Status of CTO cGPS Networks in 2011

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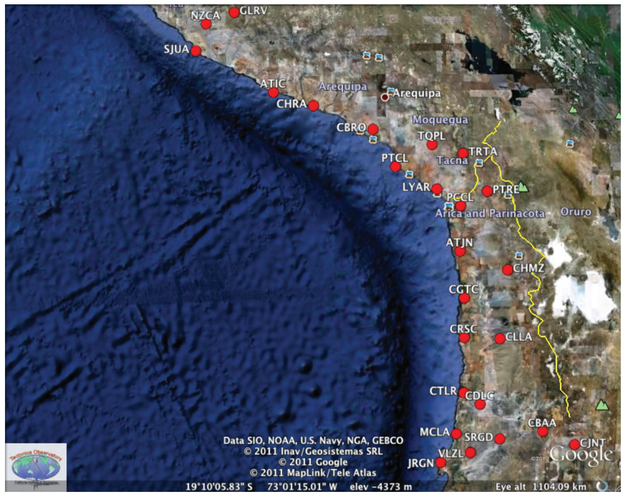

Figure 1. Map location of Central Andes cGPS stations with site codes.

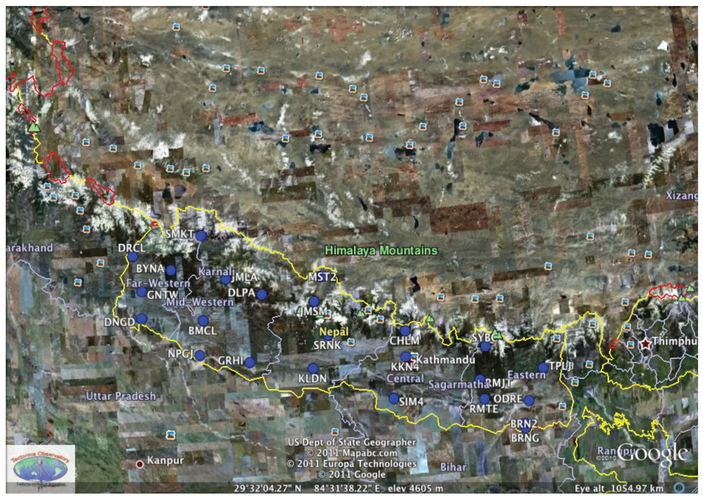

Figure 2 Map location of Nepal cGPS stations with site codes.

Currently operating networks of continuously observing GPS geodetic stations (cGPS) of the Caltech Tectonics Observatory (CTO) were first established in the Nepalese Andes in 2004 and in the central Andes region in 2005. Over the years these networks have grown to a total of 30 sites in Nepal and 25 in Chile and Peru. In Taiwan, four stations have been constructed in 2006 in important regions of the island that are not covered by the local national network. With ongoing research interests in the Southeastern Taiwan two more stations have been added in 2011. The April 2010 El Mayor earthquake in Baja California prompted the installation of 5 stations near the epicenter. In 2011 the network has been expanded by 3 more sites. The following table gives a summary of all networks:

Andes:	2011: 25 stations in total 2010: 3 additional stations in Peru 2011: 2 additional stations in Peru
Nepal:	2011: 30 stations in total 2010: 1 aditional station in East Nepal 2011: 6 additional stations in Central and East Nepal
Baja California	2011: 8 stations in total 2010: network established with 5 stations 2011: 3 additional stations
Taiwan:	2011: 8 stations in total 2011: 2 additional stations

Station design is standardized (see Figure 3). A shallow braced monument constructed of stainless steel rods supports the antenna mount that carries the GPS antenna. While most sites are equipped with a Dorne-Margolin choke ring design, several of the newer sites observe with Trimble Zephyr or Zephyr 2 antennas. The majority of GPS receivers are Trimble NetRS. Recent stations or those that need ftp-push capability employ the newer NetR8 model.

Station connectivity for remote data downloading and near real-time streaming has been the focus of a major effort during the last two years. In Chile, more than a dozen sites have ethernet links thru the fortified network of the local civil aeronautics administration (DGAC). By ftp-push or regular download commands issued automatically from a server in Santiago, measurements are arriving at DGF in Santiago and are resend to CTO. In Peru two stations have been equipped with celular phone modems for an extended period of time to test the viability of this option. Preliminary results indicate that band width and connection uptime vary significantly with modem hardware and cellular carrier. A similar effort is underway in Nepal. One station in the Himalayas is equipped with a cell phone modem. An optimal carrier has been selected, but modem hardware is still under evaluation. Test with satellite based communications (BGAN) have also been conducted at CTO in Pasadena and in Kathmandu, Nepal. While the proof of concept has been confirmed, uptime length and quality of connection is still being evaluated.
Shared communication paths with other sensors (seismometers) collocated with cGPS stations or nearby are also explored. We hope to be able to use VSAT satellite modems at seismic stations in Chile and Peru to connect our cGPS stations to the internet.

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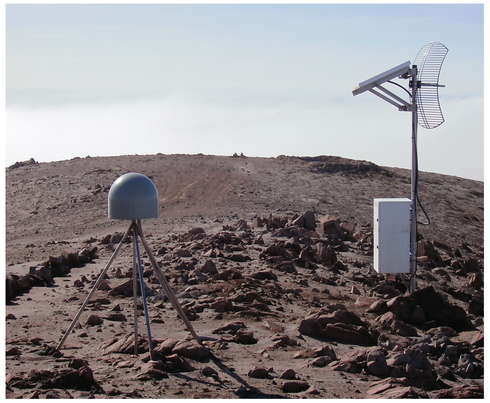

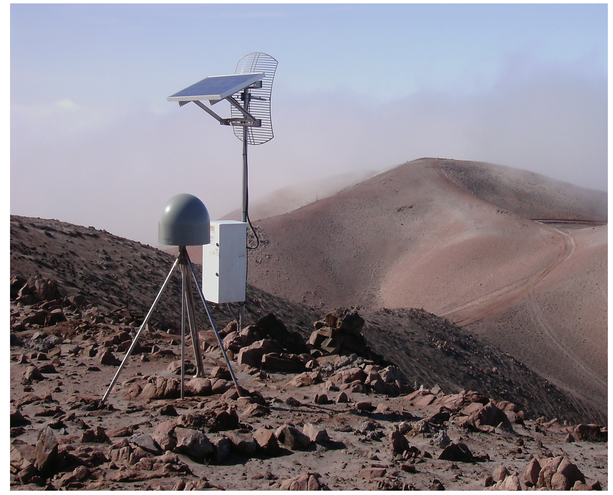

Figures 3a and 3b. Standard design of TO cGPS station. GPS choke ring antenna is located inside radome on stainless steel center rod stabilized by tripod support. White box contains GPS receiver, batteries, and commuinications equipment.

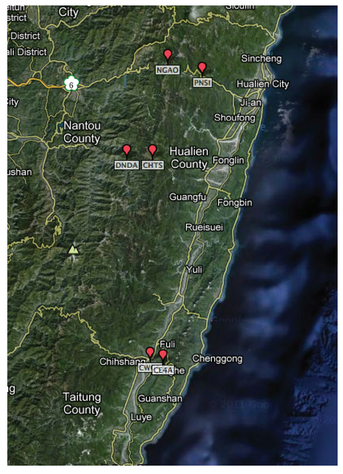

Figure 4. Map location of Taiwan cGPS stations with site codes.

Figure 5. Map location of Baja cGPS stations with site codes.