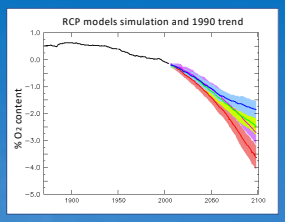
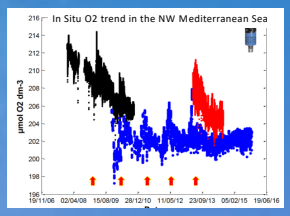
Long Term In situ Oxygen Monitoring (LIOM)

State of the art

- The **oxygen content of the ocean has declined by around 2% since the middle of the 20th century.**
- The volume of ocean waters completely depleted of oxygen has quadrupled since the 1960s.
- Ocean oxygen levels are **expected to fall on average by 3–4%** by 2100 due to **climate change and increased nutrient discharges, though the scale of effect seen will vary regionally**.
- Consequences of ocean oxygen decline include **decreased biodiversity**, shifts in species distributions, displacement or reduction in fishery resources and expanding algal blooms. Ocean desoxygenation threatens to **disrupt the ocean's food provisioning ecosystem services**.

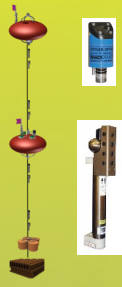


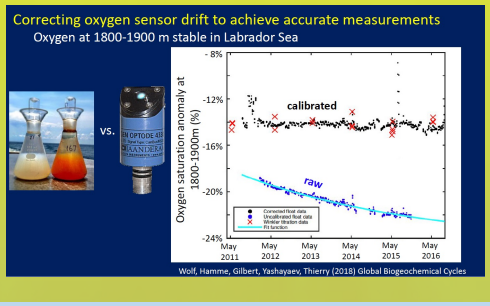
Model-mean time series of global ocean O_2 content (%) over 1870-2100 using historical simulations (black line) and four RCP scenarios.
Colours represent RCP scenarios:
RCP 2.6 – blue, RCP 4.5 – green, RCP 6.0 – lavender and RCP 8.5 – red.
Values are plotted relative to 1990s mean.



North-Western Méditerranean Sea.
- *In situ* O2 **decreasing trend of 1.5 µM a-1** @ 2300 m (● &●) but no decreasing trend @ 2000m (●)
- **Annual O2 variability** related to hydrological events (●) .

Why : Time series validation ; Existing strategy : before & after deployment , indirect measurement within the mooring vicinity (2NM), monthly at best.





Need to improve our accuracy for absolute values and drift correction

Laboratory – Metrology Pole
Multi – organismes (CNRS, Univ, IRD, Ifremer, Shom, INRA, ...)

In Situ Observation
GOOS - FROOS
OCEANSITES

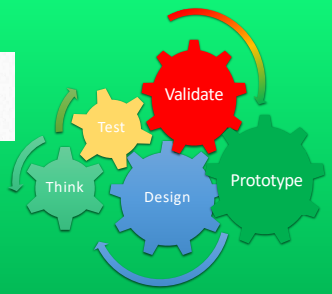
Service dedicated to EMSO, Research Infrastructure, SNO, research project
National and international

Conception of a O_2 sensor calibration bench
EMSO initiative
Ifremer, MIO, HCMR

HOW ? LIOM objective: Automatisation of the Winkler titration (1888)

Principle & Automatisation

Phase 0
Think – Test - Validate
DT INSU MIO Ifremer

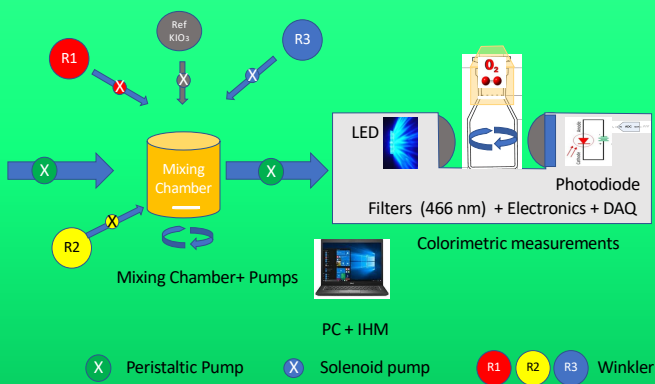


Phase 1
Calibration Bench
Improve capability

Time saving (80%)
Reliability (no human)
Easy of transfer to end users

Phase 2
In situ Sea Water Sample

No monthly ship time required
Autonomous (low frequency)
Accuracy (<1µM O_2)



End Users
→ **Direct GOOS – Oceansites ...**
→ **Indirect (ARGO Floats, Gliders) ...**

OceanSITES Taking the pulse of the global ocean