

Physical Geography

Lab Activity #16

Due date _____

California Climate Classification

COR Objective 6, SLO 3

16.1. Introduction

One of the most important factors in the physical geography of a place is its climate. Weather is what happens in terms of temperature and moisture in the atmosphere on a day to day basis. Climate is the long term average of weather events in a place. By studying the climate of a place we can begin to deduce what flora, fauna, soil type, and weathering processes will be found within it.

Use Units 14–17 of DeBlij et al's Physical Geography to answer the following questions.

1. Name the two types of data the Köppen system uses to map climate regions.
2. Explain the differences between tropical, mid-latitude, and polar locations.

16.2. Köppen's Climate Classification

Vladimir Köppen was a German climatologist who came up with a simple climate classification system based on a place's temperature and precipitation. While not perfect, it can provide a quick idea as to what weather a place experiences throughout the year. Every location in the world can be given a three letter classification based on annual weather data. Sacramento, California is a Csa climate. Bishop, California is a BWk climate.

World climates are placed into one of six major classifications:

A = Tropical climates

C = Mesothermal(mild mid-latitude) climates

D = Microthermal(cold mid-latitude) climates

E = Polar climates

B = Dry climates

H = Highland climates

3. Based on what you know about California geography and descriptions in *Units 14-17 of DeBlij et al's Physical Geography*, which major climate classifications will you not see in California? Why not?

Every location that falls into one of the first four climate classifications (A, C, D, and E) also has two lowercase letters following the main classification. The second letter in these climates refers to when precipitation occurs.

f = precipitation falls all year

w = winter dry, summer wet

s = summer dry, winter wet

The third letter tells you about the average monthly temperature extremes.

a = hot summers, warmest month above 72° F

b = warmest month below 72° and four months or more above 50°

c = warmest month below 72° and three months above 50°

d = coldest month below -35°

e = warmest month below 50°

As mentioned above, Sacramento, California is a Csa climate. The “C” means it is a Mesothermal climate. The “s” means rain falls during the winter and not the summer and the “a” means that it has hot summers.

Climates that fall into the “B” classification are treated differently. A climate that falls into this category is either an arid or semiarid climate. Arid means that the annual precipitation is less than ½ of the annual evapotranspiration. These climates are given a “W” after the B. Semiarid climates have annual precipitation greater than ½ but still less than the annual evapotranspiration. They are given an “S”. The third letter for these climates refers to annual average temperatures. A lowercase “h” means the mean annual temperature is above 65° F and a lowercase “k” means the mean annual temperature is below 65° F.

As mentioned above, Bishop, California is a BWk climate, meaning it is an arid desert with cold winters.

16.3 Applying Köppen's System

To determine which climate classification a place falls into, you first want to create a climograph. A climograph is a useful visualization of the temperatures and precipitation of a place. An example is below under question 4. The blue points and line show the normal daily temperatures averaged for each month. The red bar graph shows the normal precipitation for each month. This climograph is for Palmdale, California and was filled in using the climate data in the table just below it.

Once your climograph is complete, use the following flow chart to determine the classification.

Step 1 – Find the Major Climate Group

Climate Group	Description
A – Tropical	Wet; low latitudes
B – Dry	Not latitude specific; evaporation exceeds precipitation; typically in California, areas with less than 38 cm (15 in.) of rain per year
C – Mesothermal	Mild winters, warm or hot summers
D – Microthermal	Very cold winters
E – Polar	High latitude; very cold
H - Highland	This can be difficult to determine without contextual data, so for this lab, Highland is defined as any location above 3,000ft in elevation.

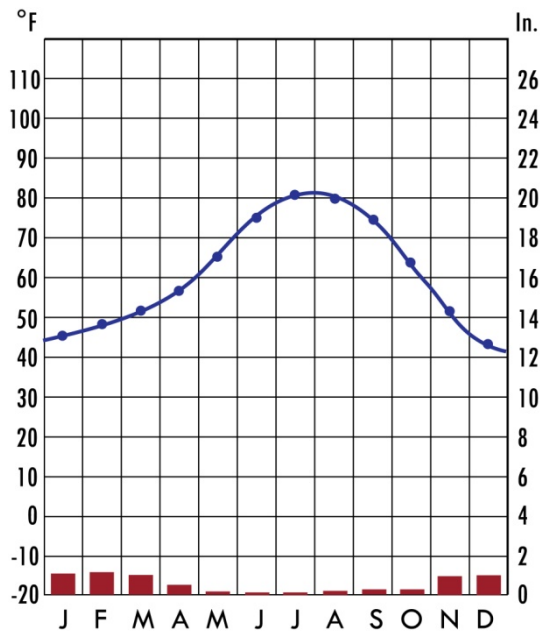
Step 2 – Identify the precipitation patterns

If climate group is...	The second letter is...
A, C, or D	f = wet year round; typically over 100 cm (40in.) of rain per year m = monsoonal precipitation (extremely wet summers) w = dry in winter, rains in summer s = dry in summer, rains in winter
B	W = arid desert; in California typically less than 25 cm (10in.) of rain per year S = semiarid steppe; in California typically greater than 25 cm (10 in.), but less than 38 cm (15 in.) of rain per year
E	T = tundra; warmest month between 0°C (32°F) – 10°C (50°F) F = ice cap; no monthly average above 0°C (32°F)
H	Highland climates do not get a second or third letter, so you're done

Step 3 – Identify temperature distinctions

If climate group is...	The third letter is...
A, C, or D	a = hot summers; warmest month above 22°C (72°F) b = warm summers; warmest month below 22°C (72°F) and four or more months above 10°C (50°F) c = cool summers; warmest month below 22°C (72°F) and three months above 10°C (50°F) d = very cold winters; coldest month below -37°C (-35°F)
B	h = hot desert or steppe; average annual temperature above 18°C (65°F) k = cold desert or steppe; average annual temperature below 18°C (65°F)

4. Use the table to fill in the blank fields to the right of the climograph and use the Köppen system to classify Palmdale's climate.



Place:

Lat./Long.:

Elevation:

Temperatures

Warmest Month/Mean:

Coldest Month/Mean:

Precipitation

Annual Total:

Wettest Month/Amount:

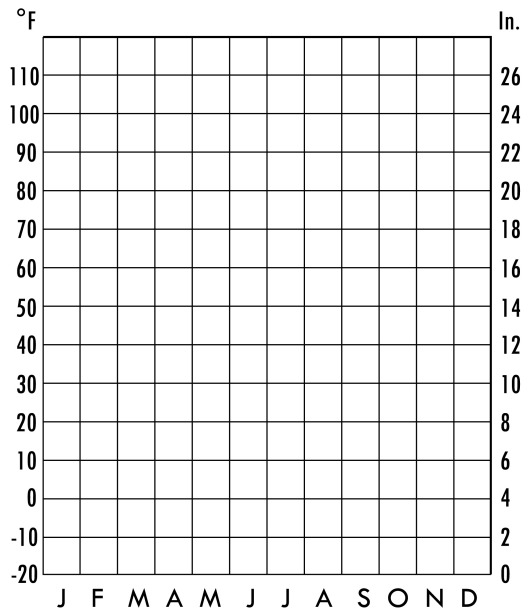
Dryest Month/Amount:

Köppen Classification:

Palmdale, Calif. | Elevation 2,596' | 34° 35' N, 118° 06' W

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave./Total
Normal Min.	31.9	35.4	38.5	42.9	50.3	57.7	64.3	63.3	56.6	47.6	38.0	31.5	46.5
Normal Max.	58.2	62.8	66.4	73.1	81.3	90.5	97.1	96.1	89.9	79.8	66.3	57.8	76.6
Normal Daily	45.1	49.1	52.5	58.0	65.8	74.1	80.7	79.7	73.3	63.7	52.2	44.7	61.6
Normal Precip.	1.23	1.29	1.13	0.41	0.13	0.06	0.05	0.18	0.25	0.23	0.95	1.01	6.92

5. Complete the following climographs and classifications:



Place:

Lat./Long.:

Elevation:

Temperatures

Warmest Month/Mean:

Coldest Month/Mean:

Precipitation

Annual Total:

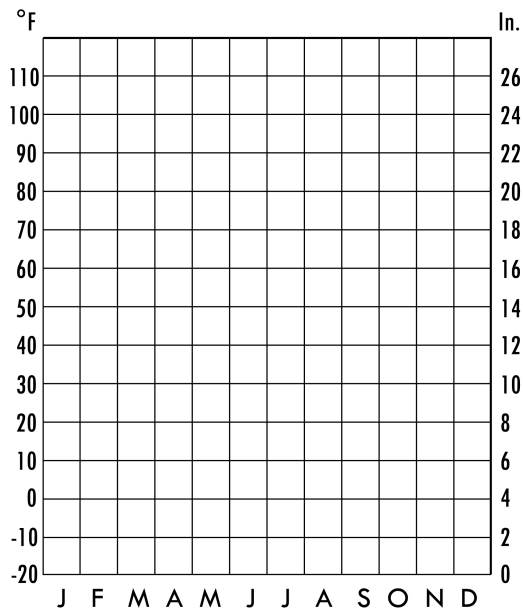
Wettest Month/Amount:

Dryest Month/Amount:

Köppen Classification:

Bakersfield, Calif. | Elevation 495' | 35° 25' N, 119° 03' W

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave./Total
Normal Min.	38.6	42.6	45.8	50.1	57.3	64.0	69.6	68.5	63.5	54.8	44.7	38.3	53.2
Normal Max.	56.9	63.9	68.9	75.9	84.6	92.4	98.5	96.6	90.1	80.7	66.8	56.5	77.7
Normal Daily	47.8	53.3	57.4	63.0	71.0	78.2	84.1	82.6	76.8	67.8	55.8	47.5	65.4
Normal Precip.	0.86	1.06	1.04	0.57	0.20	0.10	0.01	0.09	0.17	0.29	0.70	0.63	5.72



Place:

Lat./Long.:

Elevation:

Temperatures

Warmest Month/Mean:

Coldest Month/Mean:

Precipitation

Annual Total:

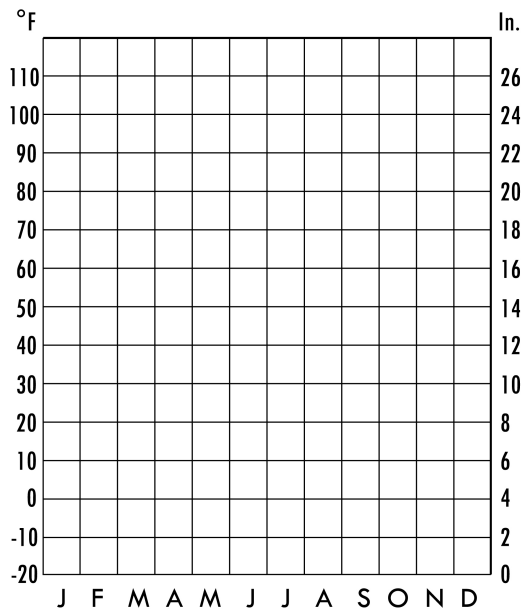
Wettest Month/Amount:

Dryest Month/Amount:

Köppen Classification:

Berkeley, Calif. | Elevation 345' | 37° 52' N, 122° 15' W

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave./Total
Normal Min.	43.3	46.2	46.8	48.2	50.6	53.3	54.2	55.3	55.9	53.4	48.7	43.8	50.0
Normal Max.	56.4	59.7	60.9	63.8	66.2	69.0	70.0	70.0	71.7	69.6	62.5	56.6	64.7
Normal Daily	49.9	53.0	53.9	56.0	58.4	61.2	62.1	62.7	63.8	61.5	55.6	50.2	57.4
Normal Precip.	5.03	3.75	3.71	1.82	0.33	0.15	0.07	0.10	0.37	1.48	3.74	3.75	24.30



Place:

Lat./Long.:

Elevation:

Temperatures

Warmest Month/Mean:

Coldest Month/Mean:

Precipitation

Annual Total:

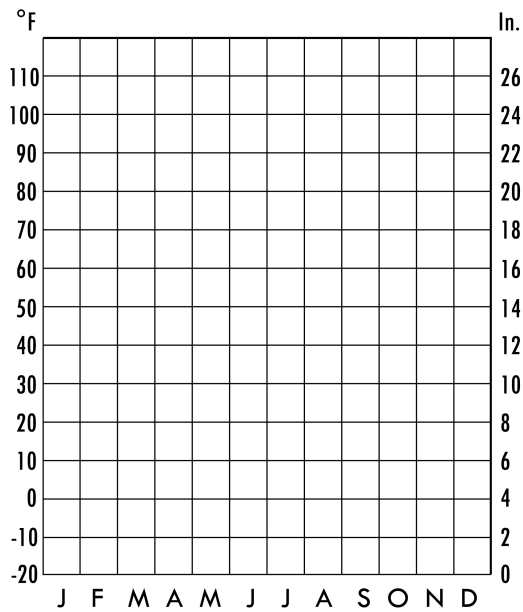
Wettest Month/Amount:

Dryest Month/Amount:

Köppen Classification:

Big Bear Lake, Calif. | Elevation 6,790' | 34° 15' N, 116° 53' W

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave./Total
Normal Min.	18.9	21.1	23.2	27.5	33.5	40.3	46.7	45.9	39.7	31.4	24.8	19.9	31.1
Normal Max.	47.4	48.5	50.4	57.0	65.6	75.2	80.3	78.8	73.4	65.2	54.3	48.1	62.0
Normal Daily	33.2	34.8	36.8	42.2	49.6	57.8	63.5	62.4	56.6	48.3	39.6	34.1	46.6
Normal Precip.	4.01	3.75	3.53	1.53	0.58	0.12	0.82	0.99	0.62	0.68	2.54	3.48	22.65



Place:

Lat./Long.:

Elevation:

Temperatures

Warmest Month/Mean:

Coldest Month/Mean:

Precipitation

Annual Total:

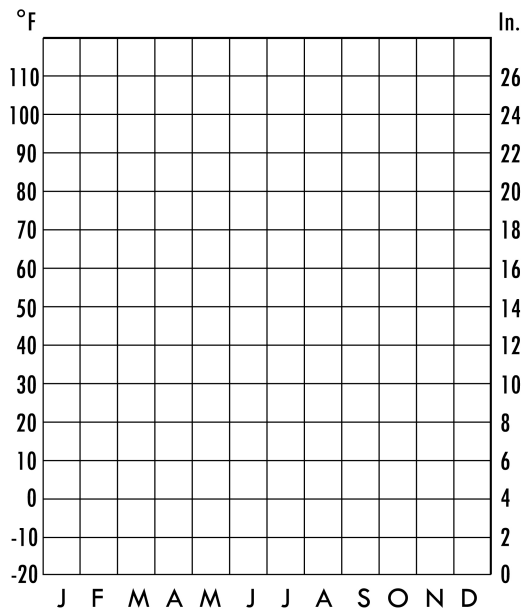
Wettest Month/Amount:

Dryest Month/Amount:

Köppen Classification:

Crescent City, Calif. | Elevation 40' | 41° 46' N, 124° 12' W

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave./Total
Normal Min.	40.0	41.5	41.7	42.6	45.6	49.1	50.8	51.8	50.1	47.0	44.0	40.4	45.4
Normal Max.	55.2	56.2	56.3	57.9	60.8	63.6	65.6	66.2	66.8	63.8	58.3	55.3	60.5
Normal Daily	47.6	48.9	49.0	50.3	53.2	56.4	58.2	59.0	58.5	55.4	51.1	47.9	53.0
Normal Precip.	9.88	8.36	8.93	4.60	2.94	1.33	0.39	0.96	1.75	4.85	10.61	10.61	65.21



Place:

Lat./Long.:

Elevation:

Temperatures

Warmest Month/Mean:

Coldest Month/Mean:

Precipitation

Annual Total:

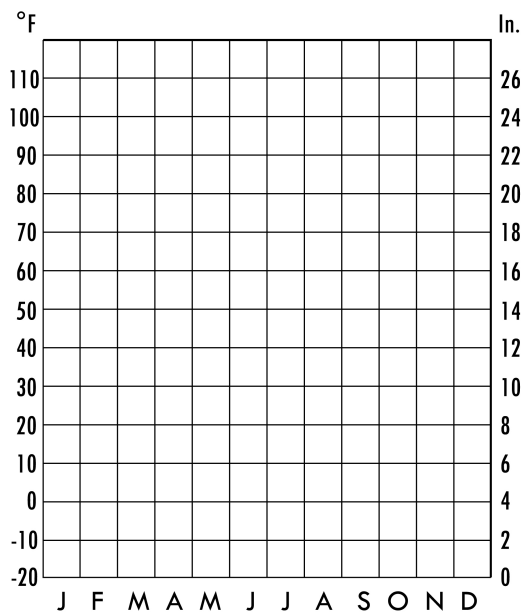
Wettest Month/Amount:

Dryest Month/Amount:

Köppen Classification:

Death Valley, Calif. | Elevation -194' | 36° 28' N, 116° 52' W

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave./Total
Normal Min.	38.5	45.7	53.5	61.7	71.5	81.0	87.4	85.5	75.5	61.7	48.2	37.8	62.3
Normal Max.	64.9	72.7	79.6	88.1	98.0	108.1	114.3	112.1	104.4	91.7	75.6	63.8	89.4
Normal Daily	51.7	59.2	66.6	74.9	84.8	94.6	100.8	98.8	90.0	76.7	61.9	50.8	75.9
Normal Precip.	0.24	0.41	0.31	0.15	0.08	0.04	0.15	0.18	0.17	0.11	0.23	0.21	2.28



Place:

Lat./Long.:

Elevation:

Temperatures

Warmest Month/Mean:

Coldest Month/Mean:

Precipitation

Annual Total:

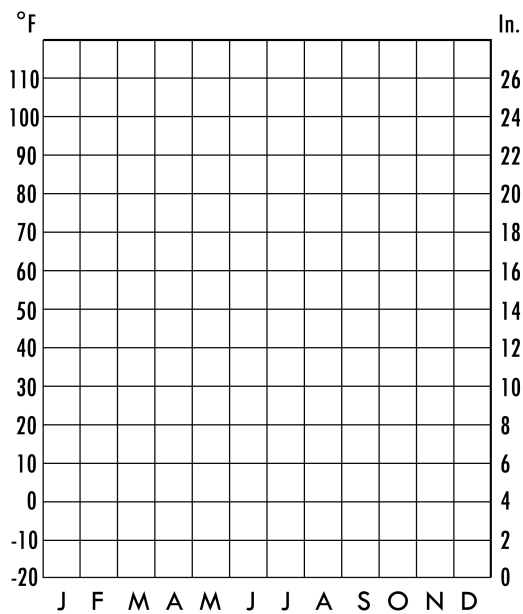
Wettest Month/Amount:

Dryest Month/Amount:

Köppen Classification:

Fresno, Calif. | Elevation 328' | 36° 46' N, 119° 43' W

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave./Total
Normal Min.	37.4	40.5	43.4	47.3	53.7	60.4	65.1	63.8	58.8	50.7	42.5	37.1	50.1
Normal Max.	54.1	61.7	66.6	75.1	84.2	92.7	98.6	96.7	90.1	79.7	64.7	53.7	76.5
Normal Daily	45.7	51.2	55.1	61.2	69.0	76.6	81.9	80.3	74.5	65.2	53.6	45.4	63.3
Normal Precip.	1.96	1.80	1.89	0.97	0.30	0.08	0.01	0.03	0.24	0.53	1.37	1.42	10.60



Place:

Lat./Long.:

Elevation:

Temperatures

Warmest Month/Mean:

Coldest Month/Mean:

Precipitation

Annual Total:

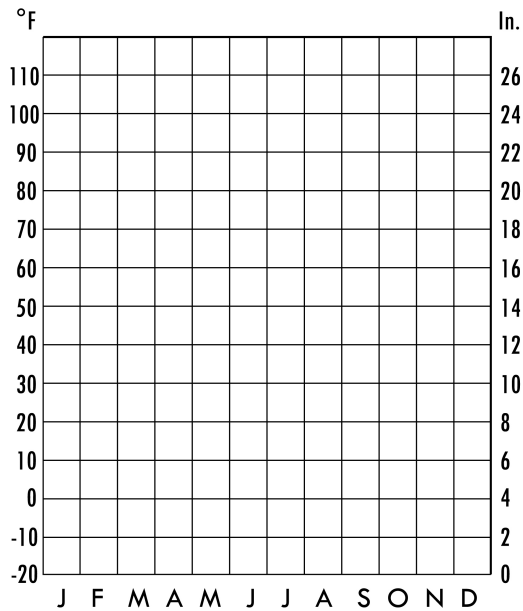
Wettest Month/Amount:

Dryest Month/Amount:

Köppen Classification:

Redding, Calif. | Elevation 502' | 40° 30' N, 122° 18' W

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave./Total
Normal Min.	35.7	40.0	41.7	46.0	52.3	61.8	64.7	63.1	58.8	49.2	41.4	35.2	49.2
Normal Max.	55.3	61.3	62.5	69.9	80.5	90.4	98.3	95.7	89.3	77.6	62.1	54.7	74.8
Normal Daily	45.5	50.7	52.2	58.0	66.4	76.1	81.5	79.5	74.1	63.5	51.8	45.0	62.0
Normal Precip.	6.06	4.45	4.38	2.08	1.27	0.56	0.17	0.46	0.91	2.24	5.21	5.51	33.30



Place:

Lat./Long.:

Elevation:

Temperatures

Warmest Month/Mean:

Coldest Month/Mean:

Precipitation

Annual Total:

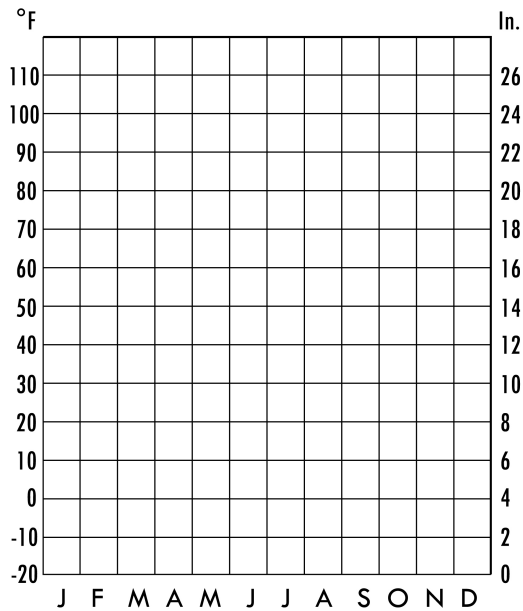
Wettest Month/Amount:

Dryest Month/Amount:

Köppen Classification:

Santa Barbara, Calif. | Elevation 5' | 34° 25' N, 119° 41' W

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave./Total
Normal Min.	43.4	45.4	47.0	49.0	51.8	55.0	57.8	59.2	57.7	53.9	48.5	43.6	51.0
Normal Max.	65.0	65.7	66.4	68.6	69.4	71.7	75.3	77.0	75.8	74.2	69.1	65.6	70.3
Normal Daily	54.2	55.6	56.7	58.9	60.6	63.4	66.6	68.1	66.8	64.1	58.8	54.6	60.7
Normal Precip.	3.57	3.75	2.75	1.27	0.20	0.07	0.01	0.05	0.31	0.33	2.18	2.49	16.98



Place:

Lat./Long.:

Elevation:

Temperatures

Warmest Month/Mean:

Coldest Month/Mean:

Precipitation

Annual Total:

Wettest Month/Amount:

Dryest Month/Amount:

Köppen Classification:

Twentynine Palms, Calif. | Elevation 1,975' | 34° 08' N, 116° 02' W

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave./Total
Normal Min.	35.3	38.8	42.5	48.3	56.2	64.3	71.0	69.9	62.8	52.3	41.6	35.0	51.5
Normal Max.	63.3	68.6	73.8	81.7	90.8	100.6	105.5	103.1	96.4	85.5	71.4	62.9	83.6
Normal Daily	49.3	53.7	58.2	65.0	73.6	82.5	88.3	86.5	79.6	69.0	56.5	49.0	67.6
Normal Precip.	0.38	0.33	0.40	0.10	0.11	0.01	0.66	0.82	0.47	0.26	0.28	0.43	4.25

6.4. Mapping Climate

Use the following map of California to map each of the places given climate classifications in this lab (including Sacramento and Bishop). Refer to your atlas if you are unsure as to the exact locations.



6. What generalizations can you make about California climates?

End of Lab 16