Hydrography in Nigeria and Research Challenges (6439)

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AIM OF PAPER

- Encourage interest in hydrographic studies in developing nations especially in Nigeria.
- Highlight few areas that should attract current research attention and studies undertaken.
- Highlight the constraints to hydrographic operations, education and research in the developing nations.
- Encourage the involvement of agencies that are expected to play role as stake holders.

CHALLENGES TO DEVELOPING NATIONS

- Lack of Awareness
- Policy Issues
  - ✓Government and Institutions
- Lack of personnel
- Undeveloped Institutional Framework
- Under-developed research activities

THE NIGERIAN CHALLANGE

- Comprehensive charting of the nations coastal waters and estuaries
- Systematic study of the tidal pattern along the Nigerian coastlines and estuaries.
  - ✓ Establishment of surge monitoring systems.
- Establishment of Institutional frame work for hydrographic education and practise .
- SOME CURRENT AREAS OF ATTENTION.
  - ✓ absence of standard tide gauge stations on Nigerian coastline and estuaries,
  - ✓ the existence of degenerate amphidromic point at Lagos
  - ✓ an unusual tide arrival time at Opobo river in rivers

WHY TIDAL STUDIES

- Control establishment and study campaigns in coastal zones.
- Surge prediction and monitoring.
- Marine traffic control.
- Reduction of bathymetric data.
- Industrial and domestic water supply.
- Agriculture.
- River pollution studies in estuarine and coastal waters.
- Analysis of tidal stream.
- Determination of Mean Sea Level.
- Definition of maritime baselines.

TIDAL STATIONS ON NIGERIAN COASTLINE

26 ARE STATIONS PUBLISHED IN EASY TIDE

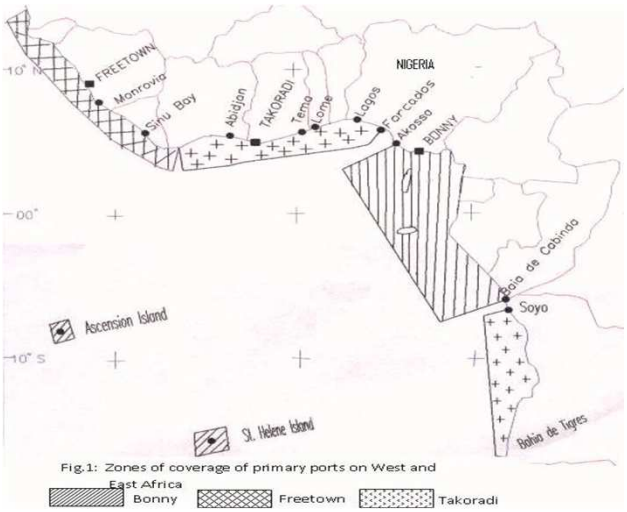
PROBLEMS WTH EXISTING TIDAL STUDIES

- Occurrence of negative values of predicted tides at some tide stations.
- High values of the annual lowest heights at other stations
  - indicate incorrectly established chart datum .
- Absence of reference bench marks at almost all tidal location.
  - results in arbitrary recovery of gauge zero in event of disturbance.
- Lack of correlation between the chart datum at the tide stations
  - resulting in inconsistencies in water level observations and predictions along the coastline.
  - does not provide seamless navigation, relative to chart datum, between the stations along the coastline or estuaries.

PROBLEMS WTH EXISTING TIDAL STUDIES contd

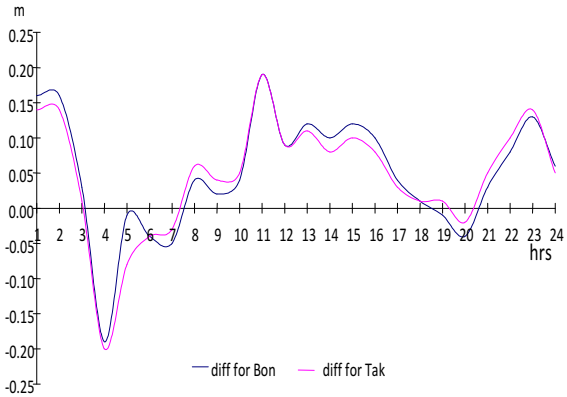
- Rate of mean sea level changes along the Nigeria coast line has been noticed to vary between stations.
- Bonny is the only published Standard port in Nigeria but does not cover the entire coastline.

SECONDARY PORTS COVERED BY BONNY

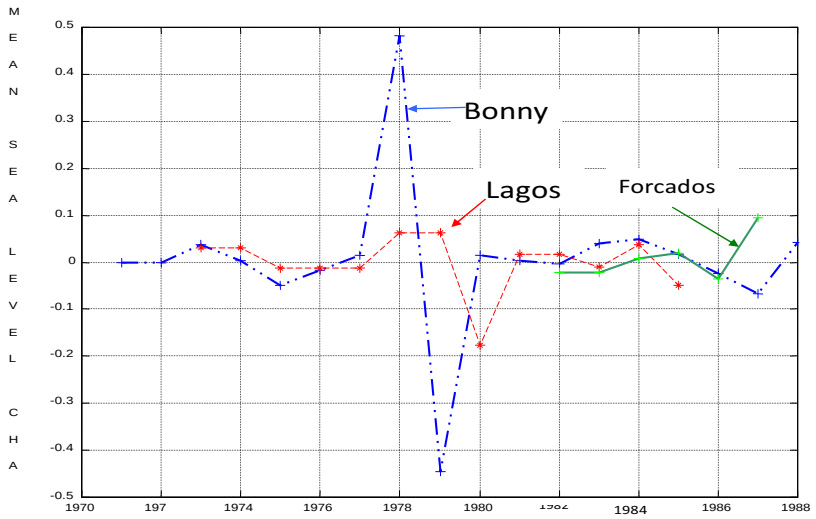


BONNY AS REFRENCE PORT FOR ENTIRE NIGERIA

PREDICTED –OBSERVED TIDES AT LAGOS REFRENCE TO BONNY AND TAKORADI STANDARD PORTS



YEARLY MEAN SEA LEVEL CHANGES ALONG THE NIGERIAN COAST



Mean Sea Level Variation

- Non uniform yearly rate of change

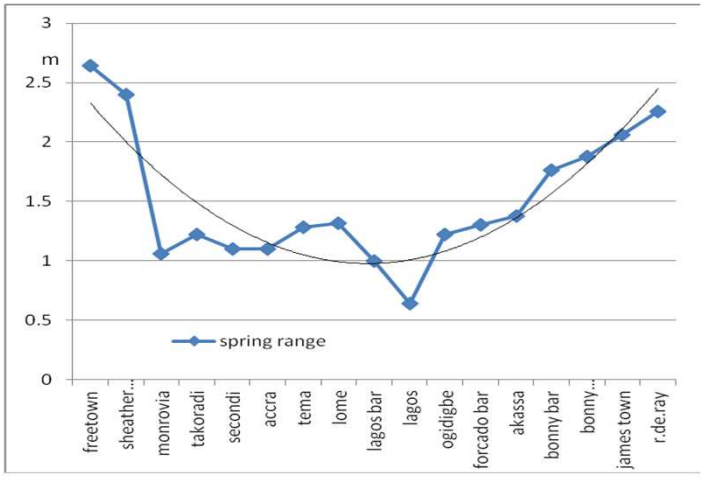
period	Lagos	Forcado	Bonny
1981-82	+0.018	-0.022	-0.004
1982-83	-0.011	-0.022	+0.039
1983-84	+0.038	+0.007	+0.05
1984-85	-0.05	+0.019	+0.018

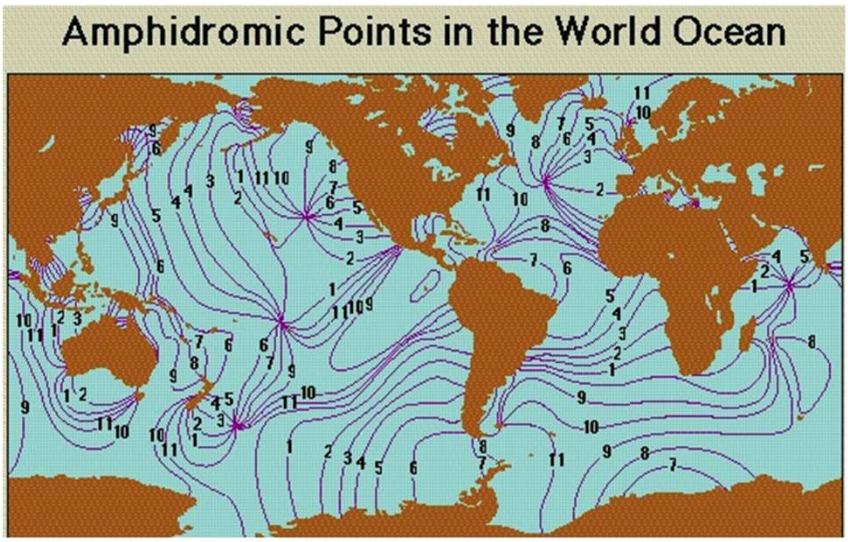
TIDES ON NIGERIAN COASTLINE

REQUIREMENTS FOR STUDIES

- Install gauges along the coast.
- At least five gauges to cover the micro-tidal and meso-tidal zones.
- Observations needed for at least one year.
- Simultaneous observations needed to verify differences in rates of MSL variation.
- Carry out analyses and apply to respective fields of study.

Degenerate Amphidrome at Lagos?
SPRING RANGE VALUES ON WEST AFRICAN COASTLINE
Note the Lowest Range value at Lagos Bar





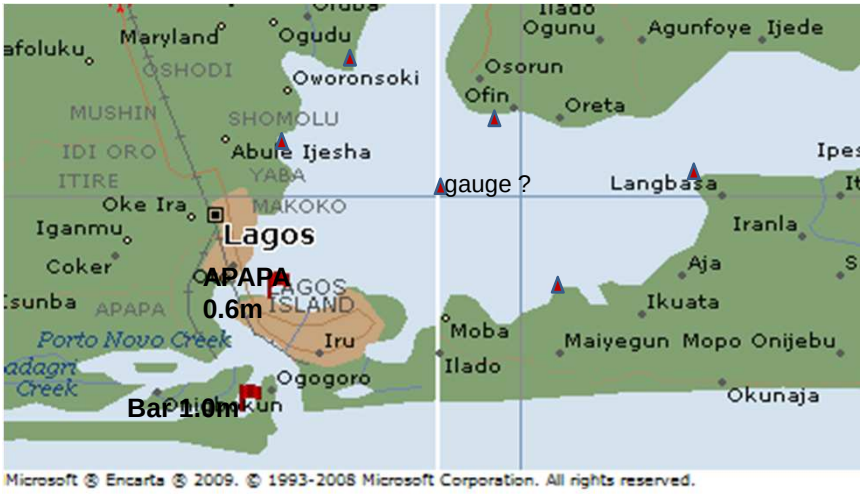
THE LAGOS AMPHIDROMIC SYSTEM

- Verify the Lagos amphidromic system.
- General amphidromic system in world ocean does not address this.
- Gauges are needed at locations indicated by red triangles.
- Analysis of observations will help generate the co-tidal lines.

Constraints: Personnel, Instruments, awareness.

TIDE PATTERN AT LAGOS

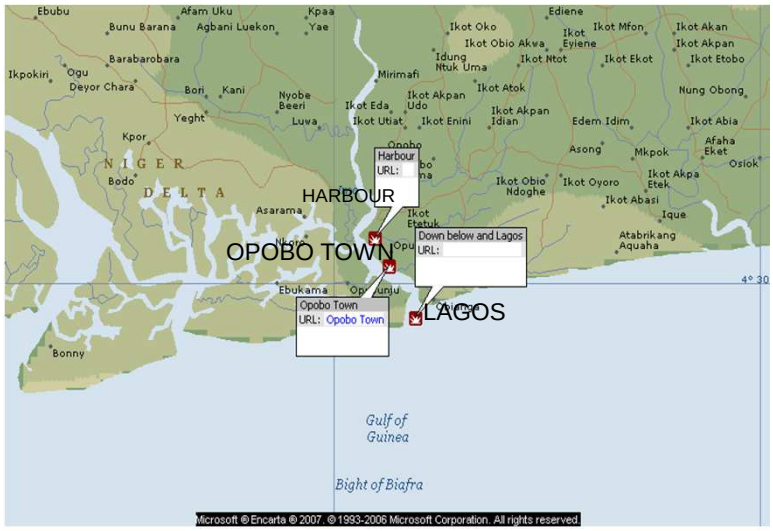
Note Change in range from 1m at Bar to 0.6m at Apapa as you move into Lagos. Amphidromic point therefore lies farther in



QUESTIONABLE TIDAL TIMES AT IMO RIVER

GAUGE LOCATIONS AT IMO RIVER

Observed High-water arrives at Habour before Opobo town!



TIDAL TIMES AT IMO RIVER

Tidal constants M_2, S_2 K_1, O_1

	M_2		S_2		K_1		O_1	
	g	H	g	H	g	H	g	H
Harbour	148	0.70	186	0.25	28	0.15	316	0.03
Opobo	147	0.67	185	0.24	24	0.14	312	0.01
Down below	138	0.62	174	0.22	18	0.15	331	0.03
Lagos-Opobo	141	0.62	174	0.22	20	0.11	312	0.02

The age of tide " t" and the mean luni-tidal interval(MHWI) "v" computed from table 1 are given follows and listed in table 2:

$t = \frac{g_{s2} - g_{m2}}{w_{s2} - w_{m2}} \approx g_{s2} - g_{m2}$ **hrs** $\qquad v = \frac{g_{m2}}{w_{m2}}$ **hrs**

where w_{s2} and w_{m2} speeds of the S_2 and M_2 constituents given as 30.000°/hr and 28.984°/hr respectively.

age of tide and MHWI

station	Age t hrs	MHWI v hrs min	Remarks
Harbour	38	05 06	HW arrives at Opobo 2 min before Habour
Opobo	38	05 04	
Down below	36	04 46	
Lagos(Opobo)	33	04 52	

TIDE APPROACH ROUTES AT HARBOUR

TIDAL TIMES AT IMO RIVER OPOBO CONTD

- Opobo to Harbour= 4.2km.
- Wave speed for approximate 7m depth = SQRT(gd)=8.4 m/s
- Expected diff. in HW time =4200/8.4= 8 min.
- HW arrives 6 min earlier than expected.
- For actual observations, HW arrived earlier at Harbour than at Opobo.

POSSIBLE CAUSES

❖ Tide arrives earlier at Harbour from any of the two alternative routes.
  - ✓ Distances are 42km and 36km from Bifurc1 and Bifurc 2 respectively.(see figure)
  - ✓ Lagos to harbour 12km

❖ Depth of creek is a factor. See wave equation above.

Research Requirements

- Install gauges along all alternative routes.
- Carry out tidal analysis
- Verify tide propagation pattern and time differences.
- Verify depth of routes and depth variation along routes.
  - ✓ **M2 will propagate as shallow water wave and celerity depends on depth.**

➢ **Tide wave propagation is important in water transport.**
  - ✓ **Needed by Emergency agencies for movement to hot spots in riverine areas.**

➢ **CONSTRAINTS: Policy, Infrastructure, Human resources, awareness.**

RESPONSE FROM AGENCIES

- Establishment of National Hydrographic Service is over due.
  - ✓Needed to formulate policies in Hydrography.
  - ✓Initiate personnel development and encourage establishment of the necessary infrastructure.
- The Nigerian Ports Plc is stake a holder and should pioneer charting of Nigerian waters.
- NEMA is a stake holder and should fund related research.
  - ✓Needs vital input from hydrography for her operations riverine areas.

RESPONSE FROM AGENCIES contd

- Office of Surveyor General of the Federation (OSGOF) needs MSL to define the vertical datum.
  - ✓Adjustment of Nigerian Vertical Network still a problem.
- The Nigerian Hydrographer of Navy to take deliberate steps to encourage hydrographic operations and research.
  - ✓ Crucial for successful operations of the Navy.

THANK YOU FOR LISTENING