Lab 10: GPS and Plate Motions
(under construction!!!!)

Overview: Students simulate plate tectonic motions by measuring linear changes in latitude and longitude using hand-held GPS receivers.

Objectives:
(1) Determine student latitude and longitude and record position
(2) Plot positions on a graph as a function of time (velocity)
(3) Relate simulated velocities of motion with real plate motions (GPS time series)
(4) Locate real GPS stations on a global velocity map & determine the velocity at which the stations are moving.

Time: Outdoor GPS activity (1hr)
Computer activity (15 mins)

Daily plotting activity: 10-15 mins (when time available)

Materials:
- GPS receivers (9?)
- Instructions for GPS receivers
- Meter stick or tape measure (9)
- Instruction sheet/Challenge Worksheet
- Print-out of real GPS time series
- Computer access

Teacher Prep: Students will gather outside on a large open space on UCSD campus to collect satellite-based GPS data reflecting their geographic location (latitude and longitude). In groups of 2 or 3, students will first try out the hand-held GPS receivers by randomly sampling their location and recording their results. General directions for acquiring this information:

(1) go outside to a relatively clear area
(2) turn on the GPS receiver
(3) hold receiver so antenna is horizontal and visible to the sky
(4) wait until receiver gives indication that a position has been acquired
(5) follow receiver instructions to display screen for latitude/longitude
(6) record latitude/longitude that is displayed on the receiver for that object

Student groups should rotate so that each student has an opportunity to use the GPS receiver. After all students have tried out the receivers, students will then be assigned a 'rate' based on a tectonic plate. Students should attempt to simulate this rate by moving a specific distance in a specific amount of time. Keep in mind (and remind the students) that these rates will be exaggerated for our purposes so that we can properly measure them (lets just make 10 mm = 1m and 1 yr = 1 min.) For example, the Pacific-North

American plate motion is ~ 50 mm/yr. So for this case, this student will need to plan out a 'dance' that moves him/her 5 meters in one minute. The student will make 5 measurements moving in such a fashion. The student will record his/her start position and the following positions in lat/long. Then the student will plot his/her lat/long position on graph paper. Finally, the student will plot his/her latitude vs. time and longitude vs. time on two separate graphs.

Next students will be given a handout showing identically-oriented plots, but this time the data will be that collected from real GPS stations over the last 10 years from Southern California. Students will need to analyze these data and calculate the rate of plate motion in latitude and longitude (it would be great if they could do some geometry to figure out the magnitude of the velocity vector!)

Lastly (if enough time), students will return to the computer lab. Students will be directed to the following website and be asked to select two global GPS stations and identify their rates of plate motion:

http://sideshow.jpl.nasa.gov/mbh/series.html