CYCLOGENESIS

EDUCATIONAL MODULES

FOR THE

ATMOSPHERIC SCIENCES

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University of Wisconsin-Madison
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INTRODUCTION

In this education module the life cycle of a mid-latitude cyclone that occurred over the central United States on 12-13 May 1978 is portrayed and studied. The module combines conventional methodology of synoptic laboratory courses with a view of the cyclone structure and evolution displayed through video computer systems. This view of the cyclone evolution is displayed through sequences of atmospheric structure analyzed from conventional data sources and from geosynchronous satellite images of cloud forms.

This module is designed for use in an introductory synoptic laboratory course. The utilization of the module assists students in the development of analysis skills in addition to introducing new methods of studying atmospheric phenomena through the use of video computer systems. The module is designed to be used over a four to ten week period within the course of a semester, providing several options in length and academic level which give it great flexibility.

The module incorporates a variety of data sources and display techniques in analyzing a case of dramatic cyclogenesis. A videocassette provides loops of satellite imagery as well as video computer analysis of atmospheric fields, while a map package contains analyzed and unanalyzed maps of conventional and computer derived data. An accompaniment guide to the videocassette, a synoptic discussion of the case for student use and a manual for instructor use are also included in this module package.

The academic level of this investigation into the spatial and temporal evolution of the mid-latitude cyclone assumes that introductory courses in atmospheric dynamics and thermodynamics have been completed. Dynamical concepts range in difficulty from mass continuity, which relates divergence with vertical motion, to quasi-geostrophic theory. Many of the derived quantities in the computer generated fields stem from approximations of terms in the omega and height tendency equations (Holton, 1979). The cyclone structure also presents an excellent example of jet streak dynamical concepts. The location of the developing surface low in relation to the upper tropospheric jet streak, the very evident dry (clear) tongue, and the location of the developing thunderstorm line can be related to the ageostrophic mass/momentum adjustments throughout the troposphere (Reiter, 1963, Palmen and Newton, 1969, and Uccellini and Johnson, 1979). The use of isentropic analyses (optional) in part of the module requires student familiarity with atmospheric thermodynamics. Strong gradients of temperature and moisture along the hyperbaroclinic zone transecting the cyclone are clearly depicted in isentropic coordinates. Through the use of cross-sectional and isentropic analyses that are included in this module, principles of dyanamics and thermodynamics can be developed and expanded for a wide range of academic levels. A number of classroom approaches to the module utilization are possible. The map package should be used to develop analysis skills, although all unanalyzed maps need not be assigned. To realize the full benefit of this study of the spatial and temporal evolution of the cyclone, surface, upper air (both pressure and isentropic surfaces) and derived fields should be analyzed for a number of time periods. During the development of the module at the University of Wisconsin-Madison students in the synoptic laboratory class analyzed approximately 35 maps. The remainder of the map package contents were distributed in an analyzed state.

Allowing student access to the videocassette and incorporating it into classroom discussion will provide a visualization and more complete understanding of the physical and dynamical processes involved in cyclogenesis. At the

University of Wisconsin-Madison the videocassette was shown in class early in the semester to introduce students to the case. Frequent references to specific segments of the videocassette were made throughout the semester. Students were encouraged to use a videotape system outside of the classroom (by appointment) to view and study the cyclone and its evolution. Finally, near the end of the semester the videocassette was again shown to the entire class as part of an extensive case study discussion.

II. Description of the Module Contents

This module provides a comprehensive view of the cyclogenetic event using a variety of resources. The innovative resource contained in this module is a 25 minute videocassette showing images displayed using the Man-computer Interactive Data Access System (McIDAS) video computer at the Space Science and Engineering Center at the University of Wisconsin-Madison. An Accompaniment Guide to the videocassette indicates the sequence of images, technical information about the fields displayed (units, contour spacing, etc.) and a brief description of important meteorological features. This manual, the third component of the module, contains; 1) a brief summary of the synoptic events of 12-13 May 1978 cyclone, 2) a large selection of maps for student analysis and study, and 3) a questionnaire in which students evalute the educational value of the module and offer suggestions for improvement.

III. Videocassette Discussion

McIDAS, which has the capability of superimposing analyzed fields of meteorological data over satellite imagery permitting the sequential looping of the analyses and images, was used to construct the imagery for the videocassette contained in this module. Through the utilization of videocassettes in atmospheric science education, the temporal evolution and multidimensional structure of the atmosphere and its processes are vividly displayed. The following is a list of the analyses and images presented on the videocassette:

<u>Satellite imagery</u>

Infrared
Enhanced infrared

<u>Surface features with satellite images</u>

Pressure
Pressure and banded temperatures
Streamlines
Streamlines and banded temperatures
Temperature advection
Streamlines and banded dewpoints
Mixing ratio advection
Weather symbols

<u>Upper air features with satellite images</u>

500 mb heights and temperatures
500 mb heights and isotachs
500 mb streamlines and absolute vorticity
300 mb divergence and isotachs
850 mb heights and temperatures

<u>Surface and upper air features with satellite images</u>

300 mb divergence and surface streamlines
500 mb vorticity advection and surface streamlines
500 mb heights and sea level pressure
500 mb streamlines and surface streamlines

<u>Cross Section</u>

Bismark, North Dakota to Jackson, Mississippi

<u>Isentropic surfaces with satellite images</u>

300 (305) K with pressure, streamlines and mixing ratio
320 K with pressure, streamlines and isotachs

IV. SYNOPTIC DISCUSSION

A. The Case Study

In early May, 1978, the polar vortex over North America was located near the Arctic Circle at about 90°-100° west longitude. As often occurs in the spring months, a series of short wave troughs in the upper troposphere were crossing the United States and bringing precipitation to the central and eastern parts of the country. From May 6-9 a large closed low at 500 mb moved from the southwestern United States to Quebec, Canada, and produced widespread rainfall across the U.S. east of the Rocky Mountains. With the movement of the system to the east coast, a series of two short wave troughs approached the west coast of the U.S. The first moved to the upper Great Plains by May 11 and proceeded northeastward into Canada. The second, located over the intermountain region of the western U.S. on May 11, intensified rapidly over the next two days and developed into a major cyclone.

B. Synoptic Description

Surface and upper air features for 1200 GMT May 12 through 1200 GMT May 13 (12 hour interval) are shown in Figures 1 and 2. At 1200 GMT May 12 the surface map (Fig. 1a) indicates the presence of three low pressure centers in the central United States. The low in southeastern Wisconsin is associated with the dissipating short wave trough in the upper Great Plains. The surface low in extreme eastern South Dakota on May 12 had formed in Wyoming in the lee of the Rocky Mountains on May 11 and drifted slowly eastward. The lower tropospheric circulation associated with this pattern transported large quantities of moist subtropical air from the Gulf of Mexico into the central United States. At 500 mb (Fig. 2a), cold advection into the trough located along the eastern edge of the Rocky Mountains was associated with amplification of the

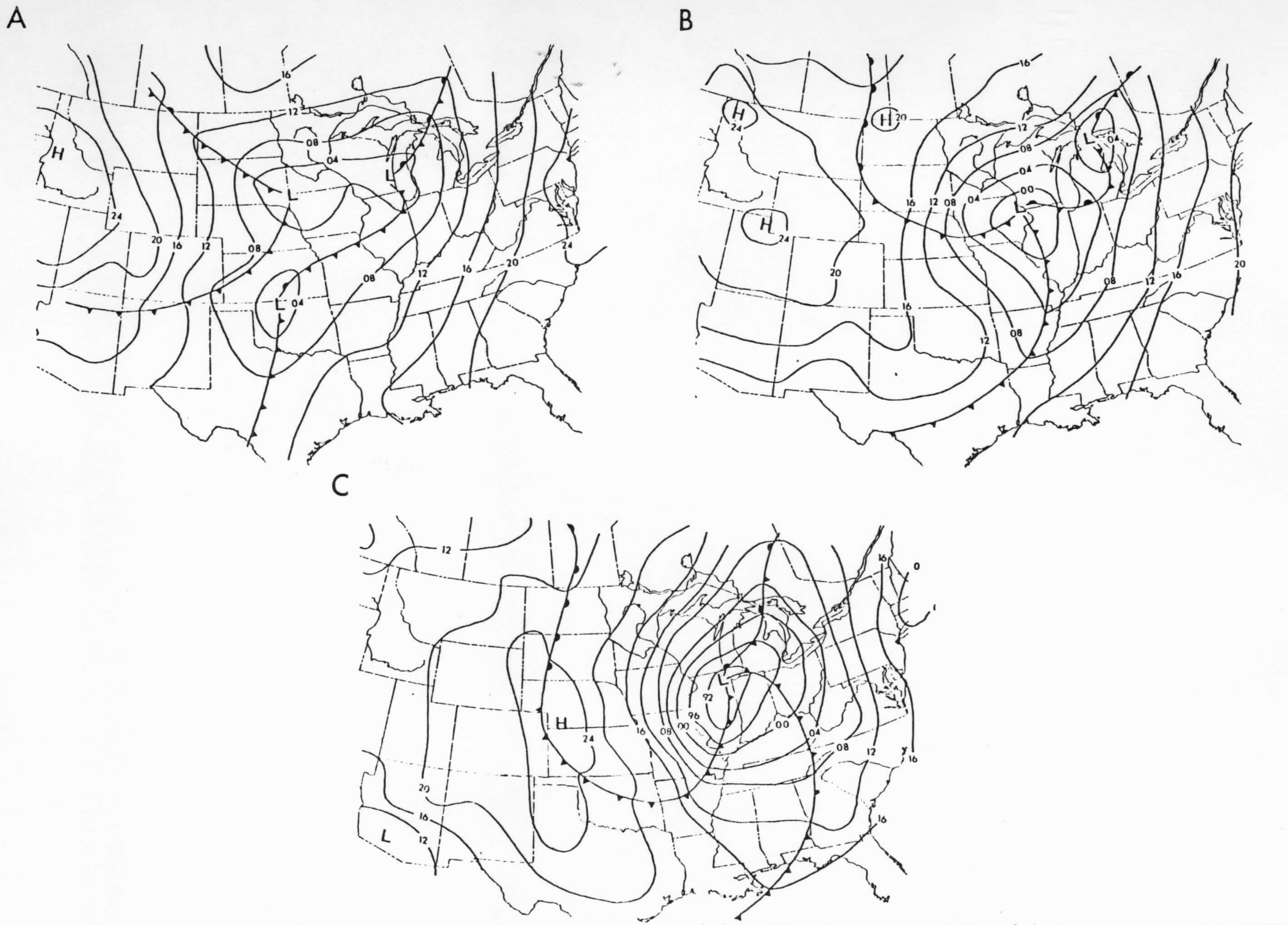

Figure 1: Surface isobars (solid: every 4 mb) and fronts from (A) 1200 GMT May 12, 1978, (B) 0000 GMT May 13, 1978, and (C) 1200 GMT May 13, 1978.

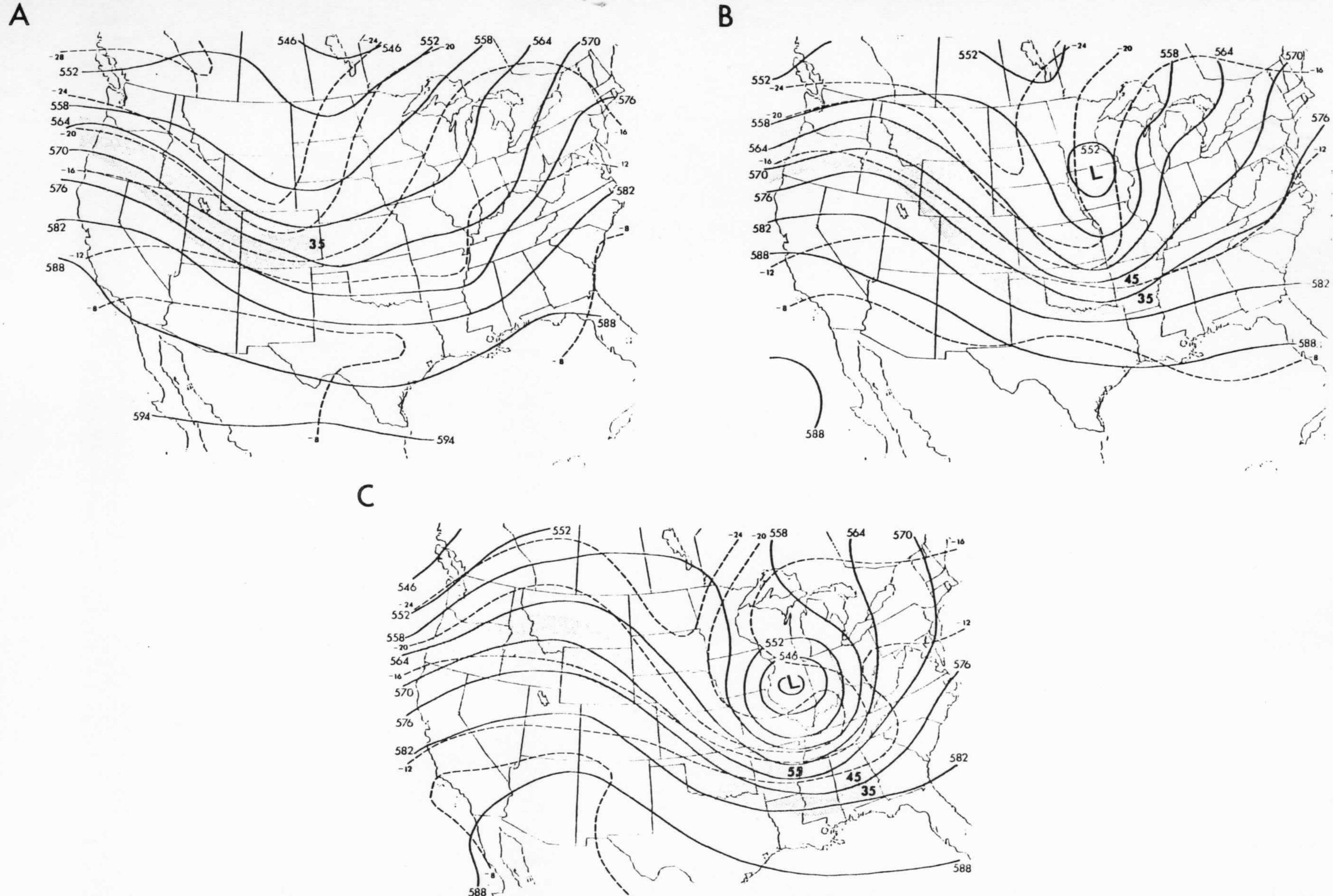

Figure 2: 500 mb height contours (solid: every 6 gpdm), isotherms (dashed: every 4°C) and isotachs above 35 m/s from (A) 1200 GMT May 12, 1978, (B) 0000 GMT May 13, 1978 and (C) 1200 GMT May 13, 1978.

short wave. The 35 m/s isotach of the 500 mb winds indicates the leading edge of the upper tropospheric jet streak located over eastern Colorado which was moving into the bottom of the trough. At this time the location of the 500 mb positive vorticity advection maximum was still to the west of the surface cyclone and a broad area of upper tropospheric divergence associated with shower and thunderstorm activity stretched from South Dakota to Kansas. With the vorticity advection, intensification of the hyperbaroclinic zone through a deep layer of the atmosphere and the amplification of the upper tropospheric short wave, the storm was an excellent example of "self development" (Palmen and Newton, 1969).

During the daytime hours of May 12 the surface low over eastern South Dakota became the dominant circulation center. As it moved across Iowa the cyclone matured while deepening to 998 mb by 0000 GMT May 13 (Fig. 1b). The 500 mb trough amplified dramatically and developed a closed circulation located over central Iowa (Fig. 2b). With the leading edge of the upper tropospheric jet streak rounding the base of the 500 mb trough (Fig. 2b) the region of strongest upper tropospheric divergence depicted by both the McIDAS 300 mb divergence and 500 mb vorticity advection fields, was located over Iowa. Satellite imagery indicated a clear (dry) tongue of air associated with the jet streak entering the region behind the intense squall line that had rapidly developed along the Mississippi River Valley. In addition to numerous reports of large hail and damaging winds over 20 tornadoes were reported across an eight state region.

Between 0000 GMT and 0900 GMT May 13 the surface cyclone's central pressure decreased 9 mb to 998 mb. By 1200 GMT May 13 the surface center, now located in north central Illinois (Fig. 1c), was entering the early occlusion stage with cooler, drier air behind a secondary cold front moving cyclonically around the surface center to the south. Satellite imagery and upper air data from 1200 GMT May 13 showed the dry air wedge had now entered into the cyclone circulation center from the southwest. Although some vertical tilt to the storm system remained, the upper tropospheric jet streak had moved around the base of the closed 500 mb low (Fig. 2c) and the coldest air aloft was now located in the base of the trough.

Over the next 24 hours the cyclone reached full occlusion and weakened slowly. With its slow eastward movement, the surface and upper air centers became vertically aligned and the cold air in the mid-troposphere was located directly over the surface circulation center. Thus, the full life cycle of a mid-latitude cyclone was completed; from inception in the lee of the Rocky Mountains, to intensification over the Mississippi River Valley and finally, dissipation over the eastern United States.

V. Map Package Contents

An extensive series of maps and radiosonde data prepared from conventional data are supplied with the module (see Appendix A). This series includes surface, isobaric, isentropic and radar charts. Additionally, gridded fields of McIDAS derived quantities and a set of hand analyzed charts for the period 12 May 1200 GMT to 13 May 1200 GMT are provided. The following is a list of the maps provided with the module.

Maps Provided with Cyclogenesis Module

1. Analyzed Charts (those noted below)

2. Surface Charts

    a. 12 May 1200 GMT*
    b. 12 May 1800 GMT*
    c. 13 May 0000 GMT*
    d. 13 May 0600 GMT*
    e. 13 May 1200 GMT*

3. Isobaric Charts
    300 mb, 500 mb, 700 mb, 850 mb

    a. 11 May 1200 GMT
    b. 12 May 0000 GMT
    c. 12 May 1200 GMT*
    d. 13 May 0000 GMT*
    e. 13 May 1200 GMT*
    f. 14 May 0000 GMT
    g. 14 May 1200 GMT

4. Isentropic Charts
    5°K interval

a.	11 May 0000 GMT	300 - 305 K	
b.	11 May 1200 GMT	300 - 305 K	
c.	12 May 0000 GMT	300 - 305 K	
d.	12 May 1200 GMT	290 - 325 K	305 K analyzed
e.	13 May 0000 GMT	290 - 325 K	305 K analyzed
f.	13 May 1200 GMT	290 - 320 K	305 K analyzed

5. Radar Charts/NMC Facsimile Product

    a. 12 May 1035 GMT
    b. 12 May 1735 GMT
    c. 12 May 2335 GMT
    d. 13 May 0535 GMT
    e. 13 May 1435 GMT

6. Isentropic Cross Sections
    HON -OMA -UMN -LIT -JAN -BVE

    a. 12 May 1200 GMT*
    b. 13 May 0000 GMT*
    c. 13 May 1200 GMT*

*hand analyzed copy included

7. McIDAS Derived Fields

a. 12 May 1200 GMT
- 850 mb temperature advection
- 850 mb divergence
- 700 mb temperature advection
- 700 mb divergence
- 700 mb vorticity advection
- 500 mb temperature advection
- 500 mb divergence
- 500 mb vorticity advection
- 300 mb divergence
- 300 mb vorticity advection

b. 13 May 1200 GMT
- 850 mb temperature advection
- 850 mb divergence
- 700 mb temperature advection
- 700 mb divergence
- 700 mb vorticity advection
- 500 mb temperature advection
- 500 mb divergence
- 500 mb vorticity advection
- 300 mb divergence
- 300 mb vorticity advection

8. Radiosonde data

VI. MODULE EVALUATION

This module, developed over the past 18 months, is an experiment in the development of new educational resources in atmospheric science. The new resources expand upon the traditional case study by incorporating videocomputer technology to display the evolution of atmospheric structure through use of satellite imagery and meteorological fields. An important need in development is feedback from instructors and students to evaluate the utility of new educational resources and to facilitate improvements in content and quality. A questionnaire is included in this manual for distribution to participating students.

MODULE EVALUATION: CYCLOGENESIS

This questionnaire is provided to allow you to express your opinion on the effectiveness of this module as a teaching device in the atmospheric sciences. Your answers to the following questions, and any additional comments you may have, will help to determine if the videotape meets this goal or if changes are necessary. When answering the following questions, please write legibly and express your opinion fully. Thank you.

1) Do you feel the videotape presents the material in a logical manner?

YES ____

NO ____

COMMENT:

2) Did the pace of the videotape segments listed below allow you to distinguish important features of the satellite imagery and derived fields? Please comment on specific fields that you would change.

	FAST	ALL RIGHT	SLOW
SURFACE FIELDS	____	____	____
UPPER AIR FIELDS	____	____	____
COMBINED FIELDS	____	____	____

COMMENT:

MODULE EVALUATION: CYCLOGENESIS

3) The overall pace of the videotape was:

MUCH TOO FAST ____

SOMEWHAT TOO FAST ____

JUST RIGHT ____

SOMEWHAT TOO SLOW ____

MUCH TOO SLOW ____

COMMENT:

4) The visual quality of the videotape was:

VERY GOOD ____

ACCEPTABLE ____

NEEDS IMPROVEMENT ____

WHAT IMPROVEMENTS ARE NEEDED?

MODULE EVALUATION: CYCLOGENESIS

5) Did the accompaniment guide aid in your understanding of the videotape contents?

YES ____

SOMEWHAT ____

NO ____

COMMENT:

6) Would a voice narration help in your understanding of the videotape contents?

YES ____

NO ____

DON'T KNOW ____

COMMENT:

MODULE EVALUATION: CYCLOGENESIS

7) In helping you to visualize the processes that occur in the atmosphere, the videotape was:

VERY BENEFICIAL ____

HELPED SOMEWHAT ____

DID NOT HELP ____

COMMENT:

8) As an aid to understanding material presented in this course the videotape was:

VERY HELPFUL ____

HELPED SOMEWHAT ____

DID NOT HELP ____

COMMENT:

MODULE EVALUATION: CYCLOGENESIS

9) If you were teaching this course would you use this videotape in your class?

DEFINITELY ____

YES, WITH EXCEPTIONS ____

NO ____

COMMENT:

10) Is there some way you would change the sequences of images or the looping structure to improve the videotape?

YES ____

NO ____

COMMENT:

MODULE EVALUATION: CYCLOGENESIS

11) Are there any synoptic fields or other features that you feel should be added or deleted on the videotape? Why?

ADDED:

DELETED:

12) Are there any other suggestions to improve this module (videotape, accompaniment guide, synoptic discussion, map package)?

COMMENT:

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Bjerknes, J., 1951: Extratropical cyclones. Compendium of Meteorology (ed. T. F. Malone), American Meteorology Society, Boston, MA, 577-598.

Haltner, G. J., and Frank L. Martin, 1957: Dynamical and Physical Meteorology, McGraw-Hill, New York.

Holton, J. R., 1979: An Introduction to Dynamic Meteorology. Academic Press, New York.

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Reiter, Elman R., 1963: Jet Stream Meteorology, The University of Chicago Press, Chicago, Chapters 4 and 6.

Uccellini, L. W., and D. R. Johnson, 1979: The coupling of upper and lower tropospheric jet streaks and implications for the development of severe convective storms. Mon. Wea. Rev., 107, 682-703.

Wallace, J. M., and Peter V. Hobbs, 1977: Atmospheric Science, Academic Press, New York.

APPENDIX A

CASE STUDY MAP PACKAGE

1. Analyzed Charts

Surface Charts
a. 12 May 1200 GMT
b. 12 May 1800 GMT
c. 12 May 0000 GMT
d. 13 May 0600 GMT
e. 13 May 1200 GMT

Isobaric Charts
300 mb, 500 mb, 700 mb, 850 mb
a. 12 May 1200 GMT
b. 13 May 0000 GMT
c. 13 May 1200 GMT

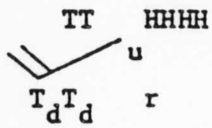
Isentropic Charts
305 K Surface
a. 12 May 1200 GMT
b. 13 May 0000 GMT
c. 13 May 1200 GMT

Isentropic Cross Sections
HON -OMA -UMN -LIT -JAN -BVE
a. 12 May 1200 GMT
b. 13 May 0000 GMT
c. 13 May 1200 GMT

Squall line Development and Cyclogenesis Plotting Models

Surface Maps: Standard WMO United States station model

Pressure Surfaces:



TT : Temperature [°C]

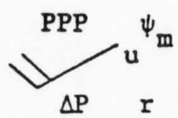
T_dT_d: Dew Point [°C]

HHHH : Geopotential height [m]

r : Mixing ratio [g/kg]

u : Units digit of wind speed [m/s]

Isentropic Surfaces:



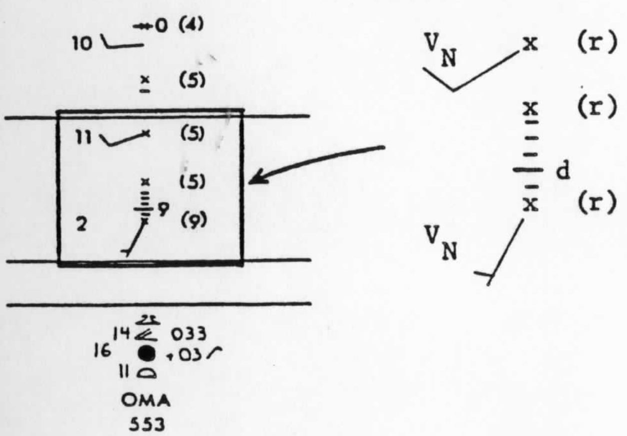
PPP : Pressure [mb]

ΔP : Pressure change between θ and θ + 5K surfaces [mb]

ψ_m : Montgomery stream function (leading 2 or 3 missing) [m^2/s^2]

r,u : (same as above)

Isentropic Cross Section:

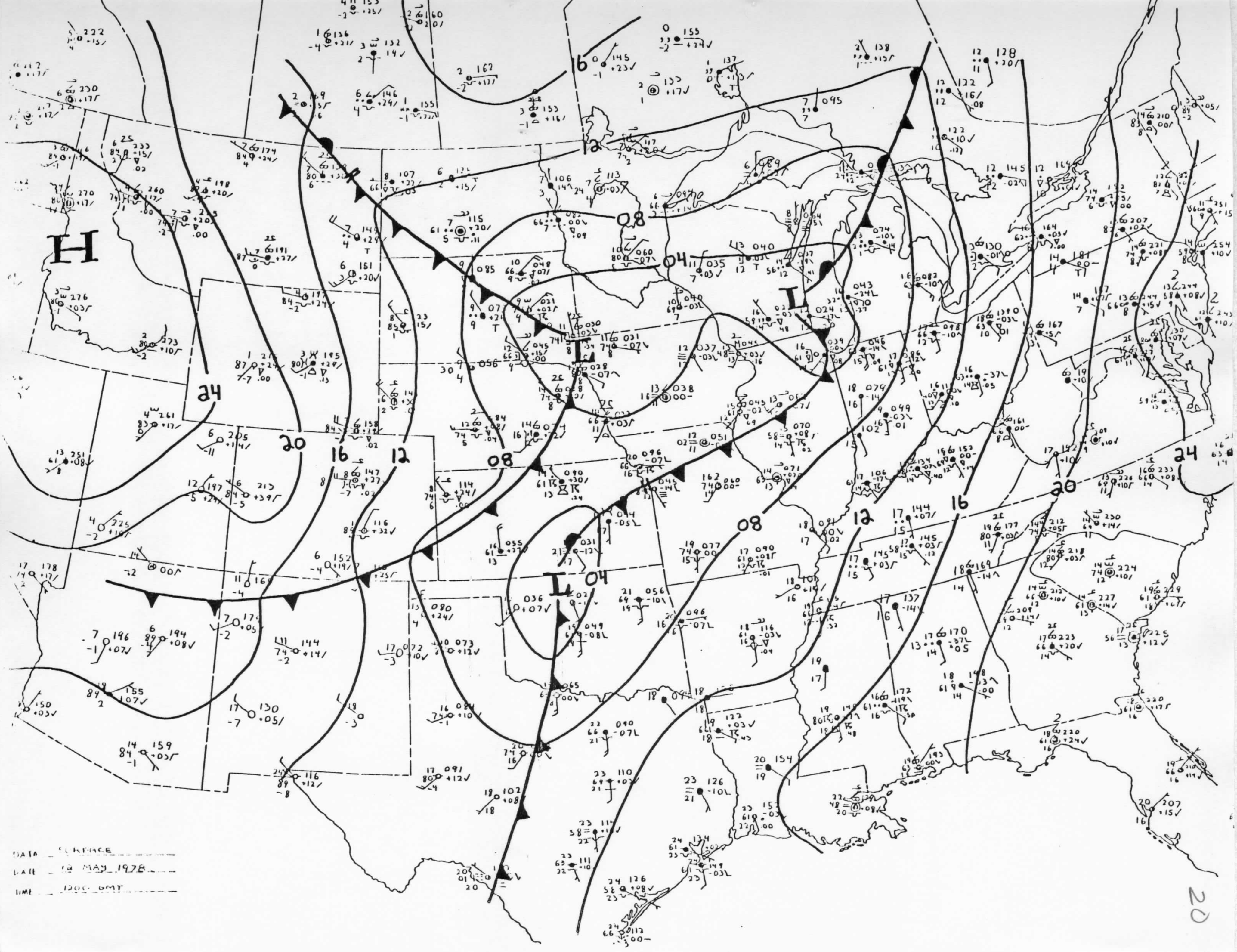


(r) : Mixing ratio [g/kg] at point x

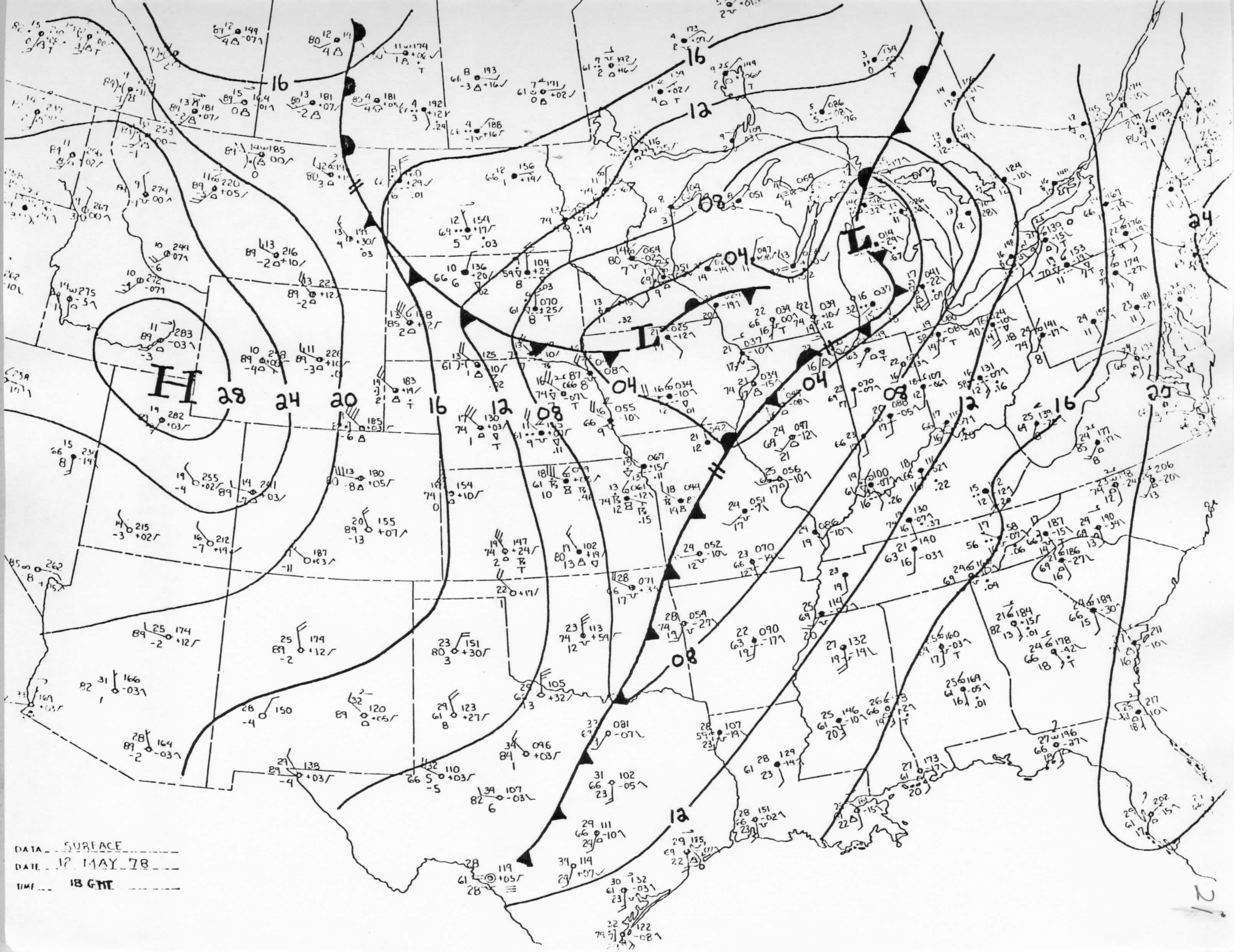
— d : $\left.\begin{matrix}3\\2\end{matrix}\right\}$d3 θ value [°K] (with 2 or 3 missing)(ie. — 9 = 293K or 393K)

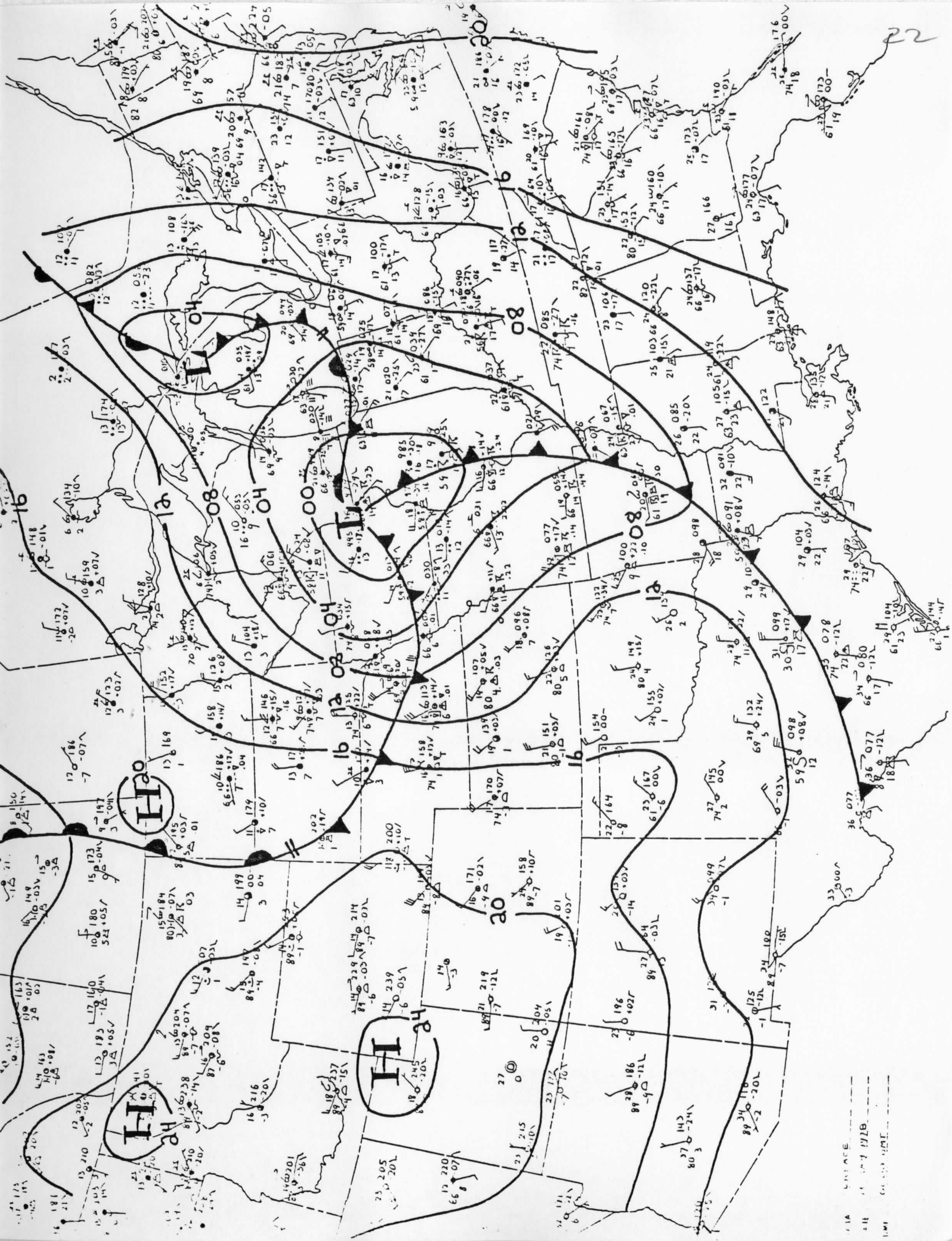
V_N : Wind speed normal to the cross section [m/s]

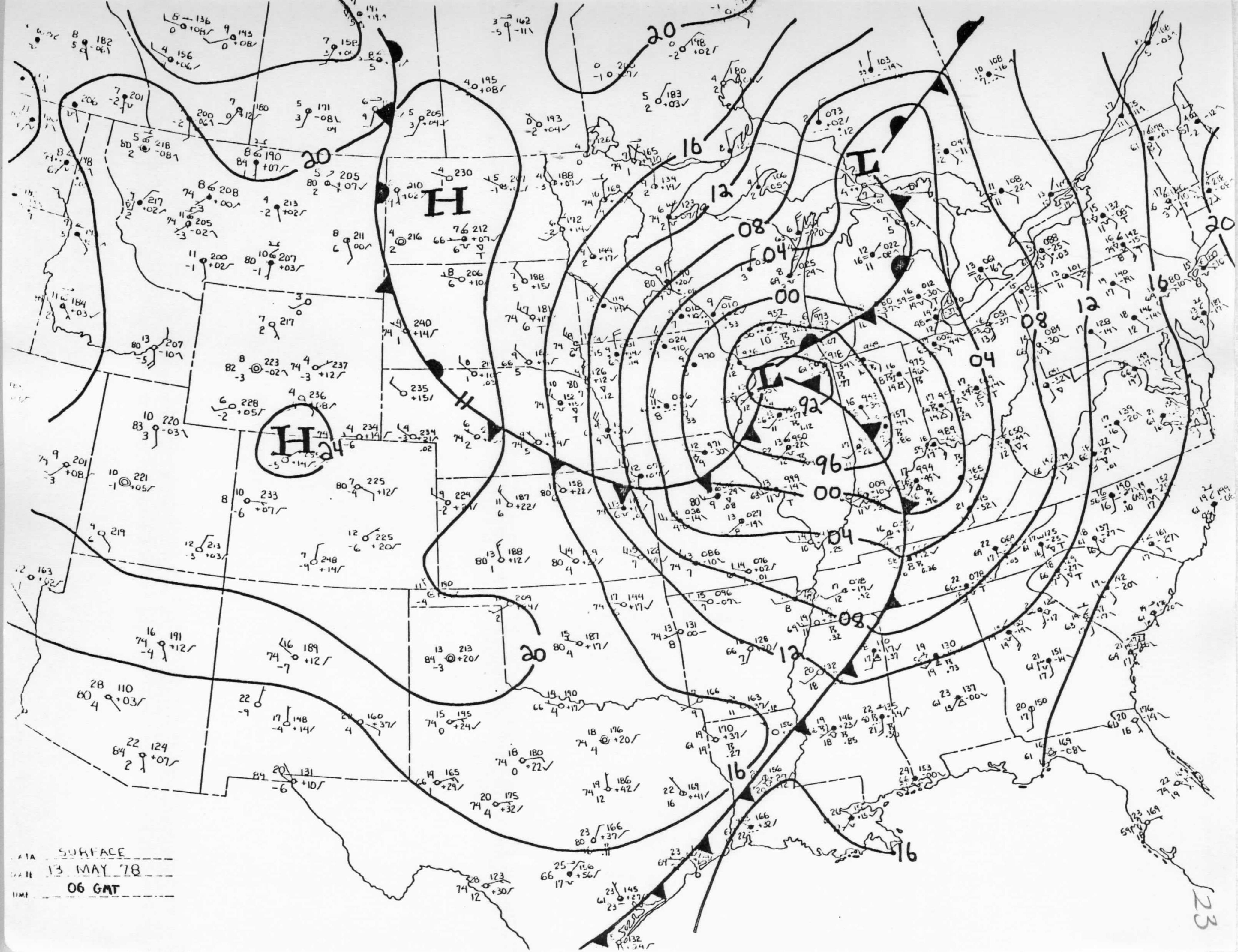
- : Isentropic value every 2K



DATA SURFACE
DATE 14 MAY 1978
TIME 1200 GMT


DATA SURFACE
DATE 17 MAY 78
TIME 18 GMT





DATA SURFACE
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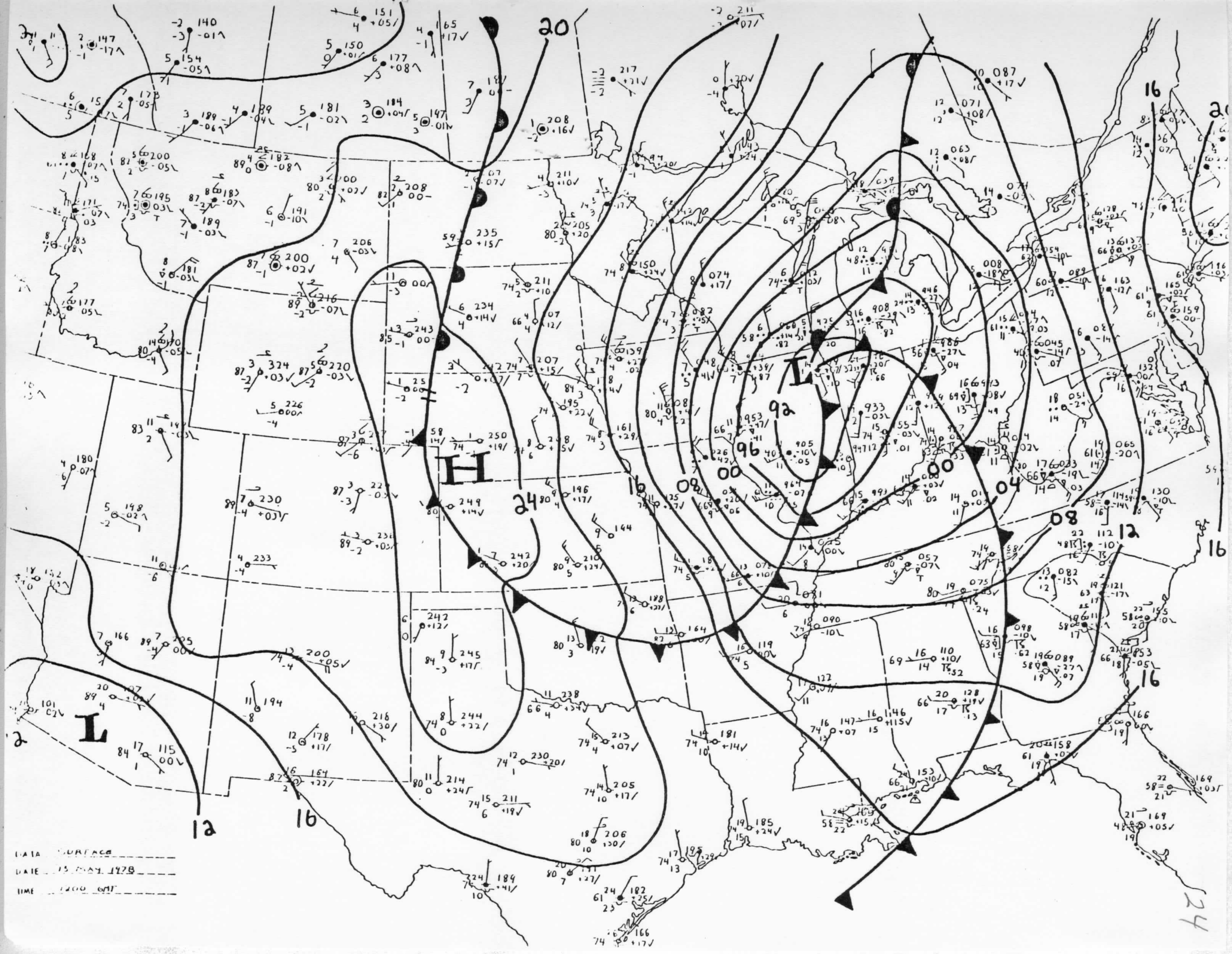
TIME 06 GMT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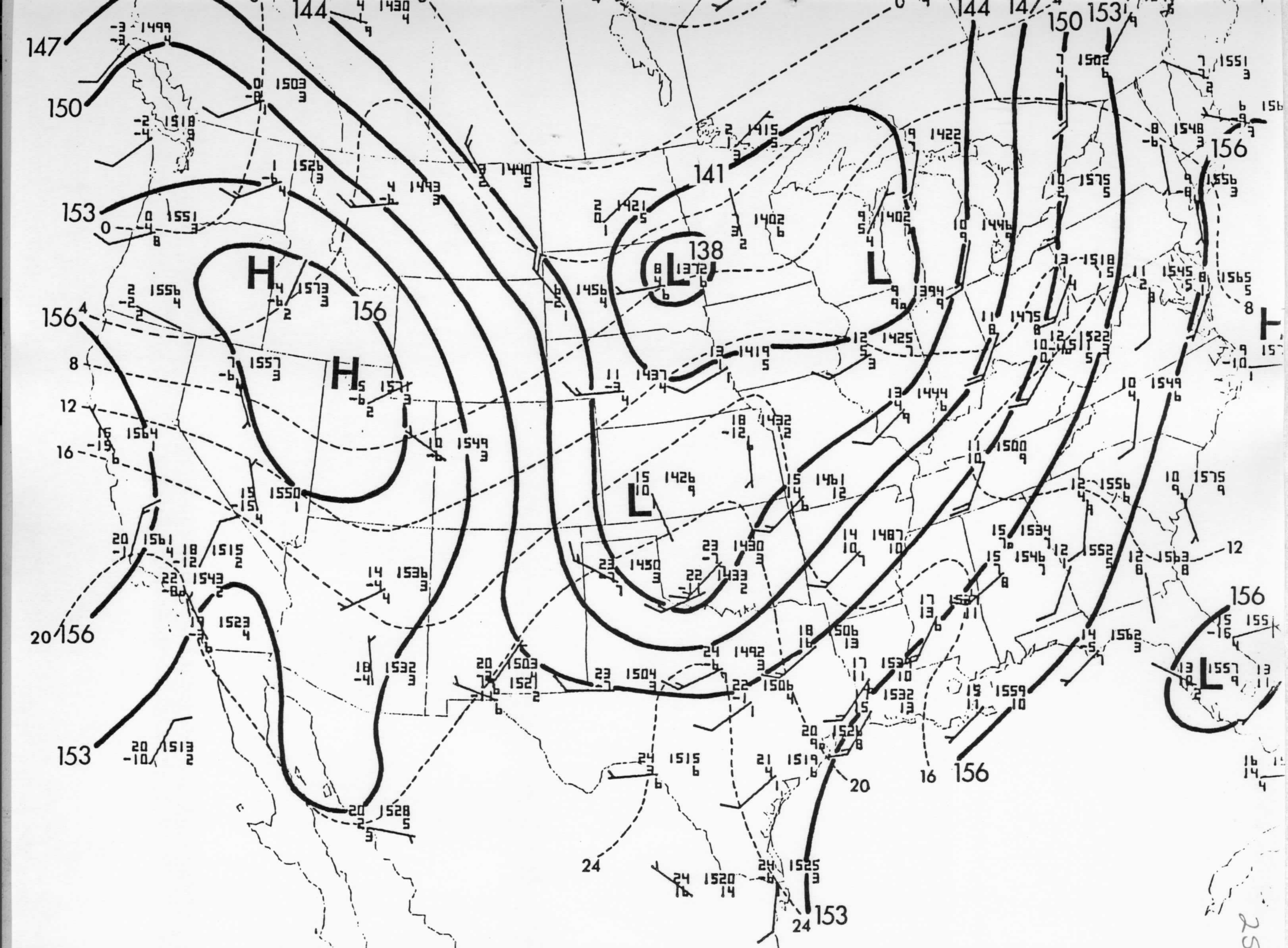
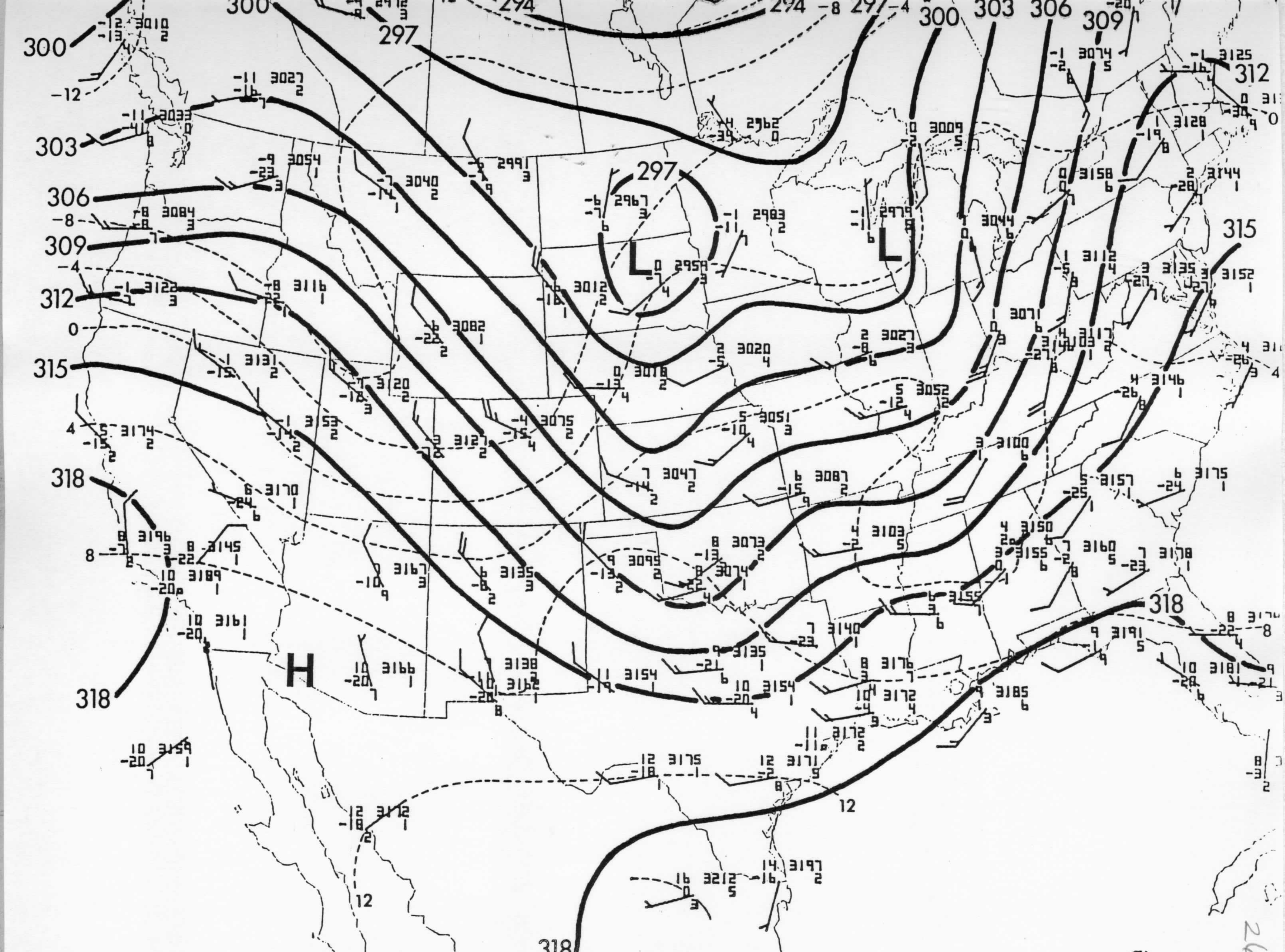
96
92
DATA SURFACE
DATE 13 MAY 1978
TIME 1200 GMT

24



PRESSURE 850MB 12UT 12 MAY 1978

25



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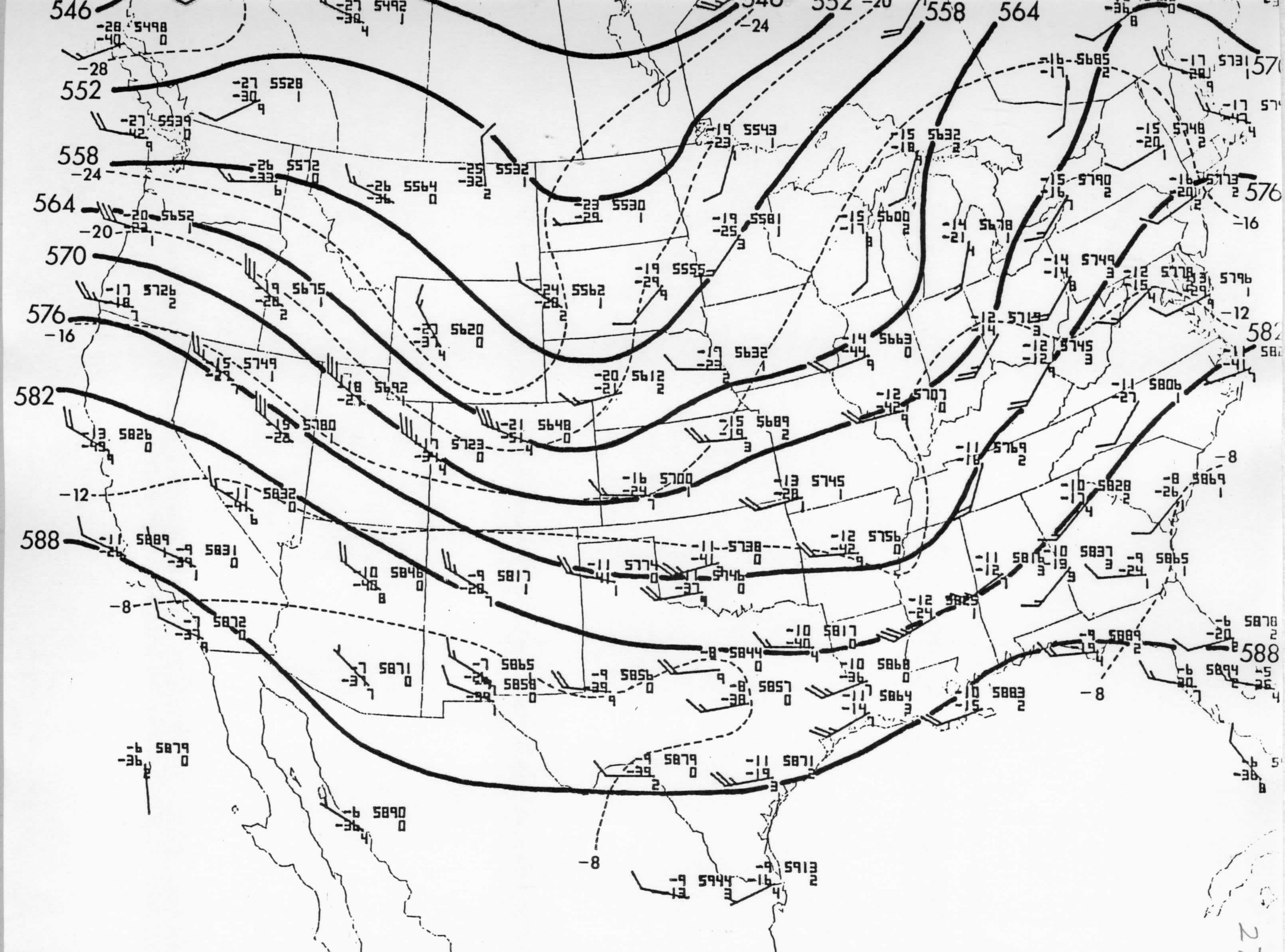
26



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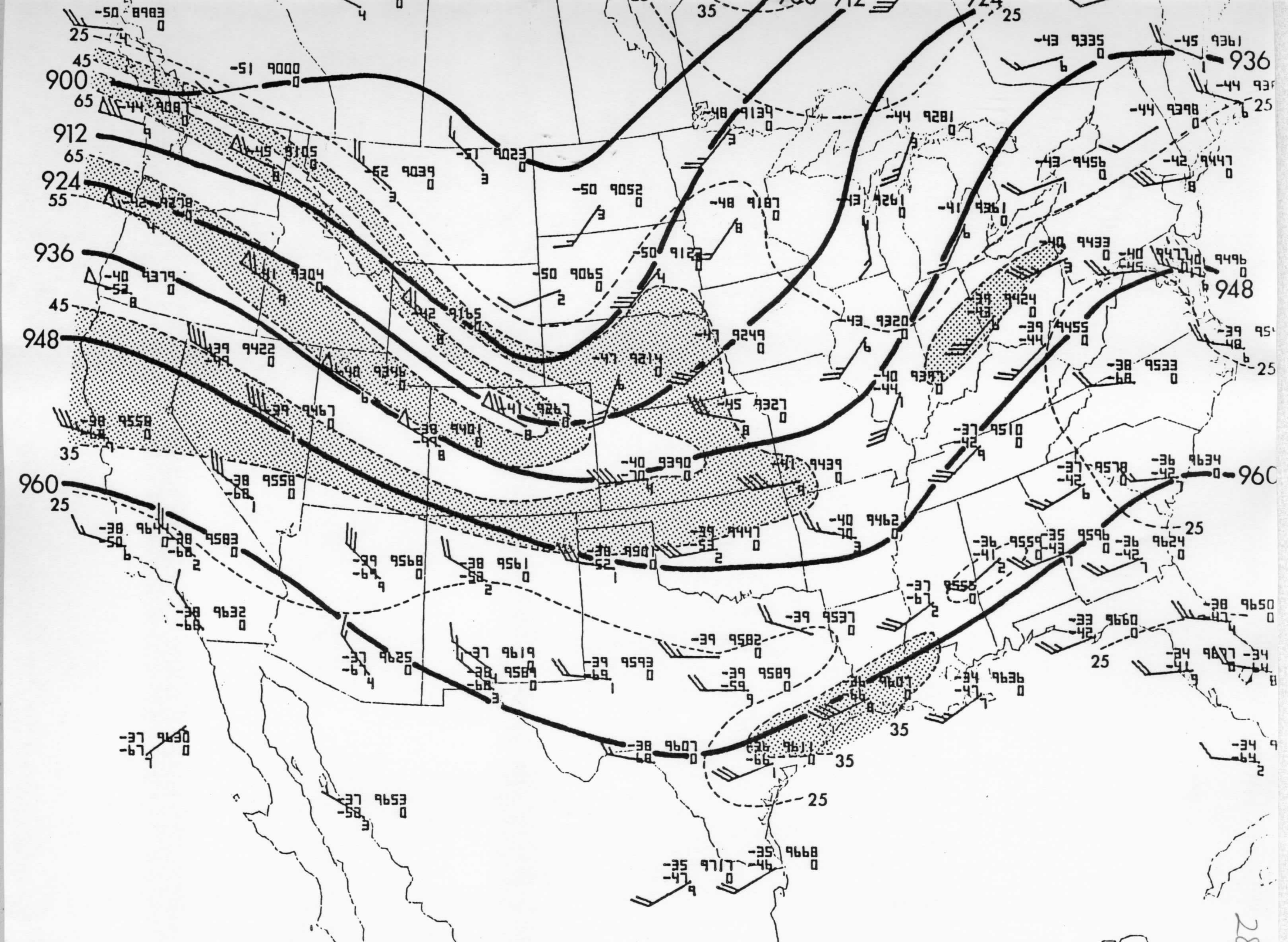

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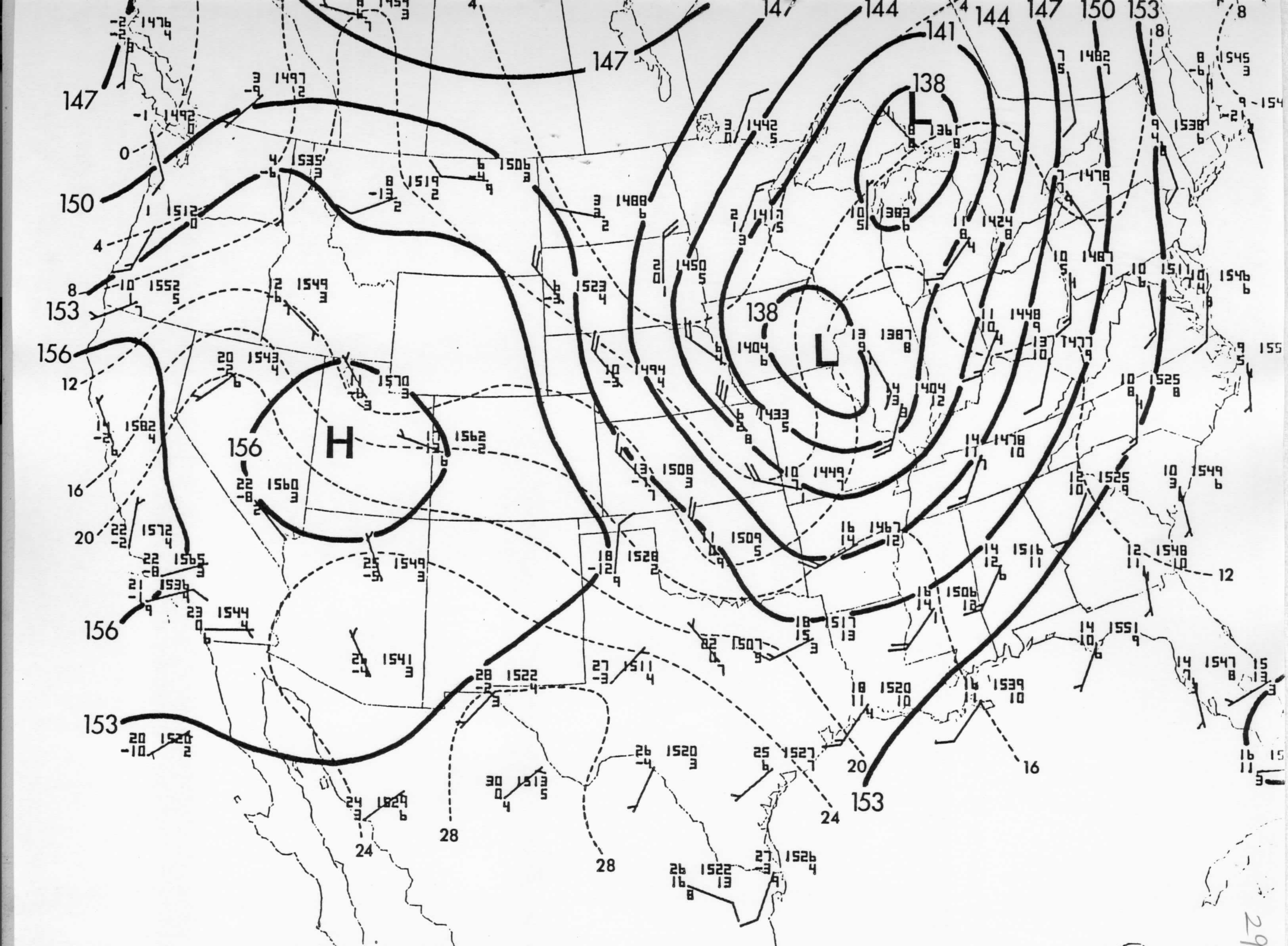

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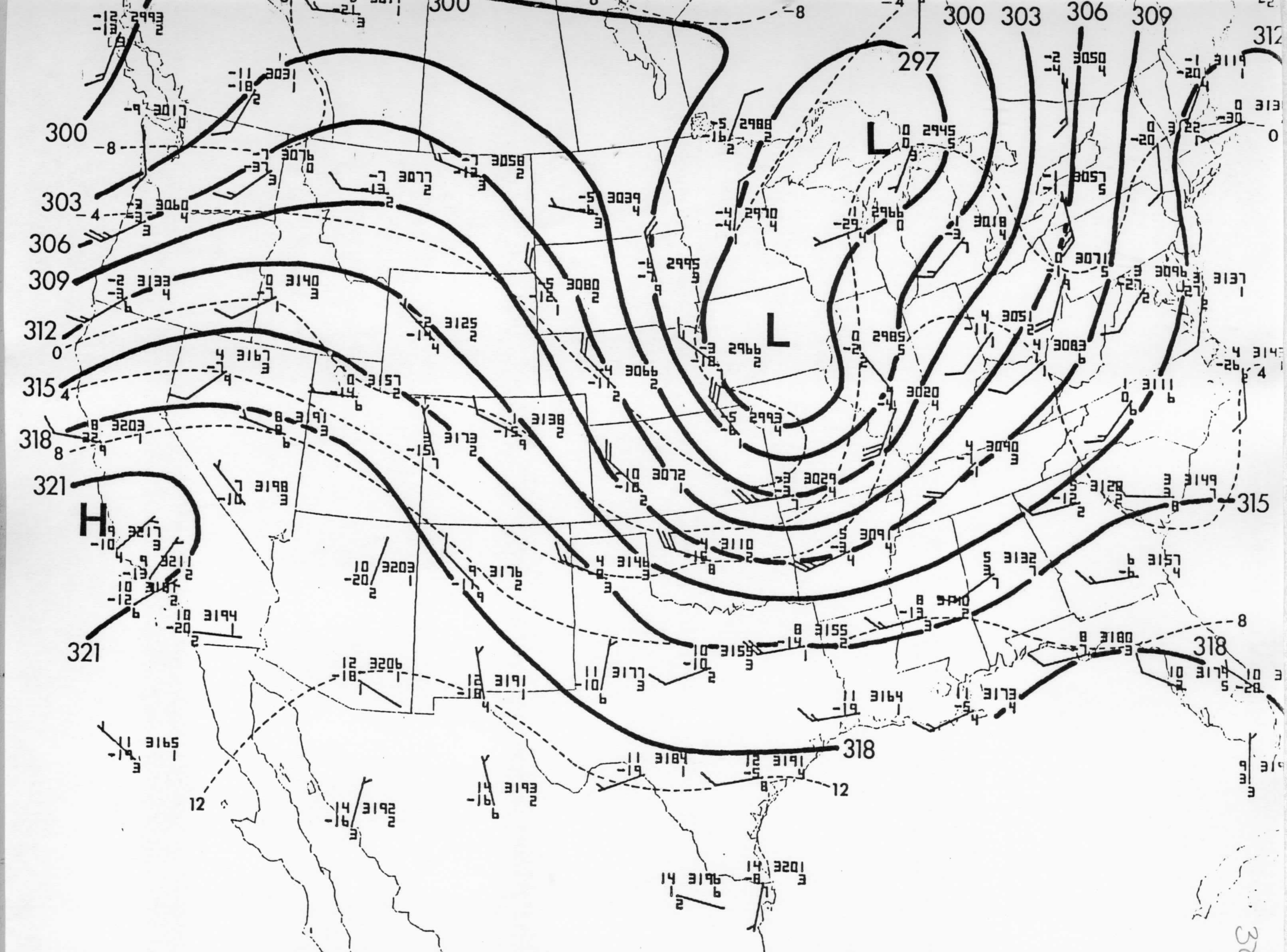

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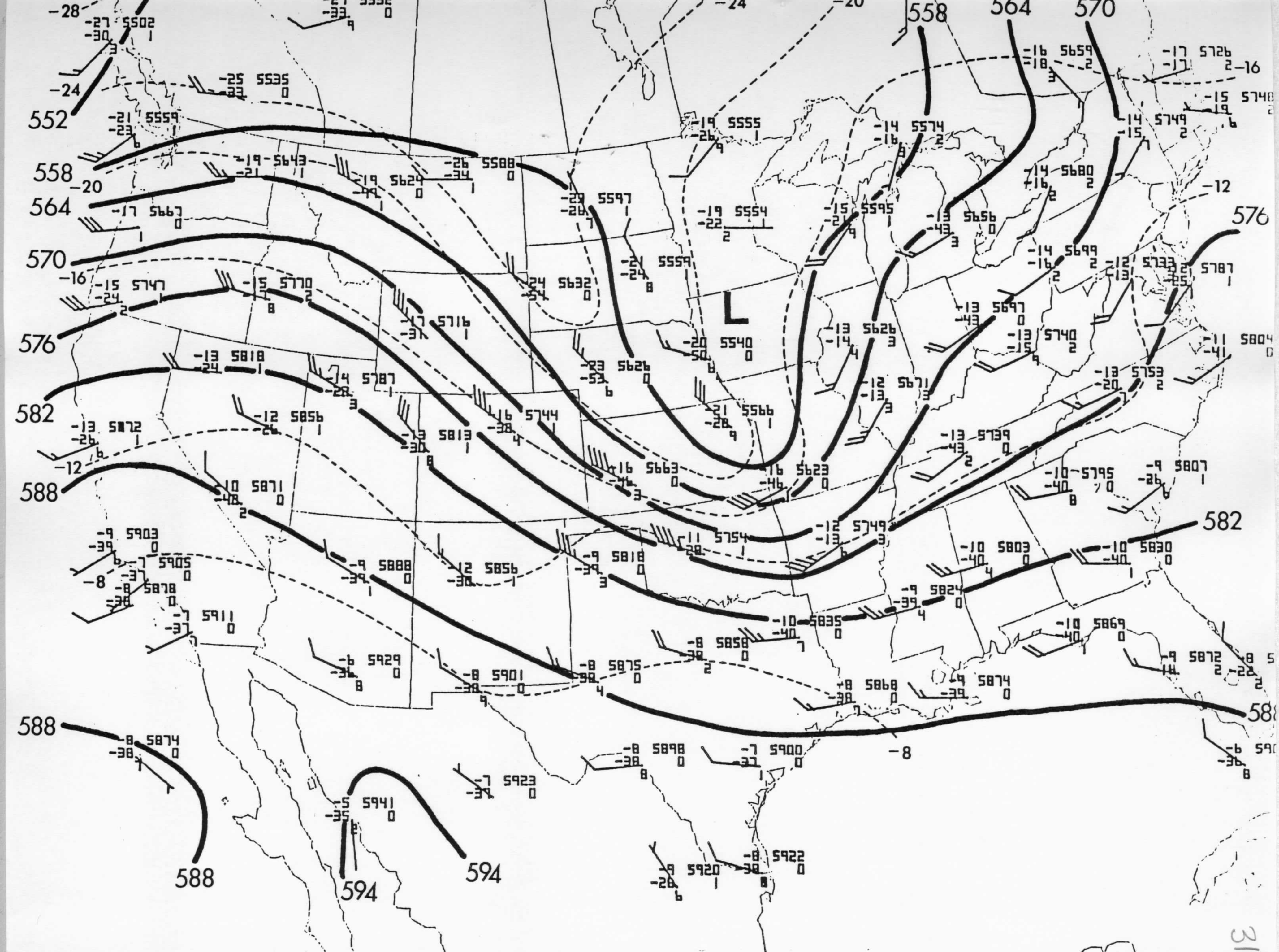

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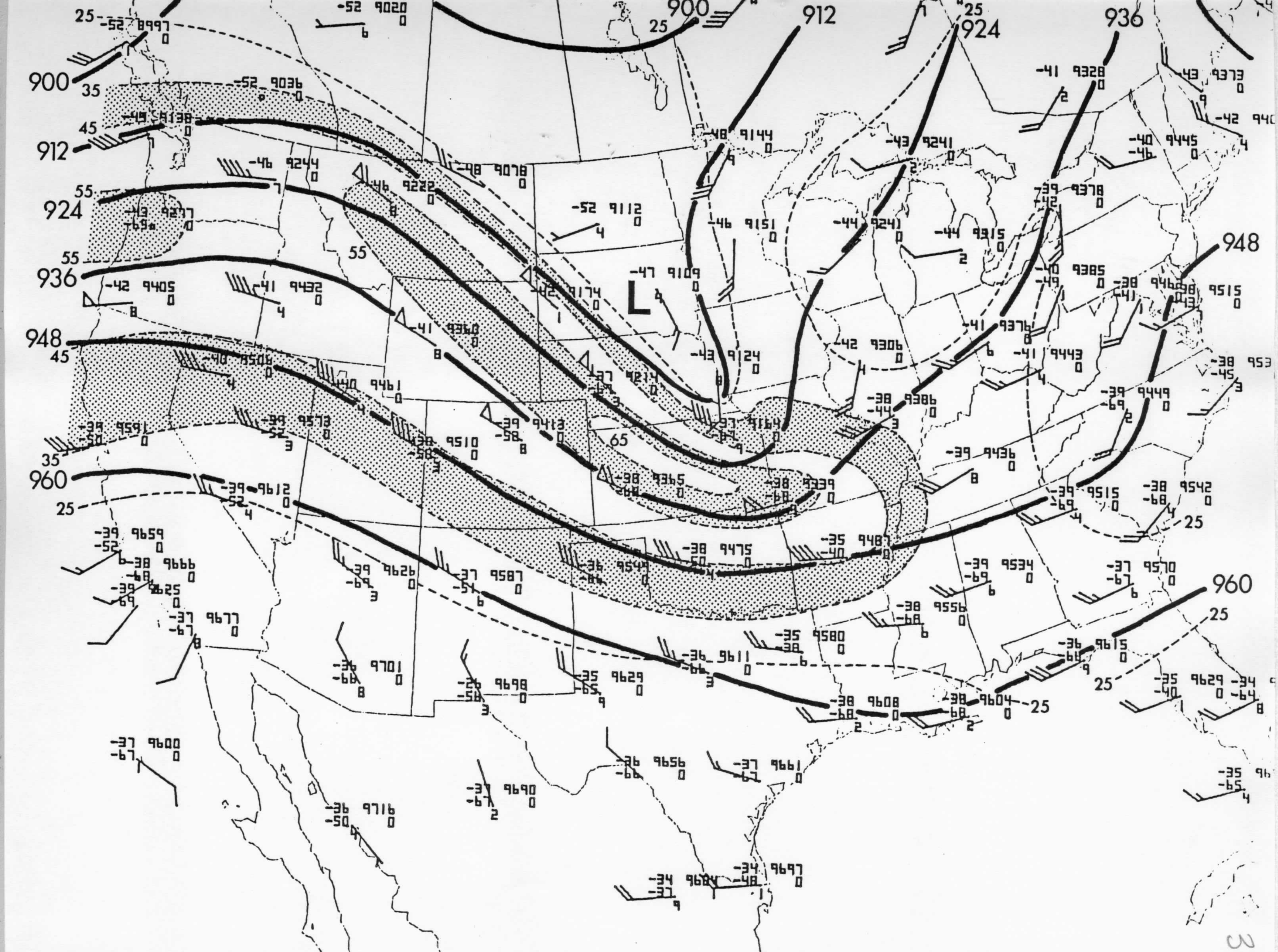

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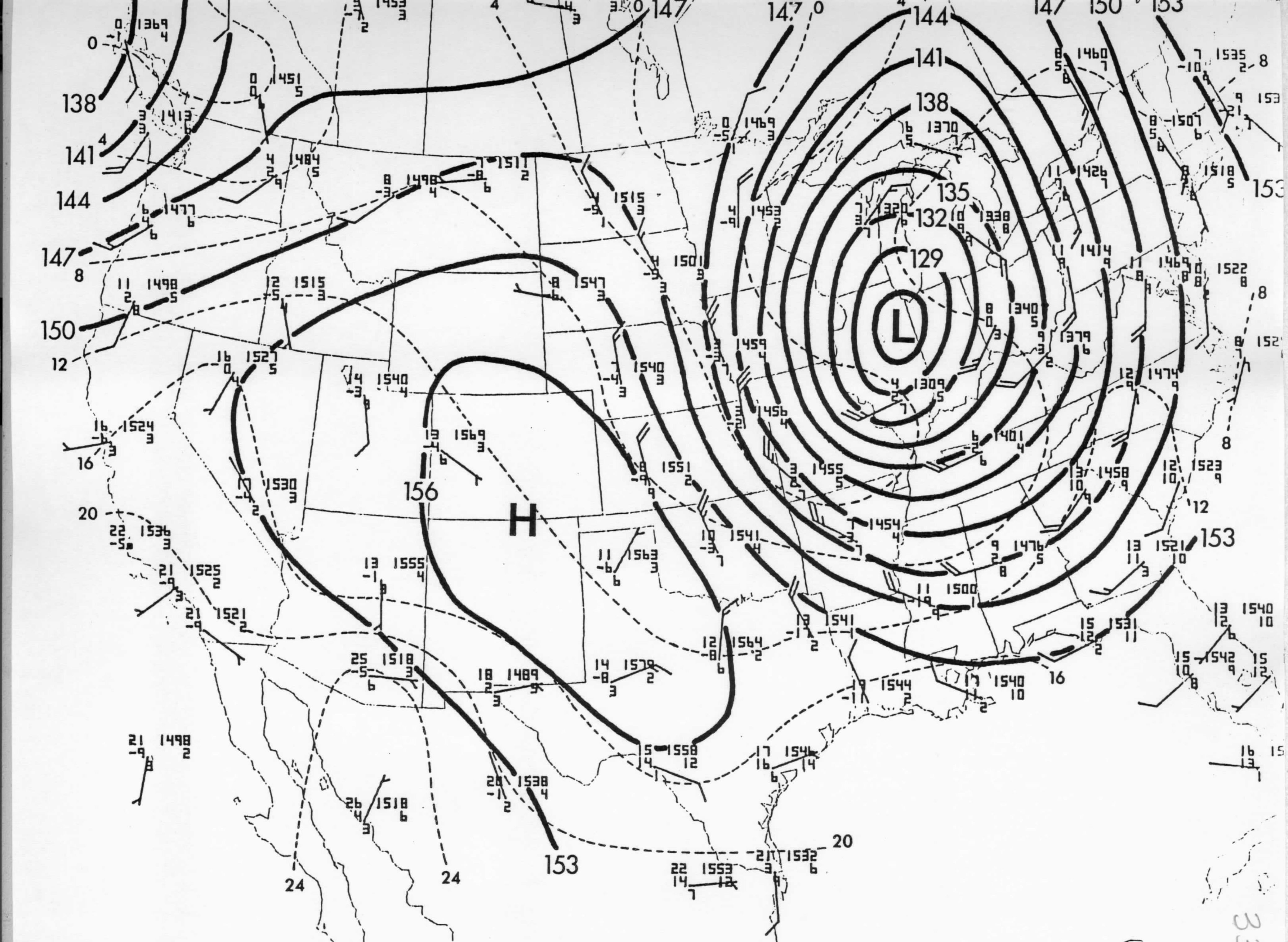

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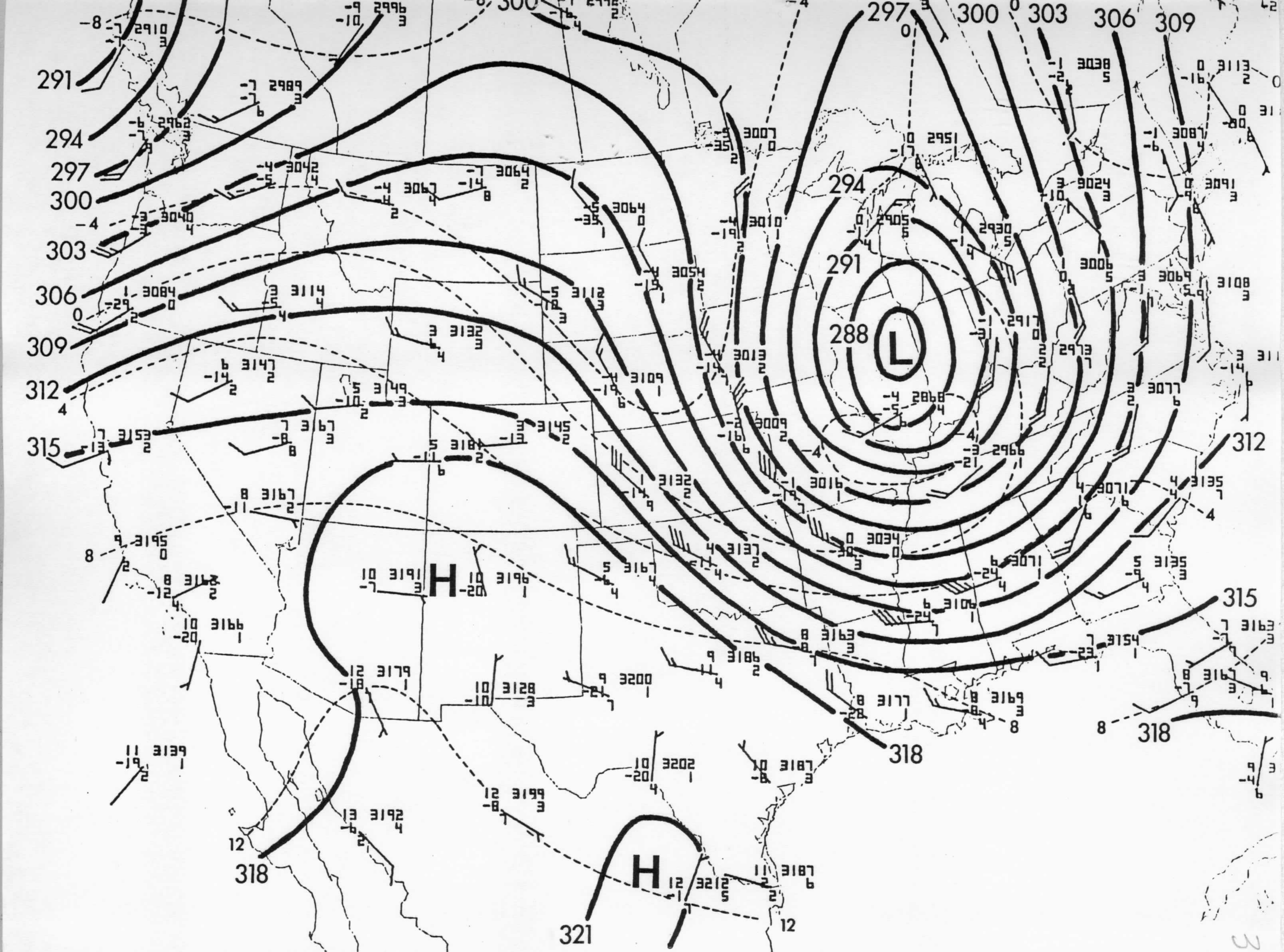

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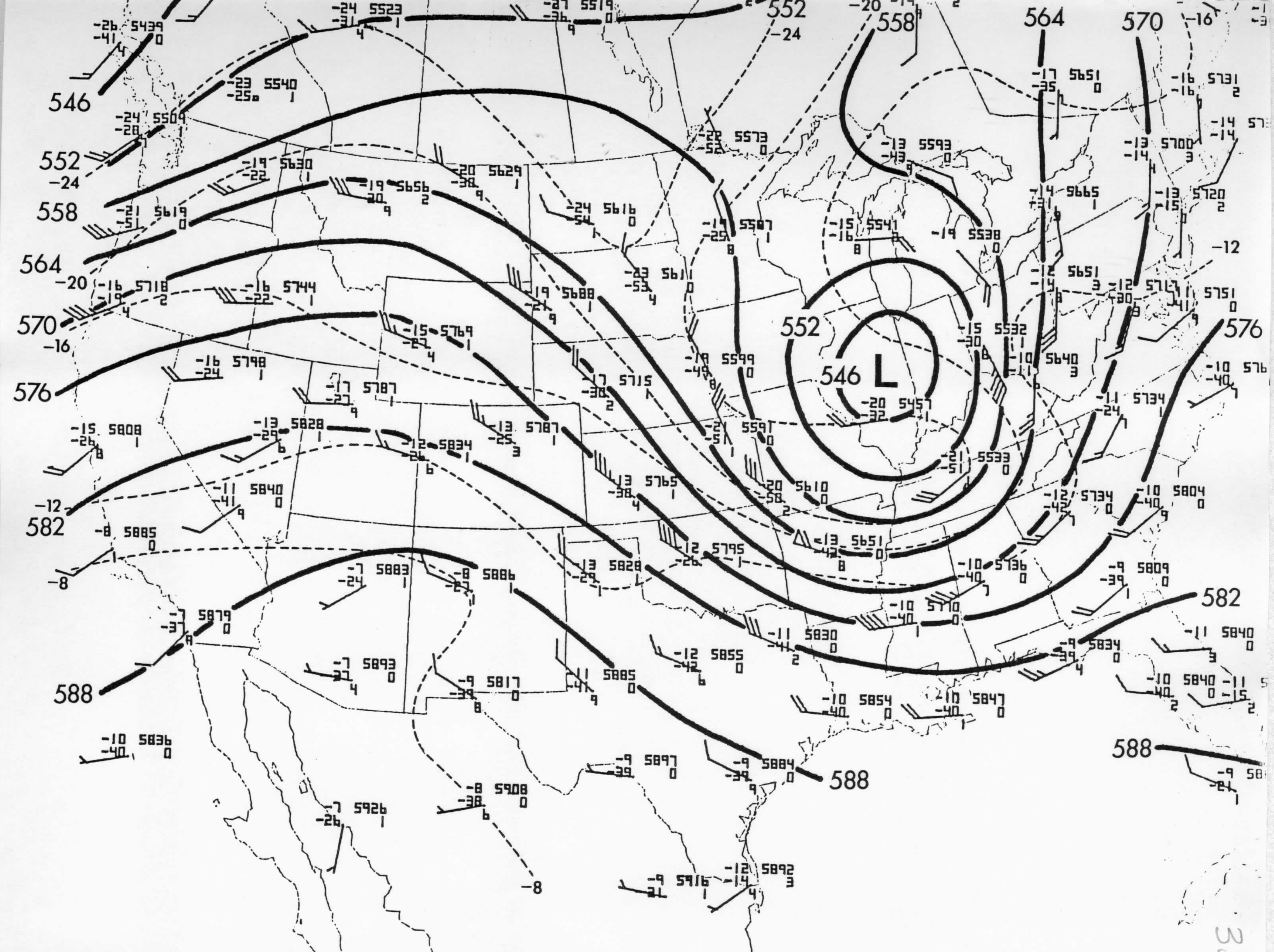

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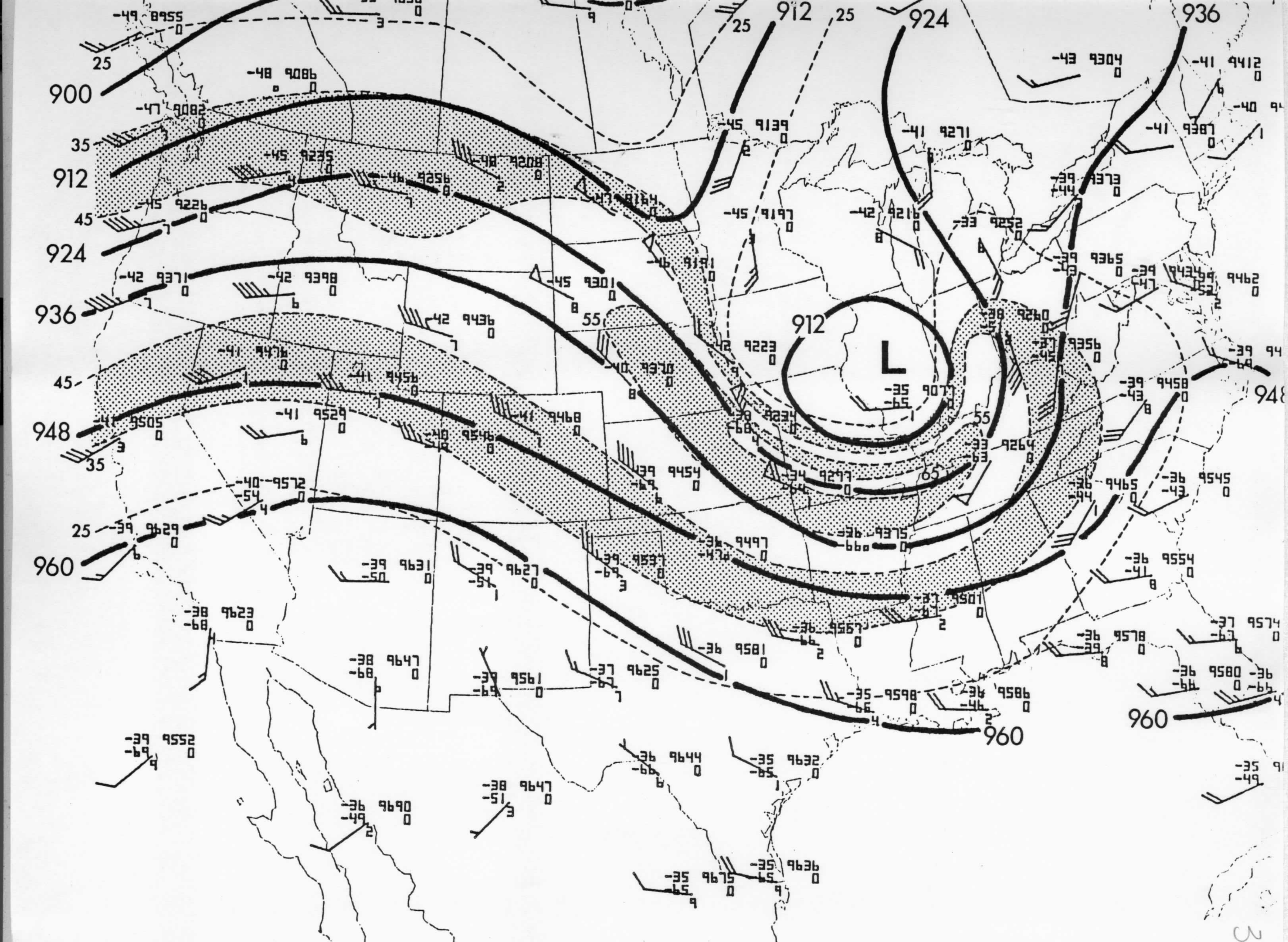

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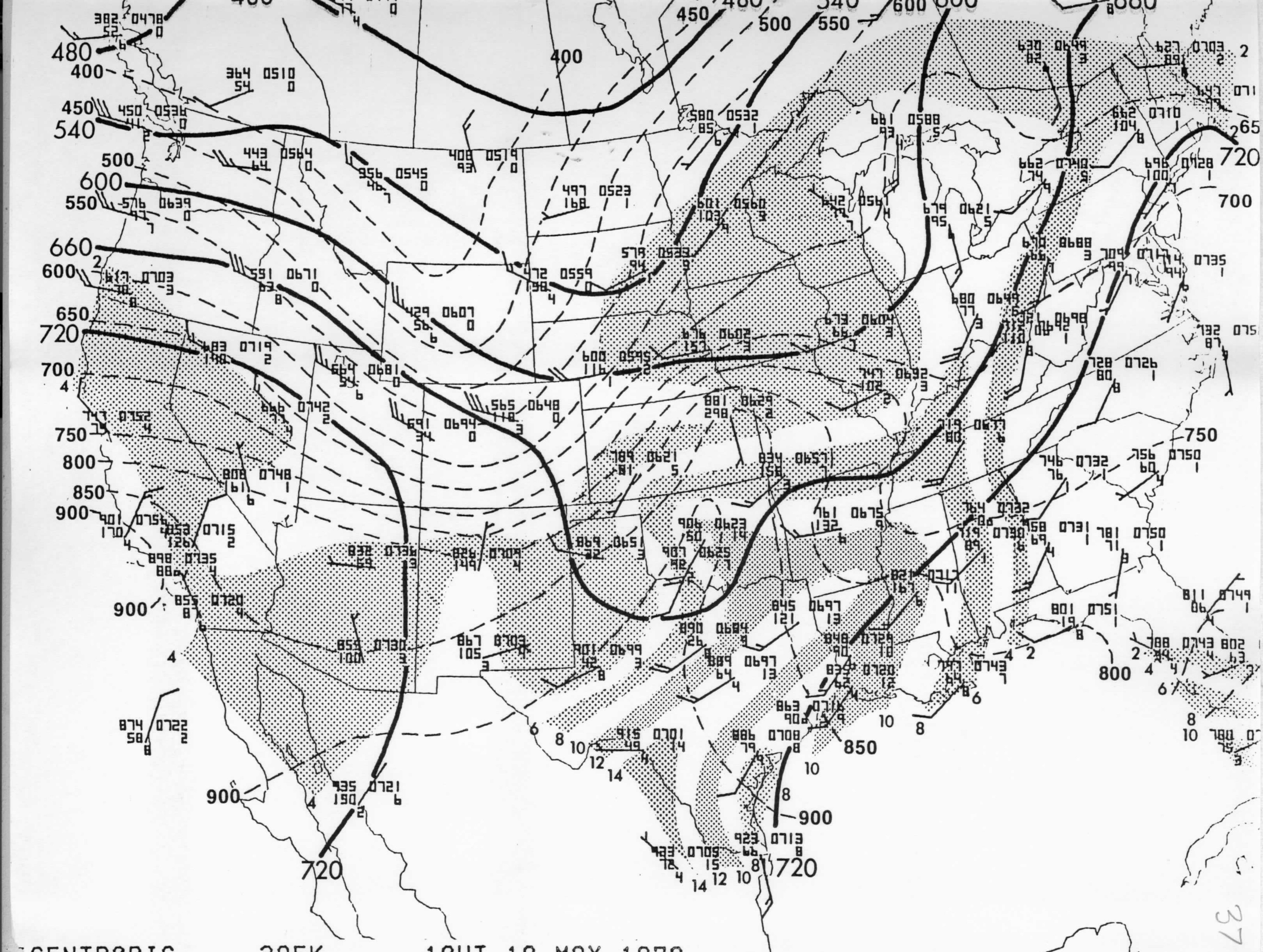

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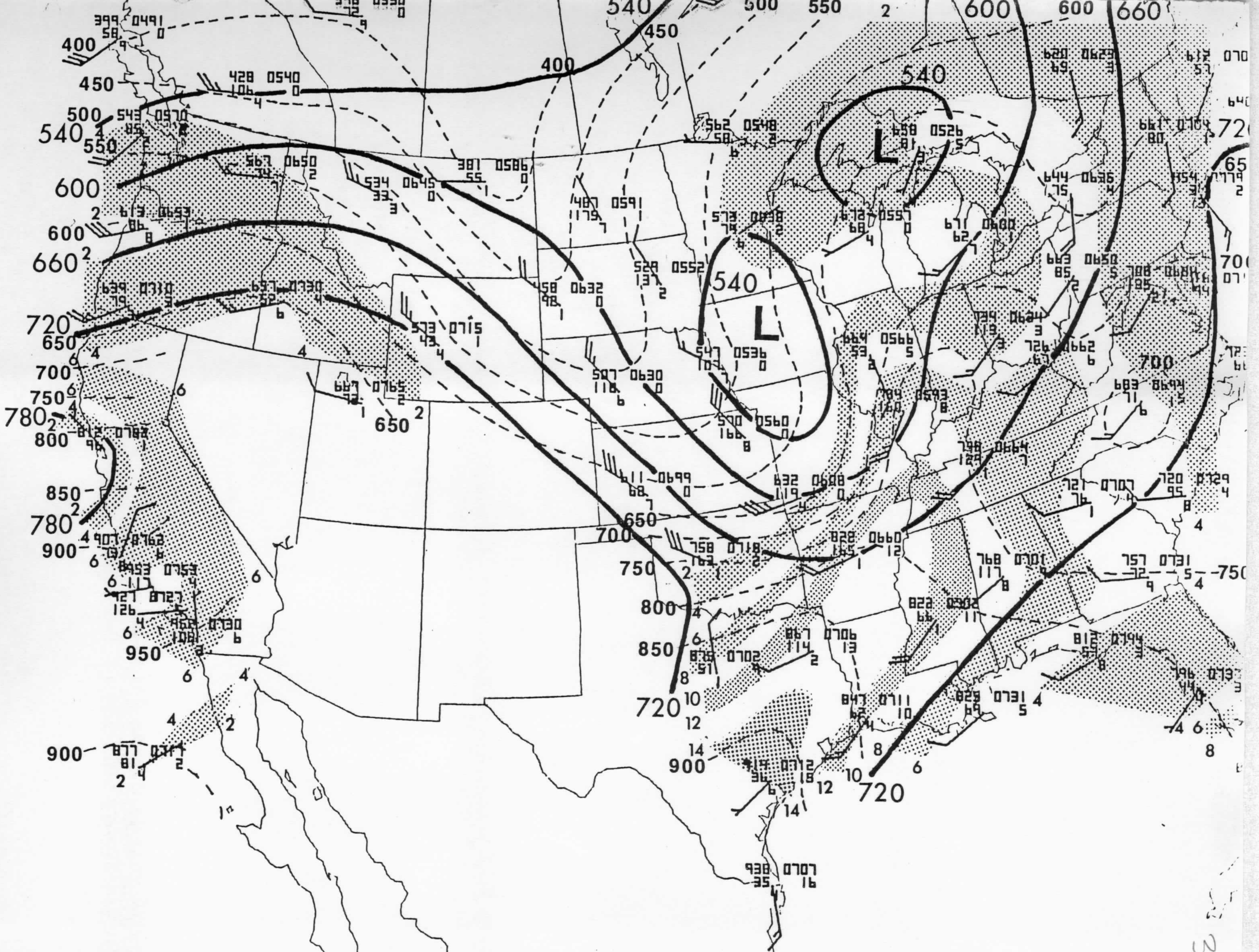

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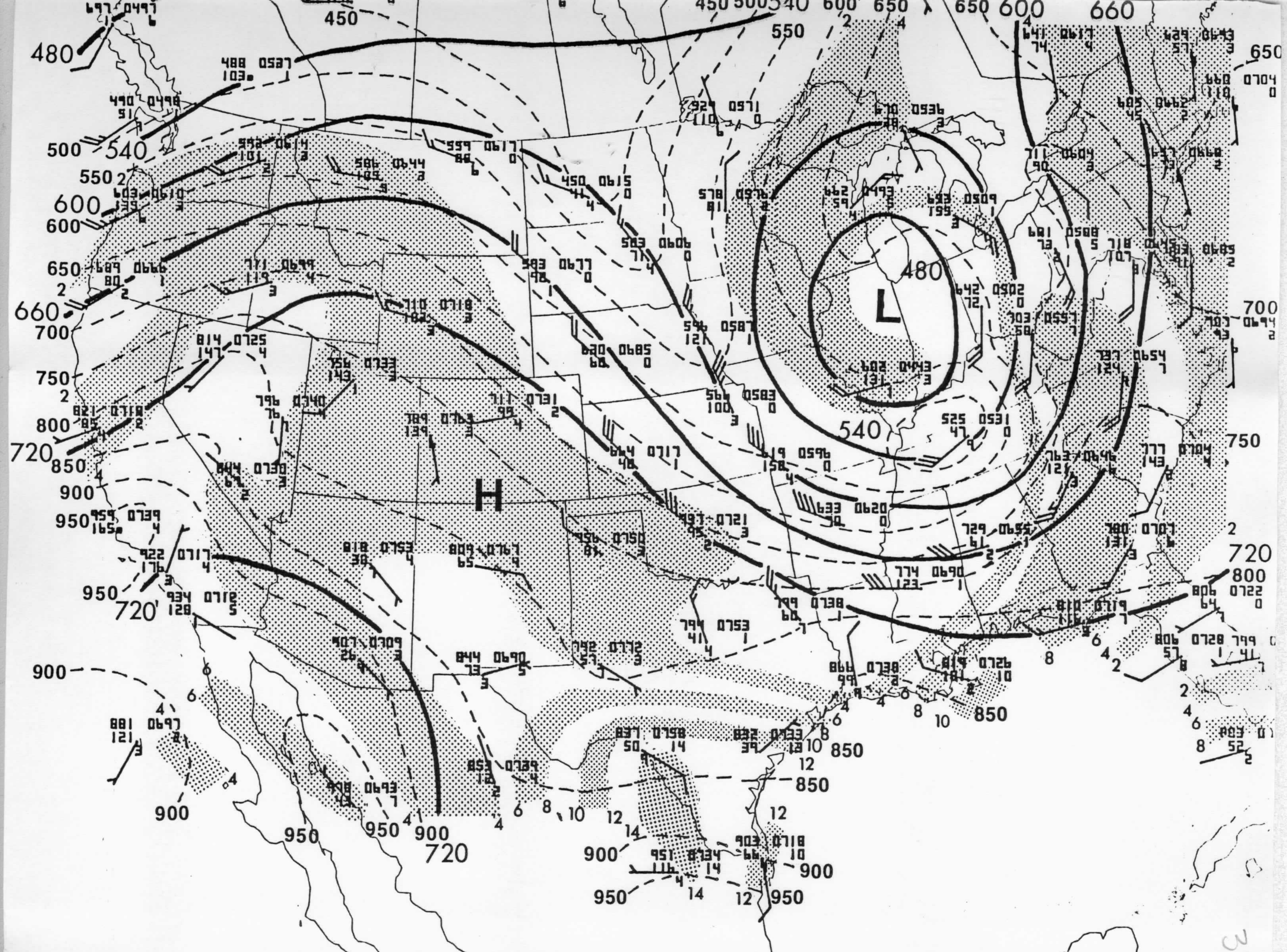

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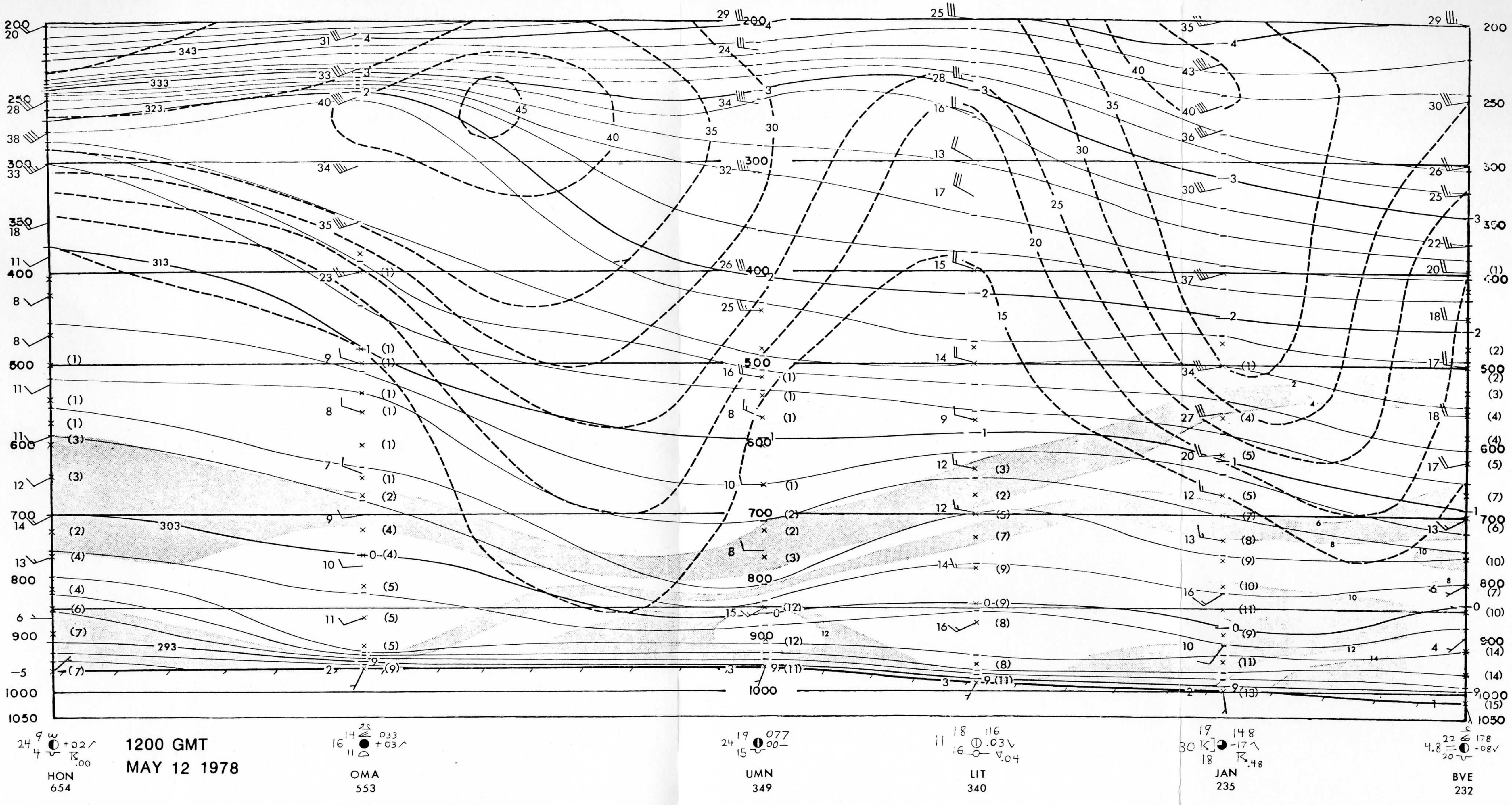
1200 GMT
MAY 12 1978
HON 654
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UMN 349
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JAN 235
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1000
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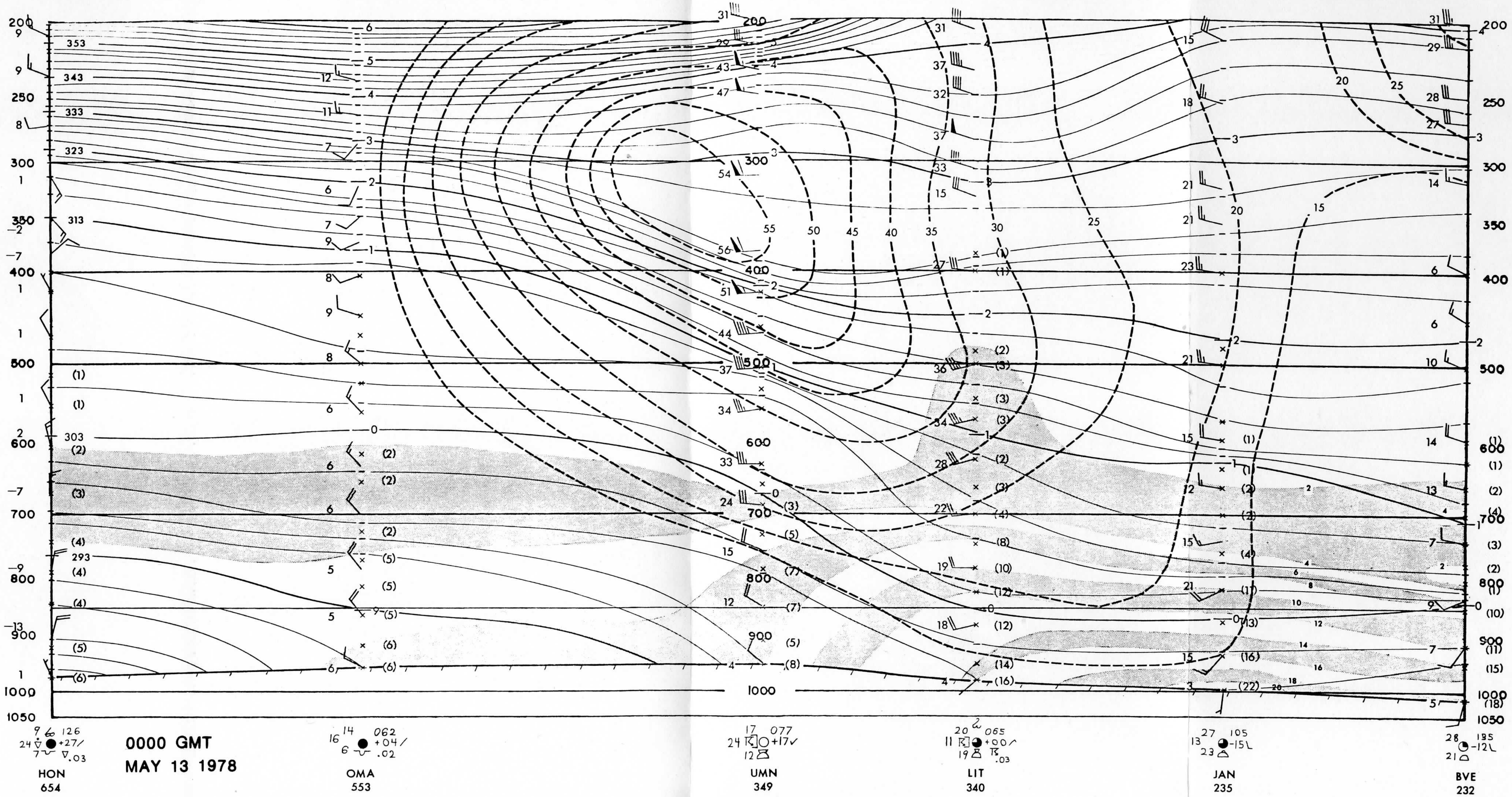
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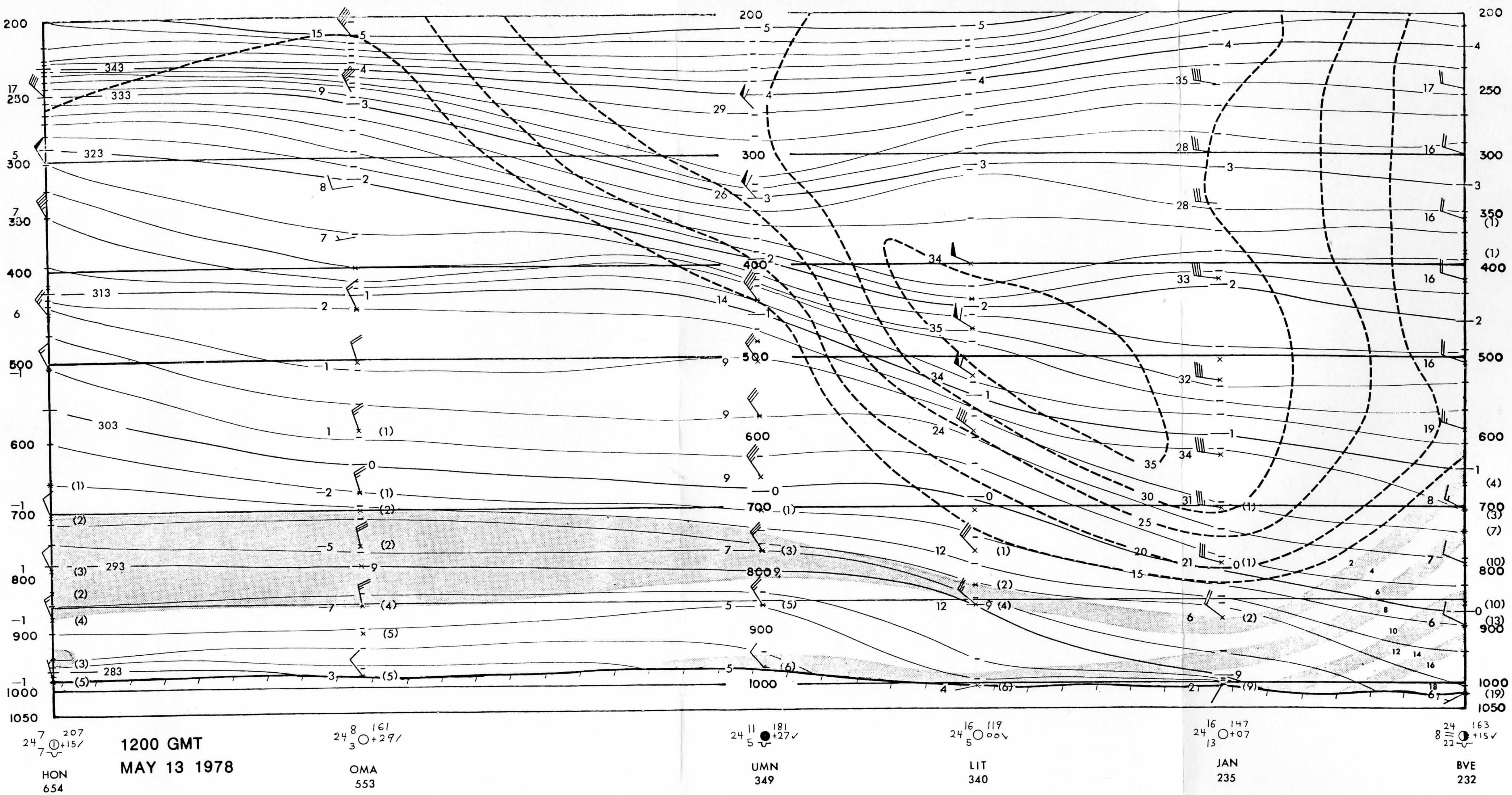
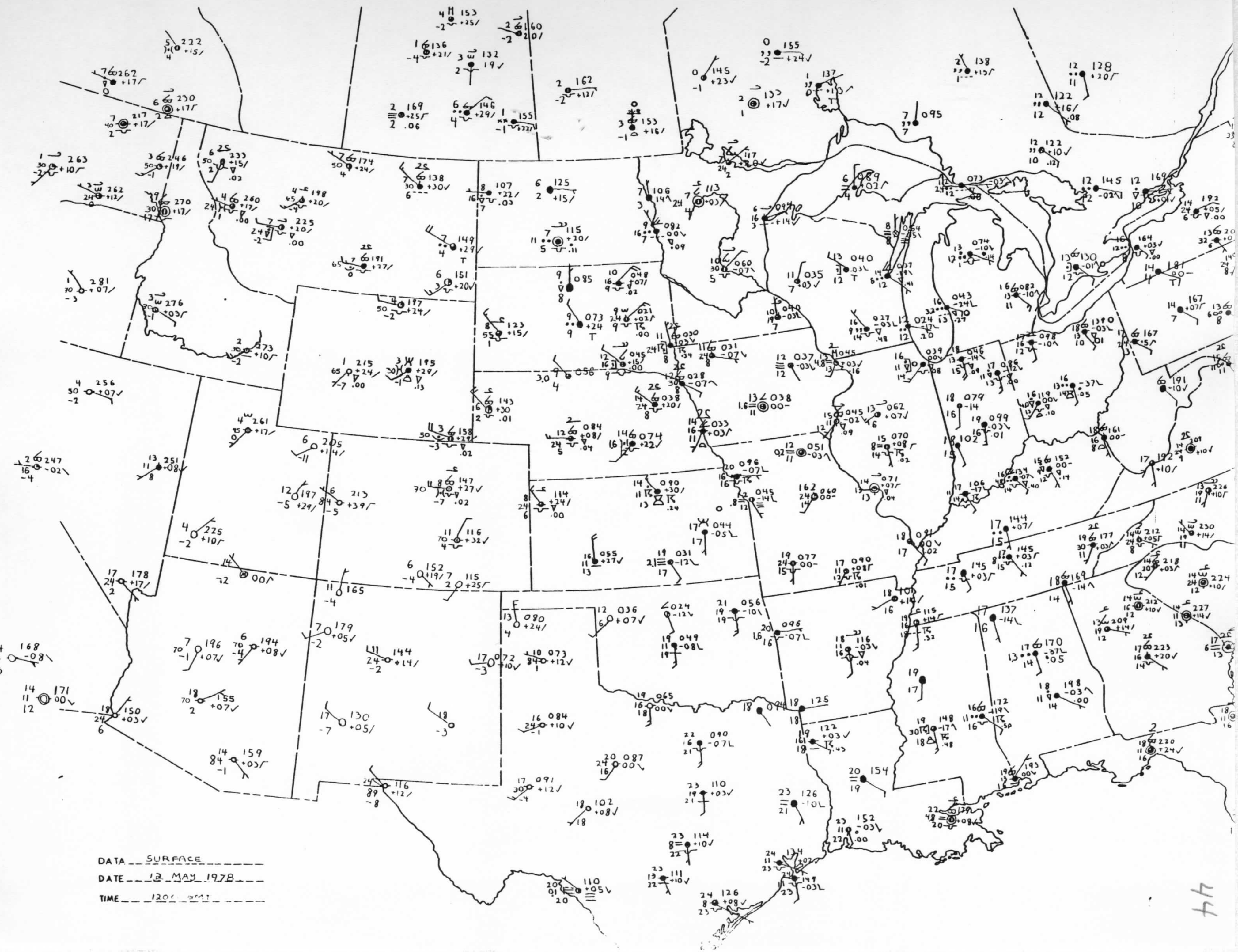
MAY 13 1978
HON
654
OMA
553
UMN
349
LIT
340
JAN
235
BVE
232
200
250
300
350
400
500
600
700
800
900
1000
1050

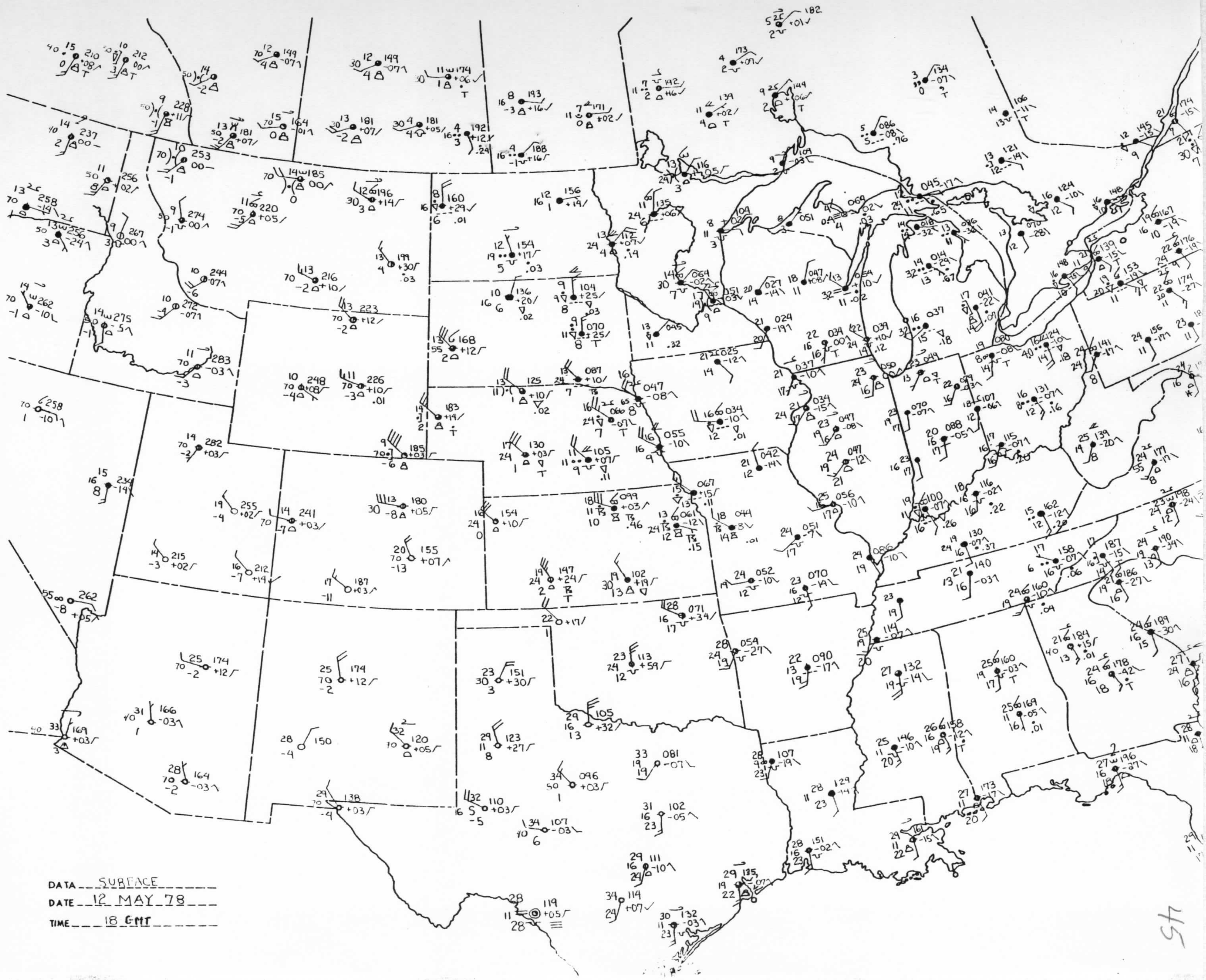

1200 GMT
MAY 13 1978
HON
654
OMA
553
UMN
349
LIT
340
JAN
235
BVE
232

2. Surface Charts

a. 12 May 1200 GMT
b. 12 May 1800 GMT
c. 13 May 0000 GMT
d. 13 May 0600 GMT
e. 13 May 1200 GMT



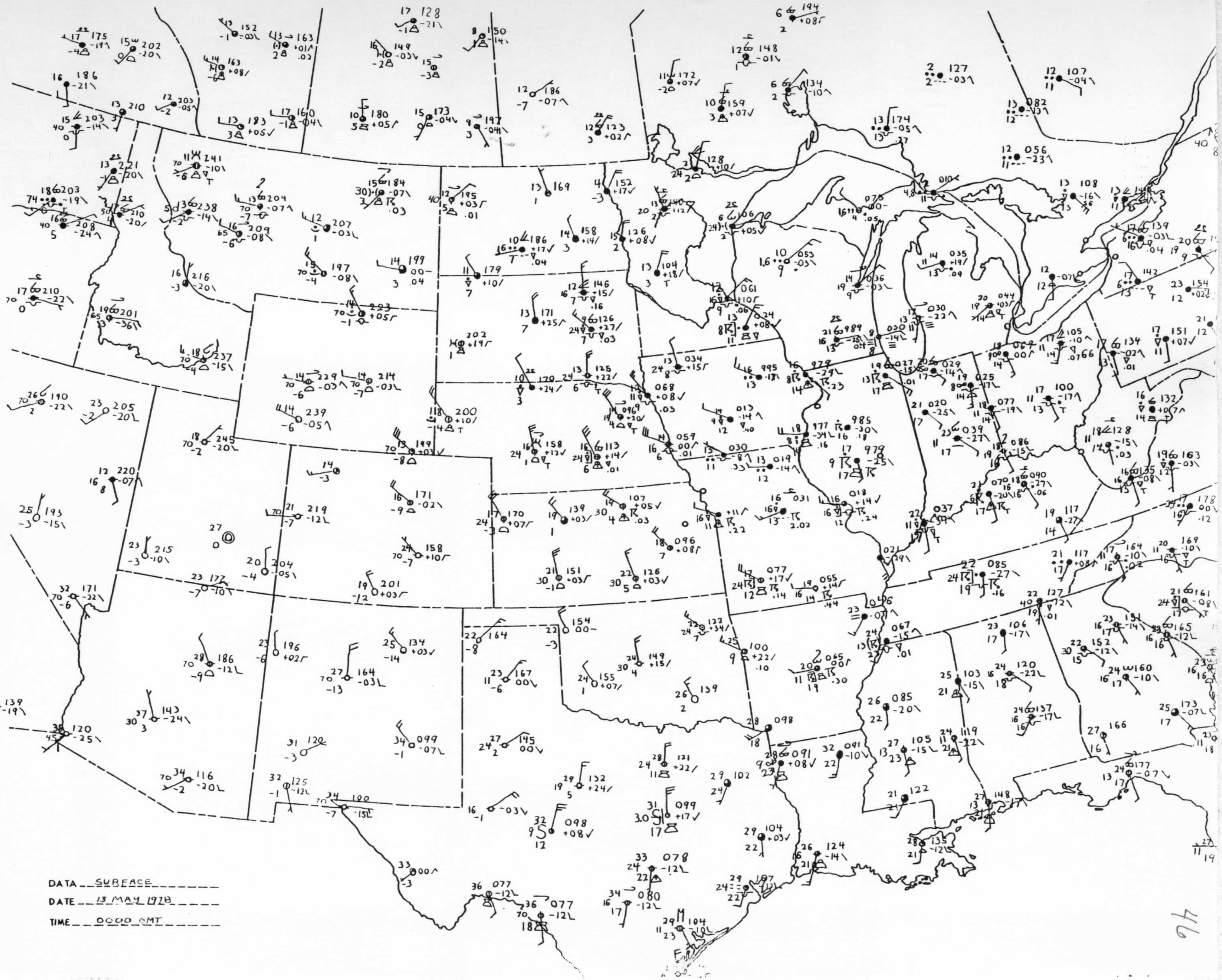
44



DATA SURFACE

DATE 12 MAY 78

TIME 18 GMT

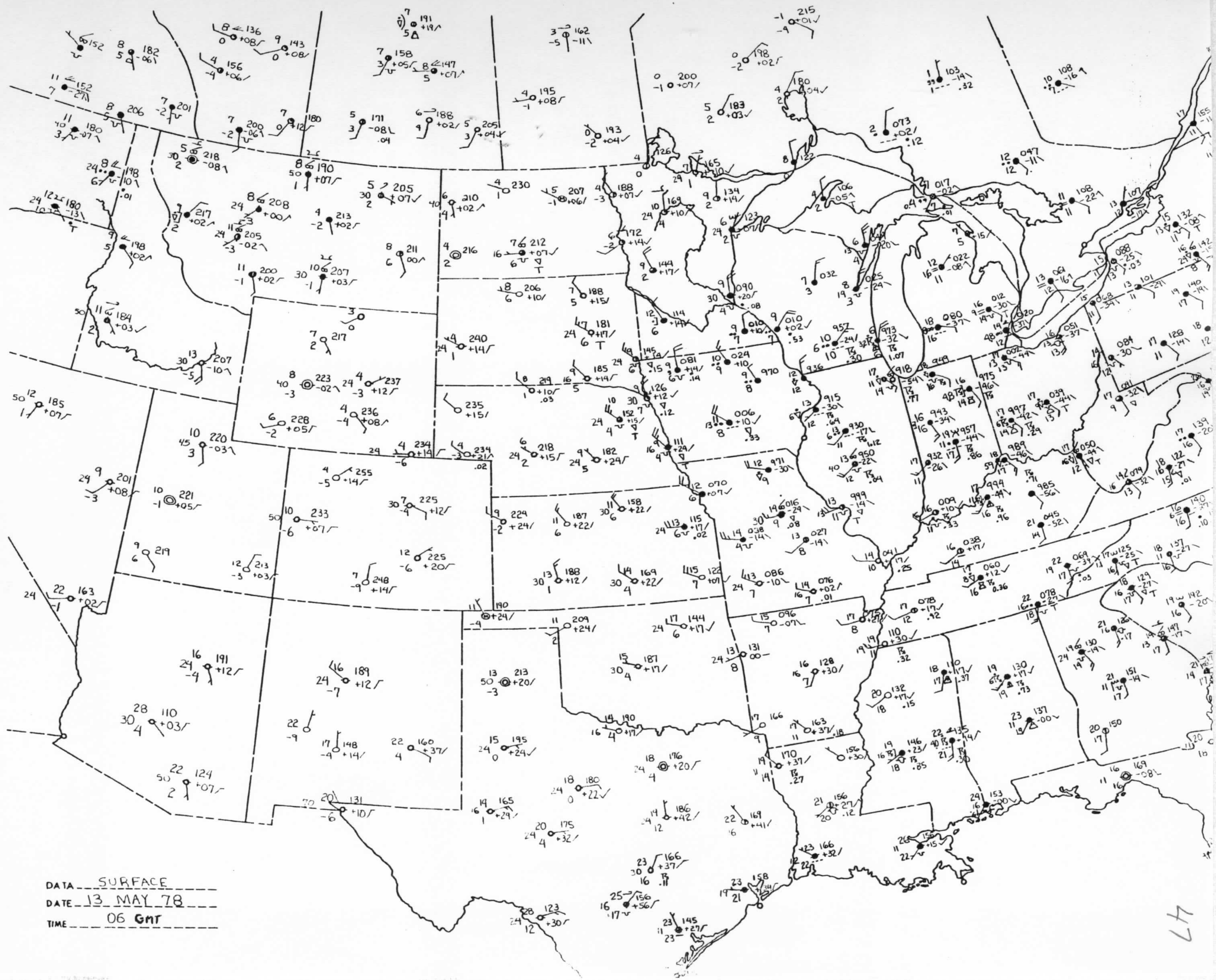


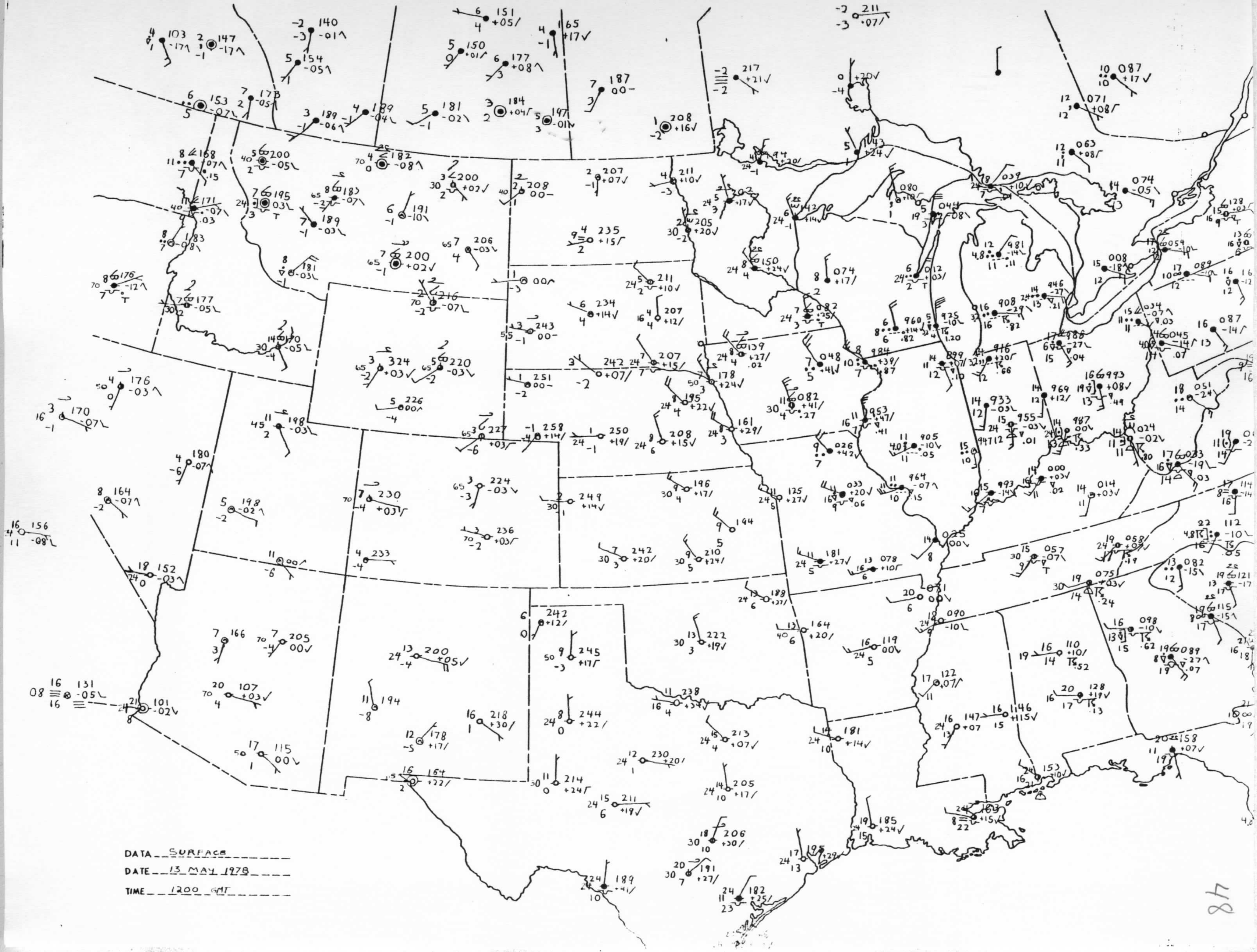
DATA SURFACE

DATE 13 MAY 1978

TIME 0000 GMT

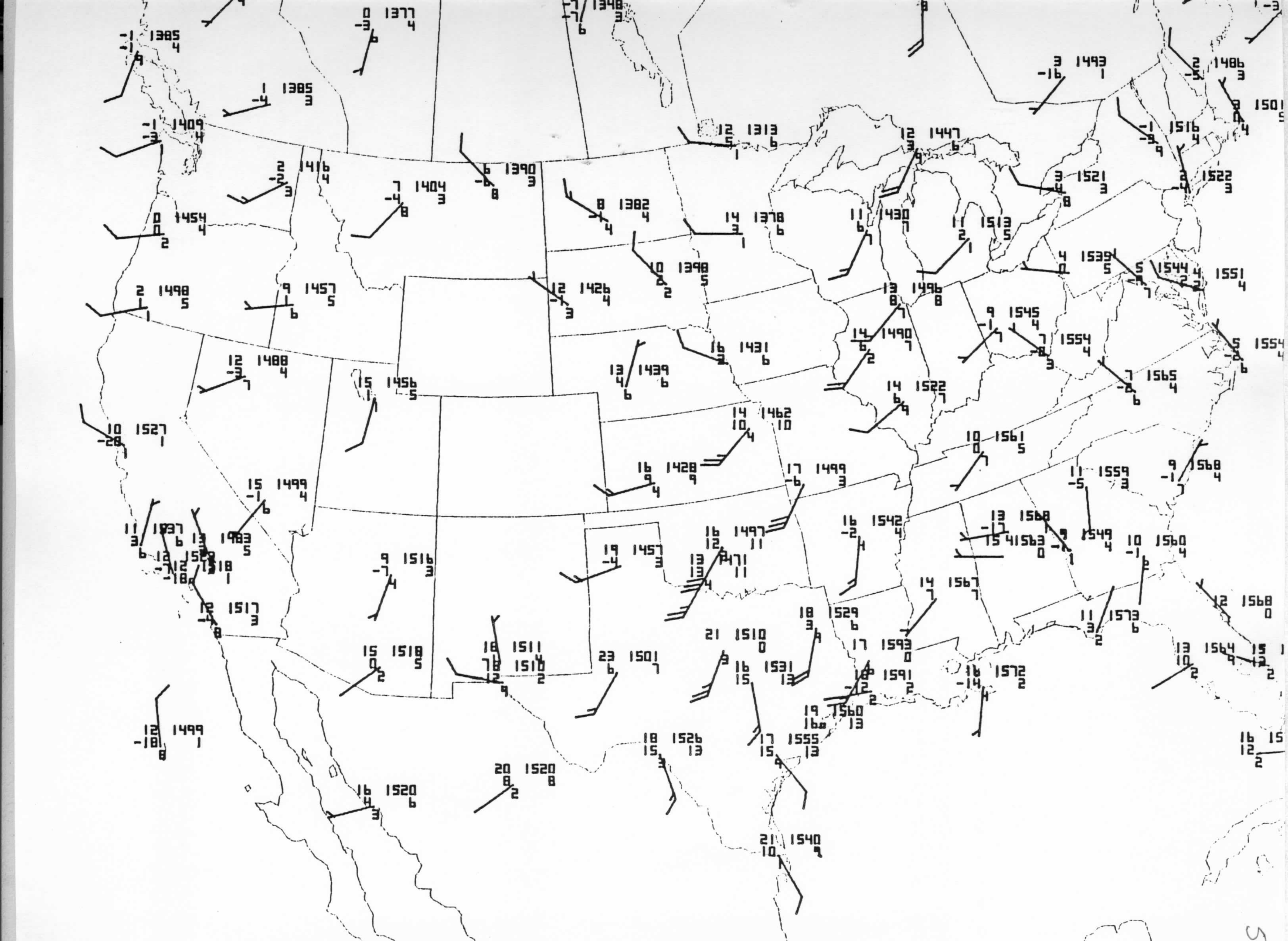
46


DATA SURFACE
DATE 13 MAY 78
TIME 06 GMT

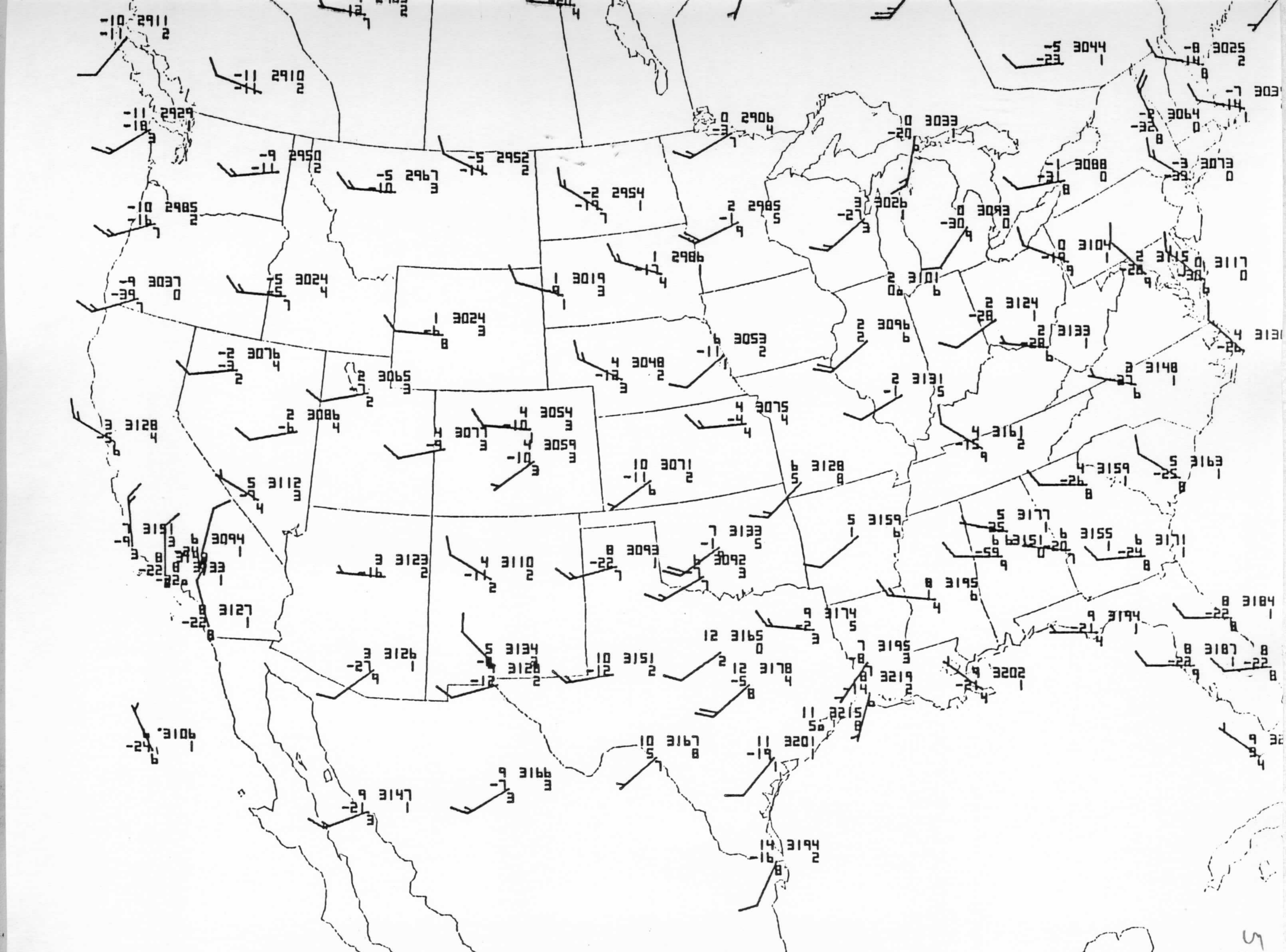

DATA SURFACE
DATE 13 MAY 1978
TIME 1200 GMT

3. Isobaric Charts
   300 mb, 500 mb, 700 mb, 850 mb

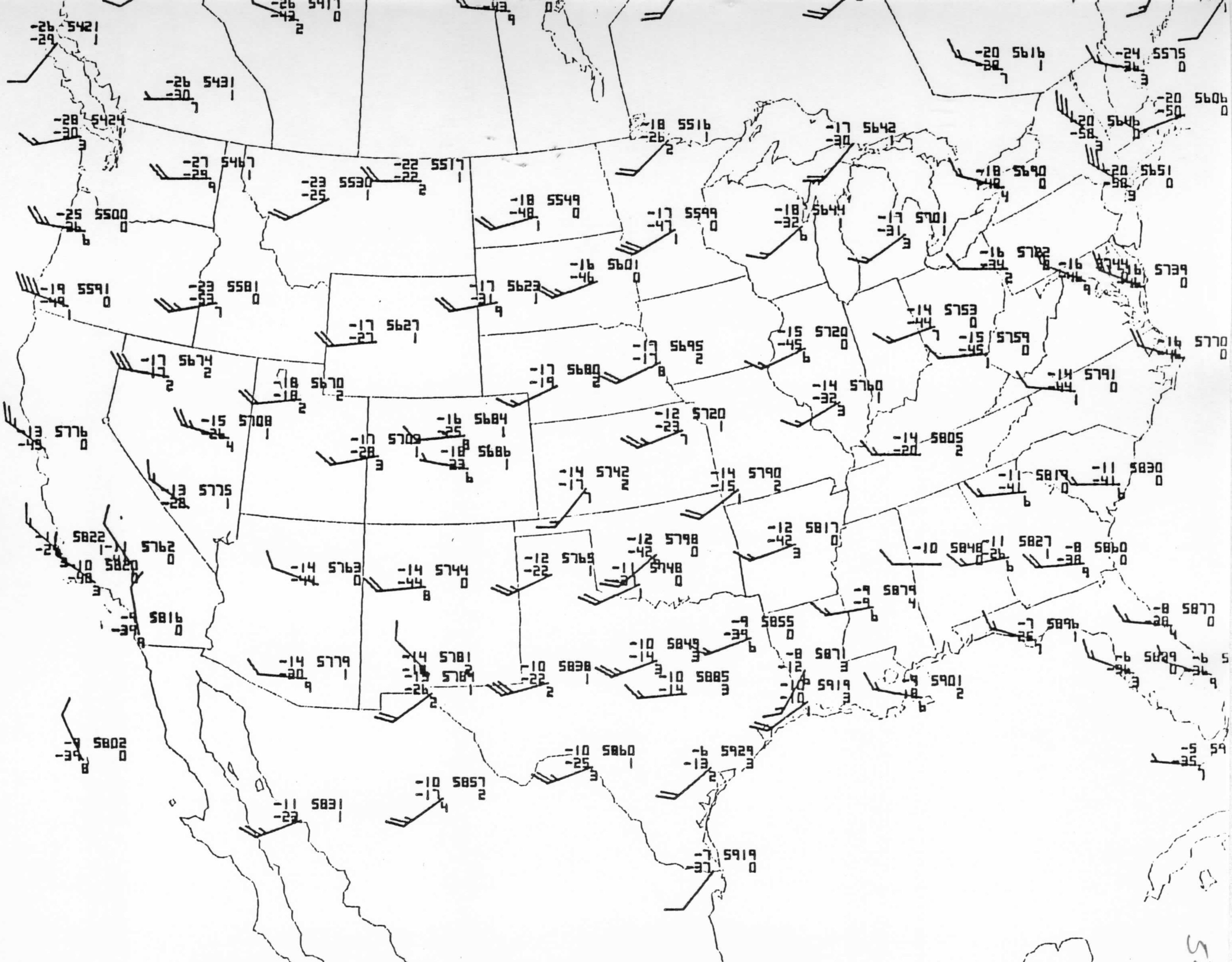
a. 11 May 1200 GMT
b. 12 May 0000 GMT
c. 12 May 1200 GMT
d. 13 May 0000 GMT
e. 13 May 1200 GMT
f. 14 May 0000 GMT
g. 14 May 1200 GMT



PRESSURE 850MB 12UT 11 MAY 1978



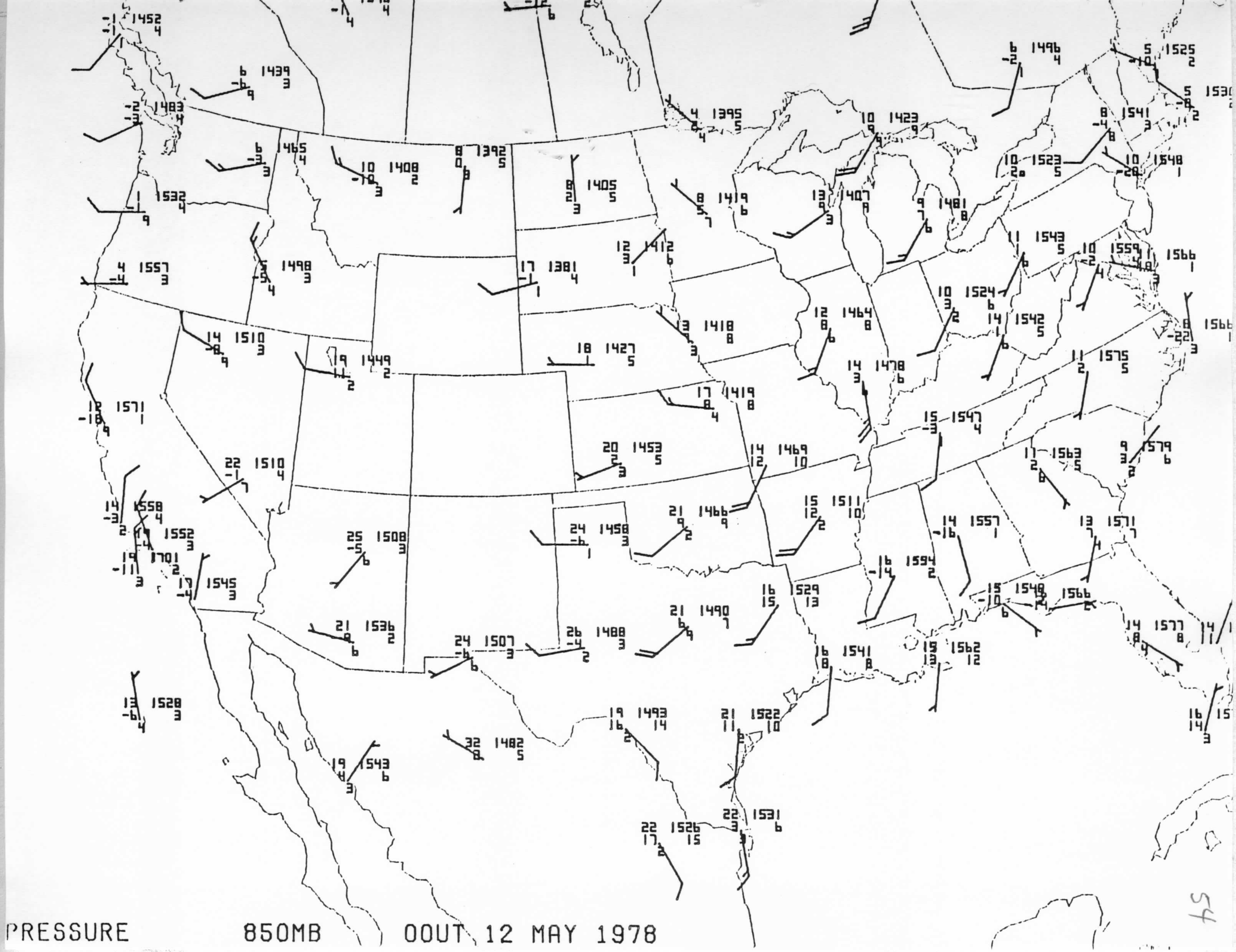
PRESSURE 700MB 12UT 11 MAY 1978



PRESSURE 500MB 12UT 11 MAY 1978

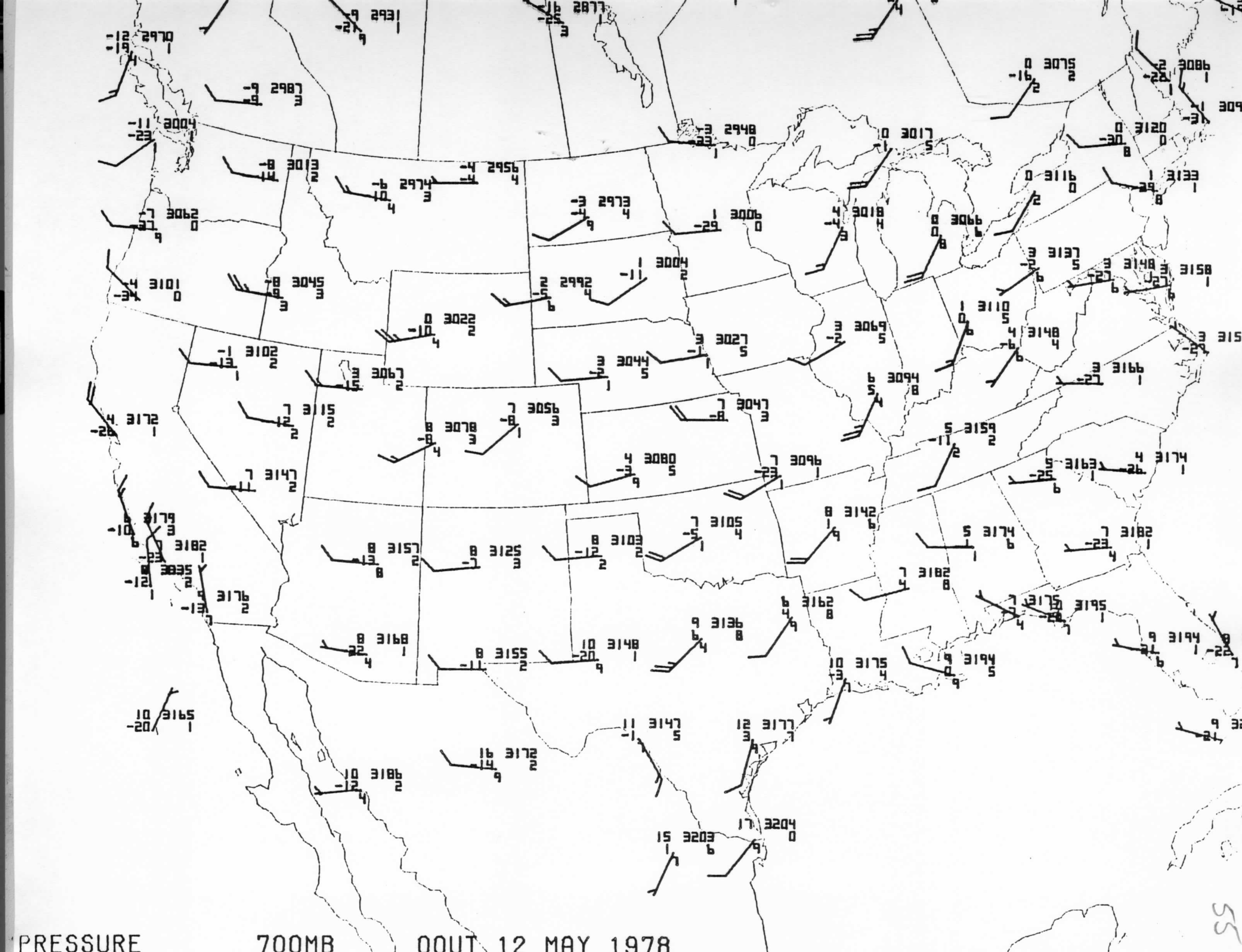
PRESSURE 300MB 12UT 11 MAY 1978

53



PRESSURE 850MB 00UT 12 MAY 1978

54

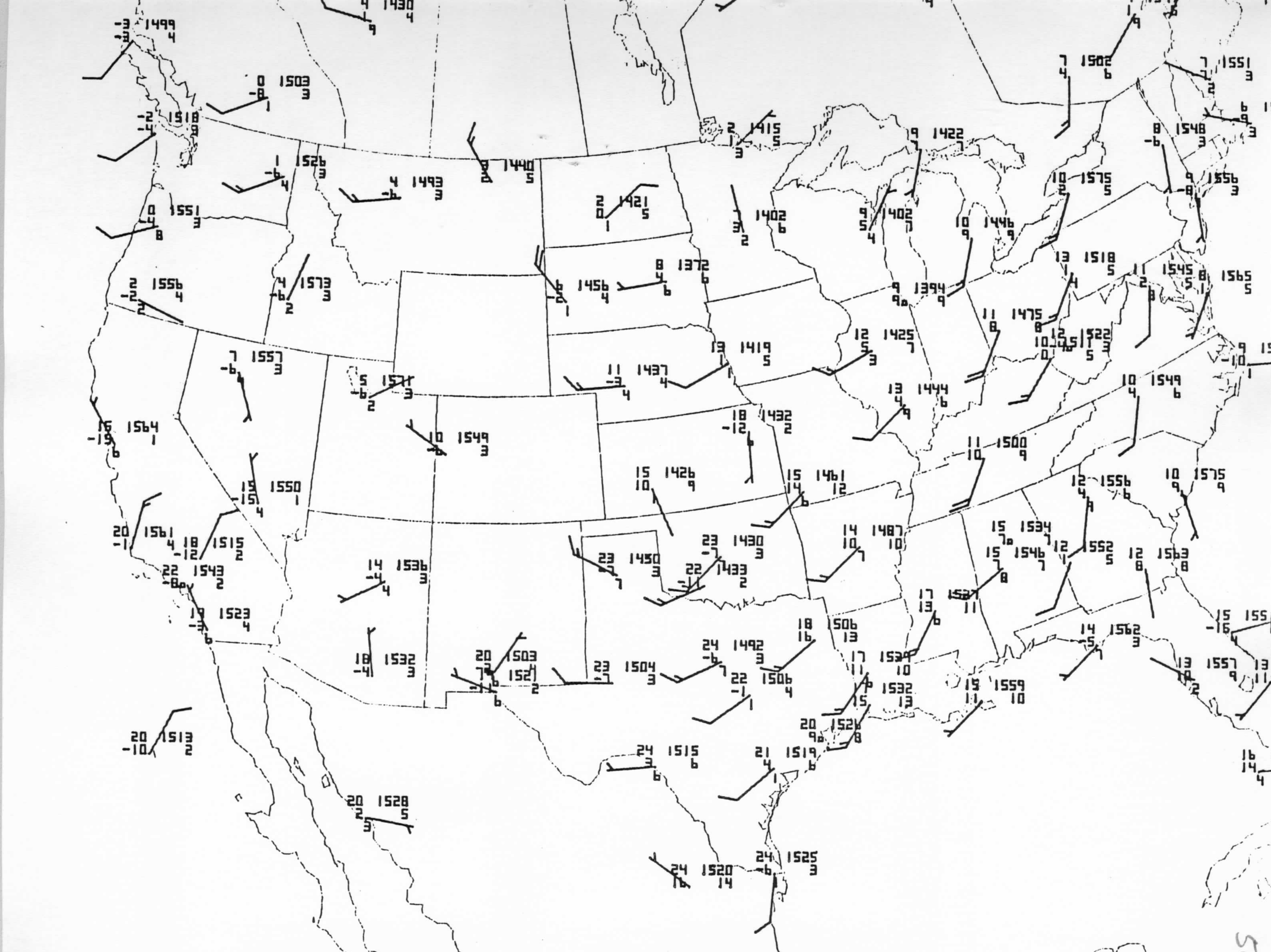


PRESSURE 700MB 00UT 12 MAY 1978

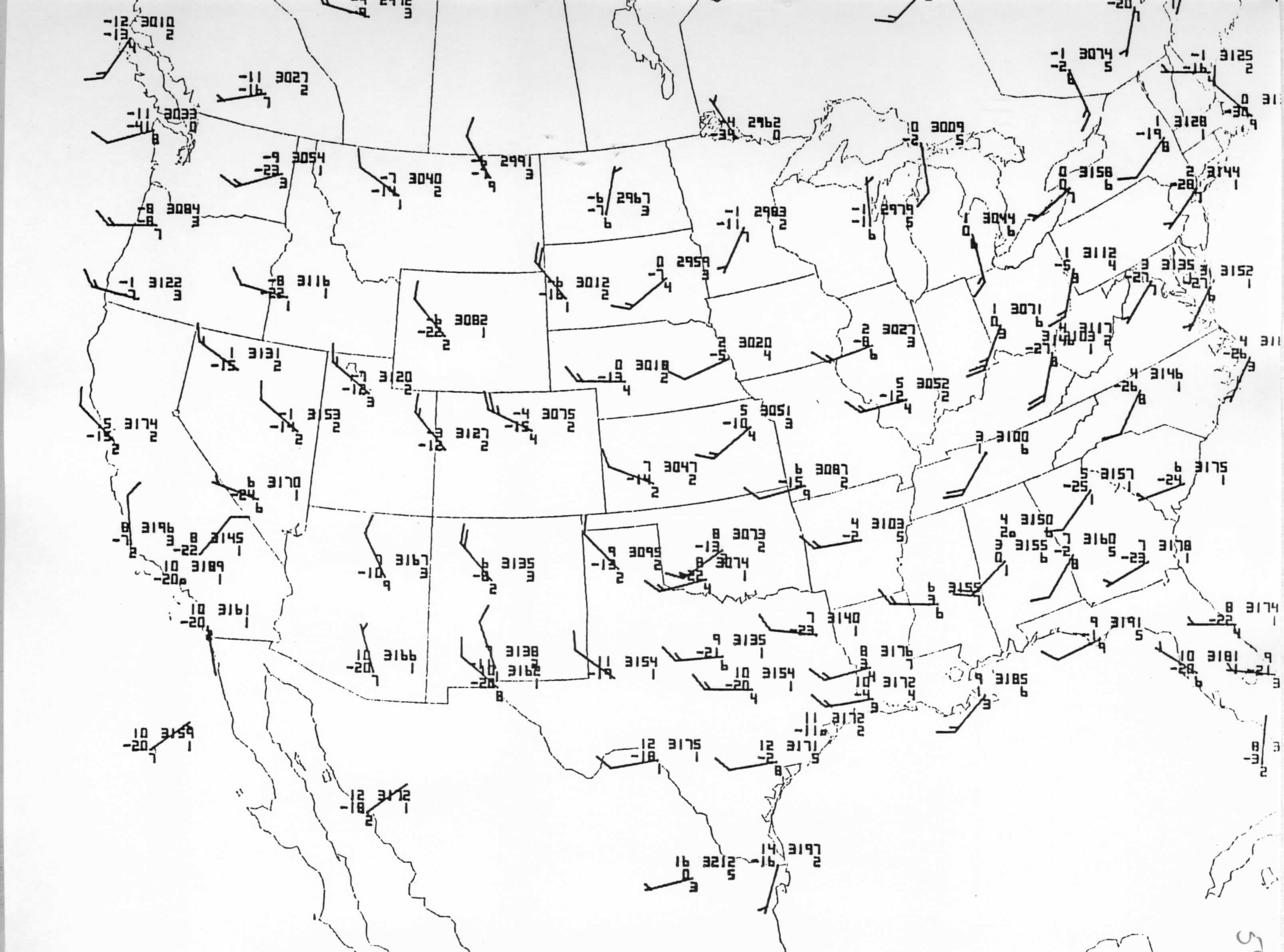
PRESSURE 500MB 00UT 12 MAY 1978

PRESSURE 300MB 00UT 12 MAY 1978

57



PRESSURE 850MB 12UT 12 MAY 1978

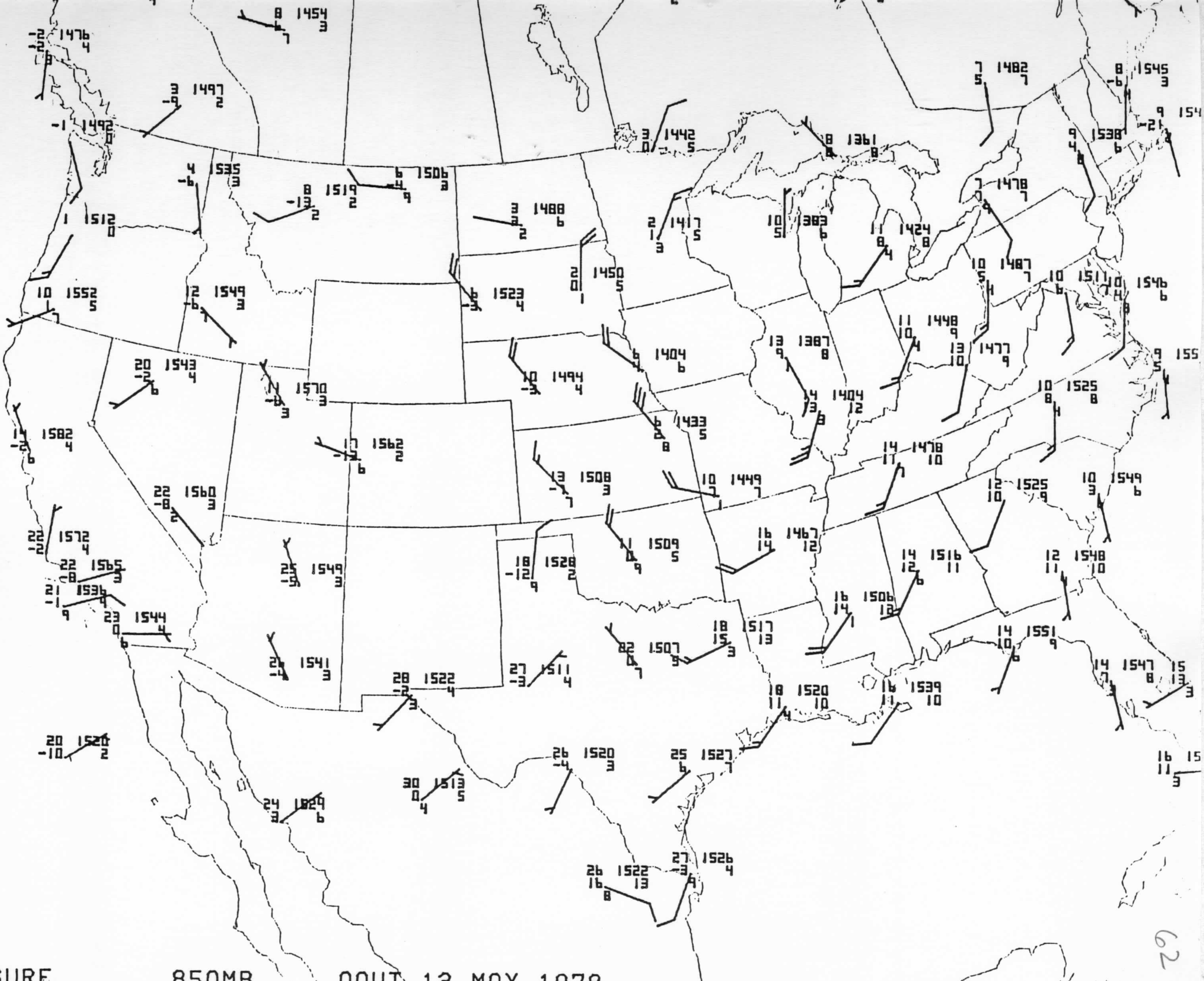


PRESSURE 700MB 12UT 12 MAY 1978

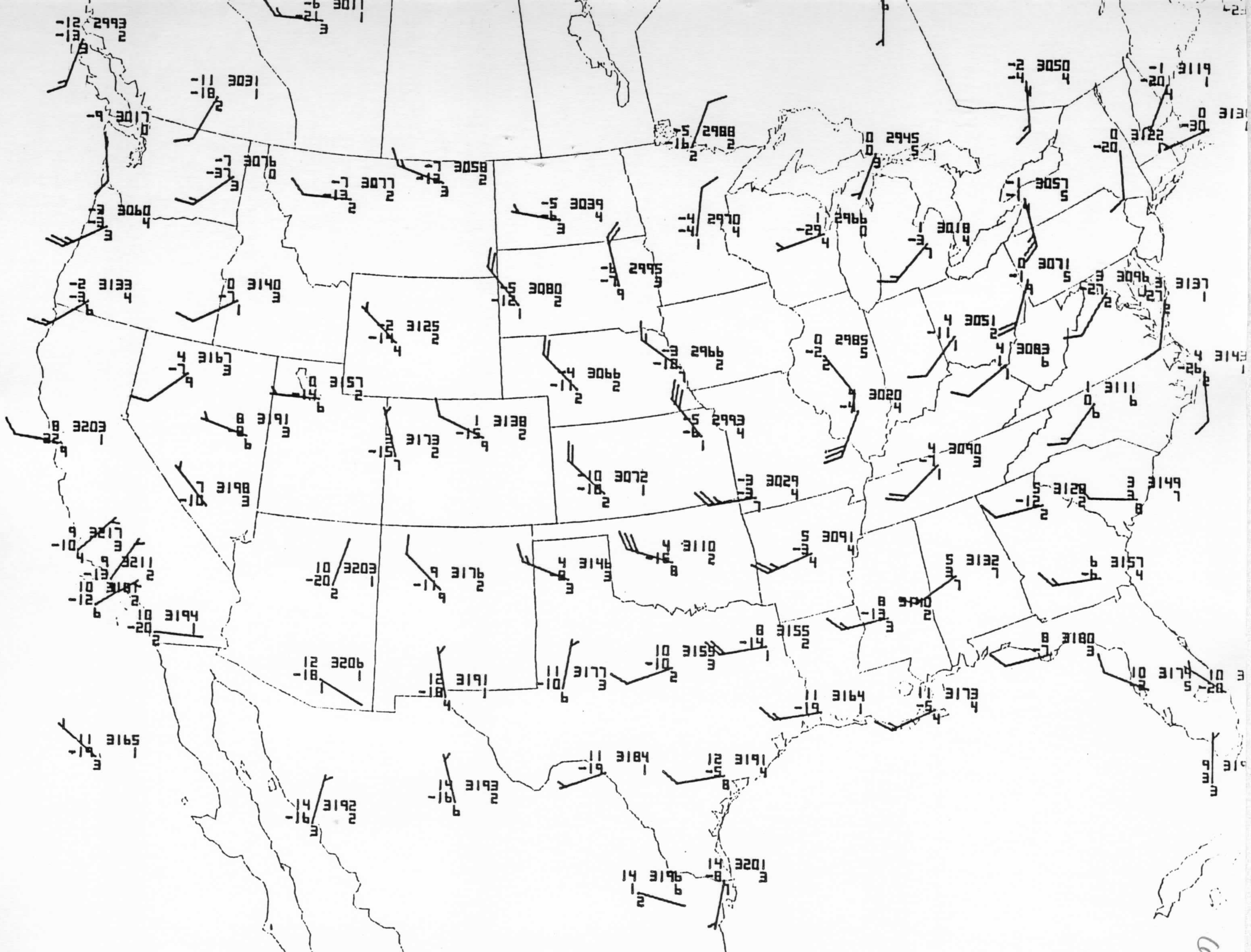
PRESSURE 500MB 12UT 12 MAY 1978

60

PRESSURE 300MB 12UT 12 MAY 1978



PRESSURE 850MB 00UT 13 MAY 1978



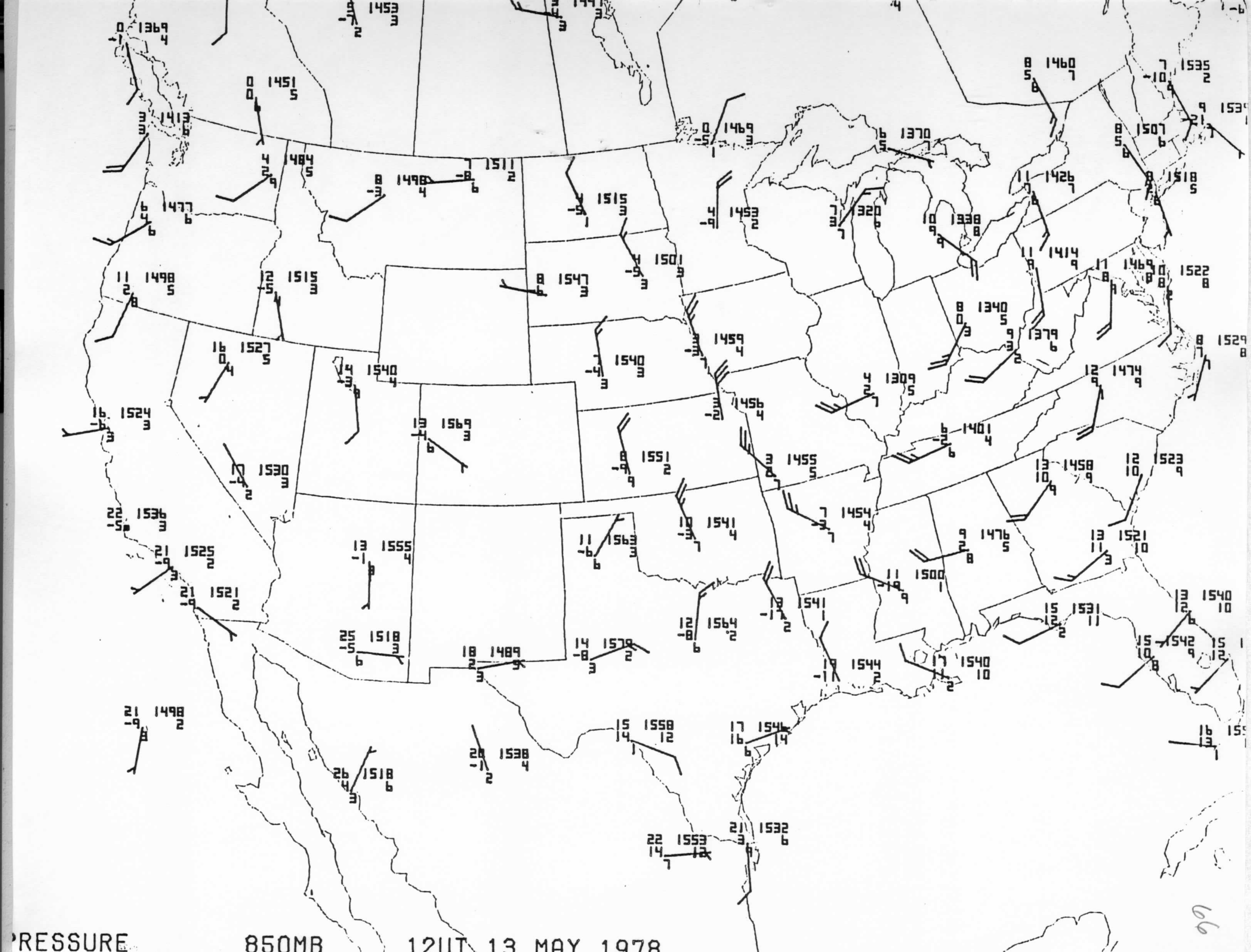
PRESSURE 700MB 00UT 13 MAY 1978

63

PRESSURE 500MB 00UT 13 MAY 1978

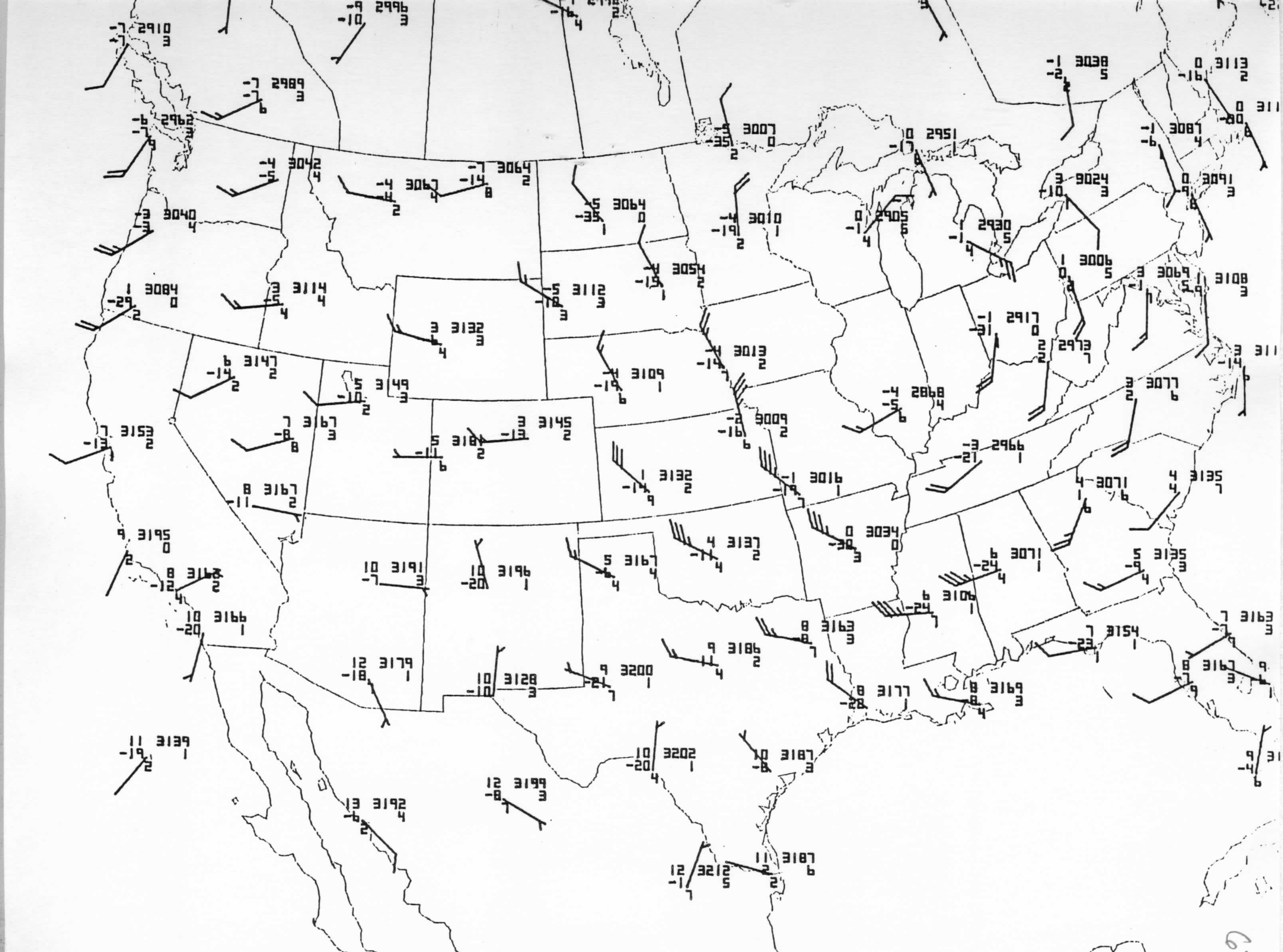
RESSURE 300MB 00UT 13 MAY 1978

65

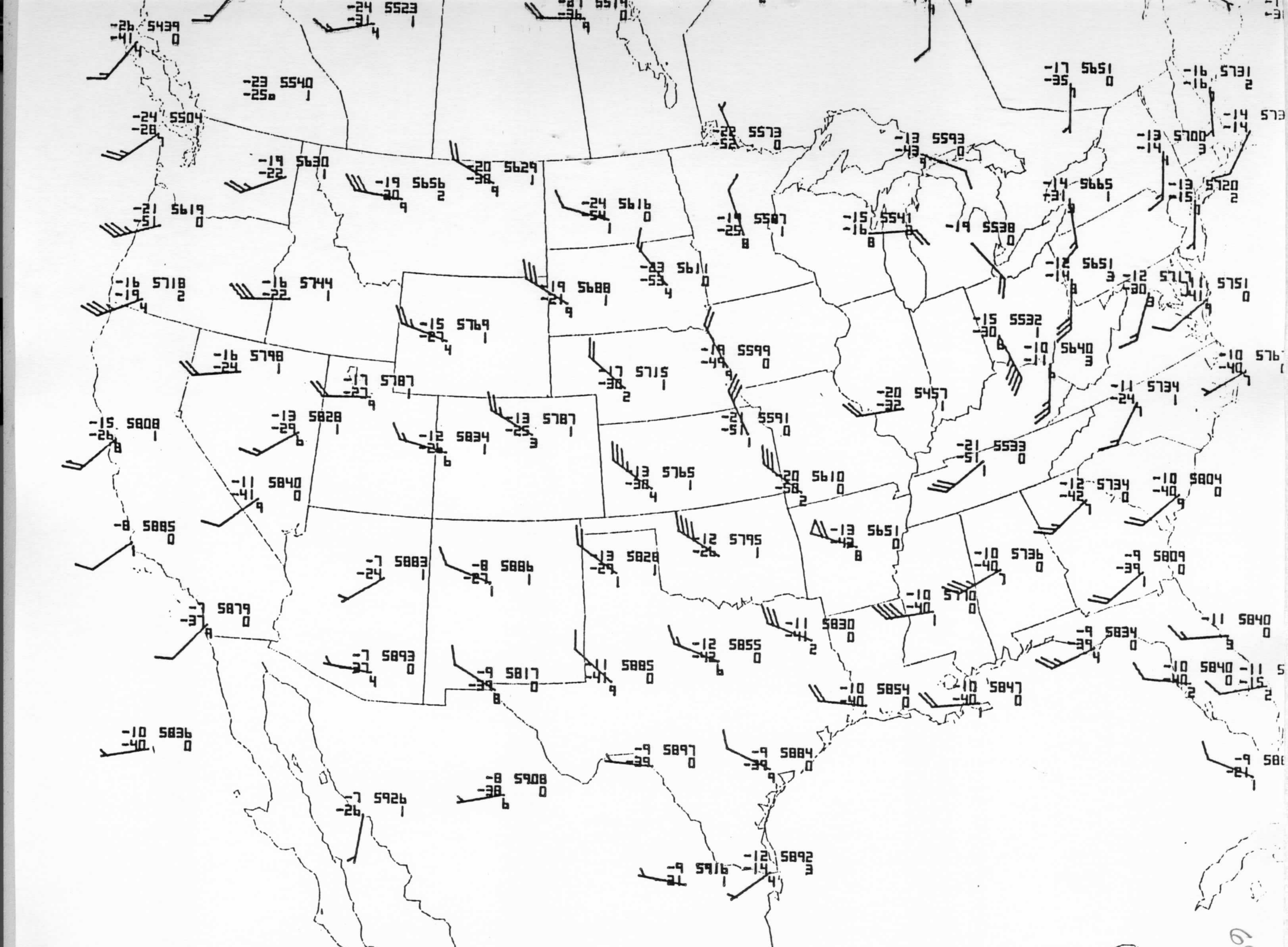


PRESSURE 850MB 12UT 13 MAY 1978

66

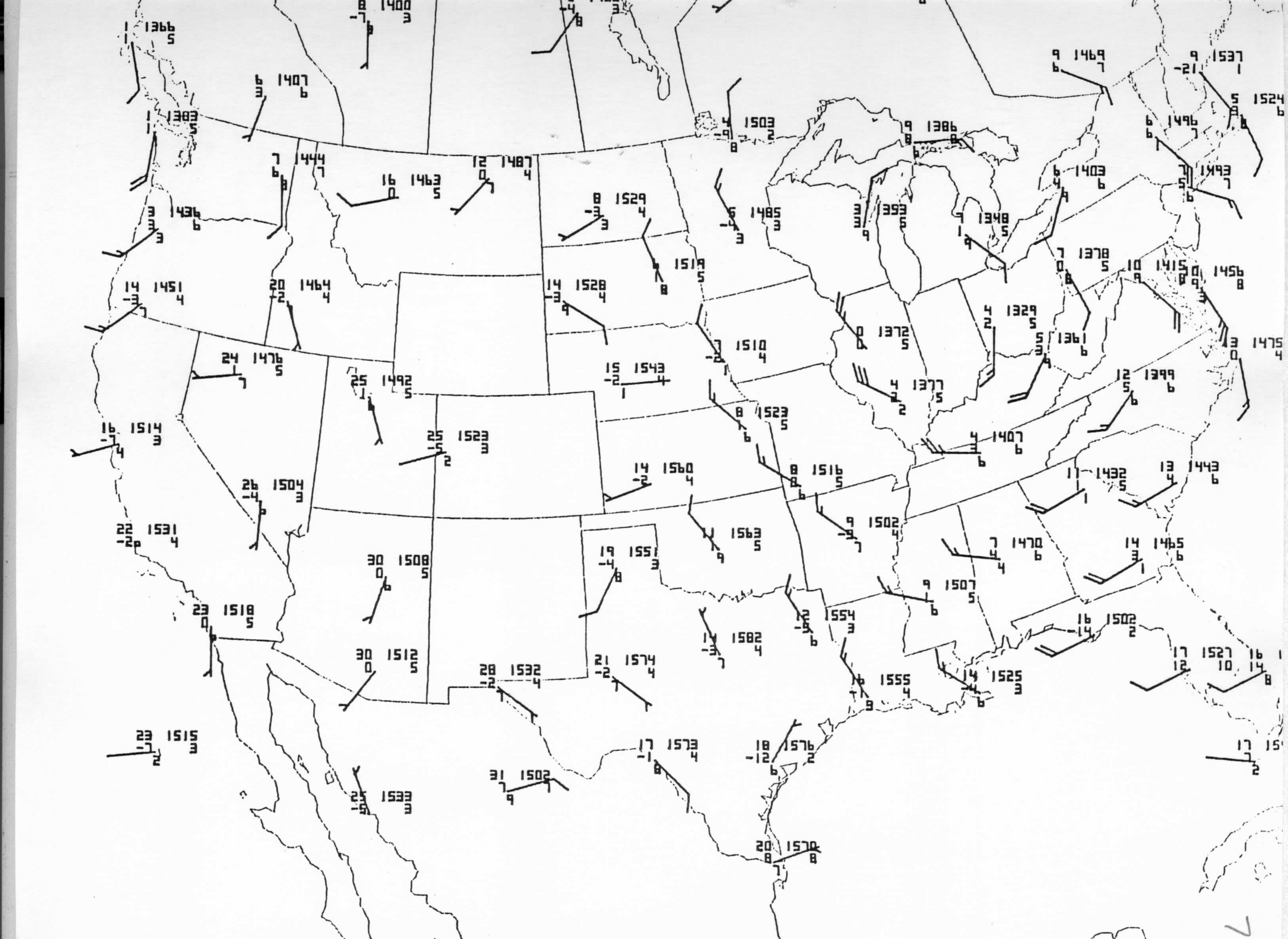


PRESSURE 700MB 12UT 13 MAY 1978



PRESSURE 500MB 12UT 13 MAY 1978

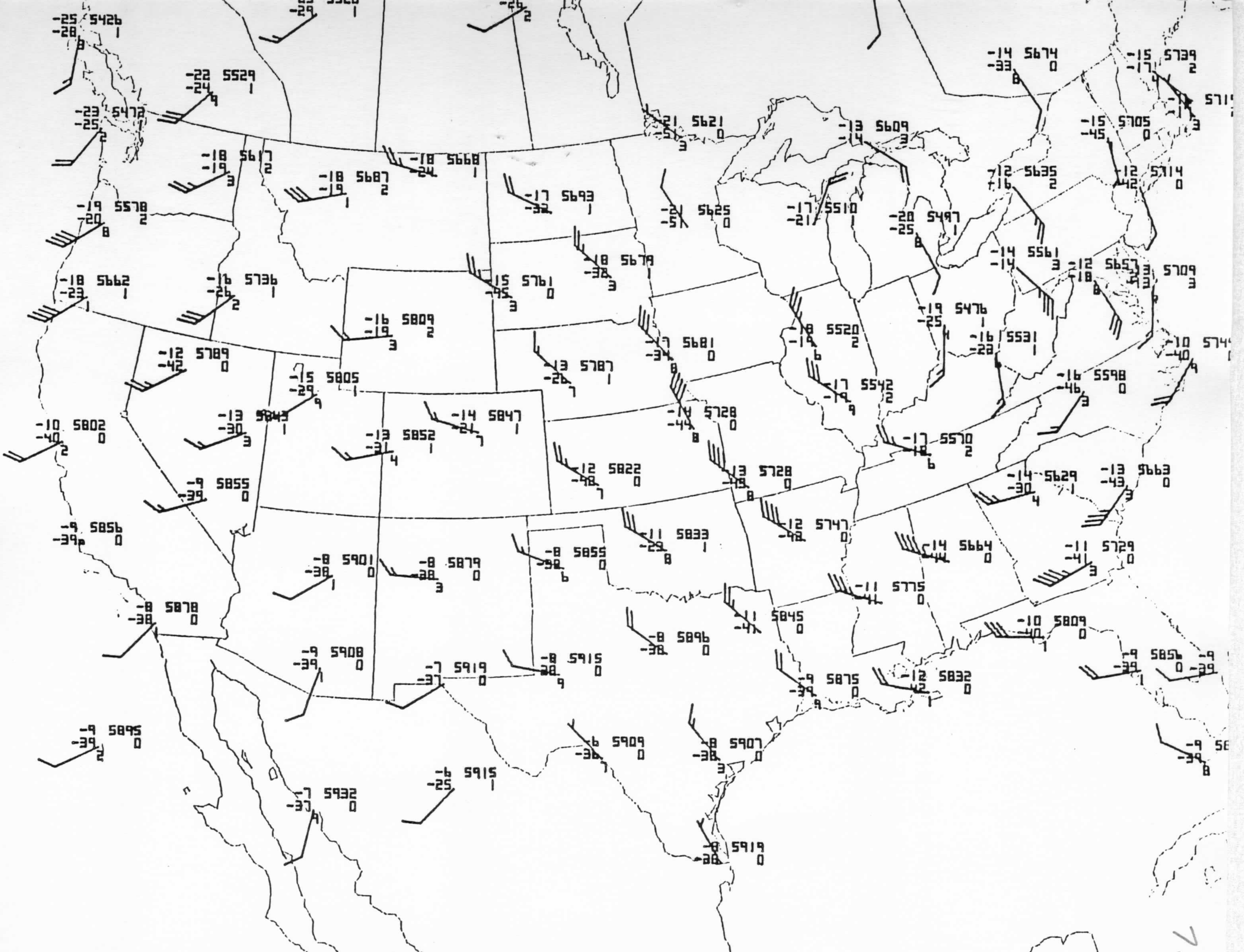
PRESSURE 300MB 12UT 13 MAY 1978



PRESSURE 850MB 00UT 14 MAY 1978

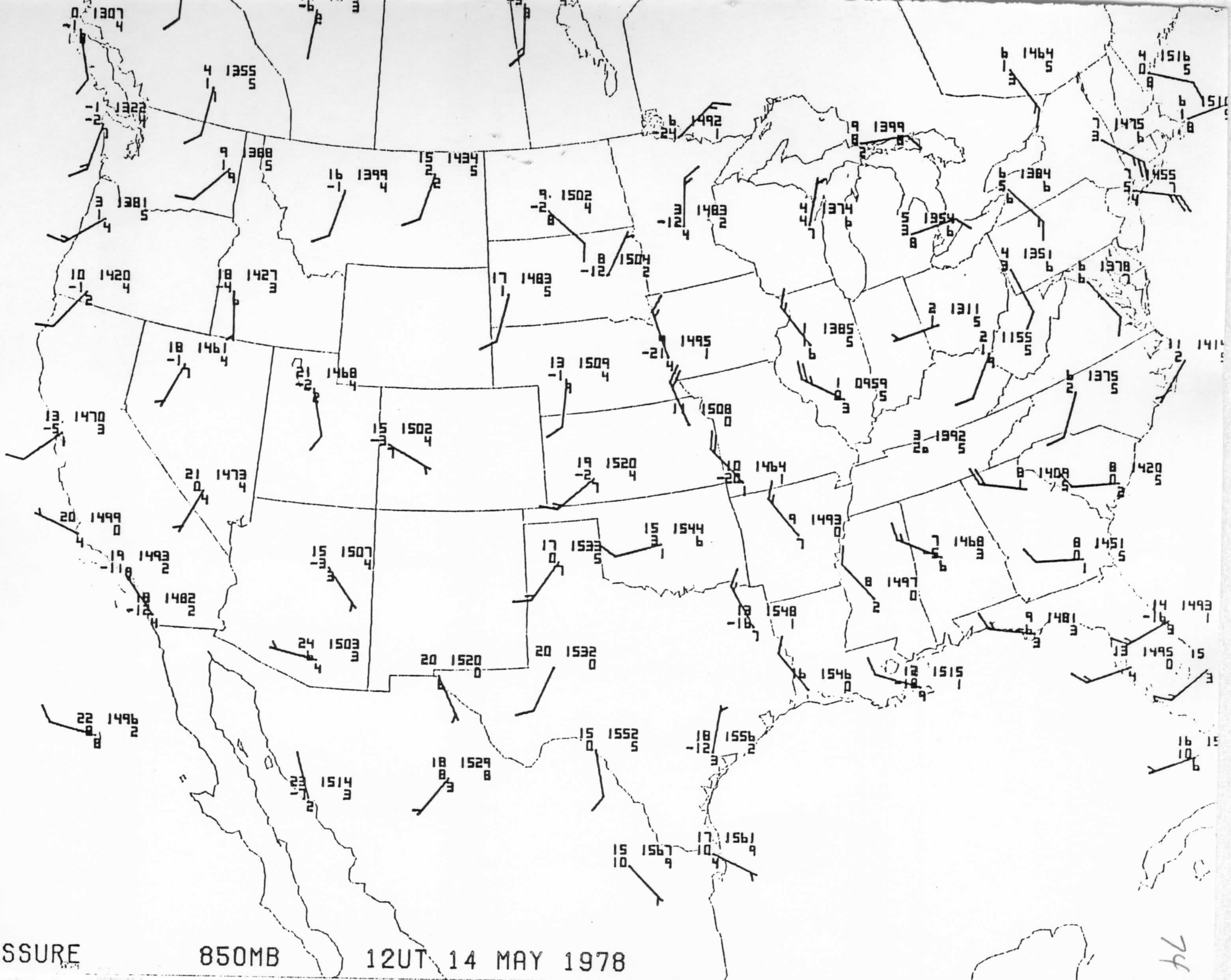
70

PRESSURE 700MB 00UT 14 MAY 1978



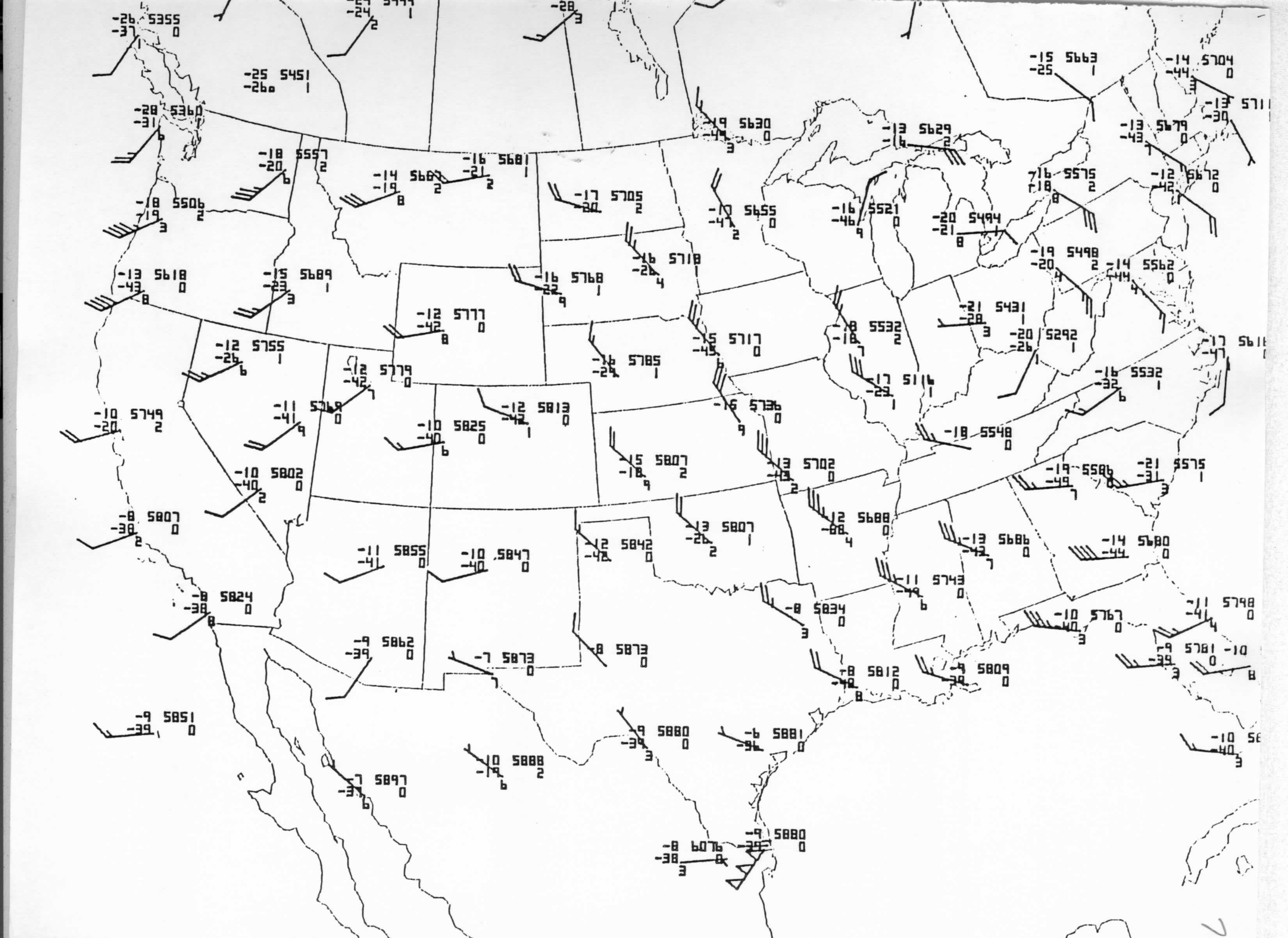
PRESSURE 500MB 00UT 14 MAY 1978

PRESSURE 300MB 00UT 14 MAY 1978



PRESSURE 850MB 12UT 14 MAY 1978

PRESSURE. 700MB 12UT 14 MAY 1978

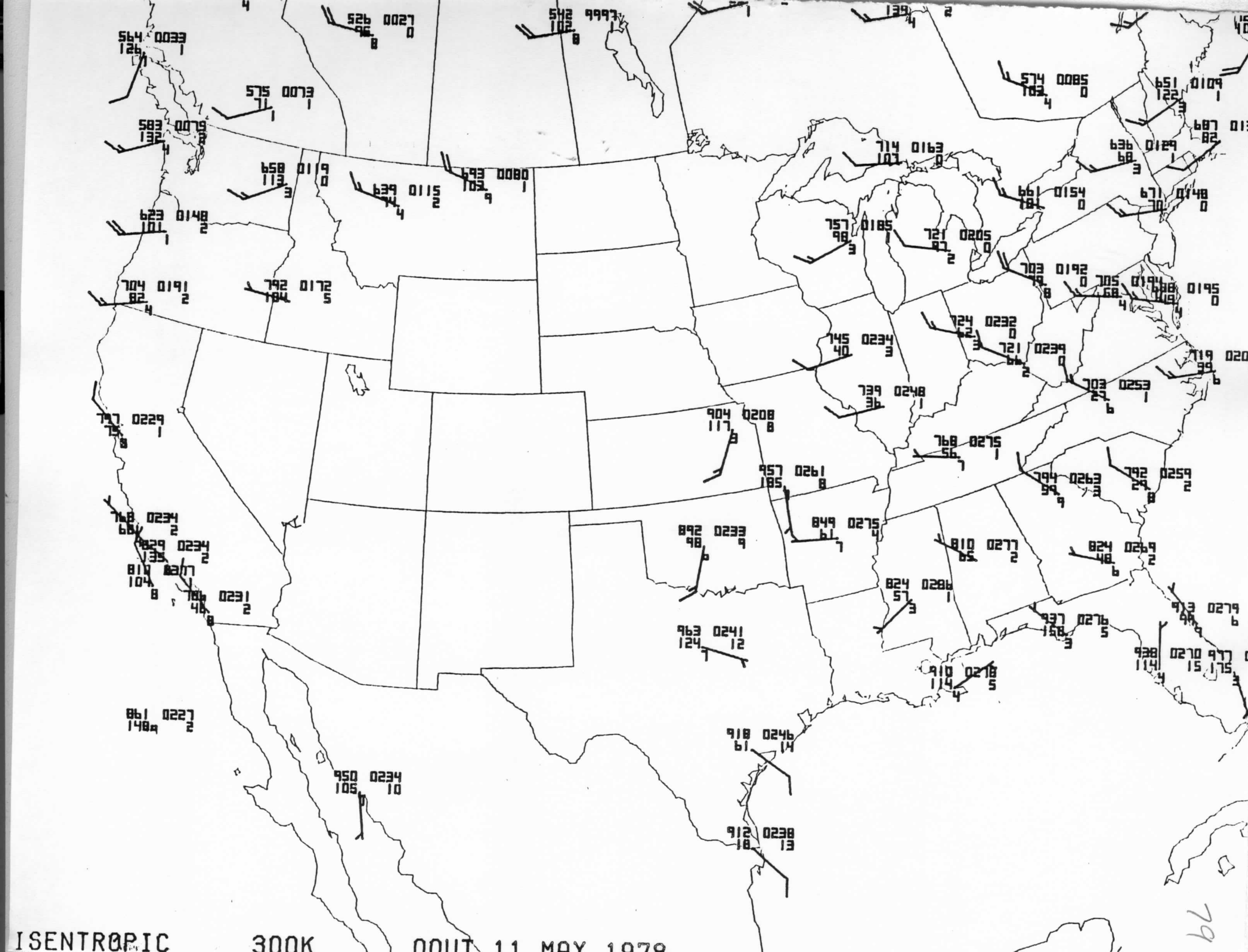


PRESSURE 500MB 12UT 14 MAY 1978

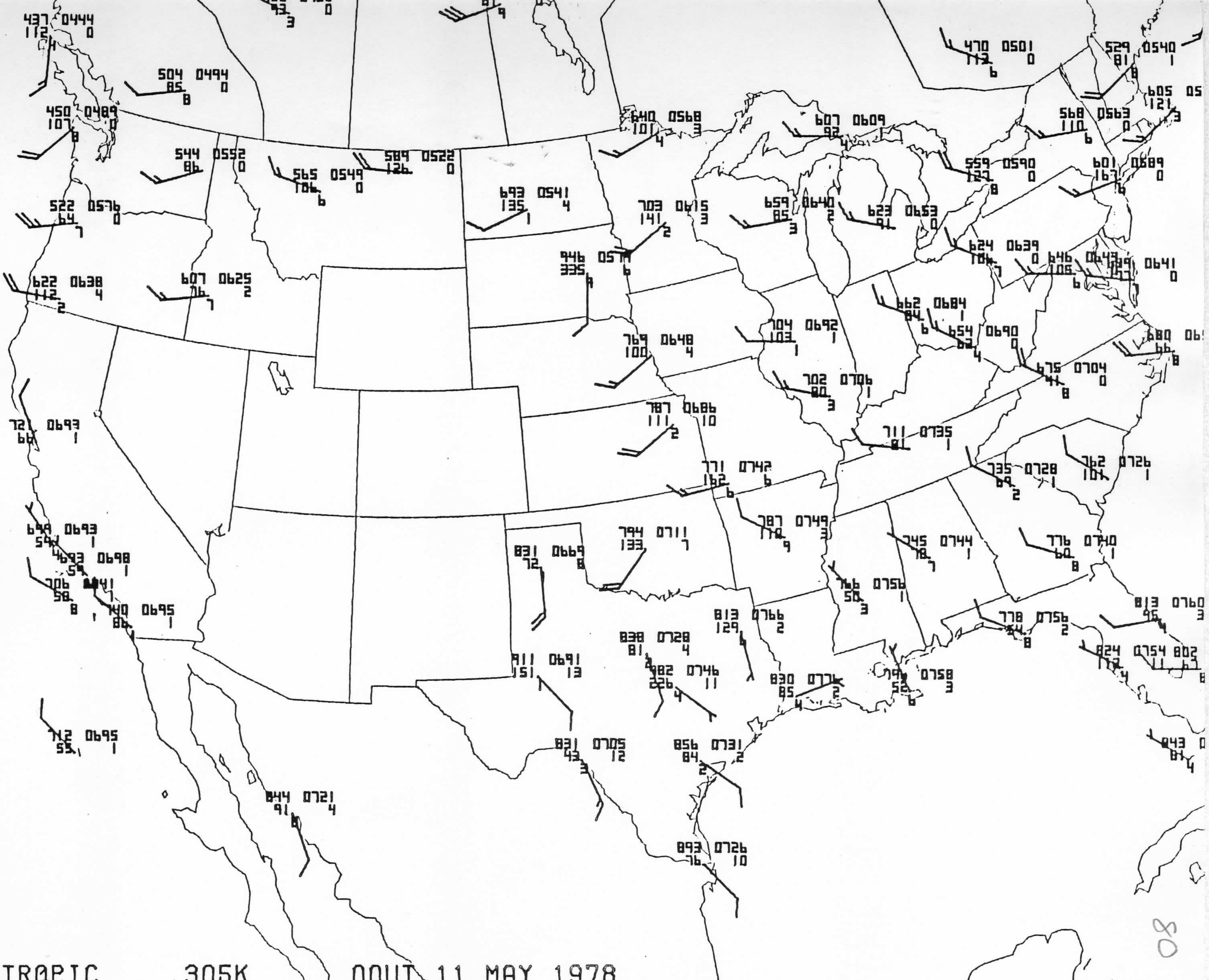
PRESSURE 300MB 12UT 14 MAY 1978

4. Isentropic Charts
5 K interval

a.	11 May 0000 GMT	300 - 305 K
b.	11 May 1200 GMT	300 - 305 K
c.	12 May 0000 GMT	300 - 305 K
d.	12 May 1200 GMT	290 - 325 K
e.	13 May 0000 GMT	290 - 325 K
f.	13 May 1200 GMT	290 - 320 K

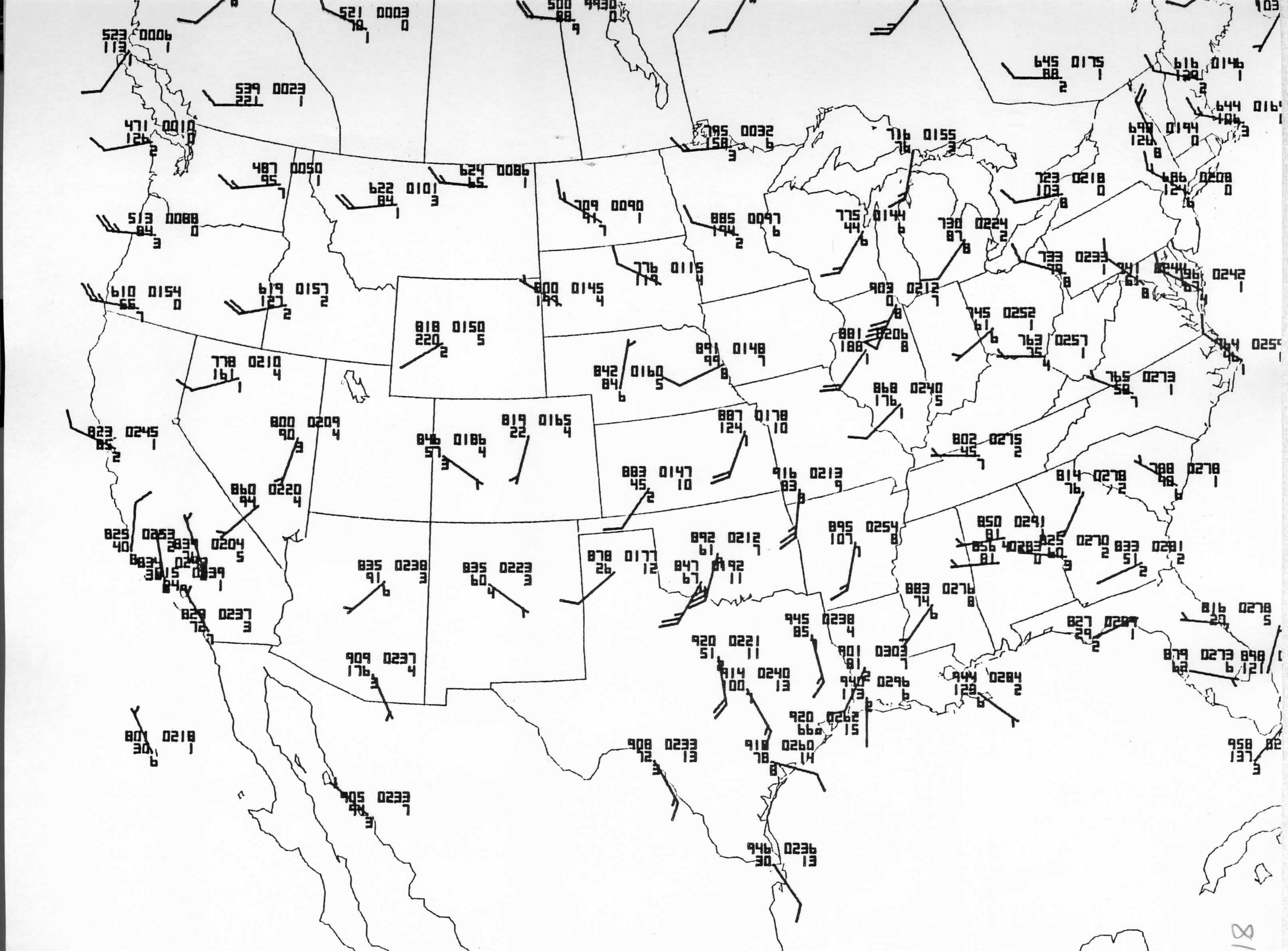


ISENTROPIC 300K 00UT 11 MAY 1978

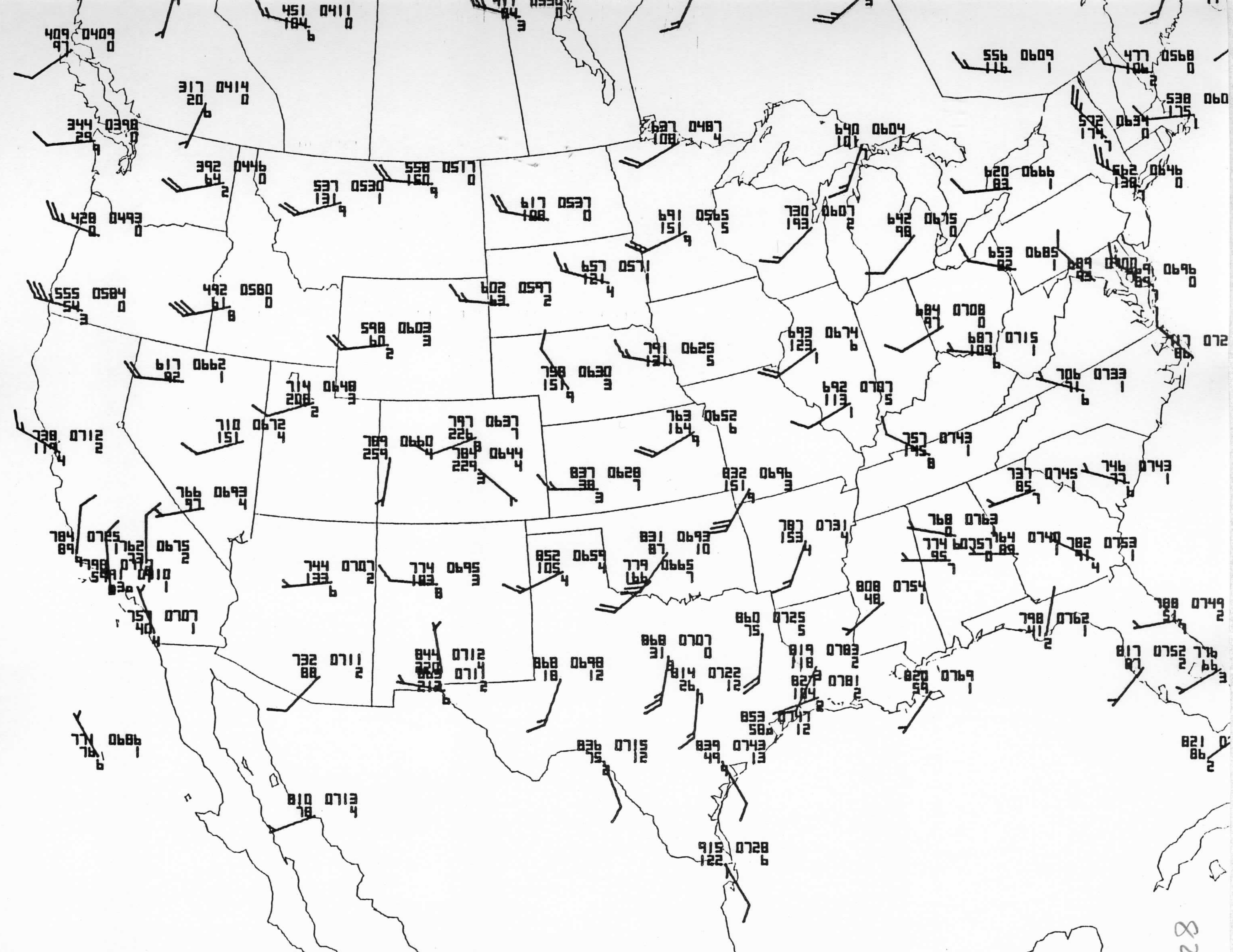


ISENTROPIC 305K 00UT 11 MAY 1978

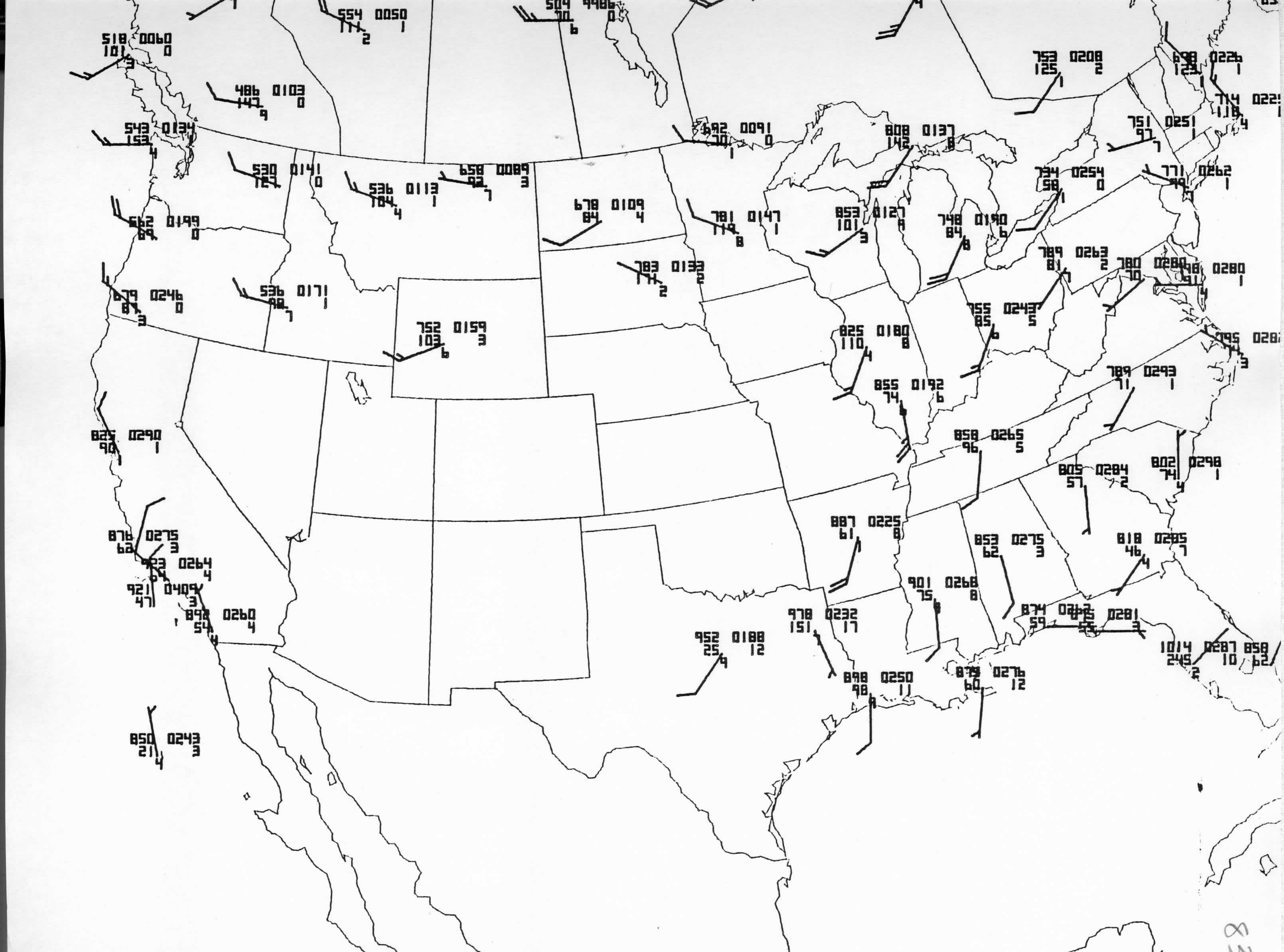
80



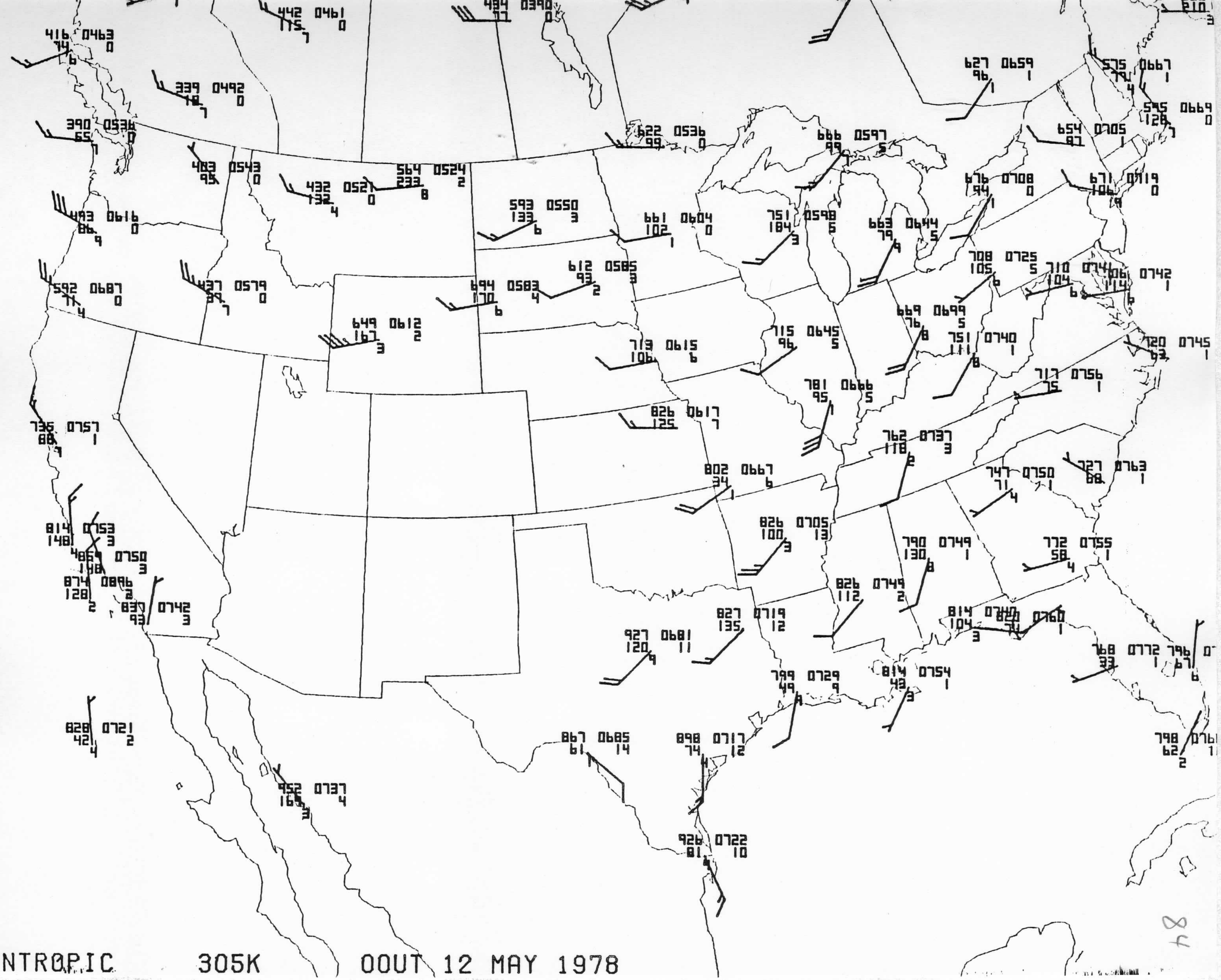
ISENTROPIC 300K 12UT 11 MAY 1978



ISENTROPIC 305K 12UT 11 MAY 1978

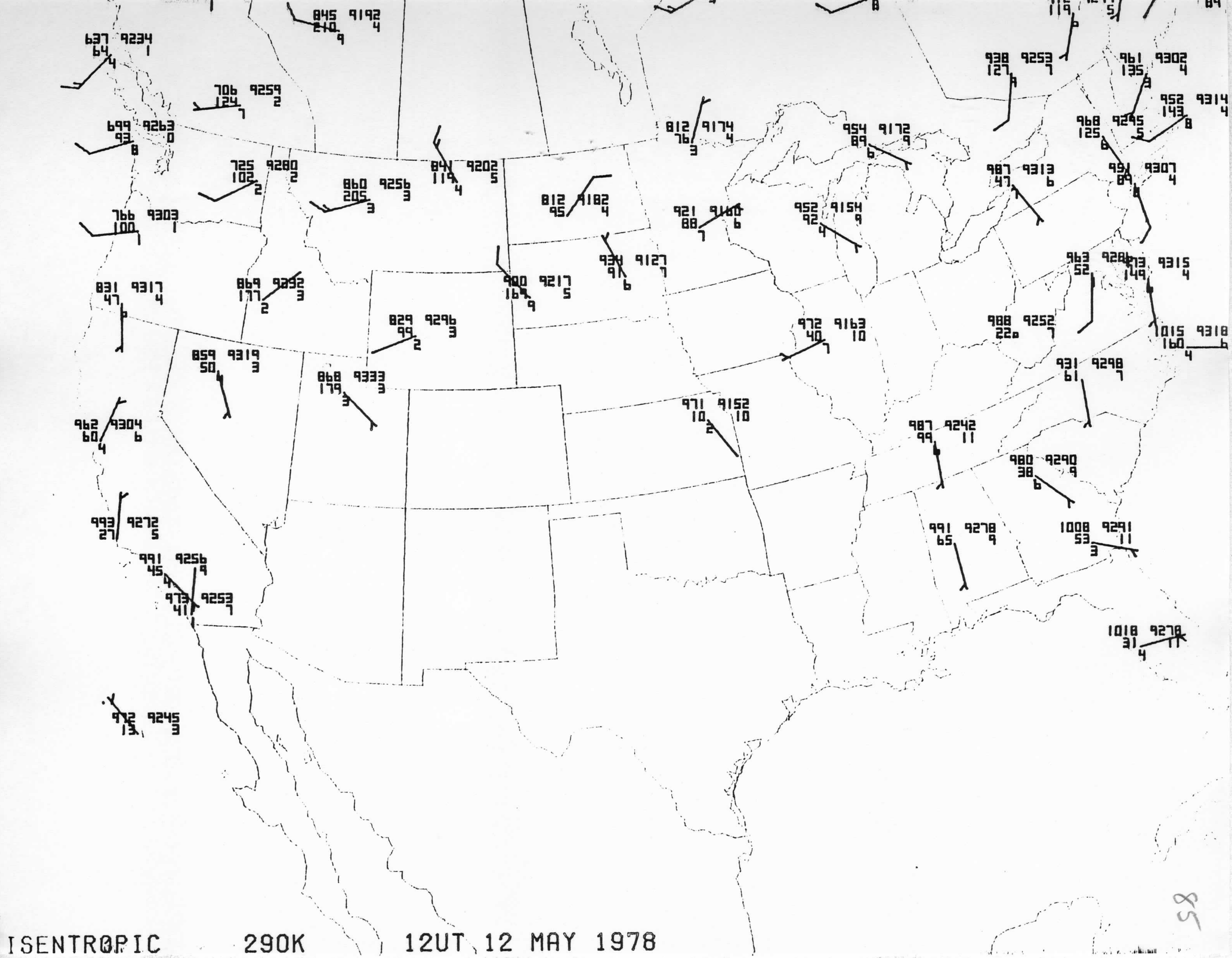


ISENTRØPIC 300K 00UT 12 MAY 1978



ISENTROPIC 305K 00UT 12 MAY 1978

84

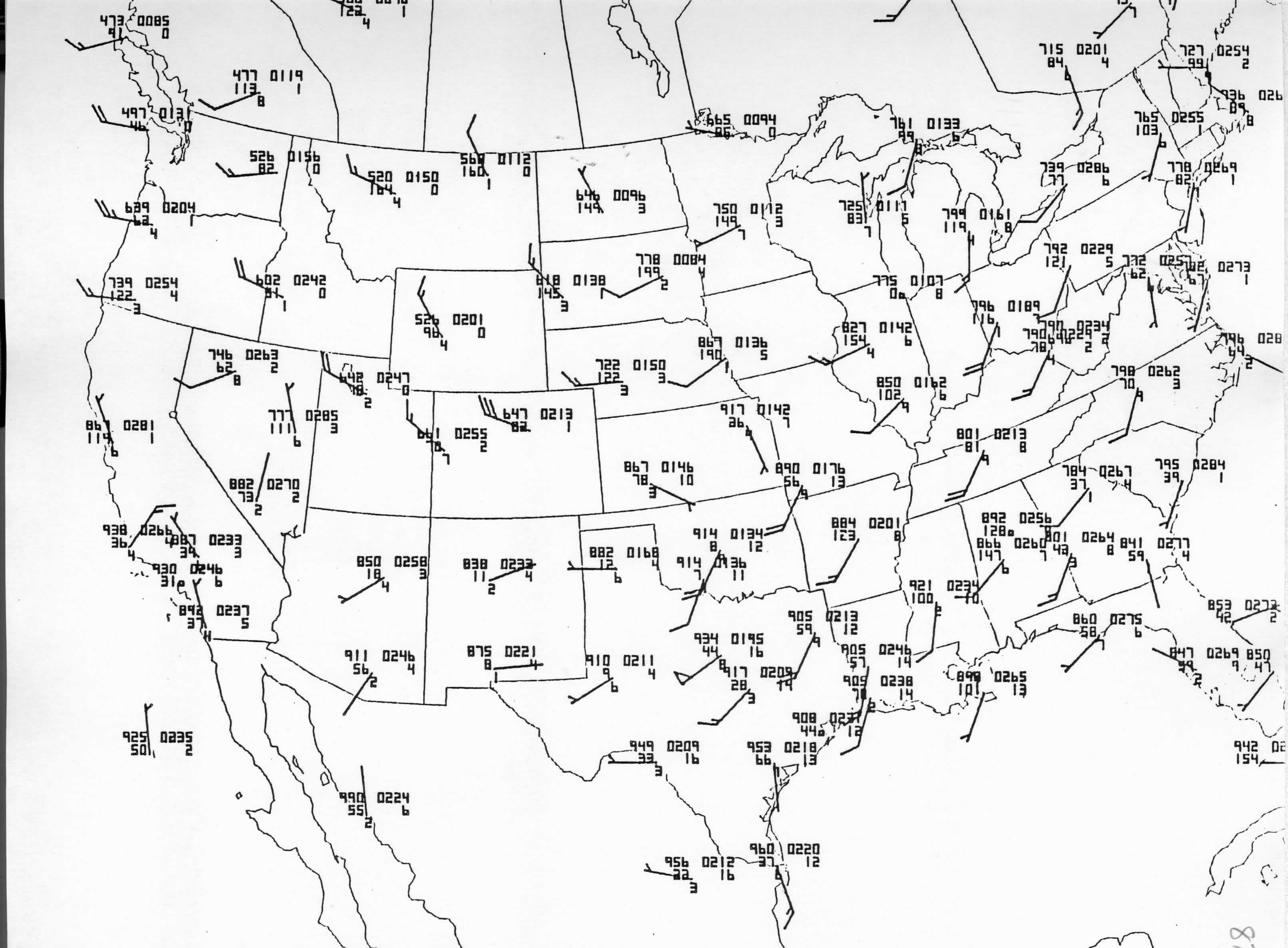


ISENTRØPIC 290K 12UT 12 MAY 1978

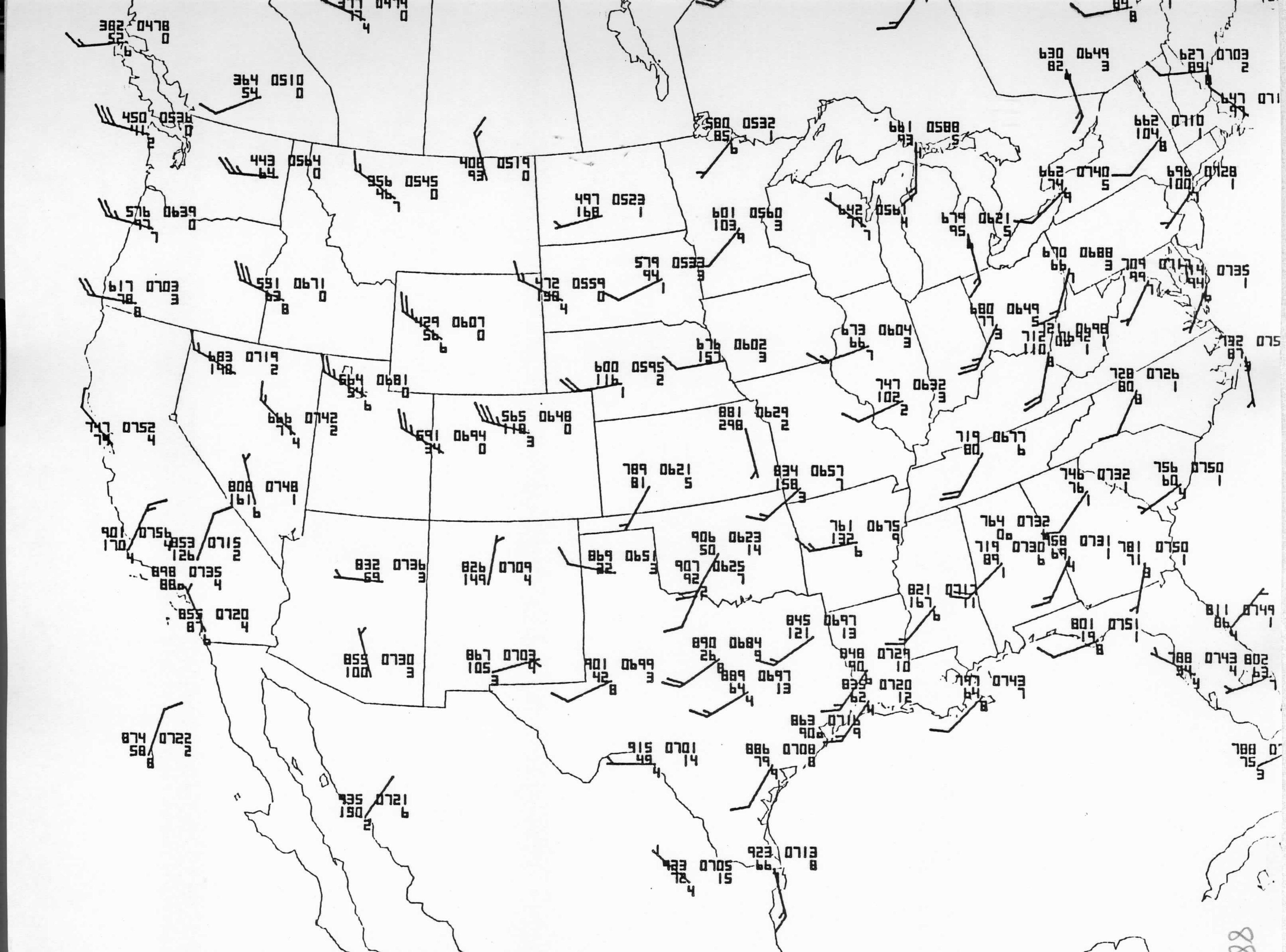
85

ISENTRØPIC 295K 12UT 12 MAY 1978

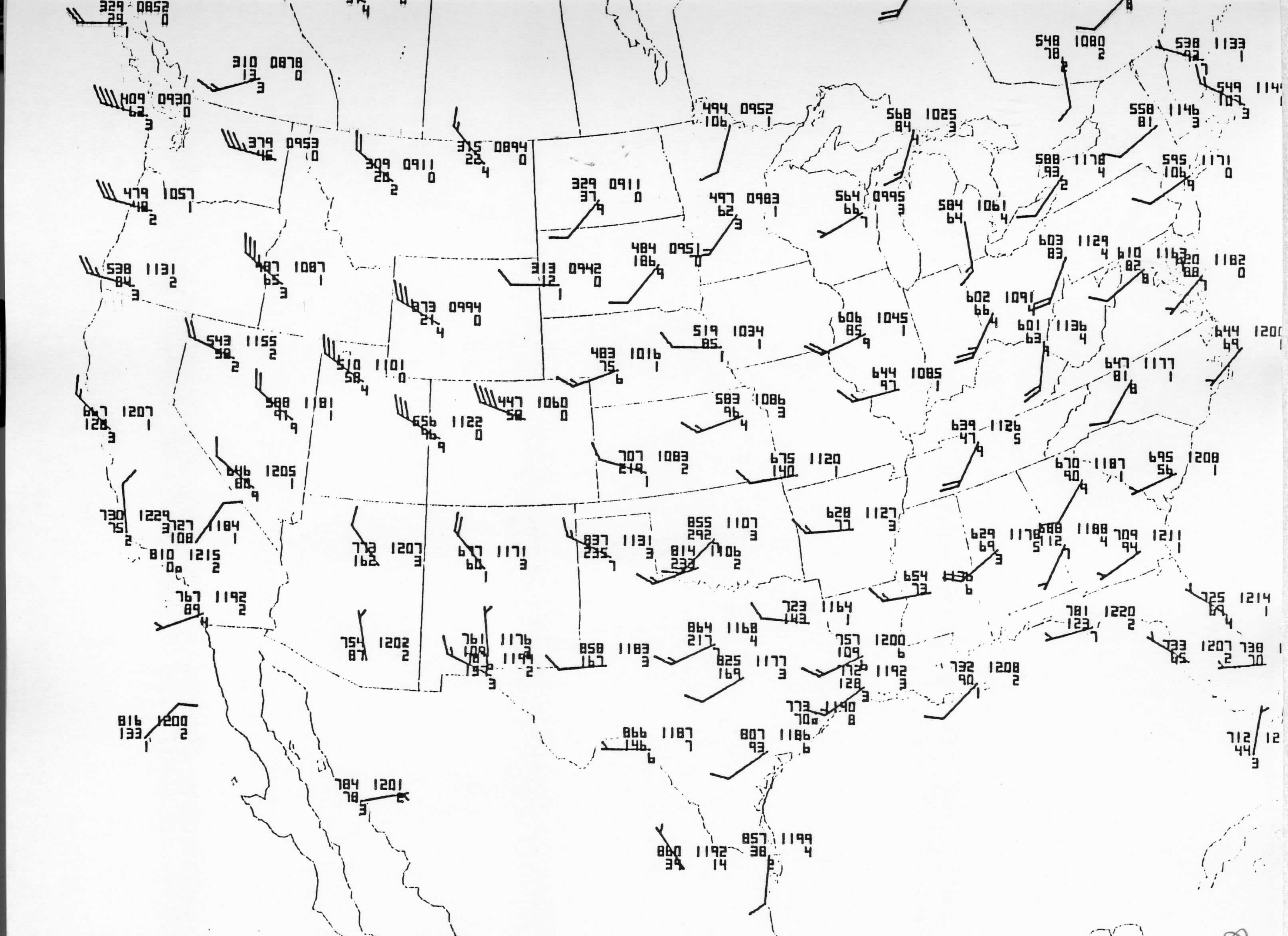
86



ISENTROPIC 300K 12UT 12 MAY 1978



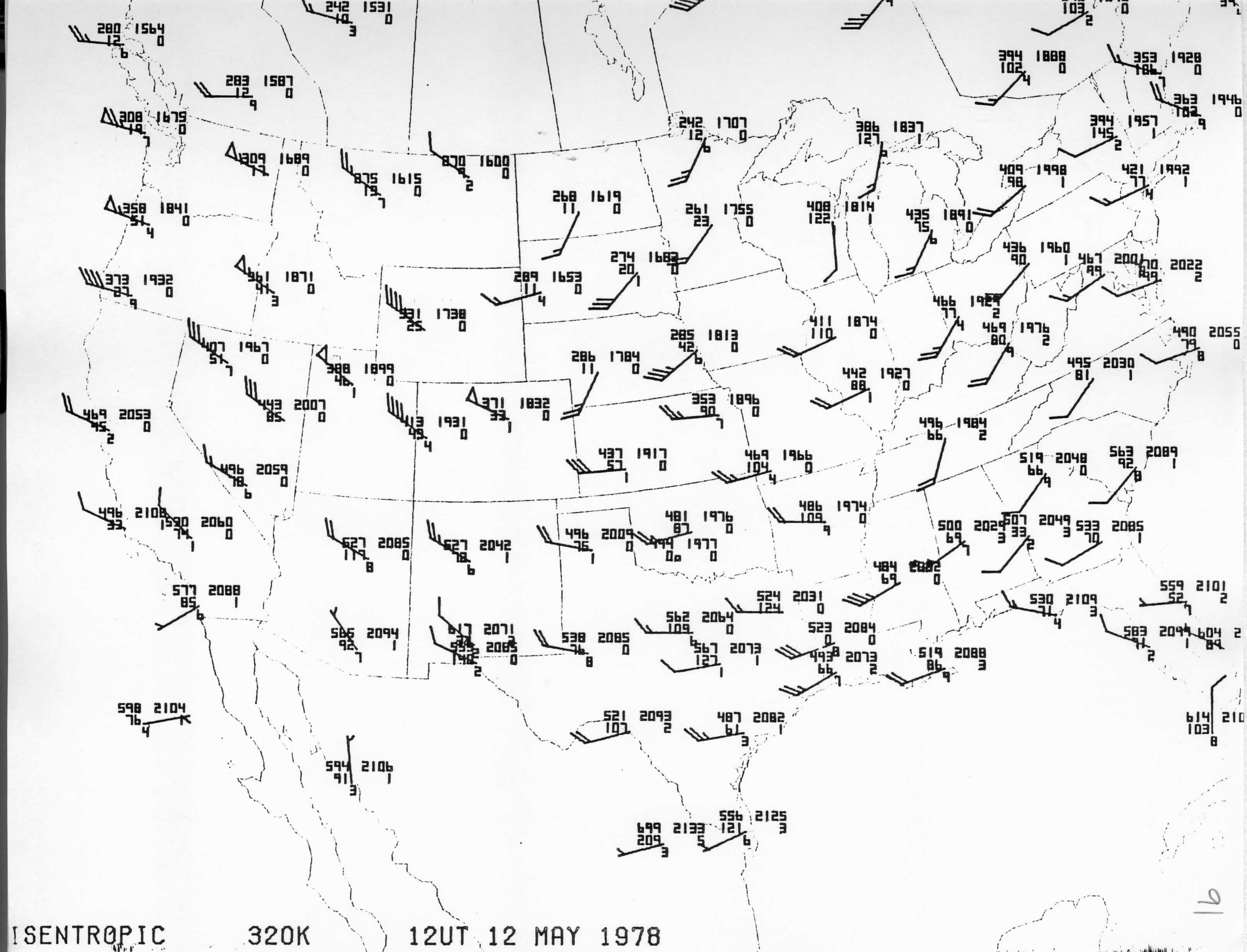
ISENTROPIC 305K 12UT 12 MAY 1978



ISENTROPIC 310K 12UT 12 MAY 1978

89

ISENTROPIC 315K 12UT 12 MAY 1978



ISENTROPIC 320K 12UT 12 MAY 1978

91

ISENTROPIC 325K 12UT 12 MAY 1978

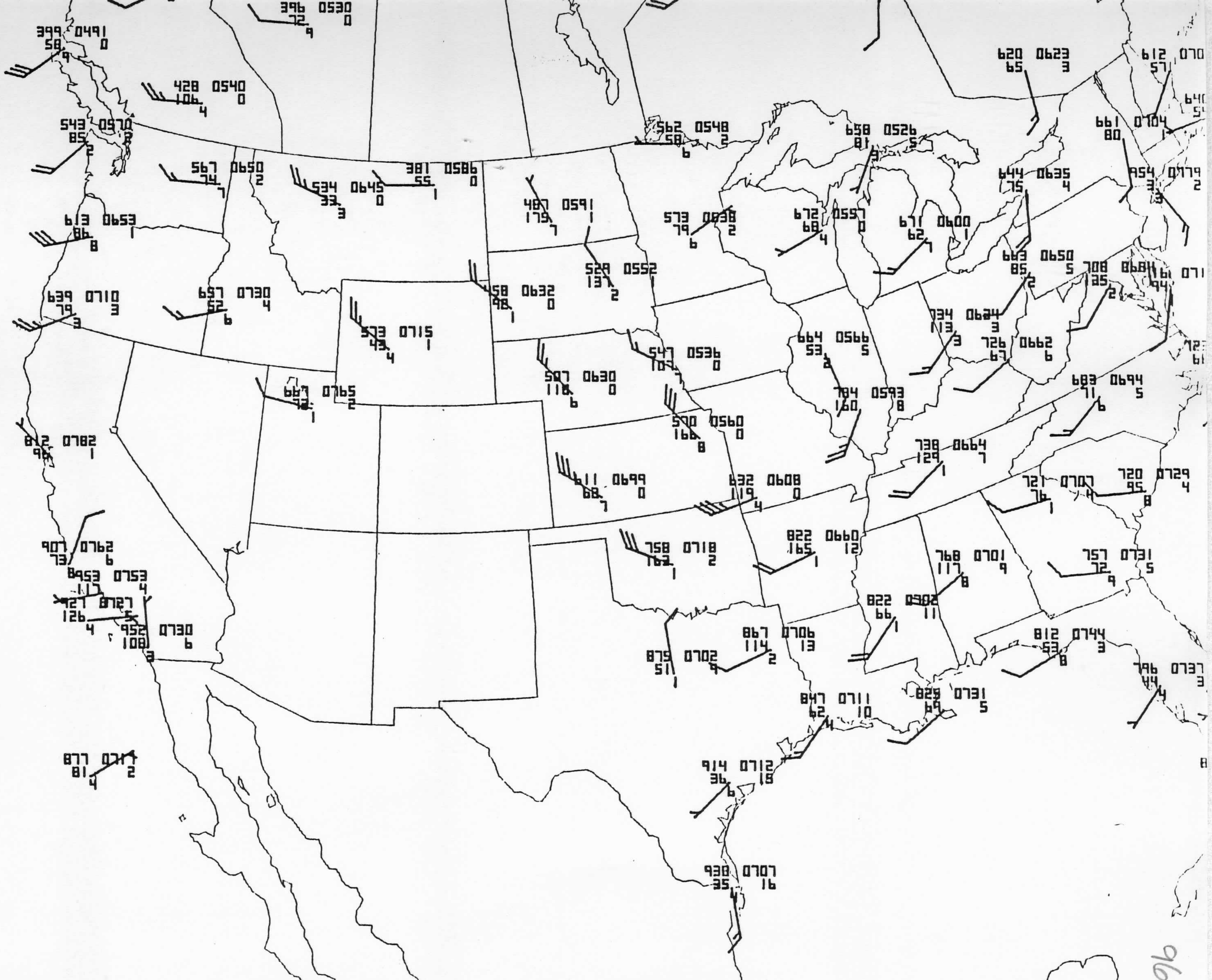
92

ISENTROPIC 290K OOUT 13 MAY 1978

93

ISENTROPIC 295K 00UT 13 MAY 1978

ISENTRØPIC 300K 00UT 13 MAY 1978



ISENTROPIC 305K 00UT 13 MAY 1978

96

ISENTRØPIC 310K OOUT 13 MAY 1978

ISENTROPIC 315K 00UT 13 MAY 1978

98

ISENTROPIC 320K 00UT 13 MAY 1978

100

SENTROPIC 325K 00UT 13 MAY 1978

ISENTROPIC 290K 12UT 13 MAY 1978

ISENTROPIC 295K 12UT 13 MAY 1978

102

ISENTROPIC 300K 12UT 13 MAY 1978

ISENTROPIC 305K 12UT 13 MAY 1978

SENTROPIC 310K 12UT 13 MAY 1978

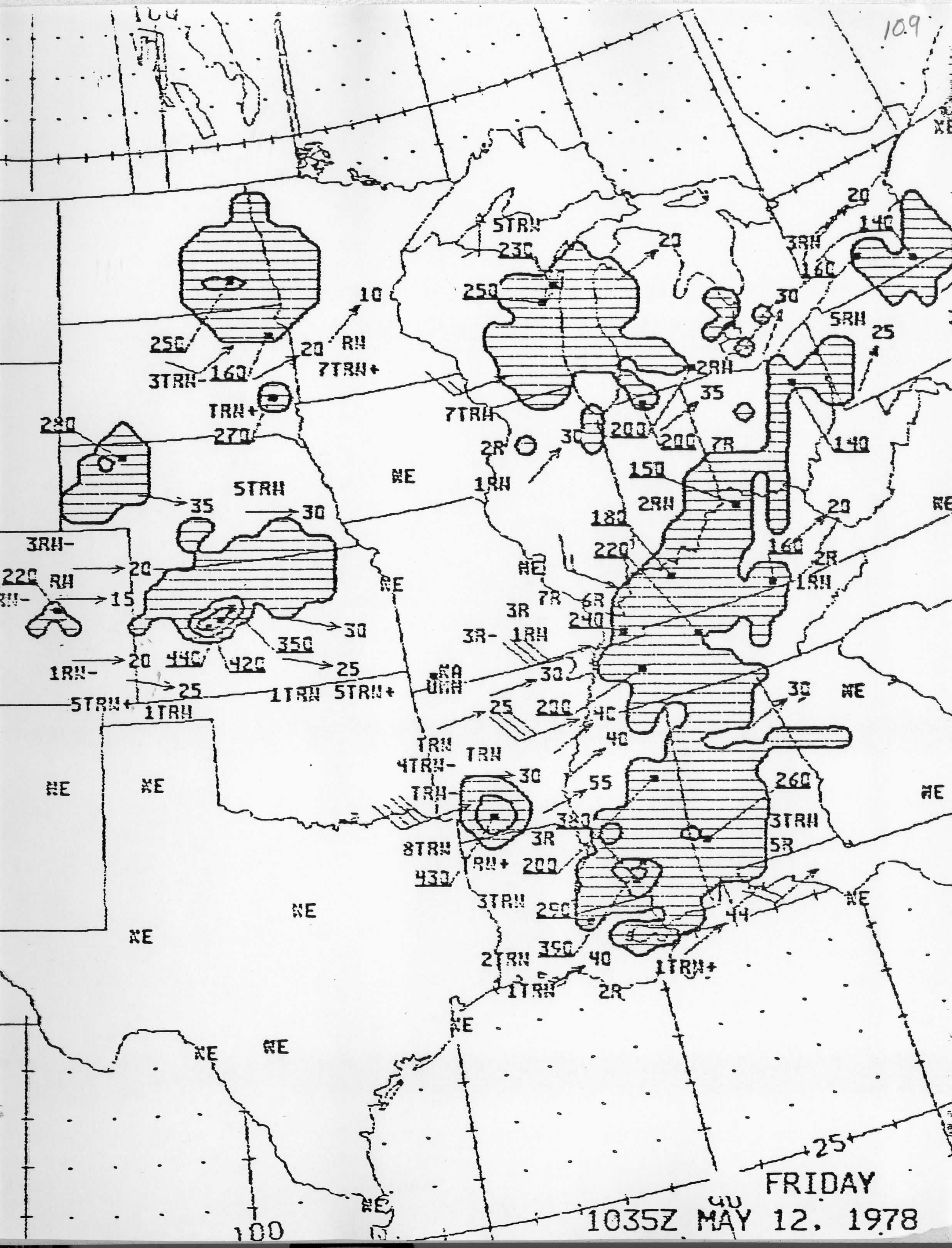
ISENTROPIC 315K 12UT 13 MAY 1978

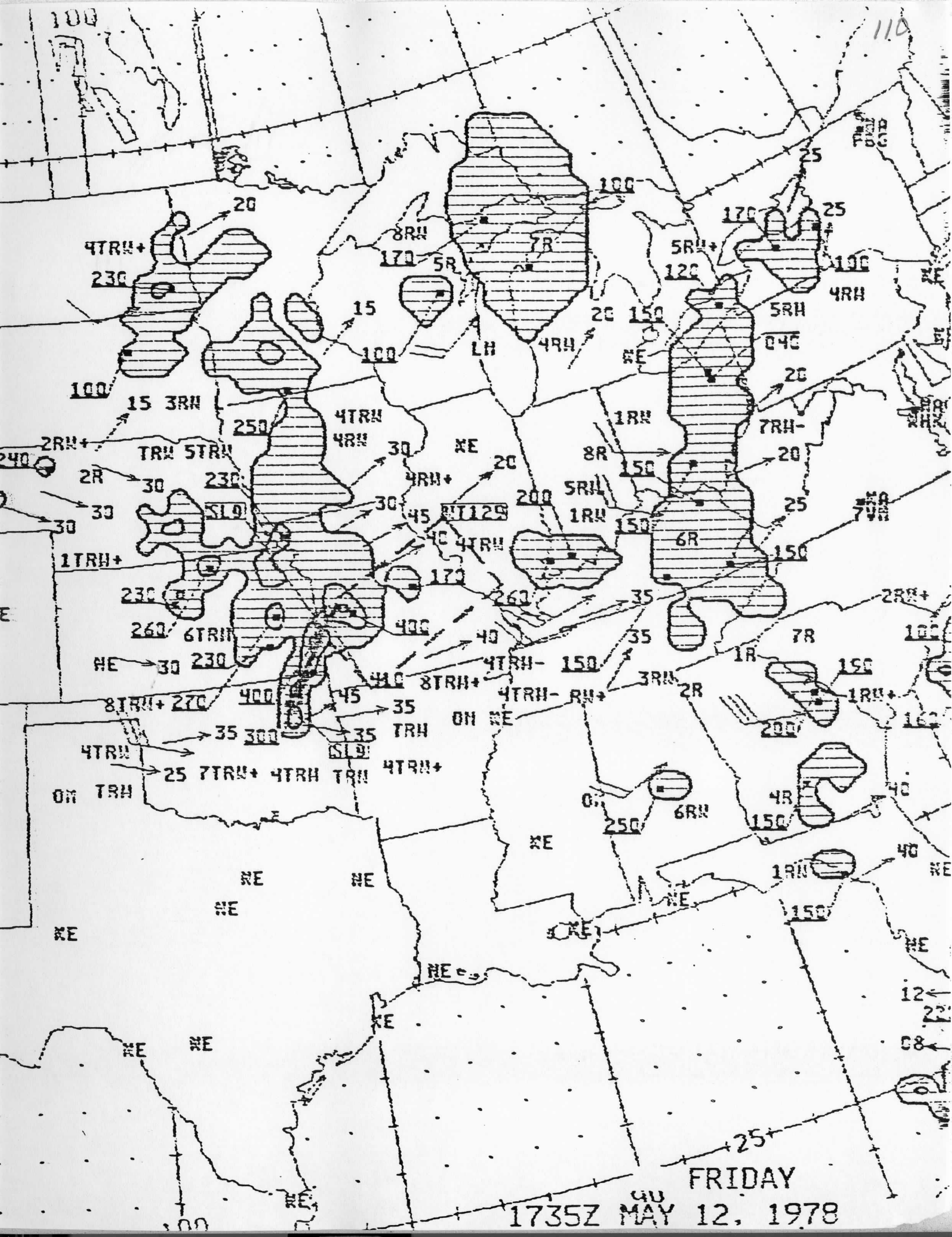
107

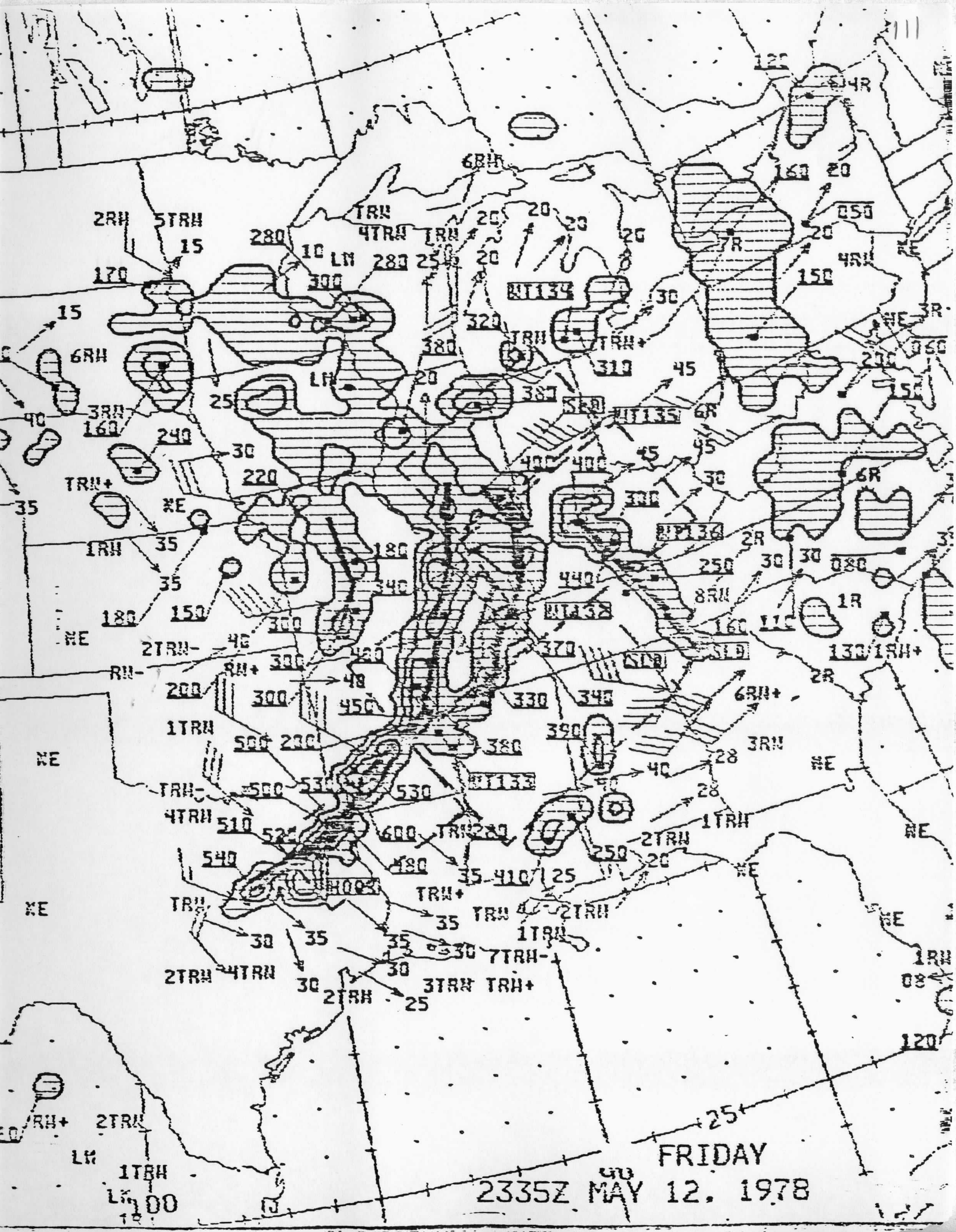
5. Radar Charts/NMC Facsimile Product

a. 12 May 1035 GMT
b. 12 May 1735 GMT
c. 12 May 2335 GMT
d. 13 May 0535 GMT
e. 13 May 1435 GMT

10.9


5TRW
230
250
20
30
3RW
160
140
20
5RW
25
10
20 RW
7TRW+
250
3TRW- 160
TRW+
270
280
2RW
35
200
200 7R
140
7TRW
2R
30
1RW
150
2RW
NE
5TRW
35
30
180
220
20
160
2R
1RW
NE
3RW-
220 RW
20
15
NE
7R 6R
3R
240
3R- 1RW
30
350
420
440
20
25
1RW-
25
1TRW 5TRW+
NA
UNA
30
25
200
40
30
NE
5TRW+
1TRW
TRW
4TRW- TRW
TRW-
30
55
40
260
NE
NE
NE
380
3R
3TRW
5R
8TRW
TRW+ 200
430
3TRW
250
NE
NE
44
350
40
2TRW
1TRW+
1TRW
2R
NE
NE
NE
25
FRIDAY
1035Z MAY 12. 1978
100


100
20
4TRW+
230
100
15 3RW
2RW+
240
2R
30
30
30
1TRW+
230
260
6TRW
WE
30
230
8TRW+ 270
4TRW
25 7TRW+ 4TRW TRW
OW TRW
8RW
170
5R
15
100
LW
4TRW
4RW
250
TRW 5TRW
230
SLD
30
4RW+
30
45
UT125
20
WE
4C
4TRW
170
400
40
410 8TRW+
400
45
35
300
35
TRW
SLD
4TRW+
7R
100
20 150
4RW
WE
1RW
8R
150
5RW
200
1RW
150
260
35
35
4TRW- 150
4TRW- RW+
3RW
OW WE
5RW+
120
170
25
25
100
4RW
5RW
040
20
7RW-
20
25
6R
150
2RW+
7R
100
1R
2R
190
1RW+
200
160
OW
250
6RW
4R
150
40
40
1RW
WE
150
WE
WE
WE
WE
WE
WE
WE
WE
WE
WE
WE
WE
12
08
25
FRIDAY
1735Z MAY 12, 1978


FRIDAY
2335Z MAY 12, 1978
WT134
WT135
WT136
WT132
WT133
H008
6RW
TRW
4TRW
2RW
5TRW
6RW
3RW
TRW+
NE
1RW
2TRW-
RW-
1TRW
TRW-
4TRW
TRW
2TRW
2TRW 4TRW
3TRW TRW+
7TRW-
1TRW
2TRW
1TRW
6RW+
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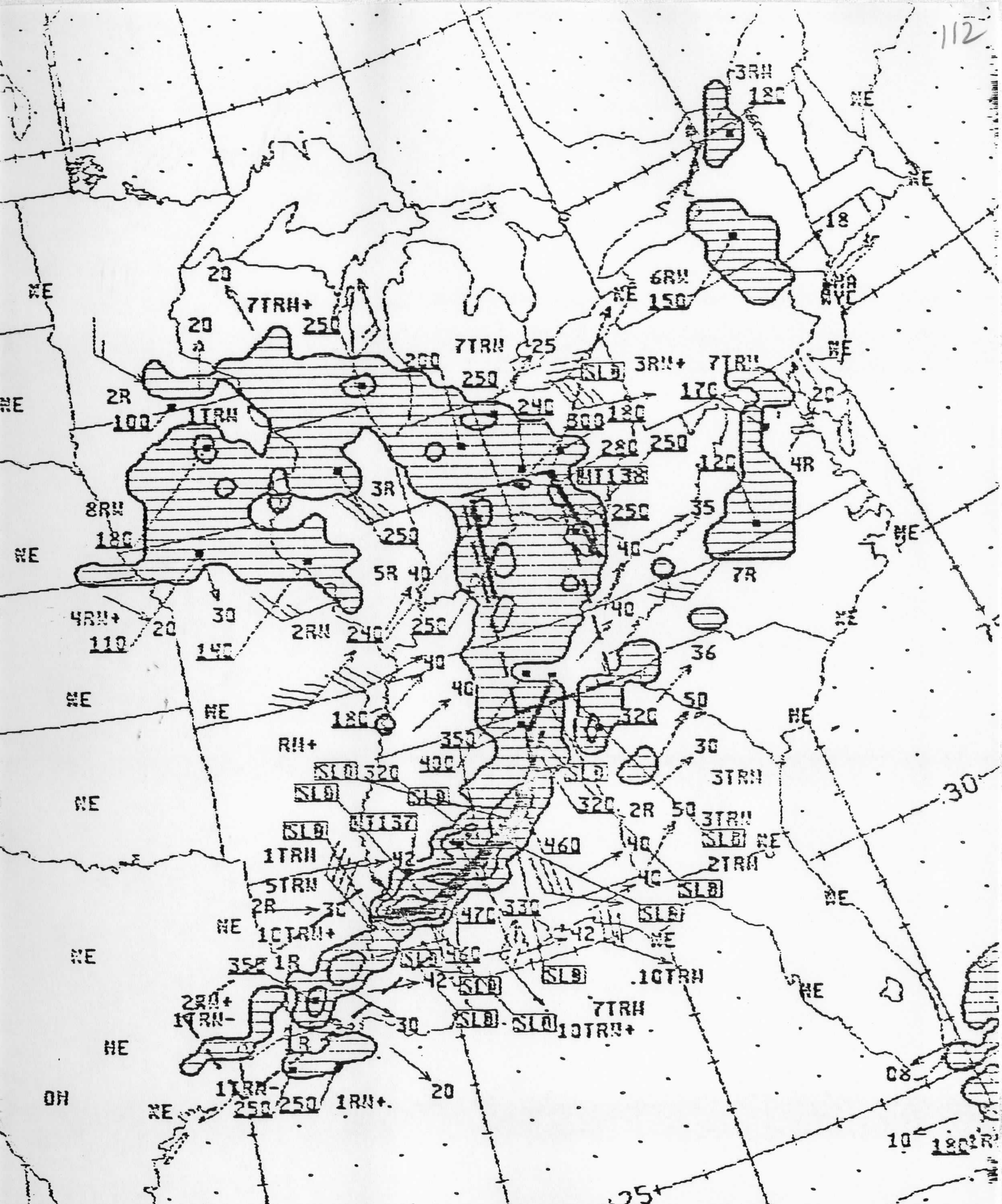
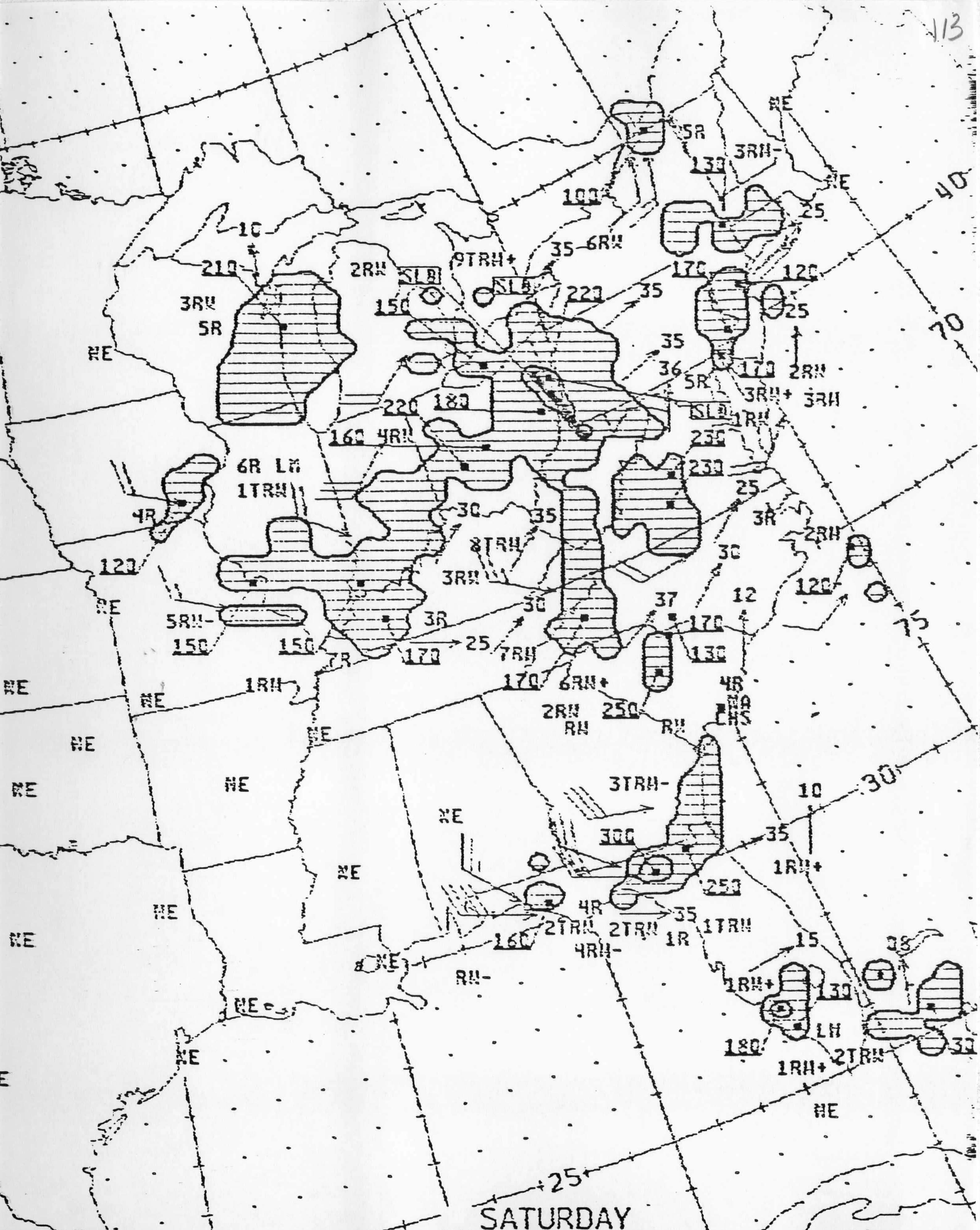
1TRW
LW
120
25



SATURDAY

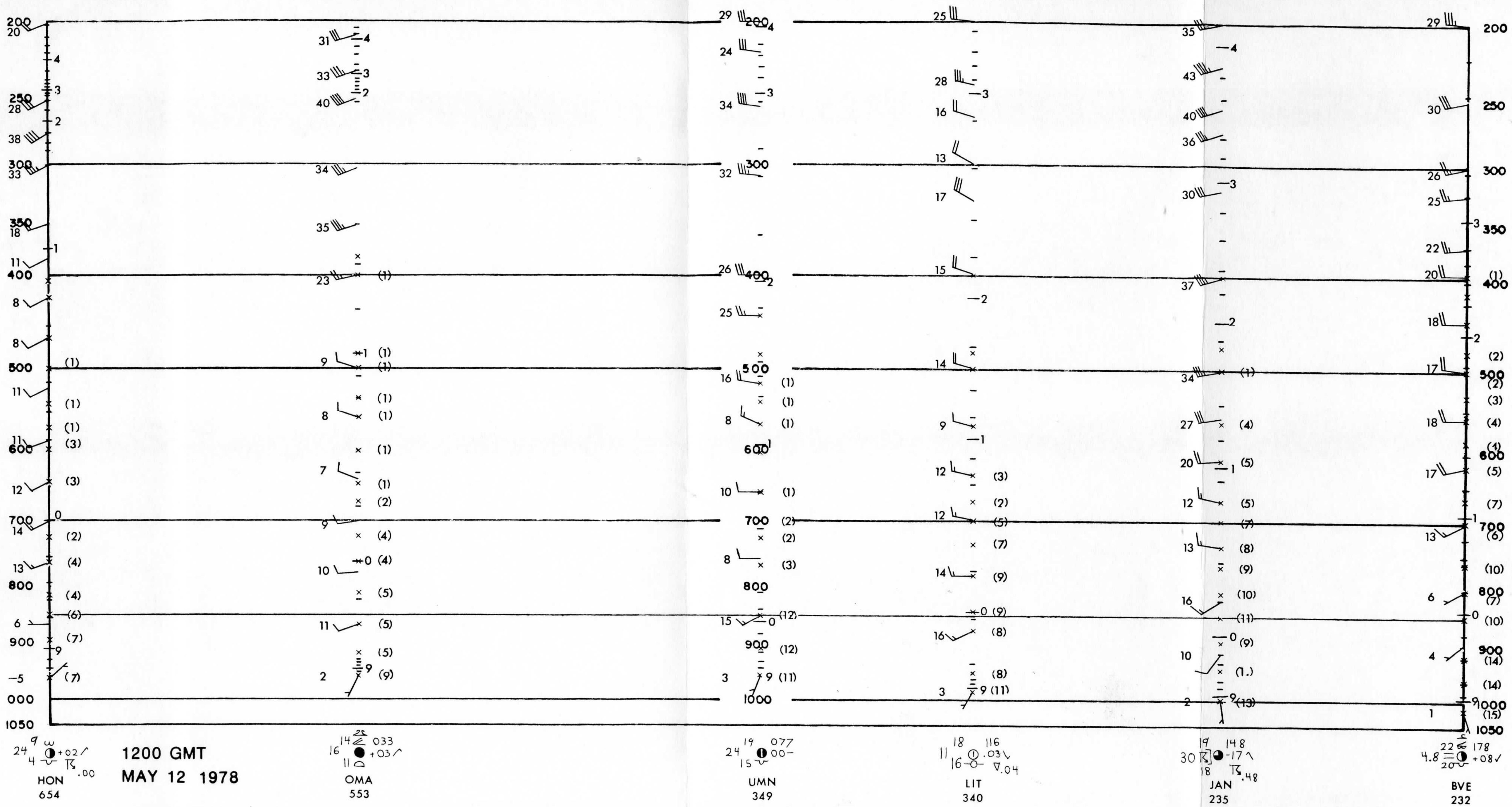
0535Z MAY 13, 1978

113



SATURDAY

14357 MAY 13, 1978


1200 GMT
MAY 12 1978
HON
654
OMA
553
UMN
349
LIT
340
JAN
235
BVE
232
200
250
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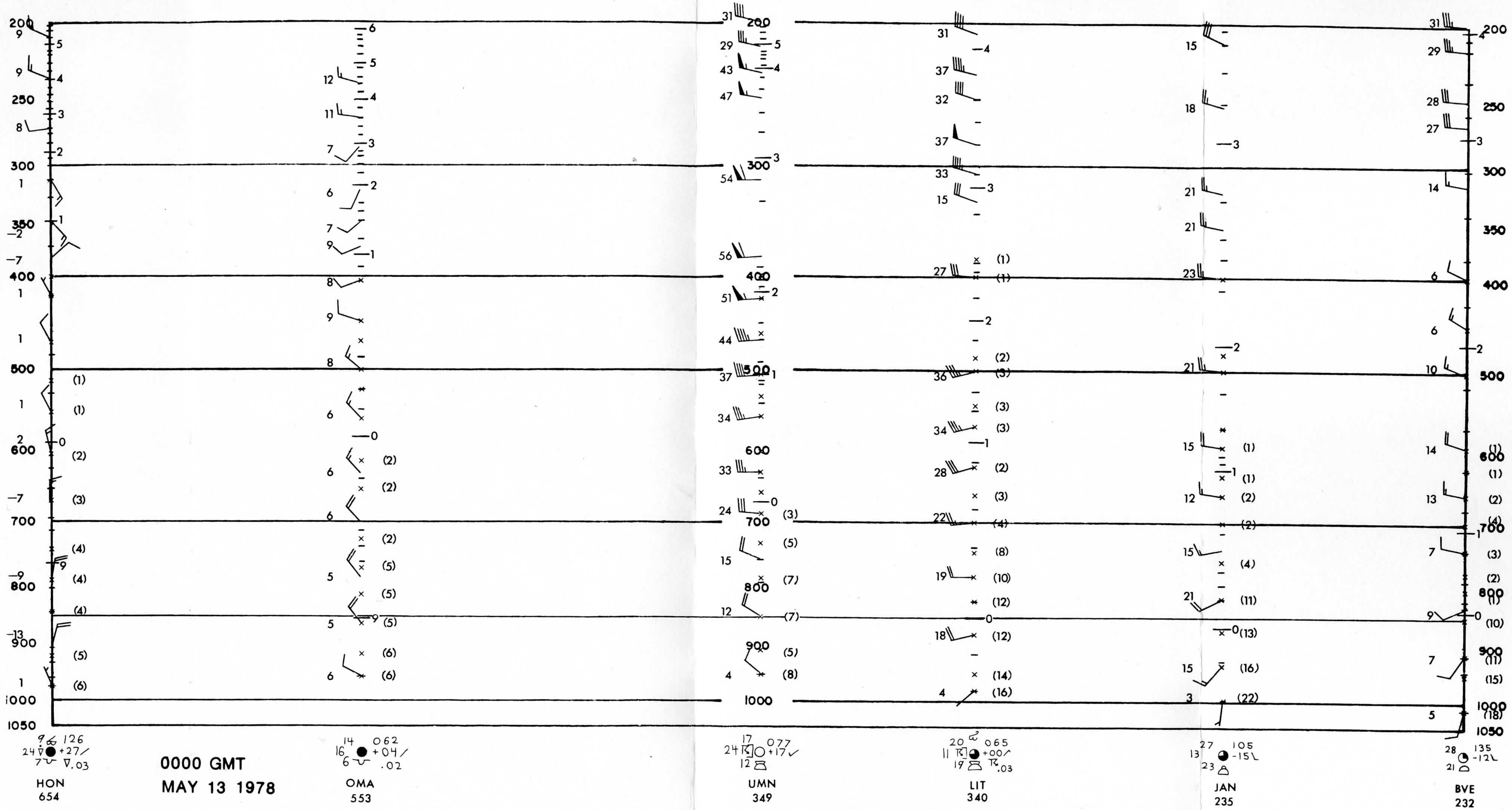
700
800
900
1000
1050


0000 GMT
MAY 13 1978
HON
654
OMA
553
UMN
349
LIT
340
JAN
235
BVE
232
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250
300
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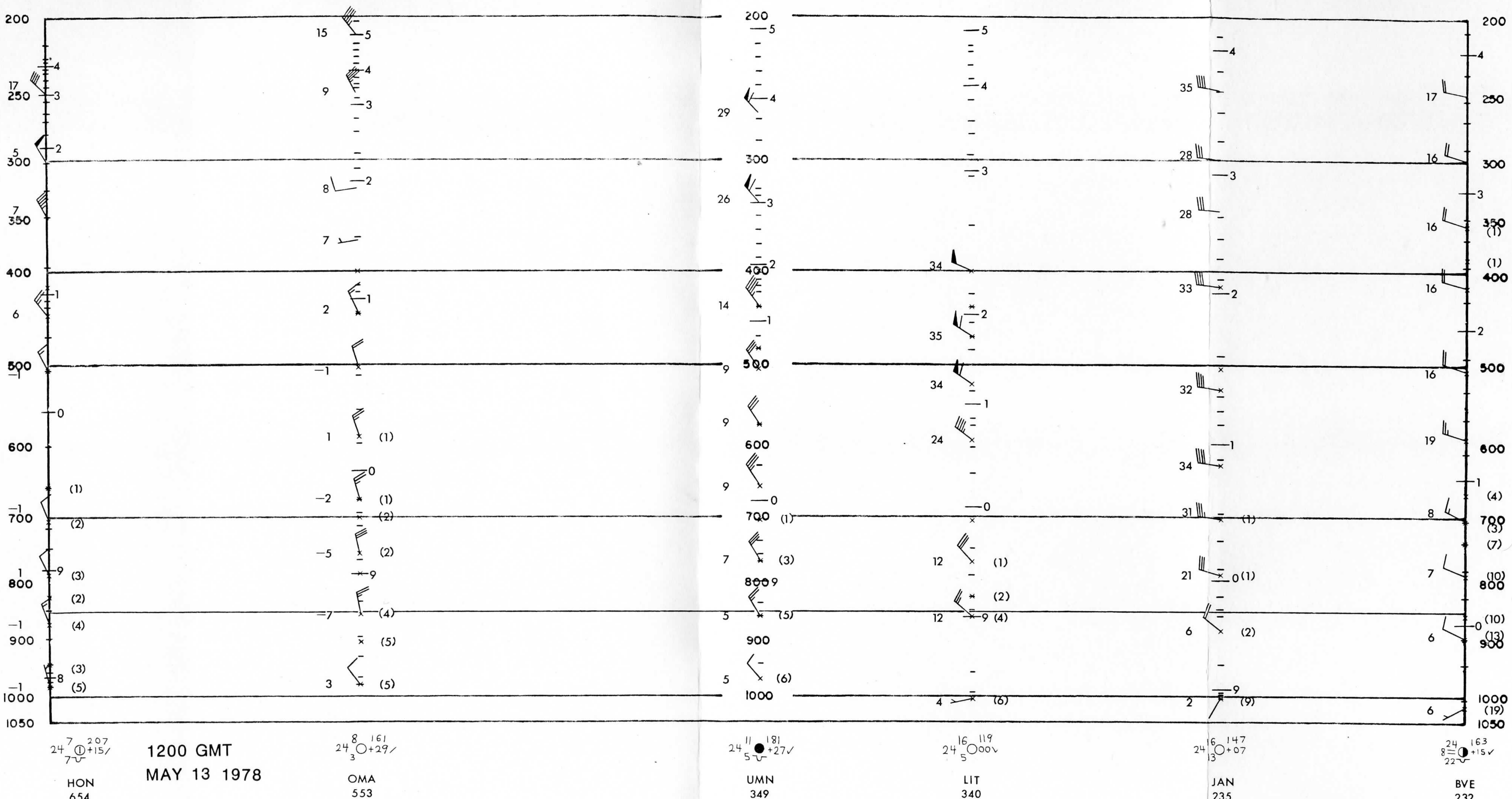
400
500
600
700
800
900
1000
1050


1200 GMT
MAY 13 1978
HON 654
OMA 553
UMN 349
LIT 340
JAN 235
BVE 232
200
250
300
350
400
500
600
700
800
900
1000
1050

6. Isentropic Cross Sections
HON -OMA -UMN -LIT -JAN -BVE

a. 12 May 1200 GMT
b. 13 May 0000 GMT
c. 13 May 1200 GMT

7. McIDAS Derived Fields

a. 12 May 1200 GMT
850 mb temperature advection
850 mb divergence
700 mb temperature advection
700 mb divergence
700 mb vorticity advection
500 mb temperature advection
500 mb divergence
500 mb vorticity advection
300 mb divergence
300 mb vorticity advection

b. 13 May 1200 GMT
850 mb temperature advection
850 mb divergence
700 mb temperature advection
700 mb divergence
700 mb vorticity advection
500 mb temperature advection
500 mb divergence
500 mb vorticity advection
300 mb divergence
300 mb vorticity advection

-2	-6	-6	-2	-0	0	-1	-5	-0	3	2	1	1	0	-2	-5	-3	-0	-0	-0
-6	-7	-4	-0	0	1	1	-1	-0	-0	-1	-0	0	1	-1	-3	-2	-1	-1	-1
-8	-7	-1	1	-0	-0	-0	-0	-0	-0	-1	-1	-0	1	2	2	2	1	1	1
-7	-6	-1	-0	-5	-6	-6	-5	-1	-0	-1	-1	-0	0	1	2	4	7	9	7
-2	-2	-1	-5	-13	-14	-14	-11	-4	0	0	-0	-0	-0	0	1	2	6	9	6
-0	-0	-0	-4	-12	-14	-15	-13	-5	1	3	2	0	0	1	2	3	6	8	7
0	-0	-0	-2	-6	-6	-8	-7	-3	0	3	5	4	3	3	2	-0	0	4	5
-1	-1	-1	-2	-3	-11	-5	-2	-0	2	4	4	5	4	3	2	-2	-3	-1	0
-1	0	1	-0	-13	-26	-15	-6	0	6	11	9	6	7	6	3	1	-1	-1	0
0	0	1	-1	-10	-23	-13	-6	0	10	20	15	10	12	13	8	3	6	-0	0
-1	-1	-2	-2	-4	-10	-6	-3	0	5	13	10	7	11	13	8	3	0	0	0
-2	-2	-1	-1	-2	-5	-4	-0	1	3	5	5	2	4	7	5	1	0	1	3
-3	-1	-0	-0	-1	-4	-2	0	3	5	3	4	1	0	2	2	0	-0	1	3

TAD 850 FROM 121200 CONTOUR INT 2

3	5	-3	-9	-3	-3	-13	-6	13	17	12	9	7	3	-1	-2	-1	-0	-1	-4
8	2	-14	-22	-11	-17	-36	-26	6	18	12	13	15	11	-0	-8	-8	-6	-10	-16
11	3	-18	-28	-19	-29	-43	-26	8	15	7	4	9	14	7	-7	-13	-14	-16	-19
22	15	-6	-21	-16	-23	-30	-15	2	2	-3	-1	3	12	13	0	-9	-10	-9	-9
25	25	15	10	7	-8	-22	-21	-15	-17	-19	-12	-6	1	8	1	-4	-1	-1	-4
-0	6	17	25	15	-9	-31	-30	-19	-17	-18	-14	-14	-13	-6	-6	-5	-0	-2	-10
-0	2	9	16	5	-8	-17	-16	-5	-1	-4	-7	-11	-15	-11	-7	-5	-5	-6	-7
6	5	5	4	4	6	-4	-2	10	14	4	-9	-17	-14	-6	-0	-3	-10	-9	-0
6	3	1	2	14	15	-1	-7	3	11	3	-10	-16	-11	-2	-2	-8	-11	-8	0
3	7	10	13	19	12	-7	-14	-3	4	2	-4	-8	1	4	-4	-8	-6	-6	-8
1	4	13	18	17	4	-8	-9	-0	7	1	-6	0	14	9	-7	-6	3	0	-8
4	-3	-0	10	13	8	0	-9	-2	3	-2	-6	7	20	7	-10	-5	8	11	2
9	-5	-5	4	13	12	0	-17	-15	-5	-4	-4	7	16	8	-4	-6	3	12	11

DIV
REV FROM 121200 CONTOUR INT 5

-2	-6	-8	-3	-Ø	-Ø	-1	-1	5	9	7	4	3	-Ø	-15	-22	-12	-3	-Ø	Ø
-4	-7	-6	-1	-Ø	-Ø	-Ø	-1	-Ø	-1	-1	Ø	3	Ø	-7	-11	-3	1	Ø	1
-5	-5	-3	-1	-Ø	Ø	Ø	-Ø	-1	-2	-2	-2	-1	Ø	3	5	7	5	3	3
-5	-4	-3	-1	-Ø	Ø	-1	-4	-3	Ø	Ø	-Ø	-1	-1	2	3	6	7	5	5
-3	-6	-5	-2	-1	-3	-1Ø	-15	-8	3	4	1	-Ø	-1	Ø	2	3	3	3	2
1	-3	-5	-4	-3	-9	-19	-22	-12	4	3	2	-Ø	-Ø	1	1	2	2	1	Ø
8	2	-6	-9	-9	-15	-24	-18	-8	Ø	2	2	1	1	5	5	3	3	2	Ø
3	-2	-12	-16	-18	-3Ø	-37	-25	-9	1	4	3	1	3	8	8	6	5	3	1
Ø	-5	-12	-19	-27	-36	-32	-15	-3	3	4	4	3	3	4	4	2	3	3	1
-Ø	-4	-9	-13	-2Ø	-24	-15	-4	-Ø	4	6	6	3	3	1	-Ø	-1	Ø	2	1
-Ø	-3	-5	-6	-8	-9	-5	-1	-Ø	1	2	3	5	7	5	Ø	-1	-Ø	Ø	1
-Ø	-1	-1	-1	-2	-3	-2	-1	-Ø	Ø	Ø	3	6	8	5	Ø	-Ø	-Ø	Ø	1
Ø	-Ø	-Ø	-Ø	-1	-2	-Ø	-Ø	Ø	1	1	4	6	5	2	-Ø	-Ø	-Ø	-Ø	Ø

TAD
7ØØ FROM 1212ØØ CONTOUR INT 2

121

2	8	3	-4	-3	-1	0	18	32	29	21	16	12	6	-2	-6	-3	-1	-1	-3
4	5	-4	-10	-6	-6	-11	-2	13	16	15	19	22	15	-1	-8	-4	-4	-13	-20
-1	-2	-9	-12	-7	-6	-11	-8	-0	-2	-5	-2	4	7	4	-0	-1	-11	-25	-35
-2	-5	-7	-6	2	7	0	-2	-9	-23	-22	-15	-6	6	13	5	-2	-3	-5	-3
4	-1	-2	4	19	20	3	-4	-12	-26	-28	-15	-8	-1	7	1	1	9	15	19
10	2	-3	6	22	11	-13	-11	-4	-13	-12	-2	-7	-16	-14	-12	-4	1	6	12
4	1	-1	11	26	8	-18	-10	3	-2	-0	10	3	-12	-17	-16	-16	-13	-7	-0
-5	-1	0	17	33	13	-8	-1	3	-0	3	11	5	-8	-13	-11	-9	-6	-2	-1
-6	-0	6	19	22	0	-11	-3	-2	-2	7	13	8	-4	-11	-6	-1	4	2	-0
0	5	8	13	1	-20	-19	-3	2	8	16	17	11	4	-2	-3	0	4	2	-1
7	4	4	3	-9	-21	-14	-0	8	13	15	15	11	10	4	-3	-3	1	1	-1
13	2	-3	0	-0	0	-2	-5	1	4	5	3	-4	-1	0	-1	0	3	0	-4
14	-0	-5	4	17	25	9	-12	-11	-3	1	-1	-12	-11	-2	0	2	0	-4	-7

DIV_{700} FROM 121200 CONTOUR INT 5

2	1	-1	-1	-0	0	0	0	1	2	0	-1	-3	-3	-2	-1	-1	-0	-0	-0
1	0	-1	-1	-0	-0	-0	-1	-0	-0	-0	-0	-1	-1	1	1	-1	-2	-0	1
-1	-1	-2	-1	-0	-1	-3	-3	-2	-0	-0	-0	-0	0	3	4	0	-2	-1	1
-2	-2	-3	-1	-1	-6	-8	-4	1	3	1	0	-0	0	3	6	3	-0	-0	2
0	-0	-1	-0	-5	-15	-14	-1	10	10	3	-0	-1	-1	1	5	2	-2	-3	-2
2	0	-0	-0	-6	-14	-9	3	12	9	1	-2	-6	-7	-1	4	4	-1	-4	-4
3	2	1	-0	-4	-6	-2	3	5	5	2	-3	-12	-14	-5	4	6	1	-3	-3
3	3	2	1	-0	-0	0	-1	0	4	4	-1	-10	-12	-5	2	4	1	-1	-2
1	1	1	0	-0	-0	-2	-4	-0	4	2	-4	-8	-5	0	1	0	-0	-1	-0
0	0	-0	-0	-2	-3	-3	-1	2	4	-1	-7	-8	-1	4	3	0	-1	-1	-0
-0	-0	-0	-0	-1	-2	-1	1	3	2	-0	-5	-4	1	5	3	-0	-1	-1	-0
-0	-0	-0	0	0	-0	-0	1	2	1	-1	-1	0	2	3	0	-1	-1	-1	-0
-1	-0	-0	0	0	-0	-0	0	1	-0	-2	-1	2	3	2	-0	-1	-1	-0	-0

VAD 700 FROM 121200 CONTOUR INT 2

-0	-3	-4	-1	-0	-0	-1	-1	6	16	16	11	8	1	-15	-19	-9	-1	0	0
-1	-3	-4	-1	-0	-0	-1	-3	-1	5	9	13	15	9	-4	-6	0	3	1	2
-0	-2	-3	-1	-0	-0	-1	-2	-4	-2	0	3	7	7	2	4	8	7	3	1
-0	1	-0	-0	0	-1	-2	-2	-3	-2	-1	-1	6	2	2	3	5	5	4	2
-2	6	5	0	-3	-6	-7	-7	-3	0	0	-2	-2	0	1	2	3	4	4	2
-5	6	4	-6	-12	-13	-12	-10	-6	-1	-1	-6	-5	-1	0	3	5	6	5	4
-3	3	-0	-10	-12	-13	-13	-9	-8	-6	-6	-10	-8	-3	-0	3	5	7	6	7
-2	-4	-9	-11	-8	-9	-11	-10	-13	-12	-9	-10	-8	-3	1	4	5	5	6	6
-3	-6	-11	-14	-13	-11	-6	-3	-8	-8	-4	-5	-4	-2	2	5	4	4	5	5
-1	-4	-7	-9	-8	-6	-0	1	-1	-0	0	0	-1	-4	-1	1	0	1	4	4
-0	-1	-2	-1	-0	-0	0	1	1	0	1	4	2	-3	-5	-3	-2	-1	3	6
0	-0	-0	1	1	0	-0	2	4	3	1	2	1	-3	-5	-4	-4	-3	0	5
0	0	0	1	2	0	-0	3	7	5	-0	-3	-3	-4	-5	-7	-8	-7	-3	-0

TAD
500 FROM 121200 CONTOUR INT 2

10	15	-1	-14	-7	0	15	47	55	30	13	7	6	1	-13	-22	-13	-3	0	0
21	12	-14	-27	-13	-3	-2	13	22	14	11	17	20	13	0	-2	4	5	0	-0
20	6	-22	-32	-19	-6	-4	-0	8	8	4	3	6	8	10	17	22	13	-1	-8
27	6	-16	-25	-14	-2	-0	-0	2	7	5	-2	-5	0	6	8	10	10	1	-0
15	-9	-22	-12	5	10	-0	-6	-1	10	14	6	-3	-1	3	0	5	9	2	-3
2	-19	-29	-8	13	12	-9	-11	0	12	23	21	9	0	-2	-6	1	9	2	-5
9	-4	-17	-3	15	0	-25	-16	6	10	13	17	11	1	-7	-12	-7	0	0	-2
-0	-2	-8	-2	7	-11	-30	-12	11	9	-1	-3	-8	-19	-20	-9	-3	1	5	3
-8	-6	-5	-0	-1	-15	-24	-10	4	2	-3	-5	-18	-34	-25	-1	2	1	4	5
-5	-8	-5	-1	-6	-13	-10	-3	-1	-2	-1	0	-12	-26	-12	7	4	-2	-3	-4
-15	-16	-6	2	0	-0	1	-2	-3	-3	1	12	7	-9	-8	2	7	7	0	-9
-13	-11	-1	9	9	4	1	-2	4	4	4	11	16	3	-6	1	13	19	17	8
2	1	2	7	3	-5	-4	3	17	15	7	0	8	6	0	6	13	14	16	15

DIV 500 FROM 121200 CONTOUR INT 5

3	3	-1	-2	-1	-2	-2	3	17	22	8	-5	-13	-16	-14	-8	-3	-1	-2	-4
2	2	-1	-2	-1	-3	-2	Ø	8	13	8	3	-2	-9	-12	-9	-5	-2	-Ø	-1
2	2	-Ø	-2	-2	-3	-1	Ø	3	6	7	7	5	Ø	-3	-3	-1	1	3	3
3	3	Ø	-3	-5	-4	-1	1	1	2	3	4	5	4	2	1	Ø	1	2	3
4	Ø	-Ø	-7	-9	-6	-Ø	3	3	1	Ø	Ø	2	4	5	5	2	Ø	-Ø	-1
-3	-8	-8	-7	-6	-1	5	7	5	1	-1	-2	-3	-1	3	7	5	1	-Ø	-1
-7	-14	-12	-4	2	8	12	9	3	-Ø	-Ø	-1	-6	-7	-Ø	5	5	2	Ø	Ø
-1	-5	-4	Ø	5	8	7	4	2	3	3	-Ø	-6	-4	1	3	1	Ø	-Ø	Ø
1	1	-Ø	-Ø	-2	-4	-3	-Ø	5	9	1	-11	-13	-1	7	6	2	Ø	Ø	Ø
2	1	-Ø	-3	-8	-10	-7	Ø	8	8	-6	-20	-17	-1	8	8	5	2	2	1
1	Ø	-1	-2	-5	-6	-4	Ø	2	-2	-9	-11	-4	1	1	1	-Ø	1	3	3
-Ø	-1	-Ø	-Ø	-Ø	-1	-1	-Ø	-4	-10	-6	7	11	3	-5	-8	-6	-1	3	4
-Ø	-1	-Ø	1	2	Ø	-1	-Ø	-4	-11	-3	13	14	-Ø	-9	-10	-7	-2	1	1

VAD
5ØØ FROM 121200 CONTOUR INT 2

25	32	10	-9	-7	-1	11	51	61	28	8	3	3	-1	-15	-23	-14	-3	1	4
34	11	-11	-23	-11	-8	-11	13	33	23	11	13	14	3	-12	-14	-4	3	10	16
-27	-41	-35	-20	-12	-16	-19	-4	18	19	12	8	0	-2	-0	5	12	15	17	16
-62	-61	-14	7	-3	-16	-11	0	3	-8	-8	-3	-10	-2	16	20	17	24	21	13
-40	-39	-2	15	-7	-19	-6	13	5	-29	-46	-36	-27	-5	21	26	28	30	16	0
-12	-27	-27	-18	-18	-23	-22	9	43	20	-21	-38	-40	-18	4	16	25	26	3	-6
11	-3	-27	-24	-6	-18	-42	1	66	76	43	0	-21	-13	7	11	13	8	-7	-9
10	10	-9	-12	-1	-10	-26	-2	24	29	28	9	-5	6	23	17	7	4	-0	4
1	2	-8	-17	-12	-8	-0	3	-12	-13	-3	-5	1	20	28	12	-4	0	8	12
0	-9	-19	-23	-19	-0	18	19	-1	-11	-7	-10	-0	11	20	10	-10	-11	3	8
-5	-16	-19	-12	-0	11	20	13	-2	-12	-9	-9	-15	-15	2	15	-4	-20	-9	4
-2	-12	-14	-3	9	15	12	8	4	-4	-6	-14	-21	-17	0	14	0	-19	-16	-4
8	-2	-8	-2	4	5	6	11	21	14	2	-19	-24	-9	0	5	3	-3	-6	-2

DIV
300 FROM 121200 CONTOUR INT 5

12	9	-5	-7	-4	-6	-3	9	29	28	7	-9	-17	-19	-15	-11	-9	-7	-5	-8
21	9	-6	-8	-6	-7	-3	6	21	24	12	3	-3	-10	-14	-13	-11	-8	-7	-7
25	9	-9	-12	-9	-6	-1	5	14	19	15	11	8	2	-2	-1	0	-0	-3	-2
4	-4	-14	-24	-19	-1	6	7	12	16	11	9	10	8	7	9	11	3	-11	-13
-0	-2	-17	-45	-41	-2	20	21	18	10	1	2	7	9	10	13	12	-0	-15	-17
-1	3	-8	-48	-50	-14	26	41	30	4	-15	-8	3	5	6	11	9	-3	-14	-11
10	16	4	-22	-37	-12	6	46	36	6	-23	-16	4	7	4	12	11	-2	-11	-5
22	21	7	-15	-18	-21	-7	30	33	0	-28	-22	6	18	15	15	12	-0	-7	-2
13	5	-8	-11	-18	-20	-27	14	18	2	-26	-29	-3	20	23	18	12	3	-3	-3
-3	-10	-16	-12	-7	-10	-7	8	10	-4	-24	-30	-6	16	20	15	10	4	-1	-2
-5	-8	-9	-6	-5	-3	4	6	-2	-18	-30	-19	9	20	13	7	4	0	-1	-1
-4	-4	-3	-2	-3	-1	2	0	-8	-20	-23	-0	21	18	6	1	0	-2	-2	-2
-1	-1	-0	-0	-1	-1	0	-2	-5	-11	-12	6	17	9	3	2	-0	-5	-5	-3

VAD

300 FROM 121200 CONTOUR INT 2

-2	-1	2	9	13	11	5	2	2	4	Ø	-3	-3	-1	Ø	3	3	1	Ø	Ø
-5	-4	Ø	4	6	8	7	4	1	-Ø	-5	-8	-8	-6	-2	1	1	-Ø	Ø	Ø
-4	-5	-Ø	2	2	4	4	2	Ø	Ø	-Ø	-2	-5	-6	-5	-2	-2	-Ø	2	2
-Ø	-2	1	3	2	2	1	Ø	-Ø	-Ø	1	3	3	Ø	-1	-1	-1	Ø	2	3
2	1	3	1	-3	-4	-4	-4	-3	-3	-3	Ø	6	4	1	Ø	1	1	2	1
1	Ø	Ø	-3	-8	-9	-1Ø	-9	-2	-Ø	-6	-6	3	4	2	2	3	4	3	3
3	Ø	-2	-4	-3	-1	-4	-5	3	4	-9	-14	-1	4	5	3	4	6	7	7
1	-1	-4	-4	-Ø	Ø	-3	-3	5	1	-14	-22	-9	1	8	7	4	4	4	5
Ø	-2	-3	-3	-1	-4	-8	-6	2	-1	-16	-2Ø	-8	1	5	5	3	2	1	Ø
Ø	-1	-3	-2	-3	-8	-14	-12	-7	-6	-7	-6	4	9	6	4	3	2	Ø	Ø
2	-Ø	-1	-1	-Ø	-3	-9	-13	-14	-6	2	6	9	9	6	4	3	2	1	Ø
3	1	Ø	Ø	Ø	-Ø	-2	-3	-4	Ø	1Ø	9	6	6	5	3	2	2	2	3
3	2	2	2	Ø	-Ø	-Ø	Ø	Ø	5	14	12	5	3	3	1	1	1	2	1

TAD 85Ø FROM 13ØØØØ CONTOUR INT 2

-1	-2	-4	-1	11	16	10	6	4	7	6	9	11	5	-6	-13	-7	-2	-0	-2
4	1	-5	-4	7	13	12	8	2	3	9	17	19	13	2	-4	-2	-0	-4	-7
20	12	-4	-10	-0	3	4	5	-5	-7	0	7	10	12	9	1	-2	-2	-3	-4
31	28	7	-1	10	15	12	6	-7	-15	-5	0	-2	0	4	-0	-7	-9	-3	-0
31	39	29	23	26	23	15	8	-2	-14	-13	-14	-15	-4	4	-2	-21	-25	-7	8
11	23	29	28	19	7	5	9	10	1	-17	-36	-36	-9	6	-0	-26	-36	-19	-2
-2	7	16	17	3	-3	-1	2	12	16	-1	-30	-36	-18	-0	-2	-14	-20	-15	-9
0	10	17	13	1	0	1	-0	1	5	-4	-19	-17	-11	-9	-12	-9	-0	0	2
9	16	15	7	-5	-7	1	4	3	-5	-24	-29	-16	-5	-6	-11	-8	2	5	6
14	15	6	-3	-16	-20	-9	5	14	8	-9	-22	-17	-11	-5	-6	-5	0	3	1
18	14	1	-4	-12	-21	-15	-0	11	13	7	-1	-5	-9	-6	-3	-3	1	5	3
17	11	2	1	0	-7	-13	-8	-5	-0	6	7	6	1	-3	-3	-1	3	9	9
8	4	1	5	10	8	-2	-8	-15	-8	5	6	8	3	-2	-4	-0	7	13	15

DIV
850 FROM 130000 CONTOUR INT 5

-4	-1	2	8	9	4	1	0	-0	1	0	-1	-1	-2	-6	-4	-0	0	0	0
-8	-5	-0	3	4	3	2	0	-3	-4	-6	-7	-6	-4	-3	-0	2	1	1	1
-3	-2	0	1	0	-1	-0	-0	-1	-2	-4	-6	-6	-4	-2	2	3	3	3	2
3	1	0	0	-1	-3	-2	-0	-0	-1	-2	-3	-3	-2	-0	0	2	4	5	4
8	4	0	-1	-3	-5	-3	-0	-2	-3	-2	-1	-1	-1	-0	0	2	3	5	6
9	6	0	-2	-4	-6	-4	-3	-6	-7	-3	-1	0	1	0	1	5	5	5	7
7	6	0	-4	-4	-2	0	-0	-6	-4	-0	-4	1	8	5	3	8	9	4	3
3	3	-1	-5	-4	-0	2	-3	-8	-4	-5	-19	-11	6	9	4	6	7	1	0
-0	-0	-2	-5	-3	-0	1	-1	-3	2	-3	-24	-21	-3	3	2	5	6	-1	-3
-0	-0	-1	-2	-1	0	-0	-4	-4	-1	-3	-9	-5	4	5	2	6	5	-1	-3
0	0	-0	-1	-1	-2	-3	-3	-0	3	2	1	5	8	7	3	4	4	-0	-2
0	0	0	-0	-1	-2	-2	-1	1	2	1	2	4	7	7	2	2	2	-0	-2
-0	-0	-0	-0	-2	-1	0	0	0	0	0	1	3	6	5	0	-3	-3	-4	-4

TAD
700 FROM 130000 CONTOUR INT 2

-2	-0	-0	-0	1	2	1	-1	-6	-4	5	15	16	7	-11	-21	-12	-3	-0	-1
8	6	1	0	1	0	-6	-15	-25	-19	4	25	31	21	1	-7	-1	1	-3	-6
11	7	3	1	-0	-7	-15	-15	-16	-15	-4	7	15	15	8	6	7	1	-6	-8
9	4	1	4	11	12	5	9	11	-1	-7	-0	3	3	1	0	-2	-12	-16	-11
4	-4	-5	7	29	30	13	7	6	-4	-10	-8	-2	1	4	1	-15	-29	-24	-11
5	-4	-9	5	24	15	-5	-11	-8	-5	-12	-25	-25	-2	14	14	-7	-20	-8	3
12	3	-3	4	15	5	-6	-3	5	14	2	-31	-42	-23	-0	13	15	14	15	10
6	1	-3	4	15	10	0	-3	9	10	-6	-25	-23	-13	-10	-5	10	20	10	-4
-0	-5	-4	4	12	11	0	-2	0	-9	-27	-26	0	18	5	-6	3	11	-3	-20
-1	-5	-2	4	8	7	7	5	-1	-15	-21	-15	9	23	10	-4	3	10	1	-7
-0	-2	-0	3	3	0	5	10	5	0	-0	-5	1	13	7	-0	-1	0	3	10
2	2	5	7	5	-0	-1	7	14	15	9	-2	-4	4	8	8	3	-6	-7	2
0	3	7	9	7	3	-3	1	10	9	4	0	-4	-3	1	7	8	-4	-13	-8

DIV
700 FROM 130000 CONTOUR INT 5

-4	-5	-3	-2	-1	Ø	3	7	8	4	-Ø	-3	-3	-4	-2	-Ø	Ø	Ø	Ø	Ø
-6	-7	-5	-3	-1	1	5	8	7	2	Ø	-Ø	-2	-2	-1	-Ø	Ø	Ø	Ø	Ø
-2	-4	-4	-2	-3	-1	2	3	1	-2	-1	-1	-1	-1	-Ø	Ø	Ø	1	Ø	-1
Ø	-1	-1	-1	-3	-5	-1	1	-3	-7	-5	-4	-1	-Ø	-Ø	-Ø	Ø	2	-Ø	-4
1	1	1	1	-2	-5	-1	-1	-7	-11	-8	-5	-1	-Ø	-1	-5	-3	1	1	-1
Ø	Ø	-Ø	Ø	-1	-2	-Ø	Ø	-4	-6	-6	-4	Ø	-Ø	-4	-11	-12	-4	1	4
-Ø	-Ø	-Ø	-Ø	-Ø	Ø	1	-Ø	-5	-11	-16	-9	2	6	-Ø	-8	-11	-6	1	5
Ø	Ø	-Ø	-Ø	1	3	2	-3	-11	-21	-25	-11	8	17	10	-3	-7	-4	Ø	1
Ø	Ø	Ø	Ø	1	4	1	-5	-13	-18	-16	-6	5	12	6	-5	-7	-3	Ø	1
Ø	Ø	Ø	Ø	1	2	1	-3	-5	-6	-5	-1	1	4	2	-5	-5	-2	-1	Ø
-Ø	-Ø	-Ø	Ø	Ø	-Ø	-1	-Ø	Ø	-Ø	-2	-3	-1	1	2	-2	-3	-3	-2	-1
-Ø	-Ø	-Ø	-Ø	-Ø	-1	-1	Ø	2	1	-2	-4	-2	2	4	Ø	-3	-3	-2	-1
Ø	-Ø	-Ø	-Ø	-Ø	-1	-Ø	1	2	1	-2	-5	-1	3	4	1	-Ø	-1	-1	Ø

VAD 700 FROM 130000 CONTOUR INT 2

2	0	0	2	2	1	0	-1	-7	-12	-9	-0	3	0	-8	-5	-0	0	0	1
0	-2	3	6	4	2	-0	-6	-12	-11	-2	6	9	5	-0	2	6	4	3	5
-8	-4	11	19	9	0	-2	-4	-8	-5	-0	2	3	1	0	5	7	8	8	8
-3	0	15	20	11	1	-3	-3	-3	-2	-0	0	-1	-3	-1	0	2	4	5	5
3	4	7	8	8	4	-2	-4	-3	-1	-0	-1	-2	-3	-2	-0	1	2	3	2
2	5	2	1	6	7	-0	-5	-6	-4	-4	-6	-3	-1	-1	-0	1	3	2	1
2	4	0	-3	3	6	-1	-6	-9	-9	-10	-17	-9	0	2	1	2	1	0	1
1	2	-2	-4	0	-2	-9	-12	-20	-19	-20	-34	-23	-3	4	2	1	0	-0	0
-0	-0	-2	-2	-4	-13	-19	-18	-26	-19	-9	-20	-16	-1	3	-0	-0	-0	-1	-0
0	-1	-1	-1	-5	-16	-17	-11	-12	-2	6	-2	-1	5	3	-1	-1	0	0	1
0	-0	-0	0	-1	-6	-8	-4	-1	6	6	-1	-0	4	4	0	-1	-0	1	6
-0	-0	0	1	0	-2	-2	-2	0	4	2	-0	1	4	5	2	-0	-3	-1	3
0	0	0	0	0	-0	-0	-0	0	1	1	2	4	3	2	2	0	-3	-4	-1

TAD

500 FROM 130000 CONTOUR INT 2

-9	5	13	14	8	1	0	0	-3	-8	-1	2	1	-5	-29	-46	-27	-6	-0	-0
-9	11	8	-4	-7	-0	5	2	-6	-11	-3	6	8	-5	-21	-18	-0	6	-1	-4
12	13	-6	-24	-18	-3	1	3	5	7	7	7	2	-12	-17	5	21	10	-6	-12
17	7	-5	-10	1	10	6	-0	2	9	12	17	13	-11	-26	-9	5	1	-7	-4
6	-1	3	11	14	11	-2	-12	-8	2	12	24	26	4	-19	-16	-7	-7	-7	-2
-3	-9	-3	4	3	-3	-12	-11	-0	11	16	17	15	11	-0	-7	-9	-6	-2	-1
4	-1	-1	3	3	-3	-7	0	11	23	21	3	-6	1	5	0	-3	-1	0	-7
12	5	-2	-2	2	6	7	4	-1	-3	-6	-20	-23	-6	4	4	3	4	1	-9
3	-2	-11	-15	-5	10	17	13	-2	-18	-32	-43	-32	-8	5	7	4	-0	-1	-4
-9	-9	-12	-13	-5	9	15	6	-3	-14	-19	-19	-7	3	5	1	-1	-8	-10	-6
-8	-7	-6	-6	-1	6	-0	-14	-13	-2	5	8	13	13	4	-5	-4	-4	-5	-0
5	0	-3	-2	0	3	-4	-14	-6	7	11	8	12	15	9	-4	-6	2	11	20
14	5	0	1	2	3	1	1	7	11	13	8	9	15	16	1	-9	-4	8	21

DIV 500 FROM 130000 CONTOUR INT 5

0	0	4	9	6	-0	-3	-4	-3	1	5	3	-4	-10	-9	-3	-0	-0	-1	-3
-4	-7	-3	8	10	5	-0	-5	-5	0	4	2	-2	-6	-7	-3	-0	1	0	-1
-17	-23	-20	-0	10	8	0	-4	-3	0	3	3	1	0	-2	-1	0	4	4	2
-9	-20	-27	-12	3	4	-1	-4	-3	-0	1	2	4	4	0	-1	-1	1	4	4
13	0	-17	-18	-6	0	-1	-4	-4	-1	-0	2	7	7	0	-5	-5	-2	0	1
15	9	-6	-17	-11	-2	-2	-5	-4	-3	-3	3	13	12	1	-7	-9	-5	-1	-0
8	9	-0	-14	-14	-7	-5	-5	-5	-9	-12	1	18	19	7	-5	-10	-7	-0	2
5	7	-0	-10	-10	-4	-3	-7	-16	-24	-17	7	26	27	14	-2	-12	-10	0	6
2	3	-1	-5	-2	2	-0	-10	-27	-29	-4	21	24	16	7	-2	-10	-9	-1	1
-0	-0	-1	-1	1	3	3	-3	-18	-19	1	15	6	-2	-2	-3	-6	-5	-1	-1
-1	-1	-0	0	0	2	3	2	-4	-7	2	6	-4	-11	-7	-3	-3	-1	2	2
-0	-1	-0	-0	-0	0	2	1	0	-0	2	1	-6	-9	-2	1	-0	1	4	4
0	-0	-0	-0	-0	0	1	1	0	0	1	-1	-6	-5	3	7	4	4	5	4

VAD 500 FROM 130000 CONTOUR INT 2

-1	24	46	68	61	27	5	-3	-15	-26	-8	3	3	-3	-22	-37	-22	-5	0	2
6	52	53	31	15	5	-5	-16	-24	-27	-11	7	13	10	3	4	15	17	11	13
18	30	1	-35	-32	-18	-24	-21	-1	19	20	9	9	11	17	34	48	41	27	21
10	-4	-33	-44	-13	14	0	-21	-12	25	43	32	14	3	-0	12	25	23	15	11
1	-17	-27	-14	21	31	-9	-57	-59	-6	46	54	25	-3	-11	-5	-6	-9	-2	9
-0	-12	-17	-6	8	-4	-40	-62	-58	-15	44	62	29	-1	-9	-13	-21	-16	5	23
-3	-5	-7	-5	-3	-17	-25	-31	-35	4	61	70	43	27	15	-7	-20	-12	11	28
-5	-2	-5	-4	1	2	7	-6	-32	-1	40	31	20	19	10	-3	-18	-14	4	21
-0	-0	-6	-10	-2	7	6	-18	-44	-9	16	-5	-23	-21	-14	-10	-14	-19	-8	4
10	6	-8	-14	-1	8	-1	-31	-39	-3	19	-3	-25	-22	-7	-2	-11	-16	-17	-22
5	1	-4	-1	7	14	2	-21	-23	-1	10	-4	-17	-7	6	0	-6	-3	-10	-25
6	-2	-7	-3	-1	2	0	-10	-6	3	7	-1	-7	5	11	0	-6	3	6	-0
16	0	-9	-10	-13	-5	-0	-6	-1	3	8	5	1	8	11	-1	-8	0	14	18

DIV
300 FROM 130000 CONTOUR INT 5

0	-2	0	14	20	7	-3	-20	-36	-15	22	33	9	-11	-14	-7	-5	-3	-3	-3
-6	-16	-11	17	29	15	2	-14	-25	-14	9	19	7	-14	-26	-20	-5	3	2	-2
-47	-50	-43	-2	21	12	4	0	-5	-6	-0	7	11	-2	-22	-22	-8	6	11	4
-39	-41	-45	-14	1	-12	-3	2	6	-2	-3	0	3	-0	-13	-19	-11	6	12	4
2	-23	-47	-23	-9	-31	-21	-13	0	-3	3	9	6	-0	-9	-16	-11	8	19	13
23	-4	-27	-10	-3	-30	-40	-25	-7	5	21	36	32	14	-3	-19	-13	10	25	25
8	0	-11	-8	-2	-24	-35	-36	-9	4	20	44	51	38	8	-18	-19	5	25	28
4	3	-2	-4	2	-1	-29	-38	-31	-0	23	45	59	48	22	-9	-17	1	19	22
2	2	1	3	6	4	-11	-31	-25	4	26	34	29	24	10	-10	-15	4	18	17
-3	-3	-1	1	-0	-7	-13	-13	-10	14	27	10	-8	-8	-6	-12	-11	8	20	14
0	-2	-3	-3	-6	-10	-12	-11	-4	8	11	-6	-19	-14	-9	-12	-11	5	17	15
2	-0	-2	-3	-4	-4	-6	-7	-4	1	0	-7	-10	-6	-3	-7	-9	-2	8	10
2	0	-0	-0	-0	-1	-3	-5	-3	-0	-1	-4	-3	1	3	0	-4	-4	-0	2

VAD

300 FROM 130000 CONTOUR INT 2

8. Radiosonde data

Pressure	Temperature	Dewpoint	Wind	GPM
[mb]	[°C]	[°C]	dddfff [°][m/s]	[gpm]

12 Z 12 MAY 1978

PRESS	TEMP	DEW PT	WIND	GPM
72220	121200			
1019	21.8	17.5	160005	11
863	14.2	6.2	245006	1437
850	14.0	-5.0	250007	1565
808	11.8	-18.2	267008	1990
785	16.0	-14.0	276007	2233
700	9.0	-1.0	270008	3193
648	6.0	-4.0	298007	3828
600	.2	-3.4	316008	4452
535	-6.1	-9.7	305013	5362
520	-6.5	-21.5	302014	5585
500	-8.9	-18.9	290014	5890
434	-15.7	-33.7	266013	6972
389	-21.7	-24.7	271018	7788
350	-25.7	-55.7	276022	8560
322	-29.8	-48.7	280026	9146
300	-33.5	-42.5	275025	9659
271	-40.1	-47.1	275027	10362
250	-44.5		280030	10907
215	-52.7		285031	11890
150	-69.9		270033	14125
137	-70.4		275036	14634
103	-72.5		272021	16347
100	-71.3		275020	16521
72229	121200			
1003	16.4	15.6	180003	141
1000	16.2	13.1	180004	167
972	17.8	9.8	215012	410
949	17.4	14.6	221012	615
928	18.2	10.2	226013	807
850	14.6	6.6	250018	1555
700	2.8	.5	245021	3162
555	-4.9	-6.9	260022	5015
500	-10.7	-12.3	255027	5827
393	-21.9	-23.8	250028	7621
289	-38.9	-43.5	248023	9823
279	-40.8	-56.2	245026	10060
250	-47.1		250022	10800
200	-59.1		260040	12236
166	-67.9		259035	13379
156	-65.6		265038	13719
150	-63.7		270013	13994
126	-69.7		266013	15048
122	-69.5		265013	15240
115	-62.3		270013	15599
100	-65.7		285014	16455
72232	121200			
1018	20.6	19.9	130002	6
1000	22.4	20.8	160004	161
850	15.0	11.5	245005	1562
760	10.2	9.3	235008	2504
743	10.8	-19.2	235008	2692
700	9.2	1.2	240013	3187
500	-10.1	-14.6	270019	5883
464	-14.1	-19.1	265020	6455
449	-15.3	-45.3	265020	6704
400	-21.1	-27.1	265022	7566
367	-24.7	-54.7	264023	8197
300	-34.3	-47.3	255027	9634
280	-38.5	-51.5	255028	10112
257	-43.4	-82.6	255031	10670
250	-45.3		255030	10879
167	-65.5		270038	13414
132	-71.9		260030	14851
100	-70.9		290016	16491
72235	121200			
1003	19.0	17.5	170005	101
897	20.2	11.2	212013	1065
850	17.2	12.7	220016	1528
700	5.8	3.2	285015	3155
649	1.0	-.3	277015	3769
558	-5.5	-7.6	255028	4972
500	-11.7	-23.7	255035	5823
494	-12.1	-42.1	256035	5915
400	-22.1	-52.1	250037	7496
276	-39.7	-69.7	253042	10120
250	-45.1		250040	10788
221	-51.0		250044	11585
174	-61.1		260033	13109
135	-64.7		268025	14677
128	-61.3		274024	15005
114	-66.7		285020	15714
100	-66.7		290014	16506
72240	121200			
1014	23.8	22.1	170004	4
867	16.4	15.1	225012	1361
850	17.2	14.6	225014	1530
820	16.2	9.4	225013	1829
808	16.4	3.4	231013	1962
752	13.8	-16.2	254016	2569
700	10.0	-4.0	275012	3168
612	2.5	-3.4	255020	4268
500	-11.1	-14.1	255026	5864
453	-17.9	-19.0	253027	6613
435	-17.3	-47.3	255027	6917
395	-21.8	-51.8	255031	7621
280	-39.3	-69.3	258039	10074
250	-46.1		250042	10839
212	-53.7		260044	11890
200	-56.7		260041	12287
100	-71.5		295015	16511

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
72247	121200								
998	19.4	18.6	160004	122	334	-32.9	-62.9	301020	8780
918	17.4	15.6	210018	841	316	-35.7	-75.0	305022	9146
885	19.8	13.8	226018	1156	300	-38.7		300019	9526
850	17.8	15.7	245015	1504	230	-50.7		265028	11280
812	15.4	11.0	264013	1895	200	-57.5		265036	12197
794	15.8	-1.2	276011	2085	170	-60.3		284033	13216
700	7.2	-22.8	290009	3136	166	-58.1		287033	13365
579	-3.7	-33.7	281014	4663	143	-58.3		305026	14304
558	-3.7	-33.7	285015	4954	109	-69.5		287016	15966
500	-9.7	-39.7	285013	5810	100	-67.9		285014	16482
72250	121200								
1011	25.6	23.5	160006	7	500	-8.9	-15.9	255004	5910
968	22.0	20.6	167014	388	315	-32.9	-38.9	250020	9321
945	26.0	8.0	175017	599	295	-36.2	-51.1	250019	9756
869	22.2	4.2	188013	1332	250	-44.9		260026	10905
850	24.2	-5.8	195010	1524	186	-59.0		270030	12804
827	24.8	-5.2	202010	1763	119	-74.1		271021	15513
700	13.6	-16.4	205004	3195	100	-75.3		280018	16524
552	-3.1	-11.1	254005	5133					
72255	121200								
1008	23.4	22.9	160003	35	612	3.7	-10.8	275015	4268
1000	23.6	22.3	165005	105	514	-10.1	-12.9	272021	5659
938	19.8	18.4	197012	663	500	-11.5	-19.5	270022	5871
931	22.4	10.4	200012	728	485	-13.3	-16.3	269022	6104
916	25.0	12.0	207013	870	478	-13.7	-43.7	269022	6215
850	20.8	3.8	240010	1521	440	-16.1	-46.1	265022	6841
812	16.6	13.7	255008	1914	300	-35.9	-65.9	260031	9606
792	17.6	5.6	295006	2127	250	-45.7		260038	10846
762	17.0	-13.0	290006	2456	205	-55.9		264041	12137
700	12.0	-2.0	270007	3172	193	-56.6		270043	12500
683	10.4	-10.6	266008	3377	100	-72.7		280010	16531
672	9.4	-2.6	264008	3512					
72260	121200								
964	19.4	19.4	190003	402	223	-54.7		280022	11517
943	21.2	20.2	210010	593	200	-57.7		275027	12208
905	20.6	17.9	236018	950	195	-53.9		277030	12369
857	24.8	-5.2	252018	1424	191	-54.1		280034	12500
674	6.2	-23.8	275016	3454	157	-57.4		280033	13719
565	-1.3	-31.3	275011	4878	139	-63.9		295032	14508
500	-7.7	-37.7	275018	5839	118	-64.1		310011	15511
378	-25.1	-55.1	270020	7926	108	-67.7		290015	16048
300	-39.1	-69.1	280024	9555	100	-66.7			16512
72261	121200								
975	20.6	19.9	280002	313	293	-39.4	-71.9	285016	9756
923	24.2	19.3	277003	792	250	-46.9		260022	10824
850	24.4	3.4	273006	1514	223	-52.1		267027	11572
700	11.8	-18.2	263013	3172	212	-53.0		270030	11890
525	-7.0	-18.8	260021	5487	100	-71.9		295009	16504
500	-8.7	-38.7	275011	5873					
72265	121200								
914	15.6	-3.4	240006	874	400	-21.1	-51.1	270021	7541
906	22.4	-1.6	247006	949	319	-35.5	-65.5	280022	9146
887	24.2	-5.8	262008	1133	255	-48.2		285025	10670
850	23.4	-6.6	275010	1504	230	-52.5		288022	11346
700	10.8	-19.2	310009	3152	200	-52.7		315027	12249
659	8.2	-21.8	280007	3652	182	-53.3		305026	12857
567	-2.5	-32.5	290017	4867	136	-67.1		305014	14673
500	-8.7	-38.7	280018	5852	121	-66.3		292015	15380
478	-10.5	-40.5	280017	6199	100	-71.5		270017	16520

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
72270	121200								
883	22.0	-10.0	290001	1206	300	-38.5	-68.5	310012	9588
850	19.4	-10.6	290006	1534	250	-48.9		315012	10812
821	17.0	-13.0	290012	1829	224	-53.9		322017	11525
764	15.5	-14.5	305012	2439	157	-63.2		280028	13719
700	10.2	-19.8	310008	3174	140	-66.3		290022	14455
636	3.2	-26.8	309010	3960	133	-63.1		290019	14768
545	-3.7	-33.7	290010	5182	100	-71.7		275014	16484
500	-8.9	-38.9	290010	5868					
72327	121200								
994	16.0	16.0	195008	188	250	-47.9		240035	10741
850	10.6	9.7	220020	1507	241	-49.9		240042	10975
700	3.4	.8	230020	3106	189	-61.6		240049	12500
640	-.5	-2.1	224019	3829	166	-66.5		275033	13318
616	.2	-.4	222019	4136	155	-59.7		298022	13740
500	-10.9	-15.9	215019	5774	135	-63.1		259015	14597
424	-18.3	-23.3	215024	7012	111	-60.9		261012	15807
285	-39.9	-44.5	245031	9862	100	-64.1		240010	16451
264	-44.4	-74.4	245037	10365					
72340	121200								
991	17.2	15.5	200004	172	468	-14.3	-44.3	285019	6255
969	20.2	11.2	199012	365	327	-35.0	-65.0	295029	8841
850	13.8	10.5	240017	1486	300	-39.9	-69.9	295022	9451
831	14.2	10.1	245016	1677	250	-50.1		280029	10668
700	4.0	-2.0	275015	3101	238	-51.5		275034	10975
663	1.6	-11.4	275015	3540	188	-59.7		270029	12491
654	.0	-4.7	275016	3650	169	-56.7		271028	13162
626	-1.9	-8.9	277015	3999	108	-65.3		285018	15935
617	-2.5	-20.5	278015	4114	100	-64.1		285015	16405
500	-11.7	-41.7	280018	5751					
72349	121200								
958	16.6	14.2	190004	438	435	-20.1	-50.1	265027	6789
939	17.4	14.3	200011	609	388	-25.7	-39.7	270037	7621
874	16.5	15.2	225022	1219	311	-39.1	-46.1	274038	9185
850	15.0	13.6	240015	1461	300	-40.7		275039	9431
841	14.8	13.3	243014	1551	250	-49.9		280042	10646
832	16.8	2.8	246013	1642	195	-57.1		265032	12243
700	6.0	-15.0	270009	3085	170	-57.1		265036	13109
603	-2.5	-32.5	290013	4286	150	-57.1		270029	13903
541	-9.3	-20.3	287016	5135	139	-55.7		271026	14386
500	-12.7	-27.7	270020	5740	106	-62.1		285013	16085
490	-12.7	-42.7	268021	5894	100	-61.1		280013	16446
72353	121200								
958	18.8	18.3	180005	397	388	-25.0	-40.7	270034	7621
927	17.6	16.8	206015	680	300	-39.5	-53.5	270032	9440
912	19.6	15.2	218018	820	250	-50.3		275039	10658
904	24.6	17.6	225020	897	228	-55.1		275041	11253
892	25.2	-4.8	226020	1014	216	-55.8		275043	11585
850	23.0	-7.0	235017	1434	196	-56.9		285037	12195
700	7.6	-13.4	245013	3075	161	-56.1		281028	13462
632	-.3	-15.3	258015	3904	119	-65.3		287021	15343
500	-11.5	-41.5	265022	5737	100	-64.9		280015	16403

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
72363	121200								
886	10.0	.0	270003	1099	250	-48.7			10719
881	18.2	-.8	276005	1147	207	-56.9			11936
850	22.6	-7.4	300017	1455	200	-55.3			12155
700	8.6	-13.4	320011	3097	180	-55.1			12827
500	-10.9	-40.9	285020	5774	150	-59.7			13978
400	-21.9	-38.9		7450	114	-68.1			15658
300	-38.3	-52.3		9494	100	-68.9			16443
72365	121200								
839	11.0	-4.0	080002	1619	437	-15.5	-45.5	298027	6841
833	15.4	-1.6	274003	1679	338	-30.7	-60.7	298023	8722
813	16.2	-1.8	310006	1885	300	-37.9	-51.9	300022	9556
700	6.4	-7.6	320022	3134	250	-47.9		305025	10785
636	1.0	-13.0	316019	3912	200	-57.1		305029	12226
610	1.2	-18.8	310021	4247	165	-60.8		305032	13414
500	-9.5	-28.5	300026	5813	100	-70.5		280022	16470
72425	121200								
987	17.8	6.8	190002	255	300	-39.3	-44.2	250024	9454
947	17.6	4.7	205011	609	250	-49.5		270028	10675
850	10.2	.2	235015	1520	200	-61.7		270043	12095
700	3.0	-27.0	215018	3111	186	-60.3		273042	12546
633	-4.7	-9.6	205019	3914	156	-66.5		283027	13626
630	-3.3	-3.3	205019	3952	150	-66.5		285022	13863
500	-12.1	-12.1	235019	5751	133	-59.9		271015	14603
389	-25.0	-27.7	245019	7621	100	-62.1		255013	16374
72433	121200								
987	17.6	14.3	180005	171	383	-27.5	-30.6	245022	7673
916	16.2	12.5	221013	809	300	-39.7	-44.0	220030	9385
901	16.4	8.4	226012	950	250	-48.5		230038	10607
850	13.2	4.2	245009	1443	225	-52.8		230051	11280
782	9.3	2.7	275011	2134	188	-59.9		230043	12432
726	5.5	-.7	275014	2743	155	-57.3		265023	13645
700	4.6	-12.4	275013	3049	138	-60.3		265021	14374
500	-12.5	-42.5	275018	5698	100	-59.3		260007	16386
449	-18.3	-48.3	267020	6510					
72451	121200								
916	15.0	13.9	360006	790	400	-23.7	-53.7	270040	7355
893	15.4	14.1	008006	1006	300	-40.1	-70.1	275044	9384
871	13.8	12.5	015006	1218	284	-42.9	-78.7	280047	9756
850	14.8	9.8	165000	1425	250	-49.3		285043	10603
807	15.2	-6.8	244003	1865	210	-56.7		285043	11726
726	10.2	-17.8	300009	2743	150	-55.9		295040	13863
700	7.2	-13.8	300012	3053	112	-57.9		285026	15712
500	-15.7	-23.7	280017	5704	100	-62.9		290013	16418
72456	121200								
973	13.8	13.2	150001	269	270	-51.1		287032	10016
956	20.6	17.4	154001	420	250	-51.7		280041	10516
945	21.2	16.2	157001	520	238	-50.9		288046	10836
920	19.0	12.0	164002	752	232	-51.5		295048	10975
908	21.4	-8.6	167002	865	210	-54.7		298044	11643
881	21.0	-9.0	175003	1125	200	-52.1		300042	11957
850	17.6	-12.4	185004	1432	193	-48.3		298035	12190
700	4.8	-10.2	240013	3049	161	-54.1		275024	13368
500	-15.5	-19.5	270023	5685	150	-52.5		285032	13824
442	-22.1	-23.8	270023	6605	145	-52.7		285034	14024
328	-39.7	-51.7	284026	8719	120	-55.1		295018	15243
308	-43.3	-81.5	290028	9146	100	-60.1		305009	16409
300	-44.9		290027	9322					

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
72520	121200								
974	16.2	4.2	180007	365	313	-38.7	-43.7	270029	9139
937	19.2	3.2	212014	696	300	-40.5		270033	9429
850	12.8	.8	225013	1523	285	-42.9		270038	9756
760	5.1	-2.2	225008	2439	186	-63.5		285055	12500
700	1.2	-4.8	215012	3116	162	-67.9		301036	13353
638	-4.5	-6.9	225020	3855	150	-62.5		315019	13822
626	-3.1	-3.1	225020	4005	133	-62.3		304010	14564
500	-13.7	-14.5	235018	5750	125	-57.9		285007	14951
400	-25.1	-27.4	255021	7408	100	-59.5		250007	16352
72528	121200								
998	15.4	7.4	160004	224	367	-30.5	-40.5	269020	8057
925	16.6	1.6	207014	870	327	-37.3	-44.3	277020	8865
889	13.8	.8	220014	1206	300	-42.7		280021	9453
863	9.8	.8	223014	1454	200	-59.1		285050	12090
850	9.8	1.8	225014	1580	162	-66.9		288037	13386
700	.2	.2	260007	3161	150	-61.1		285027	13857
541	-10.1	-10.3	233014	5188	100	-60.5		290005	16379
500	-15.1	-16.5	240017	5790					
72532	121200								
982	13.2	11.1	240003	201	452	-18.7	-48.7	270021	6402
959	17.2	11.2	278010	402	328	-39.7	-69.7	245022	8706
850	12.0	5.0	260012	1423	300	-42.7		235026	9312
752	6.8	.1	270017	2439	200	-56.5		235039	11958
706	2.2	-1.1	270016	2956	191	-58.5		238035	12249
700	1.8	-8.2	270015	3025	170	-53.9		248025	12989
656	-2.5	-12.5	265017	3544	150	-54.9		260020	13791
646	-2.5	-20.5	265017	3666	128	-59.1		263020	14795
553	-8.4	-29.2	265020	4878	123	-56.3		264020	15046
500	-13.9	-43.9	270019	5659	100	-56.7		255012	16359
72553	121200								
958	13.8	11.0	200003	405	250	-57.1		240040	10425
942	19.0	4.0	221008	548	247	-57.7		241038	10501
920	19.2	3.2	234011	751	231	-53.1		255025	10928
850	13.4	1.4	250010	1424	206	-54.7		255028	11663
700	1.6	-5.4	255009	3022	200	-52.3		255030	11853
500	-17.5	-23.5	280011	5632	164	-50.2		270031	13109
334	-39.7	-42.8	247035	8522	150	-49.1		280018	13728
300	-46.7		240035	9245	100	-58.3		285015	16330
72562	121200								
912	12.2	7.2	270005	849	378	-33.3	-35.4	220021	7621
909	13.0	5.0	270005	877	335	-39.9	-42.3	205021	8470
850	11.2	-2.8	270013	1439	300	-46.9		205025	9212
743	.8	-4.2	274013	2541	287	-49.5		213024	9504
700	-.5	-13.5	275014	3019	250	-46.3		260020	10414
625	-7.1	-21.1	271019	3915	150	-49.9		275025	13777
529	-16.5	-17.4	260022	5182	120	-52.1		280021	15228
500	-19.7	-20.6	260014	5613	100	-56.5		285017	16395
72576	121200								
833	1.2	-4.8	240002	1700	300	-42.1		310057	9163
823	2.8	-8.2	266002	1797	287	-43.5		310058	9451
700	-5.7	-21.7	320011	3085	217	-50.9		295038	11307
626	-11.5	-41.5	327016	3951	180	-51.7		295047	12500
500	-26.9	-36.9	330014	5620	135	-51.1		292028	14386
376	-39.3	-52.3	302034	7622	100	-61.1		275023	16291
326	-39.9	-69.9	306045	8598					

72637 121200

981	15.6	11.8	170005	233	382	-28.5	-32.5	218014	7661
850	10.4	9.4	215014	1442	362	-30.5	-60.5	216014	8045
726	4.0	1.9	190014	2743	356	-30.5	-60.5	217014	8164
700	1.4	.2	190015	3039	312	-38.7	-48.7	225015	9085
582	-7.5	-8.3	193014	4502	300	-41.1		230016	9353
570	-9.7	-10.8	196014	4664	184	-63.2		235046	12500
556	-9.1	-14.1	200012	4856	176	-65.1		256040	12779
500	-13.7	-20.7	215013	5671	150	-59.3		260016	13767
453	-18.5	-30.5	228016	6415	131	-57.1		255015	14620
414	-23.9	-53.9	223015	7079	100	-57.7		245010	16326
400	-25.7	-30.5	220014	7329					

72645 121200

980	13.8	12.7	160004	213	300	-43.5		190014	9252
850	9.0	5.1	045004	1404	241	-54.9		190023	10670
777	2.9	.7	010010	2134	228	-58.7		202023	11039
700	-.7	-1.3	010005	2980	207	-59.9		222023	11644
500	-14.9	-17.0	200007	5596	189	-58.1		245024	12195
379	-29.5	-32.8	195011	7621	150	-52.5		245014	13690
316	-39.9	-44.2	191011	8900	100	-57.5		245013	16278

72654 121200

956	9.4	8.3	040005	392	387	-35.1	-37.6	232011	7395
950	11.2	9.0	229005	444	367	-38.1	-40.9	237014	7763
896	11.2	7.4	262006	933	300	-50.3		230034	9113
850	7.8	4.3	270005	1371	271	-52.2		225039	9756
718	2.2	-10.1	245014	2743	250	-53.9		235026	10293
700	.4	-6.6	240014	2956	234	-49.3		237025	10722
579	-12.3	-12.3	256011	4442	140	-52.5		268025	14062
546	-14.7	-25.7	258009	4889	134	-51.0		270027	14329
500	-19.3	-29.3	230009	5550	123	-47.7		276023	14908
428	-28.5	-58.5	230008	6684	100	-51.1		280017	16264

72655 121200

969	8.4	5.3	050002	317	447	-23.2	-34.3	225016	6402
912	10.4	3.4	078008	820	400	-29.9	-41.9	230020	7208
850	7.0	3.0	360001	1403	373	-34.1	-37.4	236021	7701
834	6.6	3.7	322002	1559	342	-39.7	-53.7	238021	8301
824	7.4	-13.6	298003	1658	300	-47.7		230018	9181
777	5.6	-11.4	265007	2134	250	-57.5		225021	10358
755	3.4	-3.6	262007	2373	240	-58.3		225025	10615
731	2.2	-27.8	248007	2634	226	-56.3		230026	10975
713	.8	-29.2	233006	2835	190	-51.1		230021	12114
700	-.7	-10.7	220006	2982	181	-53.3		237021	12428
533	-14.9	-14.9	237009	5098	150	-50.7		250018	13645
500	-19.1	-25.1	230012	5578	100	-53.5		260013	16268

72662 121200

902	8.2	2.2	320008	965	436	-32.1	-36.4	295015	6540
888	8.8	1.8	320013	1094	372	-41.7	-55.8	280011	7621
850	6.0	-2.0	325020	1454	319	-51.3		282011	8657
752	-1.5	-10.8	325022	2439	250	-45.5		275020	10261
700	-6.1	-16.1	325015	3008	200	-46.7		280023	11744
642	-11.1	-14.1	318014	3679	150	-50.5		280022	13635
514	-22.1	-33.1	302010	5354	127	-50.1		277024	14721
500	-23.7	-27.9	305011	5556	100	-54.9		280028	16265
464	-28.1	-39.1	298015	6097					

72734 121200

981	11.6	11.6	090003	220	323	-39.7	-44.7	220019	8775
949	13.2	12.1	146005	499	300	-43.9		225022	9275
850	9.2	6.9	215004	1421	206	-62.7		246039	11686
700	-.5	-1.7	195010	3008	200	-57.9		250041	11870
500	-15.5	-18.2	220009	5630	150	-53.5		250019	13703
365	-32.6	-37.0	210015	7926	100	-54.9		240009	16302

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
72747	121200								
967	6.0	2.1	070002	360	300	-48.3		235022	9130
913	7.2	2.8	081004	832	250	-58.9		215026	10301
850	2.4	.9	025003	1415	235	-60.7		220026	10688
700	-4.5	-34.5	340004	2962	189	-52.1		241026	12074
500	-19.1	-22.8	210010	5542	150	-49.3		245020	13580
442	-25.3	-41.3	211011	6448	146	-49.4		255022	13719
370	-35.3	-41.3	226019	7711	100	-52.1		250015	16220
346	-39.9	-47.9	235019	8174					
72764	121200								
951	7.2	5.0	080003	505	386	-38.5	-42.0	267003	7366
850	2.0	.5	050010	1423	332	-47.3		230007	8382
700	-5.9	-6.8	015005	2968	278	-54.1		200014	9541
640	-8.8	-10.7	320004	3658	200	-48.7		255015	11680
500	-23.1	-29.1	270004	5529	100	-51.9		280021	16198
72768	121200								
931	6.0	4.8	320006	700	400	-38.3	-45.3	345014	7111
922	7.0	4.8	323008	780	354	-46.3		343015	7937
850	3.2	1.7	330015	1444	322	-50.1		330015	8561
700	-6.1	-7.5	330008	2995	268	-53.3		302012	9752
617	-13.1	-13.9	333012	3970	233	-47.5		290013	10664
577	-17.1	-47.1	335011	4476	150	-49.5		290021	13556
500	-24.7	-31.7	355011	5534	100	-52.1		275021	16195

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PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
72220	130000								
1017	24.0	19.2	170003	11	700	8.0	-7.0	280010	3183
972	21.0	10.0	164005	405	617	2.0	-28.0	279016	4212
961	21.4	12.4	169005	504	608	1.4	-7.6	280017	4330
922	18.0	16.1	179006	862	500	-9.7	-39.7	275021	5869
908	18.4	9.4	180005	993	276	-39.5	-69.5	268033	10184
850	14.0	10.0	225005	1555	250	-45.5		265038	10852
835	13.4	8.4	245005	1705	200	-56.9		255039	12298
824	14.4	-7.6	260006	1817	158	-63.7		275034	13766
755	13.2	-1.8	286010	2553	108	-69.9		310020	16067
725	10.2	2.2	288011	2893	100	-69.1		310019	16526
715	9.4	-6.6	285011	3008					
72229	130000								
997	23.2	18.6	180003	141	303	-38.2	-68.2	265026	9451
979	23.4	17.4	185008	300	250	-49.3		280024	10747
850	13.8	12.2	225015	1515	222	-55.7		285022	11514
700	4.8	3.1	255017	3130	185	-60.7		286026	12663
633	.2	-3.2	270014	3943	156	-59.1		290029	13719
537	-5.7	-35.7	279020	5244	150	-58.7		290027	13974
500	-10.1	-40.1	275023	5798	138	-59.7		294025	14496
400	-21.9	-51.9	275026	7477	104	-70.1		300019	16219
368	-25.7	-55.7	272024	8086	100	-63.9		300018	16456
72232	130000								
1015	26.8	22.9	180007	6	500	-9.3	-39.3	290015	5870
1000	24.2	21.2	185008	137	380	-25.0	-55.0	300011	7926
950	20.8	18.9	205008	585	300	-38.5	-68.5	275022	9593
850	15.8	10.8	235010	1542	250	-47.5		270032	10821
835	14.4	11.1	243010	1693	214	-55.1		270034	11831
803	16.0	-14.0	256010	2024	200	-56.3		270035	12262
710	10.4	-5.6	260013	3048	150	-61.7		295024	14065
700	10.6	-5.4	265013	3175	100	-71.9		335012	16511

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
72235	130000								
999	28.2	25.8	180006	101	343	-29.9	-59.9	275026	8613
850	16.4	13.8	230021	1507	300	-38.1	-68.1	280026	9551
734	11.5	-8.7	260014	2743	242	-49.2		290023	10975
700	7.6	-13.4	270013	3140	210	-56.5		301029	11907
625	-.1	-19.1	278017	4059	165	-59.2		295038	13414
586	-.4	-30.4	280021	4573	132	-61.9		280029	14816
500	-8.9	-38.9	270024	5822	100	-71.3		310016	16493
72240	130000								
1012	27.2	22.2	200006	4	601	1.0	-29.0	277024	4410
967	22.0	19.0	206010	404	500	-8.1	-38.1	275017	5864
920	19.2	16.1	213012	836	300	-38.1	-68.1	280022	9597
901	21.2	13.2	216013	1016	250	-46.5		300021	10829
850	17.8	10.8	230014	1519	184	-56.7		305022	12804
798	15.6	5.6	247014	2057	150	-63.7		295023	14089
769	16.6	-13.4	257013	2371	139	-67.5		289023	14552
700	10.6	-19.4	275014	3161	128	-66.3		283022	15050
635	5.3	-24.7	275025	3963	100	-73.3		310018	16519
72247	130000								
996	30.0	24.0	240004	122	300	-35.8	-38.2	284025	9572
850	18.8	14.9	261011	1516	250	-45.1	-65.4	305023	10813
700	8.5	-13.5	270019	3153	192	-56.0		310031	12500
613	-.3	-30.3	274019	4231	165	-59.5		299026	13482
611	.6	-29.4	275020	4257	142	-66.9		290030	14405
500	-10.4	-40.4	279029	5831	129	-63.1		287030	14990
394	-22.1	-35.6	280019	7621	100	-71.3			16524
345	-28.3	-30.1	278022	8585					
72250	130000								
1009	32.2	22.2	170010	7	443	-14.9	-44.9	274011	6845
1000	28.8	18.8	175011	87	419	-17.5	-22.3	265014	7264
949	25.0	18.0	187013	551	400	-19.1	-49.1	270016	7610
924	28.2	21.2	177013	788	367	-22.7	-49.9	275022	8231
922	28.2	9.2	176013	807	300	-34.5	-48.5	275020	9688
850	27.2	-2.8	210008	1526	287	-38.9	-51.9	280021	9995
700	14.4	-7.6	200007	3199	250	-44.9		270026	10929
664	11.0	-19.0	240002	3641	200	-54.5		270034	12388
615	4.8	-7.9	295003	4268	169	-62.7		272020	13446
531	-5.7	-14.7	325007	5448	105	-73.9		320011	16294
518	-5.9	-35.9	313007	5642	100	-72.7		325011	16580
500	-7.9	-37.9	295008	5918					
72255	130000								
1007	30.2	23.2	180005	35	514	-7.7	-37.7	285013	5683
1000	28.0	23.2	180006	97	500	-7.3	-37.3	285010	5898
945	23.2	21.0	205006	597	445	-13.1	-43.1	299009	6795
924	22.8	20.2	229006	794	300	-37.1	-67.1	295015	9653
903	25.8	15.8	243005	996	235	-47.4		280019	11280
850	25.2	6.2	240004	1528	184	-53.7		299016	12890
700	11.6	-5.4	270008	3189	144	-65.5		290016	14421
530	-6.9	-7.7	285014	5444	102	-74.5		308013	16470
518	-7.9	-14.9	285013	5623	100	-73.3		310012	16586
72260	130000								
965	28.2	13.2	360009	402	395	-20.9	-50.9	295023	7621
866	19.6	9.6	359011	1348	213	-49.8	-87.1	295028	11890
850	22.1	.3	356010	1509	137	-66.1		274020	14684
700	9.6	-10.4	260010	3154	121	-65.9		290018	15437
500	-7.8	-37.8	291020	5851	100	-71.9			16577

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
	72261	130000							
973	36.0	15.0	180004	313	613	4.8	-25.2	275005	4268
962	33.6	14.6	182004	416	500	-7.1	-37.1	269007	5895
850	25.6	.4	211004	1518	400	-19.7	-49.7	278009	7591
771	19.2	-10.8	234004	2364	200	-52.8		280012	12365
700	11.5	-11.9	257004	3181	100	-74.5			16587
676	8.6	-12.4	265004	3471					
	72265	130000							
913	34.4	.4	050007	874	250	-43.5		315018	10867
850	27.0	-3.0	050005	1511	168	-59.7		270016	13414
700	11.4	-9.6	015005	3175	136	-68.5		280016	14735
567	-2.4	-22.0	275012	4878	126	-65.9		275017	15196
500	-7.9	-37.9	295014	5871	100	-73.7		290022	16571
277	-39.1	-69.1	310019	10171					
	72270	130000							
882	33.6		220003	1206	400	-20.5	-50.5	305013	7595
870	30.0	.0	221003	1329	300	-26.3	-56.3	330012	9698
850	28.0	-2.0	225002	1535	283	-39.5	-69.5	326012	10108
700	11.6	-18.4	350004	3201	250	-45.3		315010	10946
500	-8.1	-38.1	300008	5905	100	-73.5		300014	16614
	72327	130000							
989	21.8	18.6	160003	188	388	-25.5	-55.5	255028	7621
978	20.2	16.9	165008	285	326	-34.8	-64.8	260032	8841
850	13.8	11.5	220017	1485	309	-37.9	-67.9	264030	9233
732	6.0	3.5	245020	2731	300	-39.1		260027	9436
726	6.2	-.8	245020	2799	210	-59.9		288032	11768
700	4.0	-7.0	245021	3097	166	-60.9		276031	13233
610	-4.3	-13.3	249021	4198	157	-55.7		280029	13584
595	-3.5	-33.5	250022	4394	100	-62.5		305005	16407
500	-12.9	-42.9	255021	5743					
	72340	130000							
987	24.6	20.8	220004	172	281	-40.1	-45.1	281048	9931
850	16.2	14.1	255019	1466	250	-45.1		280041	10720
806	14.6	13.0	265021	1918	229	-49.9		275045	11280
744	7.8	6.0	265021	2588	184	-61.5		282043	12688
700	4.6	-3.4	260023	3089	172	-56.1		285046	13109
644	.8	-10.2	245025	3764	168	-54.1		285040	13262
604	-3.8	-12.0	240029	4268	150	-56.3		275018	13985
537	-8.6	-10.1	250038	5182	128	-62.7		275018	14977
500	-11.7	-13.5	250036	5745	124	-60.5		275017	15174
383	-22.9	-26.1	272032	7740	107	-67.5		295014	16077
320	-33.9	-38.9	288035	9028	104	-65.5		295014	16249
302	-33.7	-38.4	280043	9434	100	-67.3		295014	16486
288	-38.1	-43.0	280050	9756					
	72349	130000							
958	18.8	10.8	305010	438	514	-17.5	-47.5	260038	5413
953	18.6	1.6	304010	483	500	-15.7	-45.7	260041	5621
850	10.0	6.7	295020	1449	419	-22.1	-52.1	260054	6937
814	6.2	5.5	295021	1807	411	-19.9	-49.9	260055	7079
700	-2.9	-3.2	275027	3027	381	-23.2	-53.2	260059	7621
685	-3.5	-8.5	273028	3198	300	-37.9	-67.9	270059	9332
684	-3.9	-17.9	273028	3210	232	-48.3		280056	11061
659	-3.3	-33.3	268032	3504	204	-45.7		280038	11913
621	-6.5	-36.5	265036	3963	200	-46.1		280039	12045
545	-16.1	-46.1	256035	4973	100	-64.9		285020	16441

72353 130000

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
969	25.0	2.0	350015	397	472	-12.3	-29.3	295043	6197
953	21.2	6.2	348015	542	389	-24.8	-39.1	285052	7621
850	11.0	.0	328018	1513	300	-37.7	-49.7	290055	9473
803	7.6	-5.4	319019	1984	250	-46.1		319076	10707
770	7.4	-9.6	306027	2329	200	-52.9		354101	12165
753	9.2	-10.8	299032	2513	169	-52.7		021121	13252
700	4.0	-15.0	295028	3112	150	-59.1	-63.1	040135	14010
607	-5.7	-20.7	290035	4249	126	-65.1		277026	15087
554	-6.9	-24.9	295040	4963	111	-66.3		285030	15853
512	-11.3	-28.3	291045	5573	100	-66.9		290017	16487
500	-10.7	-27.7	295045	5755					

72363 130000

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
894	23.0	-4.0	020008	1099	300	-35.9	-65.9	300040	9546
850	17.6	-12.4	010008	1533	278	-39.7	-69.7	302039	10071
700	4.2	-7.8	285017	3149	250	-44.9		305037	10788
682	4.8	-8.2	287019	3361	232	-48.2		300045	11280
544	-6.5	-36.5	315028	5162	200	-54.1		305028	12246
525	-5.9	-35.9	311029	5440	174	-57.2		305035	13109
500	-8.7	-38.7	305032	5820	141	-61.3			14446
445	-16.0	-46.0	290033	6707	107	-70.1			16121
359	-29.3	-59.3	294035	8282	100	-67.7			16526

72365 130000

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
841	25.6	-6.4	340010	1619	394	-22.0	-51.3	300022	7621
832	22.4	-7.6	340010	1713	288	-39.5	-53.5	306024	9857
700	8.6	-11.4	315008	3174	250	-46.7		300026	10810
661	3.8	-15.2	320012	3643	192	-57.0		300031	12500
566	-3.0	-22.7	315012	4878	112	-70.5		287020	15819
500	-11.9	-29.9	310014	5852	100	-68.3		290014	16495

72425 130000

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
983	18.8	12.8	180004	255	507	-11.5	-14.4	271019	5639
881	11.2	10.5	204011	1184	500	-12.7	-15.2	270021	5745
850	12.8	10.0	215009	1485	476	-14.3	-44.3	269021	6119
841	13.8	4.8	217008	1575	388	-24.9	-54.9	270023	7621
757	6.2	4.0	253008	2451	307	-39.5	-69.5	267025	9285
700	4.2	1.2	255010	3091	300	-40.7		270024	9442
641	.4	-29.6	272008	3802	286	-43.2		265029	9756
632	-.9	-11.9	273008	3915	200	-60.5		235026	12076
626	-.9	-30.9	274008	3991	194	-60.3		238026	12266
614	-2.3	-32.3	277008	4145	189	-55.7		241026	12431
599	-3.9	-4.5	280009	4341	178	-55.2		250027	12804
588	-4.9	-8.5	279009	4487	161	-54.1		250024	13456
582	-4.9	-34.9	279009	4568	150	-57.1		250021	13907
523	-9.5	-39.5	272017	5400	100	-60.5		310007	16451

72433 130000

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
981	20.6	20.6	170009	171	271	-43.7	-61.5	255040	10060
850	13.7	13.5	214022	1399	206	-58.1		264030	11844
778	11.0	5.9	220024	2134	185	-56.3		265026	12523
700	4.5	-4.2	219029	3014	181	-51.1		265026	12663
598	-4.2	-8.5	220031	4268	150	-54.9		268027	13874
540	-9.9	-11.3	227029	5071	139	-54.7		270028	14329
500	-11.7	-13.4	234025	5663	124	-54.3		285023	15092
384	-25.6	-29.6	265026	7621	100	-61.5			16447
300	-38.4	-44.4	264032	9370					

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
72451	130000								
925	21.0	.0	330011	790	469	-19.3	-49.3	311050	6135
918	18.4	-3.6	330012	855	400	-22.5	-52.5	305053	7310
850	12.6	-7.4	325017	1506	383	-24.8	-54.8	300054	7621
758	-.6	-13.5	330024	2439	309	-36.1	-66.1	300060	9146
700	-9.7	-17.7	320022	3067	246	-46.2		305052	10670
652	-7.5	-13.5	311024	3618	225	-47.2		305057	11280
633	-8.3	-23.3	310041	3848	200	-48.5		295043	12063
597	-8.1	-38.1	308044	4302	150	-57.7		275030	13915
554	-11.5	-41.5	305050	4878	133	-62.1		277026	14666
500	-16.3	-46.3	310050	5656	100	-65.1		260014	16415
72456	130000								
977	15.6	8.6	320009	269	423	-31.3	-40.3	315024	6773
965	15.8	6.8	321010	374	400	-34.5	-64.5	315022	7166
850	6.2	2.4	330027	1433	355	-37.7	-67.7	301023	7994
750	-1.3	-2.9	335031	2439	323	-35.7	-65.7	299030	8648
700	-5.5	-6.0	330030	2991	300	-36.9	-66.9	305038	9160
679	-6.9	-9.1	331030	3230	240	-40.1	-73.3	300035	10670
670	-5.9	-16.9	331030	3334	200	-44.3		295038	11926
614	-10.5	-20.5	335029	4012	150	-49.7		300033	13830
587	-12.1	-42.1	329027	4357	143	-51.9		303032	14141
544	-15.5	-45.5	320028	4935	130	-51.1		301027	14760
500	-21.5	-28.5	320028	5564	100	-63.7		285023	16415
72520	130000								
972	15.4	12.0	240004	365	482	-15.5	-18.5	265014	5979
850	9.8	5.1	205014	1492	474	-16.7	-33.7	265014	6105
759	3.2	2.3	200021	2422	355	-30.9	-60.9	255024	8213
700	-.5	-1.3	220018	3074	300	-39.9	-48.9	225020	9384
666	-2.5	-3.2	241014	3471	250	-49.3		210030	10603
661	-1.3	-2.1	247013	3531	214	-56.6		210032	11585
549	-11.3	-17.3	290010	4986	163	-60.5		236022	13311
540	-12.5	-28.5	290010	5113	150	-58.7		255025	13831
523	-11.7	-14.4	276009	5358	139	-55.3		265019	14313
500	-13.7	-16.0	260012	5701	100	-59.7		295008	16391
72528	130000								
988	15.6	12.9	100003	224	250	-50.3		210031	10592
850	7.4	6.9	175008	1484	205	-60.5		223028	11856
700	-.7	-1.3	195023	3061	157	-60.7		239023	13517
500	-14.5	-15.6	230011	5679	150	-59.1		250026	13802
369	-27.9	-30.4	214022	7921	133	-56.3		275009	14561
300	-39.1	-42.4	205025	9373	100	-59.5		235007	16358
72532	130000								
976	21.0	16.7	170003	201	381	-28.6	-55.5	230022	7621
956	21.2	17.4	176005	381	300	-41.7		210023	9291
850	13.3	8.9	170009	1385	221	-57.2		220036	11280
700	-.4	-2.1	165010	2982	207	-60.7		232032	11701
584	-5.1	-5.6	208010	4420	203	-52.7		235031	11825
550	-9.2	-9.5	220014	4878	191	-50.5		250023	12195
509	-10.9	-11.6	230012	5486	125	-53.1		270026	14939
500	-13.5	-14.2	228013	5623	100	-58.2			16394
72553	130000								
959	14.2	6.2	300012	405	400	-33.9	-63.9	244008	7151
936	12.7	5.5	310021	609	345	-39.7	-69.7	170010	8174
850	6.5	2.7	315020	1410	326	-39.7		170008	8561
767	-.3	-.7	315018	2243	312	-42.5		176008	8859
700	-2.8	-11.8	315018	2972	285	-41.1		219008	9472
603	-11.7	-15.7	310017	4134	144	-48.0		290027	14024
546	-16.4	-46.4	310017	4878	121	-50.1		270018	15184
500	-19.9	-49.9	301016	5544	100	-56.9			16409

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
72562	130000								
918	16.0	1.0	330013	849	400	-36.1	-66.1	323027	7221
850	10.4	-2.1	328020	1496	367	-37.3	-67.3	320034	7817
700	-4.0	-9.9	320020	3069	316	-35.3	-65.3	317048	8855
632	-10.9	-15.9	321021	3865	281	-39.5	-69.5	315053	9666
553	-16.3	-32.3	324022	4881	211	-48.1		308037	11590
500	-22.5	-42.9	322023	5629	156	-48.1		298032	13580
468	-26.4	-49.6	320025	6097	100	-59.9			16430
72576	130000								
834	12.6	-6.4	340003	1700	300	-41.2	-53.9	300050	9360
700	-2.0	-14.0	330003	3129	250	-49.2	-84.6	297062	10576
558	-13.9	-22.1	310027	4878	224	-54.1		295061	11288
540	-13.7	-26.7	306031	5137	182	-57.3		295058	12610
500	-17.1	-31.4	313036	5718	137	-55.7		298030	14411
457	-21.3	-37.3	318039	6387	100	-65.0			16370
360	-33.1	-44.1	305048	8101					
72637	130000								
977	21.6	14.6	240007	233	263	-50.5		278014	10176
850	11.4	8.3	238011	1420	250	-50.0		274016	10507
700	.9	-3.0	245018	3014	217	-56.1		246018	11419
645	-2.5	-32.5	250016	3658	200	-50.3		229016	11945
552	-7.8	-37.8	255015	4878	175	-54.1		229018	12809
500	-13.1	-43.1	263013	5651	150	-54.5		245023	13797
328	-38.9	-68.9	267011	8699	100	-55.9			16384
72645	130000								
978	15.6	9.6	060006	213	500	-14.9	-25.8	234018	5593
972	13.0	8.7	058006	265	488	-16.3	-20.5	231018	5776
935	10.4	8.1	040007	590	423	-24.1	-54.1	215018	6835
881	12.0	5.0	025007	1086	362	-33.5	-37.4	213015	7948
850	10.0	4.3	110005	1385	241	-53.3	-90.2	245033	10670
747	2.5	-2.8	260003	2439	212	-59.3		228022	11493
714	.4	-29.6	250003	2809	183	-52.1		228020	12429
700	-.2	-30.2	251003	2967	127	-50.9		246015	14800
593	-5.6	-35.6	215004	4268	100	-53.8			16345
537	-10.9	-40.9	224010	5049					
72654	130000								
967	9.4	5.0	330007	392	417	-32.3	-38.3	339006	6863
957	10.6	6.2	343010	478	400	-34.8	-49.8	007006	7155
905	5.4	3.6	007018	939	371	-39.3	-46.3	044002	7676
850	2.1	1.0	175020	1449	300	-47.5		154015	9102
700	-5.9	-7.1	355018	2993	213	-45.7		296016	11374
593	-12.6	-14.2	340014	4268	150	-48.7		285022	13694
500	-21.9	-25.2	345008	5555	100	-52.4			16336
72655	130000								
972	9.8	8.1	360004	317	344	-39.5	-44.2	183017	8217
960	10.2	7.0	007007	420	260	-54.3	-93.2	190030	10060
850	2.0	.7	035013	1418	239	-58.7		205025	10600
700	-3.7	-4.2	020011	2969	223	-52.1			11042
500	-19.1	-22.2	105001	5547					
72662	130000								
909	12.8	1.8	320015	965	319	-42.7		315048	8754
850	7.1	-.6	327018	1523	312	-41.3		315049	8904
762	-.7	-8.7	325023	2407	250	-45.5		315061	10394
700	-5.1	-12.1	325022	3079	200	-50.1		311043	11866
500	-23.9	-53.9	317020	5626	119	-52.8		275021	15243
373	-39.9	-53.9	315024	7695	100	-56.3			16356
345	-42.7		315027	8225					

PRESS	TEMP	DEW PT	WIND	GPM	PRESS	TEMP	DEW PT	WIND	GPM
72734	130000								
975	10.0	9.4	100003	220	319	-39.1	-43.4	285012	8808
850	8.4	8.1	341004	1359	234	-55.5		257012	10857
700	.2	-.6	226002	2942	181	-52.7		227018	12504
500	-14.2	-15.6	221003	5566	150	-55.1		230022	13710
378	-29.8	-33.0	260005	7621	100	-53.5			16309
72747	130000								
969	13.2	.2	360007	360	357	-37.9	-41.2	228022	7964
850	3.5	-1.1	030011	1442	260	-54.9		225038	10060
772	-2.9	-9.9	039009	2213	250	-57.1		225036	10317
756	-1.9	-31.9	037010	2379	230	-58.7		226032	10842
700	-5.8	-22.0	033012	2986	200	-50.9		233023	11736
584	-14.1	-15.2	196007	4381	100	-51.1			16246
500	-19.1	-24.9	235008	5551					
72764	130000								
958	11.0	3.0	260002	505	386	-38.3	-43.3	326005	7425
850	3.0	2.8	287002	1489	316	-50.5		267005	8764
700	-5.5	-5.9	287002	3038	298	-52.7		250003	9144
550	-18.1	-19.9	325007	4878	257	-46.9		290012	10112
500	-23.7	-26.3	336007	5591	100	-51.9			16299
72768	130000								
937	15.0	1.0	340003	700	400	-39.0	-46.0	271009	7164
933	13.4	-3.6	335003	736	337	-48.1		272011	8316
850	6.7	-5.1	278008	1510	214	-49.7		300038	11280
700	-7.0	-11.6	283012	3063	107	-52.9		280018	15799
500	-25.6	-35.0	267009	5592	100	-52.3			16236

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ACCOMPANIMENT GUIDE TO CYCLOGENESIS VIDEOCASSETTE

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1225 West Dayton Street
Madison, Wisconsin

A listing of the videocassette contents is provided on this page. The remainder of the guide details important features pertaining to the cyclone that are contained in the videocassette images. The time(s) of the satellite image(s) and analyses as well as the parameters depicted, contour intervals, and units are given directly beneath the videocassette image(s).

VIDEOCASSETTE CONTENTS

<u>Satellite imagery</u>

Infrared
Enhanced infrared

<u>Surface features with satellite images</u>

Pressure
Pressure and banded temperatures
Streamlines
Streamlines and banded temperatures
Temperature advection
Streamlines and banded dewpoints
Mixing ratio advection
Weather symbols

<u>Upper air features with satellite images</u>

500 mb heights and temperatures
500 mb heights and isotachs
500 mb streamlines and absolute vorticity
300 mb divergence and isotachs
850 mb heights and temperatures

<u>Surface and upper air features with satellite images</u>

300 mb divergence and surface streamlines
500 mb vorticity advection and surface streamlines
500 mb heights and sea level pressure
500 mb streamlines and surface streamlines

<u>Cross Section</u>

Bismark, North Dakota to Jackson, Mississippi

<u>Isentropic surfaces with satellite images</u>

300 (305) K with pressure, streamlines and mixing ratio
320 K with pressure, streamlines and isotachs

Satellite Images

1) Central United States satellite images...GOES-East (4 km resolution)... infrared

loop is from 12 May 1300 GMT to 13 May 0400 GMT (interval: 1 hour)

a) Two regions of extensive cloud cover are present. East of the Mississippi River Valley is a weakening storm system, while to the west is a developing cyclone. On the afternoon and evening of 12 May rapid cyclogenesis occurs in the Great Plains with the surface low tracking from north central Iowa to northern Illinois. To the south a line of strong thunderstorms develops.

b) The enhanced infrared images more distinctly depict subtle grey scale differences in infrared brightness temperatures. Warmest to coldest temperatures are indicated by the color sequence; black, blue, green, red, and white.

Surface Features with Satellite Images

loops are from 12 May 1300 GMT to 13 May 0400 GMT (interval: 3 hours)

frame duration: 10 s for first loop, 2 s for second loop

2) Sea level pressure

isobar interval = 4 mb

a) The location of the two low pressure centers is evident in the early frames. The central pressure of the western cyclone deepens from 1001 mb to 992 mb as it moves to northern Illinois during the period. A pressure trough extends southward to central Texas.

3) Sea level pressure and banded surface temperature

isobar interval = 4 mb; isotherm interval = 4°C

a) Two thermal processes are evident from the sequence; (1) the diurnal heating/cooling cycle, and (2) temperature advection associated with the cyclone circulation. Note the lack of a large thermal gradient along the pressure trough in the south.

4) Surface streamlines

a) Convergence into the two low pressure centers is depicted in the streamline pattern. By the afternoon of 12 May the circulation of the developing cyclone becomes dominant over the central United States. Later in the sequence the divergent center of an anticyclone moves into eastern Montana.

5) Surface streamlines and banded surface temperatures

isotherm interval = 4°C

a) Streamlines and contoured temperatures provide a general indication of temperature advection, although wind speed is also necessary for a quantitative evaluation. Warm air advection to the east of the developing low and cold air advection to the west are indicated.

6) Surface temperature advection (TAD)

contour interval = 4°C/day

a) Positive values, which indicate warm air advection, extend over a broad region of the Mississippi and Ohio River Valleys. Large negative values, which indicate strong cold air advection, move from the central plains to the east and south by the end of the sequence. Note the position of the zero advection line with respect to the surface pressure trough.

7) Surface streamlines and banded surface dewpoint temperatures

isotherm interval = 4°C

a) Moisture from the Gulf of Mexico is transported northward through the Mississippi River Valley and into Illinois and Michigan ahead of the developing cyclone. A strong moisture gradient (dry line) is present in central Texas behind the developing squall line.

8) Surface mixing ratio advection (QAD)

contour interval = 2(g/kg)/day

a) Recall from the dewpoint analysis (#7) that significant moisture was already present in the central United States. Thus, the moisture advection (positive values) is weak over a broad region of the country. A more intense region of dry air advection is occurring west of the surface pressure trough.

9) Weather symbols

a) Extensive early morning fog in the central United States burns off allowing surface heating ahead of the developing cyclone. Intense convective activity develops in Missouri by midday and spreads southward. Continuous precipitation is more prevalent northwest of the surface low. Reports of fog are frequent along the shores of the relatively cold Great Lakes.

<u>Upper Air Features with Satellite Images</u>

loops are from 12 May 1200 GMT and 13 May 0000 GMT (except #10)

frame duration: 10 s for first loop, 2 s for second loop

10) 500 mb geopotential heights and temperatures

height contour interval = 60 m; isotherm interval = 4°C

loop is for 6 consecutive radiosonde time periods from 11 May 0000 GMT to 14 May 0000 GMT

a) On 12 May 0000 GMT the first short wave trough is located over the mid Mississippi River Valley. During the next two periods the second short wave amplifies rapidly as it moves into this region. Note the cold advection into the amplifying trough. By 14 May the cyclone is occluded with the closed low directly over the cold pool of air at 500 mb.

11) 500 mb geopotential heights and isotachs

height contour interval = 60 m; isotach interval = 5 m/s

a) A mid tropospheric wind maximum is propagating into the region of the amplifying short wave trough. Note how maxima of height contour curvature and horizontal wind shear are located in the same vicinity during the second period, producing a vorticity maximum.

12) 500 mb streamlines and absolute vorticity

vorticity contour interval = 2×10^{-5}/s

a) At 1200 GMT on May 12 a 14 unit vorticity center is located in Wyoming. Areas of positive and negative vorticity advection can be inferred using the streamline field (and isotachs from #11). Note how the features associated with the developing cyclone and depicted by the comma-shaped cloud are related to the vorticity advection. Calculated 500 mb vorticity advection will be displayed later in the tape.

13) 300 mb isotachs and divergence

isotach interval = 5 m/s; divergence contour interval = 1×10^{-4}/s

a) An upper tropospheric wind maximum (jet streak) in excess of 50 m/s moves into the Great Plains. A 300 mb divergence maximum located on the downwind cyclonic side of the jet is positioned directly above the developing surface low. Note the position of the jet streak with respect to the dry tongue.

14) 850 mb geopotential heights and temperature

height contour interval = 30 m; isotherm interval = 4°C

a) The broad 1440 m contour at 850 mb contains the two circulation centers. Lower tropospheric temperature advection can be inferred from the images.

Surface and Upper Air Features with Satellite Imagery

12 May 1200 GMT

frame duration: 10s

15) 300 mb divergence and surface streamlines

divergence contour interval = 1×10^{-5}/s

a) The center of maximum 300 mb divergence is located in eastern Nebraska near the surface low pressure center. Note how divergence/convergence aloft is related to cloudy/clear skies. The weakening low over eastern Wisconsin no longer has 300 mb divergence support.

16) 500 mb vorticity advection (VAD) and surface streamlines

vorticity advection contour interval = $(5 \times 10^{-5}$/s)/day

a) The relationship between mid-tropospheric vorticity advection and cloud formation is evident here. Strong PVA moving into the region over the surface low provides support for cyclogenesis.

17) 500 mb geopotential heights and sea level pressure

height contour interval = 60 m; isobar interval = 4 mb

a) The inter-relationship between a propagating short wave at 500 mb and a developing surface low is depicted. Comparison with the next time period (#22) is helpful.

18) 500 mb streamlines and surface streamlines

a) Low level flow off the Gulf of Mexico veers with height to a more westerly direction at 500 mb. The differential temperature and moisture advection associated with this flow pattern is another major factor in the process of cyclogenesis.

Cross Section with isentropes, isotachs and isohumes

19) 12 May/1200 GMT from L-R (72764 BIS - 72654 HON - 72553 OMA - 72349 UMN - 72340 LIT - 72235 JAN)

isentrope interval = 5°K; isotach interval = 10 m/s; isohume interval = 2 g/kg

a) The isentrope structure shows a cold pool of air near the surface in the northern portion of the cross section. Widely spaced and steeply sloped isentropes indicate instability at mid levels near the surface front (OMA, UMN). The upper tropospheric jet maximum is located above the greatest slope in isentropes. A low level moisture intrusion is present in the south with a moist pocket above the surface over Monett, MO (UMN).

Surface and Upper Air Features with Satellite Imagery

13 May 0000 GMT

frame duration: 10s

20) 300 mb divergence and surface streamlines

divergence contour interval = 1×10^{-4}/s

a) At this time strong 300 mb divergence is located above the rapidly deepening surface low. Development of the surface low continued over the next few hours.

21) 500 mb vorticity advection (VAD) and surface streamlines

vorticity advection contour interval = $(5 \times 10^{-5}/s)$/day

a) Strong PVA is present over the thunderstorms and the surface cyclone center in Illinois with an area of PVA extending southward along the region of squall line development. Strong NVA is present southwest of the cyclone center in the vicinity of Kansas and Oklahoma.

22) 500 mb geopotential heights and surface pressure

height contour interval = 60 m; isobar interval = 4 mb

a) As the 500 mb trough amplifies, the surface low develops to the east of the trough axis, where thermal and vorticity advections create an environment favorable for cyclogenesis.

23) 500 mb streamlines and surface streamlines

a) The vertical wind sheer is especially well developed along the squall line.

Isentropic Surfaces with Satellite Images

12 May 1200 GMT

24) 300 K with pressure, streamlines and mixing ratio

isobar interval = 50 mb; isohume interval = 2 g/kg

a) The ridge of higher pressure over the Great Plains indicates warm air on the 300°K surface. Flow off the Gulf of Mexico towards lower pressure suggests that warm, moist air is being lifted as it moves to the northeast. Abundant moisture exists from Texas to Missouri while drier air is over western Texas.

25) 320 K with pressure, streamlines and isotachs

isobar interval = 50 mb; isotach interval = 5 m/s

a) Along most of this surface the air is moving essentially parallel to the pressure contours. However, motion across the pressure contours can be found in the vicinity of the shortwave trough over Nebraska.

Diffluence is also indicated over Nebraska and Iowa as the nose of 40 m/s jet moves to this region.

Isentropic Surfaces with Satellite Images

13 May 0000 GMT

26) 305 K with pressure, streamlines and mixing ratio

isobar interval = 50 mb; isohume interval = 2 g/kg

a) The area of lower pressure behind the comma cloud indicates the intrusion of colder air into the cyclone circulation. Flow towards higher pressure suggests subsidence into the dry tongue. The warm air ridge of higher pressure curves eastward into the Ohio River Valley in the region of ascending air along the squall line. The moisture ridge axis is co-located with the main thunderstorm band.

27) 320 K with pressure, streamlines and isotachs

isobar interval = 50 mb; isotach interval = 5 m/s

a) A "classic" fit of the upper tropospheric jet to the dry tongue is depicted. Even at this higher level the streamlines directed towards higher pressure suggest subsidence into the vicinity of this intrusion of drier air.

CYCLOGENESIS

Sequence	Time	Tape Counter
Title	:29	14
Satellite Imagery (Infrared and Enhanced Infrared)	:47	22
Surface Fields (superimposed on satellite images)	3:18	88
Sea level Pressure	3:25	91
Pressure and Banded Temperature	4:52	126
Streamline	6:15	156
Streamline and Banded Temperature	7:39	186
Temperature Advection	9:22	221
Streamline and Banded Dewpoint	10:48	248
Mixing Ratio Advection	12:33	281
Weather Symbol	13:56	305
Upper Air Analyses (superimposed on satellite images)	15:19	329
500 mb Height and Temperature	15:27	331
500 mb Height and Isotach	16:50	354
500 mb Absolute Vorticity and Streamline	17:26	364
300 mb Isotach and Divergence	18:00	373
850 mb Height and Temperature	18:35	382
Surface Analyses Combined with Upper Air Analyses (superimposed on satellite images)	19:10	391
1200 GMT 12 May 1978	19:17	393
300 mb Divergence and Surface Streamline	19:24	395
500 mb Vorticity Advection and Surface Streamline	19:43	400
500 mb Height and Surface Pressure	20:00	404
500 mb Streamline and Surface Streamline	20:18	409
Isentropic X-section (isotach and mixing ratio)	20:35	413
0000 GMT 13 May 1978	21:17	424
300 mb Divergence and Surface Streamline	21:24	426
500 mb Vorticity Advection and Surface Streamline	21:42	430
500 mb Height and Surface Pressure	22:00	434
500 mb Streamline and Surface Streamline	22:18	439
Isentropic Analyses (superimposed on satellite images)	22:36	443
1200 GMT 12 May 1978	22:43	445
300K Pressure, Streamline and Mixing Ratio	22:48	447
320K Pressure, Streamline and Isotach	23:36	458
0000 GMT 13 May 1978	24:23	469
305K Pressure, Streamline and Mixing Ratio	24:31	471
320K Pressure, Streamline and Isotach	25:17	482
End	26:05	493