# Long term evolution of the biogeochemical quality of Brazilian marine waters: the COCOBRAZ project

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## 1. Introduction

Coastal ecosystems represent areas of high ecological, societal and economical importance. At the interface between land and ocean, these ecosystems are particularly vulnerable to changes in environmental conditions of natural or anthropogenic origin acting on both latter geosystems. Monitoring the coastal ocean represents a prerequisite for supporting the development of sustainable, ecosystem-based environmental policies (UNESCO's Intergovernmental Oceanographic Commission, https://ioc.unesco.org/). Brazil has one of the largest inter and subtropical coastlines in the world, with about 8,000 kilometers in length. While Brazilian coastal/shelf host a mosaic of marine environments, submitted to a variety of climate induced or direct human pressures (e.g. urbanisation, intensive agriculture, deforestation…) there is currently a lack of long lasting in situ time series to evaluate the impact of environmental changes on the biogeochemical quality of the Brazilian marine domain. The ANR-FAPESP COCOBRAZ (LOG, INPE USP, 2022-2026: Characterization of Brazilian coastal waters biogeochemical quality evolution over the last two decades from satellite observation: impact of natural and anthropogenic forcings) project has been built in this context aiming to provide an overall diagnostic on the evolution (preservation/alteration) of the biogeochemical quality of the Brazilian coastal/shelf waters (including major estuaries, bays and large coastal lagoons) and to assess the origin (natural/anthropogenic) of the observed changes based on the development of an innovative ocean color satellite data set taking into account the optical complexity of the Brazilian waters and using adapted statistical techniques.

## 2. COCOBRAZ ocean color data set

The activities performed in the first part of the COCOBRAZ project have first aimed to develop an innovative ocean color data set at 1km resolution covering the whole Brazilian marine domain that will be delivered to the community. This data set has been computed using up to date atmospheric correction and bio-optical models for estimating the marine reflectance (Rrs) and key biogeochemical descriptors (phytoplankton biomass: Chla, Particulate Organic Carbon: POC, Suspended Particulate Matter: SPM, Colored Dissolved Organic Matter: CDOM and Dissolved Organic Carbon: DOC) from the MODIS (Moderate-Resolution Imaging Spectroradiometer, NASA) sensor over the time period 2002-2022. The value added of this new ocean color data set, which has been developed and validated based on extensive in situ data sets and using methods taking into account the optical diversity of the Brazilian waters will be presented, Comparing the accuracy of the COCOBRAZ products to long-term ocean color archives developed for global scale applications (e.g. GlobColour and OC-CCI merged products).

## 3. Long term biogeochemical dynamics of Brazilian ZEE

The COCOBRAZ 20-yr ocean color satellite archive has been then exploited using adapted time series analysis techniques (Census X11 time series decomposition and trend analysis techniques) to identify changes over two decades in the phytoplankton biomass, particulate and dissolved matter pools and associated organic carbon stocks dynamics at different timescales (interannual trends, evolution of the seasonality, episodic events). The first results of these analyses will be presented emphasizing the presence of significant long-term modulation in the biogeochemical characteristics of the Brazilian coastal/Shelf domain. Finally, the first outcomes of the causality analyses currently performed in order to specify the environmental changes responsible for the observed changes in response to the impact of climate or direct anthropogenic impact on the Brazilian coastal domain will be illustrated.

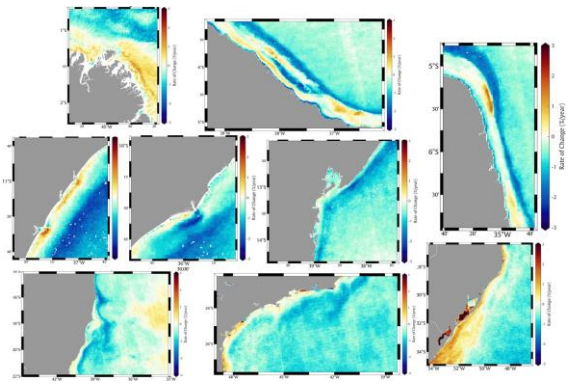

Figure 1: Identification of coastal hotspots (e.g. eutrophication) based on the trend analysis performed on the MODIS COCOBRAZ Chla time series generated in COCOBRAZ (rate of change in %/year over 2002-2022).