

CINDY 2011/DYNAMO Operation Planning Workshop



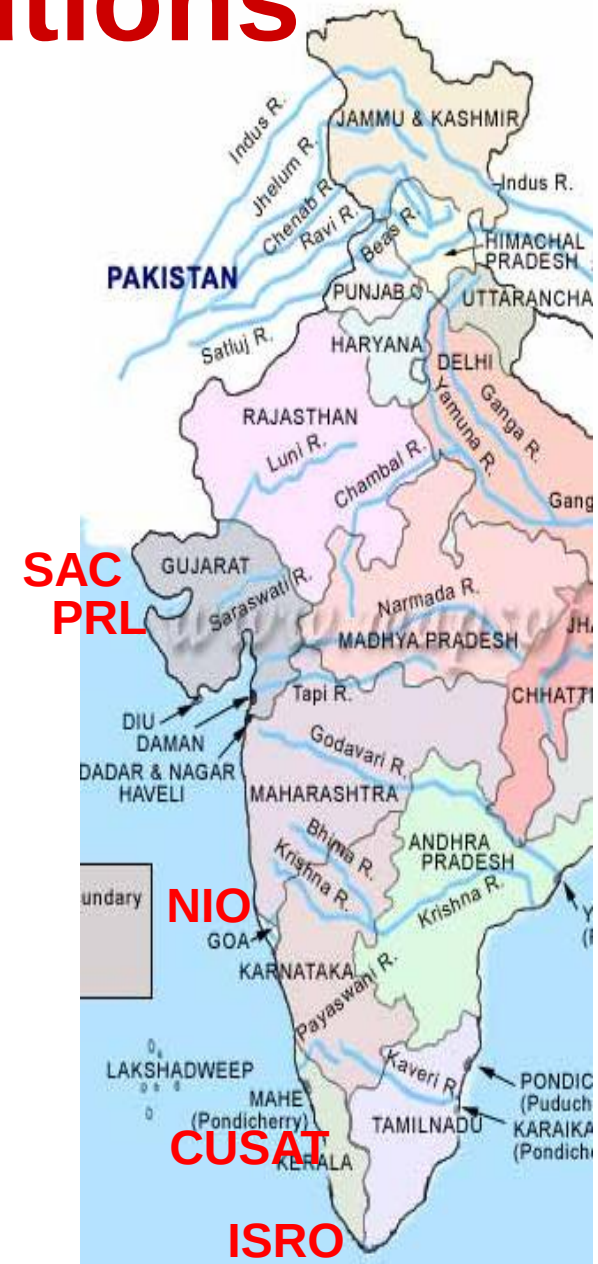
Indian Participation Plan



S. Prasanna Kumar
National Institute of Oceanography
Goa
INDIA

5 -Participating Institutions

ORGANIZATION	PARAMETERS
National Institute of Oceanography (NIO), Goa	Atmospheric and Oceanic
Cochin University of Science & Technology (CUSAT), Kochi	Atmospheric
Physical Research Laboratory (PRL), Ahmedabad	Ocean Isotope
Indian Space Research Organization (ISRO), Trivandrum	Cloud Physics
Space Application Centre (SAC), Ahmedabad	Atmospheric - Mega tropics



Measurements on board ORV Sagar Kanaya

October – November 2011

Ship time – 35 days

Atmospheric

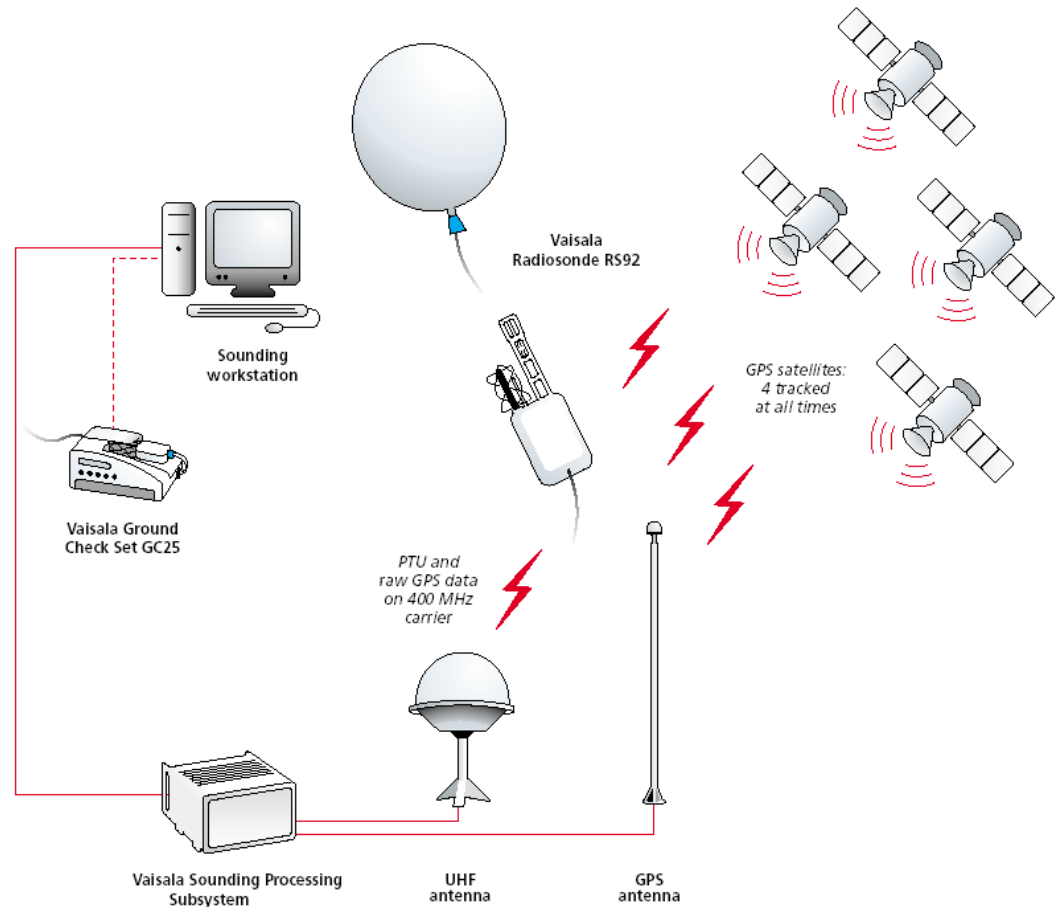
Oceanic



Atmospheric Measurements

Sl.no	Instrument	Observation	Frequency	Institute
1	Vaisala Radio Sonde	Upper Atmosphere	6 hrly.	NIO
2	Autonomous Weather Station	Surface Met.	1 minute	NIO
3	Microtop Sun Photometer	Aerosol optical depth	6 hrly.	NIO
4	Grim Aerosol Spectrometer	Particle size (31 sizes)	6 hrly.	NIO
5	----	Water isotopes	6 hrly.	PRL

VAISALA DigiCORA III MW31 SOUNDING SYSTEM



Water column Measurements

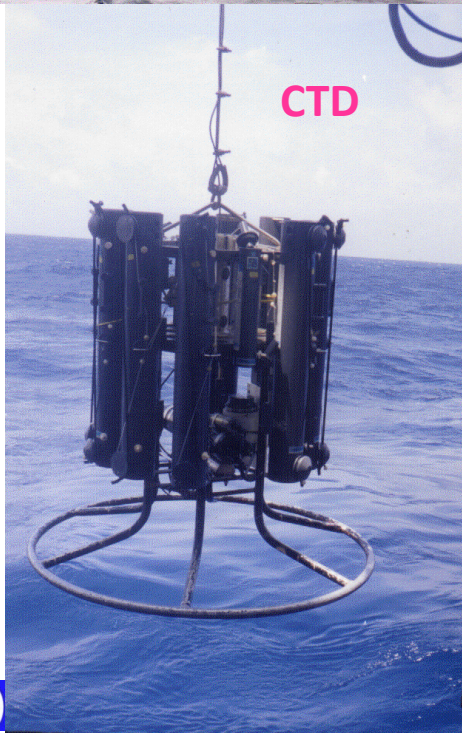
Sl.no	Instrument	Observation	Frequency	Institute
1	CTD Sea-Bird	Temperature Conductivity Pressure Fluorescence Water sampling	6 hrly.	NIO
2	MPN	Zooplankton	12 hrly	NIO
3	Deck incubation/ PP Mooring	Primary productivity	weekly	NIO
4	Deck incubation/ PP Mooring	New Production	weekly	PRL
5	ARGO/Drifters	Temperature Conductivity Pressure Currents		INCOIS

in situ Equipment and hardware.....

ORV Sagar Kanya



Thermo-
Salino-
Graph



CTD

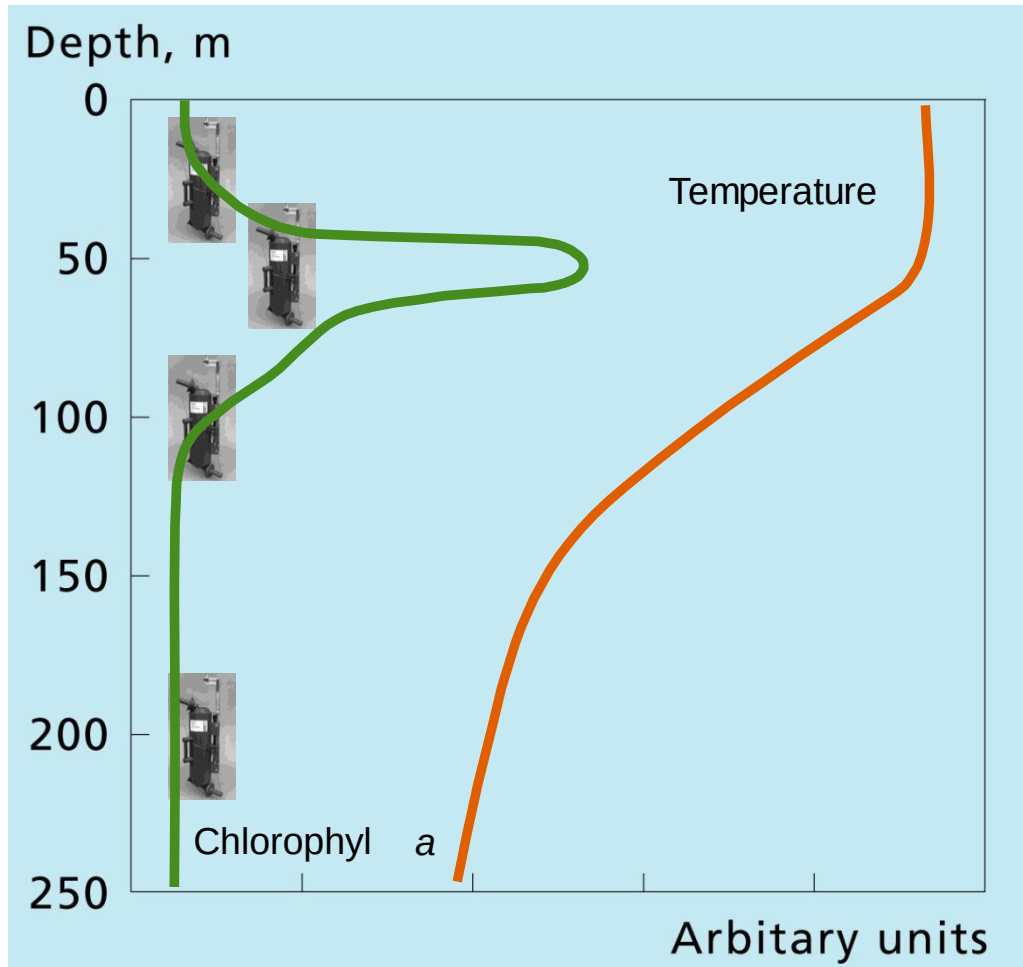


Bucket Thermometer

CTD Rosette and Water Sampling



Biological Oceanography



High resolution

- **CTD**
- **Chlorophyll *a***

Under sampling

- **Biomass**
- **Rates**

Measurement of Primary Production

Net biomass production: compare change of stocks over time $\Delta B/\Delta t$.

Problem: only possible in pure cultures,!

- **Oxygen development in light & dark bottles:** Increase in light = net production, decrease in dark = respiration, Light – Dark = gross production.

- Problem: doesn't account for photorespiration of algae, zooplankton and bacteria

- **Isotope methods:** ^{14}C is standard, easy, cheap,

- Problem: radiation safety and waste disposal

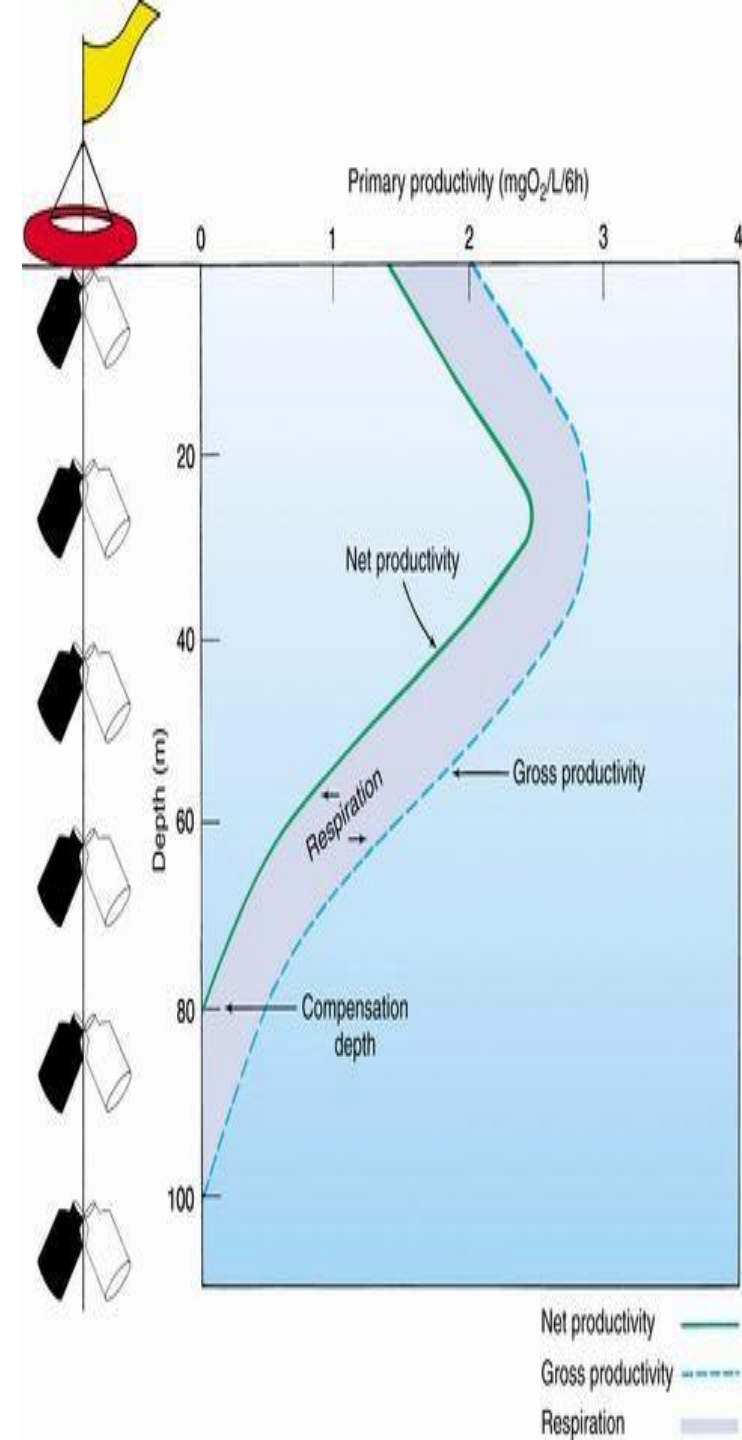
can't account for organic carbon produced and excreted during incubation: exudation

P is a measure between gross and net production

- ^{13}C method: used in Japan (radioisotopes prohibited),

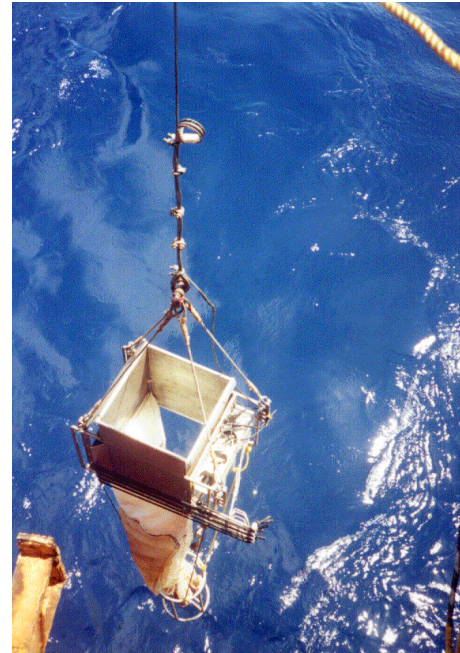
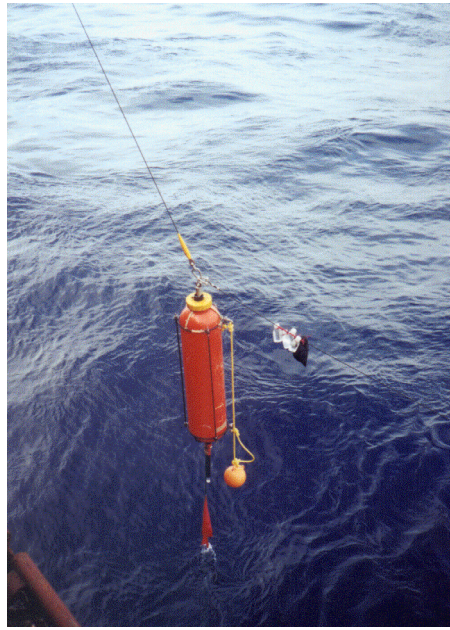
- Problem: expensive

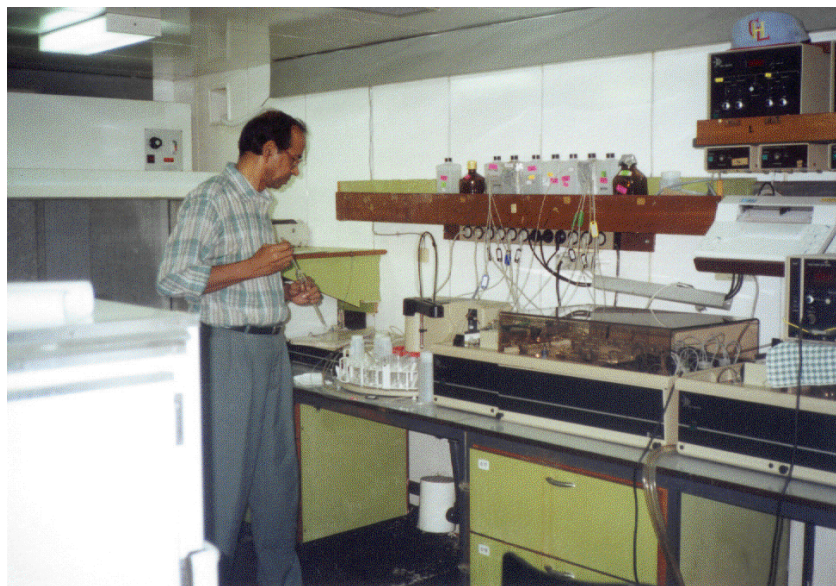
- All incubation techniques: in-situ or simulated in-situ



Multiple Plankton Net Operation







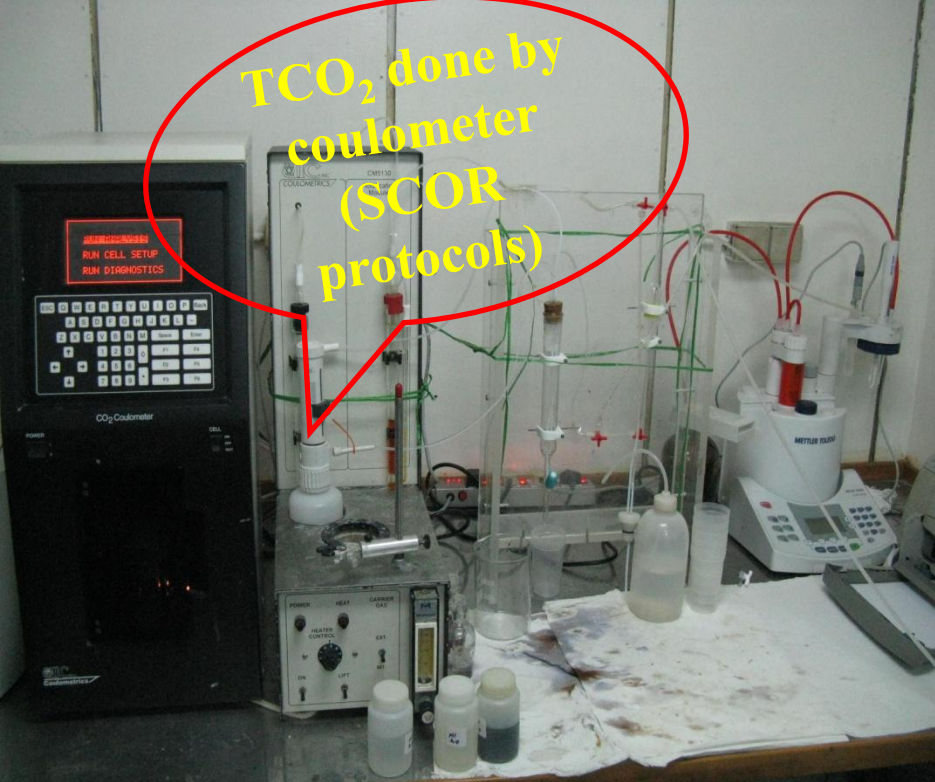
Auto analyzer for nutrients

**On board
ORV Sagar Kanya**

Chemical Oceanography



Dissolved Oxygen analysis



TCO₂
Dissolved Oxygen
Nutrients



13 - Parameters

- Temperature
- Salinity
- Currents
- Surface Met
- Nutrients
- CO₂
- pH
- O₂
- Chlorophyll
- PP
- Bacteria
- Phytoplankton
- Zooplankton

Thanks for your attention



Sampling depth for Chlorophyll & Nutrients

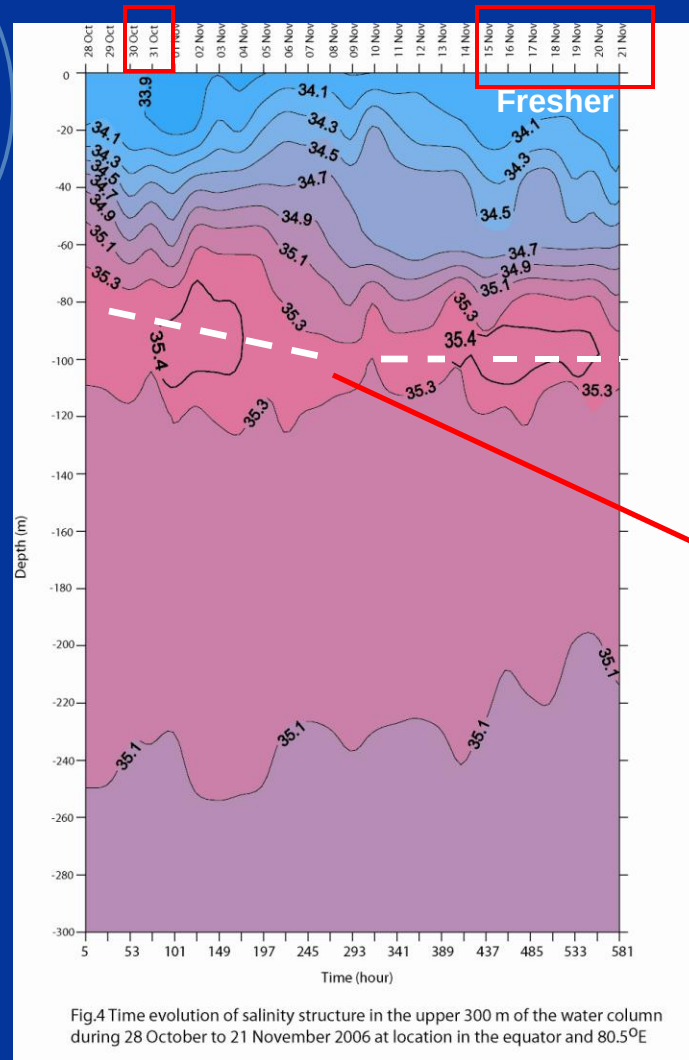
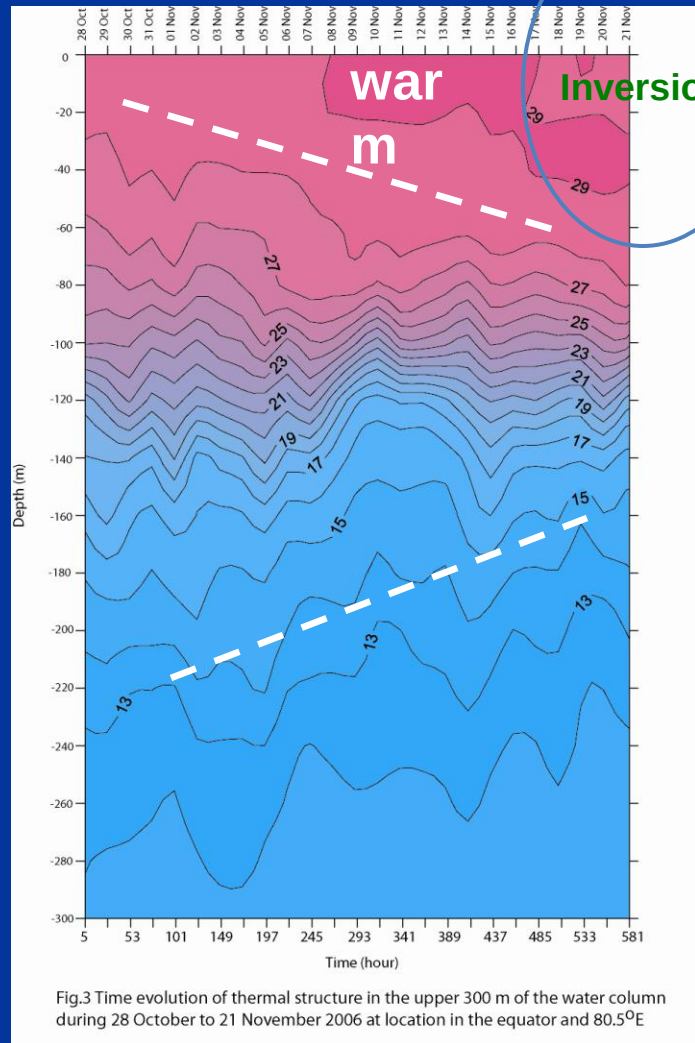
- Surface
- 10
- 20
- 40
- 60
- 80
- 100
- 120
- 150
- 200
- 250
- 300
- 400
- 500
- 600
- 800
- 1000
- 6 hourly up to 500m
- 12 hourly up to 1000m

Temperature

5-60mm/day

Salinity

20-80mm/day



High frequency thermocline oscillation
Thickness of

High salinity water mass showed large temporal variation

Thermal structure – Deepening of surface layer and shoaling of subsurface layer
Salinity structure – Two rain events leading to freshening and subsurface high salinity core

Strong upwelling signature

Meridional divergence and Northward current.....Masumoto et al 2008

.....Horii et al 2009

Chlorophyll (mg/m³)

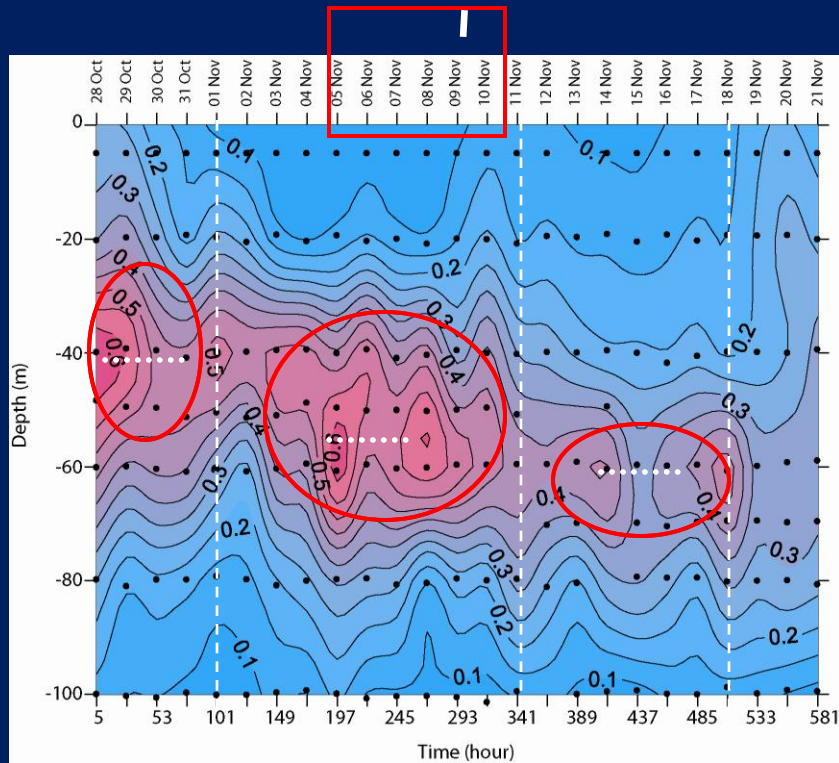


Fig.1 Time evolution of chlorophyll a distribution in the upper 100 m of the water column during 28 October to 21 November 2006 at location in the equator and 80.5°E. The filled black circles represents the sample location.

Deepening and thickening of S
Deepening of nitracline

Nitrate (micro mole/kg)

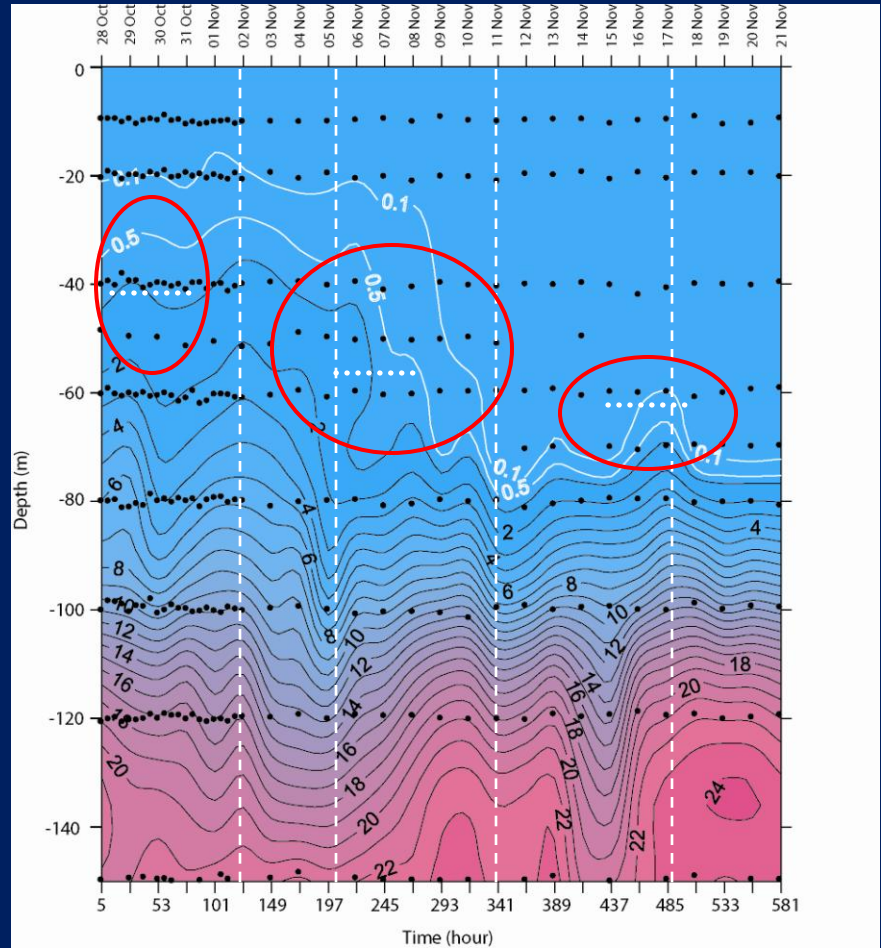


Fig.2 Time evolution of Nitrate concentrations (micro M) in the upper 150 m of the water column during 28 October to 21 November 2006 at location in the equator and 80.5°E. The filled black circles represent the sample location.

