EuroGOOS
European Global Ocean Observing System

Tide Gauge
EuroGOOS Task Team

EuroGOOS Tide GaugeTask Team activity report

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GLOSS Group of Experts XVI meeting
Busan (Korea), 11-13 April 2019

EuroGOOS
European Global Ocean Observing System

Members | Regions | Working Groups | Task Teams | EU Projects | EOOS

EuroGOOS, the European Global Ocean Observing System

EuroGOOS identifies priorities, enhances cooperation and promotes the benefits of operational oceanography to ensure sustained observations are made in Europe's seas underpinning a suite of fit-for-purpose products and services for marine and maritime end-users.

EuroGOOS is the European component of the Global Ocean Observing System of the Intergovernmental Oceanographic Commission of UNESCO (IOC GOOS). EuroGOOS Secretariat is located in Brussels, serving 42 members and supporting five regional systems in Europe.

EuroGOOS working groups, networks of observing platforms (task teams), and regional systems (ROOS), provide fora for cooperation, unlock quality marine data and deliver common strategies, priorities and standards. These many EuroGOOS networks work towards integrated, sustained and fit-for-purpose European ocean observing, underpinning the EOOS framework.

1. EuroGOOS Task Teams

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Task Teams:

Operational networks of observing platforms to promote scientific synergy and technological collaboration among European observing infrastructures

- ✓ Ferrybox
- ✓ Tide Gauges (TGTT)
- ✓ Gliders
- ✓ HF radars
- ✓ Argo
- ✓ Animal-borne instruments

http://eurogoos.eu/task-teams/

1. EuroGOOS Tide Gauge Task Team

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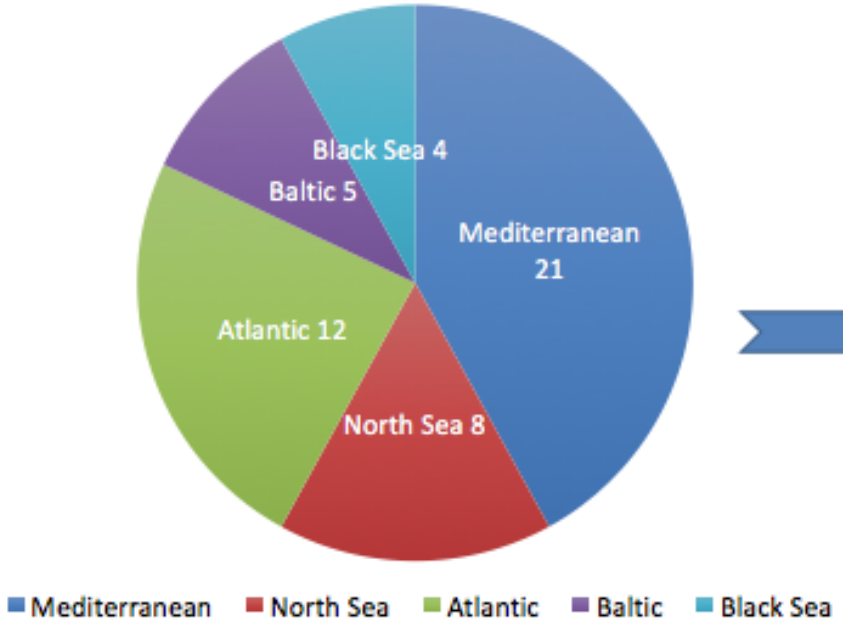
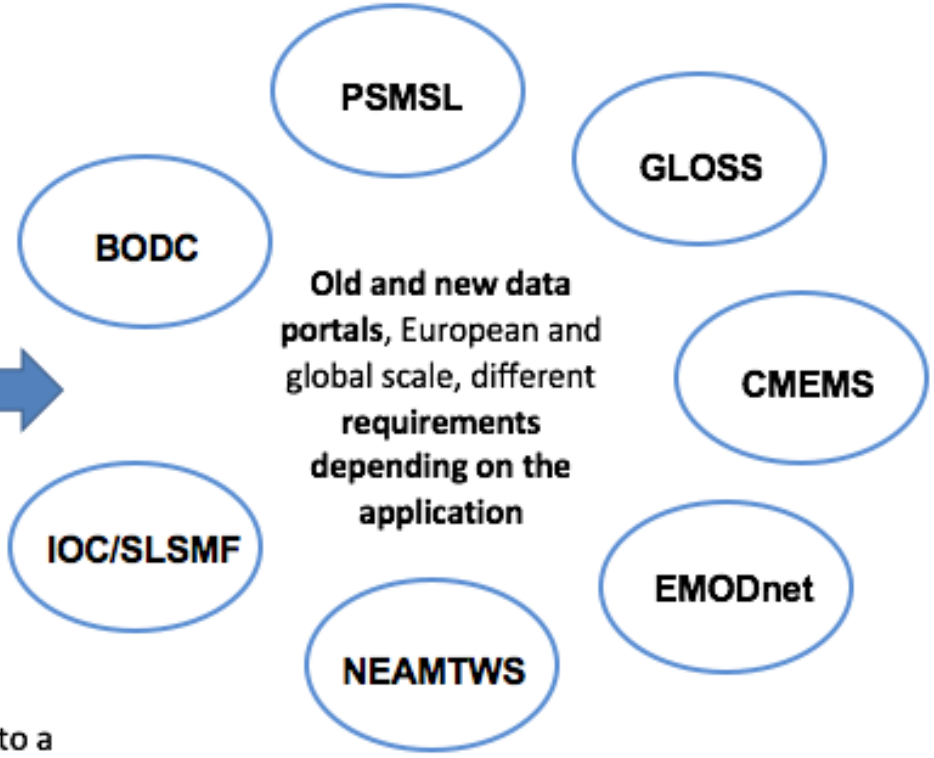
Institutions with tide gauges in the different basins



Distribution of institutions per basin, from those that answered to a survey launched in 2016: **41 institutions from 24 different countries,** most of them in the Mediterranean Sea



Need of coordination !

What the TGTT does not pretend:

- *Creating a new data portal*
- *Starting from zero with new standards*

What the TGTT is looking for:

- *Recovering european sea level cooperation*
- *Being useful for other programs in the region (GLOSS, PSMSL, NEAMTWS, Copernicus, etc)*

2. Main achievements since 2015

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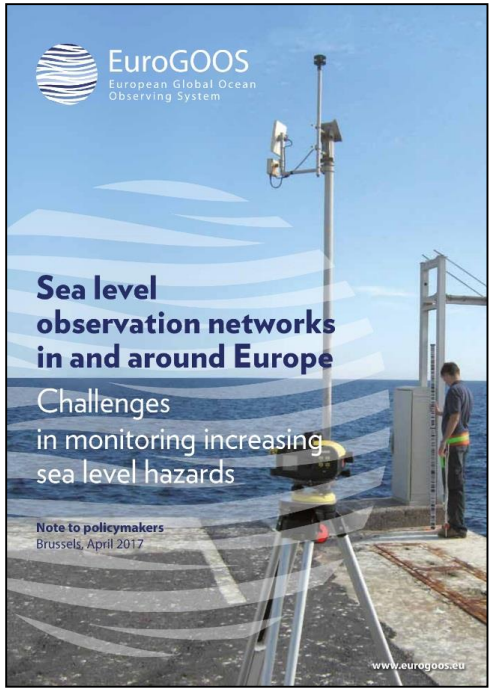
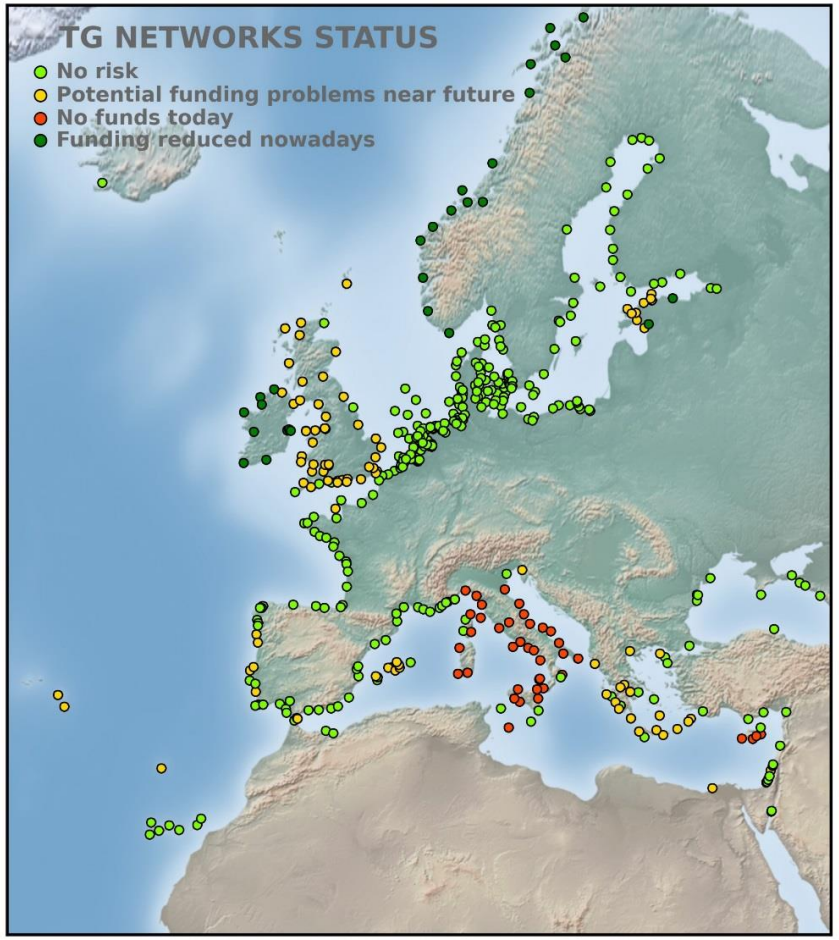
2.1 *Survey on European tide gauge networks and Note to Policy Makers*

Bottle necks:

- ✓ Finding adequate national contact
- ✓ Delay on the answers
- ✓ Lack of answer from the Mediterranean Sea and North Africa coast





Main output and concern: urgent need of ensuring the sustainability of tide gauge stations in the region, especially in the Mediterranean Sea

Funding status per tide gauge network, according to the answer from a total number of **674 tide gauges, near 25% of the stations in the region would be facing problems of funding in some way** **NOTE TO POLICY MAKERS, BRUSSELS, APRIL 2017. Presentation to DG-MARE February 2018**

2. Main achievements since 2015

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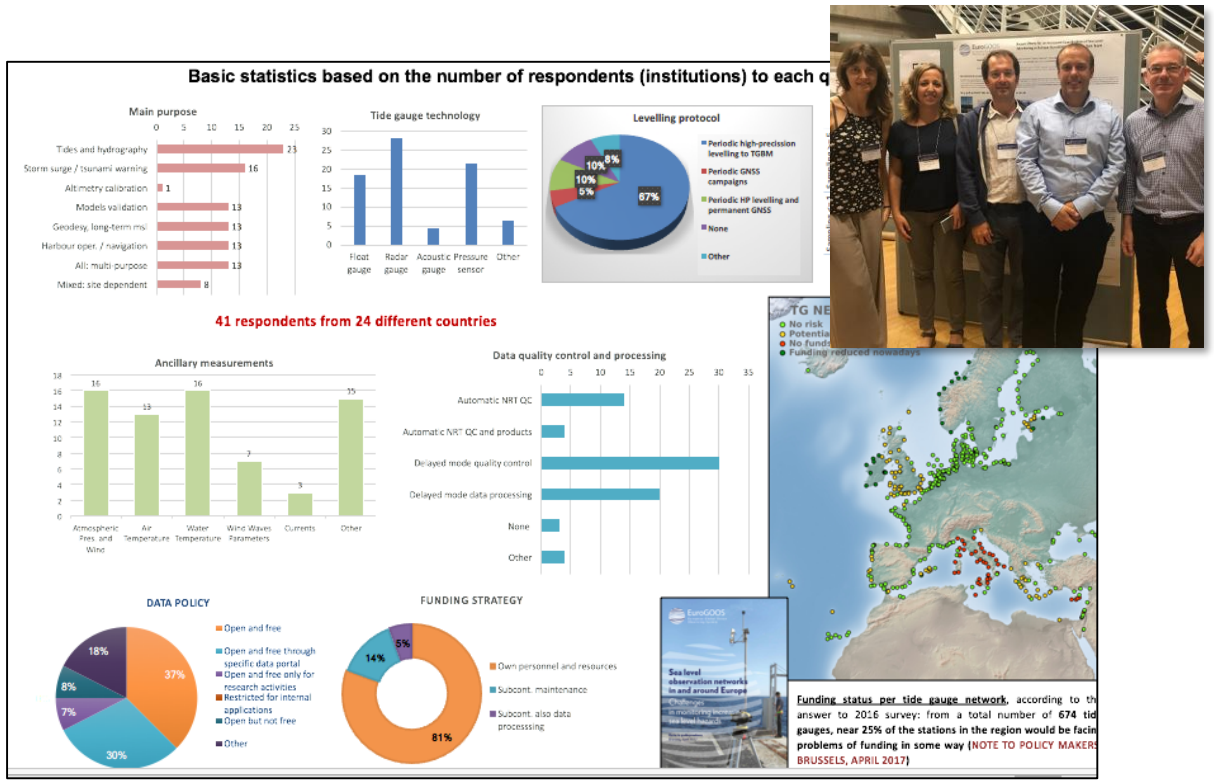
2.1 *Survey on European tide gauge networks and Note to Policy Makers*

1. M**ain purpose: tide and hydrography** followed by **storm surge and tsunami warning**
2. Only **37% have an open and free data policy**.
3. 5-min sampling and near-real time transmission most common measurement strategy, **significant increase of 1-min sampling and real time transmission** (61% of respondents)
4. **Radar gauges** are the most used in the region (68% of institutions) followed by pressure sensors.
5. Most of the institutions (67%) perform periodic high-precision levelling to the TGBM. **Only 4 respondents (10%) use also permanent GNSS stations while 4 do nothing**
6. Only **37% of the respondents perform automatic NRT quality control of data**



Poster: INTERNATIONAL WCRP/IOC CONFERENCE 2017: REGIONAL SEA LEVEL CHANGES AND COASTAL IMPACTS, New York, July 10-14th 2017

http://eurogoos.eu/download/Sea-level-monitoring-in Europe_EuroGOOS_NewYork_2017.pdf

2. Main achievements since 2015

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2.2 *Worshop and altimetry side meeting at La Rochelle, 2016*

- ✓ November 3rd: side meeting during the altimetry OST/ST workshop: Altimetry and tide gauge for sea level: link with the altimetry community. Output: list of recommendations from the altimetry community

- ✓ November 4th: one-day workshop of TG operators and sea level experts: La Rochelle University:

  - Sea level measurements technologies
  - New requirements on quality control and data processing
  - Scientific studies based on tide gauge data

  20 attendants, 12 oral presentations and a poster session

Minutes and presentations at: http://eurogoos.eu/download/EuroGOOS_TGTT_LaRochelleNovember2016.pdf

2. Main achievements since 2015

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2.2 *Worshop and altimetry side meeting at La Rochelle, 2016*

How could the European TG networks be improved for altimetry calibration / exploitation in terms of instrumentation, network coverage, data sampling and quality, data availability, co-location (GNSS, met stations, etc)?

List of recommendations from the altimetry community

1. *Vertical land movements: they request more co-location of GNSS stations with existing tide gauges to monitor vertical land motion*
2. *Tide gauges are needed in the open ocean for validation of altimetry in ocean circulation studies*
3. *There is a demand also of coastal tide gauges, including estuarine gauges to the extent of the tidal influence, for validation of altimetry near the coast*
4. *Quality controlled time series to minimize undocumented datum or reference changes and clock errors: datum control within a month (or less for near-real time validation in altimetry) and metadata with information about the origin of the error.*
5. *A homogenous product, with standard format (e.g. CF compliant) and a one-click download data bottom is required. Someone also asked for tidal predictions in the data*
6. *Homogeneous sampling: hourly data should always be provided, independently of what other high frequency samplings are available for other applications*
7. *Whenever possible, optimizing the location of stations with respect to altimetry ground-tracks and improving the spatial coverage of the in-situ network*
8. *Redundancy (double or multiple) of sea level sensors would be appreciated for avoiding gaps in the historical tide gauge time series*

2. Main achievements since 2015

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2.3 *Recommendations on CMEMS NetCDF Format:*

- ✓ Discussions with GLOSS, PSMSL, EuroGOOS and CMEMS representatives
- ✓ Agreement on variable names and creation of the following attributes for the parameter SLEV:

Mandatory attributes:

- ***time_sampling:*** *an integer in minutes*
- ***sea_level_datum:*** *description (e.g."chart datum"*
- ***processing_method:*** *"average", "instantaneous", "filtered",etc*

Optional and recommended attributes

- ***TGBM_name***
- ***TGBM_sea_level_datum****: height (m)*
- ***colocation_with_GNSS_station:*** *distance (km) /No/unknown*
- ***TGBM_ellipsoidal_height_estimate:*** *height (m)*
- ***vertical_land_movement_estimate****: trend (mm/yr) – period/unknown*
- ***GNSS_campaigns****: yes/no*
- ***comment:*** *additional information, url's etc in relation to previous ones*

- ✓ Avoid different sampling intervals in the same file
- ✓ Storage of high-frequency (1,5,6, 10..min) and hourly sea levels as different products in different files
- ✓ Approved and ready to be adopted in CMEMS

http://eurogoos.eu/download/NetCdf_Recommendations_forCMEMS_EuroGOOSTGTT_October_2017.pdf

Station metadata: need of further discussion with GLOSS/PSMSL and improvement

2. Main achievements since 2015

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2.4 *Metadata compilation of TG-GNSS collocated sta*

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Annex A: LIST OF TIDE GAUGES IN CMEMS CO-LOCATED WITH A GN

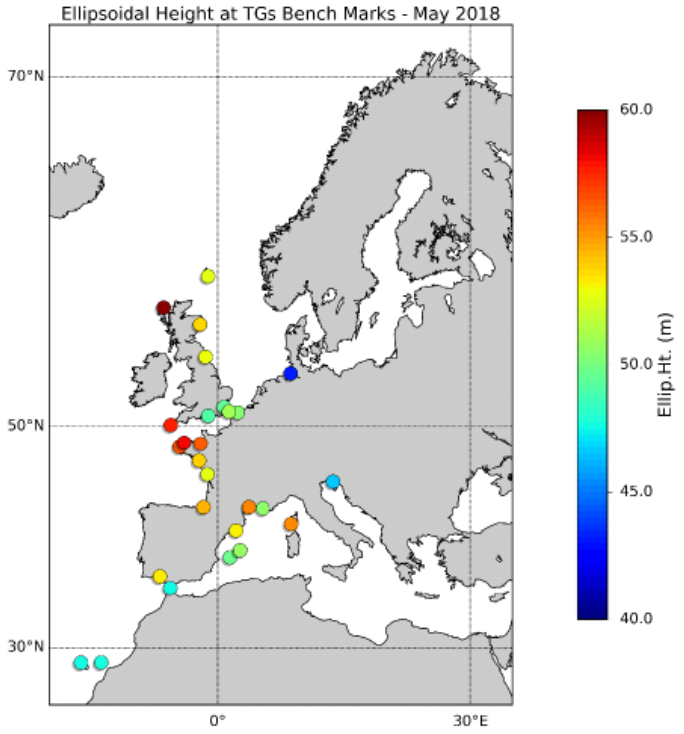
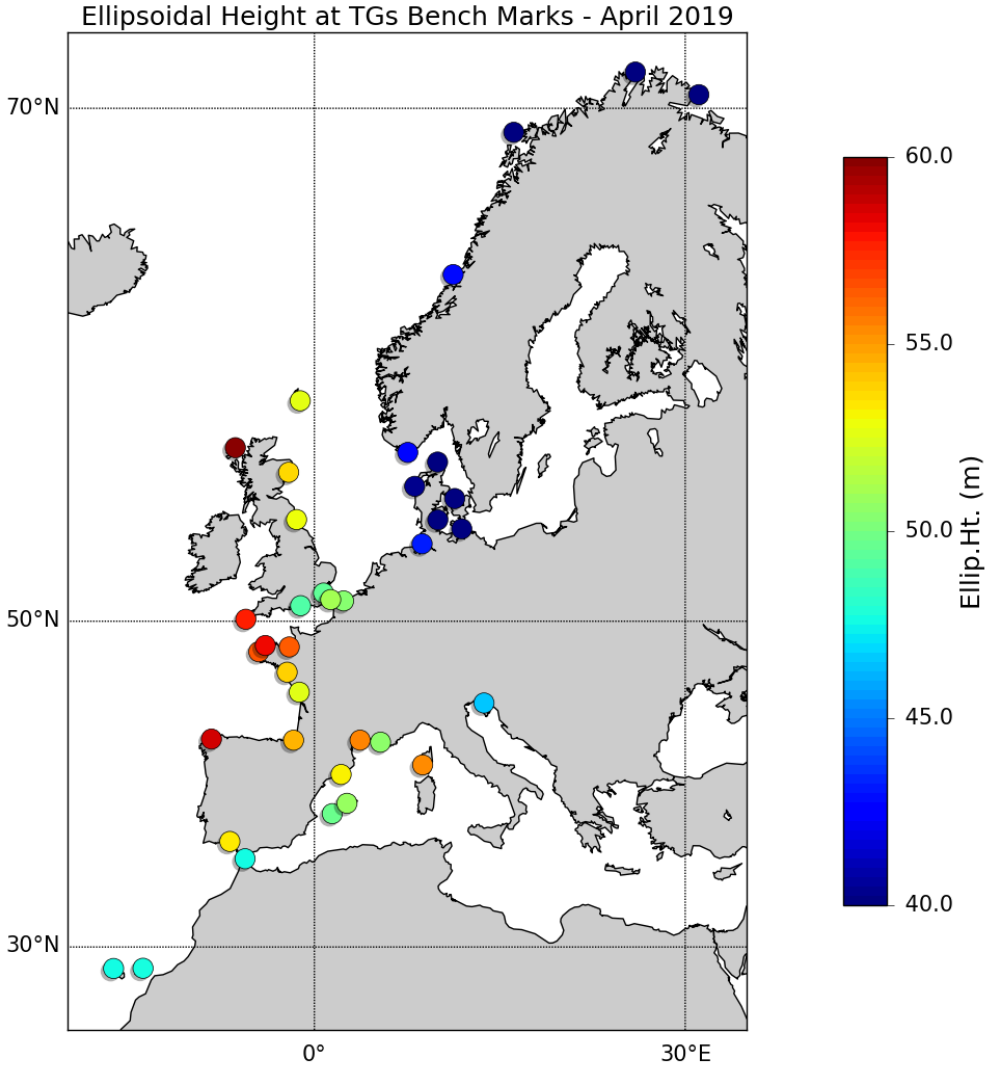


Figure 4: map of ellips
conditions:

- Data available in CME
- Geodetic information
- Tide gauge – Permane
- Geodetic tie available
stations.

Table 2: Example of

	S
Barcelona	
Palma de Mallorca	
Ibiza	
Tarifa	



2. Main achievements since 2015

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2.5 Liverpool, July 2018, Sea Level Futures Conference and TGTT side meeting

July 2: EuroGOOS Tide Gauge Task Team side meeting at the National Oceanography Centre: redundancies/gaps data portals, credit to data providers (PID, DOI's), metadata requirements, new QC tools, need of GNSS solutions, etc

Conference Statement:

Special emphasis was given to current sea level observations, synthesis of available data and discussion of future novel observational techniques in coastal areas... Sea level is rising and this is already impacting vulnerable coastal areas..

...Commitment to sustained and systematic global and coastal sea level measurements...

..Comprehensive observations in coastal areas (...sea level, vertical land movement, waves, sediment transport), with special emphasis ... in coastal regions

2. Main achievements since 2015

Tide Gauge
EuroGOOS Task Team

2.5 Liverpool: July 2018, Sea Level Futures Conference and TGTT side meeting

Sea Level Futures Conference Statement: (EuroGOOS TGTT contribution)

- *Implementation of a multi-purpose approach to tide gauge networks, focusing on the requirements of all users (e.g. scientists, port authorities, coastal engineers and hazard forecasters), to ensure the sustainability of the networks. This is particularly important when establishing stations in developing economies. Tide gauge networks are essential for improving our knowledge of coastal sea level variability, which is one of the main gaps in sea level science.*

- *Development of new technologies for sea level observations on both coastal and global scales, for example, low cost tide gauges and low cost Global Navigation Satellite System (GNSS) units fitted to buoys/floating platforms, GNSS-reflectometry, coastal altimetry and wide-swath altimetry.*

- *Broad-scale assessment of uplift/subsidence, especially human-induced subsidence, to guide analysis of local sea level change. The international community should take steps to provide all available information about the uplift/subsidence in coastal areas, e.g. GNSS or Interferometric Synthetic-Aperture Radar (InSAR). This work should involve the use of GNSS at all tide gauge stations (as per GLOSS standards) and the maintenance of an accurate International Terrestrial Reference Frame (ITRF).*

3. Major focus/work plan 2019-2020

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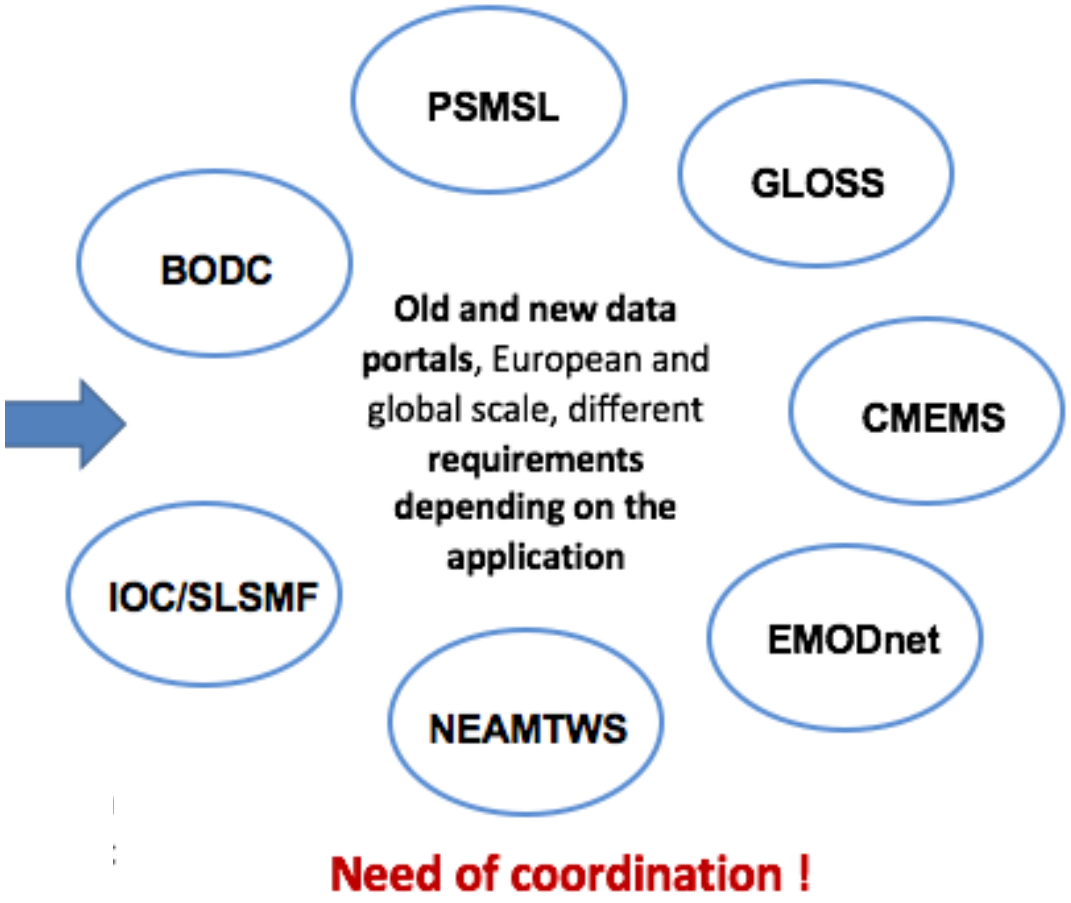
3.1 *EuroGOOS Tide Gauge Task Team Strategy: main focus in the short and medium term:*

- Sustainability of existing national networks and search for funding opportunities
- Gap analysis of existing data portals providing tide gauge data: identification of problems and needs of collaboration between different data aggregators GLOSS, PSMSL, CMEMS, EMODnet physics, etc
- Updated metadata information and tide gauge inventory, with improved visibility of ellipsoidal heights and vertical land movement information
- Contribution to the Best Practices initiative, by contributing with high-quality procedures for tide gauge managements (from operations data to information to end users)
- New technologies for coastal sea level measurements

3. Major focus/work plan 2019-2020

Tide Gauge
EuroGOOS Task Team

3.2 Status of data portals with tide gauge data: redundancies/gaps



- First: clarify information for the final users: objectives, limitations/advantages and details of each data portal
- Second: identify redundancies/gaps and ways of better coordination and mutual benefit between different programs

3. Major focus/work plan 2019-2020

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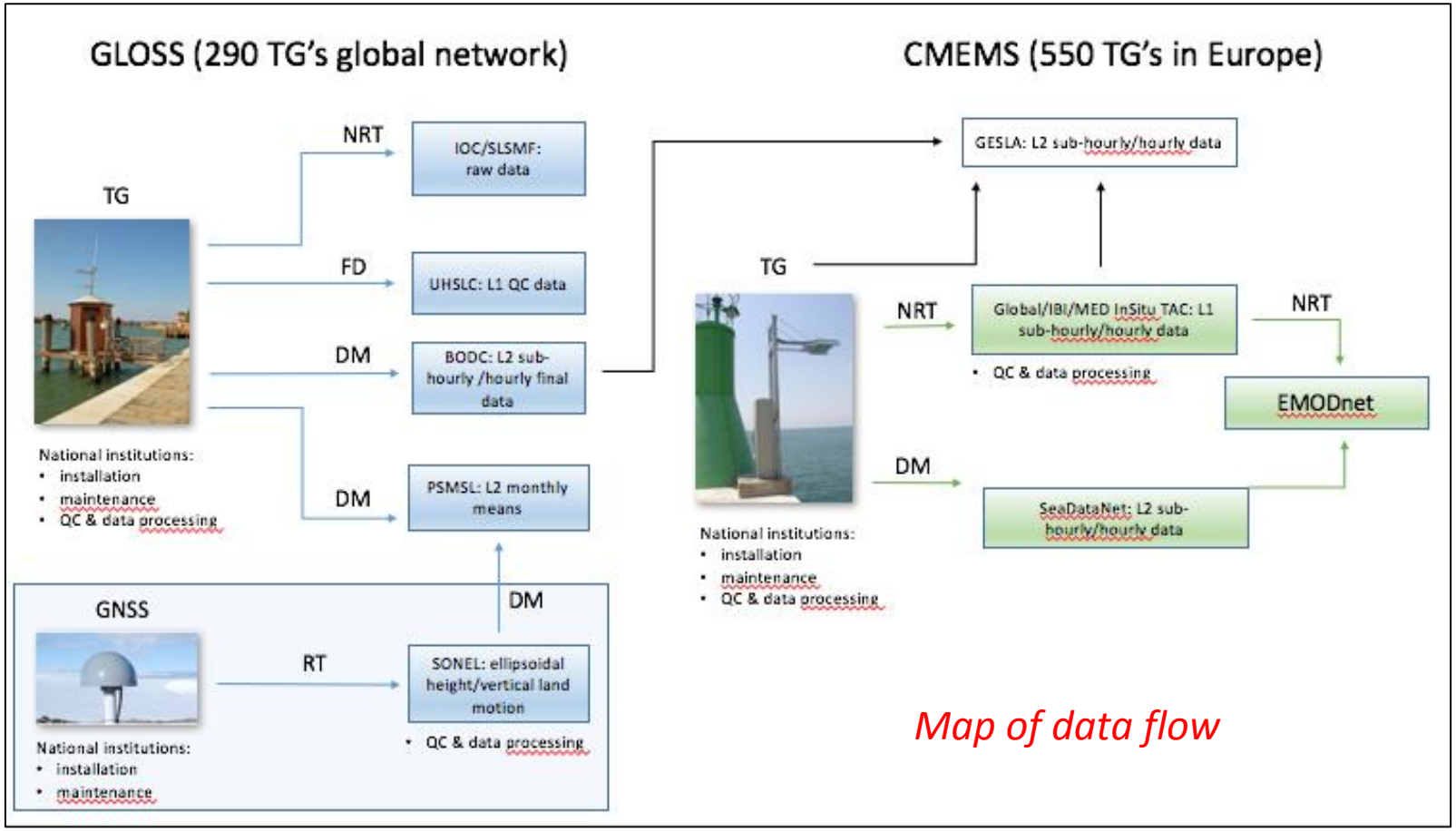
3.2 Status of data portals with tide gauge data: redundancies/gaps

Basic questions:

- Number of tide gauges
- How are data ingested
- How are data distributed
- Latency and Quality control procedures



Map of data flow

3. Major focus/work plan 2019-2020

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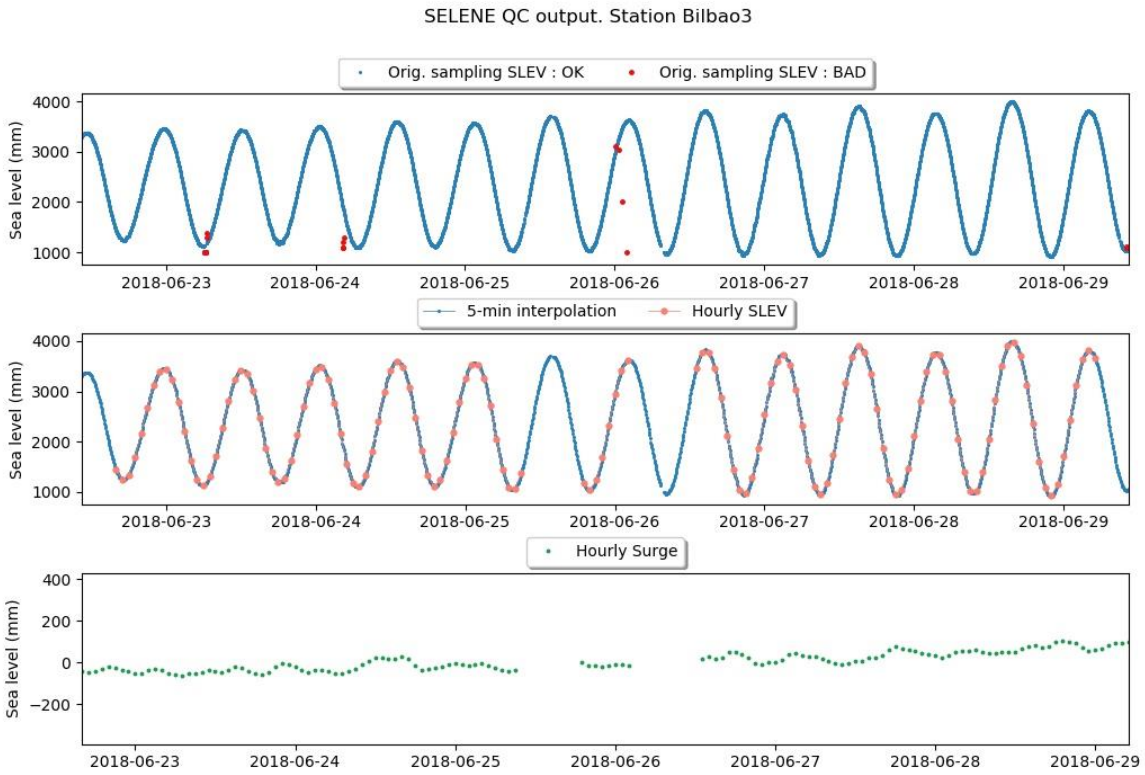
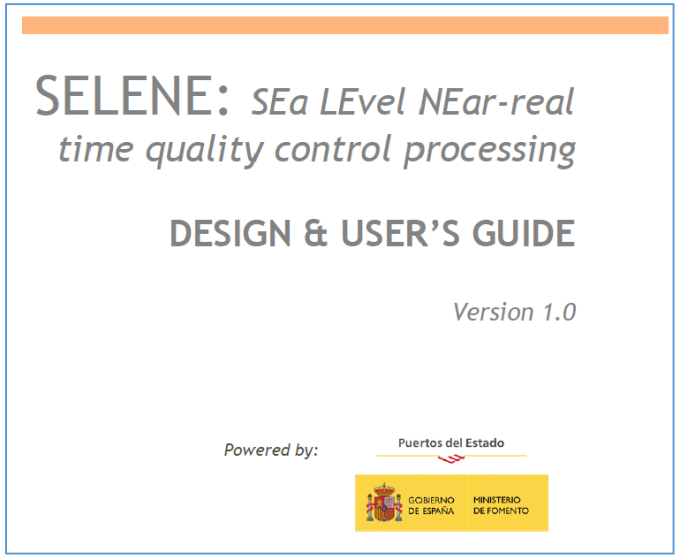
3.2 Quality control tools

Exchange/distribution and improvement of existing tools e.g. SELENE software (PdE), now in Python





Products:

- flagged data
- resampled 5 min data
- hourly sea level data
- surge/residual data

Implemented and operational in CMEMS IBI INSTAC since January 2019.

Demanded by other INSTAC's in CMEMS and national institutions

Contribution to GLOSS QC/QA manual (input to be prepared in the next EuroGOOS TGTT meeting in Madrid, June 2019).

Thank you!