



Southwest SAO **coccolithophore bloom** at different spatiotemporal scales

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CIMA - IFAECI - IUSM
CONICET / UBA / IRD / CNRS / PNA

AtlantEco/CEODOS workshop
Mission Microbiome Expedition
May 2023

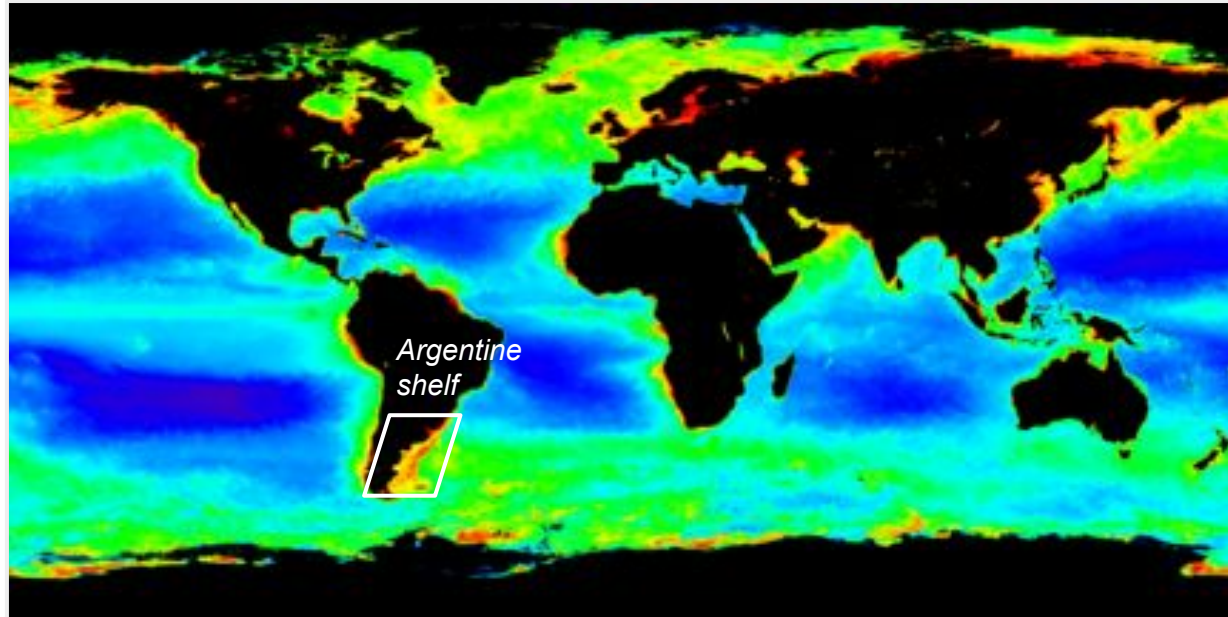


Centro de Investigaciones del
Mar y la Atmósfera (**CIMA**)

Instituto Franco-Argentino de
Estudios del Clima y sus
Impactos (**IFAECI**)

- ex UMI, now IRL -
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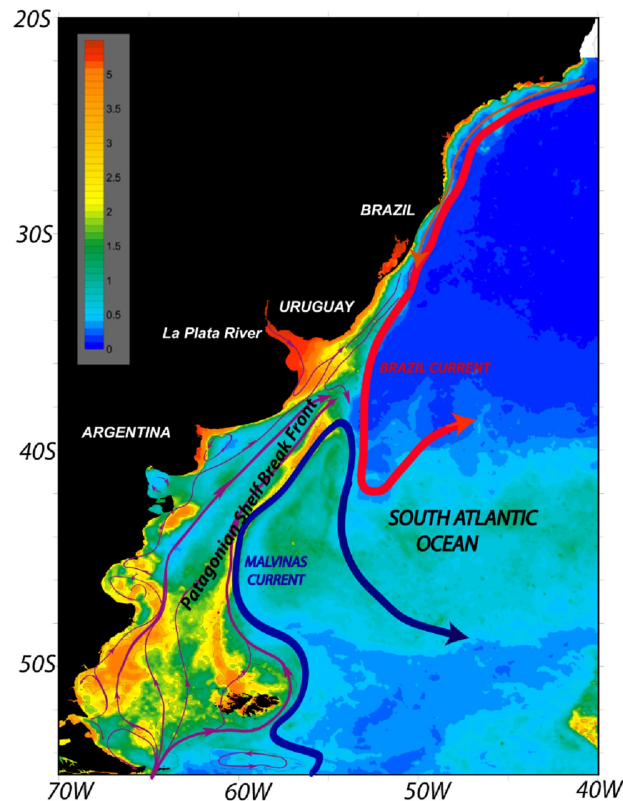
Marine primary production



Annual chlorophyll - 2021 - NASA

- Primary production in **shelf waters**
[upwellings, nutrients, fronts]
- Argentine shelf
 - 200-800 km wide
 - Influenced by west boundary current

The Argentine shelf in the southwest SAO



Franco et al., 2022

- Primary production in **shelf waters**
[upwellings, nutrients, fronts]
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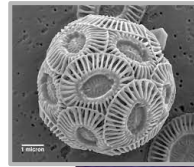
That is why it has been named:

PAMPA AZUL

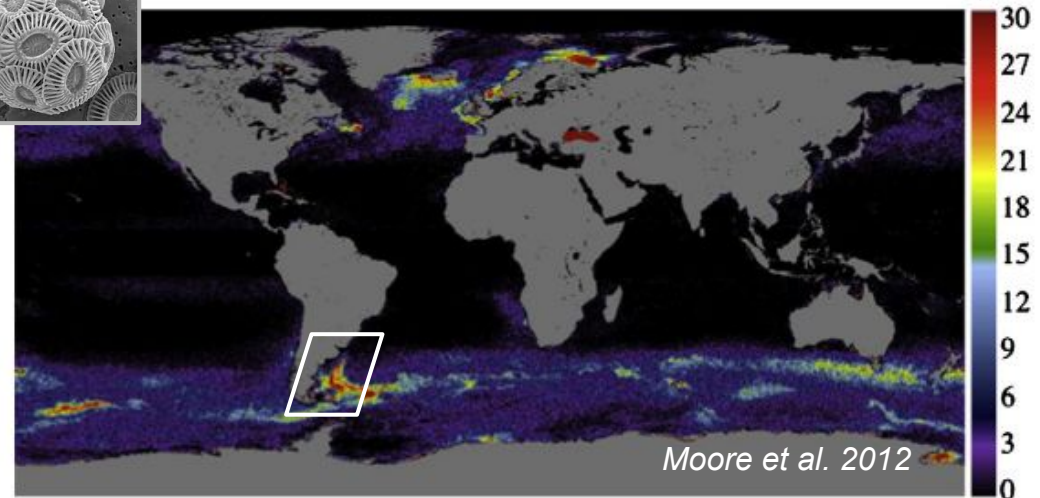
<https://www.pampazul.gob.ar/>

Coccolithophores | Great Calcite Belt

- *Emiliana huxleyi*
- **Calcifying** phytoplankton
- Optical properties
 - remote and *in situ* sensing
- Wide geographic distrib.
- Blooming conditions are well studied
- Lab cultures
- Sequenced genomes (e.g. *Read et al., 2023*)
- Known interactions with viral and bacterial pathogens (e.g. *Vardi group*)

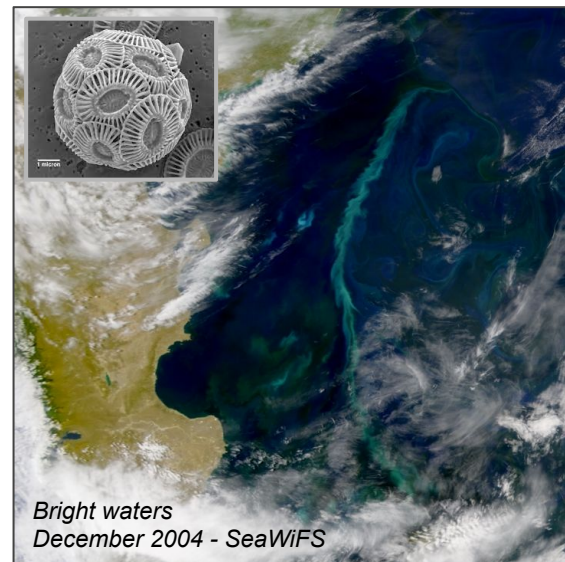
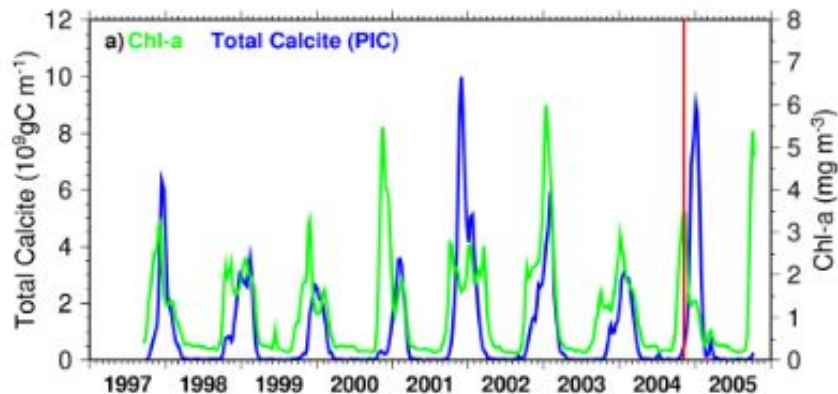
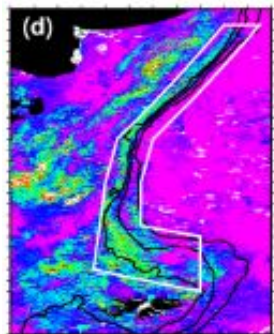


Frequency for coccolithophore blooms (1997-2010)

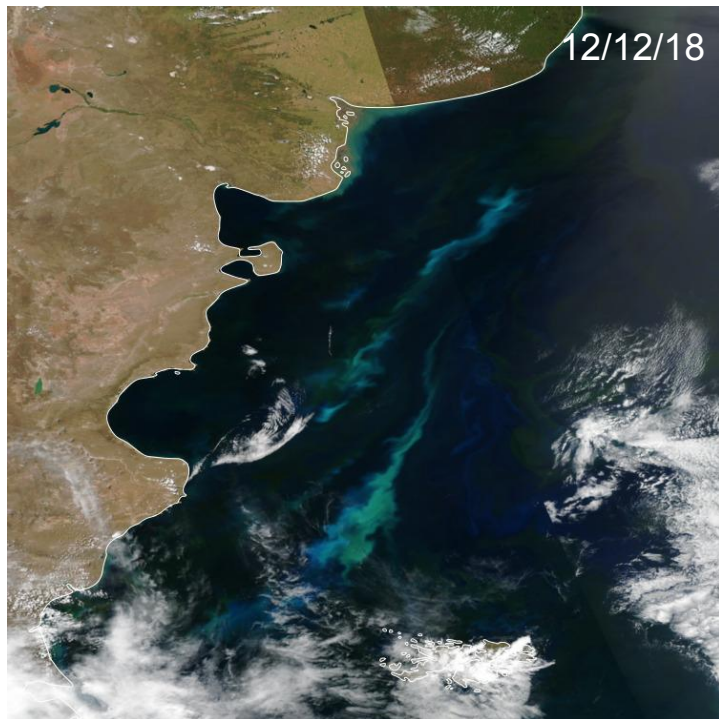


Emiliana huxleyi bloom along the shelf break front

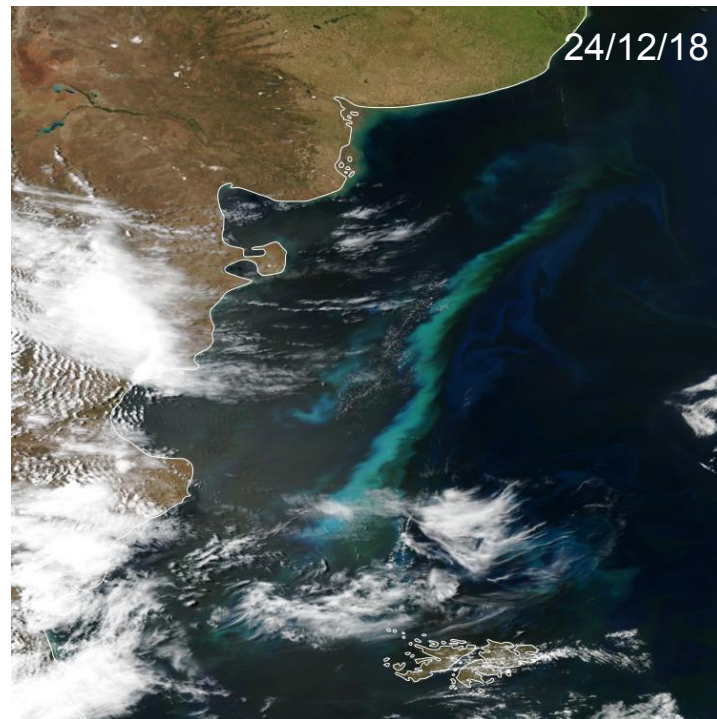
- Max reflectance in Dec - Jan
- ~1.000 km length
- Fast northward transport
- Strong interannual variation



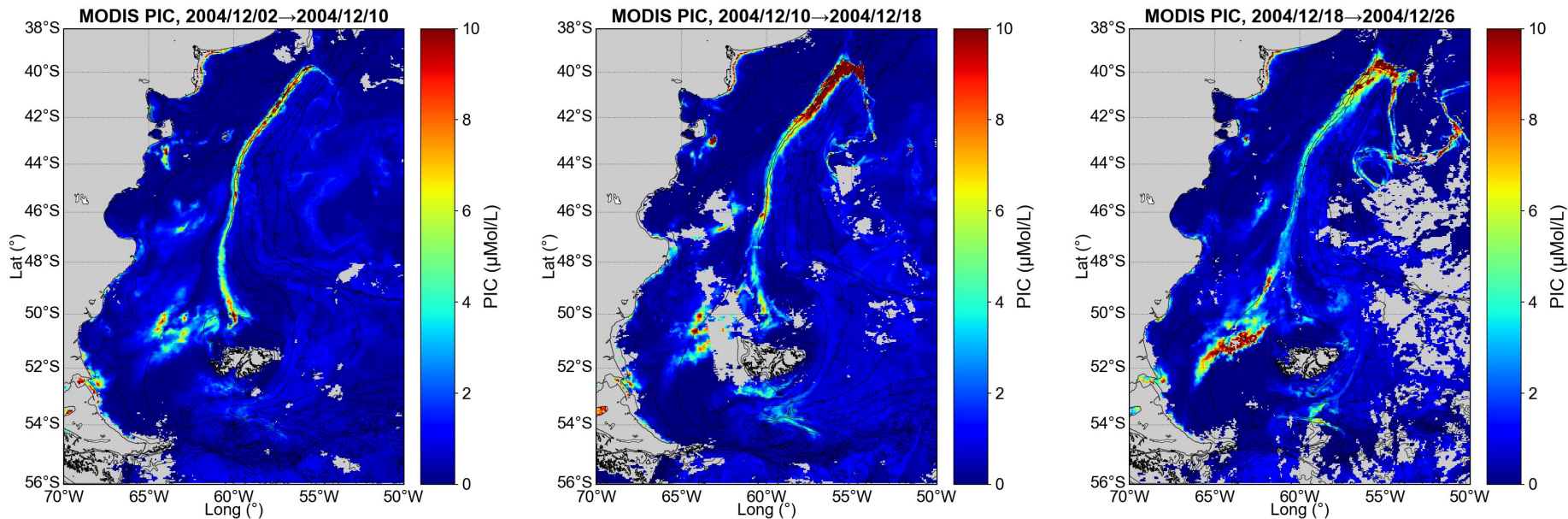
Emiliana huxleyi bloom drifting northwards



12 days →

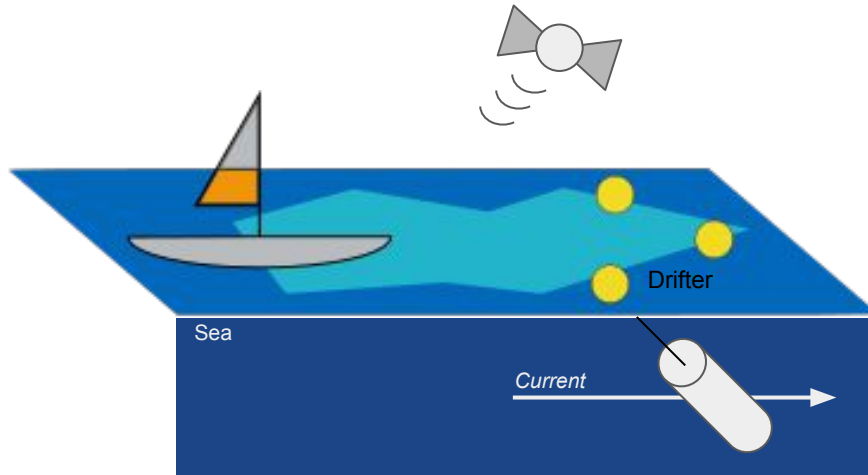


Emiliana huxleyi bloom drifting northwards



- 3 eight-day composites, December 2004
- Fast appearance of high reflectance waters along 1000 km
- Advection at 0.5 - 0.8 m/s

Lagrangian sampling of the *Emiliana huxleyi* bloom



What you **need**:

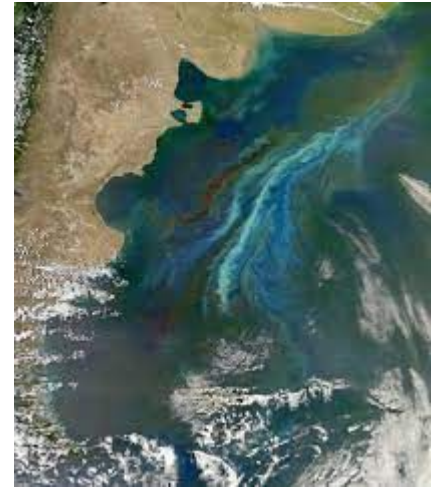
- Satellite images
- *In situ* measurements
- Drifting buoys
- Numerical simulations

It can be seen as a moving, real time series of a plankton community. This allows better addressing of ecological and physiological aspects.

Biological interactions and the *stage* of phytoplankton blooms

- **Bacterial** community. Beneficial vs pathogenic.
- **Viral** attacks
- Extracellular **vesicles** and intraspecific communication in *E. huxleyi*
- Grazers
- Other **phytoplankton**

How do all these interactions contribute to the development and demise of the coccolithophore bloom?



MODIS Aqua NASA
Patagonia, Dec. 21, 2010

International collaboration

Tara Mission Microbiomes



- Fondation Tara Ocean
- C. de Vargas (Station Biologique Roscoff)
- D. Iudicone (Stazione Zoológica Nápoli)
- Vardi team (Weizmann Institute)
- *et al.*



Argentinean consortium



Sampling calendar & teams

Stage 1: USH-BUE



Scientific team onboard

- Federico Ibarbalz (CIMA)
- Paula Huber (U. F. Sao Carlos)
- Carola Ferronato (IADO)
- Azul Gilabert (IADO)
- Román Uibrig (IADO)
- Gabriela Riviello López (PNA)



Stage 2: BUE-USH



Scientific team onboard

- Flora Vincent (I. Weizmann)
- Constanze Kuhlisch (I. Weizmann)
- Michel Flores (I. Weizmann)
- Ricardo Silva (INIDEP)
- Morgane Ratin (S. B. Roscoff)
- Guillaume Bourdin (U. Maine)

Stage 1 Houssay



Stage 2 Tara



3 videos
available
Stage 2



 YouTube ^{AR}

Search







[#FondationTaraOcéan](#) [#tara](#) [#taraocéan](#)

Étude du Bloom de Coccolithophores - Partie 1 | Mission Microbiomes

Fondation
taraocéan
explorer et partager

721 views Dec 21, 2021 📍 Au large des côtes argentines,
Tara part à la chasse aux coccolithophores! ...more

 11  Dislike  Share  Save ...



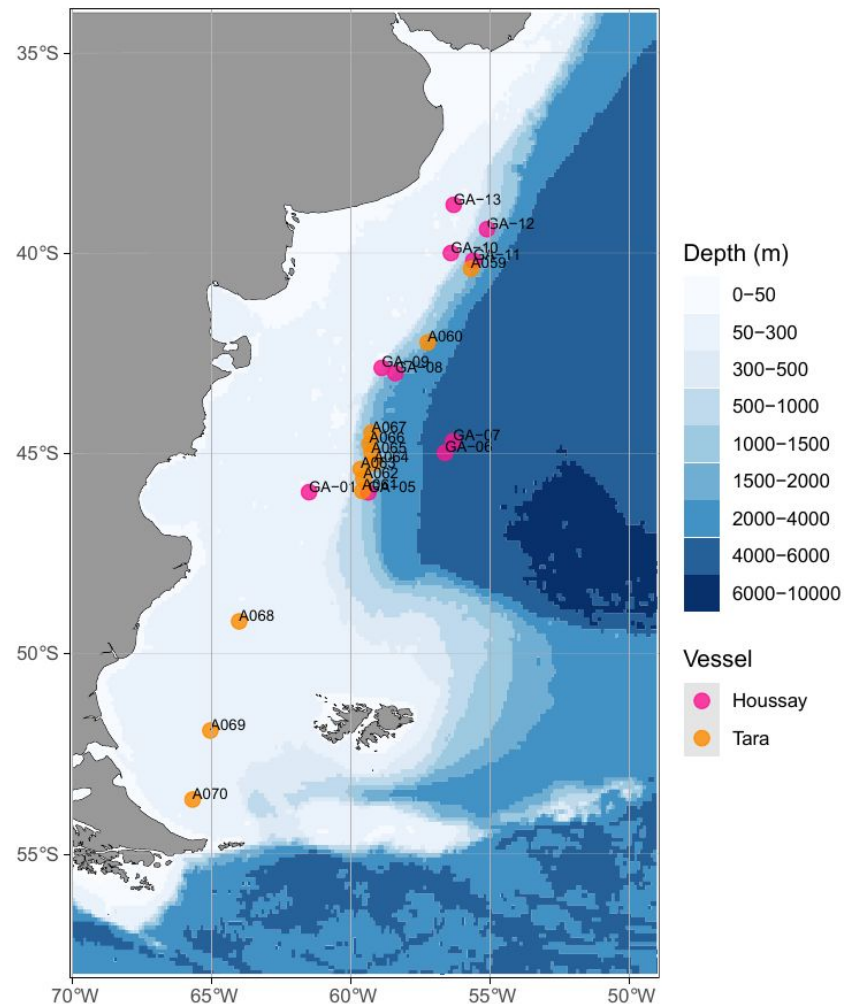
Fondation Tara Océan
5.13K subscribers



SUBSCRIBE

Sampling stations

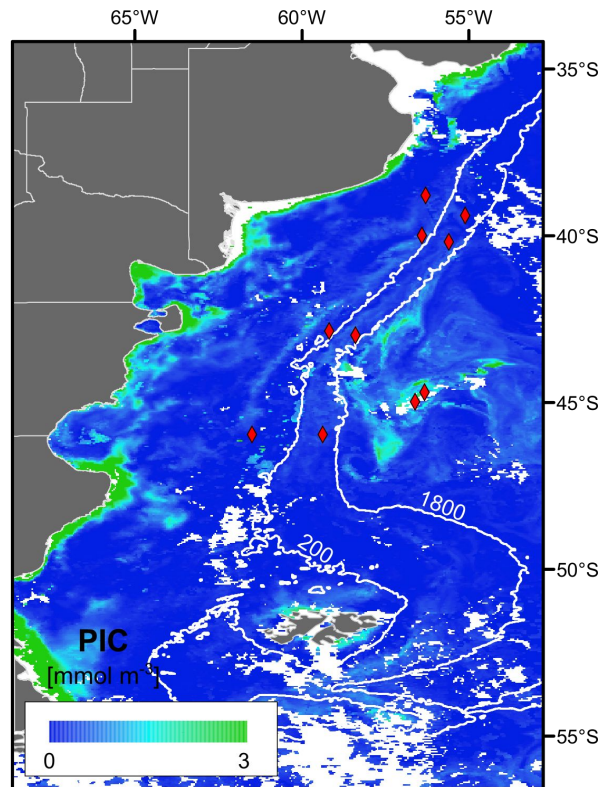
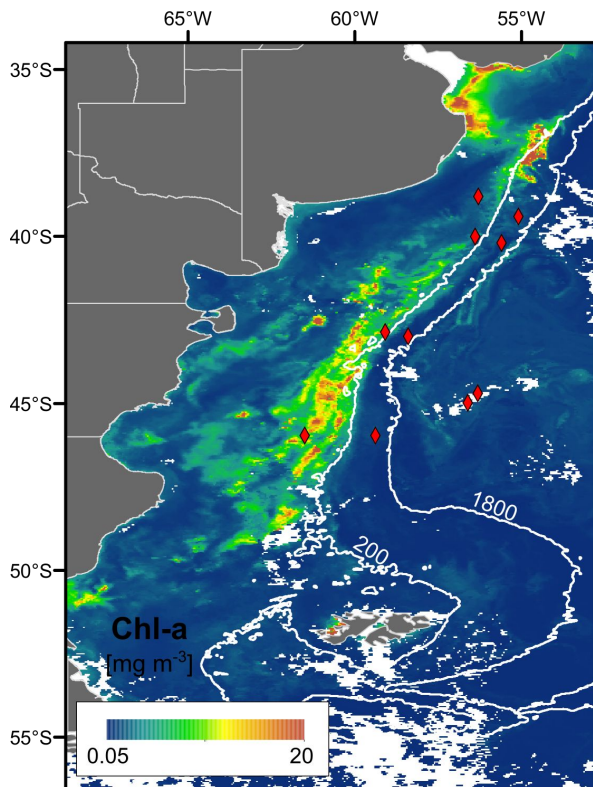
- Stage 1 (Houssay): **10** stations
- Stage 2 (Tara): **12** stations



Stage 1 Houssay



MAPS
Carola **Ferronato** (PhD student)
Martín **Rivarossa** (PhD student)
Valeria **Guinder**



4 shelf stations
(Z < 200m)

4 slope stations
(Z > 200m)

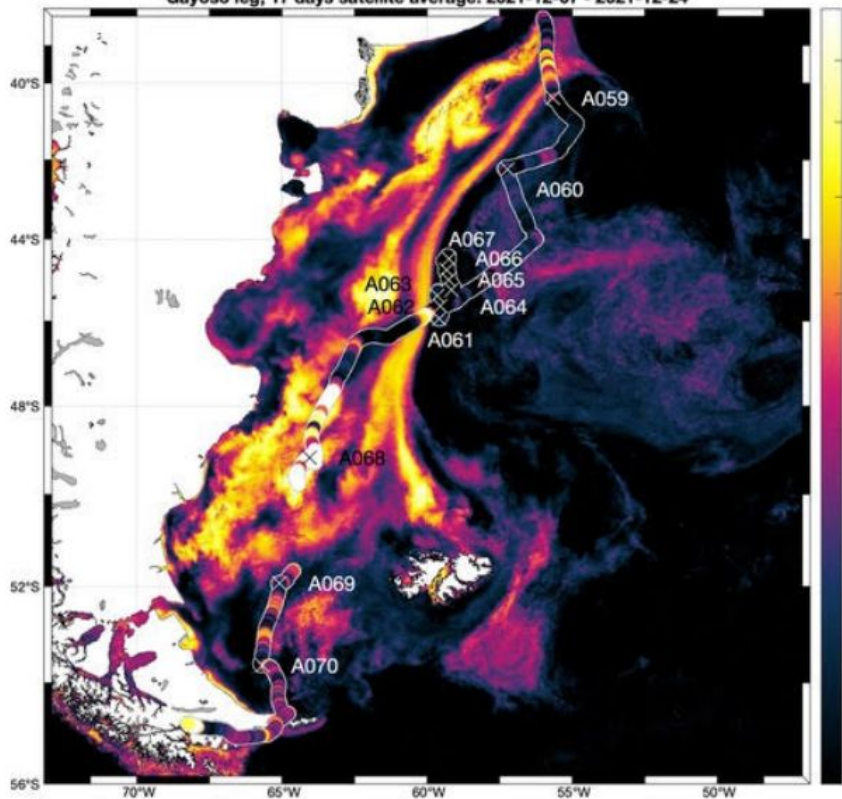
2 open-ocean
stations (Z > 2000m)

Mean Chl-a and PIC: 16- 22 Noviembre 2021 (MODIS 4km)

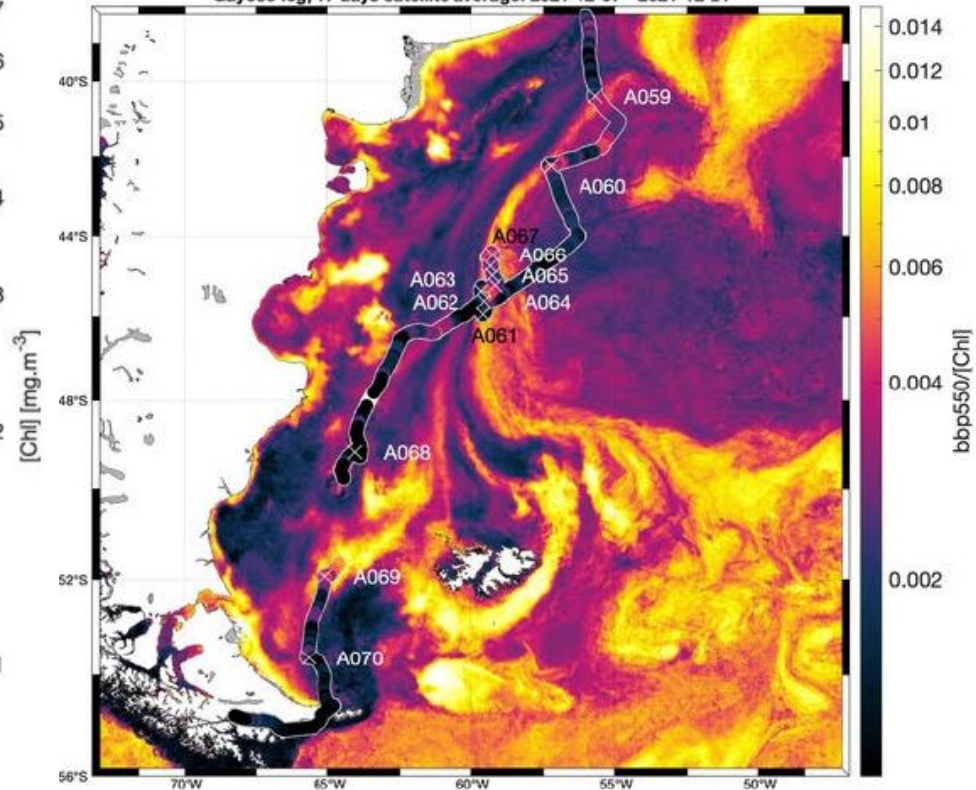
Stage 2 Tara

MAPS
Guillaume Bourdin (Maine)
Flora Vincent (EMBL)

Gayoso leg, 17 days satellite average: 2021-12-07 - 2021-12-24



Gayoso leg, 17 days satellite average: 2021-12-07 - 2021-12-24



Stage 2 Tara



Lagrangian sampling

- Identification of candidate patches by **remote sensing** (PIC/CHL, true color)
- Speed and direction from particle drift **simulation** (Mercator)
- Backscattering (in-line)
- CTD cast, water collection at multiple depths, cell count by **flow-cytometry**
- Release of 3 drifters (GPS)
- Daily collection and sampling focused on coccolithophore ecophysiology

1ST CONFIRMATION

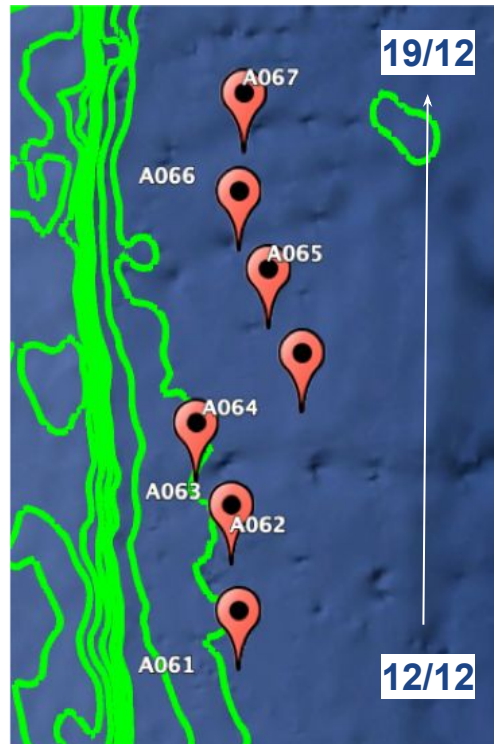
2ND CONF.

PLACE

DIRECTION

DEPTH

DIR.



Stage 2 Tara



Lagrangian sampling

- Identification of candidate patches by **remote sensing** (PIC/CHL, true color)
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PLACE

DIRECTION

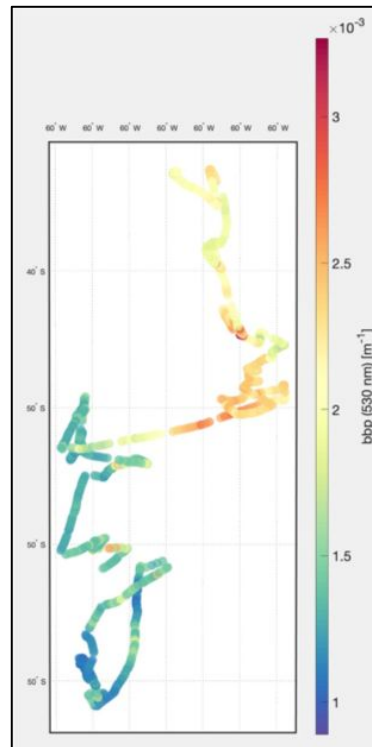
1ST CONFIRMATION

2ND CONF.

DEPTH

DIR.

bbp530



Some of the **teams** and their *activities*

Group

Martín Saraceno
Laura Ruiz

CIMA Buenos Aires



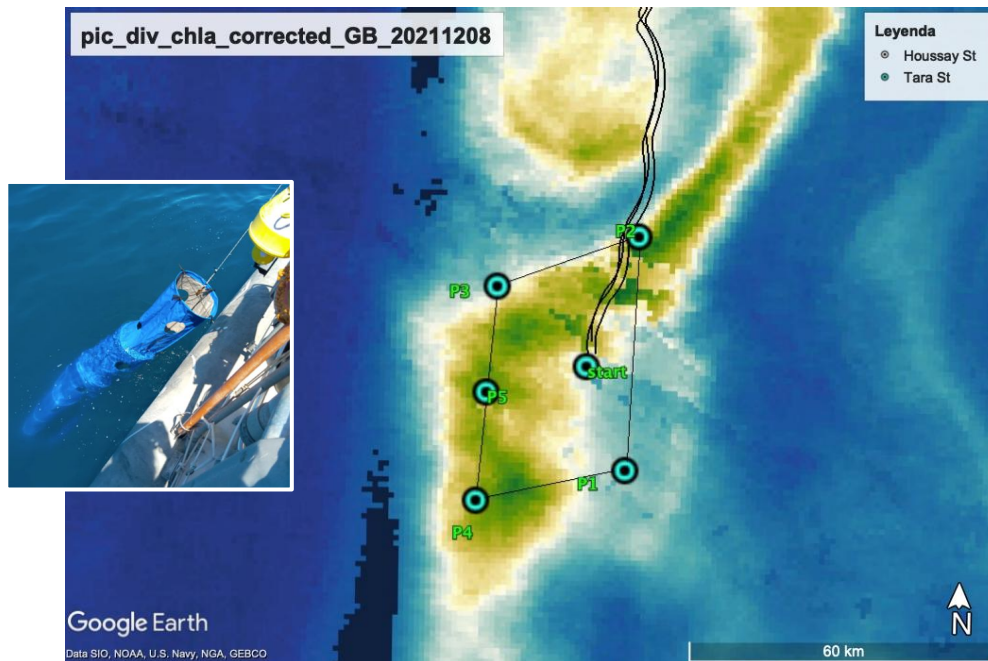
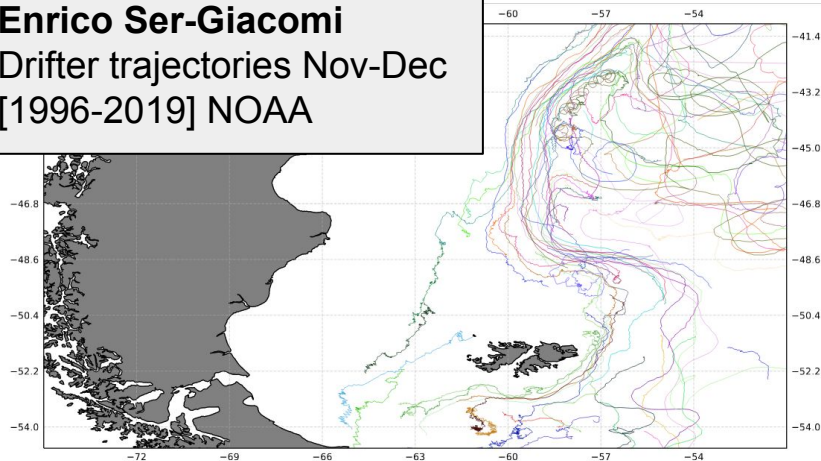
Analysis

Physical oceanography. Malvinas current. Lagrangian approach.

Leg

1 + 2

Enrico Ser-Giacomi
Drifter trajectories Nov-Dec
[1996-2019] NOAA



Google Earth

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Group

Martín Saraceno
Laura Ruiz

CIMA Buenos Aires



Analysis

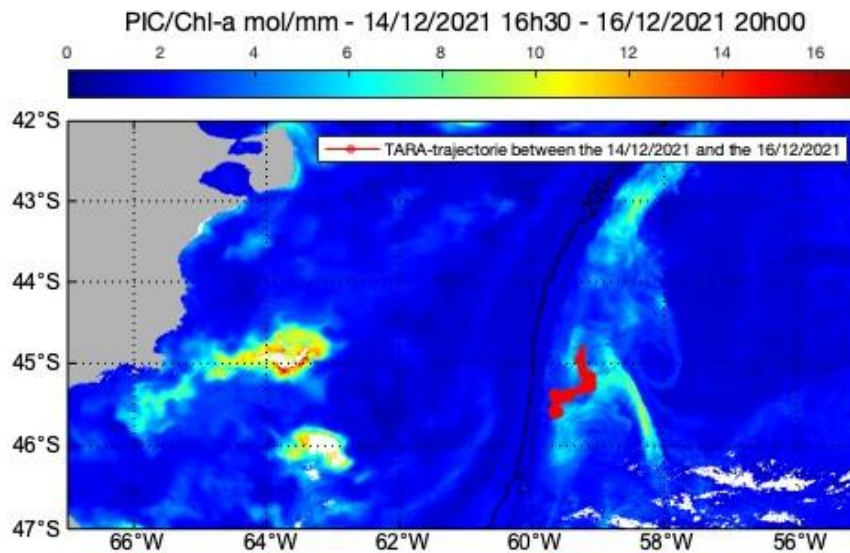
Physical oceanography. Malvinas current. Lagrangian approach.

Leg

2

Claudine Halbout

Intern from Grand Ecole de Nantes
@ CIMA



PIs

Valeria Guinder IADO Bahía Blanca

Ricardo Silva INIDEP Mar del Plata

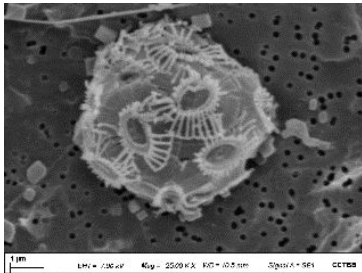


Analysis

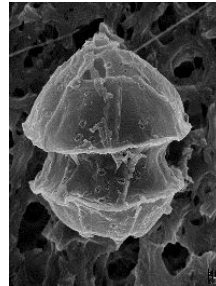
Phytoplankton. ID, distribution, pigments & toxins.

Leg

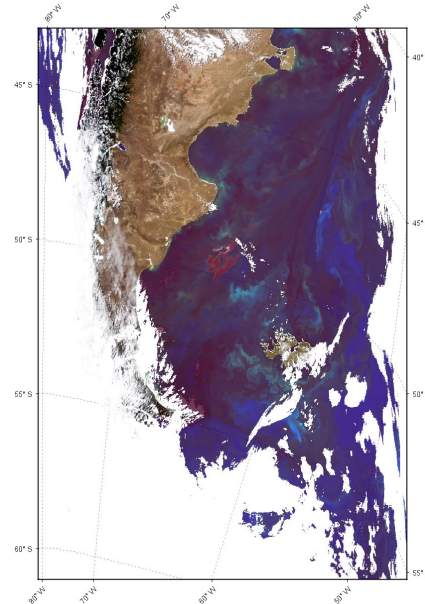
1 (+ 2)



E. Huxleyi - Eddy
(morfotipo B/C)



Agujero Azul (Angelescu),
10 días después de Gayoso



PI

Celeste López Abbate IADO Bahía Blanca

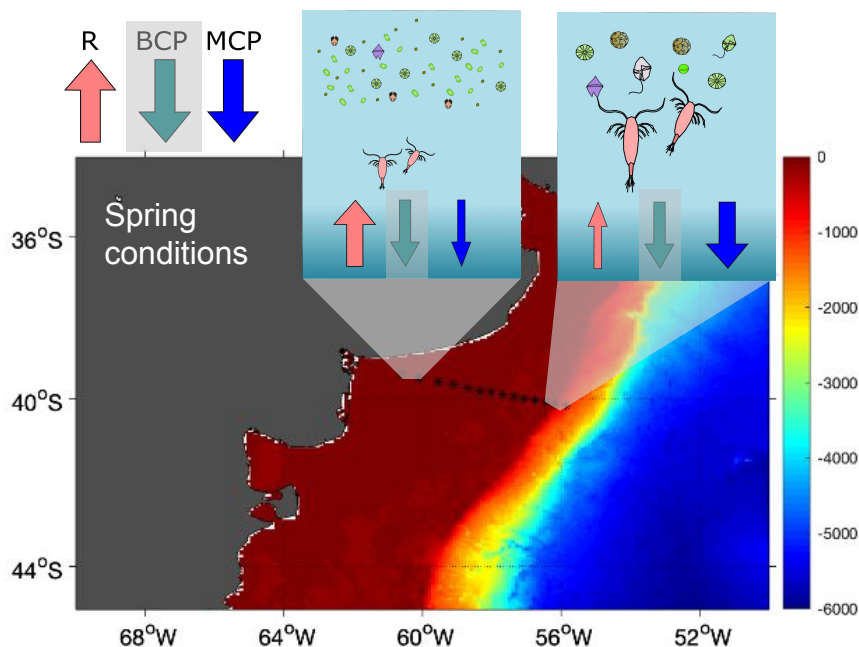


Analysis

Carbon fluxes. Respiration / Microbial Pump

Leg

1 + 2



Group

Assaf Vardi
Flora Vincent
Connie Kuhlisch
Daniella Schatz

Weizmann Israel

Analysis

Virus, vesicles & metabolomics

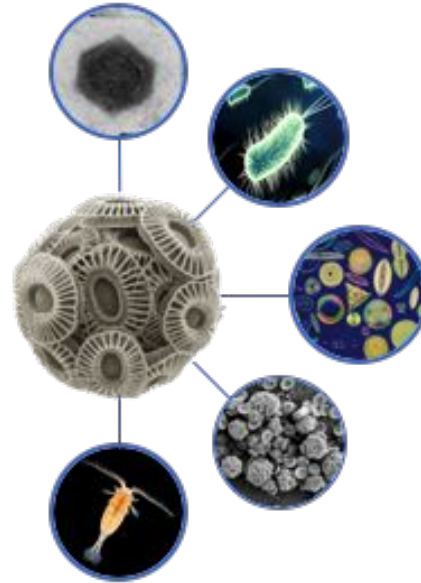
Leg

2



Some of the questions addressed:

- Contribution of different mortality agents (i.e. virus, bacteria)
- Chemical markers of metabolism and microbial interactions
- Large scale consequences of microbial interactions





Group

Assaf Vardi
J. Michel Flores

Weizmann Israel

Analysis

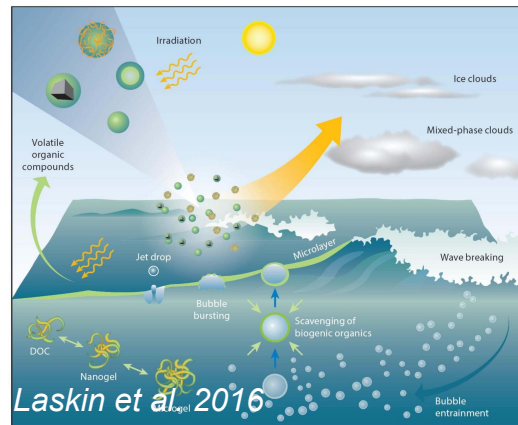
Marine aerosols and microbial processes

Leg

2

Objectives

“interplay between **microbial processes** occurring in the ocean surface, during phytoplankton blooms succession or in oligotrophic waters, and their impact on the *lower-atmosphere and cloud processes*”



Group

Rocío Loizaga
Valeria D'Agostino

CESIMAR Pto. Madryn



Ariadna
Nocera



Analysis

Marine trophic webs... Zooplankton & marine mammals

Leg

1



<https://en.lamama.com.ar/>

Mesozooplankton classified and counted!

[Including copepod species]

Groups

Pedro Flombaum
Federico Ibarbalz

CIMA Buenos Aires



Analysis

Biodiversity, ecosystem functions y climate change

Leg

1 + 2



Multiple roles

- Direction
- Coordination
- Public affairs
- Logistics - Import/Export
- Sampling

Groups

Pedro Flombaum
Federico Ibarbalz

CIMA Buenos Aires



A bloom from multiple **angles** and at different **scales**

Physics

Community

Pathogens

Chemical mediators

Sea-Atmosphere int.

Remote sensing calib.

C-fluxes

etc...



Temporal and spatial development

- Daily (Lagrangian)
- Within & between stages
- Atlantic / Global perspective with other datasets

THANKS TO MULTIPLE INSTITUTIONS AND PEOPLE



THANKS FOR YOUR ATTENTION