

# **Importance of Oceanography and Hydrography Research in Kenya**

**Charles Magori  
KMFRI  
Mombasa**



# Oceanography and Hydrography Department

- This Department deals with physical, chemical, biological and geological oceanography of the inshore, near shore and offshore waters and support bioprospecting in these waters.
- Undertake hydrographic surveys.
- Sea level data, sedimentation and mathematical modeling.
- Responsible for research on sustainable use and protection of aquatic resources in marine waters.
- Monitor and document the physical (including geological) and chemical characteristics (including pollution and nutrient dynamics) of the various aquatic ecosystems to discern natural and/or human induced changes.
- Undertake studies on the interrelationships between biota and their aquatic environments in relation to fisheries, aquaculture and conservation of biodiversity.
- Promote Integrated coastal Zone Management (ICZM) approach in the management of coastal and marine resources.



## Offshore Observations

- NIOP, 1992 – 93 (*RV Tyro*)  
Studied the effect of the monsoon on the climate system in the northern Indian Ocean.

- SWIOFP Cruises, 2011 - 2012  
*CTD profiles*

A Seabird 911 CTD plus is used to obtain vertical profiles of temperature, salinity and oxygen

- ASCLME Cruise (cancelled)
- Seismic vessels
- Delineation of outer continental shelf
- KenSea

## Nearshore Observations

- Sea Level monitoring
- Oceanography of inshore areas
- Shoreline change studies
- ASCLME MEDA process

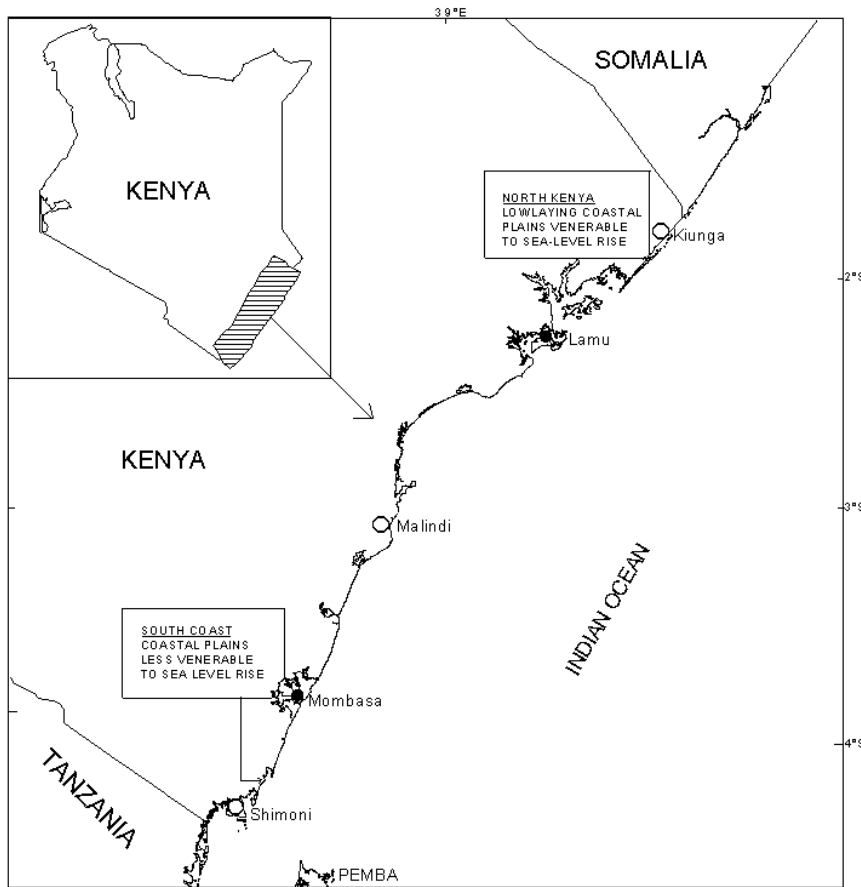
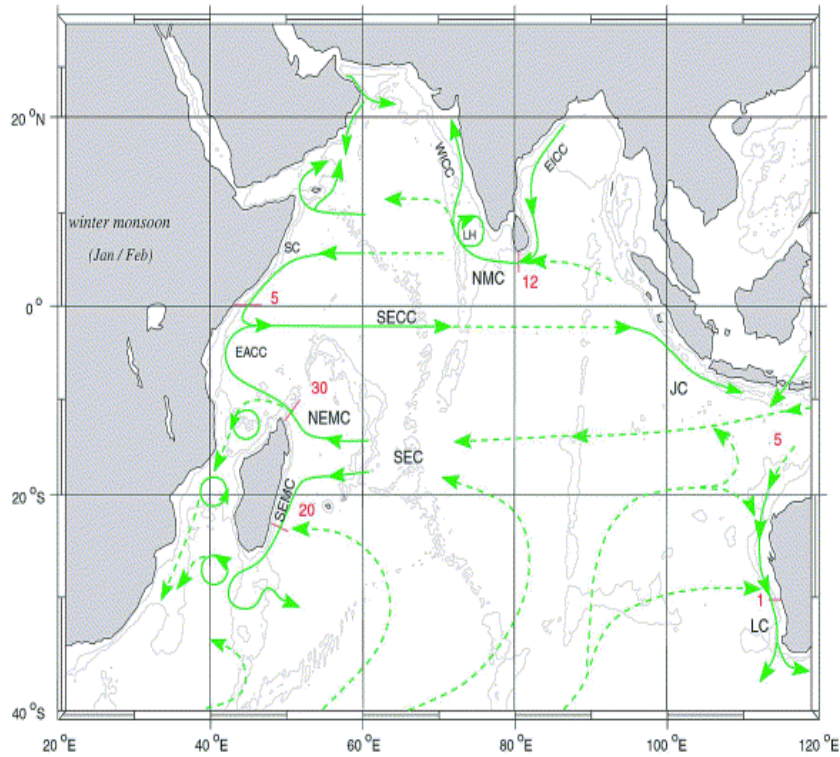


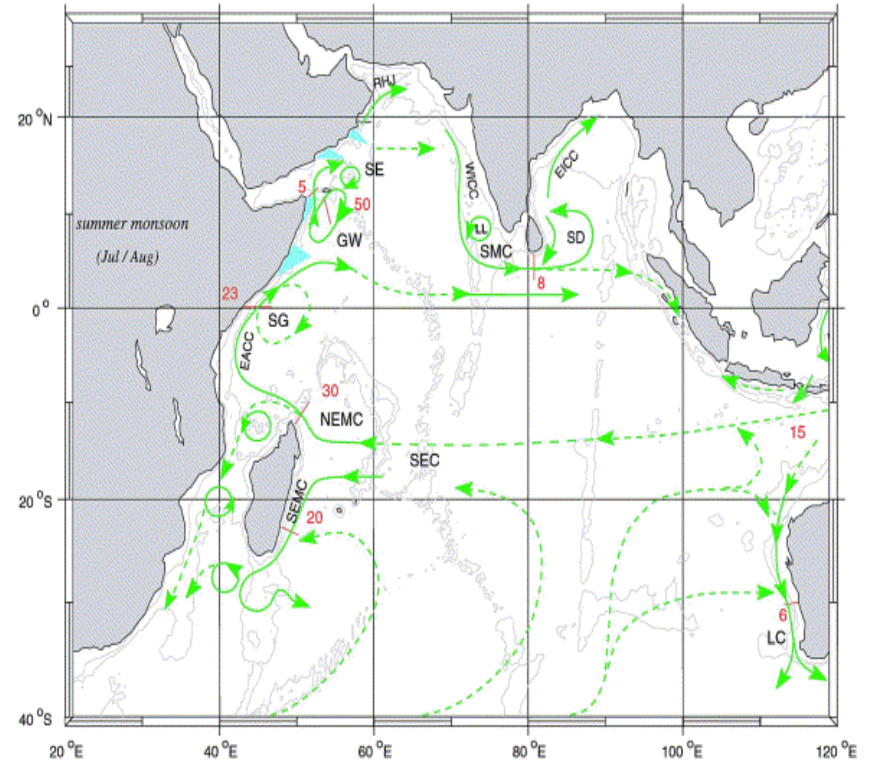
Fig 1: Map of Kenya Coastline showing location of installed tide gauge stations (●) and planned stations (○).

# Currents - Offshore

Source: Nguli 2006



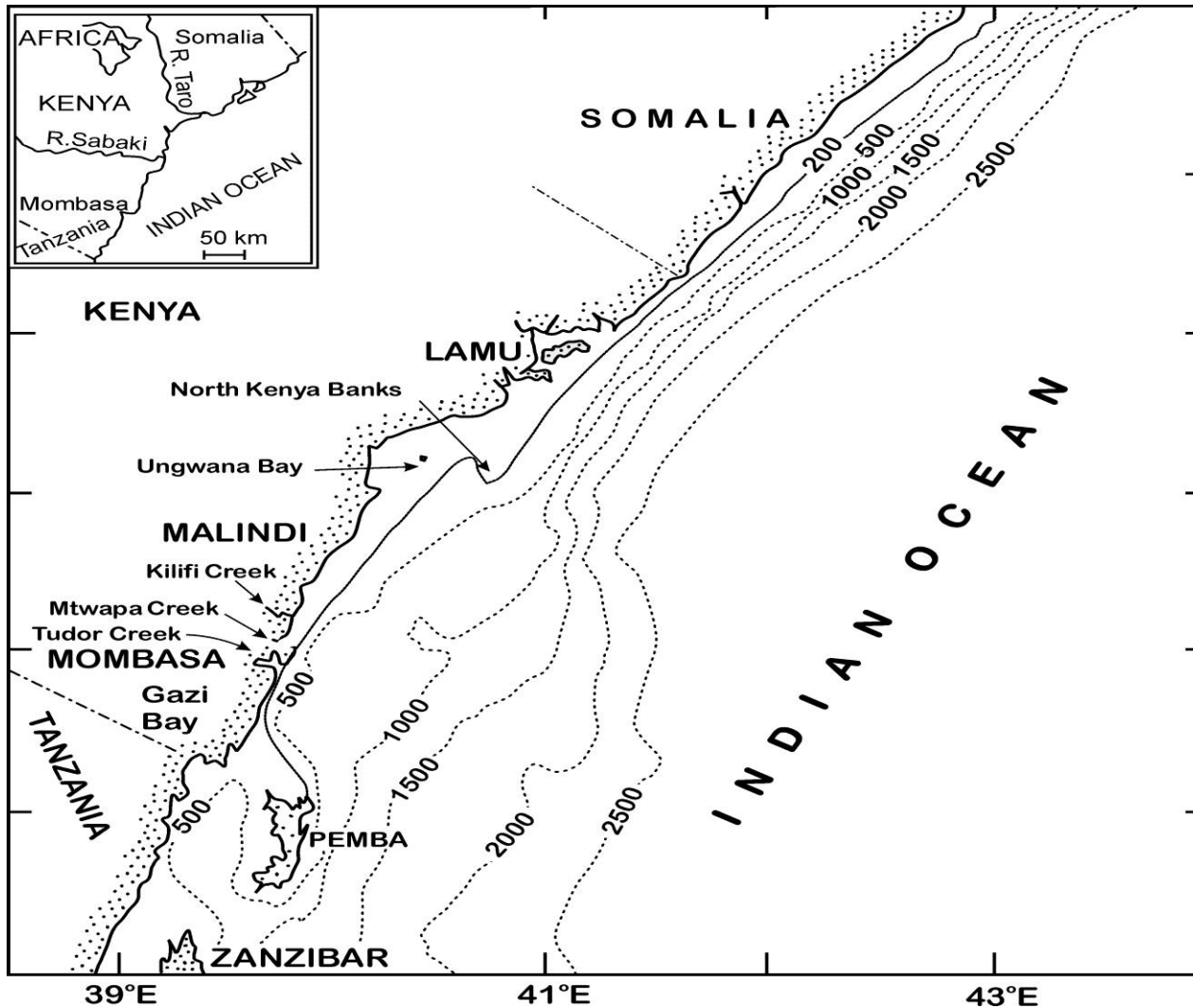
**NEM-Current systems**



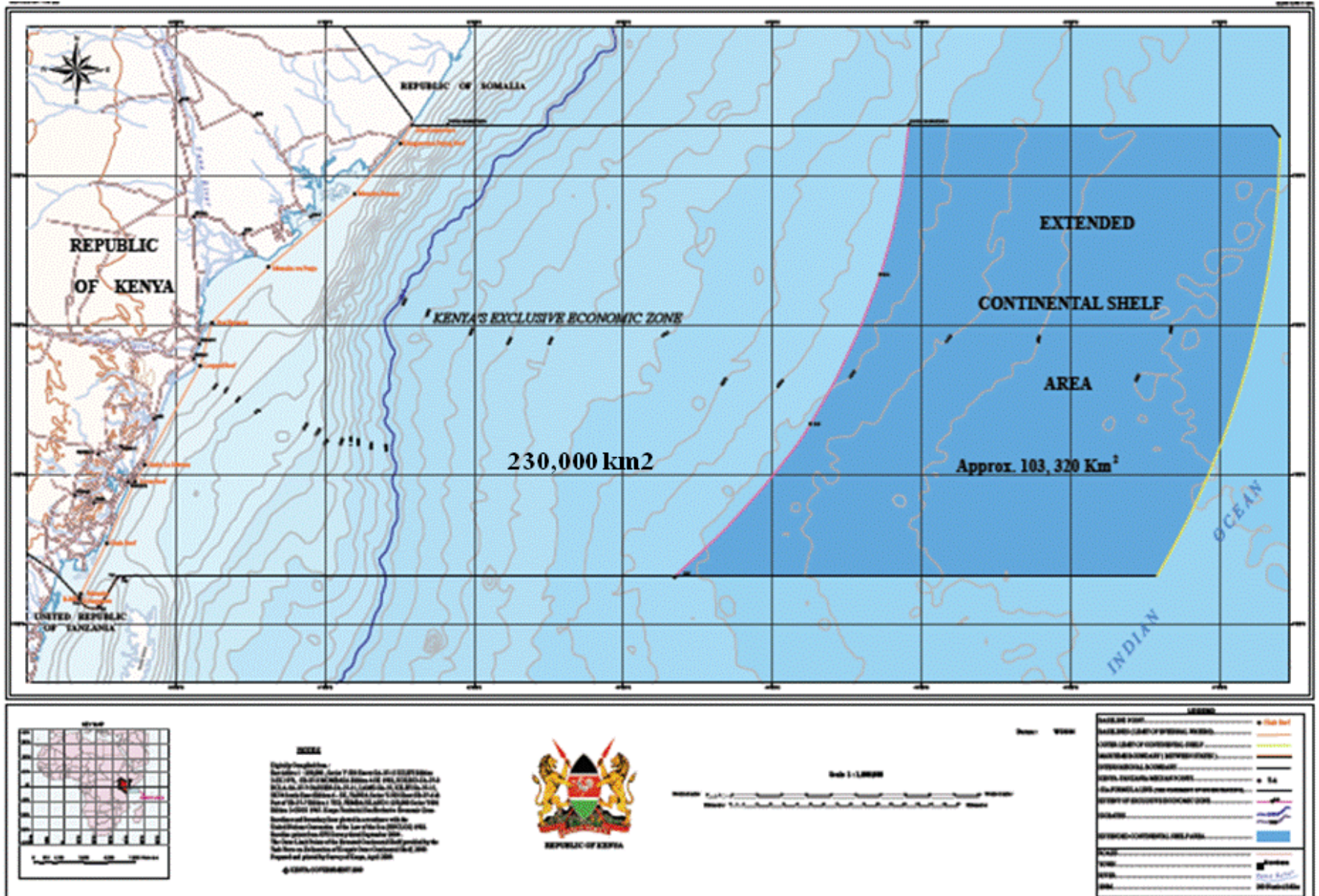
**SEM-Current Systems**

# Continental shelf of Kenya Bathymetry

Source:  
Nguli *et al*,  
2006



# Map of Kenyan coast showing the Exclusive Economic Zone (EEZ) with the agreed extension





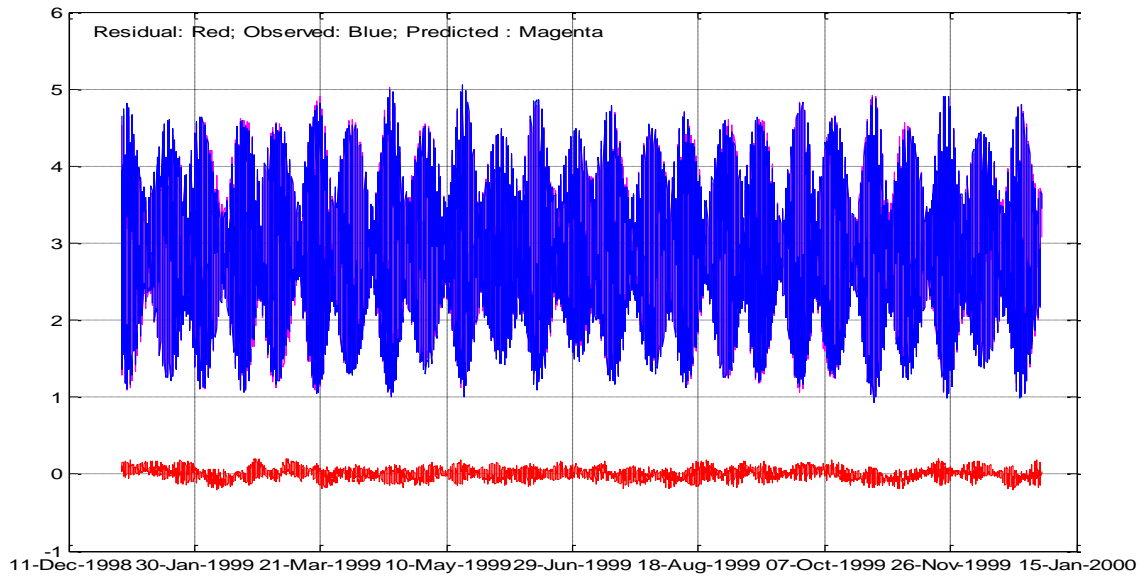
## Upgraded Mombasa KMFRI GLOSS Tide Station

# Lamu KMFRI GLOSS tide station

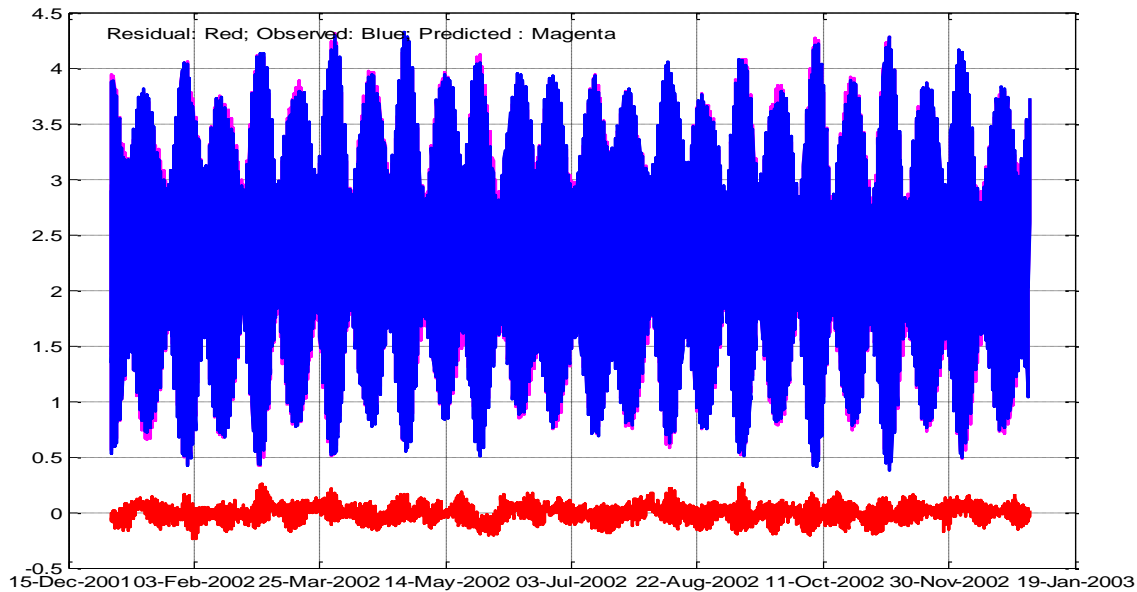




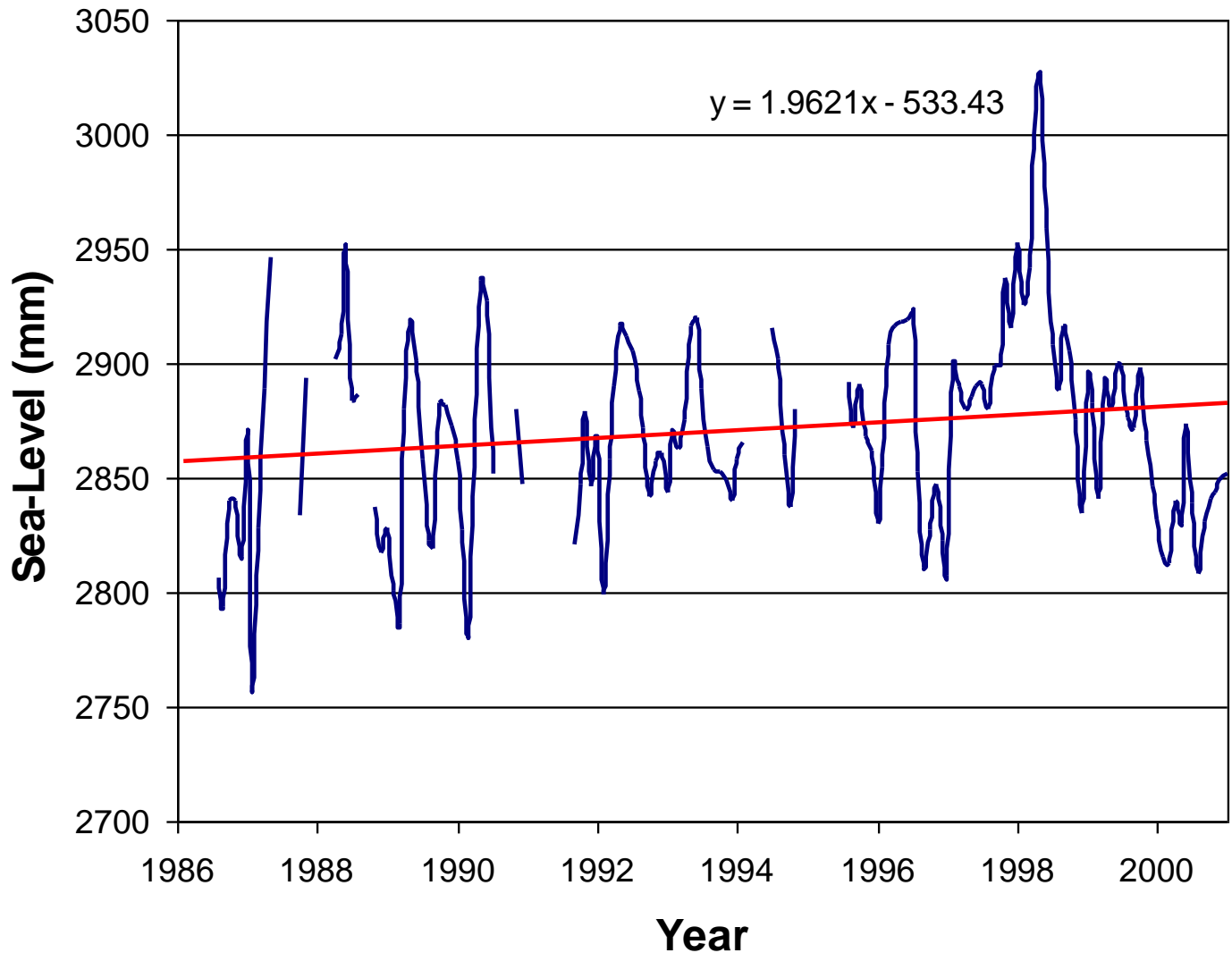
# Mombasa



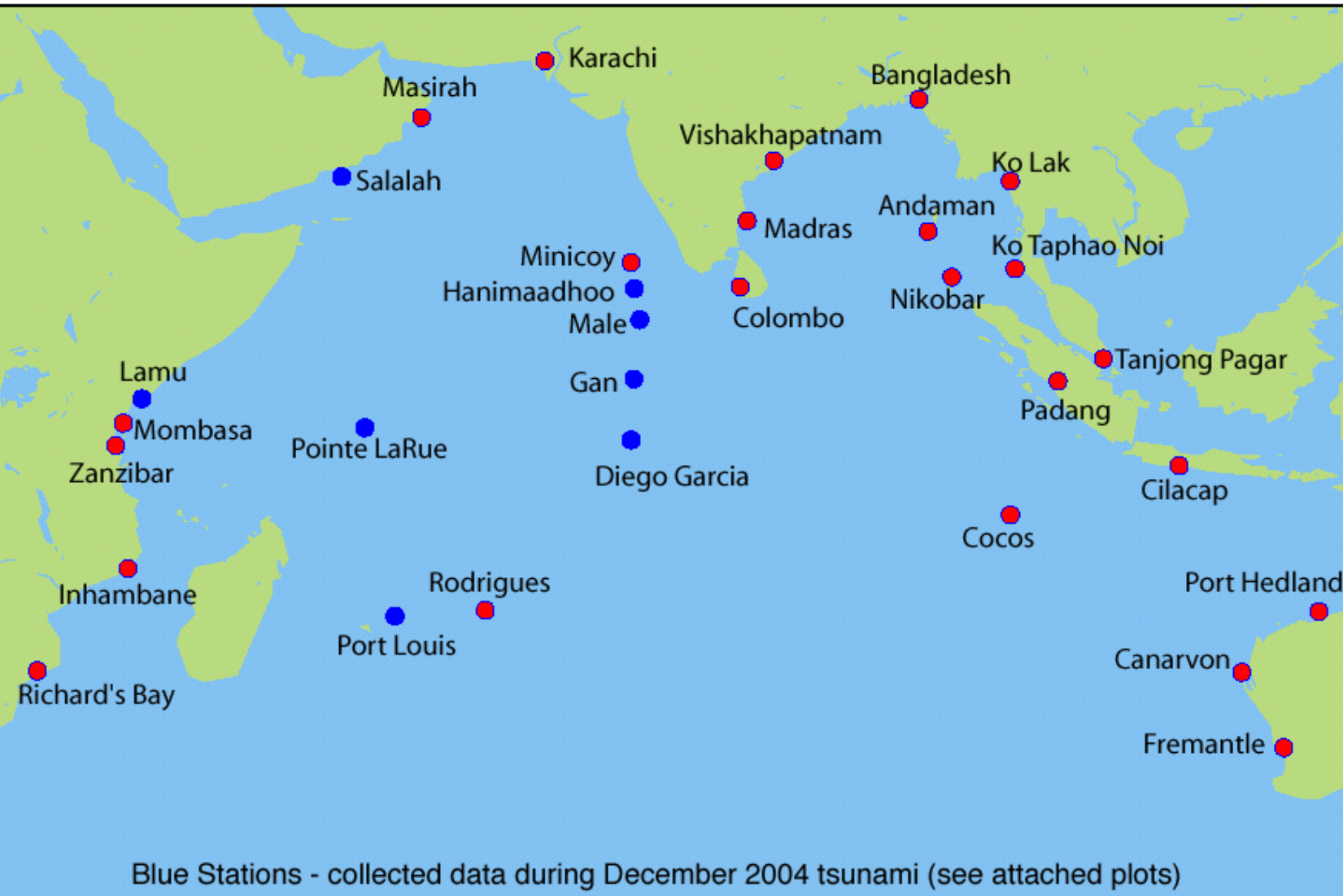
# Lamu



# Sea-level trends at KMFRI Mombasa station

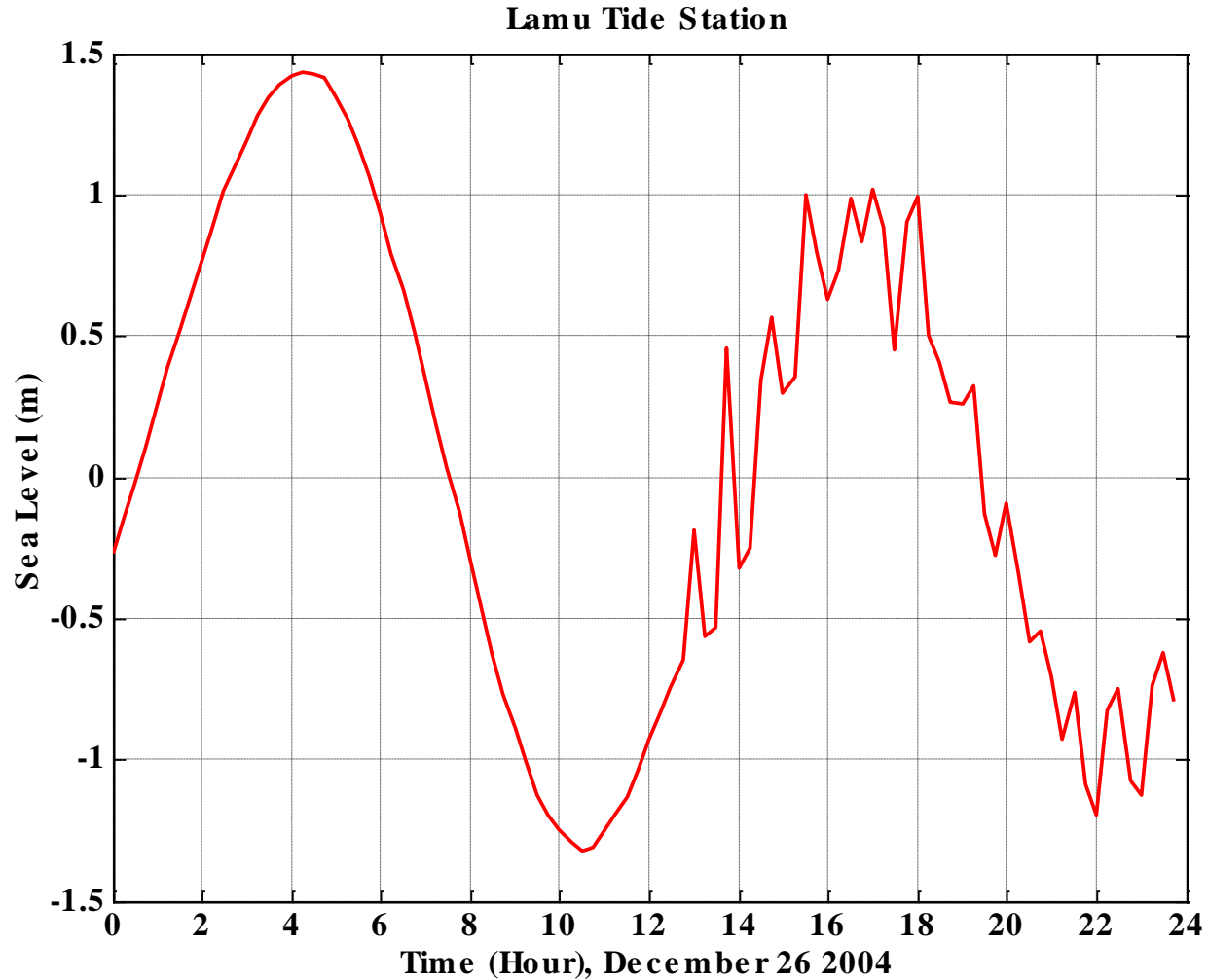


# INDIAN OCEAN TIDE GAUGES FOR TSUNAMI WARNING

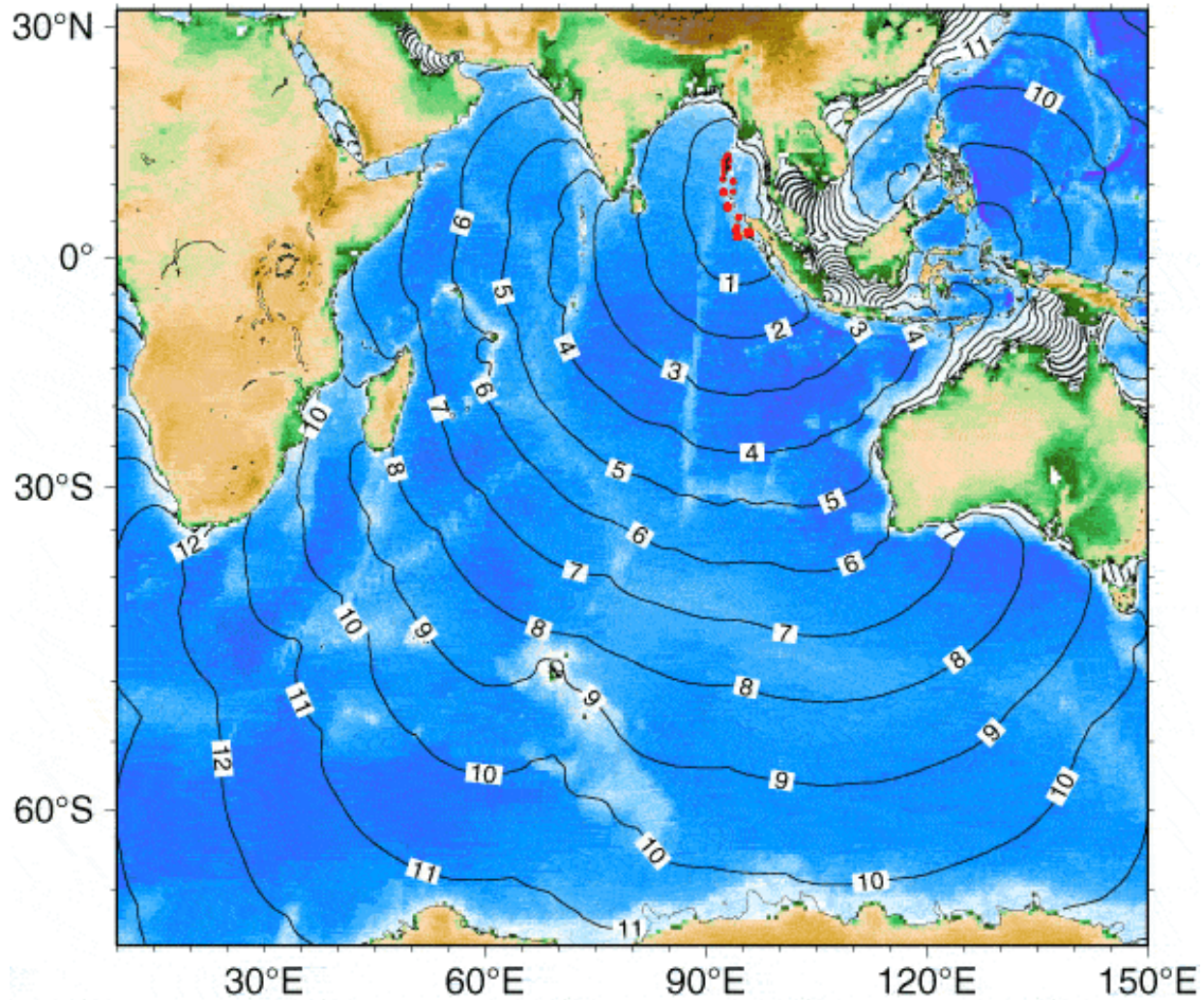


Blue Stations - collected data during December 2004 tsunami (see attached plots)

# LAMU SEA LEVEL, DECEMBER 26, 2004



# Indian Ocean Tsunami Travel Time



Map provided by Kenji Satake, Geological Survey of Japan, AIST



# KMFRI Research Vessel RV Mtafiti





**Aquadopp RCM**

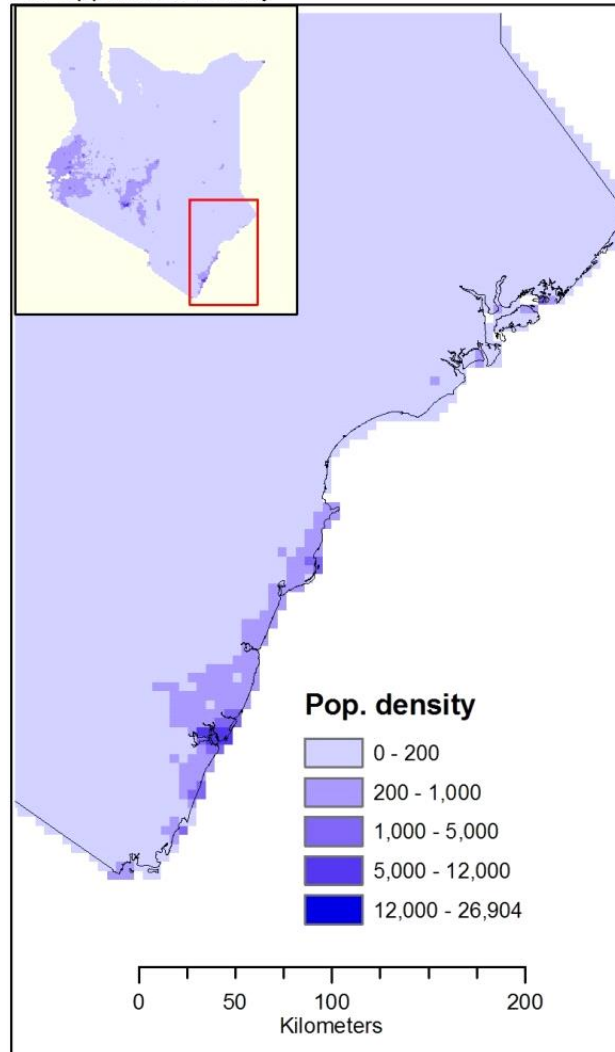


**Aanderaa RCM**

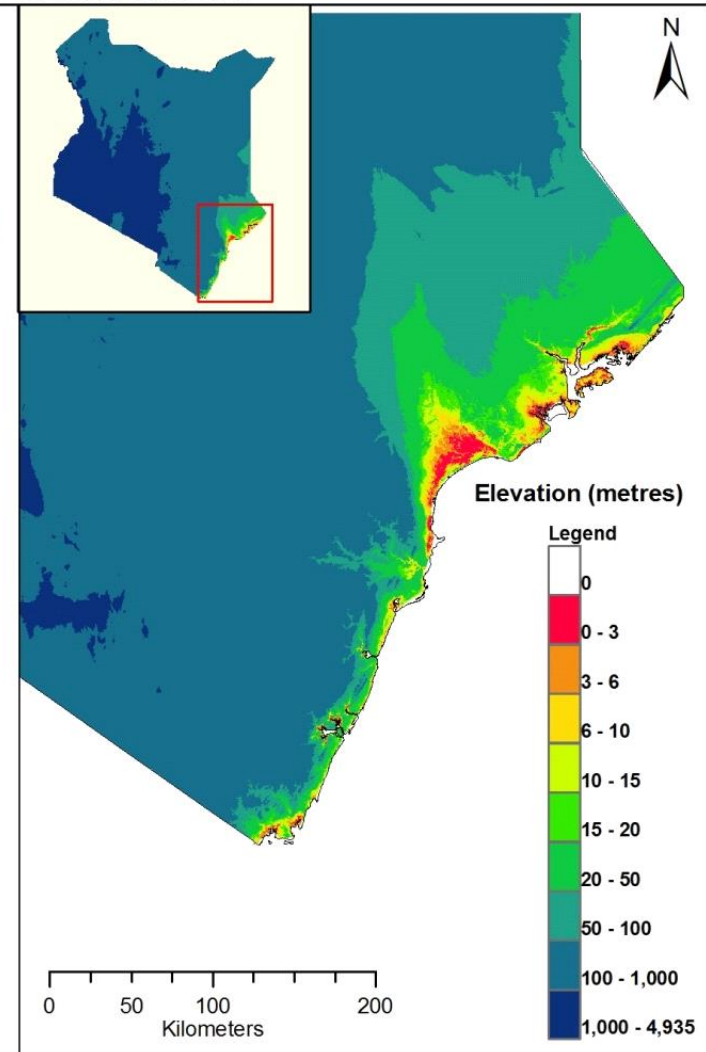
# Digital Elevation Modeling (DEM)

## *Population density, Elevation and SLR*

A. Population density

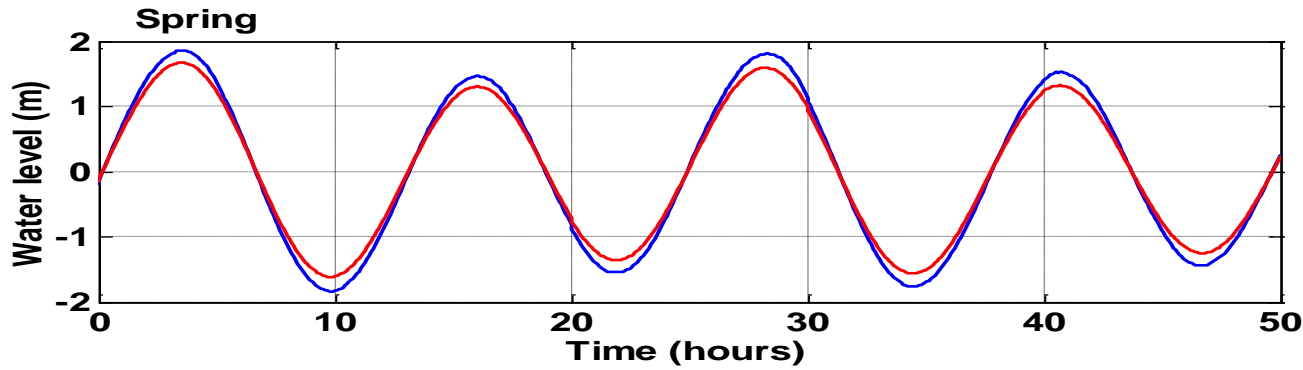
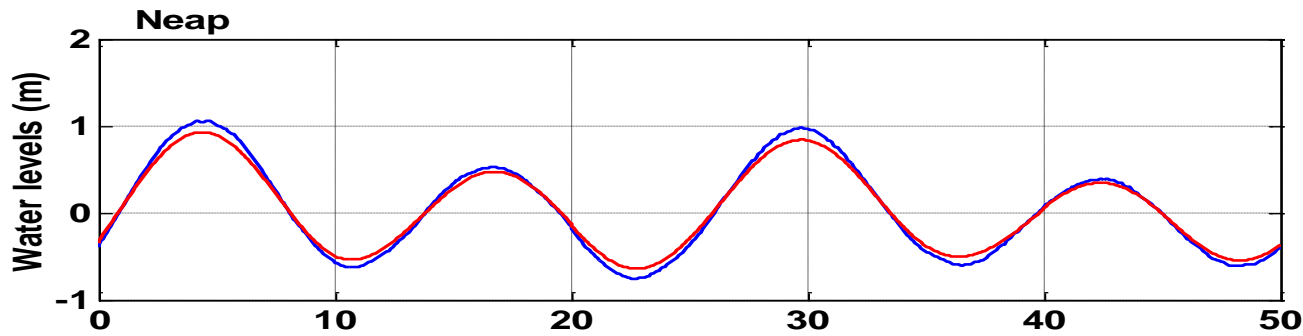


B. Elevation classes

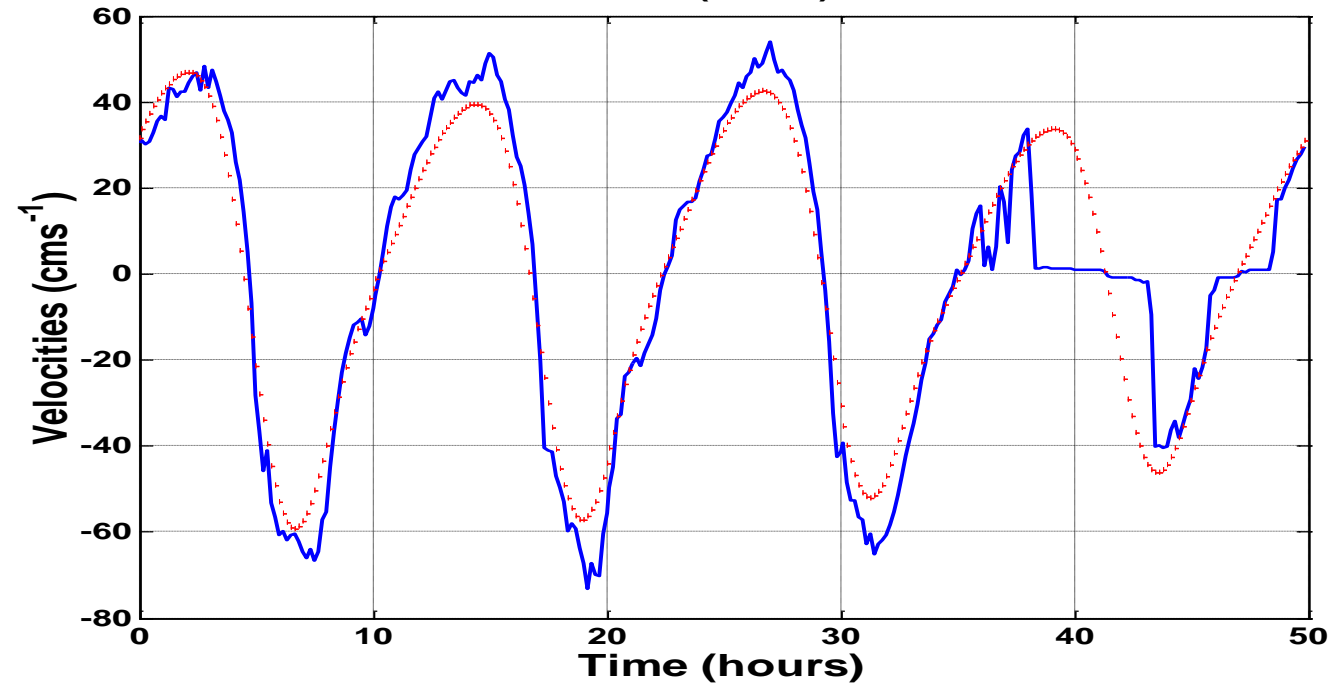




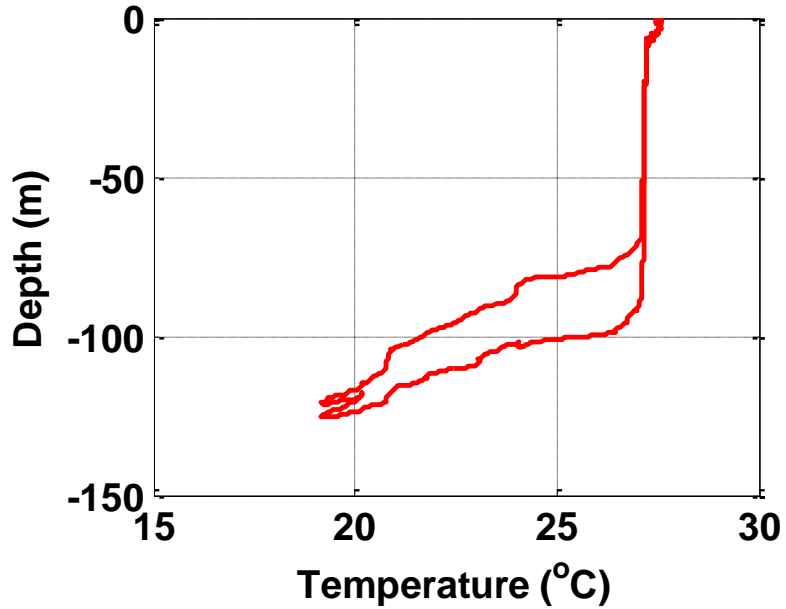
# Modeling results for Mtwapa creek



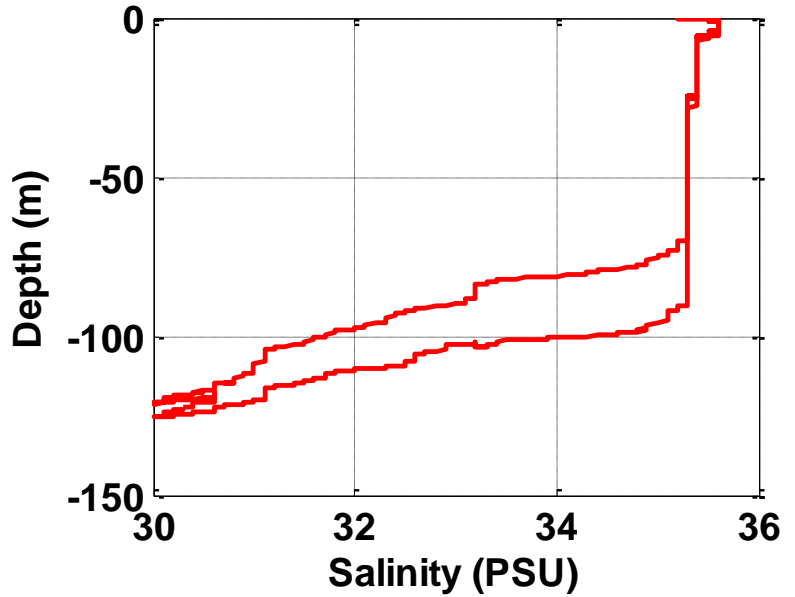
**Blue – Observed**  
**Red - Predicted**



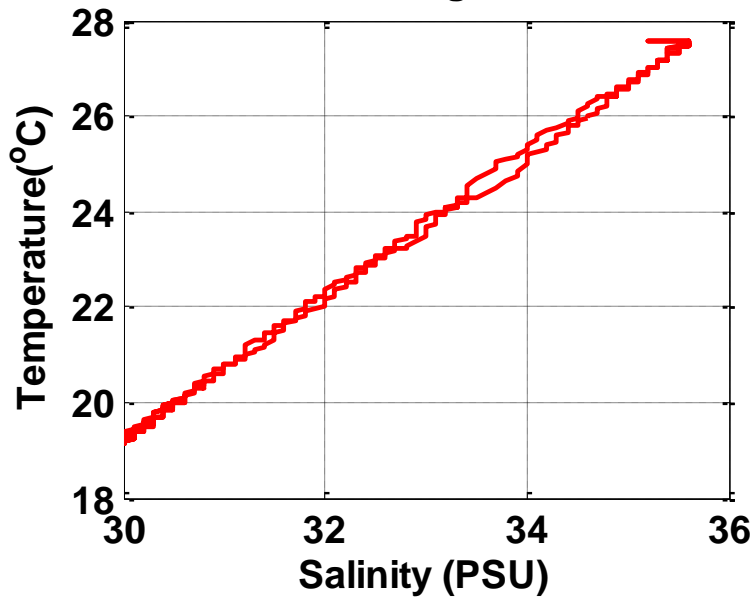
### Temperature Profile



### Salinity Profile



### T-S Diagram



## CTD Casting Ugwana Bay

# National Oceanographic Activities

- AMESD e-station
- Biodiversity assessment of critical coastal habitats.
- Enhanced regional collaboration between ocean and climate experts to improve climate forecasts
- Hosting the national oceanographic data base (KeNODC)
- Hosting regional ocean teacher academy (OTA)
- Capacity Building in Data Buoy Cooperation Panel (DBCP) in the Western Indian Ocean (WIO) region.
- UN Regular Process that aims to assess both the state of the environment and the impacts of key human interactions with ocean ecosystem including socio-economics.
- State of the Coast Report for the Western Indian Ocean (WIO) region (ICZM Process).
- preparation of the State of Marine Environment (SME) Report for Kenya.



# Challenges

- High cost of marine observations platform and equipment (e.g. Research Vessel, CTD, ADCP, etc)
- Inadequate scientific and technical capacity in the areas of Physical Oceanography and Coastal Hydrology
- Develop capacity to make our own survey charts
- Piracy in the WIO region



ASCLME planned cruise in 2009 to study EACC and SC cancelled

## Potential Areas of Collaboration and Opportunities

- Joint oceanographic (physical, chemical, biological and geological) cruises between KMFRI and VLIZ teams onboard RV Mtafiti.
- Topographic and bathymetric mapping (MBES) – bathymetric charts.
- Hydrographic surveys for the inshore areas (creeks, bays lagoons, and nearshore and some parts of the outer shelf in order to add to the GEBCO data, improve navigation and for model development to mitigate erosion, pollution (oil/sewage), tsunami inundation and early warning, maritime transportation in, into/out of harbors.
- Enhanced ocean surface, sub-surface and atmospheric observations to further understand these processes to improve the ocean forecasting.
- Deployment of drifting buoys and Argo floats for integrated observations.
- Capacity building in Oceanography (Internships, MSc. and PhD. courses for young Scientists).
- Satellite oceanography and climate change (SST, SSS, Sea state, altimeter, etc).

