Occurrence of Harmful Algae Blooms poses an emerging threat to Eastern Boundary Upwelling Ecosystems. By combining satellite-derived data and in situ measured physicochemical parameters, we assessed the possibility of detecting HAB occurrence and explored the scope of a colorimetric index (Red Tide Index, RTI). The index was able to distinguish those areas affected by the HAB during an event reported in the Humboldt Current System south of Chile during October 2003.

1. Introduction

The red tide phenomenon occurs naturally and is produced by the exaggerated increase and mass concentration of phytoplankton generating a color change of water by highly toxic cells (Hallegraeff, 1993, 2010). Those blooms of dinoflagellates associated with the production of natural toxins, depletion of dissolved oxygen and other negative effects are known as Harmful Algal Blooms (HABs). HABs can affect various water systems, being particularly prevalent in coastal marine ecosystems (Kudela et al., 2005), specially in Easter Boundary Upwelling systems (Fig. 1).

2. Data and methods

Satellite and in situ data (Fig. 2) data considering the period of HAB’s bloom reported by Rodríguez-Benítez & Haag (2004) in the Pacific (41°S-45°S) were analyzed to achieve the objectives.

HAB occurrence in the Humboldt Current System (Fig. 1) was investigated using a RTI based on Ahn and Shrumgum (2006), which is defined as:

\[
\text{RTI} = \frac{\Delta \text{LI}_5}{\Delta \text{LI}_4} - \frac{\Delta \text{LI}_4}{\Delta \text{LI}_3}
\]

where \(\Delta \text{LI}_5\) is normalized water leaving radiance at wavelength \(\lambda\).

MODIS AQUA RRS 5-day composites were used to create at time series of the RTI.

3. Results - Satellite

Figure 3 indicates chl-a and RTI at two zonal transects: 32°S and 32.5°S. The 3a bottom panel correspond to in situ data and shows a linear correlation of 0.67 between those parameters. The 3b shows significant values of chl-a anomaly near the coast and 3c indicates that a HAB has occurred in the same place that the section of in situ data, but without signal offshore.

According to the in situ data, the occurrence areas were characterized by a low subsurface percentage of oxygen saturation and high concentrations of nitrates, phosphates and total inorganic carbon near the coast.

4. Prospects

- Analysis of CHL and SST data results in a powerful tool for the identification of potential upwelling and HAB events.
- in situ data are consistent with the results obtained from the analysis of satellite images.
- RTI suggests that CHL data can be good to distinguish those areas affected by the HAB as observed with in situ data.
- Satellite remote sensing can be a powerful tool to obtain a higher frequency and integration of measurements, with a large number of images available in near real time (Hu et al. 2005).
- Multidisciplinary studies and methodologies are required due to the complexity and variable characteristics of these oceanographic phenomena.

5. References


Rodríguez-Benítez and Haag (2004). Descripcion de las corrientes de corriente oriental del Brasil y el ecuador (COEC) y de la corriente de corriente oriental del Brasil (COEB) en el océano Atlántico. Instituto de Diversidad y Ecología Animal (CONICET), Buenos Aires, Argentina.

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