

## CHAPTER III. HYDROLOGY

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### A. RAINFALL OBSERVATION

The rain gage network of the Little Washita Watershed is fully described in the report by Allen and Naney (1991). There are a total of 36 continuous recording rain gages distributed over the watershed as shown in Figure II-1. Historic daily gage records are available.

Daily precipitation at each raingage for a period of the experiment, including antecedent conditions is summarized in Table III-1. There was considerable spatial variability during individual rainfall events, however, there was a large amount of rainfall prior to the experiment at all sites. This is especially true for the period of June 5 to June 9. The cumulative totals at two widely separated rain gages are plotted in Figure III-1 and clearly show the magnitude and similarity of the total rainfall. Figure III-1 also shows that the only extended dry period was during the experiment.

### B. STREAMFLOW AND SOLAR RADIATION OBSERVATIONS

During the Washita '92 experimental period the Little Washita was gauged by the U.S. Geological Survey at two locations, Station 521, east of Ninnekah, OK gauging 222 square miles and Station 526, south of Cement, OK gauging 62 square miles. These data, together with the solar radiation collected by the ARS at their laboratory on the Oklahoma State University Agricultural Experiment Station at Chickasha, Ok is summarized in Table III-2.

### C. REFERENCES

Allen, P. B. and Naney, J. W. 1991. Hydrology of the Little Washita River Watershed, Oklahoma: data and analyses. USDA, ARS-90. 74 pp.

Table III-1. Total Daily Precipitation During the Washita'92 Experiment

		Precipitation at Raingage (mm)											
Date	110	111	121	122	123	124	125	130	131	132	133	134	135
May 16	3.6	3.0	3.8	4.3	5.1	5.6	4.1	4.6	5.6	8.9	4.3	6.6	8.9
17	35.3	19.8	8.6	3.8	33.3	24.6	6.9	13.7	10.4	5.8	15.0	17.0	13.7
18	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
19	31.5	10.7	20.3	16.5	6.4	3.0	5.6	23.1	12.4	17.3	8.1	3.0	0.8
20	3.0	2.5	1.5	2.5	1.5	0.0	5.1	0.3	8.6	25.1	3.0	2.3	0.3
21	13.0	25.9	13.0	16.8	15.5	26.7	17.3	4.8	16.5	12.2	21.3	21.3	13.7
22	0.0	4.8	3.3	2.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	17.0	15.2	11.7	13.2	11.9	18.8	12.4	9.4	11.2	17.5	17.0	13.7	16.3
26	4.1	5.3	2.3	3.3	2.5	3.6	3.6	8.6	7.1	7.9	5.6	6.1	5.8
27	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.0	0.0
28	23.4	26.7	22.9	24.1	26.4	25.7	24.6	37.1	28.7	41.4	40.6	39.1	29.2
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	6.4	10.9	17.5	13.0	9.1	8.6	6.6	9.4	11.2	7.9	6.9	9.4	10.2
June 1	7.6	6.6	33.0	6.6	4.3	6.9	8.6	14.5	26.2	18.3	10.9	4.8	5.1
2	12.7	8.4	7.1	4.8	6.1	17.3	2.8	0.5	1.3	2.5	3.8	12.7	5.1
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	19.3	17.0	24.6	18.3	22.1	22.4	20.3	29.7	26.7	23.1	26.4	25.4	32.3
6	7.6	7.4	6.9	8.4	8.6	7.4	6.1	8.1	8.1	7.9	6.1	7.6	7.6
7	12.2	9.1	10.2	9.4	9.4	8.1	8.6	13.7	10.4	7.1	12.7	6.9	8.6
8	2.8	5.1	3.8	0.0	4.8	3.3	3.3	0.8	2.8	1.8	4.3	13.5	5.1
9	2.5	5.8	14.7	5.8	1.3	1.3	3.3	4.6	9.7	3.8	2.5	2.5	8.6
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.8	13.2	8.9	4.1	1.8	0.5	0.0
20	3.8	3.8	4.6	3.8	4.3	4.6	5.8	7.6	6.4	6.1	7.1	5.8	6.1
21	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	1.3	2.8	3.6	6.9	7.6	7.9	8.6	6.9	12.7
23	0.0	10.4	0.0	1.3	1.8	1.0	3.6	0.0	0.0	2.0	1.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	4.8	3.6	3.3	3.3	3.6	2.3	1.8	3.8	4.3	3.8	2.3	1.3	1.8
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	67.8	47.8	63.2	63.8	69.3	70.4	74.7	74.9	73.2	79.8	69.6	67.6	81.3
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table III-1 (cont.). Total Daily Precipitation During the Washita'92 Experiment

## Precipitation at Raingage (mm)

Date	136	137	144	145	146	147	148	149	150	151	152	153	154
May 16	3.8	4.1	5.3	6.9	5.3	4.6	5.1	6.6	5.8	6.1	8.1	7.9	8.1
17	8.4	30.5	17.0	20.8	9.1	24.4	14.0	10.9	9.7	3.8	18.0	13.2	17.3
18	0.0	0.5	1.0	0.5	0.0	0.3	0.5	0.0	0.0	0.0	0.0	0.8	0.8
19	10.4	15.2	8.9	4.8	1.0	3.0	14.2	17.3	11.9	23.1	10.7	17.3	21.1
20	3.0	2.8	2.5	0.8	0.3	0.0	2.8	17.8	4.6	17.0	6.4	20.3	2.3
21	9.4	18.5	6.4	6.6	25.9	22.9	18.8	8.1	15.0	7.1	8.9	14.2	20.6
22	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	14.0	15.0	11.4	11.9	10.9	13.0	21.3	22.4	13.7	15.0	30.7	16.3	15.0
26	7.1	6.1	9.9	7.4	6.6	8.9	4.3	3.0	4.1	2.8	6.1	8.6	5.8
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
28	32.3	25.1	45.0	23.9	31.8	48.0	45.7	35.8	21.6	21.6	24.1	49.0	33.0
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	9.4	13.5	7.6	5.6	7.1	11.9	7.9	9.7	7.4	4.6	8.1	13.7	8.4
June 1	12.4	19.1	16.8	3.6	4.6	9.7	11.9	13.5	16.8	17.3	9.1	8.1	3.6
2	4.8	8.1	11.4	6.4	4.6	7.1	14.0	8.6	0.0	0.0	0.8	2.8	14.7
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	32.5	27.4	34.3	33.0	34.5	35.3	31.8	33.8	26.7	30.7	34.3	40.1	43.9
6	0.0	7.1	7.4	8.6	8.1	7.1	8.6	8.1	6.6	7.1	8.9	9.7	8.1
7	13.7	11.4	10.4	12.2	10.2	9.7	8.9	8.1	9.4	11.2	8.1	13.2	10.7
8	5.1	4.8	6.6	3.8	6.9	5.3	10.7	4.1	0.5	2.8	6.6	13.2	11.2
9	15.0	11.2	7.4	6.4	8.9	5.6	3.8	2.8	5.3	0.5	6.4	6.9	6.9
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	1.3	1.5	4.8	10.2	13.7	16.5	16.5	19.3	10.9
20	5.1	5.6	5.8	6.6	5.6	7.1	5.3	5.3	6.6	5.8	6.1	7.4	6.4
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	1.5	0.8	0.0	0.0	2.0	3.6	4.3	11.2	8.9	5.6	0.0	0.0	0.8
23	0.0	0.0	0.8	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	1.5	2.3	1.3	1.3	1.8	4.1	3.0	4.3	5.8	6.4	5.3	32.8	20.6
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	72.4	67.6	63.5	63.8	66.0	50.8	50.5	48.5	59.2	59.2	48.5	63.2	45.7
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	4.1	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table III-1 (cont.). Total Daily Precipitation During the Washita'92 Experiment

Precipitation at Raingage (mm)													
Date	155	156	157	158	159	160	161	162	163	164	165	166	167
May 16	3.3	7.6	6.4	3.8	5.1	7.9	15.7	17.3	10.2	18.5	10.7	8.1	11.4
17	18.5	7.1	15.0	11.9	4.1	15.2	16.5	18.5	17.3	25.9	21.1	4.8	3.0
18	1.3	2.0	2.0	0.8	1.3	1.0	0.8	0.0	0.0	0.0	0.5	0.8	0.8
19	1.3	10.4	4.8	14.7	3.6	9.1	8.4	21.8	7.9	10.9	12.2	9.7	7.6
20	0.3	1.5	6.1	4.1	0.5	0.0	0.0	2.5	14.5	9.1	2.5	0.5	0.5
21	23.9	7.6	7.9	3.8	22.1	25.4	35.3	16.8	12.2	11.7	21.6	35.1	23.4
22	0.0	0.0	2.3	12.4	3.3	0.8	0.8	1.0	0.8	0.0	1.5	0.0	2.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	6.6	8.1	11.7	18.3	8.6	9.1	9.1	13.0	14.5	14.0	12.2	5.8	9.9
26	6.9	8.1	8.9	3.8	4.8	5.6	6.9	10.2	8.9	6.6	8.4	4.3	3.3
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.0	0.0
28	31.0	29.7	25.4	19.1	25.1	35.6	28.7	29.7	31.2	23.6	34.0	21.3	37.1
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	4.6	5.1	8.6	6.6	6.4	5.8	8.1	7.1	10.9	8.4	9.1	12.7	6.1
June 1	15.0	3.6	4.6	6.1	3.0	4.6	9.4	5.3	4.3	2.8	6.6	11.9	5.8
2	7.4	14.0	19.1	21.1	11.4	5.6	4.3	5.3	2.8	3.3	6.6	5.8	6.4
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	43.7	37.3	47.5	38.6	39.6	31.8	35.3	47.0	44.7	41.1	49.3	42.9	43.2
6	11.7	8.9	8.9	12.2	12.2	9.7	9.7	9.1	9.4	8.6	12.2	10.4	11.9
7	12.2	11.4	11.4	11.2	10.4	11.7	9.1	13.5	12.4	11.4	16.3	8.9	11.4
8	6.4	6.4	4.3	7.6	6.4	8.9	12.4	8.9	13.0	9.7	14.5	11.7	7.9
9	6.4	3.3	3.8	6.1	3.8	3.0	7.4	7.6	7.1	3.0	4.1	6.4	7.6
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	3.6	1.5	0.0	5.1	4.6	6.4	9.7	14.5	10.2	8.9	7.6	12.2	5.6
20	7.6	6.1	10.9	5.1	5.1	5.6	5.1	6.1	6.9	6.9	5.3	4.3	3.8
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	2.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	4.8	3.6	2.0	6.6	10.9	20.6	19.3	8.6	2.0	2.0	7.9	10.4	14.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	59.2	60.5	51.3	30.7	33.0	39.4	43.9	46.7	45.5	36.8	40.4	37.8	37.1
29	0.5	0.0	0.5	0.0	0.0	0.0	0.0	1.5	1.8	0.0	1.5	1.3	0.8
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table III-1 (cont.). Total Daily Precipitation During the Washita'92 Experiment

Precipitation at Raingage (mm)

Date	168	181	182	230
May 16	9.1	7.4	6.4	0.0
17	4.6	4.3	11.2	10.7
18	0.3	0.0	0.8	14.7
19	4.3	18.8	3.0	0.0
20	0.5	0.3	0.3	0.0
21	17.3	10.2	24.1	0.0
22	1.8	0.0	1.3	0.0
23	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0
25	18.3	19.6	13.0	0.0
26	3.3	3.8	11.9	0.0
27	0.0	0.0	0.0	0.0
28	31.8	18.5	35.6	0.0
29	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0
31	3.8	6.6	12.7	0.0
June 1	4.3	15.2	8.6	0.0
2	7.9	0.0	15.5	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	45.2	30.5	40.6	0.0
6	13.2	7.6	8.1	0.0
7	9.1	9.7	8.1	0.0
8	7.6	3.3	8.1	0.0
9	10.7	2.5	10.2	0.0
10	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0
19	0.0	23.4	8.4	0.0
20	6.1	7.1	6.6	0.0
21	4.3	0.0	0.0	0.0
22	0.0	0.0	1.3	0.0
23	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0
25	15.7	3.6	11.4	0.0
26	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0
28	27.7	50.8	50.3	0.0
29	0.0	0.0	0.5	0.0
30	0.0	0.0	0.0	0.0

Table 111-2. Little Washita discharge and solar radiation during the Washita '92 experiment.

Date	Mean Daily Discharge (cfs)		Solar Radiation (ly/day)
	Station 521 East of Ninnekah, OK	Station 526 Chickasha, OK South of Cement, OK	
May 16		22	
17	74	35	
18	114	39	
19	103	69	
20	140	84	
21	155	69	
22	245	86	
23	137	48	
24	88	37	
25	121	91	
26	182	73	
27	114	47	
28	349	201	
29	347	140	
30	165	68	
31	134	57	
June 1	207	89	
2	262	116	
3	210	79	
4	157	55	
5	157	71	378
6	1110	425	653
7	372	134	314
8	376	145	370
9	329	96	542
10	237	67	620
11	171	50	671
12	138	43	523
13	121	38	644
14	109	36	617
15	100	33	282
16	96	33	566
17	88	29	610
18	81	27	704
19	77	26	597
20	91	50	532
21	88	33	432

Table 111-2. Little Washita discharge and solar radiation during the Washita '92 experiment (cont.).

Date	Mean Daily Discharge (cfs)		Solar Radiation (ly/day)
	Station 521	Station 526Chickasha, OK	
	East of Ninnekah, OK	South of Cement, OK	
22	80	29	595
23	80	30	507
24	76	27	734
25	82	45	
26	85	31	
27	84	53	
28	454	268	
29	660	183	
30	240	69	

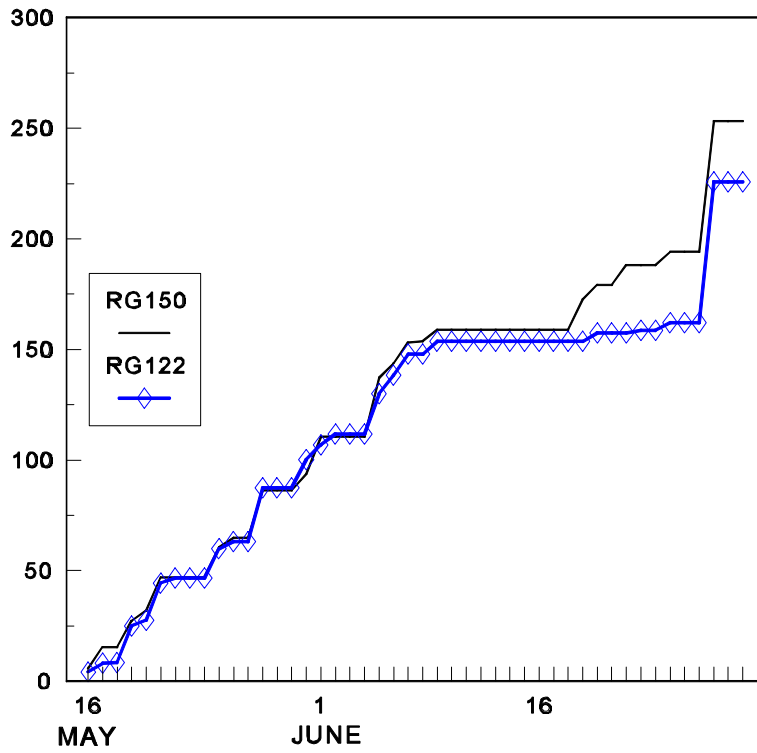


Figure III-1. Cumulative Precipitation at Two Rain Gages During Washita'92