Analysis of hydrologic conditions and currents in Gulf of Guinea from *in situ* observations

Master of oceanography physics

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PLAN

- INTRODUCTION
- MATERIALS and METHODS
- RESULTS and ANALYSIS
- CONCLUSIONS and PROSPECTS
WHY WE STUDY THE OCEANIC CIRCULATION AND ITS VARIABILITY?
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AFRICAN MONSOON MULTIDISCIPLINARY ANALYSIS
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Its oceanic component is:

EGEE

STUDY PROGRAM OF OCEANIC CIRCULATION AND ITS VARIABILITY IN GULF OF GUINEA
6 OCEANOGRAPHIC CRUISES

[Map showing oceanographic cruises]
2 EGEE cruises per year in 2005, 2006 & 2007

⇌ seasonal variability (Egee1&2, 3&4, 5&6; early summer & fall)

⇌ interannual variability (Egee 1 & 3 & 5, Egée 2 & 4 & 6)

⇌ intra-seasonal variability (Egee 3)
Coastal upwelling in the North of Gulf of Guinea (GG) influences the sea surface temperature (SST).


Coastal upwelling in the North of Gulf of Guinea (GG) influence the sea surface temperature (SST)

Guinea Current (GC) is one of major mechanisms of this coastal upwelling
surface (full arrow) and subsurface (dash arrow) Circulation in Gulf of Guinea in summer and winter. [N. KOLODZIEJCZYK, 2008]
IN THE NORTH OF 2°N → FEW KNOWLEDGES ABOUT CIRCULATION
3 vertical transects: R1, R2, R3
Data acquisition

- **CTD-O₂** (conductivity, temperature, dissolved oxygen and pressure measurements...)

- **VM-ADCP** (current velocity measurements)
Vertical section of zonal velocity
deep branch of South Equatorial Current (nSEC)
Guinea Current (GC)
Guinea Counter Current (GCC) (name adopted because of its opposite direction relatively to GC)
GUINEA UNDERCURRENT (GUC) (name adopted because flow under GC)
4 ZONAL CURRENTS MEASURED

Guinea Current (GC)

Guinea Counter Current (GCC) (name adopted because of its opposite direction relatively to GC)

deep branch of South Equatorial Current (nSEC)

GUINEA UNDERCURRENT (GUC) (name adopted because flow under GC)
Underlining westward salt (tracer) advection by nSEC and GCC from GG ground during EGEE period (via recirculation of Equatorial UnderCurrent waters)
GUC is observed along R1, R2 and R3 during EGEE period and characterized by a relative maximum of salinity (~34,8) and dissolved oxygen (120 µmol/kg)
GUC origin hypothesis:

- Local recirculation
- North Equatorial UnderCurrent (NEUC) extension

GUC is observed along R1, R2 and R3 during EGEE period and characterized by a relative maximum of salinity (~34.8) and dissolved oxygen (120 µmol/kg)
 ↔ Extrem seasonal variability illustration of EGEE1 & 2
 ↔ Current evolution along R1, R2 and R3
ZONAL TRANSPORTS (1Sv = 10^6 m³/s)

<table>
<thead>
<tr>
<th></th>
<th>GC [0-2,7]</th>
<th>GUC [0-6]</th>
<th>GCC [0-3,7]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minima mean transports</td>
<td>0,8</td>
<td>EGEE5</td>
<td>0,5</td>
</tr>
<tr>
<td>Maxima mean transports</td>
<td>1,6</td>
<td>EGEE3</td>
<td>4</td>
</tr>
<tr>
<td>Total mean transports (2005-2007)</td>
<td>1,2</td>
<td>1,8</td>
<td>1,8</td>
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</table>

⇔ transports under-estimated due to the latitudinal and vertical limitations of S-ADCP measurements

⇔ Extrem variability of transports

⇔ total mean transport of 1.2 Sv to East
Absence of surface current measurements => Utilization of MERCATOR program results

French and European Ocean Forecasting System

- Based on modelling and data assimilation (satellite and in situ)
- Analyses and predicts the global ocean in real time from top to bottom
Boreal summer: GC (~50 cm/s) is coastal and slim
Boreal fall: GC is in the offing, very intense (~70 cm/s) and wide; backwards current along the coast
North Equatorial Convergence Zone can be located at South of 2°N
Circulation in Gulf of Guinea is very complex
Extrem spatial and temporal variability of currents
the study zone don’t cover the meridionnal extension of the currents
TO BE VERIFIED:

GUC origin hypothesis:

- Local recirculation
- North Equatorial UnderCurrent (NEUC) extension
More detailed Analysis of other existent *in situ* data (FOCAL, SEQUAL, EQUALANT, CITHER)

Associated Analysis *in situ* measurements and high resolution numerical model results

Meridional transects (red lines)
THANKS FOR YOUR ATTENTION...

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