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# Tide Station and GPS buoys

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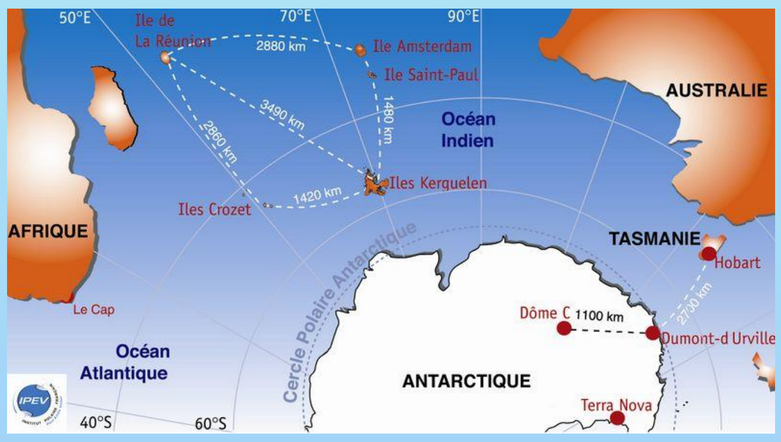
## The NIVMER program and the ROSAME network

The tide gauge network "**ROSAME**" ("Réseau d'Observation Subantarctique et Antarctique du niveau de la MEr" - Network of Subantarctic Observation and Antarctic sea level) was established in the early 1990s. This network has been labelled as Observation Service by INSU in 1997 (responsible OSU : Observatory of Midi-Pyrénées). The ROSAME Service is a French contribution to the international GLOSS (Global sea level observing system) observation network of the long-term sea level evolution.

The "**NIVMER" program** (sea level) helps to exploit the sea observation at a global scale, in the study of the climate dynamics. Tide stations measuring sea level have been installed in the field of French Southern and Antarctic Lands ("photo right: TAAF – Terres Australes et Antarctiques Françaises"). The program focuses on observing the secular variations of the sea level and provides minute real time data for Tsunamis prevention network. The observations of the sea level are performed with two types of material: coastal tide station and autonomous mooring of the tide recorders.

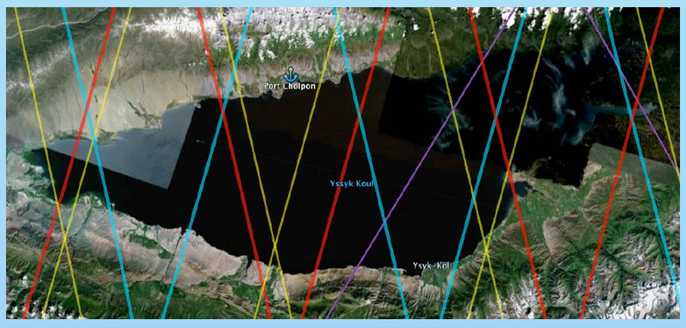
The NIVMER main objectives are:

- Recording data in hostile environment
- Contributing to the validation and the exploitation of the satellites altimetric height measurements, including tide studies,
- Controling the Antarctic Circumpolar Current variability




## The FOAM project

FOAM (From Ocean to inland waters Altimetry Monitoring) is a project funded by CNES that aims to perform calibration and validation of the altimetric measurement systems over both ocean and inland water. Continuous monitoring over ocean is performed in operational sites like Corsica that is equiped with tide recorders and permanent GPS stations for in situ measurements.
FOAM also uses several geodetic sites for single point verification over rivers and lakes (photo down: satellites tracks above lake Issykkul in Kyrgyztan) and non-dedicated sites like Vanuatu and Kerguelen islands by using their own existing instrumentations.




## Technical Description

### The tide recorder

The tide recorder is equipped with different sensors: a **pressure sensor** (Paroscientific 6000-45A) coupled to a **conductivity/temperature sensor** (Aanderaa 3919A). The tide recorder is controlled by an electronic board driven by a low drift clock. It may have its own power supply internal battery. The integration time of the pressure sensor and the sampling period can be adjusted. The average consumption under 7.2V is: 6µA standby, 54mA sampling.
A reference level for the absolute measurement of the water height is determined by a leveling process with respect to a known geodetic point, or with respect to the position relative to the sea surface given by a GPS buoy.

*Inside of the tide recorder and multiparameter version*

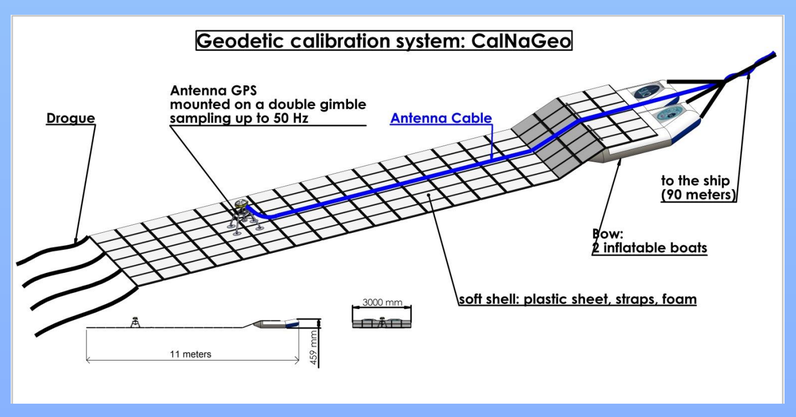
### Available versions

- Coastal station with Campbell CR1000 acquisition unit, GPS and Argos data transmission
-fibre or titanium housing
-tide recorder in stand-alone mode on bottom mooring, 3 years endurance for a 20 minutes sampling period
-multi sensor station (fluorometer wetlabs ECO FLS, oxygen Aanderaa 3835, light sensor PAR LI192SA)
-wave recorder (programmable burst interval and number of samples per burst), 2 years endurance with 4 burst sessions per day and 20 ' tide period

### The towed GPS buoy: CalNaGeo

The system consists of a geodetic GPS on a soft shell (to avoid artefacts due to rigids structures) to follow the sea surface. The antenna is gimbaled and towed (up to 15 knots) by a ship. This is used for in-situ CAL/VAL calibration of altimetric height (SSH for ocean surfaces) and waves monitoring (up to 50 Hz).

These developments are founded by CNES (Centre National d'Etudes Spatiales) through the FOAM project (From Ocean to inland waters Altimetry Monitoring).

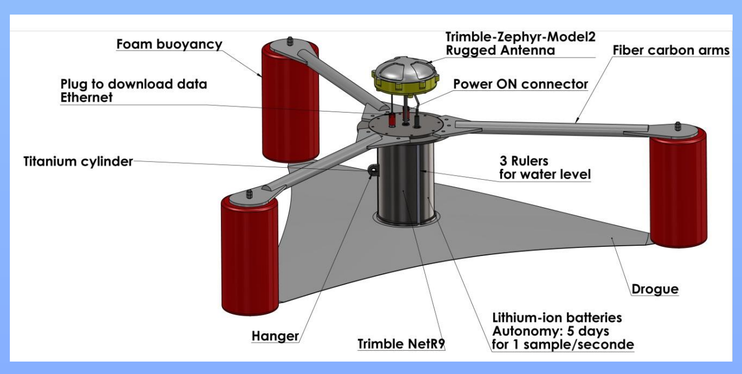


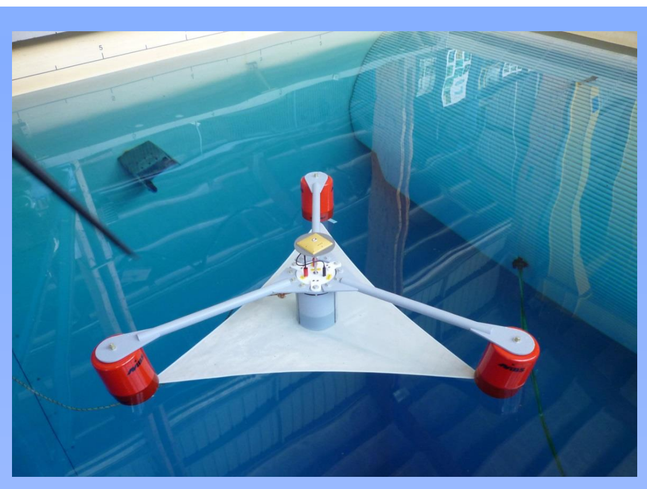

*Drawing and towed GPS buoy at sea*

### The GPS buoy

The buoy consists of a geodetic GPS (TOPCON GB1000) with an antenna (PGA1-GP) on a surface float coupled to a GPS base station located on land above a geodetic point. It allows to define an absolute level of the sea :

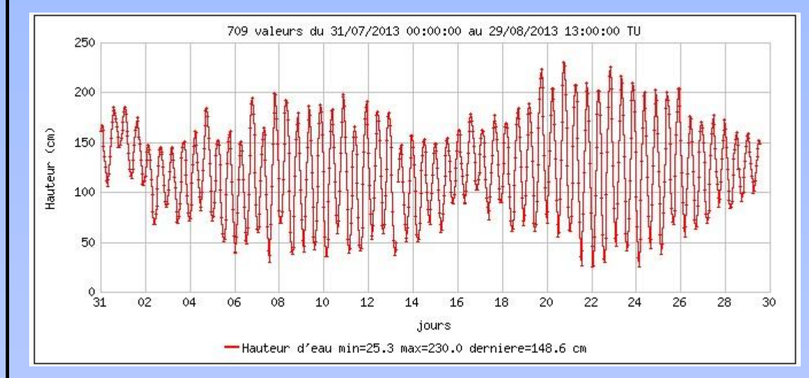
-Acquisition of high-frequency data (1-10 Hz)
-Sub-centimeter accuracy in post-processing (associated with a base station)
-Ability to deploy in the open ocean in PPP mode
-Measurement of the position of the free sea surface to calibrate altimetric satellites (JASON, ENVISAT, SENTINEL3A,3B, SARAL/ALTIKA, TOPEX/POSEIDON)
-weight 20Kg, 2m diameter
-a floating drogue is tied up at the 3 ends and the center of the buoy to improve stability.



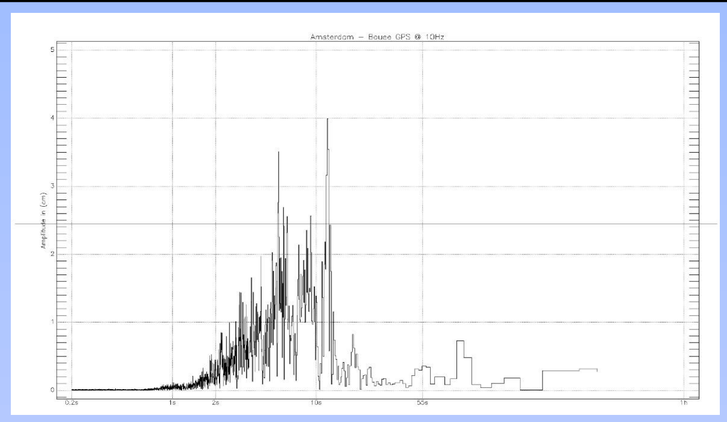
*Drawing of the buoy and launch in the test basin*

Sea level variation at Kerguelen , argos reception




Towed GPS buoy at sea

10 Hz buoy spectrum on Amsterdam island, wave signal [2,12s]

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