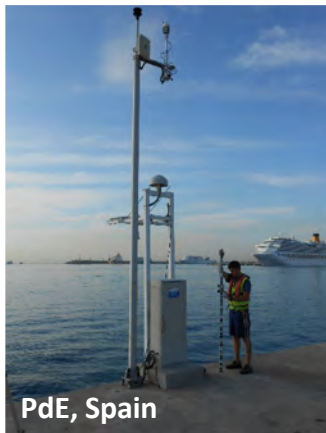


**Recent activities of the EuroGOOS Tide Gauge Task Team:  
Towards an European Tide Gauge Network linked to the global  
operational oceanography systems and GLOSS**



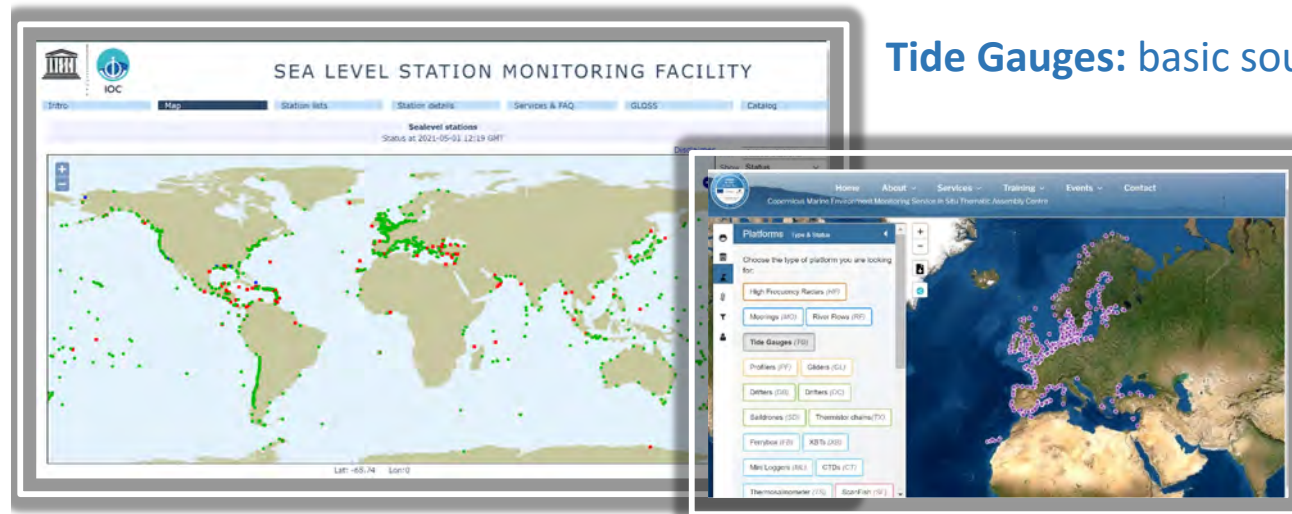
Begoña Pérez Gómez, Angela Hibbert, Laurent Testut, Guy Westbrook, Elizabeth Bradshaw, Andrew Mathews, Guy Wöppelmann, Marta Marcos, Vicente Fernández, Antonio Novellino, Sylvie Pouliquen

On behalf of the EuroGOOS Tide Gauge Task Team



**EuroGOOS International Conference 3-5 May 2021**

# Introduction



## Tide Gauges: basic source of in-situ sea level data along the coast

### EuroGOOS Tide Gauge Task Team:

#### *TG operators, representatives of data portals, scientists:*

**Co-chairs: Begoña Pérez Gómez (Puertos del Estado, Spain) and Claire Fraboul (SHOM, France)**

Thomas Hammarklint (SMHI, Sweden), Guy Westbrook, Deirdre Fitzhenry (MI-Ireland), Marta Marcos (UIB-IMEDEA, Spain), Anna von Gyldenfeldt (BSH, Germany), Fabio Raicich (CNR-ISMAR, Trieste, Italy), Laurent Testut (LEGOS, France), Oda Roaldsdotter Rovndal (Norwegian Hydr. Service, Norway), Angela Hibbert (NOC, UK), Alessandro Annunziato (JRC-EC), Francisco Hernández (VLIZ, IOC Sea Level Station Monitoring Facility), Per Knudsen (DTU, Denmark) (2017), Vibeke Huess (DMI, Denmark), Marco Picone, Arianna Orasi (ISPRA, Italy), Iviča Vilibić (IZOR, Croatia), Guy Woppelman (University of La Rochelle, SONEL), Sara Almeida and Dora Carinhas (IH, Portugal), Martin Verlaan (Deltares, Netherlands)

#### *Representatives of:*

**GLOSS:** Elizabeth Bradshaw, Andrew Matthews, Ivan Haigh, Philip Thompson

**CMEMS In Situ TAC:** Sylvie Pouliquen, Marta de Alfonso and Fernando Manzano

**EMODnet Physics:** Antonio Novellino and Patrick Goringe

*20 organizations from 13 different countries*

Old network > 600 stations only in Europe

Diverse range of applications, diverse type of national operators

Well established GLOSS data portals since the 80's

Highly demanded data in operational oceanography and for climate research/impacts studies

Main challenges:

- ❓ **Sustainability:** focus on products/data availability and users
- ❓ **Harmonization/cooperation between existing data portals (interoperability, FAIR principles)**

# Main activities 2019-2021

## Metadata inventory

Geodetic information (ellipsoidal height and vertical land movement): co-location of TG's and GNSS stations

Quality control and data processing

Gaps/duplicities in data portals and coordination



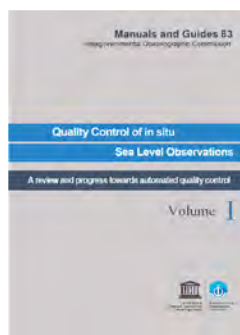
## EuroSea objectives/actions:

Task 3.5: European Sea Level Network (PdE, CNRS-LIENSs (SONEL), UKRI-NOC, MI) (total man-months: 26,2)

1. **Metadata inventory of stations** based on current user requirements OceanOPS, CMEMS, Tsunami Warning Systems)
2. Analyze **gaps/duplicities in data portals** and **new strategy for data flow**
3. **On-line portal in PSMSL** (Permanent Service for Mean Sea Level) of **uplift/subsidence land data**, including new **Multipath Reflectometry of land-based Global Navigation Satellite Systems (GNSS-MR)** technology for sea level measurements
4. Organization of **two workshops** involving the global community

Task 5.1.1: (NOC, PdE): New **low cost and maintenance free** tide gauges, to be installed in **Barcelona, Taranto and Alexandria**

IOC Manuals and Guides No. 83: Volume I: Quality Control of in situ Sea Level Observations: A Review and Progress towards Automated Quality Control  
(<https://unesdoc.unesco.org/ark:/48223/pf0000373566>, link verified 15/03/21 17:16)



<https://eurosea.eu>. EuroSea twitter account: @Euro\_Sea

# 1st EuroSea Tide Gauge Workshop



[Virtual meeting 12-14 January 2021](#)

**Topic: Status and challenges of In Situ Sea Level Measurements from Tide Gauges**

Open to the GLOSS community, focus on data flow recommendations  
37 speakers on 5 sessions:

National experiences/networks

**New** sea level technologies (e.g. **GNSS-IR technique**)

**Data flow** and data management

**GNSS co-location** of tide gauges (ellipsoidal height and VLM)

**Influence of waves, infragravity waves and meteotsunamis** on extreme sea level records

Impact of COVID-19

<https://eurosea.eu/news/1st-eurosea-tide-gauge-workshop-presentations-available/>

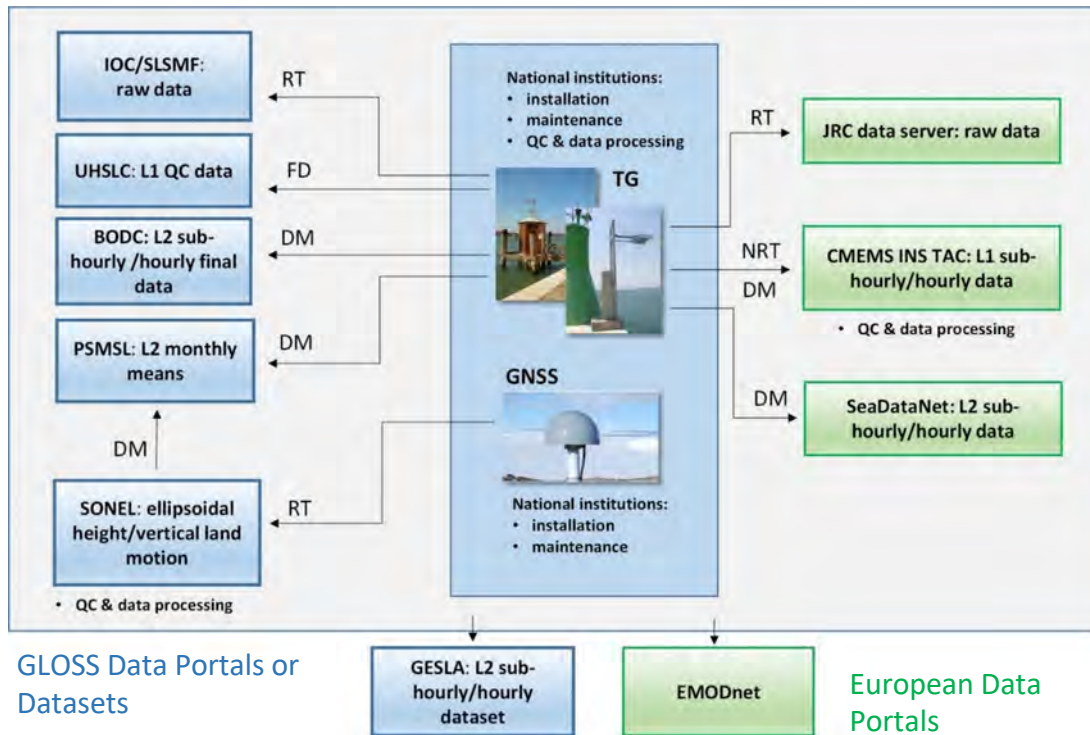


- More than **110 attendants from and outside Europe and 160 registered** !
- Status and challenges at different nations and regions
- Recommendations on data flow strategy

<https://eurosea.eu>. EuroSea twitter account: [@Euro Sea](#)

# Data Flow

## TG data and products distribution:



GLOSS Data Portals or Datasets

European Data Portals

## EuroSea D3.3: New Tide Gauge Data Flow Strategy

EuroSea Data Management Plan applied to TG network (FAIR principles, integration in European data programs)

Status:

- 10 data portals: different products/sampling/latency/QC/processing
- QC/Data processing mainly by national operators
- Need of agreement on common metadata and common vocabulary
- Significant gaps and duplicities between portals
- Lack of unique Identifier !!

[https://eurosea.eu/download/outputs\\_and\\_reports/deliverables/EuroSea-D3.3\\_New\\_Tide\\_Gauge\\_Data\\_Flow\\_Strategy.pdf](https://eurosea.eu/download/outputs_and_reports/deliverables/EuroSea-D3.3_New_Tide_Gauge_Data_Flow_Strategy.pdf)

<https://eurosea.eu>. EuroSea twitter account:

# Data Flow



## TG data and products distribution:

### Main outputs:

#### ❓ New definitions:

*tide gauge, tide gauge station, tide gauge site*

#### ❓ Proposal of minimum common metadata

#### ❓ QC/processing review and recommendations:

- Upgrade to higher sampling
- Address lack of skills at some institutions
- NRT QC applied by CMEMS (no REP product from tide gauges data)

## EuroSea D3.3: New Tide Gauge Data Flow Strategy

**Roadmap for new Unique ID assignment:** to be defined in the framework of the global network (agreement GLOSS – OceanOPS, March 2021)

Phase one	Phase two	Phase three
1-3 months	3-12 months	1-2 years
<b>OCG Data Mapping and Metadata workshop</b> IOC Observations Coordination Group and OceanOPS metadata harmonization and opportunity for networks to raise metadata issues and concerns	<b>Unique IDs for sensors, sites and stations</b> Following on from OCG workshop and GLOSS data centres meeting, liaise with OceanOPS to develop strategy for assigning unique IDs, using existing systems e.g. WIGOS IDs [8].	<b>ePIC IDs</b> Work with organisations that are able to mint ePIC PIDs to investigate assigning PIDs to instrumentation and platforms
<b>GLOSS data centres review meeting</b> Kick-off meeting for monthly GLOSS data centres meetings to discuss data integration and delivery	<b>GLOSS datasets with DOIs</b> Assign DOIs to GLOSS datasets where possible such as PSMSL and GESLA dataset	<b>PIDs for reference documentation</b> Work with IOC to obtain PIDs/DOIs for reference documentation such as GLOSS manuals
<b>Conduct global survey of organisational/national PID systems</b> Investigate systems in place/in development to see if they can be adopted/adapted and avoid duplication	<b>Unique IDs for organisations and people</b> At GLOSS biennial meeting (autumn 2021), request that GLOSS contributors request organisational unique identifiers such as EDMO and also ask individuals to consider obtaining ORCIDs.	<b>RORs</b> Investigate incorporating RORs in to existing systems, and ask suppliers/operators/funders to consider generating RORs. Establish if RORs are suitable for non-academic/research organisations

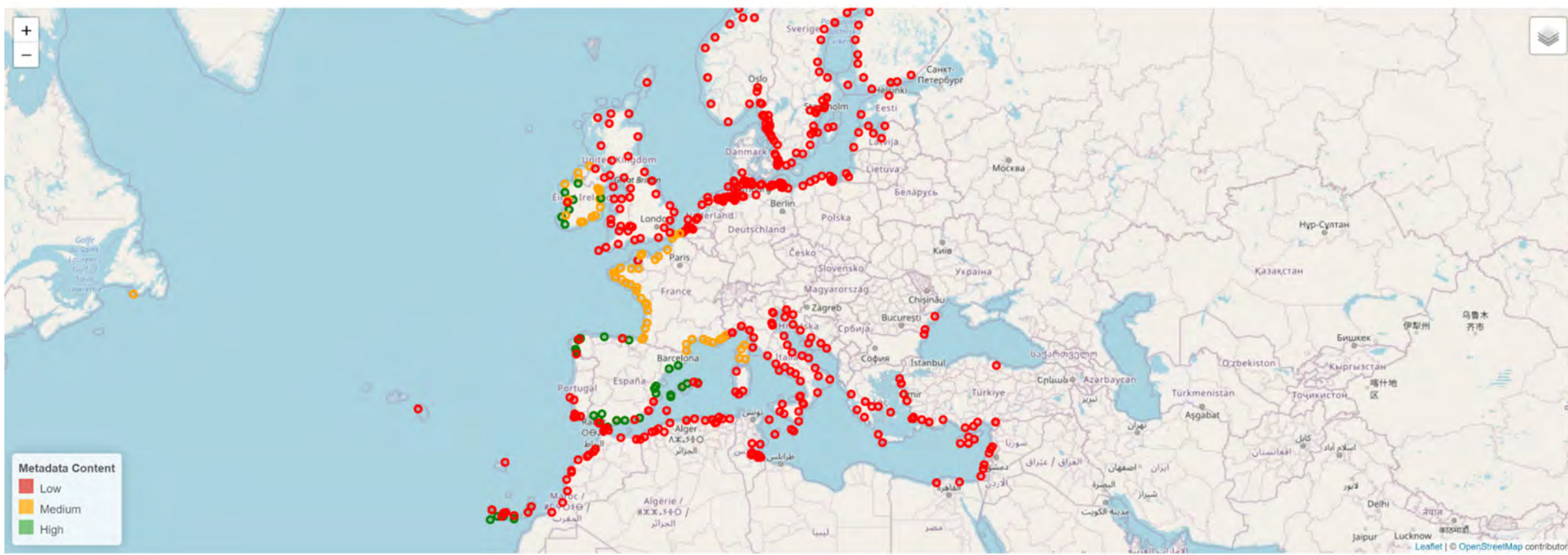
[https://eurosea.eu/download/outputs\\_and\\_reports/deliverables/EuroSea-D3.3\\_New\\_Tide\\_Gauge\\_Data\\_Flow\\_Strategy.pdf](https://eurosea.eu/download/outputs_and_reports/deliverables/EuroSea-D3.3_New_Tide_Gauge_Data_Flow_Strategy.pdf)

<https://eurosea.eu>. [EuroSea twitter account:](#)

# Metadata inventory European TG network



[EuroSea Task 3.5: Metadata tide gauge inventory: proof of concept ready, developed by the Irish Marine](#)



Source: Guy Westbrook (MI)

Link to new GLOSS – OceanOPS roadmap required !

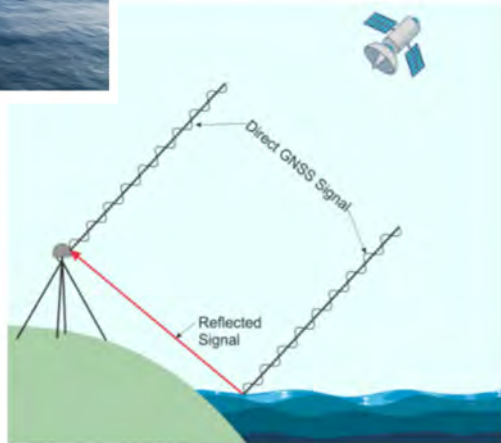
<http://eutgn.marine.ie/geonetwork/srv/spa/catalog.search#/home>

<https://eurosea.eu>. EuroSea twitter account:  
@EuroSea

# Emerging technologies

## Based on GNSS technology:

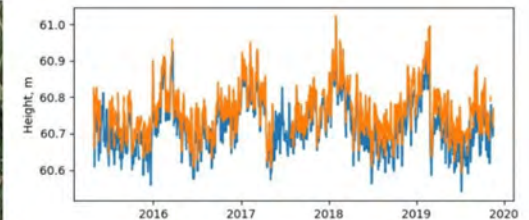
Global Navigation Satellite Systems Interferometric Reflectometry (**GNSS-IR**) – **Ground Based GNSS**



Source: Simon Williams, NOC (UK)



## EuroSea Task 3.5: GNSS-IR Data Portal (NOC- PSMSL)



Source: Andrew Mathews NOC (UK)

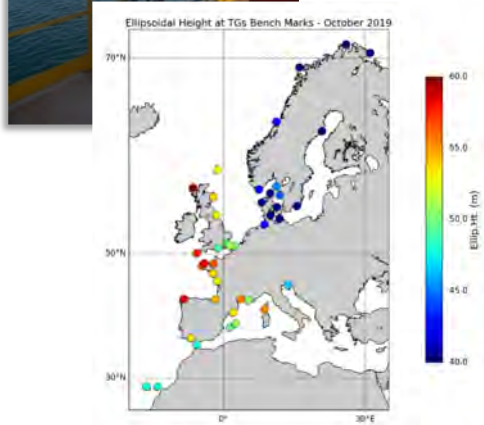
<https://eurosea.eu> EuroSea twitter account:



# Geodetic information: Co-location with GNSS

## On-going activity: compiling Ellipsoidal Height and vertical land movement information with SONEL (GLOSS)

GNSS

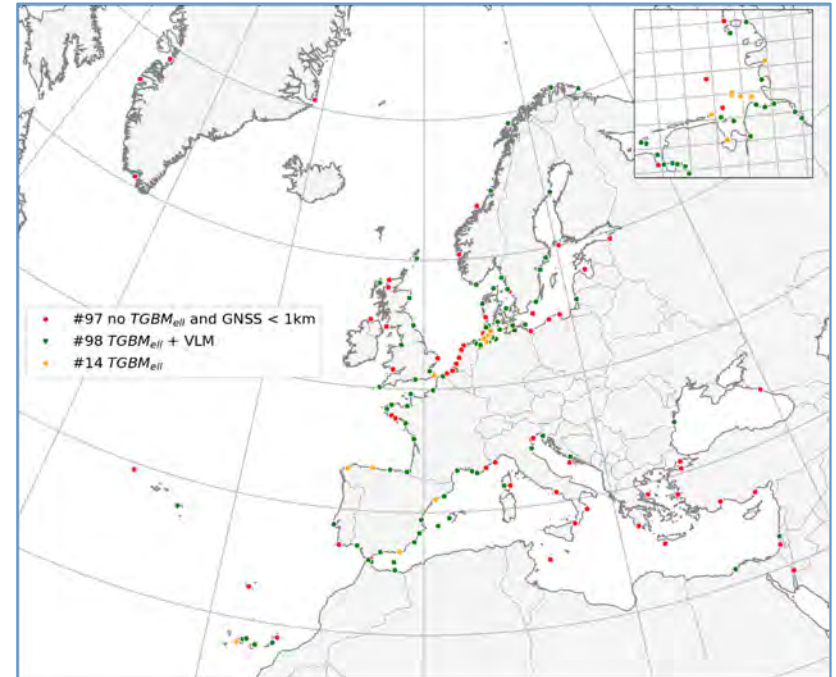


EuroGOOS EEA framework contract (EuroGOOS-COINS-2020-1): “Increased coastal sea level data provision to Copernicus” (PdE, CNRS-SONEL, Shom and NOC)

New survey launched by SONEL (end 2020)



Compilation of new relevant metadata  
Increasing number of TG’s collocated with GNSS!  
Bottle neck: **lack of unique Identifier !!**



Ellipsoidal height available for **42 stations by Oct 2019**

Ellipsoidal height available for **112 stations by March 2021 (98 including VLM)**

# Conclusions

- The **Tide Gauge Network** is well consolidated, with published best practices and widely used and demanded for a large variety of applications
- Still, several countries face **funding problems** for maintenance and/or quality control and processing

## Data flow:

- Diverse data/products at different data programs/portals: a user should know **where to search**
- Quality control and data processing adapting to new sampling and latency strategies, future: metadata QC and comparison with nearby stations (datum changes)
- **Further effort** required to adopt general oceanographic community standards (FAIR principles and enhanced interoperability)
- New **GLOSS-OceanOPS roadmap** to address assignment of **new unique Identifiers and common metadata**
- Actions in the European network should converge on the global network action plan

## The network:

- Increasing number of tide gauge stations co-located with GNSS at several countries: **better assessment of local land movements, altimetry calibration**
- Continuous studies on emerging technologies: good perspectives on the use of **GNSS-IR technique**, data to become available soon through PSMSL website
- New research challenges: **impact of waves/high frequency oscillations** on extreme sea levels

**Announcement: 2<sup>nd</sup> EuroSea Tide Gauge Network Workshop: November 2022 (Quality control and data processing)**