Siting Criteria for COCONet Stations

The COCONet proposal outlines several key science objectives that can be accomplished through the installation and operation of 50 new geodetic-quality GNSS stations. The primary criteria we will use to evaluate the suitability of candidate sites for these 50 stations are: expected ease of permitting, security, geologic setting, sky view and multipath, access considerations, data communication strategy, and power availability. Typically, the selected site is a compromise between these competing criteria.

Permitting

The international aspect of the COCONet project makes land ownership and permitting a primary consideration in site selection. It is desirable to collocate as many GNSS stations as possible with previously installed scientific infrastructure, assuming that the new stations can be added to existing permits or landowner agreements. Typically, lands held at the federal level (such as airports, ecological preserves, national parks, and possibly military installations) provide longer-term stability for scientific infrastructure than do lands held privately. The budgetary constraints of the project prohibit paying large permitting fees, which may require that the best landowners are generally receptive to scientific research. Permits should only be considered for longer than five years of duration, preferably with the option to extend. If UNAVCO is not the owner of the permit, a memorandum of understanding will be agreed to between UNAVCO and the permit holder.

Security

Securing stations from theft, vandalism, and animal interference is an important concern. Factors that directly lead to the enhanced security of a site include restricted access to the public, locating the station out of view of the public, and fencing and signage to discourage tampering. Stations that are located at manned facilities are usually more secure. To mitigate the risk of damage to the stations from animal interference, fencing can be installed around the monument and power system. However, the fencing should be as minimal as possible, to reduce the effects of increased multipath from reflected GNSS signals.

A PBO GPS station that was vandalized and subsequently had a security fence installed. Multipath values increased by 50% after the fence was installed.

Geologic Setting

The geology of the surrounding location of the GNSS monument is critical for achieving accurate measurements of the tectonic signal. Competent rock is the most desirable for the type of monuments preferred for COCONet installations: the short-drilled braced monument (SDBM). The monument legs are anchored into holes drilled in the rock to a depth of 1.5-2m using injected epoxy to secure the monument legs to the rock. With this type of shallow monument, exposed rock at the surface is required. Rock that is excessively fractured or friable near the surface should be avoided.

A GPS monument (SDBM) installed in highly competent sandstone

Skyview and Multipath

Suitable locations for the GNSS stations will have a clear view of the sky, unobstructed by trees, buildings, or topography above an elevation angle of 15 degrees. These obstructions can block and/or reflect the satellite signal, degrading the quality of the GNSS signal. The heavily vegetated character of many of the countries in the Caribbean region makes the site selection difficult and may require frequent maintenance by local personnel to keep the vegetation away from the monument and solar panels. Any potential signal reflectors such as buildings and fences should be at least 20 m from the monument, to reduce multipath effects.

A steep slope above the GPS monument obstructs a clear view to the satellites and is a source of multipath.

Access Considerations

The reconnaissance, installation, and maintenance of the COCONet stations will be accomplished using many modes of transportation, including aircraft, boats of various sizes, rented trucks and other vehicles, foot travel, and livestock for transporting equipment overland. Each of these methods has unique benefits and drawbacks. Generally, a site location that can be driven to by pickup truck from an air/sea port is preferable, although not necessarily vital if such a location would adversely impact site security or other factors. If a station cannot be driven to, the site must be accessible by some other method.

Data Communications

The primary solution for station data communications in the COCONet project is anticipated to be cellular modems. These modems can be used on both GSM and CDMA networks and are compatible with a number of cellular providers. Thus, stations sited in areas with cell coverage are preferred. In areas lacking suitable cell coverage, satellite (VSAT) modems can be installed, especially at locations where AC power is available. Another option is to utilize radio modems, which can communicate via a line of sight radio link to a relay station with Internet access.

Power Availability

Locations that have AC power are preferred for a number of reasons. The lack of solar panels simplifies station design and makes the station less attractive for potential theft. At these locations, battery backup is installed to power the system in the event of an AC power outage. Where AC power is not available, solar panels can be installed to charge the station's battery bank during the day. Solar power works well for most systems, with the exception of the power-hungry VSAT modems; to keep stations with VSAT modems online at all times requires a sizable bank of solar panels and batteries, increasing station cost and footprint.