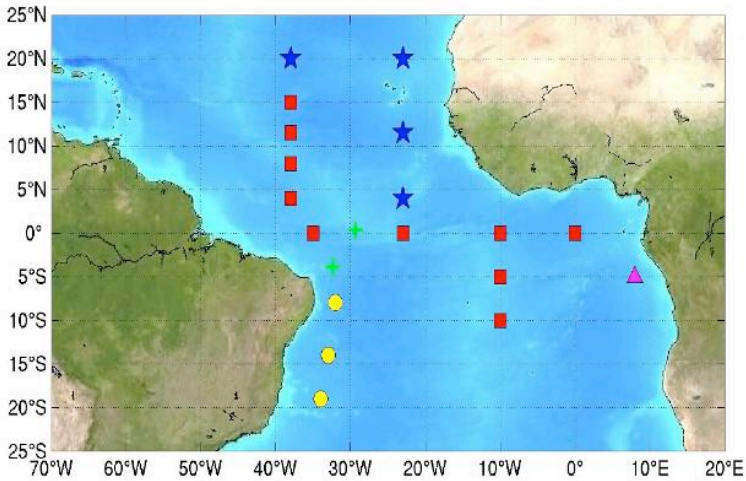
**PIRATA 6°S, 10°W readme File**

**Platform Information**

A CARIOCA $CO_2$ sensor and an oxygen optode 3830 (Aanderaa) have been installed, since June 2006, on the mooring of the PIRATA network (Bourlès et al., 2008) at 6°S, 10°W for monitoring $fCO_2$ and dissolved $O_2$ in surface water.

*Buoy equipped with a CARIOCA sensor and an Anderaa optode*




*Network of instrumented moorings (PIRATA, Predicted and Research moored array in the Tropical Atlantic)*

The seawater intake is at 1.5 m below the surface. Other measurements recorded at the mooring are shortwave radiation, precipitation, wind, relative humidity, air temperature, seawater temperature at the surface, at 20m, 40m, 60m, 80m, 100m, 120m, 140m, 180m, 300m and 500m, salinity at the surface, at 20m, 40m and 120m.

**Cruise information**
Instrumented mooring of the PIRATA network (Bourlès et al., 2008).

**Class of Data**: Surface ocean carbon dioxide and dissolved oxygen concentrations

**Investigator**
Nathalie Lefèvre
IRD
LOCEAN, Université P. et M. Curie, 4 place Jussieu, T. 45-46 5ème étage, UMR 7159 Case 100, 75252 Paris Cedex 05, FRANCE
Nathalie.lefevre@locean-ipsl.upmc.fr

**System operator & technical support**
DT INSU, CNRS
1 place Aristide Briand
92195 Meudon Cedex
FRANCE

**CARIOCA $CO_2$ sensor (fCO2)**
The measurement principle for $CO_2$ is to flow seawater across a gas permeable membrane filled with pH sensitive dye. The $CO_2$ will diffuse across the membrane until the fugacity of $CO_2$ in the dye reaches that of the seawater. The fugacity of $CO_2$ is deduced from the pH of the dye solution. The pH is determined by the change in ratio of optical absorbance at two wavelengths (596 nm and 434 nm) corresponding to the maximum absorbance of the acid and conjugate base of the dye and are measured with a spectrophotometer. A third wavelength (810 nm) where the dye does not absorb is used for control.
The accuracy of the CARIOCA system is ±3 μatm.

The calibration is done in the laboratory by comparing the response of the spectrophotometer to the $fCO_2$ of a seawater solution determined with an infrared analyzer (Licor 7000). The CARIOCA response is determined over the anticipated range of $fCO_2$. The CARIOCA sensor is calibrated before and after deployment.

**Temperature sensor**
Temperature measurements are made with a Betatherm thermistor. It is calibrated at the metrology laboratory of IFREMER (certified by COFRAC). The thermistor is calibrated between -2 and +32°C, with an accuracy of 0.01°C.

**Pressure sensor**
Atmospheric pressure on the buoy is measured using a Vaisala PTB101C, 900-1100 hPa. The accuracy is ±0.3 mb at 20°C and ± 1 mb from 0 to 40°C.

**Oxygen optode**
The oxygen sensor is an Aanderaa optode 3830.
It has a resolution < 1 μM and an accuracy < 8 μM or 5% whichever is greater. The calibration is made before and after deployment using two concentrations of oxygen (0 and 100%) as described in the optode manual. The oxygen Winkler measurement made at the mooring site is compared with the optode value on the day of deployment.

The temperature sensor of the optode has a resolution of 0.01°C and an accuracy of ±0.1°C.

**Variables info**

| Column header | Explanation |
|---|---|
| Day | Day of the year |
| dd | Day |
| mm | Month |
| yy | Year UTC date |
| hh | Hours UTC time |
| mn | Minutes |
| ss | Seconds |
| $fCO_2$ | Fugacity of $CO_2$ (μatm) |
| sst | Sea surface temperature (°C) |
| sss | Sea surface salinity from the PIRATA mooring |
| Patm | Atmospheric pressure |
| $O_2$ | Dissolved oxygen concentration (μmol/kg) |
| $TO_2$ | Temperature of the oxygen optode |

DATASET REFERENCES:

Lefèvre, N., A. Guillot, L. Beaumont, and T. Danguy (2008), Variability of $fCO_2$ in the Eastern Tropical Atlantic from a moored buoy, *J. Geophys. Res.*, *113, C01015*, doi:10.1029/2007JC004146.

Parard, G., N. Lefèvre, and J. Boutin (2010), Sea water fugacity of $CO_2$ at the PIRATA mooring at 6°S, 10°W, *Tellus B*, *62(5)*, 636-648.

METHOD REFERENCES:

Bourlès, B., et al. (2008), The PIRATA program: history, accomplishments and future directions., *Bulletin of the American Meteorological Society*, *89*, 1111-1125.

Boutin, J., L. Merlivat, C. Henocq, N. Martin, and J.-B. Sallee (2008), Air–sea $CO_2$ flux variability in frontal regions of the Southern Ocean from CARbon Interface OCean Atmosphere drifters, *Limnology and oceanography*, *53*, 2062-2079.

Copin-Montégut, C., M. Bégovic, and L. Merlivat (2004), Variability of the partial pressure of $CO_2$ on diel to annual time scales in the Northwestern Mediterranean Sea, *Mar. Chem.*, *85*, 169-189.

Hood, E. M., and L. Merlivat (2001), Annual to interannual variations of $fCO_2$ in the northwestern Mediterranean Sea: Results from hourly measurements made by CARIOCA buoys, 1995-1997, *Journal of Marine Research*, *59*(1), 113-131.

Lefèvre, N., and L. Merlivat (2012), Carbon and oxygen net community production in the eastern tropical Atlantic estimated from a moored buoy, *Gl. Biogeoch. Cycles*, *26*(GB1009), doi:10.1029/2010GB004018.

Lefèvre, N., J. P. Ciabrini, G. Michard, B. Brient, M. Duchaffaut, and M. Merlivat (1993), A new optical sensor for $PCO_2$ measurements in seawater, *Mar. Chem.*, *42*, 189-198.

Merlivat, L., and P. Brault (1995), CARIOCA Buoy: Carbon Dioxide Monitor, *Sea Technology*, *10*, 23-30.