



DCU's Research Buoy

For the 'Prediction of Irish Coastal
Transformation'

What is it for?

- This buoy was deployed for research purposes (e.g. climate, pollution) for the PREDICT Project to gather environmental data in Dublin Bay
- There are seven sensors submerged under the buoy and a weather station mounted on top.

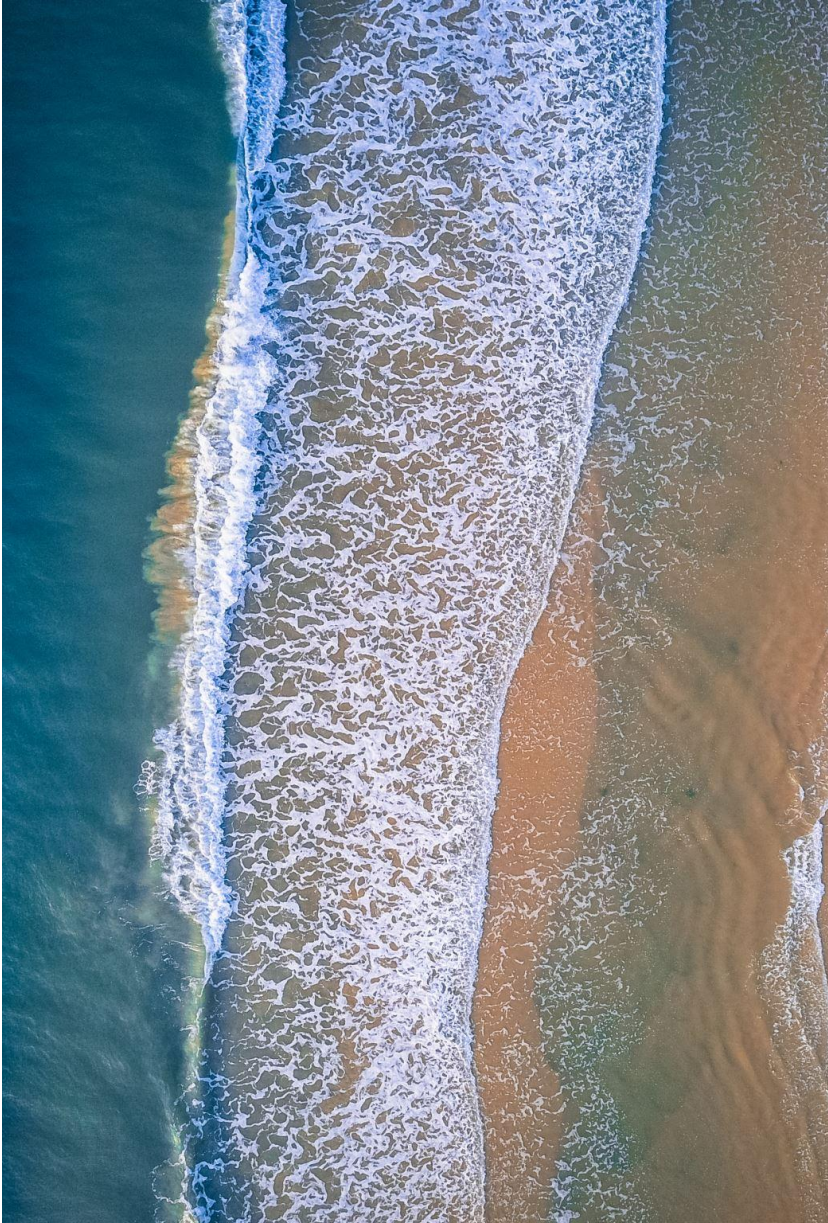




Weather Station

Parameters measured by the weather station are:

- Wind speed (m/s)
- Wind direction
- Air humidity
- Air temperature




Submerged probes

These probes measure conditions below the buoy from 2 meters under sea-level.

Parameters include:

- pH
- Temperature
- Turbidity
- Dissolved oxygen
- Partial pressure of CO₂
- Chlorophyll-a,
- Conductivity

What is pH?

- pH is measured in the concentration of hydrogen ions in moles per litre
 - The pH scale, ranging from 0-14, describes how acidic or basic a liquid solution is
 - Acidic conditions range from 0-6, neutral is pH 7 (i.e pure water) and basic is between 8-14.
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- A large yellow triangle is positioned in the bottom right corner of the slide, pointing towards the top right.

Why is marine pH important to monitor?

Oceans and coastal regions absorb a large amount of the CO₂ that enters the atmosphere through fossil fuel Combustion. This is good in that it “mops up” a lot of the carbon from the atmosphere that would otherwise increase global warming but bad in that it changes the chemistry of seawater, which we call ocean acidification.

Ocean acidification is often expressed in terms of the pH of seawater. pH is a measure of acidity or alkalinity. A pH below 7 is considered acidic, and a pH greater than 7 is considered alkaline, or basic.

Average ocean water pH is currently approximately 8.1 but the pH is decreasing.

We need to monitor pH to understand how our coastal water is changing.

For more information please see: <https://coastadapt.com.au/ocean-acidification-and-its-effects>

Why is temperature monitored?

- Temperature is the thermal energy present in matter
- The more heat an object or liquid has; the more energy it has readily available for chemical reactions
- This available thermal energy impacts the rate at which chemical reactions occur involved in biological functions of marine organisms
- Sea-surface temperature is directly related to sea-level rise, please see (<https://oceanservice.noaa.gov/facts/sealevelclimate.html>) for further information.
- And sea surface temperature provides fundamental information on the global climate:
<https://oceanservice.noaa.gov/facts/sea-surface-temperature.html>

What is turbidity?

- Turbidity is a measure of the clearness or cloudiness of a liquid
- This gives a rough indication of the concentration of suspended particles in the water that are unable to be seen by the naked eye
- High concentrations of particulate matter affect light penetration, ecological productivity.
- Turbidity readings can be used as an indicator of potential pollution in a water body.

Dissolved Oxygen

- 'DO' is the concentration of free oxygen available in water and is important for all living organisms: not only on land, but also in the sea
- Marine plants produce at least half of the oxygen in the atmosphere!
- Serious consequences can occur when dissolved oxygen concentrations fall below a threshold of 2 mg l⁻¹ or 64 μmol kg⁻¹, resulting in hypoxia.
- The concentrations of oxygen dissolved in seawater have been declining in the global ocean due to human pressures that include climate change

This change is due to:

1. a reduction in solubility due to ocean warming,
2. intensified stratification limiting the air-sea gas exchange of oxygen.

For more information please see:

<https://marine.gov.scot/sma/assessment/dissolved-oxygen-0>

Partial pressure of CO₂

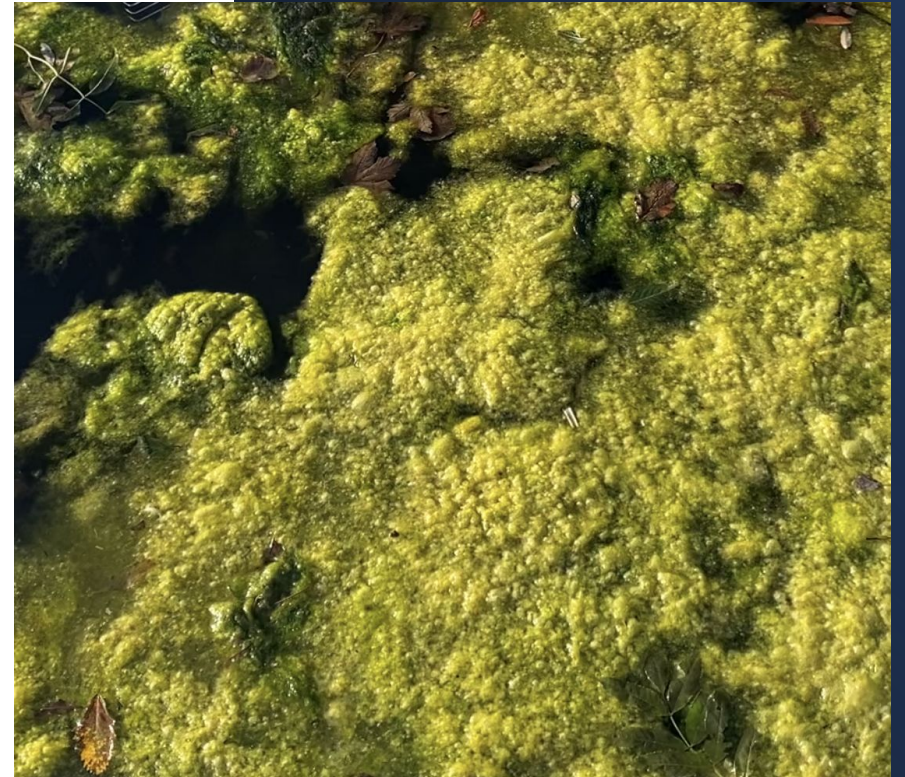
- pCO₂ is the partial pressure of CO₂ in a liquid or gas.
- In marine research, it is used to investigate carbon dioxide (CO₂) dissolved in seawater to better understand changes in ocean carbon chemistry and ocean acidification due to increased atmospheric CO₂.
- 'pCO₂' is closely associated the pH, temperature, dissolved inorganic carbon and alkalinity.
- Quantifying the amount of carbon dioxide (CO₂) in seawater is an essential component of ocean acidification research

Please also see:

<https://www.epa.gov/ocean-acidification/understanding-science-ocean-and-coastal-acidification#carbon>

Chlorophyll-a

- Chlorophyll a is a green pigment found in land and marine plants and microbes.
- It plays a major role in the absorption of sunlight during photosynthesis and converts it to sugar.
- Chlorophyll a concentrations are an indicator of phytoplankton abundance and biomass in coastal and estuarine waters.
- Phytoplankton are microscopic plants that are very important for most marine food webs and produce nearly half of the Earth's oxygen!
- Please also see:
https://earthobservatory.nasa.gov/global-maps/MY1DMM_CHLORA



Conductivity:

- Conductivity, is one of the most useful and commonly measured water quality parameters. Conductivity and salinity have a strong correlation
- In addition to being the basis of most salinity and total dissolved solids calculations, conductivity is an early indicator of change in a water system.
- Salinity affects dissolved oxygen solubility . The higher the salinity level, the lower the dissolved oxygen concentration.
- Please also see:
<https://www.fondriest.com/environmental-measurements/parameters/water-quality/conductivity-salinity-tds/>