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SECTION IV—RIVERS AND FLOODS.

FLOODS OF JANUARY-FEBRUARY, 1916, IN THE LOWER MISSISSIPPI AND IN SOUTHERN CALIFORNIA.

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SYNOPSIS.

The general rains of December 24–25, and again of the 27th–29th, 1915, while not producing severe floods, laid the foundation for a flood of great magnitude in the Mississippi from Cairo to the Gulf during February, 1916. The rains of January, 1916, were sufficient to keep the majority of tributary streams at a relatively high stage; several flood waves passed into the Mississippi from the rivers of Arkansas. The climax resulted from rainstorms of January 21–22 and the prolonged general rains of the 25th–31st. The rains of the first period were heavy over northeastern Oklahoma, southwestern Missouri, and northern Illinois, and caused sharp flood waves in the Neosho and Verdigris, tributaries of the Arkansas; also in the latter below the mouth of the Neosho. A record-breaking flood also resulted in the upper Illinois and its main tributaries, the Des Plaines, Kankakee, and Fox Rivers.

The rains of the second period covered the tributaries of the Arkansas in eastern Oklahoma and southern Missouri, and were especially heavy over the Ozark Plateau of southern Missouri, central and eastern Arkansas, southern Illinois, southern Indiana, and immediately along the Ohio below Louisville.

While the flood waves in each of the tributary streams did not reach the trunk stream conjointly, their approach was so timed as to produce a rather flat and prolonged swell from Cairo south. The fact that the rivers of Arkansas, which had been contributing large volumes of water throughout the month, delivered a heavy flow upon a river already in flood will account for the record-breaking stages in the Mississippi between Arkansas City, Ark., and Natchez.

Less water came out of the Ohio in 1916 than in 1913 and the flood at Cairo was naturally one of less magnitude and, moreover, the weather in 1916 turned cold immediately the rains ceased. That fact had a tendency to reduce the run-off in the Ohio basin as compared with 1913.

In that stretch of the Mississippi from Arkansas City to Natchez, Miss., with the single exception of Greenville, Miss., the previous records of high water were overtopped by amounts ranging from 0.6 foot at Lake Providence, La., to 1.4 feet at Vicksburg, Miss. These high stages may be attributed to two facts: First, as already stated, a greater quantity of water came out of the Arkansas and White Rivers in 1916 than in 1913, and second, the levees throughout that stretch of the Mississippi remained intact.

DETAILED NARRATIVE.

Meteorological conditions.

The weather control during the greater part of the month was apparently centered in two great highs, one purely continental and the other partly oceanic and partly continental. The continental high stretched from Alaska southeastward to the northeastern Rocky Mountain slope and the upper Missouri Valley. During

the first and second decade of the month this high—or more correctly a series of highs—was effective in causing lows to enter the continent from the Pacific at a lower latitude than usual. The oceanic and continental high in the east extended from the western Atlantic in the neighborhood of Bermuda westward over the continent to the summits of the Appalachians. This high appears to have been effective in shunting lows which had advanced southeastward to about the one-hundredth meridian, thence northeastward across the Lake region to Canada. Further details are given in Section III, Forecasts, and by Chart No. III, Tracks of Centers of Low Areas.

Floods.

*Hawaii.*¹—Record-breaking rains fell in Hawaii. At Honolulu the rainfall during the first 18 days of the month amounted to 14.73 inches, of which 7.05 inches fell during the week that ended January 24, 1916. At four other points in the island of Oahu the rainfall for the same week ranged from 10 to 17 inches. On Maui heavy rains began on the 16th, continued until about 5 a. m. of the 18th, when a veritable cloudburst swept over portions of the island, causing a flood that devastated the Iao Valley, with a loss of 11 lives and a large amount of property. A measured rainfall of 8.85 inches in 24 hours was recorded.

California.—It seems reasonable to suppose that the storm which swept over Hawaii on the 18th–19th passed inland over California on the 27th. It is charted as Low No. XIV, Chart III. About a week previous Low No. X, Chart III, passed inland over the middle California coast on the 17th, crossed the south-central part of the State on the 18th, and then moved northeastward into Wyoming by the morning of the 19th. During its movement over the south-central portion of California the storm slackened its progressive movement somewhat, meanwhile giving very heavy rains over the counties of southern California. Light rains had fallen during the previous three or four days and conditions were unusually favorable for a high run-off in connection with the heavy rains of the 17th and 18th—see Tables 11 to 16. The resulting floods were severe and much damage was done to railroads, bridges, highways, land under cultivation, and to the harbor of Los Angeles, by reason of the mass of silt deposited thereon.

A second deluge of rain descended upon the counties of southern California in connection with Low No. XIV, mentioned in a preceding paragraph. The second storm was of much shorter duration. At San Diego, Cal., the rain began at 7:18 p. m. of the 26th and ended at 7:45 p. m. on the 26th. The total fall amounted to 2.41 inches. This rainstorm was attended by unusually high winds for southern California, the average velocity at San Diego being about 30 miles per hour, with a maximum of 54 miles from the south at 4:29 a. m. of the 27th. The reservoirs in the county whence the water supply of

¹ The facts here given were compiled from newspaper clippings. Detailed information as to the precipitation will appear in the Weather Bureau reports of the Hawaiian action issued at Honolulu by A. M. Hamrick, meteorologist.

the city of San Diego is drawn were already nearly full as a result of the rains of the previous week and all of them, evidently, were not in a condition to withstand the added strain put upon them by the rains of the 26th-27th.

The lower Otay Dam broke during the afternoon of the 27th and released a total of 11,000,000,000 gallons of water. The flood thus created swept everything before it, over a strip of territory said to be 15 miles long and 2 miles wide. It is said that the reservoir held back by the lower Otay Dam had never before been filled.

Meager reports indicate serious loss in the San Luis Rey, Warner, Ti Juana, Mission, Cottonwood, El Cajon, and San Dieguito valleys in San Diego County, Cal. Further details of floods in other California rivers will be found in Table 1 on page 31.

Arizona.—Rains during the six days, January 15-20, that ranged from 3 to 4 inches on the lowlands and probably more on the uplands, started floods in the Gila and its tributaries on the afternoon of the 16th. By the afternoon of the 19th the Roosevelt Reservoir became full and the overflow added greatly to the seriousness of the situation on the lower Salt and Gila Rivers. By the evening of the 25th, however, the rivers had returned within their banks.

A second period of rains began on the 26th and ended on the 30th. Again the rivers passed flood stage, the second flood passing into the Colorado on the closing days of the month, with a crest 2 feet lower than the flood of the 21st. The details of both floods for three stations in Arizona are shown in Table 1, and Table 17 gives the details of rainfall in Arizona.

Arkansas River and tributaries.—The Arkansas was not in flood except below the mouth of the Neosho. The flood was due to two periods of heavy rains over the watersheds of the Neosho, the Verdigris and the main stream, where it passes through northeastern Oklahoma. Practically all of the smaller streams in Sequoyah, Haskell, Le Flore, Latimer, Pittsburg, Wagoner, Washington, and Nowata Counties, Okla., were swollen to an unusual height in the second period of heavy rains. There were two wave crests at Fort Smith and at other points along the Arkansas in northeastern Oklahoma—see the Fort Smith hydrograph in fig. A. J. H. 1 (XLIV-10). The first was caused by heavy rains on the 20th-21st. In the four days of fair weather that followed the rivers had receded to about half a foot below the flood stage at Fort Gibson and Fort Smith, whereupon a second period of rains set in. These later rains were not so intense as those first named, but were of much greater duration, continuing from the 26th to the 31st.

In the Neosho watershed the rains of the first period fell upon ground that was covered with 2 inches of ice. The high temperatures attending the rains caused a rapid melting of the ice cover and naturally a run-off that must have been very great. The Neosho in the neighborhood of Iola, Kans., was covered by ice 7 inches in thickness. The breaking up of the ice and the few gorges that were formed added to the height of the flood wave that passed down that river. The damage along the Neosho was confined principally to bridges, highways and levees in Allen, Neosho, and Labette Counties.

There was but a single crest in the Arkansas below Fort Smith, as at Little Rock. The river at that point was above the flood stage from January 29 to February 6, the crest being 27.3 feet on February 2 (flood stage 23 feet). It is probable that somewhat higher crest stages would have been recorded had the river remained

within its banks at all places. Gage heights are given in Table 2.

Rivers of Missouri.—The Grand River at Chillicothe crested at 24.3, 6.3 feet above flood stage, on the 24th, due to heavy rains of the 21st and the subsequent breaking up of the ice.

While the rains of the 21st were heavy over the headwaters of the Osage they were less heavy over the lower stretches of the river. At the close of the month the Osage at Bagnell was 4.2 feet above flood stage and rising. While this flood synchronized with that from the Gasconade, both floods came out later than that from the Grand, and as a result the lower Missouri did not quite reach flood stage—see hydrograph for Hermann, Mo. Flood stage at that point is 21 feet. Gage heights appear in Table 3.

Rivers of Illinois.—The region of northeastern Illinois, especially over the watersheds of the Fox, Des Plaines, and Kankakee Rivers, received a heavy fall of rain from the same storm that swept over northeastern Oklahoma. There was also a snow cover of about 3 inches at the beginning of the rains, which melted rapidly, on account of high temperatures. The average 24-hour rainfall in the watershed of the Illinois River above La Salle was not far from 1.5 inches. The area of the watershed above La Salle is 11,649 square miles. The amount of water falling over this region on the 21st aggregated 931,000 acre-feet. If half that amount reached the streams, it would have required about five days, assuming a discharge of 50,000 second-feet, to pass any given point. The hydrograph for La Salle shows that the peak of the flood was about 24 hours in passing and that the river was above flood stage as late as February 15, when the last report was received. Details of floods in rivers of Indiana and Illinois appear in Table 4.

Rivers of Indiana.—The rains which caused severe floods in the upper Illinois on the 20th-21st did not overspread Indiana, but the second period of rains, beginning January 26 and concluding on the 31st, were especially heavy over southern Indiana and, together with lighter rains in the northern portion, caused very general floods in all of the streams of the State. The hydrograph of the lower Wabash at Mount Carmel, Ill., shows the duration and intensity of the flood in the principal river of the State.

Rivers of Kentucky and Tennessee.—The rivers in these States were in flood during the early days of the month, due to rains in the last few days of December and again on January 1 and 2. Heavy rains during the period January 11-13 were instrumental in keeping the rivers at moderately high stages. Gage heights appear in Table 5.

Ohio River.—The Ohio was not at flood stage during January, 1916, above Cincinnati, Ohio, and the flood at that place was both of short duration and little intensity. At Louisville, Ky., the flood stage was reached on the 13th, the river cresting on the 15th with a stage of 31.2 feet, 3.2 feet above flood stage. The above-named flood was separate and distinct from the flood in the lower Ohio during the closing days of the month. The lower Ohio was in flood practically the whole month—see gage heights in Table 6 at Evansville, Ind. The first flood may be considered as beginning December 20, 1915, and ending about January 28, 1916. Immediately thereafter a second flood set in, which crested at 40.2 feet on February 4, and at Cairo with a stage of 53.4 on the same date. There were, however, three distinct swells at Evansville during the period December 20, 1915, to January 28, 1916—see Table 6.

Mississippi River.—The river was frozen at and north of Dubuque throughout the month. At Davenport, although an ice gorge had formed immediately below the mouth of Rock River about the close of December, 1915, the river opposite the city was open for a part of the time. The heavy rains of the 20th–21st, and again on the 26th–27th, coupled with a spell of high temperature in the closing days of the month, created much apprehension in the cities of Davenport and Rock Island, but flood stages were not reached until February 2.

Hannibal, Mo.—The warm weather and rains, as described in the preceding paragraph, caused a slight flood at Quincy, Ill., on the 28th, Hannibal, Mo., on the 29th, and Louisiana, Mo., on the 30th.

St. Louis, Mo.—The light swell mentioned in the preceding paragraph passed St. Louis on February 1, 1916, at a crest of 31.2 feet (flood stage 30 feet), the highest January stage independent of ice conditions reached since 1861. Three days later it reached Cairo, with a crest of 53.4, or 8.4 feet above flood stage. In the 1913 flood the crest stage at St. Louis was but 27.4 feet. The increase in Mississippi water was more than offset by much less Ohio water in 1916 as compared with 1913, crest stages in the last-named river being as much as 8 feet lower in 1916 than in 1913. The flood wave in the Ohio that crested at Evansville on the 18th with 43.6 feet was the greatest of the several swells that came out of the Ohio during January and February, 1916, but it was not supported by relatively high stages in the Mississippi, the stage at St. Louis being but 13.8 feet on the same date. Hence the main Ohio crest reached Cairo on a falling Mississippi and, since the Ohio at Evansville continued to fall until the 28th, the only effect of this crest was to keep the Mississippi below Cairo at relative high stages until the crest produced by the rains of January 21–31 descended upon it.

Memphis, Tenn.—The Mississippi at this station was in flood continuously from January 6 to February 23, cresting at 43.5 feet on February 9, or 3 feet lower than in 1913. Peculiar interest attaches to the Memphis crest stages for the reason that it affords the first opportunity in several years of noting the gage relations between Cairo and Memphis, with a full river and the levees holding. In the early years, when the St. Francis River carried the overflow water escaping from the Mississippi in the neighborhood of Cairo, the Memphis crest was as much as 15 or 16 feet lower than Cairo. With the extension of the levees to and above Cairo, the overflow is prevented, and naturally the difference between the Cairo and Memphis gage heights decreased. In the 1912 flood the difference sank to 8.7 feet. In 1913, with a break in the levees a short distance above Memphis, the difference between crest stages was 8.3 feet, or practically the same as in 1913, but in 1916, with levees intact, the difference amounted to 9.9 feet. Plotting Cairo stages above 45 feet against Memphis stages five days later, it is seen that the relation between the two gages is fairly constant, the Memphis gage being very nearly 10 feet lower than Cairo, except with falling stages at Cairo, when the difference becomes less, as might be expected. With a falling river at both points the difference is 8 feet or less, as against 10 feet with a rising river at Cairo—gage heights in Table 7.

Vicksburg district, including Arkansas City, Ark., Greenville and Vicksburg, Miss.—Previous high stages at Arkansas City were overtopped by 1.0 foot, at Vicksburg by 1.4 feet, at Lake Providence by 0.6 foot. The previous high record at Greenville, 51.3 feet in 1912, was, however, not overtopped.

It should be remembered that previous floods in this district caused levees to give way and hence the recorded crest stages were lower than they would have been had the levees remained intact, as in the present flood. The increased crest stages of the present flood therefore represent the water that in former floods flowed through crevasses in the levees. A table of crevasses during recent years follows:

Year.	Number of crevasses in third district.
1897.....	7
1903.....	3
1912.....	3
1913.....	1
1916.....	0

New Orleans district.—On February 28 the flood had not yet passed into the Gulf; the stage at New Orleans had about come to a stand at 21.0 feet. Gage heights appear in Table 7.

Other floods in January, 1916.—Aside from the flood in the Mississippi above described, there were brief floods in the rivers of southwestern Arkansas, in the headwaters of the Trinity River of Texas, and in the rivers of the Gulf drainage in Mississippi, Alabama, and Georgia. Also in the Atlantic drainage of South Carolina and Georgia, as shown in Tables 8 and 9.

BROKEN LEVEES, FLOODS OF JANUARY-FEBRUARY, 1916.

The following list of breaks in levees during the floods of January-February, 1916, has been compiled in the River and Flood Division, mainly from newspaper reports. These reports fail to show whether the broken levees were private, State, or Federal, but it is believed that the great majority were of private ownership.

Arizona.—Government levee on Colorado near Yuma gave way January 22. Town of Yuma and thousands of acres of agricultural land on both sides of the river were inundated.

California.—Levees near Bakersfield on Kern River gave way January 18.

Arkansas, White River, and tributaries.—Break in levee in upper White River, night of January 30, 18 miles south of Batesville, Ark., caused loss of several hundred head of cattle and large quantities of winter wheat.

A series of breaks in the levees of the upper Cache and Current Rivers, tributaries of the White, released large volumes of water. On January 31 a sheet of water about 16 miles wide extended from the Missouri State boundary to Newport, Ark.

The Jacksonport levee at Newport, Ark., broke during the night of January 31, resulting in a stage of water several feet deep in the streets of the town.

The McClelland levee, near Cotton Plant, Woodruff County, Ark., broke on the 31st, releasing considerable water from the lower Cache River, about 25 miles north of its junction with the White.

Wash from levee breaks in Greene County flooded bottom lands tributary to the St. Francis River, January 31.

Arkansas River in Arkansas.—The entire drainage area of the Arkansas River from Fort Smith to its mouth was in flood during the last few days of January and the first part of February. Levees were overtopped in many places along the main stream and the entire levee system on several of the tributaries was severely damaged. Detailed reports are missing.

Levees were reported broken near Van Buren, Crawford County, on the night of January 29. The Arkansas was out of its banks at Ozark, Franklin County, and the river was 5 miles wide at several places. Gravel deposits caused permanent injury to farming land in many places along this stretch. Cattle and stored crops were lost, but the warnings minimized the loss to a large extent.

At Neely bend, 8 miles east of Dardanelle, and at a point 20 miles east, breaks occurred during January 30, flooding about 6,000 acres of arable land. It was estimated that the loss of stored crops totaled 10 per cent of the annual crop.

A break at Index, Conway County, February 1, severed communications with a large area to the west and submerged lowland property.

The largest break occurred at Cummins, on the main river, on February 1, releasing great volumes of water, which spread over large portions of Lincoln and Desha Counties and the northern half of Drew and Chicot Counties. It is estimated that over 200,000 acres of farming land were inundated and several lives were reported lost. At this date traffic is still demoralized and detailed estimates of the damage are not available.

A break at State Farm, on the White River, a few miles north of its junction with the Arkansas, near Stuttgart, flooded lowlands between the White and Arkansas and choked the bayous draining into the Arkansas below its junction with the White.

Rivers of southwestern Arkansas.—The Red River of Arkansas went out of its banks January 29, severely damaging the newly completed levees.

The Ouachita left its banks on the same date, in Clark and Ouachita Counties, flooding thousands of acres of arable land.

The Saline River, January 30, broke out of its levees on the west side and inundated portions of Drew and Ashley Counties.

A private levee protecting the Waldo-Magnolia railway broke January 31, near Waldo, Columbia County, and was expected to be a total loss.

Lower Mississippi River.—The levee at West Hickman, Ky., gave way and water backed up into Hickman, January 31.

The levee on the right bank of the Mississippi near Newellton, La., gave way, February 15. The overflow passed into the old basin of Lake St. Joseph and the speed of the flow was thereby retarded, so as to enable the inhabitants of the lowlands to escape. Portions of Franklin and Catahoula and the larger part of Texas and Concordia Parishes were overflowed.

Atchafalaya.—The levee broke on the right bank of the Atchafalaya, 8 miles below Melville, February 13, but was closed during the afternoon of the 14th.

The levee again broke, February 15, 6 miles below Melville, on the right bank, forming a crevasse 1,000 feet wide. The flood waters extended over St. Landry and the east portion of St. Martin Parishes.

Wabash River of Indiana.—The levee at La Fayette gave way on February 1, submerging the lower section of the town.

The levee at Attica, Fountain County, was under 2 feet of water February 1. Portions of Warren County were inundated.

Flood waters overtopped the levee at Covington. Severe loss to stored crops resulted.

The Conover levee in west Terre Haute broke, February 2, inundating 1,000 acres of built-up suburban property.

The Honey Creek levee, 8 miles south of Terre Haute, broke February 2, because of backwater from the Wabash; 15,000 acres of farming land were inundated.

The levee protection along Wild Cat Creek, a tributary of the Wabash north of La Fayette, overflowed February 1. Escaping waters did considerable damage in the vicinity of Kokomo, Ind.

White River, West Fork.—The West Washington Street levee in Indianapolis, Ind., broke during night of January 31, but was kept from giving way entirely. Portions of Morgan, Greene, and Martin Counties were overflowed by escaping water from levee breaks. Shoals, Martin Co., reported the river out of its banks for the third time in five weeks.

On the lower stretches of the river, Daviess County suffered from inundation of thousands of acres of farming land. Much winter wheat was lost; highways, embankments, railway property, and bridges were washed out.

White River, East Fork.—Blue River, Flat Rock, Brandywine, and Sand Creeks were out of their banks from January 31 to February 2. Levee at Shelbyville, Shelby Co., on the Blue River, broke during the night of January 31, releasing a large volume of water which spread over lowland farms.

LOSS OF LIFE AND PROPERTY.

There has been much conflicting evidence as to the loss of life in the floods above considered. The official in charge at the Weather Bureau office in San Diego places the loss of life occasioned by the breaking of the lower Otay Dam at 18, and there appear to be fairly well authenticated reports of the loss of 8 lives in Los Angeles and adjoining counties, making the total for southern California 26.

Three lives were lost in northeastern Oklahoma, 16 at various points in Arkansas, 3 in the vicinity of Newellton, La., making a total of 22 in the Great Central Valley and a grand total of 48 during the month.

The property loss has been placed at amounts ranging from \$1,000,000 to \$7,000,000. Effort is being made to obtain a conservative estimate of the loss in the various flood-stricken regions. The loss in the Great Central Valley, so far as crops are concerned, is not large, although it is much too early to make a final report.

STAGES ATTAINED DURING THE JANUARY FLOODS.

The following tables (1 to 10) have been compiled in accordance with the uniform plan adopted in 1915 and followed in previous flood discussions during 1915 in this REVIEW. These tables show: (1) Name of river and place where it was in flood, (2) flood stage and the time during which the river was above its flood stage, (3) the crest stage and the date on which it was reached at the place mentioned. Table 10 gives a comparison of stages attained during previous floods in the Mississippi.

Hydrographs for typical points on several principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

TABLE 1.—Floods in the rivers of the Pacific slope, January, 1916.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
		<i>Feet.</i>			<i>Feet.</i>	
Willamette.....	Eugene, Oreg.....	10.0			9.0	24
Salt.....	Tempe, Ariz.....	7.0	17	25	18.7	19
Do.....	do.....	7.0	28	31	17.0	20
Gila.....	Florence.....	5.0	17	25	11.0	20
Do.....	do.....	5.0	28	31	9.0	28
Colorado.....	Yuma, Ariz.....	(?)			32.8	22
Sacramento.....	Jacinto, Cal.....	21.0			18.2	24
Do.....	Knights Landing, Cal.....	18.0			17.3	28, 29
Do.....	Red Bluff, Cal.....	23.0			22.0	25
Do.....	Sacramento, Cal.....	29.0			24.8	28
San Joaquin.....	Lathrop, Cal.....	17.0			16.2	30, 31
Kings.....	Piedra, Cal.....	12.0	17	18	18.6	17
Mokelumne.....	Bensons Ferry, Cal.....	12.0			10.2	29
Morimon Slough.....	Ballota, Cal.....	20.0			17.8	17

TABLE 2.—Floods in the Arkansas River and tributaries, January, 1916.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
		<i>Feet.</i>			<i>Feet.</i>	
Arkansas.....	Tulsa, Okla.....	16.0			10.0	21
Do.....	Fort Smith, Ark.....	22.0	22	31	32.7	30
Do.....	Dardanelle, Ark.....	20.0	23	31	29.5	31
Do.....	Little Rock, Ark.....	23.0	29	16	27.3	16
Do.....	Pine Bluff, Ark.....	25.0	29	17	29.6	13
Neosho.....	Iola, Kans.....	10.0	22	22	11.4	22
Do.....	Oswego, Kans.....	20.0	22	24	21.7	23
Do.....	Wyandotte, Okla.....	25.0	23	23	25.0	23
Do.....	do.....	25.0	29	29	25.6	29
Do.....	Fort Gibson, Okla.....	22.0	22	25	25.8	23
Do.....	do.....	22.0	27	31	29.5	30
Verdigris.....	North Muskogee, Okla.....	21.3	28	31	24.0	28
N. Canadian.....	Oklahoma, Okla.....	12.0			7.2	28
Canadian.....	Calvin, Okla.....	15.0			11.2	21
Fourche la Pave Creek.....	Bigelow, Ark.....	23.0	29	31	28.8	31
Black.....	Black Rock, Ark.....	14.0	1	31	26.5	31
White.....	Calico Rock, Ark.....	18.0	14	15	20.5	14
Do.....	do.....	18.0	28	31	51.0	31
Do.....	Batesville, Ark.....	18.0	14	18	20.6	15
Do.....	do.....	18.0	29	31	35.4	31
Do.....	Newport, Ark.....	26.0	16	18	27.4	17
Do.....	do.....	18.0	30	12	33.4	11
Do.....	Georgetown, Ark.....	22.0	3	19	27.5	13 & 4
Do.....	Clarendon, Ark.....	30.0	30	18	38.5	18

¹ February.

TABLE 3.—Floods in the Missouri River and tributaries, January, 1916.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
Missouri.....	Boonville, Mo.....	Feet. 21.0			Feet. 16.8	23
Do.....	Hermann, Mo.....	21.0			19.6	28
Grand.....	Chillicothe, Mo.....	18.0	22	25	24.3	24
Ozage.....	Bagnell, Mo.....	28.0	28	31	32.2	31
Gasconade.....	Arlington, Mo.....	12.0	29	31	21.9	31

TABLE 4.—Floods in the rivers of Ohio, Indiana, Illinois, and Michigan, January, 1916.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
Mahoning.....	Youngstown, Ohio..	Feet. 7.0	2	4	9.3	3
Muskingum.....	Zanesville, Ohio.....	25.0			24.3	3
Do.....	McConnelsville, Ohio	22.0	3	4	23.6	3
Do.....	Marietta, Ohio.....	32.0	4	5	33.7	4
Walhonding.....	Walhonding, Ohio.....	8.0	2	4	12.5	2
Tumcarawas.....	Norris Point, Ohio.....	8.0	1	5	11.6	3
Do.....	Coshocton, Ohio.....	8.0	2	5	13.4	2
Scioto.....	Prospect, Ohio.....	10.0	2	4	12.8	3
Do.....	Bellport, Ohio.....	9.0	2	2	9.0	2
Do.....	Columbus, Ohio.....	17.0			16.8	2
Do.....	Circleville, Ohio.....	7.0	2	5	14.5	3
Do.....	do.....	7.0	12	15	13.5	14
Do.....	Chillicothe, Ohio.....	14.5	3	4	18.0	4
Do.....	do.....	14.5	14	15	16.4	15
Olentangy.....	Delaware, Ohio.....	9.0	2	2	10.8	2
Little Miami.....	Kings Mills, Ohio.....	17.0	13	13	17.8	13
Miami.....	Sidney, Ohio.....	10.0	2	2	10.2	2
Do.....	Piqua, Ohio.....	12.0			10.9	2
Do.....	Tadmor, Ohio.....	12.0	2	3	15.4	2
Do.....	do.....	12.0	13	13	12.1	13
Do.....	do.....	12.0	31	31	13.9	31
Do.....	West Milton, Ohio.....	10.0	2	3	11.3	2
Do.....	do.....	10.0	31	31	16.0	31
Mad.....	Springfield, Ohio.....	10.0			8.3	13
Sandusky.....	Upper Sandusky, Ohio.	13.0	2	2	13.5	2
Do.....	Tiffin, Ohio.....	10.0	2	4	12.3	3
Do.....	Fremont, Ohio.....	10.0	2	3	12.0	2
St. Joseph.....	Montpelier, Ohio.....	10.0	4	5	10.8	5
Do.....	do.....	10.0	22	23	11.6	23
Do.....	do.....	10.0	31	31	10.6	31
Anglaise.....	Defiance, Ohio.....	10.0	1	6	12.8	4
Maumee.....	Napoleon, Ohio.....	10.0	33	6	12.6	4
Do.....	Fort Wayne, Ind.....	15.0	3	8	20.6	6
Do.....	do.....	15.0	31	31	18.8	31
Wabash.....	Bluffton, Ind.....	12.0	3	5	14.5	4
Do.....	Logansport, Ind.....	12.0	3	4	12.6	4
Do.....	do.....	12.0	31	31	12.9	31
Do.....	La Fayette, Ind.....	11.0	3	9	20.5	5
Do.....	do.....	11.0	13	16	17.9	15
Do.....	do.....	11.0	22	25	15.9	23
Do.....	do.....	11.0	29	31	21.6	31
Do.....	Terre Haute, Ind.....	16.0	4	18	18.5	9
Do.....	do.....	16.0	31	31	18.7	31
Do.....	Mount Carmel, Ill.....	15.0	1	31	22.6	21
East Fork White.....	Shoals, Ind.....	20.0	13	19	24.4	18
Do.....	do.....	20.0	31	18	32.0	14
West Fork White.....	Anderson, Ind.....	12.0	3	3	14.8	3
Do.....	do.....	12.0	31	1	16.1	31
Do.....	Noblesville, Ind.....	14.0	2	3	16.1	2
Do.....	do.....	14.0	31	12	18.8	11
Do.....	Indianapolis, Ind.....	12.0	2	5	17.0	4
Do.....	do.....	12.0	31	12	20.8	11
Do.....	Elliston, Ind.....	19.0	2	9	26.1	7
Do.....	do.....	19.0	12	17	23.7	16
Do.....	do.....	19.0	30	17	30.2	12
White.....	Decker, Ind.....	18.0	1	28	22.8	20, 21
Do.....	do.....	18.0	30	12	26.8	16
Illinois.....	La Salle, Ill.....	18.0	4	14	19.6	9
Do.....	do.....	18.0	16	21	32.9	22
Do.....	Peoria, Ill.....	16.0	23	27	23.1	25
Do.....	Beardstown, Ill.....	12.0	6	(*)	20.7	11 & 2
Grand.....	East Lansing, Mich.....	7.5	22	23	8.8	22
Do.....	Portland, Mich.....	11.6	26	26	13.2	26
Do.....	Grand Rapids, Mich.....	11.0	22	26	13.2	23

* 12.3 on Mar. 8, 1916.

¹ February.

² March.

TABLE 5.—Floods in the rivers of Tennessee, Kentucky, West Virginia, Pennsylvania, and New York, January, 1916.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
Tennessee.....	Knoxville, Tenn.....	Feet. 12.0	8	9	13.7	9
Do.....	Chattanooga, Tenn.....	33.0			32.9	1
Do.....	Florence, Ala.....	18.0	2	6	19.3	3
Do.....	Riverton, Ala.....	32.0	1	8	33.8	4
Do.....	Savannah, Tenn.....	40.0			38.9	6
Do.....	Johnsonville, Tenn.....	31.0	4	10	32.5	8
Watauga.....	Elizabethton, Tenn.....	8.0	7	9	9.4	9
North Fork Holston	Mendota, Va.....	8.0	8	8	12.0	8
Cumberland.....	Celina, Tenn.....	45.0			33.1	2
Do.....	Carthage, Tenn.....	40.0	3	4	41.2	2
Do.....	Nashville, Tenn.....	40.0	2	8	42.4	5
Do.....	Fox Bluff, Tenn.....	43.0			42.9	8
Do.....	Clarksville, Tenn.....	46.0	2	11	49.2	8
Green.....	Rumsey, Ky. (Lock 2)		7	7	30.1	6-8
Kentucky.....	Frankfort, Ky.....	31.0			28.1	14
Licking.....	Falmouth, Ky.....	28.0			27.2	13
Big Sandy.....	Louisa, Ky. (Lock 3)	20.0	12	15	25.6	12
Little Kanawha.....	Glenville, W. Va.....	22.0	12	12	29.2	12
Do.....	Creston, W. Va.....	20.0	12	13	24.0	12
Cheat.....	Rowlesburg, W. Va.....	12.0			11.5	12
Monongahela.....	Fairmont, W. Va.....	25.0	12	12	26.3	12
Do.....	Greensburg, Pa.....	20.0	12	12	24.1	12
Do.....	Lock, No. 4, Pa.....	31.0	13	13	31.5	13
Kiskiminetas.....	Saltsburg, Pa.....	8.0			7.3	2
Shenango.....	Sharon, Pa.....	9.0	2	4	10.9	3
Beaver.....	Beaver Falls, Pa.....	10.6			10.5	3
East Branch Delaware	Fish Eddy, N. Y.....	10.0			9.7	21
Mohawk.....	Little Falls, N. Y.....	6.0	26	26	6.8	28
Do.....	Tribes Hill, N. Y.....	16.0			15.4	28
Do.....	Schenectady, N. Y.....	15.0	29	29	15.0	29

TABLE 6.—Floods in the Ohio River, January, 1916.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
Ohio.....	Pittsburgh, Pa.....	Feet. 22.0			Feet. 20.7	3
Do.....	Beaver Dam, Pa.....	30.0	3	3	30.7	3
Do.....	Marietta, Ohio.....	33.0			32.0	5
Do.....	Parkersburg, W. Va.....	36.0			32.8	5
Do.....	Point Pleasant, W. Va.	40.0			39.0	1
Do.....	do.....					
Do.....	Catlettsburg, Ky.....	50.0			45.7	15
Do.....	Portsmouth, Ohio.....	50.0			49.3	15
Do.....	Maysville, Ky.....	50.0			48.8	15
Do.....	Cincinnati, Ohio.....	50.0	3	3	50.0	3
Do.....	do.....	50.0	13	17	53.2	14
Do.....	Madison, Ind.....	48.0	14	16	47.1	15
Do.....	Louisville, Ky.....	28.0	14	18	31.2	15
Do.....	Cloverport, Ky.....	40.0	3	9	43.1	5
Do.....	do.....	40.0	12	21	46.7	16, 17
Do.....	Evansville, Ind.....	35.0	1	26	43.6	18
Do.....	do.....	35.0	31	13	40.2	14
Do.....	Henderson, Ky.....	33.0	1	26	42.1	18
Do.....	do.....	33.0	31	14	38.6	16
Do.....	Mount Vernon, Ind.....	35.0	1	28	44.5	19
Do.....	do.....	35.0	30	18	42.5	18
Do.....	Shawneetown, Ill.....	35.0	1	10	47.4	20, 23
Do.....	Paducah, Ky.....	43.0	7	27	45.7	18, 19
Do.....	do.....	43.0	12	13	45.0	19
Do.....	Cairo, Ill.....	45.0	6	17	51.8	14

¹ February.

TABLE 7.—Floods in the Mississippi River, January and February, 1916.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
Mississippi	Davenport, Iowa	15.0			14.2	Jan. 25
Do.	Keokuk, Iowa	14.0			13.1	28
Do.	Warsaw, Ill.	17.0	27	27	17.7	27
Do.	Quincy, Ill.	14.0	28	30	15.1	28
Do.	Hannibal, Mo.	13.0	28	31	15.3	29
Do.	Louisiana, Mo.	12.0	24	24	12.0	24
Do.	do.	12.0	28	11	15.0	30
Do.	Grafton, Ill.	13.0	29	15	23.4	31
Do.	St. Louis, Mo.	30.0	31	12	31.5	Feb. 1
Do.	Chester, Ill.	30.0	31	14	30.8	31
Do.	Cape Girardeau, Mo.	30.0	29	17	30.4	3
Do.	New Madrid, Mo.	34.0	4	19	41.9	16
Do.	Memphis, Tenn.	35.0	6	23	43.5	11
Do.	Helena, Ark.	42.0	7	29	53.4	11
Do.	Arkansas City, Ark.	42.0	4	(²)	56.4	11-11
Do.	Greenville, Miss.	42.0	18	(²) ⁵	50.7	11, 14
Do.	Vicksburg, Miss.	45.0	17	(²)	53.9	15
Do.	Natchez, Miss.	46.0	24	(²)	53.6	15
Do.	Baton Rouge, La.	35.0	28	(²)	42.6	*1-3
Do.	Donaldsonville, La.	28.0	30	(²)	34.0	*1
Do.	New Orleans, La.	18.0	31	(²)	21.0	128

¹February. ²Still above flood stage, Mar. 10, 1916. ³March.

TABLE 10.—Highest river stages at various places during the floods of 1882, 1897, 1903, 1912, 1913, and 1916.

Station.	River.	Highest stage.					
		1882	1897	1903	1912	1913	1916
		Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Cincinnati, Ohio	Ohio	58.6	61.1	53.2	53.4	70.0	43.7
Evansville, Ind.	do.	44.9	43.6	42.4	42.6	48.4	40.2
Nashville, Tenn.	Cumberland	55.1	48.7	40.7	46.5	44.9	15.5
Johnsonville, Tenn.	Tennessee	43.8	48.0	33.7	35.4	33.3	25.0
Paducah, Ky.	Ohio	49.9	50.9	47.6	49.9	54.3	45.0
Calro, Ill.	do.	51.8	51.6	50.6	54.0	54.8	53.4
Kansas City, Mo.	Missouri	22.8	35.0	23.2	21.9	9.5	
Hannibal, Mo.	Mississippi	7.0	20.8	22.5	19.0	14.3	15.3
St. Louis, Mo.	do.	28.2	31.0	38.0	30.8	27.2	31.5
New Madrid, Mo.	do.	39.5	39.5	44.0	44.5	41.9	
Memphis, Tenn.	do.	35.0	37.1	40.1	45.3	48.5	43.5
Helena, Ark.	do.	51.8	51.0	54.4	55.2	53.4	
Little Rock, Ark.	Arkansas	25.7	21.4	24.8	24.0	17.3	27.3
Arkansas City, Ark.	Mississippi	51.9	53.0	55.4	55.1	56.4	
Yazoo City, Miss.	Yazoo	31.5	28.7	30.4	29.8	29.9	
Vicksburg, Miss.	Mississippi	48.8	52.5	51.8	52.1	52.3	53.9
Natchez, Miss.	do.	49.8	50.4	51.4	52.4	53.6	
Alexandria, La.	Red	34.8	26.3	36.2	33.6	24.2	36.7
Baton Rouge, La.	Mississippi	40.6	40.0	43.8	41.3	42.6	
Donaldsonville, La.	do.	32.8	32.2	34.8	32.7	34.0	
New Orleans, La.	do.	15.8	19.5	20.4	22.0	20.5	21.0
Monroe, La.	Ouachita	37.9	44.5	46.2	36.9	40.6	
Simmesport, La.	Atchafalaya				50.1	46.9	
Melville, La.	do.		36.1	35.7	41.9	41.7	41.9

¹ Occurred later than the lower Mississippi flood.

FLOOD-PRODUCING RAINS OF JANUARY.

The depths of rainfall day by day in the counties of southern California are shown in tabular form in Tables 11 to 16, inclusive. These data are furnished in advance of their regular publication through the courtesy of District Forecaster George H. Willson, of San Francisco, Cal. Table 18 is a résumé of the data of Tables 11 to 17, stated in the form of the daily average precipitation in southern California and Arizona.

Ordinarily the greater the area covered the less will be the average precipitation, since precipitation usually progresses from west to east, and when summed by dates may not be uniform over the entire district, being less on the eastern front as the storm approaches and diminishing on the western front as the storm recedes. Other considerations, such as altitude and exposure to the winds, tend to make the horizontal distribution extremely irregular, but when grouped by the smaller political divisions, such as counties, we should expect greater uniformity in depth, level for level, and in general a more uniform horizontal distribution than when greater areas are grouped together.

Table 19 gives the average daily precipitation in those watersheds east of the Rocky Mountains in which the streams were in severe flood. These data have been supplied in advance of their regular publication by the section directors of the several States concerned. The courtesy of the several directors is here acknowledged.

The rainstorm of the 21st in Oklahoma moved rapidly to the northeast over the Great Lakes on the afternoon of the 21st, and the weather in its rear cleared rapidly. There was practically no rain of consequence after 8 a. m. of the 22d. The precipitation of this storm was heaviest in northeastern Oklahoma and northern Illinois. Between these two regions the rainfall in the storm's path was considerably lighter. This fact is not brought out in Table 19, hence we have compiled Table 20, showing the rains of 2 inches and over in 24 hours along the storm track from Oklahoma to northern Illinois, and also for other dates and places. This table represents the local variation in intensity that in general attends widespread rainstorms.

TABLE 8.—Floods in the Red River and the rivers of the West Gulf States, January, 1916.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
Red	Fulton, Ark.	28.0	29	31	30.6	31
Ouachita	Arkadelphia, Ark.	18.0	28	28	18.0	28
Sabine	Logansport, La.	25.0			24.2	31
Sulphur	Rineo Crossing, Tex.	20.0			19.0	29, 30
Do.	Finley, Tex.	24.0	30	31	25.0	31
Trinity	Dallas, Tex.	25.0	23	25	23.5	25
Do.	do.	25.0	27	31	34.9	30
Do.	Trinidad, Tex.	28.0	30	31	30.4	31

TABLE 9.—Floods in the rivers of the East Gulf and South Atlantic States, January, 1916.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
Atchafalaya	Melville, La.	37.0	26	(²)	41.9	*1-4
Tallahatchie	Swan Lake, Miss.	25.0	10	(²)	29.1	*11-14
Yazoo	Yazoo City, Miss.	25.0	28	(²)	29.9	18
Pearl	Edinburg, Miss.	21.0	2		23.0	3
Do.	Jackson, Miss.	20.0	4	16	26.7	9, 10
West Pearl	Pearl River, La.	13.0	18	31	15.0	27
Black Warrior	Tuscaloosa, Ala.	46.0	23	25	52.9	23
Tombigbee	Demopolis, Ala.	39.0	1	11	50.2	5
Alabama	Montgomery, Ala.	35.0	1	3	43.0	1
Do.	Selma, Ala.	35.0	1	6	43.1	1
Chattahoochee	Alaga, Ala.	30.0	1	3	33.0	2
Ocmulgee	Abbeville, Ga.	11.0	5	8	12.2	7
Saluda	Chappells, S. C.	14.0	1	1	15.3	1
Wateree	Camden, S. C.	24.0	1	1	26.8	1
Santee	Rimmi, S. C.	12.0	1	10	15.2	5
Do.	Ferguson, S. C.	12.0	1	13	13.9	6
Roanoke	Weldon, N. C.	30.0	1	1	33.3	1

¹February. ²Still above flood stage, Mar. 10, 1916. ³March.

The second period of rains east of the Rockies began late on the 25th and continued intermittently until the 31st. The intensity varied on the several dates, as may be gathered from the data of Table 20. A region of marked local intensity is found in eastern Oklahoma on the 27th-28th, in southern Missouri and in the immediate drainage of the Ohio in Illinois, Indiana, and western Kentucky on the 29th and 30th. Outside of these regions (see A. J. H. fig. 2, XLIV-11) precipitation was light to moderate and did not form an important contribution to the floods.

In general, the depths of rainfall east of the Rockies in the first period were not sufficient, under the average

conditions of ground absorption, to have produced flood stages, but the sleet-ice cover in southeast Kansas and southwest Missouri and the snow cover in northern Illinois evidently prevented any considerable ground absorption at first. Hence the rapidity with which the rivers reached flood stage. At the close of the first period of rains the temperature was above freezing and the ground, in Arkansas at least, free of frost. The rains in the beginning of the second period were light to moderate, but increased in intensity during the second day and continued moderately heavy for the three consecutive days, January 28-31, 1916. (See Table 19, for Arkansas, Missouri, Illinois, and Indiana.)

TABLE 11.—Daily precipitation in Ventura County, Cal., January 16-20 and 24-29, 1916.

Stations.	Altitude.	January—					Total.	January—					Total.	
		16	17	18	19	20		24	25	26	27	28		29
	Feet.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	
Camarillo.....	*	0	3.30	1.30	0.25	0	4.85	0.07	0.55	0	1.43	1.86	0.05	3.86
Ojai Valley.....	900	*	5.85	2.15	.28	0	8.28	.18	.70	*	3.95	T.	.47	5.30
Osona.....	3,680		2.80	1.32	.49	0	4.61	.07	.14	.41	1.00	.09	.18	1.89
West Saticoy.....	150		.28	3.00	1.35	.33	4.96	.13	.24	1.88	1.88	0	.25	4.48
Daily means ¹			1.56	2.58	1.32	.22	5.68	.11	.43	.82	1.82	.49	.24	3.91

TABLE 12.—Daily precipitation in Los Angeles County, Cal., January 16-20 and 24-29, 1916.

Stations.	Altitude.	January—					Total.	January—					Total.	
		16	17	18	19	20		24	25	26	27	28		29
	Feet.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	
Alhambra.....	*		5.40	3.00	1.10	0	9.50	0	0	0	3.00	0	0.40	3.40
Arcadia.....	*		5.00	4.00	.58	0	9.58	0	1.00	0	1.02	1.60	.50	4.12
Asus.....	540	0.02	6.10	4.76	.95	0.16	11.99	T.	1.17	0.10	1.26	1.57	T.	4.10
Bassett.....		.04	3.20	3.00	.72	.50	7.46	0	.45	.08	1.40	1.40	0	3.33
Camp Bonito.....	2,000	.05	5.18	8.90	1.60	.20	15.93	0	.76	.05	1.54	3.32	0	5.67
Claremont.....	1,200	.07	4.68	4.41	.82	.42	10.40	T.	.61	.16	1.20	2.19	.58	4.74
Clearwater Power House.....	2,350	*		4.40	.30	0	4.70	0.17	.25	*	1.85	0	.60	2.77
Compton.....		.05	2.02	.78	.60	.07	3.52	.07	.66	.07	2.34	.68	0	3.72
Covina.....		*	4.45	3.65	.70	0	8.80	.75	0	0	1.15	1.65	.53	4.08
Duarte.....		.05	5.20	4.92	.45	.45	11.07	0	1.08	.07	1.18	1.70	0	4.03
El Monte.....		*	4.80	2.62	.67	.15	8.24	.50	0	1.25	1.38	.40	.40	3.93
Fairmont.....	3,047	0	2.58	3.07	.52	.09	6.26	0	.13	T.	.67	.41	.02	1.23
Iron Forks.....	3,500	0	*		16.75	0	16.75	*	*	*	4.55	0	.60	6.15
Long Beach.....		.12	1.85	.48	.40	.08	2.93	0	.45	.08	2.80	.58	.07	3.98
Lordsburg.....	0		7.40	3.65	.90	0	11.95	0	.83	0	3.30	0	.71	4.84
Los Angeles.....	457	1.07	4.16	.82	.43	0	6.48	.11	.33	.33	2.28	0	.43	3.48
Lowe Observatory.....	3,420	*	*	*	11.10	0	11.10	*	*	*	*	*	3.76	3.76
Monrovia.....		.05	5.08	4.48	.45	.41	10.47	.02	.92	.06	1.13	1.82	0	3.95
Mount Wilson.....	5,850	.58	6.38	4.37	1.14	0	12.47	.36	.76	.03	4.40	.03	.30	5.88
Nenasch.....		*	1.40	.90	.25	0	2.55	0	0	0	.12	0	0	0.12
Newhall.....	1,200	2.00	3.03	1.93	.38	0	7.34	0	0	0	2.67	0	.43	3.10
Norwalk.....		.07	2.00	1.45	.72	.25	4.49	0	.50	.10	1.80	.90	.15	3.45
Pacoima.....	1,570	*	4.50	3.05	.57	.15	8.27	.10	.75	.05	1.36	1.09	.40	3.75
Pasadena.....	825	.41	4.68	2.47	.75	0	8.31	.04	.54	0	2.58	.01	.31	3.48
Pomona.....	840	.05	3.50	4.85	1.05	.55	10.00	.02	.60	.35	1.10	2.22	0	4.29
Ravenna.....		1.25	1.45	.57	.20	0	3.47	0	0	0	.35	.45	0	0.80
San Fernando.....	975	*	3.97	2.73	.68	0	7.38	.16	0	.05	1.62	.61	0	2.44
San Gabriel.....		*	5.30	2.82	.95	0	9.07	0	0	0	2.35	0	0	2.35
San Pedro.....	62	1.00	.40	.50	0	0	1.90	0	.40	0	1.60	.60	0	2.60
Santa Monica.....	110	*	*	5.82	.63	0	6.45	0	.63	0	2.85	0	.50	3.98
Sierra Madre.....	1,400	*	5.50	3.30	.94	0	9.74	*	1.20	.10	2.50	.12	.35	4.27
Tropic.....		*	2.50	.80	.16	0	3.46	.50	0	1.06	1.40	0	.38	3.24
Valerme.....	3,750	.20	2.77	1.72	.39	.23	5.31	0	0	0	.58	0	T.	0.58
Walnut.....	149	*	*	6.00	.75	0	6.75	*	.50	*	*	3.00	.50	4.00
Wilmington.....		.60	1.90	.80	.65	0	2.95	.70	.60	0	2.20	.70	.05	4.25
Daily means ¹.....			.34	.82	2.94	.87	5.08	.11	.45	.19	1.80	.72	.24	3.51

TABLE 13.—Daily precipitation in Orange County, Cal., January 16-20 and 24-29, 1916.

Stations.	Altitude.	January—					Total.	January—					Total.	
		16	17	18	19	20		24	25	26	27	28		29
	Feet.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	
Buena Park.....		0.09	2.30	1.67	0.99	0	5.05	0	0.32	0	1.68	0.77	0.90	3.67
Old Ranch.....		.10	1.68	.87	.96	.32	3.93	0	.48	.09	2.15	1.50	.02	4.24
Orange.....		.17	2.42	1.57	.89	.42	5.47	0	.42	.22	2.01	1.32	.04	4.01
Santa Ana.....	2,850	.14	1.78	1.18	.51	.57	4.18	0	.32	.28	1.62	1.74	0	3.96
Tustin (near).....	123	.12	1.75	1.06	.78	.38	4.09	0	.41	.26	1.41	1.68	.07	3.83
Yorba Linda.....	405	.52	3.52	1.17	1.17	0	6.38	0	.40	0	3.01	.04	.47	3.92
Daily means.....			.19	2.24	1.25	.88	4.84	0	.39	.14	1.98	1.18	.25	3.94

* Rainfall included in the next measurement.

¹ For the purpose of forming the daily means the total amount of rain, as given for a few stations in the tables at which but a single measurement for the storm was made, was distributed proportionately among the several days on which rain fell.

TABLE 14.—Daily precipitation in San Bernardino County, Cal., January 16-20 and 24-29, 1916.

Stations.	Altitude.	January—					Total.	January—					Total.	
		16	17	18	19	20		24	25	26	27	28		29
	Feet.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Bear Valley Dam.....	6,700	0	0	0	0	0	0	0	0	0	0	0	0	4.07
Beaumont.....	2,317	2.08	2.20	1.71	0.70	0	6.69	0.56	0.67	1.58	2.70	0.08	0.35	5.94
Beaumont (near).....	2,558		5.95	2.55	.61	0.74	9.85	.53	.55	2.02	4.18	0	.63	7.91
Camp Baldy.....	3,850													
Chino.....	714	.15	4.80	3.57	1.56	.28	10.36	.80	.27	0	1.75	2.10	.07	4.99
Converse Nursery.....	6,000	1.02	6.80	3.64	1.70	0	13.16	T.	1.24	T.	7.42	1.76	.57	10.99
Craftonville.....		2.20	1.70	1.00	.50	0	5.40	.50	.30	.70	1.90	0	.45	3.85
Fontana.....	1,325	.54	4.91	1.86	1.28	0	8.59	.06	.72	.98	2.98	0	.55	5.29
Glen Ranch.....	3,256	.10	7.02	12.00	1.45	1.65	22.22	0	.05	0	1.98	3.10	0	5.18
Holcomb Valley.....	7,800	.29	3.72	2.60	.73	0	7.34	0	0	0	1.88	.44	.75	3.07
Mill Creek.....	3,750				14.20	0	14.20	0	.85	.60				7.15
Redlands.....	1,252	.55	3.44	.98	.79	0	5.76	0	.42	.05	2.31	.48	.07	3.33
Rialto (near).....	2,000	3.04	12.95	2.80	1.37	0	20.16	.61	1.78	1.14	5.34	0	1.05	9.32
Seven Oaks.....	5,900	5.90	6.10	3.40	.43	0	15.53	.25	1.00	2.25	6.45	.10	.35	10.40
San Bernardino.....	1,054	.80	5.29	1.18	1.20	0	8.47	0	.69	.05	3.16	.14	.53	4.57
Squirrel Inn.....	5,280	1.21	16.81	5.83	3.02	0	26.87	.12	.69	.60	7.05	.80	1.60	10.86
Summit.....	3,823	.26	2.35	2.65	.40	0	5.66	0	0	0	1.41	0	0	1.41
Daily means.....		1.30	5.70	3.05	1.05	.17	11.27	.21	.58	.62	3.25	.66	.95	6.27

* Rainfall included in a subsequent measurement.
 † The rainfall at Squirrel Inn on the 17th (16.81) is the greatest amount for one day ever recorded in California.—G. H. W.
 ‡ For the purpose of forming the daily means the total amount of rain, as given for a few stations in the tables at which but a single measurement for the storm was made, was distributed proportionately among the several days on which rain fell.

TABLE 15.—Daily precipitation in Riverside County, Cal., January 16-20 and 24-29, 1916.

Stations.	Altitude.	January—					Total.	January—					Total.	
		16	17	18	19	20		24	25	26	27	28		29
	Feet.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Aguanga.....	1,986	0	1.30	3.00	3.80	1.31	9.41	0	0	0	5.00	2.00	0.05	7.05
Cabazon.....		0.20	4.20	4.60	2.10	2.30	13.40	0	0	0.50	0.10	0	0	0.60
Cahulla.....	3,800	2.00	2.00	2.25	.50	0	6.75	0	1.50	1.50	1.50	0.25	.60	5.35
Corona.....	615	.78	4.30	1.96	.87	T.	7.91	0.03	.26	.01	5.00	.25	.46	6.11
El Casco.....		*	3.00	1.25	1.20	0.20	5.65	0	.36	.37	1.15	.08	.43	2.89
Elmore.....	1,300	3.43	2.30	1.40	.45	0	7.58	.25	.26	1.40	3.40	.02	.21	5.54
Riverside.....	851	2.26	1.15	.61	.51	0	4.53	.28	.43	.65	1.67	.03	.47	3.53
San Jacinto.....	1,560	1.10	2.78	.96	.82	0	5.66	0	.55	0	2.17	.06	.11	3.29
Daily means.....		1.35	2.50	2.00	1.28	.48	7.61	.07	.43	.55	2.50	.39	.29	4.23

* Rainfall included in a subsequent measurement.

TABLE 16.—Daily precipitation in San Diego County, Cal., January 16-20 and 24-29, 1916.

Stations.	Altitude.	January—					Total.	January—					Total.	
		16	17	18	19	20		24	25	26	27	28		29
	Feet.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Bonita.....	110	0.50	1.45	2.16	0.58	0.43	5.13	*	0.04	0.14	1.26	2.10	0.43	3.97
Campo.....	2,543	4.75	2.23	1.20	1.23	0	9.41	0	0	.55	1.83	4.35	.10	6.83
Cuyamaca.....	4,077	3.35	5.83	5.27	1.59	0	16.04	0.23	1.63	1.53	8.54	1.30	1.12	14.35
El Cajon.....	482	1.86	4.41	1.24	.60	0	8.11	0	0.26	0.05	5.60	0.74	0.10	6.75
Escondido.....	710	2.00	4.85	1.95	1.06	0	9.86	0	.71	.08	5.53	.58	.50	7.40
Julian.....	4,222	.95	5.95	6.49	1.73	1.36	16.48	.06	.19	1.31	3.31	7.68	.35	12.90
La Jolla.....	2,715	2.52	7.42	4.00	1.43	T.	15.37	.10	.57	.52	5.75	1.38	.22	8.54
Mesa Grande.....	3,350	3.26	8.08	3.99	.10	0	15.43	.17	1.19	.34	8.55	1.63	.33	12.21
Nellis.....	5,350	3.52	11.24	6.00	1.85	T.	22.61	.19	1.85	.97	10.16	2.27	.85	16.29
Oak Grove.....	2,751	1.20	5.55	2.80	1.60	.10	11.25	T.	T.	0	7.80	1.20	.18	9.18
Oceanside.....	60	1.80	1.23	1.20	.26	0	4.49	.54	.08	2.02	1.60	.06	.31	4.61
Point Loma.....	302	0.37	.80	2.10	.98	.70	4.90	.01	.15	.14	2.14	1.27	.03	3.74
San Diego.....	93	.04	1.96	1.72	2.79	1.21	7.72	7.33	1.27	3.13	1.71	2.34	.69	16.47
Warner Springs.....	3,165	2.25	5.08	2.30	1.06	0	10.69	.01	.15	.14	4.42	.77	.26	5.75
Daily means.....		2.03	4.72	3.03	1.20	.27	11.25	.62	.58	.78	4.87	1.98	.39	9.22

* Rainfall included in a subsequent measurement.

TABLE 17.—Daily precipitation in Arizona, January 15–21 and 25–30, 1916.

Stations.	Alti- tude.	January—								Total.	January—						Total.
		15	16	17	18	19	20	21	25		26	27	28	29	30		
<i>Gila Watershed.</i>																	
Alamo Ranger Station	3,155	0.75	1.02	0.80	0.77	0.39	0.20	0.03	3.95	0	0.49	0.28	0.55	0	0.68	1.40	
Ashdale Ranger Station	3,500	.92	.99	1.94	1.42	1.20	.07	.12	6.56	T.	.26	1.31	2.35	T.	.09	4.01	
Ashfork	5,229	.16	.30	.30	.60	.40	0	0	1.76	0.10	.30	.20	.20	0	.15	.96	
Astec	492	.55	.08	.03	.27	0	0	0	.93	0	0	.12	.08	.03	0	.23	
Bald Hill ranch	4,600	*	*	*	*	*	3.46	0	3.46	T.	T.	.69	.72	.15	0	1.56	
Baseline Ranger Station	4,481	.62	.70	1.27	1.14	.76	.46	0	4.95	0	.27	.32	.31	0	0	.90	
Benson	3,523	0	.15	.16	.16	1.72	.26	0	2.45	0	0	0	0	T.	0	T.	
Bisbee	5,350	0	0	0	0	1.68	1.45	.05	3.18	0	0	0	0	0	.14	.14	
Blue	6,500	.25	.62	.33	.24	1.81	.41	0	3.66	.28	.25	.06	.49	0	.05	1.13	
Bowie	3,756	0	T.	0	0	*	2.20	0	2.20	0	0	0	0	0	0	0	
Buckeye	980	.98	.36	.21	.45	0	.02	0	2.02	0	0	.15	.13	.04	0	.32	
Canille	5,225	.07	.06	0	0	.88	1.32	0	2.33	0	0	0	.05	.06	.01	.12	
Carr's ranch	5,410	1.12	1.45	2.18	2.25	.88	.30	.28	8.46	T.	1.35	1.80	2.81	.05	.26	6.27	
Casa Grande	1,422	.35	.44	.13	.24	.13	.28	.13	1.70	0	0	.09	.39	0	.09	.57	
Cedar Glade	4,610	.16	.69	.55	.60	.41	0	0	2.41	.81	0	.93	.40	0	.10	2.24	
Chandler	1,213	*	*	*	1.75	0	.14	0	1.89	0	T.	.05	.09	0	.06	.20	
Childs	2,650	.65	1.95	0	1.33	.96	0	0	4.89	0	.22	1.56	1.48	0	.22	3.48	
Clifton	3,584	.22	.42	.35	.20	1.38	.72	.10	3.39	.02	.07	0	.05	0	0	.14	
Clima	2,300	1.29	1.25	1.63	1.61	.98	.26	.33	7.35	0	.30	1.04	1.80	0	.15	3.29	
Cornville	3,300	.19	.40	.55	.47	.17	0	.13	1.91	0	.35	.79	.20	0	.05	1.39	
Douglas	3,930	T.	T.	0	0	.56	2.39	.09	3.04	0	0	0	0	0	0	.08	
Dudleyville	2,204	.45	.49	.25	.60	1.88	.55	.18	4.38	.02	.02	.08	.13	.16	.08	.49	
Elgin (near)	4,900	0	T.	T.	.02	1.10	3.25	.14	3.51	0	T.	T.	.14	T.	T.	.14	
Fairbank	0	0	T.	0	T.	1.39	1.62	0	3.01	0	0	0	0	0	0	T.	
Florence	1,493	.36	.25	.21	.41	0	.41	.11	1.75	0	0	.14	.54	0	0	.68	
Fort Apache	5,200	.41	.94	.79	.71	2.51	.18	.11	5.65	.02	.48	.27	1.66	.07	.04	2.54	
Fort Huachuca	5,100	0	0	0	0	0	2.00	0	2.00	0	0	0	0	0	0	0	
Gila Bend	737	0	.82	0	.42	.04	0	0	1.50	0	0	0	0	0	0	.81	
Gisela	2,300	.75	.69	1.20	1.20	.27	.05	.02	4.18	0	.27	0	1.44	0	.04	1.75	
Glendale	1,160	.25	1.24	.62	.46	.10	.01	.01	2.69	0	0	.11	.26	0	0	.37	
Globe	3,625	.75	1.19	.72	.69	.94	.24	.05	4.58	0	.17	.20	.75	T.	.09	1.21	
Gould's ranch	1,195	.45	.90	.35	.25	.05	.05	0	2.05	0	0	0	.35	0	.09	.44	
Granite Reef Dam	1,325	.42	1.06	.67	.46	.75	.30	.19	3.85	0	.08	.15	.39	0	.11	.73	
Hackberry Ranger Station	2,422	1.92	1.90	2.00	1.91	1.07	.10	.22	9.12	0	.30	1.04	1.30	0	.15	3.29	
Henry's camp	6,600	.51	1.06	.86	0.96	.83	.85	.08	5.13	.08	.94	0	0	0	.23	1.26	
Hersford	0	0	0	0	0	1.40	.80	0	2.20	0	0	0	0	0	0	0	
Higley	1,322	.20	.96	.46	.37	.43	0	.28	2.70	T.	0	.04	.03	.15	0	.22	
Honeymoon	5,440	.65	.95	.70	.60	1.70	.40	0	5.00	.11	.67	.28	.76	.02	.06	1.91	
Intake	2,230	*	*	3.10	*	.85	*	.22	4.27	.19	*	*	.59	.17	0	.95	
Jerome	4,743	.43	.70	.82	1.12	.64	.15	0	3.86	.06	.69	1.03	1.00	0	0	2.78	
Johnson Wash	4,650	*	*	*	*	4.60	0	0	4.60	*	*	*	*	2.40	0	2.40	
Klondyke	3,225	.35	.59	.57	1.73	1.34	.34	.02	4.94	.15	.02	.02	.45	.15	.06	.85	
Lewis Springs	0	.09	0	0	0	1.08	.40	0	1.57	0	0	0	0	0	0	.04	
McNeal	4,150	0	0	0	0	2.48	1.30	0	3.78	.04	0	0	0	0	0	.04	
Maricopa	1,180	.25	.32	.43	.17	0	0	0	1.49	0	0	0	.10	0	0	.14	
Maricopa	1,150	.24	1.18	.70	.40	.14	0	0	2.66	0	0	0	0	0	0	.49	
Mesa	1,244	.50	.87	.64	.34	.28	.04	0	2.67	0	T.	0	.15	.34	0	.46	
Miami	3,633	.33	1.57	1.18	.80	1.09	.06	.36	5.36	0	.54	.18	1.59	.53	.02	2.86	
Mohawk	538	.10	0	0	0	1.32	.11	.08	2.71	0	0	.13	0	0	.08	.07	
Naco	0	0	0	0	T.	1.21	1.50	0	2.71	0	0	0	T.	0	.07	0	
Natural Bridge	4,990	.98	.70	2.30	1.65	.40	.11	0	6.14	0	.50	1.30	.45	0	.28	2.53	
Nogales	3,830	T.	T.	0	.55	3.81	.36	0	4.72	0	0	0	.01	0	.03	.04	
Oracle	4,502	.75	1.10	.28	.50	3.41	.28	0	6.32	0	.20	0	1.30	.07	.55	2.12	
Osborn	0	0	0	0	1.23	.98	0	0	2.21	0	0	0	0	0	.12	.19	
Paradise Valley	0	.66	.90	.69	.30	.45	.01	0	3.01	0	.01	.06	.40	.05	0	.52	
Payson	5,550	.33	0	1.25	1.16	.35	.17	0	3.26	0	.44	1.36	.65	0	.11	2.56	
Phoenix	1,092	.29	1.05	.19	.32	T.	.02	0	1.87	T.	0	0.08	.05	0	.07	.20	
Pinal Ranch	4,520	2.36	2.25	2.00	0	.45	0	0	7.06	.44	2.22	1.20	0	0	.46	4.38	
Prescott	5,320	.06	.85	1.22	1.60	.52	.48	.05	4.46	T.	.02	.35	1.25	1.28	0	3.09	
Do. (Dry Farm)	5,038	.06	.50	.75	.52	.48	.05	.10	2.46	0	.24	.85	.62	.04	.19	1.75	
Rice	2,540	.42	.50	.48	.38	1.50	.38	.03	3.99	0	.33	.14	.43	.08	.06	1.04	
Roosevelt	2,175	.90	1.64	2.53	1.26	.54	0	.20	7.07	.03	.33	1.10	.80	0	.20	2.46	
Sacaton	1,390	.48	.61	.19	.23	.34	.18	0	2.10	0	0	.09	.27	.02	.27	.65	
San Simon	3,600	0	0	0	1.15	2.63	1.02	0	3.88	0	0	0	0	.05	0	.06	
Scottsdale	1,250	.45	1.03	T.	.15	.44	.10	0	2.87	0	0	.20	.40	0	.05	.65	
Seligman	5,219	*	*	1.50	0	0	0	0	1.50	T.	0	0	.75	.35	0	1.10	
Sentinel	685	.02	.58	.07	.19	.08	.23	0	1.17	0	0	.10	.03	0	.13	.13	
Tempe	1,166	.37	.85	.49	.21	.15	.18	.01	2.58	0	0	.08	.40	T.	.05	.53	
Tempe (near)	0	.36	1.12	.40	.41	0	0	.09	2.68	0	T.	.07	.09	0	.28		
Thatcher	2,800	.09	.41	.34	1.04	1.06	.07	0	3.01	T.	0	T.	T.	0	0	T.	
Tombstone	4,550	0	1.20	0	0	3.00	0	0	4.20	0	0	0	0	0	.08	.08	
Tonto Ranger Station	4,470	.60	.64	.68	.51	1.09	0	T.	3.20	0	.16	1.46	2.94	0	.01	3.57	
Walnut Creek Ranger Station	0	0	0	0	0	0	0	0	0	0	.55	1.40	.95	0	.23	3.33	
Walnut Grove	3,649	*	*	*	3.85	0	0	0	3.85	T.	*	*	5.10	0	.28	5.38	
Wickenburg	2,072	0	.56	.54	1.20	0	0	0	2.30	0	0	1.67	0	0	.11	1.78	
Windmill Ranch	0	.50	0	1.13	.79	.25	0	0	2.66	.70	0	0	1.10	0	.60	2.70	
Young	0	.25	2.01	1.12	1.01	2.09	.30	0	6.78	.68	.10	2.05	.20	0	0	2.98	
Means*		0.38	0.67	0.61	0.61	0.85	0.37	0.05	3.54	0.05	0.18	0.40	0.55	0.03	0.08	1.29	
<i>Little Colorado Watershed.</i>																	
Flagstaff	8,907	.04	.55	1.25	1.32	.21	.02	0	3.39	.66	.60	1.81	.85	.18	.19	4.29	
Fort Valley	7,500	.37	.37	1.70	.47	1.45	0	T.	4.31	0	1.20	.35	1.50	T.	.35	3.40	
Greer	8,500	T.	.20	.10	.20	1.00	.30	0	1.80	T.	.27	.19	.57	0	T.	1.03	
Heber	6,84	.04	.21	*	*	3.00	.27	0	3.68	0.01	.50	.					

TABLE 17.—Daily precipitation in Arizona, January 15-21 and 25-30, 1916—Continued.

Stations.	Altitude.	January—								Total.	January—						Total.
		15	16	17	18	19	20	21	25		26	27	28	29	30		
<i>Little Colorado Watershed—Continued.</i>																	
Tuba.....	4,500	T.	T.	0.77	0.14	0	T.	0.01	Inches.	0.05	0.15	0.09	0.07	0	0.05	0.41	
Willow Wash.....	6,400	0.05	0.47	.73	1.46	0.67	0.31	0	3.69	.06	.40	.40	1.41	0.04	.08	2.39	
Winslow.....	4,848	0	.37	.85	0	.26	0	0	1.48	0	.01	0	.01	0	0	.02	
Means*.....		0.11	0.47	0.72	0.62	0.62	0.21	T.	2.75	0.10	0.30	0.30	0.59	0.05	0.07	1.41	
<i>Colorado Watershed.</i>																	
Allen Lake Ranger Station.....	6,500	0	T.	.78	1.15	.65	0	T.	2.58	T.	T.	.76	.38	0	0	1.14	
Echo Park.....	6,600	.23	.17	.94	.37	.40	T.	.08	2.19	.40	.64	1.19	.46	0	.30	2.99	
Grand Canyon.....	6,866	.22	.10	.74	.48	.33	0	T.	1.87	0	.62	1.02	T.	0	.32	1.96	
Kingman.....	3,326	0	.34	.64	.32	.13	0	0	1.43	0	0	.60	.11	0	.24	.95	
Moccasin.....	4,500	.38	0	.58	.44	.19	0	0	1.59	.25	.60	.04	.01	.01	.03	.94	
Parker.....	353	0	.40	.58	.62	.55	.04	0	2.19	0	0	.30	.54	0	.84		
Supai.....	3,200	0	.32	.04	.38	0	0	0	1.19	.19	0	.52	0	0	.11		
Williams.....	6,750	0	.23	1.36	1.54	.81	.27	0	4.21	0	.42	.63	.21	0	.84		
Yuma.....	141	.11	.18	.02	.07	.10	0	0	.48	0	0	.03	0	T.	0		
Means*.....		0.10	0.19	0.63	0.60	0.35	0.03	0.01	1.91	0.09	0.25	0.57	0.19	T.	0.15	1.25	
<i>Desert Watershed.</i>																	
Ajo.....	1,805	.03	.13	.05	.30	.16	T.	0	.67	0	.02	.10	.56	.18	.01	.87	
Bonita.....	4,916	0	.90	0	0	2.00	.85	0	3.75	.15	0	0	0	0	.10	.25	
Cochise.....	4,250	.02	.02	.08	.04	1.74	.10	0	2.00	0	0	.04	0	0	0	.04	
Cyclopic.....	4,500	0	0	1.05	.83	.05	0	0	1.93	.04	.03	.48	0	0	.20	.75	
El Dorado.....	5,250	0	0	0	0	2.00	2.24	0	4.24	0	.05	0	0	.09	0	.14	
Hackberry.....	3,500	0	.09	.51	.53	.05	0	0	1.18	T.	.02	.33	T.	0	.20	.55	
Light.....		T.	.02	T.	.02	1.58	2.05	0	3.77	0	T.	0	0	0	T.	T.	
Paradise.....	5,436	0	0	0	*	*	3.60	0	3.60	0	T.	0	0	0	0	0	
Pearce (near).....	4,400	.02	.09	T.	.15	1.30	1.69	.04	3.29	0	T.	0	0	.02	T.	T.	
Portal.....	5,000	0	0	0	0	2.30	0	0	2.30	.08	0	0	.01	0	.03	.12	
Redrock.....	1,864	0	.50	.13	1.35	.55	0	0	2.53	0	0	0	.40	0	0	.40	
Rosemont.....	4,800	0	.04	T.	.18	*	4.18	0	4.40	0	0	0	.25	0	.10	.35	
Ruby.....		0	0	.10	0	2.51	1.25	.37	4.23	0	.05	0	.28	0	.15	.48	
Salome.....	1,875	.24	.88	.32	.47	0	0	0	1.91	0	0	.60	.13	0	.13	.86	
Truxton.....	3,997	0	.16	.56	.35	.30	0	0	1.37	0	.07	.70	.40	.14	0	1.31	
Tucson.....	2,425	.05	.07	.06	.07	2.63	.51	.01	3.40	0	0	T.	.14	0	.05	.19	
Willcox.....	4,203	0	0	.10	.12	.50	1.50	.52	2.74	0	0	0	0	.10	0	.10	
Means*.....		0.02	0.18	0.17	0.26	1.16	0.94	0.06	2.79	0.02	0.01	0.13	0.13	0.03	0.06	0.38	

* For the purpose of forming the daily means, the total amount of rain, as given for a few stations at which but a single measurement was made for the storm, has been distributed proportionately among the several days on which rain fell.

TABLE 18.—Average daily precipitation in counties of California and Arizona, January 16-20 and 24-29, 1916.

Counties.	Number of stations.	January—					Total.	January—					Total.	
		16	17	18	19	20		24	25	26	27	28		29
<i>California.</i>														
Ventura.....	4	1.56	2.58	1.32	0.22	0	5.68	0.11	0.43	0.82	1.82	0.49	0.24	3.91
Los Angeles.....	35	0.34	0.82	2.94	0.87	0.11	5.08	0.11	0.45	0.19	1.80	0.72	0.24	3.51
Orange.....	6	0.19	2.24	1.25	0.88	0.28	4.84	0	0.39	0.14	1.98	1.18	0.25	3.94
San Bernardino.....	16	1.30	5.70	3.05	1.05	0.17	11.27	0.21	0.58	0.62	3.25	0.66	0.95	6.27
Riverside.....	8	1.35	2.50	2.00	1.28	0.48	7.61	0.07	0.43	0.55	2.50	0.39	0.29	4.23
San Diego.....	14	2.03	4.72	3.03	1.20	0.27	11.25	0.62	0.58	0.78	4.87	1.98	0.39	9.22
<i>Arizona.</i>														
Gila watershed.....	77	0.67	0.61	0.61	0.85	0.37	3.11	T.	0.05	0.18	0.40	0.55	0.03	1.21
Little Colorado watershed.....	22	0.47	0.72	0.62	0.62	0.21	2.64	T.	0.10	0.30	0.30	0.59	0.05	1.34
Colorado watershed.....	9	0.19	0.63	0.60	0.35	0.03	1.80	T.	0.09	0.25	0.57	0.19	T.	1.10
Desert.....	17	0.18	0.17	0.26	1.16	0.94	2.71	T.	0.02	0.01	0.13	0.13	0.03	0.38

¹ Total for period Jan. 15-21, 3.54 inches; Jan. 25-30, 1.29 inches.
² Total for period Jan. 15-21, 2.75 inches; Jan. 25-30, 1.41 inches.

³ Total for period Jan. 15-21, 1.91 inches; Jan. 25-30, 1.25 inches.
⁴ Total for period Jan. 15-21, 2.79 inches; Jan. 25-30, 0.38 inch.

TABLE 19.—Average daily precipitation in the watersheds named for January 31-22 and 26-31, 1916.

State.	Number of stations.	Watershed.	January, 1916.		Total.	January, 1916.						Total.
			21	22		26	27	28	29	30	31	
Kansas.....	21	Neosho.....	1.36	0	1.36	1.06	0.36	0.20	0.04	0.04	0.05	1.75
Oklahoma.....	28	Arkansas.....	0.25	2.59	2.84	0.74	1.20	0.21	0.15	0.60	0.26	3.16
Arkansas.....	21	White.....	0.56	0.33	0.89	0.17	1.49	0.68	1.11	1.24	0.89	5.58
Do.....	12	Arkansas.....	0.84	0.41	1.25	0.32	1.36	1.03	1.19	0.76	0.99	5.65
Missouri.....	9	White.....	0.59	0.34	0.93	0.38	1.53	0.74	1.39	1.84	0.39	6.27
Do.....	7	Osage.....	1.20	0.16	1.36	0.83	1.16	0.22	0.31	0.37	0.20	3.09
Do.....	3	Gasconade.....	0.06	T.	0.06	T.	1.13	0.42	1.19	2.04	0.17	4.95
Do.....	1	Meramec.....	0.11	0	0.11	0	0.95	1.22	0.76	3.05	0.28	6.27
Iowa.....	114	Mississippi.....				0.40	0.35	0.14	0.22	0.07	0.05	1.23
Illinois.....	13	do. 1.....	0.93	T.	0.93	0.05	0.92	T.	0.43	0.19	0.16	1.75
Do.....	19	do. 2.....	0.14	0.05	0.19	T.	0.63	0.60	1.06	2.24	0.65	5.18
Do.....	15	Illinois.....	1.56	0.01	1.07	0.05	0.37	0.14	0.49	0.56	0.13	1.74
Do.....	6	Ohio.....	0.22	0.26	0.48	0.01	0.42	1.25	2.08	1.08	1.81	6.65
Do.....	14	Wabash.....	0.19	0.12	0.31	T.	0.29	0.28	0.65	2.16	1.09	4.47
Indiana.....	11	West Fork White.....	0.11	0.18	0.29	T.	0.20	0.35	0.76	1.84	1.41	4.56
Do.....	11	East Fork White.....	0.09	0.36	0.45	T.	0.30	0.28	0.69	1.38	1.02	3.67
Do.....	1	White.....	0.12	0.48	0.60	T.	0.02	0.36	0.58	2.62	2.12	5.70
Kentucky.....	8	Green.....	0.13	0.85	0.98	T.	0.20	0.66	0.48	0.03	1.06	2.43
Do.....	7	Ohio.....	0.15	0.70	0.85		0.01	0.25	0.54	1.80	0.75	4.50
Ohio.....	120	do.....				0.01	0.08	0.09	0.39	0.62	0.44	1.63
West Virginia.....	53	do.....				0.04	0.07	0.06	0.40	0.47	0.17	1.21
Pennsylvania.....	40	do.....				T.	0.01	0.02	0.03	0.49	0.42	0.97
Tennessee.....	16	Cumberland.....				T.	0.05	0.13	0.22	T.	0.48	0.88

¹ Above the Illinois.

² Below the Illinois.

TABLE 20.—Precipitation of 2 inches and over in 24 hours, Jan. 21-31, 1916, at the places and on the dates named.

TABLE 20.—Precipitation of 2 inches and over in 24 hours, Jan. 21-31, 1916, at the places and on the dates named—Continued.

Station.	Amount.	Date.	Station.	Amount.	Date.
ARIZONA.			ARKANSAS—continued.		
<i>Watershed of Gila and tributaries, Jan. 15-28.</i>			<i>Ouachita watershed.</i>		
Pinal ranch.....	2.36	15	Crossett.....	3.02	21
Childs.....	1.95	16	Fordyce.....	2.00	21
Pinal ranch.....	2.25	16	Huttig.....	2.37	21
Young.....	2.01	16	Portland.....	3.55	22
Carr's ranch.....	2.18	17	El Dorado.....	2.12	22
Natural Bridge.....	2.30	17	Sheridan.....	2.20	22
Pinal ranch.....	2.00	17	Warren.....	2.00	22
Hackberry Ranger Station.....	2.00	17	Fordyce.....	4.09	28
Carr's ranch.....	2.28	18	Camden.....	3.70	29
Bonita.....	2.00	19	Sheridan.....	3.70	29
El Dorado.....	2.00	19	Arkadelphia.....	2.00	30
Fort Apache.....	2.51	19	Rison.....	2.47	30
McNeal.....	2.48	19	Crossett.....	2.43	31
Nogales.....	3.51	19	Fordyce.....	2.10	31
Oracle.....	3.41	19	Huttig.....	3.12	31
Portal.....	2.30	19	Portland.....	2.05	31
Ruby.....	2.51	19	<i>Red watershed.</i>		
San Simon.....	2.63	19	Whitecliffs.....	2.00	27
Tomestone.....	3.00	19	Emerson.....	4.20	28
Tucson.....	2.63	19	Hope.....	2.12	28
Young.....	2.09	19	Lewisville.....	2.90	28
Douglas.....	2.39	20	Emerson.....	2.20	31
El Dorado.....	2.00	20	Texarkana.....	2.10	31
Elgin (near).....	3.25	20	<i>St. Francis watershed. †</i>		
Fort Huachuca.....	2.00	20	Marked Tree.....	2.20	31
Pinal ranch.....	2.22	26	Wynne.....	2.90	31
Young.....	2.05	27	<i>White watershed.</i>		
Ashdale.....	2.35	28	Eureka Springs.....	3.25	27
Carr's ranch.....	2.81	28	Fayetteville.....	4.10	27
Tonto Ranger station.....	2.94	28	Clarendon.....	2.20	29
Walnut Grove.....	*5.10	28	Hardy.....	2.00	29
OKLAHOMA.			Mammoth Springs.....	2.31	29
<i>Arkansas watershed.</i>			Dodd City.....	2.25	30
Bacona.....	3.38	21	Eureka Springs.....	2.82	30
Calvin.....	3.40	21	Fayetteville.....	2.65	30
Claremore.....	2.30	21	Nail.....	3.00	30
Fort Gibson.....	3.90	21	Brinkley.....	3.36	31
Muskogee.....	3.68	21	Georgetown.....	2.80	31
North Muskogee.....	4.12	21	Jonesboro.....	2.10	31
Tahlequa.....	3.73	21	MISSOURI.		
Tulsa.....	2.20	21	<i>Mississippi watershed.</i>		
Vinita.....	2.00	21	Ironton.....	2.35	28
Wagoner.....	3.00	21	Marble Hill.....	2.00	30
Vinita.....	1.98	26	Patton.....	2.75	30
Wagoner.....	2.60	26	Calro, Ill.....	2.26	30
Webbers Falls.....	2.00	26	Ironton.....	4.65	30
Fort Gibson.....	2.36	27	St. Louis (1).....	2.37	31
North Muskogee.....	3.07	27	St. Louis (2).....	2.74	31
Tahlequa.....	1.95	27	Cape Girardeau.....	2.10	31
Webbers Falls.....	2.12	27	Cardwell.....	2.70	31
Wyandotte.....	2.00	27	Caruthersville.....	2.77	31
<i>Canadian watershed.</i>			New Madrid.....	3.20	31
Ada.....	6.50	21	Sikeston.....	2.25	31
Bristow.....	2.00	21	<i>Gasconade watershed.</i>		
Chandler.....	2.80	21	Houston.....	3.65	30
Eufania.....	2.68	21	<i>Black watershed.</i>		
Holdenville.....	5.72	21	Goodland.....	3.67	30
Okemah.....	3.20	21	Koshkonong.....	2.47	29
Okmulgee.....	2.50	21	<i>Meramec watershed.</i>		
McAlester.....	6.81	27	Oakfield.....	2.16	30
<i>Red watershed.</i>			Gano.....	3.05	30
Durant.....	3.82	27	Rolla.....	2.51	30
ARKANSAS.			<i>Neosho watershed.</i>		
<i>Arkansas watershed.</i>			Neosho.....	2.03	20
Dumas.....	2.55	21	Dean.....	2.28	21
Lake Farm.....	2.30	21	Mountain Grove.....	2.10	21
Pond.....	2.52	21	Dean.....	2.01	27
Pine Bluff.....	1.97	22	Mount Vernon.....	2.30	27
Bentonville.....	3.30	26	Neosho.....	2.30	27
Fort Smith.....	2.50	26	<i>Osage watershed.</i>		
Pond.....	2.00	26	Clinton.....	2.35	20
Booneville.....	2.10	27	Nevada.....	2.70	20
Lake Farm.....	2.60	27	Bollivar.....	3.15	28
Lutherville.....	2.18	27	Lebanon.....	2.20	27
Rogers.....	3.32	27	Lockwood.....	2.38	27
Bee Branch.....	2.00	28	<i>White watershed.</i>		
Lake Farm.....	2.10	28	Hollister.....	4.00	26
Little Rock.....	2.43	28	Springfield.....	2.08	26
Stuttgart.....	1.96	28	Hollister.....	2.90	30
England.....	2.50	29	Mountain Grove.....	3.58	30
Pine Bluff.....	3.62	29	MISSISSIPPI watershed.		
Pond.....	2.02	30	Arkansas City.....	2.76	22
Rogers.....	2.40	30	Helena.....	2.87	22
Dumas.....	2.45	31	ARKANSAS.		
Okay.....	**2.70	31	<i>Arkansas watershed.</i>		
Stuttgart.....	1.99	31	Dumas.....	2.55	21
<i>Mississippi watershed.</i>			Lake Farm.....	2.30	21
Arkansas City.....	2.76	22	Pond.....	2.52	21
Helena.....	2.87	22	Pine Bluff.....	1.97	22

Station.	Amount.	Date.	Station.	Amount.	Date.
ILLINOIS.			OHIO watershed—contd.		
<i>Illinois watershed.</i>			<i>KENTUCKY—continued.</i>		
Aurora.....	2.10	21	Louisville.....	2.13	29
Dwight.....	1.03	21	Louisville (Cherokee).....	2.30	29
Henry.....	2.00	21	Taylorville.....	1.96	30
Joliet.....	2.08	21	Paducah.....	2.69	31
La Grange.....	1.90	21	<i>Green watershed.</i>		
Morris.....	2.65	21	Franklin.....	2.05	31
Streator.....	2.07	21	<i>Mississippi watershed.</i>		
Macomb.....	**3.00	21	Blandville.....	2.40	31
Carlinville.....	2.08	30	INDIANA.		
Decatur.....	2.06	30	<i>Wabash watershed.</i>		
Morrisonville.....	2.03	30	Farmersburg.....	2.68	30
<i>Ohio watershed.</i>			Rockville.....	2.82	30
Equality.....	2.12	28	Salamonia.....	2.02	30
Anna.....	2.15	29	Terre Haute.....	3.13	30
Golconda.....	2.02	29	Vincennes.....	3.00	30
McLeansboro.....	2.30	29	Do.....	2.00	31
New Burnside.....	2.22	29	<i>White watershed.</i>		
Shawneetown.....	2.47	29	Decker.....	2.62	30
Golconda.....	2.55	31	Do.....	2.12	31
Shawneetown.....	2.50	31	<i>White watershed, East Fork.</i>		
<i>Mississippi watershed.</i>			Shelbyville.....	3.42	30
Chester.....	2.62	29	Shoals.....	2.31	30
Du Quoin.....	2.35	29	<i>White watershed, West Fork.</i>		
Ewing.....	2.60	29	Bloomington.....	2.46	30
Grafton.....	2.40	30	Elliston.....	2.87	30
Hillsboro.....	2.23	30	Greencastle.....	2.34	30
Greenville.....	2.21	30	Worthington.....	2.42	30
Cairo.....	2.26	30	Bloomington.....	2.34	31
Chester.....	3.56	30	Elliston.....	2.32	31
Mascoutah.....	2.35	30	<i>Ohio watershed.</i>		
Mount Vernon.....	2.00	30	Mount Vernon.....	2.14	29
Nashville.....	3.18	30	Rome.....	2.05	29
Salem.....	2.76	30	Mount Vernon.....	2.08	31
Sparta.....	4.12	30	<i>Whitewater watershed.</i>		
Waterloo.....	2.34	30	Cambridge City.....	2.00	30
Windsor.....	2.35	30	Richmond.....	2.00	30
Pana.....	2.05	30	TENNESSEE.		
<i>Wabash watershed.</i>			<i>Cumberland watershed.</i>		
Fairfield.....	2.30	30	Dickson.....	2.45	31
Montrose.....	2.77	30	Cedar Hill.....	2.45	31
Newton.....	2.92	30	OHIO watershed.		
Olney.....	2.83	30	Owensboro.....	2.35	29
Palestine.....	3.62	30	Anchorage.....	2.00	29
Sidel.....	2.33	30	Cloverport.....	2.13	29
Tuscola.....	2.09	30	Irvington.....	2.51	29
Mount Carmel.....	2.35	30	KENTUCKY.		
Paris.....	2.45	31	<i>Ohio watershed.</i>		
KENTUCKY.			Owensboro.....	2.35	29
<i>Ohio watershed.</i>			Anchorage.....	2.00	29
Wabash watershed.....	2.30	30	Cloverport.....	2.13	29
Fairfield.....	2.30	30	Irvington.....	2.51	29
Montrose.....	2.77	30	OHIO watershed.		
Newton.....	2.92	30	Owensboro.....	2.35	29
Olney.....	2.83	30	Anchorage.....	2.00	29
Palestine.....	3.62	30	Cloverport.....	2.13	29
Sidel.....	2.33	30	Irvington.....	2.51	29
Tuscola.....	2.09	30	OHIO watershed.		
Mount Carmel.....	2.35	30	Owensboro.....	2.35	29
Paris.....	2.45	31	Anchorage.....	2.00	29
KENTUCKY.			Cloverport.....	2.13	29
<i>Ohio watershed.</i>			Irvington.....	2.51	29
Owensboro.....	2.35	29	OHIO watershed.		
Anchorage.....	2.00	29	Owensboro.....	2.35	29
Cloverport.....	2.13	29	Anchorage.....	2.00	29
Irvington.....	2.51	29	Cloverport.....	2.13	29

SNOWFALL AT HIGH ALTITUDES, JANUARY, 1916.

The snowfall of January, 1916, particularly in California, Nevada, Arizona, New Mexico, Wyoming, Montana, Utah, and Idaho, was exceptionally heavy. Not for many years has the January snowfall in the high altitudes been so abundant. Further details are given in the monthly reports of section directors.

MEAN LAKE LEVELS DURING JANUARY, 1916.

By UNITED STATES LAKE SURVEY.

[Dated: Detroit, Mich., Feb. 3, 1916.]

The following data are reported in the "Notice to Mariners" of the above date:

Data.	Lakes.			
	Superior.	Michigan and Huron.	Erie.	Ontario.
Mean level during January, 1916:				
Above mean sea level at New York.....	Feet. 602.59	Feet. 579.22	Feet. 571.68	Feet. 245.05
Above or below—				
Mean stage of December, 1915.....	-0.13	-0.29	+0.31	+0.27
Mean stage of January, 1915.....	+0.77	-0.22	+0.57	+0.35
Average stage for January, last 10 years.....	+0.62	-0.76	-0.09	-0.51
Highest recorded January stage.....	-0.19	-3.45	-1.87	-2.55
Lowest recorded January stage.....	+1.71	+0.14	+0.72	+1.25
Average relation of the January level to:				
December level.....	-0.3	-0.2	0.0	+0.1
February level.....	+0.2	0.0	+0.1	-0.2

*Total for 3 days. **Total for 2 days. † Two stations only in St. Francis watershed.