Seal level effects on the mangrove along the margins of Bons Sinais estuary, Mozambique

Jorge A Catandica* (catandicajorge@gmail.com), Fialho PJ Nehama (fialho.nehama@gmail.com), Ellis Ash** (e.ash@satoc.eu), Amani Becker ***.****

* Escola Superior de Ciências Marinhas e Costeiras, UEM, 1º de Julho ave., Quelimane, Mozambique
** Satellite Oceanographic Consultants Ltd, 49 Seal Road, Stockport, SK7 2JS, United Kingdom
***National Oceanography Centre, 6 Brownlow Street, Liverpool L3 5DA, United Kingdom
****University of Liverpool, Dept of Geography and Planning, Liverpool L69 7ZT, United Kingdom

Background

There are an increasing number of researchers considering human activities as the main cause of recent climate changes, which have severe consequences to the global environment in general and coastal zones in particular. The consequences include sea level rise which potential to dramatically alter the coastal landscape, impacting negatively the mangrove ecosystems in tropical coastal zones. Based on a considerable number of reports indicating changes (mostly decrease) in mangrove coverage in different sites of the country, and provided the availability of satellite-derived sea level data in recent times, we set out to investigate the mangrove responses to the changing sea level at the margins of the Bons Sinais Estuary, central Mozambique. In particular, the present study seeks to describe the changes observed in sea level and mangrove coverage between 2002 and 2016, as well as identify responses using the NDVI index.

Methods

Our approach consisted in evaluating satellite-derived sea level trends over 2002-2016 using a specific software made available through the C-RiSe project (www.satoc.eu/projects/c-rise), visual image inspection, and NDVI index determination from LANDSAT images. The sea level data comprises altimetry data for a location closer to the Quelimane port, where tide gauge data was made available for validation of the satellite products. Three satellite images for the years 2002, 2009, and 2016 were analysed using the UNESCO Bilko software in which the NDVI
index was calculated at 50 control stations from the reflectances at the near infrared and red bands.

Results

The sea level at the nearest site along the Jason-1 and Jason-2 satellite passes indicated an increasing trend over the years 2002 through 2016, with the mean sea level having increased from about -4.7 to 2.9 centimetres. The annual sea level cycle has amplitude 42 cm and phase lag 315 days, and seasonal cycle with amplitude 12cm and phase lag of 56 days. Satellite imagery has indicated that in most of the control stations the mangrove coverage was relatively high in 2002 and 2009, as indicated by the small NDVI index, but in 2016 the coverage lowered a great deal. The response pattern observed in the study area comprises elevation of the mean sea level, whose impacts includes mangrove migration, soil erosion, and change in the NDVI, amongst others.

Conclusions

We conclude that sea level rise and mangrove coverage are negatively correlated, which implies that the sea level rise is the cause for mangrove retreatment in the area. These results urge the local authorities and communities to foster the implementation of adaptation measures to ensure endurance of the surrounding environment and sustainability of the way of life along the estuary.