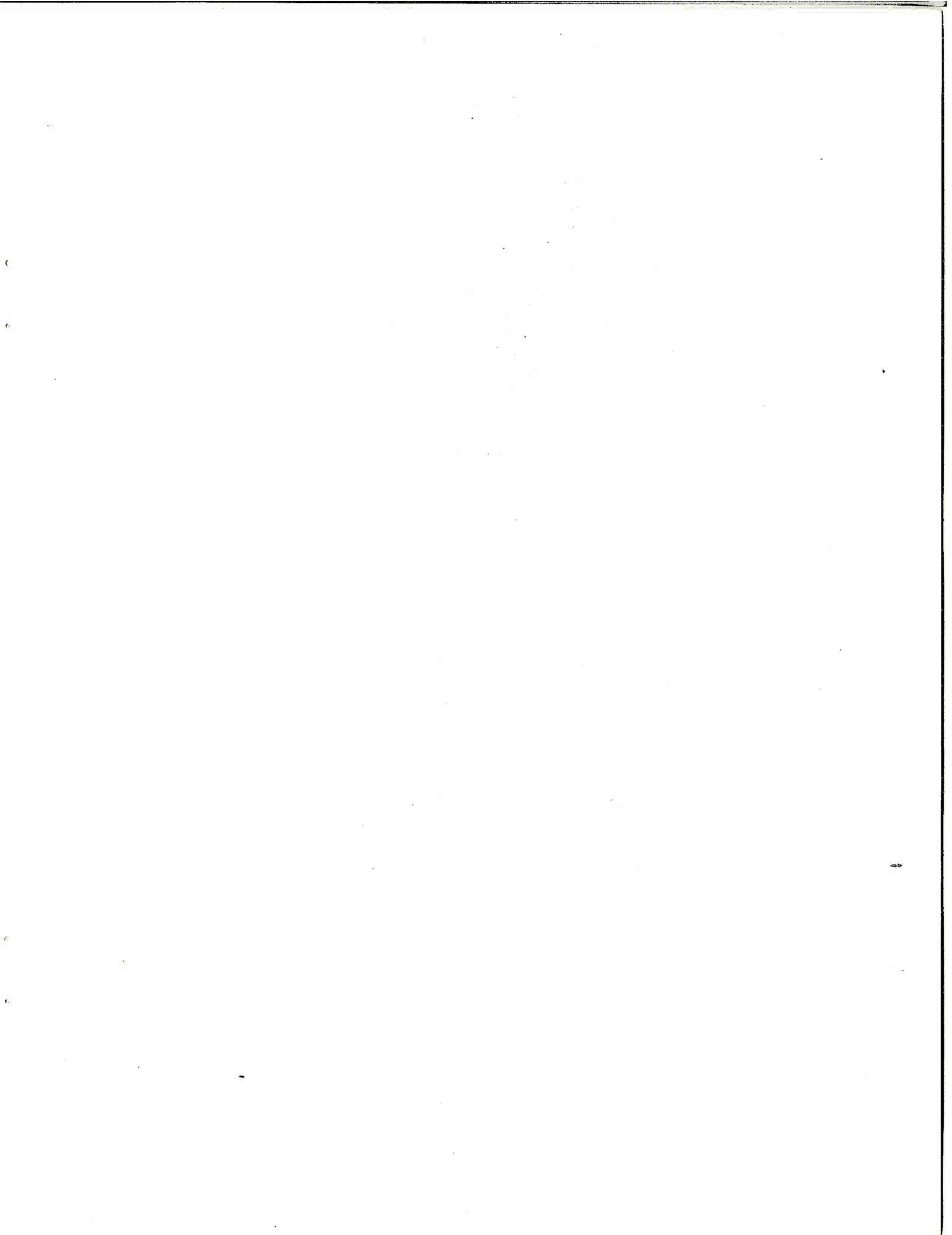


A Summary and Index of the Weather Documentation
for the 1983
Cross-Appalachian Tracer Experiments

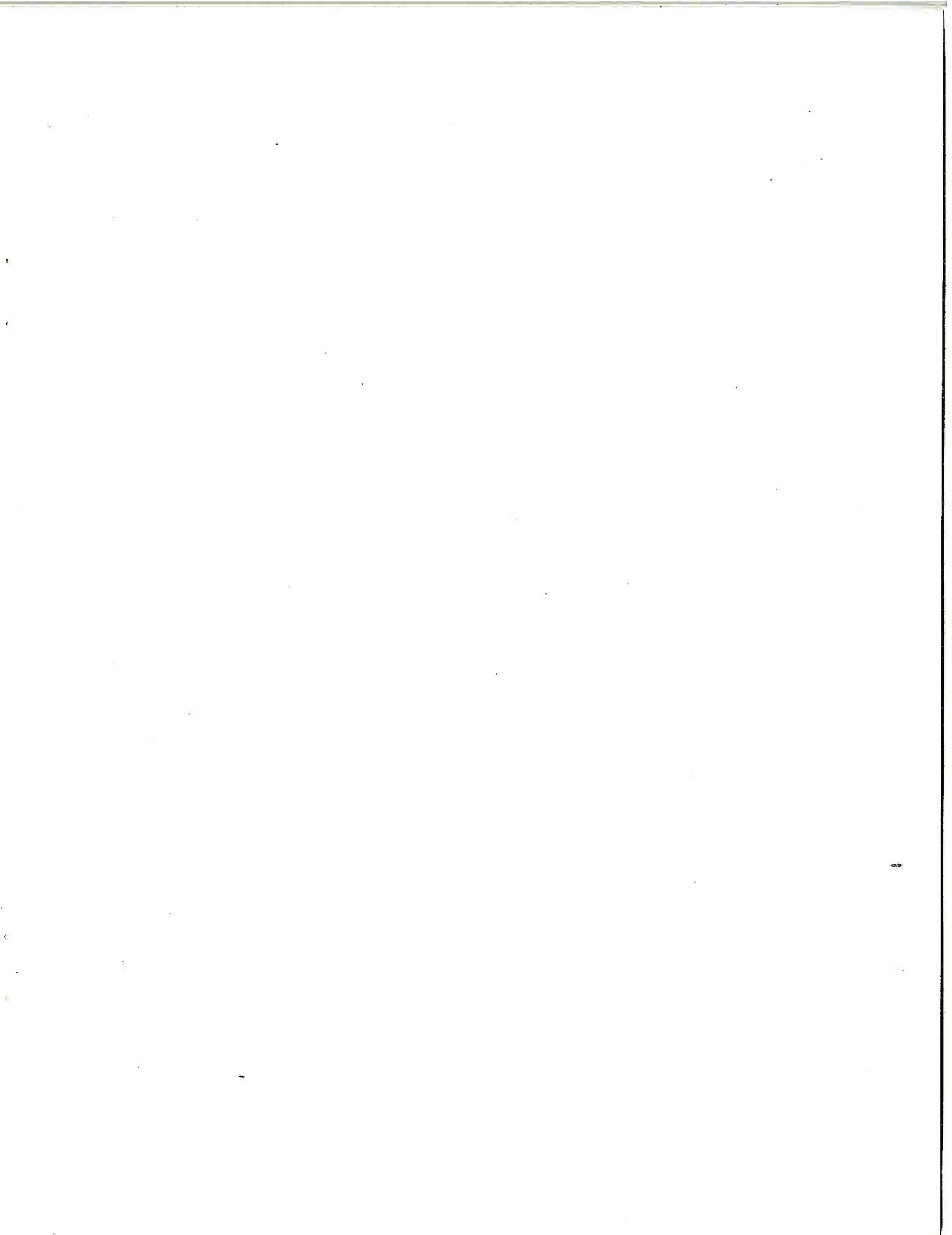
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Introduction

There was general agreement at the November 15, 16 1983 CAPTEX review meeting that a meteorological document be made for each of the CAPTEX 83' experiments. Since the standard National Weather Service (NWS) weather data is routinely recorded at Brookhaven on a PDP-11/70 computer system, BNL participants agreed to supply the CAPTEX community with a set of documents describing some of the more important weather parameters that occurred prior to, during and after the tracer releases. The reports that are available and described in this summary are intended to provide the type of information that might be needed in future research.

Six volumes of data have been completed on the experiments. Each volume contains about 200 pages of data and each represents a particular CAPTEX experiment except for the last which includes CAPTEX 6 and 7.

This summary and volume index was prepared to provide the reader with information concerning the full data set and its availability so that if desired the required data could be requested.

Summary

Each volume contains the following information:

1. A memorandum describing the tracer release times and the aircraft involved. The release times are given to differentiate them from the overall volume times.
2. A word description of the general features of:
 - a. the surface, 850, 700, and 500 mb maps,
 - b. the surface and upper wind flows,
 - c. the clouds observed,
 - d. current weather,
3. Surface weather maps including:
 - a. the 0700 EST (NWS) map covering Canada and the United States,
 - b. regional surface maps analyzed for each 3 or 6-hour period.
4. The 0700 EST standard (NWS) 500 mb level map, the 24-hour maximum and minimum temperatures and the total 24-hour precipitation maps.
5. Analysis of the 850, 700 and 500 mb levels.
6. Vertical wind profiles for 10 stations.
7. Profiles of temperature and dew point.

This summary includes parts 2 (a,b,c,d) and 3 (a) of each volume as listed. If a reader requires more than this, a particular volume or the complete set can be obtained from BNL.

Examples of 3 (b), 5, 6 and 7, taken from volume 1, follow at the end of this summary. Each of the volumes contain about twenty-five 3 or 6-hourly surface maps, about eight sets of 850, 700 and 500 millibar level maps, forty individual vertical wind profiles and forty temperature-dew point profiles. The examples are included to show the area covered by the maps and the type of analysis that has been done. Standard NWS meteorological nomenclature is used on the maps and profiles.

The six volumes were made prior to the completion of the data base which has been established at BNL for all measurements made during CAPTEX 83'. That vast amount of data is now available for use by CAPTEX participants and those interested in obtaining information on it should contact C. Benkovitz at BNL.

Index

The following gives the volume numbers and dates for each:

1. CAPTEX 1
September 17, 18, 19 and 20.
2. CAPTEX 2
September 24, 25, 26 and 27.
3. CAPTEX 3
October 1, 2, 3 and 4.
4. CAPTEX 4
October 13, 14, 15 and 16.
5. CAPTEX 5
October 24, 25, 26 and 27.
6. CAPTEX 6 and 7
October 28, 29 and 30.

The following meteorological stations were selected for use in plotting and analyzing the weather conditions at the 850, 700 and 500 millibar levels and for determining the vertical wind and temperature-dew point profiles:

1. Dayton, Ohio
2. Flint, Michigan
3. Huntington, West Virginia
4. Greensboro, North Carolina
5. Pittsburgh, Pennsylvania
6. Buffalo, New York
7. Albany, New York
8. Washington-Dulles, Virginia
9. Wallops Island, Virginia
10. Atlantic City, New Jersey

Another report titled "Airborne Wind Measurements for CAPTEX 1983" is available from BNL which documents the aircraft wind measurements taken during CAPTEX flights. It involves the calibration, measurement and analysis of the winds from the Brookhaven "Islander" aircraft and also includes some of the winds measured by the Canadian "Twin Otter" aircraft.

Weather Documentation for CAPTEX 1
September 17, 18, 19, 20, 1983

The National Weather Service (NWS) 0700 EST surface weather map for September 17, 1983 shows a weak low pressure center just east of the Great Lakes area with a weak cold front extending from the low southward through New York, Pennsylvania and southern Ohio. A high pressure cell, located over Illinois, caused variable surface winds in the CAPTEX region. The upper wind flow on the 17th, as indicated on the 850, 700 and 500 mb level maps and the vertical wind profiles, was west-northwest. Low clouds and a few widely scattered rain showers were observed along the front. The front and high pressure cell moved eastward during the 17th. The front moved off the east coast early on the 18th and the high slipped slowly southward along the east coast. The NWS 0700 EST surface weather map for the 18th shows the high pressure cell located over South Carolina with another deep low located over Manitoba, Canada. An occluded front from the low pressure center extended southeastward across Lake Superior and then southward to Wisconsin. The occluded front became a cold front in central Wisconsin and continued southward to Iowa and Kansas. A warm front also extended from Wisconsin across Lake Michigan and southward through Ohio and into Virginia.

The 1900 EST 850 mb level map shows a pattern similar to the surface, that is, a high pressure system was located off the Carolinas and a deep low was centered over Manitoba.

The surface wind flow during the 18th in the experimental area was south to southeast ahead of the warm front. As the warm front progressed northeastward the winds became more south to southwest after the front passed through the northeastern states. The upper winds were more southwest to west during the 18th and 19th.

High and middle clouds were observed over most of the experimental area during the 18th. Visibilities were generally 10 to 15 miles except in isolated areas where fog was recorded.

By the morning of the 19th, the warm front had passed northeastward through Pennsylvania and New York and was located in northern New England by 0700 EST. The cold front had passed through most of the Great Lakes region and was aligned parallel to the St. Lawrence River and over Lakes Ontario and Erie. The high pressure system off the east coast had moved slightly northward and was located off North Carolina while the low pressure center had moved northeast and was centered over the Hudson Bay.

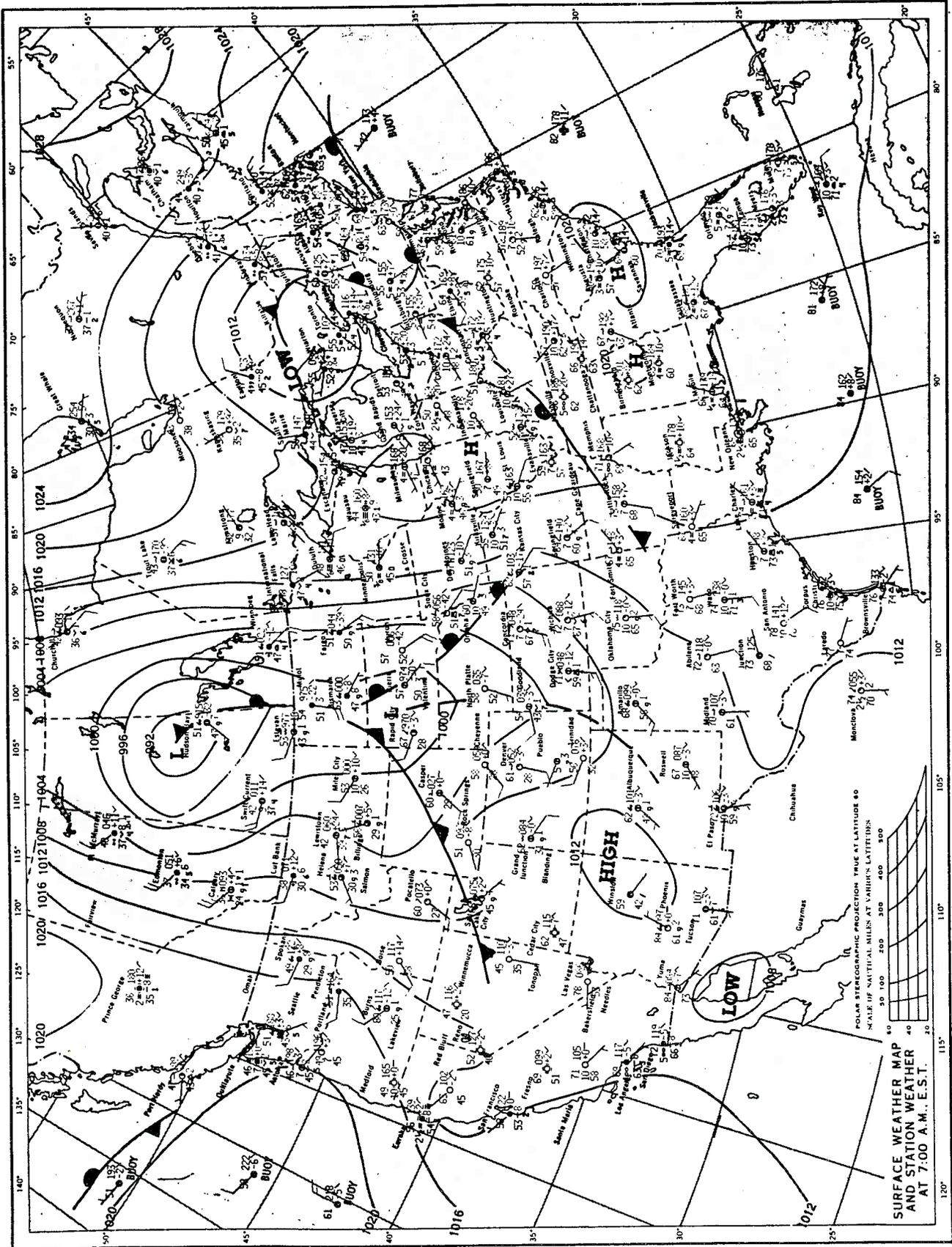
The surface wind flow on the 19th was typical of that around the back side of a high pressure system in the experimental area. The surface winds in the Ohio region were south to southwest turning more westerly in Pennsylvania and New York. The upper winds were veering with height and were more westerly over Ohio and west to west-northwest in Pennsylvania and New York.

High and middle clouds continued to be observed on the 19th in northern Ohio, northern Pennsylvania and most of northern New York State. Some low clouds were recorded along the St. Lawrence River near the cold front. The visibility remained 10 to 15 miles except in some isolated areas.

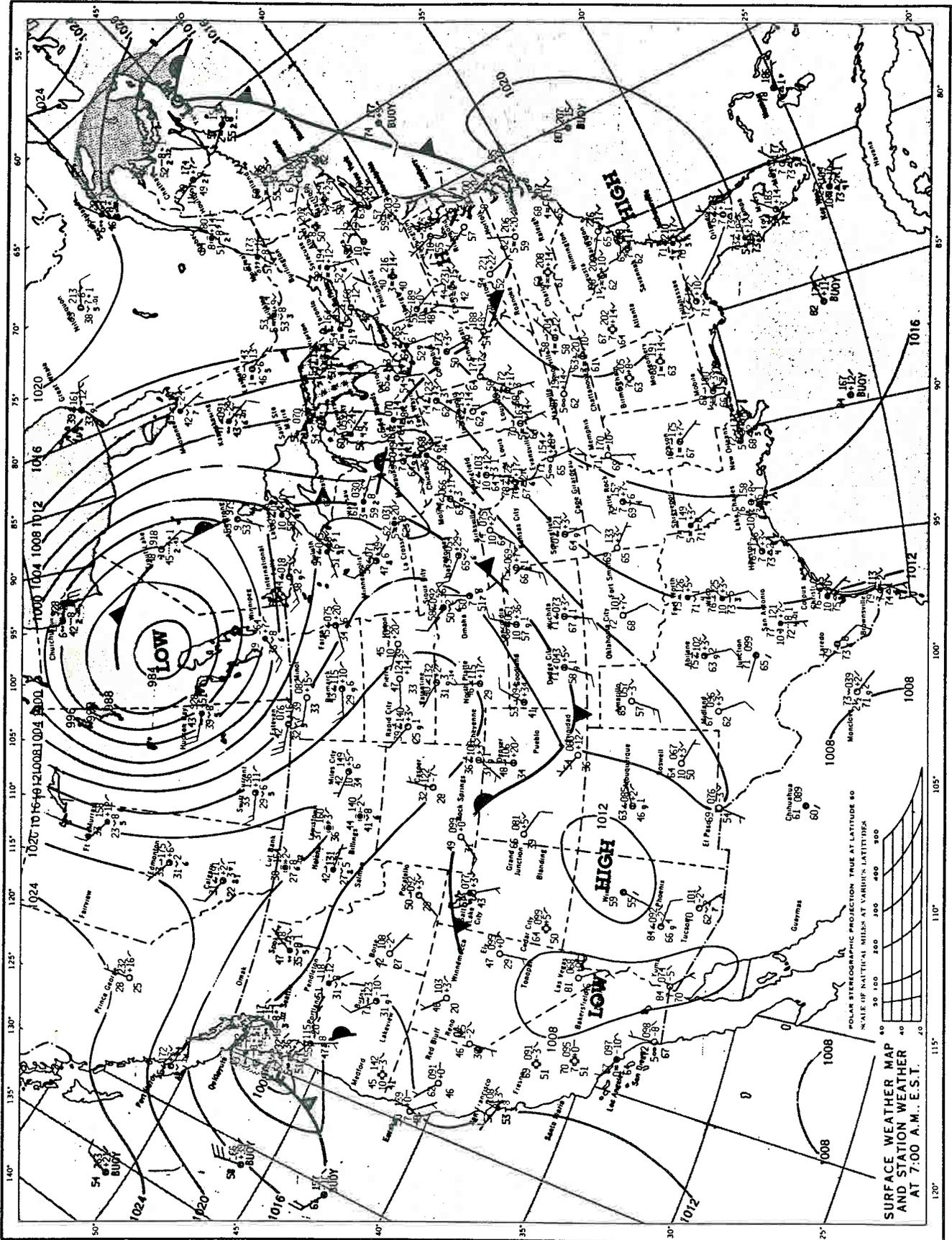
The cold front along the St. Lawrence River weakened considerably late on the 19th and became quasi-stationary by the 20th. The surface wind flow continued to be south to southwest and the upper winds southwest to west around the back side of the high pressure system located off the Virginia coast.

Skies were mostly clear of clouds over the experimental area during the morning of the 20th. Some low clouds moved into western Ohio late in the morning and scattered light rain showers began in that area, however, the rest of the sampling area remained clear of clouds.

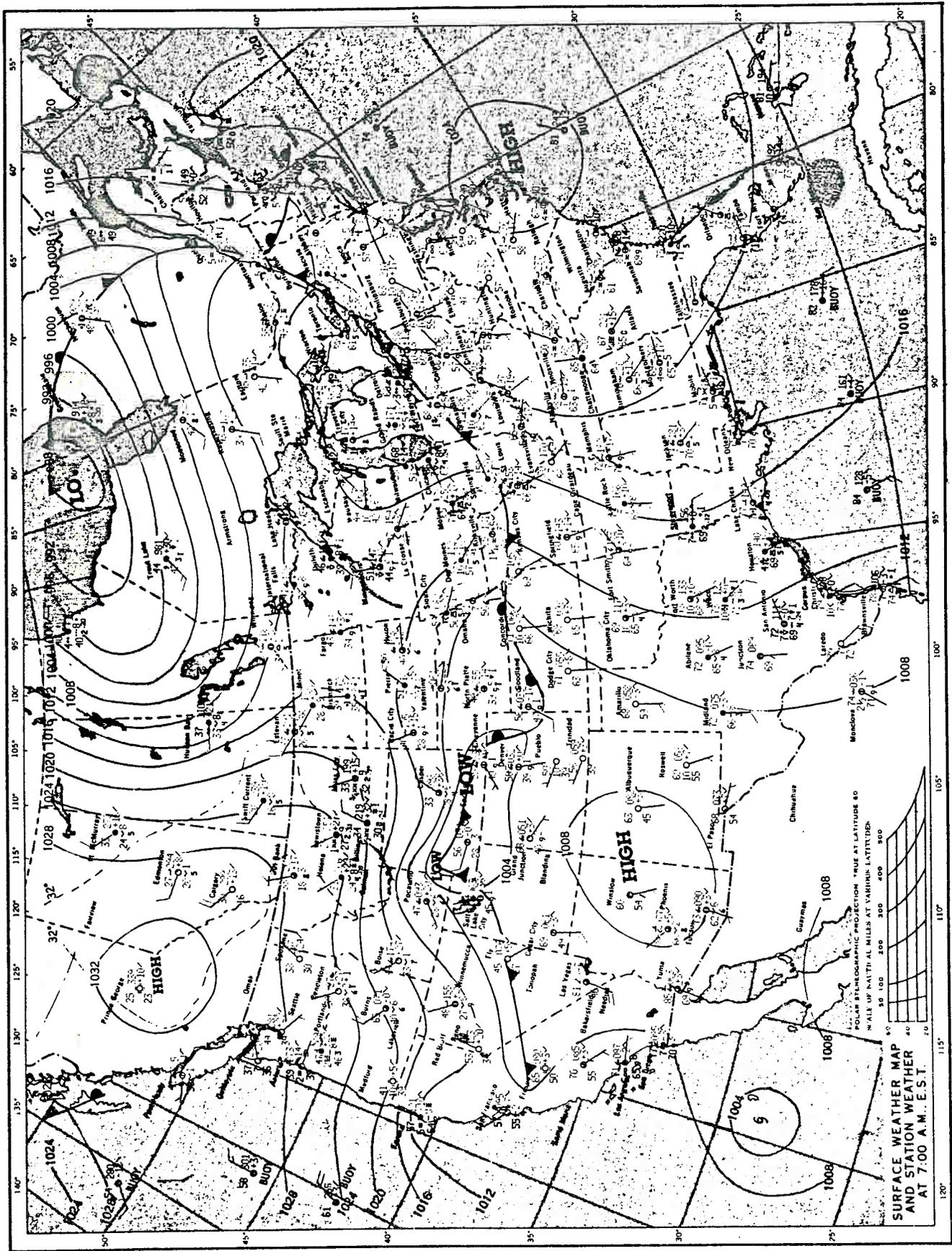
SATURDAY, SEPTEMBER 17, 1983



SUNDAY, SEPTEMBER 18, 1983

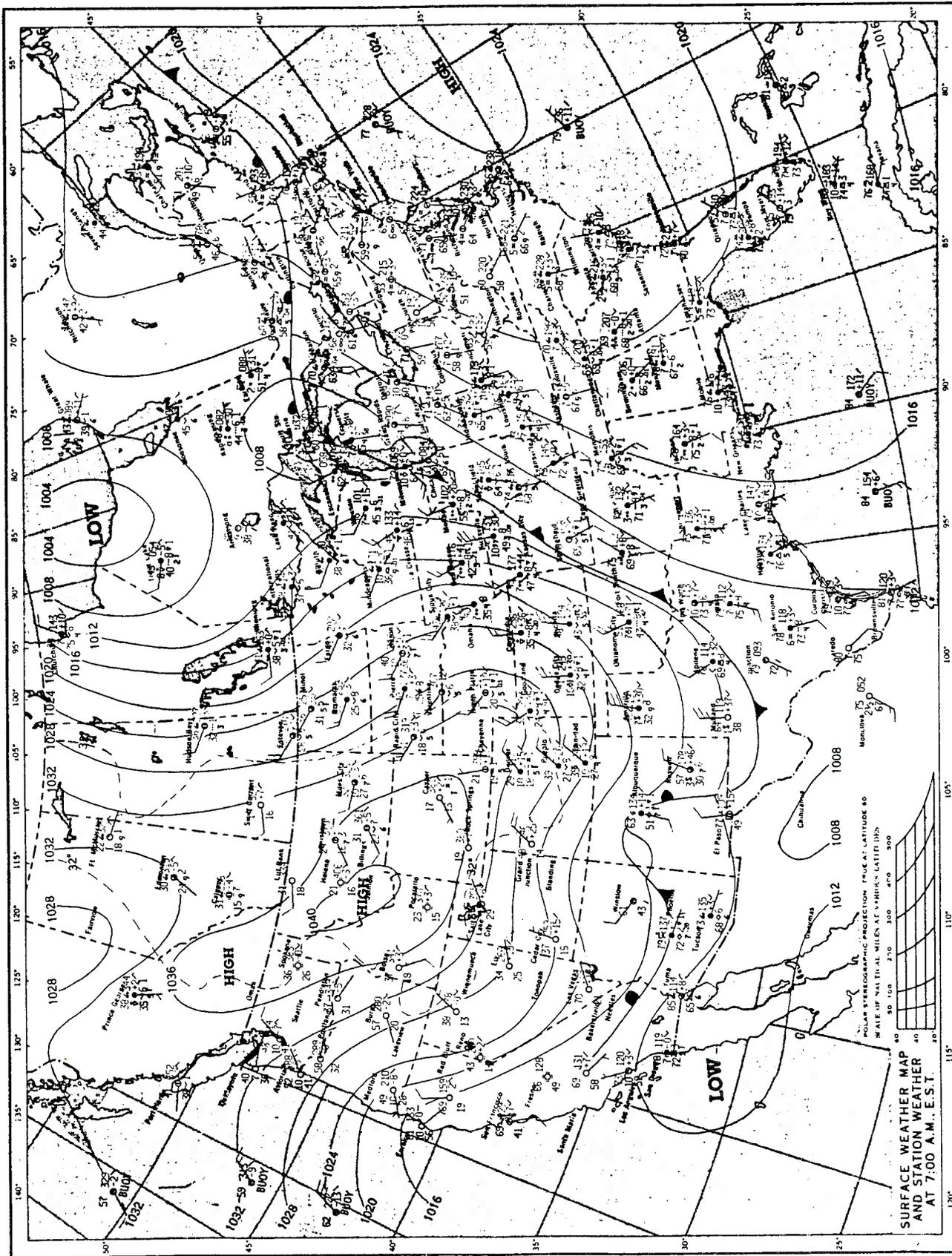


MONDAY, SEPTEMBER 19, 1983



SURFACE WEATHER MAP
AND STATION WEATHER
AT 7:00 A.M. E.S.T.

FOR INFORMATION: PROJECTIONS TRUE AT LATITUDE 40
SCALE OF HALF INCHES AT VARIOUS LATITUDES
30 100 200 300 400 500



Weather Documentation for CAPTEX 2
September 24, 25, 26 and 27, 1983

The prominent feature of the NWS surface weather maps for the entire CAPTEX 2 period is a high pressure system covering the sampling region with its center oscillating from southern Pennsylvania and West Virginia to lower New York, New Jersey and back to West Virginia and Ohio. Regional surface weather maps were made every 6 hours and clearly show the extent of the high pressure system and the meandering of its center over the four day period.

A weak cold front developed northwest of Lakes Ontario and Erie early on September 26th and moved south-eastward into the sampling area during that day. It became very diffuse and more or less dissipated by the evening of the 26th. No other frontal action occurred during CAPTEX 2.

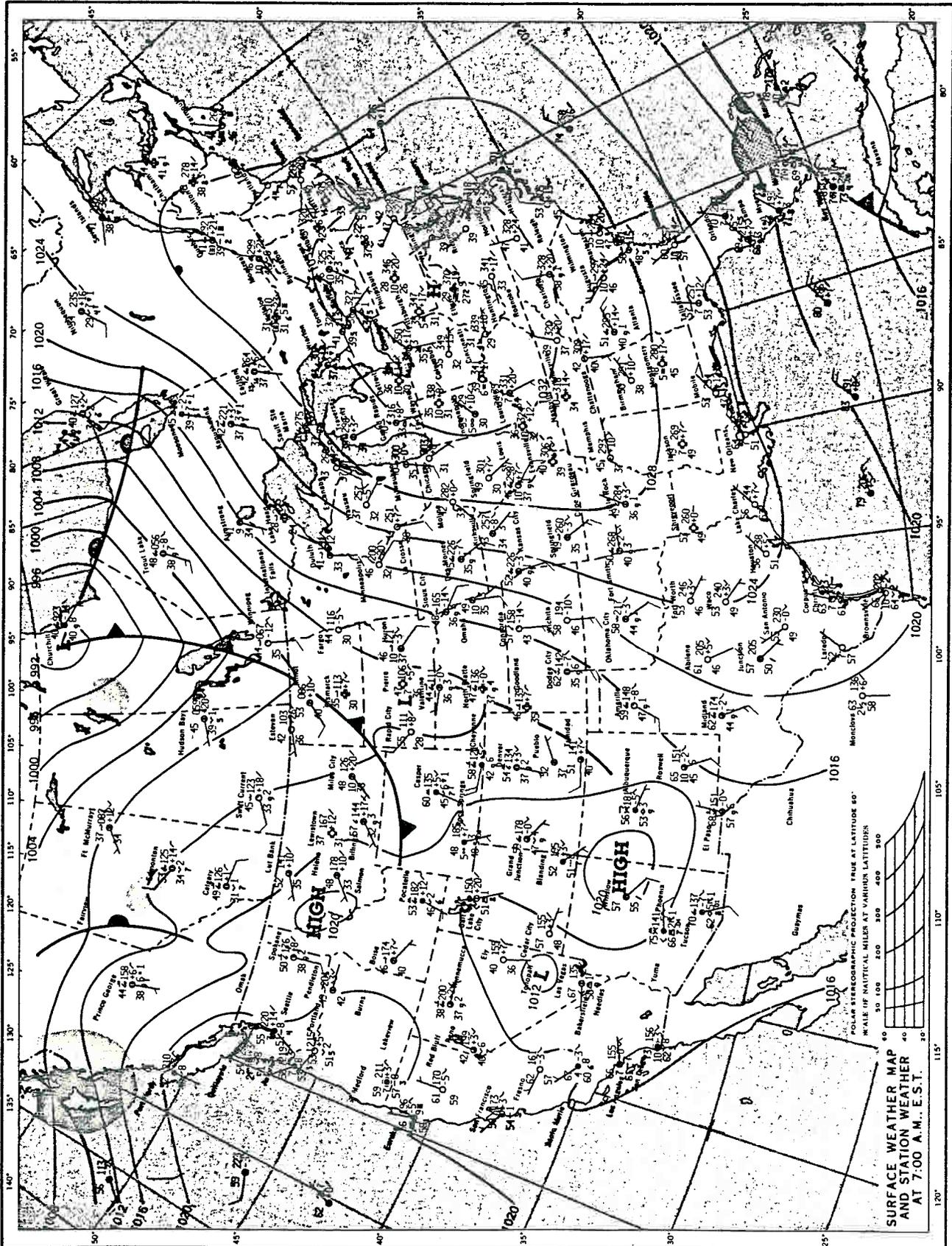
The 850 mb level maps indicate a high pressure cell over Virginia on September 24th and 25th and another cell forming over western Pennsylvania and Ohio on the 26th. The 700 mb level maps do not indicate a closed pressure system until late on the 26th and during the 27th when the surface high over Ohio reached the 700 mb level height. The 500 mb. level shows no closed system over the sampling area during CAPTEX 2.

The surface wind flow near the center of the high pressure was light and variable during all of CAPTEX 2. The general flow around the perimeter of the high was counterclockwise and outward as is typical of high pressure systems and since the backside of the high was mostly west of Pennsylvania, the flow in the Ohio region was south to southwest on the 24th and early on the 25th but became more southwest by the 26th due to the approach of the weak cold front and by the high pressure center moving eastward. The surface flow in Pennsylvania and western New York was southwest on the 24th and 25th but became more westerly after the front passed on the 26th. It became west to northwest by the 27th.

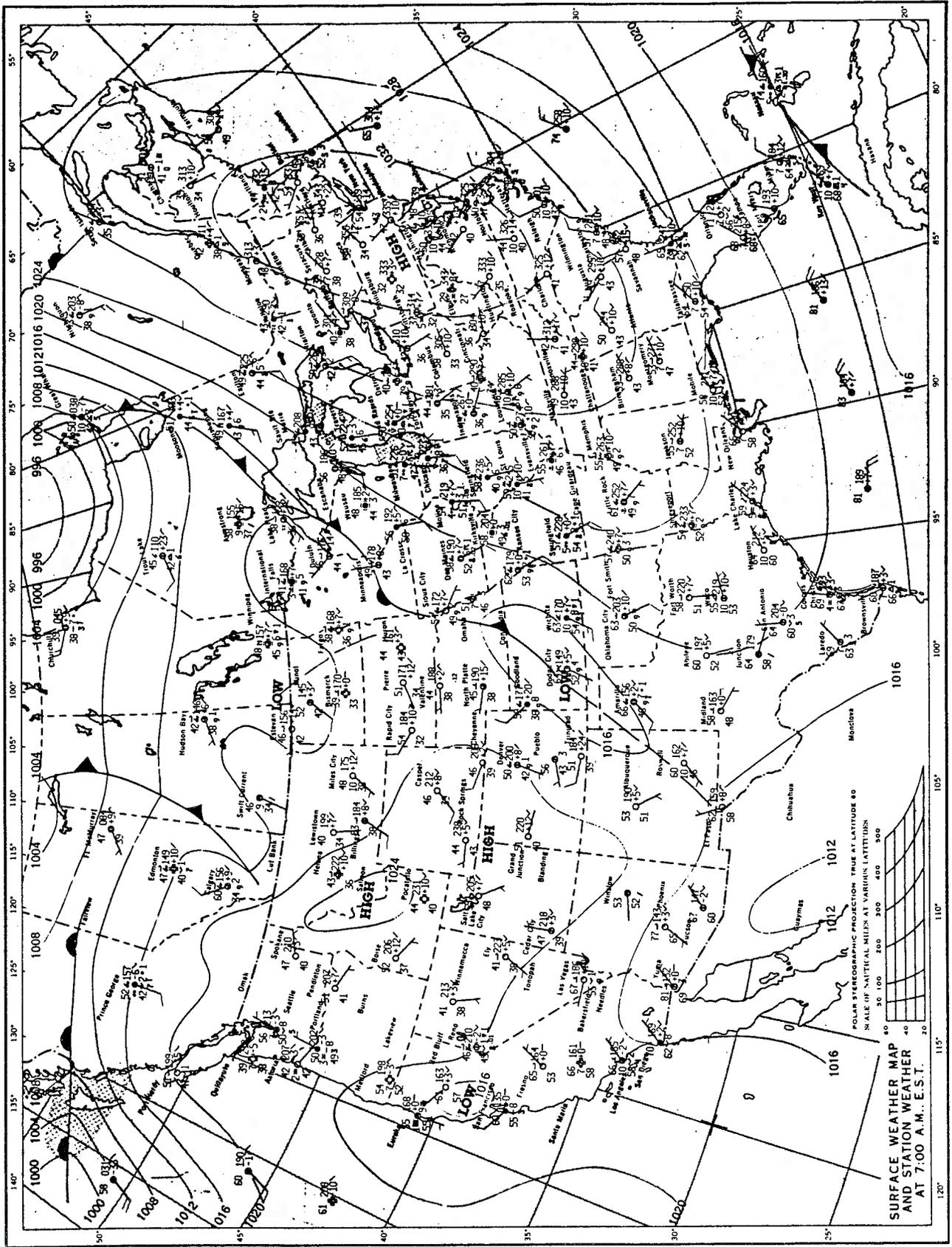
The upper wind flow as indicated on the 850, 700 500 mb level maps and the vertical profiles show similar winds when compared to the surface flow except that the upper winds are a little stronger in speed. There is a tendency for the winds to veer with height on the backside of the high and to back on the leading side of the high. The general upper wind flow in the sampling region was southwest in the Ohio area, westerly in Pennsylvania and New York through the 26th but changed to west to northwest in Ohio and north to northeast in Pennsylvania and New York by the 27th.

Skies were clear throughout the entire sampling region on the 24th and early on the 25th. Scattered to broken high clouds began moving across the northern section of the sampling area during the 25th and low clouds with scattered light rain was reported in northwestern Ohio by the evening of the 25th. The low clouds and scattered rain moved eastward into northern Pennsylvania and southwestern New York on the 26th but dissipated late that day. Skies were clear of clouds over most of the sampling area on the 27th. The visibility was 15 miles or more throughout the four day period except near the front on the 26th and where ground fog occurred in low lying areas.

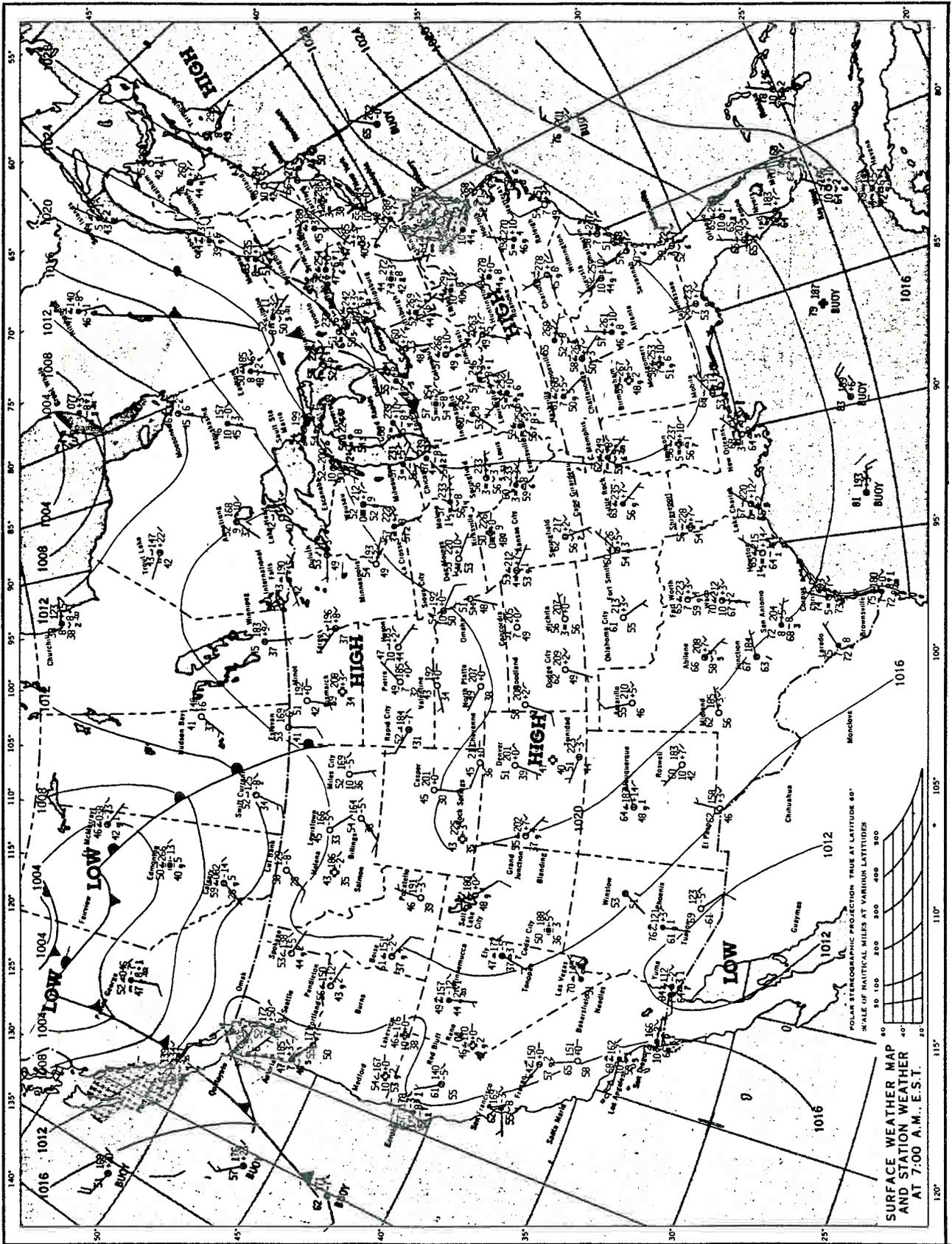
SATURDAY, SEPTEMBER 24, 1983



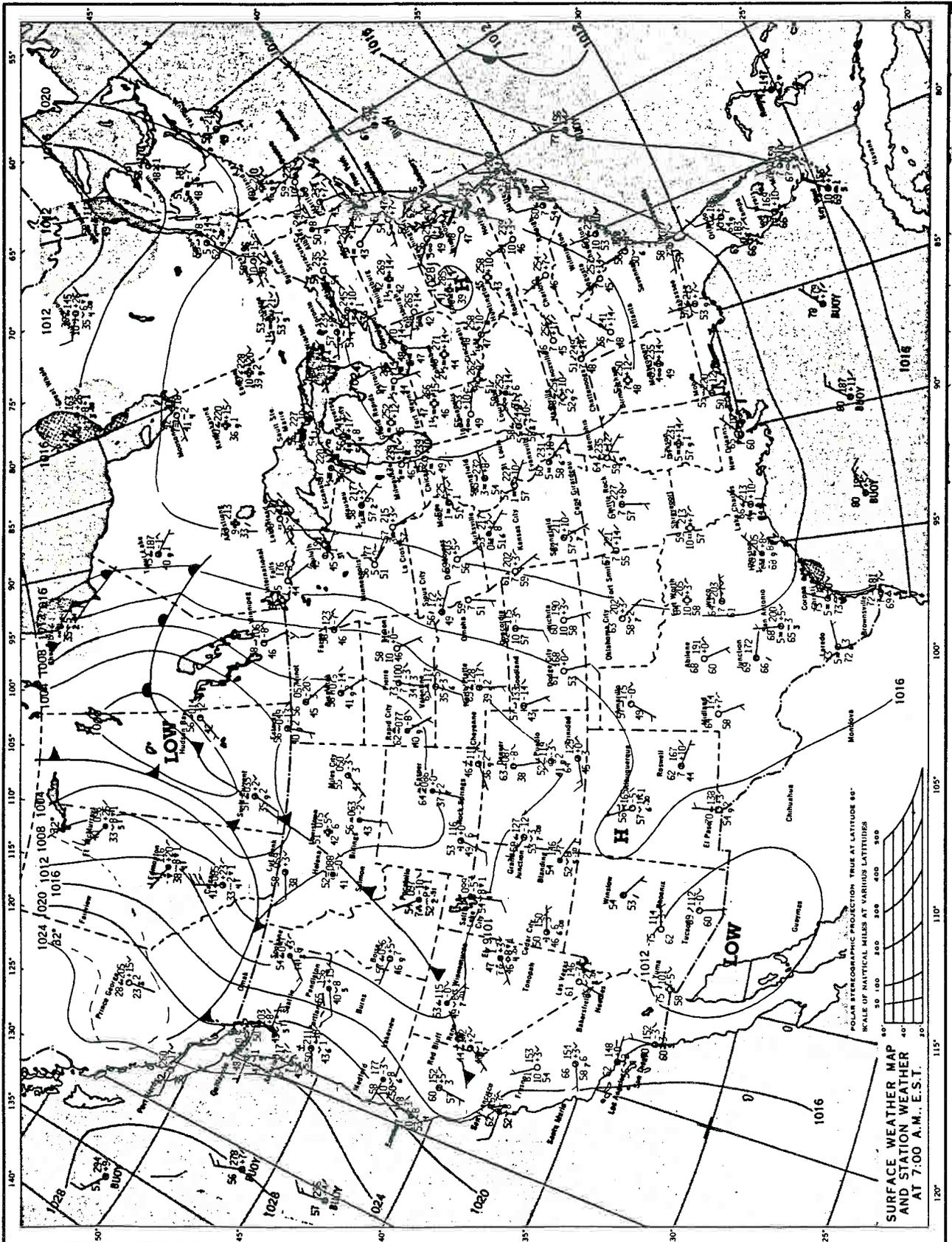
SUNDAY, SEPTEMBER 25, 1983



MONDAY, SEPTEMBER 26, 1983



TUESDAY, SEPTEMBER 27, 1983



Weather Documentation for CAPTEX 3
October 1, 2, 3 and 4, 1983

The NWS standard surface weather maps for October 1, 2, 3 and 4, 1983 show a large dominant high pressure system covering the eastern half of the United States during the experimental period of CAPTEX 3. Its center, initially located in Tennessee and the Carolinas area, moved slowly southeastward during the period.

A weak cold front, located along a line from Minnesota to western Oklahoma, moved slowly eastward during the period but remained west of the sampling area.

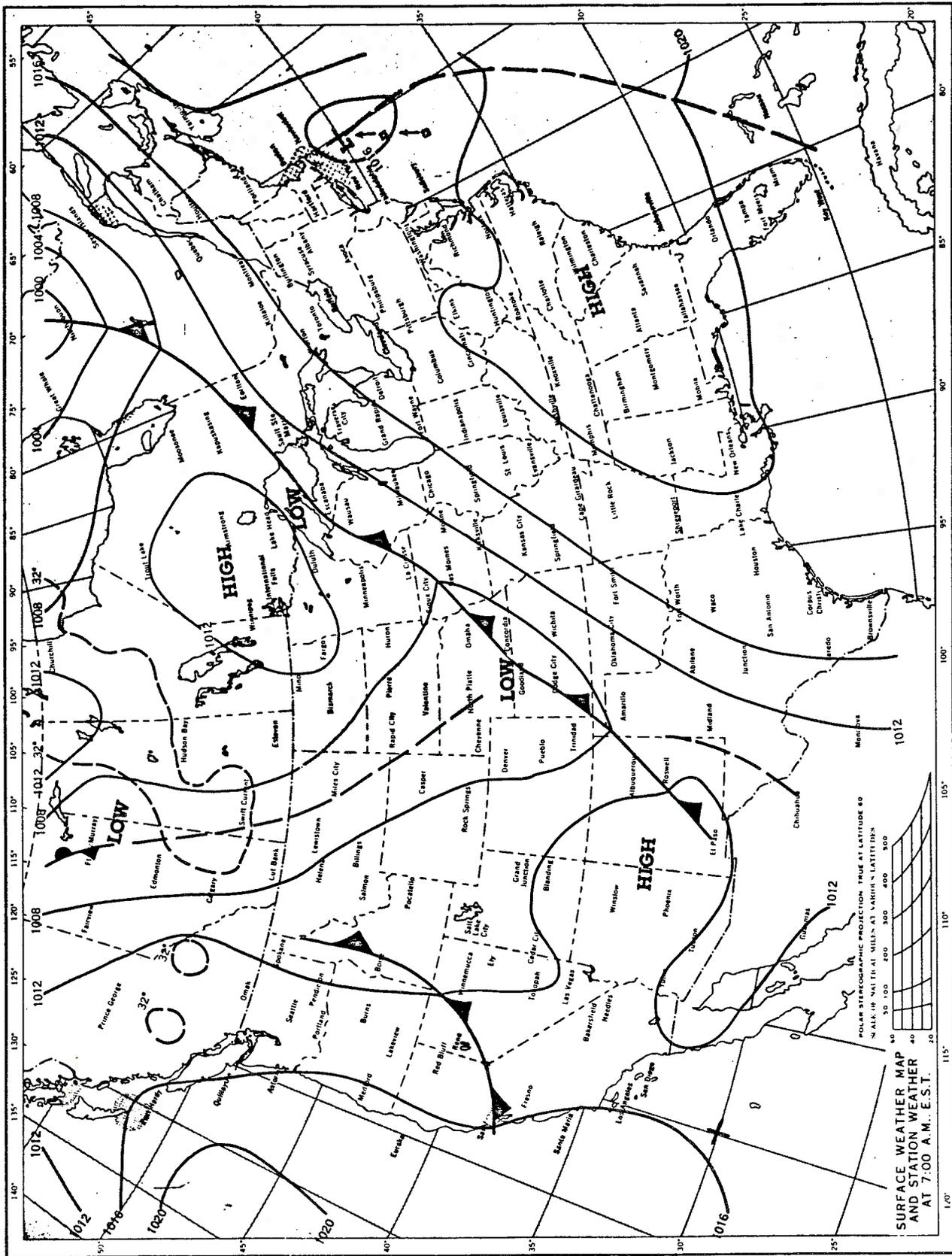
The 850, 700 and 500 mb level maps show a closed low over W. Virginia and Pennsylvania at 0700 EST on Oct. 2nd. By 1900 EST of Oct. 2nd, the closed low had opened and the pressure lines were less curved. The upper level pressure pattern continued to have less curvature on the 3rd and 4th.

A light and variable surface flow occurred throughout the sampling area on Oct. 1st and early on Oct. 2nd. It became more definitive during the afternoon of the 2nd and the speed increased significantly on Oct. 3rd and 4th. The surface flow was southwest in the Ohio region during most of the experimental period and southwest to west in western New York State during the same period.

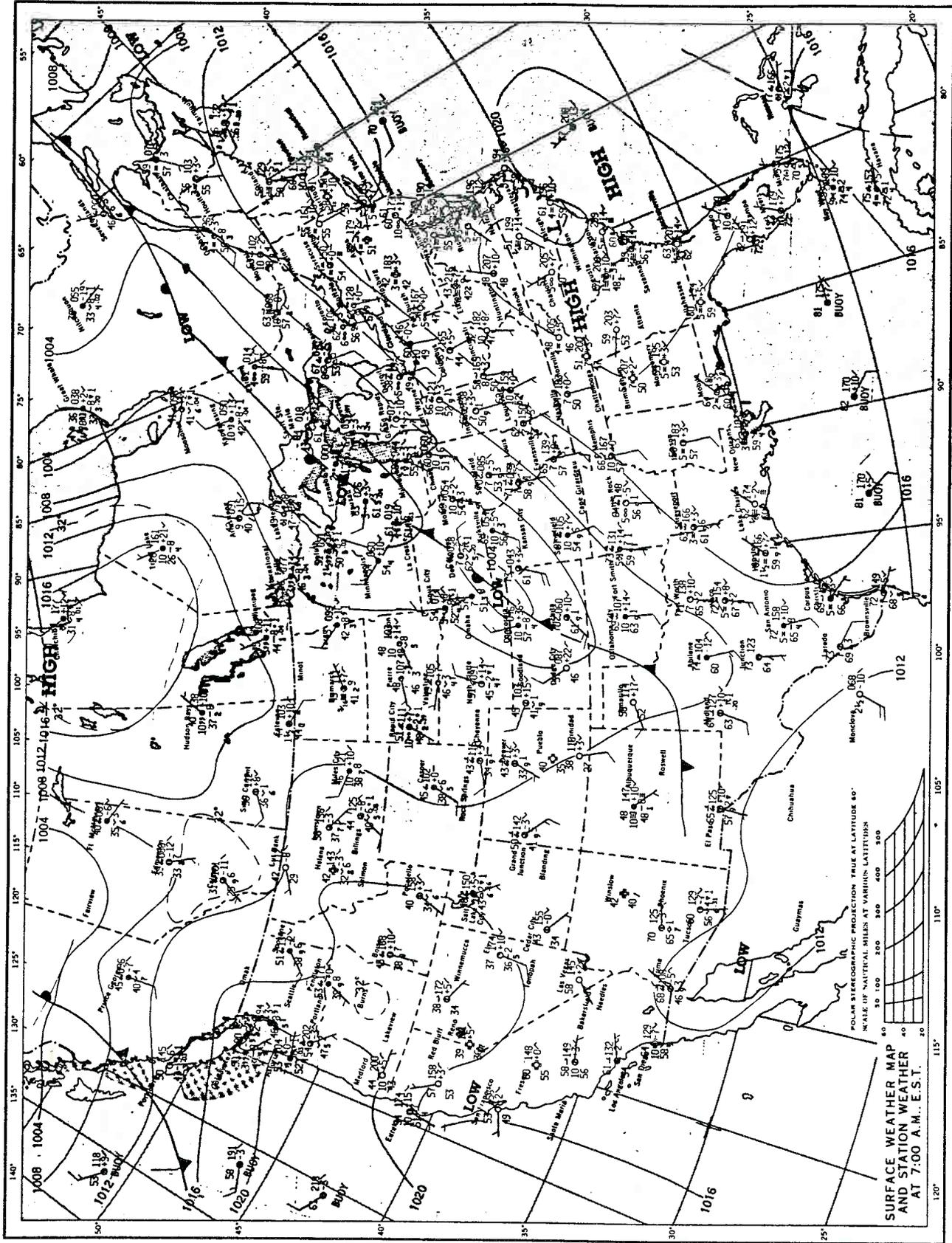
A considerable amount of vertical wind shear existed during the early part of the experiment as shown by the difference in wind direction on the surface, from that shown by the 850, 700 and 500 mb levels and by the vertical wind profiles. The vertical wind profiles for most of the western sites taken early on Oct. 2nd show almost a 90 degree vertical wind shear in the first 2000 ft. It became less later on the 2nd and 3rd, however, it was evident during the entire sampling period. The upper wind directions were generally more southwest to west in Ohio and westerly in Pennsylvania and New York. The upper level wind speeds also increased from Oct. 2nd to the 3rd and 4th.

Scattered to broken middle and low clouds in the western and southern sections of the experimental region on Oct. 2nd began to dissipate during that day. Scattered cirrus clouds began to spread over most of Ohio, Pennsylvania and New York on the 3rd and some middle to low clouds were observed as the weak cold front approached the region from the west late on the 3rd and 4th. There were large areas of ground fog reported in low lying areas, along river beds and coastal zones during the entire period. The only precipitation reported was late on Oct. 4th in New York State as the front approached.

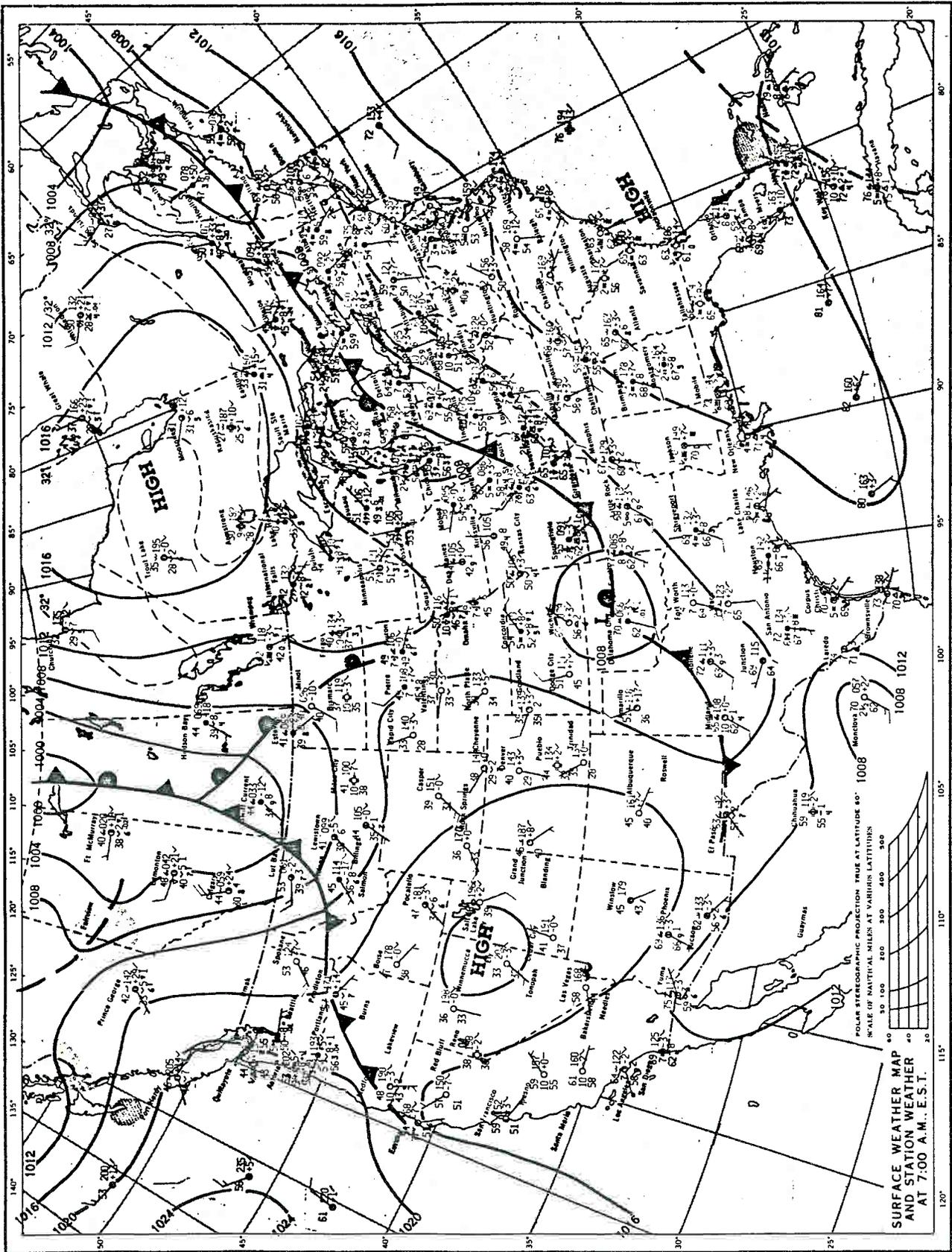
SUNDAY, OCTOBER 2, 1983



MONDAY, OCTOBER 3, 1983



TUESDAY, OCTOBER 4, 1983



Weather Documentation for CAPTEX 4

October 13, 14, 15 and 16, 1983

A weak cold front existed along a north-south line through the Great Lakes area and southward into central Virginia early on October 13th. It progressed eastward during the 13th and passed off the east of the U.S. early on the 14th. A deep low pressure cell developed north of the Great Lakes over Canada during the 13th and it moved northeastward quite rapidly and was located well to the northeast of the CAPTEX sampling area by October 14th. A high pressure center built up behind the frontal system and its center was located in eastern Tennessee early on October 14th. The combination and location of the low over Canada and the high over the southeastern U.S. provided suitable conditions for a CAPTEX tracer release during the afternoon of the 14th.

The surface and upper level pressure gradients tightened considerably during the 14th causing the wind flow to increase substantially during this time period. The general flow directions changed during the experimental period as well and are indicated on the 850, 700' and 500 mb level maps. They show that the overall wind flow direction in the sampling area from the 14th through the 16th was from southeast to northeast early then from the west to east and finally from the northwest to the southeast by the 16th.

The vertical wind profiles taken during the experimental period show less vertical wind shear than in previous experiments. The steepness of the pressure gradient probably kept the vertical wind shear to a minimum. The profiles indicate the increase of the wind speeds during the 14th and that the winds decreased by the 16th.

The temperature-dew point profiles show the moisture decrease after the cold front passed through the sampling area but that the general temperatures remained relatively constant.

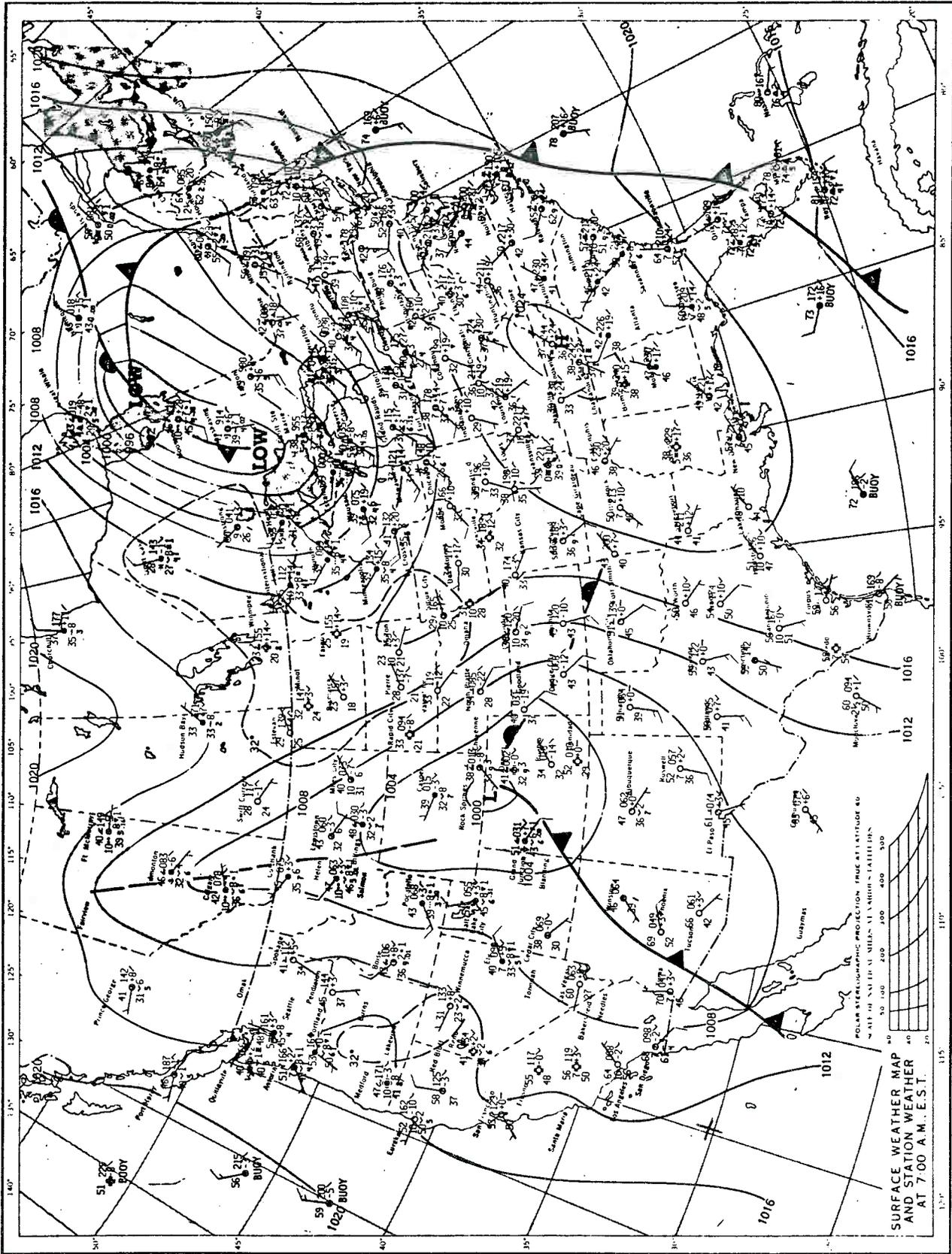
Low clouds and scattered rain and showers were associated with the cold front as it passed through the sampling area on the 13th. Scattered to broken low clouds were reported in New York State during the tracer release time and during the 14th whereas skies were mostly clear in Pennsylvania. The low clouds in New York State dissipated on the 15th and skies in the sampling area were clear on the 15th and 16th.

Some precipitation amounts are shown on the NWS Precipitation Areas and Amounts maps for October 13th and 14th. They show no precipitation for the 15th and 16th.

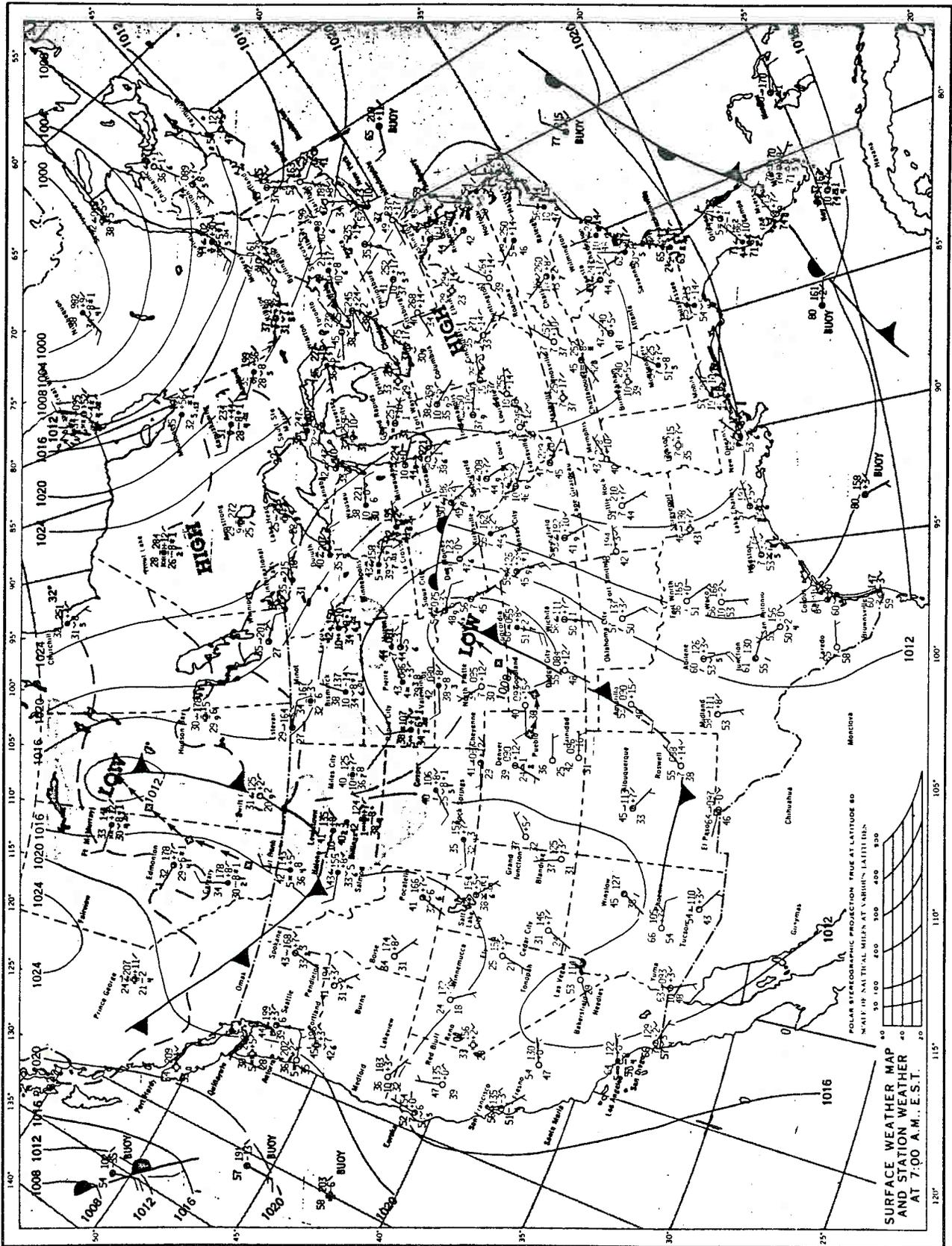
THURSDAY, OCTOBER 13, 1983



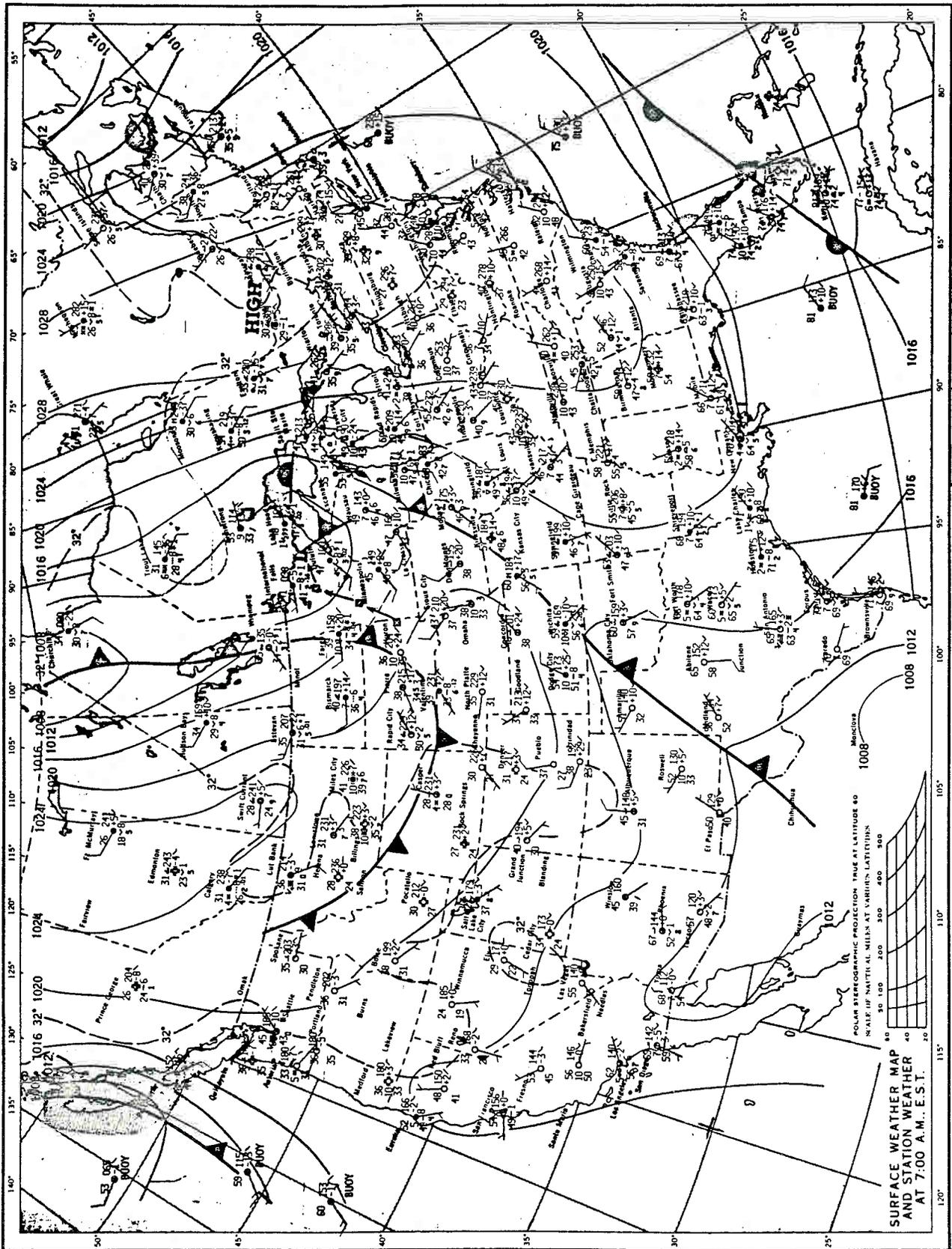
FRIDAY, OCTOBER 14, 1983



SATURDAY, OCTOBER 15, 1983



SUNDAY, OCTOBER 16, 1983



Weather Documentation for CAPTEX 5

October 24, 25, 26 and 27, 1983

A high pressure cell, located over Montana early on October 24th, moved southeastward during October 24, 25, 26 and 27 and its center traveled to and was positioned over Arkansas by the 27th. The leading edge of the high pressure cell moved through the Great Lakes area during this time period and the wind flow accompanying it produced conditions suitable for a tracer release from Sudbury, Ontario by early on October 26th.

A cold front developed just ahead of the leading edge of the high pressure system and it passed from the western section of the sampling area to and through the eastern section by the end of the 26th. Some low clouds and rain showers accompanied this front causing some minor difficulties with planning and executing the sampling aircraft flights.

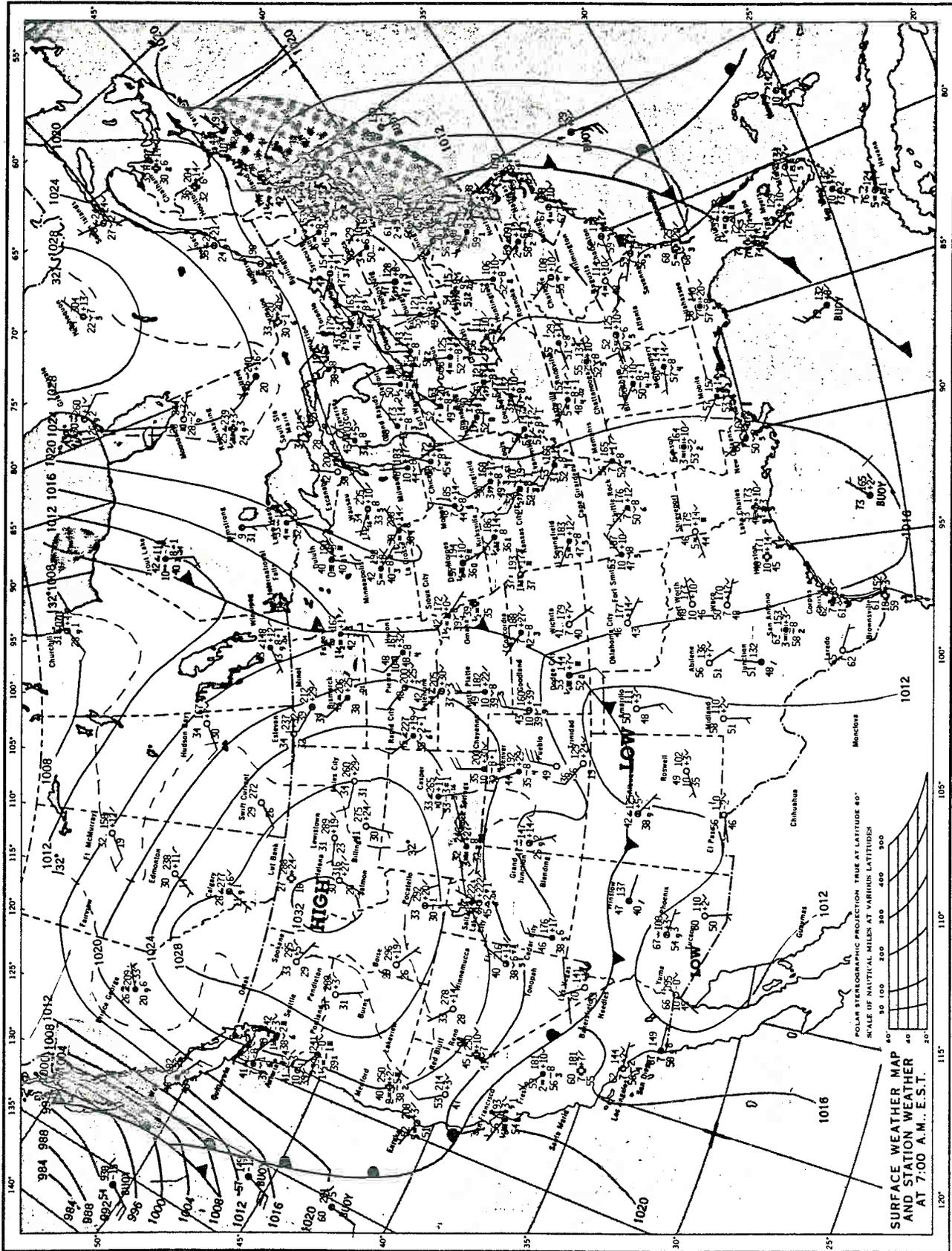
The 850, 700 and 500 mb level charts show a closed low over the Kentucky, W. Virginia area on October 24th. The center moved northeastward during the 25th and away from the sampling area by the 26th. The upper level wind flow was northeasterly during the 24th and variable on the 25th but by the 26th the flow had become northwest and had increased in speed. A solid northwesterly flow persisted through the 26th and 27th.

The vertical wind profiles also indicate northeasterly flows until the cold front passed through the area by late on the 25th when the wind shifted to the northwest. Although there was some low level wind shear, the major wind gradient was fairly constant with height both in direction and speed after October 25th.

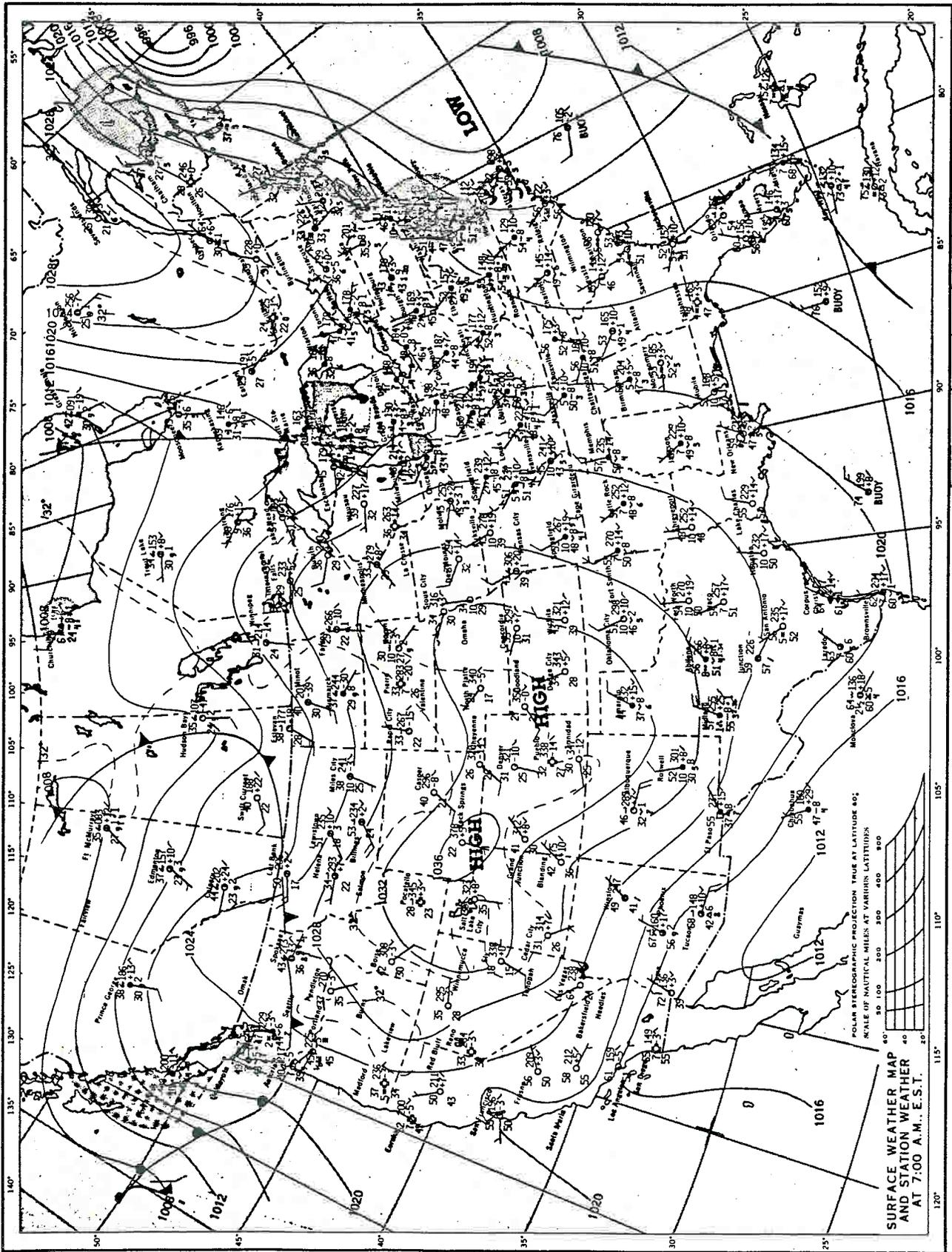
The temperature-dew point soundings show that the atmosphere over the entire sampling area remained relatively moist during the CAPTEX 5 experimental period. The overall temperature decreased somewhat during the period but the temperature-dew point spread did not change substantially.

Low clouds, fog, drizzle and light rain were observed and recorded throughout the entire CAPTEX sampling area on October 24th and 25th as can be seen on the 6-hourly surface maps in this report. The Precipitation Areas and Amounts charts for the CAPTEX 5 sampling period show measurable amounts of precipitation during the entire time.

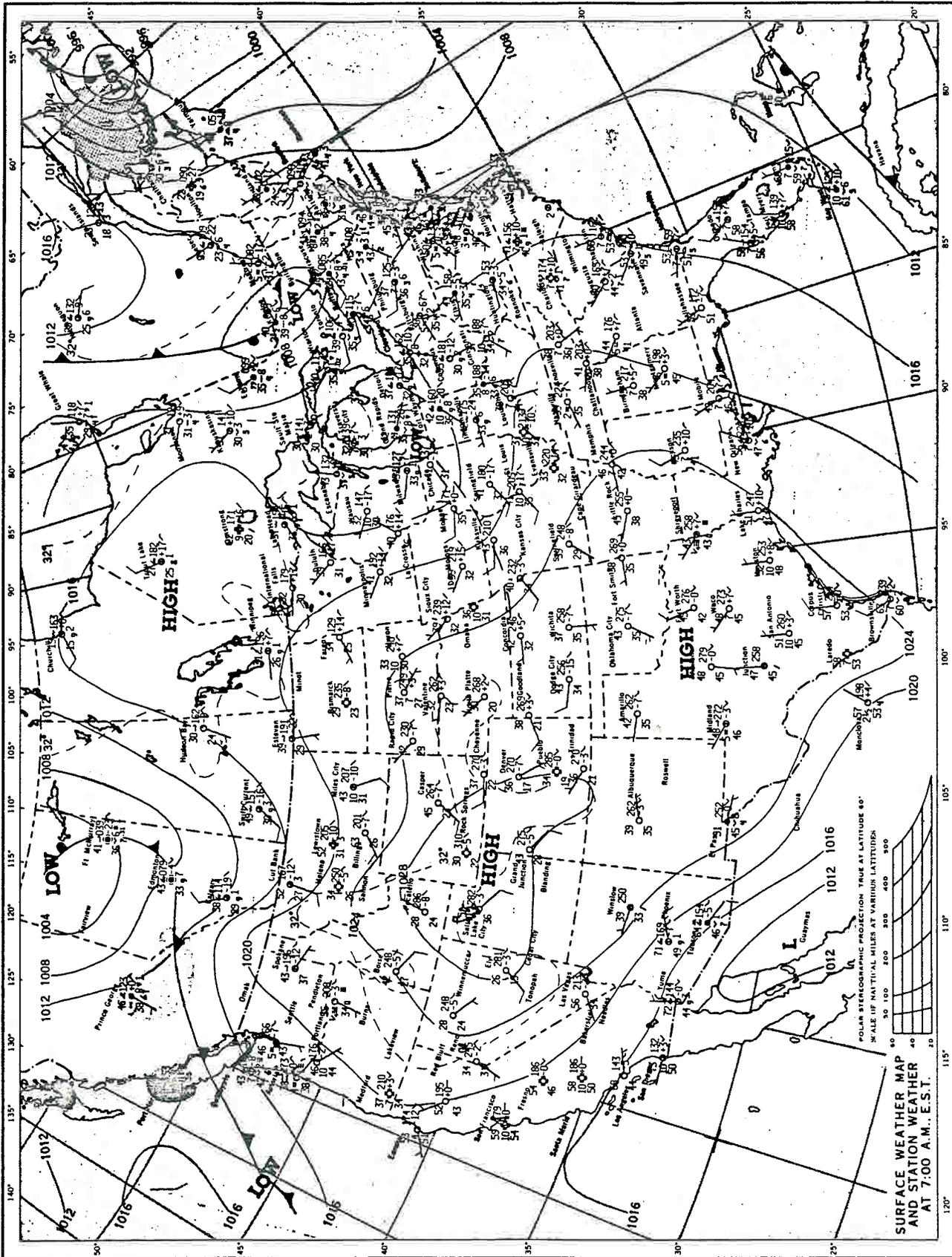
MONDAY, OCTOBER 24, 1983



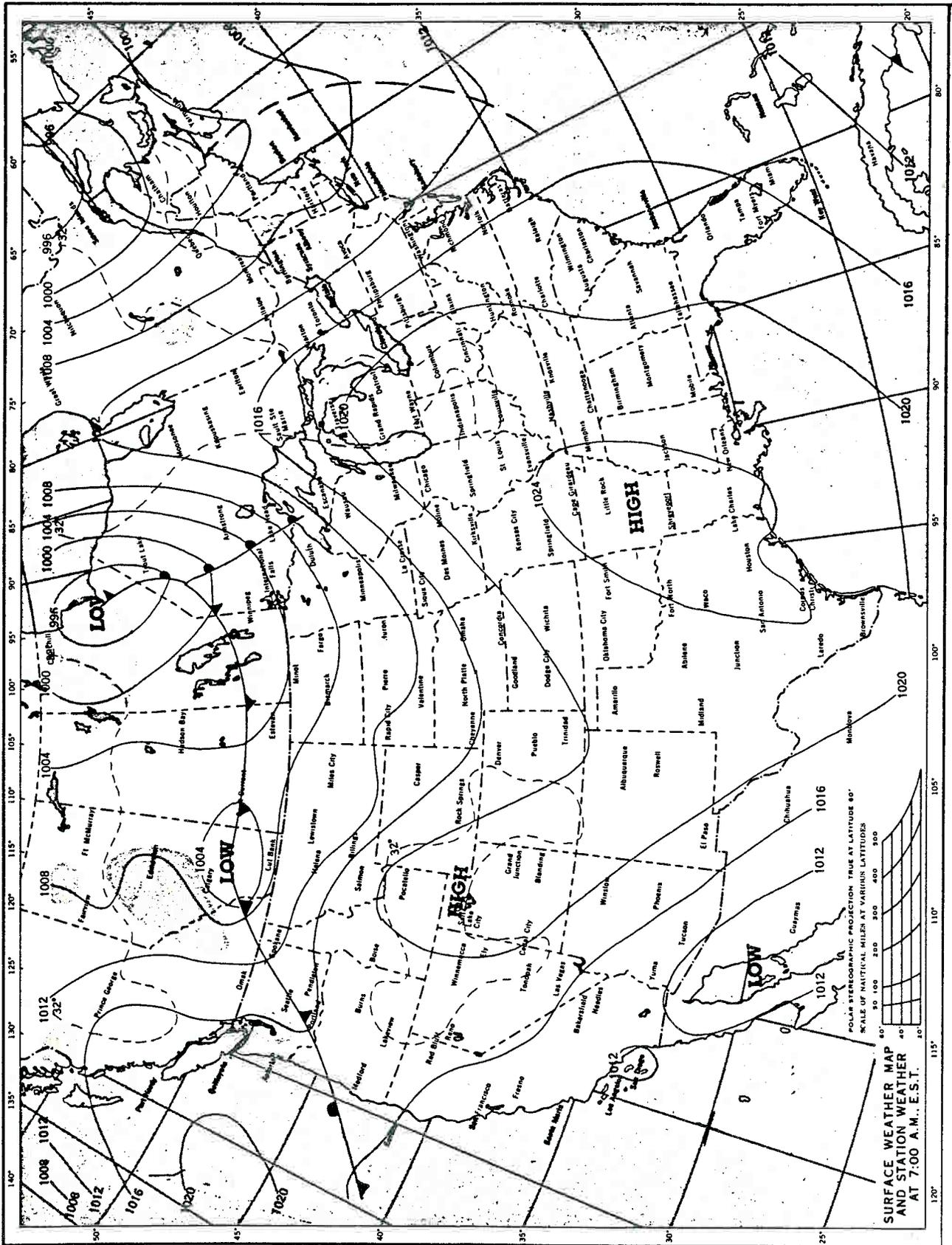
TUESDAY, OCTOBER 25, 1983



WEDNESDAY, OCTOBER 26, 1983



THURSDAY, OCTOBER 27, 1983



Weather Documentation for CAPTEX 6 and 7

October 28, 29 and 30, 1983

The combination of a large high pressure cell over the southeastern U.S., a low just northeast of the Great Lakes and another high pressure system over the northern plains States produced a tight pressure gradient and a southwest to west wind flow throughout the CAPTEX sampling region on October 28, 1983. Although the winds were strong and the high and low pressure systems were moving rapidly, a tracer release was made during the middle of the day from Dayton, Ohio. All meteorological conditions suggest that the tracer plume must have traveled rapidly through Ohio and central Pennsylvania after its release from Dayton.

A cold front, ahead of the high pressure system in the plains States, moved rapidly southeastward and passed through the CAPTEX sampling area by late on October 28, 1983. The passage of the cold front through Ontario caused the winds to shift to the northwest and provided ideal conditions for a tracer release from Sudbury early on October 29, 1983. The high pressure system moved eastward and was centered over the sampling area by October 30, 1983.

The three NWS surface maps show the position of the pressure systems described above and clearly show the warm sector with strong winds during the tracer release from Dayton on the 28th. They also show how fast and how far the cold front and high pressure center moved from the 28th through the 30th.

The plotted six-hourly surface maps show greater detail of the steepness of the pressure gradient on the 28th and provides better resolution on the movement of the cold front through the CAPTEX sampling region. They also show that the high pressure cell caused the winds to become light and variable by the middle of October 30th.

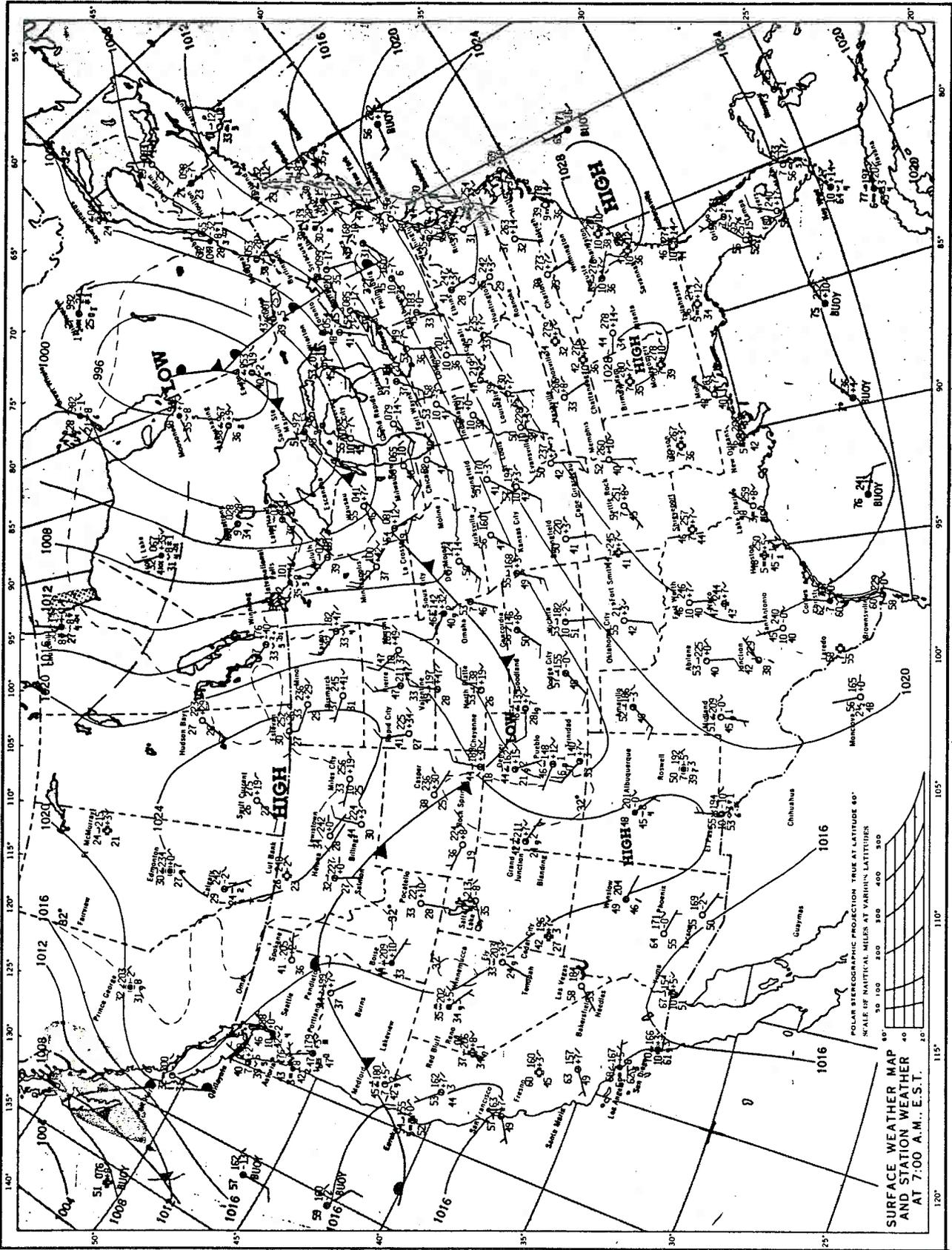
The 850 mb level maps show a west to northwest wind flow in the Ohio, Pennsylvania area during the release on October 28th. Some of the vertical wind profiles also show that there was a tendency for the winds to veer with height during the 28th experiment. They all show that the wind speeds were relatively strong during the release and sampling times on the 28th. The upper level maps and profiles clearly indicate a moderate to strong northwest wind flow throughout the sampling area after the cold front passed early on the 29th.

Most of the vertical wind profiles show very little vertical wind shear during the seventh CAPTEX experiment so the tracer plume distortion due to shear should have been minimal during this experiment.

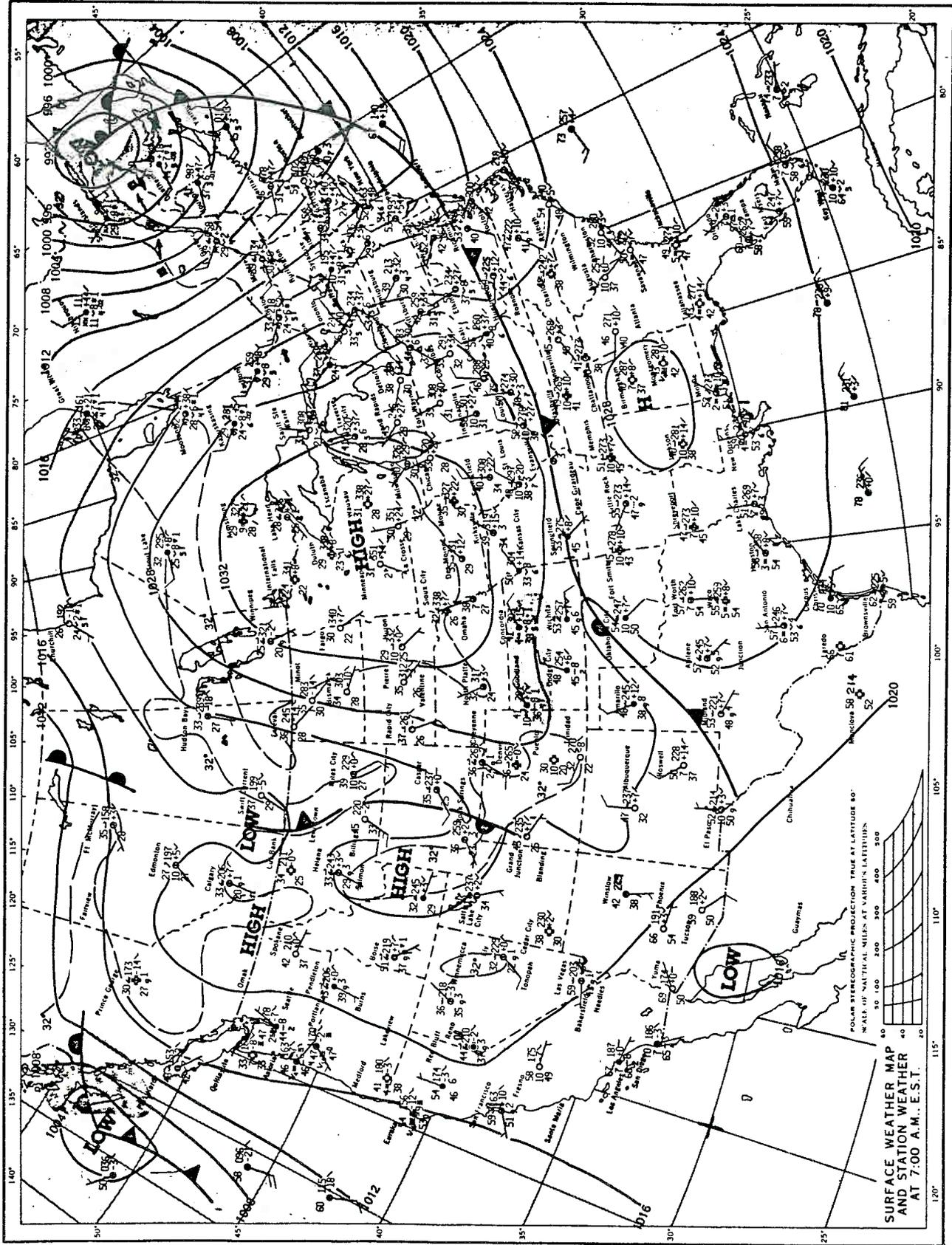
The temperature-dew point profiles cover the period October 27 through October 31, 1983. There is some indication that the temperature-dew point spread was governed by the approach of the cold front and the intrusion of the cold, relatively dry high pressure system during the time period of the sixth and seventh CAPTEX experiments.

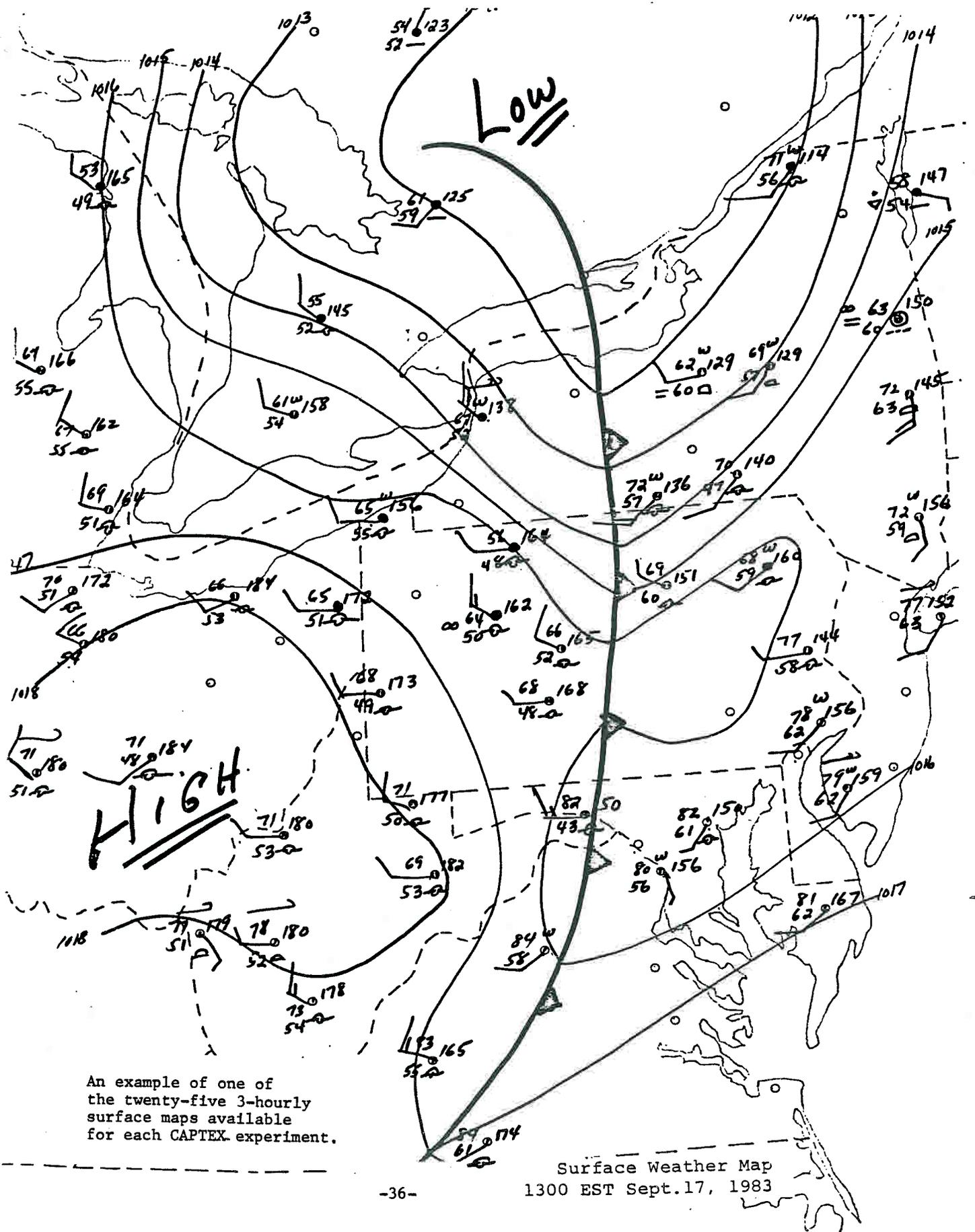
The Precipitation and Amounts maps for this period show trace amounts of precipitation in the northern section of the sampling region during the 28th and 29th due to low clouds and showers associated with the passage of the cold front through the region. Otherwise, skies were generally clear, especially after the cold frontal passage.

FRIDAY, OCTOBER 28, 1983



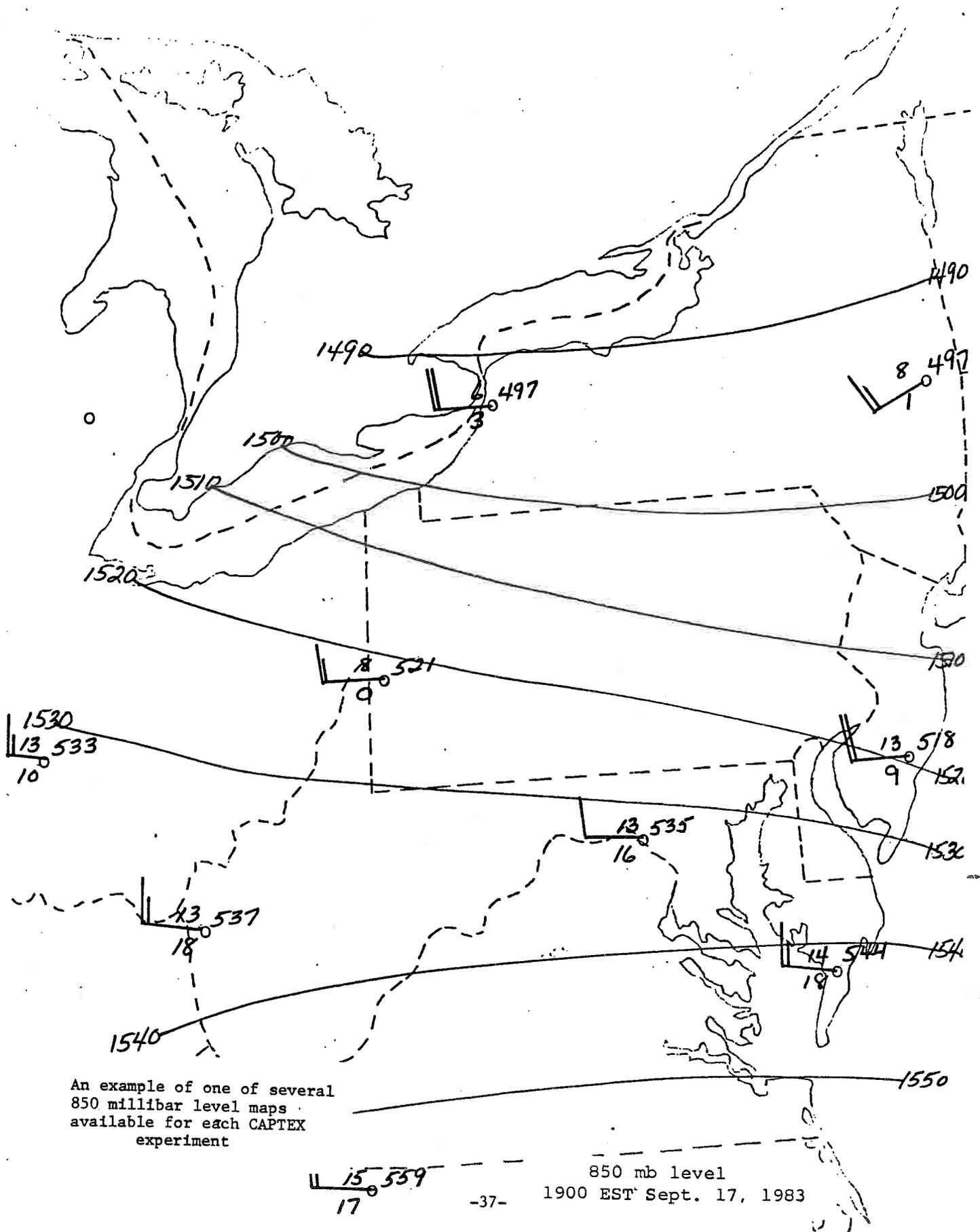
SATURDAY, OCTOBER 29, 1983





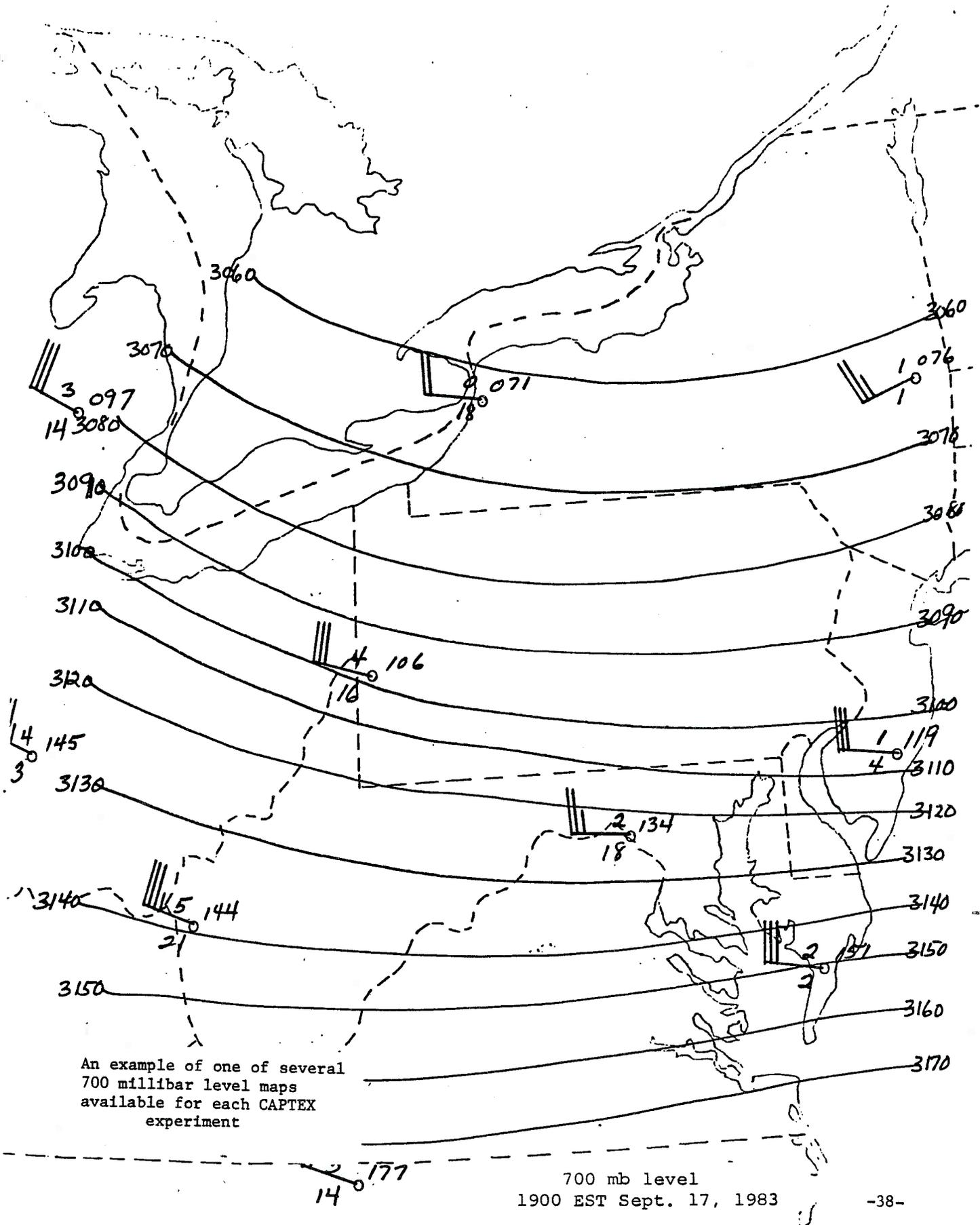
An example of one of the twenty-five 3-hourly surface maps available for each CAPTEX experiment.

Surface Weather Map
1300 EST Sept. 17, 1983



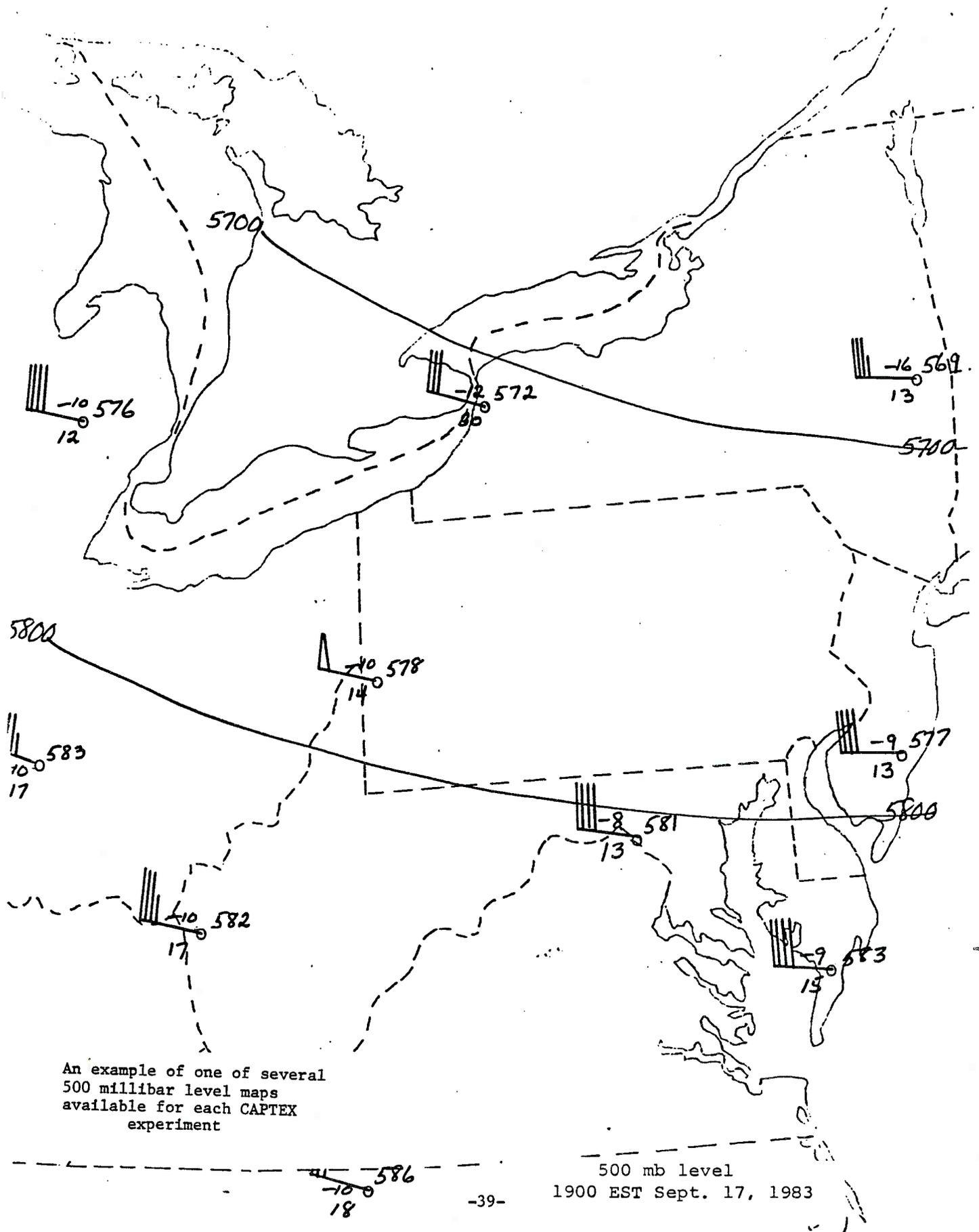
An example of one of several 850 millibar level maps available for each CAPTEX experiment

850 mb level
1900 EST Sept. 17, 1983



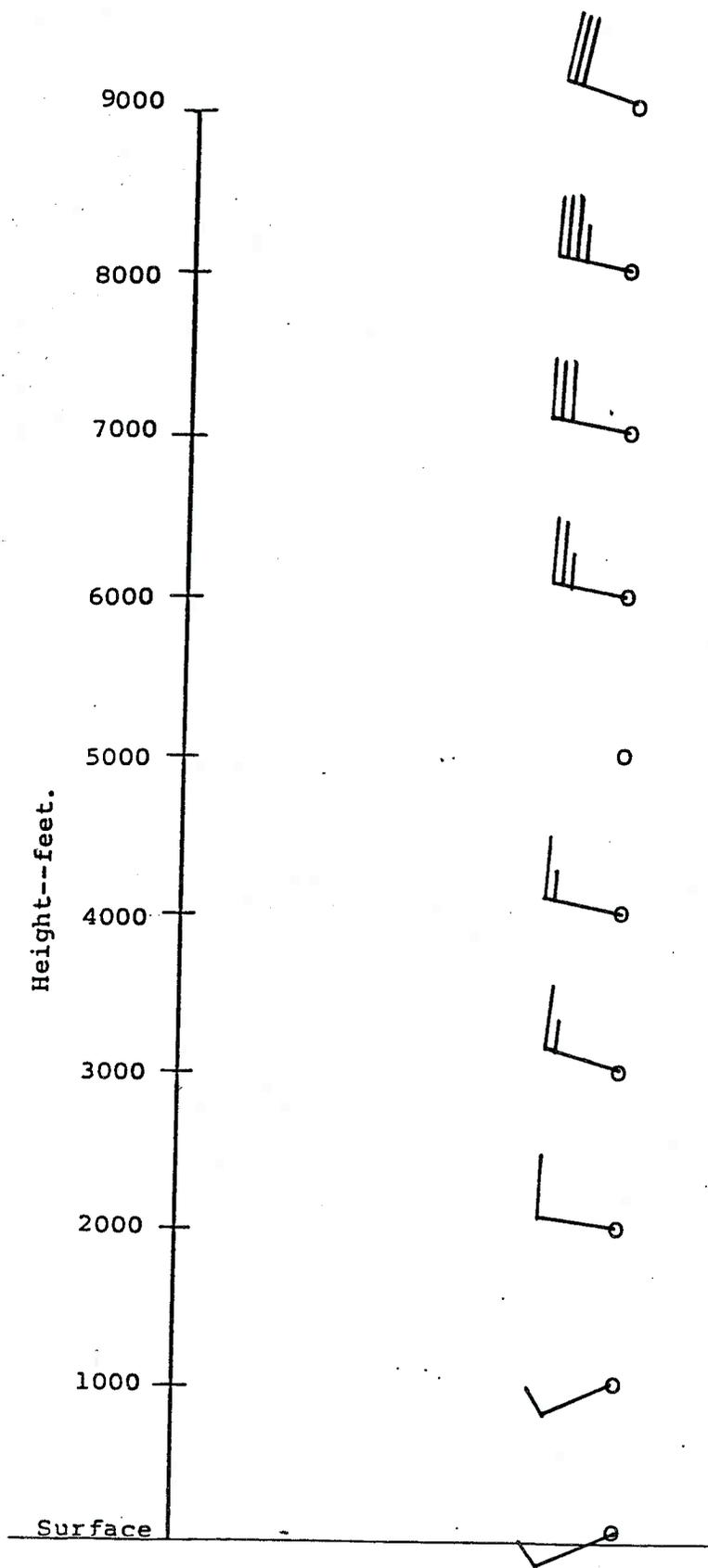
An example of one of several
700 millibar level maps
available for each CAPTEX
experiment

700 mb level
1900 EST Sept. 17, 1983



An example of one of several
500 millibar level maps
available for each CAPTEX
experiment

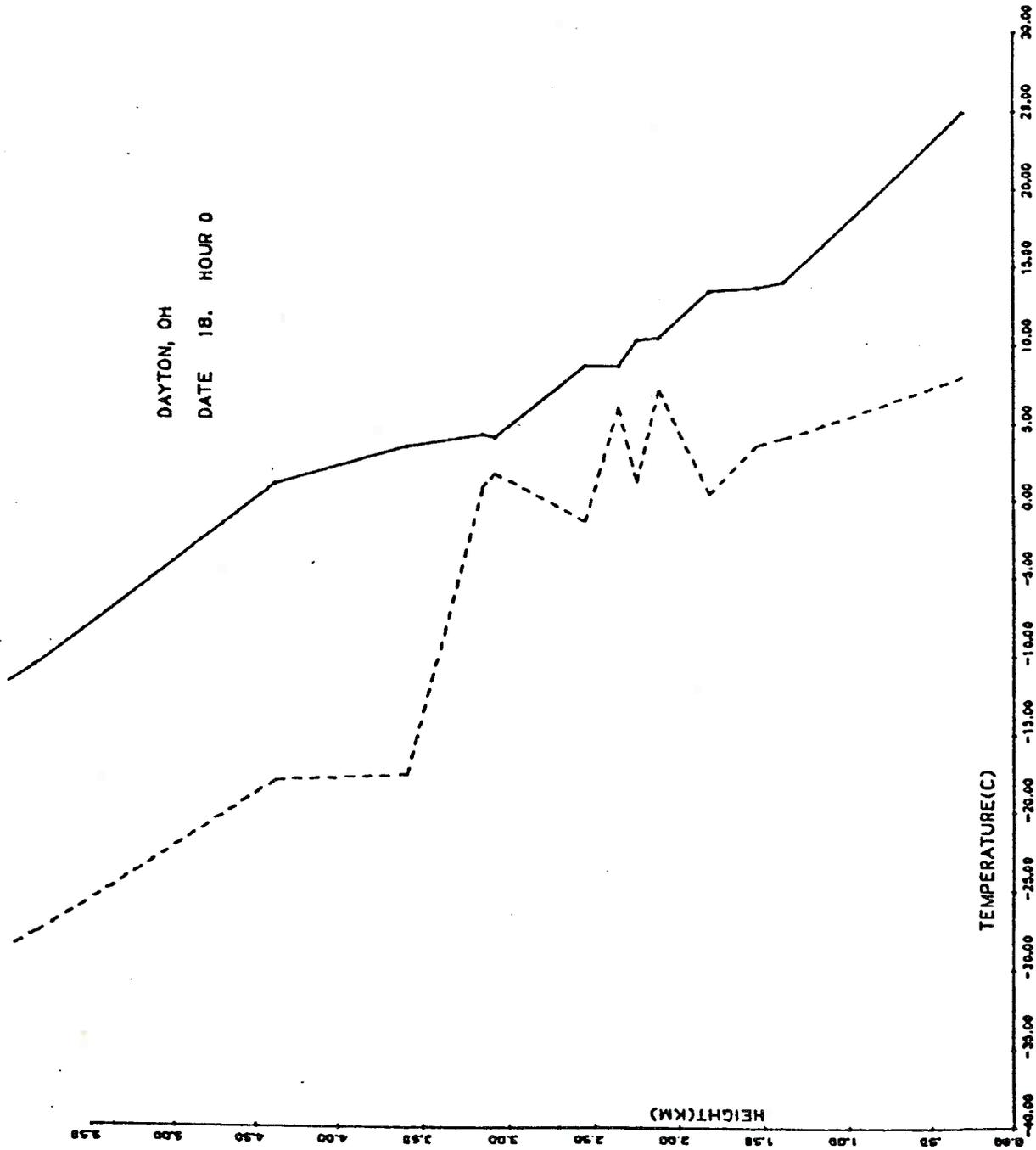
500 mb level
1900 EST Sept. 17, 1983



Dayton, Ohio
 0700 EST
 Sept. 17, 1983

An example of one of forty
 vertical wind profiles
 available for each CAPTEX
 experiment

DAYTON, OH
DATE 18. HOUR 0



An example of one of forty
temperature-dew point profiles
available for each CAPTEX
experiment