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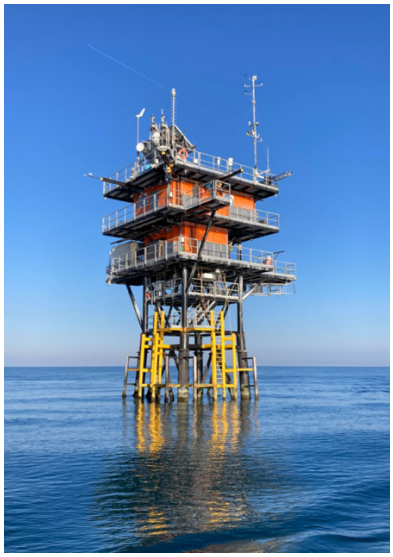

"ACQUA ALTA" OCEANOGRAPHIC RESEARCH TOWER

PIATTAFORMA DI RICERCA OCEANOGRAFICA "ACQUA ALTA"

Adriatic Sea, Italy
45.314° N, 12.508° E

- BULLETTIN 2024

With the contribution of: *Alvise Benetazzo, Francesco Barbariol, Mauro Bastianini, Alessandro Bergamasco, Fabrizio Bernardi Aubry, Luciana Bertotti, Andrea Bonometto (ISPRA), Federica Braga, Vittorio Brando, Silvano Buogo (CNR-INM), Luigi Cavaleri, Silvio Davison, Luca De Nat (CVN), Sandra Donnici (CNR-IGG), Federico Falcini, Christian Ferrarin, Irene Guarneri, Tihana Marčeta, Damoon Nazarpour, Alvise Papa (Comune di Venezia), Angela Pomaro, Andrea Sabino, Marco Sigovini, Luigi Tosi (CNR-IGG), Valerio Volpe (Provveditorato OO.PP. Veneto, Trentino Alto Adige e Friuli Venezia Giulia), and Davide Tagliapietra**

*Davide Tagliapietra passed away prematurely on 09/15/2023

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The anomaly of air temperature

According to the Copernicus Climate Change Service (C3S), 2024 was the warmest year on record globally, with the average temperature reaching 1.6°C above pre-industrial levels. This marks the first time a calendar year has exceeded the 1.5°C threshold set by the Paris Agreement. The global average surface air temperature was 15.1°C, surpassing the previous record set in 2023 by 0.12°C. This unprecedented warming has led to significant climate events, including floods, heatwaves, and wildfires, underscoring the urgent need for decisive action to mitigate climate change. In the North Adriatic Sea, the earliest signs of how unusual 2024 was to become began to emerge in February, when air temperature monthly anomalies relative to 2003-2022 surpassed +2°C at "Acqua Alta" (Fig. 1). During the summer of 2024, monthly air temperature anomalies above +2°C became regular in July and August. Yearly, the air temperature anomaly was of +1 °C. Only November had a negative anomaly with respect to the reference.

Data: https://www.comune.venezia.it/it/content/3-piattaforma-ismar-cnr

Link: https://climate.copernicus.eu/copernicus-2024-first-year-exceed-15degc-above-pre-industrial-level?utm_source=chatgpt.com

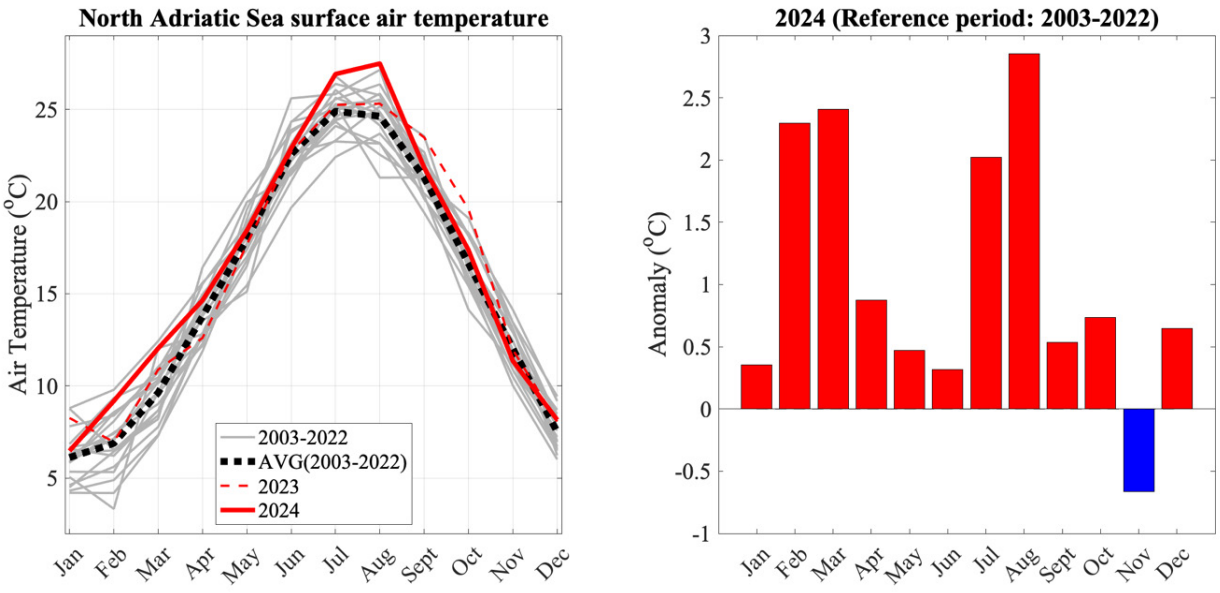

Figure 1 | (left) Trend of air temperatures, in the form of monthly averages, recorded at the "Acqua Alta" tower. Year 2024: solid red curve; Year 2023: dashed red curve; Years 2003-2022: grey curves; Average of years 2003-2022: dashed black curve. (right) Monthly anomaly relative to the reference period 2003-2022.

The record of mean sea level

The mean sea level of 2024 was 43.1 cm, the highest value ever recorded from “Acqua Alta" since the beginning in 1974 of sea level measurements. The annual mean value reflects the anomalously high mean level of the North Adriatic Sea that occurred for a large part of the year, even during the spring and summer months as shown in Fig. 2. It is interesting to highlight that the monthly mean levels recorded from March to October 2024 correspond to the maximum values ever observed. This condition determined the occurrence of 14 high-sea level events with peak values above 110 cm, observed even in the absence of significant meteorological events. On 18 October 2024, the maximum annual value of 124 cm was measured, due to a moderate Sirocco event. We also highlight that, in 2024, 42 events with peak values above 100 cm were recorded, and the MOSE barriers were operational on 27 events. Furthermore, in 2024 the sea level remained above 80 cm for more than 800 hours (the second year is 2023 with about 600 hours). In conclusion, 2024 was characterised by a higher-than-average sea level despite the almost absence of relevant storm surge events.

Data: https://www.comune.venezia.it/it/content/3-piattaforma-ismar-cnr

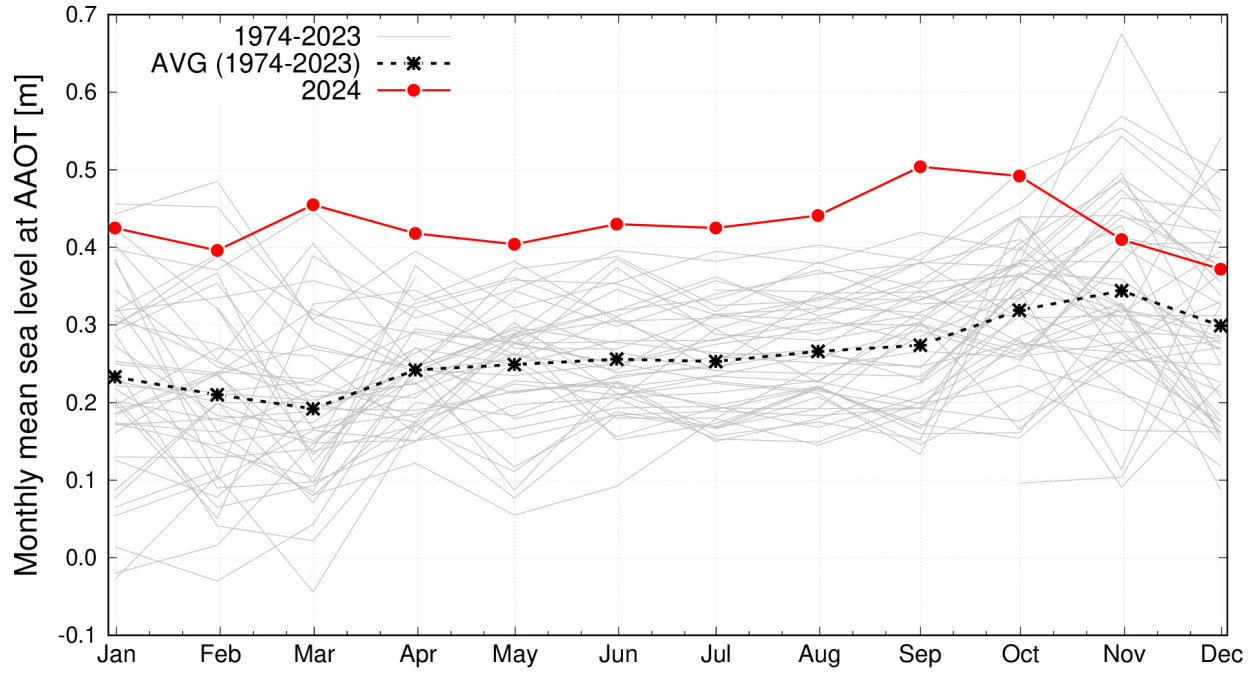

Figure 2 | Monthly-mean sea level recorded at the “Acqua Alta” tower. Year 2024: red curve; years 1974-2023: grey curves; average of 1974-2023: dashed black curve.

November negative anomalies of wind and waves

November is among the months, if not the month, when the strongest winds and highest waves are usually expected over the year in the North Adriatic Sea, especially when Sirocco wind blows over the whole basin, forced by westerly atmospheric flows entering the Mediterranean Sea or by synoptic-scale cyclonic systems. Monthly wind and wave statistics at the "Acqua Alta" tower (from long-term measurements by onboard anemometer and wave gauge managed by Venice Municipality) confirm November peaks in the average mean and 99th percentile wind speed U and significant wave height H_s (Fig. 3). In 2024 (red dots in Fig. 3), November wind and waves were considerably milder than in the past (2003-2023 reference period) with mean and 99th percentile of U and H_s below the lower bound of the long-term statistics confidence interval (average +/- one standard deviation). Other 2024 months were characterised by milder-than-average or stronger-than-average wind and waves conditions (e.g., February and August or October and December, respectively); in November, the negative anomalies (2024 differences to reference period averages) were -1.06 m/s and -4.0 m/s, for mean and 99th percentile wind speed, and -0.23 m and -0.91 m for same statistics of H_s. This behavior was not a North Adriatic Sea unicum, as the negative anomaly of wind and waves in November extended to the whole western and central Mediterranean Sea area, with small exceptions. This is shown in Fig.4 through the prevalence of negative anomaly in the November 99th percentile U and H_s from model reanalyses, covering not only the Adriatic Sea but all the seas that are typically interested by Autumn cyclonic systems causing, for instance, Mistral in the Gulf of Lion and Sirocco in the Adriatic Sea. The causes of these remarkable anomalies, here just conjectured, deserve a more in-depth investigation.

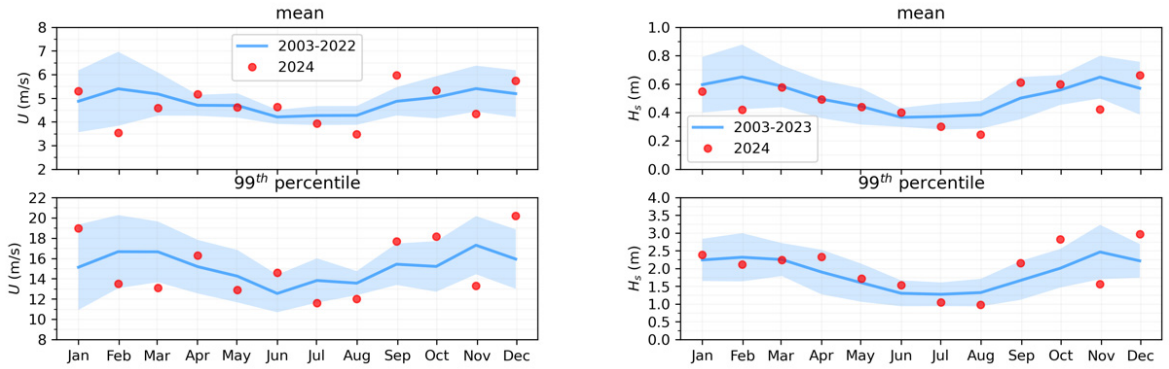

Figure 3 | Wind (left) and waves (right) at "Acqua Alta" in 2024, compared to 2003-2023 (2003-2022 for wind) climatology. Left: monthly mean and 99th percentile of wind speed U. Right: monthly mean and 99th percentile of significant wave height H_s. Solid curves represent the 21-year average and shaded regions the standard deviation above and below the average.

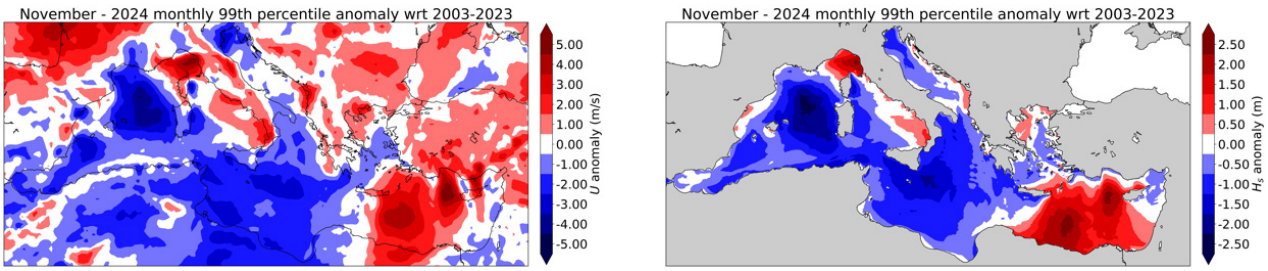

Figure 4 | November 2024 extreme (99th percentile) wind and wave anomalies in the Mediterranean Sea, compared to the 2003-2023 climatology. Left: 99th percentile anomaly of U from the ERA5 atmospheric model reanalysis. Right: 99th percentile anomaly of H_s from the CMEMS wave model reanalysis.

45 years of directional wave data

A thorough analysis of the extended directional wave dataset recorded at the "Acqua Alta" Oceanographic Tower in the North Adriatic Sea, spanning 45 years, was performed and the related dataset made accessible. Managed by the Institute of Marine Sciences of the National Research Council of Italy, this dataset enables the description of the wave climate in the region and provides a source for the identification of trends and links with large-scale climate patterns. The available data spans distinct periods, each characterized by different measuring instruments and methodologies. With the due changes of instruments and recording apparatus, wave data were continuously collected and disseminated originally as a 39-year-long homogeneous time series. Detailed analysis of the climate implications that could be inferred from this source of information was provided in previous studies. In the subsequent years, while measurements were continued over time, new, more accurate and complete recording systems were added. In addition to extending the timeseries, this led to an a posteriori additional revision and correction of part of the data, offering higher accuracy.

The objective is to extend the whole time series until May 2024, for an overall duration of 45 years. The updated dataset, complemented with also modelled data for non-recorded extreme events, provides data at 15-minute intervals extending the information previously made available on a three-hourly basis. Current studies are addressing the additional information provided by the extended dataset in offering valuable insights into the wave climate of the North Adriatic Sea, highlighting long-term trends and the impact of climate change.

Reference: Cavaleri, L., Pomaro, A., Bertotti, L. *et al.* 45 years of directional wave recorded data at the Acqua Alta oceanographic tower. *Sci Data* **12**, 224 (2025). https://doi.org/10.1038/s41597-025-04541-8

Data: Cavaleri, Luigi; Bertotti, Luciana; Bonometto, Andrea; Conchetto, Matteo; De Nat, Luca; Papa, Alvise; Pomaro, Angela (2025): 45 years of directional wave recorded data at the Acqua Alta Oceanographic Tower [dataset]. *PANGAEA*, https://doi.pangaea.de/10.1594/PANGAEA.974074

Air-sea interactions during a sudden, intense Bora event

On 16 April 2024, a low-pressure trough of Atlantic origin fed by cold polar air, triggered a sudden period of instability over the northern Adriatic region. This resulted in very intense, cold, northeasterly Bora winds, causing air temperatures to drop by as much as 10 °C across the region, bringing modest rainfall at lower altitudes and snow above 1600 meters. The initial phase of this event is illustrated by the synoptic wind field from the ECMWF reanalysis model ERA5, shown in Fig. 5 (top-left panel). At "Acqua Alta", the measured wind speed began to rise rapidly at 16 local time. By 17, wind gusts had surged to over 25 m/s, before gradually decreasing during the rest of the day. This intense burst of wind led to a rapid growth of wind-driven waves during the mid-afternoon, which reached a maximum significant wave height (H_s) above 2.5 meters by 20 local time, as recorded by an Acoustic Doppler Current Profiler (ADCP) ultrasonic probe located on the sea floor. An interesting feature of the ADCP data is the ability to observe also bubble plumes, generated by the breaking surface waves, through the backscatter intensity of the vertically-emitted acoustic signal as a function of depth which allows the identification of the bubble penetration depth. Indeed, this represents a key variable for the efficiency of exchange of gases, such as CO_2, between the atmosphere and the ocean interior and is rarely measured in the ocean. The three snapshots in the bottom panels of Fig. 5 illustrate how the bubble plumes, directly linked to the breaking wave height, deepen as the significant wave height increases. By the end of the event, the bubble plumes reached depths of nearly 15 meters. The combination of these deep-penetrating bubbles and the sinking of surface waters, caused by atmospheric boundary layer cooling (with an initial air-seawater temperature difference ΔT_{aw} of about 7 °C), contributed to the rapid mixing and cooling of the ocean's bottom layers, as may be deduced by the reduction of the temperature difference between the surface and the bottom layers (ΔT_{sb} dropped from 3.6 °C to 1.8 °C) in a short period.

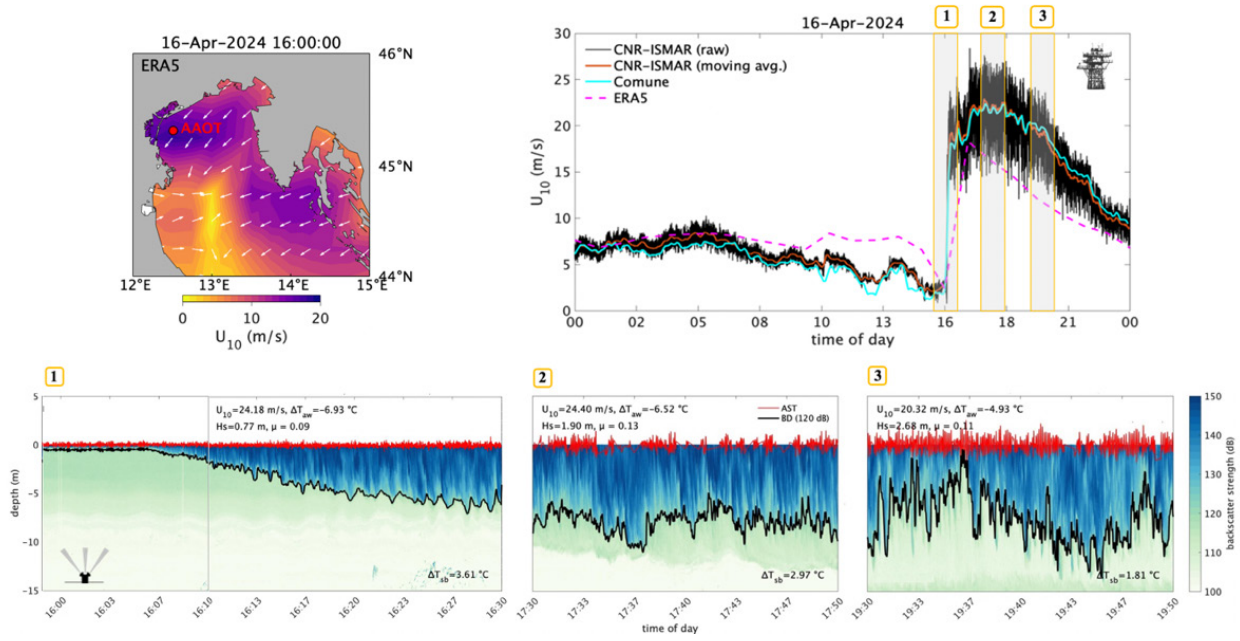

Figure 5 | Wind and wave conditions during a strong Bora event on 16 April 2024. (top-left) ERA5 model field of wind speed (colour shading) and direction (white arrows) during the peak of the event. The position of "Acqua Alta" is shown with a red marker. (top-right) Comparison of time series of wind speed measured using an ultrasonic 3D anemometer (solid black and red curves) and a 2D mechanical anemometer (solid cyan curve), as well as the time series obtained from ERA5 (dashed magenta curve). (bottom) Snapshots of the echo backscatter strength (colour shading) and surface elevation (AST, solid red line) measured at different time intervals from an up-looking ADCP. The air bubble penetration depth (BD, solid black curve) is also shown.

Monitoring CO_2 exchanges between the atmosphere and the sea

In 2024, “Acqua Alta” was equipped for the first time with continuous measurements of atmospheric and surface water CO_2 partial pressure (pCO_2), providing valuable data for monitoring the complex seasonal CO_2 dynamics of the Northern Adriatic Sea, which are influenced by a combination of physical and biogeochemical drivers. Given the pivotal role that wave breaking plays in the exchange rate of gases between the atmosphere and the ocean, additional measurements on surface waves and penetration depth of entrained air bubbles are also collected routinely, improving the accuracy of air-sea CO_2 flux estimates. Fig. 6 shows an example of a set of atmospheric and oceanographic measurements at the onset of autumn 2024, during several meteorological events with wind speeds of 15 m/s or higher and significant wave heights up to 3 m (top-left panel). Most of these events were associated with a rapid drop in air temperature, which contributed to the cooling of the surface waters (centre-left panel). As a result, the temperature-driven CO_2 partial pressure of the surface waters also decreased gradually, going from near-equilibrium conditions at the end of summer to a substantially lower concentration of CO_2 compared to the atmosphere at the end of the displayed period. Indeed, during the strongest event on 3 October 2024, the combination of the lower CO_2 partial pressure in seawater compared to the atmospheric level, indicating that the ocean acts a sink for atmospheric CO_2, and the turbulent mixing of the upper layers driven by strong winds and intense wave breaking led to estimated CO_2 fluxes (right panel, positive upwards) from the atmosphere to the ocean of more than 30 mmol m^2 d^{-1} (the exact value depends on the parametrisation used), with the bubble-mediated contribution representing more than 30% of the total flux at the peak of the event.

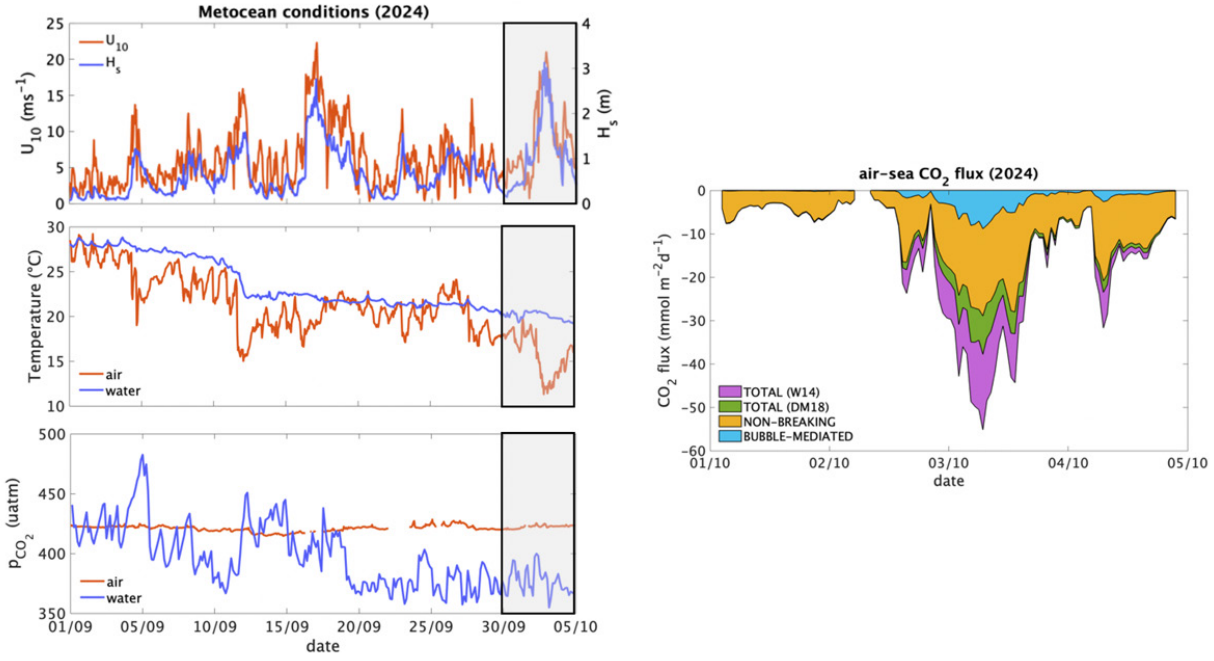

Figure 6 | Metocean conditions and air-sea CO_2 fluxes (Sep-Oct 2024). (top-left) wind speed (U_{10}, red curve) and significant wave height (H_s, blue curve). (centre-left) air temperature (red curve) and water temperature at -3 metres below MSL (blue curve). (bottom left) CO_2 partial pressure (pCO_2) in air (red curve) and water at -3 metres below MSL (blue curve). (right) total air-sea CO_2 flux computed using a wind-only formulation (W14, purple shaded area) and a wind and wave formulation (DM18, green shaded area), as well as the two non-breaking (yellow shaded area) and bubble-mediated (cyan shaded area) contributions.

Tara EUROPA expedition

During Tara EUROPA expedition (https://fondationtaraocean.org/en/expedition/tara-europa/), within the Leg from Ancona (IT) to Kotor (MT) (April 2023 – July 2024), the schooner "Tara" carried out a station near "Acqua Alta". Tara EUROPA is the ocean part of a larger program, TREC – Traversing European Coastlines (https://www.embl.org/about/info/trec/) –, whose main goals are to: (*i*) study the invisible biodiversity at the land-sea interface across 19 European countries from Finland to Greece, and understand the effect of environmental changes on the interactions and evolution within and between ecosystems (soil, sediments, air, water); (*ii*) understand the impact of human activities (pollution and global change) on marine coastal biodiversity and ecosystems; (*iii*) share systems bio/ecology knowledge and advanced technologies with scientists and the general public from all coastal European countries. In this framework, an international team on board Tara realize the sampling of coastal waters, at the same time and sites where an EMBL team realizes the sampling of shallow water, sediments, and soils. The sampling sites are pre-selected along the coastline or in estuaries, and represent either pristine or human-impacted (agriculture, cities and ports, pollution) conditions. There is usually a single Tara Ocean station at regular coastline sites, and 2 to 3, onshore to offshore stations in estuary settings, allowing to characterize environmental gradients from brackish to marine waters, with a putative decreasing impact from land biochemistry. The positions of the coastal stations are pre-adjusted based on historical remote-sensing (ocean color) and oceanographic (bathymetry, Hydrographic) data, and can be slightly modified depending on real-time remote sensing data and weather/navigation conditions. Overall, the Tara Europa stations represent a patchwork of coastal water masses with different degrees of impact from the land ecosystems. At each Tara Europa station, the team onboard realizes a complex suite of at least 60 protocols and collects c.a. 100 samples stored in appropriate conditions for future analyses in laboratories. These protocols allow characterisation of the biological content and diversity present in the water (from viruses to animals, from genomes, expressed genes, metabolites, proteins, to cellular and organismal features), together with contextual physical, biophysical, and chemical and biochemical properties. The Tara Europa "Acqua Alta" station represented a unique opportunity of matchup and intercalibration of bio-optical, radiometric and biodiversity data. Measurements and water samples were taken about five hundred meters from the tower on 5 June 2024. All protocols were carried out, with a match-up with Sentinel3-OLCI, Sentinel2-MSI, and ASI PRISMA satellite sensors for coastal ocean colour properties.

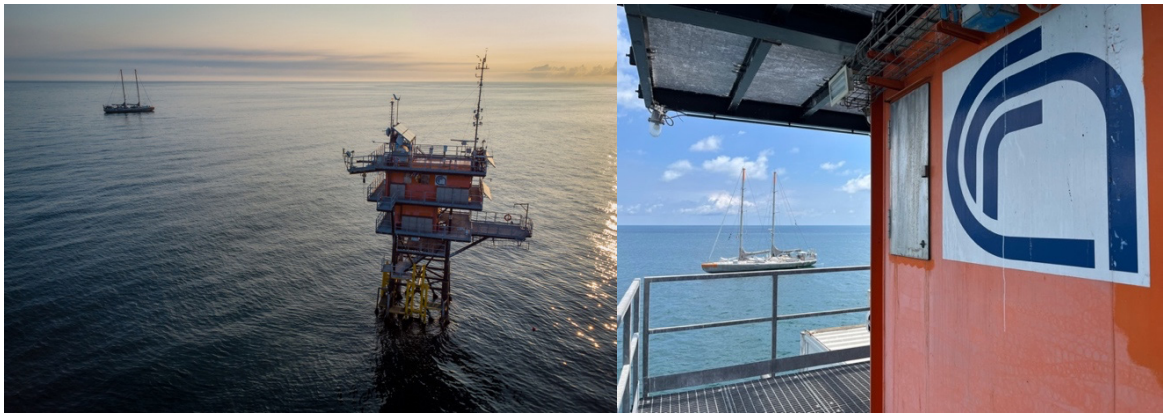

Figure 7 | The schooner "Tara" next to "Acqua Alta", after sampling activities (Credit: left, Yann Chavance; right, Vittorio E. Brando).

Preliminary validation of NASA PACE OCI

The NASA Earth science satellite PACE ("Plankton, Aerosol, Cloud, ocean Ecosystem") spacecraft was successfully launched from Cape Canaveral Space Force Station in Florida on 8 February 2024. Its primary sensor, the Ocean Color Instrument (OCI), is a hyperspectral spectrometer that acquires continuous measurement of light at finer wavelength resolution than previous NASA satellite sensors.

During 2024, data acquired at "Acqua Alta" with the HYPSTAR® (HYperspectral Pointable System for Terrestrial and Aquatic Radiometry, https://hypstar.eu) was used to provide to NASA a preliminary validation analysis of the PACE/OCI radiometry. During the analysis period covered 180 days (5 March - 31 August 2024), 160 potential match-ups between in situ + satellite data were identified and after quality control 53 Valid match-ups were obtained. The preliminary validation analysis of the PACE/OCI radiometry for "Acqua Alta" (Fig. 8) confirmed the results obtained by NASA for other cases, showing that PACE OCI radiometry underestimates the *in-situ* radiometry for the UV and blue portions of the spectral range. Based also on these results, NASA is currently undergoing a reprocessing of the PACE/OCI radiometry to improve its quality and thus ensure its use to extend key system ocean color data records for climate studies.

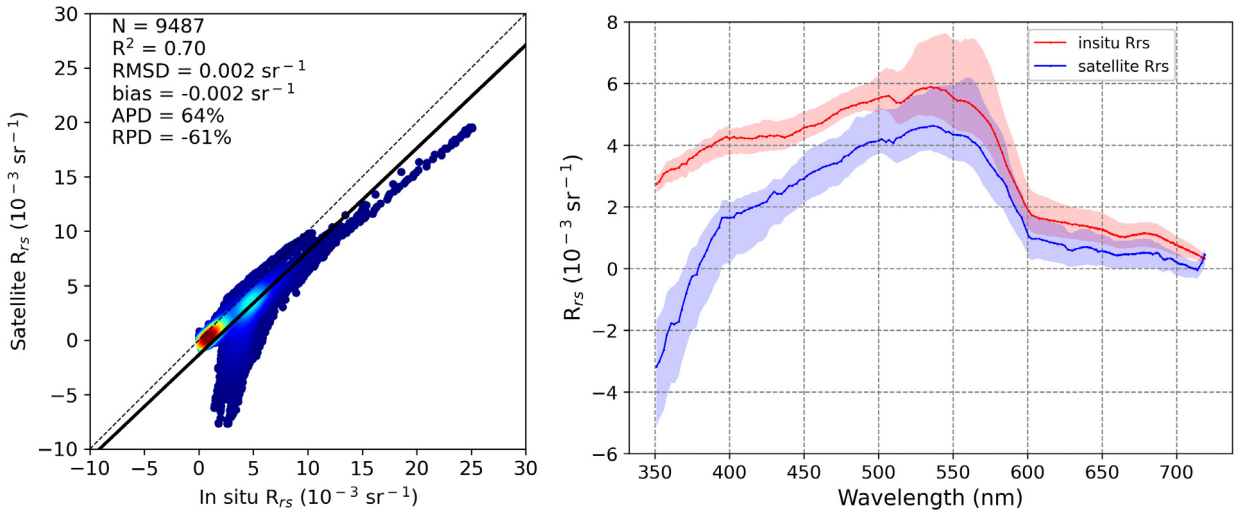

Figure 8 | Preliminary validation analysis of the PACE/OCI radiometry based on the *in-situ* data acquired at "Acqua Alta" with the HYPSTAR®. (left) Global scatterplots (N = 9487, 53 match-ups x 179 bands); (right) Spectra distribution comparison.

FICE24 course on above water radiometry

The Copernicus FICE-2024 Training Event on In situ Ocean Colour Above-Water Radiometry towards Satellite Validation Radiometry took place from 6 to 17 May 2024 at the "Acqua Alta" Oceanographic Tower.

Thirty-one participants were trained in the principles of above water radiometry, derivation of uncertainty budgets, and protocols for matchup analysis with satellite data. They explored the challenges of collecting high-quality measurement data at sea beyond statistical assessments of measurement results. Over time, the response of field optical radiometers to light may change significantly. Additionally, these field radiometers are calibrated in laboratory-controlled conditions, which are very different from the conditions at sea. If not properly understood and assessed, these concerns can jeopardise the validity of measurement results. The course included three field trips to the tower for hands-on fieldwork training. Every day during the hands-on fieldwork training, ten trainees, two trainers providing the training and ensuring the communication with the crew on the logistics and some of the other trainers went on board. All trainees provided positive feedback in final presentations on their lessons learnt and on how they can and will improve their above water radiometric measurements.

Dr Juan Gossn from EUMTETSAT wrote a detailed blog post describing the visits at the tower during training, offering a deeper look at the experience and the techniques used: https://frm4soc2.eumetsat.int/sites/default/files/inline-files/Fice%2024%20shift%201_Blog_0.pdf.

Figure 9 | FICE24 field trips to "Acqua Alta" for hands-on fieldwork training. (left) Dr Giuseppe Zibordi providing details on the radiometric instrumentation and measurements carried out on board; (right) group photo of trainers and trainees in front of the AEROMET-OC and HYPSTAR autonomous above-water radiometers.

Wood durability study, another year of exposure

Wood biodegradation in the coastal environment is assessed here through tests on EN275 panels. This methodology is a powerful technique for evaluating the durability of wood treatments against wood-boring organisms, such as shipworms and gribbles.

The analysis provides not only insights into the durability of materials, but also an understanding of the effectiveness of innovative and environmentally sustainable treatments. The ongoing tests at the "Acqua Alta" tower began in 2021 within the framework of the DuraSoft project. Specifically, 36 samples from five different tree species (*Abies alba* - silver fir, *Picea abies* - Norway spruce, *Pinus sylvestris* - Scots pine, *Pinus radiata* - Monterey pine, and *Quercus rubra* - red oak) were installed on a pillar at a depth of 10 meters. Various treatments were applied to these samples (e.g., acetylation, thermal modification, and impregnation with specific formulations for treating coniferous wood).

Samples were periodically collected and evaluated using radiography, a non-destructive method that allows continuous monitoring of the biodegradation process over the years. (Fig. 10). Tests are carried out simultaneously in different geographical areas and environments of the North Adriatic, allowing the assessment of material response under diverse conditions and subjected to the action of different marine xylophage communities. This evaluation is ongoing and will conclude in 2026.

Link: http://2014-2020.ita-slo.eu/it/durasoft; https://link.springer.com/article/10.1007/s10530-021-02461-3, https://www.ismar.cnr.it/wp-content/uploads/2024/02/rapporto-tecnico-25-CNR-ISMAR.pdf

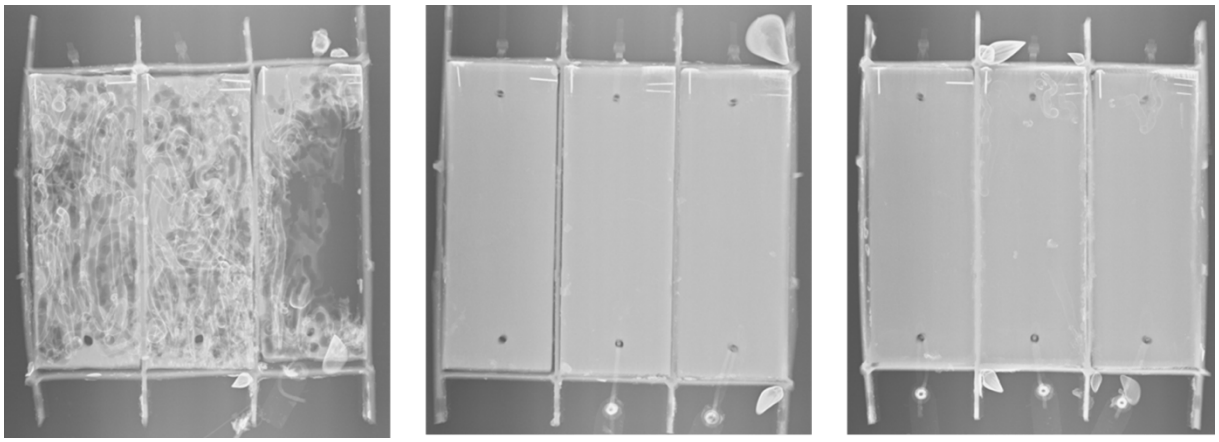

Figure 10 | Wooden samples of *Picea abies* not treated (left) and with impregnation (two different treatments; centre and right).

Underwater acoustics under the SEAmPhonia project

Underwater acoustics is gaining political attention due to the impact of anthropogenic activities on marine environments and their sustainable exploitation. The SEAmPhonia project, funded by the European Union's Next Generation EU initiative (PRIN 2022), aims to propose an innovative approach that leverages underwater acoustic 3D field to enable the modelling of marine ecosystems. This project involves the installation of a system of submarine sensors to investigate the physical processes generating submarine noise, focusing on the development of a new generation of optical fiber-based hydrophones equipped with Fiber Bragg Gratings (FBGs) for precise acoustic signal sensing.

The preliminary activities were carried out in 2024 and focused on the design and implementation of dedicated experimental campaigns at the "Acqua Alta" Oceanographic Tower, carried out between December 2023 and November 2024, enabling data acquisition suitable for the successive data analysis operations. The "Acqua Alta" Tower plays a crucial role in advancing underwater acoustic monitoring by providing a controlled environment, it helps address the challenges associated with several research topics, from air-sea interaction to marine ecosystem status research. The hydrophones were calibrated at the Underwater Acoustic Laboratory of CNR-INM in Rome, and different procedures for the synchronization of remote instrumentation have been tested. Field experiments at "Acqua Alta" demonstrated the effectiveness of using multiple hydrophones within a strictly controlled layout with different spectral sensitivities to monitor underwater noise, suggesting to extend the calibration and data acquisition frequency range up to 40 kHz. The data collected from these experiments provide valuable insights into the dynamics of marine ecosystems and the impact of anthropogenic activities, whose study is currently in progress.

Reference: Moretti, P.F., Pomaro, A., and Buogo, S. (2024). Metrology for Underwater Acoustics: Rethinking Measurement Strategies for the Assessment of the Environmental Status. *2024 IEEE International Workshop on Metrology for the Sea; Learning to Measure Sea Health Parameters (MetroSea)*, 546-551. https://dx.doi.org/10.1109/MetroSea62823.2024.10765621

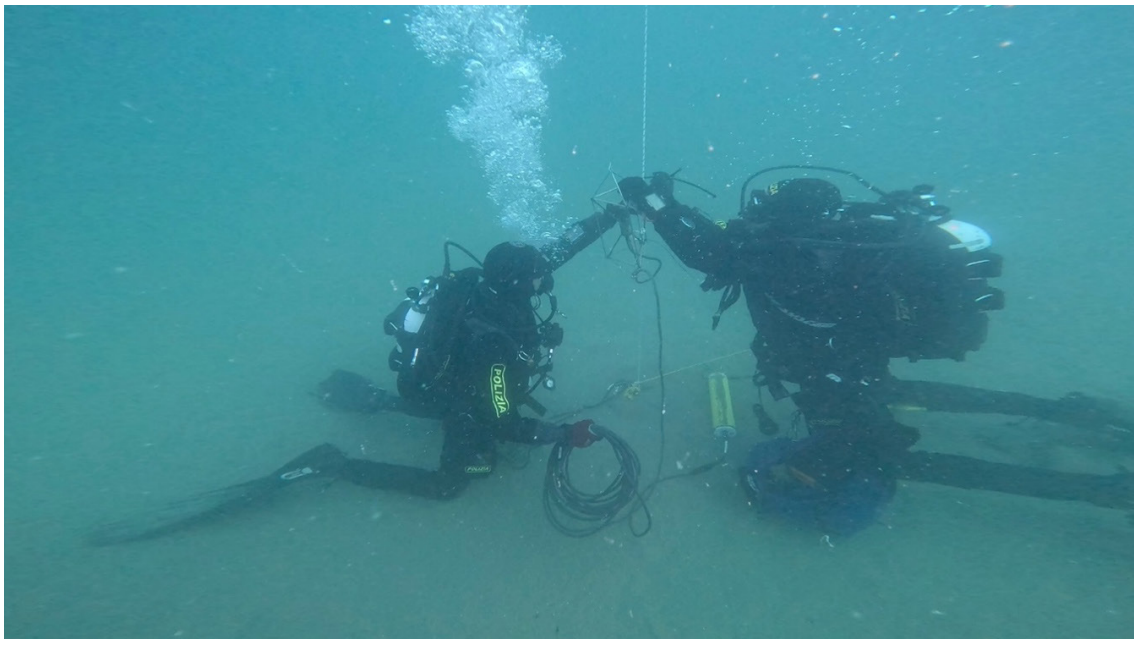

Figure 11 | Hydrophone field installation close to the "Acqua Alta" tower.

Monitoring and research on the protected species *Pinna nobilis*

The fan mussel *Pinna nobilis* (L. 1758) is an endemic species and the largest bivalve of the Mediterranean Sea, where it is distributed over various benthic habitats. Due to its ecological value and vulnerability, the species is subject to protection by national and international laws, such as the Habitat Directive. In 2016, an epidemic associated with the protozoan *Haplosporidium pinnae* broke out, causing Mass Mortality Events (MMEs) with mortality rates up to 100% and a drastic decline of populations all over the species range. "Acqua Alta" has been included in 2024 among marine sites subject to monitoring *Pinna nobilis*, in collaboration with the Veneto Region, within the framework of INTERREG IT-SI POSEIDONE project. Exploratory surveys (Fig. 12) were carried out by the CNR-ISMAR and CNR-IGG scuba diver team on 4 July 2024 and 1 October 2024, with about 2400 m^2 seabed surveyed. During the first survey in July, two 1-year juveniles were found alive; however, neither of them survived up to October.

To investigate the spawning, dispersal and population recruitment, the settlement of juveniles has been monitored using larval collectors (five different depths, three replicates each), placed in the immediate surroundings of "Acqua Alta" on 26 June 2024, at the start of the spawning season, by the scuba team of the State Police of Venice. The tower is part of the Northern Adriatic network of settlement monitoring sites. Two types of collectors have been installed, for intercalibration: one proposed by CNR-ISMAR (Marčeta et al. 2024; https://doi.org/10.5281/zenodo.14528163), and the other in use at Slovenian waters. The activity has been carried out as part of INTERREG IT-SI TRECap project, and it follows a similar monitoring conducted in 2023. The collectors were retrieved on 17 December 2024 and 8 January 2025, and they were checked for the presence of settled juveniles. In contrast to the 2023 monitoring, which resulted in several alive juveniles, no individual dead or alive has been found.

A purpose-built enclosure for *in-situ* rearing of the *Pinna nobilis* juveniles collected during 2023 monitoring was installed in January 2024 in the immediate surroundings of the tower, a couple of meters over the seafloor. The reared juveniles have been subject to periodic inspections, and environmental conditions have been monitored. The surviving specimens were replanted at the beginning of 2025 in the *Tegnùe di Porto Falconera* Natura2K site in the framework of TRECap project, with the authorisation from the Ministry of Environment and the Veneto Region. The results of the activities will contribute to the understanding of the ecological dynamics and the status of the species, as well as to conservation efforts.

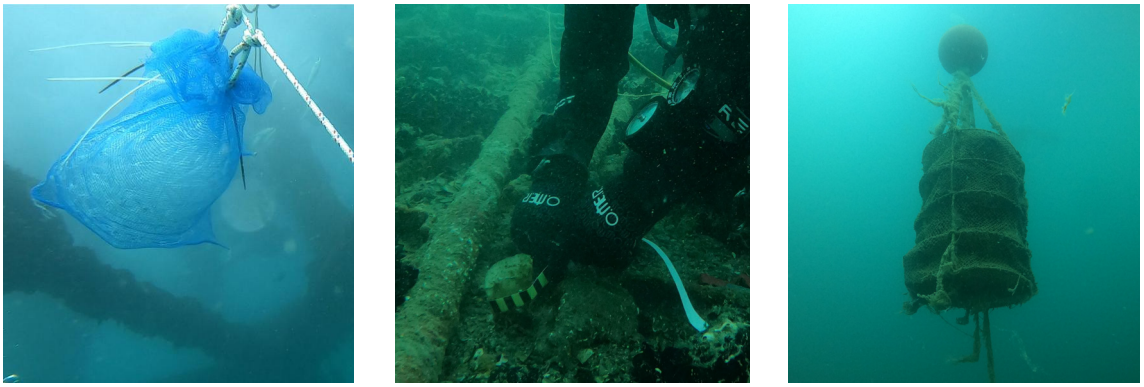

Figure 12 | (left) *Pinna nobilis* juvenile found on 4 July 2024; (centre) collector for *Pinna nobilis* planktonic larvae; (right) enclosure located at the "Acqua Alta" tower, hosting juveniles from larval collectors.