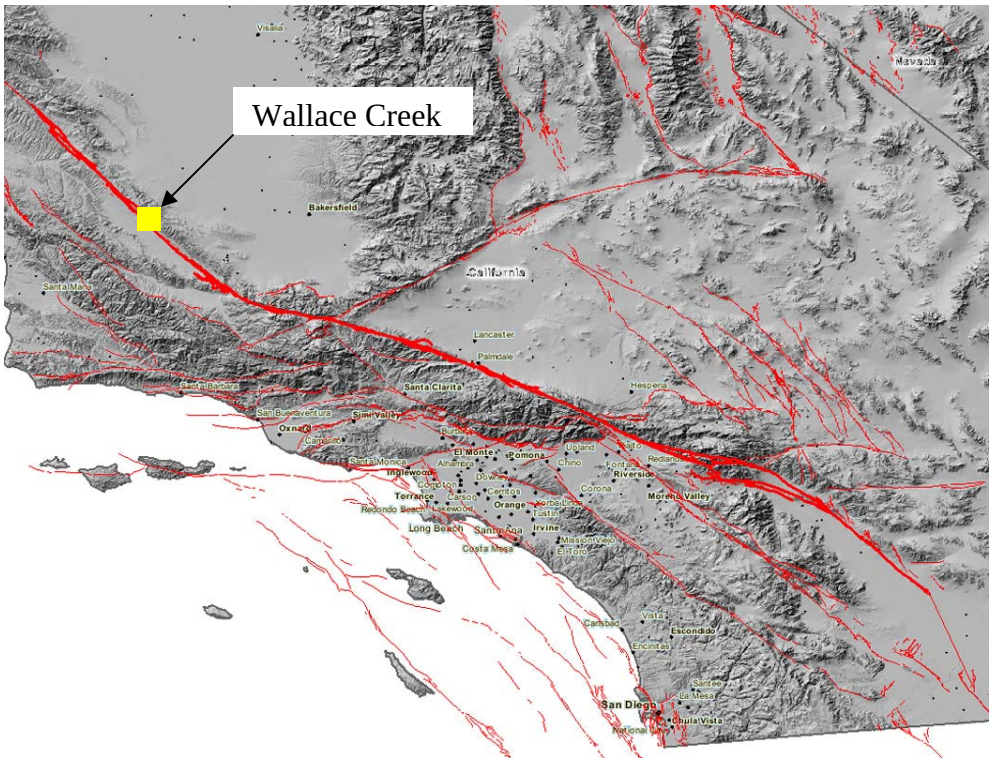
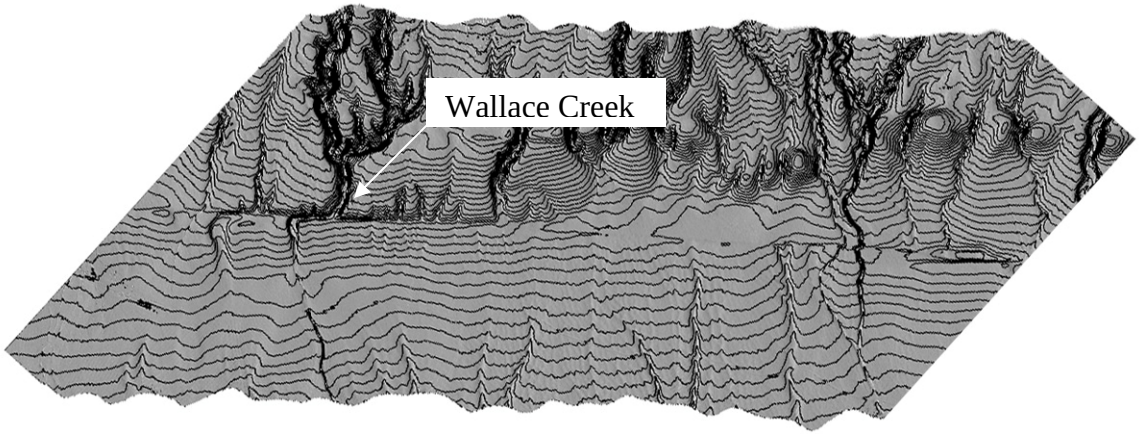
Long and short term deformation along the San Andreas Fault System:
Exercise: Offset stream channels in the Carrizo Plain



Rarely are tectonic landforms as well expressed and dated as they are at Wallace Creek on the Carrizo Plain in south-central California. In the area surrounding Wallace Creek are examples of most of the classic geomorphic features of strike-slip faults. These landforms were noted by numerous geologists through the early and mid 1900s as indicating horizontal motion along the SAF.



In this exercise we will visualize and analyze digital versions of the topography shown above in Google Earth to better understand what these fault related landforms can tell us about earthquake behavior.

INSTRUCTIONS:

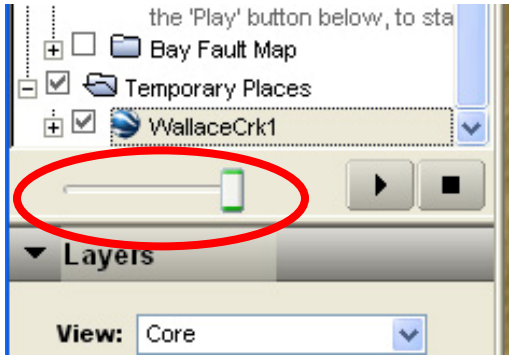
1. Go to http://lidar.asu.edu/TeacherTech08.html - here you will find information from this course, copies of the exercises, and the data we are going to view in Google Earth

2. Download the four Wallace Creek Google Earth files located under "Data" (e.g. WallaceCrk1.kmz).

3. Open all four of these files in Google Earth. If Google Earth is struggling to load all four files, start with WallaceCrk1.kmz and WallaceCrk2.kmz.

These files are hillshade images of ½ meter digital elevation models (DEM). The hillshade is created by artificially illuminating the DEM with sunlight to make it appear to look like a grey-scale photograph. A hillshade is typically how geologists view these data.

4. Use the "transparency slider" in the left hand menu to adjust the transparency of the image so that you can partially see through the grey image to the Google Earth imagery underneath – experiment until to get a perfect "blend" of the topography (grey image) and the photography beneath.



5. Familiarize yourself with the measuring tool in the menu at the top of Google Earth- you will be using the measuring tool to answer the following questions.

INTRODUCTION:
The Wallace Creek area of the Carrizo Plain is a world famous locality for studying the San Andreas Fault (SAF). The landforms here preserve both the long term motion of the SAF (many earthquakes) and the short term (single earthquake) motion. The most recent earthquake on this portion of the SAF was in 1857.

QUESTIONS:
I. – Long Term Slip Rate: Using the measuring tool in Google Earth, measure the horizontal offset of Wallace Creek. Researchers have determined via radio carbon dating that the Wallace Creek channel is 3700 years old. What is the average rate of motion defined by the offset at Wallace Creek (hint: offset/age)? How does this rate compare to the rate we got from the GPS data in the previous exercise?

II – Slip Per Event. Now, pan southeast along the fault and look for other offset channels – many will be quite small. Measure them as you encounter them and record the offsets you see. What is the smallest offset you encounter? Offsets from the 1857 earthquake can be seen in the data – what is your estimate of the offset in 1857? At the rate we calculated above (part I), how long will it take to build up the offset that occurred in 1857 (hint: offset/rate)?

III – Recurrence: Based on your calculation of how long it takes to build up the offset that occurred in 1857 (part II above), when would you expect the next earthquake? Should we be concerned?

IV – Characteristic?: In part II you were documenting offsets along the fault. If all earthquakes on the SAF are like the 1857 event, we should only see multiples of the 1857 offset – i.e. 2 EQs = 1857 x2, 3 EQs = 1857 x3 etc. Do your observations agree with this? How many 1857 EQs did it take to produce the Wallace Creek offset?