

# *Study of two major events of thin layers of phytoplankton in the Galician Rías using a 3D Ocean Model*

**Rosa Reboreda, Carlos Souto, Beatriz Mouriño-Carballido, Paloma Chouciño, Miguel Gilcoto, Bieito Fernández, and Enrique Nogueira**



UNIVERSIDADE  
DE VIGO

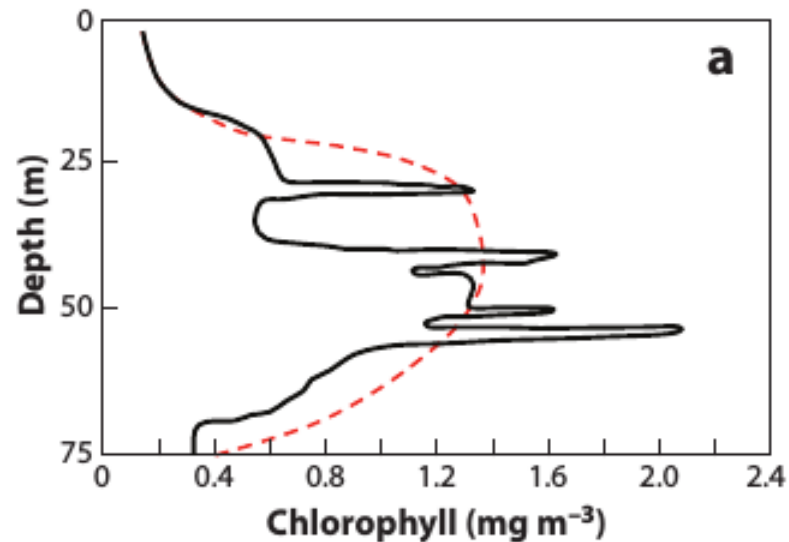


**CSIC**  
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS



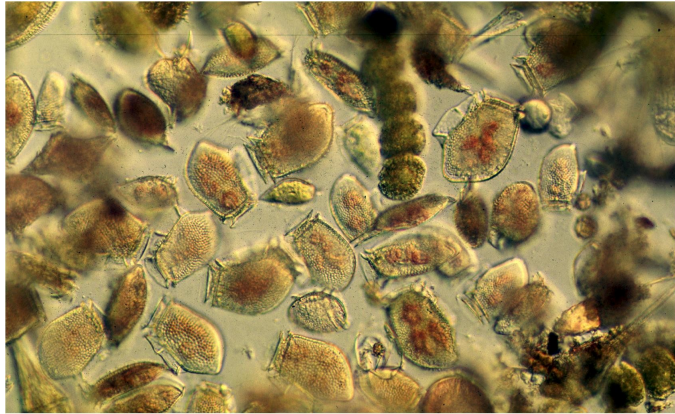
# What are Thin Layers of Phytoplankton (TLP)?

TLP are a particular case of phytoplankton blooms that occur when large number of photosynthetic cells are located within a narrow depth interval.



Strickland (1968, L&O)

# TLP have been recurrently observed in the Galician Rias



PSP causing *Gymnodinium* and DSP causing *Dinophysis* in Galician waters  
Photomicrograph offered by the Marine Environmental Quality Control Center (CCCMN) of Galicia, NW Spain WESTPAC-HAB IOC Harmful Algal Bloom Programme R0014



Foto: Lalo R. Villar. El País

They are believed to play an important role in the formation of harmful algae blooms.

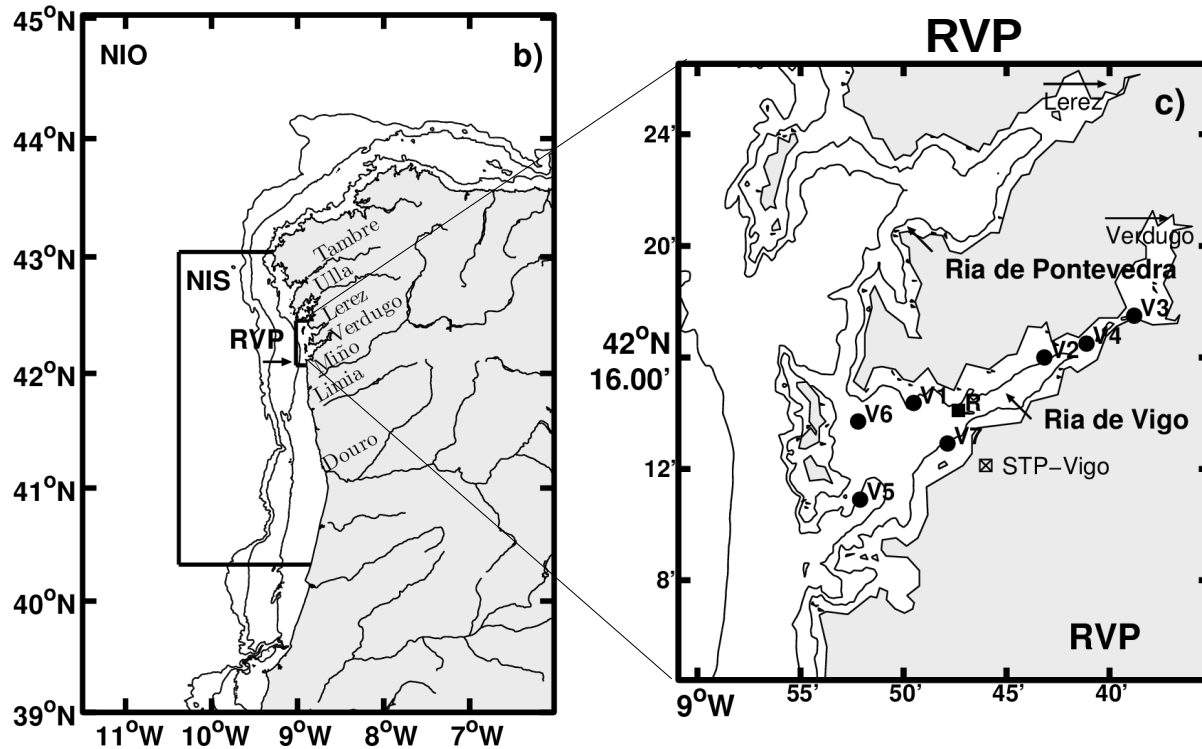
Our understanding about the formation mechanisms and the spatial persistence in the Galician Rías is poor.

Aim of this study:

- Reproduce two TLP events observed in the Rías of Vigo and Pontevedra.
- Reproduce the oceanographic conditions preceeding and during the TLP.

**3D Ocean circulation model (ROMS)  
coupled to a biogeochemical model  
(PISCES)**

# 3D OCEAN MODEL CONFIGURATION: ROMS + PISCES



- Initial and boundary conditions (2012-2013):  
IBI Reanalysis (PHYS & BIO)
- Surface forcing:  
WRF MeteoGalicia

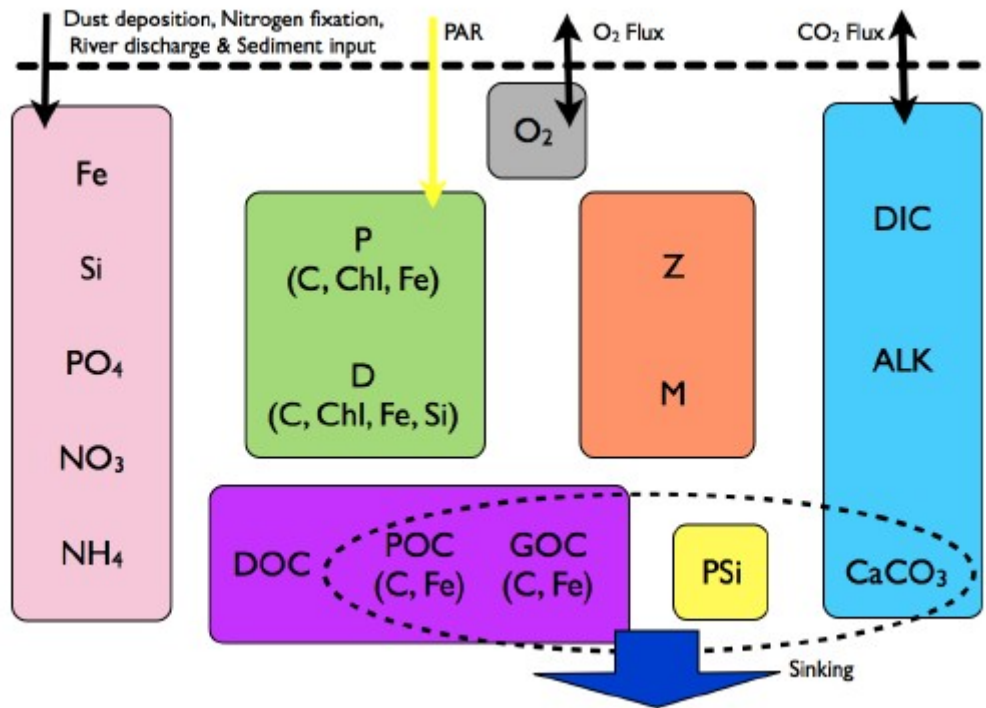
- AGRIF two-way nesting of increasing resolution:
- NIO (NW Iberia-Ocean): 4.5 km (30  $\sigma$ -levels)
  - NIS (NW Iberia-Shelf): 1.5 km (30  $\sigma$ -levels)
  - RVP (Rías Vigo-Pontevedra): 500 m (30  $\sigma$ -levels)

Rivers input

Tide



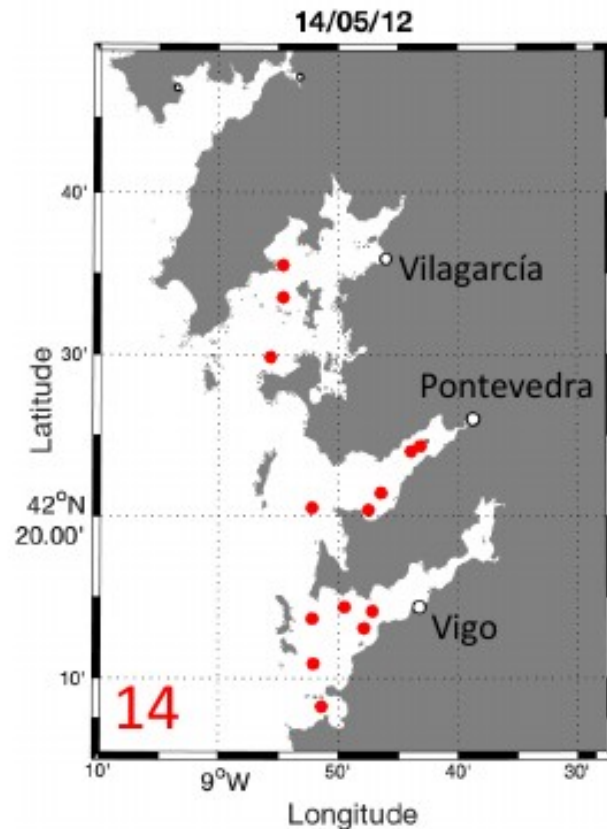
# 3D OCEAN MODEL CONFIGURATION: ROMS + PISCES



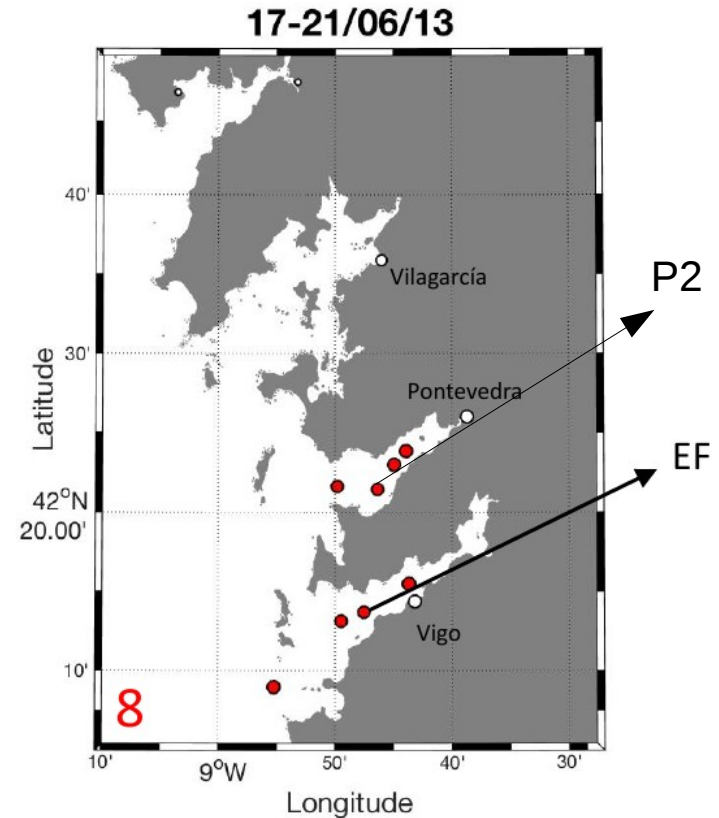
## PISCES (24)

# SELECTED TLP EVENTS IN THE RÍAS OF VIGO AND PONTEVEDRA IN THE PERIOD 2012-2015

## INTECMAR / DISTRAL



## ASIMUTH / (INTECMAR)

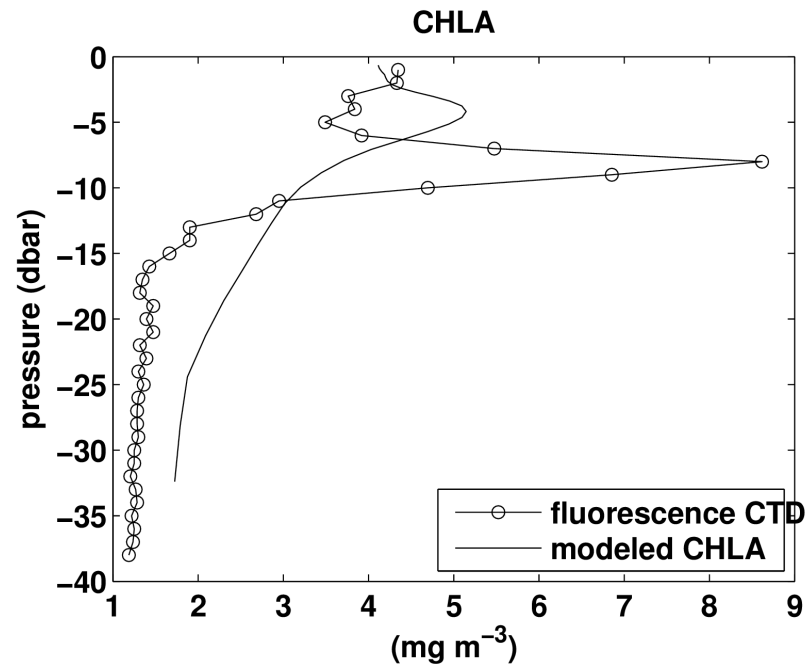
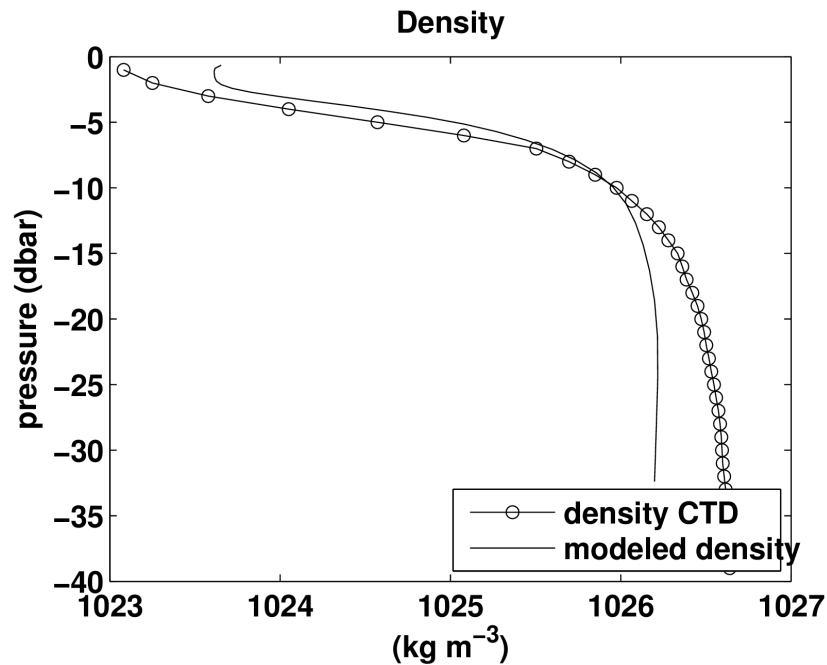
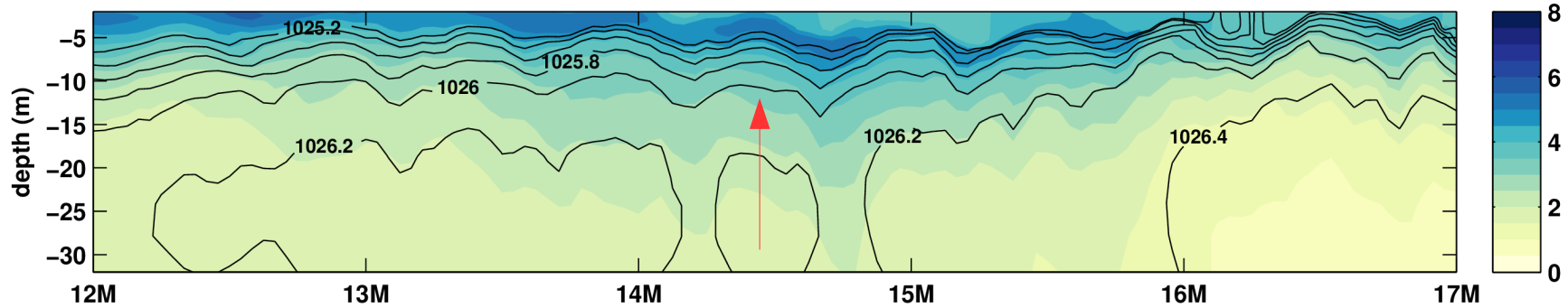


# TPL 14/05/2012

## RÍA DE VIGO: EF

12-17 may 2012

PISCES hourly chlorophyll ( $\text{mg m}^{-3}$ ) 2012 EF-Vigo



14/05 06:50 a.m.

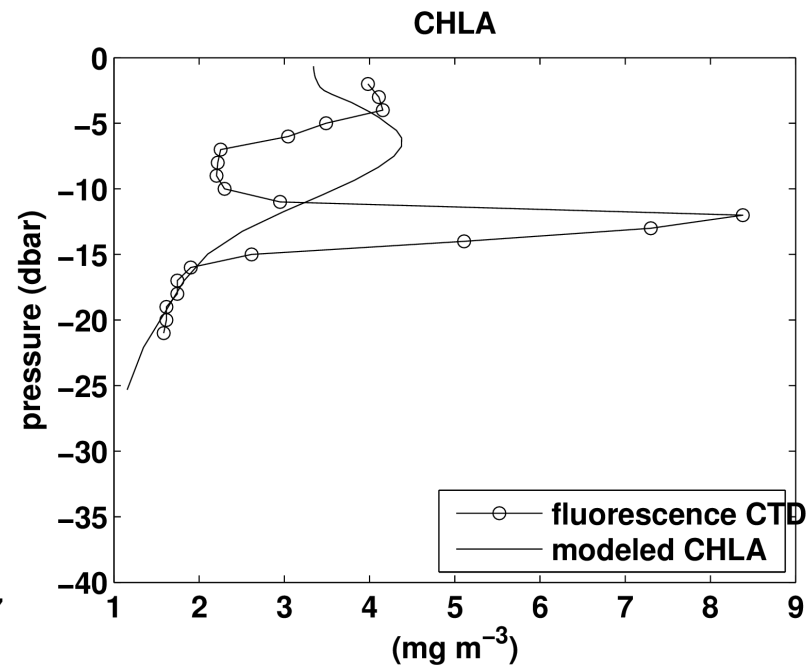
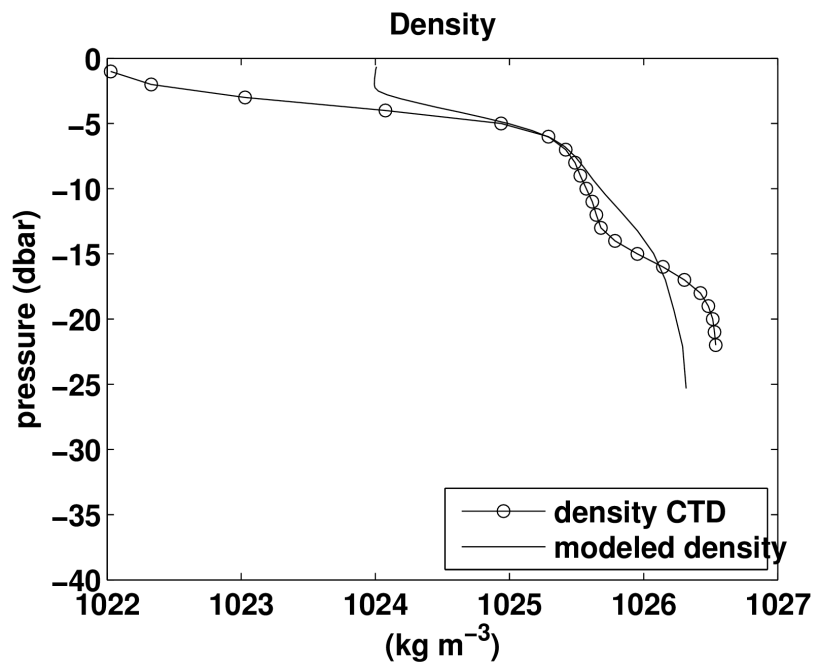
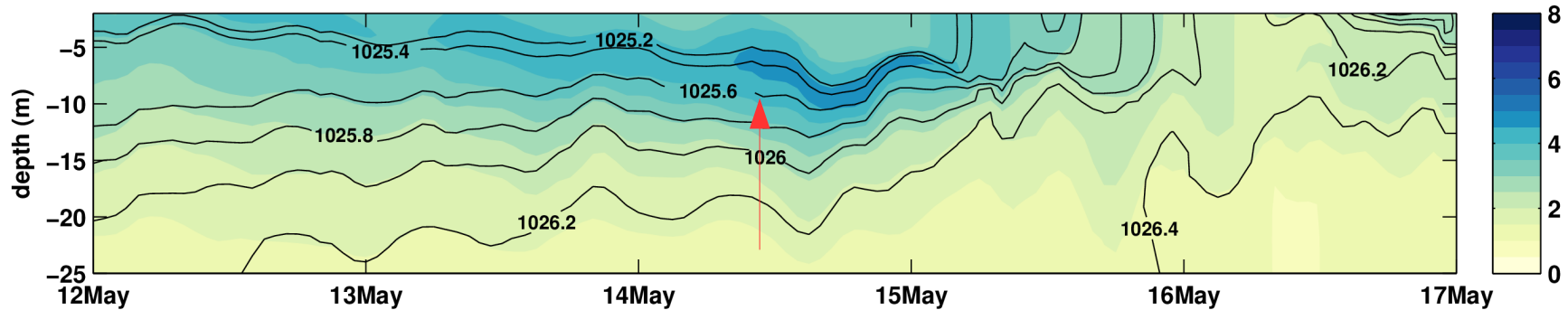


# TPL 14/05/2012

## RÍA DE PONTEVEDRA: P2 - BUEU

12-17 may 2012

PISCES hourly chlorophyll ( $\text{mg m}^{-3}$ ) 2012 P2-Bueu

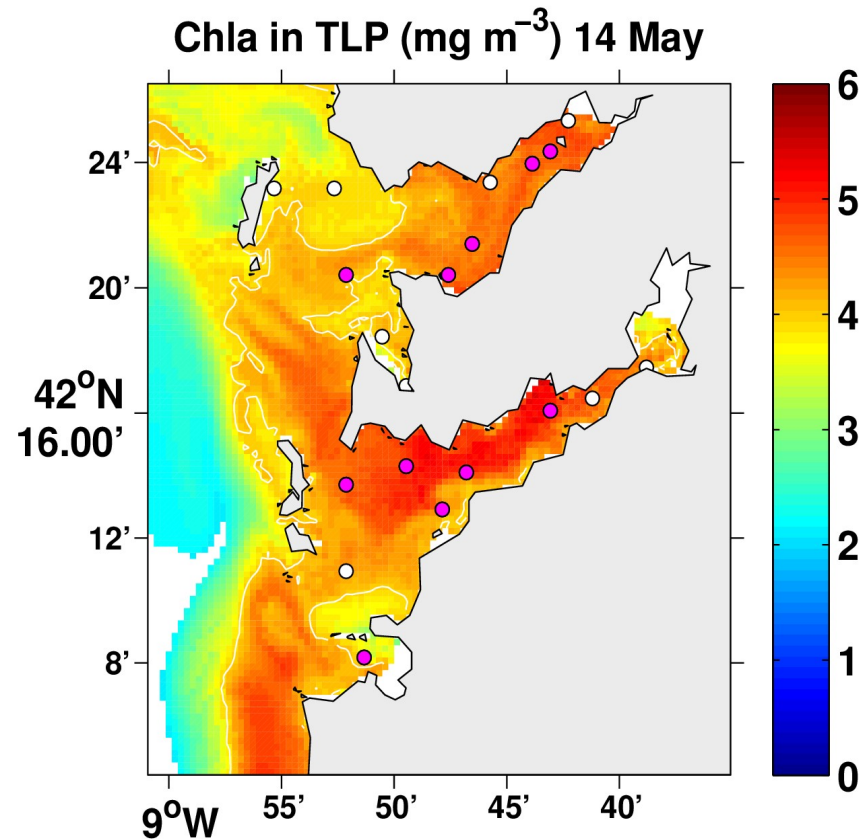


14/05 10:44 a.m.

TPL 14/05/2012

## SPATIAL EXTENSION

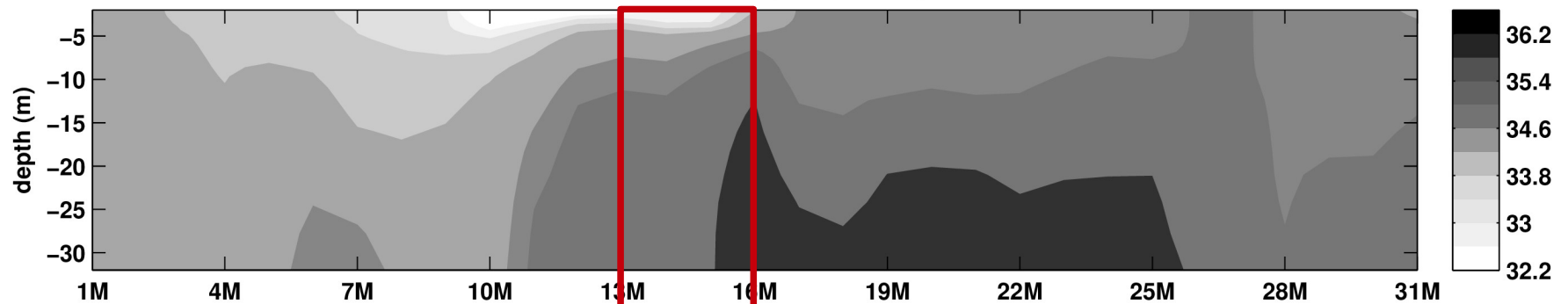
[CHLA] in isopycn  
1025,2 – 1025,4



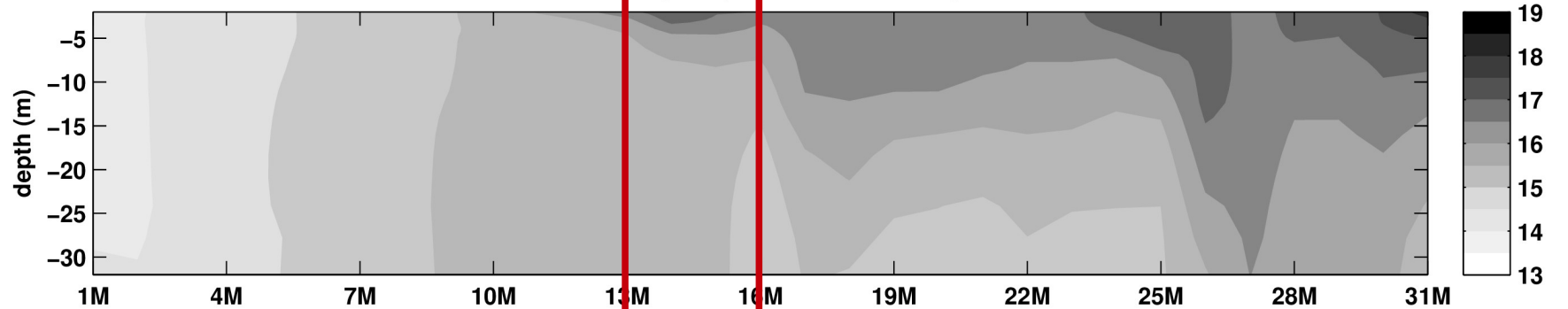
TPL 14/05/2012

# RÍA DE VIGO: EF OCEANOGRAPHIC CONDITIONS

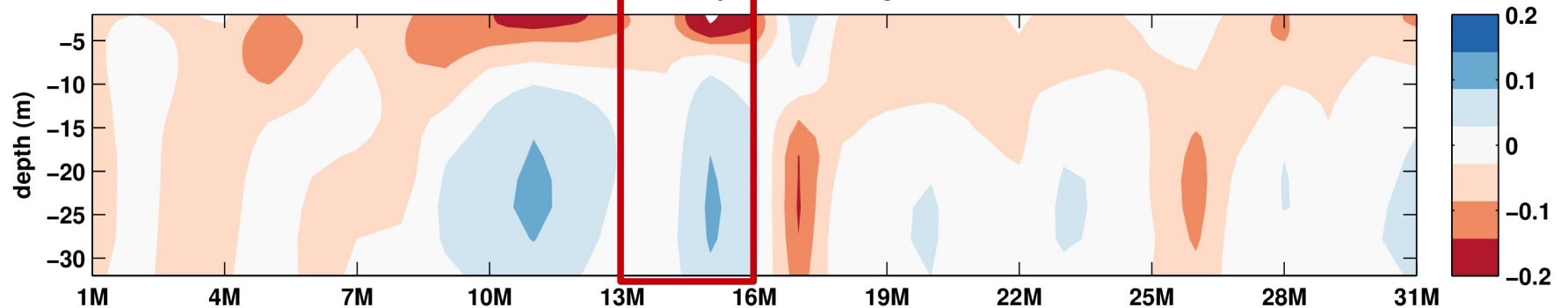
ROMS daily salinity 2012 EF-Vigo



ROMS daily temperature 2012 EF-Vigo

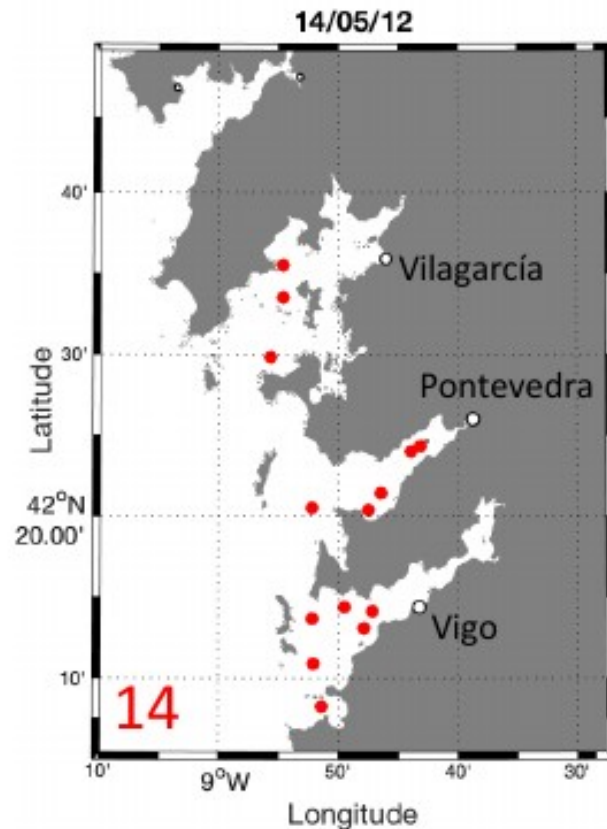


ROMS daily u 2013 EF-Vigo

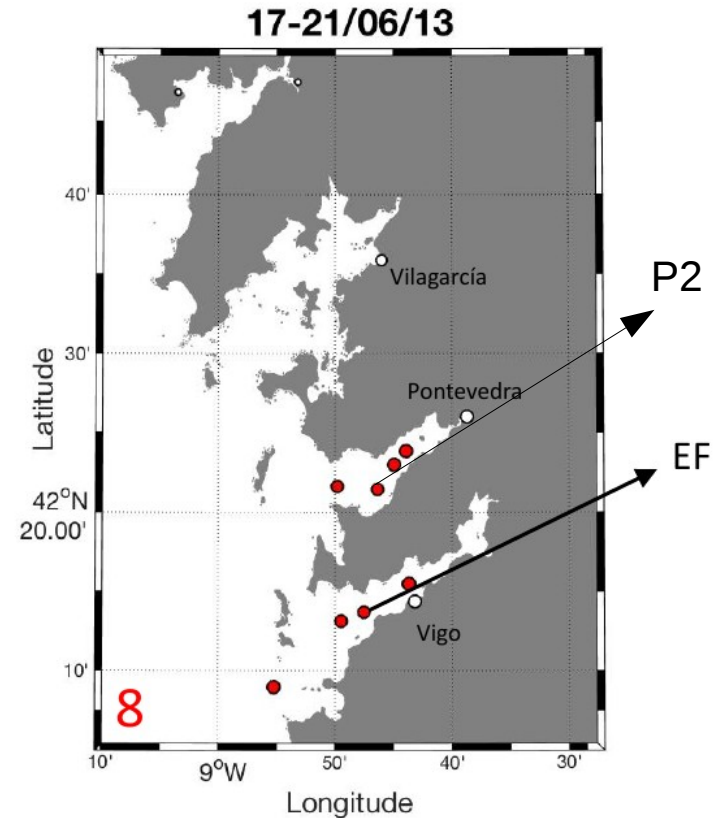


# SELECTED TLP EVENTS IN THE RÍAS OF VIGO AND PONTEVEDRA IN THE PERIOD 2012-2015

## INTECMAR / DISTRAL



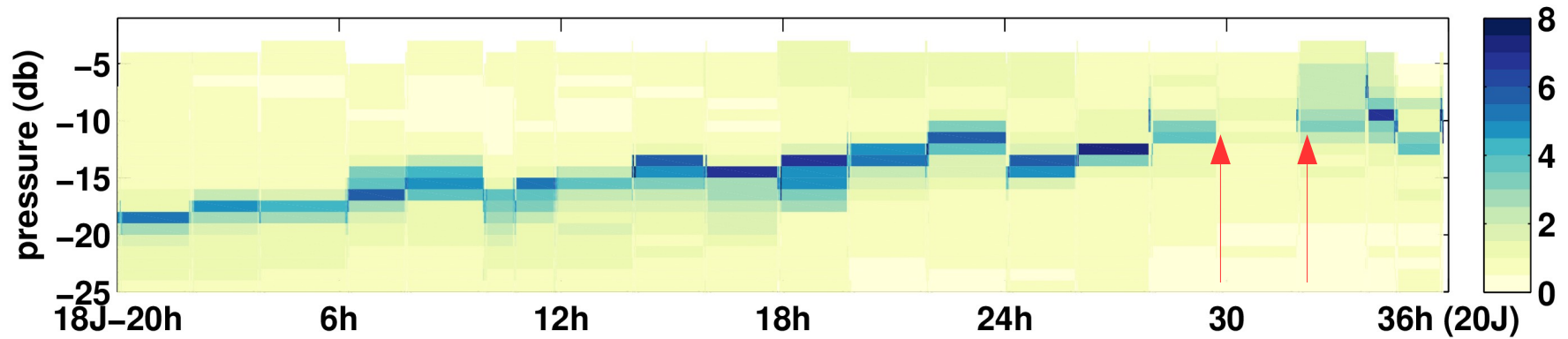
## ASIMUTH / (INTECMAR)



# TLP 18-20/06/2013

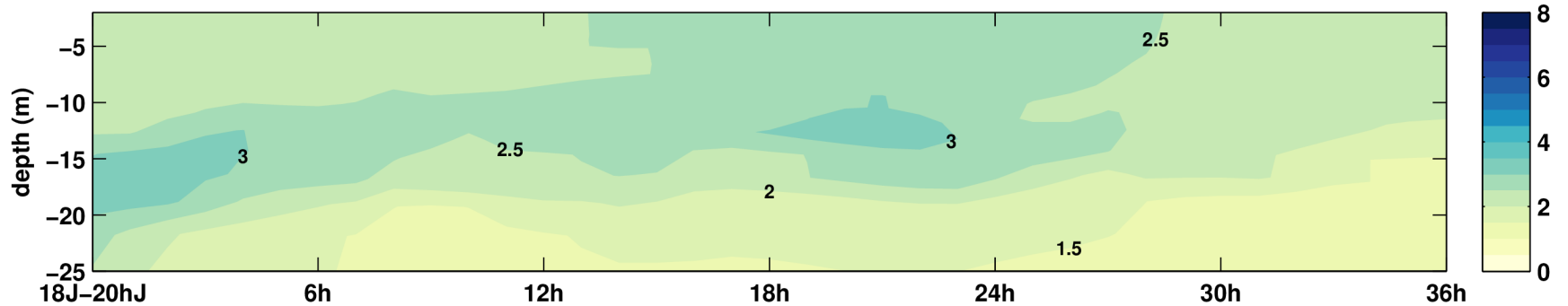
## RÍA DE PONTEVEDRA: P2

ASIMUTH fluorescence 2013 P2-Bueu



TLP destruction

PISCES hourly chlorophyll ( $\text{mg m}^{-3}$ ) 2013 P2-Bueu

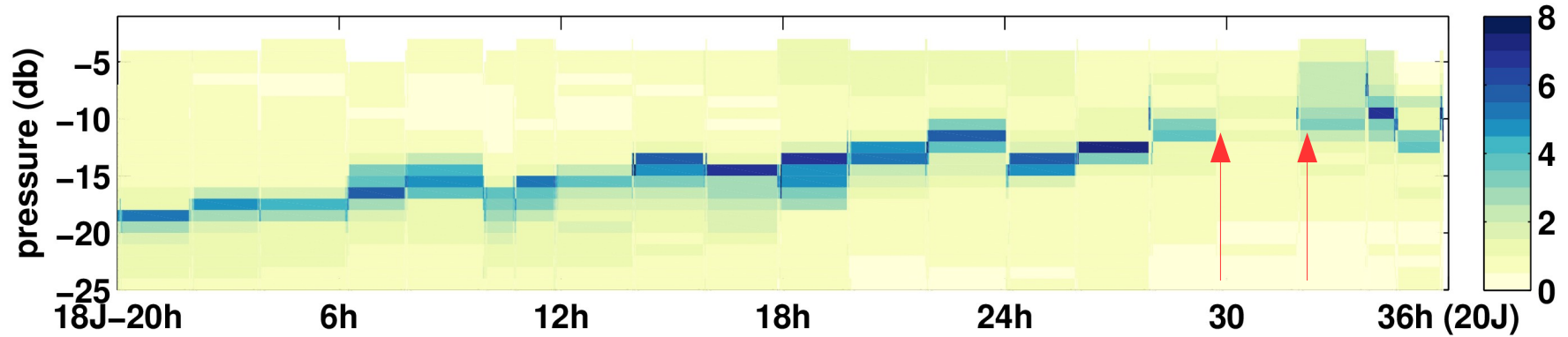


# TLP 18-20/06/2013

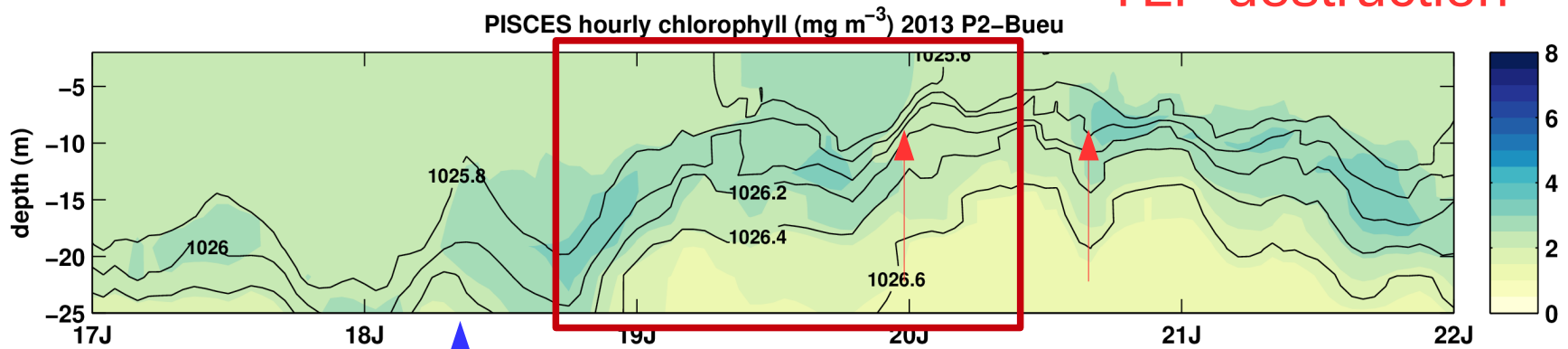
## RÍA DE PONTEVEDRA: P2

Microstructure turbulence profiler

ASIMUTH fluorescence 2013 P2-Bueu



TLP destruction

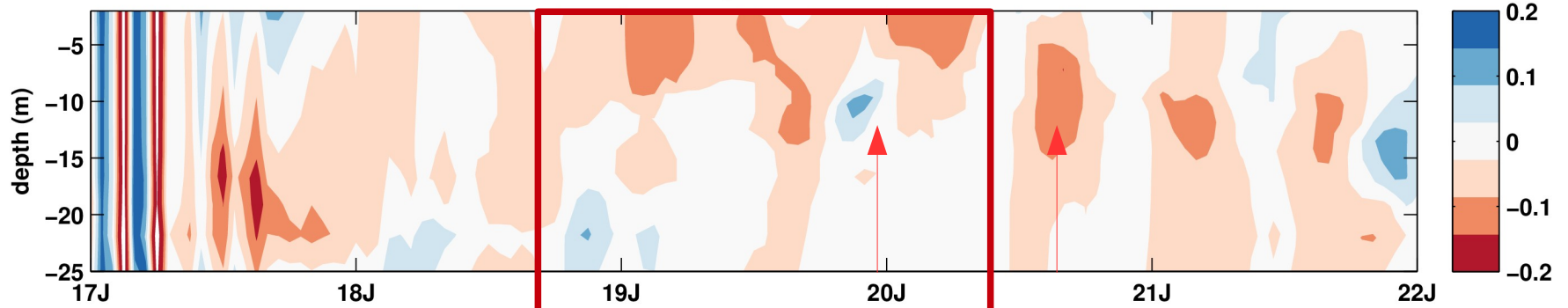


INTECMAR  
8:59h

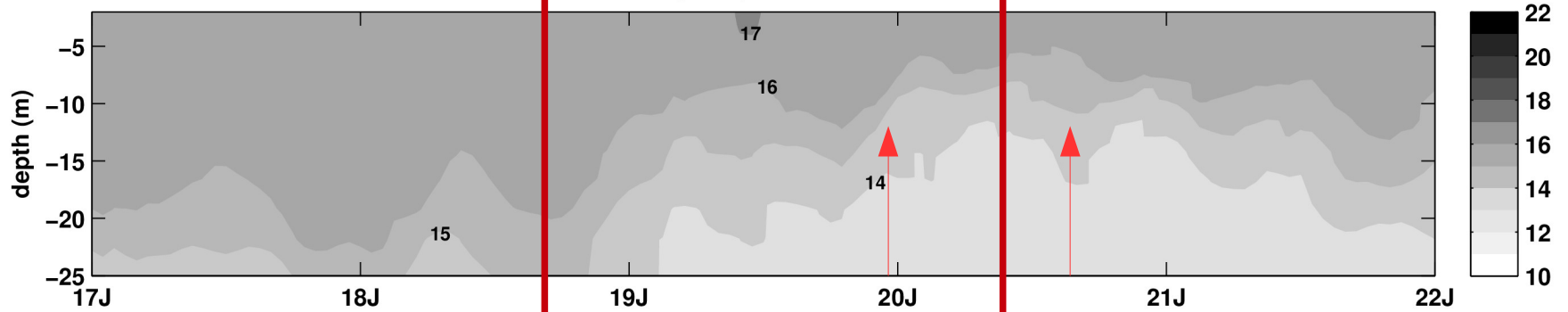


# OCEANOGRAPHIC CONDITIONS 17-22/06/2013 P2:

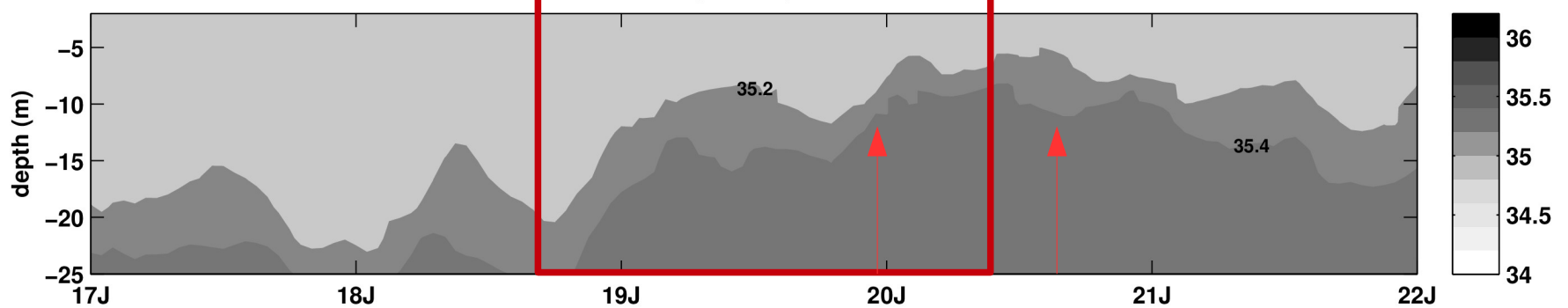
ROMS hourly u 2013 P2-Bueu



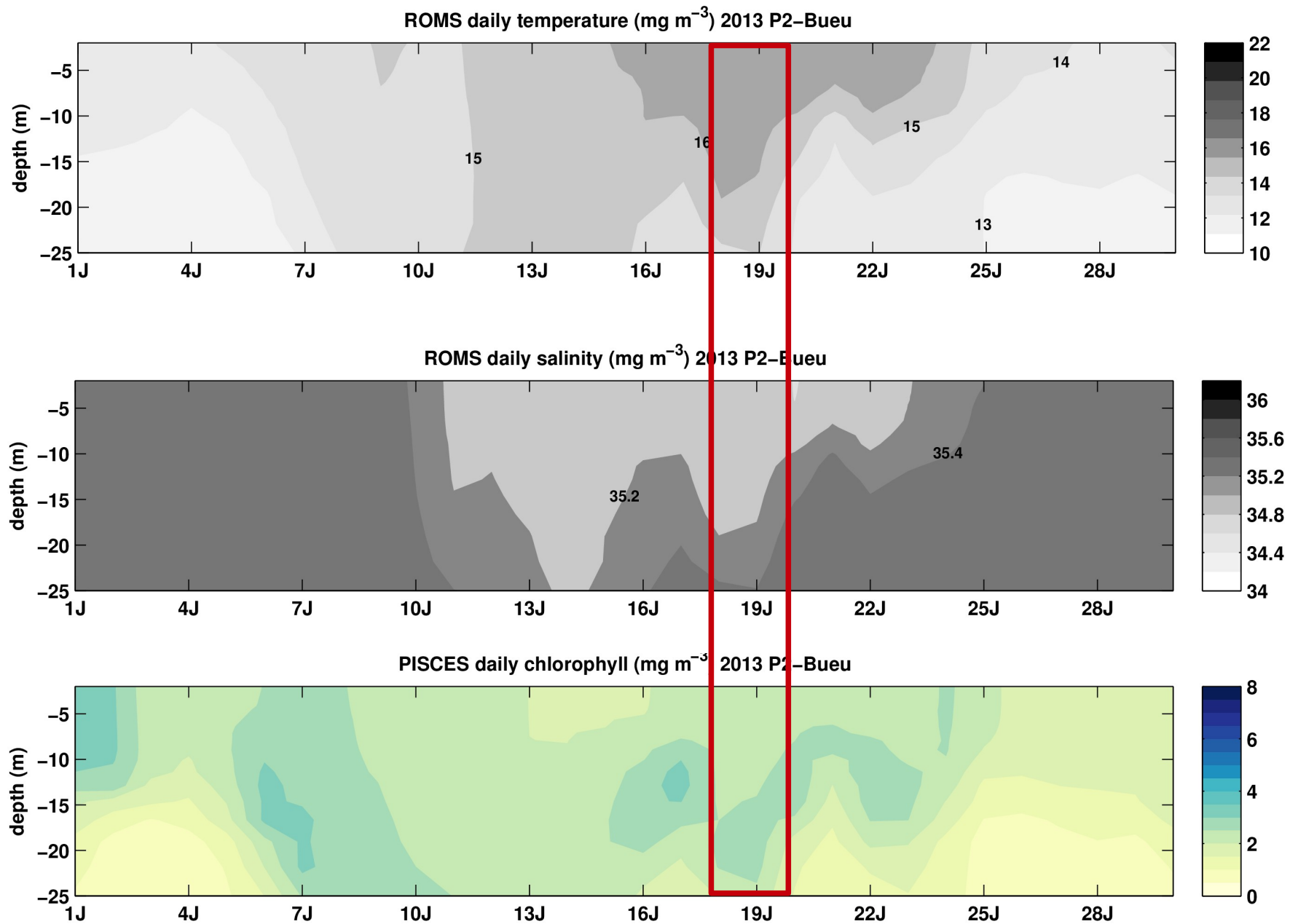
PISCES hourly temperature 2013 P2-Bueu



PISCES hourly salinity 2013 P2-Bueu

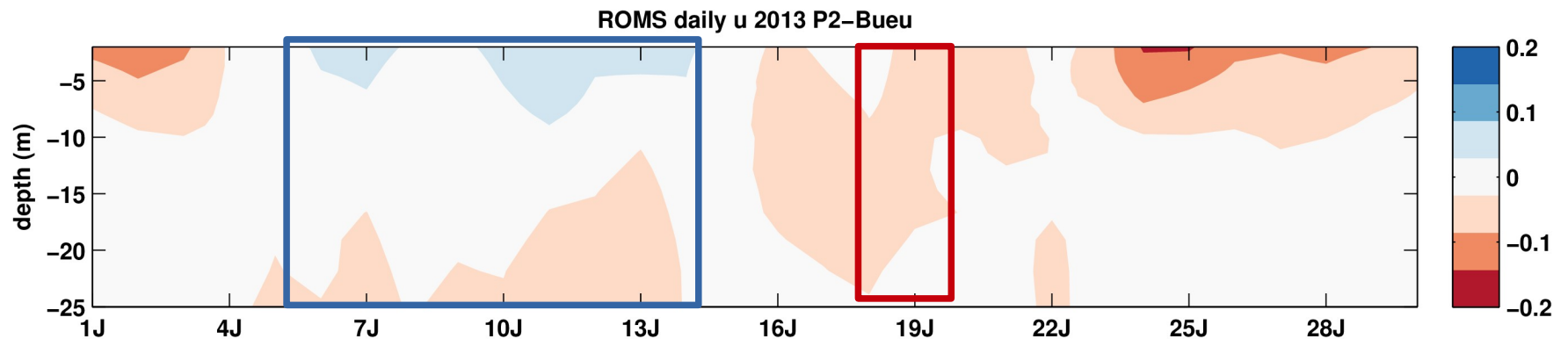
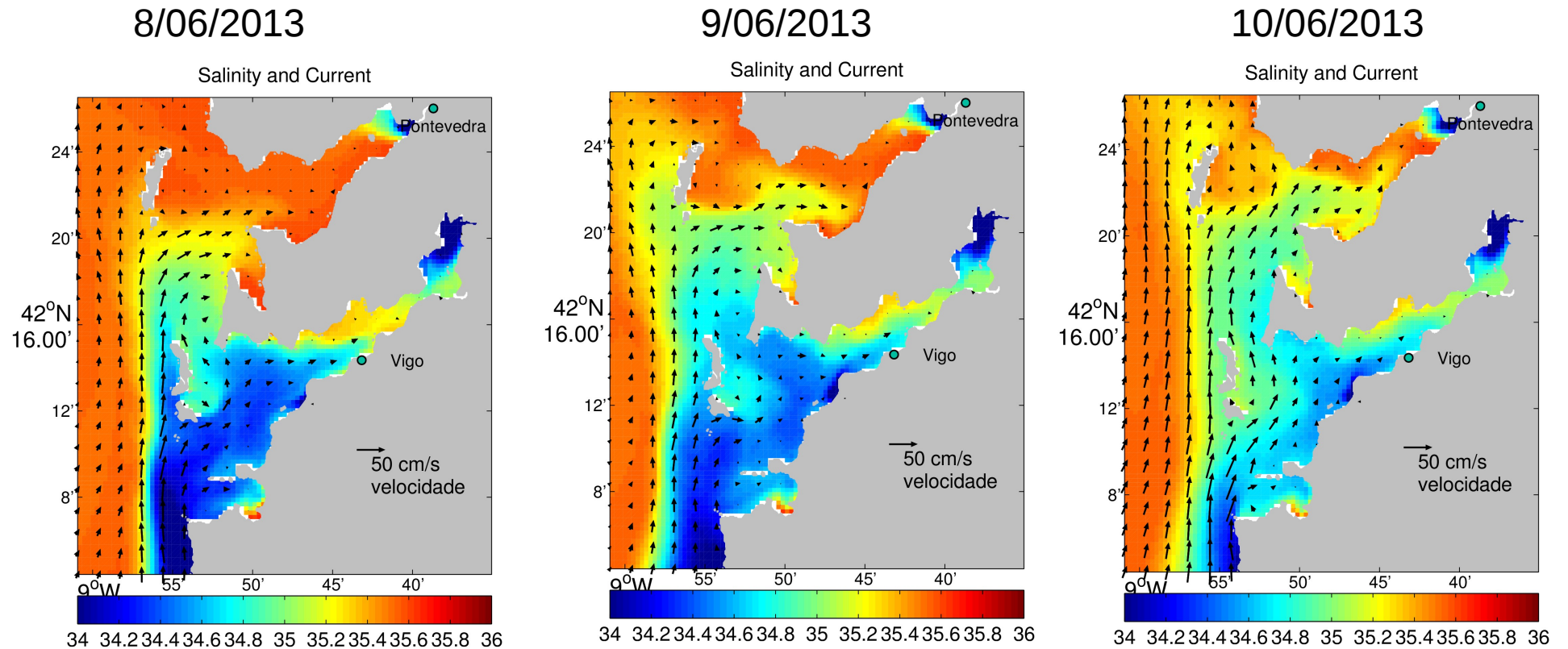


# MODELED EVOLUTION ALONG JUNE 2013





# ENTRANCE OF IBERIAN BUOYANT PLUME (MIÑO,DOURO...) DAYS BEFORE TLP 18-22/06/2013



# Conclusions:

- The **model could satisfactorily reproduce** the formation of the subsurface Chla maximums, as **an approximation to the TLP observed.**
- Both TLP analysed developed under **strong surface haline stratification** followed by upwelling pulses.
- The **source of freshwater** driving the stratification was associated to **local river discharges** in May 2012, whereas in June 2013 it was associated to the **advection of the Iberian Buoyant plume into the Rias.**

# More about REMEDIOS results:

1. *Thin layers and harmful phytoplankton in Ría de Pontevedra.* **Esperanza Broullón. REDIBAL. Oral Presentation: 20th June 18:30**
2. *Time-scale of mixing in the surface mixed-layer.* **Bieito Fernández. EOF. Oral Presentation: 21 June: 17:45**
3. *Spatial structure of a fluorescence patch in Ría de Vigo.* **Marina Villamaña. EOF. Poster: 21st June 18:15h**
4. *General presentation REMEDIOS* **Beatriz Mouriño-Carballido. ISMS2018. Poster: 21st June**
5. *Environmental conditions favorable for TLP in the Galician Rías.* **Marta López. ISMS2018. Poster: 22nd June**
6. *Variation of the vertical distribution of chlorophyll in Ría de Vigo.* **Eva Rodríguez. ISMS2018. Poster: 22nd June**





# PLAN ESTATAL DE INVESTIGACIÓN CIENTÍFICA Y TÉCNICA DE INNOVACIÓN 2017-2020.



## Proyecto ASIMUTH. FP7. (IP Manuel Ruíz Villarreal)



## Programa Juan de la Cierva - formación



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