

SECTION IV. - RIVERS AND FLOODS.

RIVERS AND FLOODS OF NOVEMBER, 1915.

By ALFRED J. HENRY, Professor of Meteorology, in Charge of River and Flood Division.

The rainfall for the month was moderate and well distributed. Many of the larger streams throughout the country were considerably swollen due to general rains, though few attained a hankful stage, and those which reached or exceeded the flood stage occasioned no material damages as a consequence. While the rainfall for the month as a whole was not unusually heavy, there were two or three periods between November 10 and 27 of continuous rains moderate to heavy in amount. The sections visited by the heaviest rainfalls east of the Rockies together with the dates of heaviest falls are as follows: The lower Arkansas and Red River valleys, from the 9th to 15th, and on the 26th. The lower Mississippi Valley from 12th to 15th, and on 26th. The middle Mississippi and Ohio valleys on the 12th to 15th, 19th and 26th. In the Carolinas on the 19th. The heaviest rainfalls of the Ohio Valley occurred over the Cumberland watershed. The entire month was rainy on the North Pacific slope, producing swollen streams in the rivers of that region, with flood stages in the Willamette River of Oregon. The heaviest rains for this region occurred on the 12th, 16th, 18th, 23d, 25th, and 29th.

In the following table will be found the gage heights in all the rivers at points where the crest reached or closely approached the flood stage:

Flood stages in all rivers. November, 1915.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
Cumberland.....	Burnside, Ky.....	Fect. 50.0			Fect. 47.0	15
Do.....	Celina, Tenn.....	45.0			39.6	19
Do.....	Carthage, Tenn.....	40.0			38.5	20
Do.....	Nashville, Tenn.....	40.0	19	22	41.5	20
Do.....	Clarksville, Tenn.....	46.0			44.1	21 & 22
Santes.....	Rimlni, S. C.....	12.0	21	26	13.2	23
Do.....	Ferguson, S. C.....	12.0	23	28	12.6	26
Nueces.....	Cotulla, Tex.....	9.9	9	9	9.9	9
Salt.....	Tempe, Ariz.....	2.6	8	8	2.6	8
Willamette.....	Eugene, Oreg.....	10.0	26	26	14.5	26
Do.....	Albany, Oreg.....	20.0			19.6	27
Do.....	Oregon City, Oreg.....	12.0			11.0	28
Santiam.....	Jefferson, Oreg.....	10.0	18	18	11.5	18
Clackamas.....	Cazadero, Oreg.....	8.0	26	26	10.3	26
			23	23	10.0	23

Flood warnings were issued from the river district centers at Columbia, S. C., and Nashville, Tenn., in ample time in advance to allow for the removal of property in lowlands subject to damage.

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.

SNOW SURVEY ON COTTONWOOD CREEK, IDAHO.

By ALFRED J. HENRY, Professor of Meteorology.

In the MONTHLY WEATHER REVIEW for November, 1914, 42:634, a brief account is given of the results of a snow survey on the watershed of Cottonwood Creek, a tributary of the Boise River which enters that stream near Boise, Idaho, conducted under the direction of Section Director E. L. Wells, of Boise, Idaho. The results of a similar survey conducted over the identical watershed during March, 1915, together with the discharge measurements of Cottonwood Creek, made as before, through cooperation with the United States Geological Survey, Water Resources Branch, are now available.

The snow survey of March, 1915, indicated that the snow cover at that time contained 8,457.5 acre-feet of water available as run-off, during the melting season. Daily precipitation and discharge measurements were made from March to September, inclusive, at a point on Cottonwood Creek below the area covered by the snow survey. The total monthly precipitation in inches and hundredths and the monthly discharge in acre-feet are given in Table 1, to which have been added corresponding data for 1914:

TABLE 1.—Total monthly precipitation and discharge, 1914-15.

	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Total
Precipitation, inches, 1914.....	0.34	2.85	1.02	0.84	0.92	T.	1.20	7.17
Precipitation, inches, 1915.....	0.93	1.56	5.21	0.65	0.67	0.13	0.77	9.95
Run-off, acre-feet, 1914.....	2,420	3,730	2,200	881	295	73	111	9,710
Run-off, acre-feet, 1915.....	587	791	1,130	566	183	50	93	3,400
Mean temperature departure (1914).....	3.0	1.3	-2.7	-1.7	1.4	0.6	-1.4
Do.....(1915).....	4.4	5.0	-1.6	-2.7	-2.5	4.2	-1.2

Run-off in 1914 was 61 per cent of water equivalent of snow.
Run-off in 1915 was 42 per cent of water equivalent of snow.

It is at once apparent that the diminished run-off of 1915 was due primarily to the diminished snowfall of the winter of 1914-15, the amount of water in the snow cover of 1915 being just about half of that of the year previous.

The total precipitation of 1915 was a little more than 2 inches greater than for the corresponding period of the previous year, but it is clear that a large part of the precipitation did not appear as run-off.

The temperature conditions during the two years were not greatly different, as may be seen from the data of the table. The precipitation of the warm season of 1915, although fairly generous in April and May, followed upon a year of exceptionally light precipitation. The winter snowfall, as before stated, was very little more than half of the preceding winter and the months of March and April were relatively warm and rapid melting must have taken place.

The run-off in March and April, 1915, was less than a quarter of that of the corresponding months in 1914, but in May, 1915, doubtless due to the fairly heavy precipitation, the run-off was 51 per cent of May, 1914. This increase over the two previous months, amounting to about 30 per cent of the whole, was maintained until the close of the season, when, for one reason or another, the run-off of September, 1915, was almost equal to