Tide Gauge Benchmark Monitoring

Tilo Schöne, GFZ Potsdam, Chair TIGA-WG and
Members of the TIGA-WG

- Maintain a global **virtual** GNSS @ TG network

  - Promote the establishment of local ties (leveling) between GNSS and TGBMs.

  - Promote the establishment of more continuous operating GNSS stations, in particular in the southern hemisphere.

  - Provide meta information, e.g. on leveling between benchmarks or data access

- Compute precise coordinates and velocities of GNSS stations at or near tide gauges with a significant delay to allow as many as possible stations to participate (reproX). *Provide a combined solution as the TIGA official product*.

- Provide training to tide gauge operators through workshops, collect metadata. Through GLOSS advice station operators about the operation of GNSS @ TG stations.

We aiming on providing the best possible GNSS solution for sea level research

connecting the GNSS, tide gauge and sea level community

Progress since last AM Meeting (Dec 2019)

- Contributions by ULR and GFZ with dedicated repro3 solutions, UoL in 2022

- www.SONEL.org:

  - Integration of new levelling data (TGZ to ARP)

  - Integration of **RINEX3** files. Now collecting RINEX3 data for 566 stations.

  - « Last data events » tool : a table is automatically updated when :

    - A new station in added to SONEL database

    - A new sitelog has been recovered

    - A large amount of data has been downloaded out of the daily process

- (no meetings with GLOSS the past years -> important outreach activities are missing)

PROGRESS

Applications of GNSS@TG

- Altimetry calibration and stability monitoring

- World Height System Unification

  - GNSS@TideGauges are the contact between the **physical** (geoid/MSL) and **geometrical** reference (ITRF) frames

- ITRF densification

- Reference for InSAR coastal/subsidence mapping

  - Coastal hazard assessment

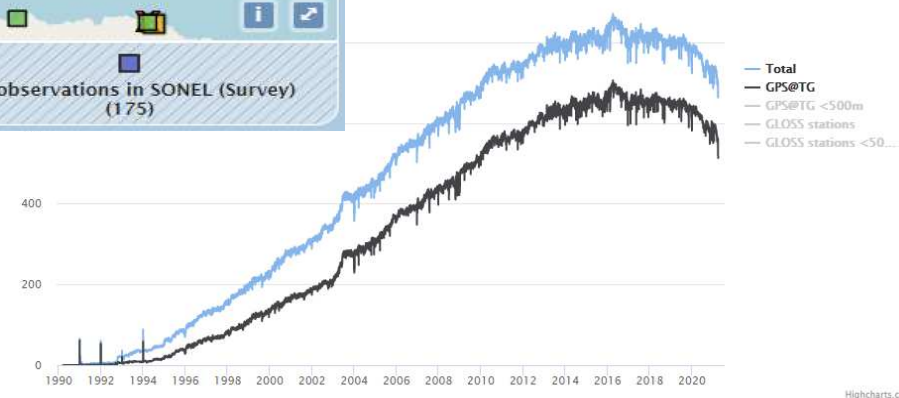- Near-coastal wet troposphere product for altimetry

TIGA SONEL Data Holding
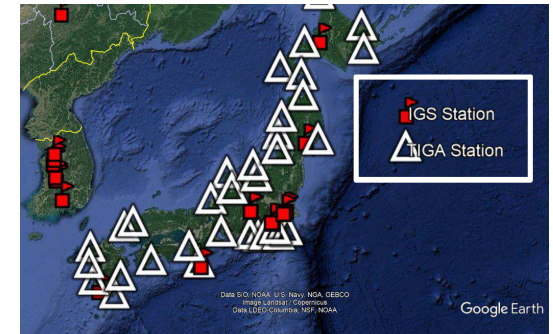
1229 GNSS@TG stations (**600** are active (49%), **267** are dormant (22%, no data within the last 30 days), and still 175 (14%) have been identified as collocated with a tide gauge but no data freely available).
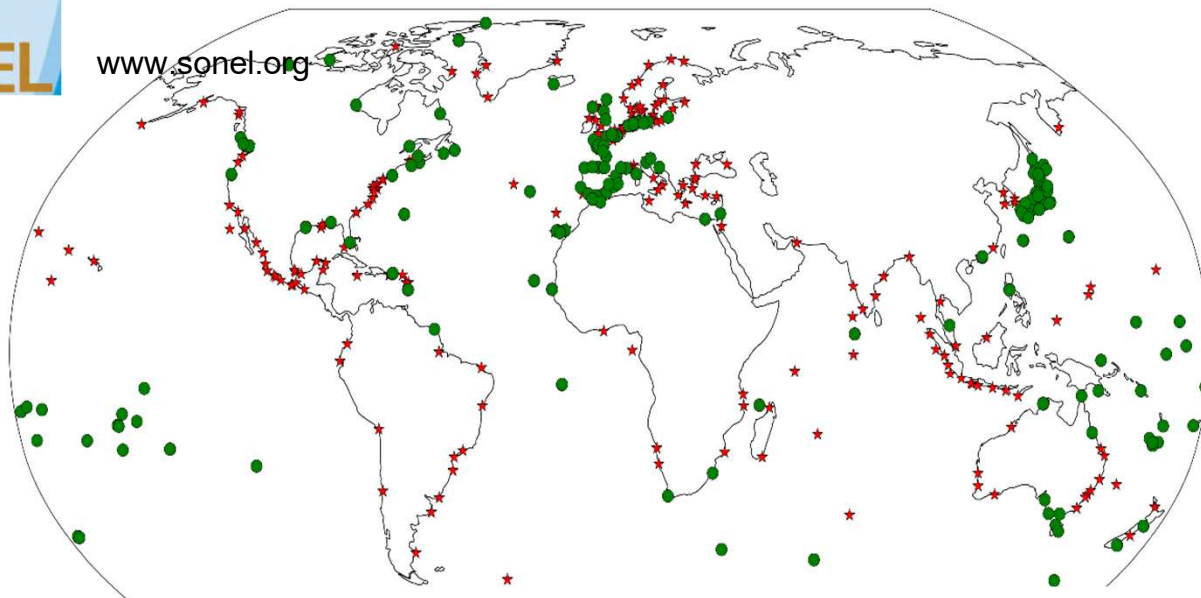
www.sonel.org

www.sonel.org

IGS INTERNATIONAL GNSS SERVICE

Geodetic levelling and benchmarks

| Map | Results of the calibration tests | Calibration measurements |

OPTIONS

209 STATIONS ARE DISPLAYED ON TF

Tide Gauge (TG) (27) | TG linked with GPS station (160) | TG linked with Doris station (5) | TG linked with GPS and Doris station (17)

Precise levelling Thule GNSS marker Domes 43001M002 to Aanderaa WLR7 sensor pressure inlet

Year	Instrument	From Thu.bolt	To Alt.bolt	From Thu.5 bolt	To Thu.5 bolt	From Fund.bolt	To Fund.bolt	From Blue.bolt	To Blue.bolt	From Vet.bolt	To Vet.bolt	From WLR7 (pari) avg	To WLR7 (pari) avg	From WLR7 pressure inlet	To	Height diff. 43001M002-pressure inlet WLR7 dH	from	to	WL R7 s/n
2013	TCA	-1,6711	-5,6712	-3,0980	-6,2260			-0,9506		-7,3672		-0,0850				-25,0691	2013/09/06	2014/09/15	1514
2014	TCA	-1,6711	-5,6714	-3,0975	-6,2274			-0,9524		-7,3660		-0,0850				-25,0708	2014/09/15	2015/09/12	1514
2015	TCA	-1,6711	-5,6714	-3,0979	-6,2257			-0,9536		-7,3656		-0,0850				-25,0703	2015/09/13	2015/10/02	1357
2016	Wild T2	-1,6710	-5,6712	-3,0980	-6,2261			-0,9544		-7,3679		-0,0850				-25,0746	2016/07/01	2017/01/02	1357
2017	TCA	-1,6710	-5,6703	-3,0981	-6,2268			-0,9557		-7,3679		-0,0850				-25,0748	2017/01/02	2018/09/25	1357
2018	TCA	-1,6711	-5,6716	-3,0979	-6,2267			-0,9560		-7,3610		-0,0850				-25,0693	2018/09/26	2019/09/06	1514
2019	TS16	-1,6715	-5,6722	-3,0981	-6,2264			-0,9575		-7,3568		-0,0850				-25,0675	2019/09/06	2020/09/04	1514
2020	GNSS									-17,6239		-7,3560	-0,0850			-25,0649	2020/09/04		1514

Table 2 Height differences in Thule [m]

Thule levelling GNSS marker Domes 43001M002 to WLR7 pressure sensor
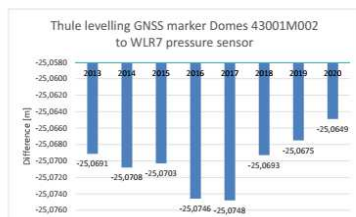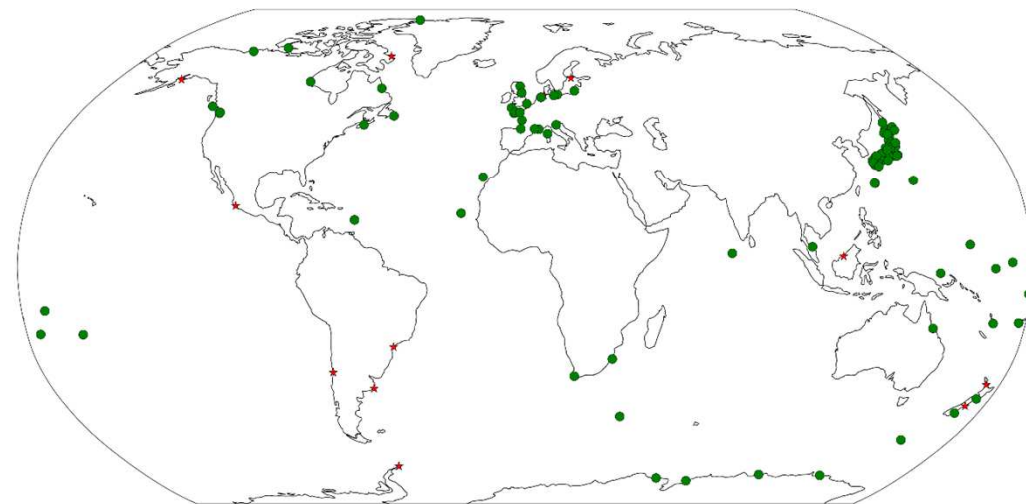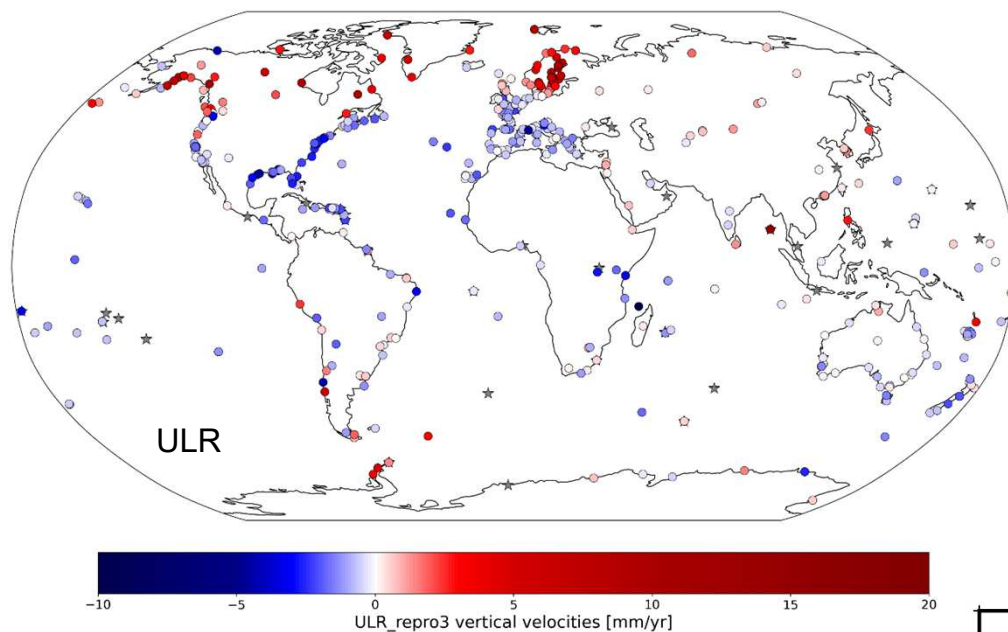

Figure 7 Height differences Thule

The changes in pressure sensor position is likely a combination of debris-buildup in the well and subsidence of the pier/concrete block where the Datum point is placed.

★ No tie - GNSS@TG < 1km   ● Tie

Finn Bo Madsen/DTU
Levelling info for Greenland ☺

★ No tie - GNSS@TG < 1km   ● Tie

TIGA repro3 contribution

ULR

ULR_repro3 vertical velocities [mm/yr]
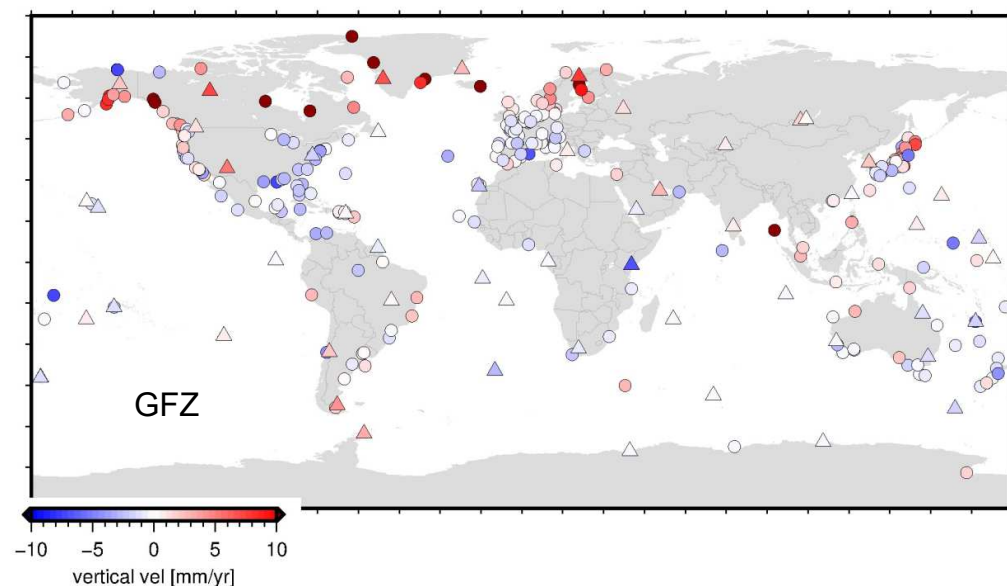
Network of **601** stations over the period [2000-2020],
554 « robust » velocities (**468** GNSS@TG velocities)

Network of **341** stations (**101** TIGA and **153** GNSS@TG
stations + 66 IGS14 core stations)

GFZ

vertical vel [mm/yr]

IGS INTERNATIONAL
GNSS SERVICE

IGS NETWORK - 509 STATIONS DISPLAYED

Full Screen Views : 🏠 Default   🗺 Map   ▦ Table


Leaflet | Tiles © Esri — Esri, DeLorme, NAVTEQ

Filter...

Ways have been establish for seamless integration of collocated tide gauges information between IGS (*www.igs.org*), SONEL (*www.sonel.org*) and PSMSL

Site Info ➕		
Site ▲	Location	Latitude

Overview

Receiver – Firmware	JAVAD TRE_3 – 4.1.01-210527
Receiver SN	4171601
Antenna – Radome	JAVRINGANT_G5T – NONE
Calibration	ROBOT
Clock	INTERNAL
Last Data Available	2021-12-01 (v3)
DOMES Number	23501M003
Constellation	GPS+GLO+GAL+BDS+QZSS+IRNSS+SBAS
Data Center	CDDIS
Nearby Tide Gauge	COLOMBO – 5313m
Station Log	sgoc00lka_20211028.log

Leaflet | © IGS.org

Location	Narahenpita, Colombo, Sri Lanka
Latitude, Longitude	6.892, 79.874
Elevation	–78.5 m

Email Advisories

Photos

https://www.sonel.org/spip.php?page=maregraphe&idStation=1994

TIGA-WG plan@2022

- Integration of GFT & ULR solution in SONEL

- UoL repro3 solution based on CODE orbits & integration into SONEL

- Time Series Analysis at tide gauges

- Outreach to GLOSS-GE and sea level community
  - *e.g., GLOSS-GE, OSTST*

- Work towards more levelling ties

- How-to-tie: Manual for **Tides, Water Level and Currents Working Group of IHO**

- Most GNSS@TG are legacy receiver of the TG community delivering GPS signals only
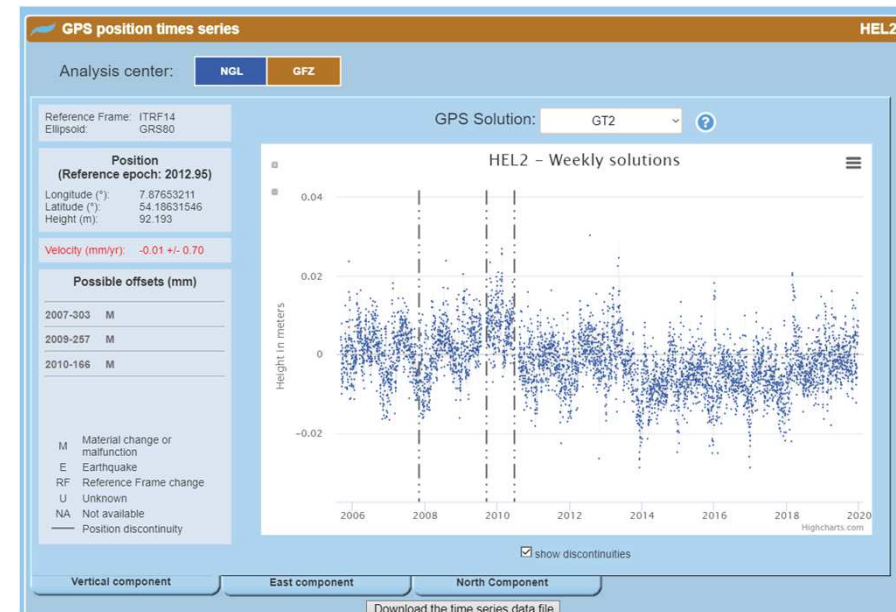
Thank You!

Contact:

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