



UNESCO



## NATIONAL REPORT ON SEA LEVEL OBSERVING ACTIVITIES

COTE D'IVOIRE

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## **Introduction**

For most regions of the world, sea level is increasing at a rate of only a few millimetres (1~2 mm) per year (Douglas, 2001). A future rise of approximately 50 cm would pose serious threat to vulnerable coastal cities and infrastructures, small islands and coastal environments. In spite of this impending danger, continuous sea level measurements around Africa began relatively recently, and the longest available records in Africa are very short (less than 20 years generally). If one considers the Gulf of Guinea as an example, during the last two decades most coastal tide gauges have been abandoned or provided poor quality records. As we can see, there is a lack of in situ measurements network. Before December 2006, the only tide gauge maintained adequately into recent times in the Gulf of Guinea was located at Sao Tome Island.

With concerns over climate change, global warming and sea level rise issues in the scientific literature and public media, it becomes urgent to promote the establishment of high quality sea level observations and access to data. With the initiative of the IOC of UNESCO with the Flanders collaboration, two operational tide gauges have been installed along the Gulf of Guinea (Takoradi, December 2006 and Pointe Noire, April 2007). One tide gauge should be installed in June 2007 at Port Sonara in Cameroon. A technical visit could take place at Abidjan and San Pedro in order to collect information for a Kalesto radar tide gauge installation. This report provides an overview on the Ivorian tide gauge status.

## **Ivorian tide gauges status**

Five float tide gauges are operational in Côte d'Ivoire. Four are installed in the Abidjan port but only the station known as "wharf" is used for sea level forecasting. The other stations are used for civil engineering studies. The fifth station is installed at San Pedro port. For historical and financial reasons, the prediction of the tide off the Ivorian coastline is always produced by SHOM based on the tide measurements recorded from "Wharf" station.

The San Pedro Port authority uses the same predictions for ship navigation. Tide gauges records from Abidjan and San Pedro stations exist in digital form with many gaps. The comparison of these data and those derived from altimetric system points out the necessity to upgrade and to develop a tide gauge network along the Ivorian coastline as they could be used for satellite calibration, ocean circulation models and help to access local/regional rates of sea level rise.

A seasonal upwelling occurs each year along the northern coast of the Gulf of Guinea. The upwelling which occurs in this area, especially off Ghana and Côte d'Ivoire need to be actively studied. The mechanisms causing this upwelling are not well understood, thus complex interactions among several processes are thought to contribute to the observed cooling and the related upwelling. Figure 1 presents sea level (SL) and sea surface temperature (SST) variations at San Pedro station. This figure shows that the appearance of the upwelling event is detected by a drop of mean sea level. There is a shift in time of the sea level and the sea surface temperature minimum.

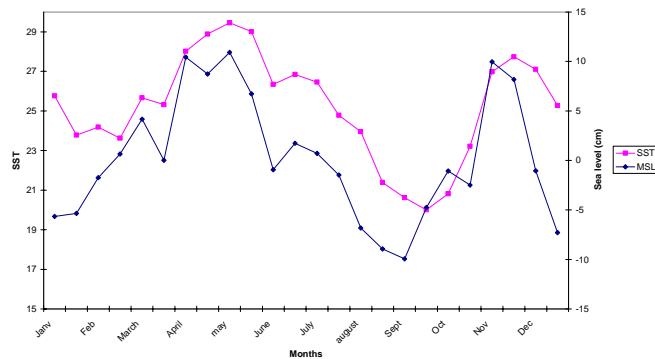
The analysis of the sea level from altimetric signal shows that the upwelling propagates westward along Côte d'Ivoire, Ghana, Togo and Benin coasts (Figure 2). However, the phase lag between the equator and the northern coast varies from year to year. This figure demonstrates the urgent need to have an operational network of sea level stations from Congo to Côte d'Ivoire to analyse the upwelling event. It could also contribute significantly to the efforts of GLOSS and World Ocean Circulation Experiment (WOCE) communities in Tropical Atlantic.

## **Conclusion and recommendations**

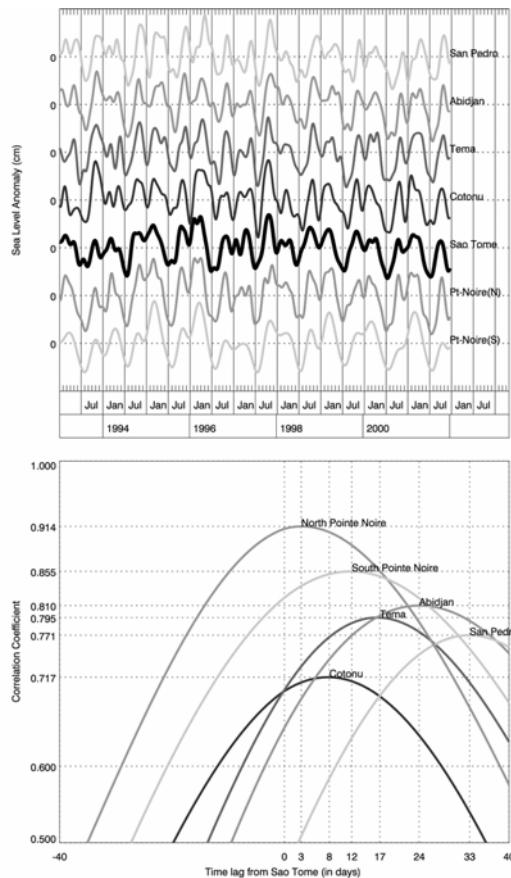
Up to now, limited sea level data is available in West Africa, especially in Côte d'Ivoire. Côte d'Ivoire has two operational ports equipped with float tide gauges. The data is essential for

port hydrographic charting, safe ship navigation and production of annual tide tables for shipping. It could be also used to study the seasonal upwelling which occurs off Ghana and Cote d'Ivoire. A near real time gauge systems from Congo to Cote d'Ivoire could contribute to the coastal upwelling understanding and could constitute an integral part of a tsunami warming system for the Gulf of Guinea. In December 2006, Takoradi (Ghana) have received new equipment funded through GLOSS and ODINAfrica programmes. Last month (April 2007), a radar Kalesto tide gauge was installed at Pointe Noire (Congo). GLOSS/ODINAfrica has planned to install one tide gauge at Sonara Port (Cameroon) in June 2007. One tide gauge should be installed at San Pedro or Abidjan to have full network systems of sea level observations along the Gulf of Guinea. Local technicians from San Pedro and Abidjan ports exist. Researchers from Cocody University are interested in the sea level data analysis for local and regional climate studies.

**Figure 1: Sea Level (SL) and Sea Surface Temperature (SST) variations (San Pedro, 1996).**



**Figure 2: Time lag from Sao Tome**



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