Dynamics of storm surge characteristics and its devastating flooding of Nigerian coast: A case study of Lagos Beach

Mutiat O. Sholademi
Mary O. Iso
Kamoru A. Lawal
Marine Weather Laboratory, Nigerian Meteorological Agency, Lagos, Nigeria.

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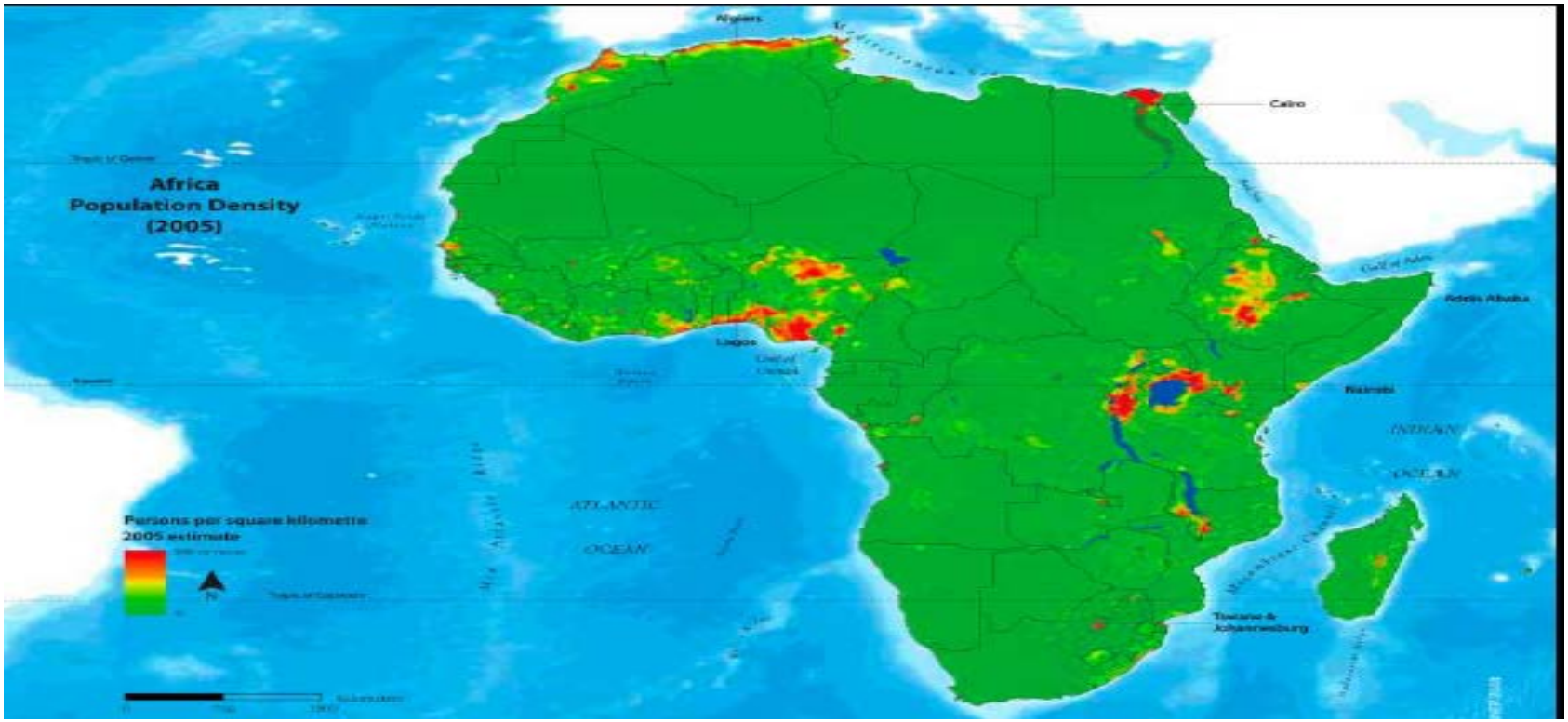
Overview

- Nigerian coast - Study area
- Introduction / Motivation
- Objectives
- Data Sources
- Results and Discussion
- Conclusion
- Recommendation

Nigeria Coastal Areas are one of the most populated and vulnerable coastal areas

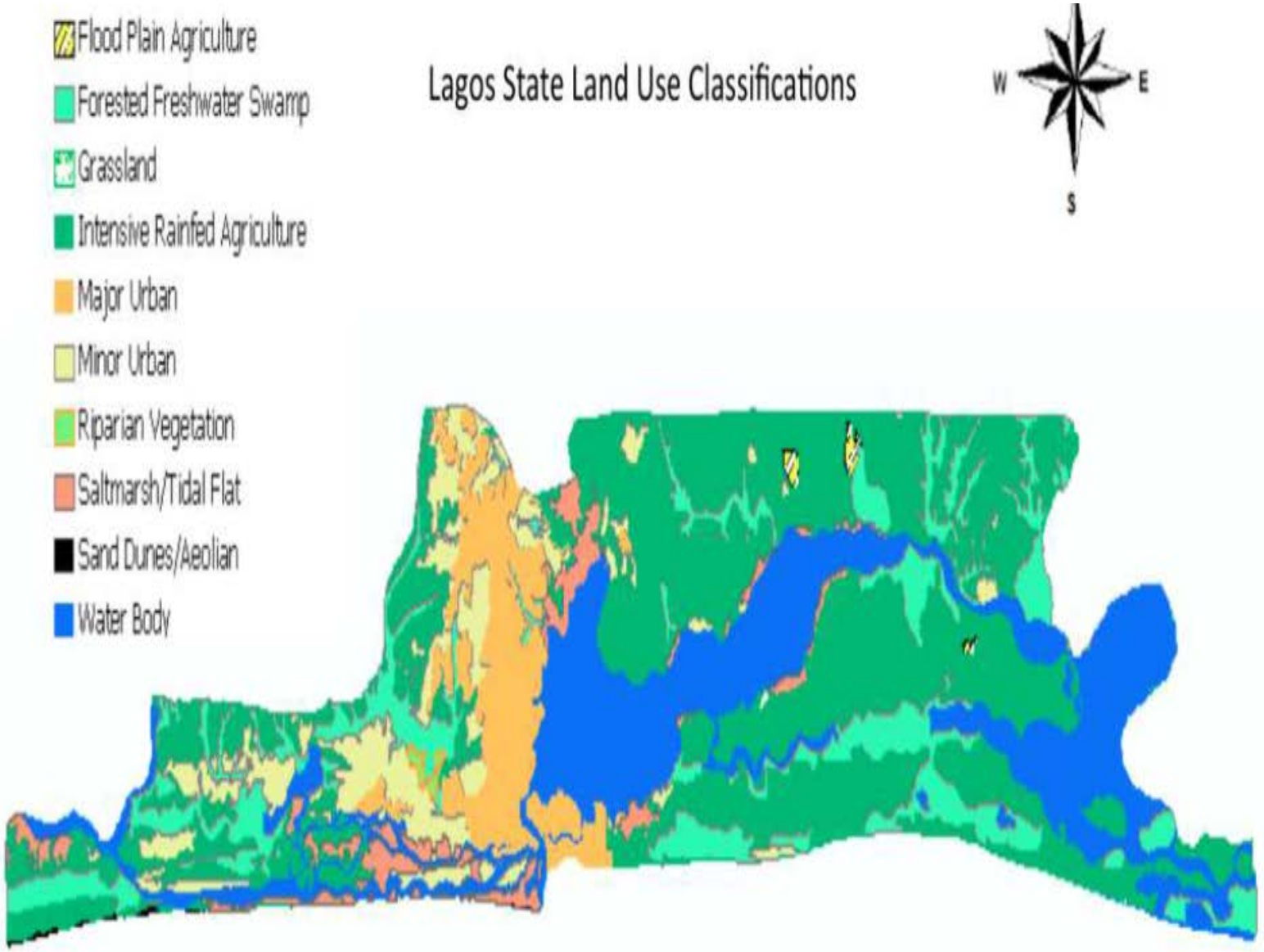


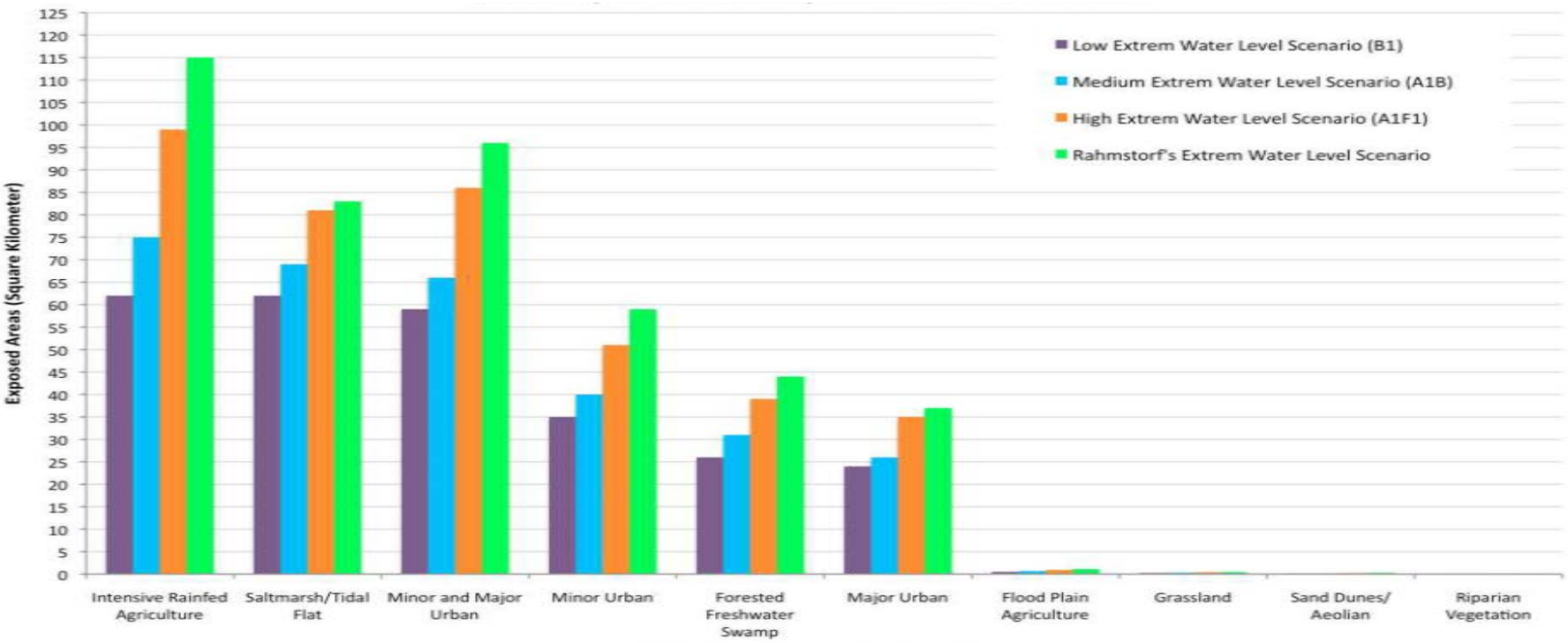
Lagos (Nigeria) is one of the cities projected to be the ***hardest hit by storm surges, like*** the one that ravaged New Orleans post- Katrina (World Bank, 2008) and One of the Top Countries with ***100% coastal zone impact due to Storm Surges.***

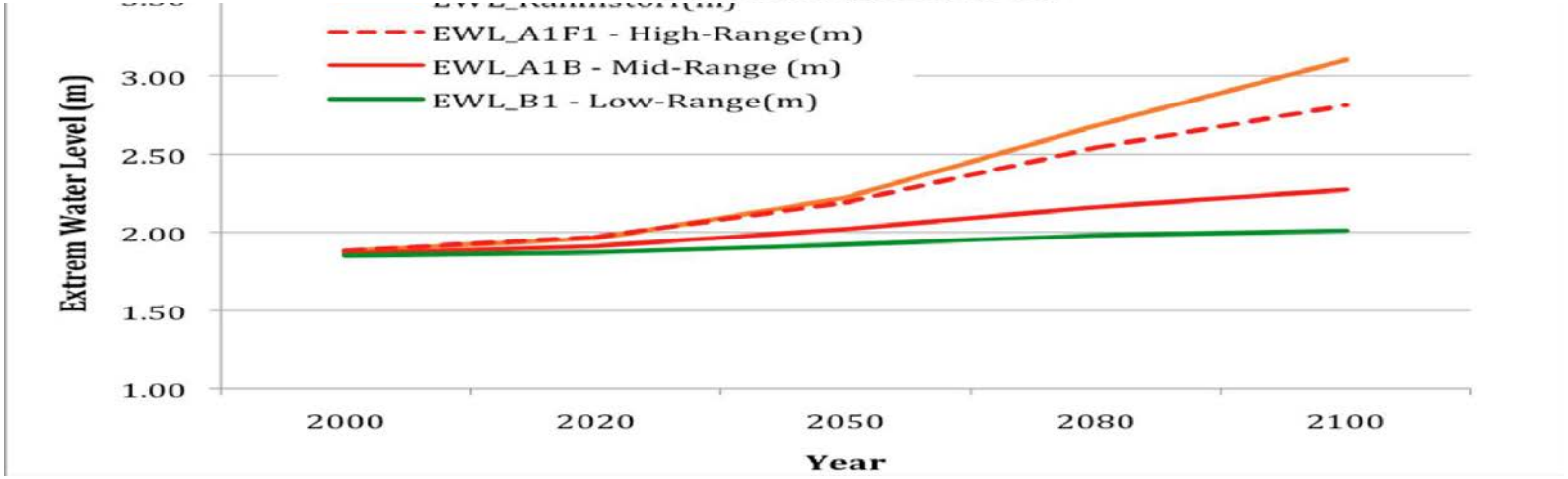
Study Location

- The Lagos beach… a low lying sandy beach with maximum elevation of about 3m located immediately east of the natural inlet into the harbour.

- It is bounded in the north and west by creeks, while in the south by the Atlantic Ocean.


Lagos State Land Use Classifications
Flood Plain Agriculture
Forested Freshwater Swamp
Grassland
Intensive Rainfed Agriculture
Major Urban
Minor Urban
Riparian Vegetation
Saltmarsh/Tidal Flat
Sand Dunes/Aeolian
Water Body
W
E
S





Source: **United Nations Industrial Development Organization (UNIDO) (April, 2012)**

Occurrence of storm surge over Nigerian coastal cities is always accompanied by catastrophic hazards and often result into environmental degradation.

Before Barrier Construction

After Barrier Construction

After Storm Surge

On August 17-18, 2012 a catastrophic surge of the sea water towards the coast occurred over one of the Nigerian coastal cities, Lagos Beach.

The hazard and the accompanying environmental degradation cannot be quantified economically

- **Wreaks havoc on the beach community.**
- **Loss of sixteen lives and missing of several people.**
- **Leveling of the entire beach community**

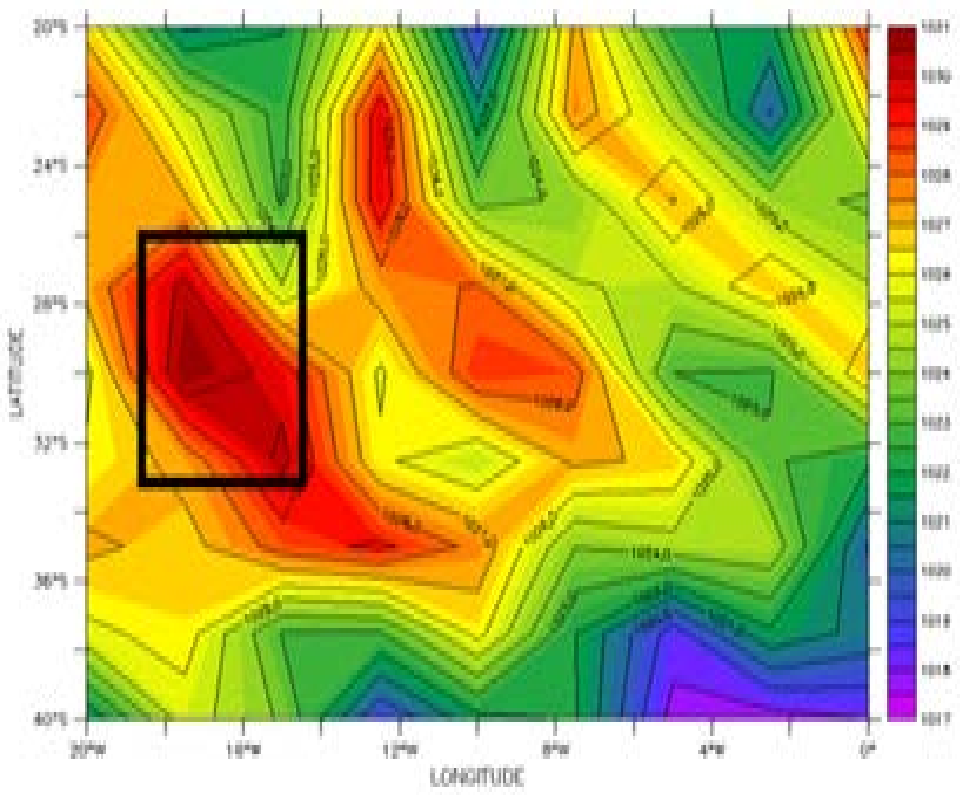
Objectives

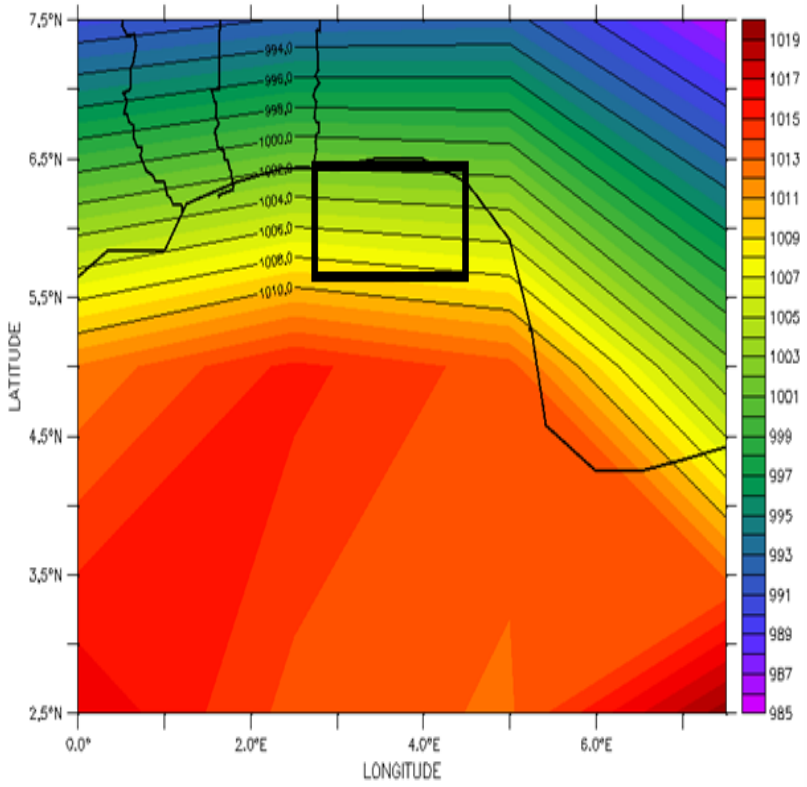
- To investigate and identify the atmospheric dynamics that influence the occurrence of ocean surge of August 17-18, 2012 over Lagos beach

- Examine the characteristics of pre, during and post atmospheric dynamics in storm surge event

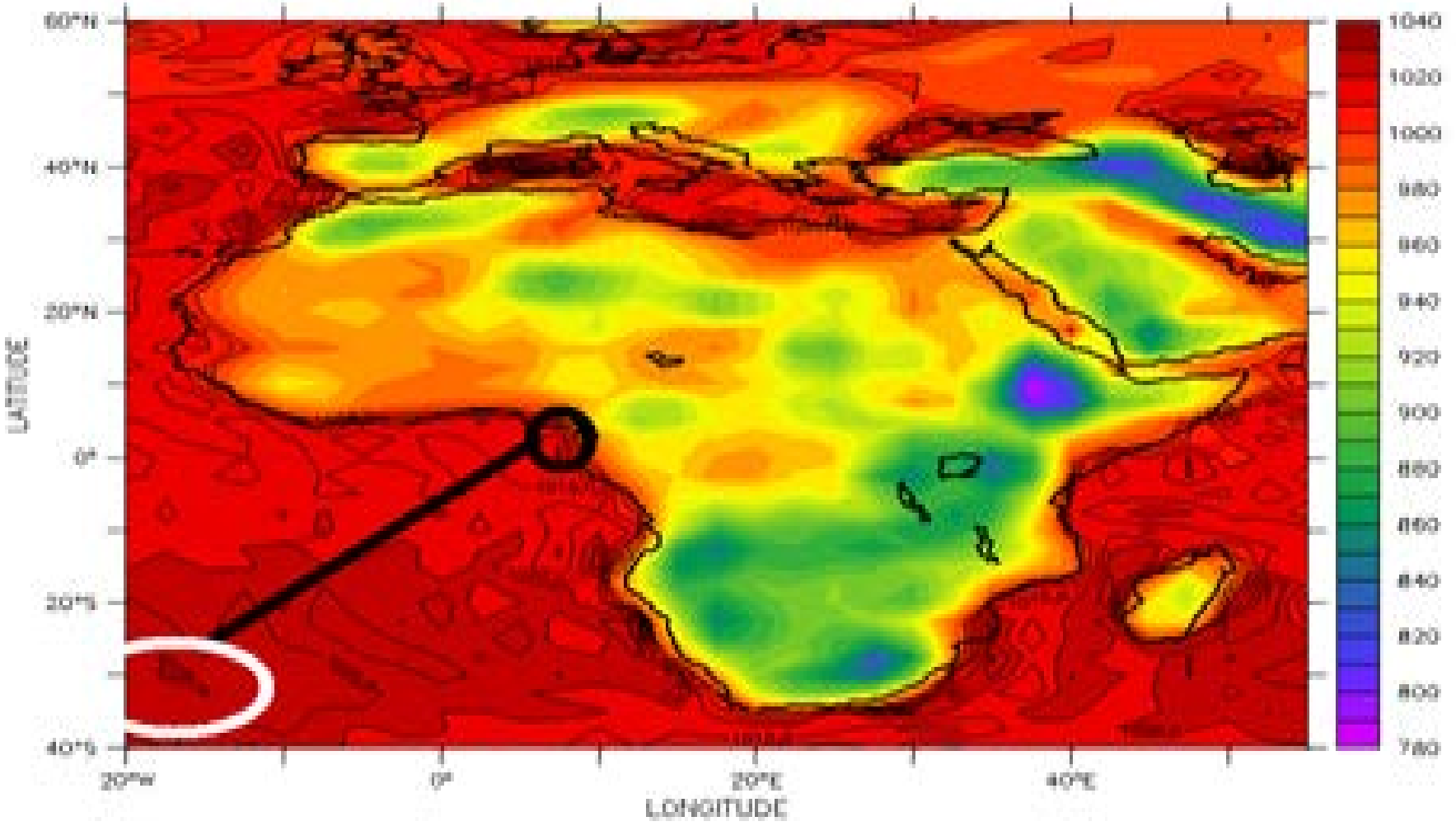
Major Data and Sources

- Mean sea level pressure (MSLP) data over the Atlantic Ocean: http://www.esrl.noaa.gov/psd/data/gridded/data.ncep.reanalysis.pressure.html
- Sea surface temperature anomalies over the Gulf of Guinea: International Research Institute for Climate Prediction (IRI) at 2° × 2° spatial resolution (Toure, 2000)
- Wave model charts: http://www.passageweather.com/.
- Surface wind speed and direction: Nigerian Meteorological Agency (NIMET)
- 10m Wind: Atlantic Ocean (lat.10^{o}S - 20^{o}S and long 10^{o}E - 20^{o}W) from general circulation model of METEO-FRANCE
- *Digital Elevation Model (DEM): NASA Shuttle Radar*
- Topographic Mission (SRTM).
- Land Use Classification: Prepared by the Triple E Systems Associates Ltd, Lagos, Nigeria.

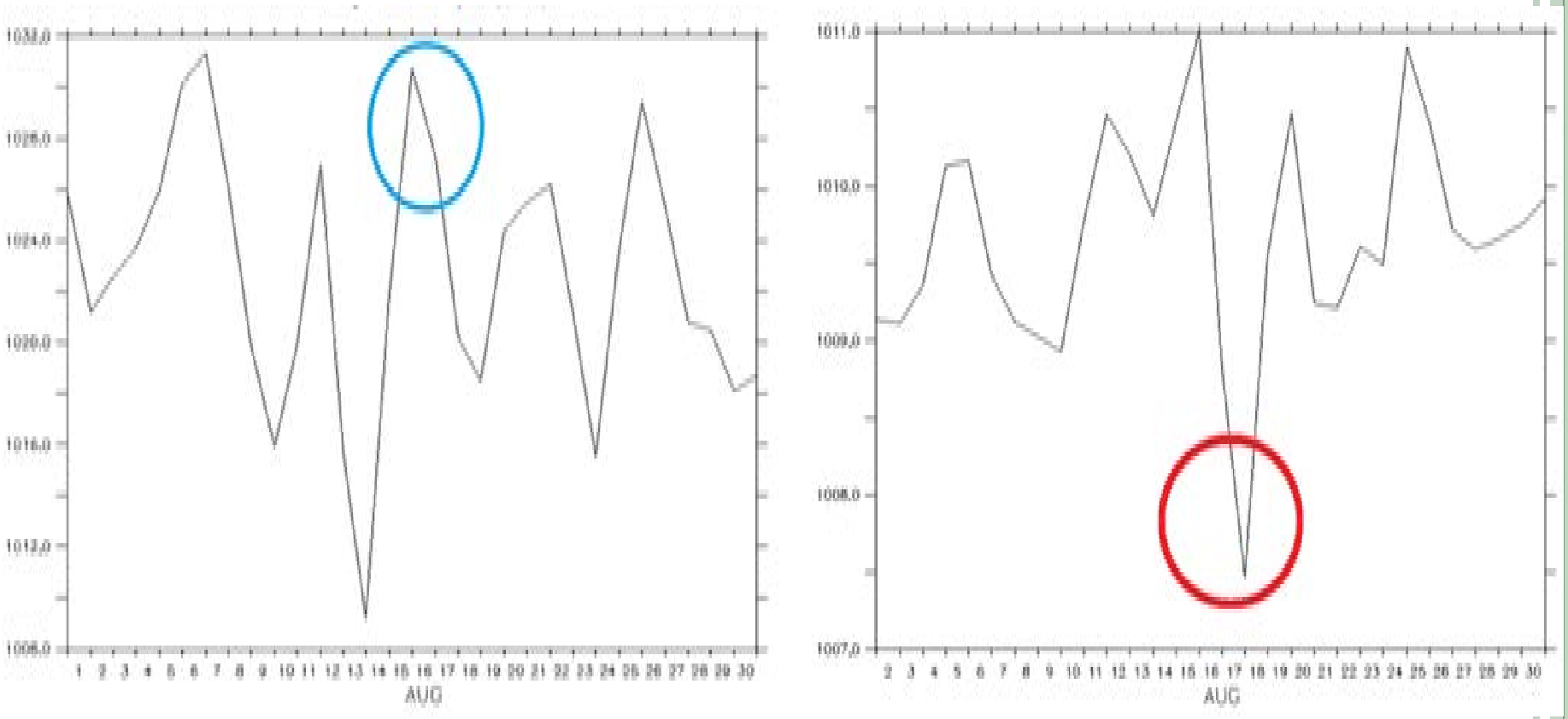




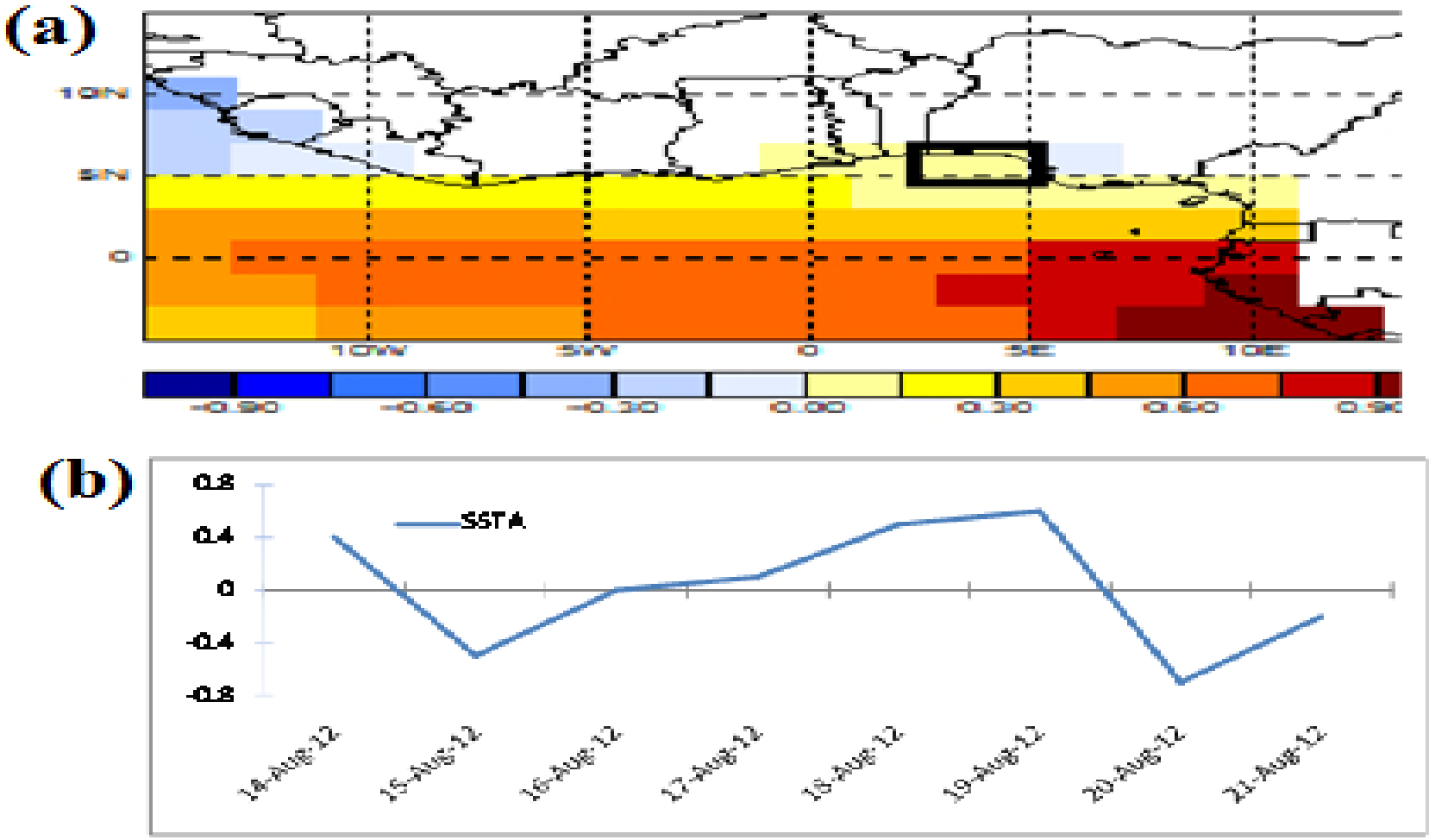
Spatial distributions of the average mean sea level pressure (MSLP) over the western flanks of the southern Atlantic Ocean (left) and the Gulf of Guinea (GOG: right) in August 2012.



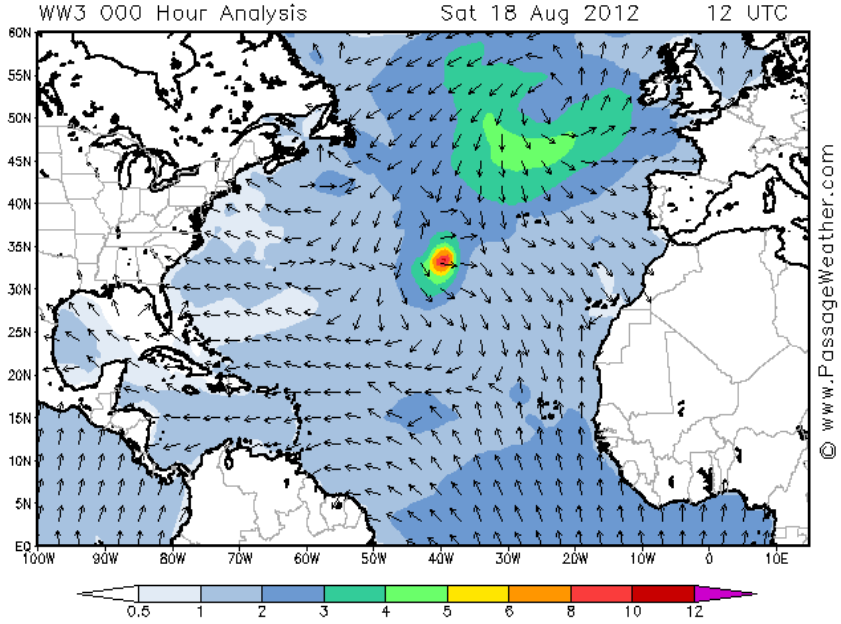
Spatial distributions of the average MSLP over the Atlantic Ocean in August 2012. Black and white circles indicate respectively the GOG and the center of St Helena high pressure system

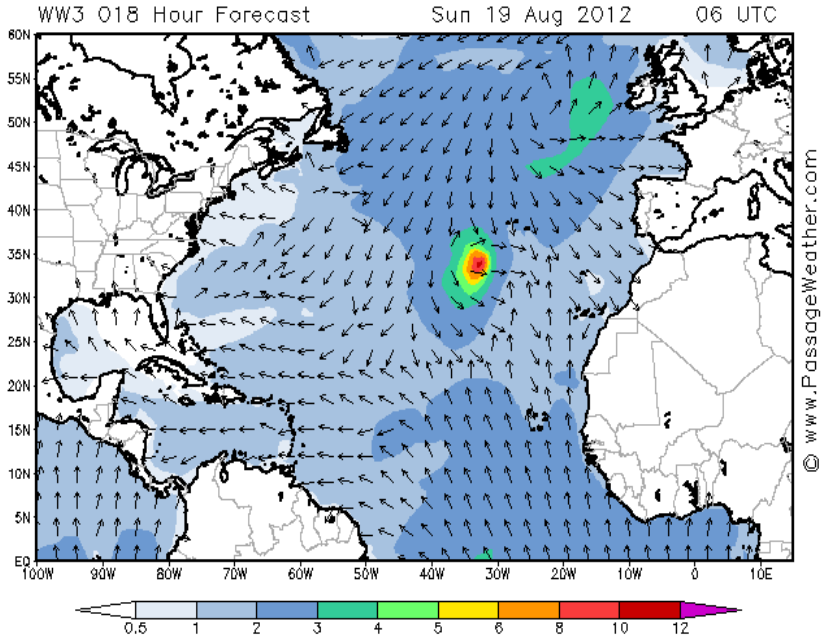


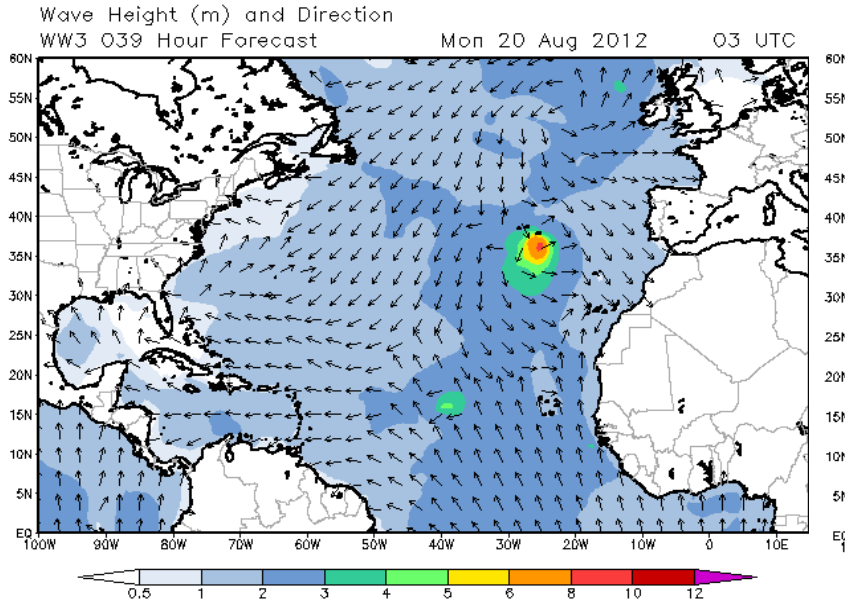
Daily evolutions of the average mean sea level pressure (MSLP) over the center of St Helena high pressure system and GOG in August 2012. Blue and Red circle indicates the surge event periods. (left and right respectively)

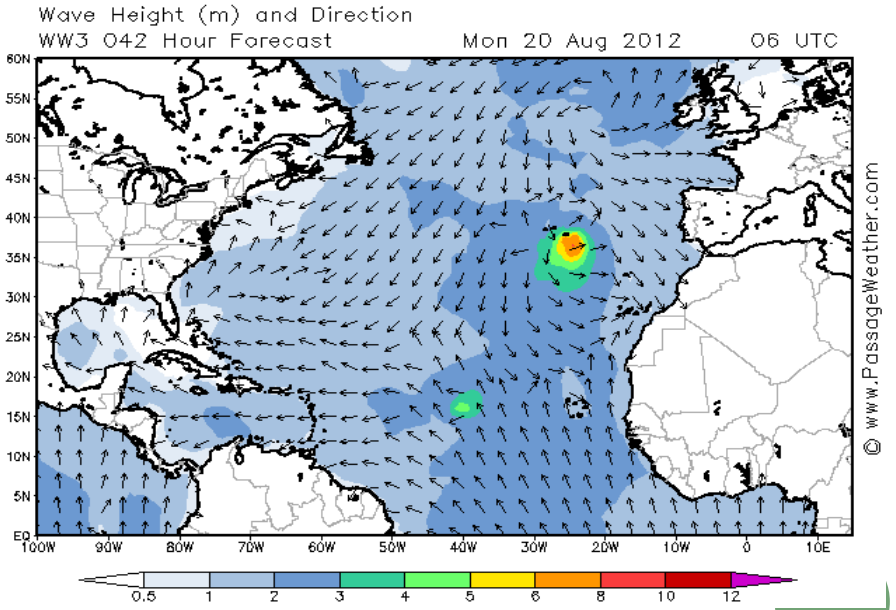


Sea surface temperature anomalies (SSTA) over the GOG for (a) the spatial distributions over the Atlantic Ocean in August 2012 and (b) the daily evolutions over GOG during the surge event in August 2012.

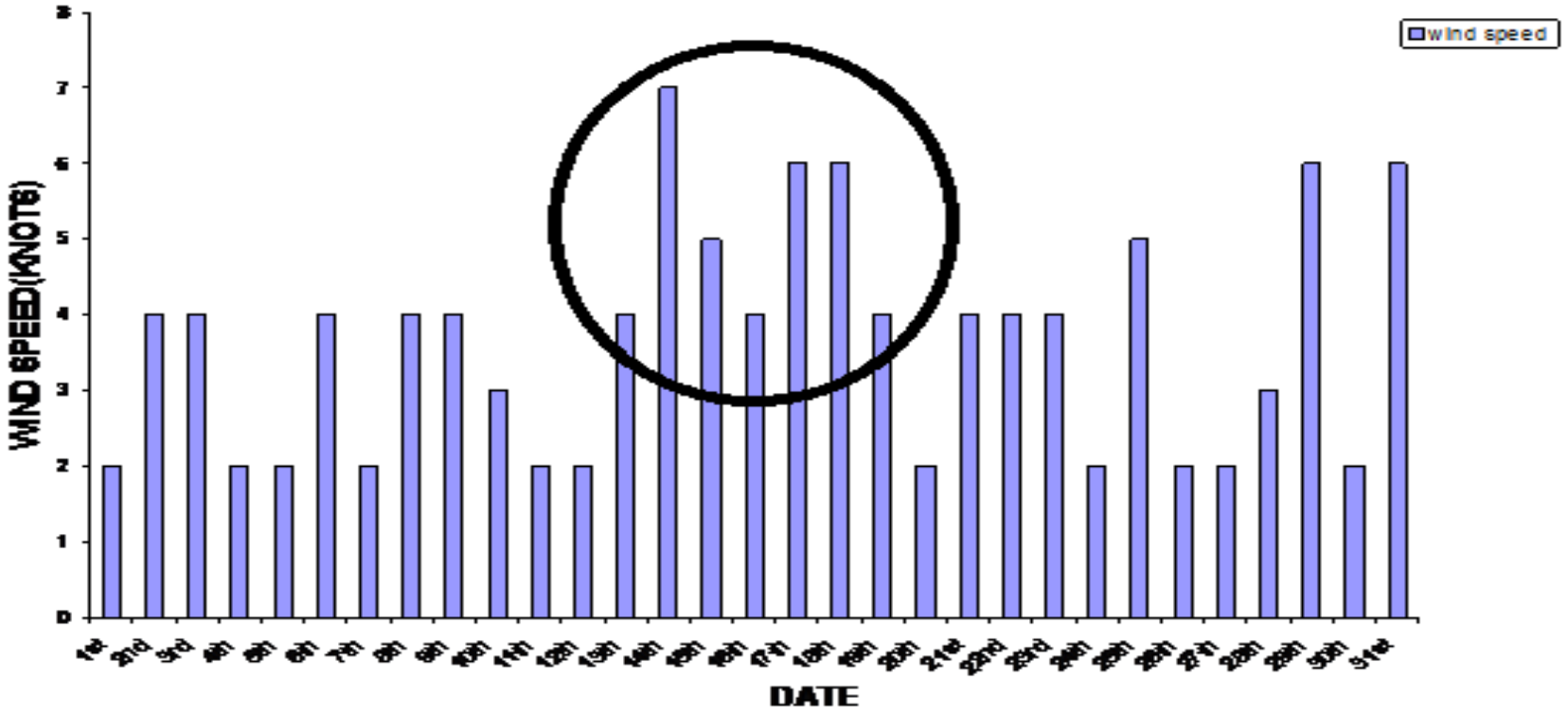








Wave height (m) and direction over the northern Atlantic Ocean for (left) August 18 -20, 2012.



Wind speed for the month of August over Lagos beach. Black circle indicates period of the surge.

Conclusion

- Investigations carried out in this study have shown that storm surges over Lagos beach are influenced by ocean-atmospheric dynamics such as SST, MSLP, Wind (Speed and direction), Wave (height and direction).

- Deepening of MSLP over GOG and its intensification over St Helena always precede an ocean surge along the Nigerian coast by setting up a strong pressure gradient.

- Kinetic impact of the surge may have also been influenced by the impacts of positive anomalies of the ocean temperature.

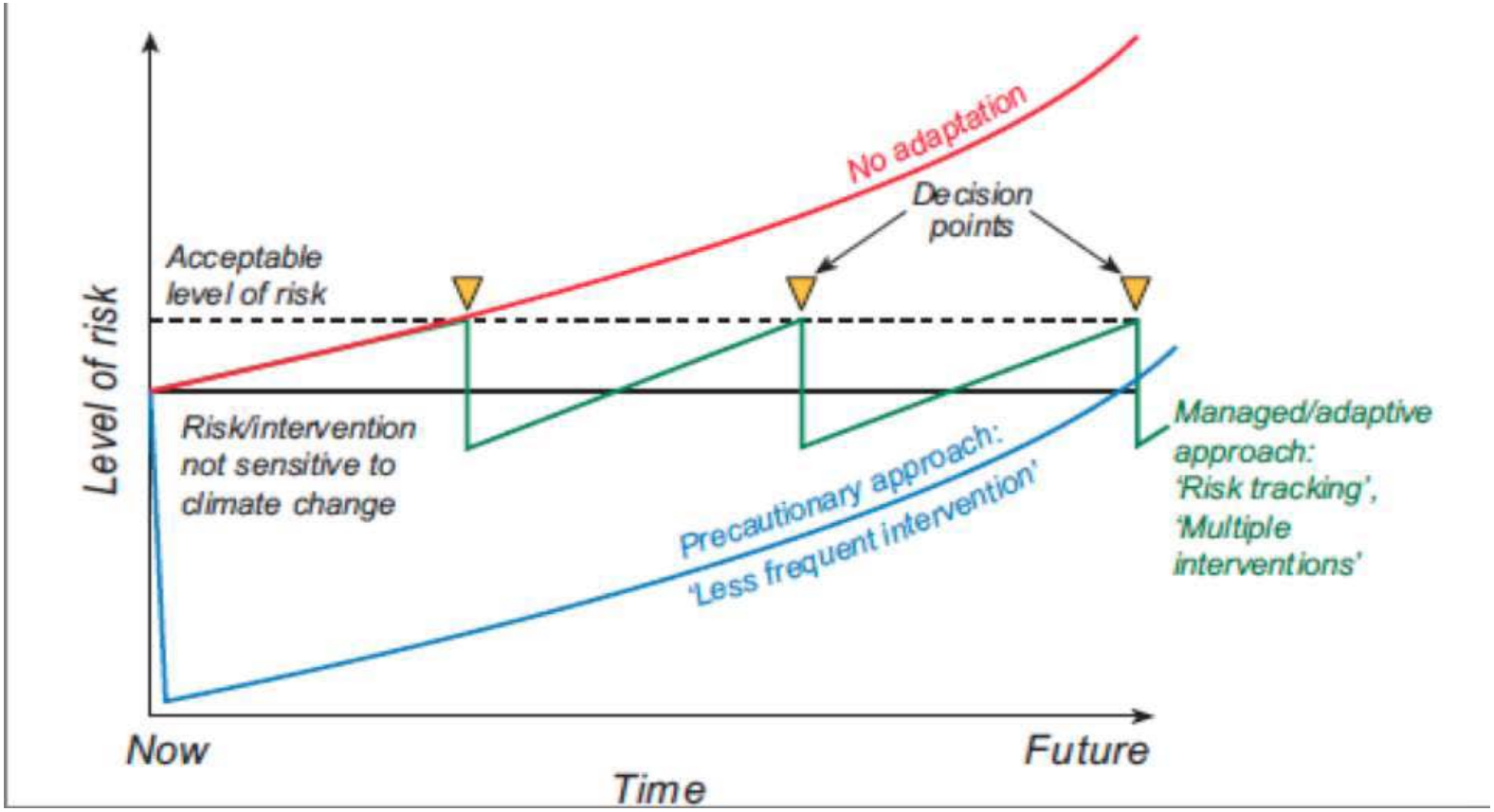
Recommendation

These coupled behaviors of atmospheric phenomena could be seen as a useful forecasting tool for ocean surges over Nigerian coasts.

Today, there is virtually no beach left this implies that if no concrete and very urgent solution is taking we might be heading to a very great devastating consequence.

A Comprehensive Coastal Adaptation Strategy should be developed.

Adaptation Approaches



Source: Australian Government, 2009

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www.nimet.ng.gov, mut_eye@yahoo.com .