200 miles apart, so that good forecasts are not always officially verified. Again, when these local storms are forecast for a given State, some of the towns may have a storm and some may not, so that certain persons may criticise adversely a perfectly correct forecast. Again, a discrepancy between the general public and the Bureau arises as to the system of verifying forecasts in one particular, viz, as regards temperatures in summer. The public notes the maximum temperatures of the afternoon; the Bureau verifies by the 8 p. m. map, several hours later than the time of maximum temperature. Now, if, after a hot day, a thunderstorm comes up and lowers the evening temperature decidedly, there is this difficulty in making the forecast. In the natural recovery of the ordinary summer temperature, the forecast should be warmer; but as the temperature before the storm was, for example, 95°, it is hardly fair to the public to make the forecast "warmer" for the 8 p. m. hour, since a higher maximum temperature would not probably occur. There is little else to be done than to sacrifice the record of the forecaster in favor of the public comfort.

A peculiar case of unexpected thunderstorms occurred on July 19, when they suddenly spread from the Lake region to the middle Atlantic coast, directly across the isobars of a high area. A fall of temperature occurred generally in New England and the North Atlantic States, where one would have expected a decided rise, judging from the positions of the high and low areas. These anomalies, in addition to the stagnant condition of the eastward movements, sometimes render the forecast of the summer months unusually difficult.—*F. H. Bigelow, Professor.*

COOL WAVE FORECAST.

An interesting case of the development of unusual weather conditions occurred during July 6–10. On the 6th an area of high pressure was central over New England, with every prospect that it would move to the northeastward. But on the 7th it began to settle southward along the Atlantic coast, and gradually became central on the south Atlantic coast, causing meanwhile thunderstorms in the east Gulf States. These were forecast on the 6th and 7th. Then, on the 8th, occurred a sudden fall in the pressure generally over the Atlantic States, with no apparent reason for it, and a low area developed over New England; at the same time a high area formed in the Northwest. On the morning of the 8th the forecast was made "pleasant temperature will prevail for two or three days in the District of Columbia, New England, and the Middle Atlantic States." A large high area passed over the northern districts, and from the 9th to the 13th cool and fair weather prevailed generally in these districts. These meteorologically rare conditions are by no means easy to understand, and they probably depend upon the atmospheric currents of the higher strata.—*F. H. Bigelow, Professor.*

HIGH TEMPERATURE FORECASTS.

On July 1, 2, 3, and 4 a warm wave with very high temperatures passed from the South Atlantic States northward over New England. During this period an area of high pressure was stationary off the south Atlantic coast, and a low area moved from the lower Missouri Valley and the Lakes to New England; these are conditions favorable for producing hot weather in the Atlantic States. On Chart VIII will be found the isotherms of the maximum temperatures for the above dates, showing the location of the hot wave. The forecasts of June 29 and 30 foretold the formation of the hot wave by saying, "high temperatures are indicated for the central valleys, the Gulf and Atlantic States, and New England," June 30; "continued high temperature" in same districts, July 1; "very high temperature," "very warm," July 2; "very warm," July 3, a. m.; "the temperature will be lower Monday in New England and the Middle Atlantic States," July 3, p. m.; "cooler weather," "cool in New England and the Atlantic States," July 4.

By following the progress of the heated area toward the northeast, and comparing with the forecasts, it will be seen that the course of development was satisfactorily anticipated.

From July 22 to 29 high temperatures prevailed on the Rocky Mountain slope, and the air being dry this period was unfavorable to the crops of those districts. A sketch of the series of maximum temperatures, frequently above 100°, is found on Charts Nos. IX, X, XI, and XII. The following forecasts were made: July 21, 8 p. m., "the temperature will continue warm throughout the Rocky Mountain districts;" July 22, "very high temperature will prevail on the Rocky Mountain slope;" July 23, "the temperature will continue high in the Southwest States;" and similarly for the following dates till the hot wave was broken. During this period the temperatures were high also in the Atlantic States but moderate in the Lake region.—*F. H. Bigelow, Professor.*

FORECASTS AT CHICAGO, ILL.

No storm signals were ordered for the upper Lakes during the month and no winds of a violent character occurred, except in the form of local squalls, which were forecast in daily advisory telegrams sent to Lake ports.

The most important weather feature of the month in the agricultural districts of the West and Northwest was the very warm and dry period, which continued until the 19th. The hot winds, which marked the closing days of the heated spell, had become a serious menace to crops, and the break in temperature during the day and night of the 19th was attended by local rains and thunderstorms generally in the principal corn and wheat growing States.

The Chicago morning forecast of the 18th called for—

> Local rains and thunderstorms in the northern tier of States from Michigan to Montana.

And the forecast of the 19th reads:

> The indications are that showers will occur this afternoon and to-night in the States of the Missouri and upper Mississippi valleys and the western Lake region, with a more moderate temperature. On the upper Lakes fresh to brisk south to southwest winds, with local rains and thunder squalls, during the next twenty-four hours.

The anticipated thunderstorms were not severe, except over extreme southern Lake Michigan and in the neighborhood of Chicago, where a day of intense heat was followed, about 7 p. m., by a fall in temperature of 25° in twenty minutes and a rather severe squall of wind and rain. The morning local forecast for Chicago and vicinity was:

> Conditions will be favorable for thunderstorms, squalls, and lower temperature to-night.

The forecasts were verified in detail.

Although high temperature prevailed in the corn and wheat growing districts during the remainder of the month, local rains, which were copious in localities, prevented a reestablishment of the drought conditions which were developed prior to the 19th.

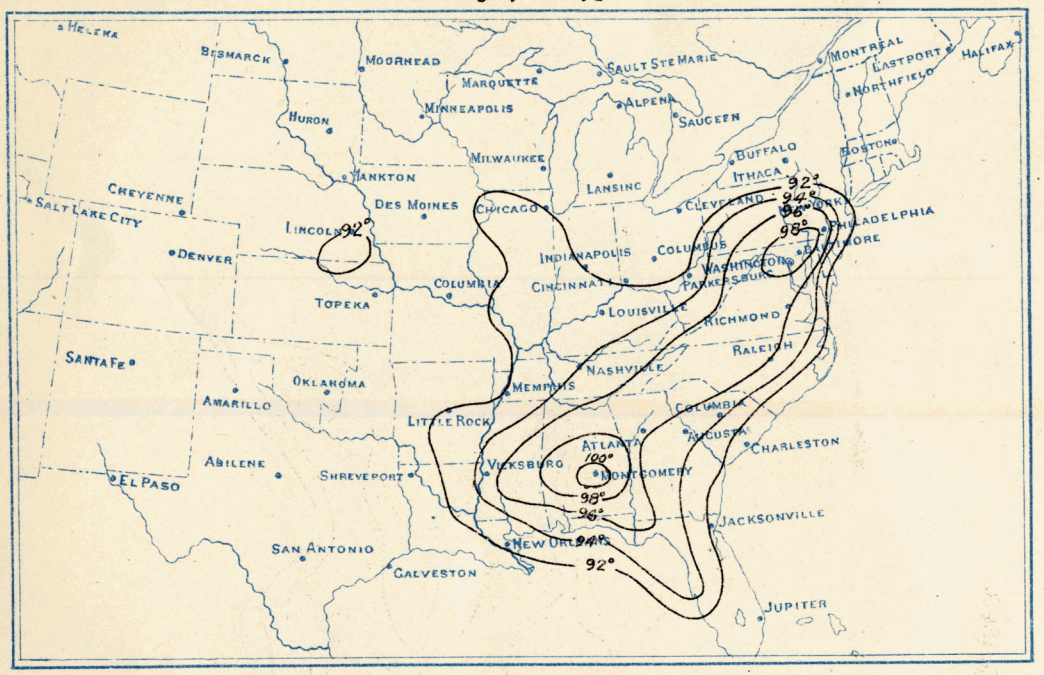
An extraordinary fall of hail attended a thunderstorm at Chicago the evening of the 28th. Hail, varying in size from one-half to two inches in diameter and one-fourth to one-half inch in thickness, fell in a comparatively narrow belt which crossed the city from west-southwest to east-northeast, covering the business center and causing considerable damage, principally to window glass.—*E. B. Garriott, Professor and Forecast Official.*

FORECASTS AT SAN FRANCISCO, CAL.

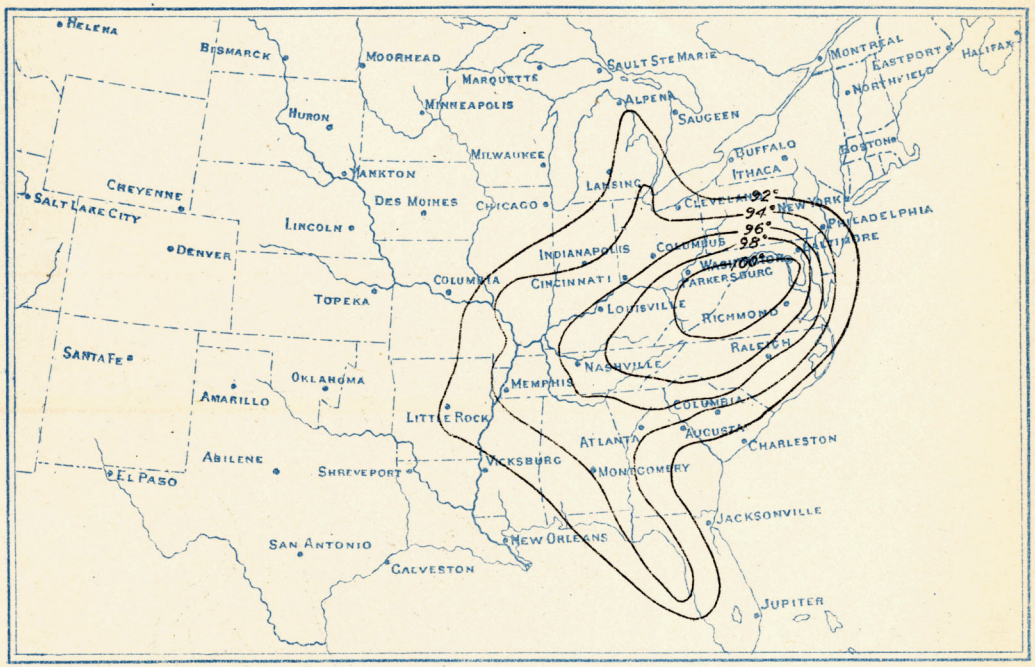
No wind signals were ordered from this station during the month.

Chart VIII. Maximum Temperatures.

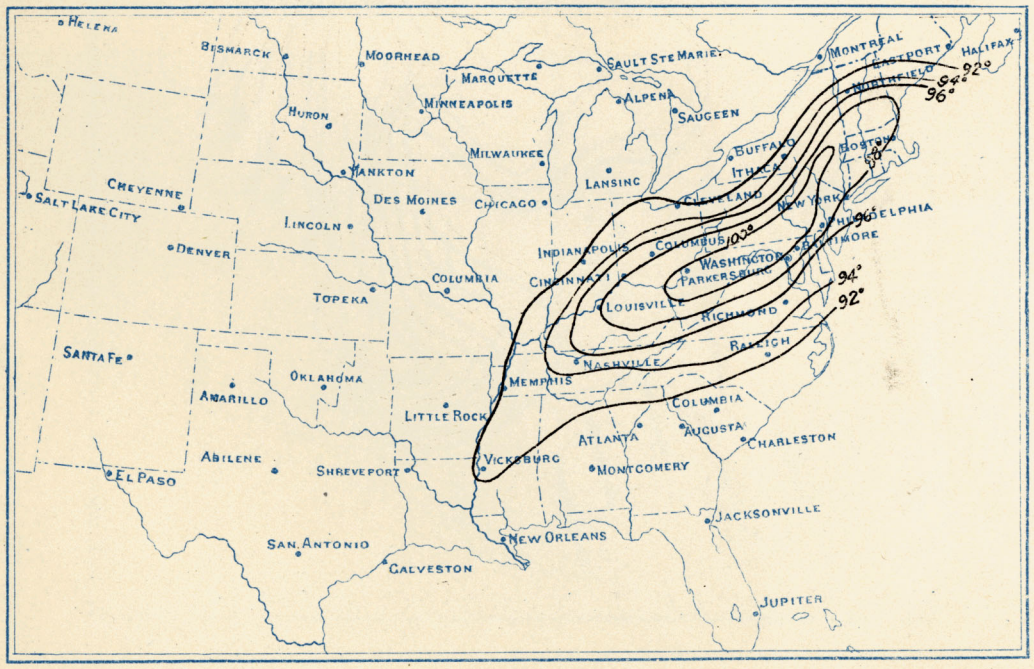
a. July 1, 1898, p. m.



b. July 2, 1898, p. m.



c. July 3, 1898, p. m.



d. July 4, 1898, p. m.

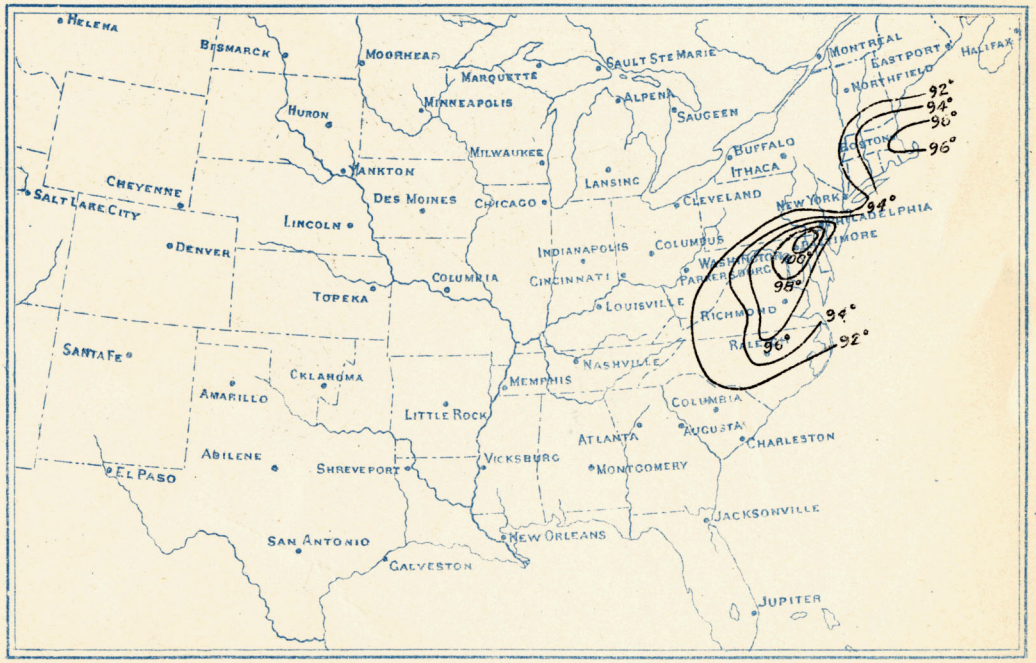
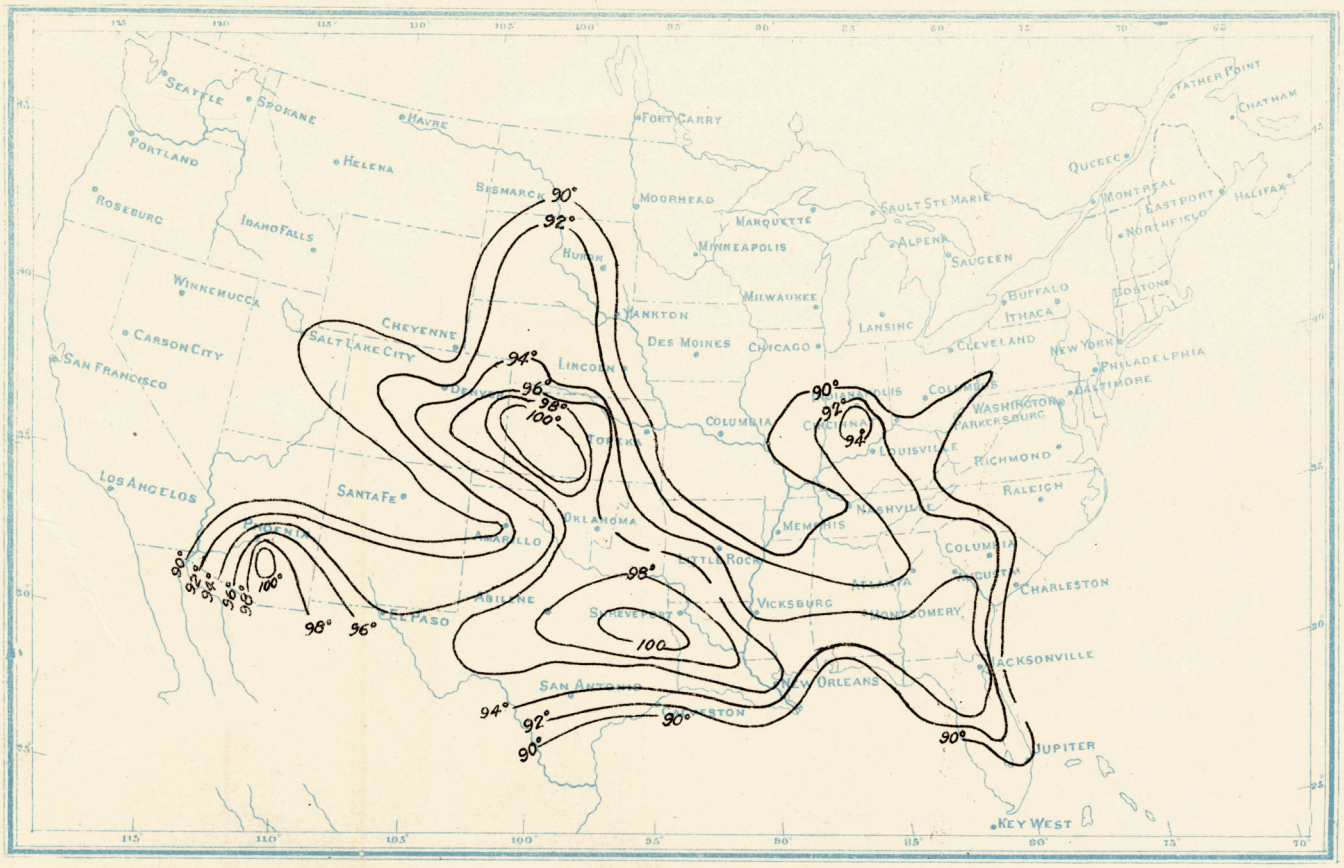


Chart IX. Maximum Temperatures.

a. July 22, 1898.



b. July 23, 1898.

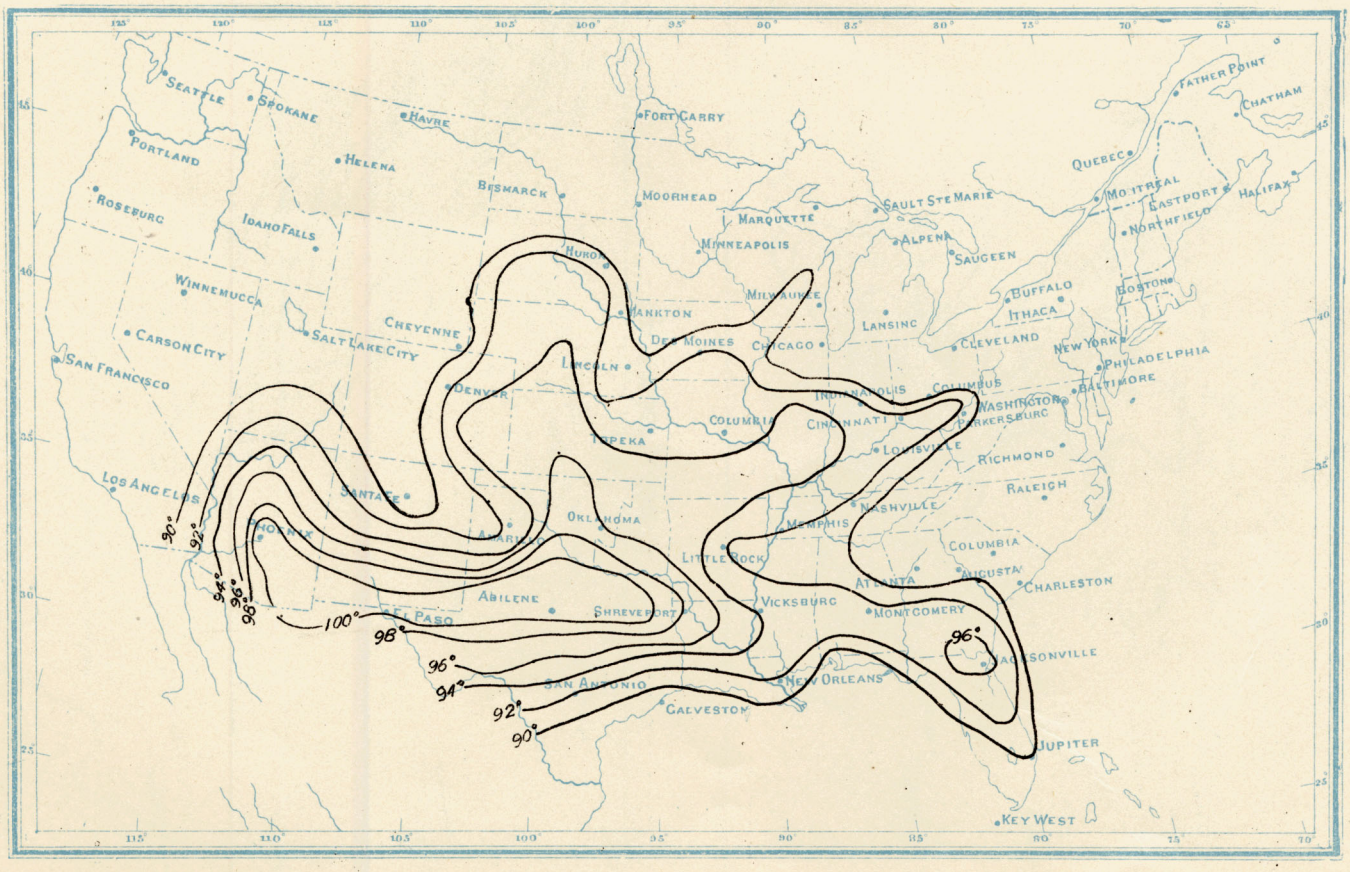
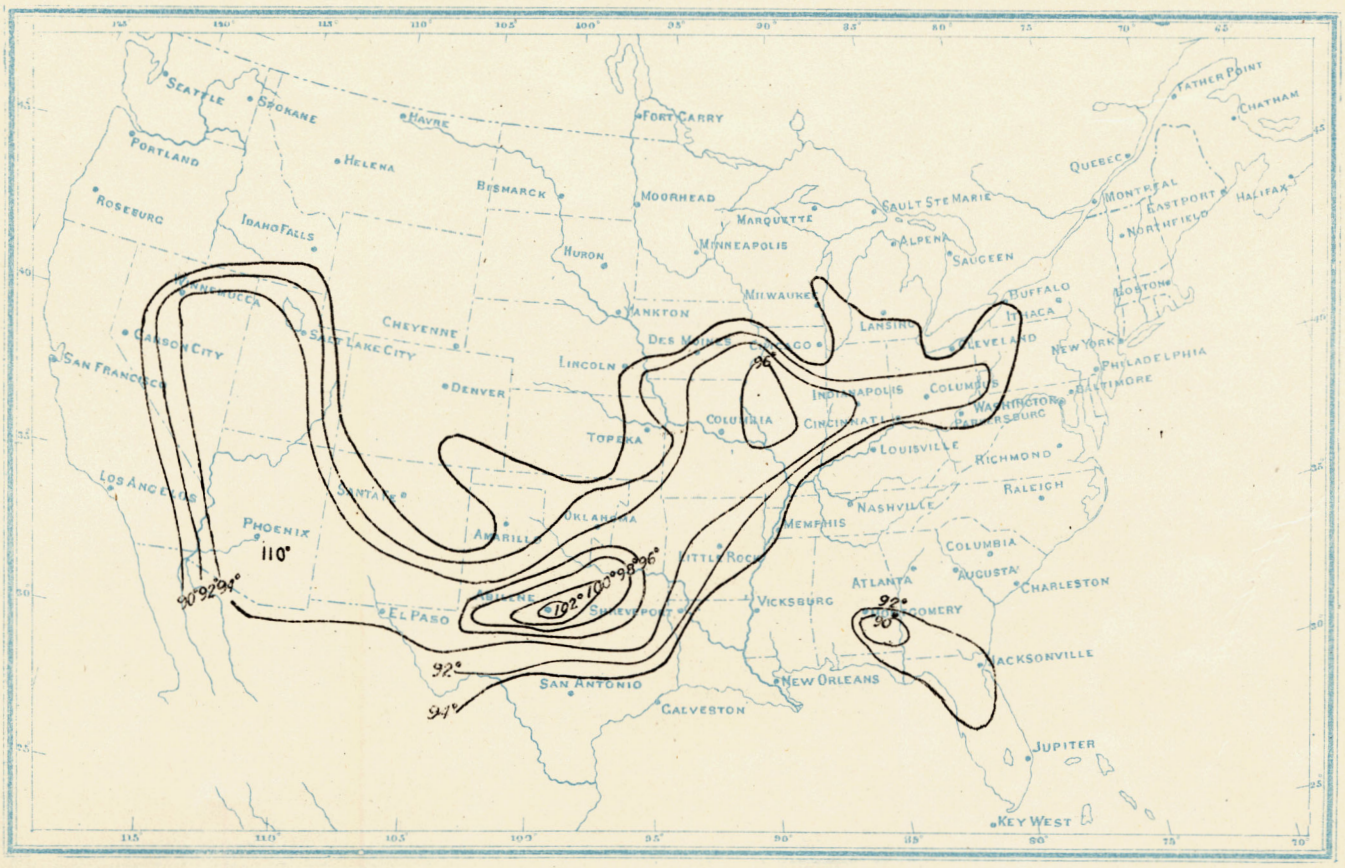


Chart X. Maximum Temperatures.

a. July 24, 1898.



b. July 25, 1898.

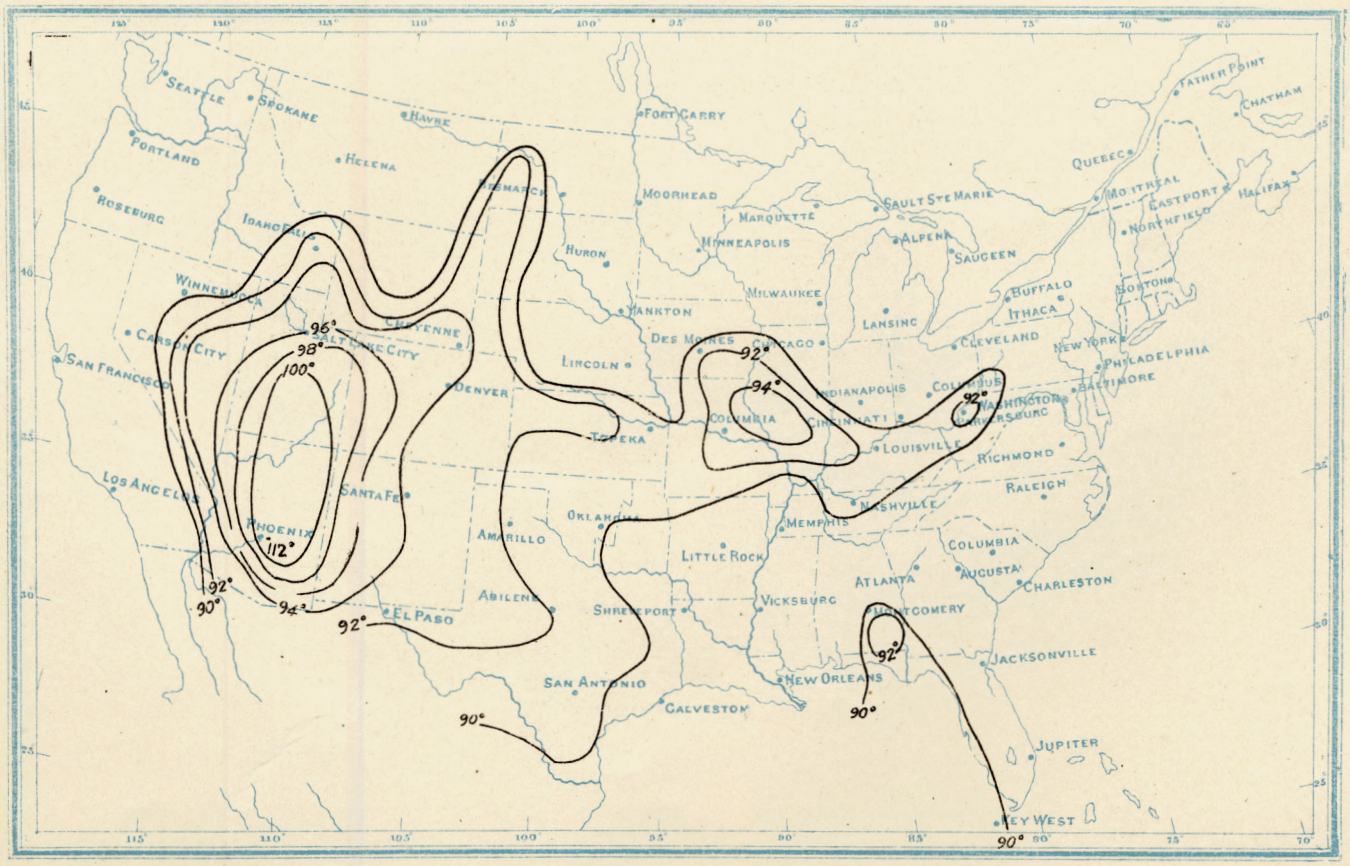
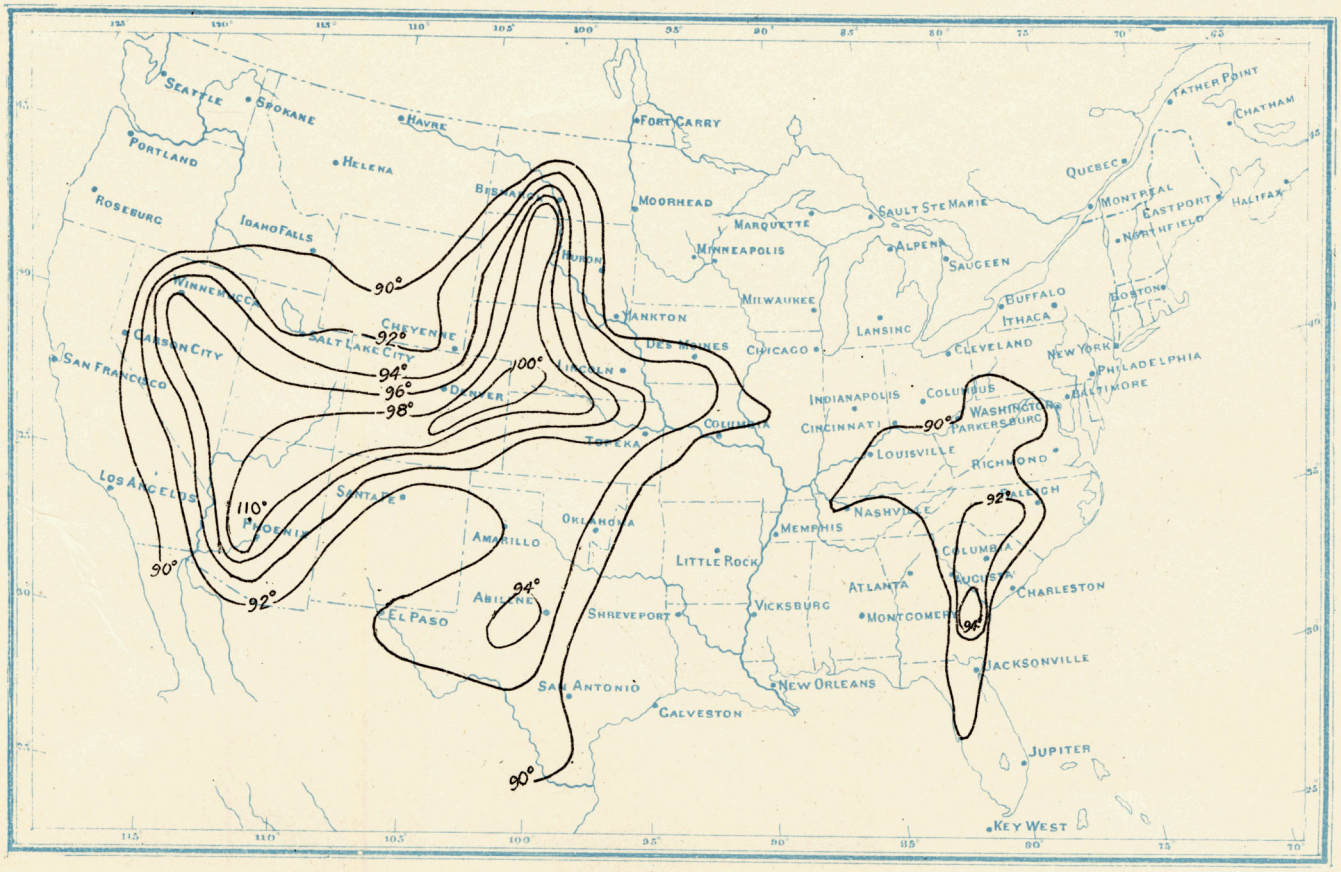


Chart XI. Maximum Temperatures.

a. July 26, 1898.



b. July 27, 1898.

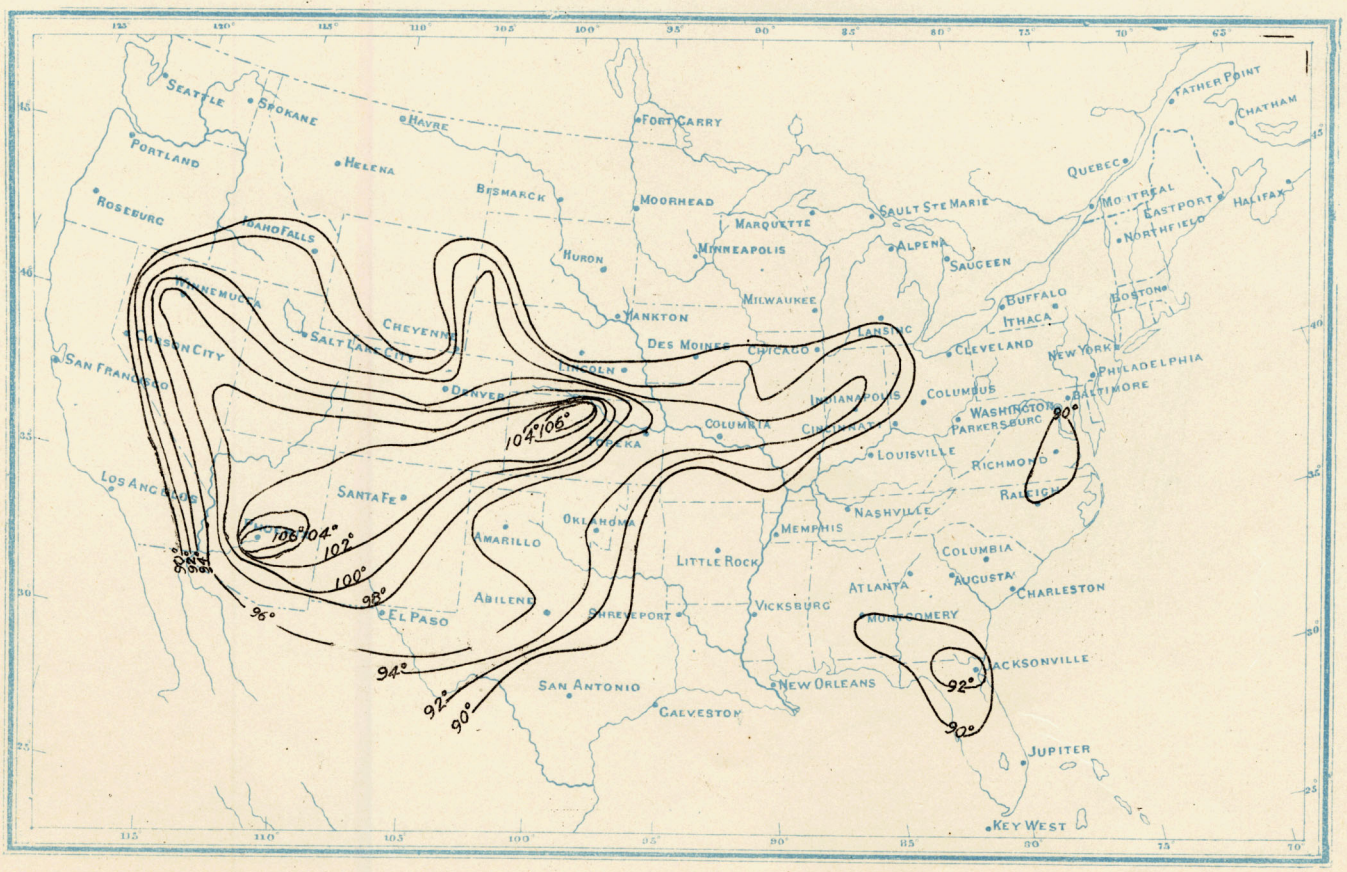
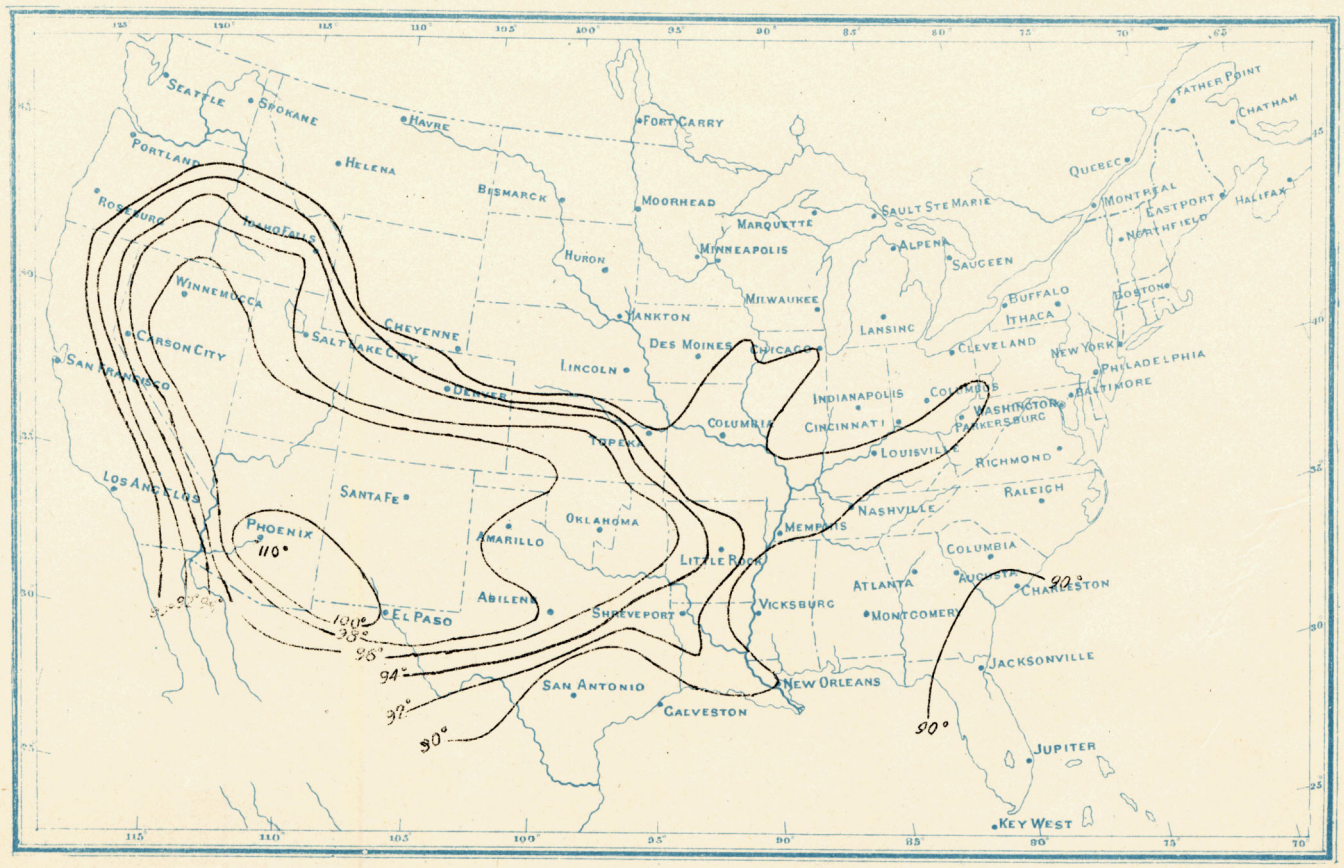
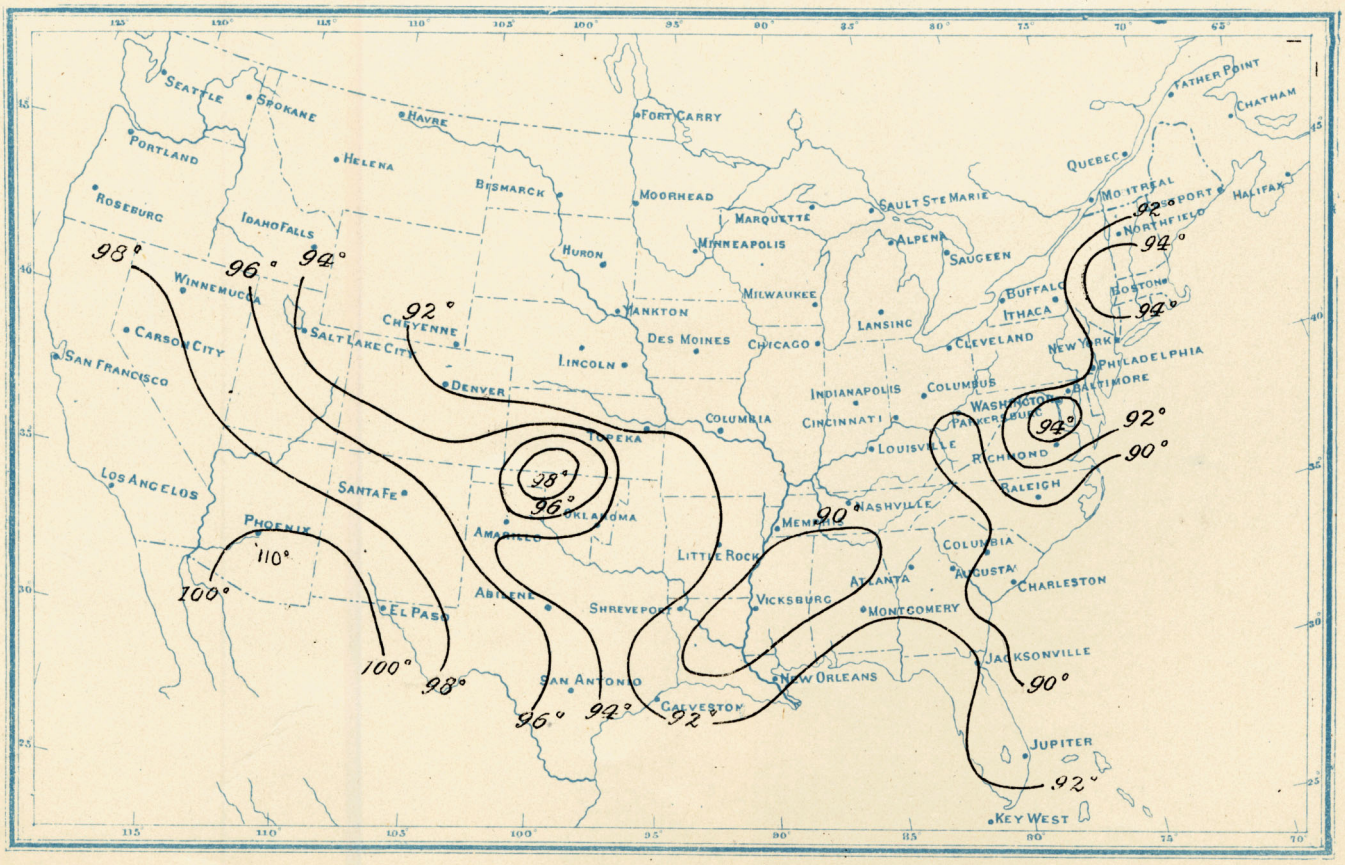


Chart XII. Maximum Temperatures.

a. July 28, 1893.



b. July 29, 1893.