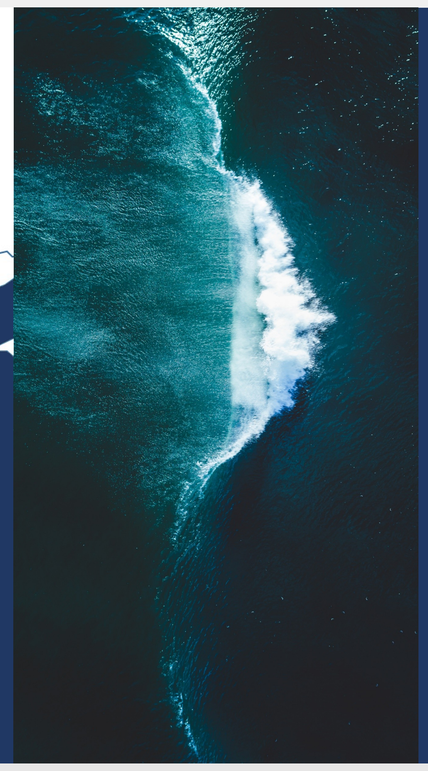
Wave Profile and Tide Monitoring System for Scalable Implementation

CIÊNCIA 2023
ENCONTRO COM A CIÊNCIA E A TECNOLOGIA EM PORTUGAL

There's more sea than land in Portugal

-The Portuguese sea makes up 18 times its land area;
-Has the third largest Exclusive Economic Zone in the European Union;
-Rich in resources and plenty in opportunities;



Why sea and river monitoring is so important

The climate is changing
-Growing human activity;
-Rising sea levels;
-Worsening weather conditions.

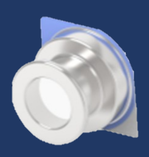
There is a need for
-Abundant reliable data;
-Real-time monitorization;
-Wide area surveillance and study.

What needs to be done
-Efficient management of resources;
-Mitigate impact on ecosystems;
-Anticipate with precision where to act ahead.

Wave and Tide Monitoring System

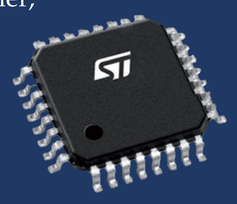
Pressure sensor

-MS5837-30BA pressure sensor;
-Range of 0 bar to 30 bar;
-0.2 mbar resolution;
-Low-power;
-Allows water height measurement with 0,2 cm resolution;



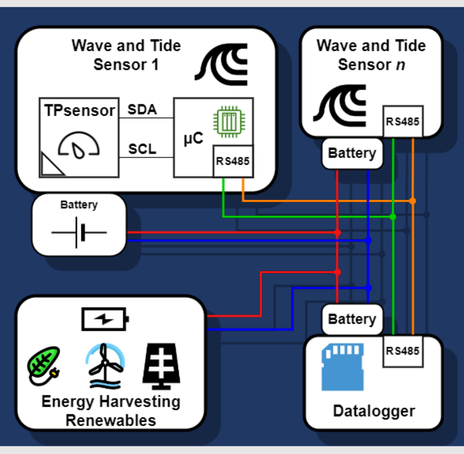
µController

-STM32 low-power microcontroller;
-High timing precision;
-Versatile for a wide range of application;
-Can integrate different sensors.



Monitoring System

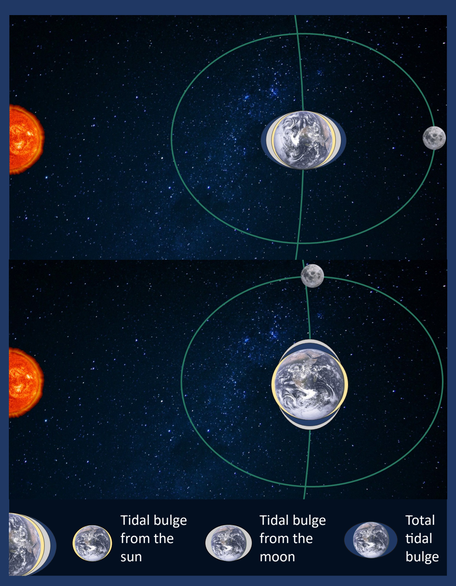
-Pressure sensors connected in a network;
-Datalogger for centralized data storage and real-time broadcast;
-Energy harvesting tech, for longer periods of monitoring without user intervention;
-Wired or acoustic network, allowing efficient energy management or highly versatile deployment;



Tide Monitoring

Tide cycles

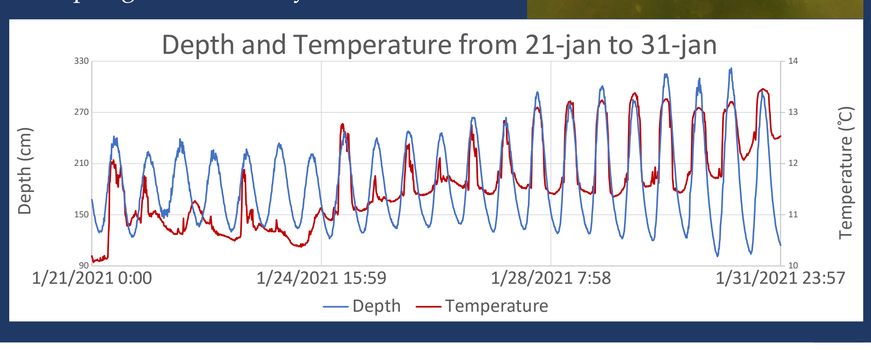
-Tides are affected by the moon and sun's gravity;
-High and low tide refer to a 12 hours and 25 minutes cycle.



-When the moon and the sun are aligned, it results in a higher amplitude tide;
- This is called Spring tide.

-When the moon and the sun's gravity act in perpendicular to each other, it results in a lower amplitude tide;
-It is called Neap tide.

-Sensor deployed in the estuary of the Cávado River;
-It was possible the distinguish the two daily high/low tide cycle, as well as the Neap tide in the first days and the Spring tide seven days later.



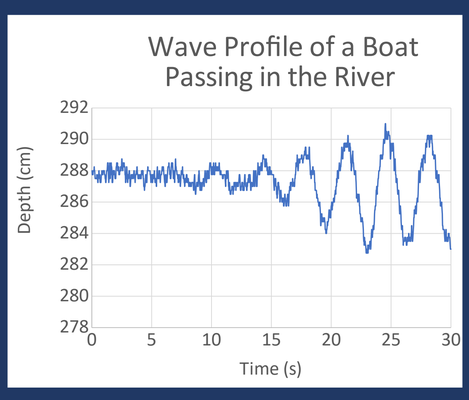
Wave Monitoring

What produces waves?

-Most sea waves are caused by wind;
-Occasionally may be caused by tectonic plates shifts (such as tsunamis);
-In lakes and river, a boat or ship passing by also produces waves.

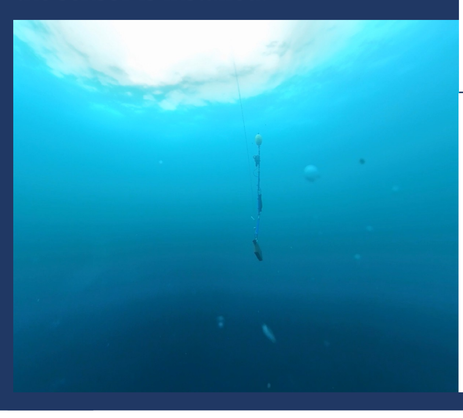
Measuring river waves

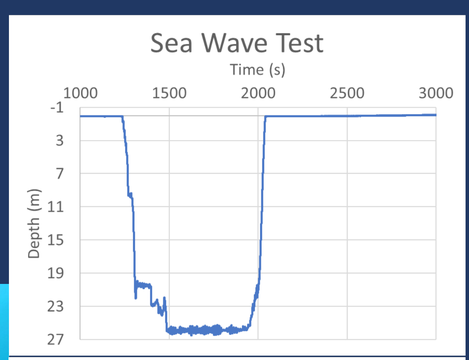
-A passing boat generates waves large enough to disturb the riverbank and accelerate erosion;
-Sensor installed 2.8 m deep;
-Waves up to 10 cm measured;
-The pressure is attenuated as it propagates down the water, making 20 cm waves seem like 10 cm.

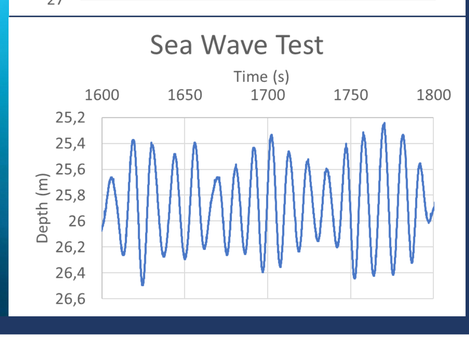


Measuring sea waves

-Sensor dropped to a depth of 26 m;
-Wave's profile and frequency easily identified;
-The amplitude needs to be calibrated, because the pressure propagation is attenuated the deeper the sensor is installed.







J.L. Rocha[1] T.Matos[1] C.L. Faria[1] C.M. Penso[1] M.S. Martins[3] P.A. Gomes[4] L.M. Gonçalves[1,2]
1 CMEMS-UMinho, University of Minho, Guimarães, Portugal
2 LABBELS—Associate Laboratory, Guimarães, Portugal
3 INESC-TEC, Porto, Portugal
4 CBMA, University of Minho, Braga, Portugal

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