



DIVING INTO THE NORTH IBERIAN UPWELLING: SOLVING THE SPATIAL AND TEMPORAL VARIABILITY

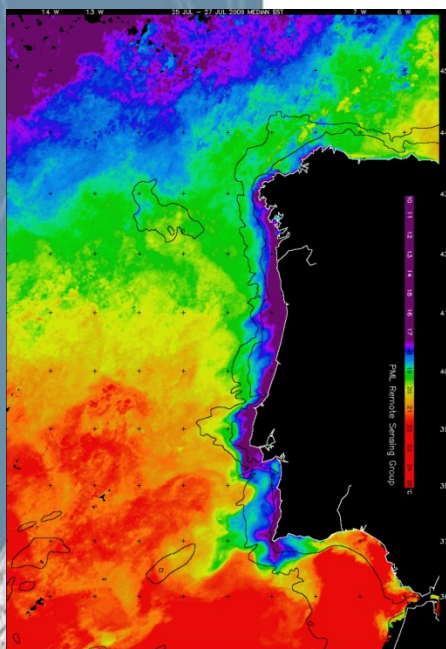
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C/Eduardo Cabello s/n
Vigo, Spain*



Area of Study:

The region of study, in the NW of the Iberian Peninsula encompasses the area between 41.3°N and 42.30°N, & 9°W and 10°W



Summer 2008. Satellite image of the surface temperature

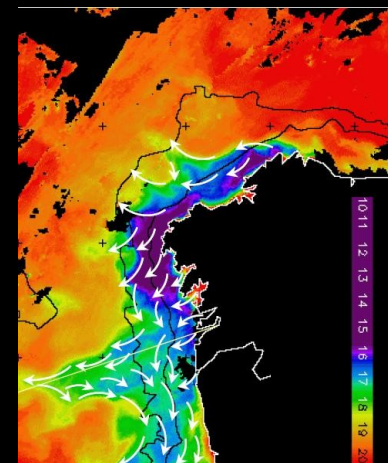
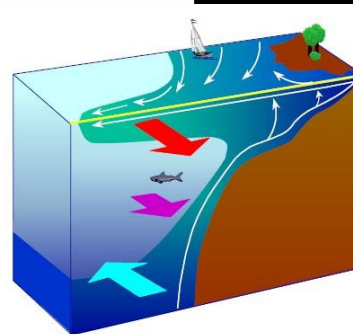
The Iberian coast, at the Northern boundary of the Canaries-Iberian Large Marine Ecosystem, constitutes the only upwelling regime in Europe

MAIN GOALS...

The study of the upwelling ecosystem of

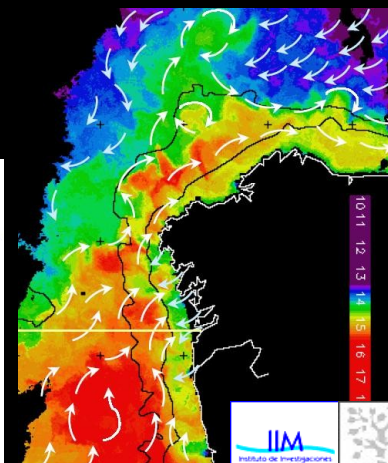
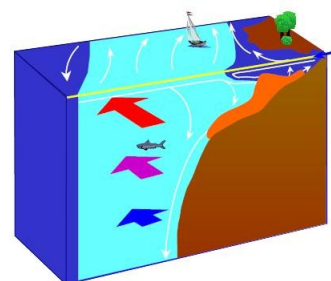
Spring & Summer

- **Southward winds are predominant.**
- **Surface coastal currents (<100m) have Southward direction.**
- **From 100m to 1500m currents have Northward direction.**
- **These Southward winds force an offshore Ekman Transport in the upper layers.**



Autumn & Winter

- **Northward winds are predominant.**
- **Coastal currents (0 to 1500m) have Northward direction.**



STRATEGIES

PROJECTS:



CALIBERIA



- Cross-frontier.
- Multidisciplinary.

DIFFERENT SAMPLING STRATEGIES

STUDY THE TEMPORAL VARIABILITY

STUDY THE SPATIAL VARIABILITY.

STRATEGIES



**Exchanges between continental shelf and ocean in the
ecosystem.**

October 2008 to September 2010

Objective

**Understand the time varying vertical & horizontal
exchanges from coast to ocean.**

Methods

Observations in two zones of upwelling filaments by:

- **Oceanographic cruises for biogeochemical sampling.**
- **Multiparametric moorings.**
- **Seasoar & MiniBat samplings.**
- **Satellite images .**





Objectives

- **Develop new technologies that will allow construction, completion and consolidation of cross-frontier ocean observation.**
- **Adapt and validate operational ocean dynamics models.**
- **Establish a platform of cross-frontier inter-operability for the management and distribution of the observatory data and services.**
- **Develop a management model for the cross-frontier ocean observatory.**



Methods

Multiparametric Oceanography buoys

Objectives

- **Calibrate multi proxy records along the NW Iberian margin**
 - (a) the characterization of the modern hydrographic conditions.
 - (b) the seasonal variability in the circulation patterns and the water chemistry characteristics.
 - (c) productivity and planktonic microorganisms within the water column.
- **Validate and reconstruct paleoceanographic conditions.**

Methods

- **Oceanographic cruises for biogeochemical sampling.**
- **Multiparametric moorings.**
- **Oceanographic buoys.**
- **Satellite images and a wide range of materials, such as plankton nets, sediment traps, and surface sediment samples.**

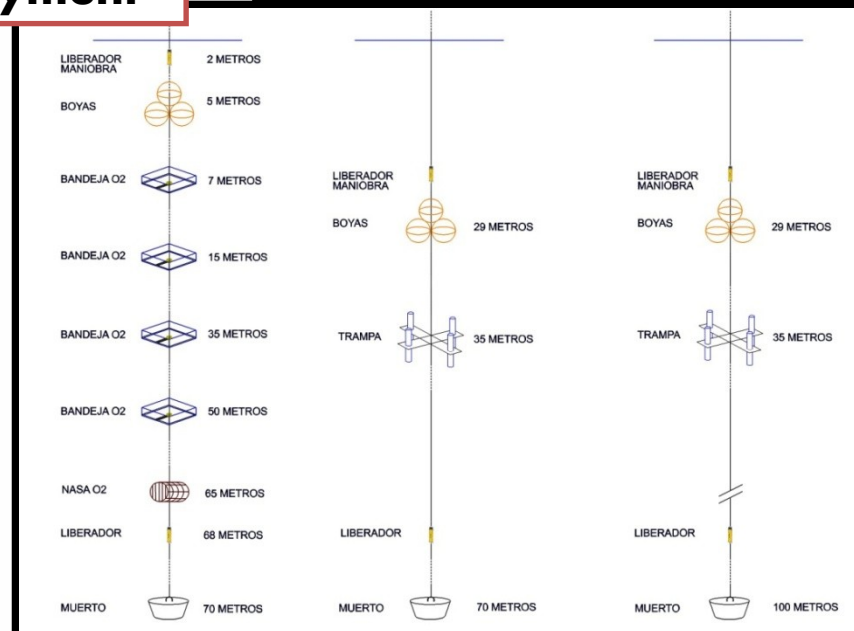


Short term deployment

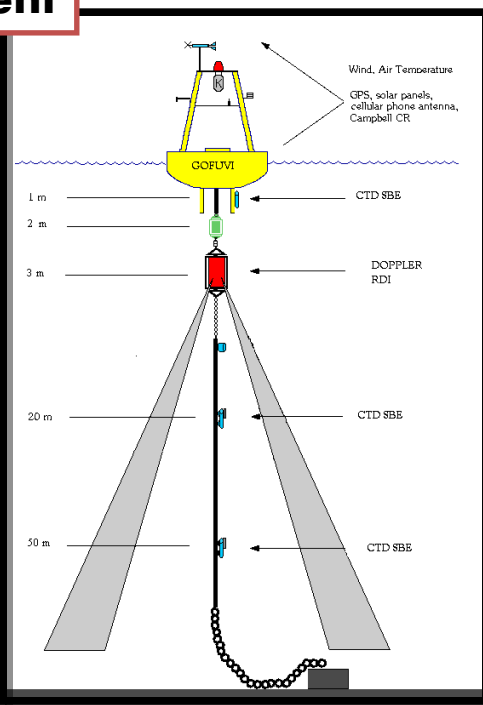
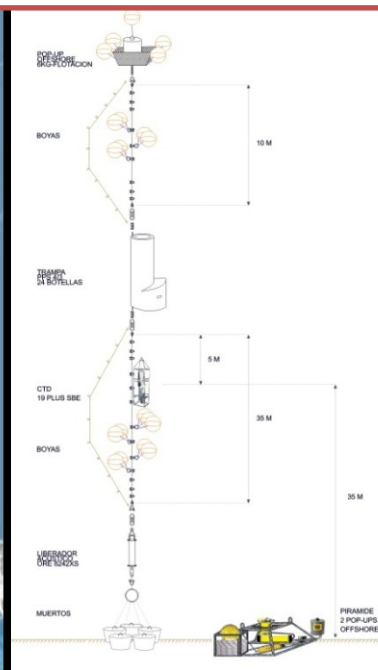
Moorings:

- O₂ incubations.
- Sediment traps.

24 Hours moored



Long term deployment



- Oceanographic buoys.
- CTD & sed. Trap moorings.
- Doppler moorings.

5 Months moored

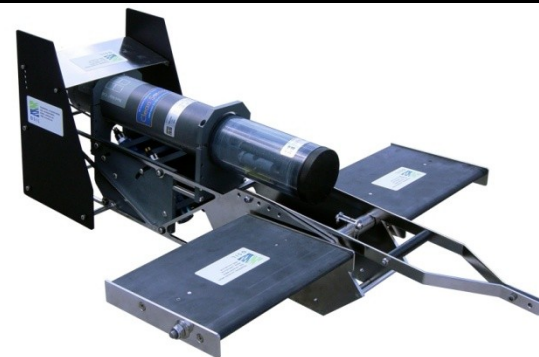
IRobot SeaGlider

Glider



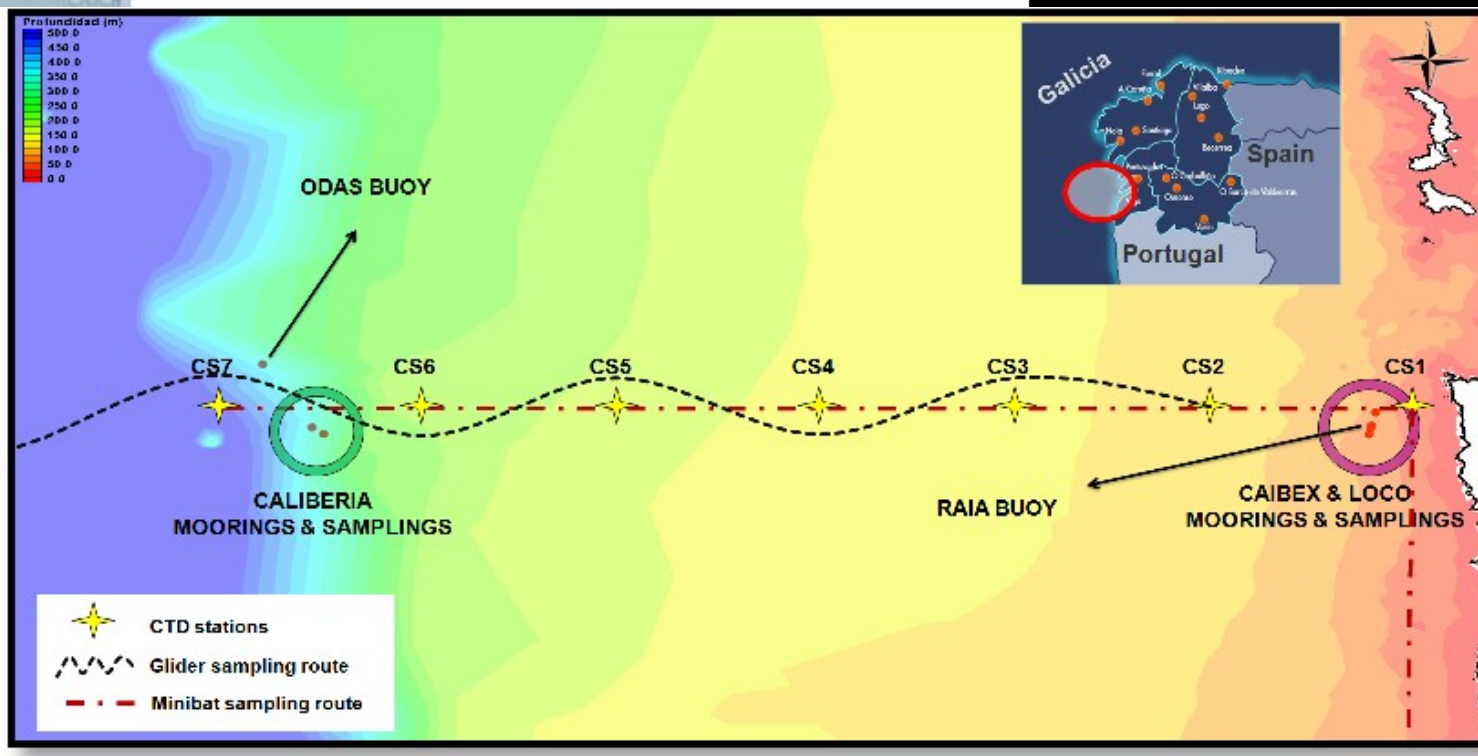
- **SBE CTD.**
- **SBE dissolved oxygen (43F)**
- **Dissolved oxygen (Optode)**
- **WET Labs fluorescence and backscatter (ECO Triplet)**
- **Biospherical PAR (QSP-2150)**

MiniBAT & SeaSoar



- **Conductivity**
- **Temperature**
- **Oxygen**
- **Fluorescence**
- **Turbidity**

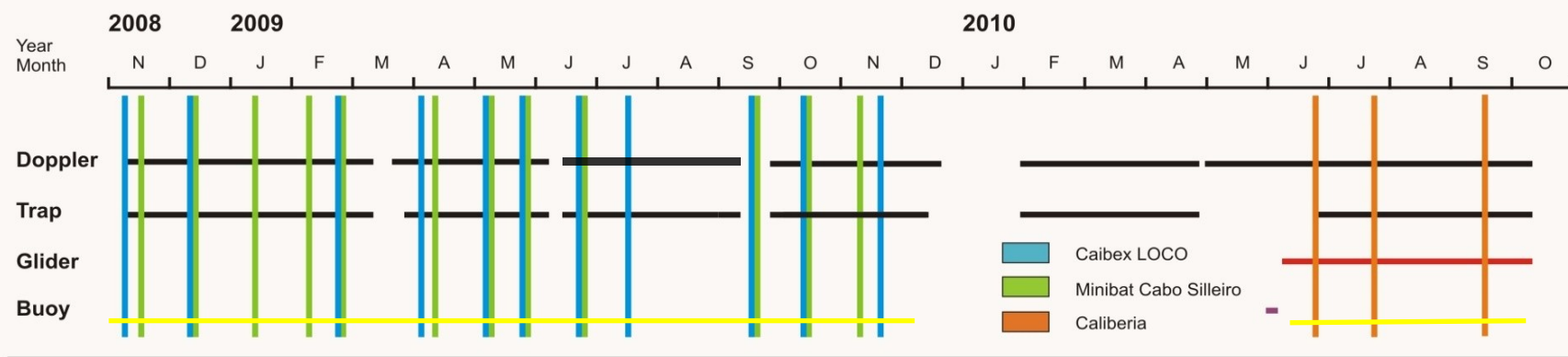
TECHNICAL RESULTS



- **MiniBat sampling route.**
- **Glider sampling route.**
- **CTD stations.**
- **Moorings & Biogeochemical sampling.**
- **Oceanographic Buoys**

TECHNICAL RESULTS

Activities Calendar



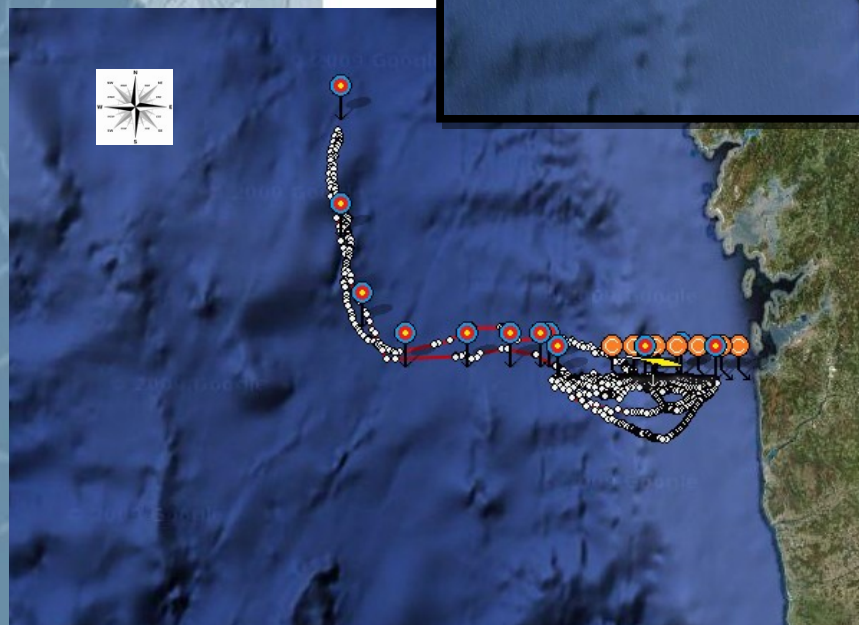
Monthly short time deployments and sampling.

- Biogeochemical moorings and sampling.
- Doppler mooring.
- Sediment trap mooring.
- Buoy observations.
- Glider observations.

DIVING...

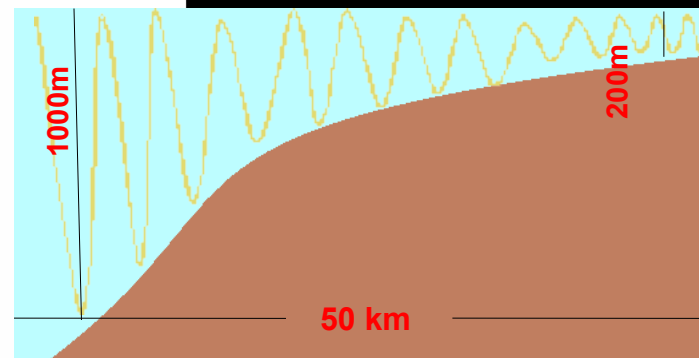


Deployed 1st July.
Recovered 22nd September.



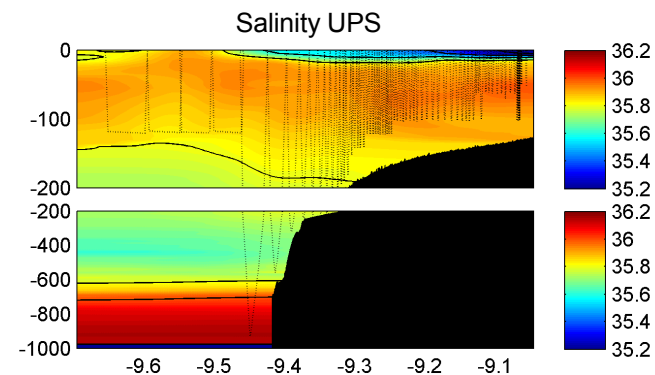
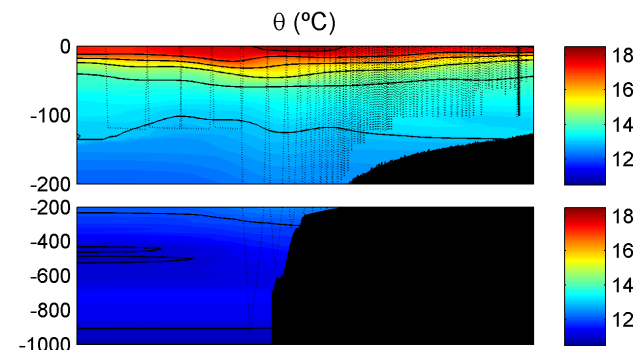
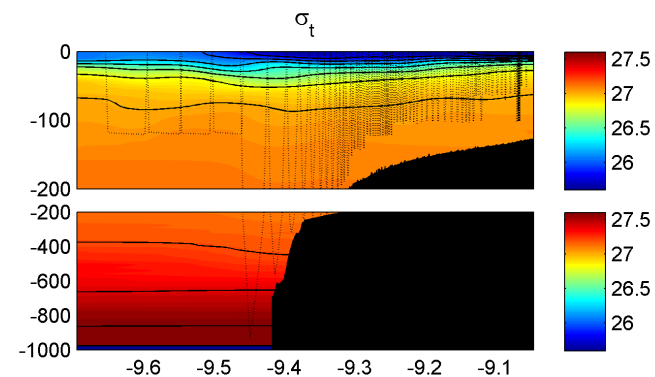
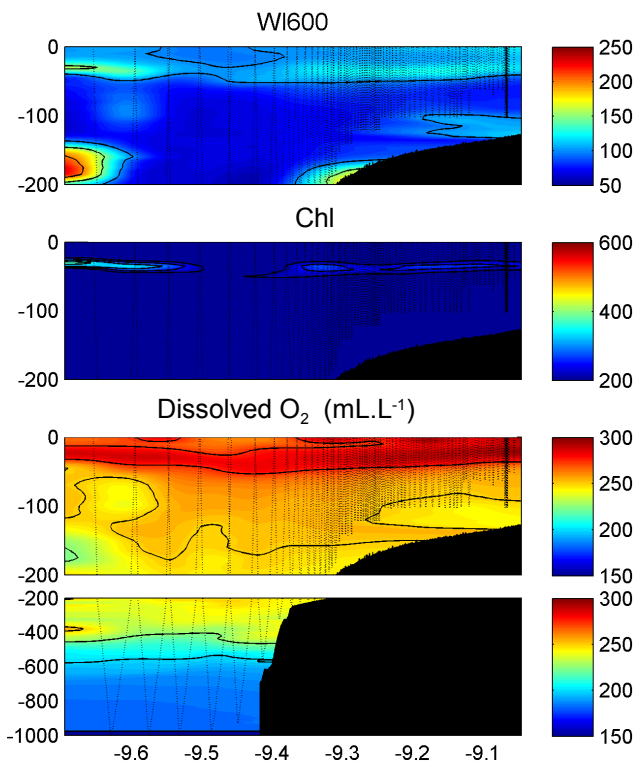
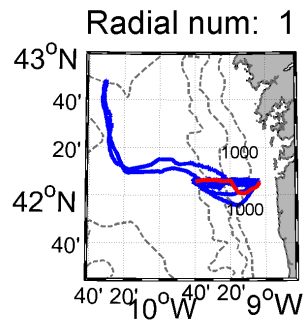
Operation Mode by Profiles
through a sequence of
waypoints.

- **1500Km vertical distance.**
- **1600Km horizontal distance.**
- **1400 Profiles.**



SOME EXAMPLES

Typical values in this season.

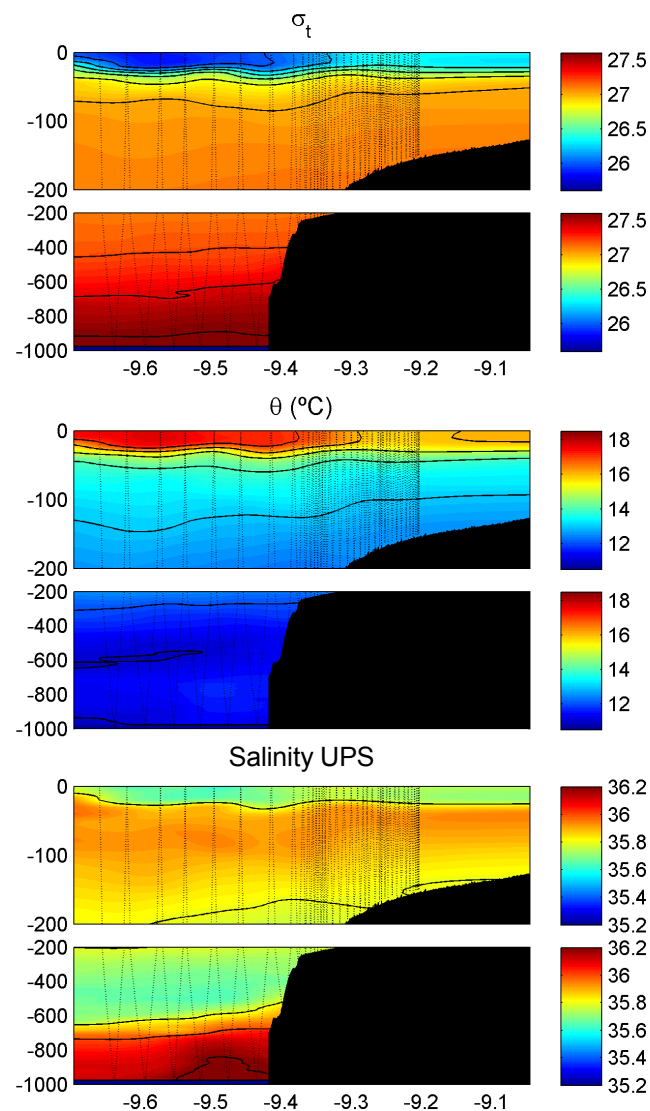
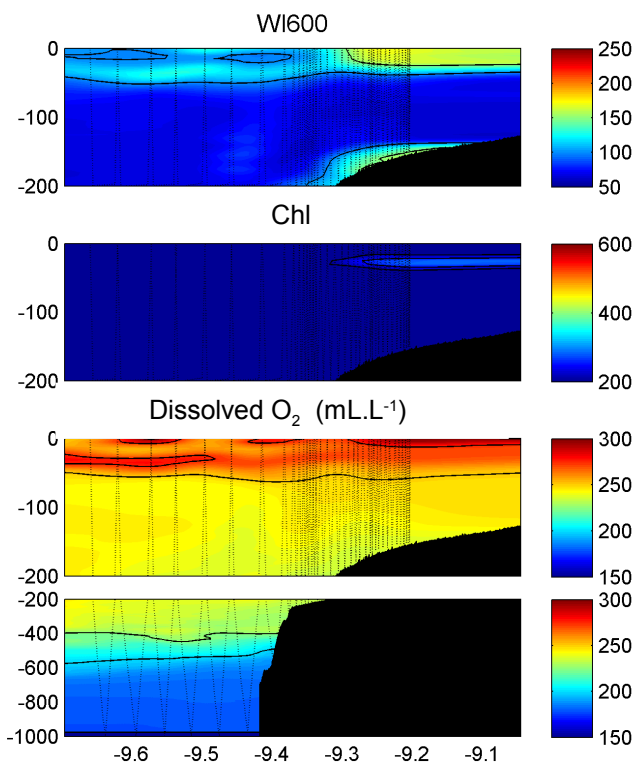
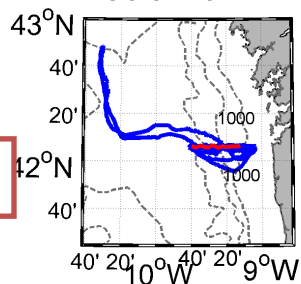


74 Profiles Start 1st Jun 2010 End 5th Jun 2010

SOME EXAMPLES

Starts the upwelling

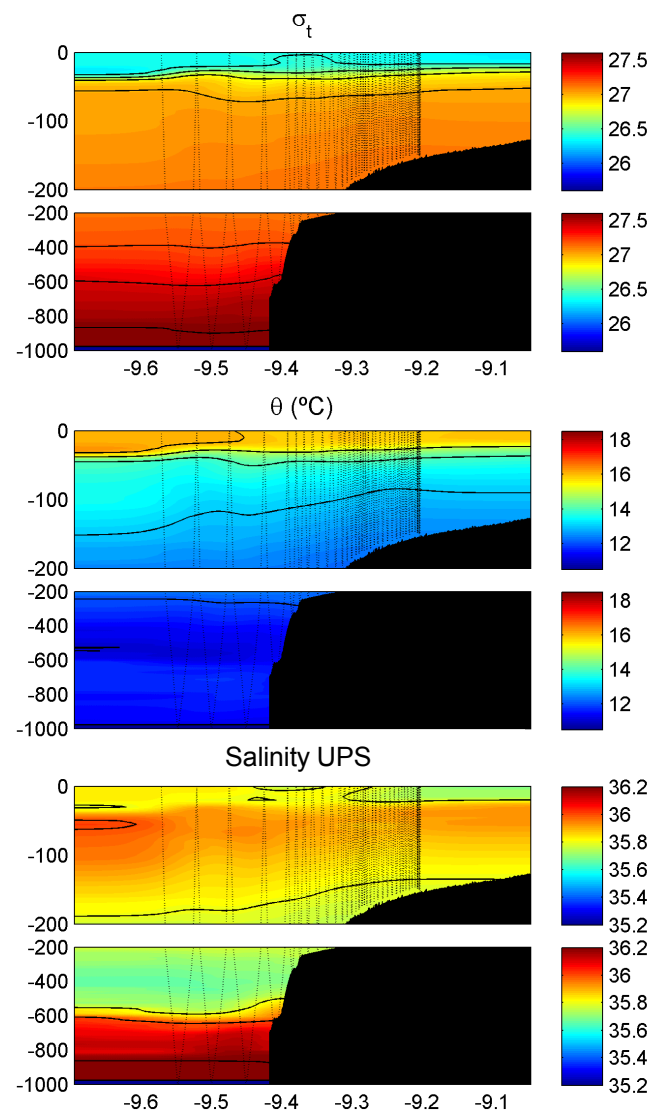
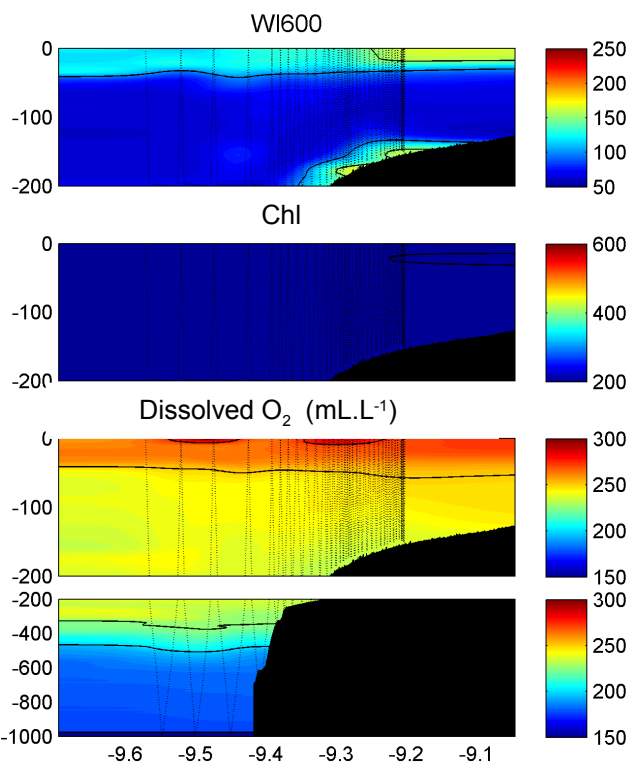
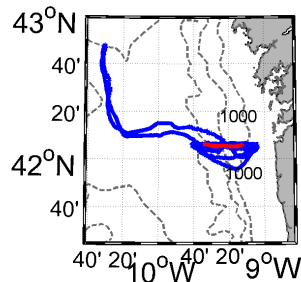
Radial num: 4



35 Profiles Start 12_{nd} Jun 2010 End 14_{th} Jun 2010

SOME EXAMPLES

Radial num: 5

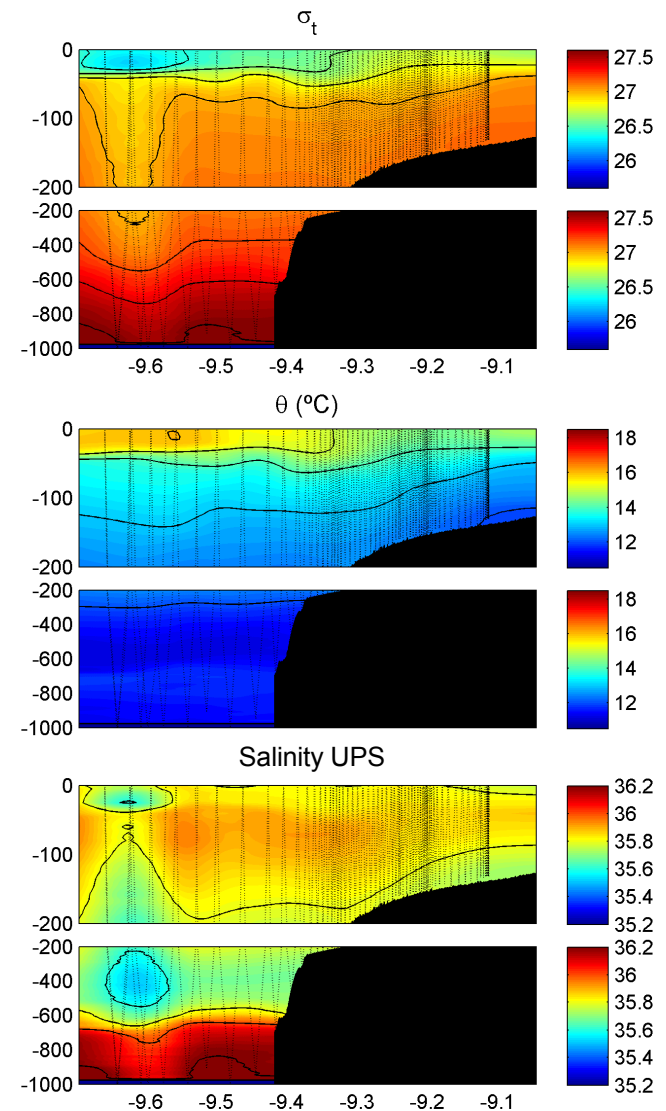
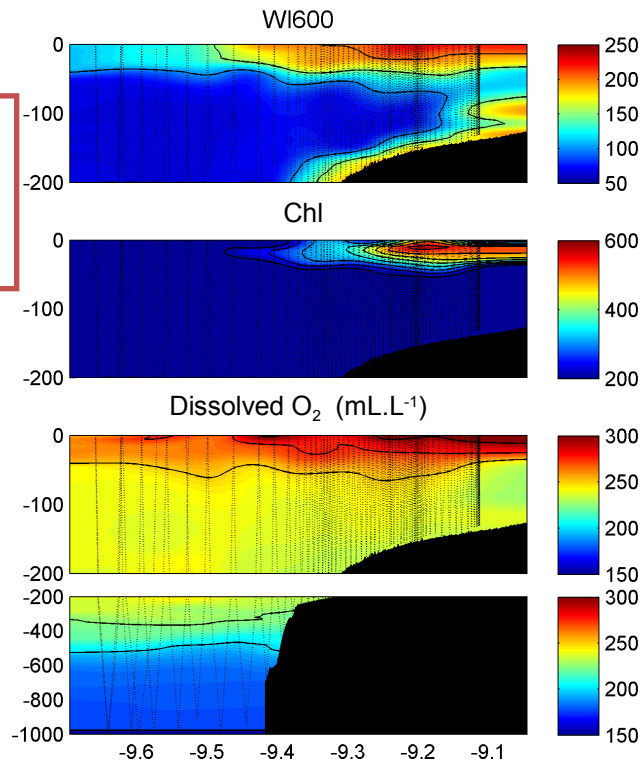
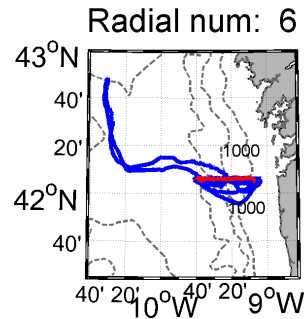


36 Profiles Start 14th Jun 2010 End 16th Jun 2010

SOME EXAMPLES

Continuous the upwelling...

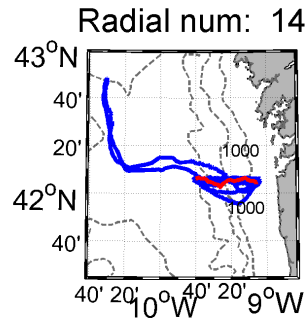
High chlorophyll signal



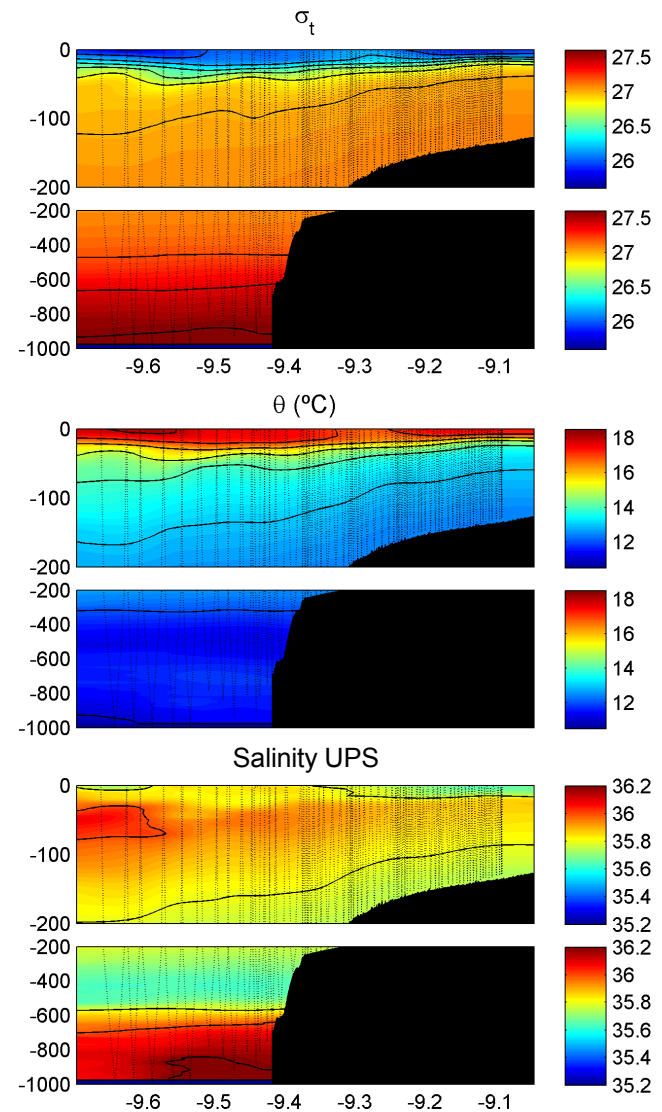
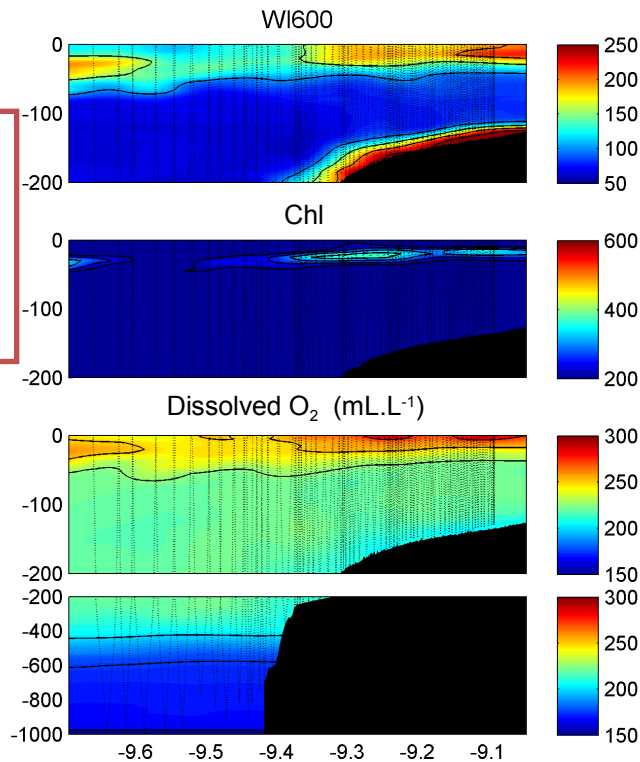
55 Profiles Start 16th Jun 2010 End 20th Jun 2010

SOME EXAMPLES

**Relaxing
Southward winds.**



**Normal
values
during this
season.**

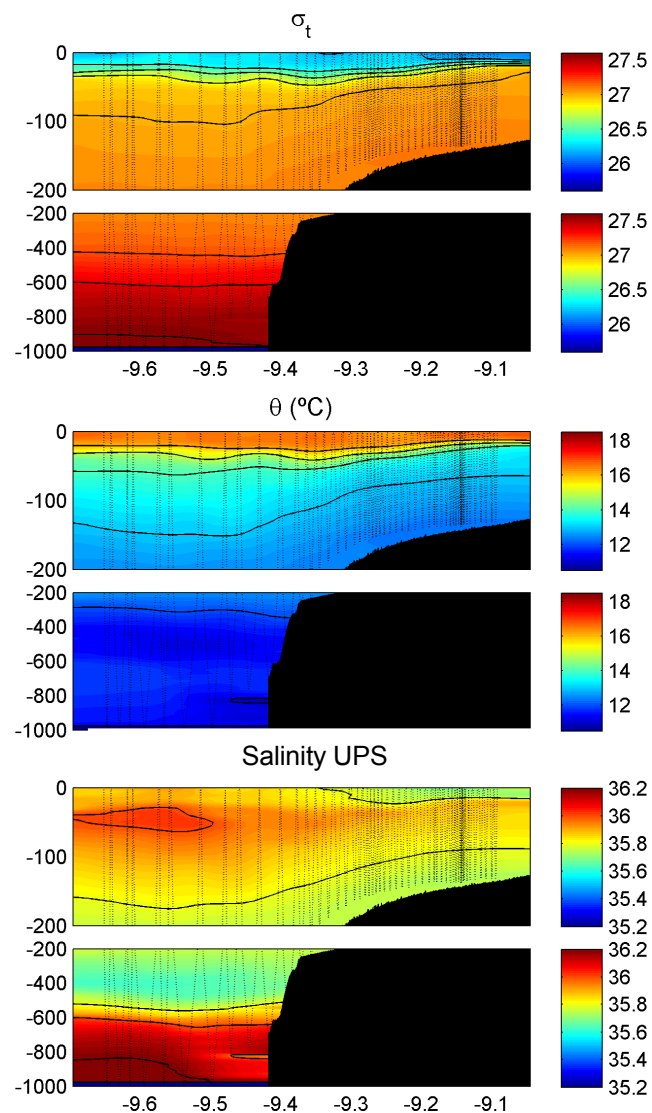
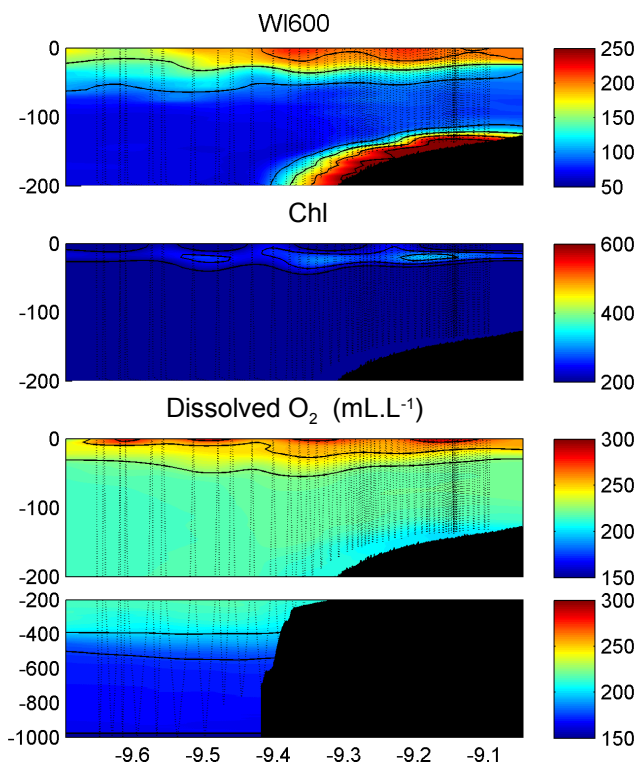
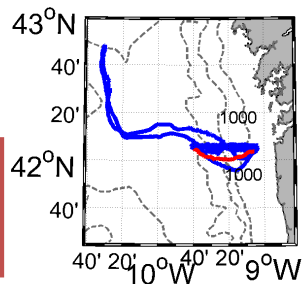


65 Profiles Start 15th Jul 2010 End 21st Jul 2010

SOME EXAMPLES

Starts again the upwelling

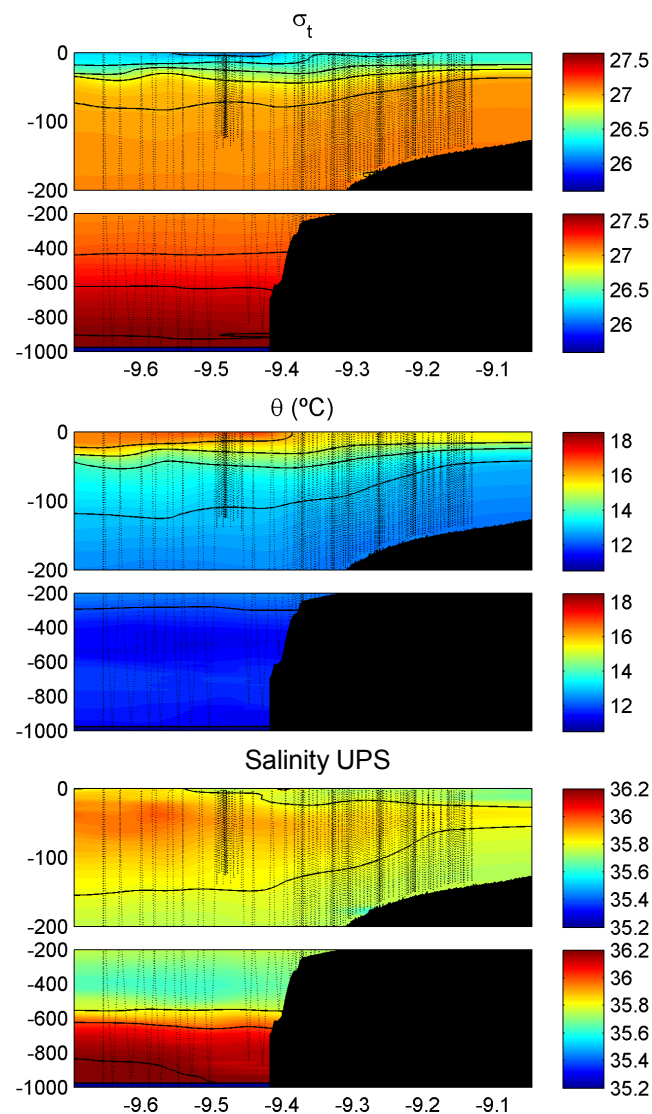
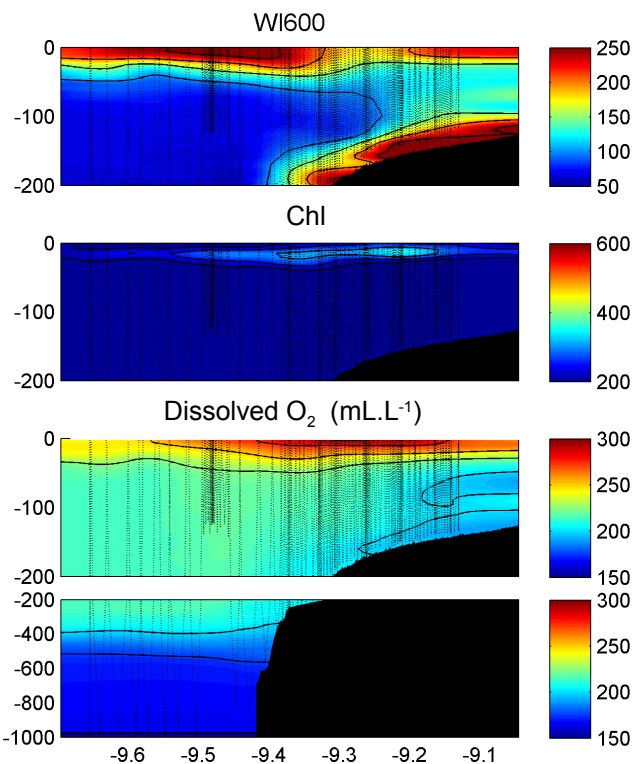
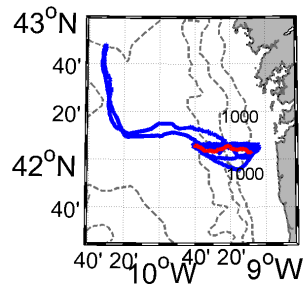
Radial num: 15



53 Profiles Start 21st Jul 2010 End 25th Jul 2010

SOME EXAMPLES

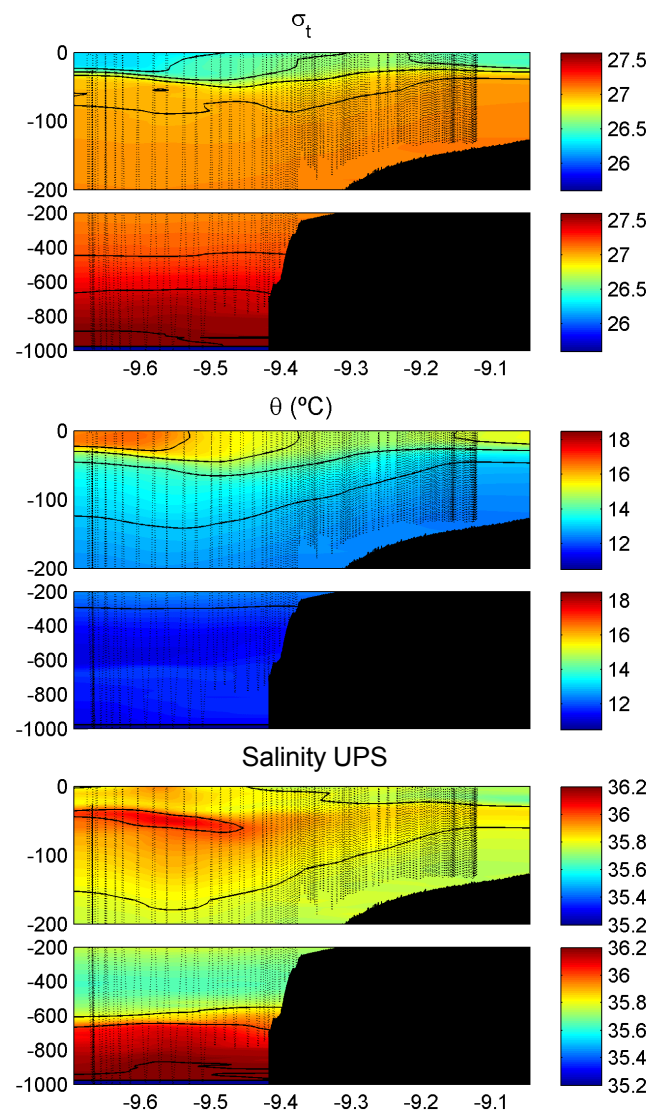
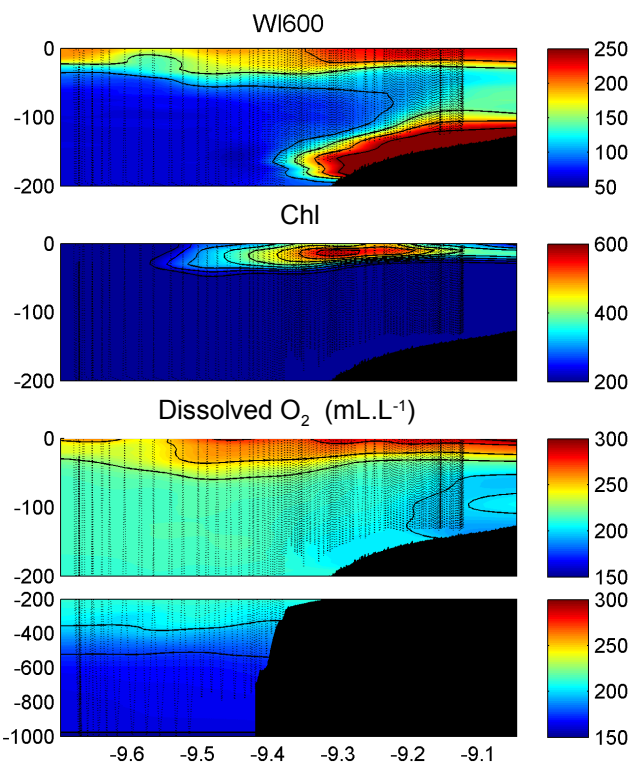
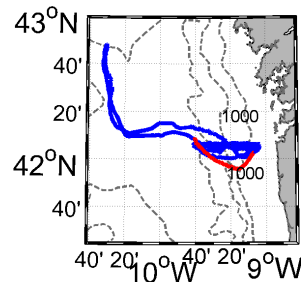
Radial num: 16



98 Profiles Start 25th Jul 2010 End 1st Aug 2010

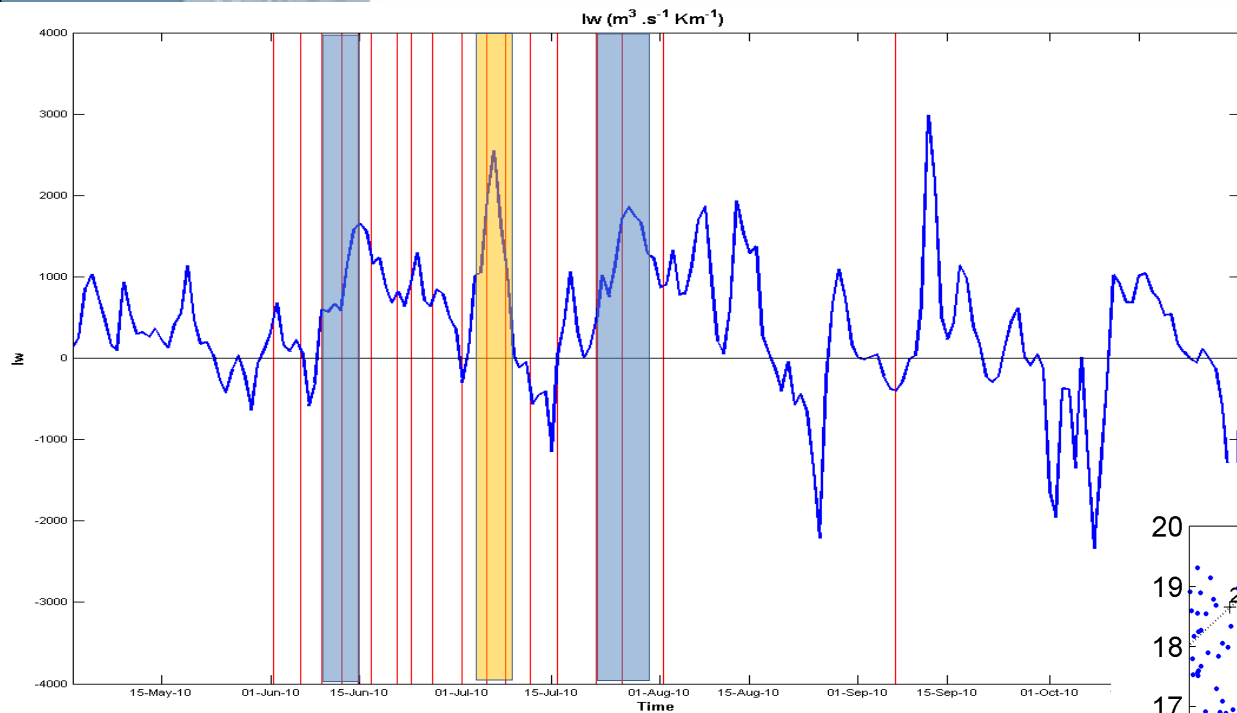
SOME EXAMPLES

Radial num: 17



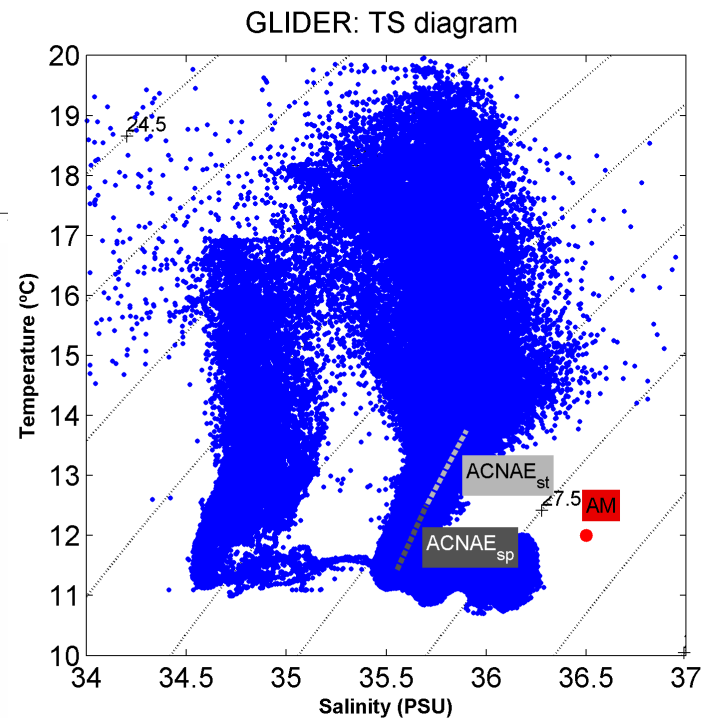
83 Profiles Start 1st Aug 2010 End 8th Aug 2010

SOME EXAMPLES



Upwelling Index.

**Three upwelling episodes,
 but only two detected.**



CONCLUDING REMARKS

- **CARRYING OUT MULTIFACETED OBSERVATIONAL PROGRAMS WITH MOST RECENT TECHNIQUES INCLUDING GLIDERS AND REAL TIME MOORINGS.**
- **ACCUMULATING A LARGE DATABASE FOR BETTER KNOWLEDGE OF THE AREA AND IN SUPPORT OF PREDICTIVE MODELLING.**
- **IMPLEMENTING PROGRAMS IN COLLABORATION WITH OTHER NATIONAL AND INTERNATIONAL RESEARCH ORGANISMS.**
- **RAW DATA ARE AVAILABLE, AS WILL BE THE COMPLETELY PROCESSED DATA SET.**
- **DATA LOOK PROMISING AND THEY WILL BE USED FOR PHD PROJECTS AND FORMAL PAPERS.**
- **WE ARE AT THE BEGINNING, STARTING AND LEARNING:
LEARNING BY DOING.**

Acknowledgements:

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MUCHAS GRACIAS

"Caminante no hay camino... se hace camino al andar"

"Traveller, there is no path... Only your own path"

