CARIACO Time Series Station

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PROJECT SUMMARY

The CARIACO oceanographic time series started in November 1995 at 10°30′ N, 64°40′ W. The objectives of the program are to collect a set of biological, chemical, geological and physical measurements designed to answer scientific questions about ocean processes that affect the flux of particles sinking to the bottom of the Cariaco Basin. This is a 1,400 m deep depression located on the Venezuelan continental margin in the southeastern Caribbean Sea. Because of slow turnover, decomposition of sinking material leads to anoxia below about 250 m. These conditions preserve an excellent sediment record that is used by the international community to study Holocene and late Pleistocene changes in climate. Understanding processes that affect the sinking material is the key to understanding the ocean's role in past, present, and future climate, and to educate decision-makers and the public about this relationship. Therefore, CARIACO improves accuracy in dating of climate variations detected using sediment records.

Intellectual merit: The scientific program is guided by the following set of hypotheses:

(1) The sinking flux of particulate matter contains a record of to interannual-scale changes in upper ocean conditions, including upwelling, and terrigenous input events.

(2)Changes in nutrient supply result in ecosystem shifts that are preserved in sinking particles.

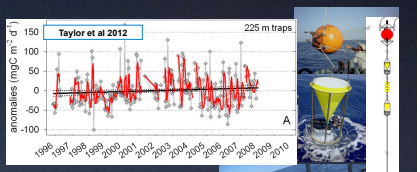
(3)Temporal changes in the hydrography of the basin are directly related to regional wind variability, the passage of eddies near the shelf break, and circulation changes of the Atlantic Ocean.

(4)Chemoautotrophic bacteria near the oxic-anoxic interface alter the composition of the vertical particulate flux and the dissolved organic matter concentration.

The program generates, on a monthly basis, observations in the Cariaco Basin to assess variability in lateral transport and upwelling, changes in phytoplankton, zooplankton and bacteria community composition, variations in primary productivity and chemoautotrophy, and changes in the composition and amount of the particulate flux sinking to the bottom. The program uses intensive traditional oceanographic and meteorological techniques, as well as modern tools such as satellite and molecular observations .

Methods

PARAMETER	UNITS	METHOD	REFERENCES
Temperature, salinity, pressure, oxygen, fluorescence and light attenuation	°C, psu, db, µM, mgCl a m^{-3}, ml L^{-1}, m^{-1}	Electrometric, CTD	SeaBird SBE–3F, SBE-4C,SBE–29, SBE-43, WETlabs ECO-FLRTD, WETLabs C-star
Salinity discrete		Induction	Guildline Portasal®
Dissolved oxygen	µM	Volumetric	Aminot y Chaussepied, (1993)
pH		Spectrophotometric	Clayton y Byrne (1993)
Alkalinity	mol kg-1	Spectrophotometric	Breland y Byrne (1993)
Organic carbon and nitrogen in particles	µg kg^{-1}	Coulorimetric	Sharp (1974)
Chlorophyll *a*	mgChl*a* m^{-3}	Fluorometric	Holm-Hansen et al. (1965)
Primary production	mgC m^{-3} h^{-1}	Tracers 14C	IOC (1994)
Particles absorption	m^{-1}	Radiometric	Kishino *et al.* (1985) modification
Total organic carbon and nitrogen and dissolved	µM	High temperature combustion	Dickson *et al.* (2007)



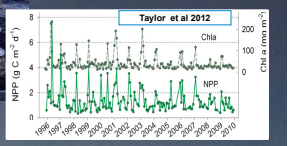
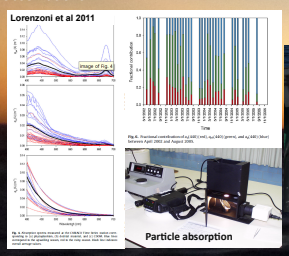
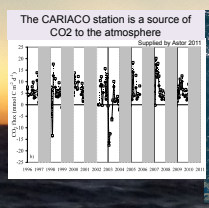


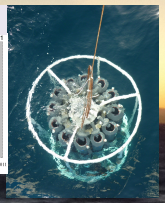
Table 1. Rates of change in surface ocean and meteorological and climatic conditions at Station CARIACO and the tropical Atlantic

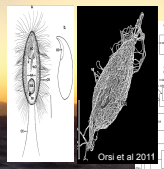
Variable	Slope* (y^{-1})	SE*	Coefficient of determination* (r^2)	Significance* (P)	First-order constant† k (%·y^{-1})
NPP (mg C·m^{-2}·d^{-1})‡	−39	8.5	0.12	<0.001	−1.7
Chla (mg·m^{-2})¶	−1.5	0.38	0.10	<0.001	−2.8
mg *phaeo* mg $Chla^{-1}$	+0.03	0.004	0.23	<0.001	+2.5
Zooplankton (mg (dry wt)·m^{-2})	+102	22	0.16	<0.001	+5.0
POC flux (mg C·m^{-2}·d^{-1})§	+1.2	0.50	0.02	<0.02	+1.0
PN flux (mg N·m^{-2}·d^{-1})§	+0.20	0.07	0.02	<0.01	+1.3
$CaCO_3$ flux (mg·m^{-2}·d^{-1})§	+6.6	1.0	0.14	<0.001	+6.0
Opal flux (mg·m^{-2}·d^{-1})§	+3.9	1.0	0.06	<0.001	+2.4
Total mass flux (mg·m^{-2}·d^{-1})§	+22.6	8.2	0.03	<0.007	+2.8
PO_4^{3-} (mmol·m^{-2})¶	−0.66	0.11	0.16	<0.001	−2.4
$Si(OH)_4$ (mmol·m^{-2})‡	−3.7	1.4	0.03	<0.01	−1.2
21 °C isotherm depth (m)	+0.85	0.24	0.10	<0.005	+1.2
SST (°C)	+0.07	0.01	0.14	<0.001	+0.32
Mean density (n_0, $kg·m^{-3}$)¶	−0.02	0.003	0.15	<0.001	−0.07
Buoyancy frequency (cycles/h)¶	+0.35	0.05	0.19	<0.001	+0.93
Zonal winds (cm·s^{-1})	−7.6	1.1	0.21	<0.001	−1.9
ITCZ precipitation (mm)	+0.04	0.007	0.16	<0.001	+0.40
ITCZ longitude (°E)	+0.36	0.06	0.19	<0.001	+0.08
ITCZ latitude (°N)	+0.17	0.03	0.18	<0.001	+0.39
Azores High latitude (°N)	+0.08	0.03	0.05	<0.005	+0.20

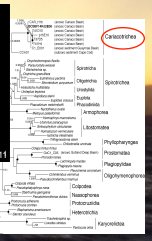
Taylor et al 2012

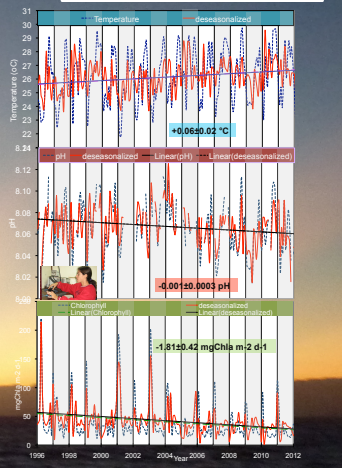












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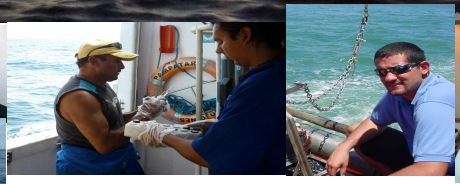
This poster summarizes major achievements of the CARIACO program and the program data policy. Data are available via our web page (http://imars.usf.edu/cariaco/index.html).



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