LAB 2: GENERALIZATION AND ANALYSIS OF PRECIPITATION DATA

OBJECTIVES:

a. to become familiar with precipitation data sources
b. to learn methods of generalizing precipitation over a drainage basin
c. to analyze rainfall distribution at several gages during a storm
d. to analyze regional patterns of rainfall and to speculate on the causes of variation in this pattern
e. to estimate the mean annual rainfall over a drainage basin
f. to learn some techniques for frequency analysis of precipitation data

I. PRECIPITATION DATA SOURCES

The purpose of the following exercises is to familiarize you with the chief sources of precipitation data in California. All the items mentioned below are on reserve in the library (library use only).

a. (7) Refer to the *Index to Sources of Hydrologic Data*, California Department of Water Resources Bulletin 230-81.

1. (1) In what hydrologic basin, unit, area, and subarea is Kneeland 10SSE gage located? Use the DWR symbol and number code.

   basin _____unit_____ area _____ subarea_____

2. (3) What are the maximum and minimum recorded yearly rainfalls at Scotia, and in what years did they occur? (Note: the index gives values in mm; I would like you to also convert them to inches. Round them to two decimal places. Remember that 25.4 mm = 1 inch.)

   maximum: _____mm = _____ in year _____

   minimum:_____mm = _____ in year _____

3. (3) Look through the hydrologic regions spanning Humboldt Co. What two stations have the longest precipitation records, and what years do these records cover? How many years of record at each one?

   Longest record at: _____ time span _____ # years _____

   2nd longest at: _____ time span _____ # years _____

b. (3) Refer to *Climatological Data for California, November 1982.*

1. (2) What was the total monthly rainfall at Shelter Cove gage?_____

   What were the three days of the month that had the most precipitation at this gage?

   November:_____, _____, _____

2. (1) What was the average monthly maximum temperature at Shelter Cove? _____ ˚F

c. (5) Refer to *California Rainfall Summary: Monthly Total Precipitation 1849-1980*

1. (2) Use the microfiche records (in pocket in back of report) to determine the maximum recorded annual rainfall at Honeydew 2WSW gage and the year in which it occurred. (Note: there are microfiche readers in the periodicals section on the 2nd floor of the library.)

   Max. annual rainfall_____ in Year _____

2. (1) What agency supplied the Honeydew 2WSW data? (Use agency code and refer to table on p. vi of report.)

   agency:_____

3. (2) Look at the compiled statistical data for Honeydew 2WSW gage (second of the two tables labeled "Honeydew 2WSW".)

   How many years of record are available for the annual total? N= _____ yr

   What is the estimated return period for a rainfall equal to the largest measured annual rainfall (see part 1 above) at this gage?

   Return period = _____ yr

d. (3) Refer to *Hourly Precipitation Data: California, November 1982*

   For November 1982, what are the maximum 1-hour, 2-hour, and 6-hour rainfall amounts at Kneeland 10SSE gage?

   1-hour: _____in 2-hour:_____in 6-hour:_____in

II. Rainfall Pattern over Humboldt County

Accompanying this lab are:

1. a list of mean annual rainfall at 57 precipitation stations in Humboldt Co. and near-by areas. Note that the periods of record at these stations vary widely, and that for many stations (e.g., Table Bluff Lighthouse) the number of complete years is very much smaller than the number of years of record. (Complete years are years without missing data -- I used only these years to compute mean annual precipitation)
2. a map showing the location of precipitation stations on the list. Stations are identifed by number.
3. a map showing mean annual precipitation at the precipitation stations.
4. 1:250000 map showing only gages 10A, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, and 23. I have shown the boundaries of the Jacoby Cr. basin on this.
5. a plot of mean annual precipitation vs. gage elevation for stations on the list. The station number is shown for each point.
6. a plot of cumulative rainfall at Honeydew 1SW, Eureka WSO CI and Kneeland 10SSW recording gages for the storms of 16-19 November 1982.

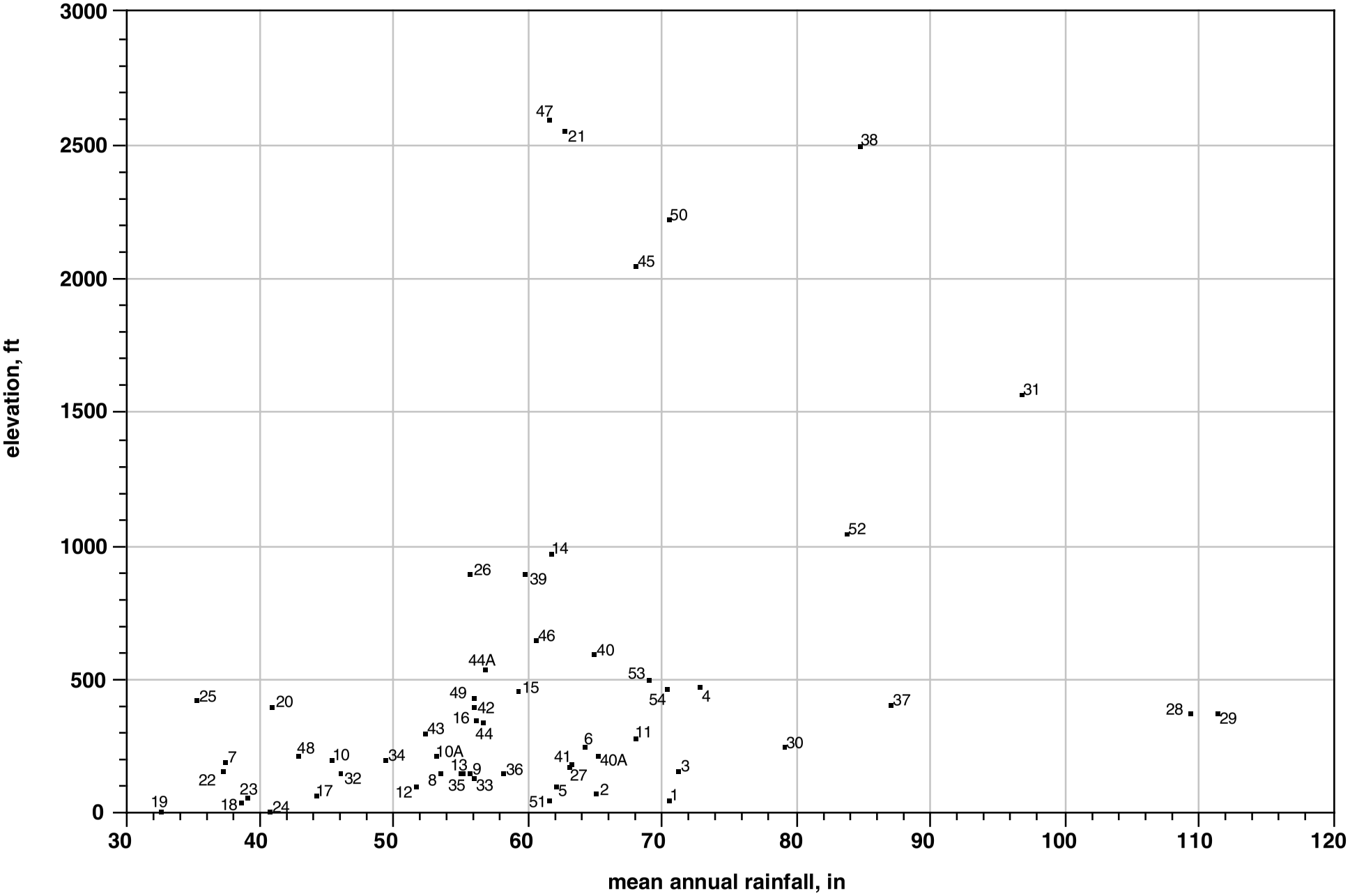
These maps and data can also be accessed online through the "Diagrams and Maps" and "Hydrologic Datasets" pages of the Geology 531 website at <http://www.humboldt.edu/~geodept/geology531>

a. (7) Look at the pattern of rainfall values on the map, then look at the accompanying graph of mean annual precipitation versus elevation. How good does the relation between precipitation and elevation appear to be? Can you think of any reasons -- either physical or in the nature of the data (see list of stations) -- as to why the relation is not better than it is?

After you have thought about this and studied the map, I would like you to *briefly discuss below the factors that you infer to be most important in controlling the pattern of precipitation in Humboldt Co.* Please present your answer in *list format*, with each point numbered. Don't forget to include a discussion of the precipitation–elevation relation (see above) as part of your answer. Please limit yourself to the space below; I prefer succinct, to-the-point answers.

HUMBOLDT COUNTY RAINFALL VS. ELEVATION

numbers refer to precipitation stations on accompanying Humboldt Co. list



b. (15) Use the data points on the mean annual rainfall map, together with your analysis of factors affecting precipitation, to draw isohyets (contours) of mean annual rainfall on your overlay. Use a contour interval of 10". Your lowest contour should be 30" and the largest 110" or 120". You may wish to refer to contour maps of the area. If you do, I suggest the USGS 1:250000 Weed, Redding, Crescent City, and Eureka sheets.

c. (10) On the 1:250000 map construct Thiessen polygons about the stations shown. Refer to handout Fig. 3-11. Then sketch in isohyets. You can transfer them by eye from your Humboldt Co. map.

d. (6) Determine the mean annual rainfall over the Jacoby Creek drainage by : 1) the Thiessen polygon method and 2) by the isohyetal method. I suggest that you use Excel or the attached tabulation sheets. An example of how to set up the tables is posted in the lab. You will need to use a dot grid or a planimeter to determine the polygon and inter-isohyet areas within the basin.

Jacoby Creek Mean Annual Precipitation:

Thiessen P_{mean}: _____ in

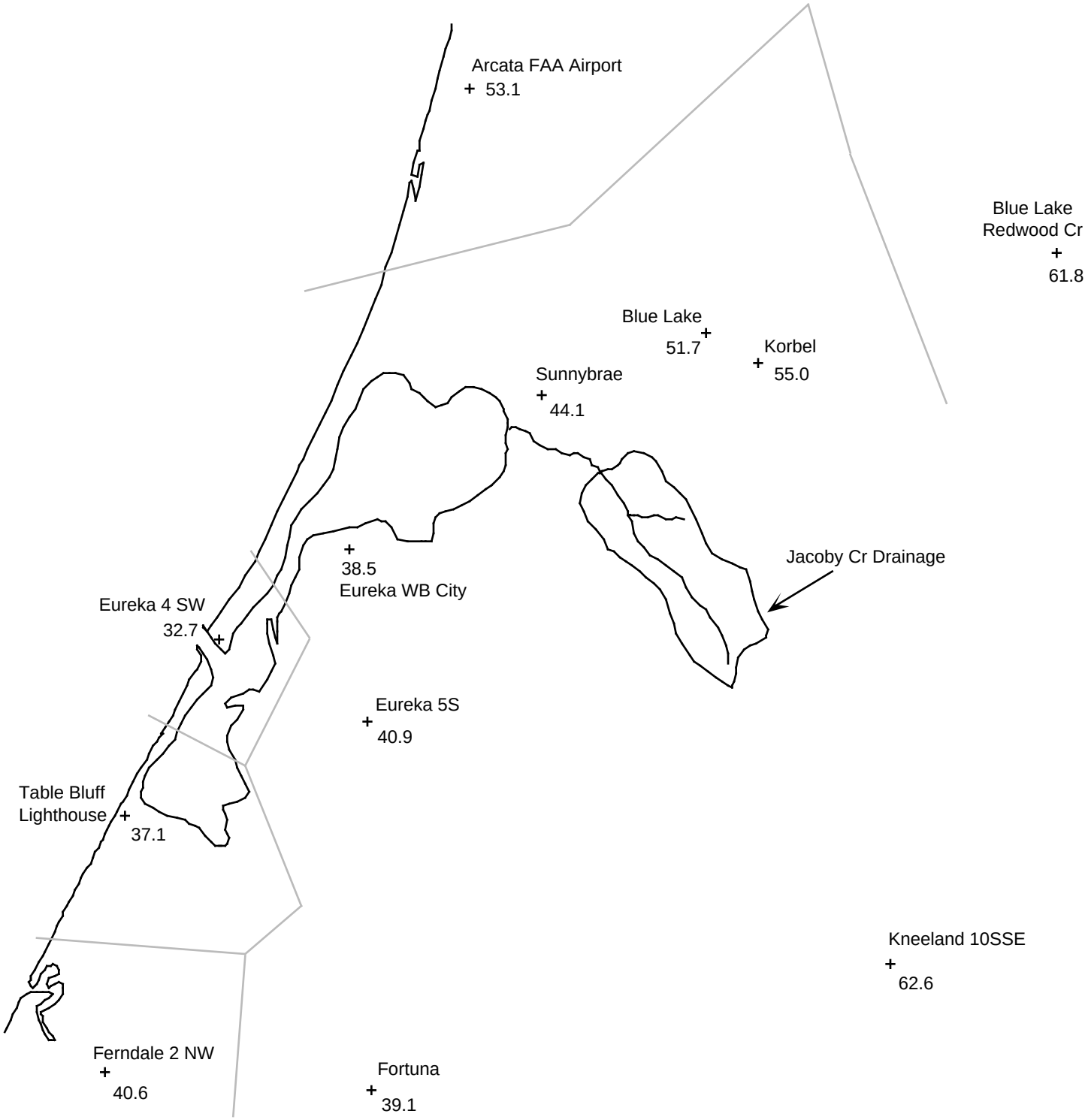
isohyetal P_{mean}: _____ in

Which estimate do you think is better? Justigfy your choice.

e. (6) Refer to the graph showing the Honeydew 1SW, Eureka WSO CI and Kneeland 10SSE cumulative rainfalls.

Compare and *explain* the differences in storm pattern at these three gages. In particular, consider: 1) total amount of rainfall; 2) timing of onset and ending of rainfall; 3) timing of periods of greatest rainfall intensity. (Be sure to mention for each gage when the *maximum* rainfall intensity occurred-- give the hours bracketing it.) Try to come up with hydrologically reasonable explanations for the differences.

RAINFALL IN THE HUMBOLDT BAY REGION

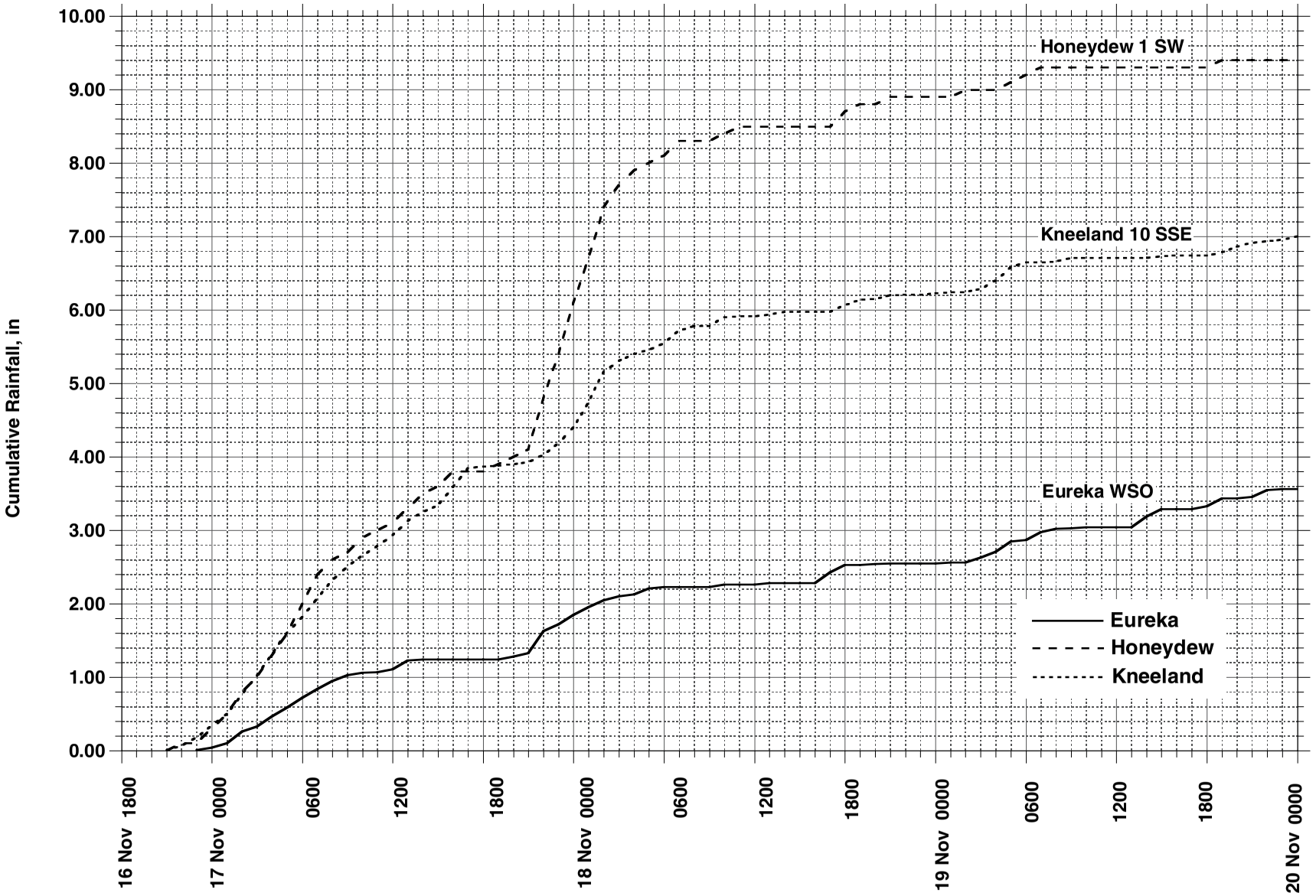


SCALE 1:250,000

1 inch = 20833 ft

5 mi

Cumulative Rainfall at Eureka, Honeydew and Kneeland
16 Nov - 20 Nov 1982



III. FREQUENCY ANALYSIS OF RAINFALL DATA

a. (12) **Frequency of annual rainfalls**

References: Dunne and Leopold p. 42-48
Rainfall Frequency Analysis handout (also online via the "Handouts and Analysis" page on the Geology 531 website)

Attached are annual precipitation data for two Humboldt Co. stations with long records, Eureka WSO City (110 yr) and Upper Mattole (93 yr). I have used Excel to sort the annual data and to rank them from smallest to largest. This data is also available online through the "Hydrologic Datasets" page of the Geology 531 website

Note: the exercise below assumes that you will do this by hand and so uses handout procedure 2. If you wish, you may use handout procedure 1 and make an ungrouped table of cumulative percents on the computer. You will still need to plot the data by hand unless you have access to a copy of KaleidaGraph, which allows creation of probability plots. No matter how you analyze the data, you will need to plot up the histograms of item 4 below.

1. Divide the data for each station into 8 -12 size classes. I suggest that you use classes 5" wide (starting with 15") for Eureka and classes 10" wide (starting with 30") for Upper Mattole.
2. On the attached tabulation sheet, tally the number of rainfalls in each size category and compute the appropriate cumulative %'s. Also compute the actual % in each size category.
3. On a sheet of arithmetic probability paper, plot P_i vs. cumulative % for each gage and fit the points with a straight line. I suggest using a scale of 1" (on the paper) = 20" (rain).
4. From the frequency data on your tabulation sheet, plot a histogram of the annual rainfalls at each station. If you are doing this by hand, use a vertical scale of 1" = 4 events and a horizontal scale of 1" (paper) = 10" (rain).

b. (10) **Statistics of annual rainfalls**

References: Dunne and Leopold p. 44-45
Haan, *Statistical Methods in Hydrology*, p. 47-51
Chow, *Handbook of Applied Hydrology*, p. 8-6 to 8-8
Statistical Analysis handout

From your plots, histograms, and by direct calculation from the supplied data, determine the following statistics for the annual rainfalls at Eureka and Upper Mattole. It will be easiest if you use a microcomputer.

quantity	Eureka	Upper Mattole
mean		
median		
mode		
range		
standard deviation		
graphical standard deviation		
coefficient of variation		
skewness		
coefficient of skewness		
95% confidence limits on mean		

c. (4) Compare the Eureka and Upper Mattole rainfall distributions.
Which population shows the greater variability? How are you judging this?

Are the distributions skewed? If so, is the skew in the same or different directions?

Speculate on some possible hydrologic causes for the differences between the two stations.

d. (2) How often would you be likely to get an annual rainfall of less than 23 inches in Eureka? Give the answer as both % of time and in *how many* years out of a century.

_____% _____ yr/century

e. (11) **Depth-duration-frequency analysis for Jacoby Cr. drainage**

Reference: Dunne and Leopold p. 49-65

In this part of the lab you will see how design storms of different intensities and return periods can be estimated for an ungaged site. You will need to refer to the *Precipitation Frequency Atlas of California* on reserve in the library. This publication contains detailed maps of the estimated rainfall for various durations and return periods. The maps are also available as GIF's online from the "Diagrams and Maps" page on the Geo 531 website. ***Be sure that you pay attention to the units that the maps are contoured in. Some are contoured in tenths of an inch*** -- so a reading of "18" would be 18 tenths of an inch or 1.8 inches!

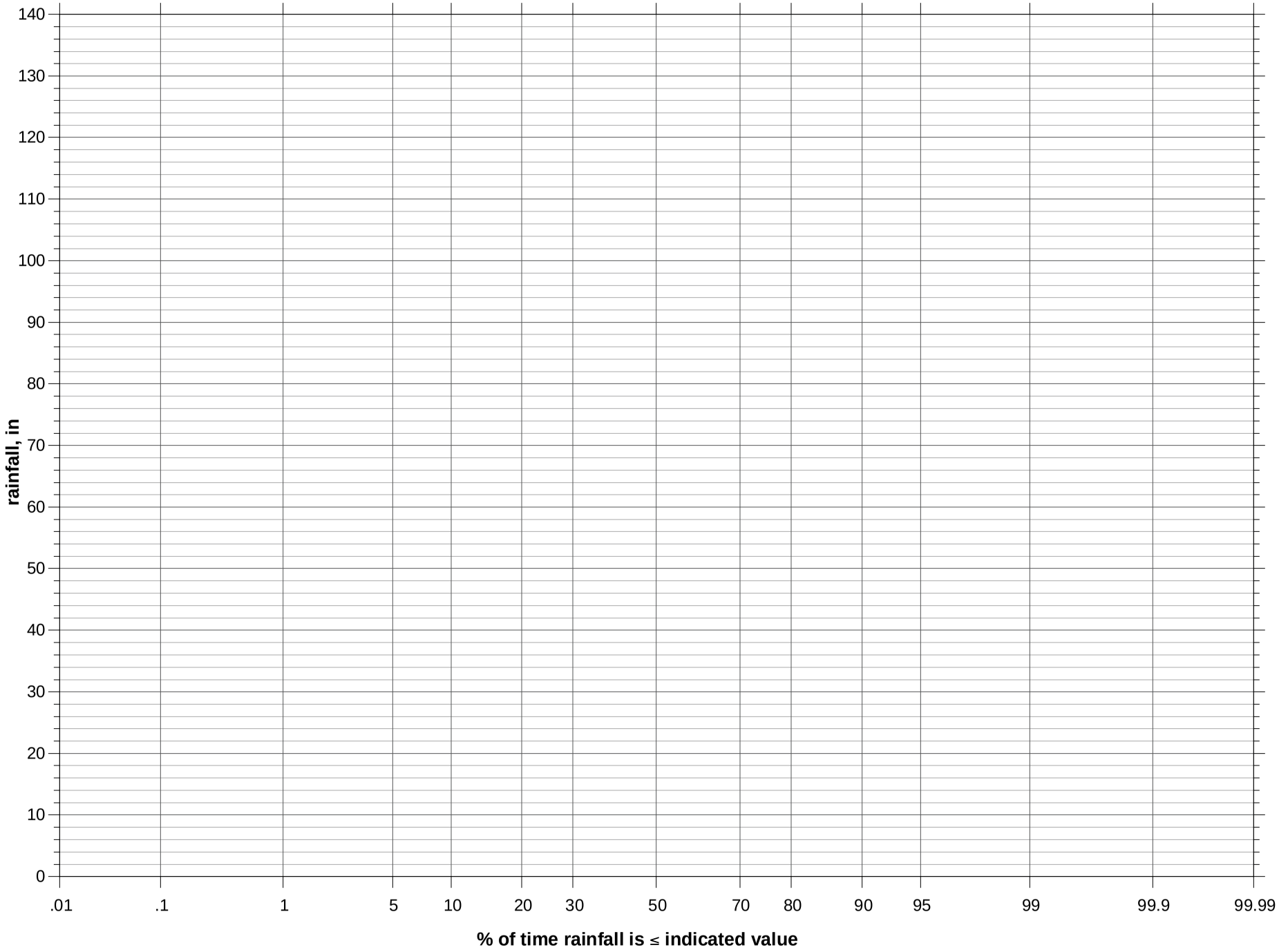
The text in the front of the atlas discusses how the maps were prepared. Pages 15-18 in the Atlas explain how to estimate the 1, 3, and 12-hour rainfalls for various return periods.

1. (6) Using the Precipitation Frequency Atlas, determine the following rainfall values for the Jacoby Creek drainage.

	Duration	
Return Period yr	6 hr	24 hr
2		
5		
10		
25		
50		
100		

2. (5) What is the total *volume* of water, in cubic feet, that would be dumped on the Jacoby Cr. watershed by the 25-year 24-hour storm? Use 13.6 mi^2 as the drainage area of the basin. Neatly show computations.

Volume: _____ ft^3


140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
rainfall, in
.01
.1
1
5
10
20
30
50
70
80
90
95
99
99.9
99.99
% of time rainfall is ≤ indicated value

	Eureka WSO		Honeydew 1SW		Kneeland 10SSE	
Date and time	Rainfall	Cum. Rainfall	Rainfall	Cum. Rainfall	Rainfall	Cum. Rainfall
	in	in	in	in	in	in
16-Nov 2100	0.00	0.00	0.00	0.00	0.01	0.01
16-Nov 2200	0.00	0.00	0.10	0.10	0.06	0.07
16-Nov 2300	0.01	0.01	0.00	0.10	0.11	0.18
17-Nov 0000	0.03	0.04	0.20	0.30	0.16	0.34
17-Nov 0100	0.06	0.10	0.20	0.50	0.16	0.50
17-Nov 0200	0.16	0.26	0.30	0.80	0.27	0.77
17-Nov 0300	0.07	0.33	0.20	1.00	0.25	1.02
17-Nov 0400	0.14	0.47	0.30	1.30	0.30	1.32
17-Nov 0500	0.12	0.59	0.30	1.60	0.29	1.61
17-Nov 0600	0.13	0.72	0.40	2.00	0.21	1.82
17-Nov 0700	0.12	0.84	0.40	2.40	0.26	2.08
17-Nov 0800	0.11	0.95	0.20	2.60	0.24	2.32
17-Nov 0900	0.08	1.03	0.10	2.70	0.19	2.51
17-Nov 1000	0.03	1.06	0.20	2.90	0.15	2.66
17-Nov 1100	0.01	1.07	0.10	3.00	0.13	2.79
17-Nov 1200	0.04	1.11	0.10	3.10	0.15	2.94
17-Nov 1300	0.12	1.23	0.20	3.30	0.19	3.13
17-Nov 1400	0.01	1.24	0.20	3.50	0.12	3.25
17-Nov 1500	0.00	1.24	0.10	3.60	0.09	3.34
17-Nov 1600	0.00	1.24	0.20	3.80	0.25	3.59
17-Nov 1700	0.00	1.24	0.00	3.80	0.26	3.85
17-Nov 1800	0.00	1.24	0.00	3.80	0.02	3.87
17-Nov 1900	0.00	1.24	0.10	3.90	0.01	3.88
17-Nov 2000	0.04	1.28	0.10	4.00	0.02	3.90
17-Nov 2100	0.05	1.33	0.10	4.10	0.03	3.93
17-Nov 2200	0.30	1.63	0.70	4.80	0.10	4.03
17-Nov 2300	0.09	1.72	0.60	5.40	0.16	4.19
18-Nov 0000	0.13	1.85	0.70	6.10	0.21	4.40
18-Nov 0100	0.11	1.96	0.60	6.70	0.35	4.75
18-Nov 0200	0.09	2.05	0.70	7.40	0.41	5.16
18-Nov 0300	0.05	2.10	0.30	7.70	0.15	5.31
18-Nov 0400	0.03	2.13	0.20	7.90	0.09	5.40
18-Nov 0500	0.08	2.21	0.10	8.00	0.06	5.46
18-Nov 0600	0.02	2.23	0.10	8.10	0.09	5.55
18-Nov 0700	0.00	2.23	0.20	8.30	0.17	5.72
18-Nov 0800	0.00	2.23	0.00	8.30	0.06	5.78
18-Nov 0900	0.00	2.23	0.00	8.30	0.00	5.78
18-Nov 1000	0.03	2.26	0.10	8.40	0.12	5.90
18-Nov 1100	0.00	2.26	0.10	8.50	0.02	5.92
18-Nov 1200	0.00	2.26	0.00	8.50	0.00	5.92
18-Nov 1300	0.02	2.28	0.00	8.50	0.02	5.94
18-Nov 1400	0.00	2.28	0.00	8.50	0.04	5.98
18-Nov 1500	0.00	2.28	0.00	8.50	0.00	5.98
18-Nov 1600	0.00	2.28	0.00	8.50	0.00	5.98
18-Nov 1700	0.15	2.43	0.00	8.50	0.00	5.98
18-Nov 1800	0.10	2.53	0.20	8.70	0.09	6.07
18-Nov 1900	0.00	2.53	0.10	8.80	0.07	6.14
18-Nov 2000	0.01	2.54	0.00	8.80	0.01	6.15
18-Nov 2100	0.01	2.55	0.10	8.90	0.05	6.20
18-Nov 2200	0.00	2.55	0.00	8.90	0.01	6.21
18-Nov 2300	0.00	2.55	0.00	8.90	0.00	6.21
19-Nov 0000	0.00	2.55	0.00	8.90	0.02	6.23
19-Nov 0100	0.01	2.56	0.00	8.90	0.01	6.24
19-Nov 0200	0.00	2.56	0.10	9.00	0.00	6.24
19-Nov 0300	0.07	2.63	0.00	9.00	0.04	6.28
19-Nov 0400	0.08	2.71	0.00	9.00	0.12	6.40
19-Nov 0500	0.14	2.85	0.10	9.10	0.18	6.58
19-Nov 0600	0.02	2.87	0.10	9.20	0.07	6.65
19-Nov 0700	0.11	2.98	0.10	9.30	0.00	6.65
19-Nov 0800	0.04	3.02	0.00	9.30	0.01	6.66
19-Nov 0900	0.01	3.03	0.00	9.30	0.05	6.71
19-Nov 1000	0.01	3.04	0.00	9.30	0.00	6.71
19-Nov 1100	0.00	3.04	0.00	9.30	0.00	6.71
19-Nov 1200	0.00	3.04	0.00	9.30	0.00	6.71
19-Nov 1300	0.00	3.04	0.00	9.30	0.00	6.71
19-Nov 1400	0.15	3.19	0.00	9.30	0.00	6.71
19-Nov 1500	0.10	3.29	0.00	9.30	0.02	6.73
19-Nov 1600	0.00	3.29	0.00	9.30	0.01	6.74
19-Nov 1700	0.00	3.29	0.00	9.30	0.00	6.74
19-Nov 1800	0.04	3.33	0.00	9.30	0.00	6.74
19-Nov 1900	0.11	3.44	0.10	9.40	0.05	6.79
19-Nov 2000	0.00	3.44	0.00	9.40	0.07	6.86
19-Nov 2100	0.02	3.46	0.00	9.40	0.06	6.92
19-Nov 2200	0.09	3.55	0.00	9.40	0.02	6.94
19-Nov 2300	0.01	3.56	0.00	9.40	0.02	6.96
20-Nov 0000	0.00	3.56	0.00	9.40	0.05	7.01

Annual Rainfall at Eureka and Upper Mattole Gages

year	Eureka	M	F	year	Upper Mattole	M	F
1890	74.39	1		1890	136.12	1	
1904	66.45	2		1904	133.76	2	
1983	63.83	3		1958	118.20	3	
1938	58.03	4		1938	117.36	4	
1998	55.98	5		1941	116.33	5	
1894	54.71	6		1974	115.92	6	
1907	53.03	7		1915	111.45	7	
1995	52.59	8		1927	111.23	8	
1903	52.21	9		1909	111.18	9	
1997	52.11	10		1921	108.83	10	
1901	51.59	11		1895	106.30	11	
1896	51.27	12		1940	104.00	12	
1974	51.05	13		1925	103.03	13	
1900	50.71	14		1914	102.45	14	
1971	50.65	15		1900	102.35	15	
1927	50.48	16		1956	101.42	16	
1893	50.46	17		1952	98.85	17	
1999	50.13	18		1902	98.39	18	
1897	50.01	19		1907	97.68	19	
1982	48.10	20		1903	95.92	20	
1902	48.06	21		1954	95.62	21	
1958	48.06	22		1942	93.87	22	
1953	47.91	23		1893	93.46	23	
1941	47.89	24		1905	93.42	24	
1895	47.55	25		1978	92.89	25	
1952	47.28	26		1969	92.79	26	
1951	46.72	27		1951	91.64	27	
1921	46.00	28		1963	90.96	28	
1956	45.37	29		1953	90.20	29	
1969	45.29	30		1961	89.91	30	
1961	45.05	31		1946	89.27	31	
1996	45.04	32		1971	88.93	32	
1887	44.49	33		1901	87.97	33	
1984	44.01	34		1967	87.94	34	
1993	43.97	35		1894	87.75	35	
1909	43.94	36		1919	85.56	36	
1945	43.93	37		1912	84.89	37	
1925	43.85	38		1936	82.42	38	
1967	43.63	39		1945	82.16	39	
1954	43.52	40		1965	81.74	40	
1948	42.45	41		1966	81.27	41	
1963	42.17	42		1948	80.99	42	
1886	42.13	43		1896	80.97	43	
1942	41.73	44		1933	80.64	44	
1916	41.46	45		1970	79.93	45	
1882	41.16	46		1888	78.87	46	
1940	41.13	47		1916	78.77	47	
1943	41.11	48		1897	78.66	48	
1915	40.96	49		1975	77.27	49	
1912	40.86	50		1906	76.83	50	
1950	40.59	51		1959	76.61	51	
1935	40.52	52		1972	75.68	52	
1975	40.13	53		1910	75.50	53	
1965	40.05	54		1973	74.97	54	
1986	39.95	55		1935	74.46	55	
1919	39.49	56		1980	74.33	56	
1906	39.42	57		1949	74.28	57	
1946	39.30	58		1911	72.29	58	
1910	39.21	59		1957	72.15	59	
1914	38.36	60		1892	68.15	60	
1970	38.13	61		1928	67.65	61	
1972	38.03	62		1960	66.53	62	
1957	37.90	63		1943	66.23	63	
1880	37.79	64		1937	65.58	64	
1964	37.67	65		1950	65.38	65	
1892	37.17	66		1913	65.25	66	
2000	36.64	67		1891	64.81	67	
1980	36.59	68		1932	63.89	68	
1891	36.57	69		1889	63.37	69	
1985	36.33	70		1968	62.50	70	
1932	36.24	71		1898	61.69	71	
1973	36.08	72		1908	61.09	72	
1978	35.96	73		1922	60.93	73	
1989	35.77	74		1962	60.39	74	
1899	35.48	75		1930	60.15	75	
1933	35.44	76		1955	59.90	76	
1898	35.43	77		1934	58.90	77	
1922	34.88	78		1964	57.81	78	
1976	34.80	79		1944	54.86	79	
1888	34.63	80		1939	54.57	80	
1913	34.29	81		1923	53.84	81	
1889	34.24	82		1947	53.83	82	
1883	34.21	83		1976	53.77	83	
1966	34.03	84		1926	53.56	84	
1936	33.49	85		1929	51.25	85	
1959	33.42	86		1917	48.53	86	
1960	33.18	87		1979	47.31	87	
1908	32.88	88		1899	46.94	88	
1955	32.68	89		1918	46.93	89	
1911	32.45	90		1920	45.39	90	
1949	32.24	91		1931	36.45	91	
1988	32.20	92		1924	32.16	92	
1881	32.12	93		1977	31.94	93	
1905	31.03	94					
1962	30.71	95					
1928	30.48	96					
1937	30.39	97					
1981	30.28	98					
1917	30.20	99					
1968	29.52	100					
1939	29.48	101					
1929	28.76	102					
1994	28.55	103					
1944	28.07	104					
1990	26.89	105					
1923	26.37	106					
1918	25.51	107					
1920	25.50	108					
1987	25.49	109					
1991	25.49	110					
1930	24.73	111					
1884	24.43	112					
1926	23.95	113					
1979	23.20	114					
1947	22.83	115					
1885	21.65	116					
1934	21.39	117					
1992	21.01	118					
1931	20.73	119					
1924	20.59	120					
1977	19.17	121					

MEAN ANNUAL RAINFALL AT SELECTED HUMBOLDT COUNTY AND NEAR-BY GAGES

Map No.	Gage	Period of Record	Number of Years	Elevation, ft	Mean Annual Rainfall, in
1	Orick 3NNE	1950-80	25	50	70.40
2	Orick Arcata Redwood	1954-79	21	75	64.99
3	Orick Prairie Creek	1938-80	43	161	71.10
4	Orick 5SSW	1951-56	4	475	72.81
5	Big Lagoon	1948-80	27	100	62.10
6	Patricks Point State Park	1947-72	11	250	64.24
7	Trinidad Lighthouse	1919-39	18	198	37.31
8	Crannell	1933-48	14	150	53.51
9	Little River	1950-68	19	150	55.55
10	Arcata FAA Airport	1958-67	9	200	45.37
10A	Arcata AP	1967-76	9	217	53.08
11	Fieldbrook 4D Ranch	1956-80	12	285	68.04
12	Blue Lake	1951-70	18	105	51.63
13	Korbel	1938-75	36	150	54.99
14	Blue Lake Redwood Creek	1953-65	6	975	61.77
15	Willow Creek 1NW	1970-80	9	461	59.19
16	Hoopa	1942-80	39	350	56.00
17	Sunnybrae	1966-80	13	70	44.08
18	Eureka WB City	1878-1980	102	43	38.51
19	Eureka 4SW	1913-36	21	10	32.65
20	Eureka 5S	1976-80	5	400	40.87
21	Kneeland 10SSE	1942-78	31	2556	62.62
22	Table Bluff Lighthouse	1916-48	5	160	37.12
23	Fortuna	1942-80	17	60	39.10
24	Ferndale 2NW	1963-73	9	10	40.62
25	Cape Mendocino Lighthouse	1893-1947	28	425	35.26
26	Petrolia 4NW	1954-69	15	900	55.49
27	Petrolia	1958-80	21	175	63.08
28	Honeydew 2WSW	1956-78	19	380	109.43
29	Honeydew Hunter	1956-69	14	380	111.35
30	Upper Mattole	1887-1980	93	255	79.03
31	Ettersburg 2SE	1953-64	10	1570	96.81
32	Rohnerville	1901-20	18	150	45.97
33	Scotia	1926-80	54	139	55.86
34	Shively	1912-21	6	200	49.24
35	Holmes	1954-80	13	150	54.84
36	South Fork	1944-60	15	155	58.01
37	Bull Creek	1962-80	7	410	87.01
38	Fox Camp	1961-80	10	2500	84.63
39	High Rock	1961-80	14	900	59.76
40	Weott 2SE	1961-70	7	600	64.81
40A	Burlington State Park	1951-80	28	217	65.18
41	Myers Flat	1957-80	13	190	63.16
42	Miranda Spengler Ranch	1940-78	36	400	55.90
43	Phillipsville 1SE	1963-69	5	300	52.33
44	Garberville	1939-80	16	340	56.51
44A	Garberville HMS	1943-80	37	540	56.73
45	Bridgeville 4NW	1954-80	24	2050	67.92
46	Bridgeville P.O.	1940-80	24	650	60.60
47	Bridgeville Hansen	1939-47	6	2600	61.58
48	Fort Seward	1956-78	22	217	42.86
49	Alderpoint	1941-80	35	435	55.82
50	Old Harris	1956-75	18	2225	70.51
51	Shelter Cove	1960-78	12	55	61.51
52	Whitethorn	1962-80	18	1050	83.67
53	Richardson Grove	1962-80	18	500	68.98
54	Hartsook Inn	1957-68	9	470	70.24