International GNSS Service (IGS)

Tide Gauge Benchmark Monitoring - Working Group

TIGA

CHARTER

Changes of sea level are of great concern for communities at coasts and may effect the social and economic development in dramatic ways. For decades to centuries the sea level and it's change has been measured using tide gauges. However, gauges constitute a local datum, affected not only by climate-related but also by local land changes. Space geodetic techniques are the only viable tool to establish the necessary global reference frame for constraining sea level records to a common global and long-term consistent datum. Providing this frame facilitates the distinction between the relative and geocentric sea level changes by accounting for the vertical uplift of the station, and is, therefore, an important contribution to climate change and coastal hazard studies.

The IGS Tide Gauge Benchmark Monitoring - Working Group (TIGA-WG) is providing the service to analyze GNSS data from stations directly at or near tide gauges (TG). TIGA is recognized by the Global Sea Level Observing System (GLOSS) of the International Oceanographic Commission (IOC) of UNESCO to provide positions and vertical rates for tide gauges and is an important contribution of the IGS to the overarching goals of the Global Geodetic Observing System (GGOS), the Global Climate Observing System (GCOS) and the World Climate Research Programme (WCRP).

The primary product of TIGA is sets of coordinates, velocities, and accuracy estimates for monitoring vertical motions of Tide Gauge Benchmarks (TGBM). The product is made public to support and encourage other applications, e.g. sea level studies. The service may further contribute to the densification of the IGS network, the calibration of satellite altimeters, other oceanographic applications, or the establishment of a World Height System.

Goals and Objectives

1. Maintain a global virtual continuous GNSS @ TG network

   - Select a set of tide gauges equipped with GNSS, with a long and reliable history, useful for both sea level change studies, and e.g. satellite altimeter calibrations. IGS network operation standards should be applied.

- Promote the establishment of more continuous operating GNSS stations, in particular in the southern hemisphere.
- Promote the establishment of local ties (leveling) between GNSS and TGBMs.
- Provide meta information, e.g. on leveling between benchmarks or data access.
- Provide training to tide gauge operators through workshops, encourage station operators to provide necessary metadata. Through GLOSS advice station operators about the operation of continuous GNSS @ TG stations.

2. Compute precise coordinates and velocities of GNSS stations at or near tide gauges in-line with the IGS reprocessing campaigns. Provide a combined solution as the TIGA official product.

3. Study the impacts of corrections and new models on the GNSS processing of the vertical. Encourage other groups to establish, e.g. nearby absolute gravity sites.

4. Provide advice to new applications.

Organizational Structure

The Working Group is utilizing the existing infrastructure of the IGS as much as possible without disrupting standard activities. The processing of GNSS data is performed by TIGA Analysis Centers (**TAC**) outside the IGS operational activities, but may be carried out by existing IGS AC's. The TIGA network is additionally including non-IGS stations (TIGA Observing Stations, **TOS**) meeting the IGS network requirements which are collocated with the tide gauges. The time lag for providing GNSS data is less stringent compared to standard IGS operations, to allow also remote stations to participate. IGS, other IAG Services or Groups, GLOSS and the PSMSL may propose and advice on the inclusion of additional TOS stations. The TIGA Product will be generated by TIGA Combination Centers (**TCC**). The network maintenance and interaction with TOS operators is supported by the TIGA Network Coordinator (**TNC**), closely related to the support of the TIGA Data Centers (**TDC**).

Current Membership:

Name	Entity	Host Institution	Country
Guy Wöppelmann	TAC, TNC, TDC	University La Rochelle	France
Laura Sánchez	TAC	DGFI/TUM Munich	Germany
Minghai Jia		GeoScience Australia	Australia
Norman Teferle	TAC/TCC	University of Luxembourg	Luxembourg
Allison Craddock	IGS Central Bureau	ex officio	USA
Tom Herring Michael Moore	IGS AC coordinator(s)	ex officio	USA Australia
Carey Noll	TDC	CDDIS, NASA	USA
Tilo Schöne	Chair	GFZ Potsdam	Germany
Simon Williams	PSMSL	PSMSL, NOC Liverpool	UK
Gary Mitchum	GLOSS GE (current chair).	University of South Florida	USA

Mark Merrifield	GLOSS GE (past chair)	UHSLC, Hawaii	USA
Matt King		University of Tasmania	Australia
Benjamin Männel	TAC	GFZ Potsdam	Germany
Elizabeth Prouteau	TNC	University La Rochelle	France
Médéric Gravelle	TAC/TDC	University La Rochelle	France
Daniala Thaller	?	BKG	Germany

Work plan 2021-2022

- Finalize the reprocessing of the TIGA network as contribution to IGS-repro3
- Provide a combined product based on the most recent reprocessing (repro3), with
  - mean rate per GNSS @ TG with reliable error estimate
  - time series of the vertical with scaled formal errors
  - full SINEX combined product
- Include the latest TAC results (time series) into the SONEL framework
- Work with GLOSS on the improvement of the network situation
- Work with the IGS CB to increase the visibility of TIGA and its products
- Maintain and expand the current inventory of GNSS @ TG stations at www.sonel.org
- Encourage station operators through GLOSS to provide regular leveling between benchmarks
- Provide a technical guidance document to GLOSS and IHO describing techniques for establishing local ties

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