

U. S. DEPARTMENT OF COMMERCE

W. AVERELL HARRIMAN, Secretary

WEATHER BUREAU

F. W. REICHELDERFER, Chief

In cooperation with
U. S. Department of the Interior, Bureau of Reclamation

Highest Persisting Dewpoints In Western United States

For Durations of 12 to 120 Hours



TECHNICAL PAPER NO. 5

Division of Climatological and Hydrologic Services
Cooperative Studies Section

WASHINGTON
January 1948

INTRODUCTION

This project was undertaken by the Cooperative Studies Section, U. S. Weather Bureau, in cooperation with the Branch of Project Planning, U. S. Bureau of Reclamation, to provide information on the highest dewpoints that could persist for various durations. These dewpoints can be defined as the highest minimum dewpoints for the various durations, i.e., the highest dewpoints equalled or exceeded throughout these periods. They can be considered to be the highest, as indicated by the record, that can persist for the various durations.

The results of a survey of dewpoint records for 70 Weather Bureau first-order stations in the western half of the United States are presented in this report. Values derived from a smoothed envelopment of the highest observed, persisting dewpoints, and these values reduced to the 1,000-mb surface, for durations of 12, 24, 36, 48, 60, 72, 84, 96, 108, and 120 hours at the mid-period of each month of the year, are plotted on a series of maps to show geographical variations. The location, elevation, and period of record for each station are shown on the index map.

Basic dewpoint data for 11 stations in the eastern section of the area were tabulated from original records by the Hydrometeorological Section, which also provided valuable criticism in the preparation of this text.

PROCEDURE

There are no extended records of hourly or continuous dewpoint observations. However, there are available long records of observations made twice daily at times corresponding to 8 a.m. and p.m., E.S.T. From 1918 to about 1939 additional dewpoint observations were made at local noon; and a program of 6-hourly observations, corresponding to 2 and 8 a.m. and p.m., E.S.T., was inaugurated in 1936.

In general, selection of stations was limited to those having records of dewpoint observations at intervals of 12 hours or less for at least 40 years. A few stations with shorter records were used in some regions where longer records were not available or to reflect topographical influences not otherwise indicated.

Dewpoint data for the selected stations were transcribed from original station records to a form suitable for visual selection of highest values for specific durations. In addition to the 2, 3, or 4 dewpoints entered for each date, the minimum temperatures were also transcribed. In selecting the highest persisting dewpoint for a given interval, it was assumed that the dewpoint did not fall below the lowest observed value, unless a lower value was indicated by the minimum temperature

for that interval. The minimum temperature defines the upper limit of the lowest dewpoint in the interval between observations, because the dewpoint cannot exceed the concurrent air temperature. Consequently, whenever the recorded dewpoints for an interval exceeded the minimum temperature, it was assumed that the highest dewpoint which could persist for that interval was equal to the minimum temperature.

A sequence of dewpoints for a station taking 12-hourly observations would be analyzed as follows:

| Date | 3 | | 4 | | 5 | | 6 | | 7 | |
|------------|------|------|------|------|------|------|------|------|------|------|
| | a.m. | p.m. | a.m. | p.m. | a.m. | p.m. | a.m. | p.m. | a.m. | p.m. |
| Dewpoint | 48 | 52 | 50 | 52 | 52 | 54 | 53 | 57 | 51 | 48 |
| Min. Temp. | 50 | 54 | 51 | 55 | 52 | 55 | 55 | 53 | 49 | 50 |

| Duration (hours) | Highest Persisting Dewpoint | Period |
|------------------|-----------------------------|--------------------------------------|
| 12 | 53 | 5th p.m.-6th a.m.; 6th a.m.-6th p.m. |
| 24 | 53 | 5th p.m.-6th p.m. |
| 36 | 52 | 4th p.m.-6th a.m.; 5th a.m.-6th p.m. |
| 48 | 52 | 4th p.m.-6th p.m. |
| 60 | 50 | 3rd p.m.-6th a.m.; 4th a.m.-6th p.m. |
| 72 | 50 | 3rd p.m.-6th p.m. |
| 84 | 49 | 3rd p.m.-7th a.m. |

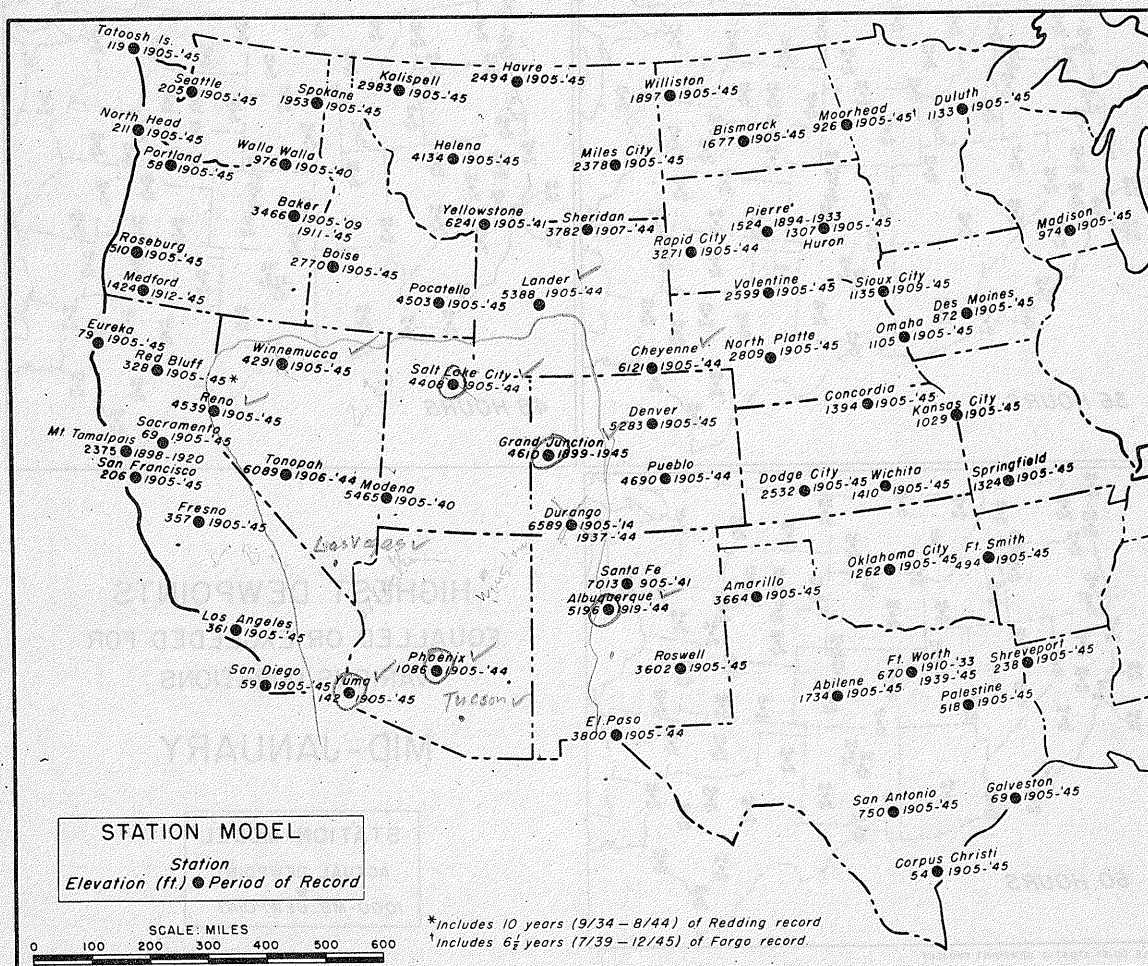
Selection of the highest dewpoint that was equalled or exceeded for each duration is straightforward through 48 hours. In the 60 hours from the 4th p.m. to the 7th a.m., the highest persisting dewpoint is apparently 51°. It is actually 49°, however, because the highest dewpoint that could have persisted from the 6th p.m. to the 7th a.m. can be no higher than the minimum temperature recorded on the 7th a.m. Therefore, the highest persisting dewpoint for 60 hours is 50°, which can be obtained from the periods of the 3rd p.m. to the 6th a.m. and 4th a.m. to 6th p.m. Selection of the highest persisting dewpoints for 72 and 84 hours is influenced likewise by the same minimum temperature.

To determine the annual march of the highest persisting dewpoints, the transcribed data were analyzed so that the highest values for each duration were obtained for consecutive 10-day periods throughout the year. These values were then plotted at their dates of occurrence. A smoothed minimum-envelopment curve of the plotted data was drawn. Mid-month values were read from the curve, tabulated in ascending order of duration, and plotted for each month on semi-log paper, on which the

logarithmic scale was used for duration and the linear scale for dewpoint. These data were then enveloped by a curve to smooth out apparent inconsistencies in the dewpoint-duration relationship. The highest persisting dewpoints for each duration were obtained from these curves and are shown above the station circles on the maps.

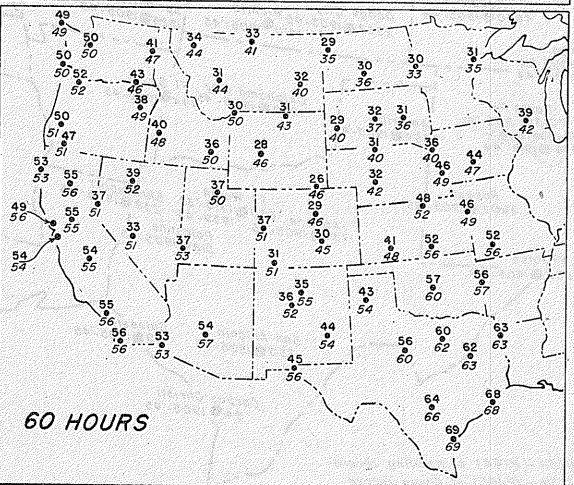
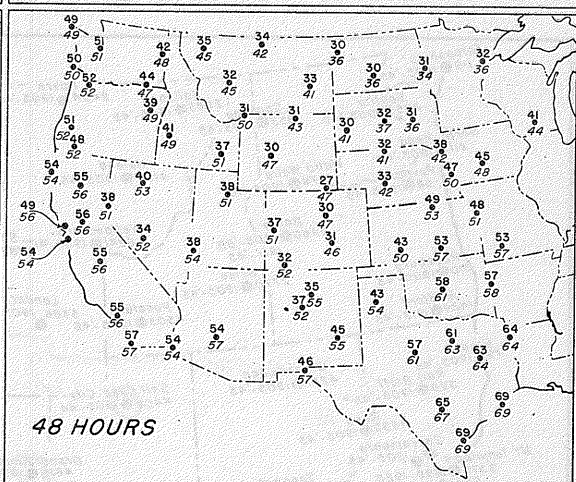
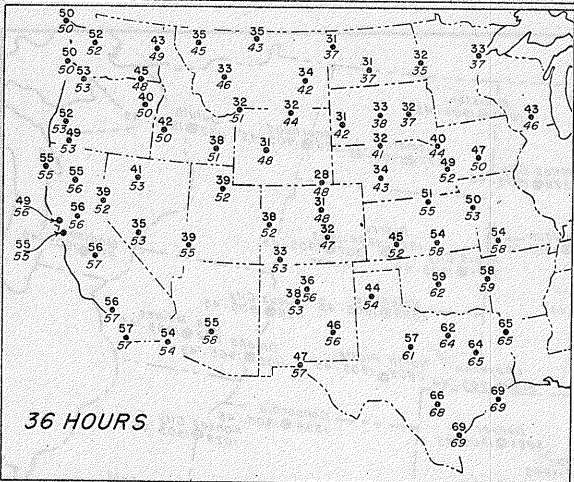
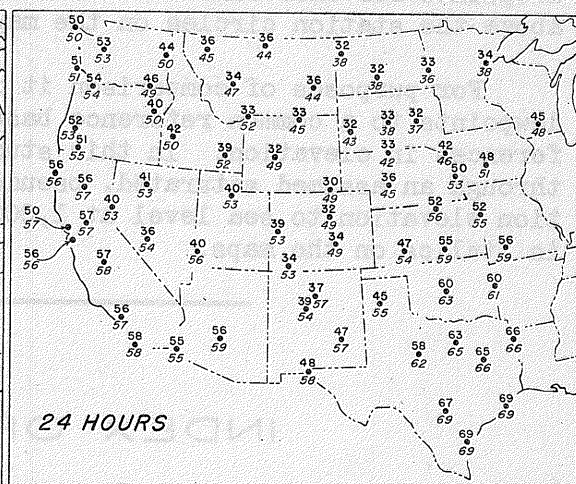
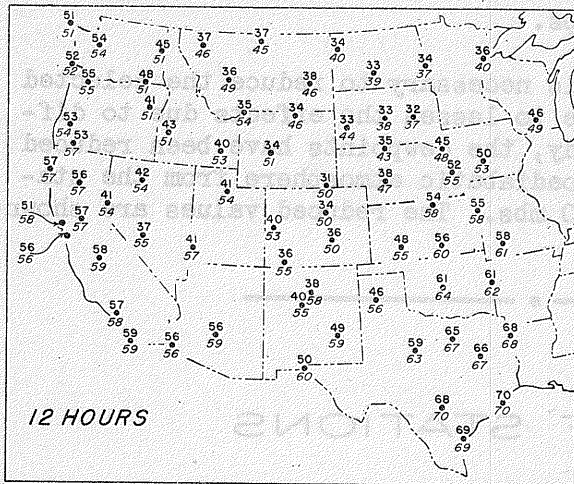
For purposes of comparison it is necessary to reduce the selected dewpoints to a common reference base to lessen the effects due to differences in elevation. In this study, the dewpoints have been reduced through an assumed saturated, pseudoadiabatic atmosphere from the station elevation to sea level at 1,000 mbs. The reduced values are shown in italics on the maps.

INDEX OF STATIONS



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Weather Bureau

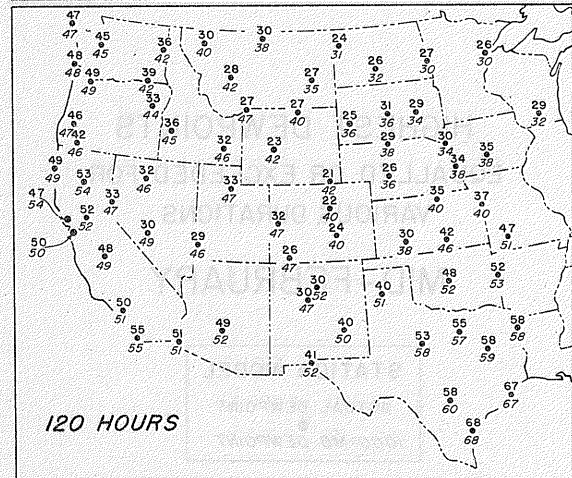
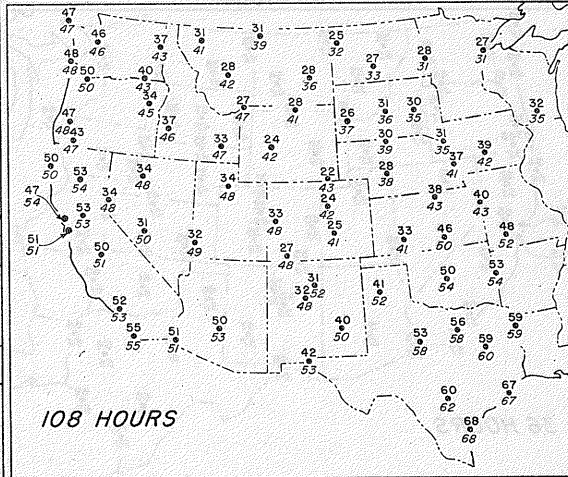
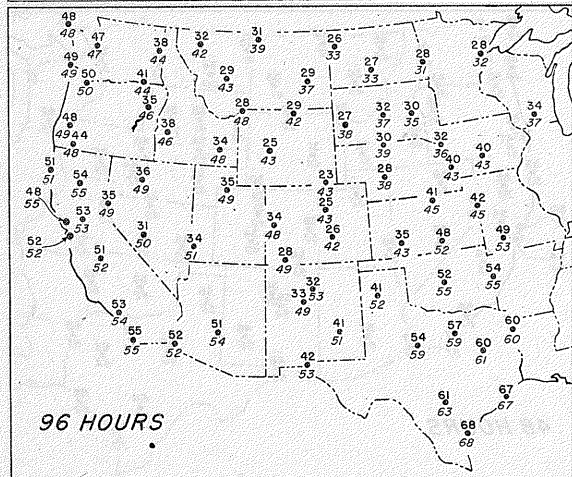
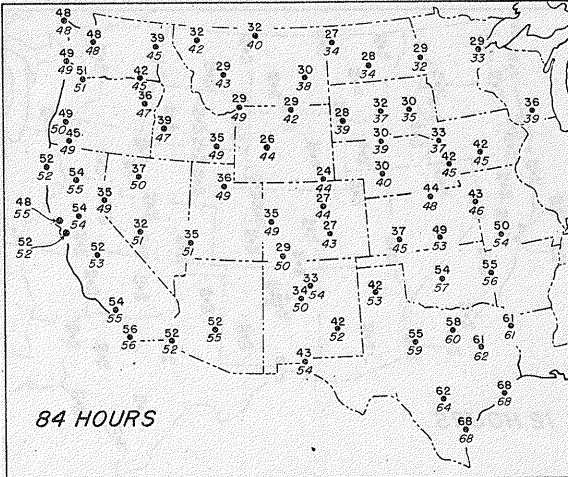
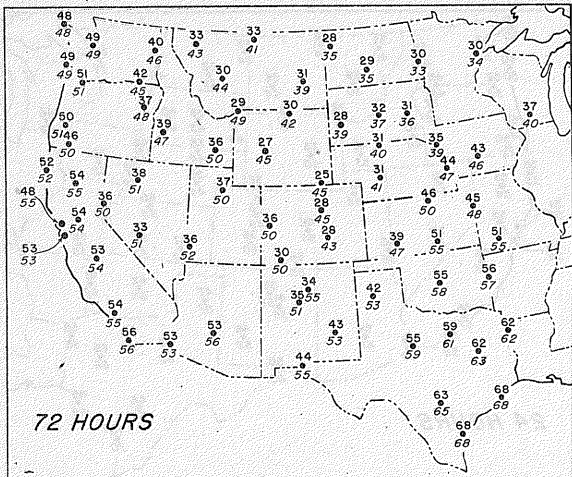


HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS
MID-JANUARY

STATION MODEL
ACTUAL DEWPOINT
●
1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau

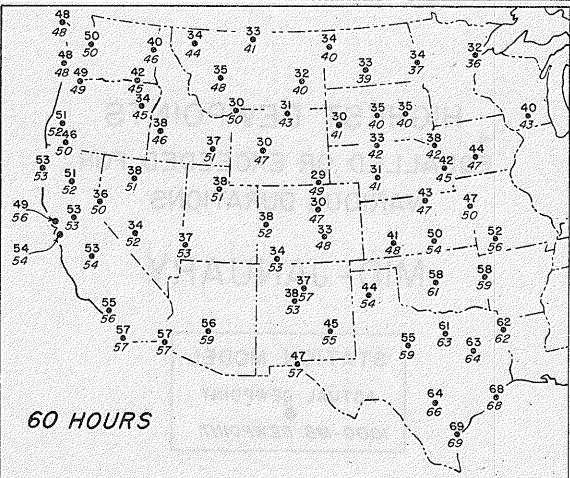
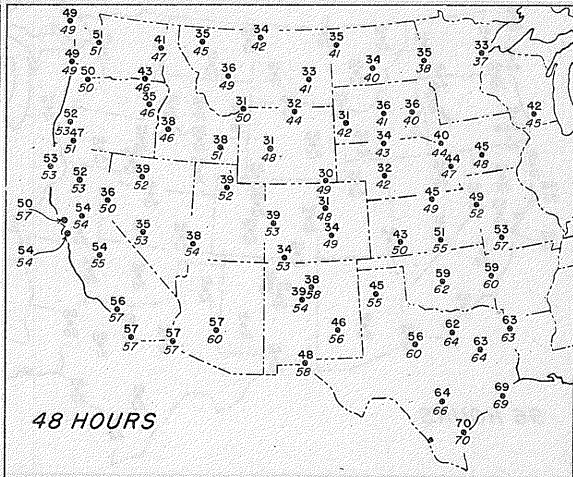
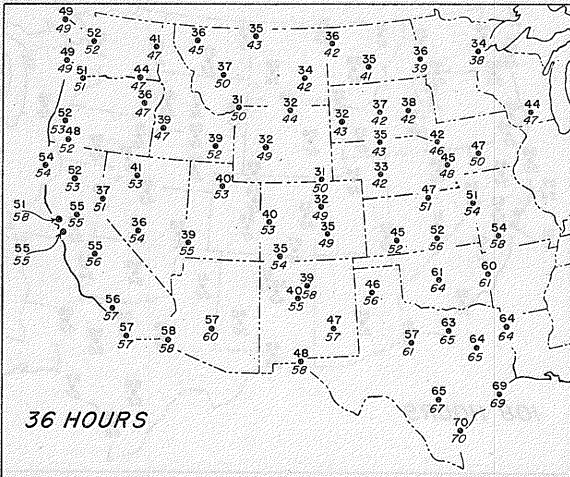
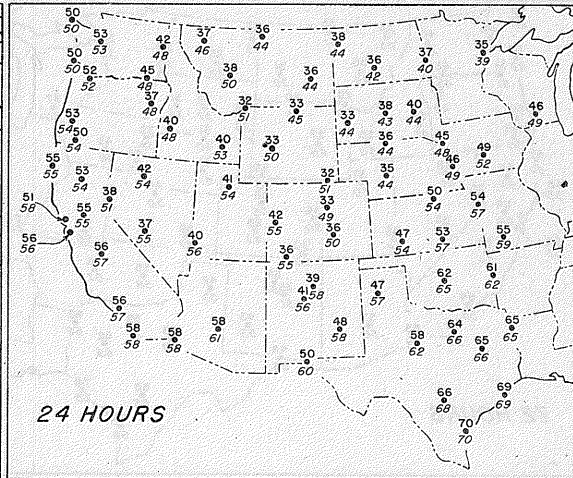
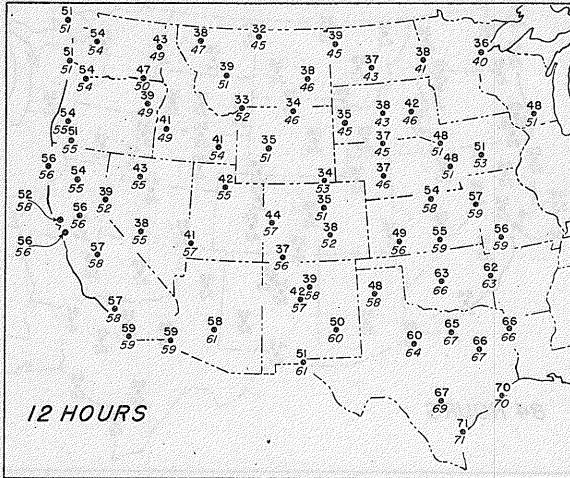


HIGHEST DEWPOINTS
 EQUALLED OR EXCEEDED FOR
 VARIOUS DURATIONS
 MID-JANUARY

STATION MODEL
 ACTUAL DEWPOINT
 1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau

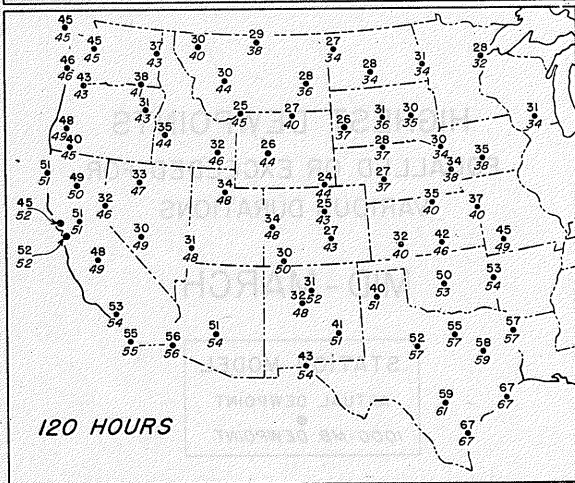
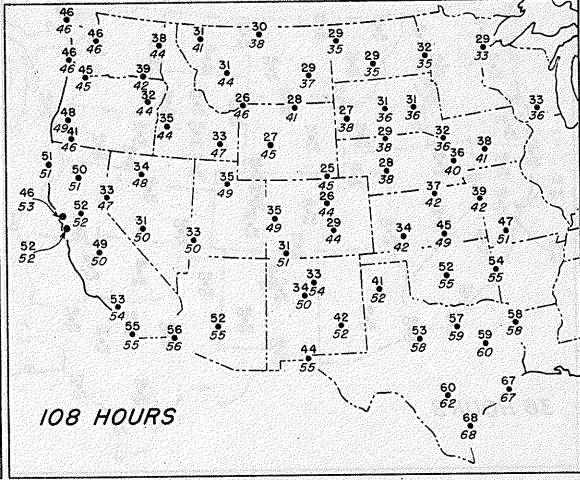
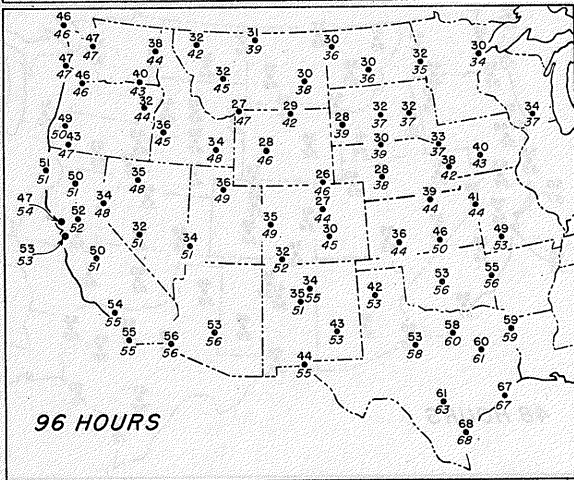
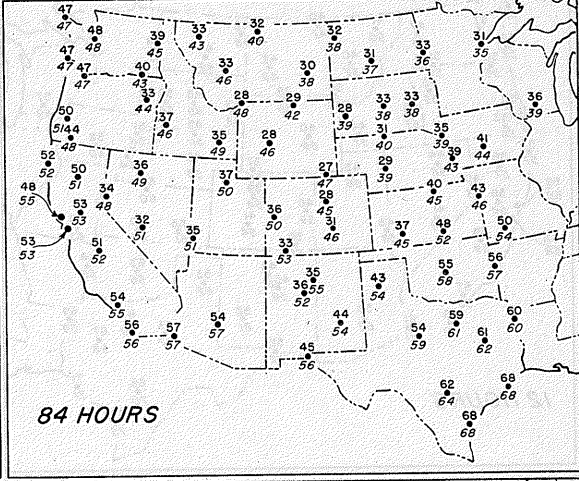
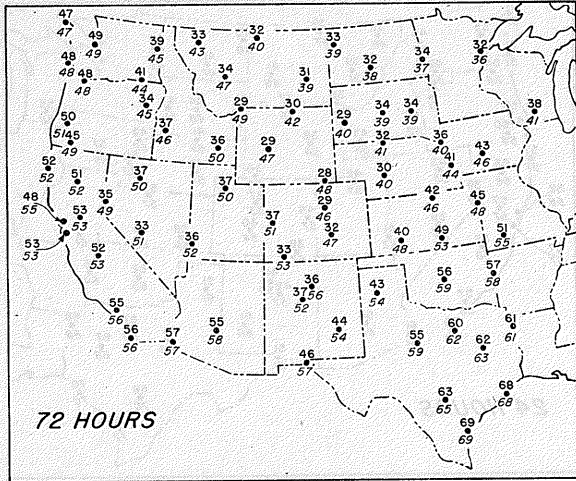


HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS
MID-FEBRUARY

STATION MODEL
ACTUAL DEWPOINT
1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau

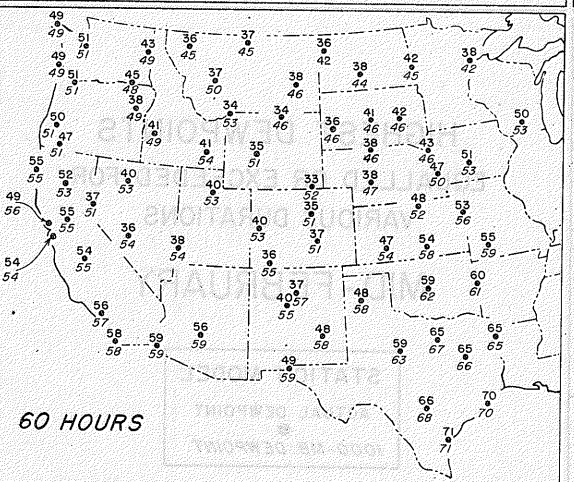
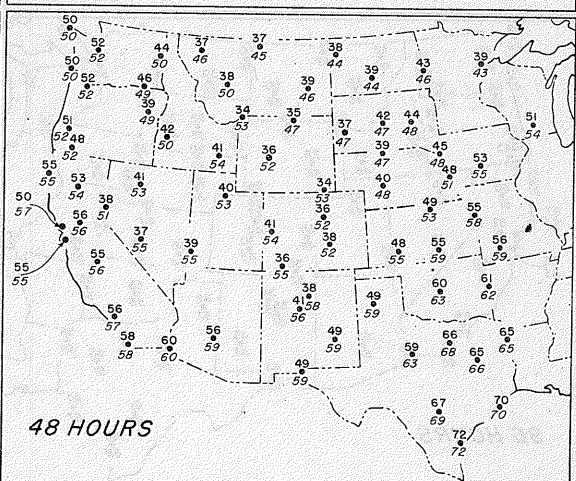
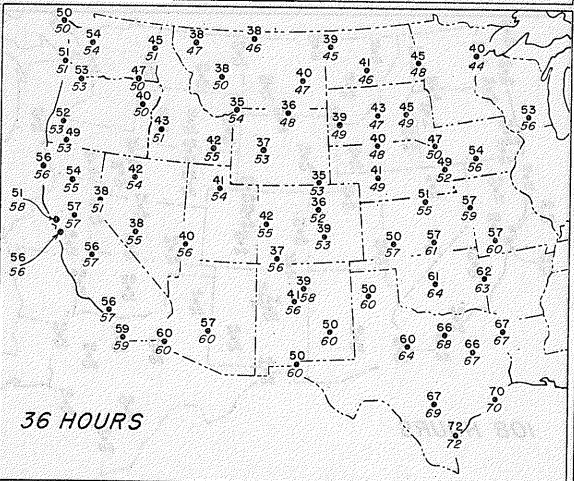
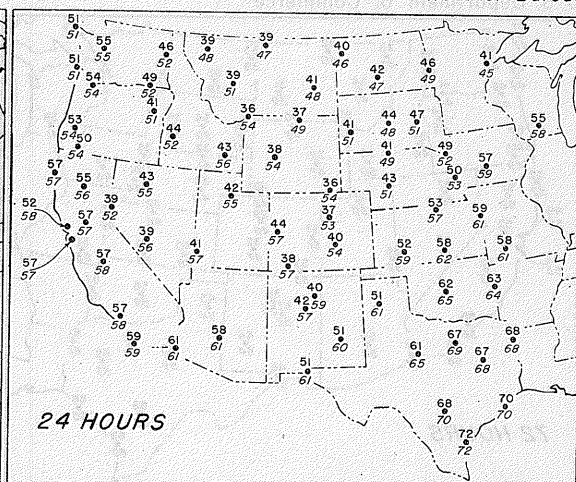
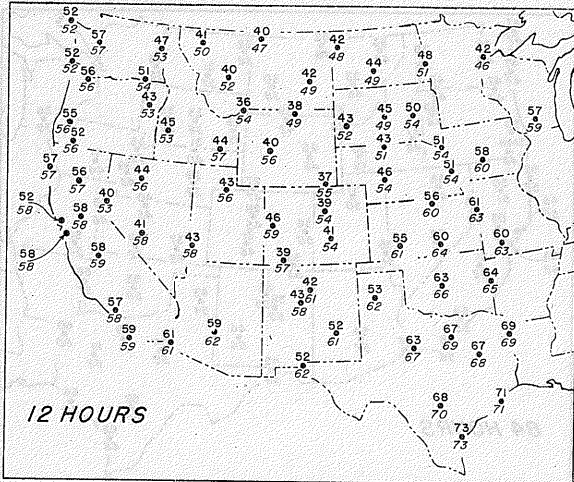


HIGHEST DEWPOINTS
 EQUALLED OR EXCEEDED FOR
 VARIOUS DURATIONS
 MID - FEBRUARY

STATION MODEL
 ACTUAL DEWPOINT
 1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau



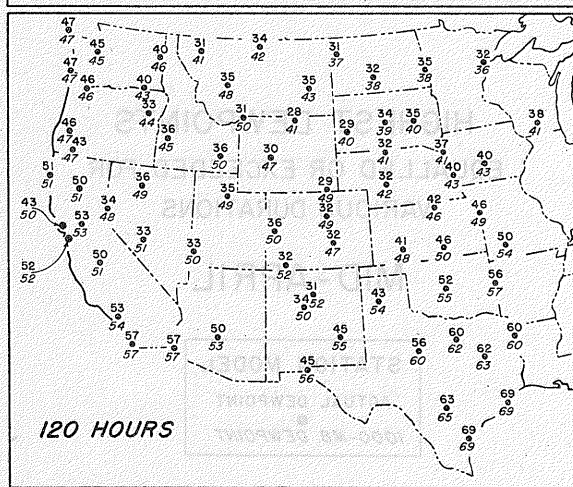
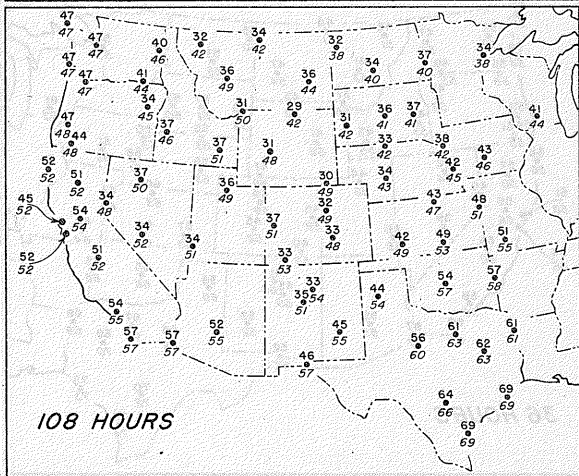
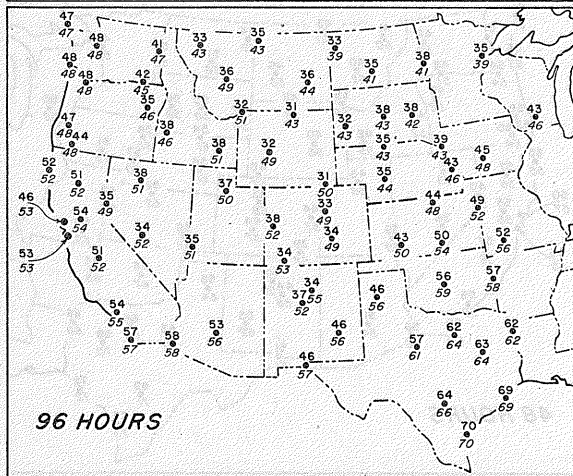
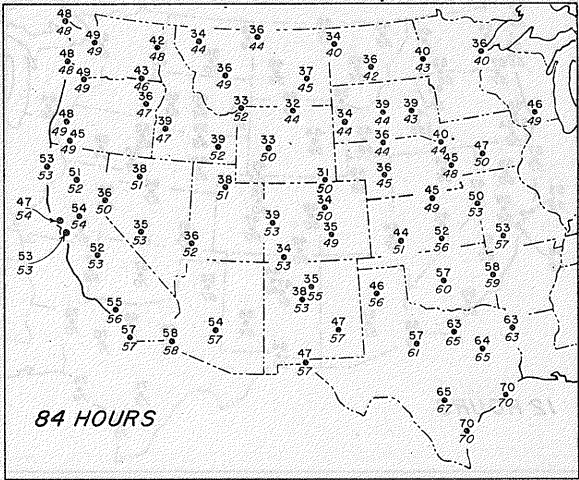
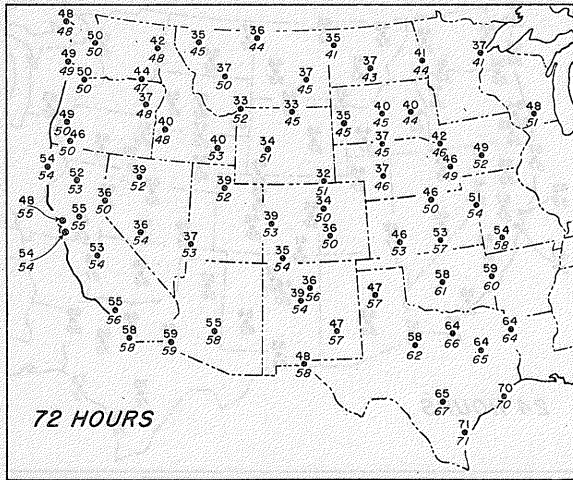
HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS

MID-MARCH

STATION MODEL
ACTUAL DEWPOINT
1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau



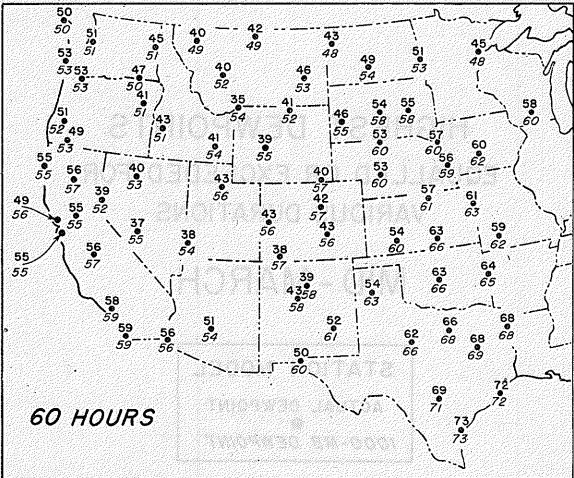
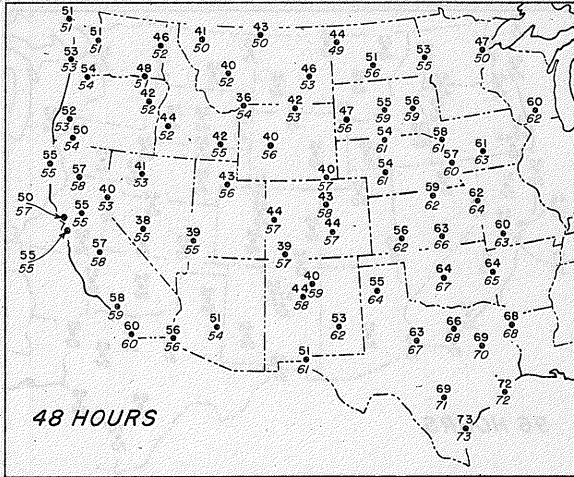
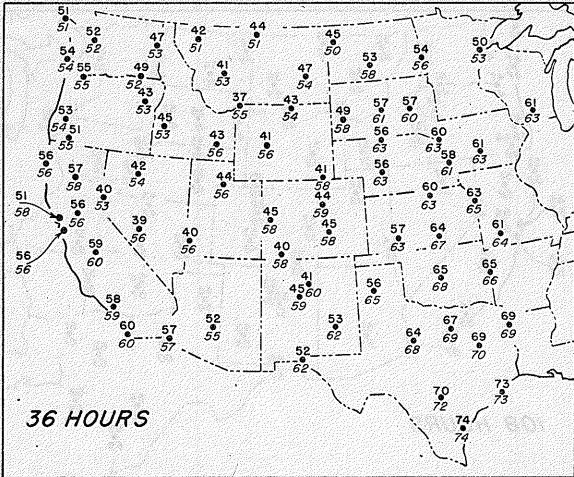
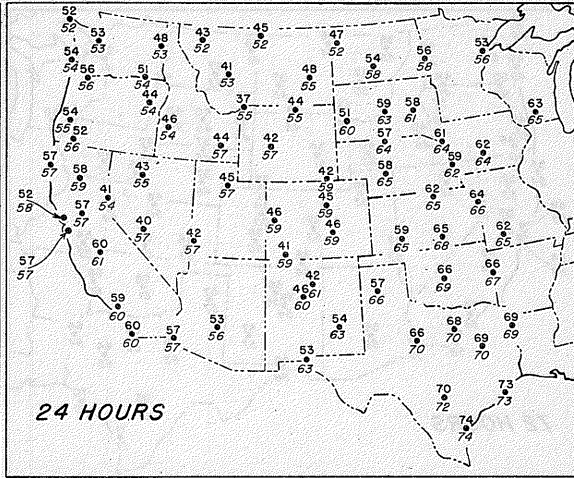
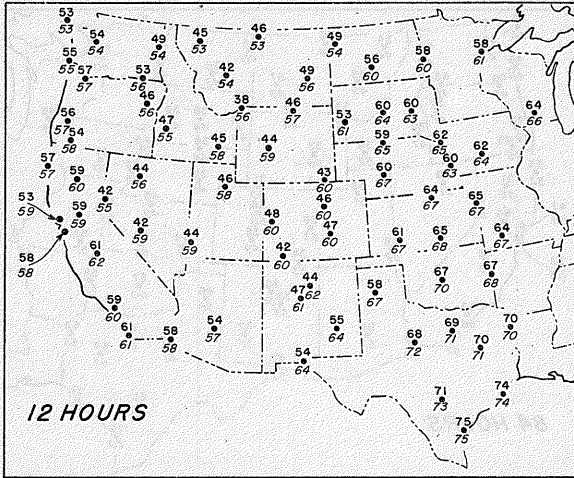
HIGHEST DEWPOINTS
 EQUALLED OR EXCEEDED FOR
 VARIOUS DURATIONS
 MID - MARCH

STATION MODEL
 ACTUAL DEWPOINT
 1000-MB. DEWPOINT

FILE CO-ST 47047-7 DEWPOINT PROJECT

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Weather Bureau



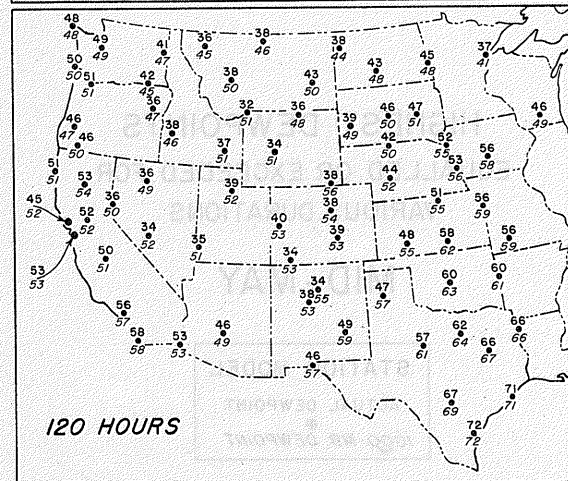
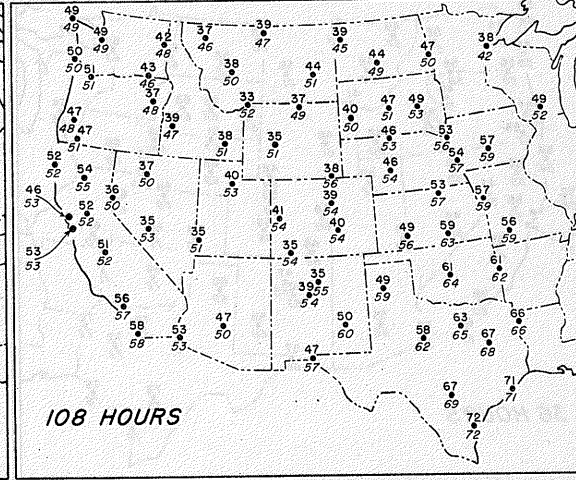
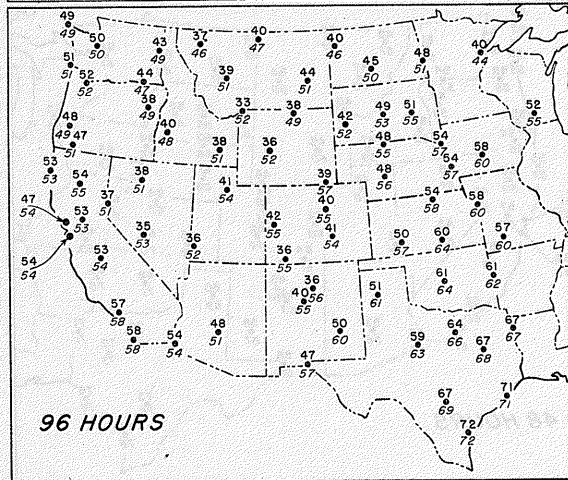
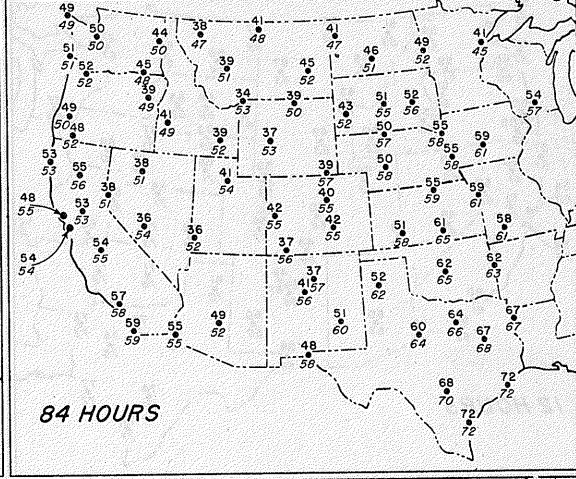
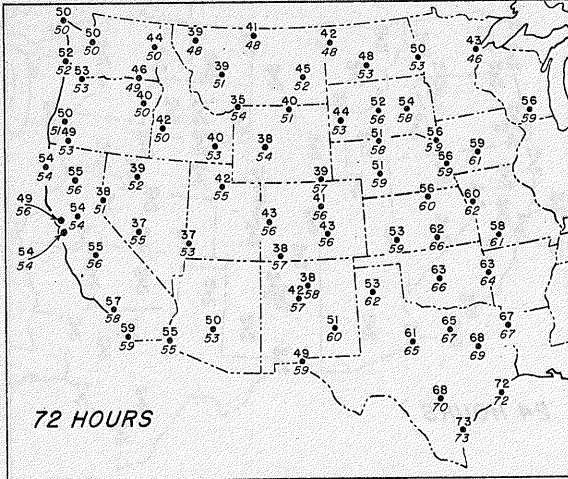
HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS

MID-APRIL

STATION MODEL
ACTUAL DEWPOINT
●
1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau



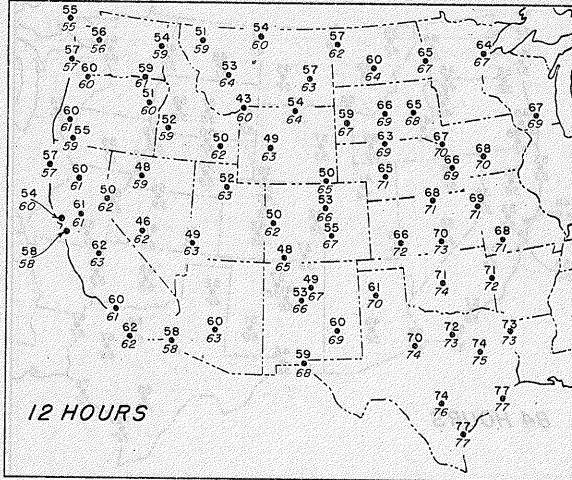
HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS

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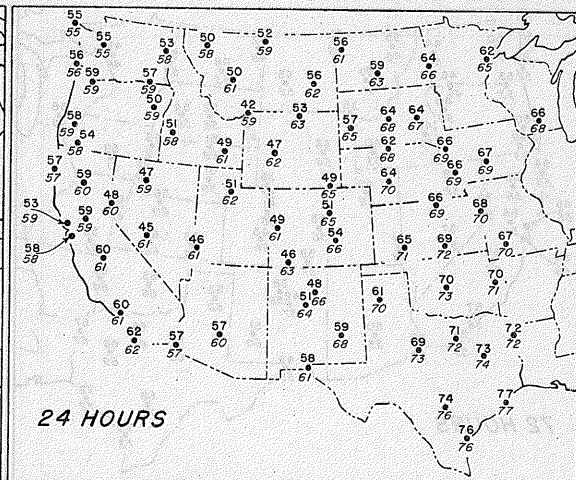
STATION MODEL
ACTUAL DEWPOINT
1000-MB. DEWPOINT

U. S. Department of Commerce

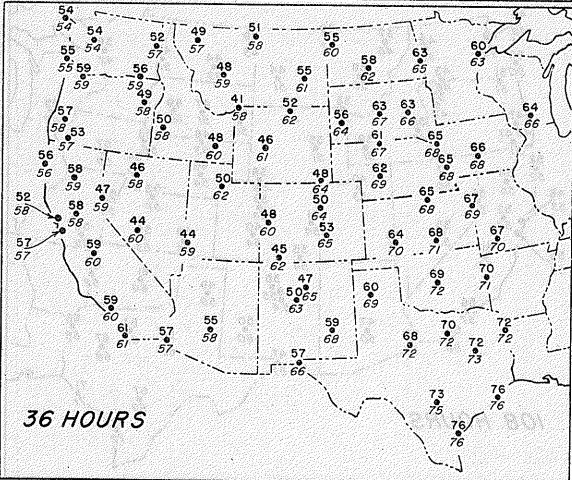
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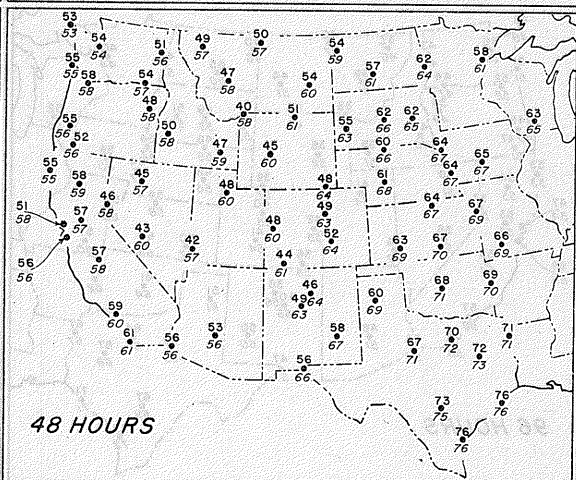
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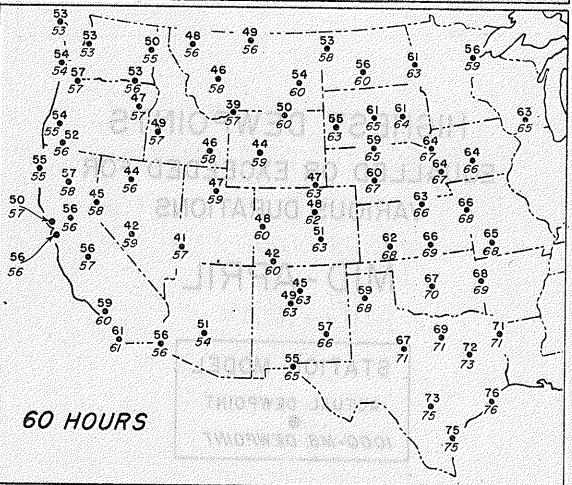
24 HOURS



36 HOURS



48 HOURS



60 HOURS

HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS

MID - MAY

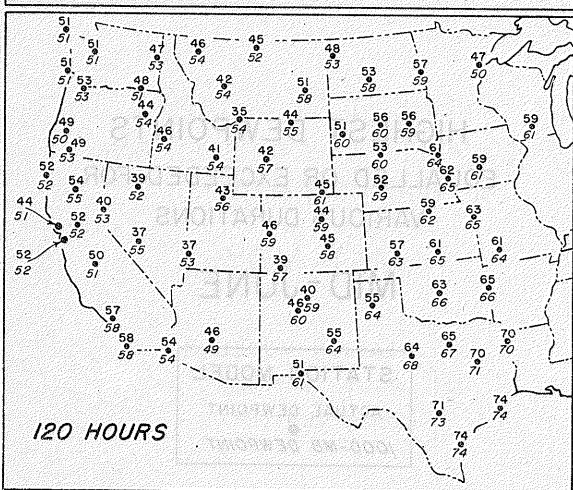
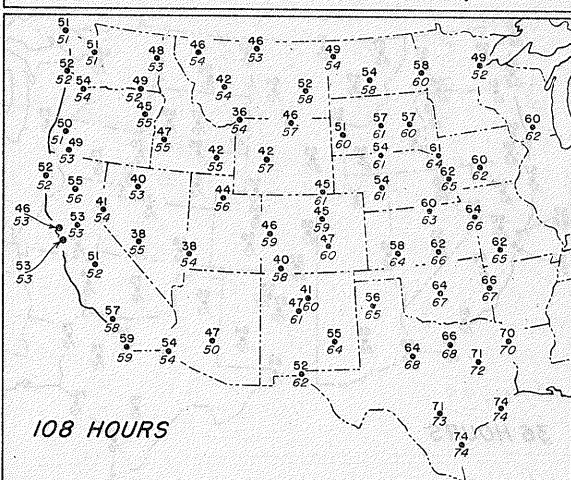
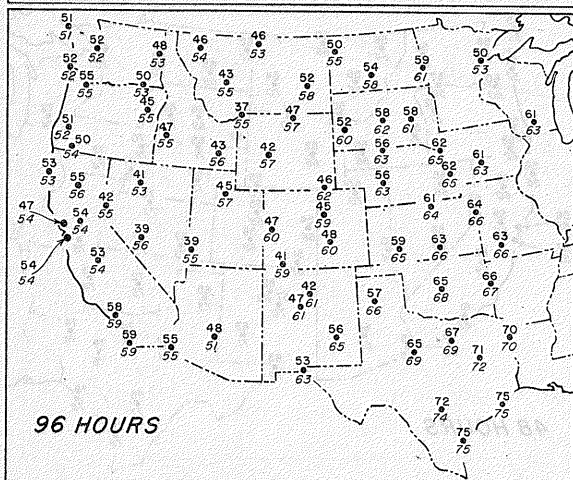
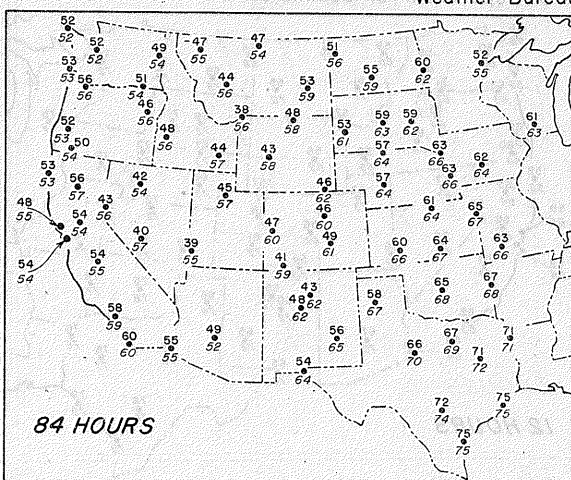
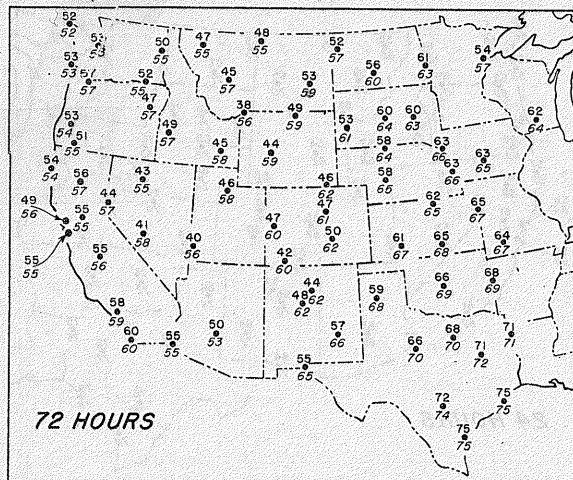
STATION MODEL

ACTUAL DEWPOINT

1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau



HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS

MID-MAY

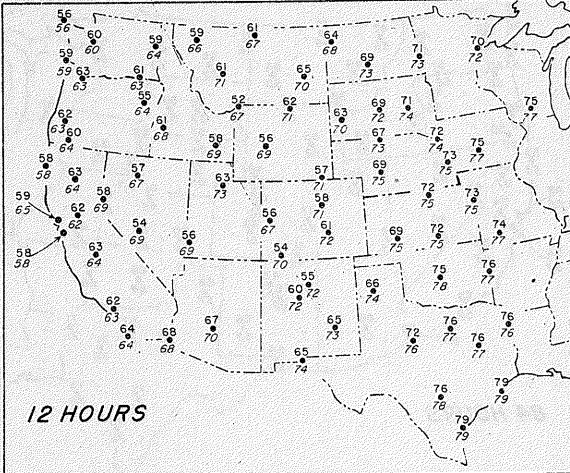
STATION MODEL

ACTUAL DEWPOINT

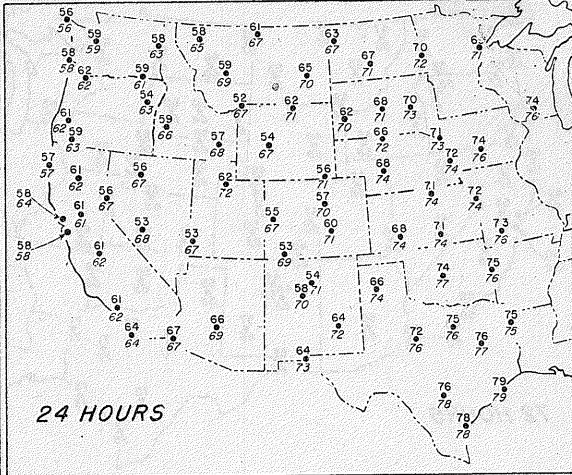
1000-MB. DEWPOINT

U. S. Department of Commerce

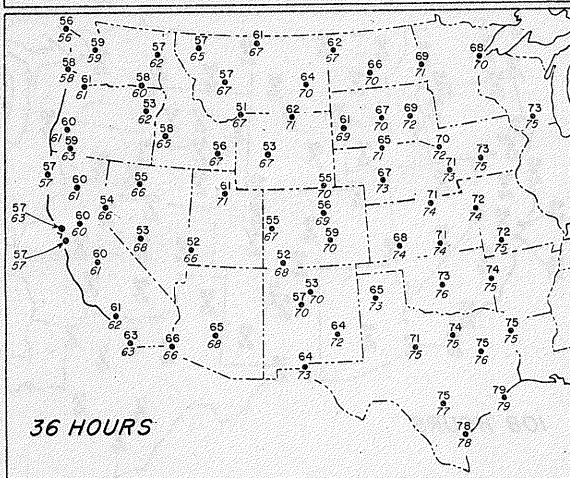
Weather Bureau



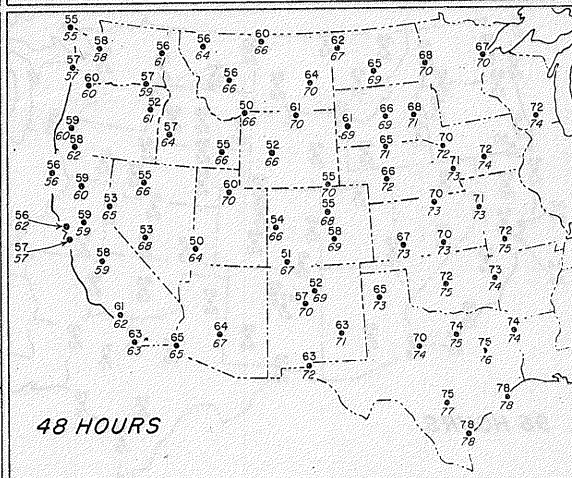
12 HOURS



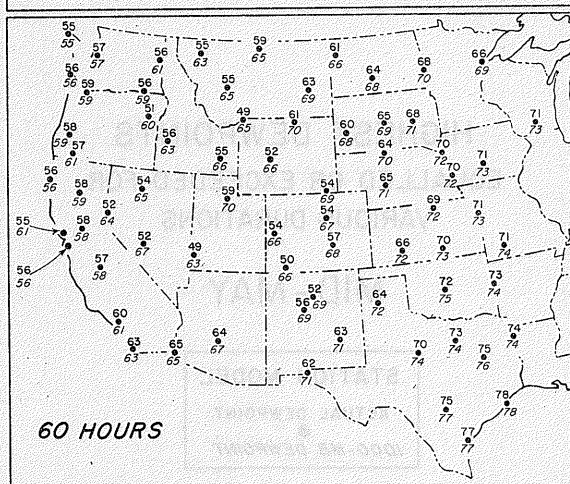
24 HOURS



36 HOURS



48 HOURS



60 HOURS

HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS

MID-JUNE

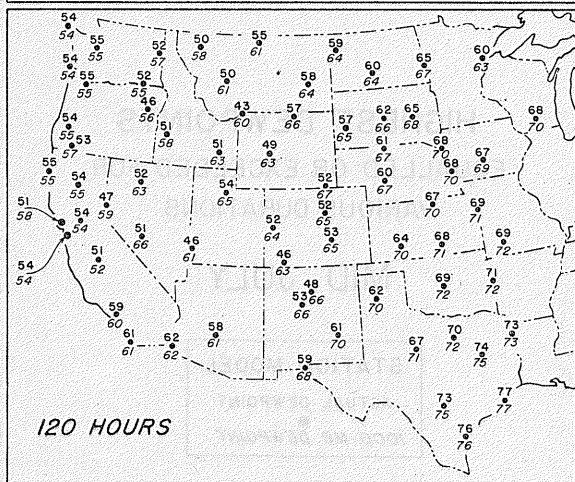
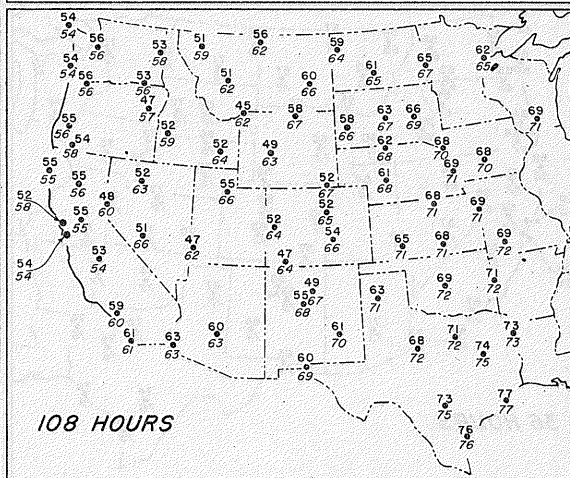
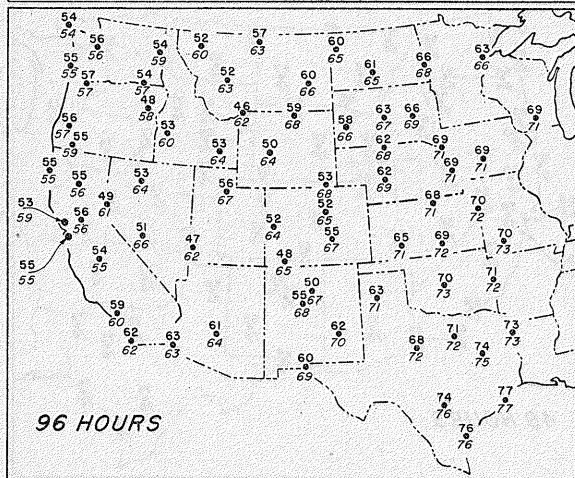
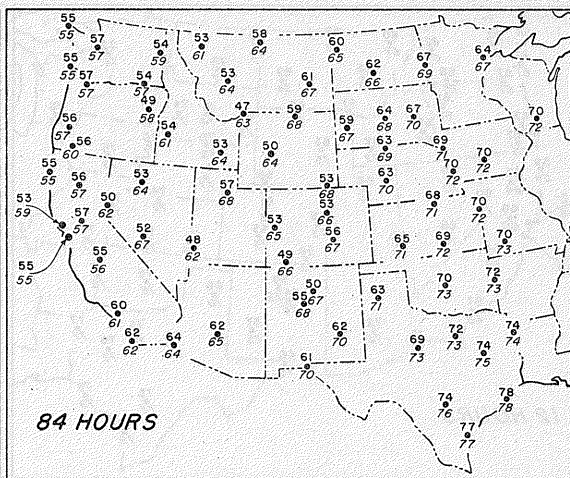
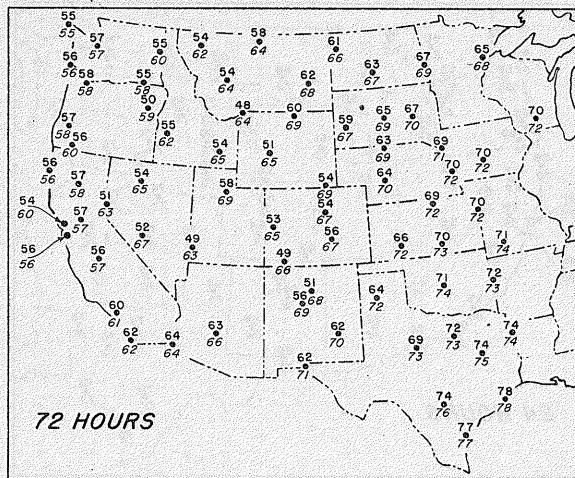
STATION MODEL

ACTUAL DEWPOINT

1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau



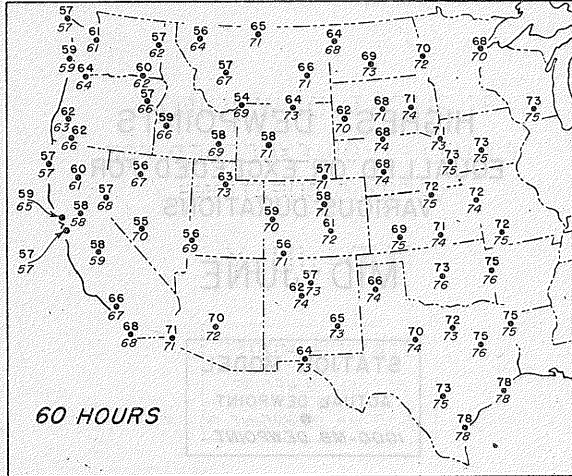
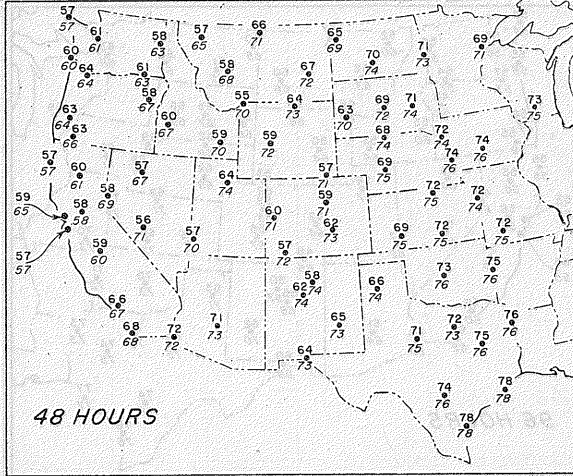
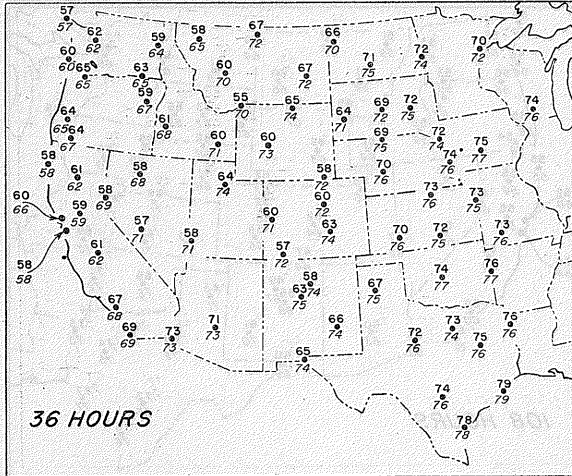
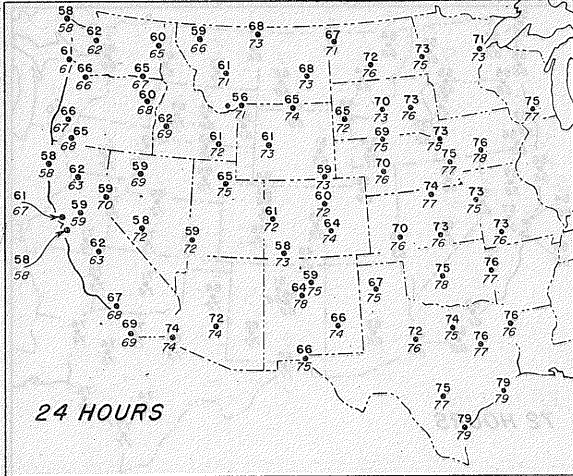
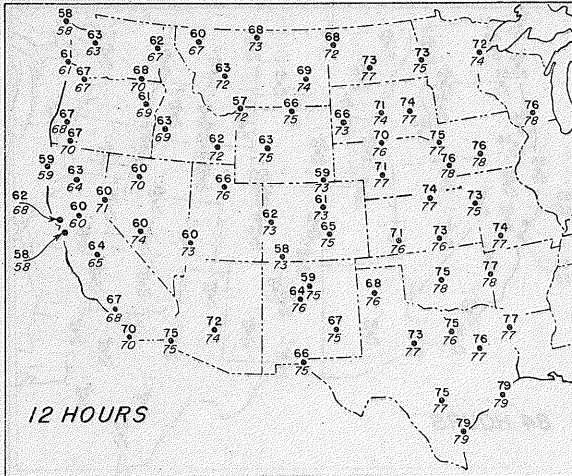
HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS

MID - JUNE

STATION MODEL
ACTUAL DEWPOINT ●
1000-MB. DEWPOINT ○

U. S. Department of Commerce

Weather Bureau



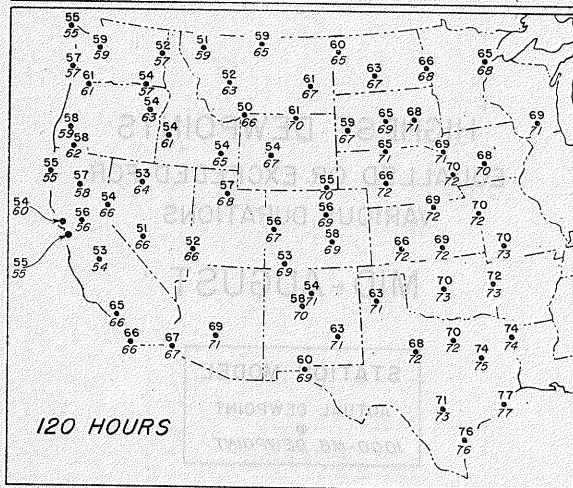
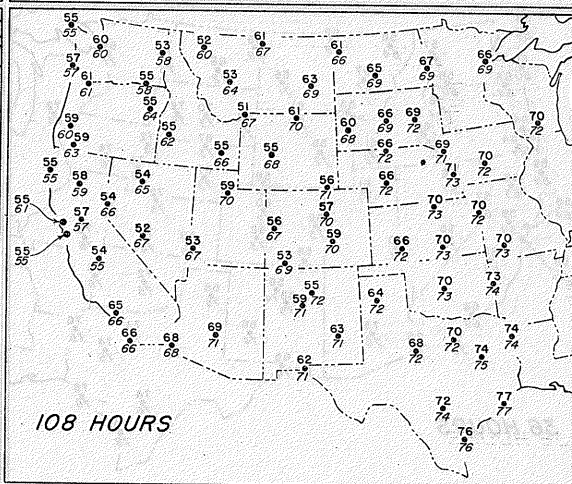
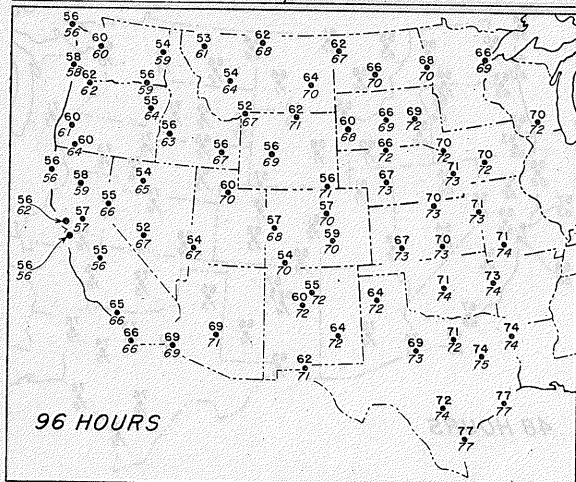
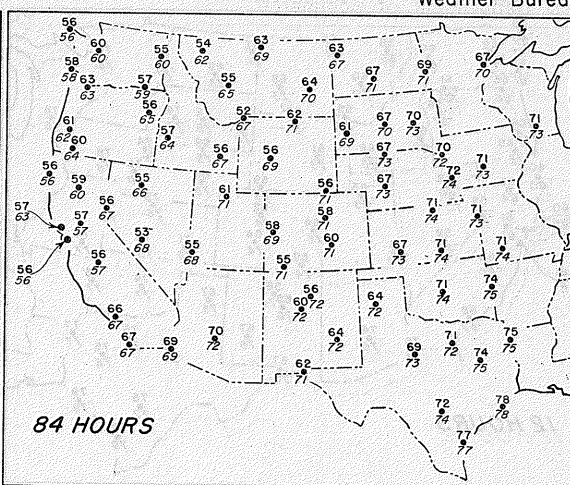
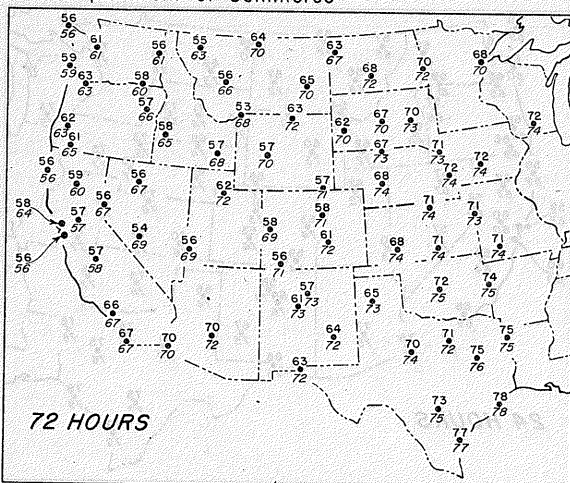
HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS

MID-JULY

STATION MODEL
ACTUAL DEWPOINT
●
1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau



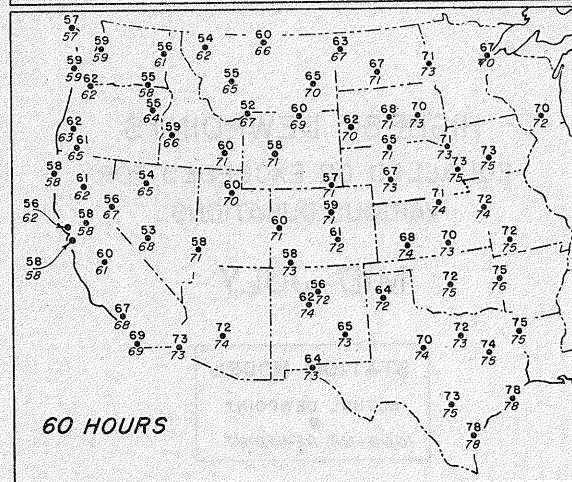
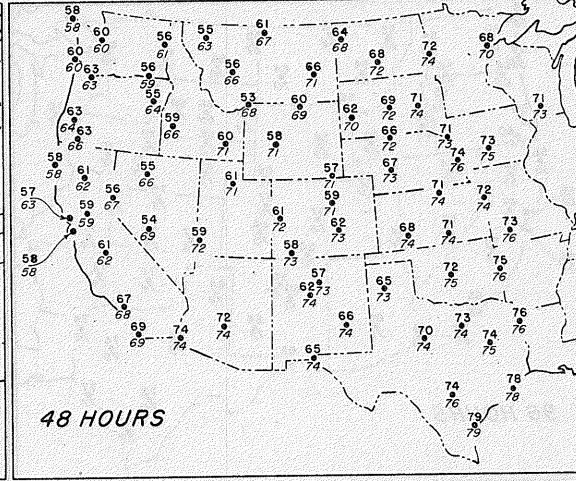
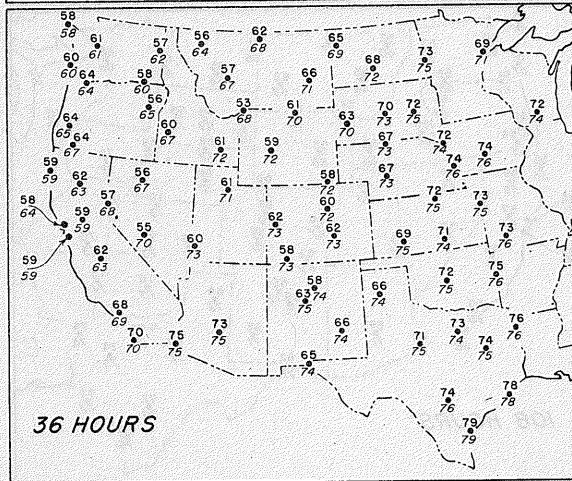
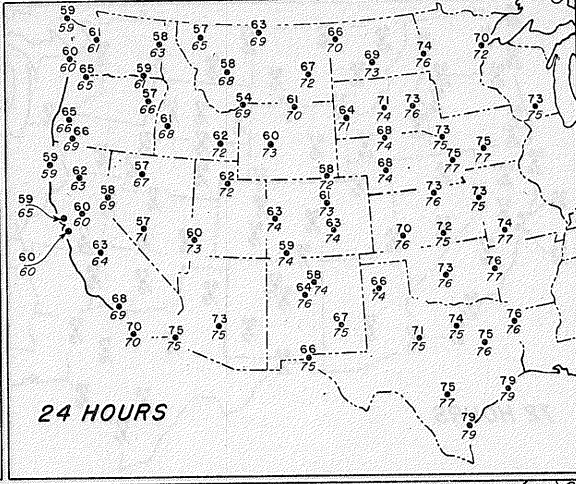
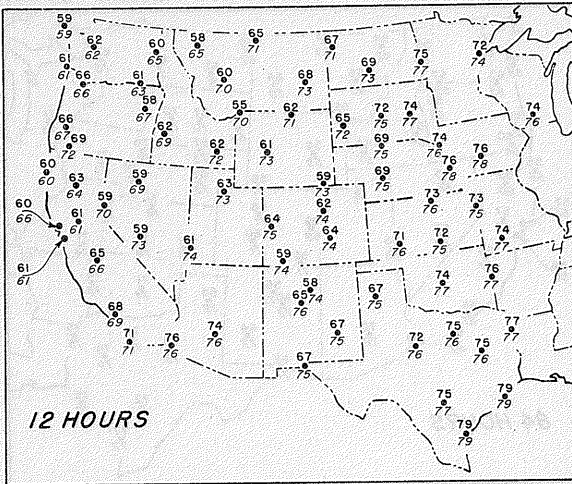
HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS

MID-JULY

STATION MODEL
ACTUAL DEWPOINT
1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau



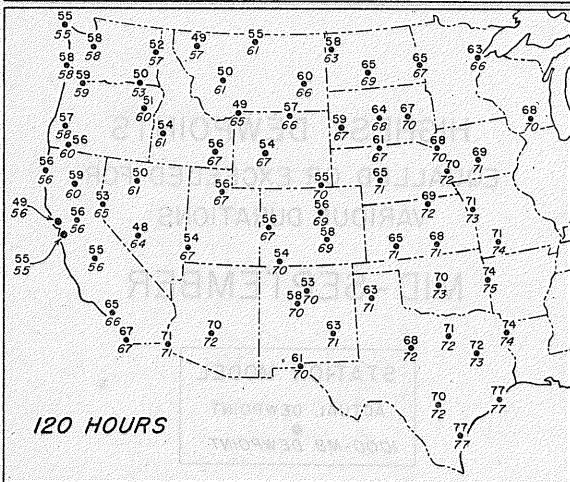
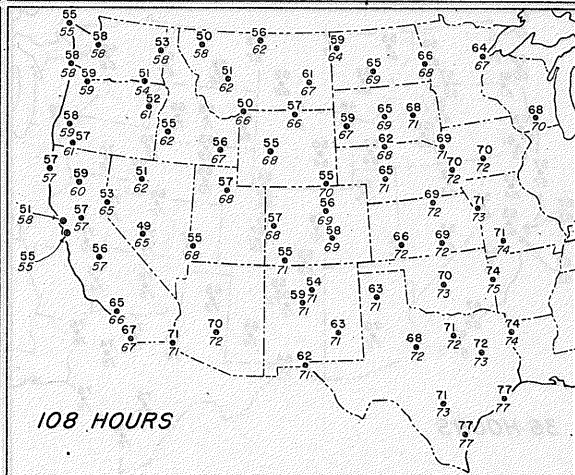
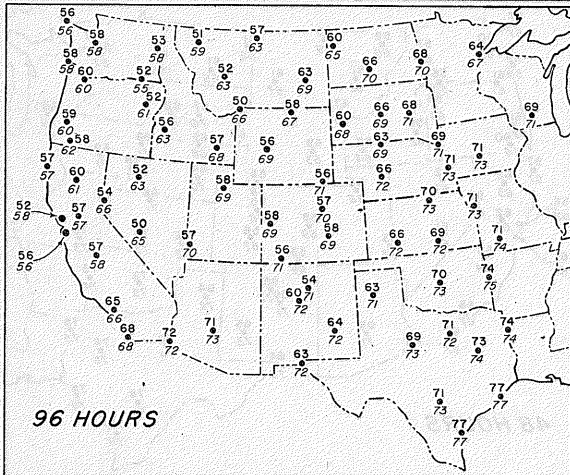
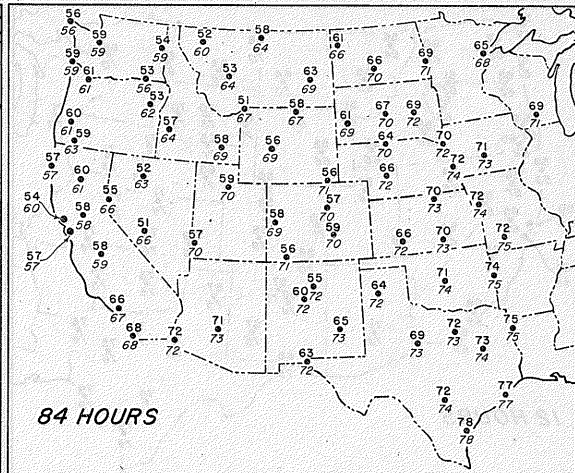
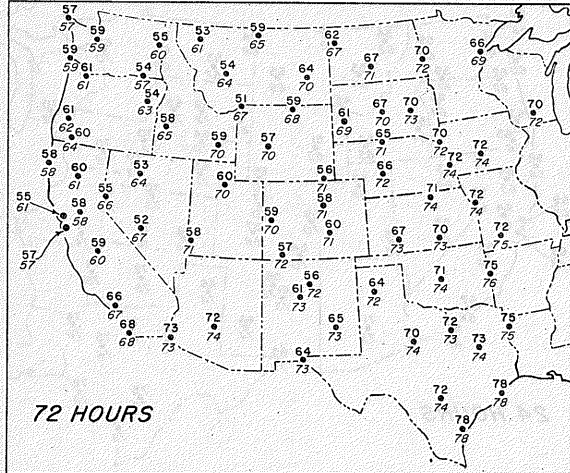
HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS

MID - AUGUST

STATION MODEL
ACTUAL DEWPOINT
1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau

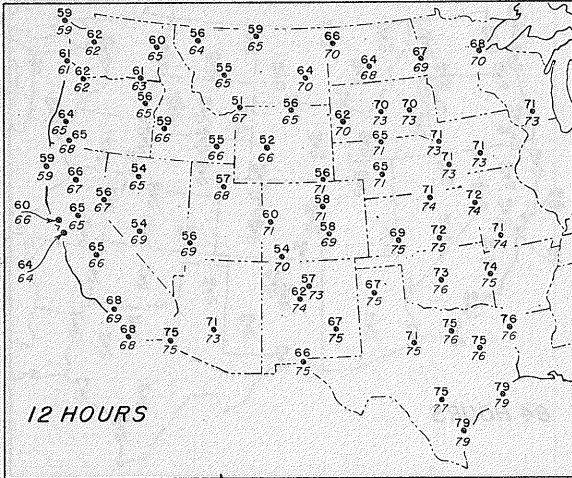


HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS
MID-AUGUST

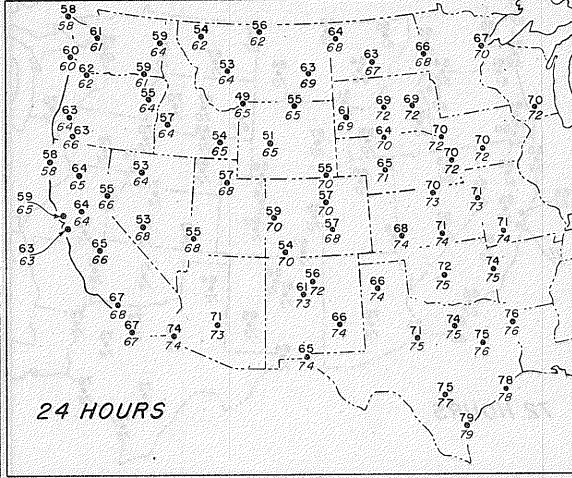
STATION MODEL
ACTUAL DEWPOINT
●
1000-MB. DEWPOINT

U. S. Department of Commerce

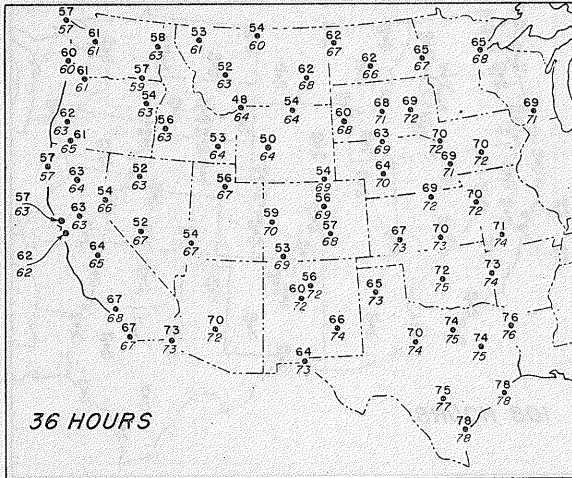
Weather Bureau



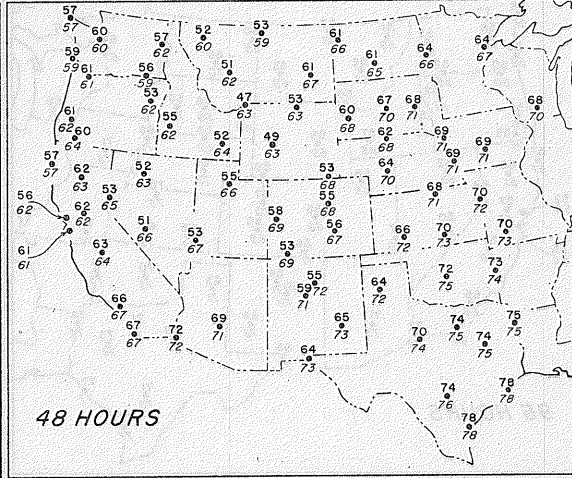
12 HOURS



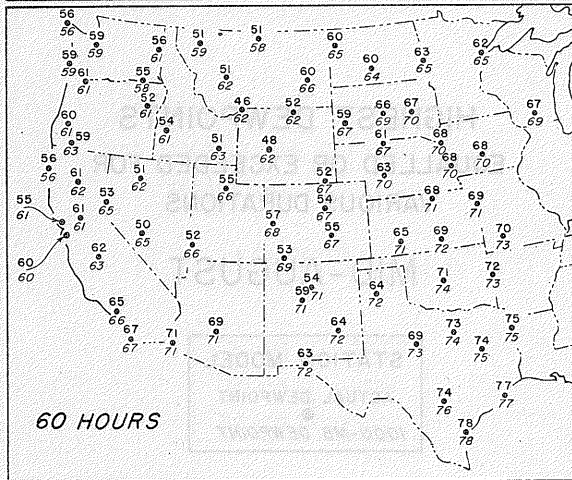
24 HOURS



36 HOURS



48 HOURS



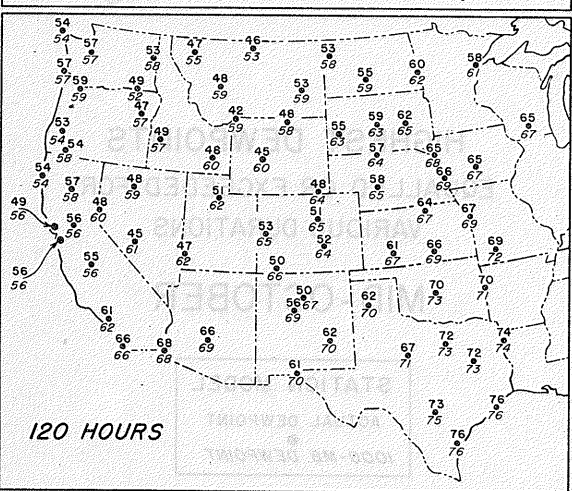
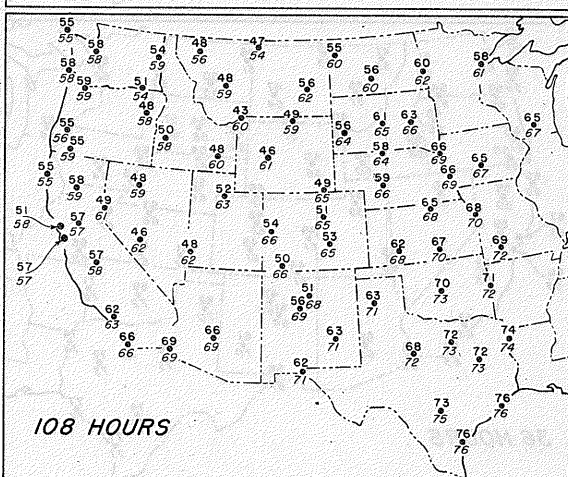
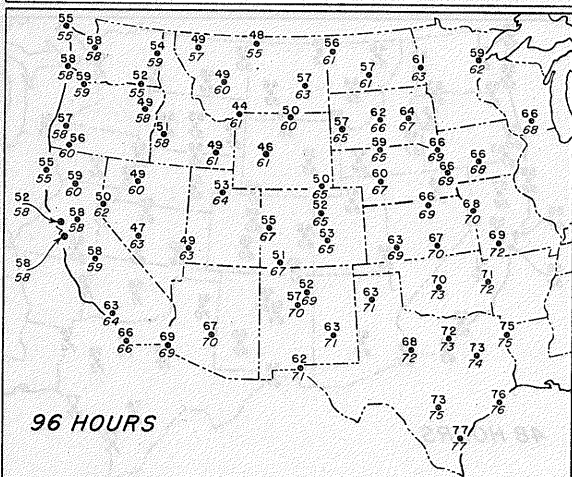
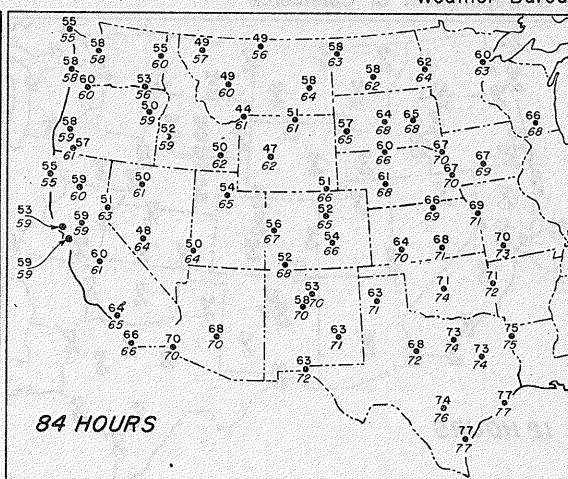
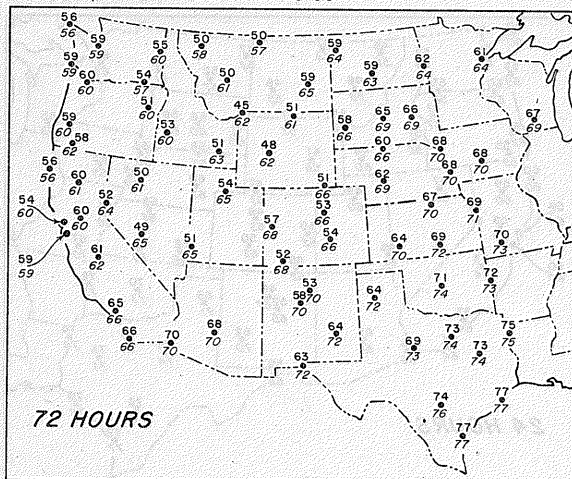
60 HOURS

HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS
MID-SEPTEMBER

STATION MODEL
ACTUAL DEWPOINT
●
1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau

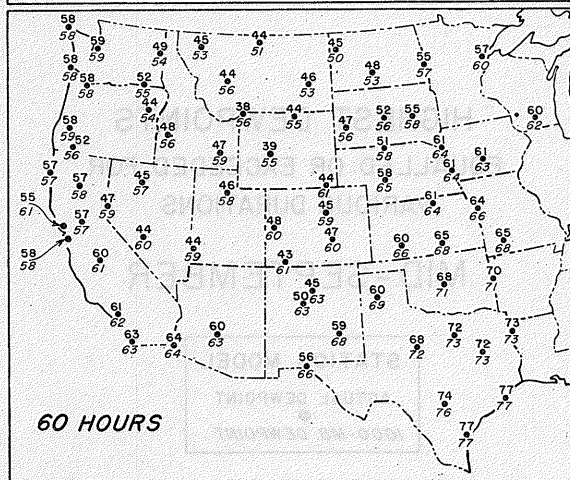
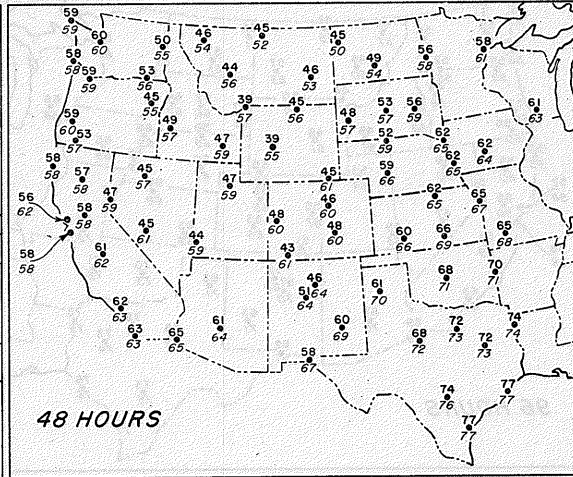
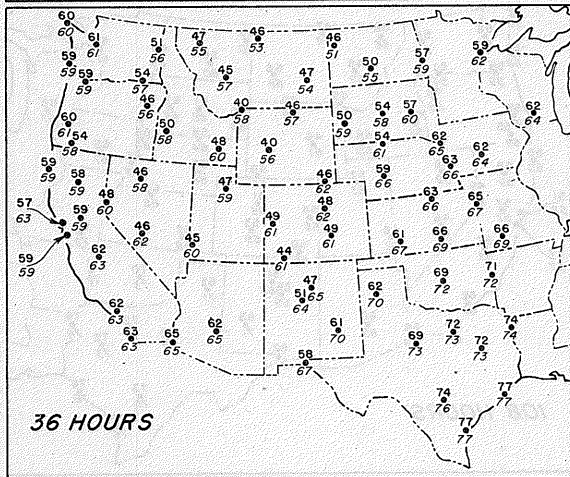
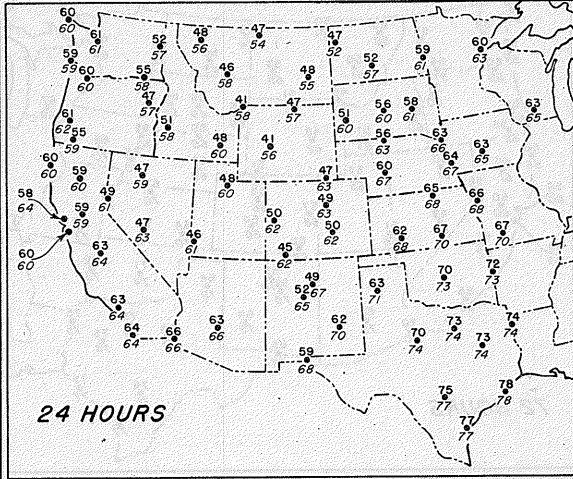
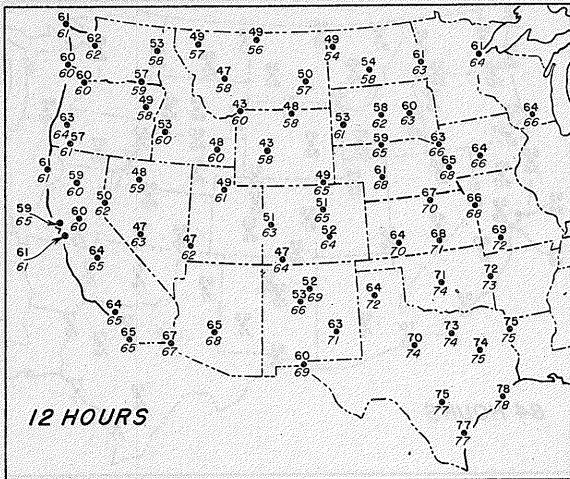


HIGHEST DEWPOINTS
EQUALED OR EXCEEDED FOR
VARIOUS DURATIONS
MID-SEPTEMBER

STATION MODEL
ACTUAL DEWPOINT
1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau

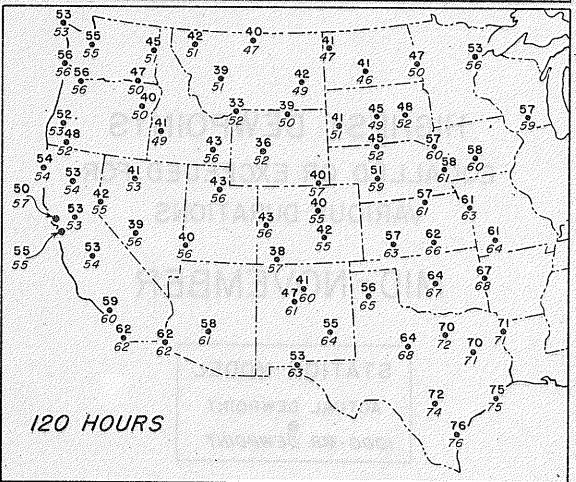
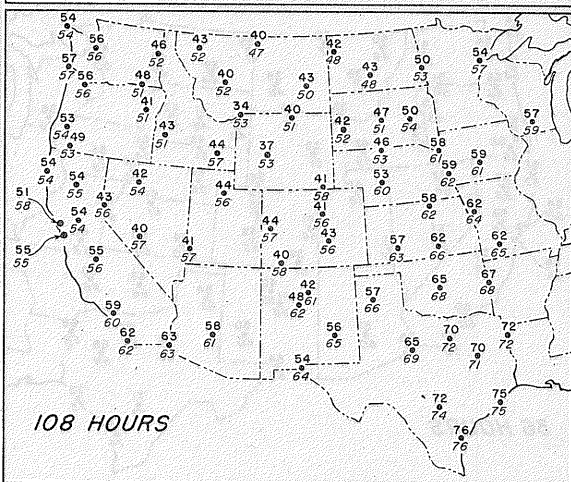
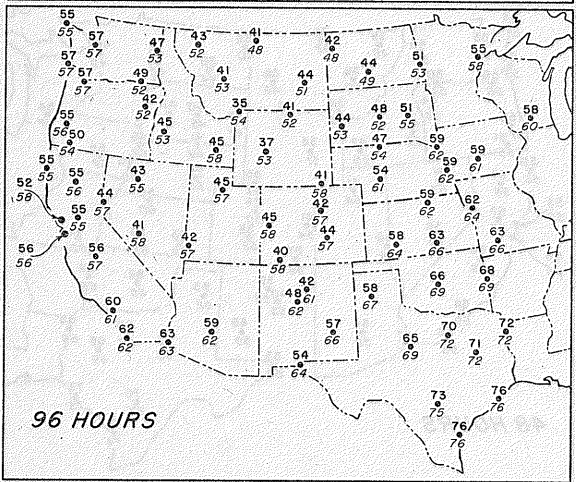
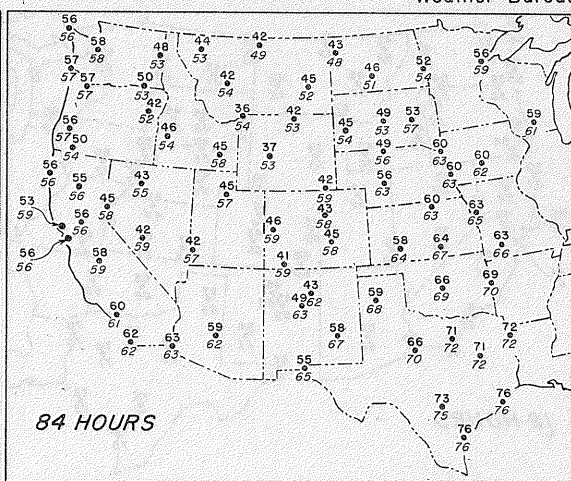
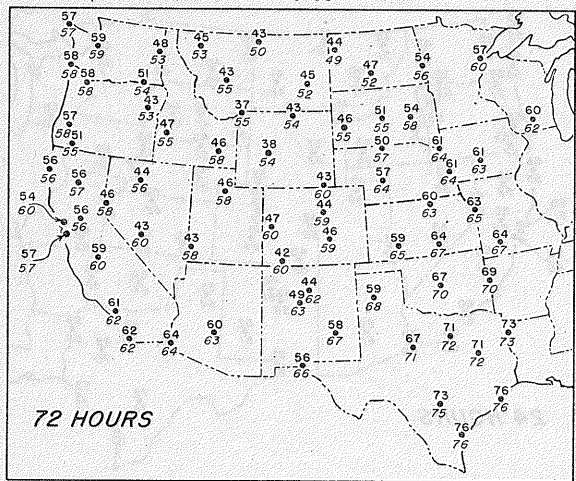


HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS
MID-OCTOBER

STATION MODEL
ACTUAL DEWPOINT
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1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau



HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS

MID-OCTOBER

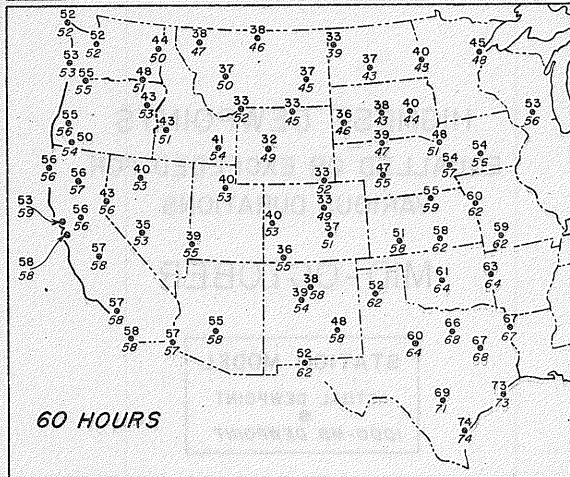
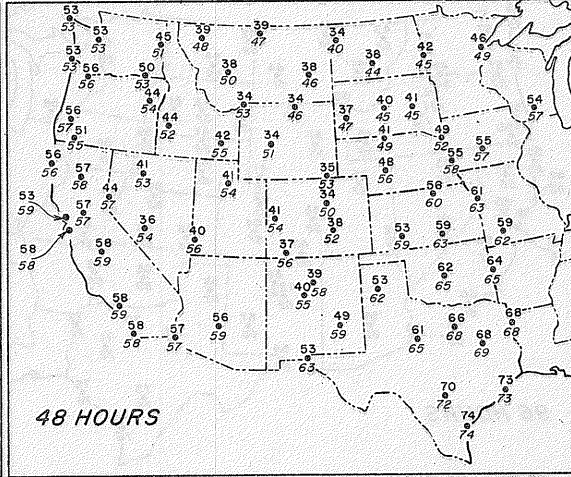
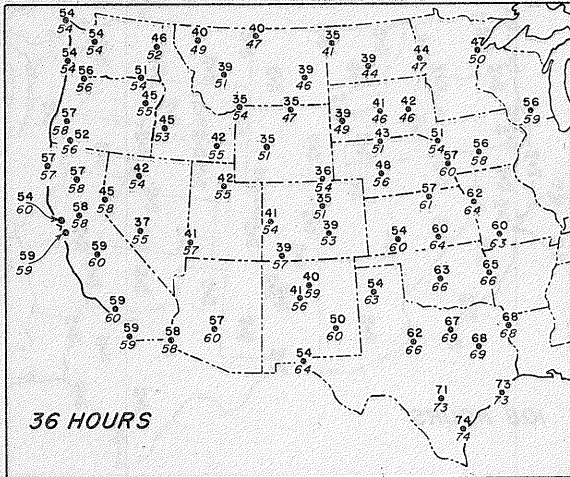
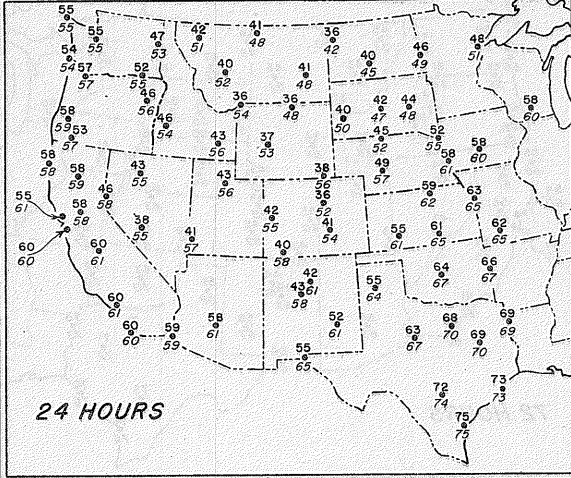
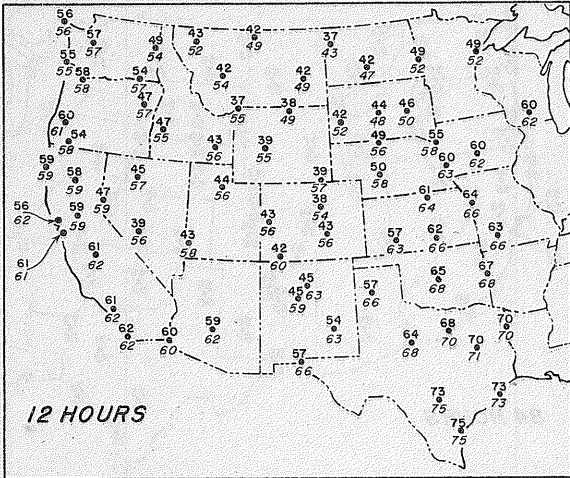
STATION MODEL

ACTUAL DEWPOINT

1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau

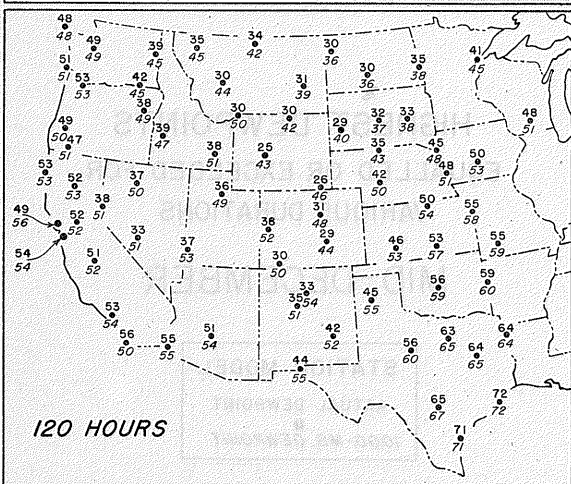
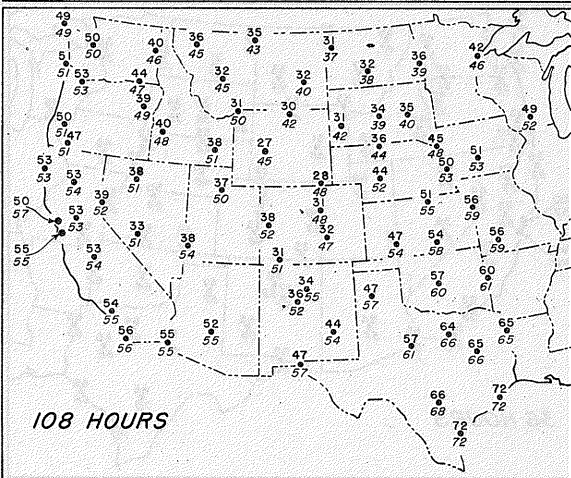
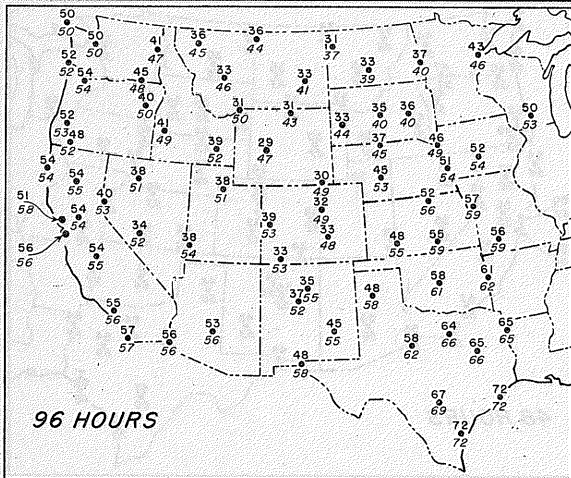
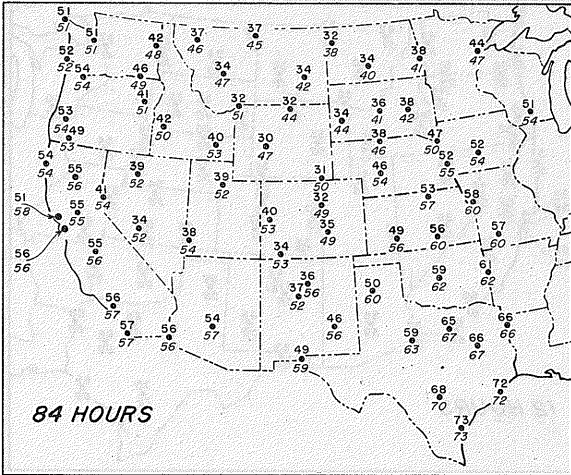
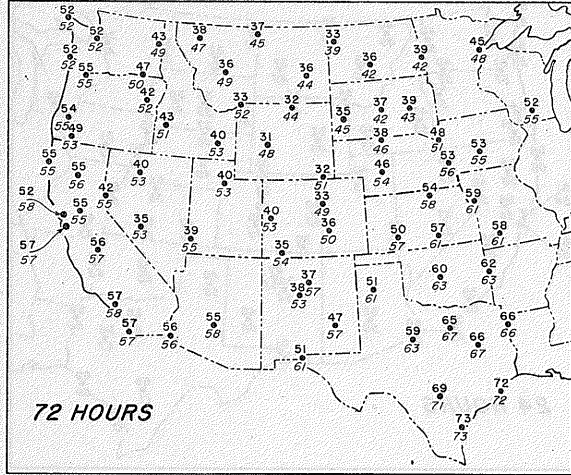


HIGHEST DEWPOINTS
 EQUALLED OR EXCEEDED FOR
 VARIOUS DURATIONS
 MID - NOVEMBER

STATION MODEL
 ACTUAL DEWPOINT
 1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau



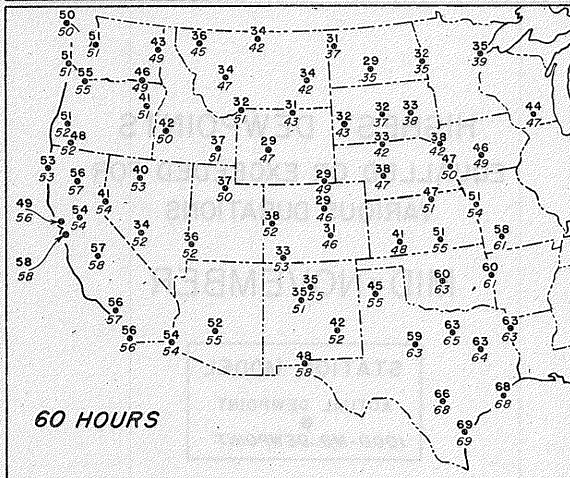
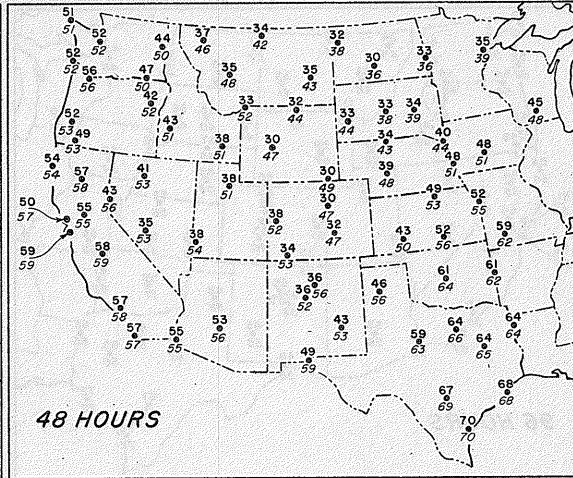
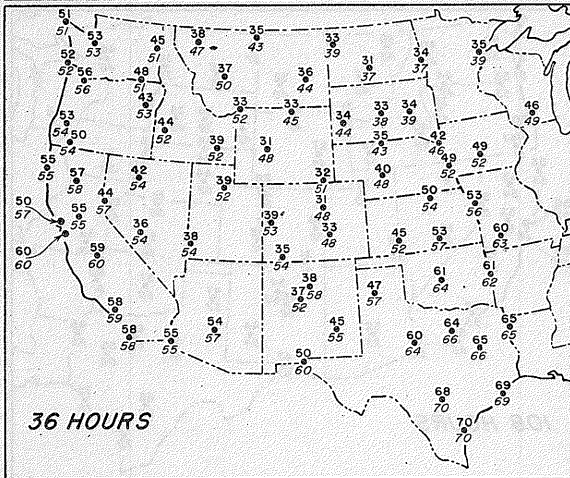
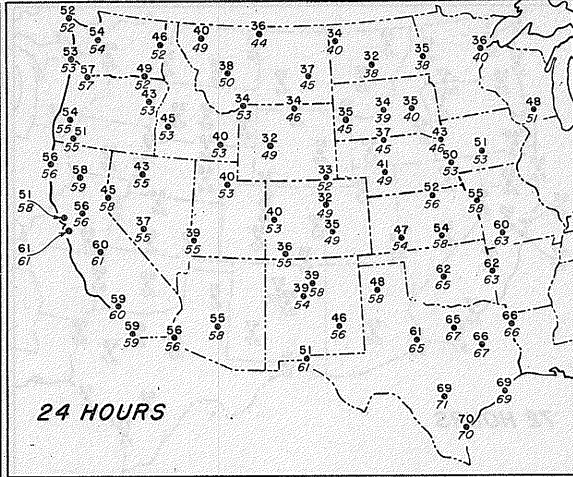
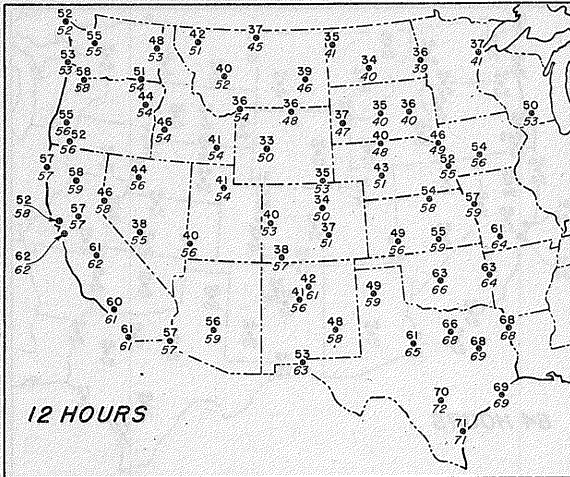
HIGHEST DEWPOINTS
EQUALLED OR EXCEEDED FOR
VARIOUS DURATIONS

MID-NOVEMBER

STATION MODEL
ACTUAL DEWPOINT
1000-MB. DEWPOINT

U. S. Department of Commerce

Weather Bureau

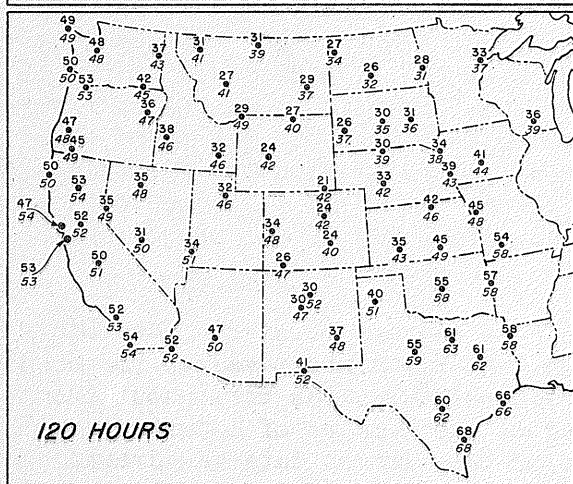
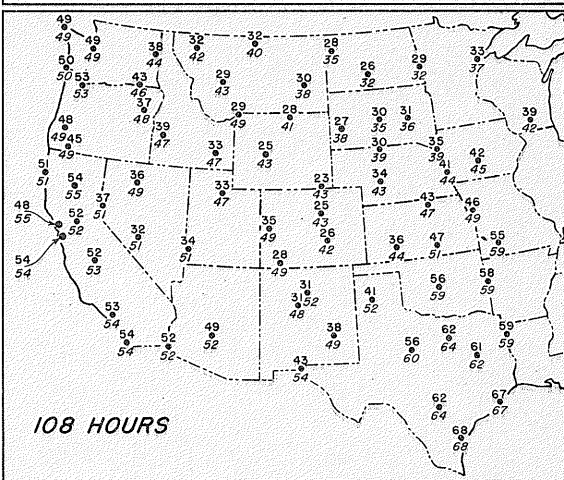
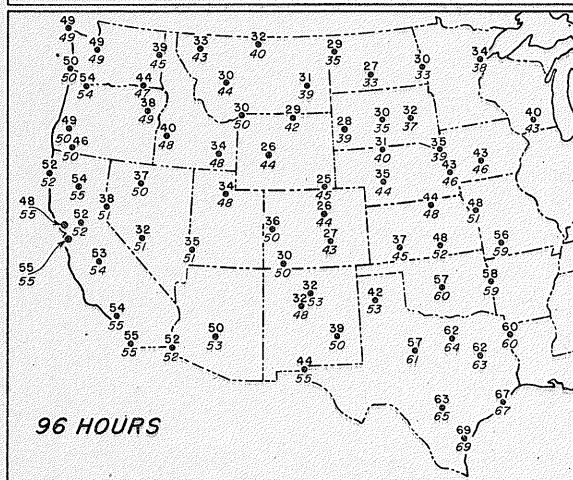
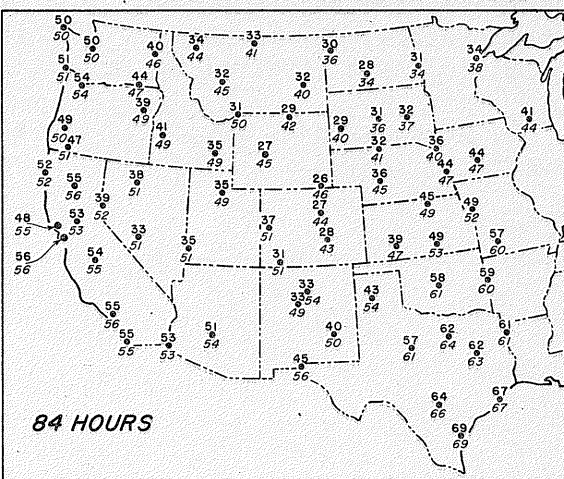
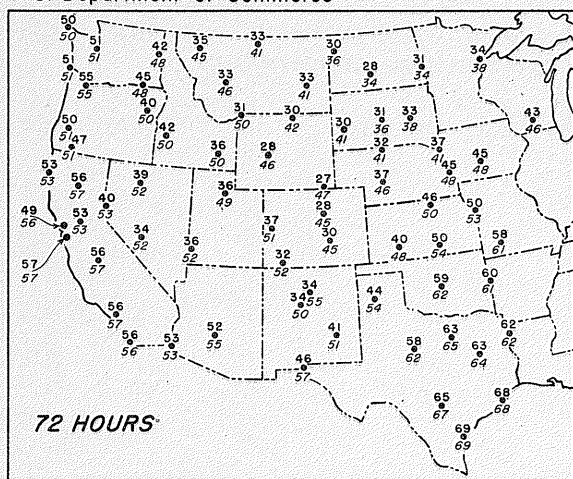


HIGHEST DEWPOINTS
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 VARIOUS DURATIONS
 MID-DECEMBER

STATION MODEL
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U. S. Department of Commerce

Weather Bureau



HIGHEST DEWPOINTS
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VARIOUS DURATIONS
MID-DECEMBER

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