Topic:
Differential GPS and Spring term UROP

Aim:
Discuss the implementation issues associated with differential GPS and start a discussion of the Spring semester UROP.

Discussion

*Differential GPS*
Differential GPS involves using measurements from a receiver at nominally a known location to effectively estimate the satellite clock errors and using those corrections to correct measurements from other GPS receivers.
Differential methods are the most effective way to use carrier phase measurements because the unknown number of cycles at the beginning of tracking a satellite reduces to the difference in the number of cycles between the two receivers.
One method of processing the data is called "double differencing" where measurements between satellites at one station are differenced (single difference) thus removing effectively the unknown receiver clock and phase offset, and then single differences between from another station are differenced (hence the term double differencing).
In the differencing processing, the initial values of the phase of the oscillators in the GPS receivers cancel (provided the measurements are made at the same time) and the unknown starting values for the phase reduces to the integer number of cycles between the two receivers.
If the two receivers are close enough, then this number of cycles can be resolved to integer values. This process is called "ambiguity resolution" or "bias fixing".
When the ambiguities can be resolved to integer values, GPS is capable of making measurements in real-time or post processing to better than 10 mm.
For real-time applications, a radio link is established between two receivers (could be more since the fixed station only needs to transmit and the receiving/moving site does all the calculations). This is called RTK (real-time kinematic GPS).
Differential GPS corrections can be transmitted locally over VHF radio (or even higher frequencies now e.g. FreeWave 900Mhz and 2.4 Ghz radio modems) or from satellites (normally just pseudo range corrections).
JPL is testing a system called RTG (Real-time-GYPSIE (name of JPL GPS processing software) that transmitted phase correction information globally in near real-time (about 1-3 second latency).
UROP Project:

Our research group (Geodesy and Geodynamics Laboratory) works on many GPS projects. Freshman advisees can participate in a spring term UROP associated with this research.

Web pages for the group and related GPS projects:
http://www-gpsg.mit.edu/~tah/cont98g/cont98.html
http://www-gpsg.mit.edu/~tah/MIT_IGS_AAC/
http://www.scecdc.scec.org/group_e/release.v2
http://www.scign.org

Look at these web pages to get some ideas on the activities taking place

From the students: Need to know programming skills; discussion of presentation of scientific results e.g. animation, representation of results.

Discussion in last seminar will be on types of projects to undertake.