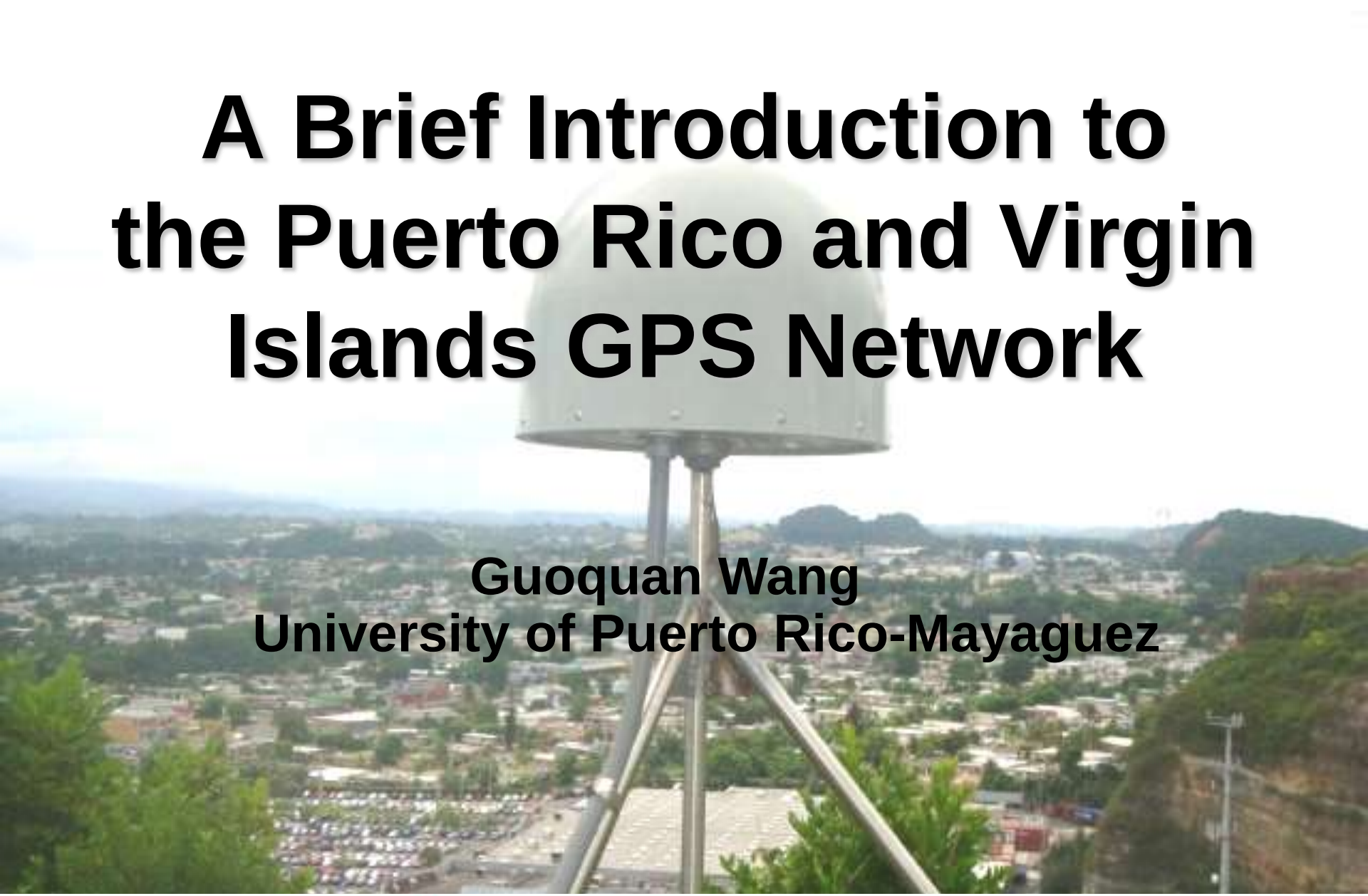
A Brief Introduction to the Puerto Rico and Virgin Islands GPS Network



Guoquan Wang
University of Puerto Rico-Mayaguez

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UNAVCO Data Archive Interface

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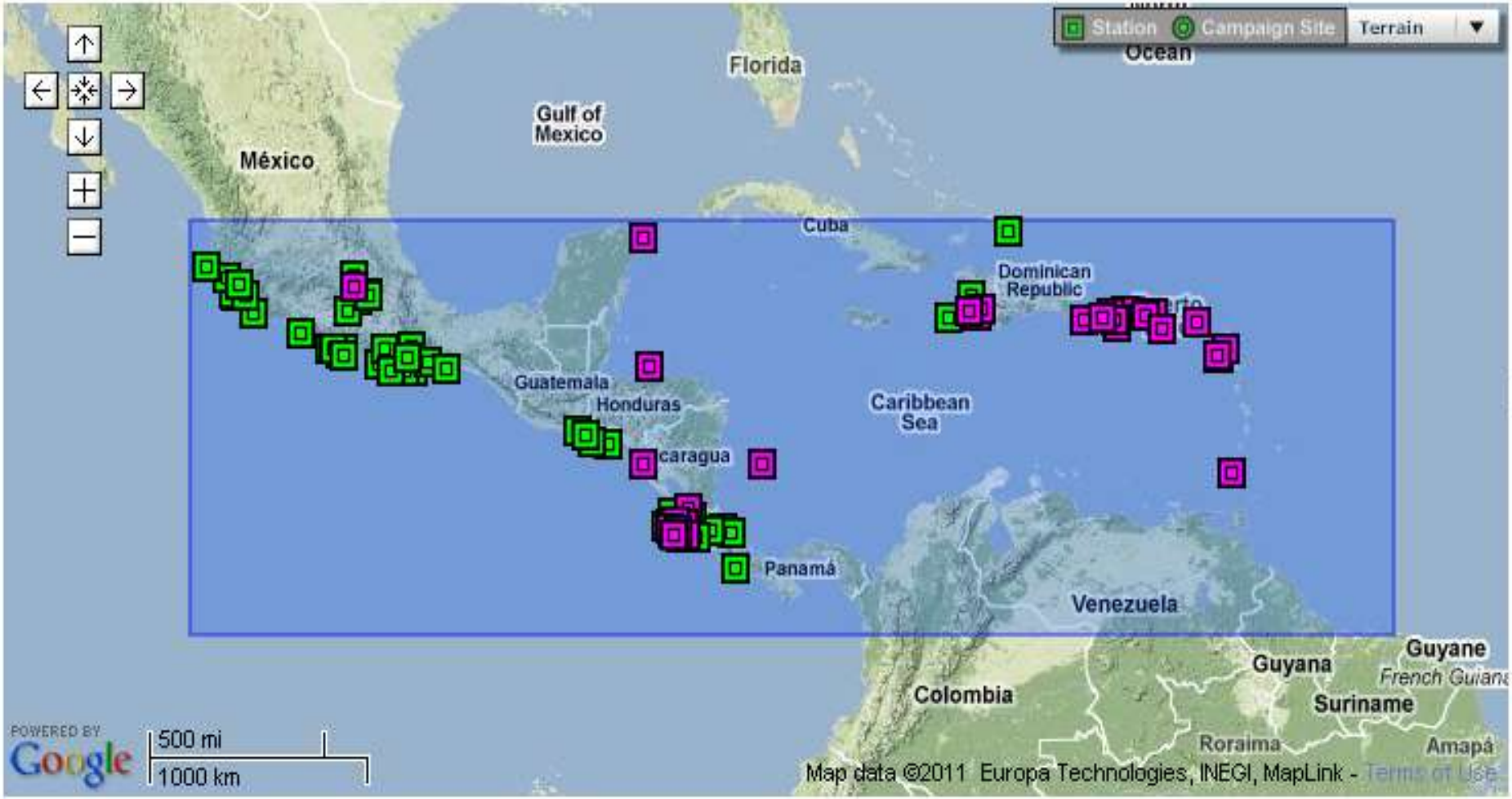
Stations | Campaign sites | All

Current results: 99 items

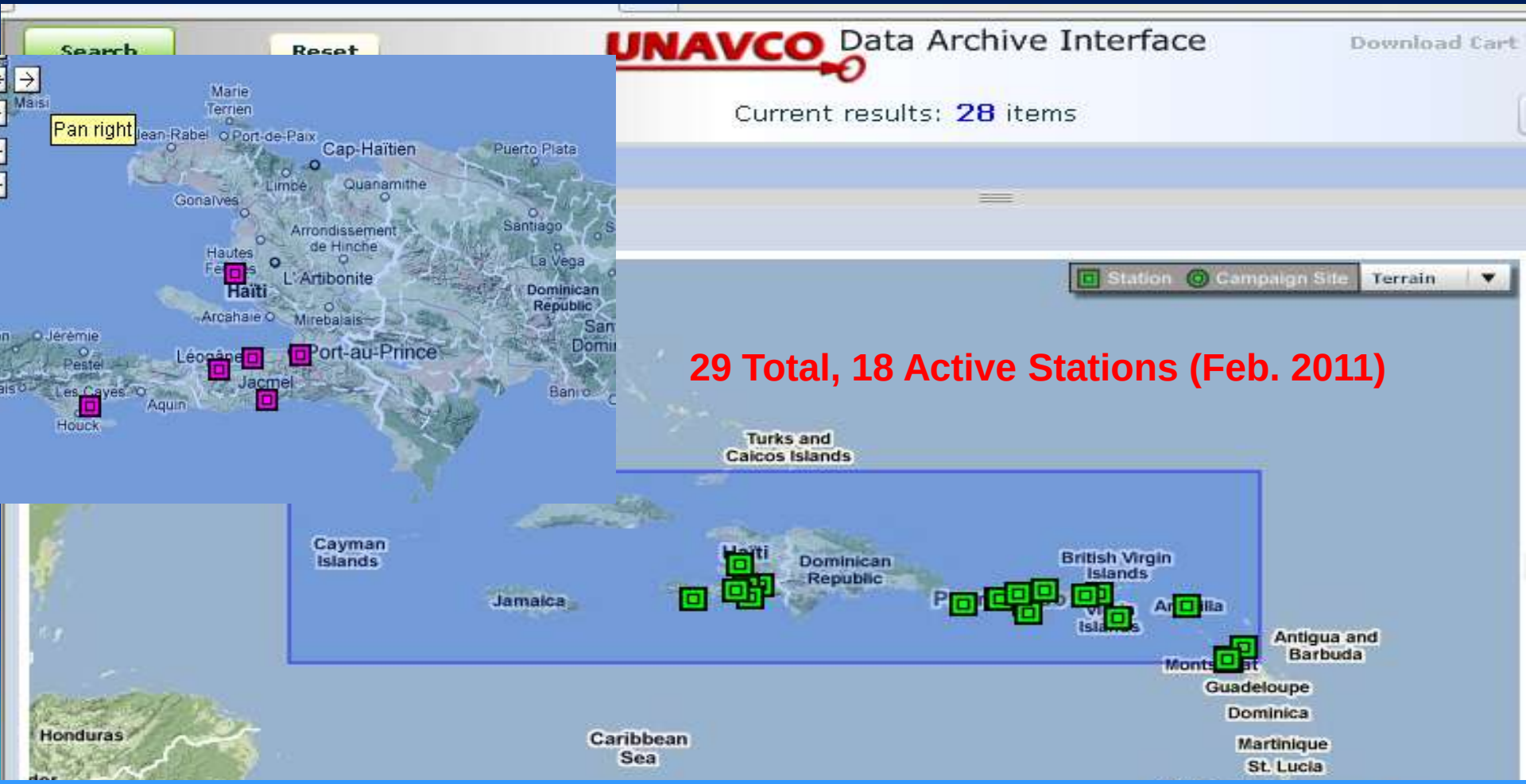
In

Metadata

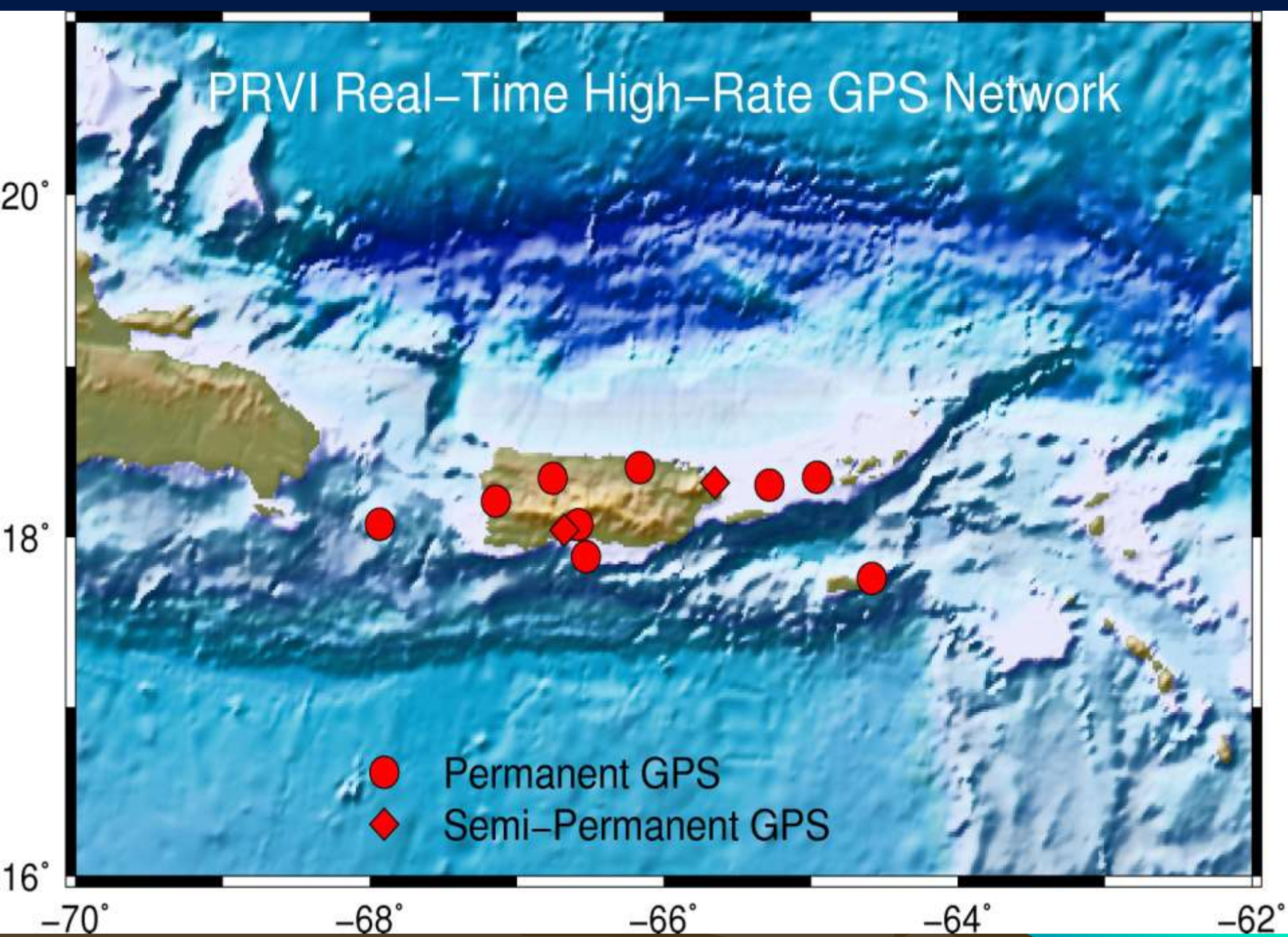
Spatial



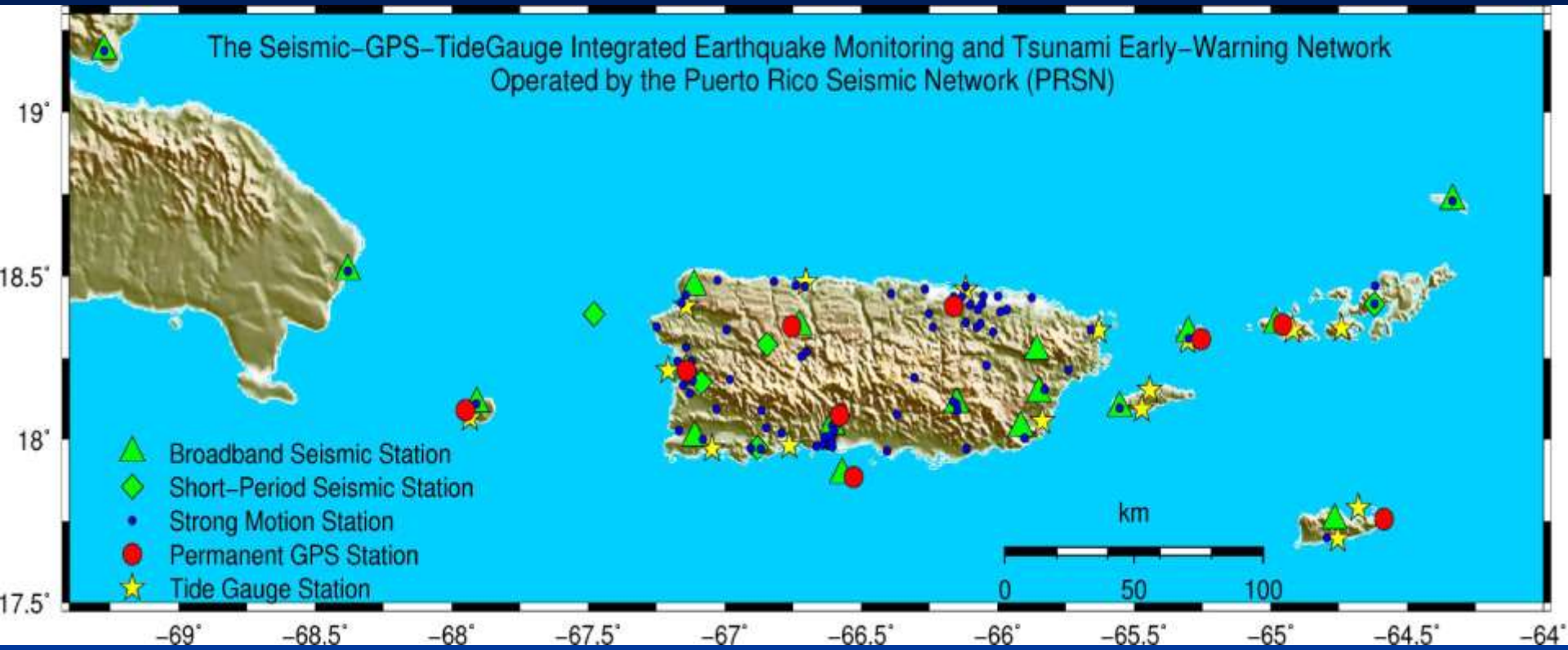
Cayman Isalnds-Hispanola-PRVI



- Location, Installation, Data Archiving, and Applications
- A Big Lesson Learned From the Chile EQ


PRVI Real–Time High–Rate GPS Network
20°
18°
16°
–70°
–68°
–66°
–64°
–62°
Permanent GPS
Semi–Permanent GPS

GPS + Weather + Seismic + TideGauge



Mona Island Seismic Observation Station

GPS+Accelerometer+Velocitymeter+TideGauge+WeatherSensor

Weather Station

Strong Motion Sensor

Solar Panel

VSAT

GPS Antenna

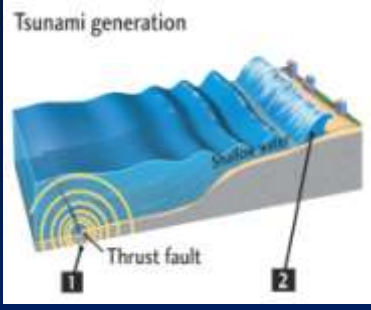
GPS Receiver

Broadband Seismic Sensor

A Real–Time Velocitymeter–Accelerometer–GPS Integrated Earthquake Observation Station at Mona Island, Puerto Rico

June 14, 2009

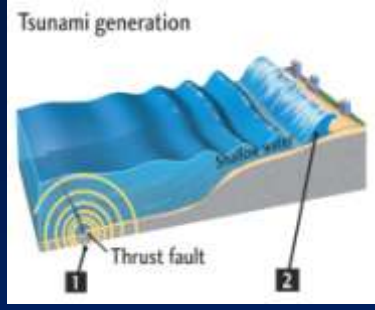
GPS + Strong Motion Sensor



StrongMotion Accelerograph—Short and Middle Periods

GPS Seismometer---Middle and Long Periods

GPS + TideGauge



- Verify a Tsunami --- Absolute Sea-Level Change
- Long-term sea level monitoring

GPS + Weather Sensors

- Weather Forecasting
- Improve “Wet-Delay Model” in the Caribbean Region

Installation

Short Drilled Braced GPS Monument

- Pre-Investigation: 1-2 week
- MOU (Memorandum of Understanding): 2 months

  A Great Challenge: <u>Signatures Acquisition</u>

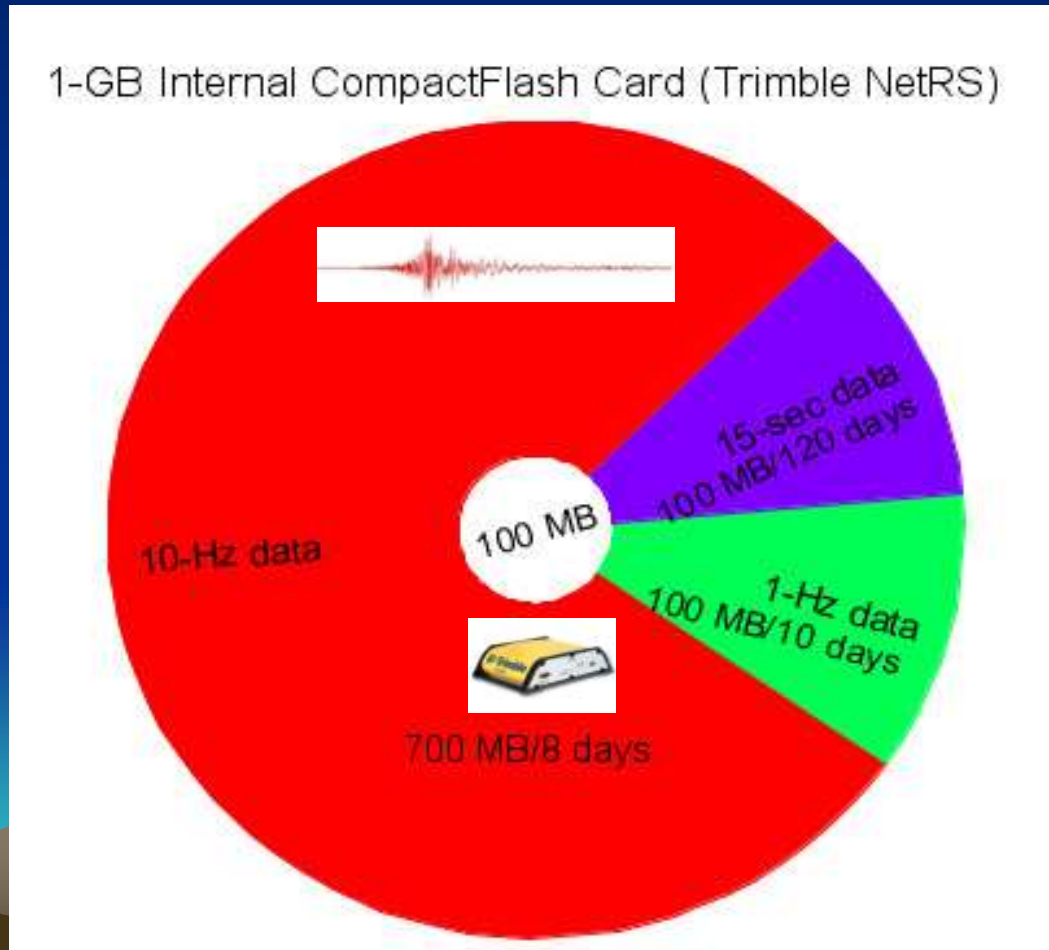
- Field Installation: 2-3 days

Data and Data Archiving

- 15-sec
  - 2.5 years
- 1-Hz
  - 2.5 years
- 10-Hz

January 12, 2010 Haiti EQ (M7.0)

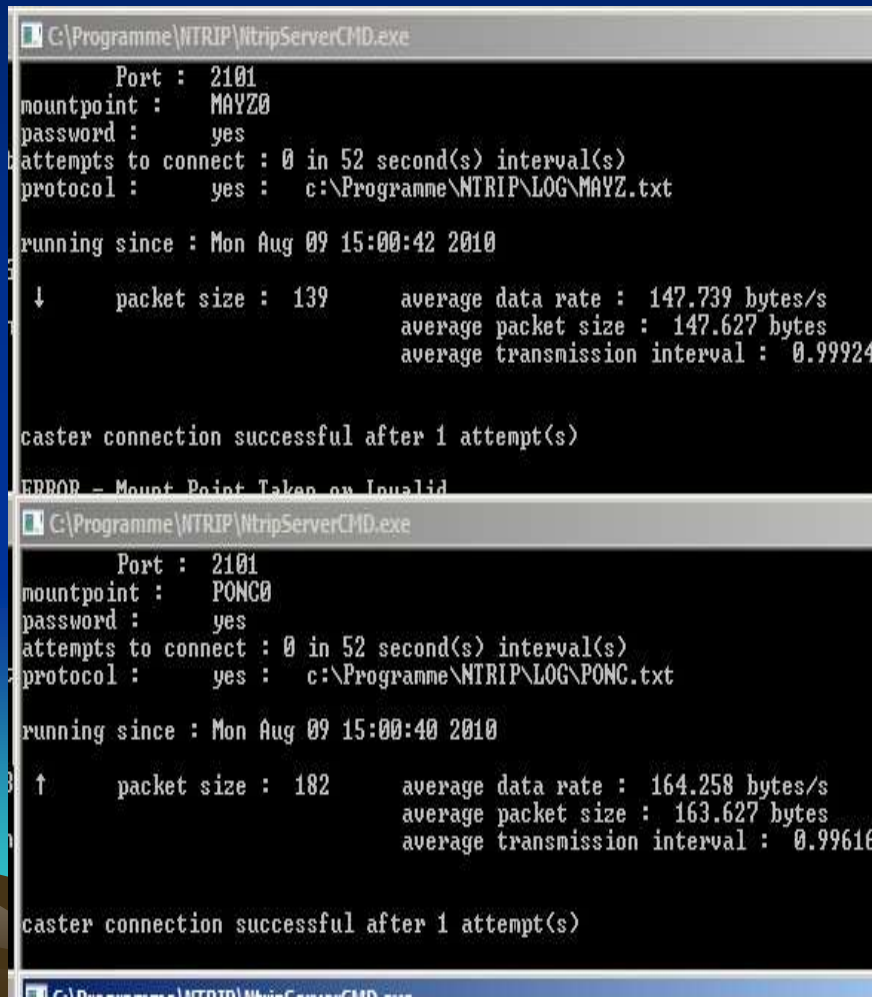
May 16, 2010 Puerto Rico EQ (M 5.7)



Data Archiving

Real Time Data Streams (RTCM3.0)
NTRIP Server and Caster: gps1.uprm.edu

- Major Users:
  - Local Land Surveying
  - Local Landslide Monitoring
  - IGS real-time GNSS data dissemination network.
  - NASA's JPL-**G**PS **R**eal Time **Ea**rthquake and **T**sunami Alert Project



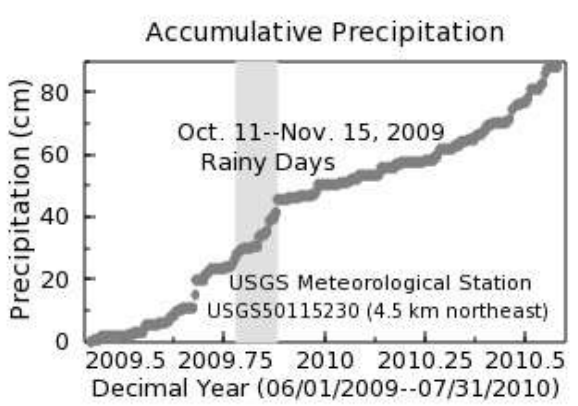
Applications

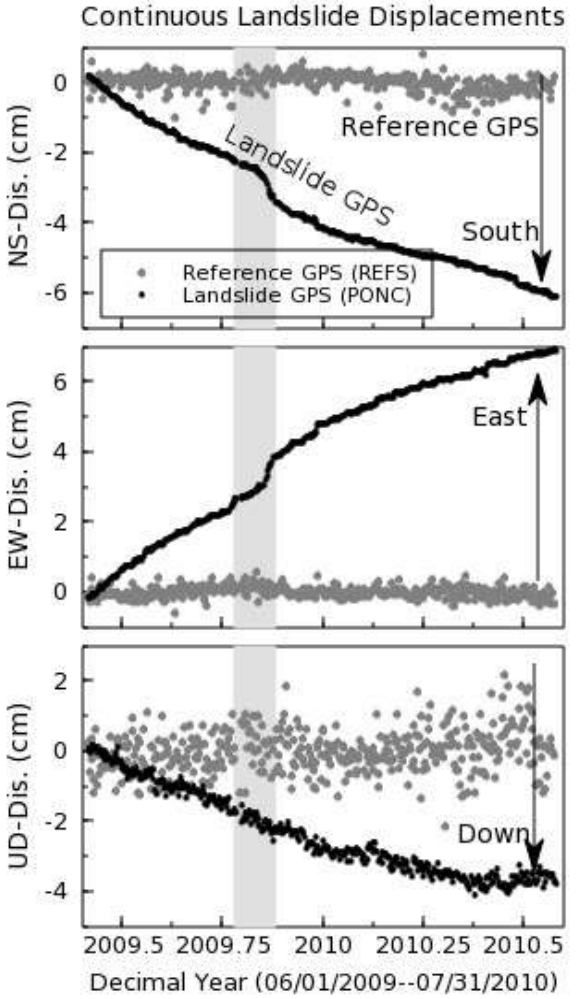
- Plate Tectonics, Micro-Plate Tectonics
- Large Earthquake Monitoring & Tsunami Early Warning (PRSN)
- Hurricane Intensity Forecasting (UCAR)
- Landslide Monitoring

An Infrastructure for Multi-Hazard Minimization

GPS Landslide Monitoring

- Post Static Monitoring
- Real-Time Kinematic Monitoring
- Near Real-Time Rapid Static Monitoring (30 minutes)



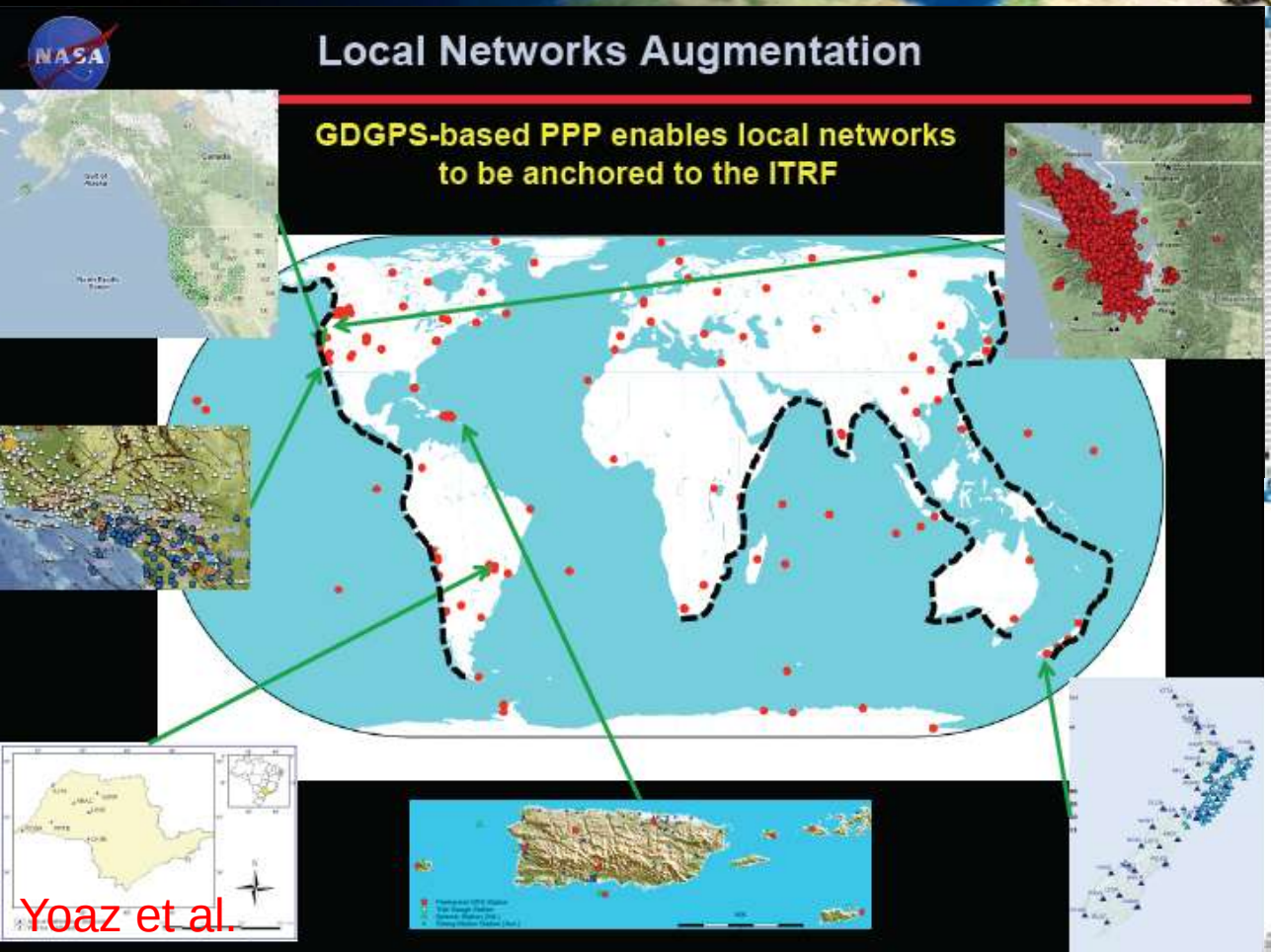


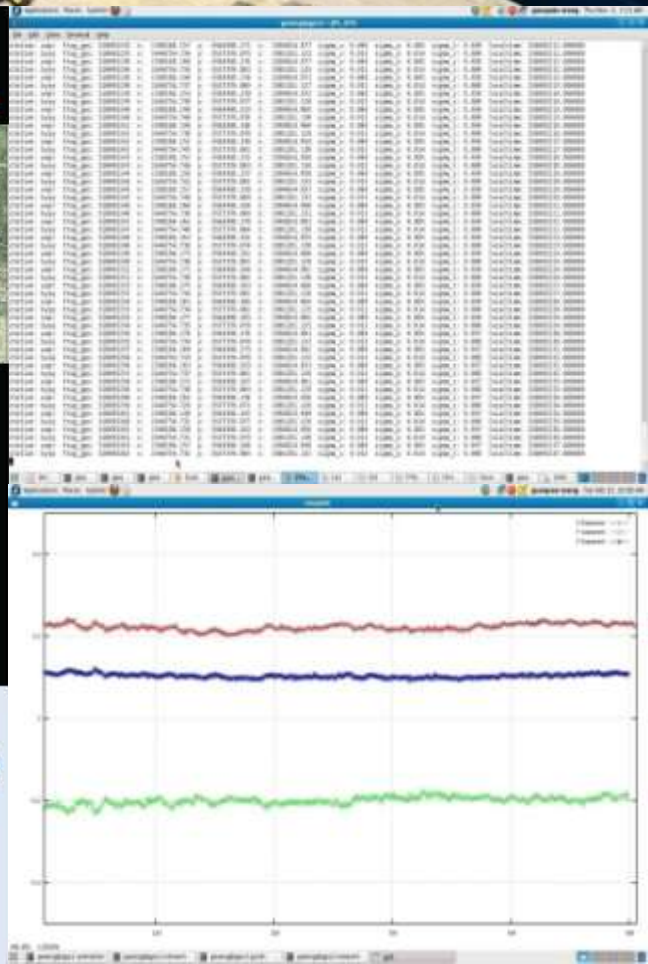
Real-Time Kinematic Monitoring

- TrackRT Developed at MIT
- JPL's GREAT (**G**PS **R**eal Time **Ea**rthquake and **T**sunami) Alert Project

  Real-Time PPP

GPS Real Time Earthquake and Tsunami *Alert* Project





Yoaz et al.

Near Real-Time Rapid Static Monitoring

- **Real Time GAMIT**

  FTP—Hourly Raw Data

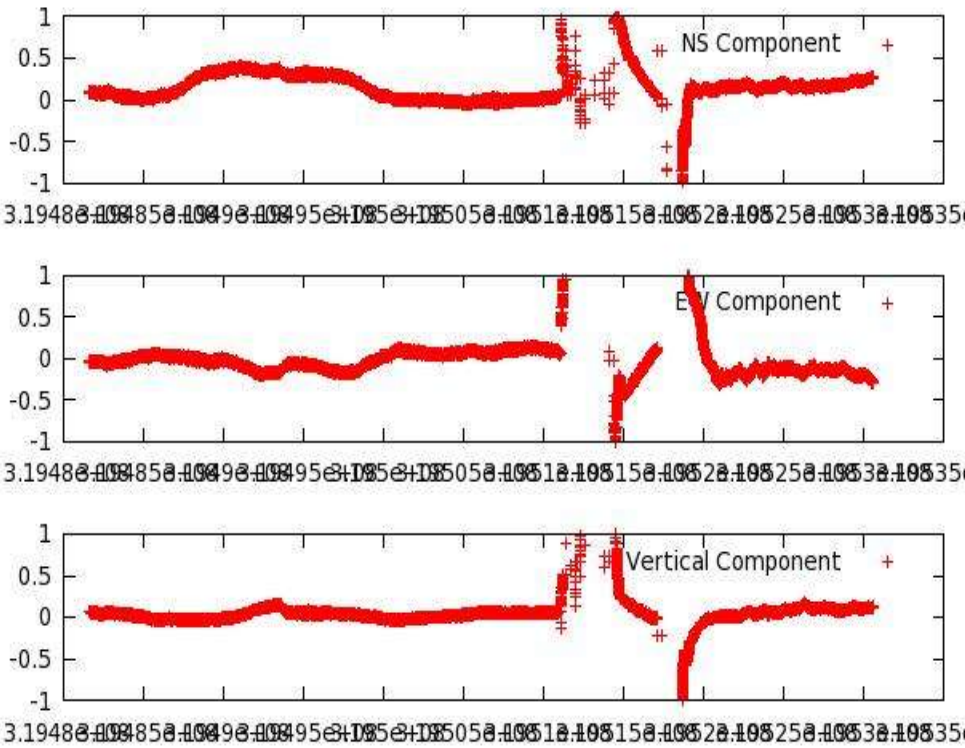
  FTP---IGS Ultra-Rapid Orbits (updated every 6-hours)

  GAMIT---Hourly Position

Precision:
Single Base 1--3 cm

Spurious Excursions

24-Hour 1-Hz Real-Time PPP

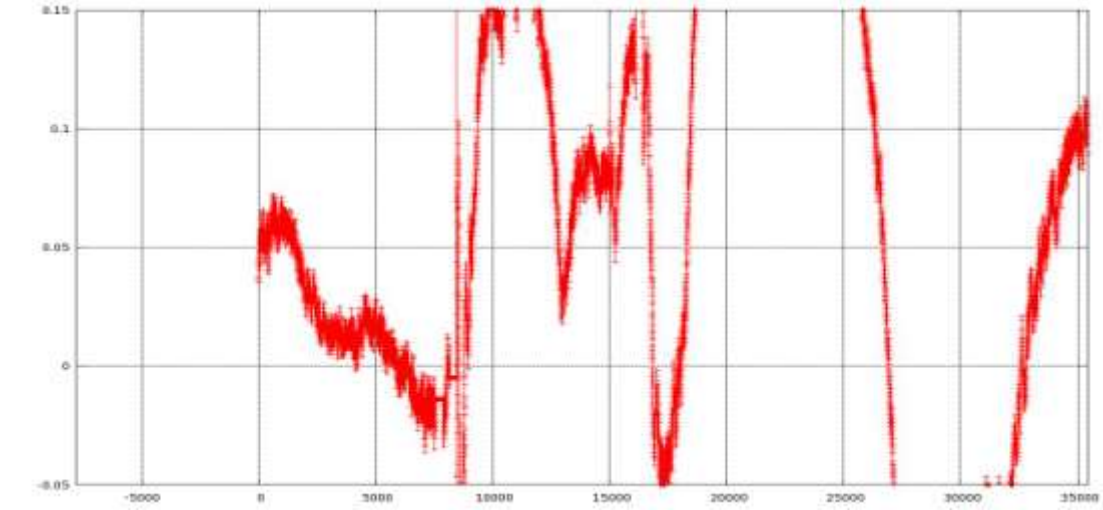


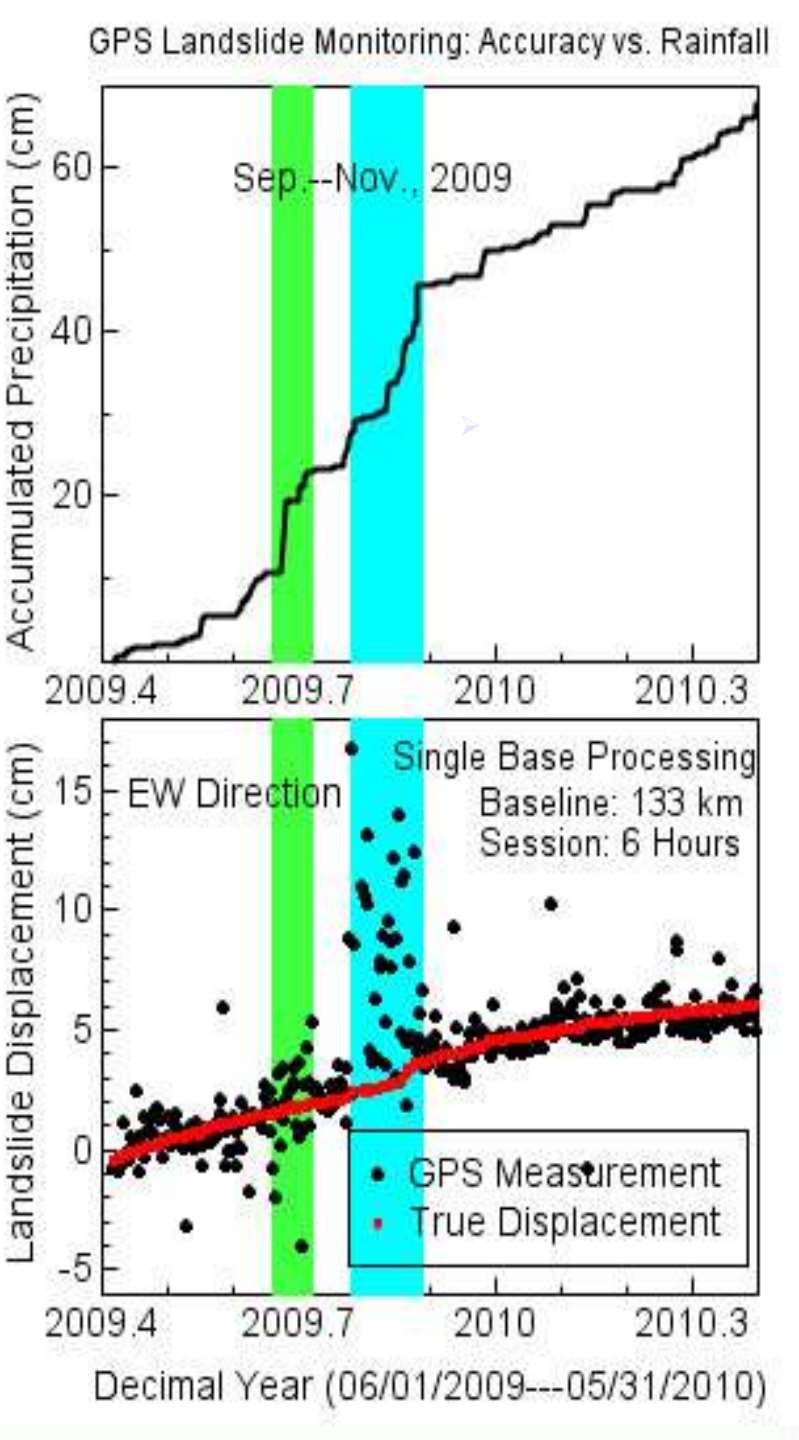
A Challenge for GPS Landslide Monitoring!

Does GPS work in all weather conditions?

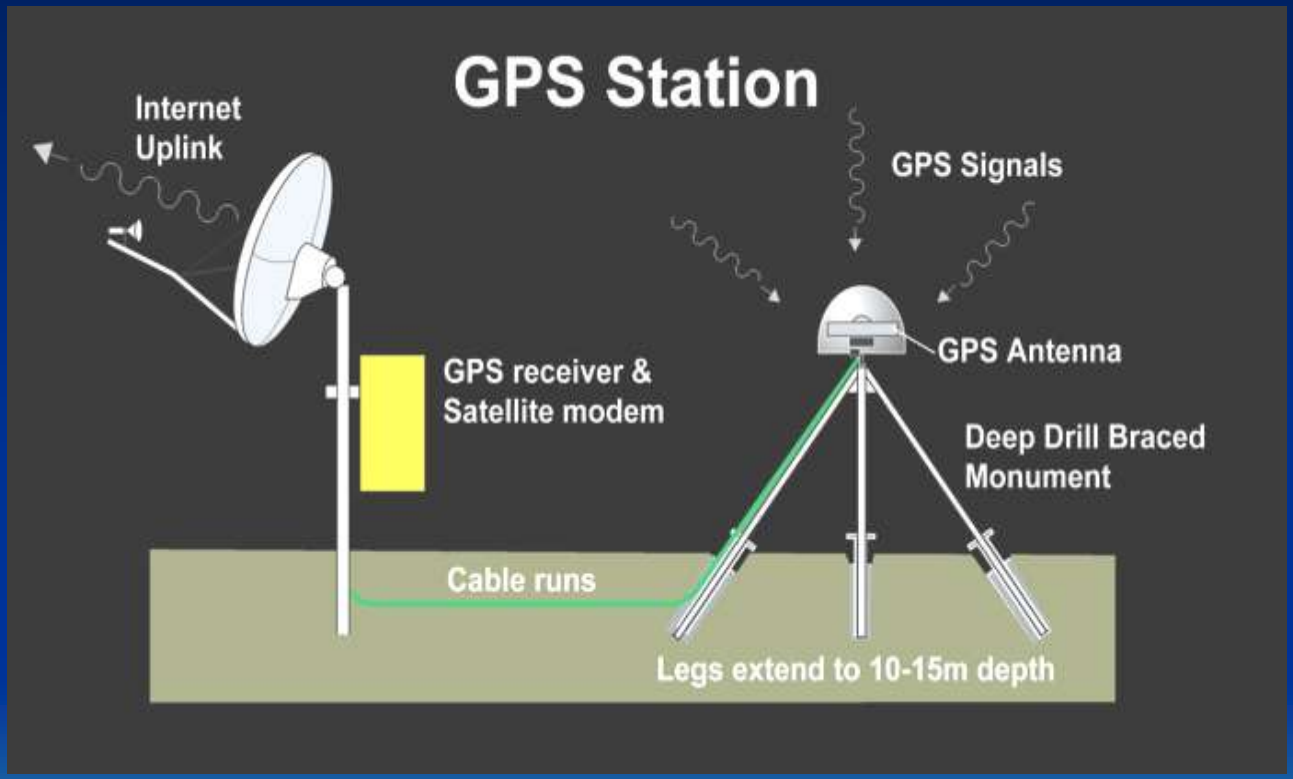
- Most catastrophic landslides happened during or after heavy rainfall events.
- Rainfall events can significantly degrade the precision of GPS measurements.

  Reasons: unmodeled wet delay, multipath, liquid water

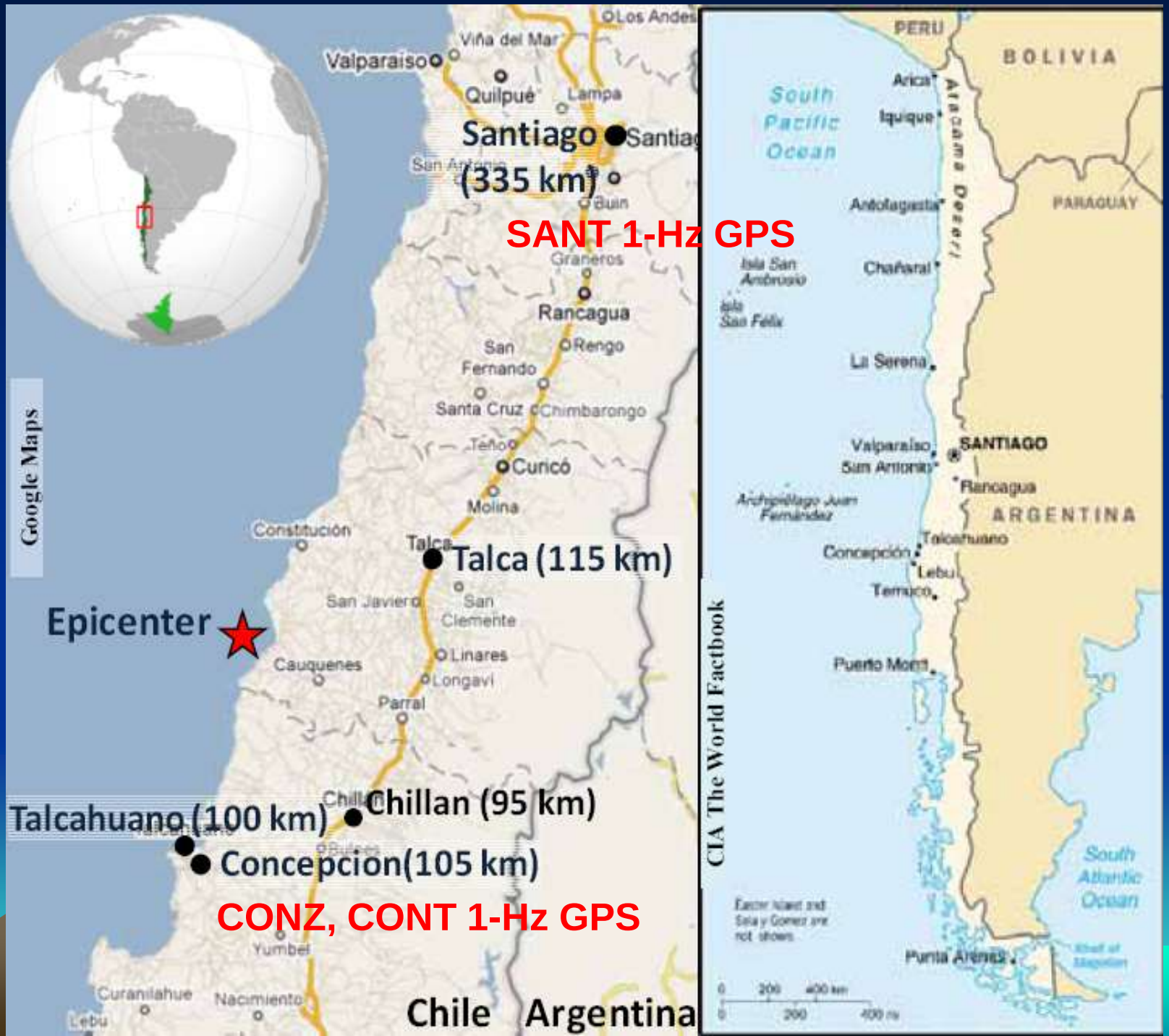




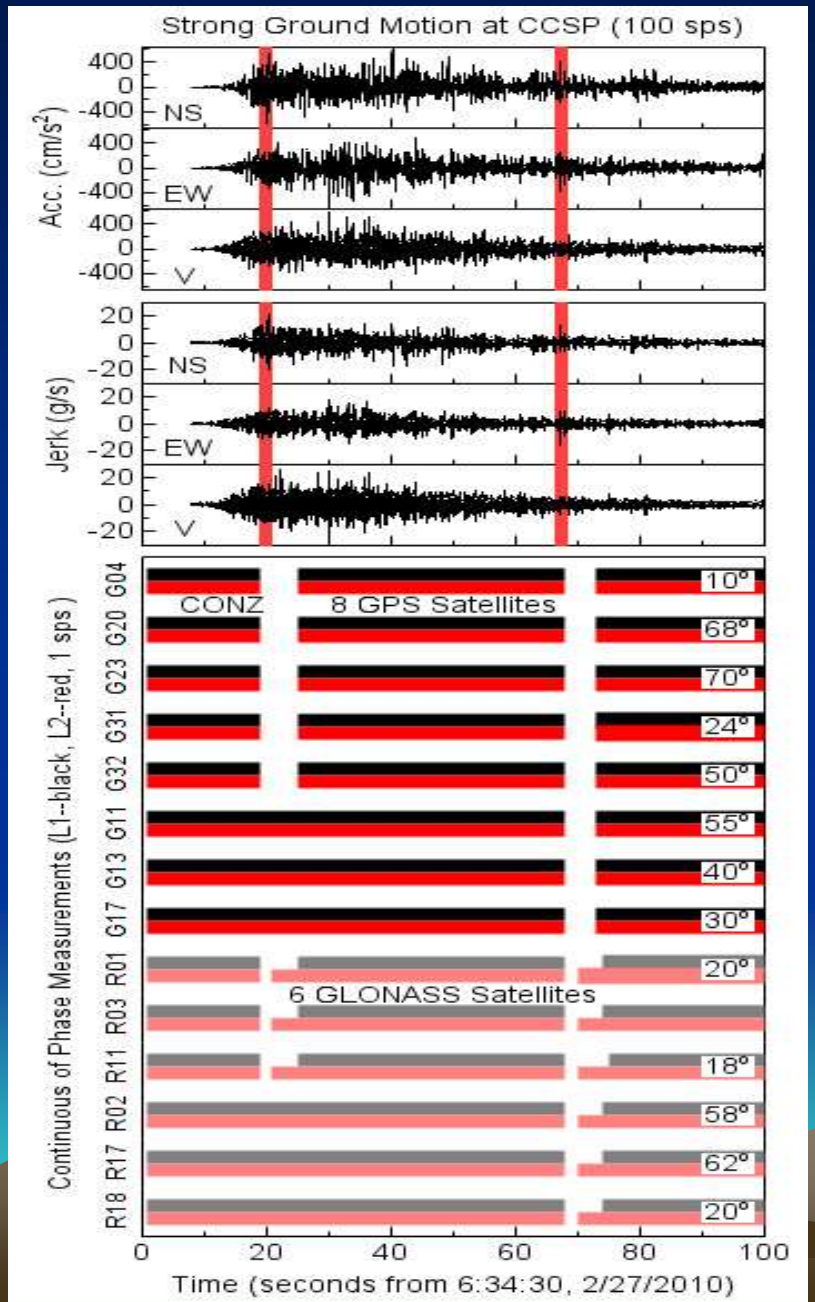
A Big Lesson Learned from The Chile Earthquake

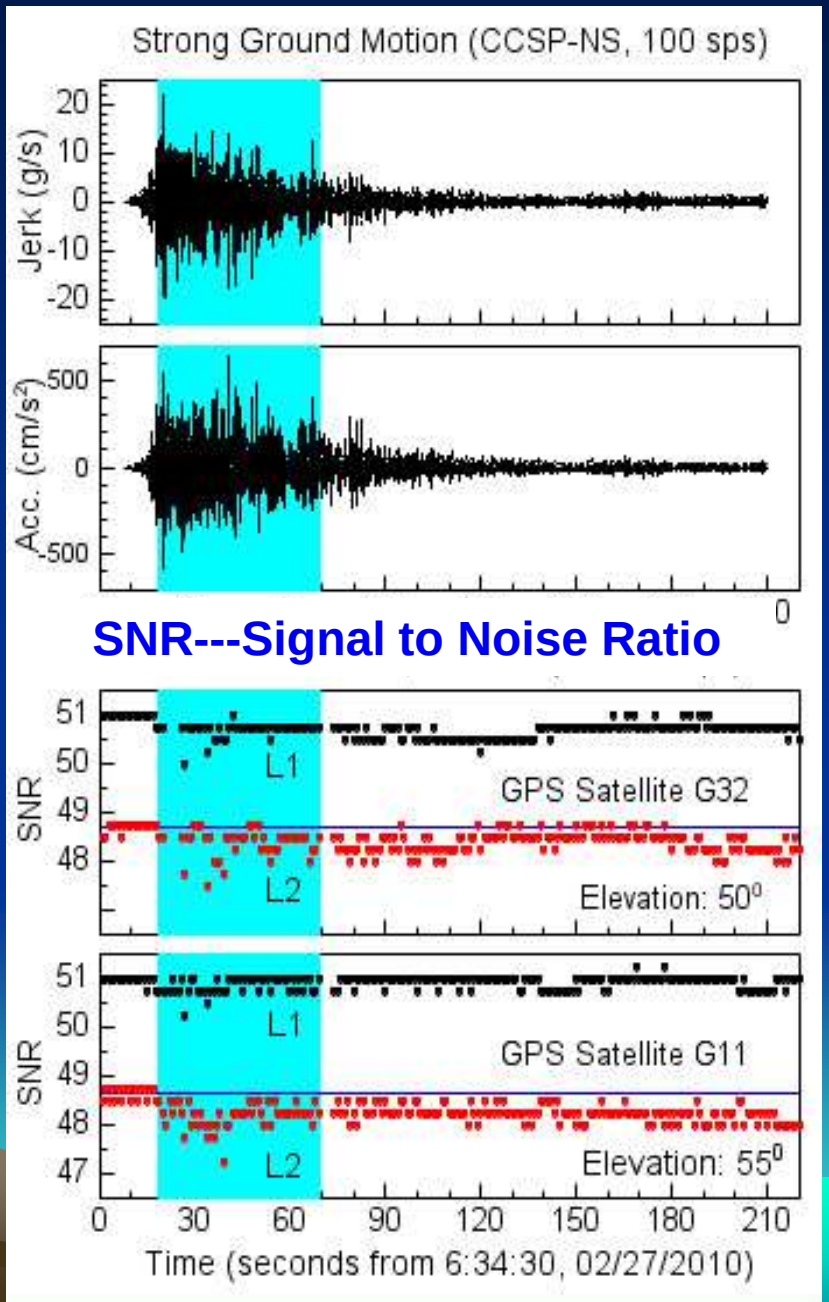


- Can our GPS stations resist large earthquakes?

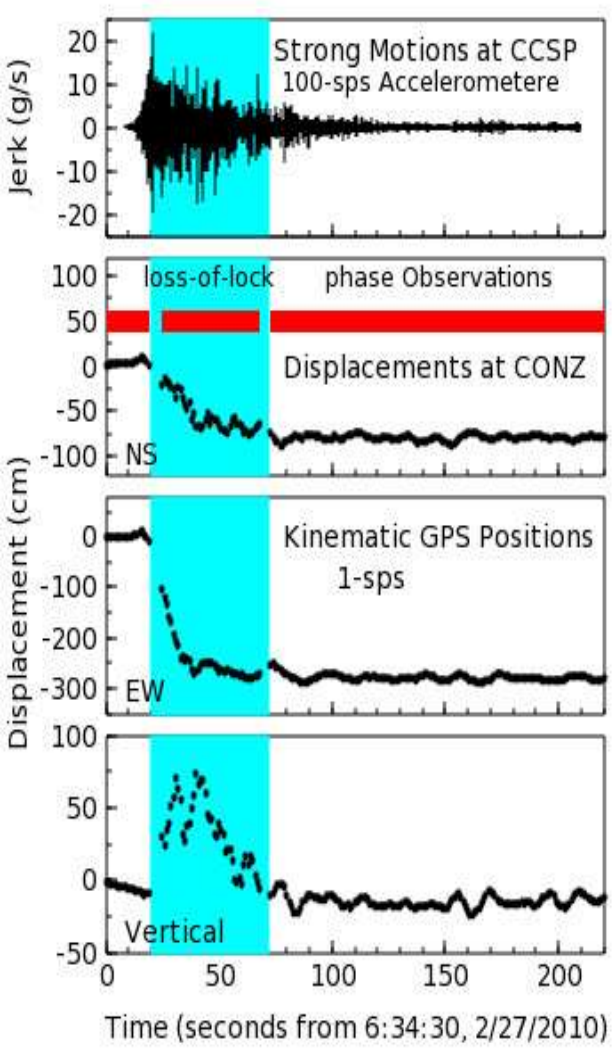

Valparaiso
Viña del Mar
Los Andes
Quilpué
Lampa
Santiago
(335 km)
SANT 1-Hz GPS
Graneros
Rancagua
San Fernando
Rengo
Santa Cruz
Chimbarongo
Curicó
Molina
Constitución
Talca
Talca (115 km)
Epicenter
San Javiero
San Clemente
Cauquenes
Linares
Longavi
Parral
Chillan (95 km)
Talcahuano (100 km)
Concepcion(105 km)
CONZ, CONT 1-Hz GPS
Yumbel
Curanilahue
Nacimiento
Lebu
Chile
Argentina
Google Maps
PERU
BOLIVIA
South Pacific Ocean
Arica
Iquique
Atacama Desert
Antofagasta
PARAGUAY
Isla San Ambrosio
Isla San Félix
Chañaral
La Serena
Valparaiso
SANTIAGO
San Antonio
Rancagua
Archipiélago Juan Fernández
ARGENTINA
Talcahuano
Concepción
Lebu
Temuco
Puerto Montt
South Atlantic Ocean
Punta Arenas
CIA The World Factbook

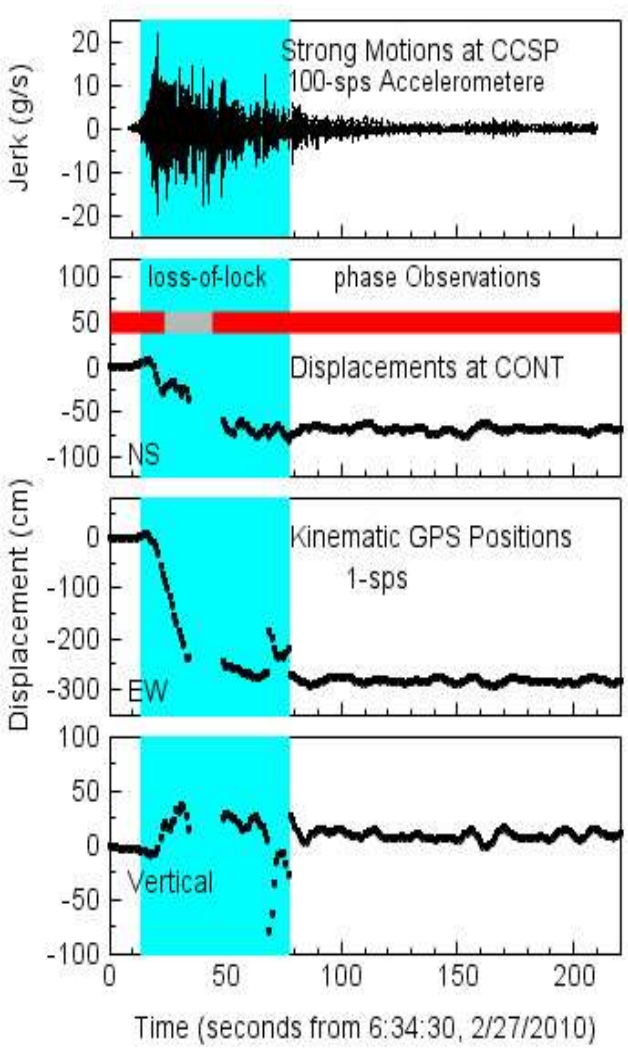
GPS Lost Track on Satellite Signals

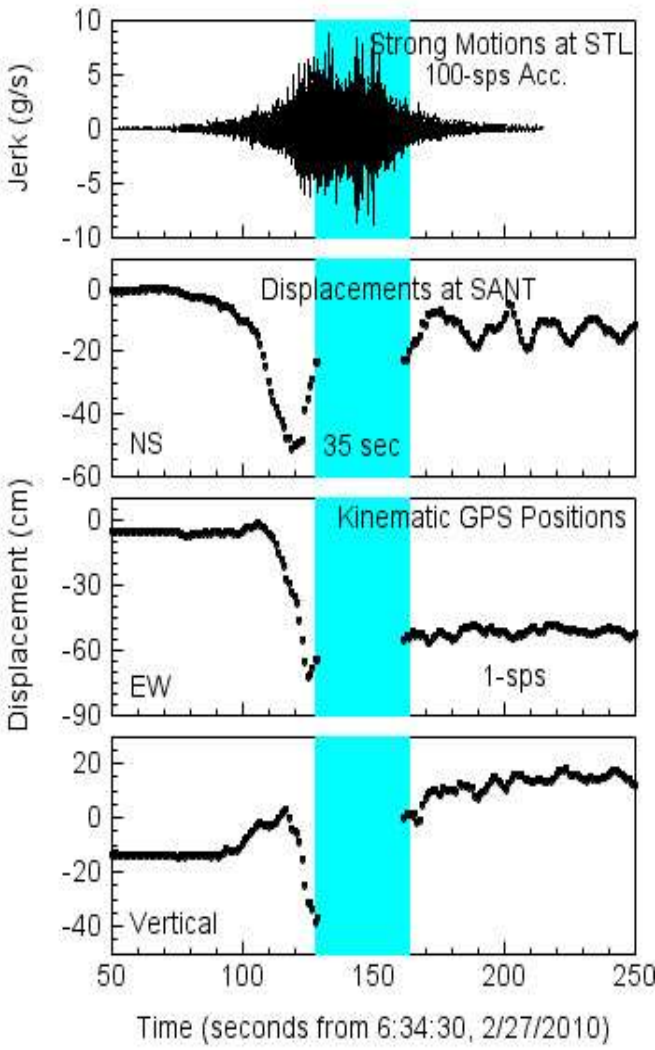




GPS Seismograms Were Clipped!





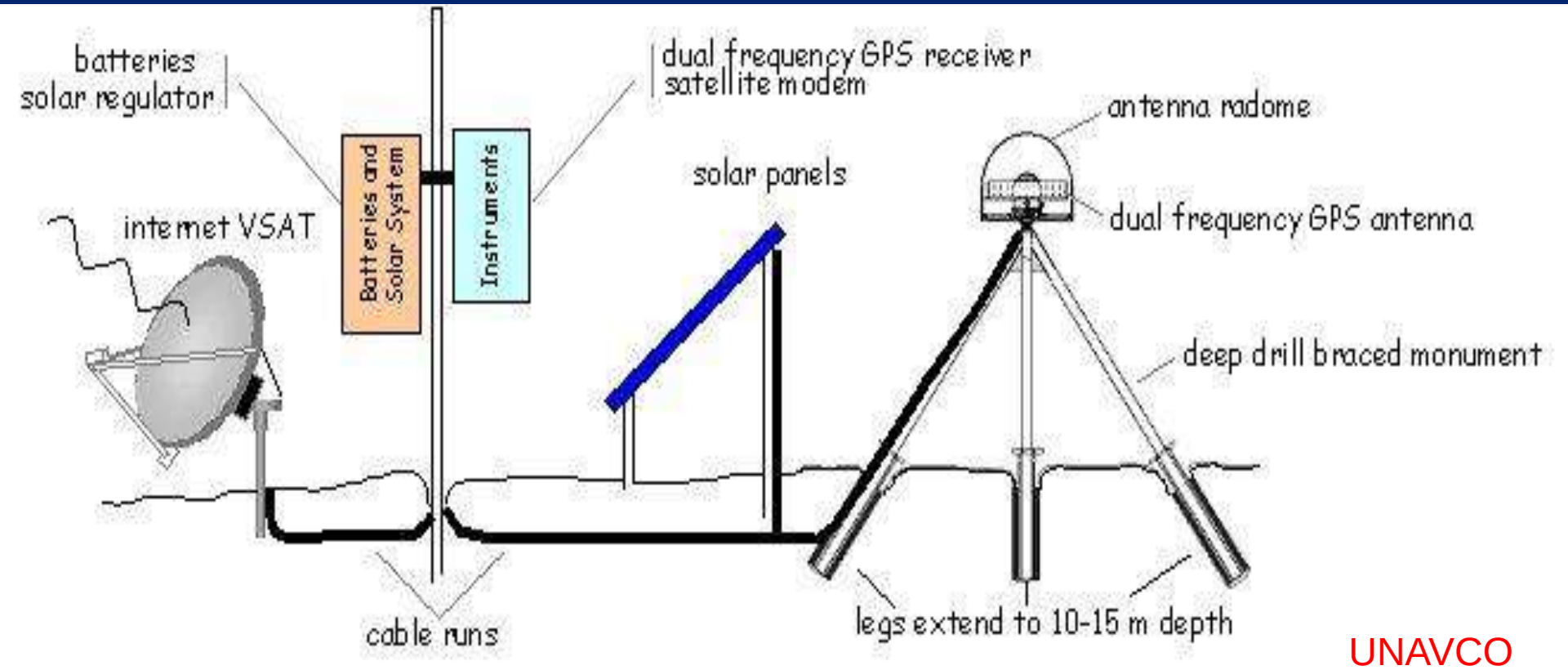


CONZ
TPSCR3-GGD

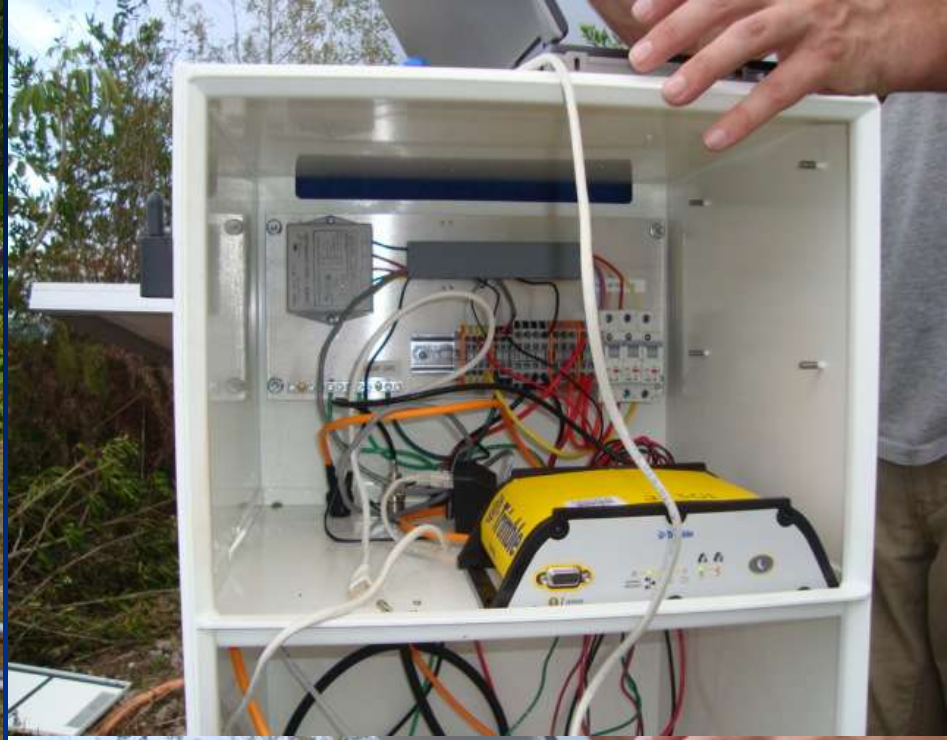
CONT
ASH700936E

SANT
ASH700936D-M

Evaluation of Earthquake Resistant Ability of a Total GPS Seismic station



UNAVCO



Future COCONET GPS

The Invention of a Seismic Isolation Device for Mounting GPS Receivers

- **The failure of (Loss-of-Track) was caused by**
- ***large Acceleration or Jerk*** **suffered by the GPS receiver and/or antenna.**


Thank You!