

Synchronous Oceanic and Atmospheric Data Acquisition: field test release and validation of atmospheric, oceanographic, and deep-sea probes in the Azores Islands

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Synchronous Oceanic and Atmospheric Data Acquisition





Synchronous Oceanic and Atmospheric Data Acquisition

Atmospheric probe



- HAB launch
- Atmospheric sensors testing
- Real-time communications

Oceanographic probe



- Oceanographic monitoring
- Data acquisition and sensors testing
- Watertight capabilities

Deep-sea probe



- Materials and sensors suited for high pressures
- Drifter mode
- Satellite communications



Synchronous Oceanic and Atmospheric Data Acquisition

Atmospheric probe

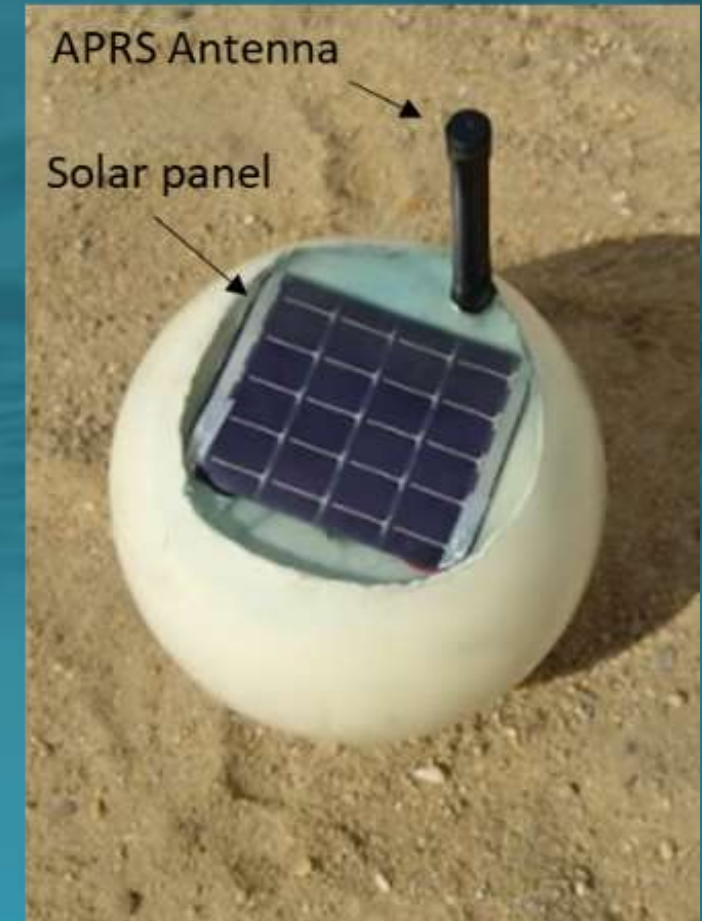
WiMo PicoAPRS-Lite APRS Transceiver Module

- Temperature sensor
- Pressure sensor
- APRS long-range communications
- GPS tracking

Super-capacitor and solar panel to supply the system

Probe built in polyuremethane material

- Diameter: 200mm
- Weight: 1,8kg





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Oceanographic probe

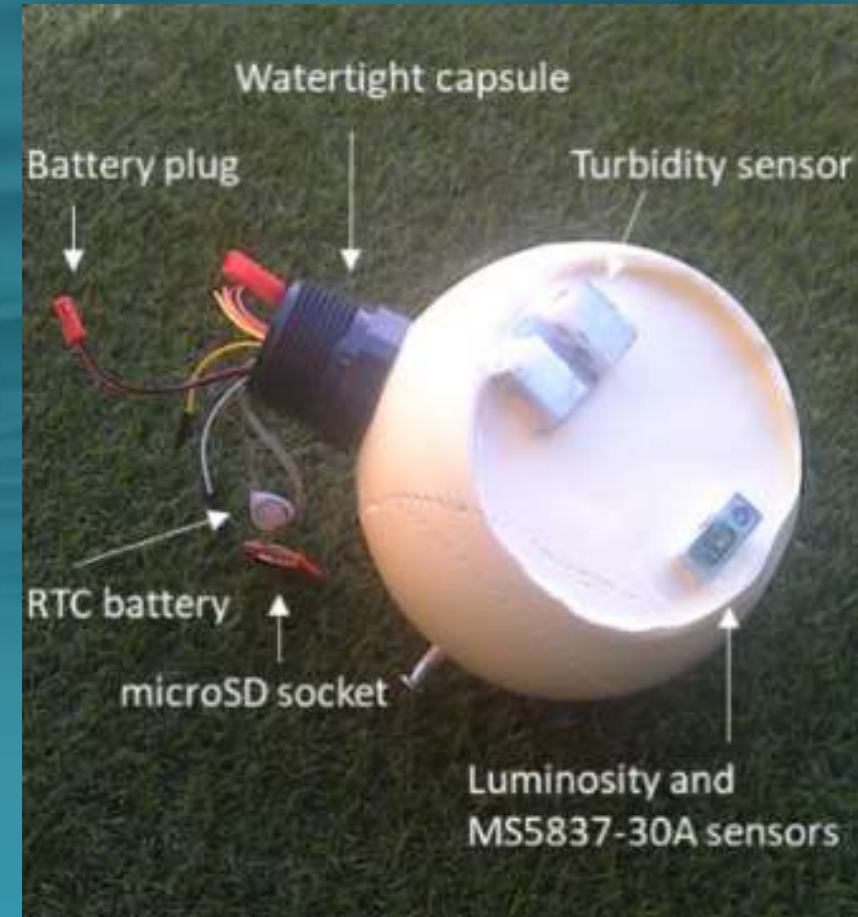
Customized data-logger based on stm32L496ZG processor

- real time clock to keep date and time
- data stored on a microSD card

Sensors

- turbidity
- luminosity
- water temperature
- hydrostatic pressure (depth)

LiPo battery and power manager module





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Deep-sea probe

Sensors

- Pressure/depth (0 – 400 bar)
- Water temperature
- luminosity

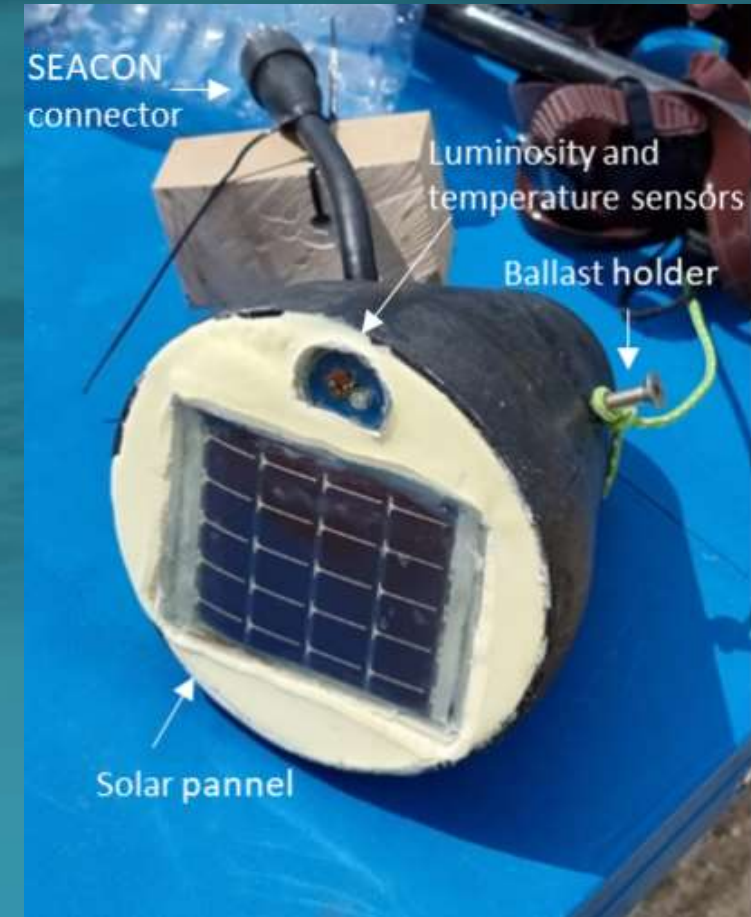
GPS module

RockBlock 9603 IRIDIUM Satellite communications

Underwater connector (plug the power and program the firmware)

Probe built in polyurethane and borosilicate glass microspheres (<math><10\mu\text{m}</math> diameter) in a proportion of 3:1

- Weight: 1,6kg
- 27% positive buoyancy





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Preliminary tests in a semi-controlled environment

- Test of the APRS communications (atmospheric probe)
- Validation of the oceanographic probe
- Dive simulation of the deep-sea probe





Synchronous Oceanic and Atmospheric Data Acquisition

Preliminary tests in a semi-controlled environment

Atmospheric probe

- Short-range communication tests on the ground
- KENWOOD TH-D74 used as APRS receiver

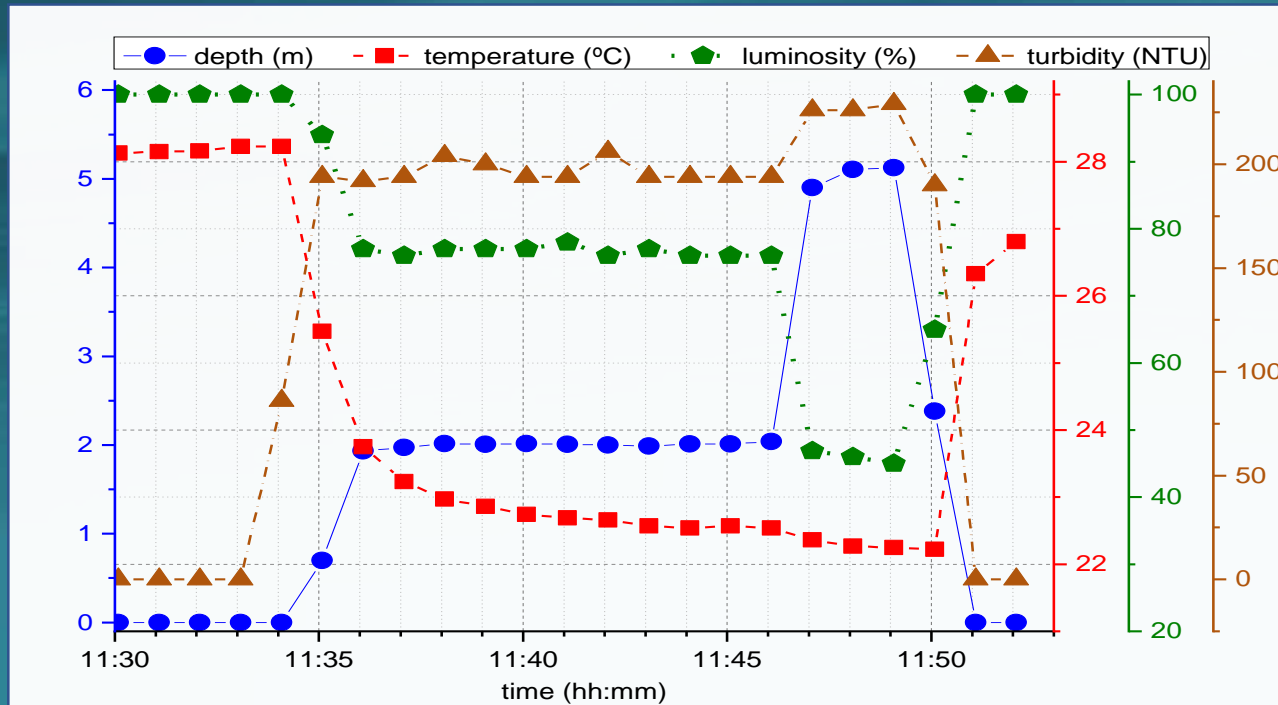




Synchronous Oceanic and Atmospheric Data Acquisition

Preliminary tests in a semi-controlled environment

Oceanographic probe

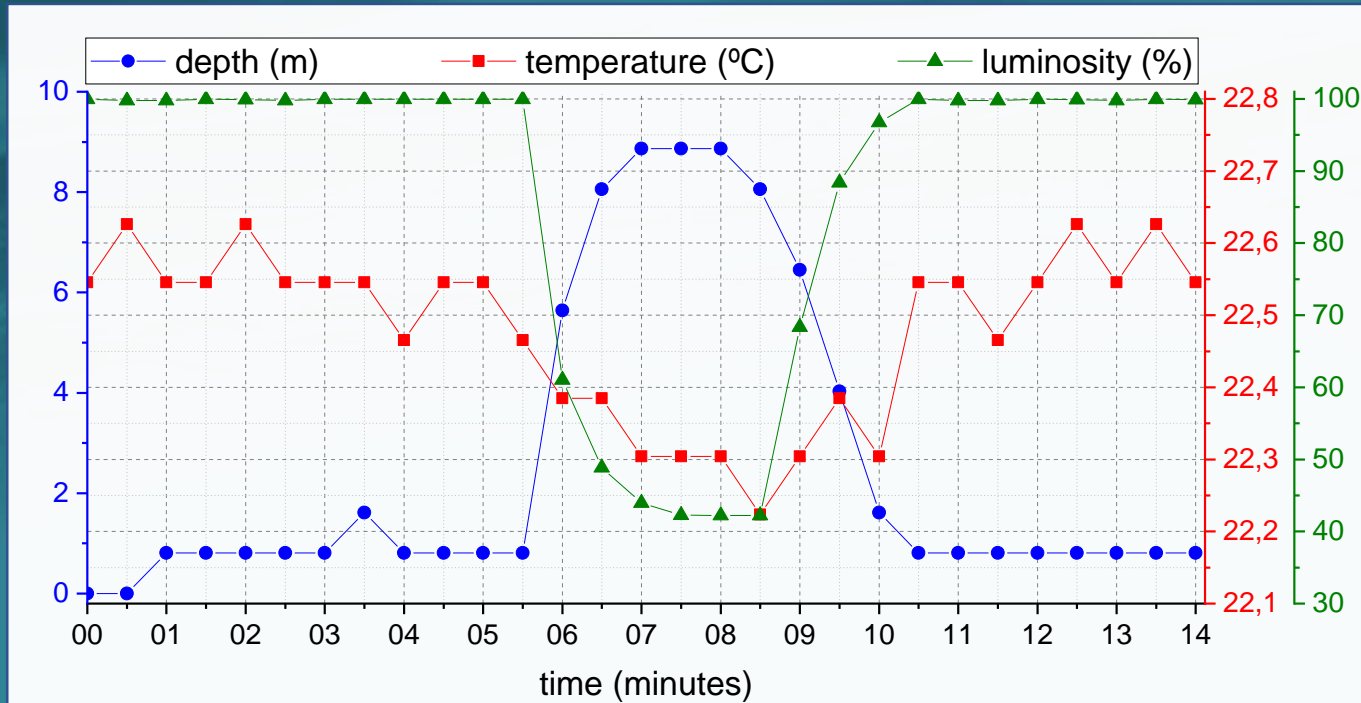




Synchronous Oceanic and Atmospheric Data Acquisition

Preliminary tests in a semi-controlled environment

Deep-sea probe





Synchronous Oceanic and Atmospheric Data Acquisition

Preliminary tests in a semi-controlled environment

Deep-sea probe

- 5/20 IRIDIUM packages transmitted with the probe on the water
- 16/20 IRIDIUM packages transmitted with the probe outside the water





Synchronous Oceanic and Atmospheric Data Acquisition

Test and validation in São Miguel, Azores

- Launch of the atmospheric probe by HAB
- Coastal monitoring with the oceanographic probe
- Release of the deep-sea probe in the Atlantic

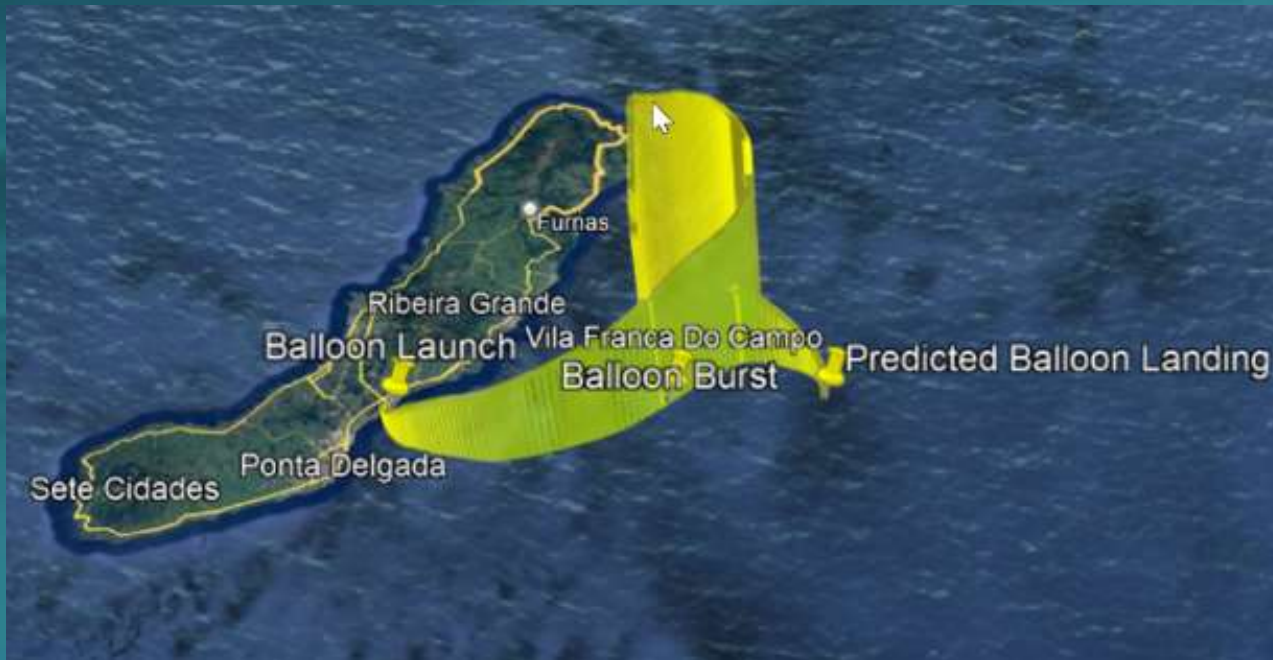




Synchronous Oceanic and Atmospheric Data Acquisition

Test and validation in São Miguel, Azores

Atmospheric probe



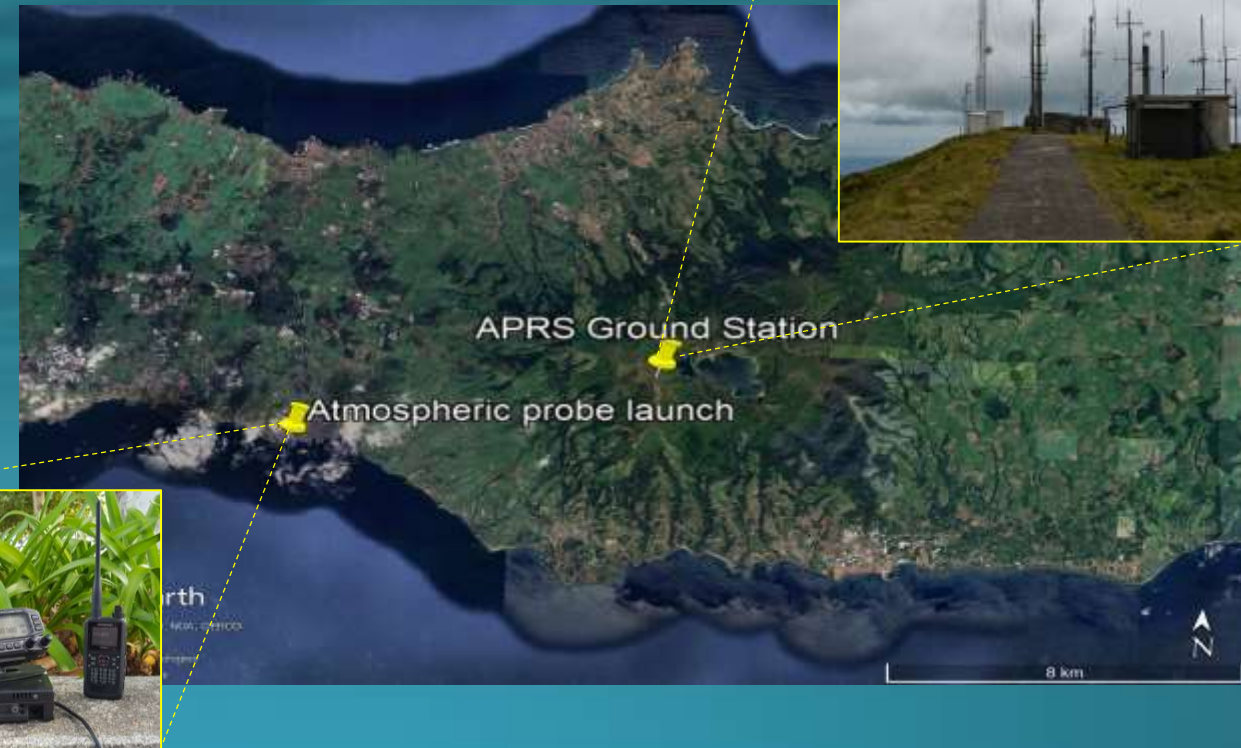


Synchronous Oceanic and Atmospheric Data Acquisition

Test and validation in São Miguel, Azores

Atmospheric probe

- Mobile station (KENWOOD TH-D74)
 - Lost communications with the HAB at 10km horizontal distance
 - Change to an international frequency (?)
- Fixed ground station (FM VHF/UHF and APRS transceiver with LoRa Gateway)
 - No communications
 - Noise and interference from other amateur radio signals

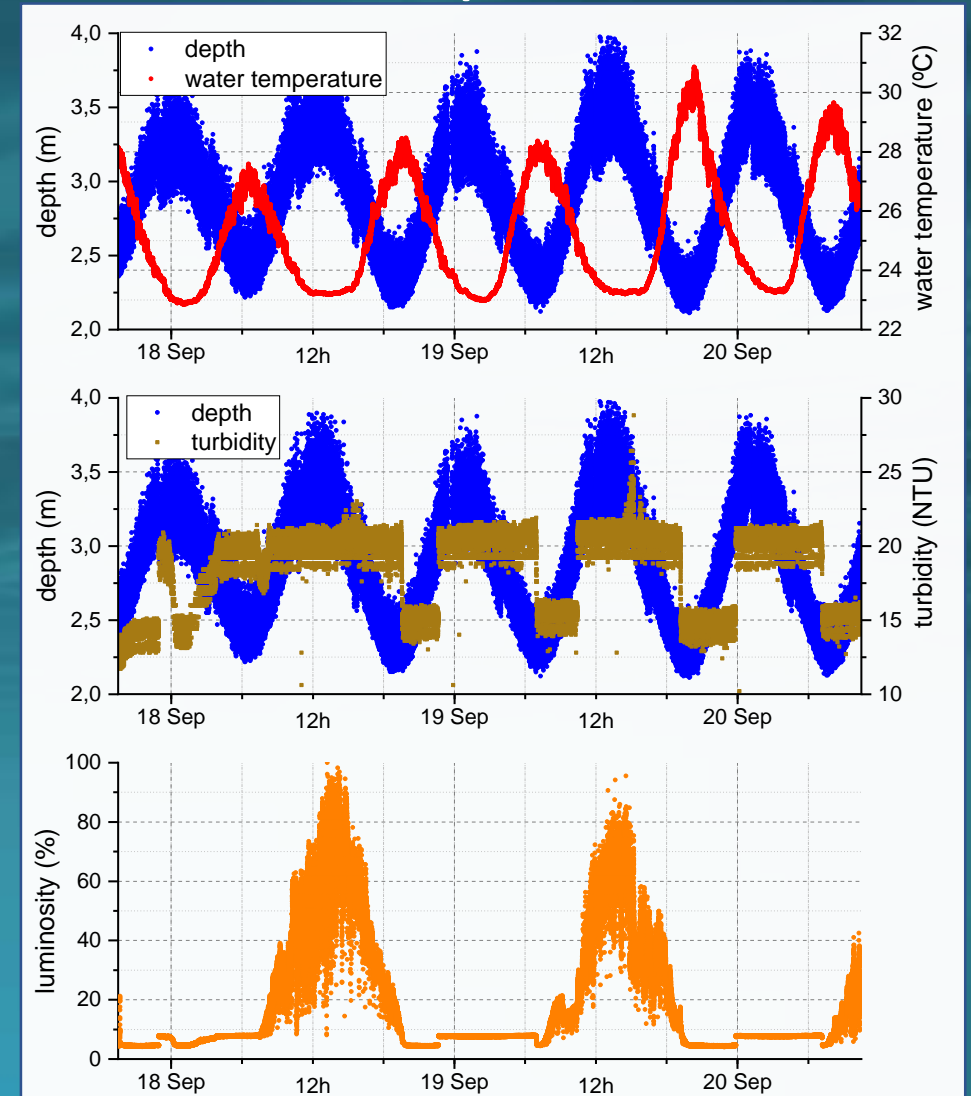




Synchronous Oceanic and Atmospheric Data Acquisition

Test and validation in São Miguel, Azores

Oceanographic probe





Synchronous Oceanic and Atmospheric Data Acquisition

Test and validation in São Miguel, Azores

Deep-sea probe





Synchronous Oceanic and Atmospheric Data Acquisition

Test and validation in São Miguel, Azores

Deep-sea probe

- probe stuck under the surface (e.g., fishing nets or flora)
- malfunction of the ballast
- materials did not resist to high pressures
- change in the buoyancy level or position of the probe due to high pressure
- water infiltrated into the electronics
- malfunction of the software or electronics
- problems with the satellite communications





Synchronous Oceanic and Atmospheric Data Acquisition

Conclusion and future work

Atmospheric probe



- Use an APRS fixed frequency
- Validate new atmospheric sensors

Oceanographic probe



- Validate new sensors
- New monitoring experiments

Deep-sea probe



- Test new materials resistant to high pressures
- Increase buoyancy
- Iridium antenna outside the probe



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<https://sonda.uac.pt/en/>

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