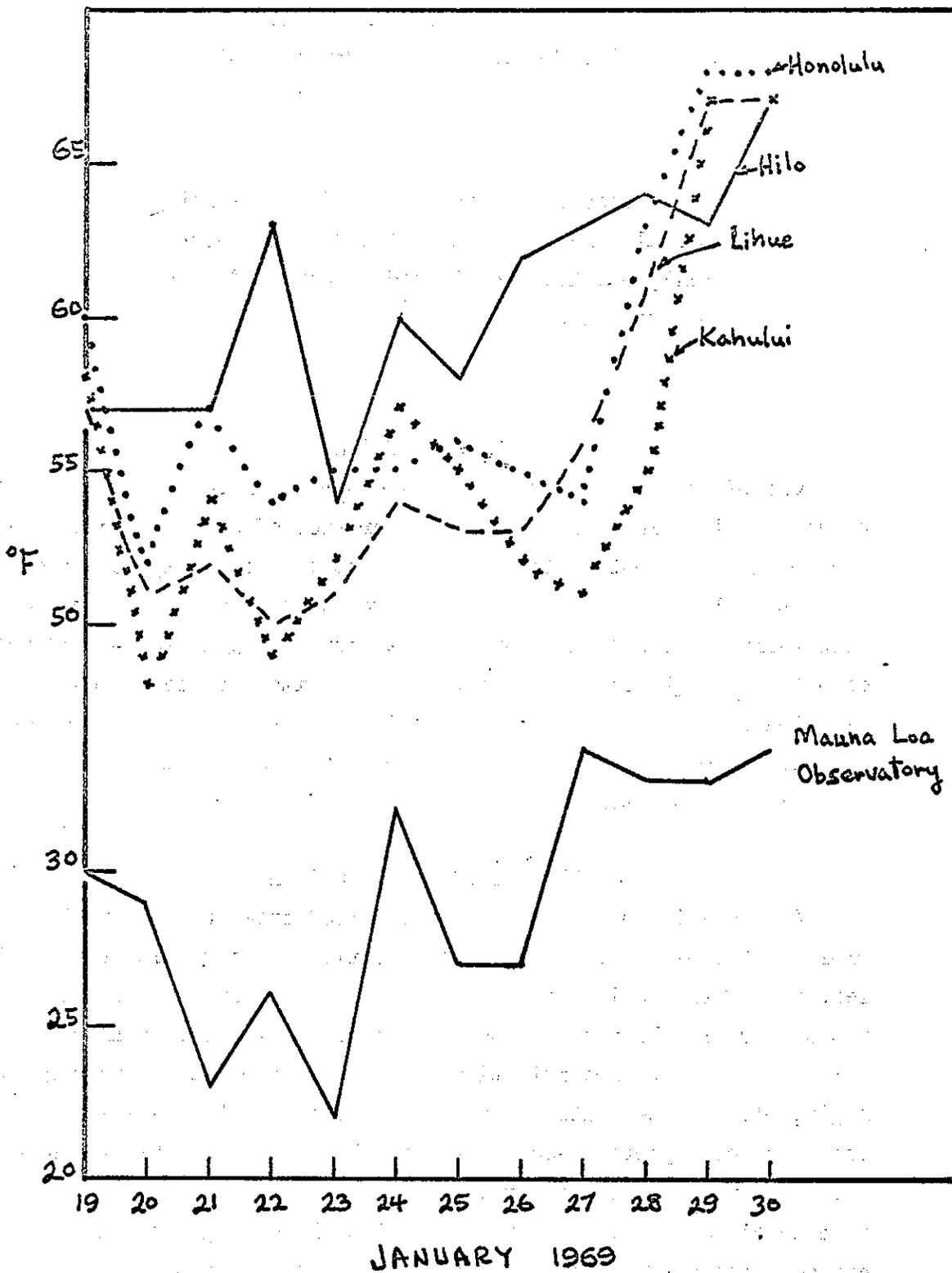


Fig.1. Daily minimum temperatures.

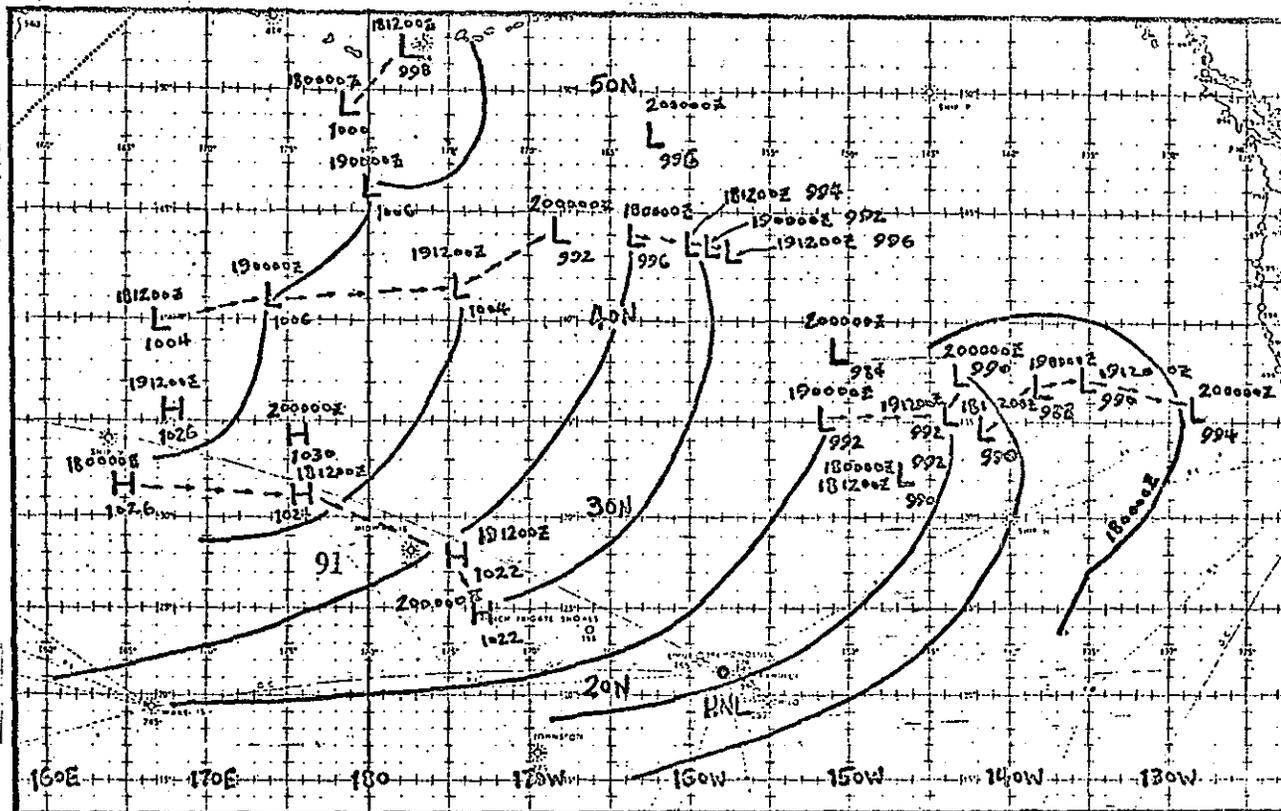


Fig.2. Surface high, low and frontal positions (January 18-20, '69).

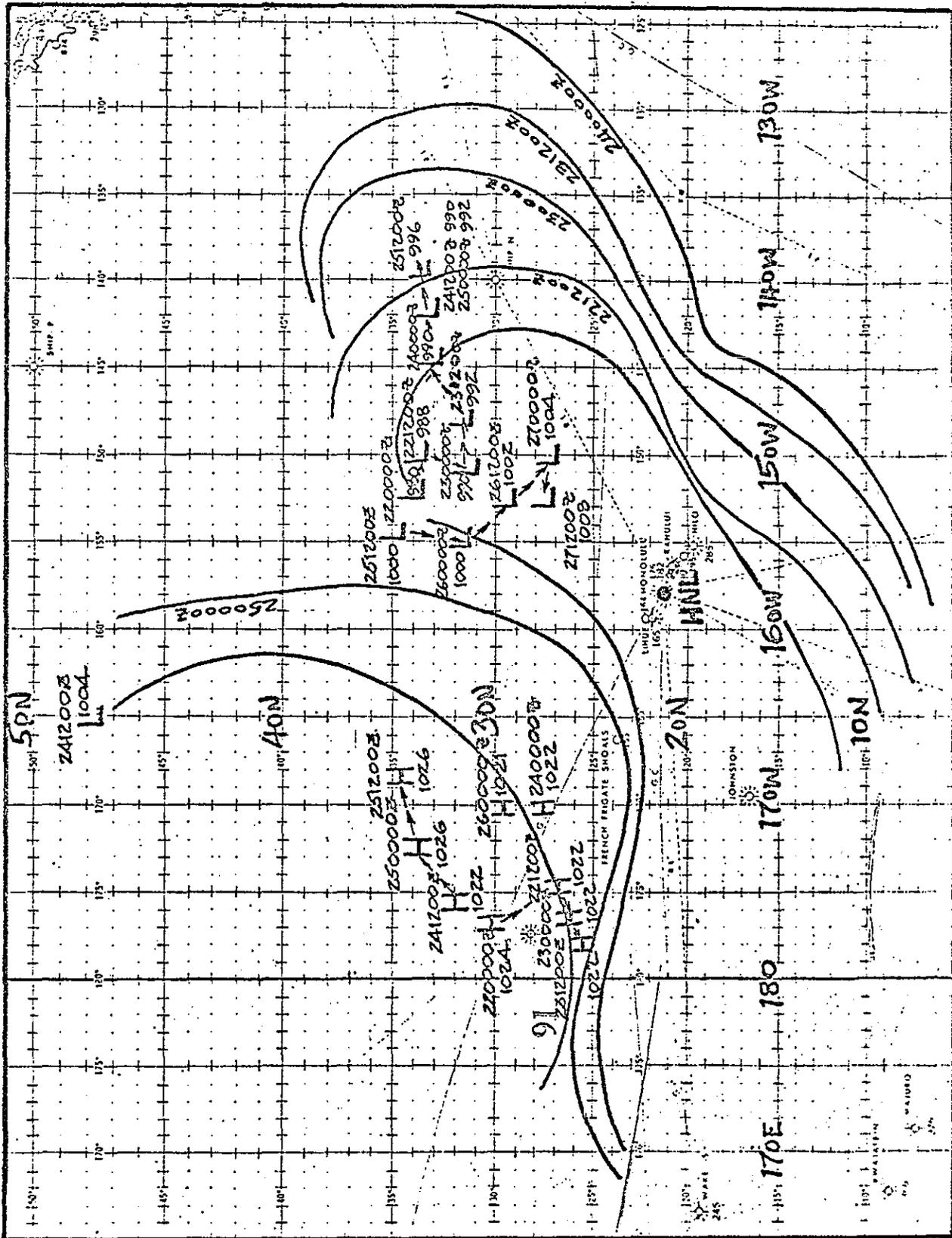


Fig. 4. Surface high, low and frontal positions (January 22-27, '69).

During the late evening of January 18 and the morning of January 19, a weak cold front emanating from a 992 mb. low situated about 900 miles north northeast of Oahu (see fig. 2) traversed through the northern and central islands of the Hawaiian chain bringing only a trace of rain at WBO Lihue, .03 inch at WBFO Honolulu, .02 inch at WBO Kahului and none at WBO Hilo. By the evening of January 19, sky conditions over the State had become scattered to clear and surface wind speeds had dropped to below ten knots. On January 20, the freezing level on the Lihue 2 a.m. IST sounding had dropped down to 9200 feet but the freezing level over Hilo remained up near 11,500 feet. On this same morning, Honolulu's previous all-time record low temperature of 54°F established on December 20, 1962, was superseded by a new all-time low of 52°F. Concurrently, Kahului's previous all-time record low established on January 6, 1952, was bettered by three degrees with a new reading of 48°F and the all-time record low of 51°F established on March 25, 1955 was equaled at Lihue.

On the evening of January 20, another weak cold frontal passage occurred (see fig. 3). Only .01 inch of rain fell at Lihue, .03 inch at WBFO Honolulu, .01 inch at Kahului and none at Hilo. The associated low with a central pressure of 990 mb. was situated approximately 900 miles north of Oahu. On the morning of January 21, there was no evidence of cold air reaching Hilo, however the minimum temperature at Mauna Loa Slope Observatory (elevation 11,146 feet) fell six degrees from 29°F the previous morning to 23°F, fig. 1, which indicated that cold air had reached the island of Hawaii at high levels ahead of the front. By the evening of January 21, sky conditions over the Hawaiian Islands, were, at most, scattered clouds and surface wind speeds averaged under ten knots. The following morning, on January 22, this new surge of cold air plummeted the freezing level over Kauai down to about 7300 feet after it had temporarily recovered to the 11,000-foot level earlier. This is one of the lowest if not the lowest freezing level ever experienced over the Hawaiian Islands. On the average, during the winter months, the freezing level has fallen below 10,000 feet less than five percent of the time (1). Lihue's all-time record

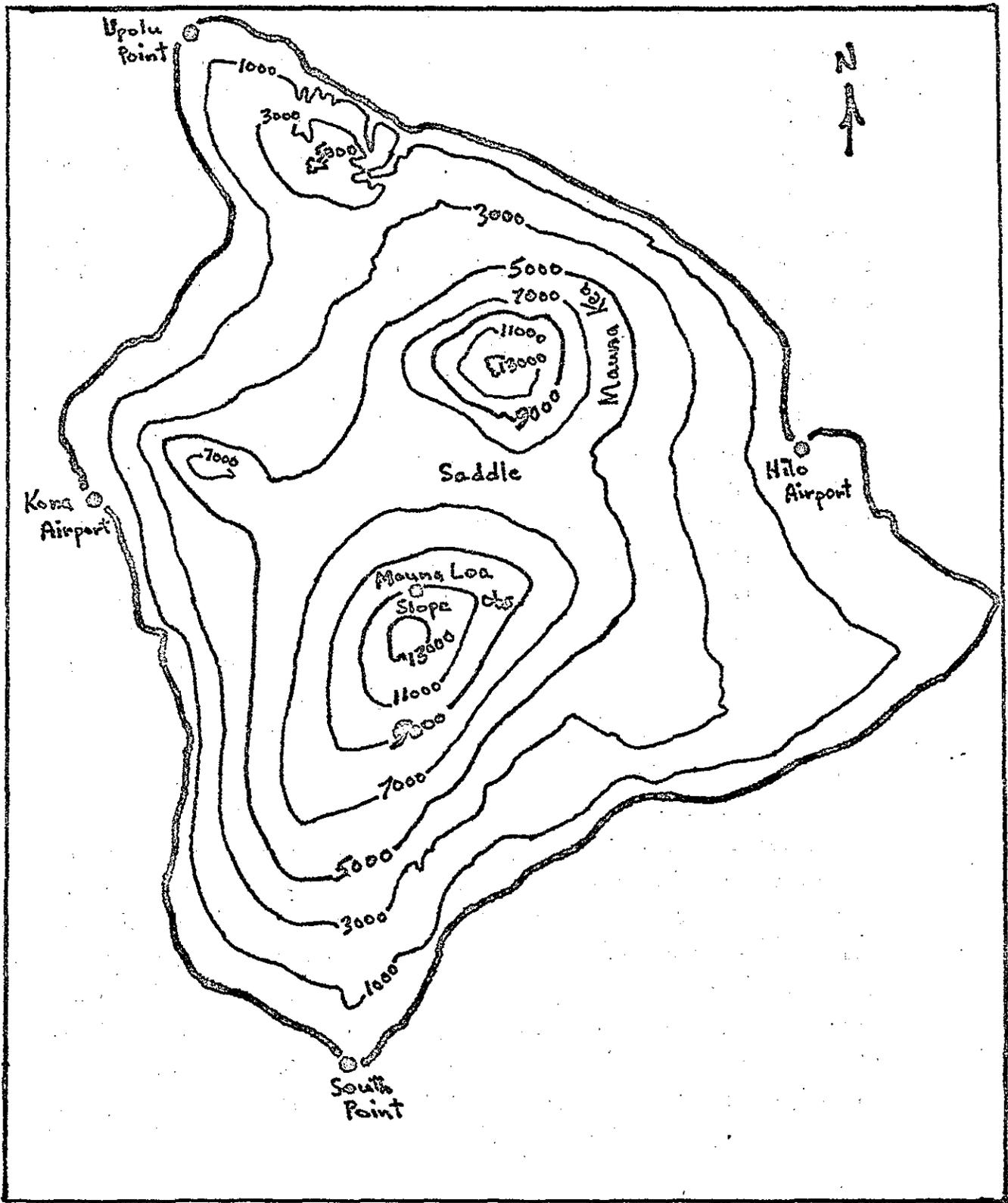


Fig. 5. Island of Hawaii.

low temperature was shattered by a measurement of 50°F. Kahului recorded a low of 49°F, just a degree short of equaling its record breaking all-time low established just two mornings previously but again surpassing its old record of 51°F. Honolulu equaled its old record with a reading of 54°F.

By the afternoon of January 22, Hilo's freezing level finally worked its way down to 8500 feet and on the morning of January 23, the temperature reading at WBO Hilo came to within one degree of equaling its record all-time low of 53°F set on February 21, 1962. The Mauna Loa Slope Observatory recorded a minimum temperature of 22°F after recovering to 26°F on the previous morning, fig. 1. Except for this one morning, Hilo's temperatures remained relatively warm compared to those of the other primary observing stations. The chilly air had not been advected quite far enough south and east to reach Hilo for the greater part of this cool spell. When it finally did approach the island of Hawaii, the large peaks of Mauna Loa and Mauna Kea, fig. 5, acted as a barrier to the predominately northwesterly surface flow, fig. 6, and the westerly upper air flow, fig. 9. Consequently, most of the air in the first few thousand feet was channeled through the "saddle" (elevation about 6000 feet) between these two great mountain masses and adiabatically warmed as it moved downslope before reaching Hilo. Cool weather continued on through January 27 with only Hilo escaping its extreme effects (see fig. 1).

It is interesting to note that all four primary observing stations, Lihue, Honolulu, Kahului and Hilo are situated at an elevation very close to mean sea level and within a distance of a mile from the ocean. The average sea surface temperature during this cold spell was 75°F, nearly equal to the January mean of 76°F. On the average, during the month of January, the sea surface temperature is about one degree warmer than the air temperature (1). However, during the hours of minimum temperatures of this protracted cold spell, a temperature differential of as great as 25°F existed between the adjacent land and ocean.

MEAN CIRCULATION PATTERNS

The mean sea level pressure chart for the period January 20-27, 1969, fig. 6, and the departure from mean sea level pressure chart for the same period, fig. 7, indicate abnormally low pressure over a large area northeast of the Hawaiian Islands. The central pressure of the mean low situated about 900 miles northeast of Oahu in fig. 6 is well below 1000 mb. and its departure from normal at the center (see fig. 7) is in excess of minus 20 mb. This deep low has replaced the normal 1022 mb. high pressure cell seen on the long-term mean sea level pressure chart for January, fig. 8. The average 250 mb. streamline-isotach chart (January 20-27, 1969), fig. 9, indicates that the upper winds over and in the vicinity of the Hawaiian Islands are directly from the west with a jet stream core in excess of 100 knots lying over or just to the north of the State. The average radiosonde sounding at Lihue, fig. 10, has a freezing level at about 10,600 feet with a Showalter stability index calculated at about plus 10. The average Hilo sounding, fig. 11, has a freezing level at about 11,800 feet with a Showalter index of about plus 9.

CONCLUSION

The author has attempted to portray the sequence of events during this prolonged period of abnormally cold weather for Hawaii in terms of a narrative and graphical chronological description of the associated significant synoptic features as well as in terms of mean charts. This study is by no means an exhaustive one and does not offer answers to inquiries such as the frequency of occurrence, the probability of future occurrence, or the possibility of prolonged cold periods in Hawaii occurring as a result of conditions other than discussed here. However, it is hoped that the information presented in this paper will assist the forecaster in recognizing synoptic situations which may foretell events similar to those of the unusually cold period of January 1969 in Hawaii.

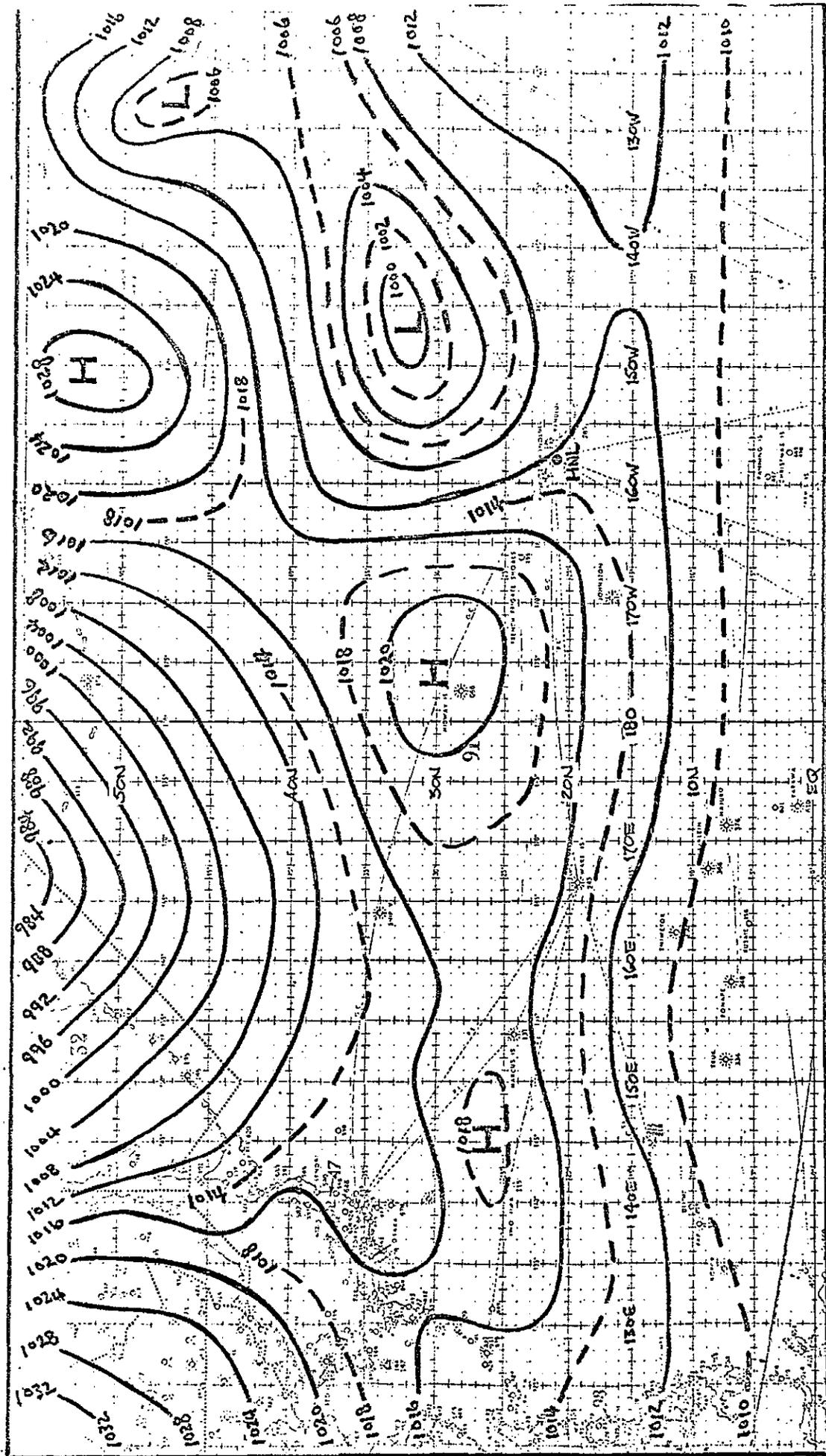


Fig. 6. Mean sea level pressure chart (January 20-27, 69).

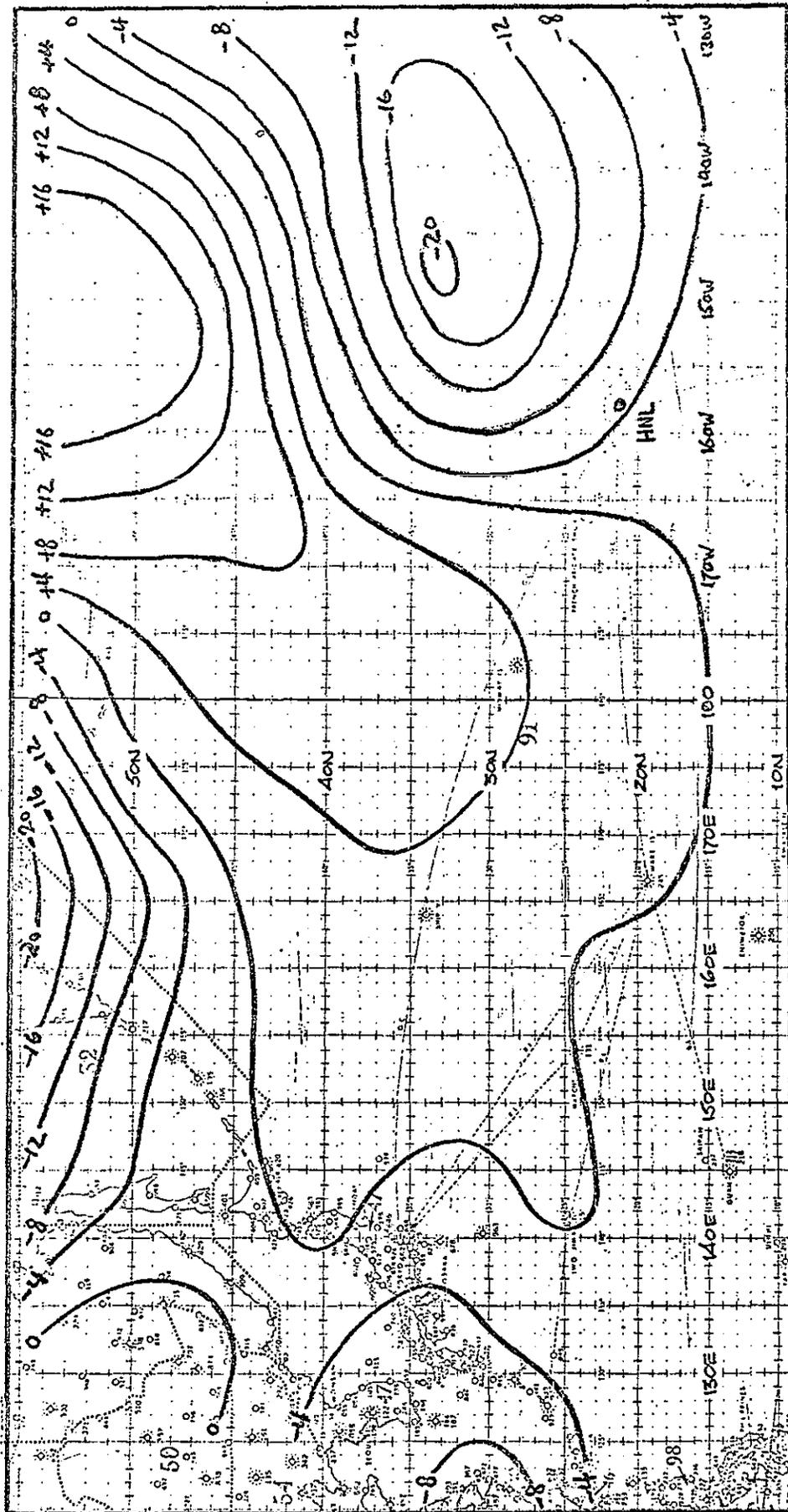


Fig. 7. Departure from mean sea level pressure chart (January 20-27, '69).

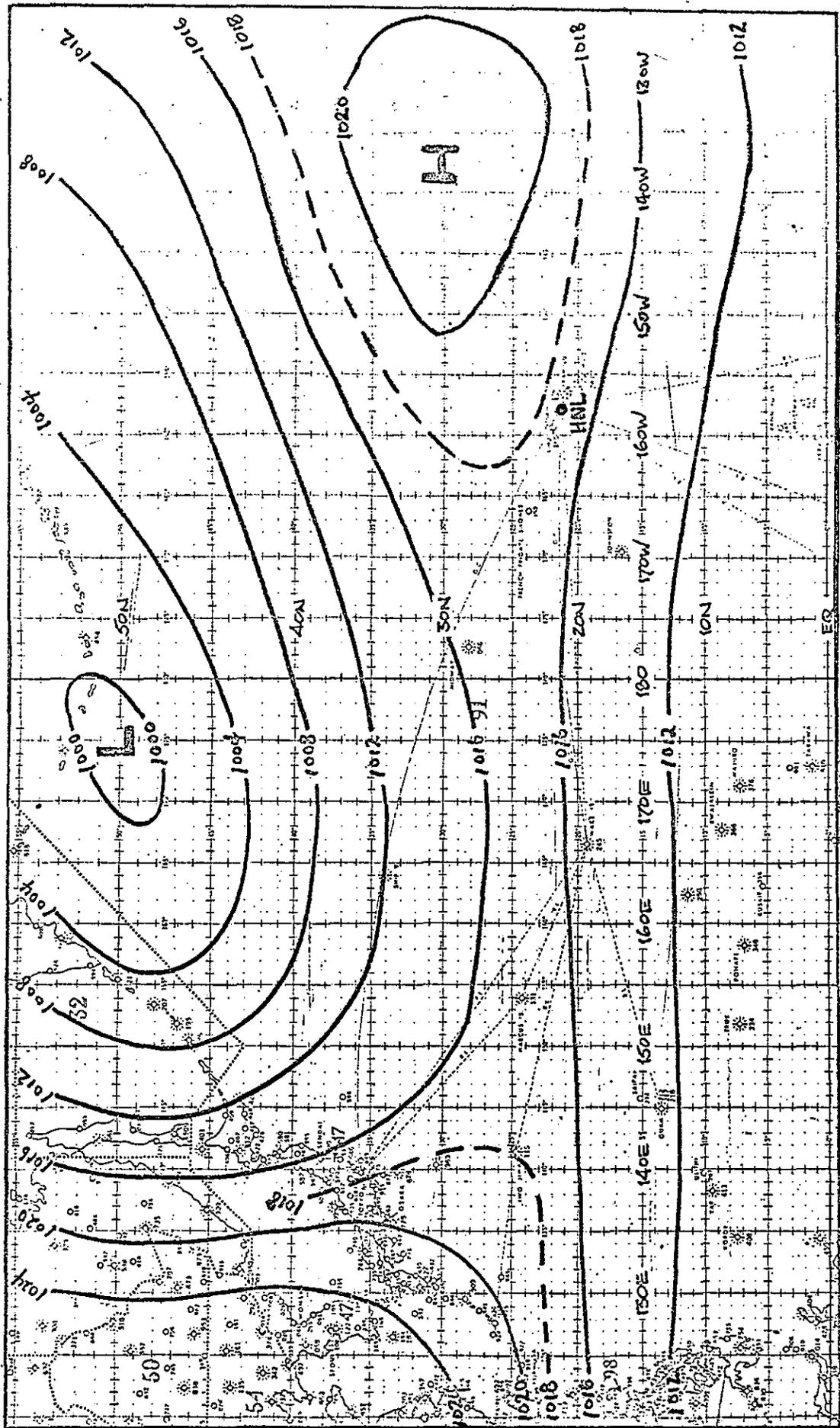


Fig. 8. Mean sea level pressure chart (January).

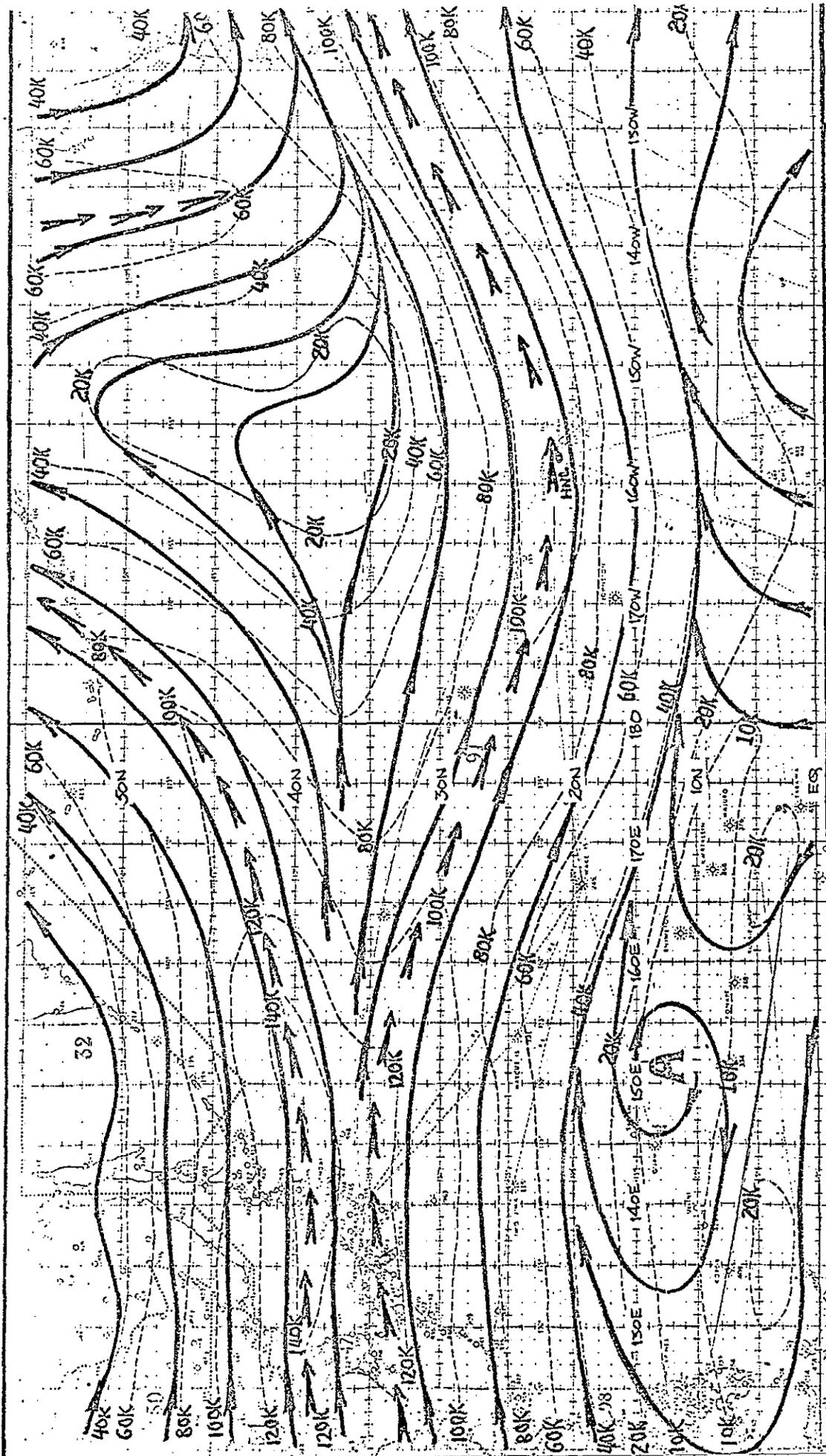


Fig. 9. 250 mb streamline-isotach chart
(January 20-27, 69).

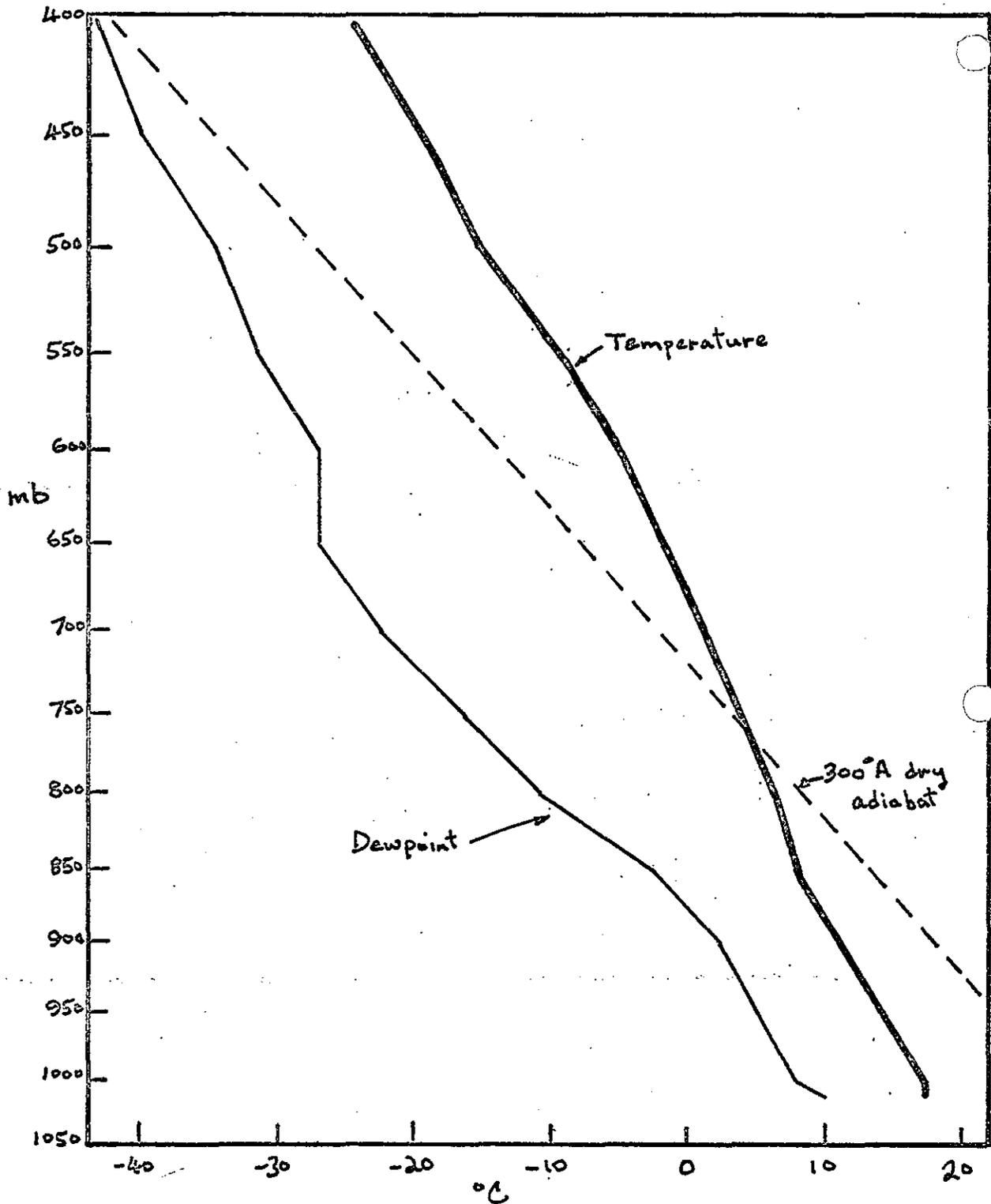


Fig. 10. Lihue average temperature and dewpoint (Jan 20-27, '69) sounding.

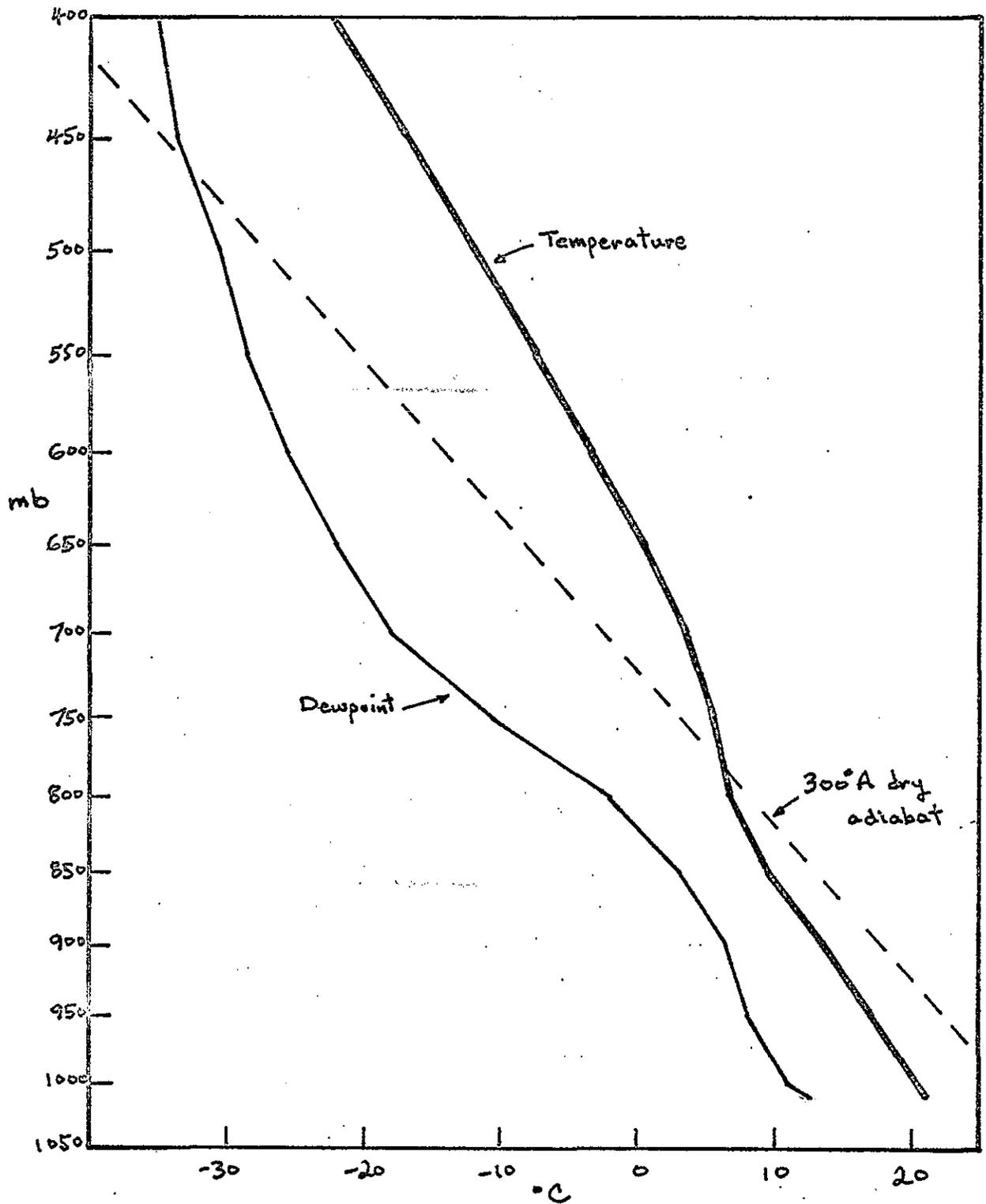


Fig.11. Hilo average temperature and dewpoint (Jan 20-27, '69) sounding.

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1. U. S. Navy Marine Climatic Atlas of the World. Vol. II North Pacific Ocean. NAVAER 50-1C-529. Washington: Government Printing Office.