Physical and biological effects of the 2014-2015 northeastern Pacific's climatic anomaly on northern Baja California Peninsula, diagnosed by a numerical NPZD model

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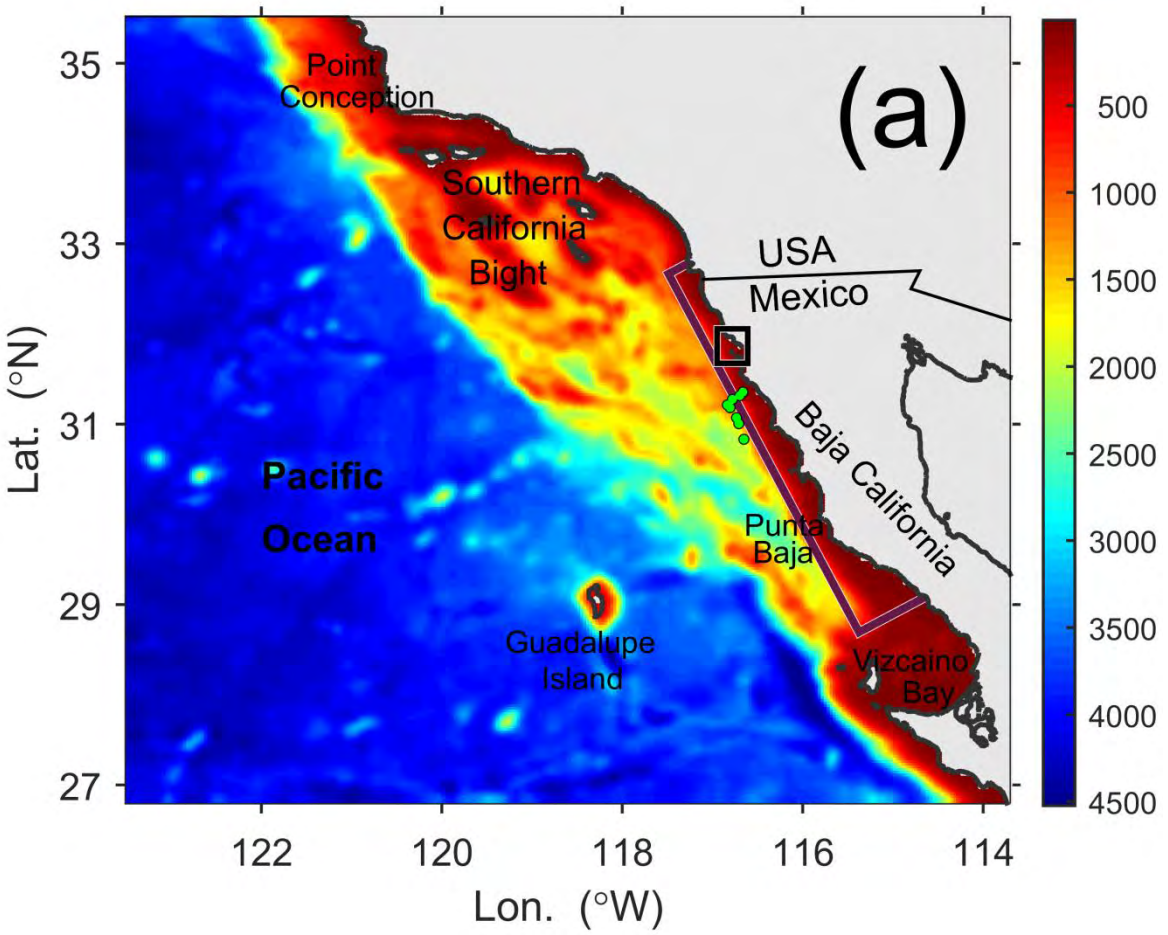
The numerical model

Modeling shelf dynamics off Baja California:



- ROMS
- 3 km resolution
- 31 levels in the vertical
- Realistic bathymetry and forcing
- Multi-year simulation

- A nutrients-phytoplankton-zooplancton-detritus (NPZD) was included

Interannual variability 2004-2011

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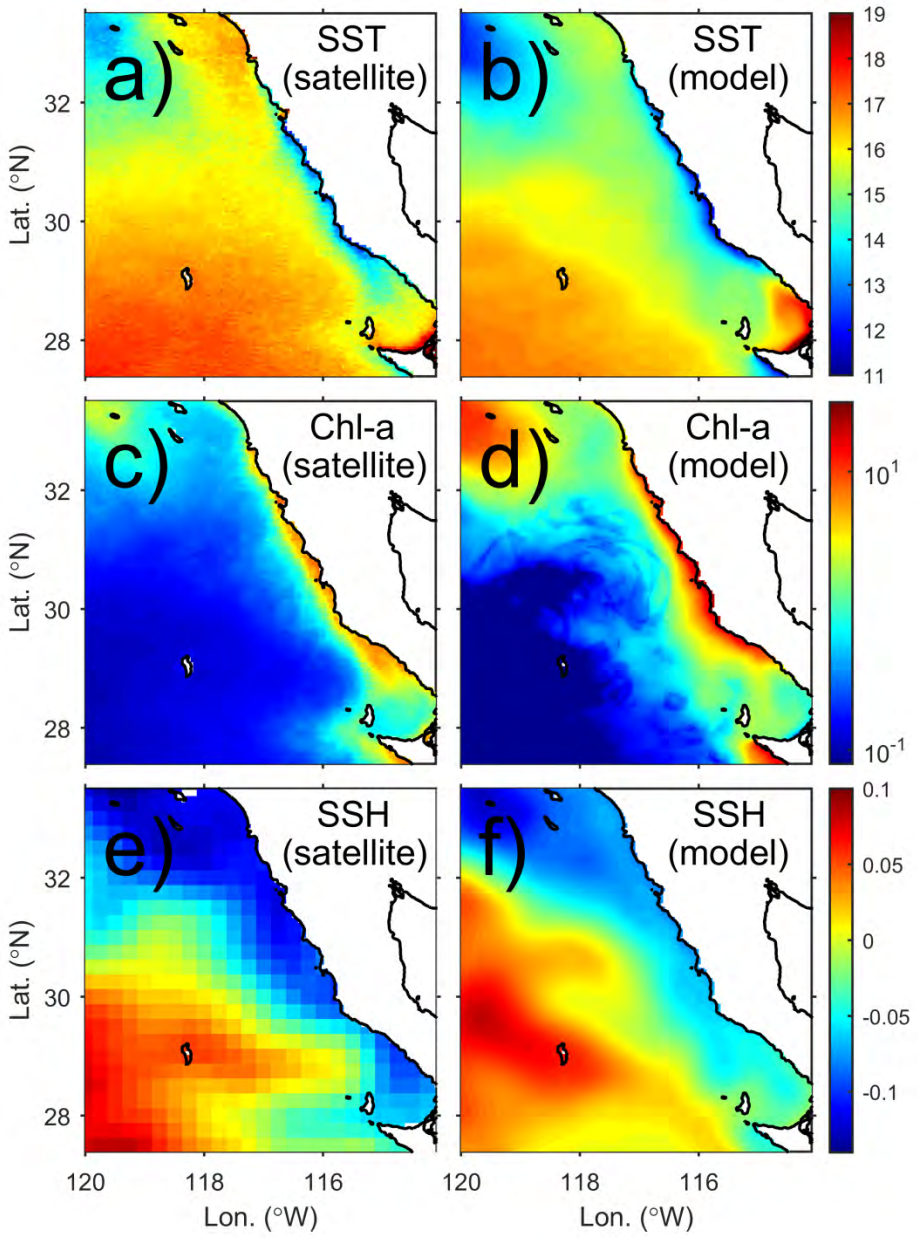

- The main oceanographic features are reproduced
- Shelf dynamics consistent with the observations
- Focus on Baja California shelf

(Cruz-Rico & Rivas, 2018)

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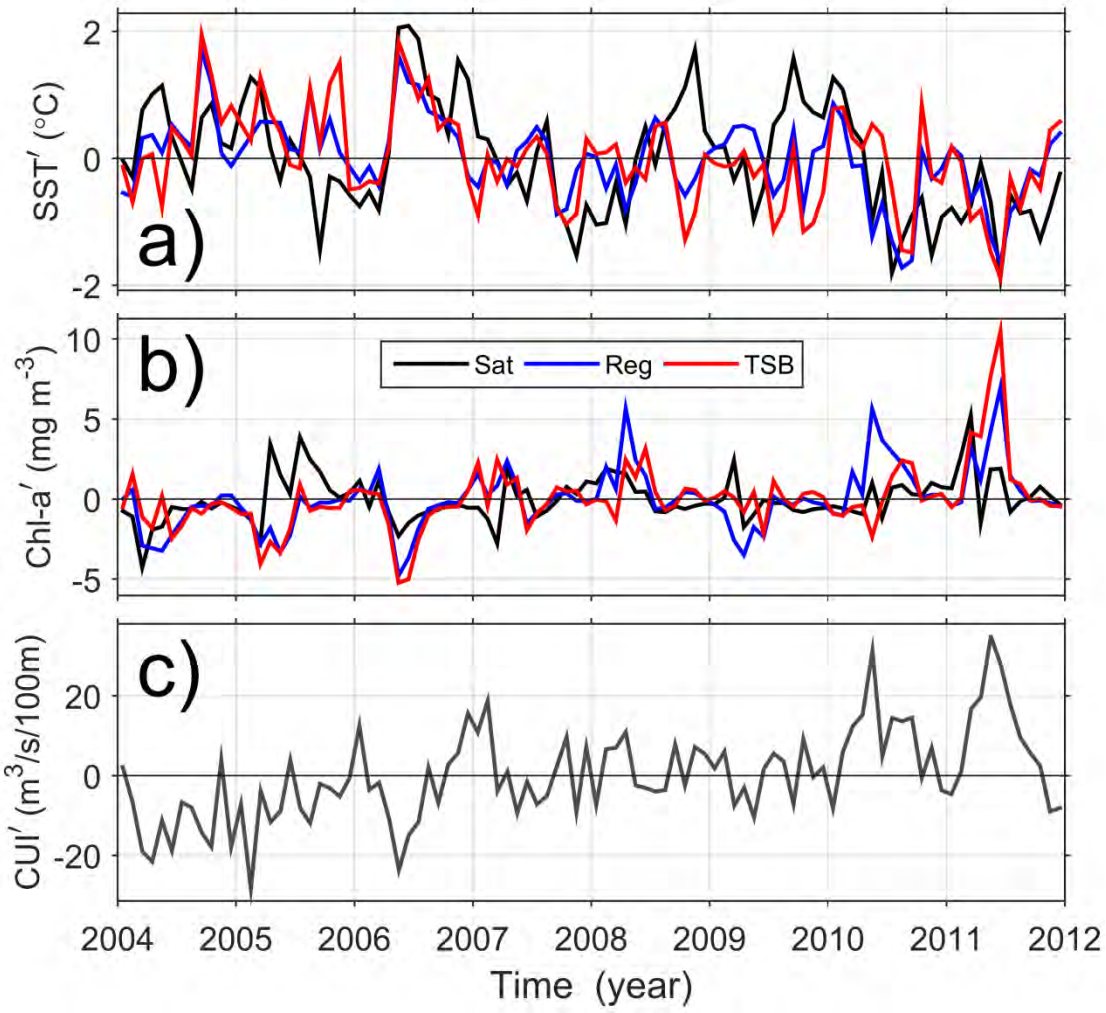
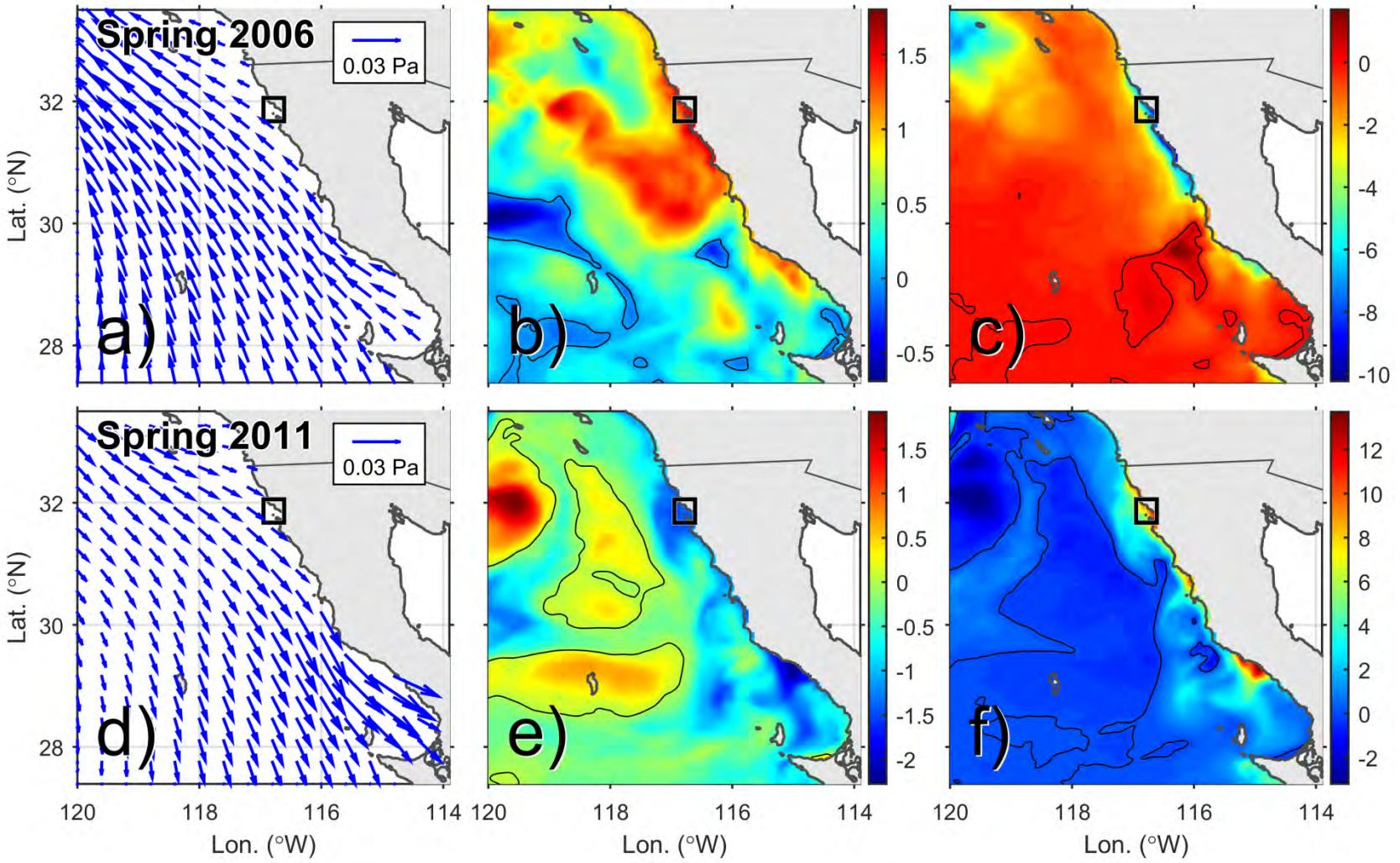


- Analysis of interannual variability (2004-2011)
- Year 2006 was the warmest year
- Year 2011 was the coldest year

(Cruz-Rico & Rivas, 2018)

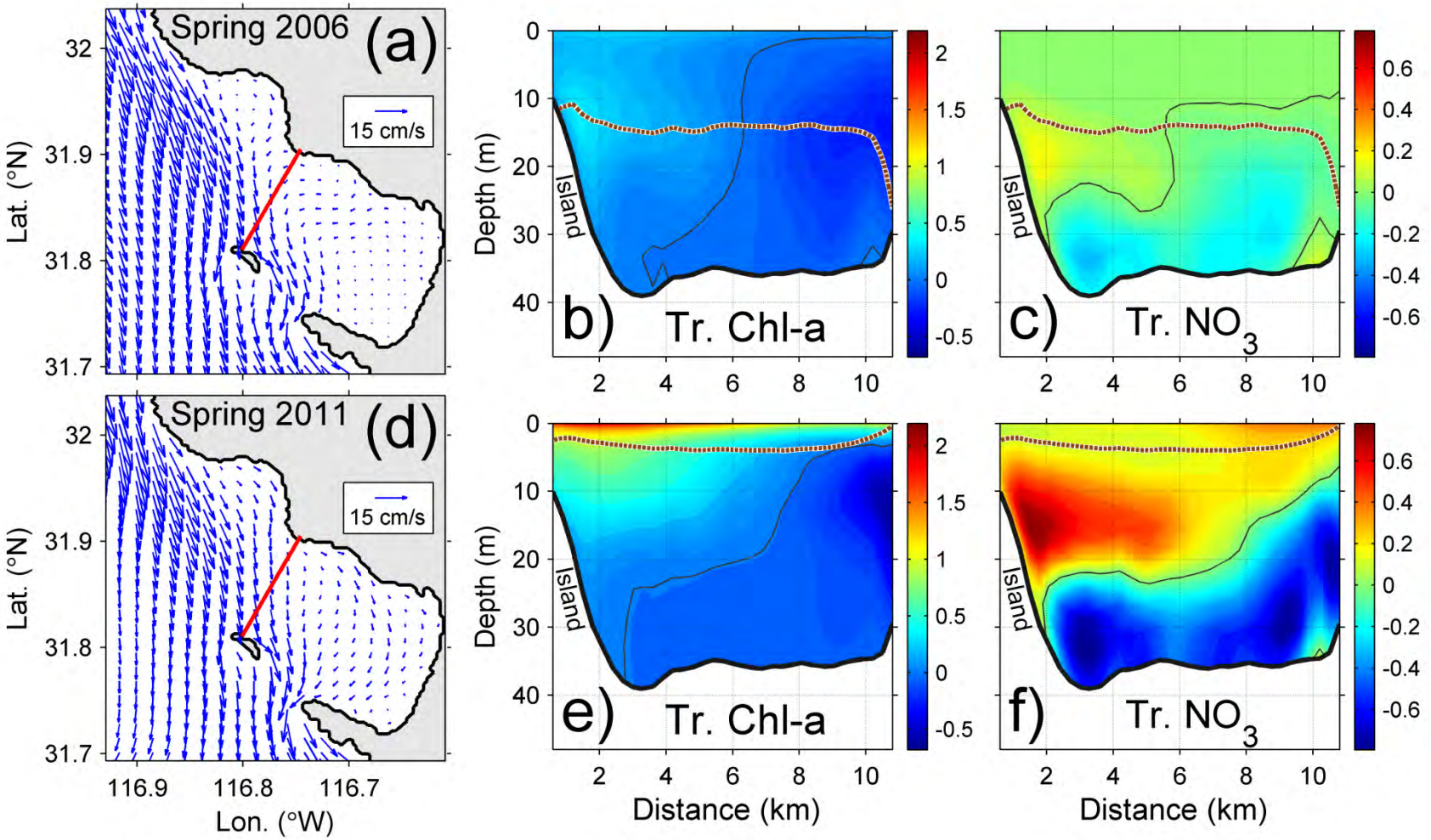
Modeling shelf dynamics off Baja California:



- Anomalies: downwelling in 2006 (warm), upwelling in 2011 (cold).

(Cruz-Rico & Rivas, 2018)

Effects on Todos Santos Bay (Ensenada):

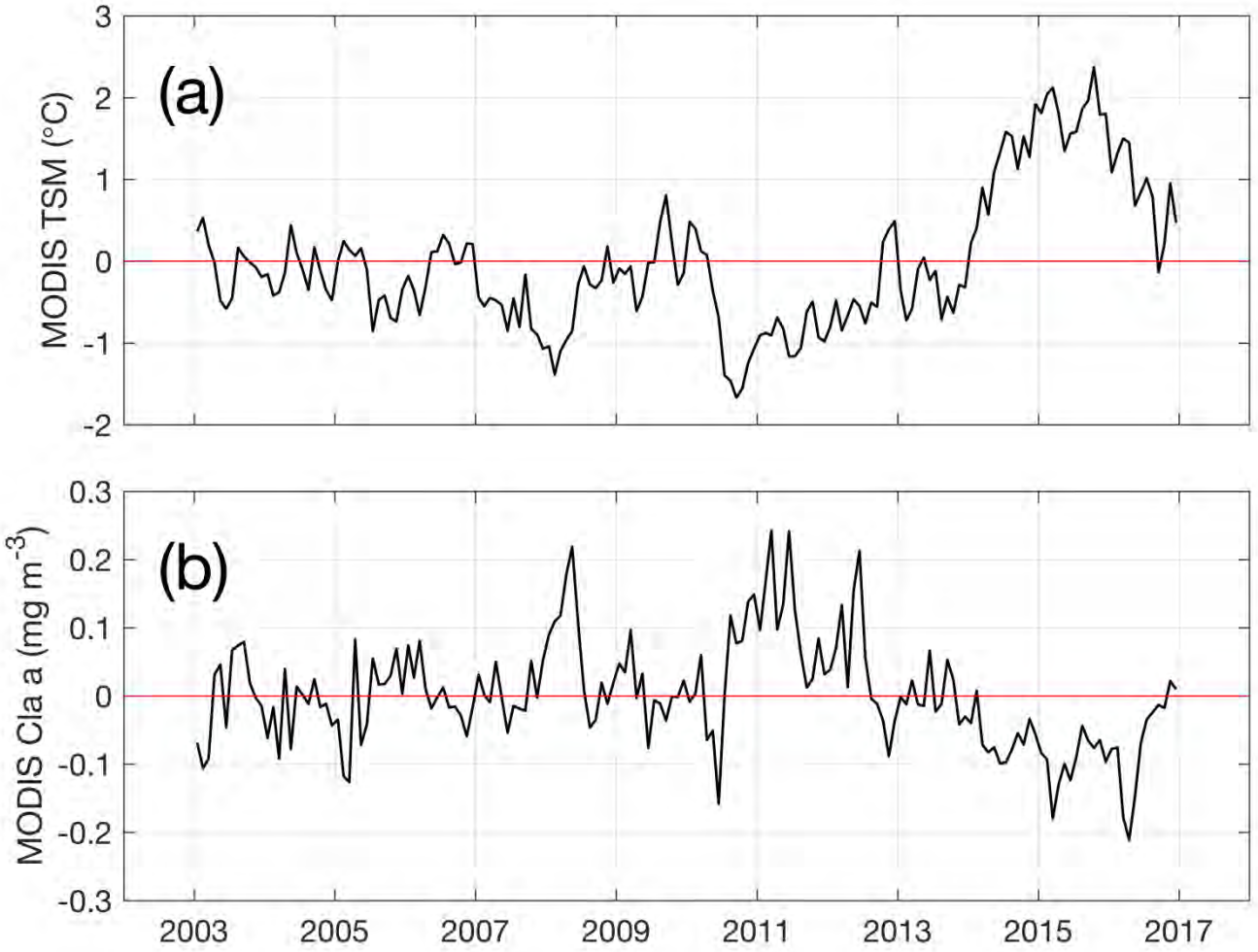


- Input of nutrients/phytoplankton: weak in 2006, vigorous in 2011.

(Cruz-Rico & Rivas, 2018)

Warm period 2014-2015

Warm period 2014-2015

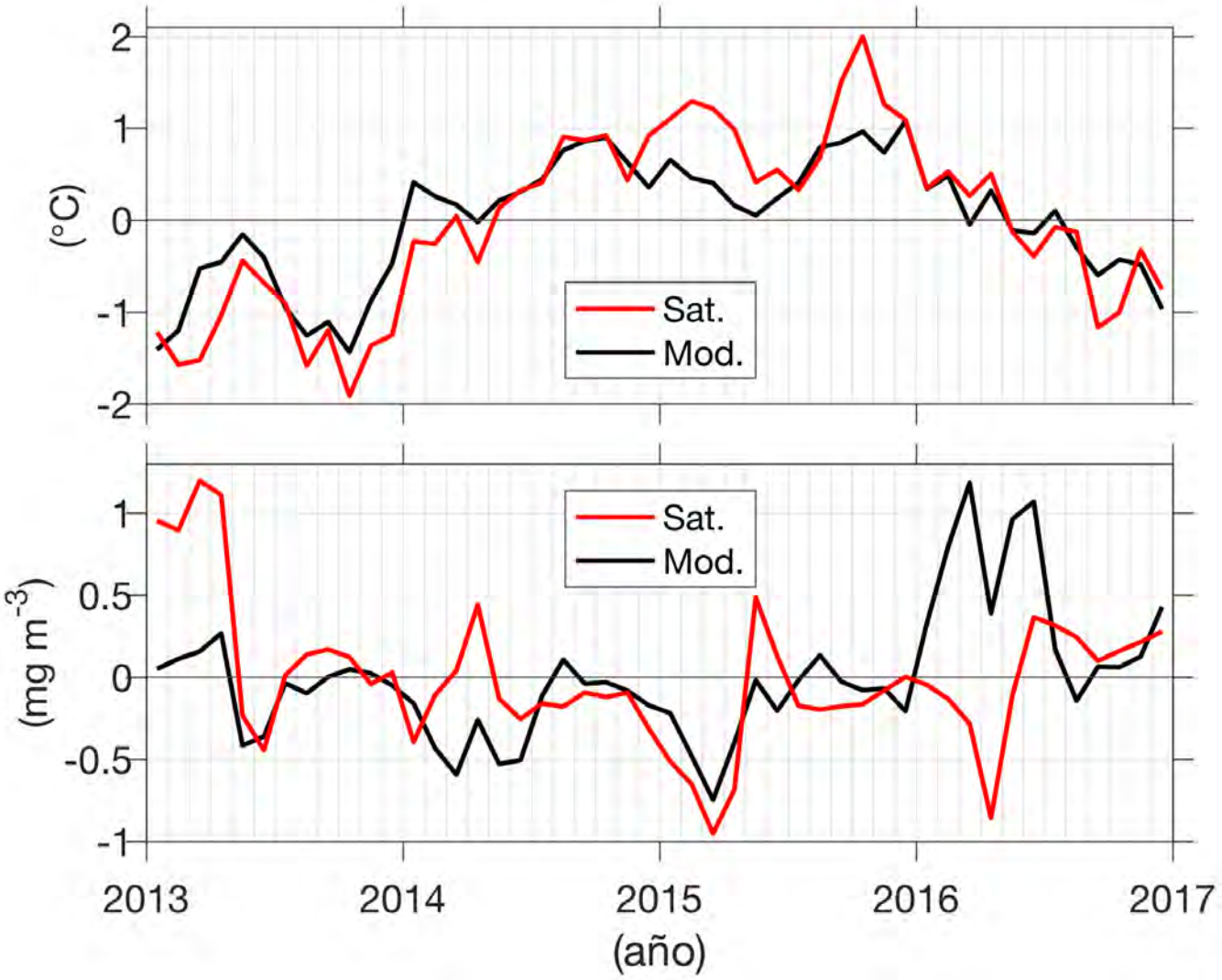


<= SST anomaly (averaged in the BC's shelf)

<= CHL anomaly (averaged in the BC's shelf)

- The anomalous warm period started in 2014.
  - CHL was remarkably low.

Warm period 2014-2015

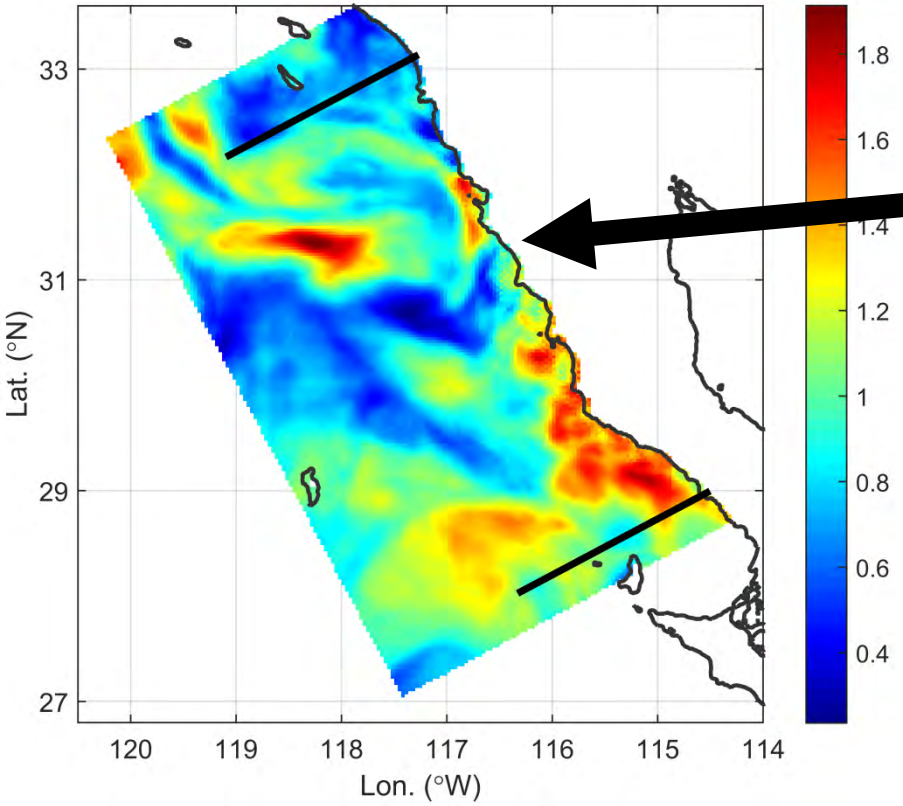


<= SST anomaly (averaged in the BC's shelf)

<= CHL anomaly (averaged in the BC's shelf)

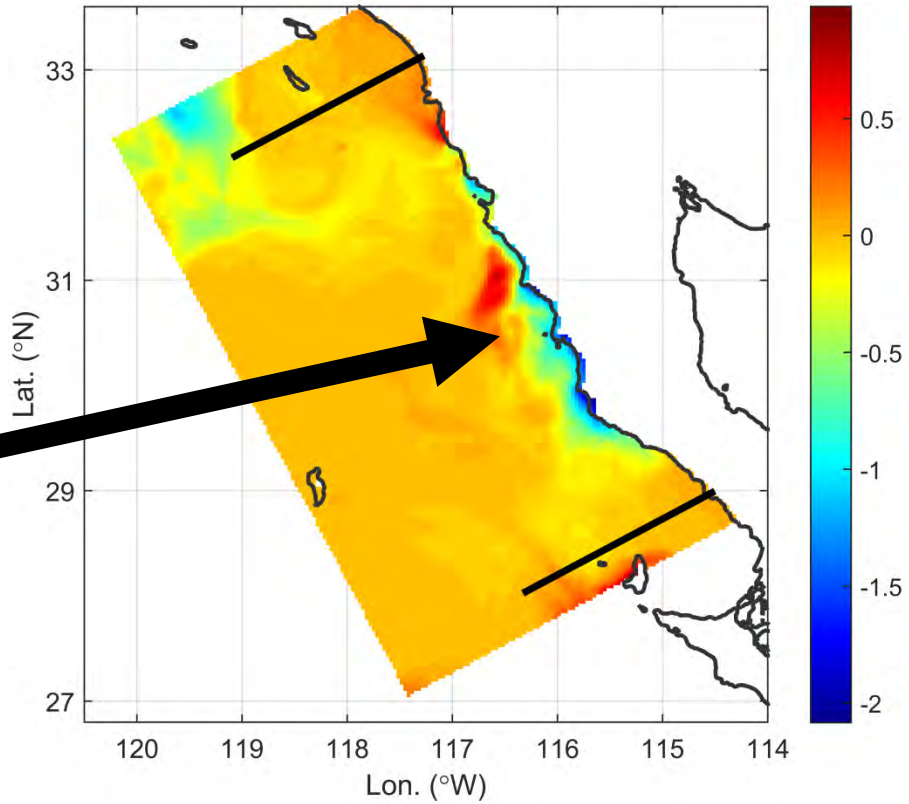
- The anomalies are seasonably reproduced by the model

Warm period: October 2015

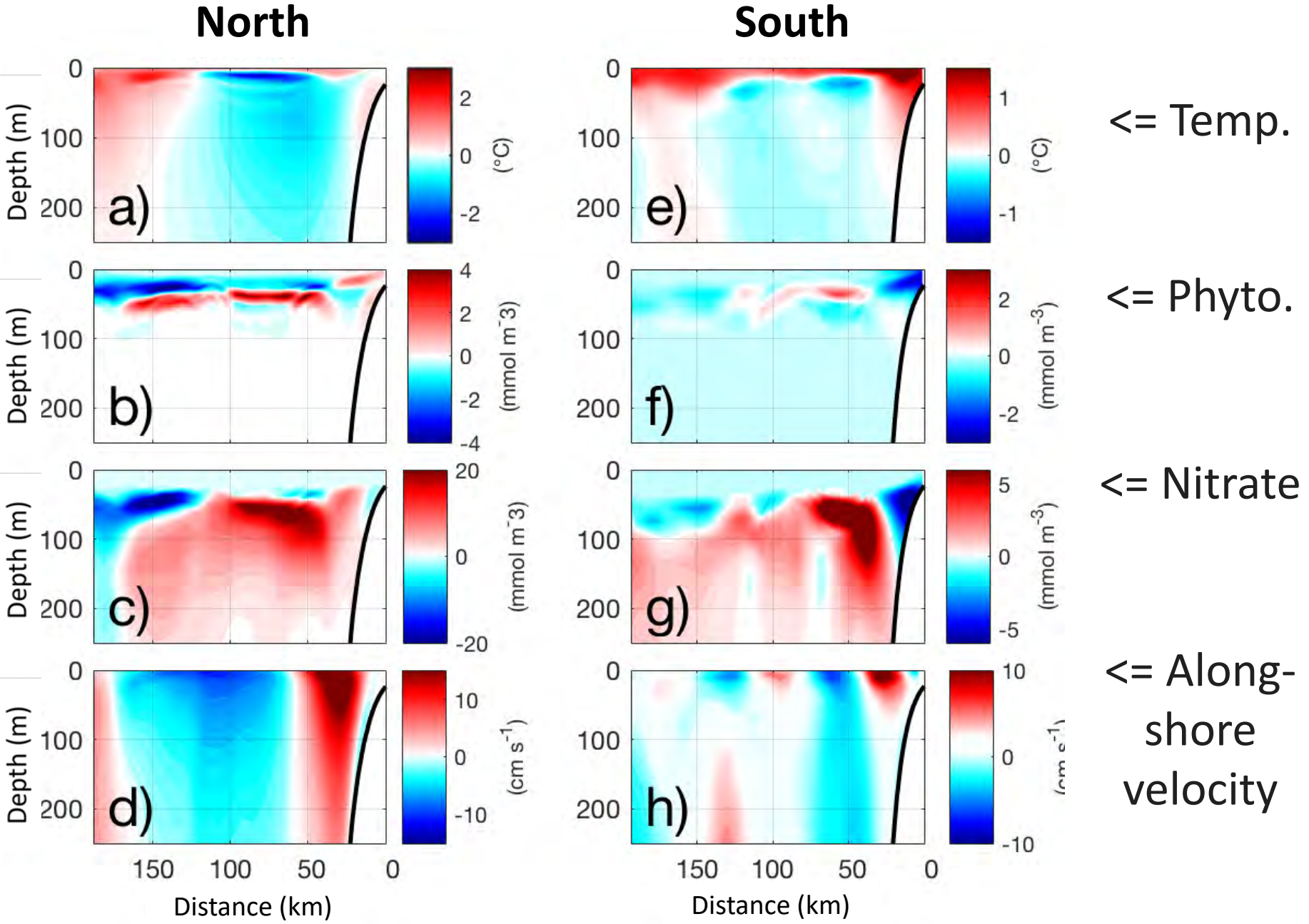


Positive SST anomaly

Negative CHL anomaly



Warm period: October 2015



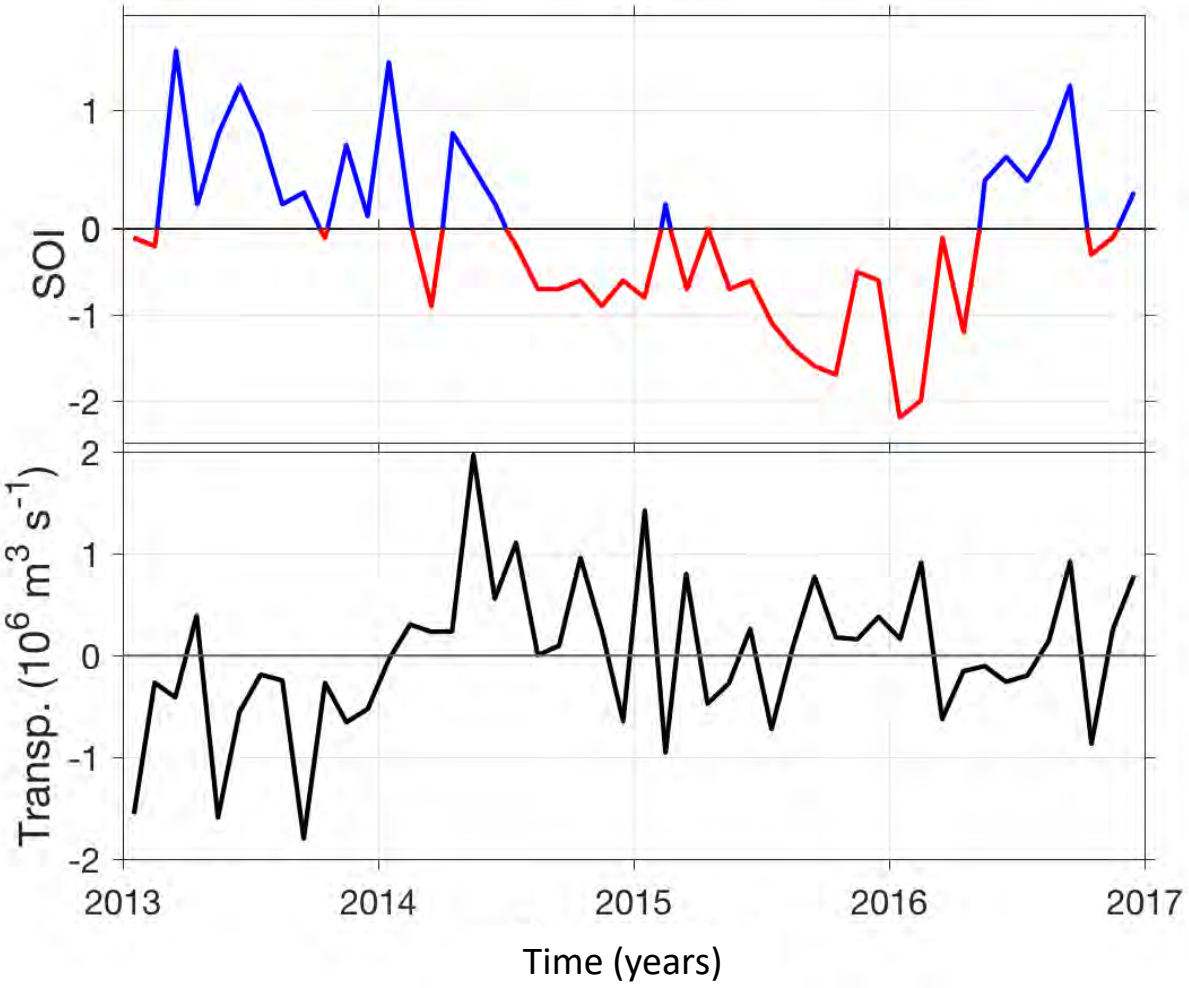
<= Temp.

<= Phyto.

<= Nitrate

<= Along-shore velocity

Warm period 2014-2015

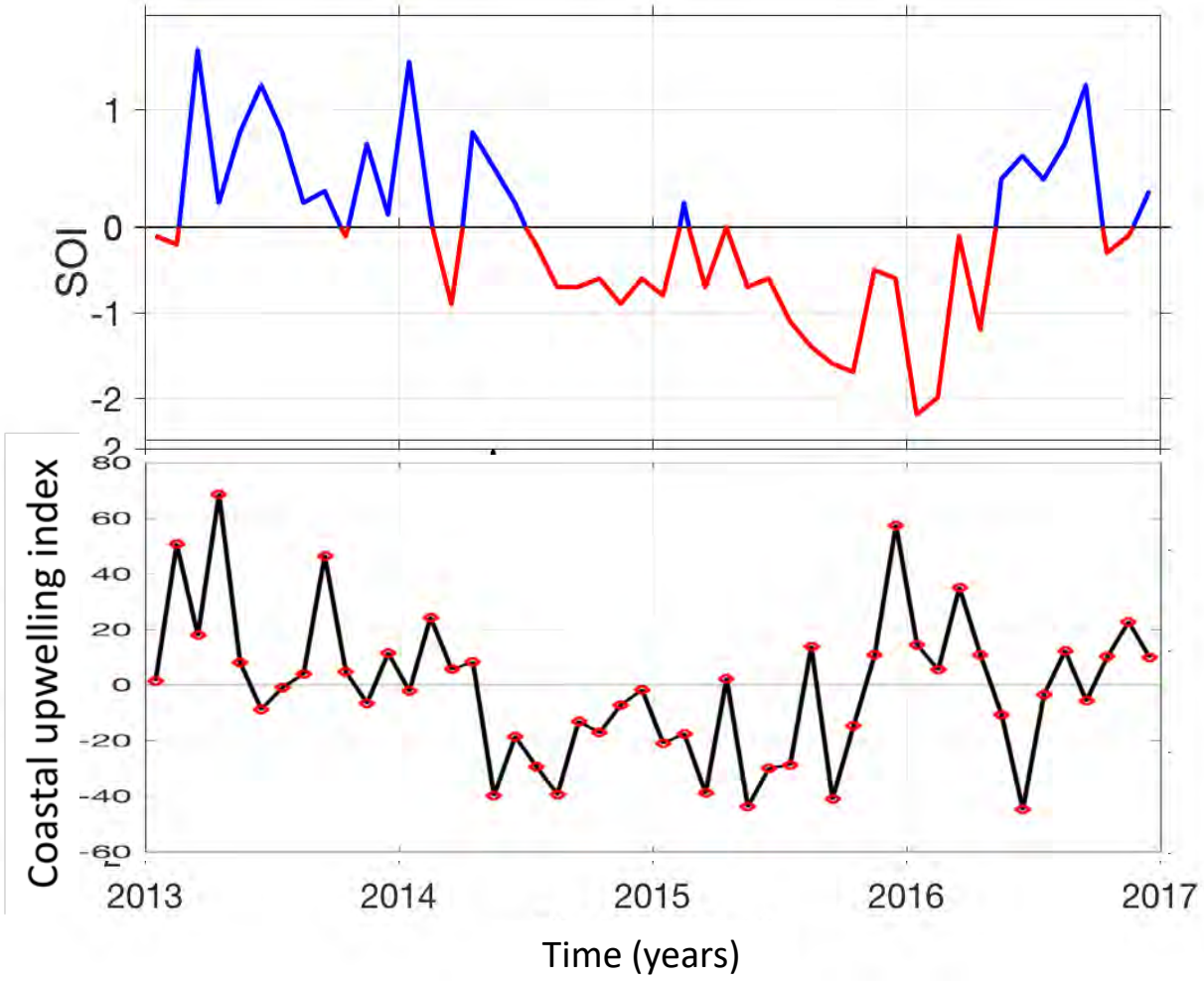


<= Southern Oscillation Index

<= Alongshore transport

- El Niño: June 2014 to May 2015 (2 years)
- Mostly northward transport during El Niño

Warm period 2014-2015



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Conclusions

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- Climatic anomalies are succesfully reproduced by a coupled physical-biogeochemical model.
- The warm anomaly modified the thermocline, the subsurface CHL maximum, and nutricline.
- Alonshore winds were weakened by the El Niño signal.
- The El Niño event was characterized by northward alongshore transports.
- According to the transports, upwelling index, and the SOI, the El Niño event lasted from June 2014 to May 2015.

Thank you for your attention

Comments/questions:

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