# Flussi di $CO_2$ all'interfaccia aria-mare nel Mediterraneo: una panoramica su un anno di dati a Lampedusa

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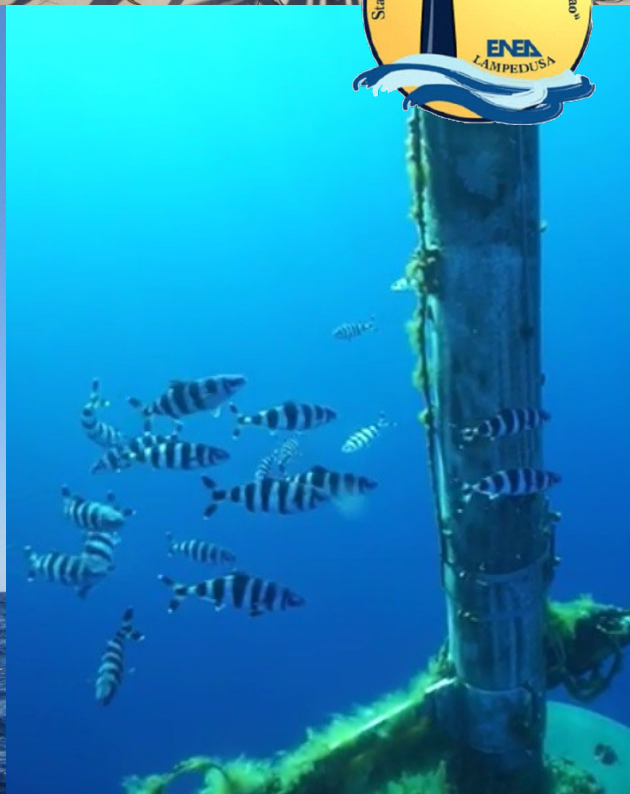
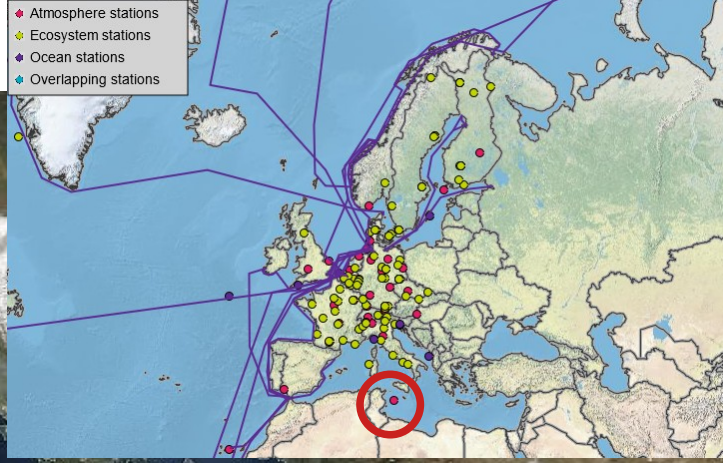
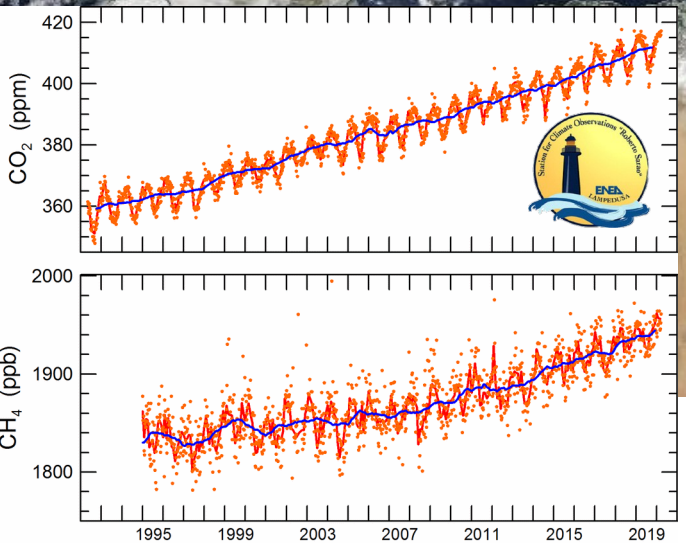


# MODIS Aqua – 11 Apr 2020




ICOS
Integrated Carbon Observation System

ICOS

Integrated Carbon Observation System

Station for Climate Observations "Roberto Sarao"

ENEA LAMPEDUSA

http://www.lampedusa.enea.it


35.52°N, 12.63°E

ACTRiS Exploring the Atmosphere

emso ERIC EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

GLOBAL ATMOSPHERE WATCH

PRO-ICOS-MED

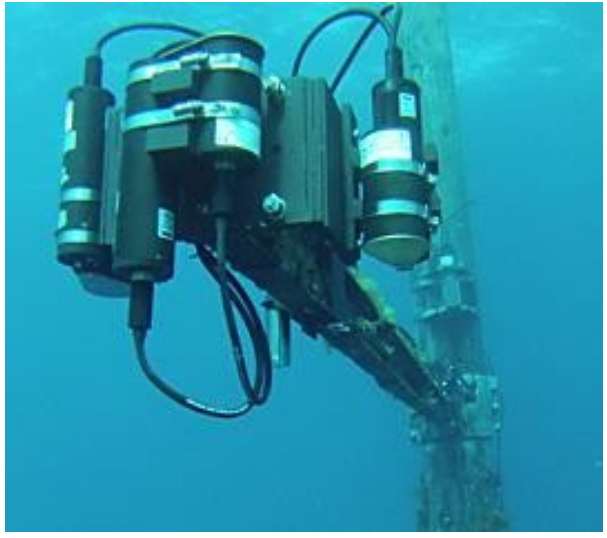
ICOS Integrated Carbon Observation System

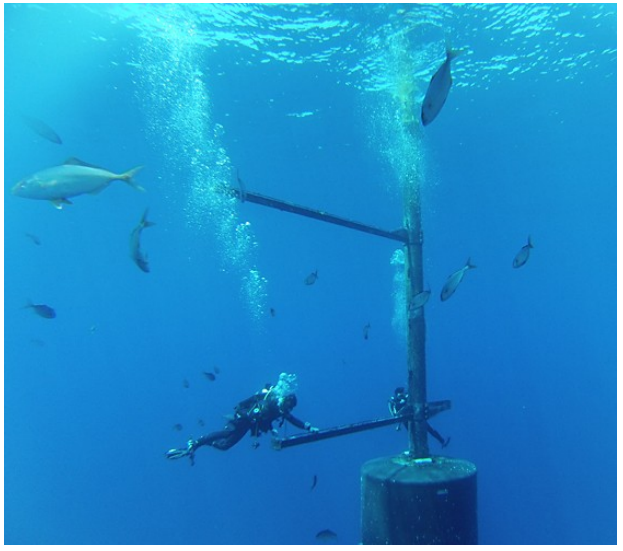
ACTRiS Exploring the Atmosphere

- Within the ICOS and ACTRIS EU infrastructures significant upgrades of atmospheric, marine, and terrestrial instruments is ongoing
- Within ICOS, also the terrestrial ecosystem site is under development
- Lampedusa will be the only atmosphere/ocean/terrestrial ecosystem integrated site within ICOS

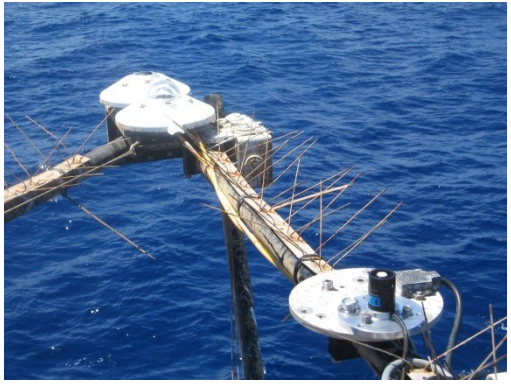


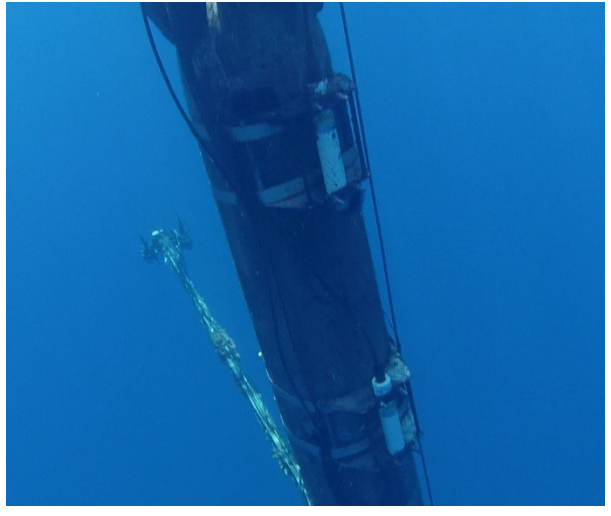
emso ITALIA



Rotation < 5°
Pitch/roll < 10°
Bottom at 74 m

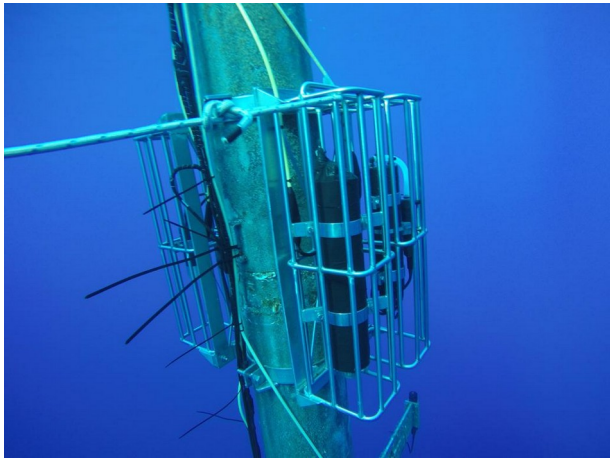


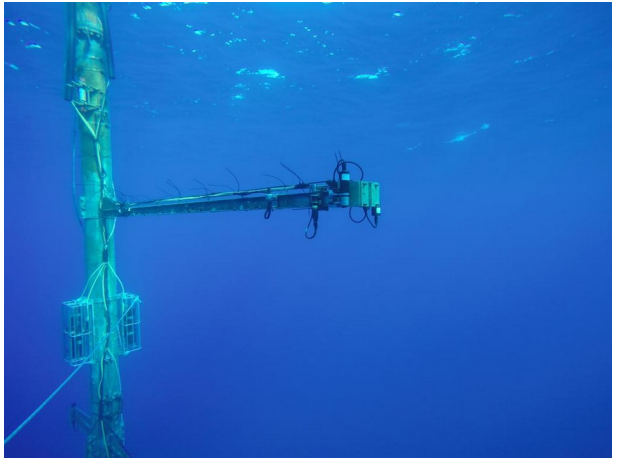


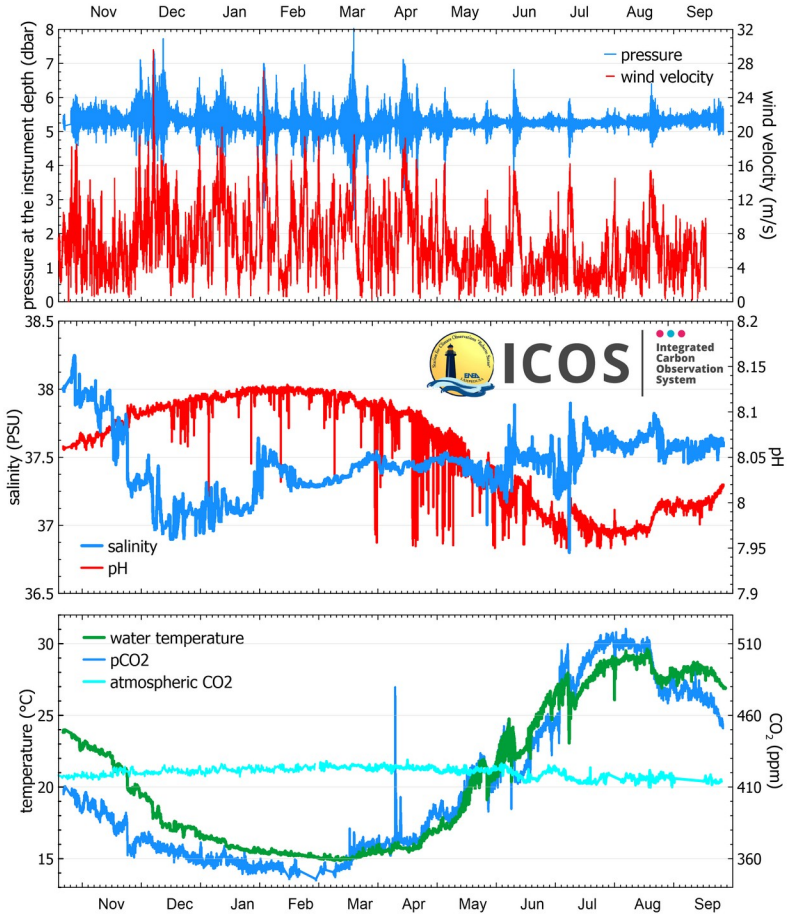
35.49°N, 12.47°E

- Meteorological station [air pressure, temperature, humidity]
- Gill Windsonic anemometer [wind speed and direction]
- CMP21 pyranometer [downward shortwave irradiance]
- CGR4 pyrgeometer [downward longwave irradiance]
- Photosynthetic radiation radiometer [downward photosynthetically active radiation]
- Electronic level [radiometers' attitude]
- Satlantic Hyper-OCR [spectral downwelling irradiance; CNR]

- Seabird SBE39P at 1 m depth [ocean pressure and temperature]
- Seabird SBE39P at 2 m depth [ocean pressure and temperature]
- 2xSatlantic Hyper-OCR at 2.5 m depth (upwellling and downwelling spectral irradiances; CNR]
- Satlantic OCR-507R10W at 2.5 m depth [7-band upwelling radiance; CNR]
- Seabird SBE50 at 2.5 m depth [pressure; CNR]
- **Seabird PAR sensor at 2.5 m**
- **WetLabs ECO-3 at 5 m depth [backscattering, chlorophyll, F-DOM]**
- **$pCO_2$, at 5 m depth**
- **CTD at 5 m depth**
- **pH at 5 m depth**
- 2xSatlantic OCR-507ICSW at 6 m depth (upwellling and downwelling 7-band irradiances; CNR]
- Satlantic OCR-507R10W at 6 m depth [7-band upwelling radiance; CNR]
- Seabird SBE50 at 6 m depth [pressure; CNR]
- Seabird SBE37 at 18 m depth [ocean pressure, temperature, salinity, dissolved oxygen]
- WetLabs ECO-3 at 17 m depth [backscattering, chlorophyll, F-DOM; CNR]
- Chlorophyll, CDOM, backscattering at 17 m depth
- 40 m thermistor chain






Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
pressure at the instrument depth (dbar)
wind velocity (m/s)
pressure
wind velocity
ICOS
Integrated Carbon Observation System
salinity (PSU)
pH
salinity
pH
temperature (°C)
$CO_2$ (ppm)
water temperature
pCO2
atmospheric CO2

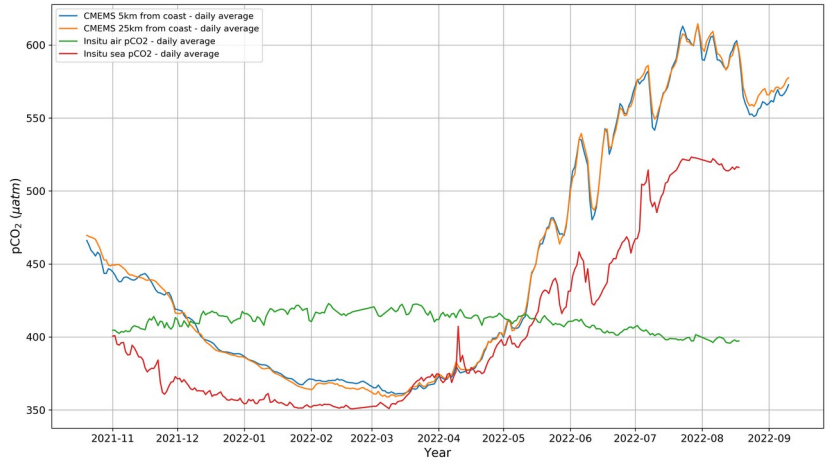
$$F = K_{wa}\ KH\ (\Delta pCO_2)_{sea\text{-}atm}$$

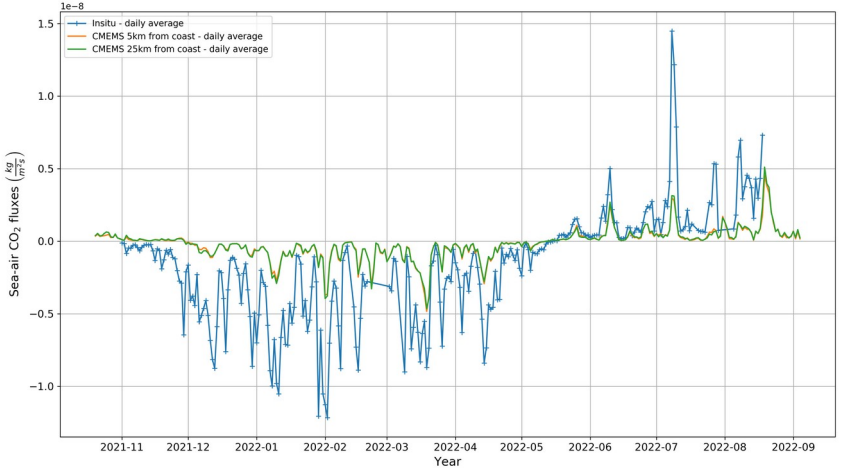
-$K_{wa}$: gas transfer velocity → SST, $<U^2>$

-KH: solubility → SST e SSS

-$pCO_{2sea}$

-$pCO_{2air}$ → xCO2, SST, SSS, $P_{atm}$

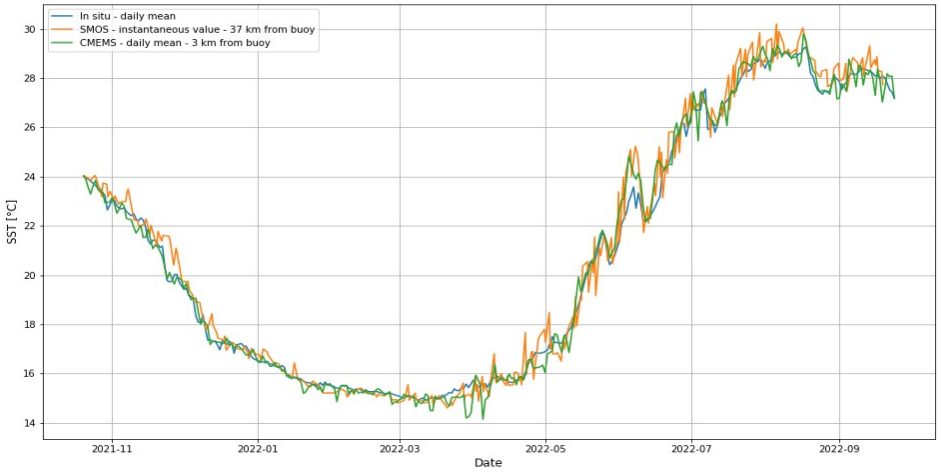


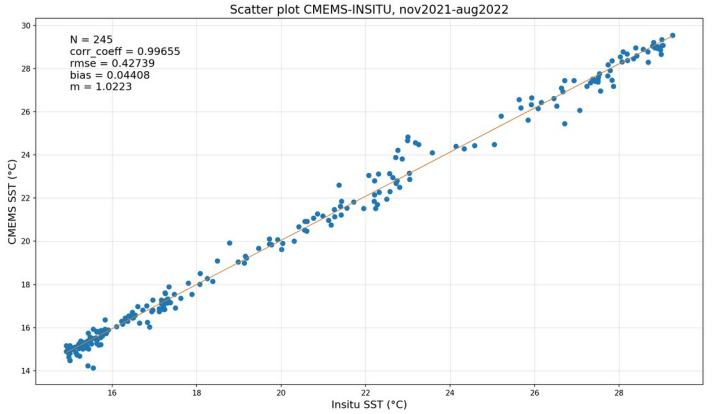



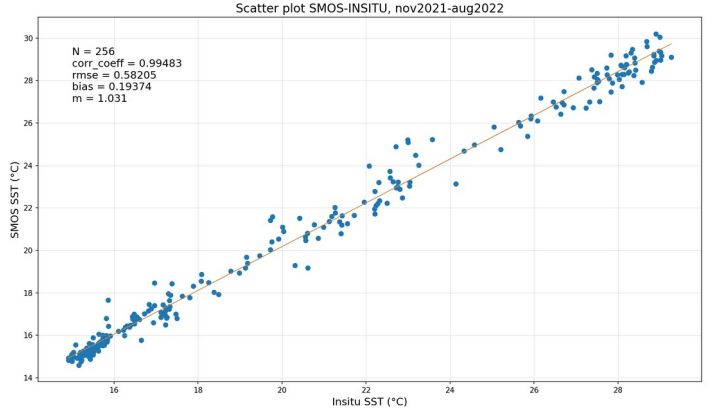

Mediterranean Sea Biogeochemistry Analysis and Forecast - https://doi.org/10.25423/cmcc/medsea_analysisforecast_bgc_006_014_medbfm3

**Next steps:**

-Satellite data → SST



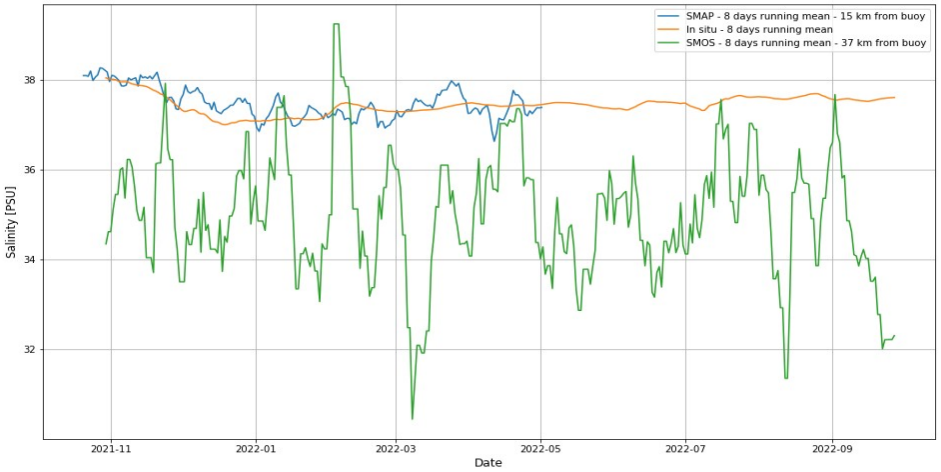



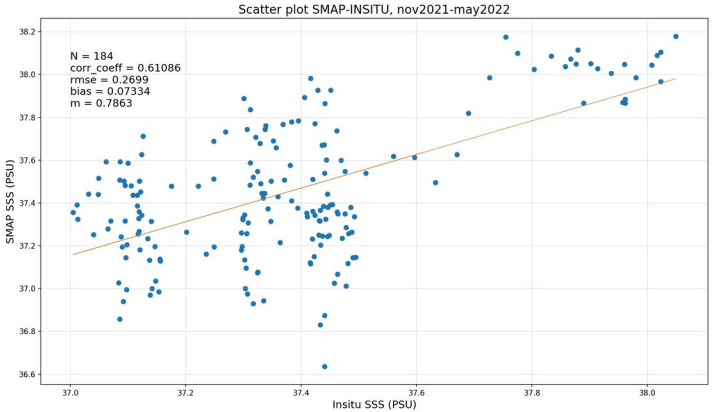

Mediterranean Sea High Resolution and Ultra High Resolution Sea Surface Temperature Analysis - https://doi.org/10.48670/moi-00172

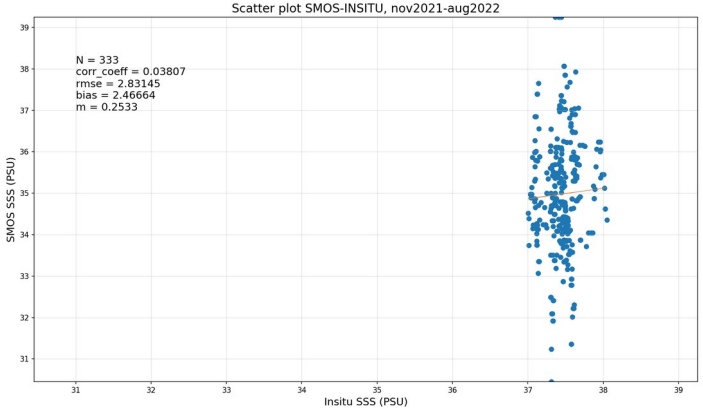
MIRAS L-band radiometer – SMOS ESA Satellite

# Next steps:

-Satellite data → SSS



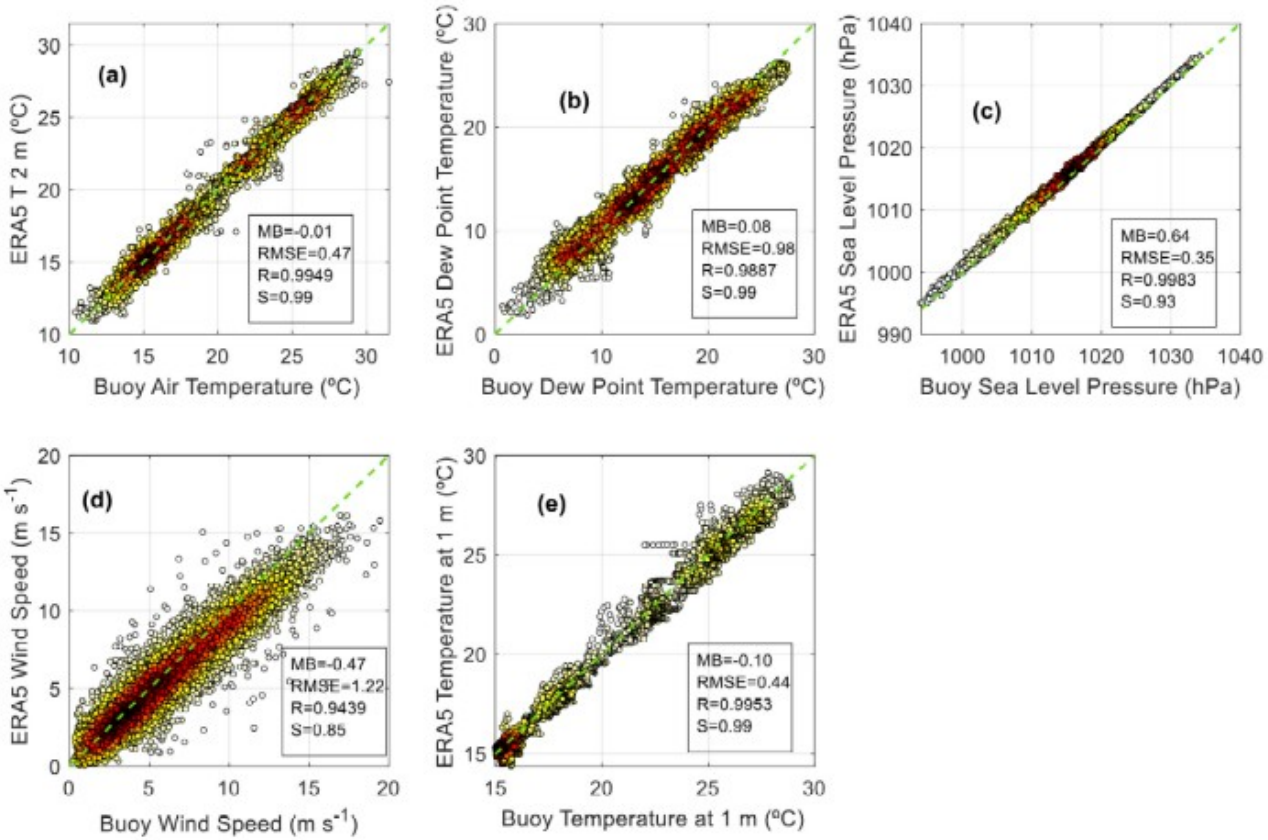




L-band radar and radiometer - NASA SMAP Satellite

MIRAS L-band radiometer – SMOS ESA Satellite

**Next steps:**

-Satellite data → wind data




Marullo et al., 2021

**Next steps:**

-Satellite data

-Satellite $pCO_2$ estimation → Integration of insitu and satellite data to compute fluxes

-Satellite algorithm optimization for Mediterranean

-Basin-scale extension → monitoring spatio-temporal variability

# Thank you

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