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TAKING THE PULSE OF OUR PLANET FROM SPACE

Marine heatwaves in the Southeast Pacific Ocean

An overview over the last 40 years and a focus on a 5 months marine heatwave

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What are marine heatwaves?

Anomalously warm water events

Formed due to processes

- **Atmospheric**
- **Oceanic**

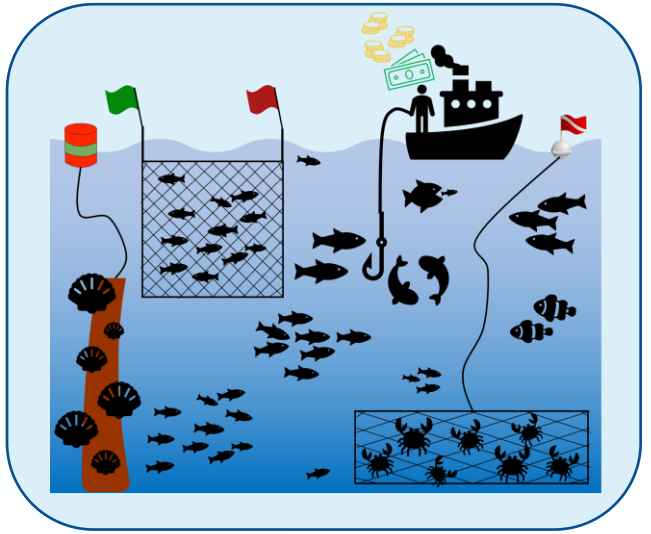
Recently studied

↓

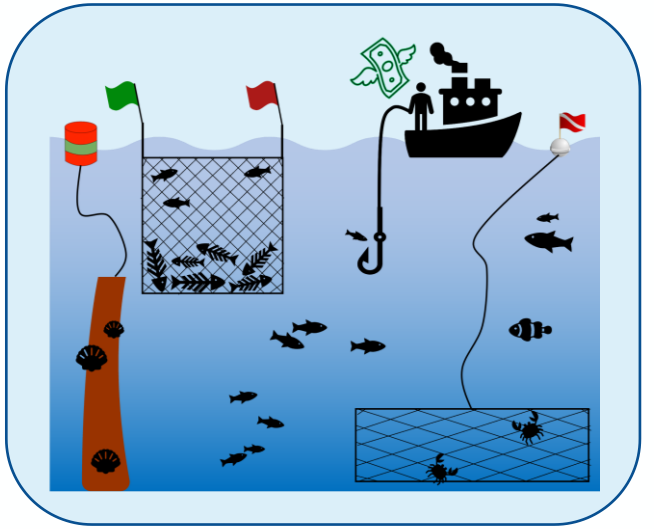
Amplification linked to human induced global warming

Devastating consequences

Before a MHW



During a MHW



Objectives

1st part:

To study MHWs at large scale:

the Southeastern Pacific (offshore Central and South Chile)

2nd part:

To study MHWs at smaller scale:

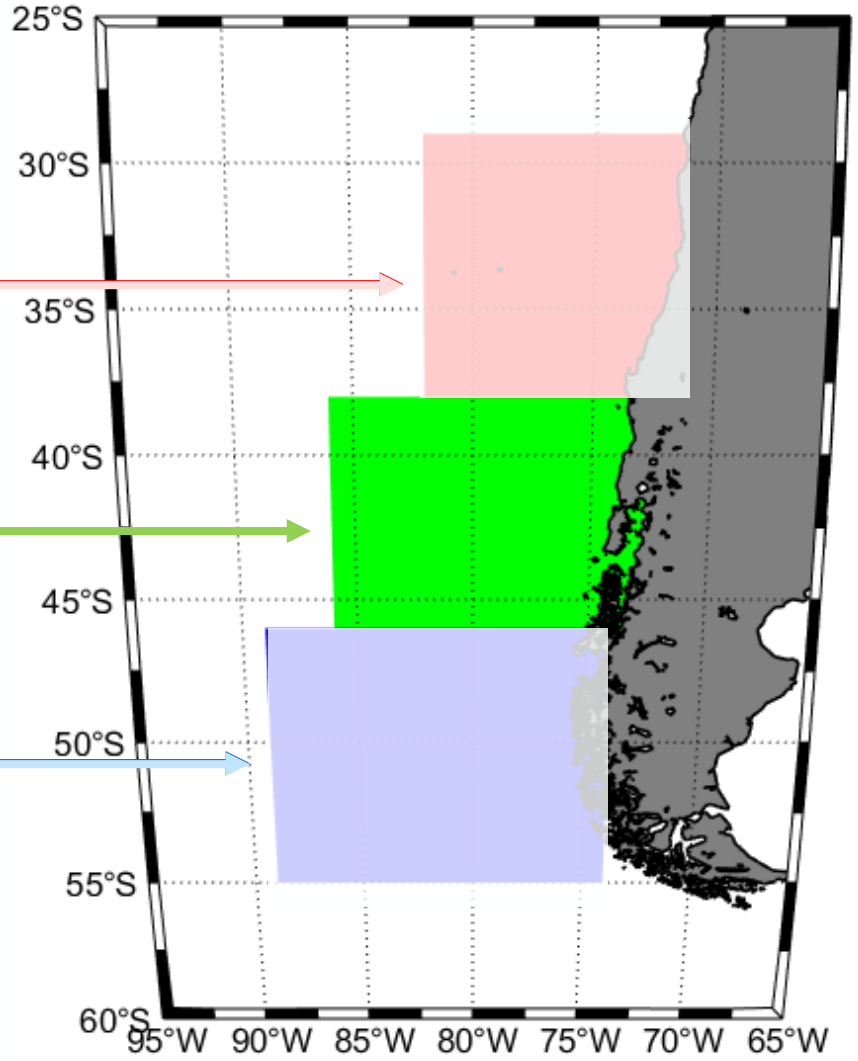
the inner Sea of Chiloé

Study area

Central Chile

North Patagonia

South Patagonia



Further information: Pujol C, Pérez-Santos I, Barth A and Alvera-Azcarate A (2022) Marine Heatwaves Offshore Central and South Chile: Understanding Forcing Mechanisms During the Years 2016-2017. Frontiers in Marine Science.

Method: Detection of MHWs at large scale

How to detect MHWs?

SST
NOAA Optimum Interpolation Sea Surface Temperature (OISST)

NOAA SATELLITES

1982 to 2020 with daily resolution

Spatial resolution: 1/4 degree

heatwaveR

Schlegel and Smit, 2018

Climatology: 1982-2020

Threshold: 90th percentile

Detection of the MHWs

How were MHWs formed?

Atmospheric pressure

Winds

Heat fluxes

ECMWF ERA5

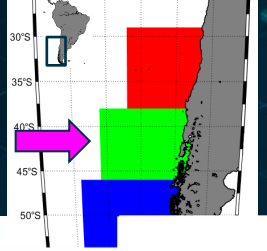
Spatial resolution: 1/4 degree

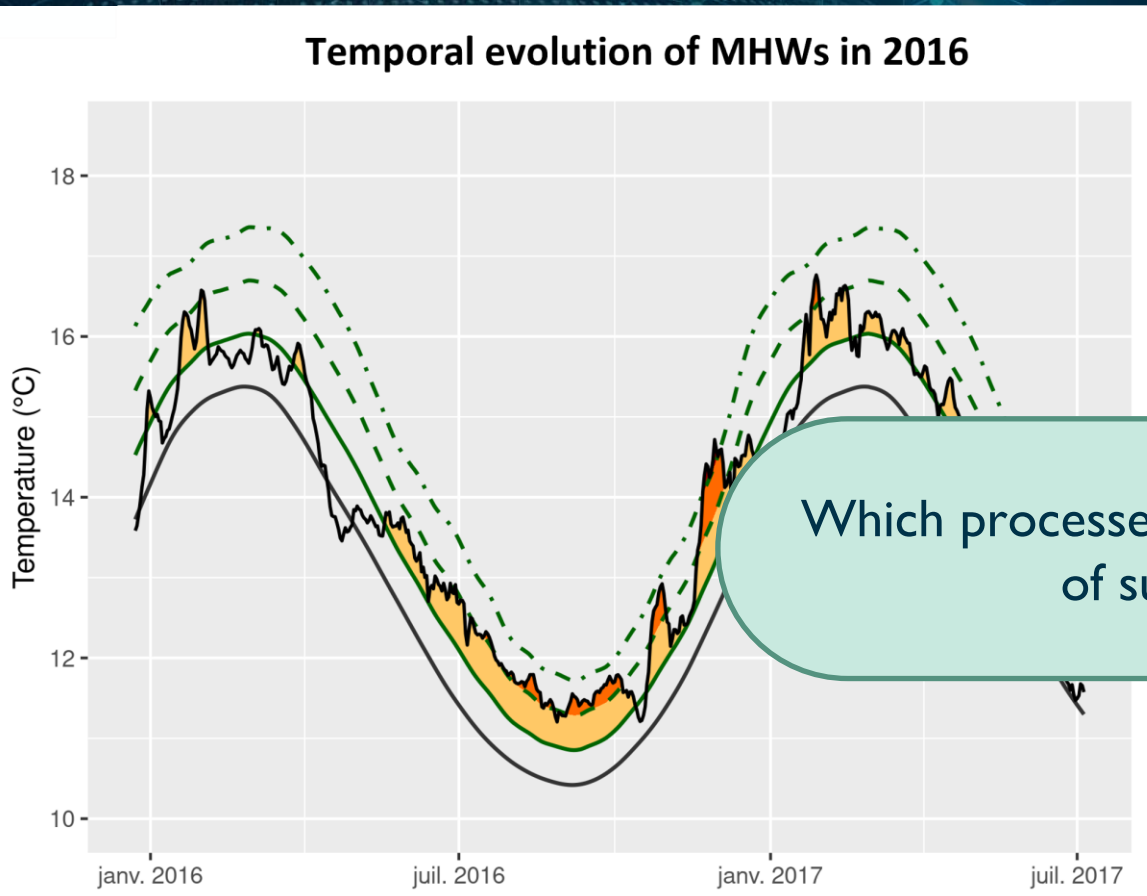
SST anomaly

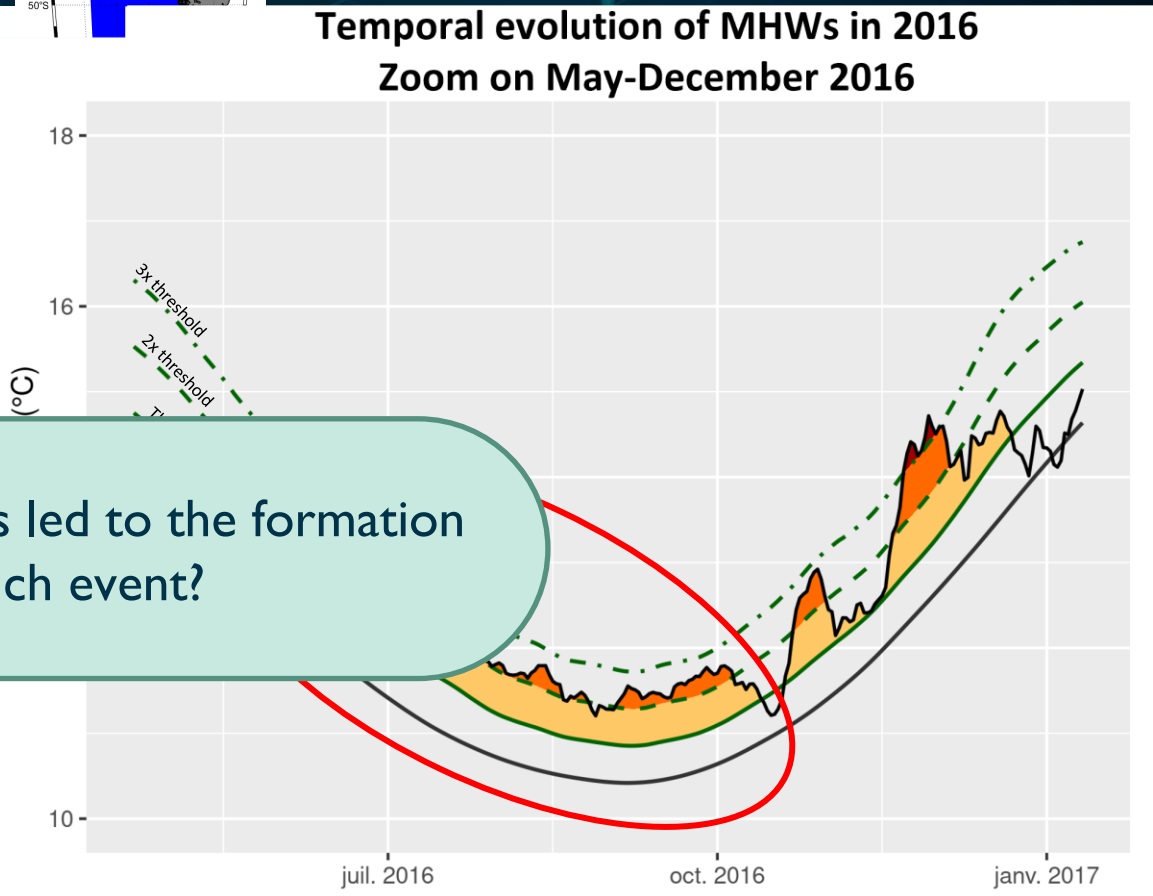
GCOM-W1 Global Change Observation Mission 1st-Water

AMSR-2 instrument
Microwave sensor

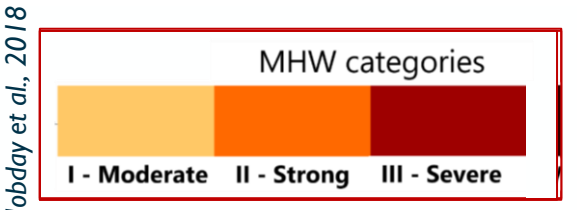
Detection of the MHWs







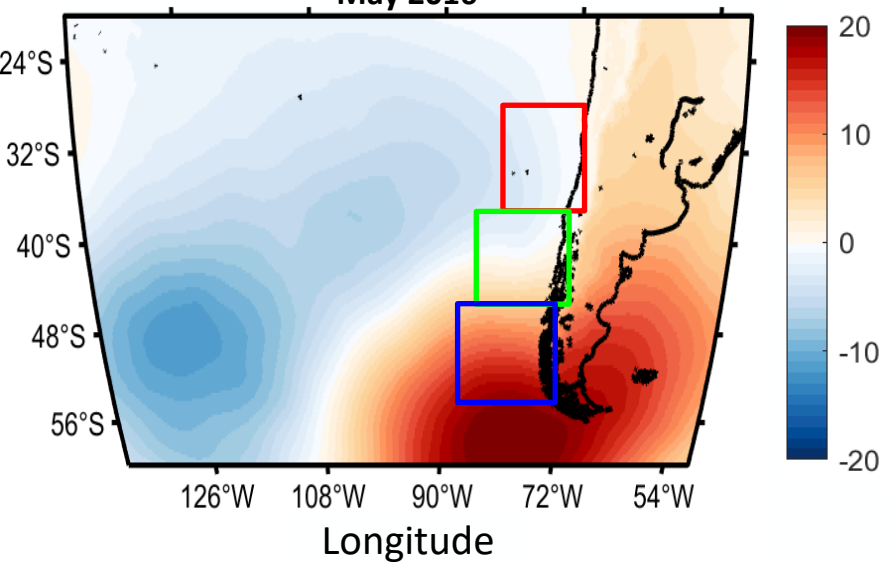
Which processes led to the formation of such event?



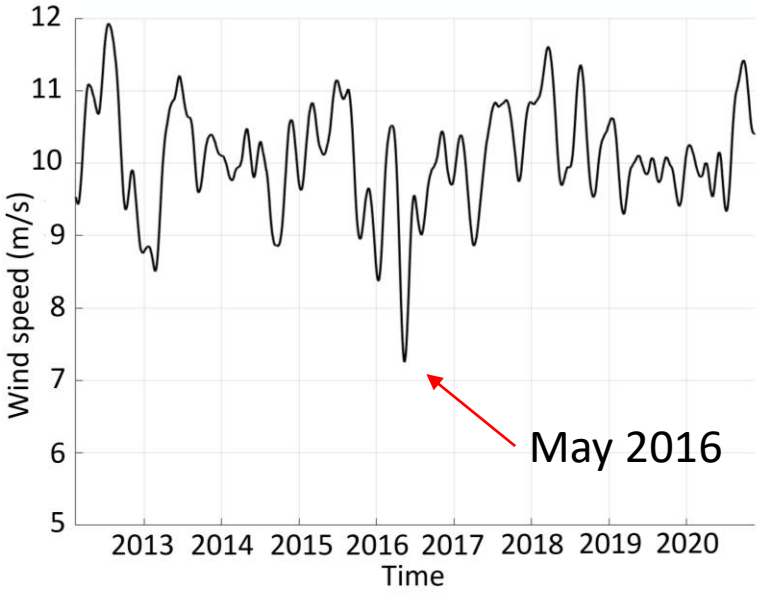
Hobday et al., 2018

Atmospheric processes involved

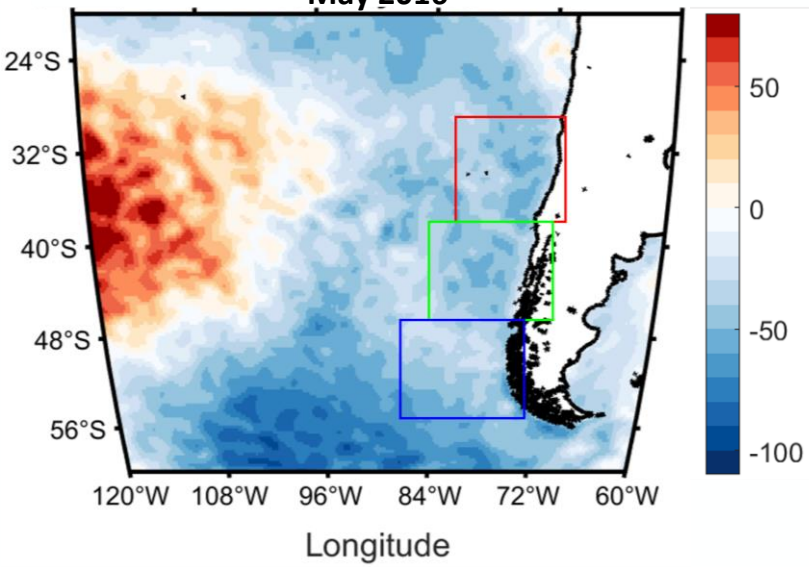
Sea level pressure anomaly (hPa)
May 2016



Wind speed (m/s) in the South Patagonia



Heat transfer anomaly from the ocean to the atmosphere (W/m²)
May 2016



High pressure system → **Reduced winds** → **Weaker heat transfer**

MHW !

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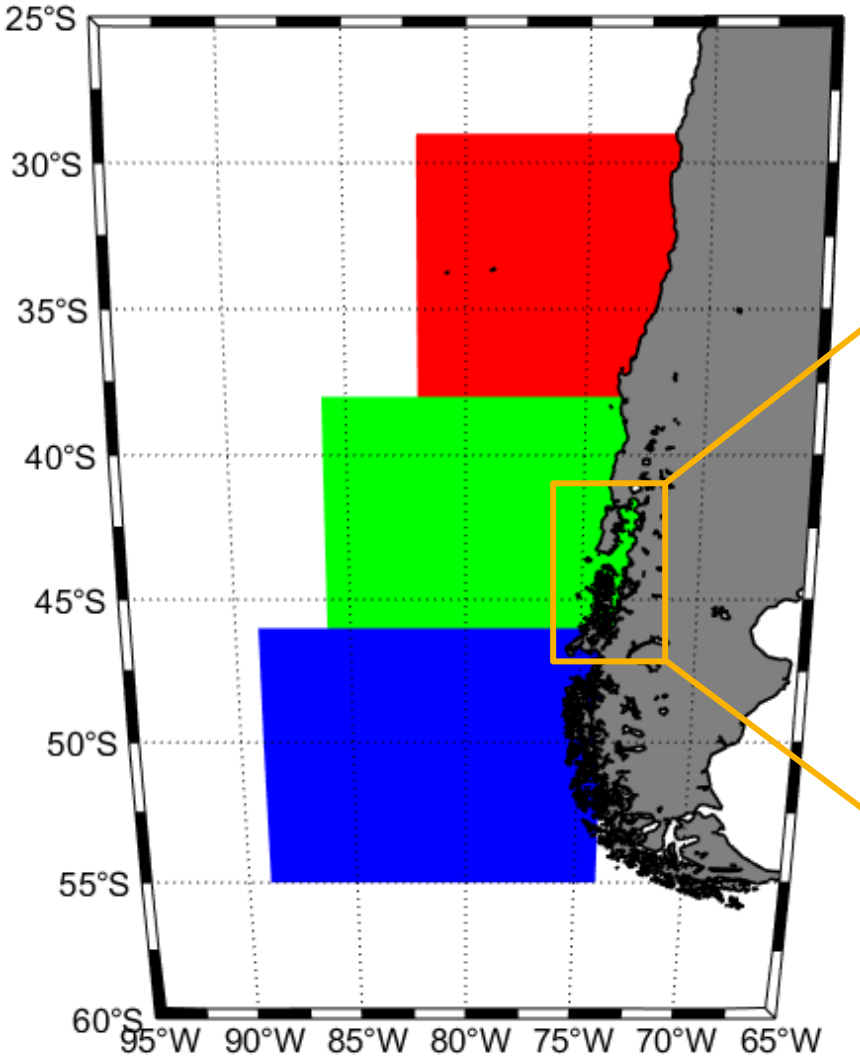
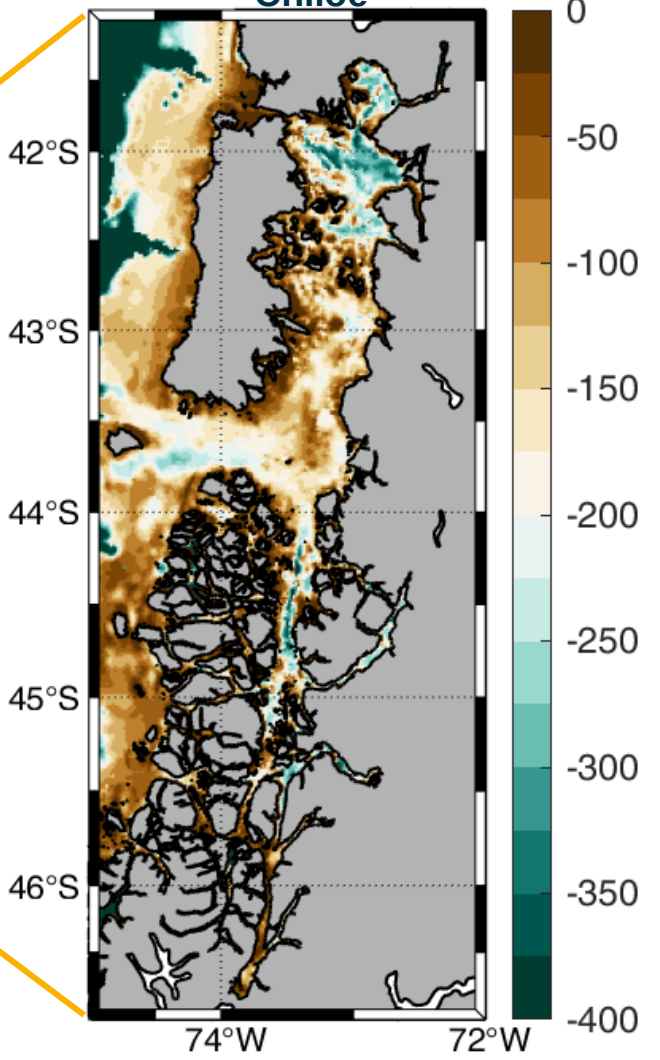


Bathymetry (m) in the Sea of Chiloé



First step: Build a monthly climatology of the sea temperature

Only in situ data used for interpolation

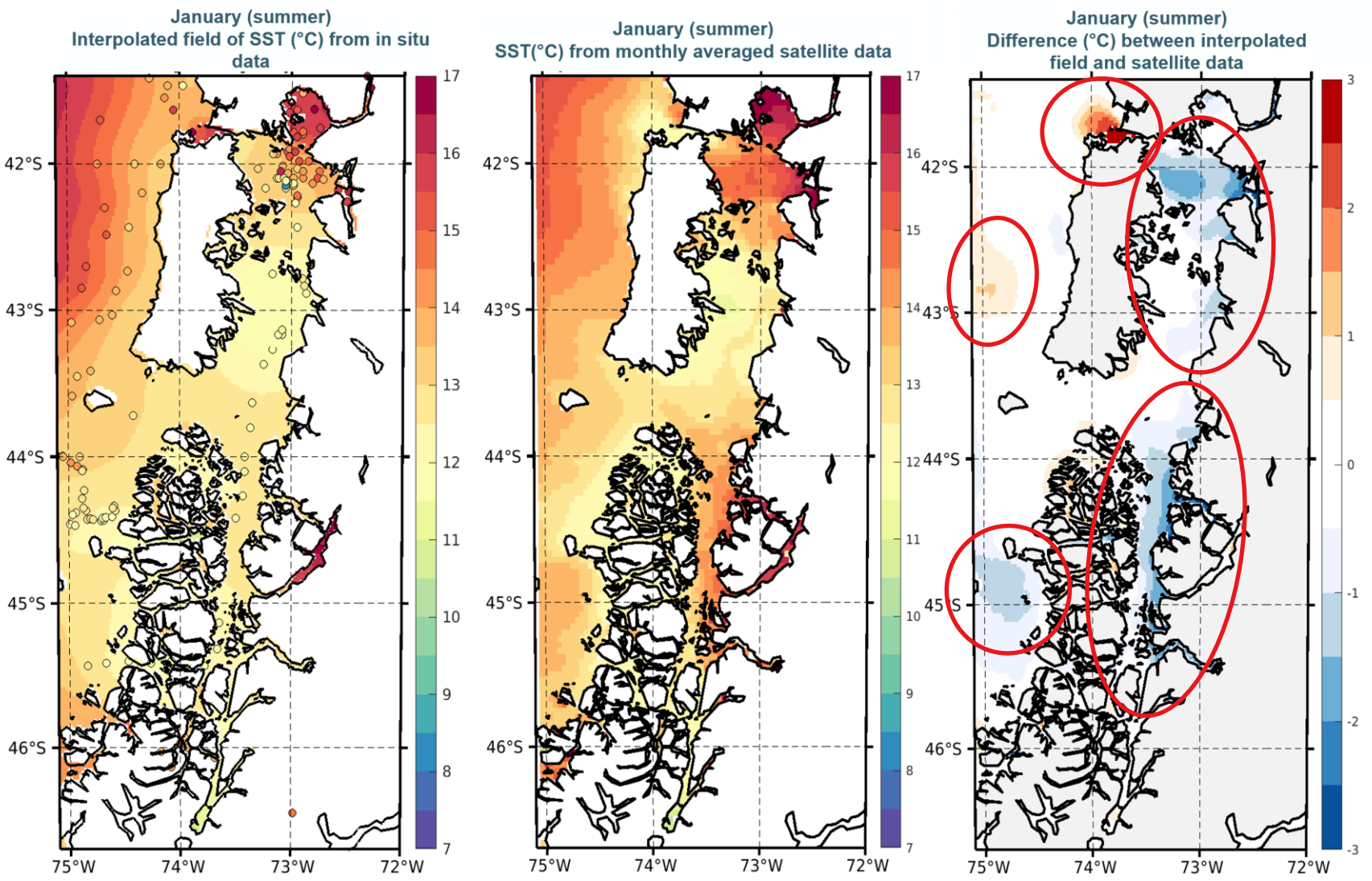
Data:

In situ from 1950 to present

Reconstruction of the field

Interpolation with DIVA (Data-Interpolating Variational Analysis; Troupin et al., 2014) → resolution 0,02°

Problem: lack of data in some parts of the sea



First step: Build a monthly climatology of the sea temperature

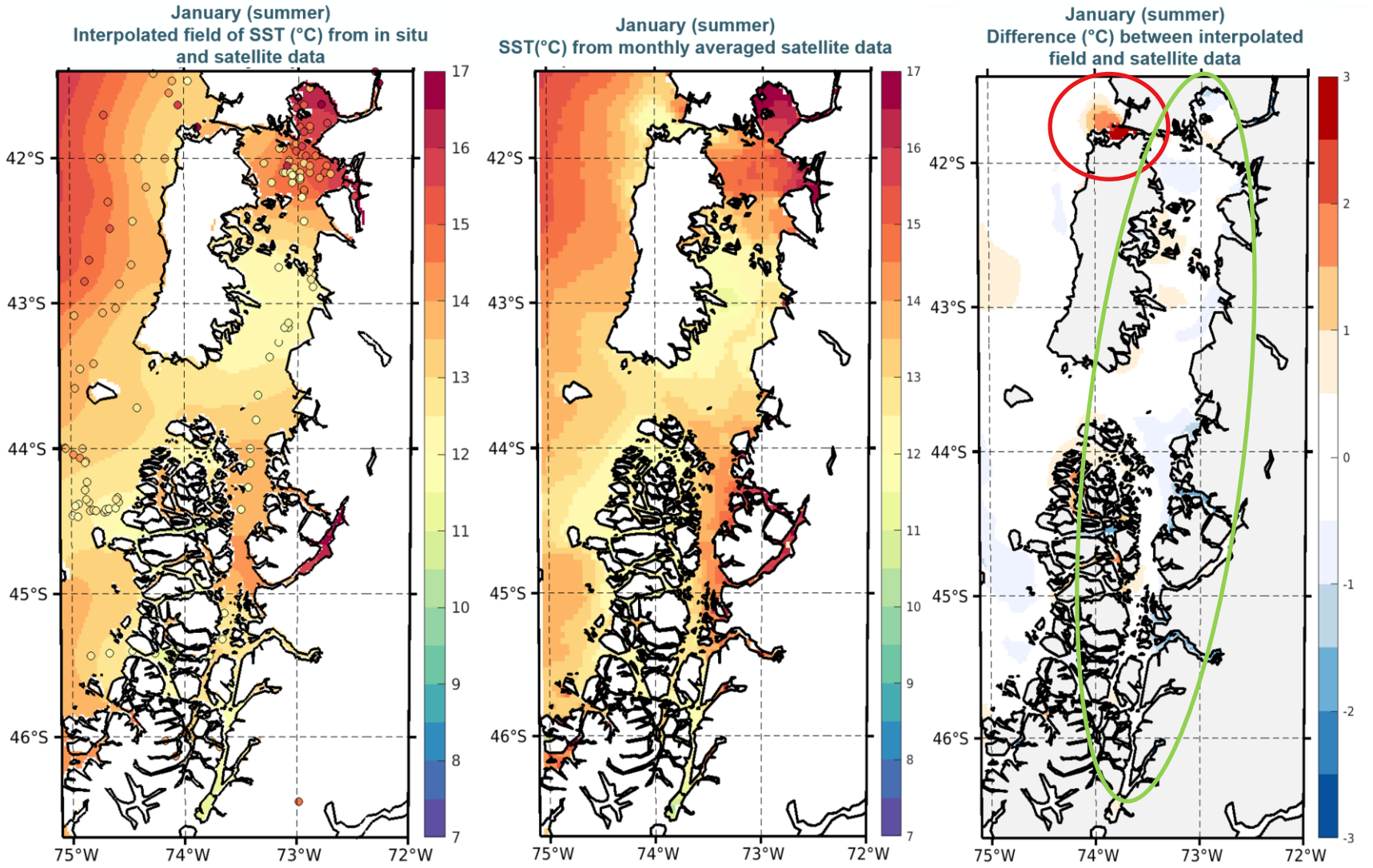
in situ
+ satellite data
used for interpolation

Data:

In situ from 1950 to present

+

Monthly averaged satellite SST (MODIS/Aqua; resolution 4km) over the last 20 years (only 36 satellite points per 100km² and per month are selected)



Ongoing work…

Improve the climatology

Detect the MHWs in the Sea of Chiloé

Connection between MHWs offshore Chile and inside the sea ?

Impacts of MHWs on ocean properties