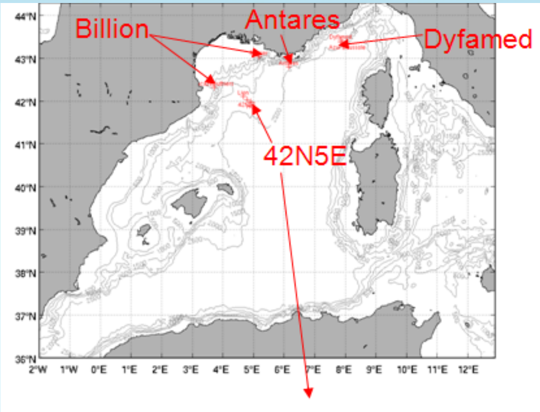
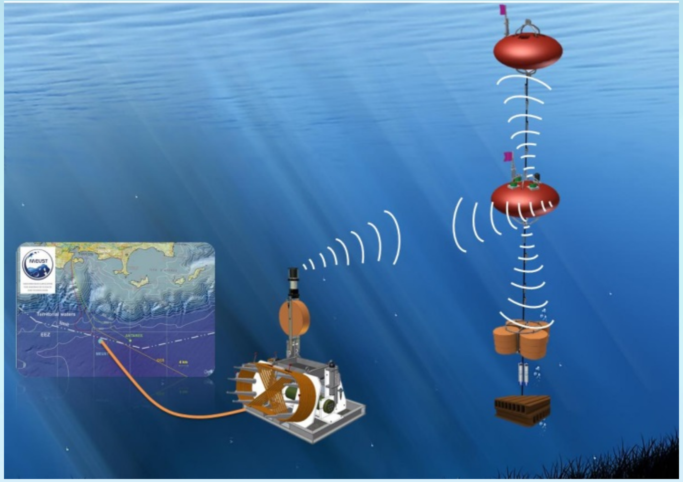
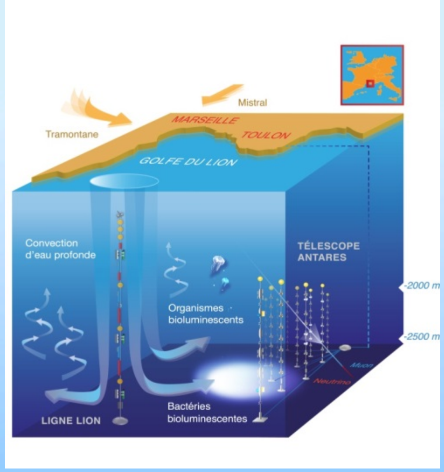
The Observing Long Term Strategy
MOOSE & EMSO





P, Theta, Salinity, O_2
High frequency, real time
500-2400 m



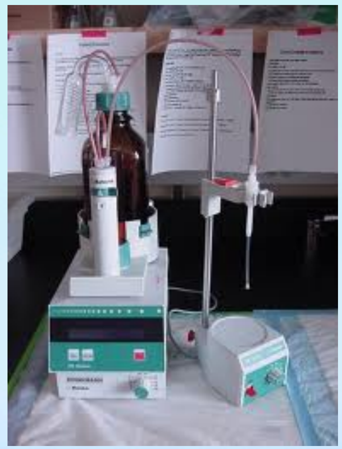
P, Theta, Salinity, O2, BGC
variables
Monthly, Water column

Mooring O2 « Validation »

- CTD Profiles BSE43 and Winkler discret samples
- Propagation of calibration and O2 extraction at O2 sensors depth.
- Mooring O2 – Ajustement using CTD O2 data (Down profile)

- MOORED INSTRUMENTS ON Winkler calibrated CTD_O2
- Direct comparison @ 5m and 2000 m, before and after mooring deployment.
  - Surprise

Profiling → Sampling → Analysing → Qualifying



[O2]=f(Z) @ 12 Z each month

[O2] = f(volt, SOC, offset, pCorr)
24 hz averaged @ 1m resolution
With adjusted parameters

Procedure based on application note
Murphy et al.
64, 64-1, 64-2 64-3

O2=f(Z) @ 1 m resolution

http://www.seabird.com/application-notes

Seabird Murphy's Equation

The equation below, used in Sea-Bird's software for calculating dissolved oxygen in ml/l from SBE 43 output voltage, is a form of that given in Owens-Millard (1985):

$$\text{Oxygen (ml/l)} = [Soc * (V + Voffset + tau(T,P) * dV/dt)\} * Oxsol(T,S) * (1.0 + A*T + B*T^2 + C*T^3) * e^{(E*P/K)}$$

Eqn 1

Where:

- V = SBE 43 output voltage signal (volts)
- dv/dt = time derivative of SBE 43 output signal (volts/second)

- T = CTD temperature (°C)
- S = CTD salinity (psu)
- P = CTD pressure (dbars)
- K = CTD temperature (°K)
- tau(T,P) = sensor time constant at temperature and pressure
- Oxsol(T,S) = oxygen solubility function (ml/l), which converts oxygen partial pressure (sensor measurement) to oxygen concentration (*Garcia and Gordon, 1992*). See *Appendix A* in *Application Note 64* for values at various temperatures and salinities.
- Soc, Voffset, A, B, C, E, and Tau20, D1, D2 [terms in calculation of tau(T,P)} are calibration coefficients

Seabird Murphy's Equation

$$\varphi = Oxsol(T,S) * (1.0 + A*T + B*T^2 + C*T^3) * e^{(E*P/K)} \qquad \textit{Eqn 2}$$

The oxygen equation then reduces to the form in equation 3:

$$Oxygen\ (ml/l) = Soc * (V + Voffset) * \varphi \qquad \textit{Eqn 3}$$

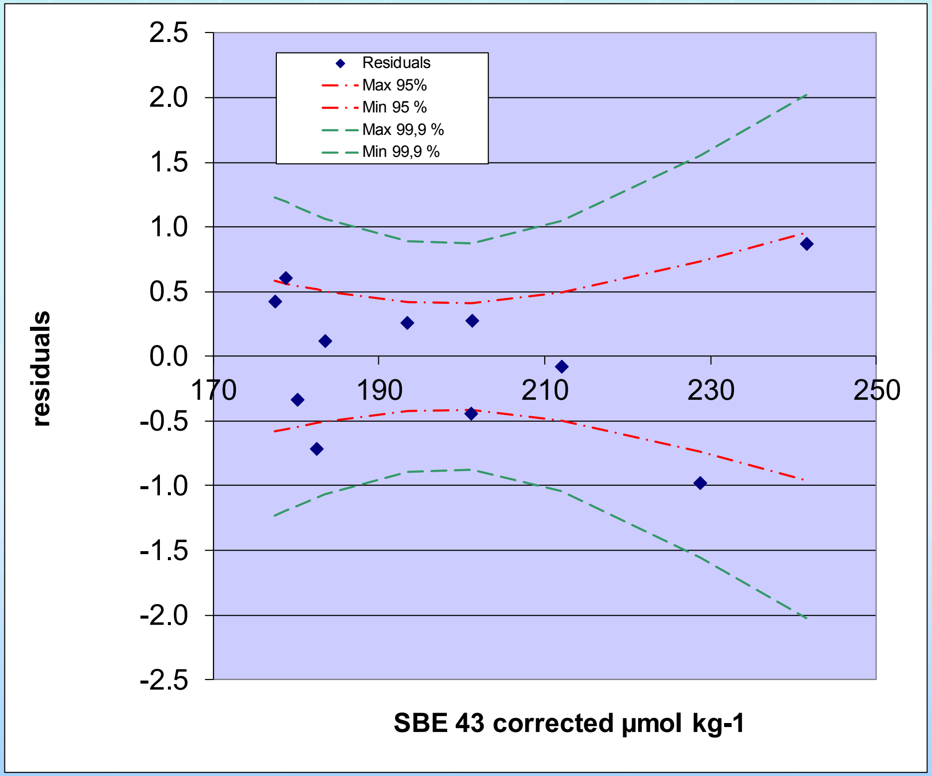
This may be expressed in a linear form in equation 4.

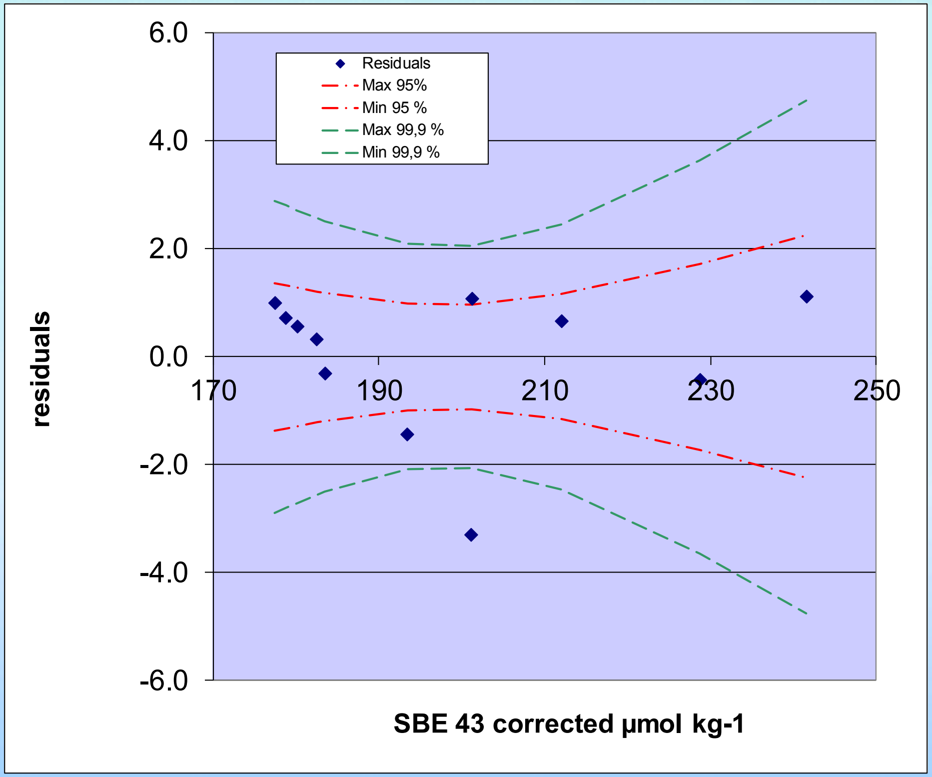
$$Oxygen\ (ml/l) / \varphi = Soc * (V + Voffset) = M * V + B \qquad \textit{Eqn 4}$$

Where:

- *Soc* = M
- *Voffset* = B / M

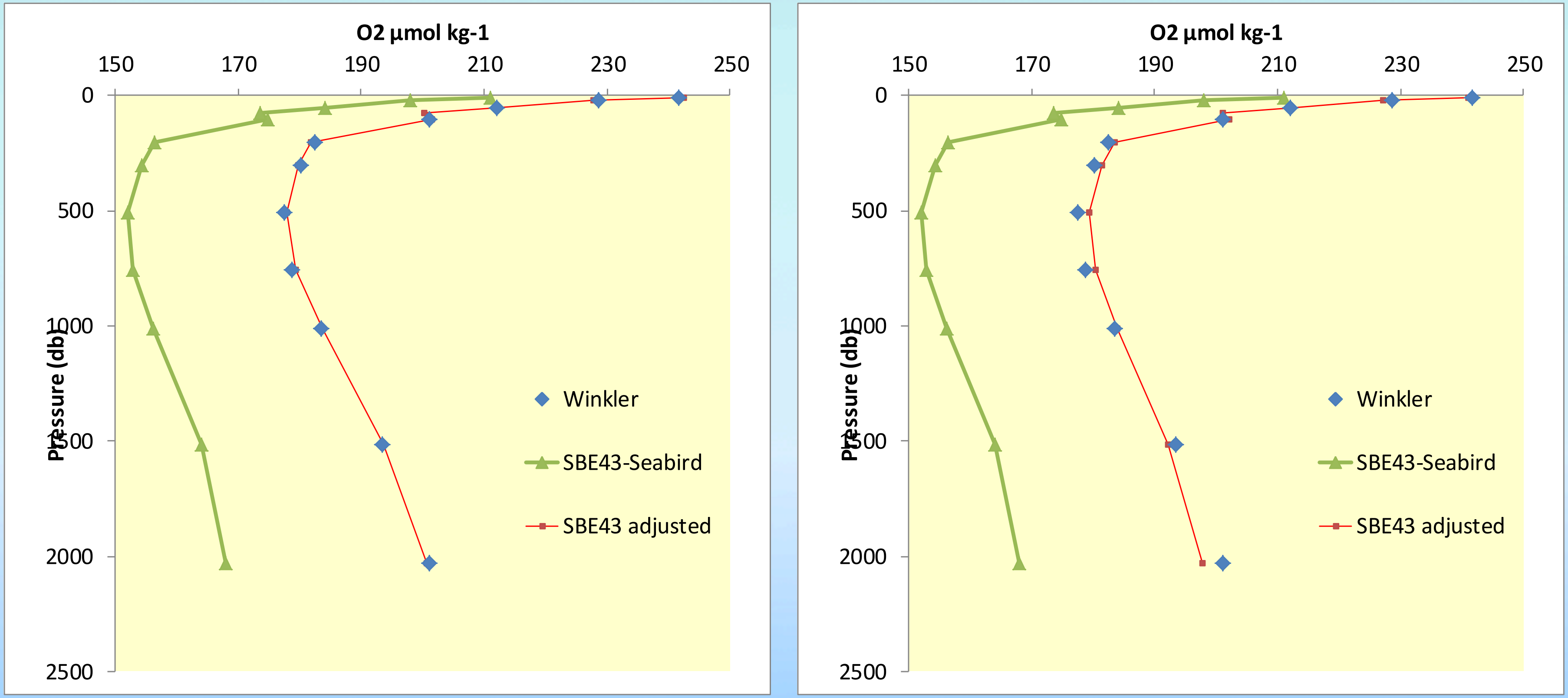
Residuals
(SOC OFFSET pcorr) vs (SOC OFFSET)





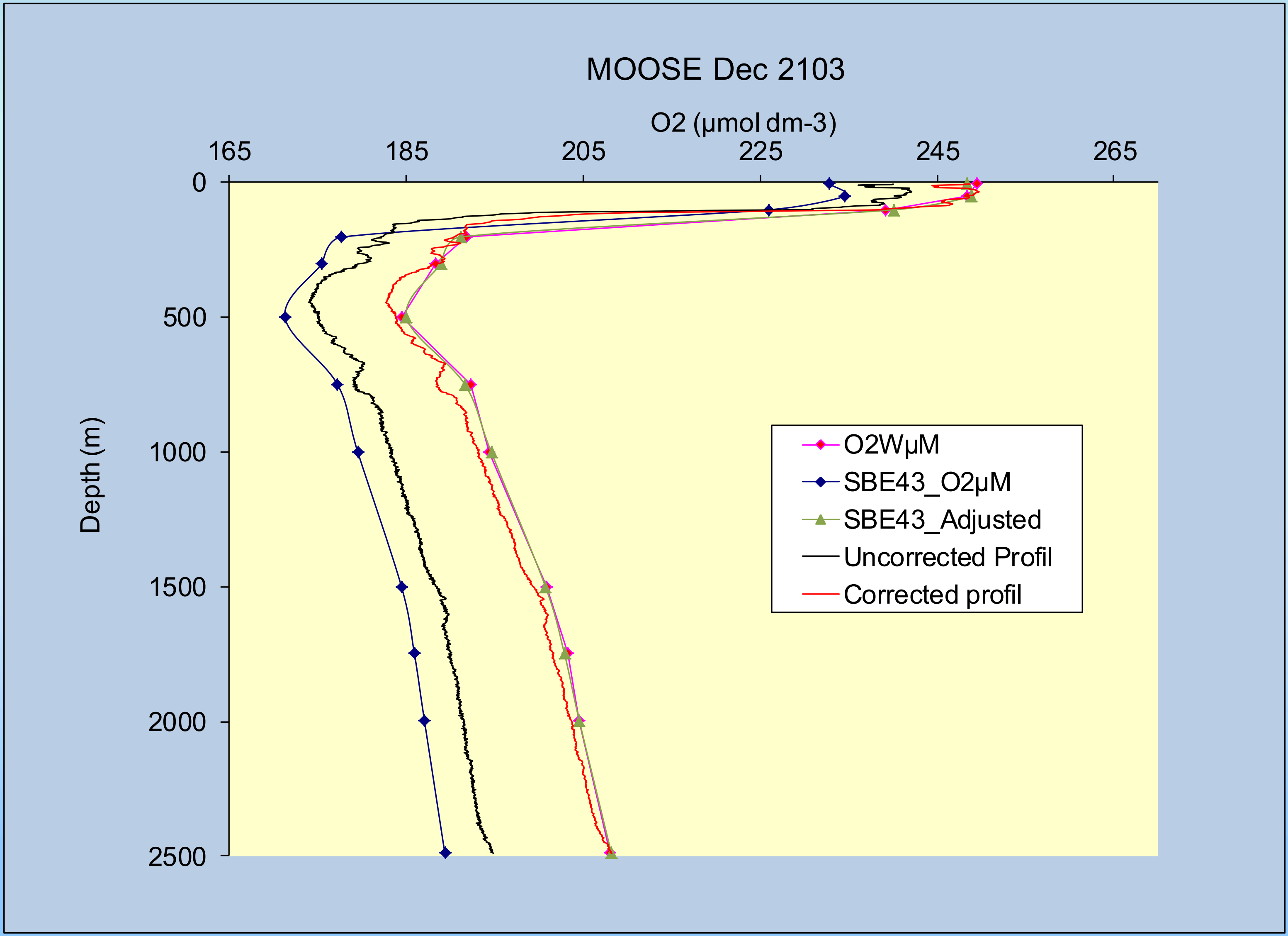
Parameters optimisation after iteration (minimising residuals).

Profiles
(SOC OFFSET pcorr) vs (SOC OFFSET)



Parameters optimisation after iteration (minimising residuals).

Calibration with Winkler sample : porpagation to the descending profil
Error propagation : +/- 2 µM

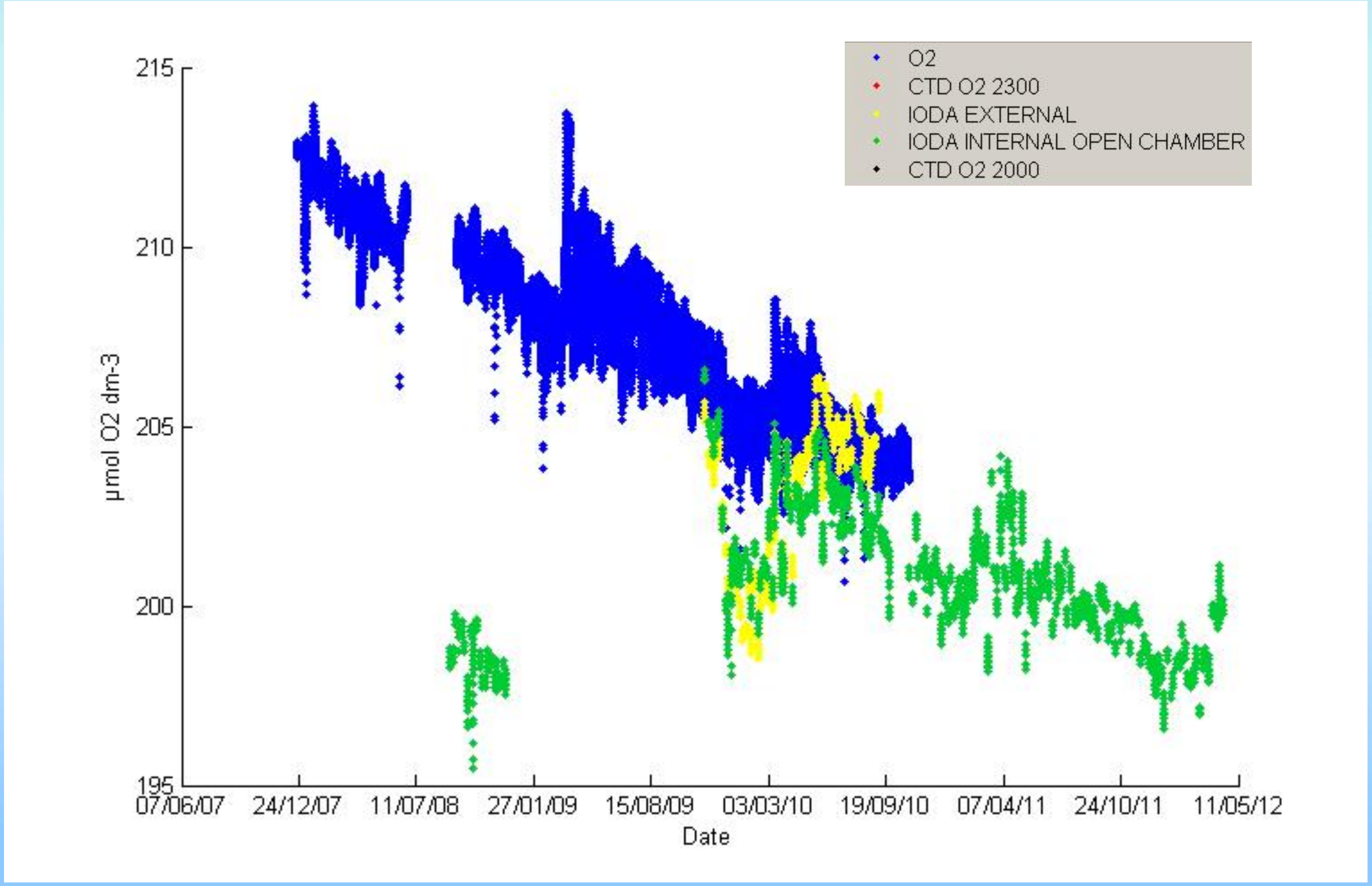


Step 2
Extract data from CTD O2 profiles

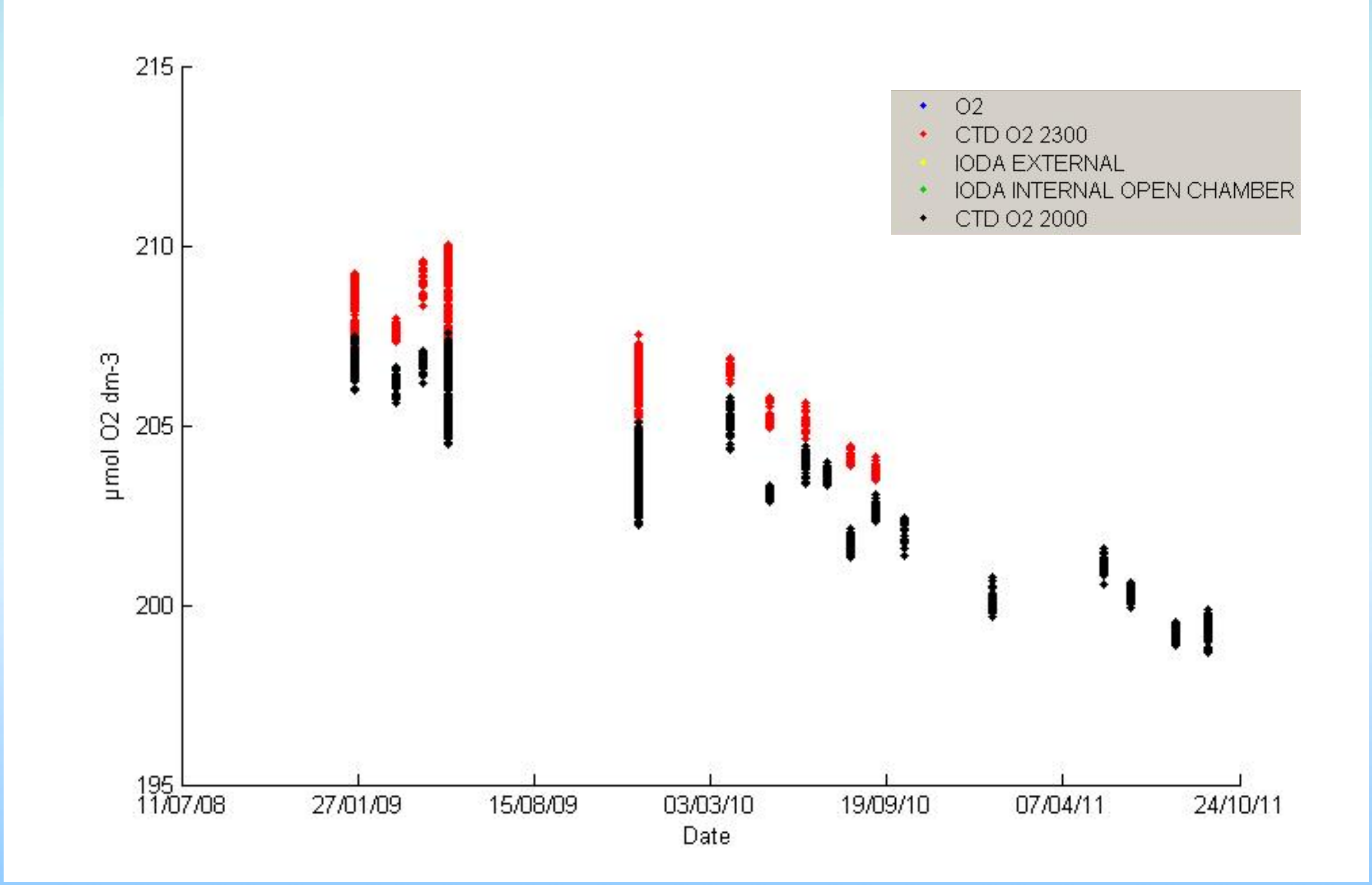
- For each sensor depth
- For each montly profile

- Average O2 data   @ sensor depth
- Compute offset between sensor and Winkler
- Apply offset on time series

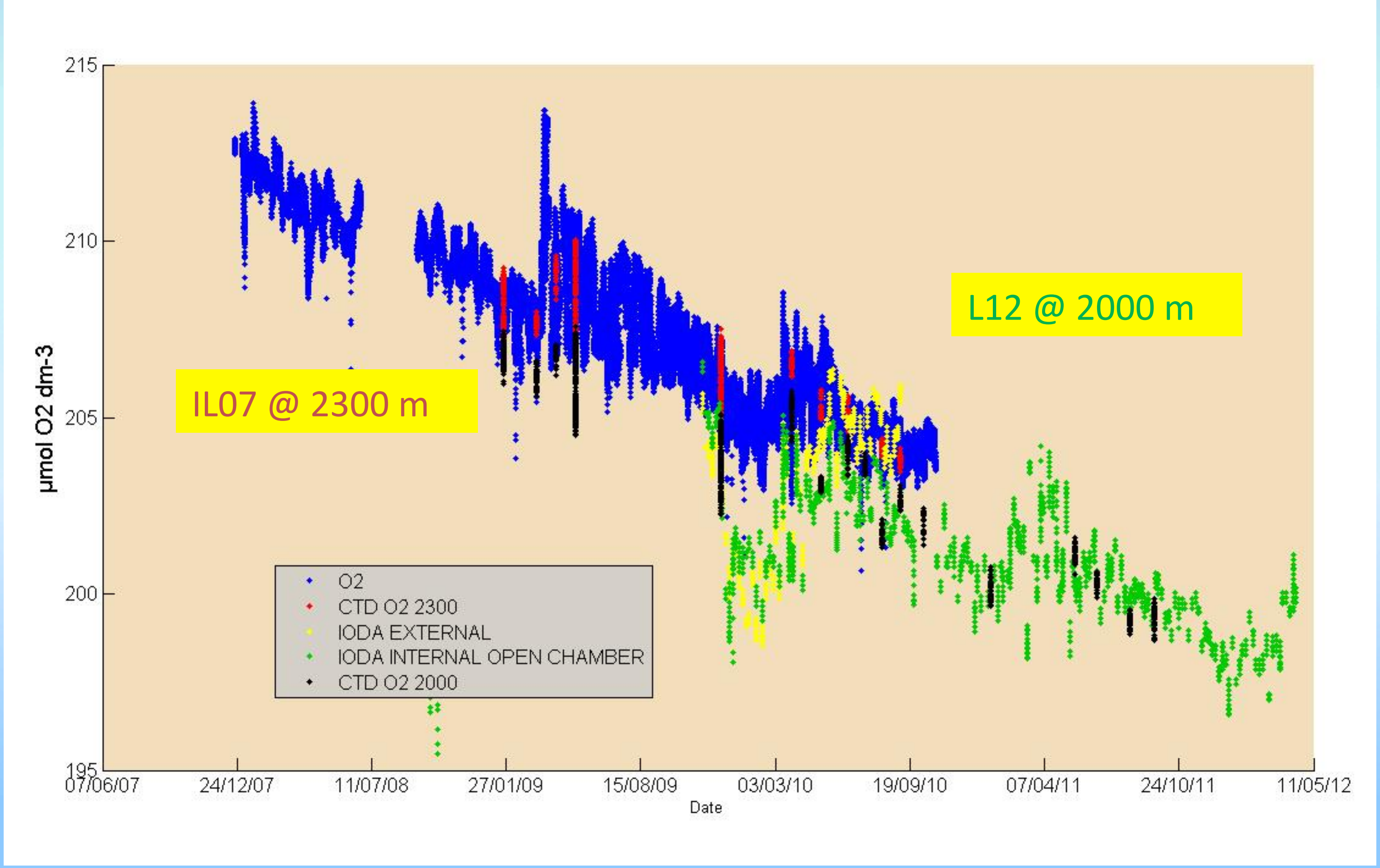
IL07 Oxygen Data @ 2300 m
L12 Oxygen data @ 2000 m – IODA Ext
L12 Oxygen data @ 2000 m – IODA Int



CTD Cast Oxygen Data @ 2300 m
CTD Cast Oxygen Data @ 2000 m



Oxygen Time Series @ 2000 m

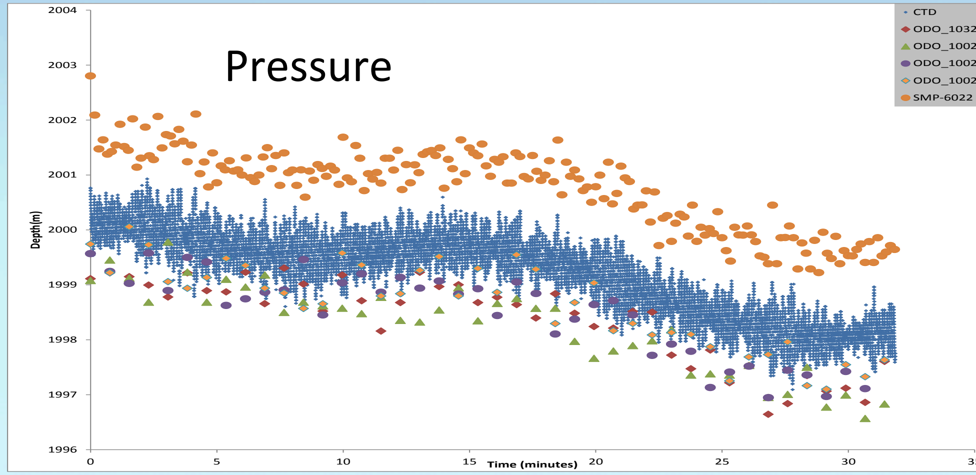


Data acquisition CTD

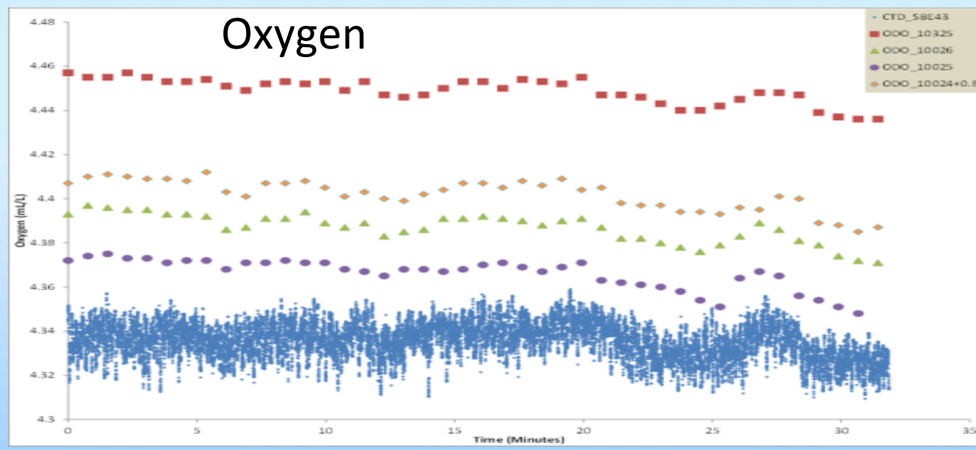
Sensors @ 2 depths (5 and 2000 m)

30-45 mins

Time series of available parameters



Microcat mounted on CTD caroussel



Co variability, offset → correction pre-deployment

→ correction post-deployment

and then drift correction to apply on acquired data =set

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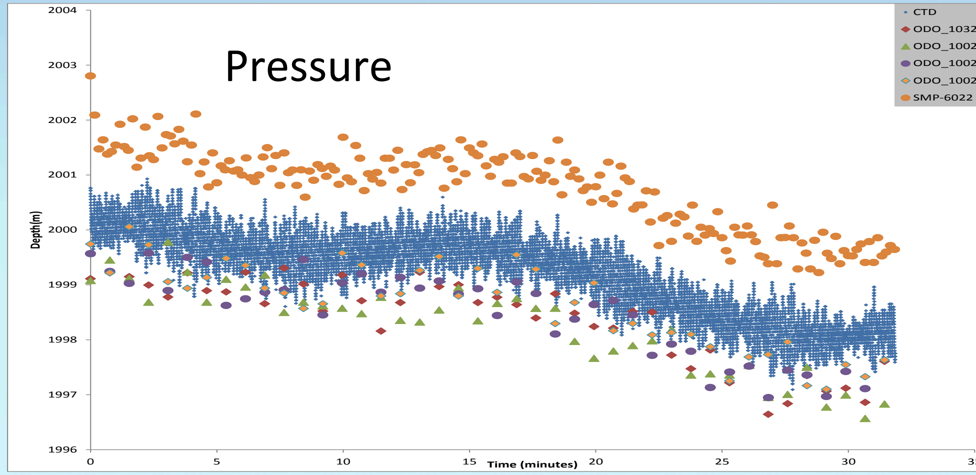

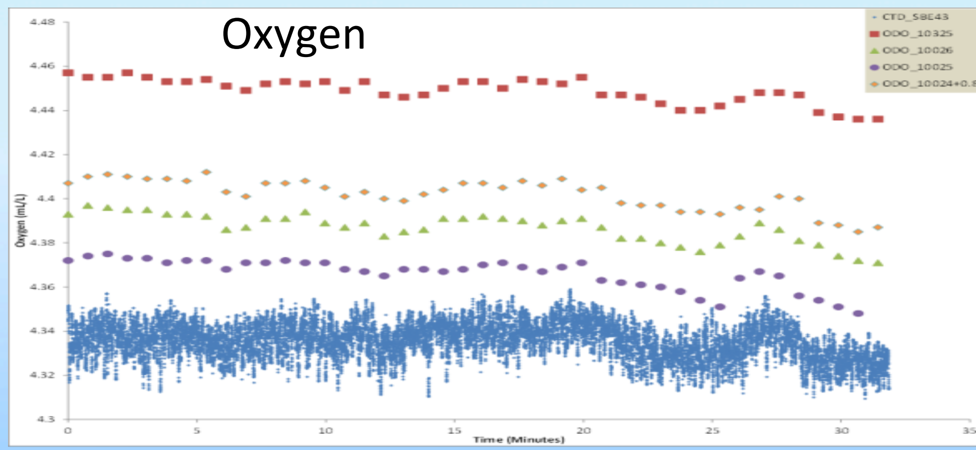

Microcat mounted on CTD caroussel

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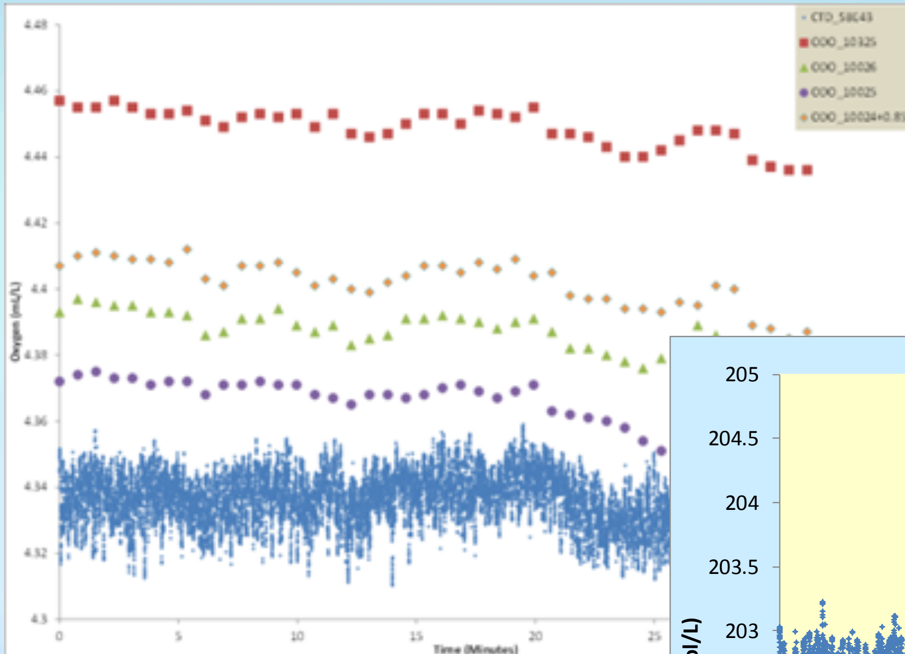
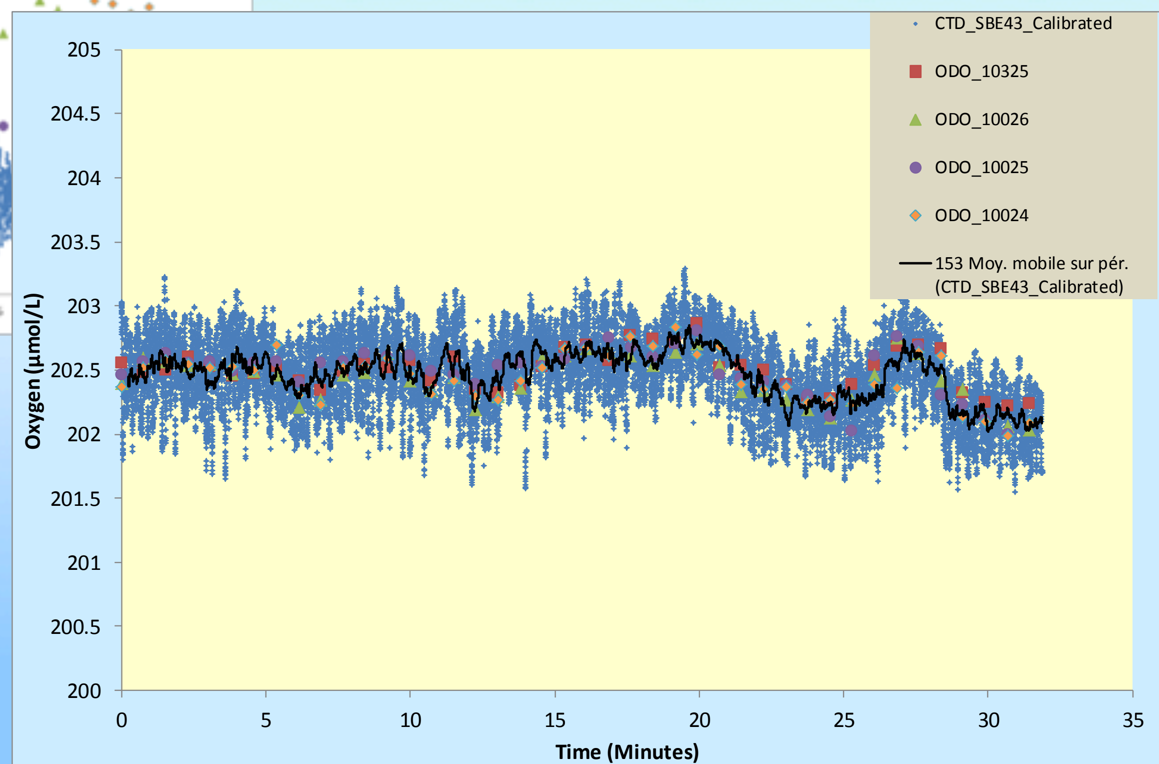
1) Fit a LOESS function for each time series
2) Compute offset from average distance during the «standby » @ lower acquisition frequency
3) Apply specific offset to each sensor





Offset evolution

	DeltaO210024	DeltaO210025	DeltaO210325	DeltaO210325
Predeployment	34.99811	1.35030	2.28234	5.05691
Postdeployment	**35.44678**	**3.49237**	**0.16203**	**4.52230**

OK, apply a drift over time of deployment

Offset 5 m and 2000 m

	DeltaOx10024	DeltaOx10025	DeltaOx10026	DeltaOx10325	DeltaOx11375
Pallier_2000	-31.102	7.025	4.480	8.919	11.886
Pallier_5	26.012	-2.559	-4.668	0.212	4.552

What do we do ?