Tide Gauge Benchmark Monitoring

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2012, 2013, 2018
Global Ocean Coastal Impact

Sea Level Trend: 04/1993–02/2022

Global Mean Sea Level

Coastal Impact

GMSL regional local

1000 mm

Trend [mm/year]

-4 -2 0 2 4 6 8

100 yrs

Height [cm]


Trent Poseidon
Jason–1
Jason–2
Jason–3
deseasoned

1000 mm

© ESA
We aiming on providing the best possible GNSS solution for sea level research bringing the GNSS, tide gauge and sea level community

- Work with the UNESCO/IOC (GLOSS) community to provide the reference frame for tide gauges
- 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 open 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 training to tide gauge operators through workshop. Through UNESCO/GLOSS advice station operators about the operation of GNSS @ TG stations.
Major Accomplishments (1)

- University of La Rochelle and GFZ Potsdam processed large networks of GNSS@TG stations in IGS-repro3, which goes beyond the repro3 coverage
- Results (time series) are available
  - TIGA/GFZ-repro3: doi 10.5880/GFZ.1.1.2022.001
  - SONEL ULR7: doi 10.26166/sonel_ulr7a
- SONEL (@ University of La Rochelle)
  - acts as TIGA-WG DC and hosts TIGA-NC
  - Collects and distributes levelling ties between ARP/TGBM
  - provides an excellent service for the GLOSS, TIGA, and sea level community
  - NC provides service to keep the TIGA network up-to-date and growing
Major Accomplishments (2)

- www.SONEL.org:
  - Integration of new levelling data (TGZ to ARP)
  - Integration of RINEX3 files. Now also collecting RINEX3 data
  - « Last data events » tool: established at SONEL to assist the operators and users

- Corona affected our work
  - important outreach activities are missing
  - Missing input about new stations and GNSS@TG from this community
  - GLOSS GE18 meeting in November 2022 (Guy Wöppelmann)

- Support "Navi-Tech", (China) for the installation of 5 new GNSS@TG stations (and now a few more under discussion)
1253 GNSS@TG stations (603 are active (49%), 278 are dormant (22%, no data within the last 30 days), and still 184 (14%) have been identified as collocated with a tide gauge but no data freely available).
Finn Bo Madsen/DTU
Levelling info for Greenland 😊
200 GLOSS stations co-located or nearby a GNSS stations (68%)

- 113 with active GNSS (136 in 2019)
- 87 dormant GNSS (55 in 2019)
- 5 decommissioned GNSS (6 in 2019)
- 19 nearby GNSS, but data not available (22)
- 69 with no nearby GNSS identified in SONEL (71) using NGL database

https://www.sonel.org/-GLOSS,81-.html

Courtesy Guy Wöppelmann
TIGA repro3 contribution

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

- do we have sufficient network coverage
- can we increase the number of contributing stations (and how)
- are there any other AC/AAC/groups which may contribute
- how can we come to a combined products of all (non)repro3 solutions
- Multi-GNSS ; RINEX2/3

Network of 341 stations (101 TIGA and 153 GNSS@TG stations + 66 IGS14 core stations) [1994-2020]
Providing vertical land motion @TG through SONEL
Discussion **Highlights at the June IGS Meeting**

- Understanding sea level change and coastal hazards requires a stable reference frame and GNSS@TideGauge time series
- Community appreciates SONELs capability for displaying time series from different solutions/ACs
  - more efforts are needed to (study and) explain differences between solutions at a specific site
- Can we provide better service to non-IGS users, non-GNSS experts?
  - comparison of solutions
  - combination of TIGA-repro3 (GFT and UoL are not in the IGS-repro3 solution)
  - Outreach at sea level conferences
Emerging Ideas (1) from the IGS2022 meeting

- Work with GLOSS-GE to get feedback for the QoS, define more stations, and connect to the TG community
- Work with IAPSO/CMSLT (President: Gary Mitchum)
  - to define and (later) provide a better service to non-expert GNSS users of time series and trends (what are and why we have different solutions and results)
  - analyze the impact in respect the sea level change estimates
  - Develop a test strategy for time series of GNSS@TG
  - CMSLT plans establishing a working group on GPS/GNSS datums, which will provide an excellent forum to get both communities together
Emerging Ideas (2) from the IGS2022 meeting

- Develop a “How-to” for the IHO-TWCGW (action item from last GLOSS-GE)
- Guidelines for TIGA-labeled stations should be renewed
  - beyond the IGS CORS Guidelines, reflecting the way of the ARP to the TGZ
  - IOC manuals on Sea Level (IOC Manuals and Guides No. 14: Volumes I–V), esp. IV

Recommendations

- Non-expert community needs guidelines for the understanding of jumps, drifts, non-concruent GNSS time series from individual solutions
Thank You!

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