SPECIAL REPORT ON THE FLOOD IN THE BRAZOS RIVER VALLEY, TEXAS, JUNE 27 TO JULY 15, 1899, WITH NOTES OF PREVIOUS OVERFLOWS OF THE BRAZOS.

By I. M. CLINE, Local Forecast Official and Section Director.

The Brazos River, with its tortuous channel of nearly one thousand miles in length, passes through a narrow valley which ranges in width from a few miles to several miles in different localities. This valley is unsurpassed for productiveness. The banks of the Brazos for 200 miles from its mouth range in height from 20 to 40 feet, and in ordinary seasons are not overflowed to any serious extent. Heavy rains about its source cause the river to swell into a torrent, which flows with great impetuosity, but does not often overflow its banks. The banks of the river are formed of a tenacious red or blue clay which yields very slowly to the force of the current. The width of the channel ranges from 150 to 200 feet. The gradient of the river from Waco to the Gulf of Mexico is little more than two feet to the mile.

The recent flood resulted from heavy rains which set in near the mouth of the Brazos on the afternoon and night of June 26 and progressed slowly inland until June 28, when phenomenally heavy rains occurred over the central portion of the Brazos drainage basin. In some localities the rains were unprecedented in the history of Texas.

The heaviest rains were recorded as follows during the seventy-two hours ending 8 a. m., June 28: Alvin, 7.27 Brazoria, 7.83; Galveston, 3.20. During the seventy-two hours ending 8 a. m., June 29: Columbia, 8.06; Conroe, 7.31; Danevang, 11.07; Houston, 5.49; Rock Island, 10.15; Sugarland, 10.50; Victoria, 5.00. During the seventy-two hours ending 8 a. m., June 30: Brenham, 19.99; Cuero, 12.86; Hewitt, 14.95; Lampasas, 4.80; Panter, 7.12; Waco, 7.30. The rain gage at Hearne overflowed at 24 inches. The observer at that station estimates the amount at 30 or 40 inches in less than twenty-four hours during the 28th and early morning of the 29th. These rains were all at an elevation of less than 500 feet above sea level.

The heavy rains appear to have resulted from a semitropical storm which had moved northward from the central portion of the Gulf of Mexico. This storm was first noted on the a. m. weather map of June 26, 1899, and later in the day a high tide and heavy swell at Galveston, Tex., indicated a storm of considerable energy at sea to the south of Galveston. Storm signals were displayed at Galveston on the afternoon of June 26 as a warning that a Gulf storm was approaching. During the night of June 26 the storm moved inland and its energy had greatly diminished from that at first shown by the ocean swell. Judging from the progressive movement of the heavy rainfall, the storm died out as it moved inland at the slow rate of about five miles per hour. The heavy rainfall occurred near the coast twenty-four to thirty-six hours earlier than at Hearne and Waco. A study of the rainfall at all stations shows the progressive movement of the storm from the coast inland, notwithstanding the barometric gradients at the surface were not sufficient after the storm left the coast to indicate the position of its center on the chart. The lowest barometer recorded at Galveston during this storm was 29.74 inches, at 8 p. m., June 26. The dying storm was opposed on June 27 and 28, by an area of high pressure moving southward from the northwest. Such was the distribution of atmospheric pressure at the earth's surface during the occurrence of these rains.

The heavy rains recorded on the mornings of June 27 and 28 near the mouth of the Brazos filled all its tributaries and the main river in that section almost to the top of their banks, while the phenomenally heavy rains recorded on June 28, 29, and 30 in the central portion of the Brazos drainage basin not only filled all the tributaries of the Brazos in that section, but overflowed all low lands. On June 29 all streams in Bosque, McLennan, Falls, Milam, Robertson, Brazos, Burleson, and Washington counties were higher than ever before known, and the Brazos was rising at an unprecedented rate. The flood in these counties was the most sudden in the history of the country. The Brazos did not overflow its banks north of McLennan County. At Waco the river reached its highest on the morning of June 30 when it was within six inches of the highest water ever noted at that point; in east Waco 50 to 100 blocks were flooded. On the afternoon of June 30 the Brazos began falling at Waco, but was rising with the same rapidity and suddenness at all points south of McLennan County and north of Austin County as that which characterized the rise at Waco. On July 1 a second flood reached McLennan County, and the river rose nearly as high as it did on June 30. On July 1 and 2 the crest of the flood appears to have occupied a position near the junction of the main Brazos and Little Brazos rivers in Robertson and Brazos counties. The waters from the two rivers rose rapidly over the rich valley between them on which were large plantations with gins, stores, and residences. The waters from the two rivers joined so rapidly that some of the inhabitants did not have time to escape, and 24 lives were lost in Robertson County. The thriving town of Calvert, in this county, was cut off from communication with other portions of the State from July 1 until July 3, when communication was again restored. From this time the crest of the flood moved slowly toward the Gulf of Mexico at the rate of about twelve miles per day and disappeared in the Gulf July 15, 1899. The crest of the flood was seventeen days in passing from Waco to the mouth of the Brazos. At Richmond the water was 3 to 7 feet in all the houses on the lower streets on July 5 and 6. Small towns in Brazoria County suffered as the flood moved southward. This flood was not only marked on account of the suddenness with which it reached dangerous proportions, but it was also the most extensive flood in all respects that has ever been known in the Brazos Valley.

The following table gives the rainfall during the flood period from June 27 to July 4, inclusive:

Station.	Rainfall.	Station.	Rainfall.	Station.	Rainfall.
	Inches.		*Inches.*		*Inches.*
Abilene	5.58	Emory	5.80	Luling	4.58
Alvin	7.28	Estelle	3.54	Mann	10.08
Amarillo	0.90	Fort Brown	T.	Marathon	0.18
Anna	3.21	Fort Clark	3.31	Monahans	0.00
Austin	2.10	Fort Ringgold	0.54	New Braunfels	1.02
Ballinger	2.24	Fredericksburg	0.80	Palestine	9.68
Beaumont	3.34	Fruitland	0.72	Panter	8.36
Beeville	1.01	Gainsville	3.59	Paris	0.52
Blanco	1.00	Galveston	3.38	Point Isabel	0.00
Boerne	2.38	Georgetown	5.66	Roby	1.10
Brazoria	6.68	Grapevine	5.64	Rock Island	10.64
Brenham	21.46	Hale Center	T.	Rock Springs	0.00
Brighton	0.42	Hallettsville	12.91	Runge	2.32
Brownwood	1.64	Henrietta	0.38	Sabine Pass	0.44
Burnet	2.70	Hewitt	15.70	San Antonio	1.46
Camp Eagle Pass	3.50	Hondo	1.80	Sanderson	0.00
Coleman	2.48	Honeygrove	0.64	San Marcos	2.84
Colorado	1.54	Houston	7.02	Sherman	1.62
Columbia	10.46	Hulen	2.80	Sugarland	10.50
Conroe	7.95	Huntsville	8.56	Temple	12.42
Corpus Christi	0.92	Jacksonville	4.94	Texarkana	1.43
Corsicana	6.10	Jasper	1.02	Tyler	4.10
Cuero	13.80	Junction	0.96	Victoria	5.27
Dallas	3.58	Kent	0.89	Waco	7.30
Danevang	13.12	Kerrville	0.68	Waxahachie	7.04
Dublin	6.54	Lampasas	6.22	Weatherford	5.36
Duval	6.64	Llano	1.02	Wichita Falls	1.43
El Paso	0.34	Longview	1.98		

The geographical distribution of rainfall in Texas during this flood is shown on fig. 1, which has been drawn to represent the rainfall as given in the accompanying table.

Nearly a half century had passed since a flood of such proportions has occurred in the Brazos River, and it has been fourteen years since there has been an overflow of any consequence. The planters had constructed tenant houses on the low lands,

and owners of small farms had built their homes without considering the possibilities of such a flood. The productiveness of the soil had caused the agriculturists to approach nearer the banks of the river each year until the greater portion of this valley had reached a high state of cultivation. Hence the damage from this flood to agricultural interests was very great. All crops on the first bottoms of the Brazos and several of its tributaries from McLennan County south were totally destroyed, and in places the crops on second bottoms were badly damaged. Cotton planters suffered most; a large amount of corn was destroyed, and much sugar cane was lost. The loss to truck growers was very heavy. Farming implements, stock, and many of the small houses in the bottoms were washed away. The number of lives lost was between 30 and 35. Some of those reported drowned at first have since been found alive. This is said to be the first loss of life from overflows of the Brazos River.

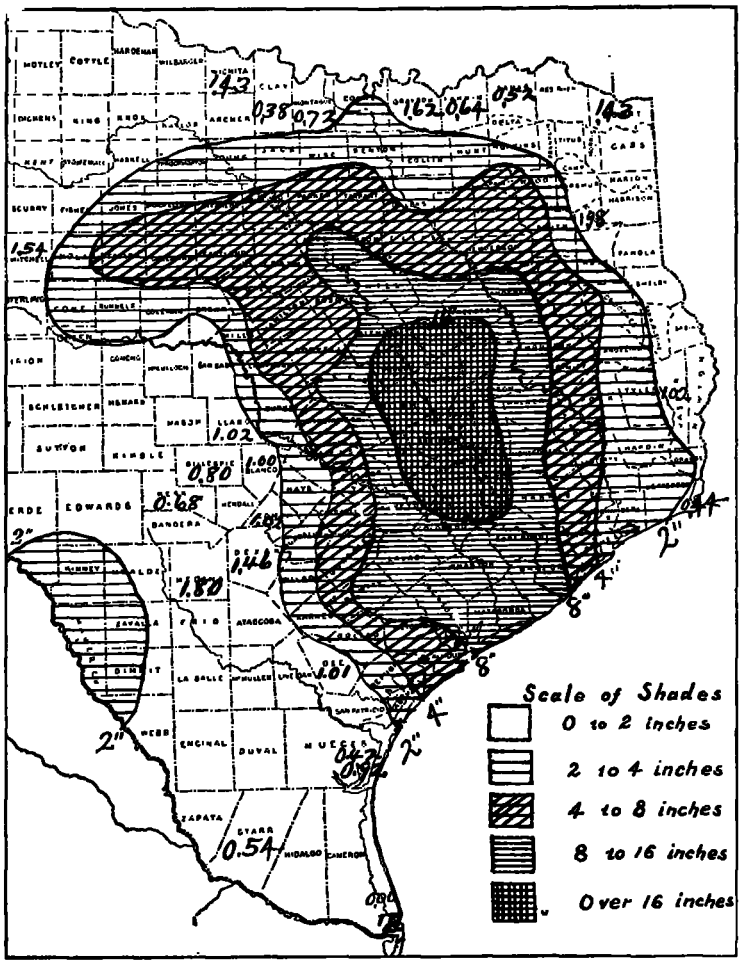

Fig. 1.

From the best available sources a conservative estimate has been made of the losses to agricultural and kindred interests by counties is as follows: Limestone, $10,000; McLennan, $10,000; Bell, $46,200; Falls, $345,000; Milam, $1,000,000; Robertson, $320,000; Burleson, $716,000; Brazos, $350,000; Washington, $1,036,656; Grimes, 275,000; Austin, $450,000; Waller, $480,000; Fort Bend, $2,500,000; and Brazoria, $152,000. There were small areas flooded in other counties, but the water did not remain over the crops long enough to seriously injure them.

The aggregate loss to individuals, plantations, municipalities, and counties is, according to these estimates, $7,690,856. The loss to railroads is conservatively estimated at $1,000,000, which makes the total loss as a result of the overflow, $8,690,856.

The extent of the flooded area is shown on fig. 2. The information on which this chart is based was carefully and systematically collected, and it is believed that it represents the actual flooded area as nearly as can possibly be shown. On receipt of instructions to prepare this report, rough charts of the counties in which the flood occurred, on a large scale, were sent to each postmaster and crop correspondent in the flooded district requesting each to show the width of the river, when at its highest, in his locality according to the scale. On receipt of the individual charts they were all redrawn on one chart. The width of the flood along the Brazos varied from about two miles in McLennan County to 25 miles near the mouth of the river. There are some small elevated places along the river which were not covered with water, but which could not well be shown through the shading.

THE PREVIOUS FLOODS OF THE BRAZOS.

The occurrence of this flood has called up references to previous extensive floods along the Brazos. The first in 1822, the next in 1833, another in 1843, one in 1852, and one in 1885. Since there is no written history of these floods, it appears that the publication of reliable information concerning them, along with the report of the flood of this year, will be of interest and value as part of the history of the weather in Texas. All available information should be published so as to preserve it. It is difficult to obtain information regarding the earlier floods, as files of newspapers published at the time of their occurrence, and which might have contained some account of their extent, have been destroyed by fire. All floods previous to this year have been earlier in the season, as a rule, in May.

On May 26, 27, 28, and 29, 1885, heavy rains fell over the central and northern portions of the Brazos drainage basin. The heaviest rainfall reported, 8.38 inches, was at Hewett, in McLennan County. Floods were reported from McLennan, Bosque, Falls, and Robertson counties, May 29, 1885. In Falls County the Brazos was five miles out of its banks, and all the bottom lands in the county were inundated. The loss at Waco on May 29, 1885, was placed at $103,000. The crest of the flood reached the vicinity of Hearne, May 31; between the main Brazos and Little Brazos everything was submerged, and water was higher than since 1852. The crest of the flood reached Austin County June 4, 1885, and reached Columbia, in Brazoria County, June 12. The water was within four inches of the highest water of 1852 at Columbia. North of Brazoria County the overflow of 1885 was not as high as that of 1899 by four to six feet.

The overflow of 1852 commenced during the latter part of February, and its crest reached the Gulf of Mexico about March 5. I can find no reference to the extent of this flood north of Brazos County. The overflow being early in the season no material damage resulted to crops, hence it received very little attention. The high water mark of 1852 is 2 to 3 feet below that of 1899, at Allen Farm, Brazos County.

The overflow of 1843 occurred during the month of May, but I have been unable to locate the exact dates of its occurrence. The stage of the river during its overflow was about twenty inches higher than in 1852, but was not as high as that of 1899 by about five feet in the vicinity of Duke, Fort Bend County.

The flood of 1833 was highest in the vicinity of Duke, Fort Bend County May 1, where the high water mark is three inches below that of 1899. This overflow commenced during the latter part of April and passed into the Gulf of Mexico early in May.

Very little is known of the flood of 1822, except that it was

FIG. 2.

Brazos Drainage Basin

FROM WACO SOUTH

DRAWN UNDER THE SUPERVISION OF I. M. CLINE, Local Forecast Official, by W. T. LATHROP, Observer

SCALE OF MILES

FLOODED AREA SHOWN THUS:

the greatest that had occurred for several years prior to that time.

The following extract from a letter, dated Navasota, Tex., August 18, 1899, from Hon. Rufus Grimes, who has resided in Grimes County in the neighborhood of seventy years, is an interesting bit of flood history pertaining to the Brazos River:

In regard to the overflows of the Brazos River, my information comes from several men who had been repeatedly through portions of Texas previous to the introduction by S. F. Austin of his 300 families as colonists. These men told my father when I was a small boy (Mr. Grimes was born in 1819), and told me after I had attained the age of maturity, that the Brazos River had not been out of its banks for over thirty years until 1822, when there was a great overflow. The next overflow was in 1833, which came in May of that year; this overflow was considered by the early settlers the greatest overflow that had ever been known by white people in the streams west of the Mississippi River. I passed over the prairie where the present City of Navasota now stands in May, 1833, and the back water was 2 to 4 feet deep all over the prairie. I can not state positively the difference between the overflow of 1833 and that of the present year (1899), but I think the water was several feet higher at this place in 1833 than in 1899. The 1833 overflow did very little damage, as there was not exceeding 100 acres in cultivation in the present Grimes County portion of the Brazos bottom, and there was no stock in the bottoms.

The next overflow was in 1843. Perhaps the greatest damage done by this overflow was the destruction of a grist and flour mill on Beason's Creek near the present town of Courtney, constructed to run by water power.

I do not remember anything of the overflow of 1852.

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The overflow of 1899 has been by far the most destructive of any that we have ever had, for the reason that in recent years there nas been a mania among farmers for bottom lands, and nearly all the bottom lands are in cultivation. While I do not think that any overflow since 1833 has been as high as that by 5 or 6 feet, the present flood has destroyed crops, stock, and other valuables amounting to perhaps two or three times the value of that destroyed by all preceding overflows combined in Grimes County.

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I have never known of any loss of life from overflows on the Brazos until the flood of 1899.

Mr. John R. Fenn, Duke, Tex., has had a cattle ranch in the Brazos bottoms for many years and has noted the high water marks of the several floods. In a letter dated Duke, Tex., August 19, 1899, Mr. Fenn gives valuable information regarding overflows, as follows:

Both in 1833 and 1843 the creeks and lakes in this locality were dry; in fact there was no water in the county whatever, and all waters of the two floods were brought down by the rivers from up the country, while in 1899 every creek and slough was filled to its utmost by the heavy rains prior to the overflow; such being the case there could not have been any more river water brought down the stream in 1899 than in 1833. The flood of 1899 is the only overflow that has hurt the farmers of this section of Texas. All previous floods came before planting time, or sufficiently early to enable farmers to replant their crops. The overflow of 1852 was 18 or 20 inches below the highest water mark of 1843.

Efforts are being made to obtain reliable information from other points along the Brazos regarding the early floods, and if anything of interest is secured the same will be submitted for publication as a supplement to this report. I wish to acknowledge valuable assistance from Col. John D. Rogers, of Galveston, for references in connection with the early floods of the Brazos.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of the Central Meteorologico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the *Boletin Mensual*. An abstract, translated into English measures, is here given, in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for July, 1899.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inch.*	°*F.*	°*F.*	°*F.*	%	*Inch.*		
Colima	1,600	.....	91.4	68.0	.....	.....	.....	.....	.....
Culiacán Rosales (E. d. S.)	112	29.71	97.5	73.4	85.1	67	9.00	ne.	.....
Durango (Seminario)	6,243	24.06	107.6	55.4	69.4	65	4.08	sw.	se.
Leon (Guanajuato)	5,934	24.33	86.7	52.7	68.9	68	5.70	se.	se.
Mexico (Obs. Cent.)	7,472	23.07	78.3	50.9	62.1	68	3.33	n.	ne.
Morelia (Seminario)	6,401	23.98	77.0	53.6	64.0	80	7.85	e.	e.
Oaxaca	5,164	25.10	95.0	52.7	68.2	78	5.46	nw.	ne.
Puebla (Col. Cat.)	7,112	23.37	78.6	51.1	65.7	80	8.40	ese.	ese.
Saltillo (Col. S. Juan)	5,399	24.82	88.3	61.7	73.2	64	1.30	nnw.	se.
San Isidro (Hac. de Guanajuato)	.....	.....	77.4	66.2	.....	.....	7.83	se.	.....
Sllao	6,063	24.30	80.1	59.7	70.0	.....	7.91	ese.	ese.
Tuxpan	19	30.13	104.9	69.8	84.0	79	3.69	e.	e., s.
Zapotlan (Seminario)	5,078	25.20	85.1	57.2	69.8	66	6.23	n.	s., e.

VOLCANIC ERUPTIONS IN HAWAII.

By CURTIS J. LYONS (dated July 29, 1899).

In reference to my note "Sun spots and Hawaiian eruptions," in the MONTHLY WEATHER REVIEW for April, page 144, the Editor remarks that only one side of the question is presented.

The distinction which I make between crater activities and actual flows of lava was not, I perceive, sufficiently emphasized in that article. It was the intention to do that by the heading of the second column, viz, "Most important lava flows or eruptions."

The flow of 1877 should have been added to the list as belonging to the minimum sun spot period of 1878. This leaves only the brief and unimportant flow of 1851, which might be regarded as only preliminary to 1852, so that very little indeed can be said on the other side if the distinction above made is observed.

The newspapers, of course, make the most of every source of excitement and count brilliant activities in both Kilauea and Mauna Loa in the same category with flows of lava. The latter change the topography of the island and, moreover, cause what is termed "volcano weather," and are preceded and accompanied by vast volumes of smoke, not steam.

This smoke rises to a height which I carefully estimated on a previous occasion (in 1877) to be 16,000 feet above the summit of the mountain, making 30,000 feet above sea level, and then floats off to the northeast, carried in a horizontal direction by the upper current. On this occasion it appears to have sunk to the level of the sea about 600 miles from Hawaii and was then brought back by the trade wind, covering the entire group with heavy smoke from the 18th to the 20th, fourteen days after the eruption. The steamer *Mariposa*, coming from San Francisco, met the smoke cloud at the above distance from Honolulu. At first the smoke was overhead, then as the steamer proceeded it covered everything at sea level. Meanwhile the disturbance caused by the local heat on Hawaii had interrupted the trades to leeward, and a surface southerly current brought the light lower smoke to Honolulu on the 12th of July.

The editor's reference to "only one side of the question" was intended to suggest that in investigating the connection between two remote subjects, such as solar sun spots and Hawaiian eruptions, it is necessary to consider, not only the agreements of the facts with any given hypothesis, but also the cases of disagreement, and it is not clear that the latter has been properly done in the present case. We have not at hand a complete list of the eruptions of lava from Mauna