The climate of California

The climate of California is controlled by three major factors:

1) the Pacific high pressure that builds to a maximum during the summer months and which partly collapses and shifts southward in the winter
2) the presence of the ocean with low water temperatures resulting from the northerly current
3) the effect of topography, particularly the Sierras to the east which largely suppress the influx of cold continental air masses from the northeast.

Seasonal distribution of precipitation

The Pacific high has two main effects. In the summer, storm systems are held far to the north. Meanwhile, subsidence in the vicinity of the high makes the atmosphere stable and largely could free. The result is minimal rainfall during the summer months. Using a diagram to follow, we can contrast this seasonal rainfall pattern with those of, say, Bismark, ND, and Mobile, Alabama. The first of these is almost the inverse of a California location because of summer convective storms, and the low wintertime humidity because of the coldness of the air masses predominant at that time of year. Mobile, Alabama, on the other hand has a much more uniform rainfall distribution throughout the year. Presumably, wintertime traveling cyclones more or less balance summertime convective activity.

Topography and precipitation profiles

As you would expect, and as shown in the following diagrams, topography has a huge influence on rainfall (or rain equivalent of snowfall). The profiles across the Central Valley and to the peak of the Sierras' at different latitudes show that maximum rainfall occurs on the west facing slopes of the range. This, of course, correlates with maximum uplifting by the terrain. A distinct rain shadow effect is also apparent to the east of the Sierras.

The coastal climate of northern California

Most new visitors to California are surprised to find the coastal waters so cold, particularly in the northern half of the state. Disappointing to many is

the coolness and dampness of the weather along the coast in the summertime due to the coastal fog and stratus cloud that are so predominant.

An examination of sea-surface temperatures shows why. The northerly ocean current along the coastline of the US and Canada is further enhanced by north westerly winds circulating clockwise around the Pacific high. The Coriolis effect, acting upon this current forces the current to the right and away from the shore. To compensate, upwelling of deeper and colder water occurs along the coastline and temperatures end up being colder than found further offshore (see diagram). Air masses approaching the coast from further out to see are cooled from below by the coastal waters resulting in the formation of fog and stratus cloud, which can be advected inland for some tens of kilometers. Over land, this cloud and fog experiences a diurnal cycle in which the sun “burns off” the condensate during the day but it reforms at right.