

Existing observing systems integrated

Final version June 2023
Deliverable number 5.5.2.

Project Acronym	STREAM
Project ID Number	10249186
Project Title	Strategic Development of Flood Management
Priority Axis	2 – Safety and Resilience
Specific objective	2.2 – Increase the safety of the Programme area from natural and man-made disaster
Work Package	5
Work Package Title	Pilot projects
Activity Number	5.5.
Activity Title	Puglia Pilot Sites
Partner in Charge	LP
Partners involved	PP5, PP7
Status	Final
Distribution	Public

Table of contents

Introduction	4
1. The governance of marine monitoring: an overview	5
2. The National Tide Gauge Network (RMN) and the existing sensors	6
3. Monitoring stations of the National Tide Gauge in Apulian territory	7
4. The National Ondametric Network (RON): the measuring station in Puglia	10
5. The Coastal Video Monitoring Experimental System	11
6. Automatic Monitoring of the Sea in Mar Grande (TA)	12
Conclusion	14

Introduction

The STREAM project deals with territorial challenges connected to flooding in the different Adriatic regions. STREAM pilot sites involved in the modelling and forecasting activities greatly differ for morphological characteristics, potential flood and erosion hazards and vulnerabilities. Using the existing observation and monitoring systems, which provides data in real time, in various locations within the Puglia Region, the protection against possible floods is facilitated and more effective.

1. The governance of marine monitoring: an overview

In Italy, the monitoring activities related to the marine environment are carried out by ISPRA, the National Institute for the Environment Protection and Research, established by Law no. 133/2008 – converting with amendments Decree Law no. 112 of 25 June 2008. It plays a crucial role in monitoring extreme natural events, potentially dangerous for the territory and human beings. In fact, together with the National Institute of Geophysics and Vulcanology and the Civil Protection Department, ISPRA is part of the National Alert System for Tsunamis (SiAM) generated by earthquakes in the Mediterranean Sea. ISPRA is responsible for the collection and unification at a national level of the data on the state of the coasts, real-time data collection referred to maritime climate, their processing and dissemination, and coordinates the National System of Environmental Protection (SNPA). Moreover, within the framework of the SNPA, criteria, methods and standards for data collection, analysis and consultations are adopted.

In operative terms, the coordination and management of the activities for marine and maritime climatology and monitoring, including the detection and measurement of anomalous waves, are specific tasks of the ISPRA's **National Centre for Environmental Characterisation and Coastal Zone Protection and Operational Oceanography (CN-COS)**. It deals with the assessment of the state of the evolution of environmental matrixes induced in the coastal strip by the state and dynamics of the sea, by the transport and dispersion of sediments and contaminants because of human activities in the coastal area and waters, marine coastal and transitional waters, and lagoons. The National Centre, by collaborating with the Agencies of the National System for Environmental Protection - SNPA - also ensures the innovative development of methods, tools, and operational procedures. Furthermore, it monitors the physical state of the sea and, using innovative systems, carries out systematic survey of quantities referred to the marine and maritime climate, and controls, processes, analyses and disseminates and reports the data and information collected. The Centre is also responsible for real-time monitoring: it designs, implements, manages, and maintains national tide gauge and wave gauge networks and systems for real-time monitoring of the meteorological and oceanographic characteristics of the Italian seas, by integrating them with regional and local features. In particular, it plays an organizational role as well, managing the meteorological-marine monitoring networks including the National Tide Gauge Network (RMN), fundamental for real time monitoring of tsunami waves, providing for the collection, validation and statistical processing of the data collected by the national networks and systems, promoting their coordination with other tide gauge and wave gauge survey activities promoted and managed within SNPA and administrations at regional and local level.

2. The National Tide Gauge Network (RMN) and the existing sensors

The National Tide Gauge Network includes 36 measurement stations, i.e. the tide gauges, installed within the ports throughout the Italian territory - therefore also in Apulian region - and in the smaller islands, namely Lampedusa, Ginostra, Elba and, with reference to the Apulian region, **Tremiti islands**, as shown in the picture below.



The purpose is to monitor some weather parameters such as wind and atmospheric pressure, and of the sea level fluctuations due to the astronomical tides cycle, weather as in the case of storm waves, volcanic eruptions etc.

The sensors used to monitor the sea level area of different types, and the comparison of measurements taken by these stations with the various types of sensors ensures maximum precision and continuity of the data series. Namely, the n. 3 types of sensors used are:

- Floating level sensor, which is a mechanical sensor;
- Radar, which is a microwave sensor with a millimetre accuracy;
- Ultrasonic sensor, used as a historical reference for the collected data, and also for the calibre of the other tools, within the RMN, since 1998.

The operation of the National Tide Gauge Network foresees an autonomous local system to store and manage the data collected in each of the 36 measurement stations, including a real-time data transmission system UMTS, a device serving to receive, process and file data installed at the headquarters of CN-COS in Rome, which allows to send data in real-time to the Operations Room of the Civil Protection Department and to the Operations Room of the CAT-INGV.

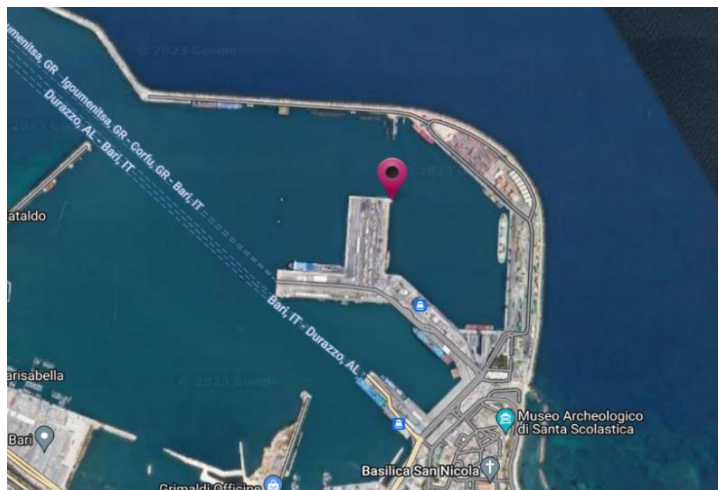
In the night between 26 and 26 October 2018, Puglia region was involved in one of the most important measurements by the RMN monitoring system, during the tsunami event observed along the Ionian coast of Puglia, Calabria and Sicily as a consequence of the strong seismic event recorded in the Ionian Sea with epicenter located near the Greek island of Zakynthos.

3. Monitoring stations of the National Tide Gauge in Apulian territory

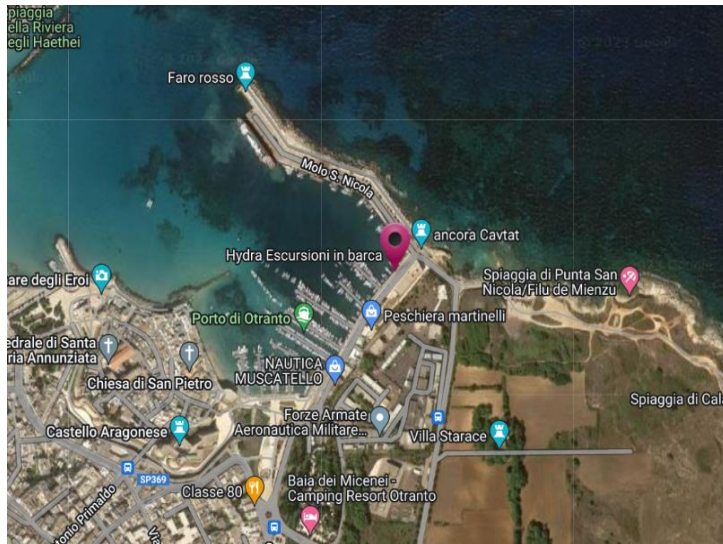
As it is easy to find on the ISPRA website at the link <https://www.mareografico.it/en/homepage.html> which also offers an interactive map, the comparison stations and parameters as well as the data archive, the monitoring stations included in the National Tide Gauge Network present in Puglia are n. 5. Each station equipment includes air temperature and relative humidity transducer, digital barometer, float hydrometer, radar level transducer, staff gauge, ultrasonic anemometer, water temperature transducer.

The monitoring stations of the National Tide Gauge Network in Puglia are the following:

1. **BARI.** The station is located in Porto Traghetti, near warf 12. Coordinates: 41° 08' 24.74"N LAT; 16° 51' 57.72"E LON.



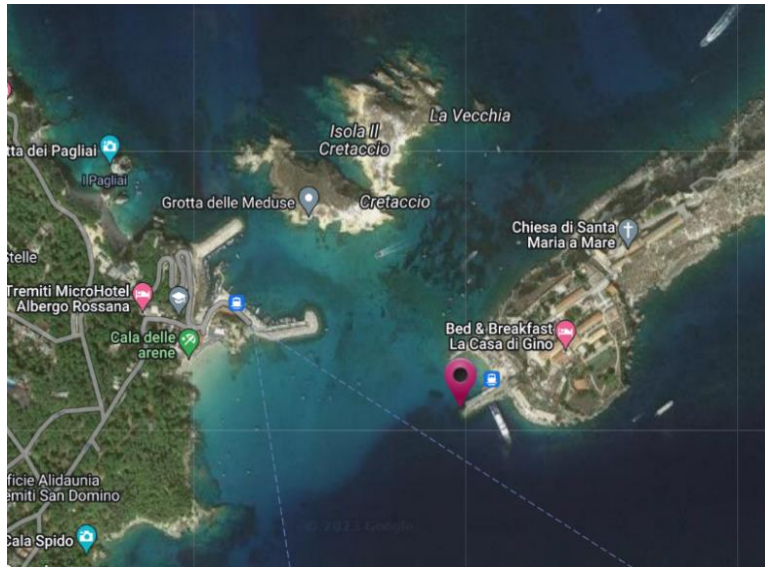
- OTRANTO.** The station is located inside the Capitaneria di Porto palace. Coordinates: 40° 08' 49.74"N LAT; 18° 29' 49.52"E LON.



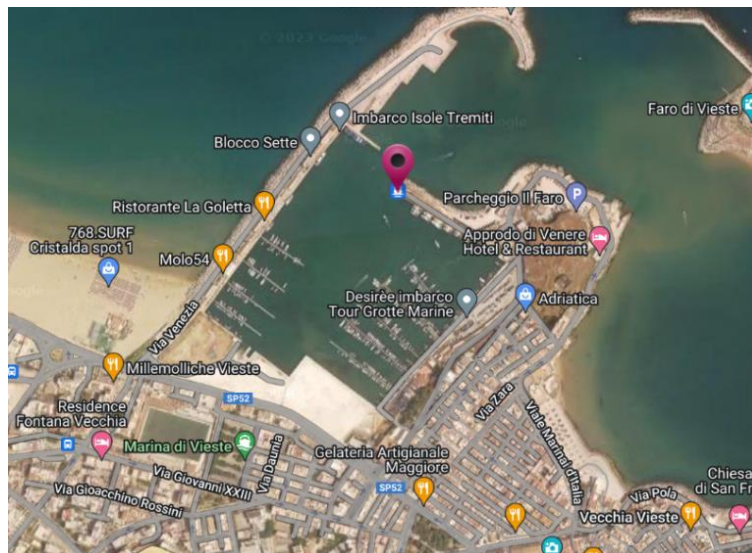
- TARANTO.** The station is located near St. Eligio wharf. Coordinates: 40° 28' 32.17"N LAT; 17° 13' 25.55"E LON.



4. **TREMITI ISLANDS.** The station is located on the terminal part of the dock for the ferry of the Isola di S. Nicola (Tremeti Islands). **Coordinates:** 42° 07' 07,97"N LAT; 15° 30' 05,64"E LON.

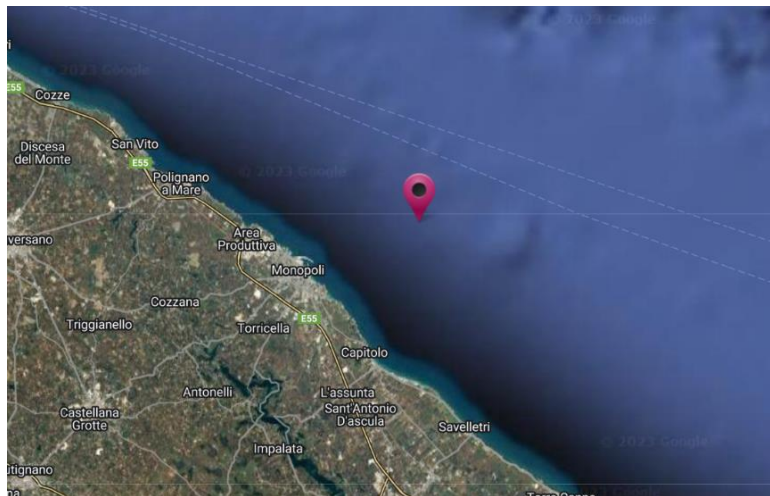


5. **VIESTE.** The station is located inside the seaport. **Coordinates:** 41° 53' 17.10"N LAT 16° 10' 37.24"E LON.



4. The National Ondametric Network (RON): the measuring station in Puglia

The National Ondametric Network is the wave detection system of ISPRA; in Puglia Region is located one of the monitoring stations of the network, namely in **Monopoli**; the station equipment foresees an ondametric buoy. The Monopoli ondametric buoy is located offshore Monopoli town, nominal depth 85m, coordinates 40° 58' 30"N LAT; 17° 22' 40"E LON.



The dedicated webpage displays the comparison configuration between the different stations, located in Alghero, Ancona, Crotona, La Spezia, Mazara del Vallo, Ponza and Ragusa, selecting parameters such as hydrometric level, water temperature, air temperature, precipitation, relative humidity, atmosphere pressure, wind direction and speed, mean period, peak period, significant wave height, average wave direction, wind speed and direction, wave height and direction, peak and average periods, significant height and peak period.

5. The Coastal Video Monitoring Experimental System

The Coastal Video Monitoring Experimental System for “near real time” monitoring of the coastal morphological state is a part of the remote coastal survey techniques capable of providing continuous and quantitative information on the processes of coastal dynamics and coastal flooding. “near real time” means within 24 hours of video acquisition. Thanks to the installation of video-monitoring systems along natural sandy coasts, where there are no rigid defence works, it is possible to observe and monitor the autonomous dynamics of the beach/seabed system.

As explained in the dedicated website <https://videomonitoraggio.isprambiente.it/> the first experimental activities were later implemented in the System Action for the “Mapping of coastal protection and resilience in sandy coasts belonging to protected areas”, promoted by the national park authorities and marine protected areas, included among the activities aimed at conservation of biodiversity.

One of the experimental sites, located along portions of sandy coasts included in protected natural areas and, in order to make comparison, along sandy coasts with a high touristic pressure, is located in Puglia region, in **Rodi Garganico** (FG), Gargano National Park. The other sites are located in Sabaudia (LT); Circeo National Park, Latina, Circeo National Park; Pineto (TE), Torre del Cerrano protected marine area; Terracina (LT); Senigallia (AN).

The data collected thanks to the video-monitoring systems (such as shoreline position, usable area of the beach, placement, number and shape of submerged bars, swash oscillations, presence of potentially dangerous currents for bathing, area of the beach submerged during storm surges, trends of emerged and submerged morphological elements, numerical modelling support data) depending on the management, processing and analysis procedures used, can provide information in “Near Real Time”, as already mentioned, or in delay mode, and therefore available at a specific time interval, e.g. monthly, quarterly, yearly.

In Rodi Garganico a control unit is installed at the “Mauro del Giudice” Higher Education Institute, at an altitude of 54m above sea level, and it is operative since December 2018.

The area which is monitored by this control unit is the portion of the sandy coast next to the Gargano National Park.

In technical terms, the system consists of:

- industrial pc card with 2Gb memory bank,
- ssd storage unit,
- 3G modem,
- digital video cameras with CMOS sensor and equipped with 8 and 12mm fixed lenses,
- 5-12v power supply module.

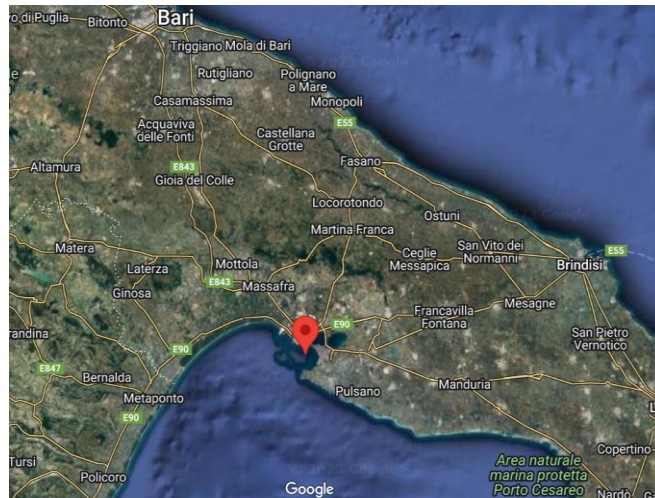
6. Automatic Monitoring of the Sea in Mar Grande (TA)

In the Mar Grande of Taranto, an automatic monitoring system of the sea has been installed within the activities of the RITMARE (Italian Research for the Sea) flagship project, which is one of the flagship projects of the National Research Program funded by the Ministry of University and Research. In particular, RITMARE, with a budget of 250 million euros, co-funded by public and private resources, is the Italian leading national marine research project for the period 2012-2016, gathering the scientific community and the major industrial groups involving different competences in an integrated work on marine and maritime issues.

The Project is articulated in sub-projects, namely:

- Maritime Technologies for the development and construction of a Demonstration Vessel
- Technologies for Sustainable Fishing
- Planning of the Maritime Space in Coastal Waters
- Planning of the Deep Marine Environment and the Open Sea
- Observation System for the Marine Mediterranean Environment
- Research, Training and Dissemination Structures
- Interoperable Infrastructure for the Observation Network and Marine Data.

In this framework, within RITMARE flagship project activities, the research group of the Civil, Environmental, Building Engineering and Chemistry Department (DICATECh) of the Technical University of Bari (research unit of the Co.N.I.S.Ma.) led by prof. Michele Mossa, has installed a system in the Mar Grande of Taranto (Italy) for the monitoring of sea currents, waves, water quality and weather.



Considering that the system is installed on a seamark managed by the Taranto Port Authority (coordinates: 40°27,6' N; 17°12,9' E.) a special agreement is in force between the DICATECh and the Taranto Port Authority. Besides the RITMARE project, this installation of the monitoring system has been also funded by the Italian National Project PON R&C 2007-2013.

The technical features of the monitoring system in Mar Grande include:

- Basic system-integration on seamark, including solar panels, 12V rechargeable batteries and electronics housing;
- Remote control and management module-LISC MASTER (LOGIC INTELLIGENT SYSTEM CONTROL), completed by: Firmware “Event Detector”, Internal non-volatile memory, capacity 1 GB, Interfacing meteorological sensors, 2 level interfacing options for LISC MASTER, Orientation sensor, Pitch and Roll;
- Communication system: GSM/GPRS remote communication module;
- Control system, including video camera for sea state display and surveillance;
- Data visualization software ROCS- Remote Oceanographic Control System software for remote control, management, data download, visualization and achieving;
- Weather sensors: Gill MetPack Pro Weather Station including sensors such as wind speed and direction, temperature and relative humidity of the air, atmospheric pressure, net solar radiation, automatic calculation of the dew point temperature etc.;
- Oceanographic sensors in the water column: probe for conductivity, temperature, pressure and dissolved oxygen measurements;
- Combined Fluorometer and Turbidimeter;
- Fluorometer (until December 2019);

Profiler for current and wavemetry measurements multidirectional.

Conclusion

In Italy, the monitoring activities related to the marine environment are carried out by ISPRA, the National Institute for the Environment Protection and Research, together with the National Institute of Geophysics and Vulcanology and the Civil Protection Department. Within the deliverable, the existing monitoring systems in the area of the Puglia Region are described - The National Tide Gauge Network, The National Ondametric Network, The Coastal Video Monitoring Experimental System and an automatic monitoring system of the sea in Mar Grande.