

BEYOND DATA REGULATION: FINDING SOLUTION TO A PERSISTENT PROBLEM OF MARINE DEBRIS AND SEA SURFACE TEMPERATURE MEASUREMENT ALONG COASTLINE OF LAGOS, NIGERIA

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ABSTRACT

We discuss in this paper environmental changes along the coastal line of Nigeria, especially in the region around Lagos, basing on provisional multi-disciplinary analyses of meteorological and maritime observations. The study has revealed that the environmental change in the Nigerian coastal region has been much more apparent than before (i.e. some few years back 1989-2007). Various kinds of ocean debris, transported mainly by coastal wind, are affecting marine and coastal environment severely. Since the current ocean monitoring system is found to be troubled by ocean debris, it is urgent to establish a new system to obtain reliable observational data to monitor and preserve the environment of the coastal region.

Keywords: Marine Environment, Nigeria, Coastal degradation, Data Analysis.

1 INTRODUCTION

Meteorological data have shown that sea surface temperature (SST) plays an important role over the coastline of Nigeria and that SST and the rainfall are linked with each other. Afiesimama (1996) and Indeje (1995) established a relationship between the Pacific Ocean surface temperatures and rainfall over parts of East Africa. An Enso episode is the primarily evidenced through the appearance of sea SST anomalies (WMO, 1996). Adedokun (1978) has noted that upwelling process that takes place, for instances off the Accra Coast, can be weakened or strengthened by increase or decrease in SST respectively, which can result from a weakening or strengthening of the south westerly winds. Edafienene et al. (1997) observed that the temperature of Nigerian coastal water is warmest in April and coldest in August, using SST data for the period of 1989-1997.

In this paper, we discuss sharing data and information about marine debris including a wide variety of man-made items that persist in the marine environment. While ship wrecks and other artifacts indicate that man-made items are already present in the marine environment, the social and technical changes in modern times have added a new dimension to the marine debris problem. We attempt to highlight multi-disciplinary data analysis in finding solutions to a persistent problem of marine debris and SST measurements along the coastline of Lagos, Nigeria.

2 STUDY AREA

The Nigeria coastline runs about 860 km along the Atlantic Ocean. It is bounded in the west by the Republic of Benin and in the east by the Republic of Cameroon. It lies generally between latitudes 4⁰10'N and 6⁰20'N, and longitude 2⁰45'E and 8⁰35'E, adjacent to the Gulf of Guinea. A map of the coastal region of Lagos, Nigeria, and an example of aerial photographs of the coastline (from Google Map) are shown in Figure. 1. A common feature of the coastline is its low-lying nature. The coastline has been classified into four broad regions according to differences in general morphology, vegetation and beach types. The regions from west to east are; the Barrier Lagoon Coast, the Transgress Mud Coast, the Niger Delta and the Strand Coast. The Victoria Island beach is known to be a part of the Barrier Lagoon Coast. This region is located to the east of the Eastern Breakwater (East Mole) of the down drift side of the inlet into the Lagos Harbor. To the east of this island, the Kuramo Waters and the Igbosere Creek are located. The Nigerian Coastline is bounded to the north by Five Cowries Creek and to the south by the Atlantic Ocean, where Tin Can and Apapa Port are located. The island beach has suffered degradation resulting from a number of natural and anthropogenic causes in the past two and half decades.



Figure 1. A map showing the geomorphology of the Lagos coastal area, Nigeria (left), and an aerial photo of a lagoon (Kuramo Waters) in Lekki Peninsula (right). The aerial photo is taken from Google Map.

3 TRANSPORTATION OF MARINE DEBRIS ALONG THE COASTLINE OF LAGOS

The frequency of anomalous transportation of marine debris along the coastline of Nigeria, especially the coastline of Lagos, has increased in the last decade. Marine debris can enter into the marine environment through a variety of vectors. Land-based debris can be transported to the marine environment as a result of:

- Urban runoff,
- Sewer overflow,
- Inadequate garbage management
- Industrial activities
- Terrestrial dumping and littering activities.

Sea based vectors include cruise ships, cargo ships, recreational boats, fishing vessels, and plant forms. The problem, which marine debris prevention along the coastline of Lagos, is that the ocean's ability to move and circulate the debris. The combination of ocean currents and atmospheric winds can transport debris across great distances. It can also retain and concentrate items for later deposition.

4 DATA AND METHODOLOGY

4.1 Data sources

In this analysis, we use data of the SST and the annual maximum temperatures in the coastal region of Lagos, Nigeria, in the period from 1952 to 2007. We also use daily wind data (speed and direction) at 0900z which were obtained for a period of 11years (1997 -2007) at a maritime meteorological station at Victoria Island, near Lagos harbor. This dataset was provided by the Nigerian Meteorological Agency. Outcomes from independent statistical analyses conducted by the Federal Office of statistics, Lagos and the Institute of Oceanography in Victoria Island are used to compare with our results.

4.2 Data analysis

Analyses of the trend and the pattern of sea SST variations were carried out. The monthly averaged data for the period 1989-2007 were statistically treated to obtain the mean yearly SST values which gives adequate and necessary information on the changes in the Nigerian coastal areas. When the SST increased above the mean level in the analyzed interval, the amount of marine debris decreased. On the other hand, the movement of marine debris was significantly enhanced when a sharp decrease in the SST occurred.

The trend of the annual maximum temperature in the coastal region of Nigeria in 1952-2007 is shown in Figure 2. This analysis shows a clear increasing tendency of the annual maximum temperature as indicated by the linear fit to data, but the increasing tendency is suggested to have been accelerated in 1990s. The increase in temperature results a decrease in the atmospheric pressure, and the movement of marine debris increases, while decrease in

temperature results an increase in pressure, and marine debris movement decreases. Figure 3 shows the monthly frequency of the wind direction in the coastal region of Nigeria, in 1997 - 2007. It is apparent that the south-westerly winds were dominant in this region over the year. Winds play a huge role in the occurrence and movement of marine debris. Ocean debris is transported mainly by the westerly coastal wind in this region. As shown in Figure 3, winds blew predominantly from WSW and WNW directions. However, there were no cases of wind speeds greater than 19 kts. Within the period of this analysis, the weakest wind speeds were observed in the months between October and January, while the strongest winds were mostly observed in August.

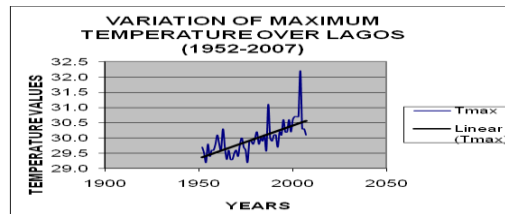


Figure 2. Variations of annual maximum temperatures in the coastal region of Lagos, Nigeria, in 1952-2007.

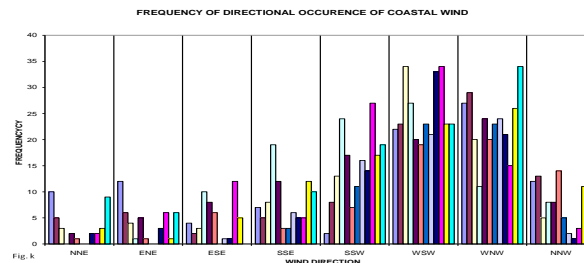


Figure 3. Monthly frequencies of wind directions in the coastal region of Nigeria in 1997-2007. The horizontal axis is divided into 8 bins of wind directions. Bars in each bin show the monthly frequencies from January to December, respectively.

5 DISCUSSION

Our investigation revealed that the island beach of Nigeria has suffered degradation resulting from ocean surges, influenced by strong winds of a number of natural and anthropogenic causes for the past two and half a decades. Along the coastline of Lagos, persistent debris has played a significant role in the degradation of the marine environment. Such persistent materials include product packages and single-use beverage containers such as aluminum cans and bottles. These items injure and kill marine species. The negative effect is suffered not only by animals, but also by humans who interact with these coastal resources. SST measurement sare frequently influenced by marine debris, and the effect results missing data and incorrect measurements because marine meteorological stations are using rubber sea-temperature bucket thermometers on an hourly basis. The Investigation which was carried out on the coastline of Nigeria revealed that ocean surges were strong in the months of April to October, by the influence of prevailing South-Westerly wind not less than 18 knots. Over the area of $10^{\circ}5N - 2^{\circ}5N$ in the latitude and $0^{\circ}E - 10^{\circ}E$ in the longitude, high spring tides of about 1.8 m or more are predicted using a parametric wave model (Afiesimamaet al., 2000). Also, the amount of marine debris along the coastline of Lagos shows seasonal variation and usually highest in the summer months, April-October, due to strong westerly wind (Figure 3).

6 COLLABORATIVE DECISION MAKING TO PREVERT MARINE DEBRIS IN COASTLINE OF LAGOS

As technology advances, the concept of Collaborative Decision Making (CDM) has been proved to be useful. In anutshell, CDM will be effective when users of services have a chance to add their expertise to the decision making process. For the process to work effectively, it is important to have tools to view the information seamlessly and data are readily available. Some of Nigerian organizations have been involved; e.g. the Nigerian Maritime Administration and Safety Agency, NIMASA, Lagos State Environmental Protection Agency (LASEPA) and the Nigerian Meteorological Agency. The Nigerian Maritime Administration and Safety Agency,

NIMASA, are committed to the enthrone of global best practices in the provision of maritime services in Nigeria. The core functions include marine pollution protection, marine pollution control, waste management facilities, and marine environment management. Also the Lagos State Environmental Protection Agency (LASEPA) inherits the responsibilities of the Pollution Control Unit, in addition to the functions that were indicated in the edict that later established the agency. The Nigerian Meteorological Agency (NIMET) is a federal government parastatal established by the Act No.9 of 2003. The agency is responsible for production of weather, water and climate information for socio-economic development of Nigeria. The Marine Division in the Applied Meteorological Services of the agency plays its role in information and data to prevent marine debris in the Lagos coastline.

7 CONCLUSIONS

Effects of marine debris are seen in the mortality among marine species along the coastline of Nigeria especially the coastline of Lagos, and also influence and affect the measurement of SST. The study has revealed that the change in the Nigerian coastal climate is much more apparent than before (i.e. some few years back 1989-2007). Taking some past years into consideration, it can be seen that the rate at which the coastal change in Nigeria is higher than that before 1989, but in the Nigerian coastal area over Lagos, the rate was even below the average before 1989. However, it shows in the recent years that it is even more above the average. The wind plays an important role in the transport of marine debris along the coastline of Lagos, Nigeria, i.e. the swells (waves generated at a distance) became very active while the sea state becomes slight to moderate over the South Atlantic Ocean extending to North Atlantic. However, the provision of adequate equipment by the Nigerian Meteorological Agency will be a spring board for improvement of monitoring system in the Nigerian Coastal areas. This will enable data to be readily available for research work. Our recommendation to enforce the monitoring system in the Nigerian coastal area is given in Appendix.

8 REFERENCES

- Adedokun, J.A. (1978) West African Precipitation and Dominant Atmospheric Mechanism: *Arch. Met Geoph. Biometeorol*, Ser; A 27, 289 – 310
- Afesimama, E.A. (1996) On the variability of the mean sea surface temperature and its influence on the rainfall pattern over coastal station, *West Africa pioc of the 4th inter conference on school and popular met and Oceanographic*, Royal-met Soc. Publication, p 321.
- Gbuyero, E. & Afesimama, E.A. (1997) Sea surface temperature analysis from *institu* data at East Mole, *Lagos Nigerian Meteorological Society proceedings of the 12th and 13th Department Symposia*, p 35.
- Indeje M. (1995) Pacific Ocean sea surface temperatures and east African seasonal rainfall. *Second International Symposium on Assimilation of Obs. Met.and Oceanography*, Vol. II WMO /TD No. 651, p 655.
- WMO (1996) WMO Statement on the status of the global climate in 1995, WMO – No 838.

9 APPENDIX

Recommendation

The Nigerian meteorological Agency and the Institute of Oceanography and Marine research should do more in research works because they understand the impact of marine debris, and can proffer solution based on scientific knowledge and oceanographic conditions. Advanced models developed in Europe and UK will be able to predict the movement of marine debris in coastal areas of Nigeria. The immediate challenge for Nigeria Meteorological Agency and other stake holders in marine industry is to set up and maintain systems which collect data, process, store, retrieve and disseminate them as necessary, especially data related to sea surface temperature and marine debris. Drawing strong inference from this, there is no doubt that the effort toward ensuring a sustainable environment quality and healthy economy is highly desirable and this can be achieved only if there is a co-operation among the government, general public, and the science world. New research on sea surface temperature and its relation to marine debris is needed and the government should continue to support existing private sector.