Hydrodynamic Fluxes of the Commodore Channel in the Lagos Lagoon: Implication for Transport Circulation.

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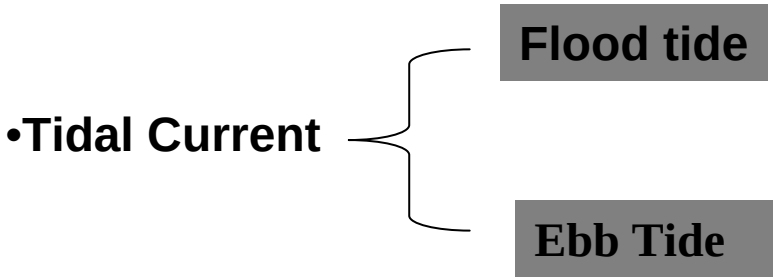
Outlines

- Introduction
- Materials and Method
- Results
- Discussion
- Conclusions

Introduction

• The Lagos lagoon opens into the Atlantic ocean through the commodore channel. Through this estuary, fluxes of seawater are discharged into the lagoon during high tide (Flood tide), and during low tide (Ebb tide) fluxes of water from the lagoon are discharged into the ocean. Hence, fluxes of water through the study area is driven by tidal current.



•There is therefore a need to understand the seasonal variability of the current velocity of these fluxes.

•ADCP data
•CTD data

…introduction

Motivation

This study is motivated to understand the cause of the water movement in and out of the lagoon; the flow of the water current, and to unravel the circulation pattern of water in the commodore channel of Lagos lagoon.

Justification

The commodore channel is lined up with Harbours, and serves as a special route for vessels entering or leaving the Apapa and Tin Can ports in Lagos.

The Lagos Lagoon has been previously studied, yet only very few documented studies have been carried out in the commodore channel.

Therefore, it is important to understand the dynamics controlling the transport of water in this environment as well as its seasonal variability of flow and discharge so as to understand the mechanisms of how sediments from the lagoon are deposited into the Ocean and seawater discharge into the lagoon respectively.

Materials and Method

Data Sampling

ADCP
CTD (Cruise 1-5)
Tide data (from NIOMR 2001)

15m, 20m, 40m, and 70m water depth

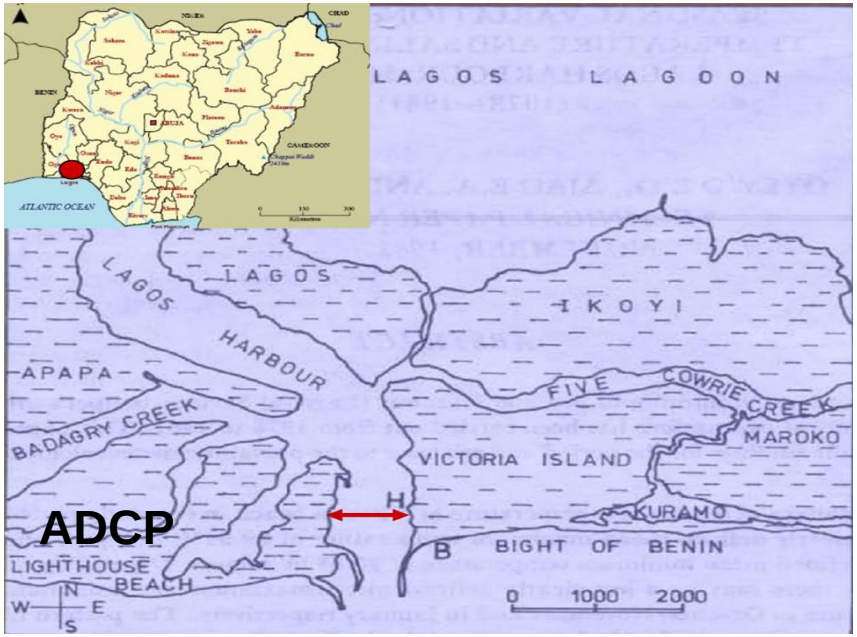


Fig. 2: Map of Commodore Channel.

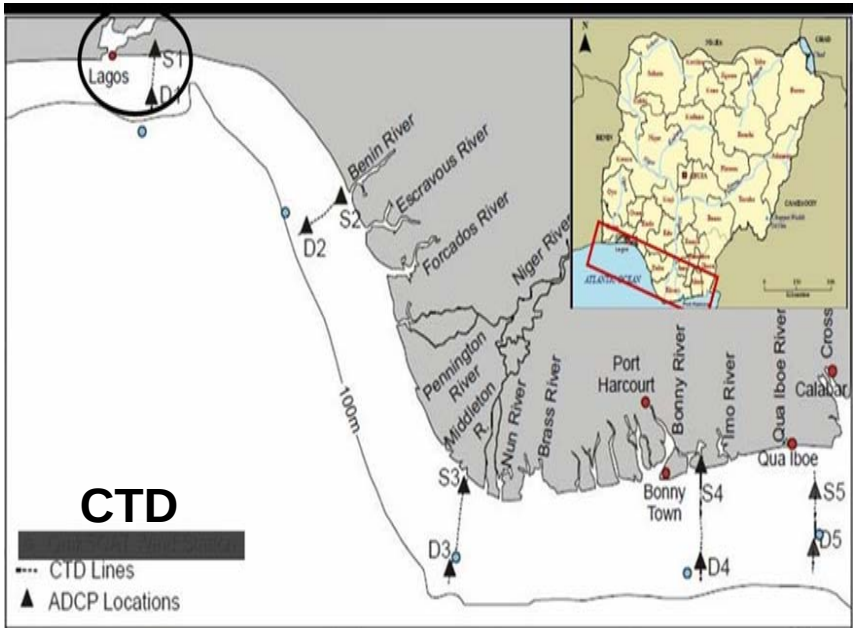
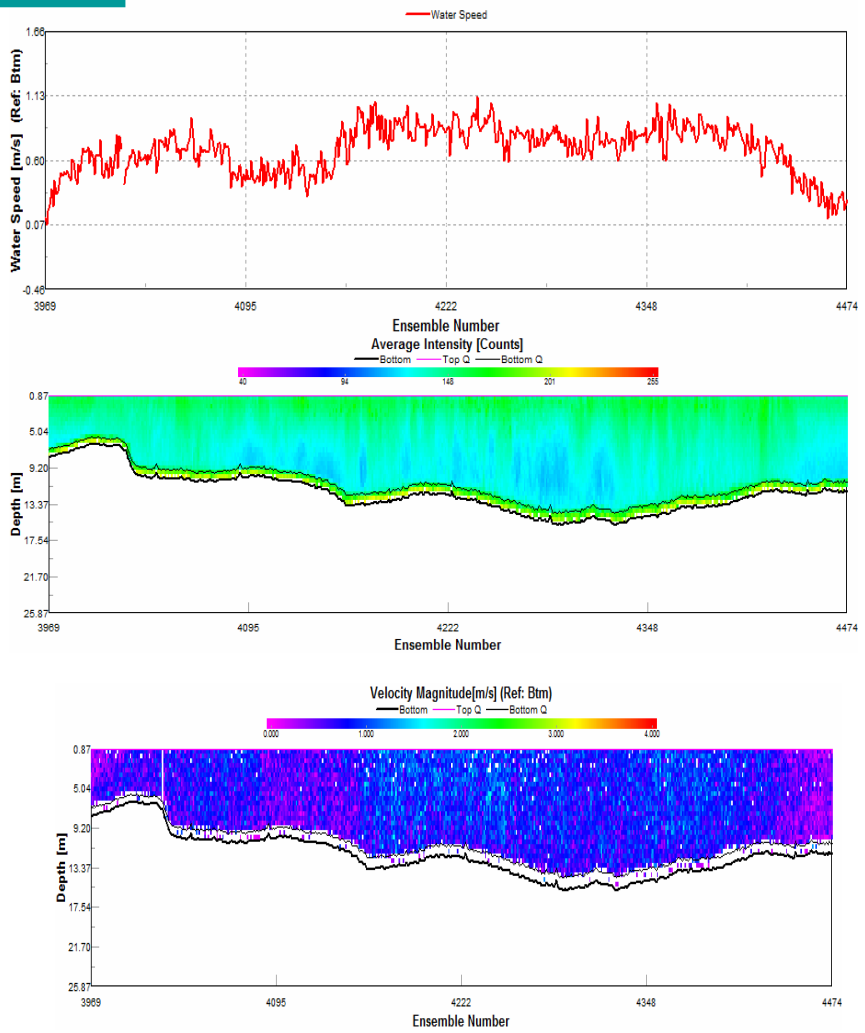


Fig.1: Map of Nigerian Continental Shelf.

ADCP Results.

Rainy Season Flood Conditions (May 2000)

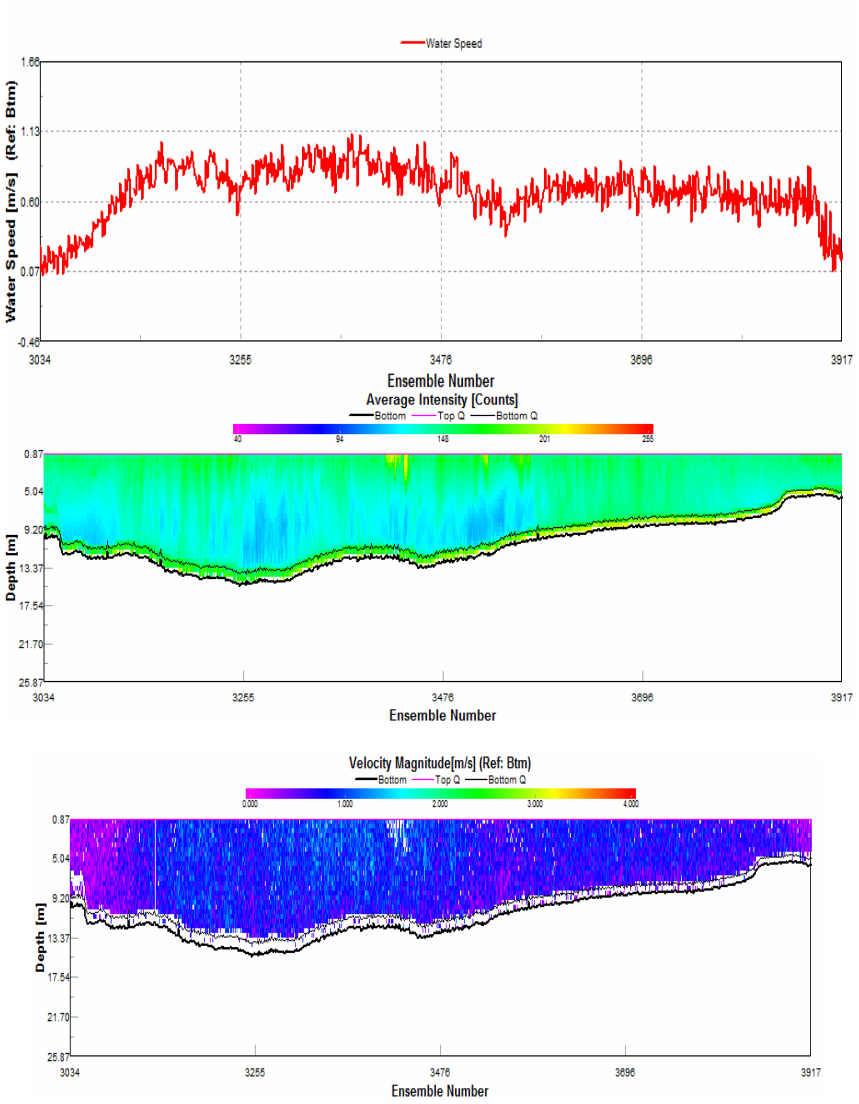
- **Table 4.1. ADCP discharge data during flood tide**
- Discharge (Btm) Left to Right
- # Ensembles 506
- Start Time 07:18:00
- Duration 656.44 [s]
- Total Q 8175.97 [m³/s]
- Top Q 672.22 [m³/s]
- Measured Q 6872.81 [m³/s]
- Bottom Q 630.93 [m³/s]
- (T+M+B) Q 8175.97 [m³/s]
- Left Velocity 0.257 [m/s]
- Left Depth 7.64 [m]
- Right Velocity 0.240 [m/s]
- Right Depth 11.84 [m]
- Width 937.01 [m]
- Total Area 11558.70[m²]
- Q/Area 0.71 [m/s]
- Flow Dir. 17.87 [°]



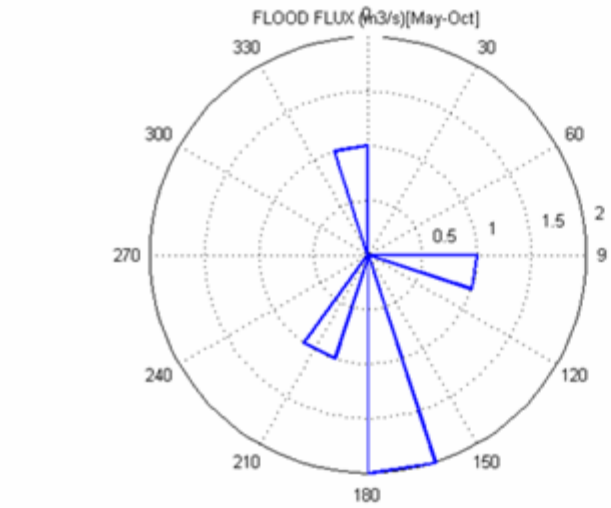
Rainy Season Ebb Conditions (May 2000)

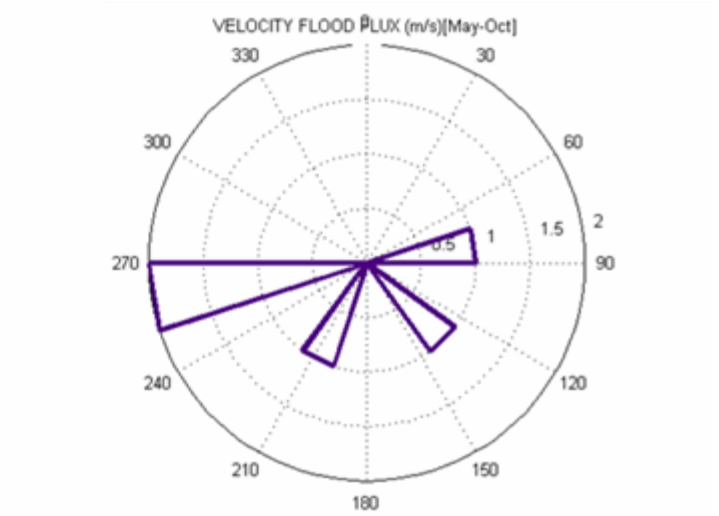
- **Table 4.2. ADCP discharge data during ebb tide.**
- Discharge (Btm) Left to Right

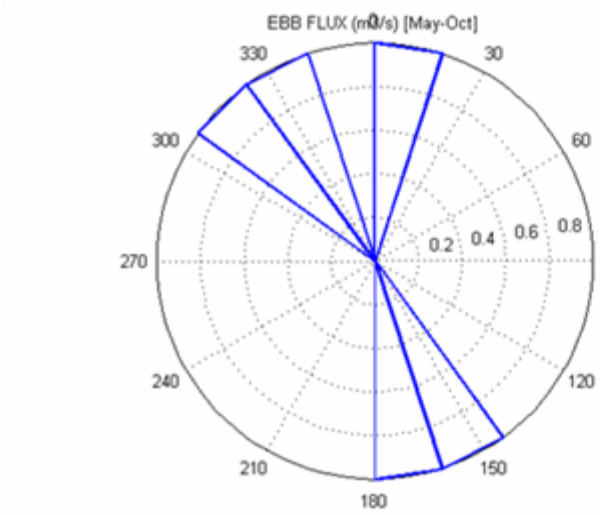
# Ensembles	883	
Start Time	06:57:44	
Duration	1147.85	[s]
Total Q	-8397.87	[m³/s]
Top Q	-739.70	[m³/s]
Measured Q	-6964.85	[m³/s]
Bottom Q	-693.32	[m³/s]
(T+M+B) Q	-8397.87	[m³/s]
Left Velocity	-0.105	[m/s]
Left Depth	9.90	[m]
Right Velocity	-0.168	[m/s]
Right Depth	5.66	[m]
Width	977.19	[m]
Total Area	11600.14	[m²]
Q/Area	0.72	[m/s]
Flow Dir.	16.84	[°]

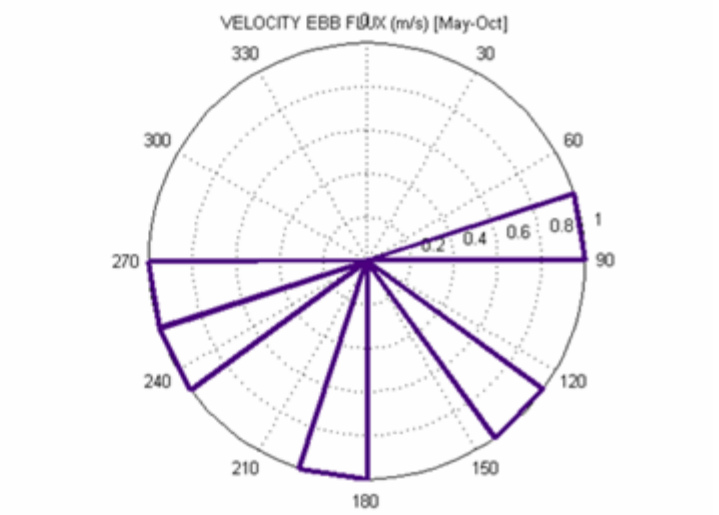


Current Velocity Variability and Fluxes in the Flood and Ebb Tide Conditions during the Rainy Season.

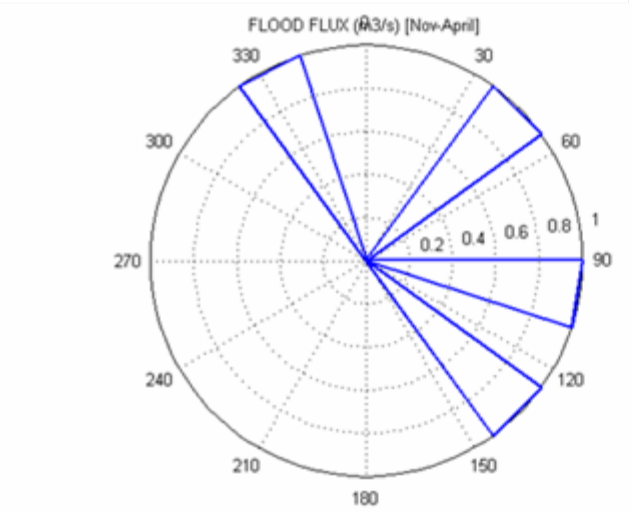


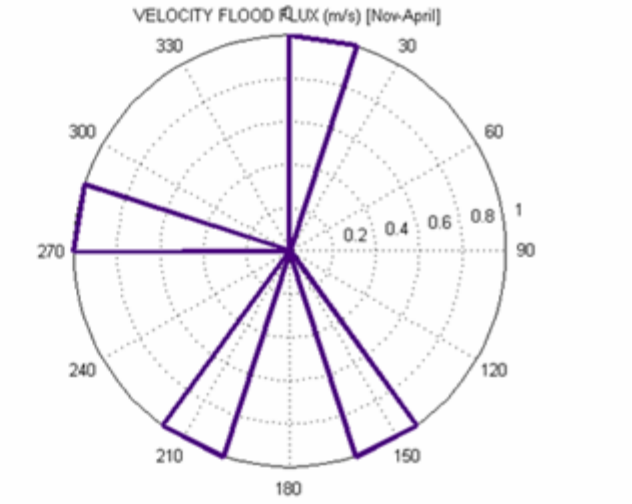


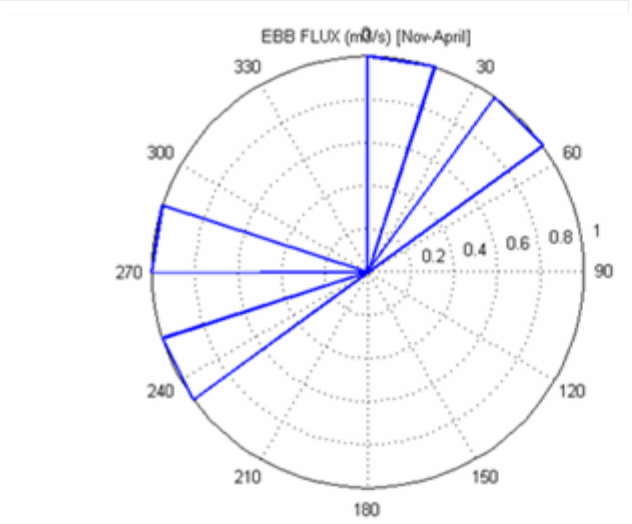


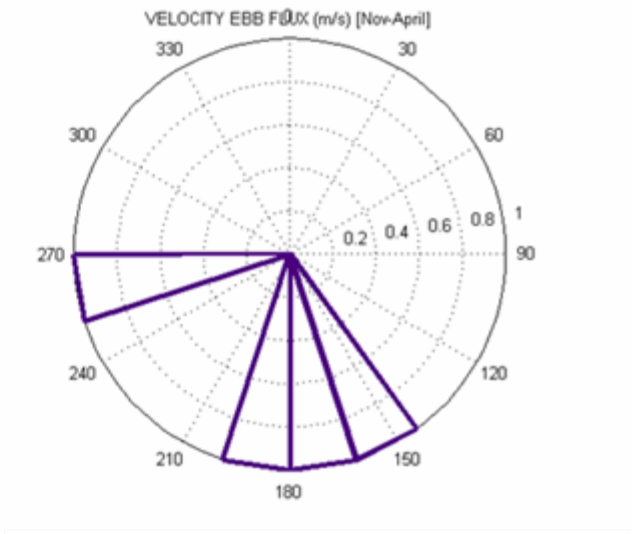


Current Velocity Variability and Fluxes of the Flood and Ebb Conditions during the Dry Season.



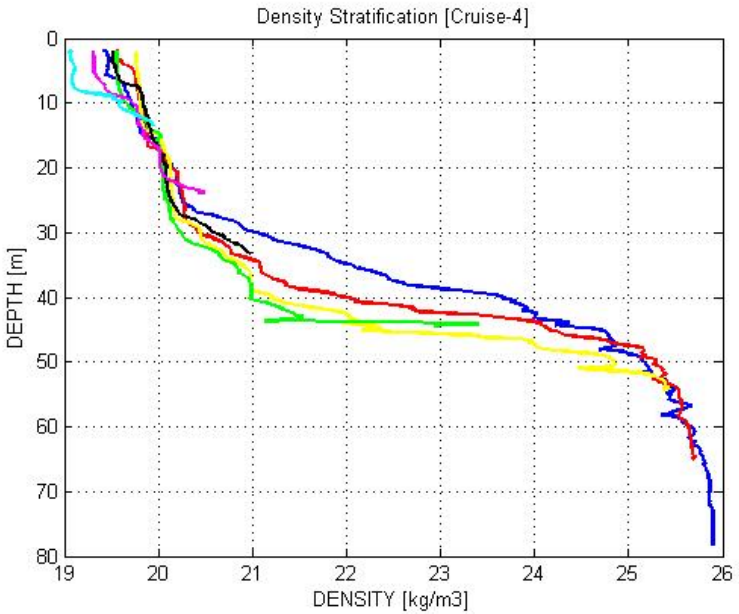


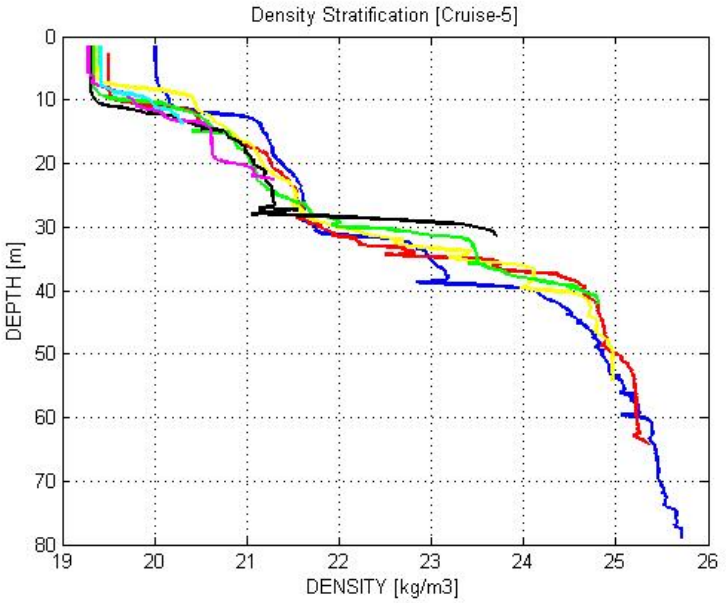




CTD Results

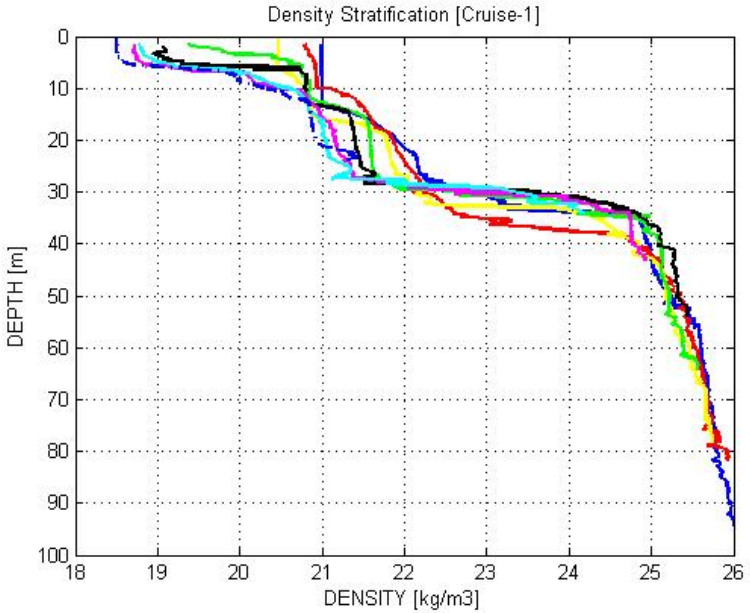
Cruises 4 and 5 CTD Profiles during the Rainy Season

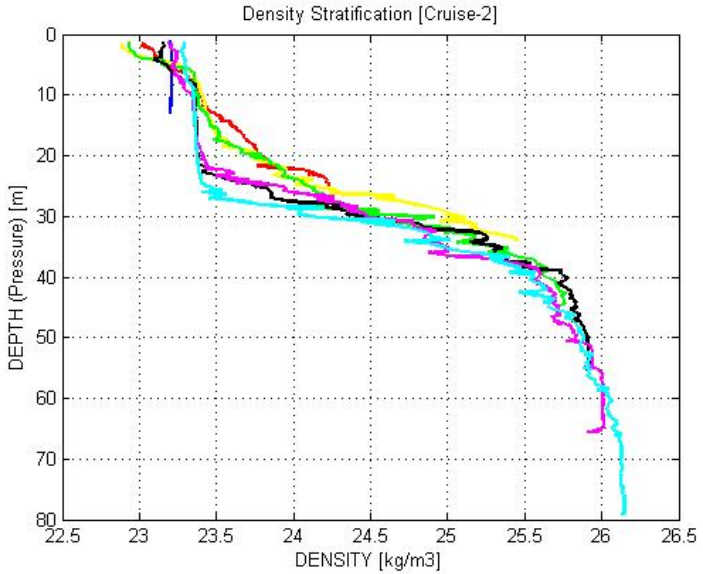


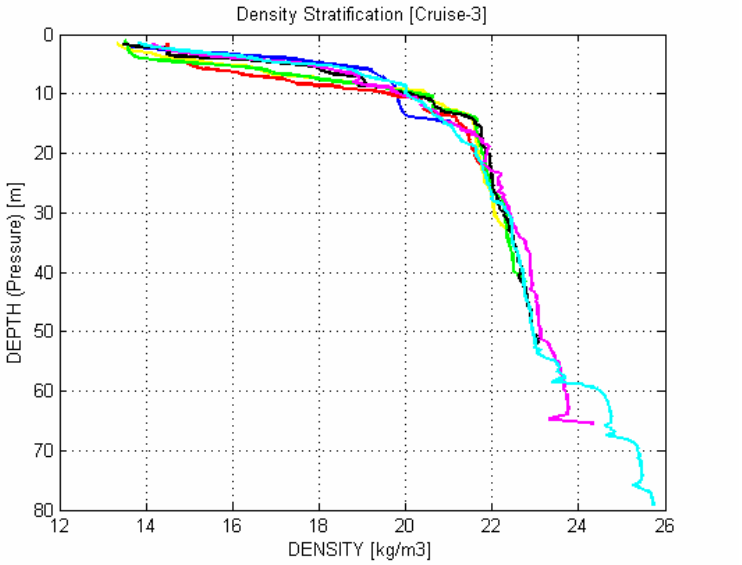


Density Stratifications during Rainy season

Cruises 1, 2 and 3 CTD Profiles during the Dry Season



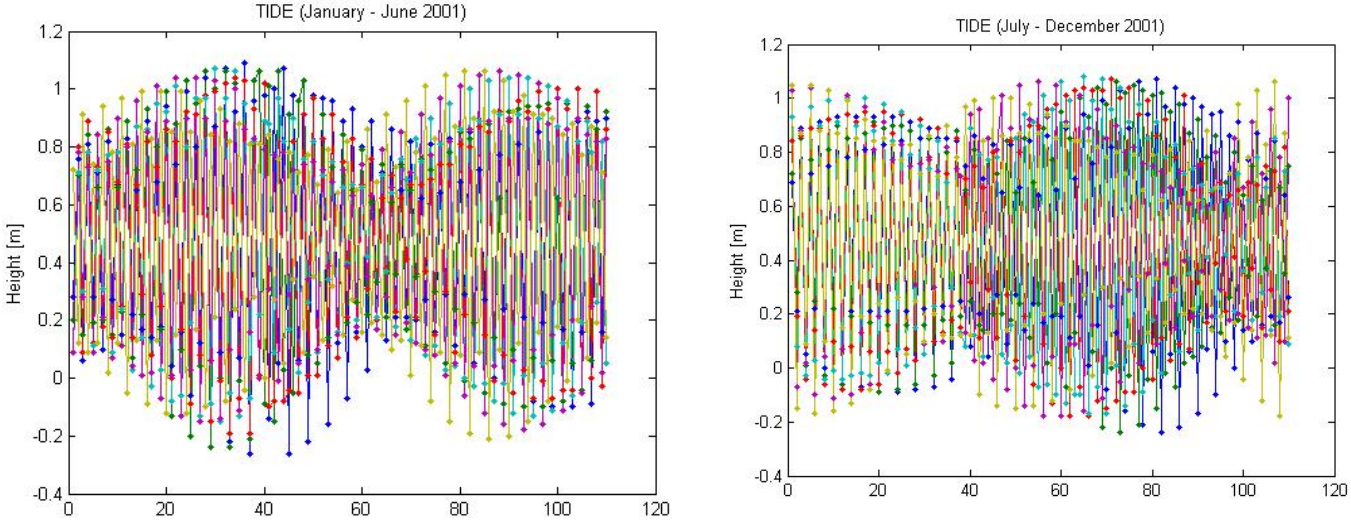




Density Stratifications during dry season

Tide Data Result

- Analysis of the tide data collected in 2001 revealed that the dominant tide along the commodore channel of Lagos lagoon is semi diurnal tide with two daily inequalities. For clarity and better elucidation of the semi diurnal tide, we separated the data into two major parts such as from January to June, and from July to December.



Semi diurnal Tide in the Commodore Channel of Lagos lagoon. (Tide data 2001).

Discussions

- The hydrodynamic study carried out revealed that the force responsible for the flow of water in and out of the commodore channel of Lagos lagoon is tidal current. The tide observed along the commodore channel is semi diurnal and the period of oscillations of the tide is determined by the Ocean tides. The average high tide and low tides last for about 4.5 hours and 3.4 hours respectively, and the slack tide last for about 25 to 30 minutes.

- Consequently, the current velocity causing the fluxes of seawater inflow from the ocean and discharge from the lagoon was observed to vary.

- Hence, current velocity for ebb flow in the rainy season was found to have a maximum value of 0.72m/s (72cm/s) and minimum value of 0.24m/s (24cm/s). While the current velocity for flood tide condition in the dry season was found to have a maximum velocity of 0.75m/s (75cm/s) and minimum velocity of 0.45m/s (45cm/s).

Hence, the current velocity of the flood fluxes during the flood tide condition.

- was low: rainy season
- was high: dry season

Current velocity of the ebb fluxes during the ebb tide condition

- was high: rainy season
- was low: dry season

•The offshore end of the commodore channel was found to be stratified. The water column is stratified into two layers as a result of density difference, comprising less dense, less saline water at the upper layer, and dense, more saline water layer below.

Conclusion

- Commodore channel of Lagos lagoon is under the influence of semi-diurnal tides with two inequalities. Flood tide conditions and ebb tide conditions are recorded as the two conditions of the hydrodynamic forces responsible for the flux of water into or out of the commodore channel of Lagos lagoon. Flood current speed in the commodore channel are estimated at about 0.72m/s (72cm/s) for rainy season and 0.75m/s (75cm/s) for dry season. While ebb tidal current are estimated at 0.72m/s (72cm/s) for rainy season and 0.71m/s (71cm/s) for dry season. Hence, it is convenient to say that current velocity of the fluxes through the study area varies seasonally.

- Significant variations exist also in the volume of inflow of sea water and discharge from the lagoon. Generally, during a tidal cycle for rainy season, the ebb tidal flux (river discharge) is larger than the seawater inflow, and less during a tidal cycle for dry season. On the other hand, during the dry season, the volumes of seawater inflow into the study area assume high values. Hence, fluxes of water are discharged, through the commodore channel into the lagoon or into the ocean seasonally.

- The offshore end of the commodore channel was a stratified channel of water column .The water column is stratified into two layers as a result of density difference, comprising less dense, less saline water at the upper layer, and dense, more saline water layer below.

THANKS FOR LISTENING