Nansen Tutu TRIATLAS Summer School 2020

KONE Mamadou

Theme: Dynamics of coastal upwelling and ocean-atmosphere interaction in the gulf of guinea

Presentation plan

1-Introduction
2-Study zone and used tools

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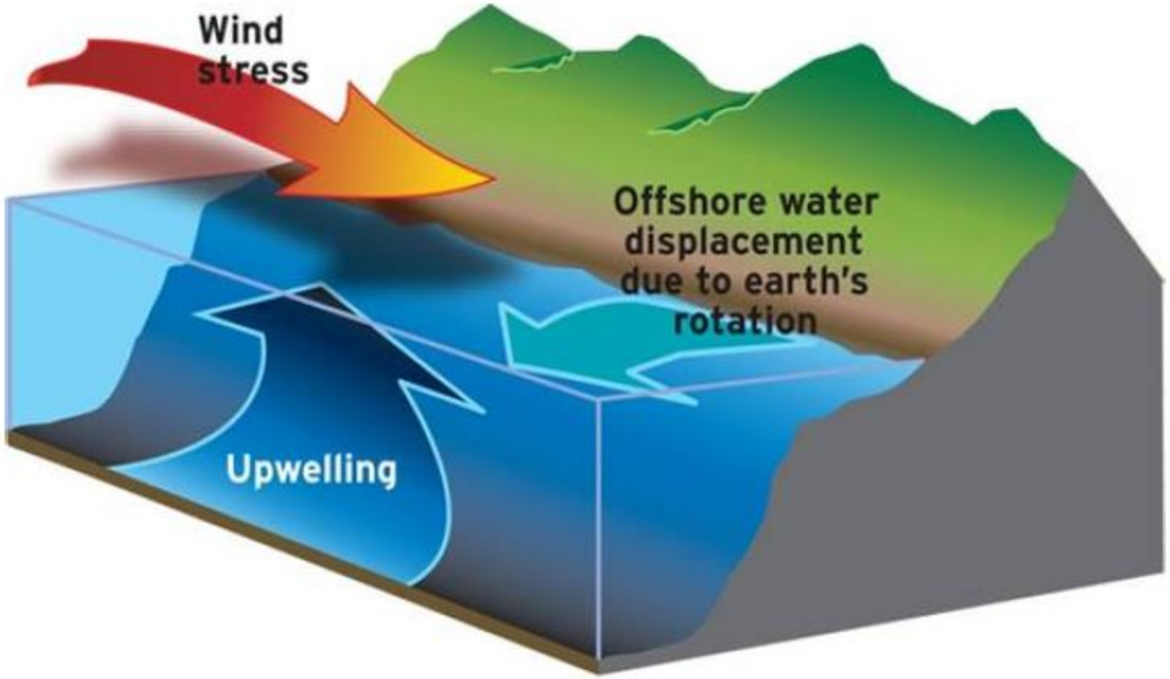
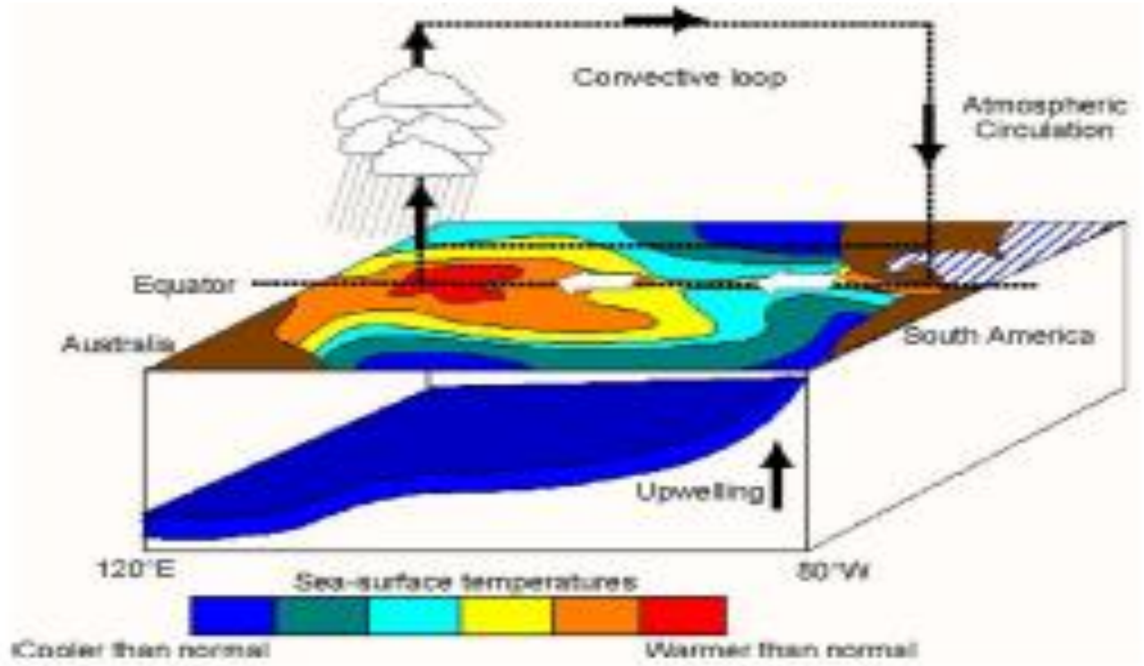
Introduction



General upwelling mechanism (*Lionnel, 2008)*



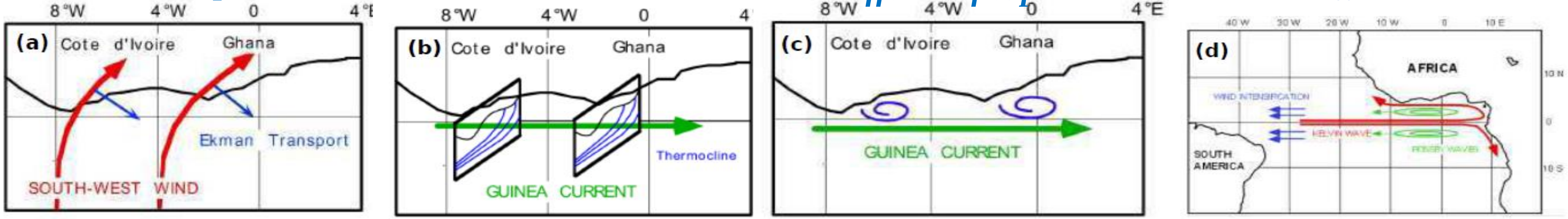
Schemic description of coupled ocean-atmosphere processes (Cindy *et a*l., 2008)

The general mechanism of upwellings is described as the fact that wind pushes warm surface water towards the sea, raising thermocline towards the surface, which increases the sensitivity of the oceanic mixture layer to atmospheric fluctuations.

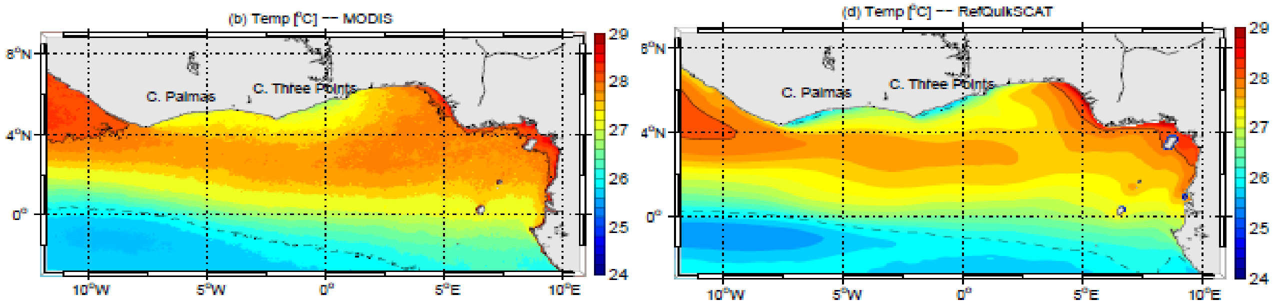
What are our goals?

1-Study the processes responsible for the upwelling in our study area

Ekman Transport ***Guinea current*** ***The effects of caps*** ***Costal Waves***

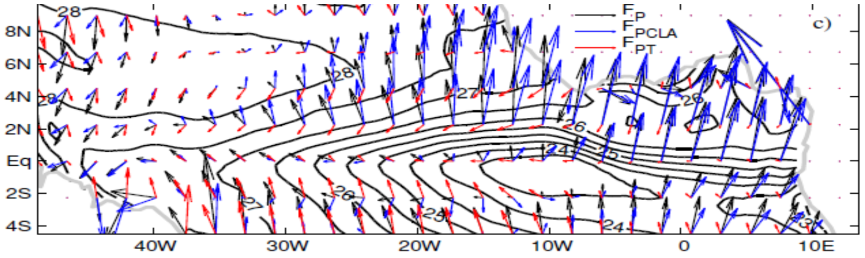


Figue adapted from a personal communication of Roy (1995)



Spatial distributtion map of mean surface temperature of in gulf of Guinea (Djakoure et *al.*,2015)

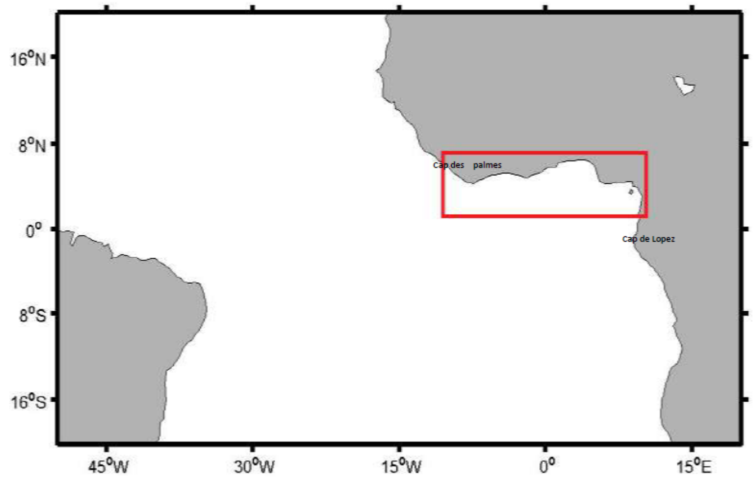
2-Study the dynamics of coastal upwelling using ROMS and compare the results to high resolution satelite images and various in situ measurements



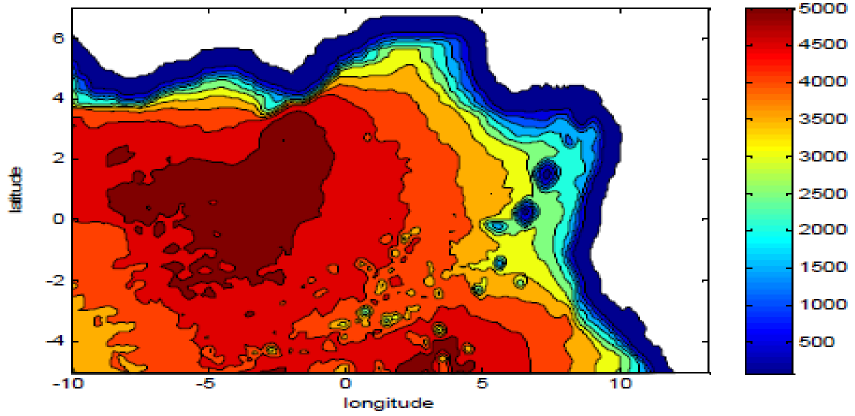
3-Present the heat balance calculated with ROMS and the momentum

Study zone and used tools

Study zone



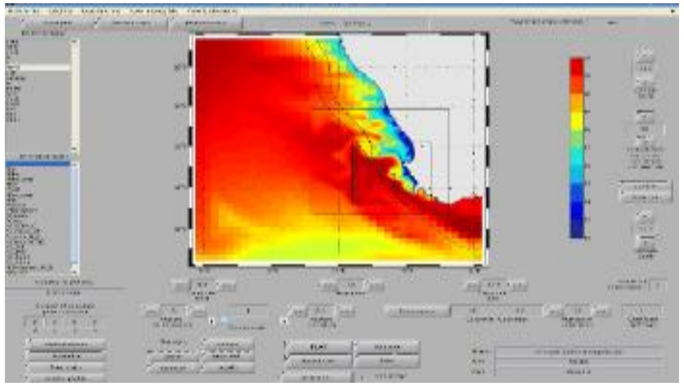
The gulf of guinea is part of the atlantic ocean.
Latitude 10N- 10S
Longitude 15W-15E



Gulf of Guinea bathymetry (Adanmaze, 2013)

0-200m deep plateau
Talus 200-2000m deep
Abyssal plains over 5000m

used model



Characterization of the model ROMS

- Primitives equations

$$(1)\ \frac{\partial u}{\partial t} + u\nabla - fv = \frac{1}{\rho_0}\frac{\partial P}{\partial x} + A_h\nabla^2 u + A_v\frac{\partial^2 u}{\partial^2 z}$$

$$(2)\ \frac{\partial u}{\partial t} + u\nabla - fv = \frac{1}{\rho_0}\frac{\partial P}{\partial x} + A_h\nabla^2 u + A_v\frac{\partial^2 u}{\partial^2 z}$$

$$(3)\ 0 = \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z}$$

$$(4)\ \frac{\partial T}{\partial t} + u\nabla T = K_h\nabla_h{}^2 T + K_v\frac{\partial^2 T}{\partial^2 z}$$

$$(5)\ \frac{\partial S}{\partial t} + u\nabla S = K_h\nabla_h{}^2 S + K_v\frac{\partial^2 S}{\partial^2 z}$$

$$(6)\ \rho = \rho_0(T,S,z)$$

Used model

- Hypothesis

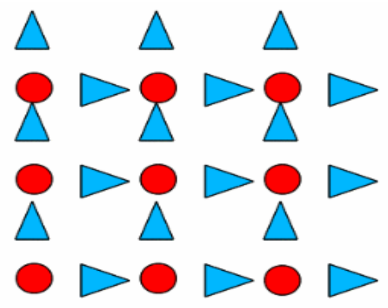
Boussinesq approximaton

Hydrostatic hypothesis

Turbulence shutdown

Isotropic horizontal turbulence hypothesis

Horizontal discretization

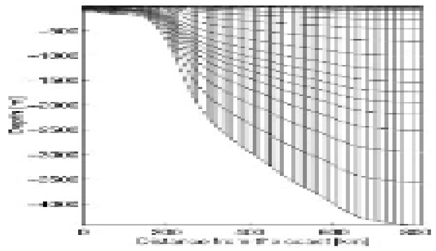


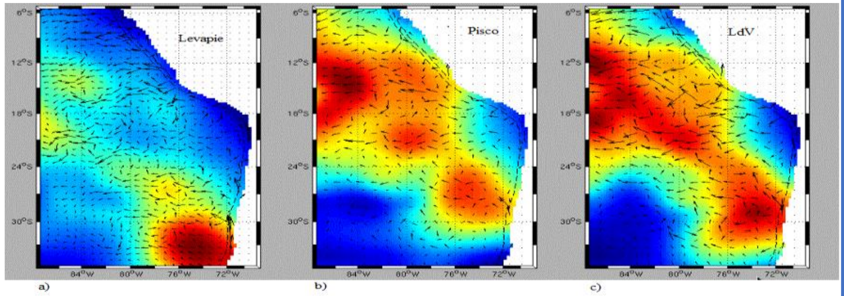
CFL stability criterion

$$(7)\Delta t \leq \frac{1}{c}\left[\frac{1}{\Delta x^2}+\frac{1}{\Delta y^2}\right]^{-\frac{1}{2}}$$

- discretization

Vertical discretization





Water level assessment and current vector (Meure, 2014)

Expected results

1-Understanding the ocean-atmospheric processes that influence the West African climate

2-Understanding the behavior of oceanic pre-conditioning and conditioning in the Gulf of Guinea

3-Understanding the momentum balance the heat balance in the Gulf of Guinea