

Network of the Americas GNSS Network Operations in the Caribbean Basin

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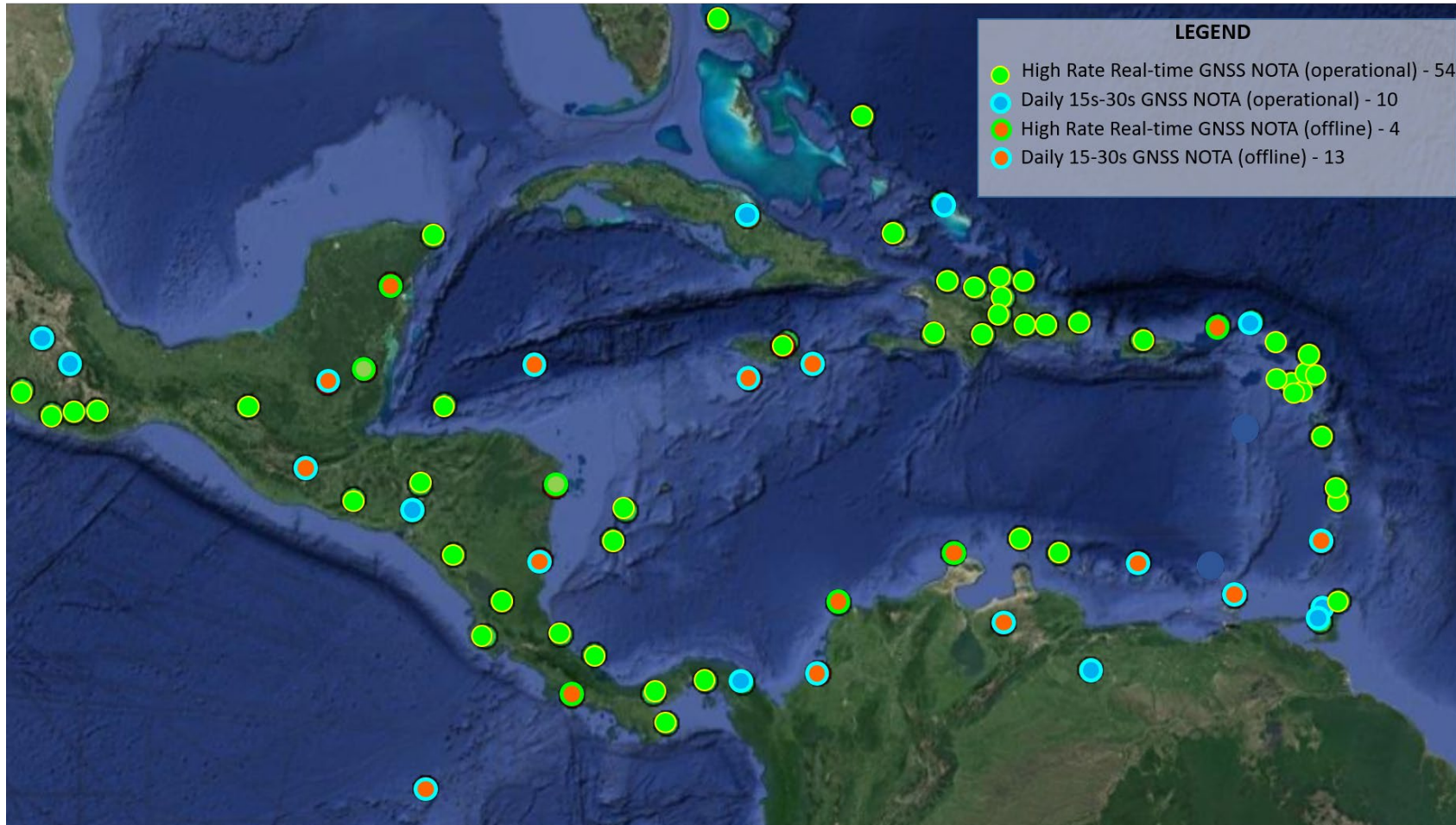
Network of the Americas – Caribbean Region



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- 80+ GNSS stations in 26 countries around the perimeter of the Caribbean Basin
- Funded by the NSF; work closely in partnership with local agencies
- 58 stations transmitting real-time 1Hz data stream
- All stations contributing 15s daily files to the EarthScope archive
- Approx 2/3 new builds with geodetic quality monumentation in 2012-2015
- Approx 1/3 refurbished stations original built by collaborator agencies, as early as 2000

Typical NOTA GNSS Station Design



- Solid monumentation which is well coupled to the bedrock
- GNSS antenna and receiver
- Power system
- Communications/telemetry
- Meteorology sensor
- Environmental enclosure



Public data availability



Access to archived data:
<https://www.unavco.org/data/gps-gnss/gps-gnss.html>

Access to real-time data stream:
<https://www.unavco.org/data/gps-gnss/real-time/real-time.html>

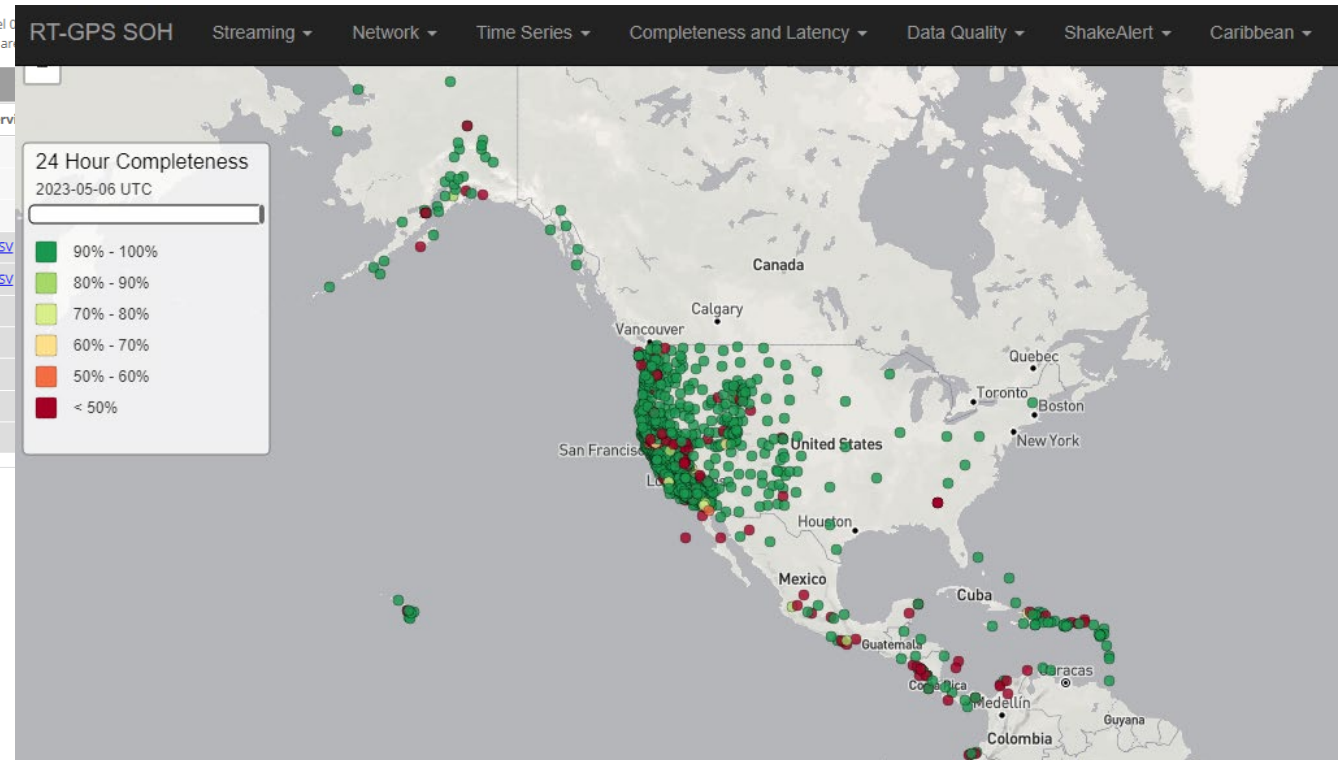
home » data » gps/gnss

GPS/GNSS Data

The UNAVCO Data Center handles data management tasks for GPS/GNSS data and products from thousands of globally distributed permanent stations and ten thousand globally distributed campaign sites. A large fraction of the data are contributed by UNAVCO community investigators. Our [GNSS Data Management Overview](#) illustrates the UNAVCO GPS/GNSS data flow from stations and campaigns to users.

UNAVCO archives and distributes GPS/GNSS data in a variety of product levels, formats and access methods. Product levels distinguish between raw data (Level 1) processed/derived (Level 2) data products. In addition to direct file server access, web based graphical user interfaces, command line clients, and web services are available.

GPS/GNSS Data Products				Access Method / Product Format		
Data Product Level	Description	Generation Frequency	Creator	File Server	Web Graphical Interface	Web Services
Level 1	Standard rate data (15-sec)	Daily, varies	UNAVCO	RINEX	RINEX	n/a
	High rate data (1-, 2-, 5-sps)	Varies	UNAVCO	RINEX	RINEX	n/a
	Survey-mode (campaign) data	Daily, varies	UNAVCO	n/a	RINEX	n/a
Level 2	Position solution time series	Daily	MIT	ASCII, CSV	ASCII, CSV	ASCII, CSV
	Velocity solutions	Monthly	MIT	ASCII	ASCII	ASCII, CSV
	Position offsets (e.g. coseismic)	Varies	MIT	ASCII	n/a	n/a
	Events (e.g. coseismic)	Varies	MIT	ASCII	n/a	n/a
	Tropospheric parameter estimates	Daily	CWU	ASCII	n/a	n/a
	Position solution QA parameters	Daily, varies	UNR	ASCII	ASCII	n/a
	Position solutions (loose)	Daily	CWU	SINEX	SINEX	n/a
	Position solutions (tight)	Daily	CWU	SINEX	SINEX	n/a



All Caribbean archived and real-time GNSS data is publicly accessible and currently free to all users.

Science applications – Tectonic motion

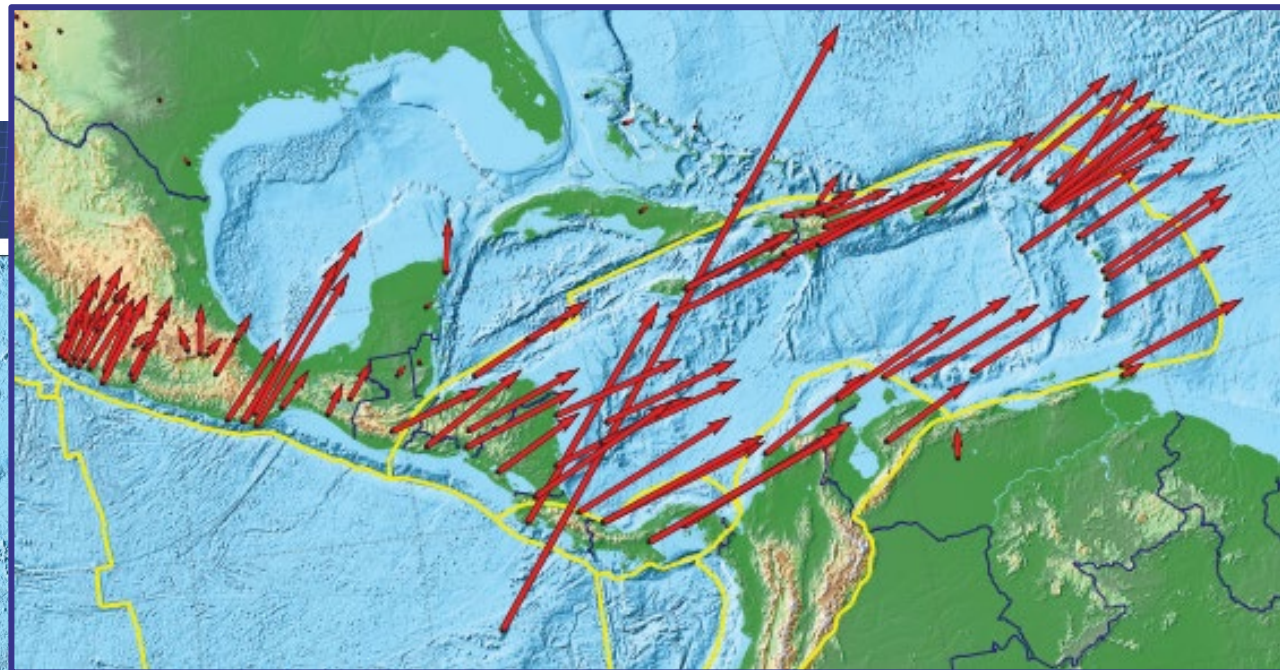
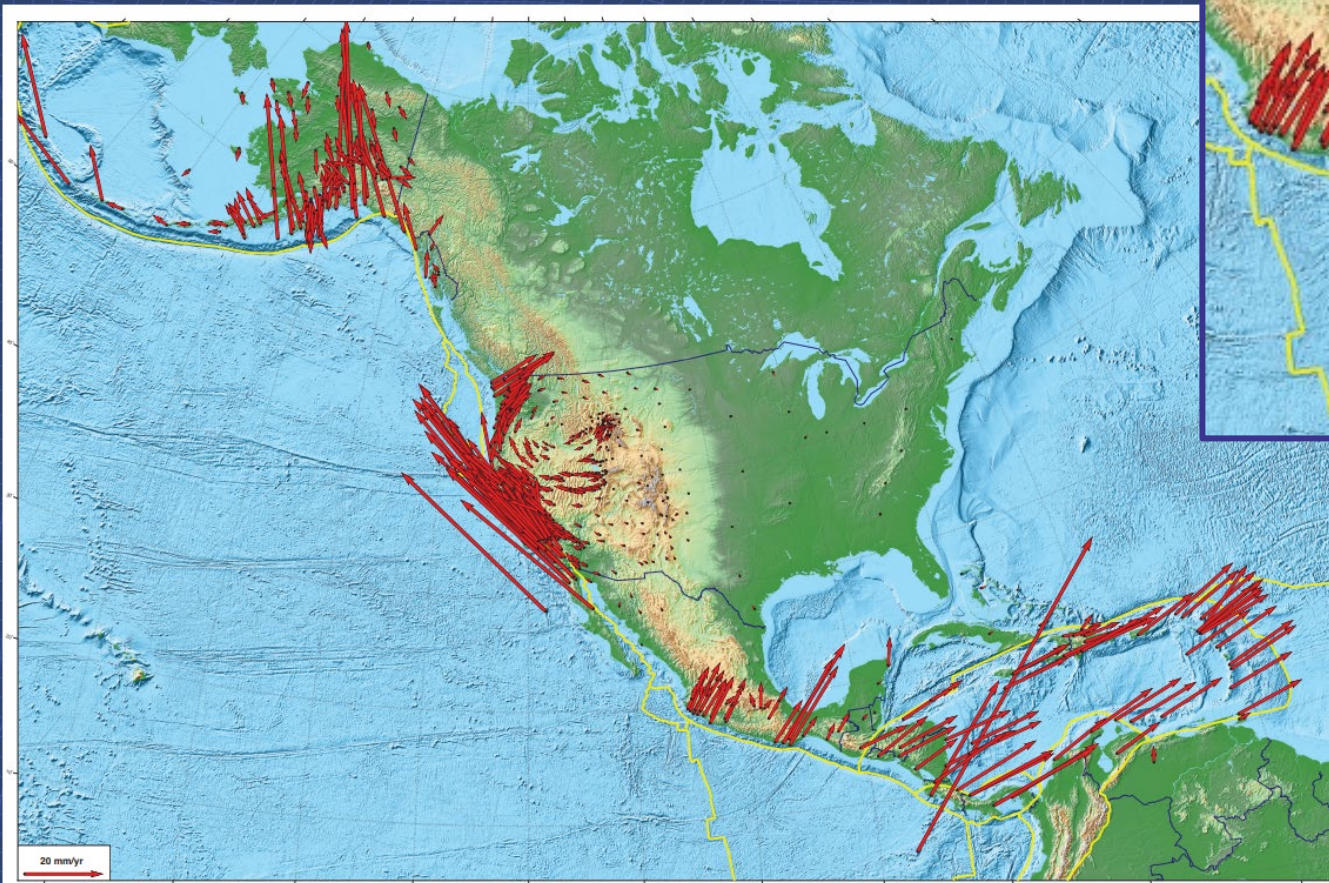


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Tectonic Motion Measured By GPS



Long time series from stations provides mm scale accuracy of tectonic motion, subsidence/uplift, etc

Reference stations for local mapping projects (ex: coastline mapping)

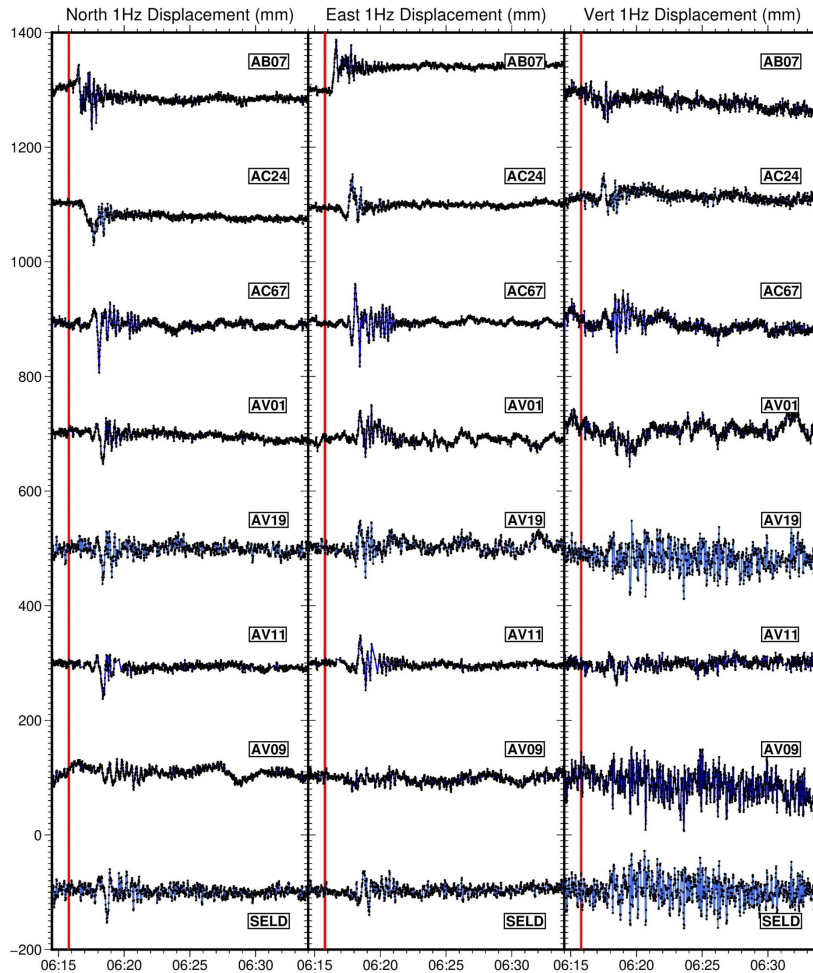
Science Applications – Earthquake Response



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M8.2 Chignik, AK
July 28, 2021

Peak Ground Motion

- Using high rate data, GNSS sensors can detect actual ground displacement in real time

Rapid Magnitude Solutions

- Seismometers may saturate during high intensity shaking, especially close to the earthquake source
- GNSS data may be used to supplement, and generate more rapid earthquake magnitude estimations
- Can be particularly useful for earthquake and tsunami early warning systems

Science applications – Tide gauge reflectometry



USGS
science for a changing world

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- GNSS antennas detect both direct signals coming from GNSS satellites and indirect signals which may reflect off of nearby bodies of water
- GNSS stations located close to shoreline can be used to supplement existing tide gauge networks
- GNSS stations may be lower cost and more robust against storm damage, due to the passive, contained station requirements

Collocated EarthScope GNSS site and PRSN tide gauge in Barahona, Dominican Republic

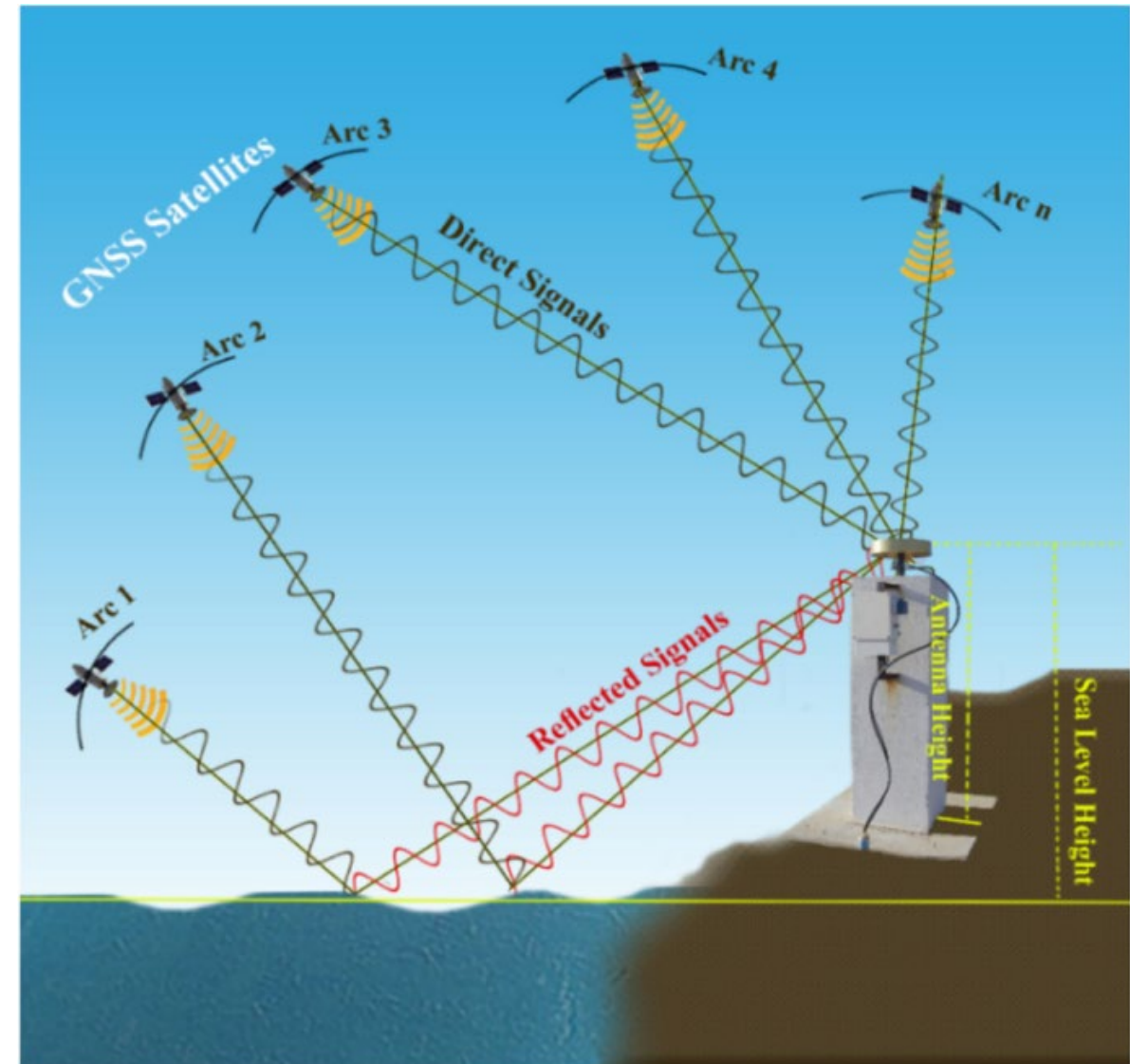
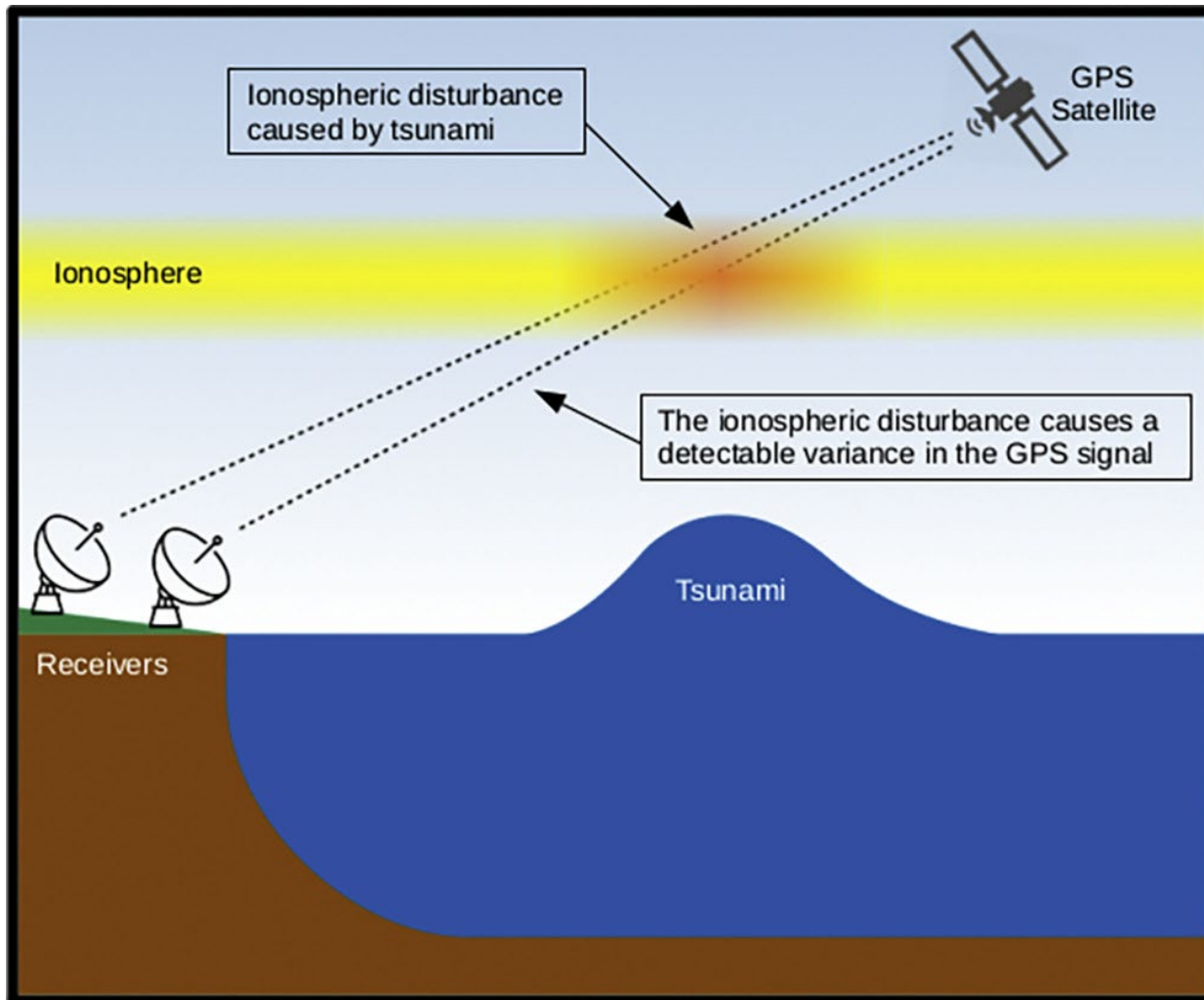


Figure source: Farzaneh, S., Parvazi, K. & Shali, H.H. GNSS-IR-UT: A MATLAB-based software for SNR-based GNSS interferometric reflectometry (GNSS-IR) analysis. *Earth Sci Inform* **14**, 1633–1645

Science applications – Tsunami Wave Detection



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- A tsunami creates a gravity wave that is amplified in the ionosphere. This creates a disturbance in the total electron content of the ionosphere, which slows the transmission time between the satellite and GNSS receiver
- This anomaly can be tracked by multiple GNSS stations and characterized
- Detection of this anomaly may occur far from the current location of the wave

Grzan et al, 2021

doi.org/10.1016/j.pdisas.2021.100191

Recommendations



First EarthScope participation in an IOCARIBE GOOS meeting

- How can this data be of benefit to this community?
- What opportunities do we have for future collaboration?

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