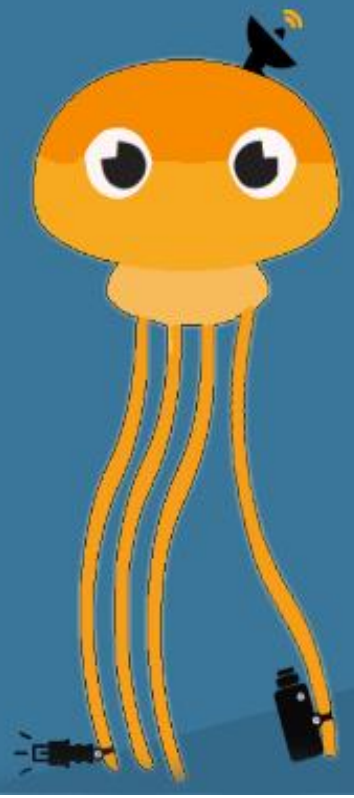
EGU General Assembly 2019 - Vienna (AT), 7-12 April

medusa

Monitoring shallow water environment



MEDUSA

Multiparametric Elastic-beacon Devices and Underwater Sensors Acquisition system

Gian Paolo Donnarumma, Sergio Guardato, Prospero De Martino, Giuseppe Pucciarelli, Giovanni Macedonio, Francesco Chierici, Laura Beranzoli, and Giovanni Iannaccone

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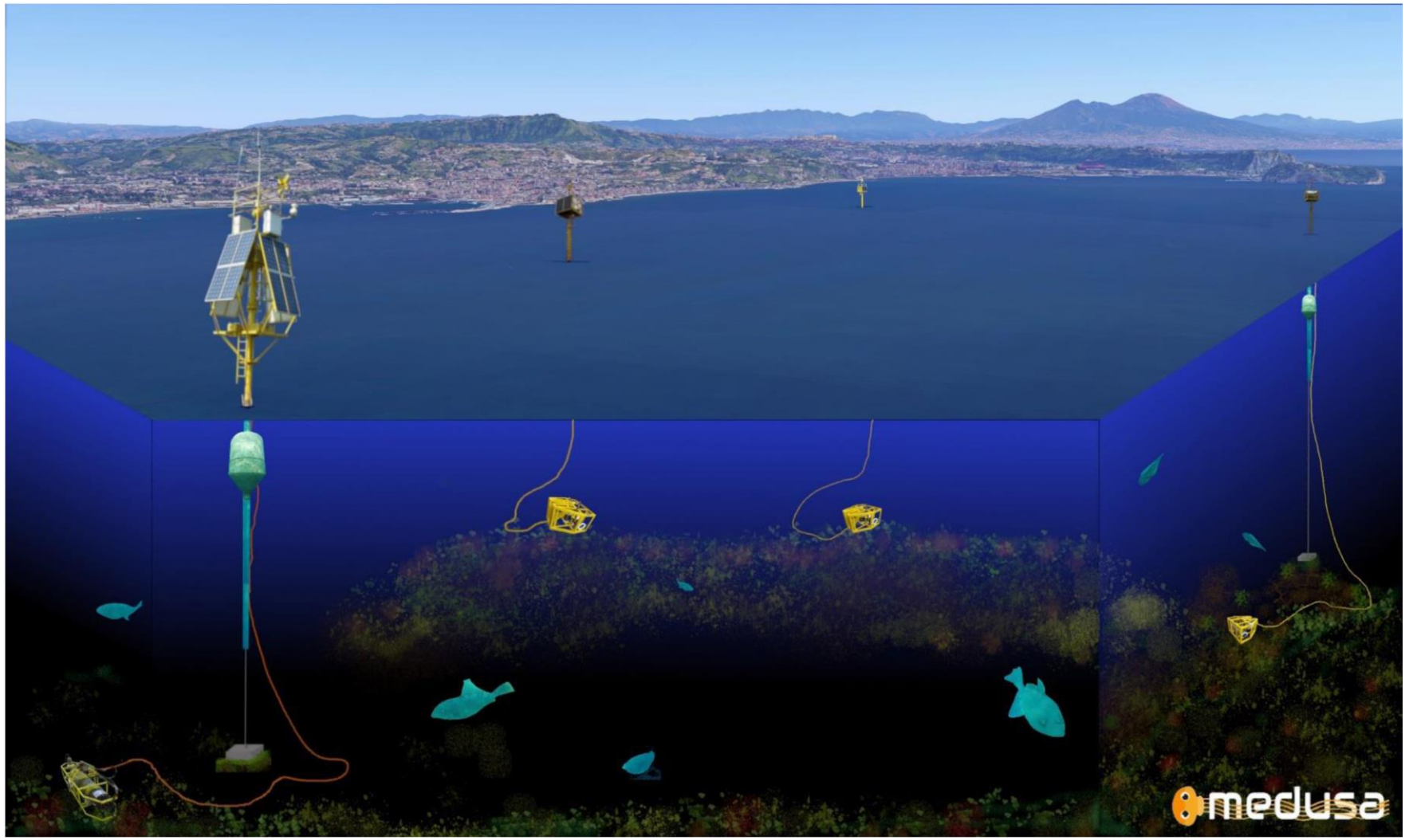
What is "MEDUSA" infrastructure?



MEDUSA

Multiparametric

Elastic-beacon

Devices and

Underwater

Sensors

Acquisition system

It's a **marine monitoring research infrastructure** based on instrumented geodetic-buoys with cabled seafloor multi-parametric modules.

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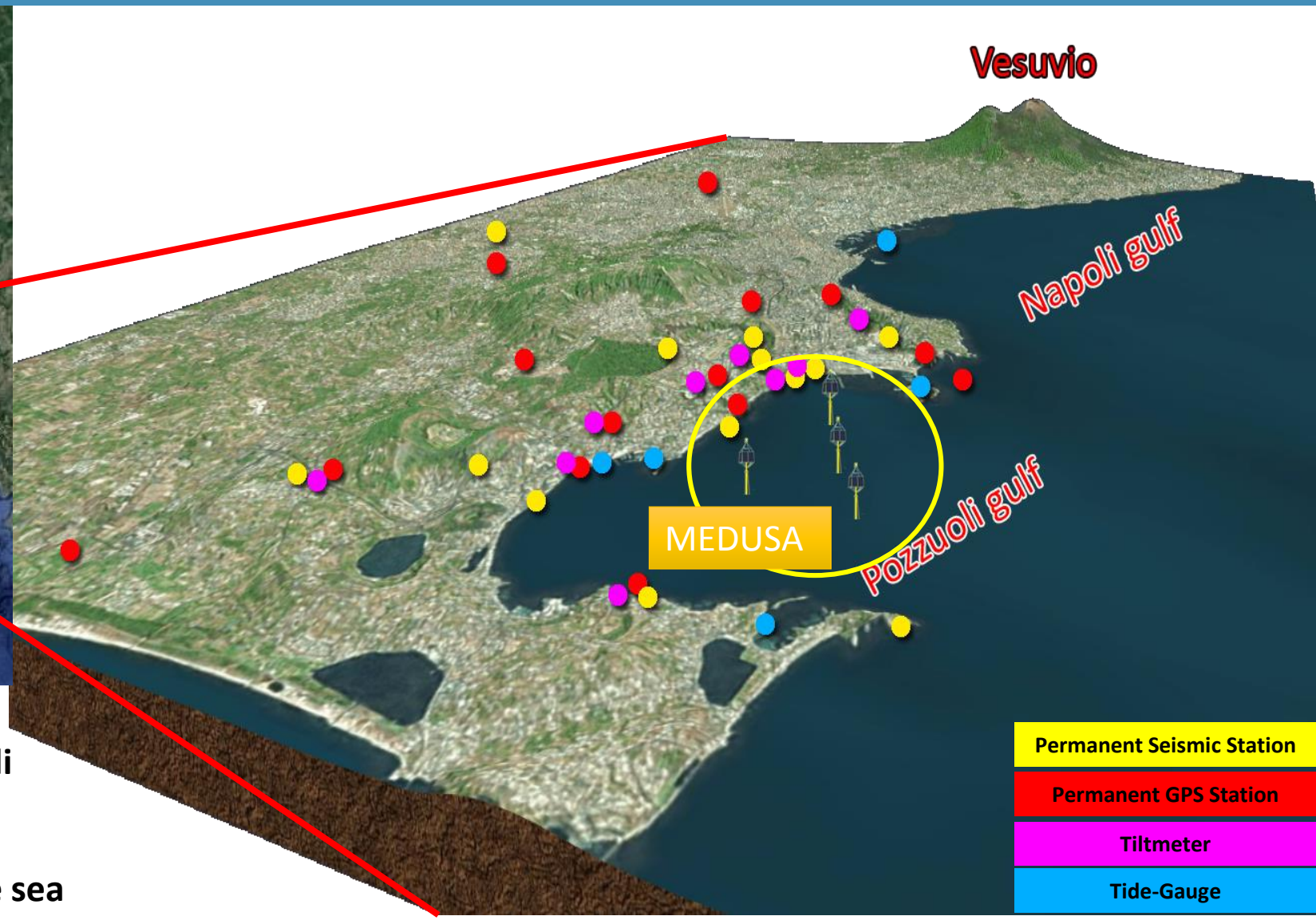
Where is located?



MEDUSA marine monitoring research infrastructure is located in the **Gulf of Pozzuoli** (Naples, IT), in the **Campi Flegrei caldera**.

MEDUSA has been developed **to extent in the sea the land monitoring system** managed by the **INGV-Osservatorio Vesuviano**
It is aimed to monitor the local seismicity and the **continuous slow seafloor movements** characterizing the area (**bradyseisms**).

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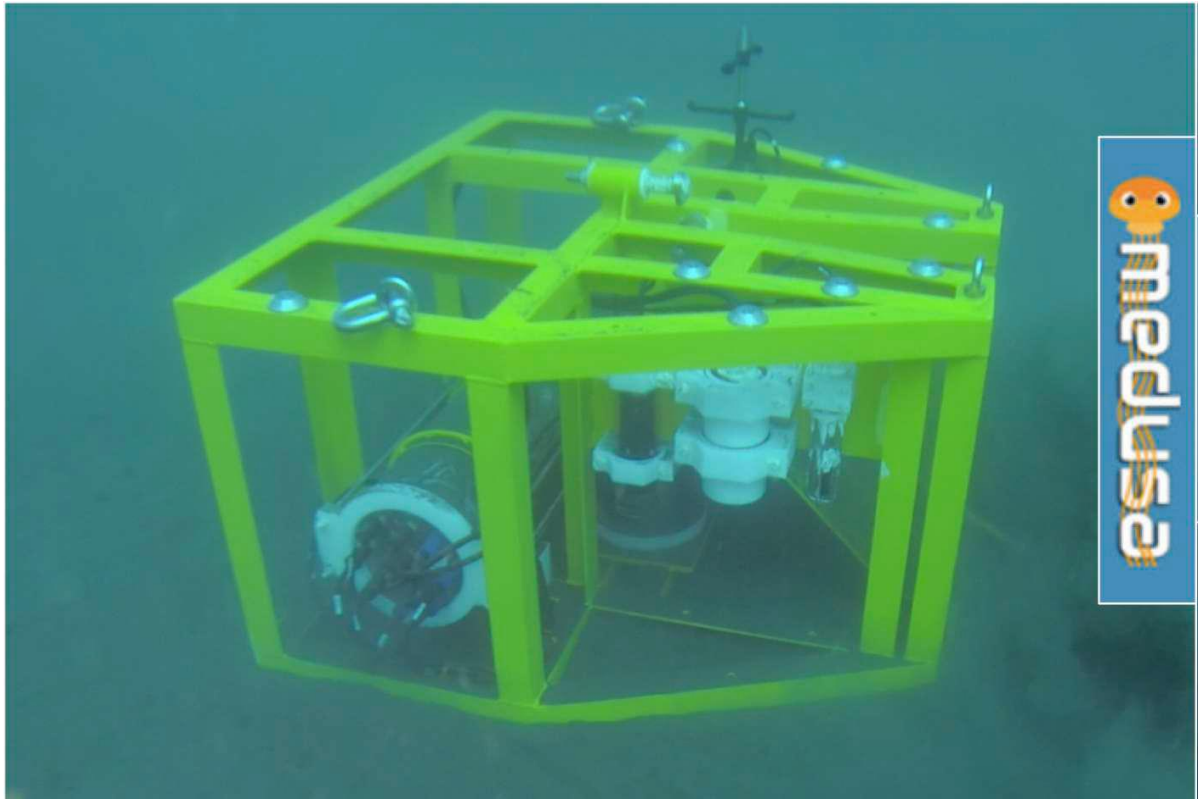
How MEDUSA is made

The infrastructure consists of **4 buoys and as many submarine cabled modules** equipped with geophysical and oceanographic sensors.



The overall marine monitoring research infrastructure therefore acquires **more than 150 channels** with sampling rates varying from 60 seconds to 200 Hz.

The data are stored in a relational database and the complete time series can be visualized on a data portal (http://portale.ov.ingv.it)

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How is made – Top buoy

Geodetic GPS
X coordinates position
Y coordinates position
Z coordinates position

Tide Gauge
Sea level variation

Weather Station
Barometric pressure
Air Temperature
Air Humidity
Wind Direction
Wind Speed

Web Camera
Real time image

Lowpower CPU
Compass
Pitch / Roll
Temperature
Power monitoring
Local data store

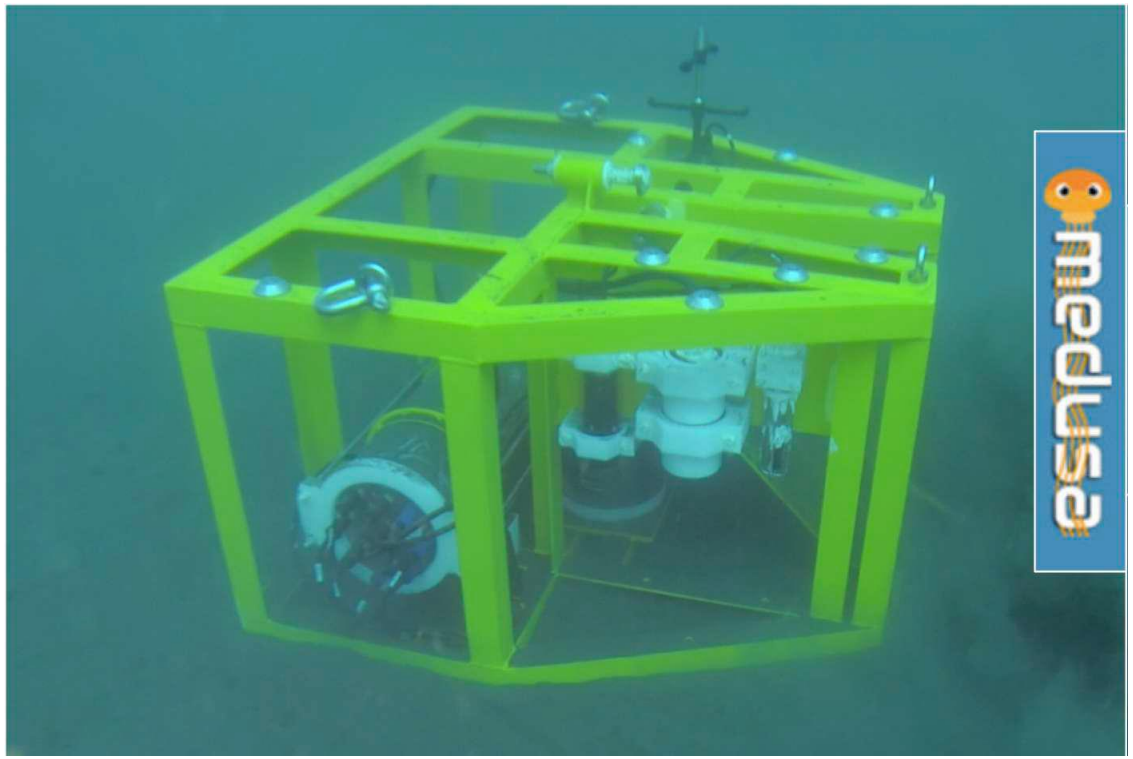
WiFi Transceiver
Real time data transmission

How is made – Sea floor module

BroadBand Seismometer
3C Trillium Compact OBS
120 s – 100 Hz frequency band

Accelerometer
high quality 3C MEMS accelerometer

Broadband Hydrophone
0.01 – 100 Hz frequency band



Current meter
N/S water speed
W/E water speed
U/D water speed
Water temperature

Lowpower CPU
Compass / Pitch / Roll
Internal Module Temperature
Internal Module Pressure
Water intrusion Alert
Module Power monitoring
Local data store

Bottom Pressure Recorder
Water column Pressure

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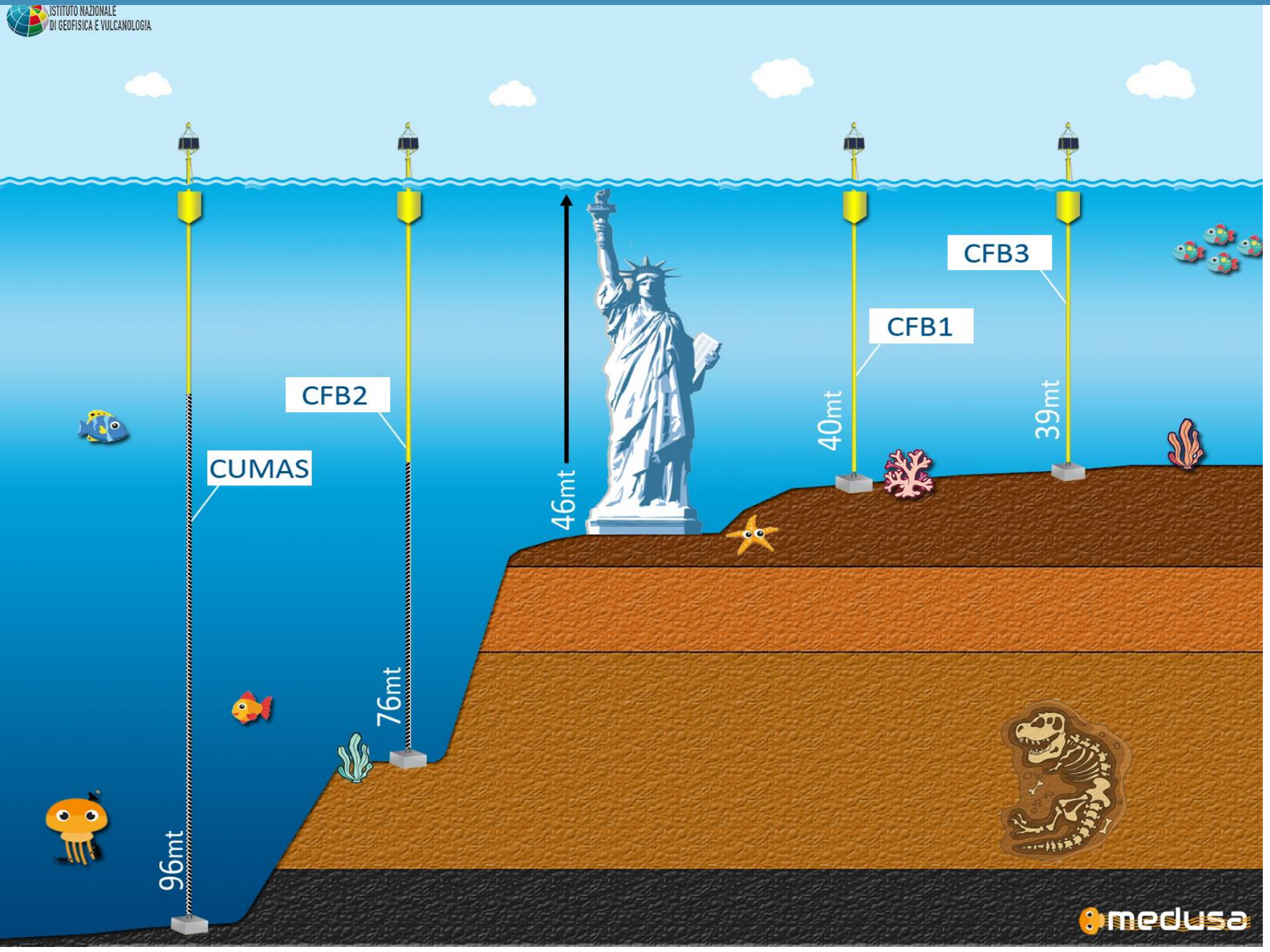
How Big is it?



Size matters

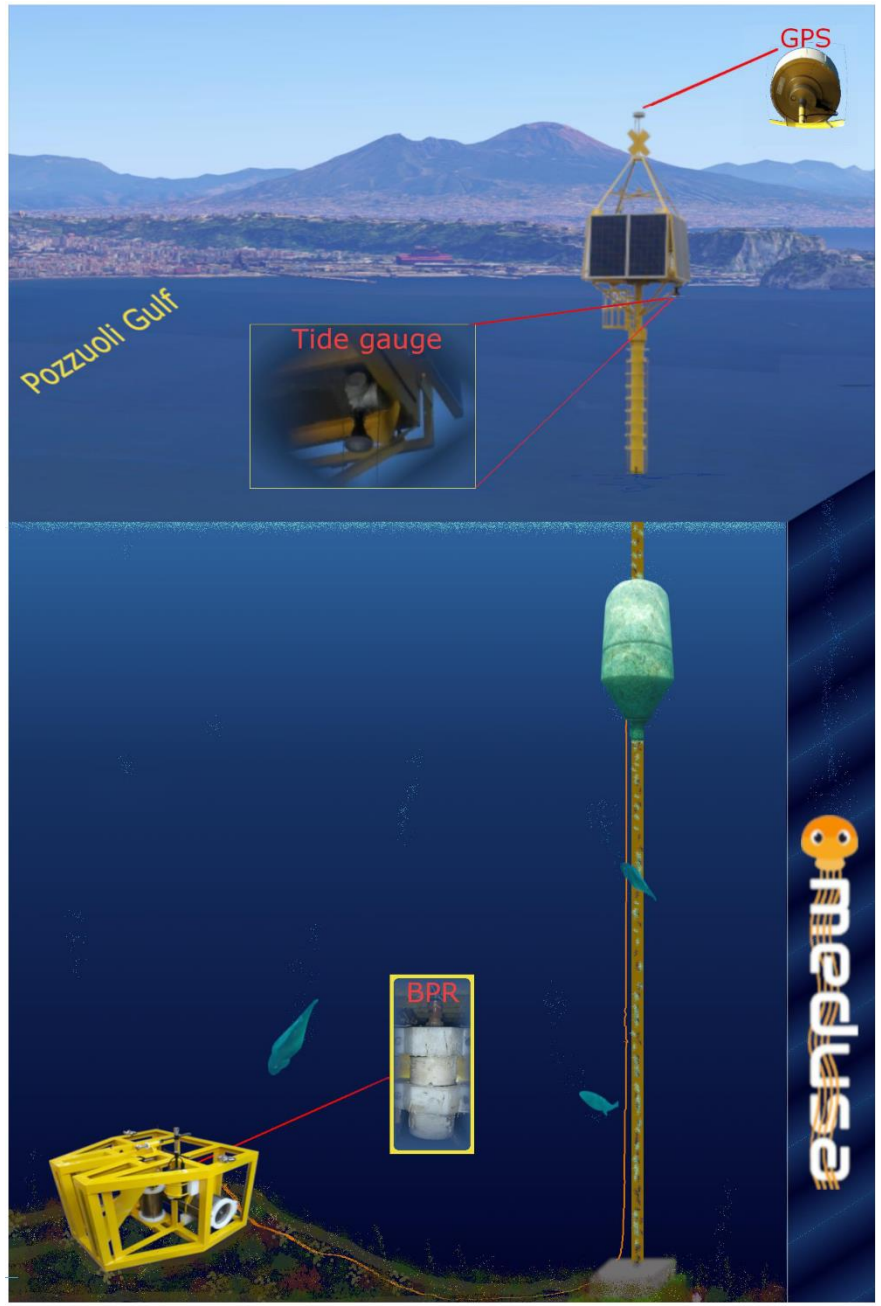
Centimetric Seafloor vertical displacements measurements, at water depth ranging **from 39 to 96 m**

Sea floor Geodesy

Marine geodesy aimed at determining absolute coordinates on the seabed, or **for monitoring the movements of fixed points on the seabed**, is now applied in various industrial and scientific contexts.

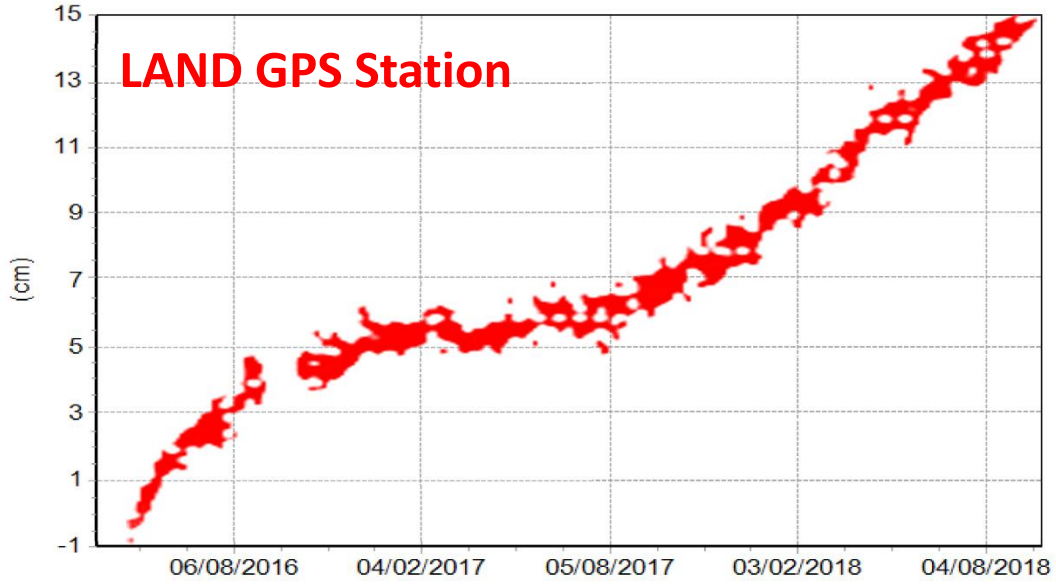
Campi Flegrei, where MEDUSA is located, is a volcanic caldera located west of Naples, in Southern Italy. This area is characterized for repeated cycles of **significant slow uplitf followed by subsidence**.

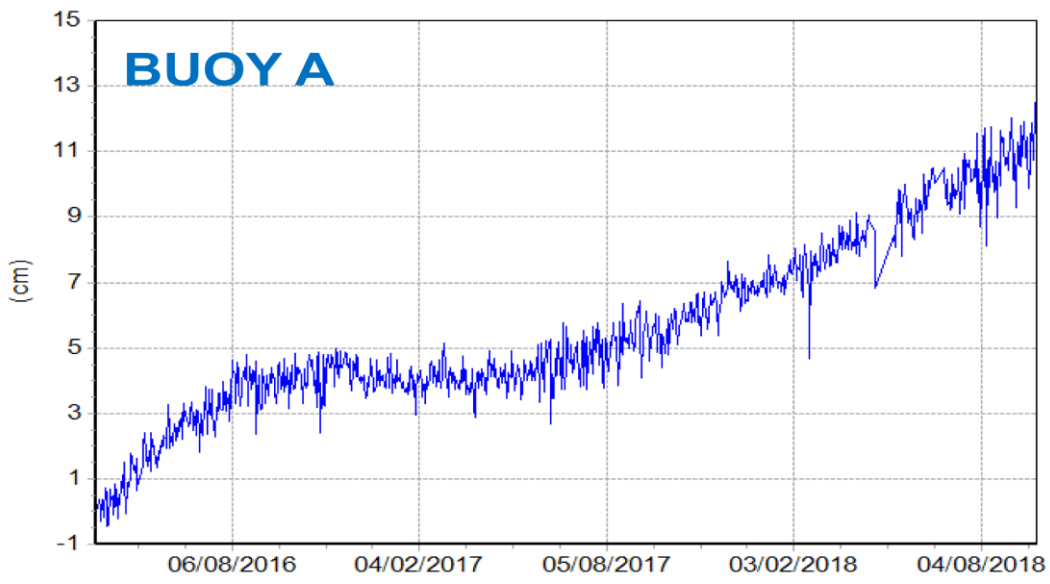
The use of **GPS**, **BPR** and **TIDE GAUGE** data provided by MEDUSA, have allowed assessing for the first time the seafloor deformation field in the Gulf of Pozzuoli: we estimated a seafloor vertical displacement of **about 10 +/- 1 cm** over a period of **twenty months embracing 2016 to 2018**.

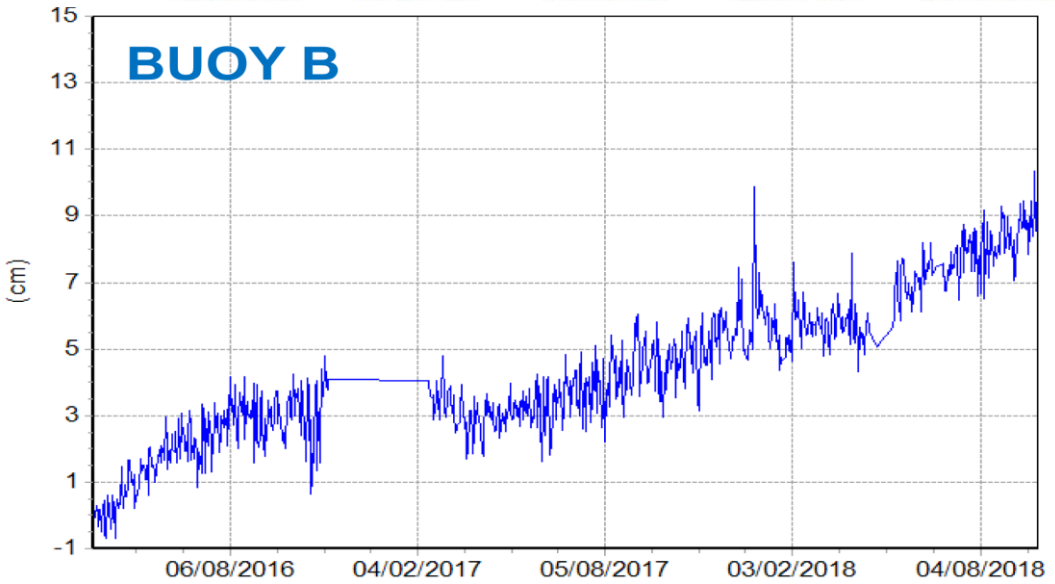


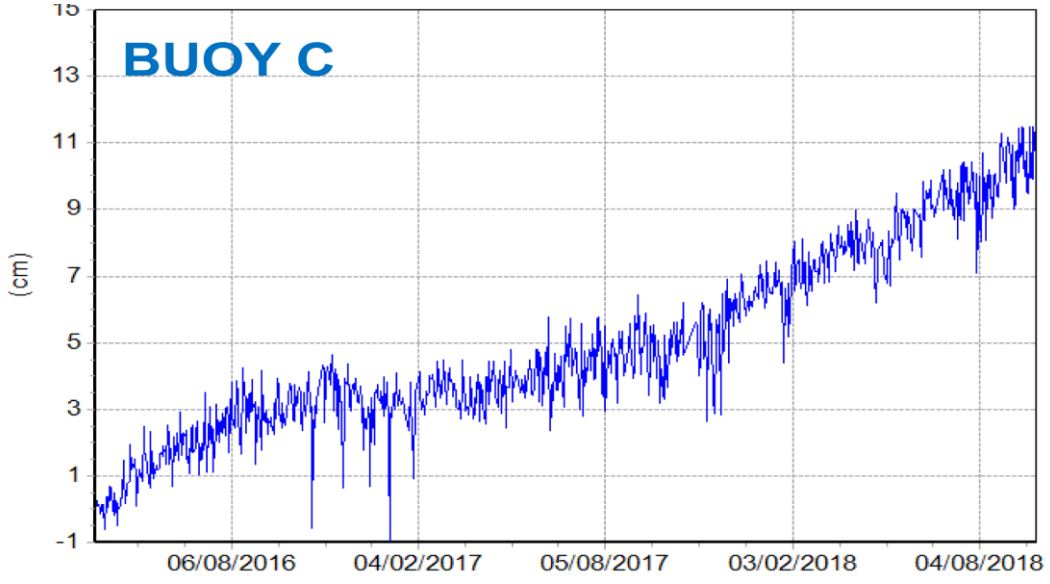
Geodetic GPS

The long time-series of the **geodetic GPS** data acquired on the MEDUSA buoys show an accurate and stable agreement of the vertical seafloor displacement measured with the land GPS stations.



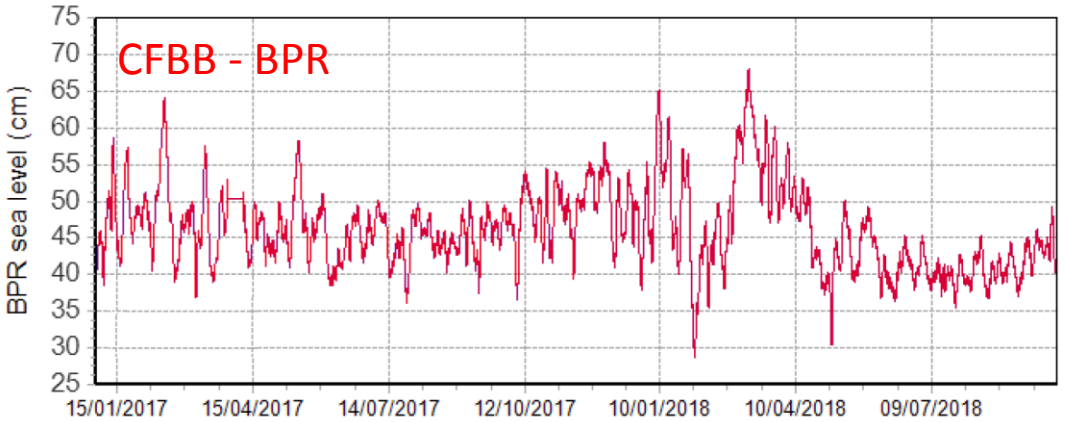


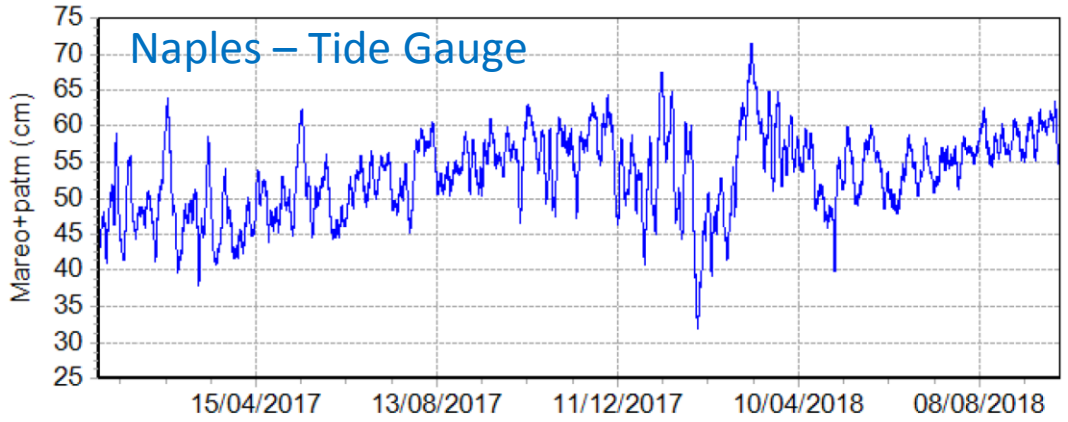




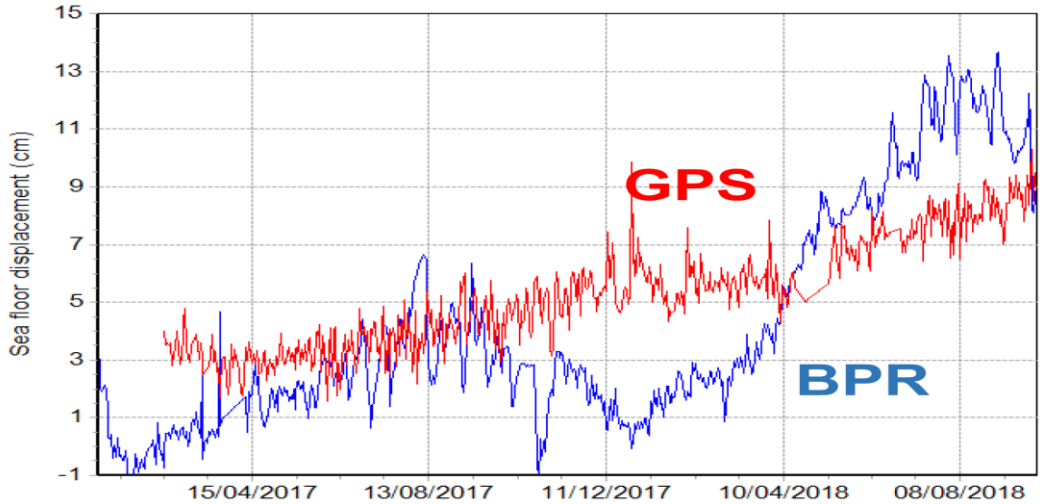
Bottom Pressure Recorder

Another method to measure the vertical seafloor displacement is the analysis of the changes in the hydrostatic pressure, measured at the bottom of the sea, due to slow vertical movements of the soil that translate into the corresponding variation in height of water column and consequently of pressure measured





Sea level changes measured by BPR (Buoy CFBB) have been divided for density of the sea water and gravitational acceleration. Than we use the Naples Tide Gauge, **located outside the deformation area**, as stable reference



The trend of the two measures is consistent.
A periodic component not yet correclty interpreted remain probably due to temperature variation. Different temperature models was applied but the difference remains.
A more precise temperature (and salinity) measurement is needed to correclty calculate water density.

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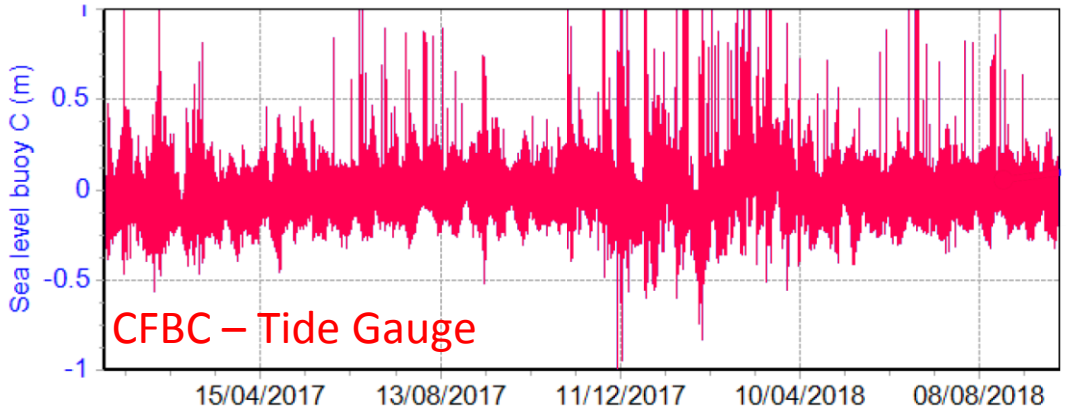
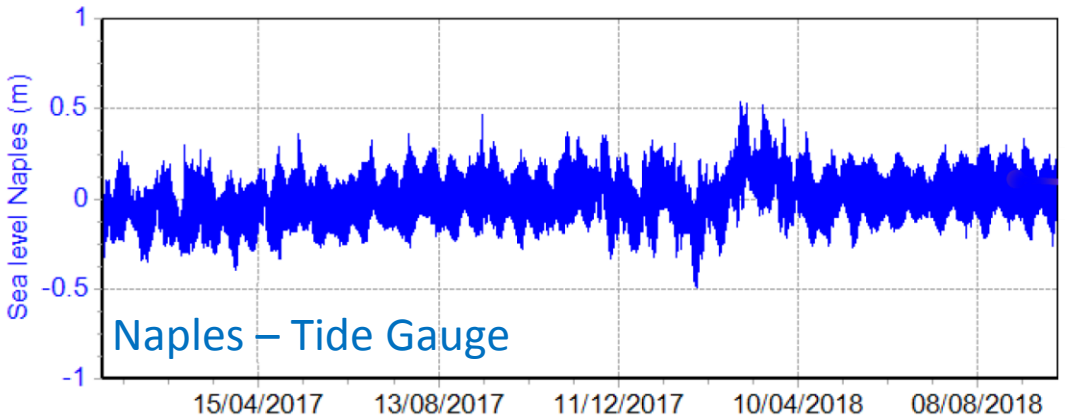
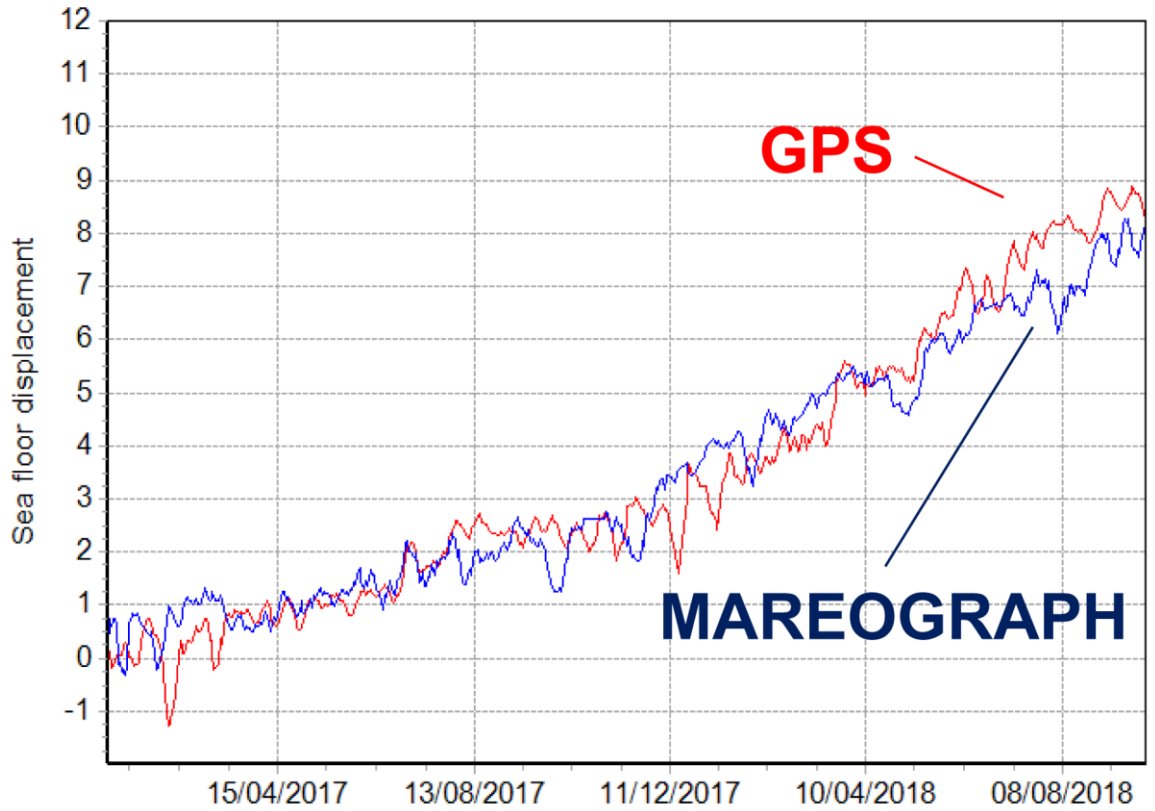
Tide Gauge

The data from the mareograph were also analyzed using the same approach as those with the BPR. It is therefore possible to obtain measurements of vertical displacement by monitoring the effects caused on the tide level.

Also in this case we use the Naples Tide Gauge, **located outside the deformation area**, as stable reference.







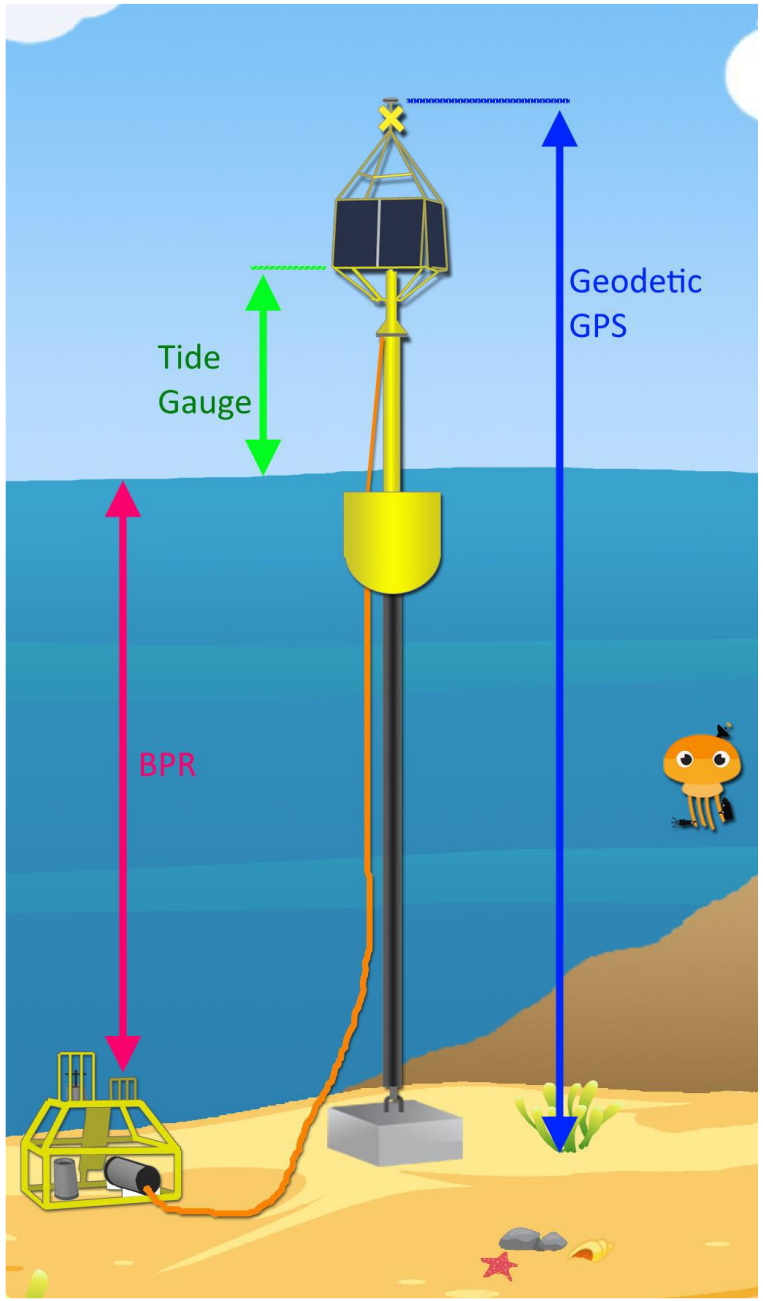
Conclusions

MEDUSA marine monitoring research infrastructure is located in the **Gulf of Pozzuoli** (Naples, IT), within the **Campi Flegrei caldera**, to monitor the local seismicity and the low-rate ground subsidence and uplift of seafloor movements (**bradyseisms**).

MEDUSA extends the Campi Flegrei caldera seismic monitoring network of at sea.

The use of **GPS**, **BPR** and **TIDE GAUGE** data provided by **MEDUSA**, have allowed assessing for the first time the seafloor deformation field in the Gulf of Pozzuoli: we estimated a seafloor vertical displacement of **about 10 +/- 1 cm**

MEDUSA provides an infrastructure to **test new methodologies for monitoring and assessing** seafloor deformation and vertical displaement



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MEDUSA data acquisition system

Gian Paolo Donnarumma
gianpaolo.donnarumma@ingv.it

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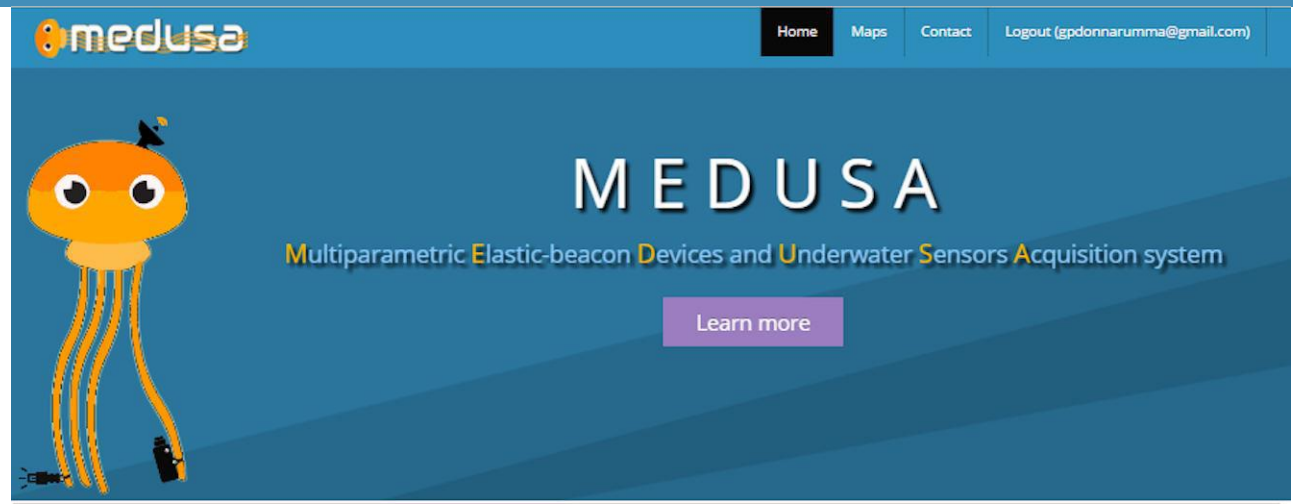

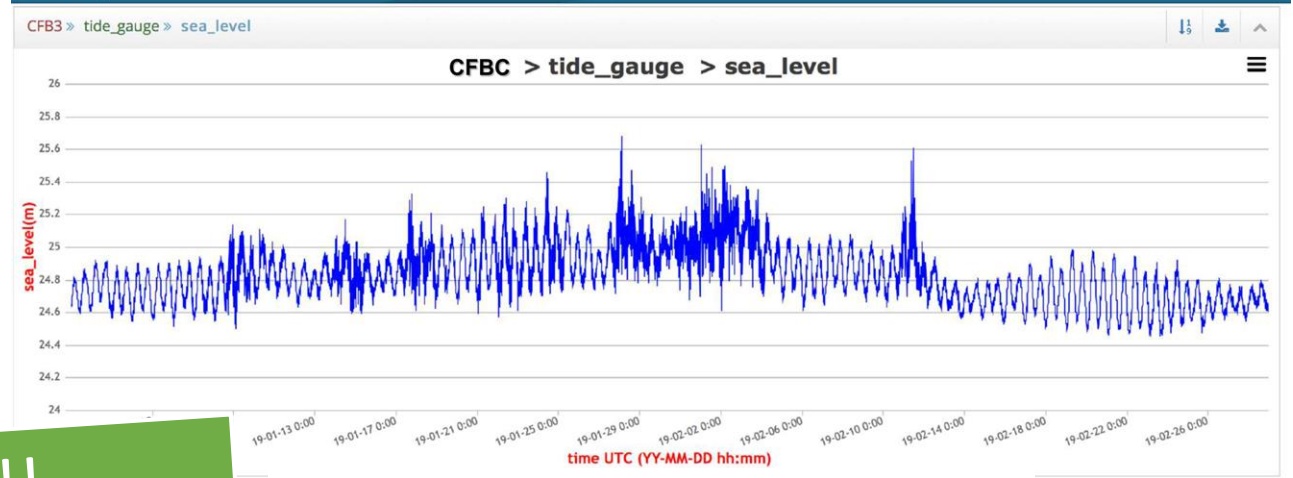

Thank you for your attention!!

http://portale.ov.ingv.it/medusa

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