**Figure 1.** Examine the graphs of snow water equivalent (SWE) and streamflow for one river. Assume that essentially all of the precipitation falls as snow. Answer the following.

a. What is snow water equivalent (SWE)?

b. Describe why the SWE pattern for a mountain catchment appears as it does in this graph.

c. Why does the streamflow lag the SWE? By how much does it lag?

d. How would this graph change under a warmer climate?

e. The period from Oct 1 through the following September 30 is called a “water year.” Why do you suppose hydrologists use a water year rather than a calendar year for water planning?
Figure 3. Consider the effect of a possible 3°C increase in mean annual temperature on the fraction of rain versus snow, as shown on the map. Answer the following.
   a. What parts of the Western U.S. show the greatest possible effect of this increase?

   b. How much is the effect in western mountains?

   c. Why is the fraction of rain versus snow important?

Figure 4. Consider the effect of a possible 3°C increase in mean annual temperature on the length of the “snow season.”
   a. What parts of the Western U.S. show the greatest possible effect of this increase?

   b. How much is the effect in western mountains?

   c. Why is the length of the snow season important?
**Figure 5.** Consider the effect of a possible 3°C increase in mean annual temperature on the largest 5-day storms.

a. What parts of the Sierra Nevada show the greatest possible effect of this increase?

b. How much is the effect in the Sierra Nevada?

c. Why is the temperature of large storms important?

**Figure 6.** Examine the trend in fraction of annual flow occurring during the snowmelt season for the Sacramento and San Joaquin basins.

a. Why might there be a difference between the Sacramento and San Joaquin basins?

b. By how much have values declined over the past 100 years?

c. How does the amount of decline compare to the interannual variability
Timing of precipitation & stream discharge for a snow-dominated mountain basin

Figure 1

PROJECTED CHANGES IN ANNUAL TEMPERATURE, NORTHERN CALIFORNIA

Figure 2
Figure 3
Illustration of the possible influence of a +3°C increase in average daily temperature on snow versus rain, presented as the historical fraction of annual precipitation that fell in the temperature range –3°C to 0°C.

Figure 4
Illustration of the possible influence of a +3°C increase in average daily temperature on snow-season length, presented as historical number of days per year with mean temperature in the –3°C to 0°C range.
Illustration of the possible influence of a +3°C increase in average daily temperature on rain-flood storms, presented as the fraction of 25 largest storms with temperatures in the −3°C to 0°C range.

Figure 5

How much of the Year’s Flow is Occurring during Snowmelt Season?
April-July Full-Natural Flows/Water-Year Full-Natural Flows

Spring Fraction of Annual Flow

Sacramento Basin
San Joaquin Basin

Figure 6