

Shift or increases of CO₂ sink and acidification of two polar oceans

D.Ruiz-Pino, N. Sabata, P. Coupel, H. Isbaert, A. Bianchi, V. Rerolle, V. Thailandier, M. Rafizadeh, J.B. Sallé, C. Jianfang

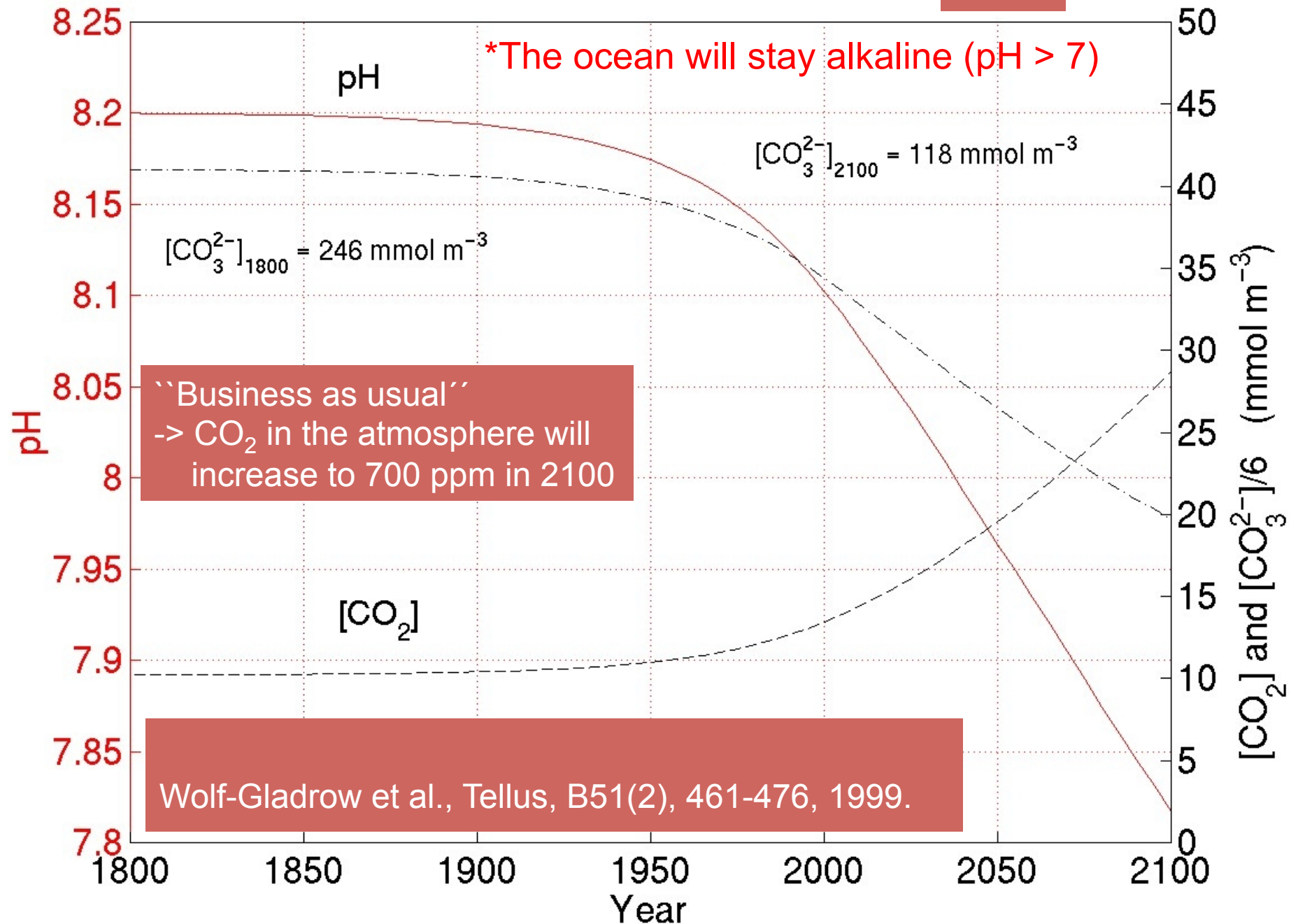
Sea ice in the Earth system: a multidisciplinary perspective

June 4-6 Brest, France

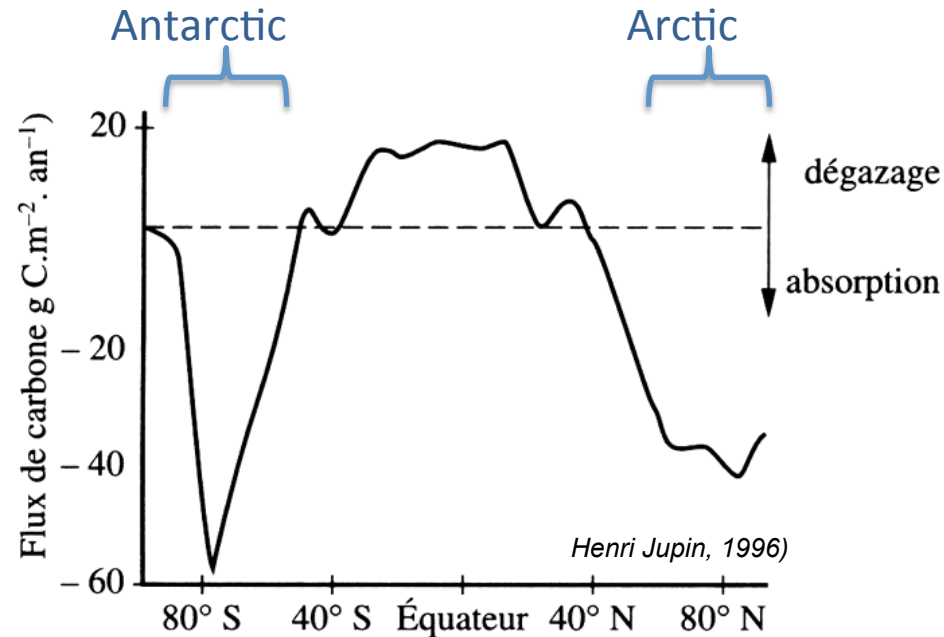


'Ocean Acidification' (OA) Faster and Higher in SO and AO

Future



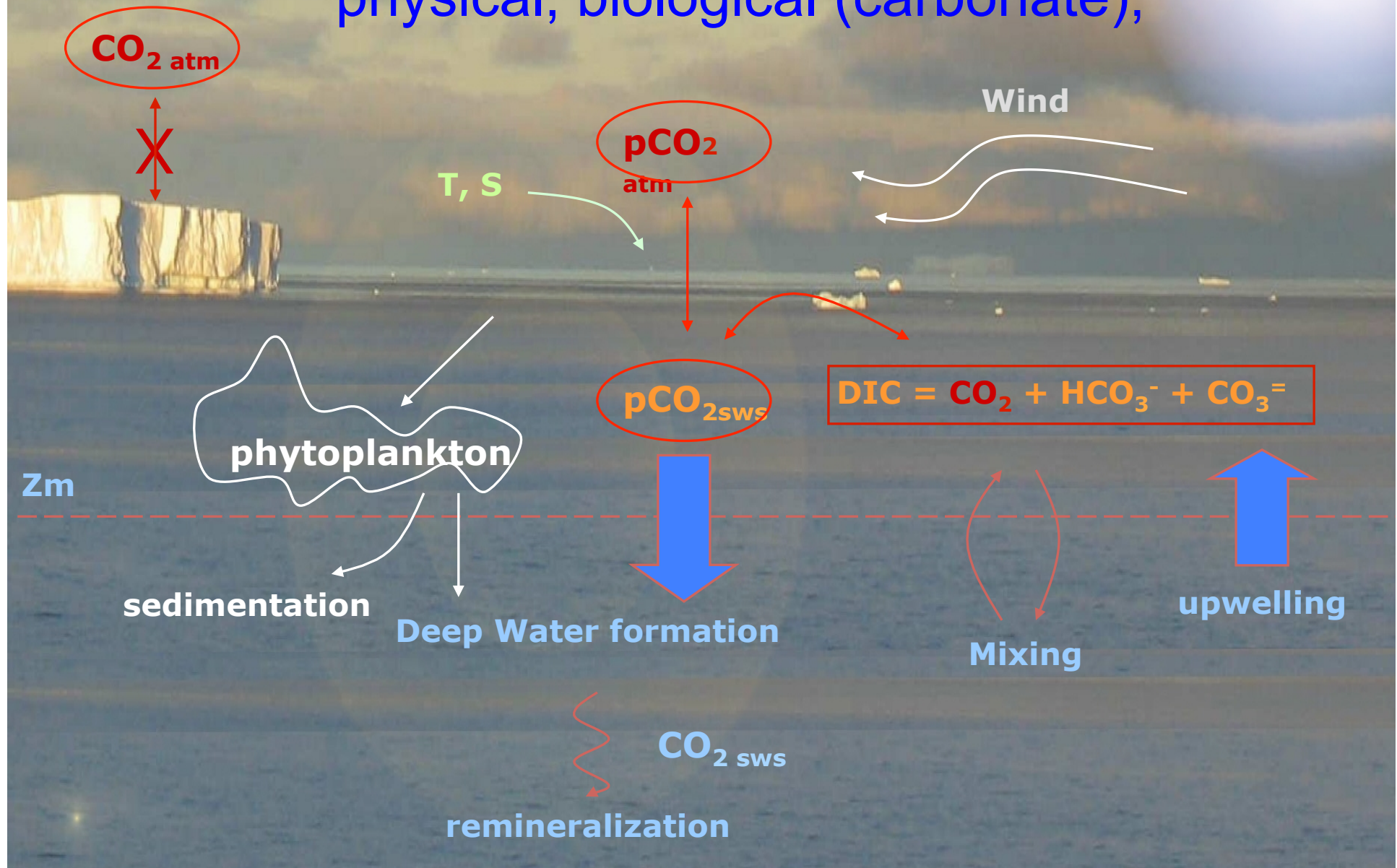
Are sea ice changes causing the same impact on the carbon biogeochemistry of two polar oceans?



- ❖ Among higher CO_2 sink
- ❖ 5-14% net uptake of CO_2 of the global ocean (Bates et Mathis, 2009)

Polar Ocean : High Sink of CO_2

Tree CO₂ pump : solubility physical, biological (carbonate),

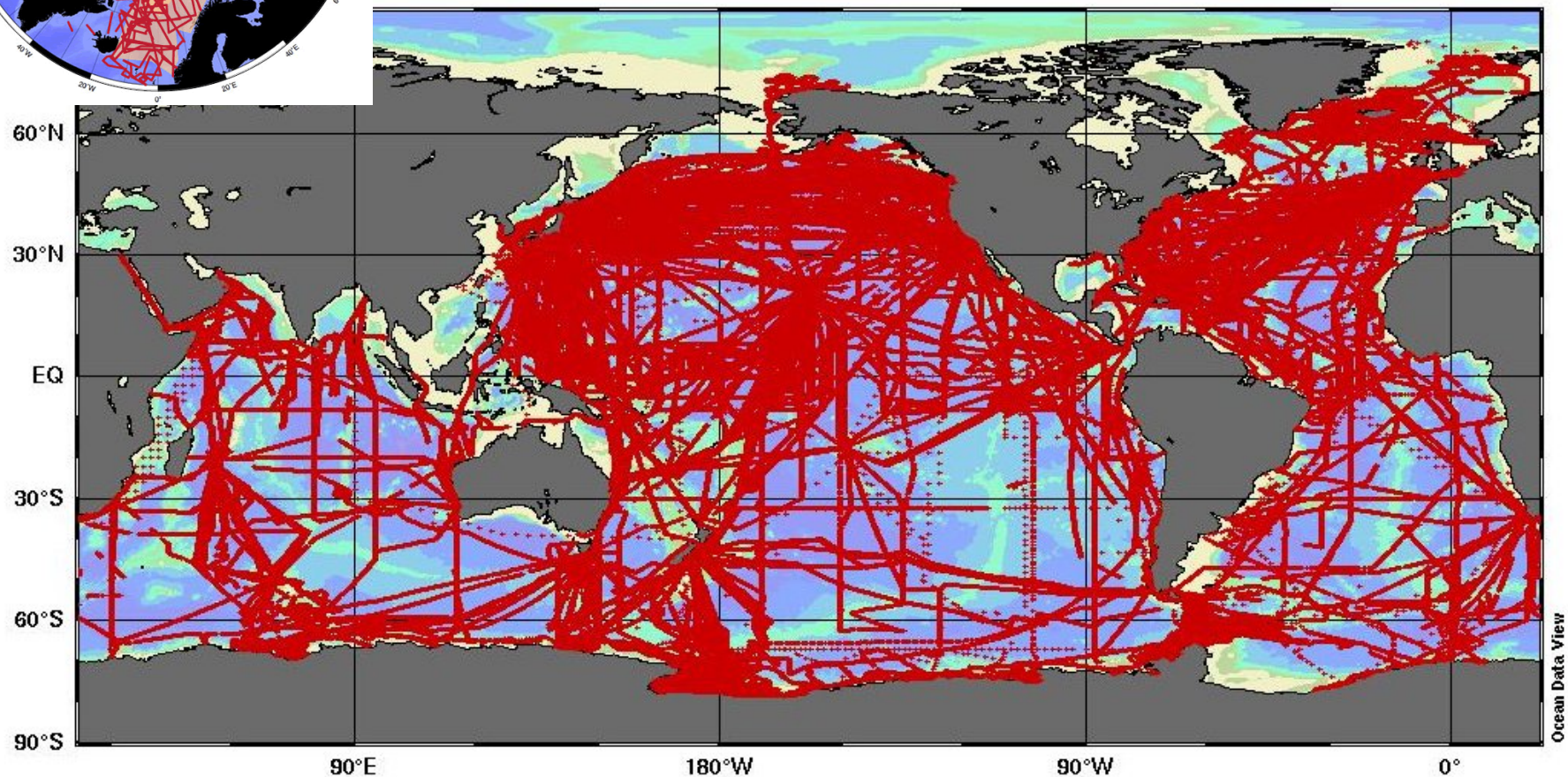
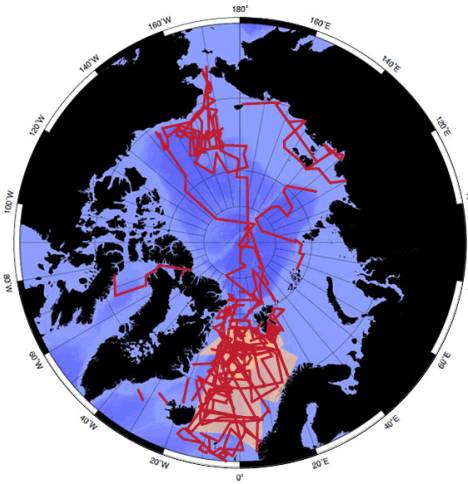


Scarcity of Carbon biogeochemistry Data

Takahashi et al. (2008)

CDIAC-SOCAT CO₂

(CARINA, 1980-2006)



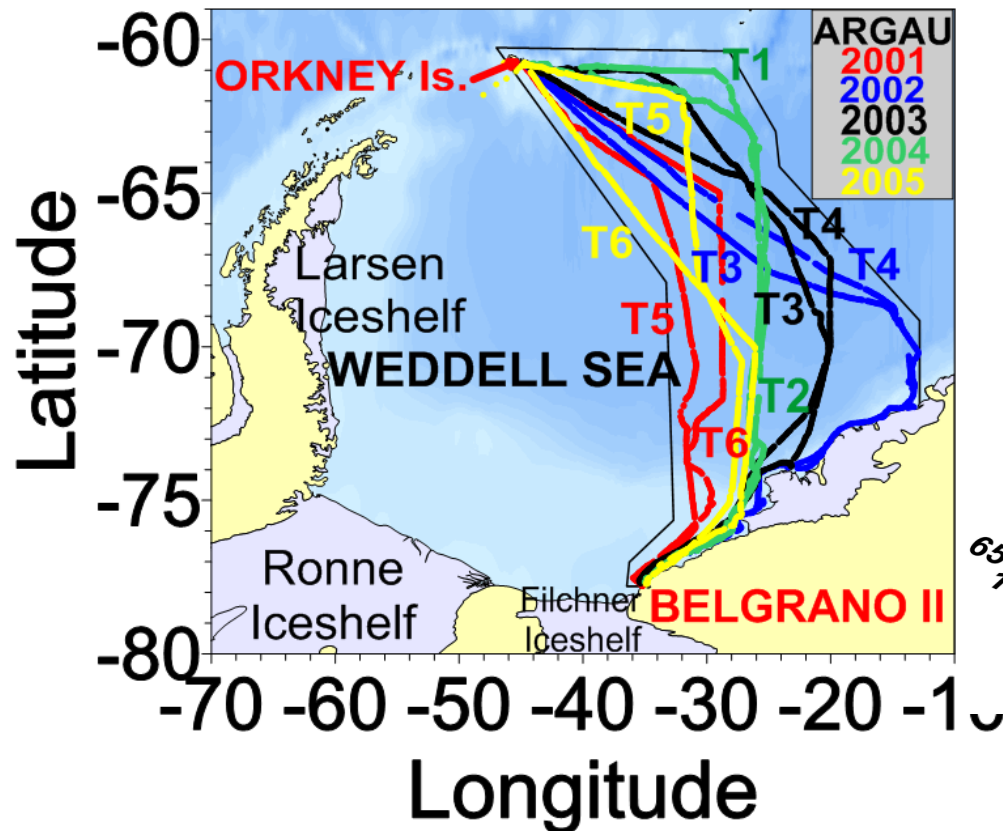
- I. What is the role of Sea Ice formation in CO₂ uptake and acidification in the most heavily covered regions of Antarctic?
- II. Is Arctic CO₂ sink, pH and phytoplankton changing as a result of the recent strong ice melting?

Tow polar zones

- **The Weddell Sea**

60°S-80°S Large MIZ

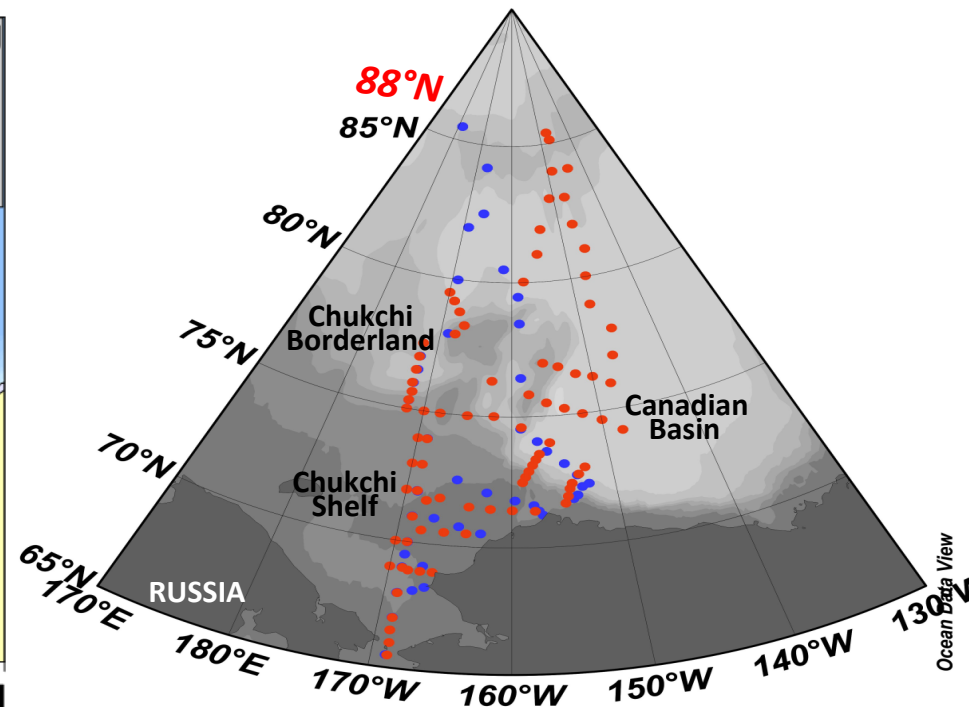
Water formation



The Pacific (Western) Arctic

Sea Ice Melt - New Free Ice Deep

Zone CHINARE 2008...2018



I. What is the role of Sea Ice formation in CO₂ uptake and acidification in the most heavily covered regions of Antarctic?

A case of Study :
Richness and CO₂ sink
the Weddell Sea

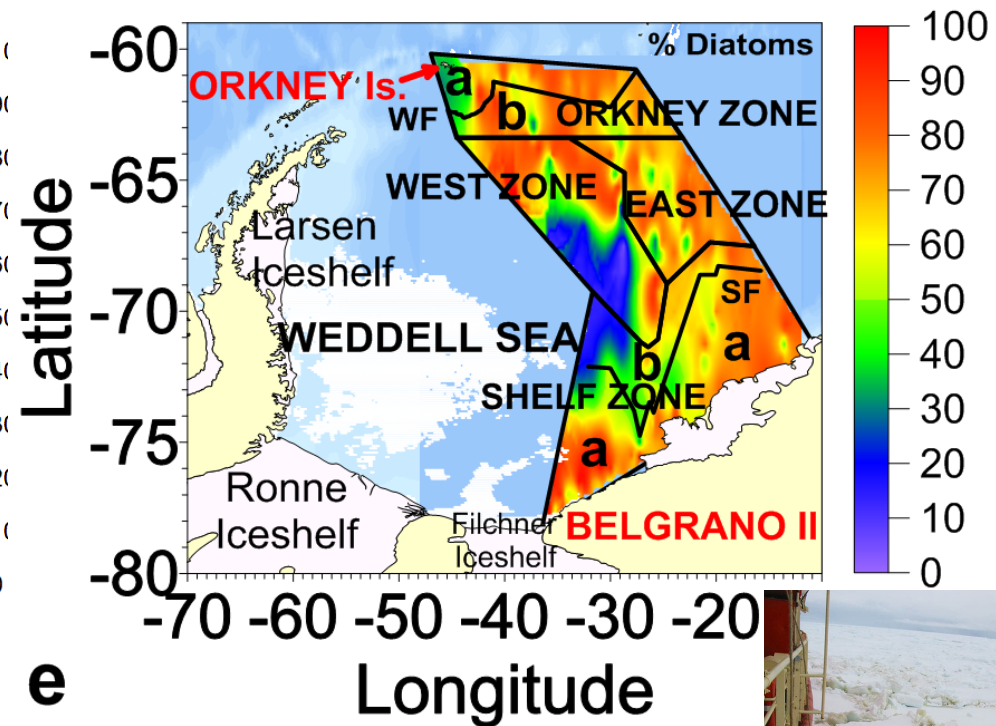
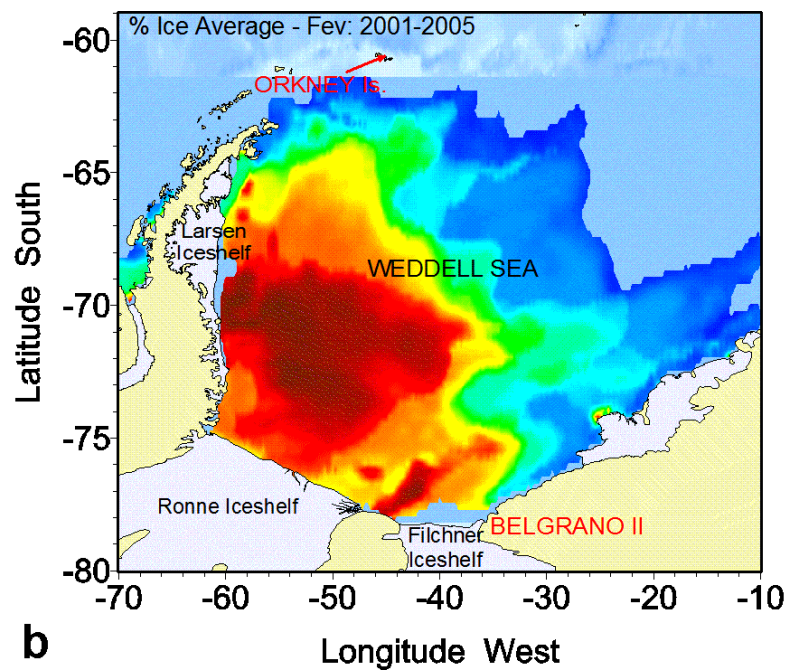
ARGAU
Argentina Ice Breaker, Irizar)
6 Oceanographic cruises 2000-2005



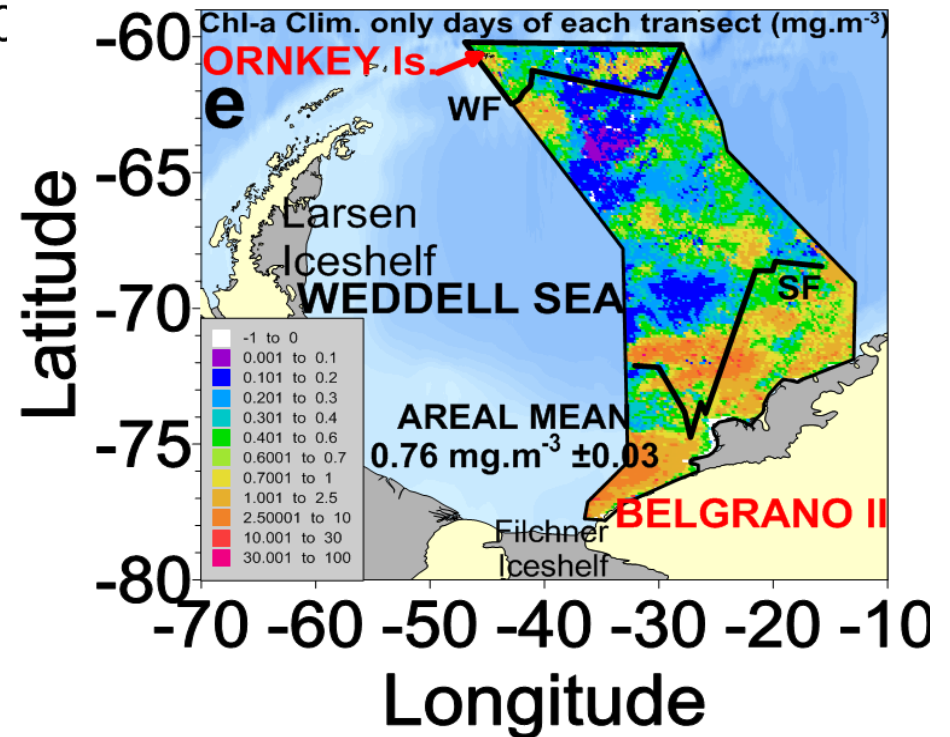
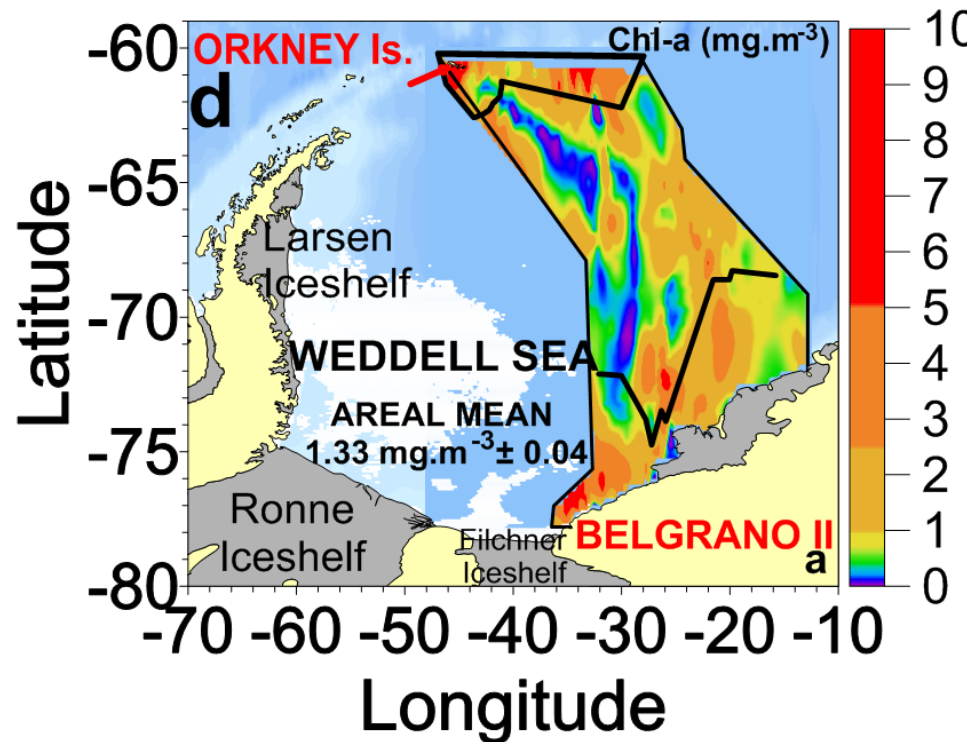
tiometry (onboard Argentinian Ice breaker)



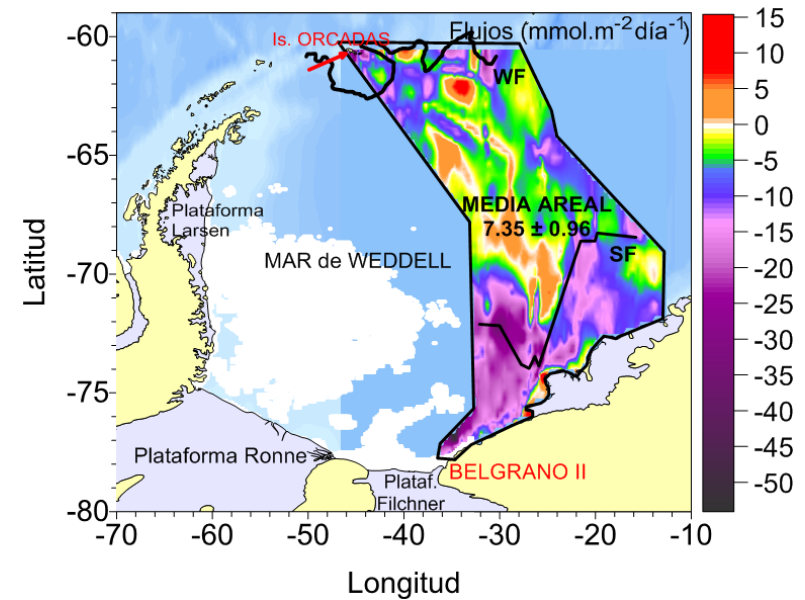
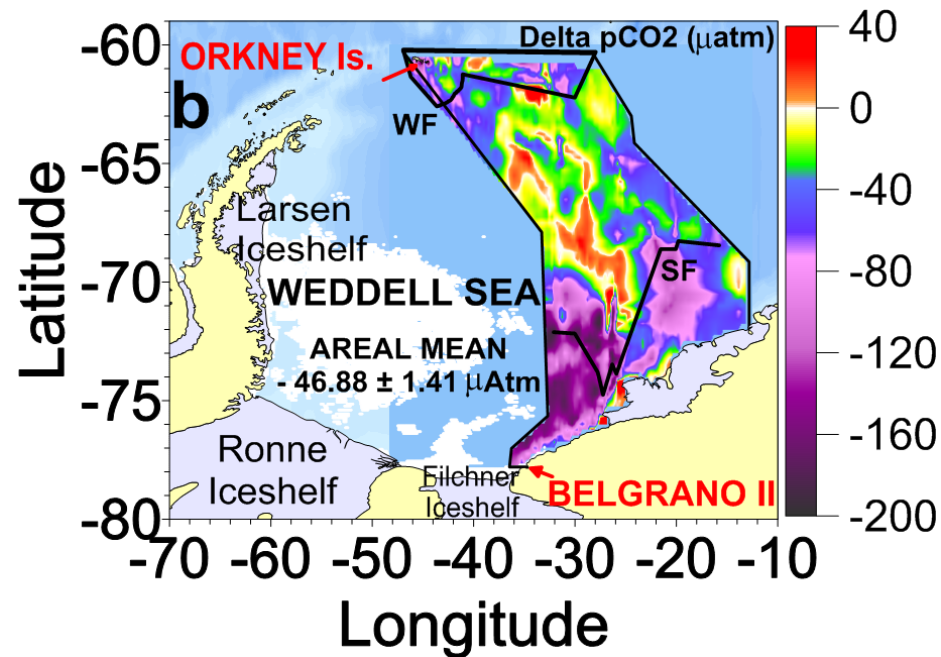
Sea Ice (MIZ) and Diatoms summer bloom 2000-2005



A remarkable phytoplankton richness !



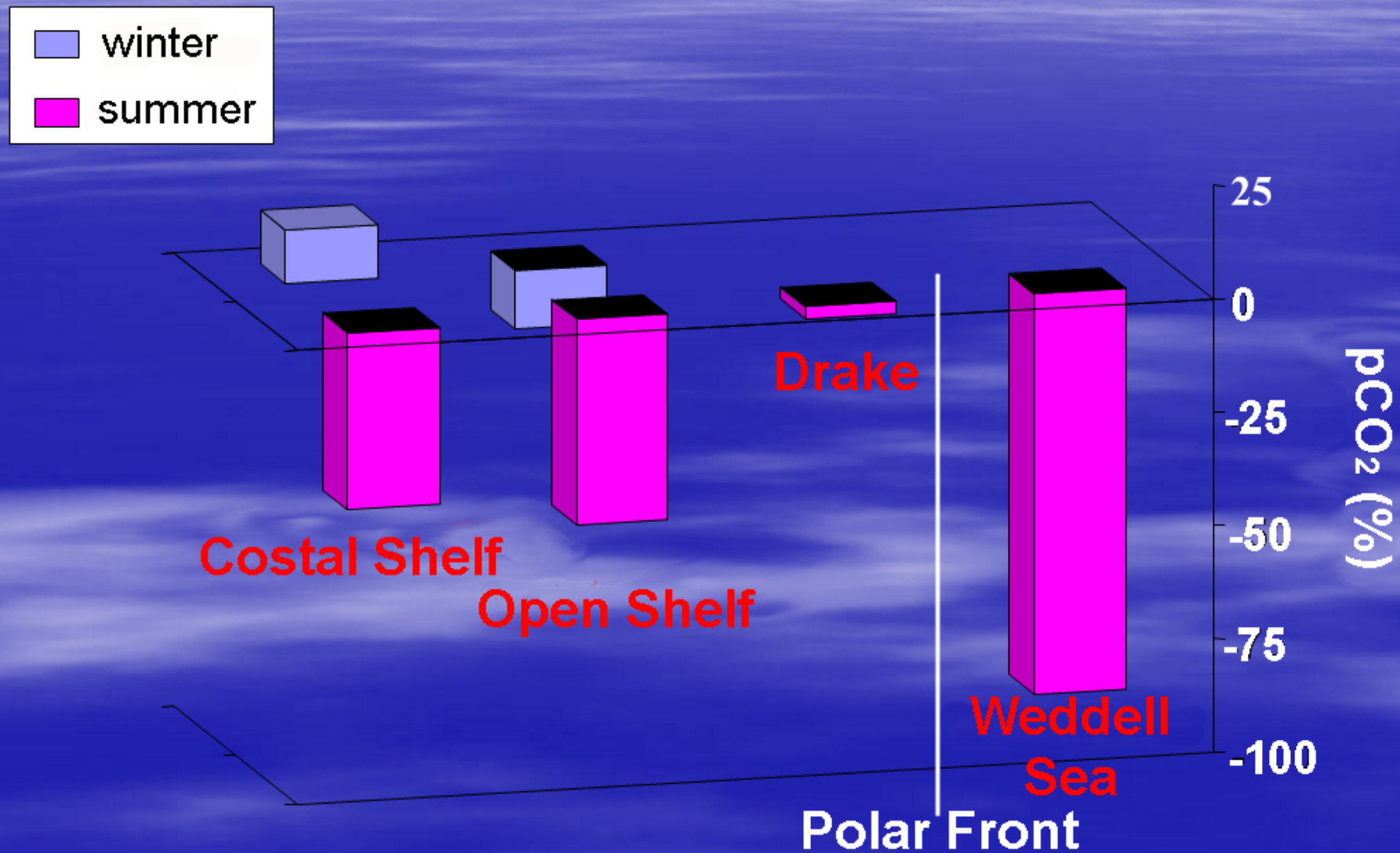
A huge CO₂ sink in the Weddell Sea !

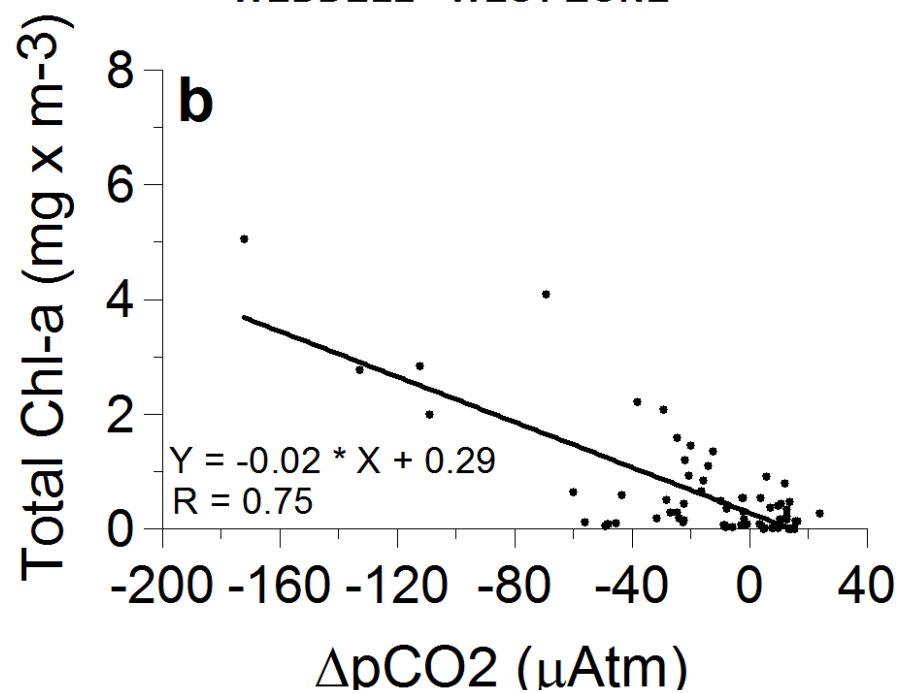
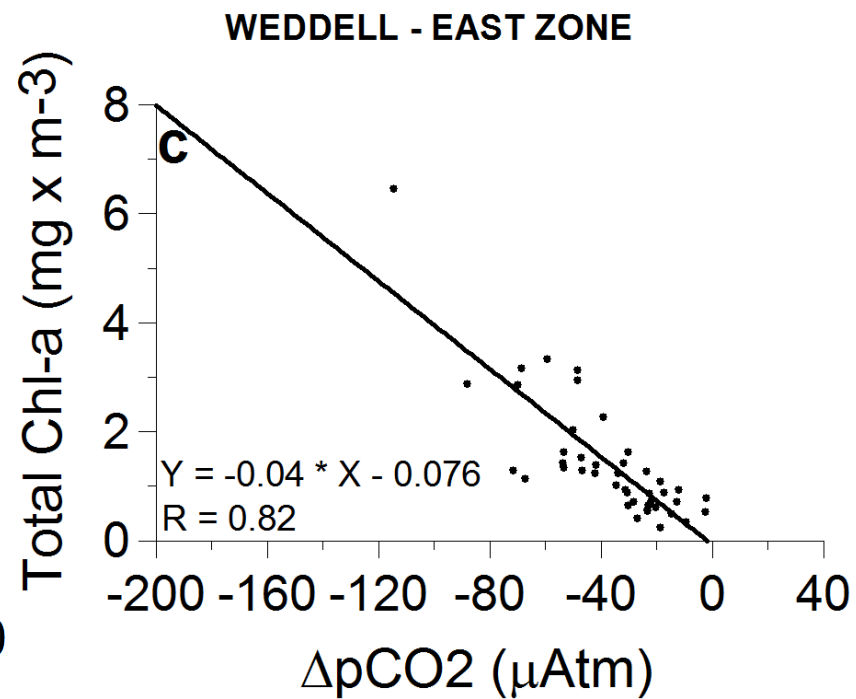
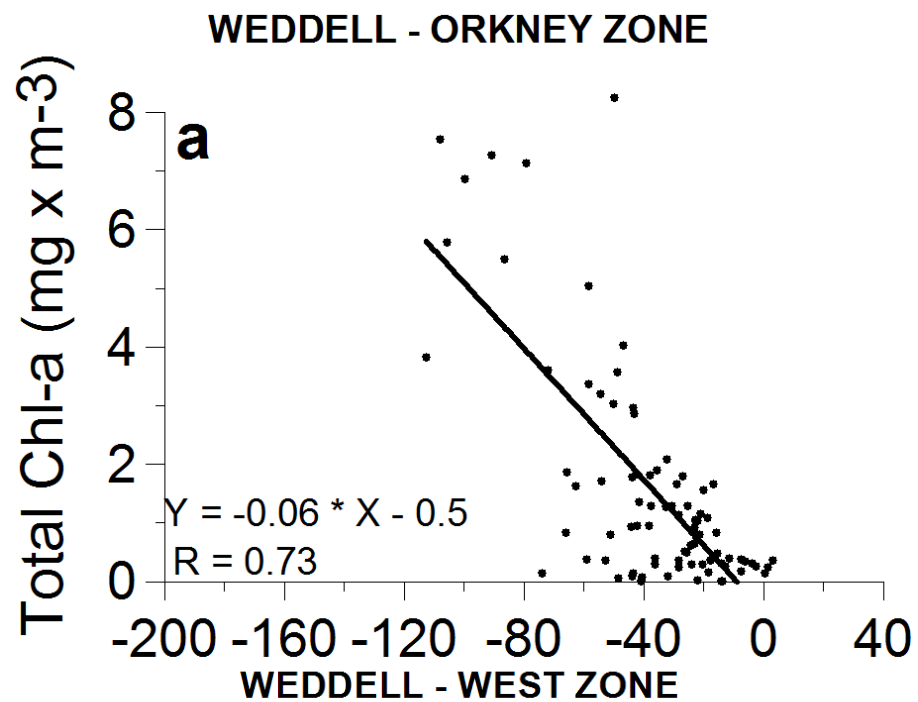


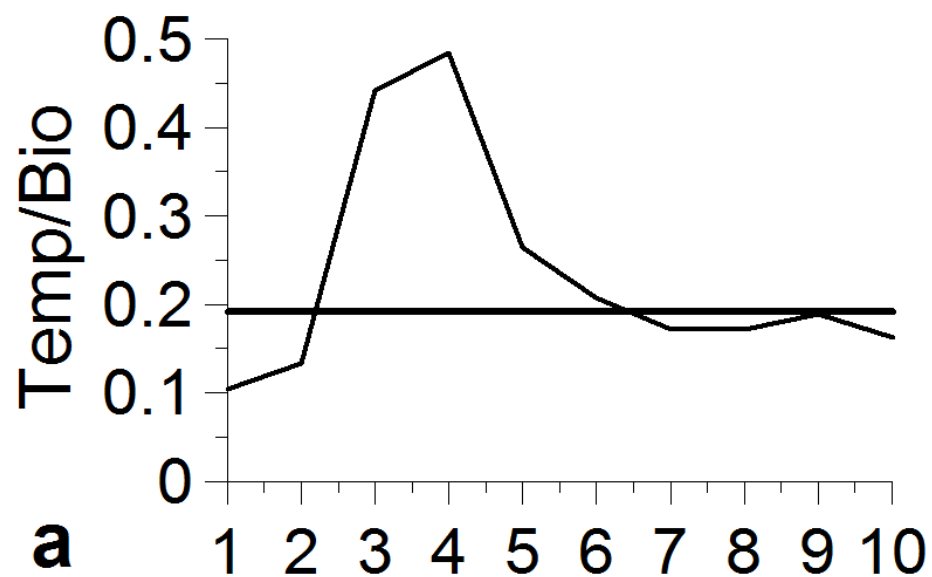
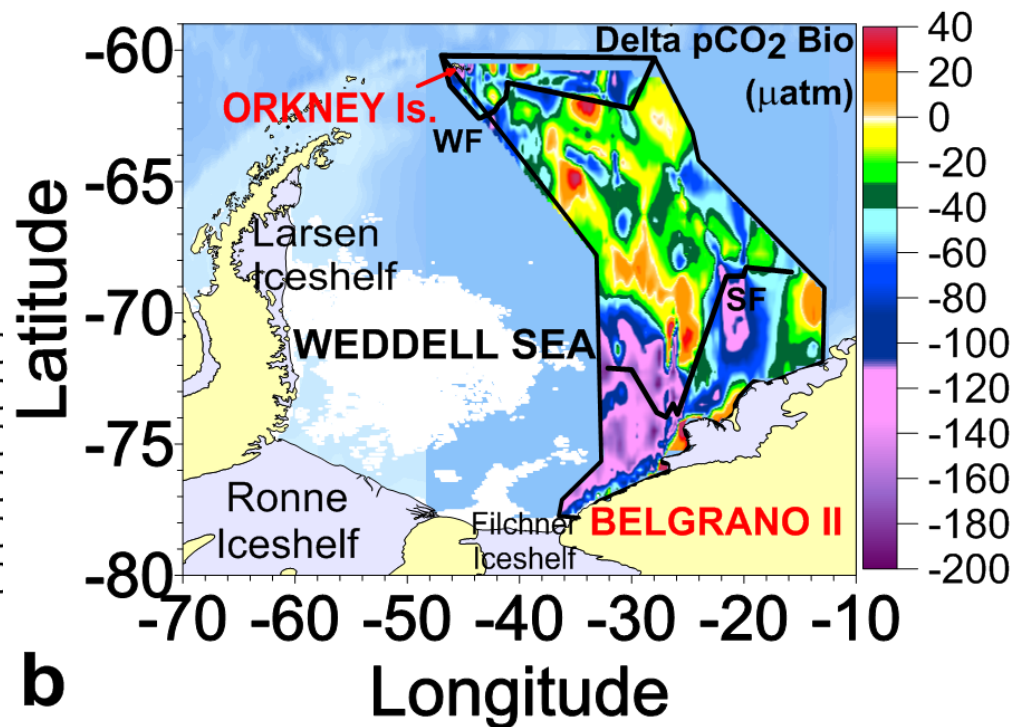
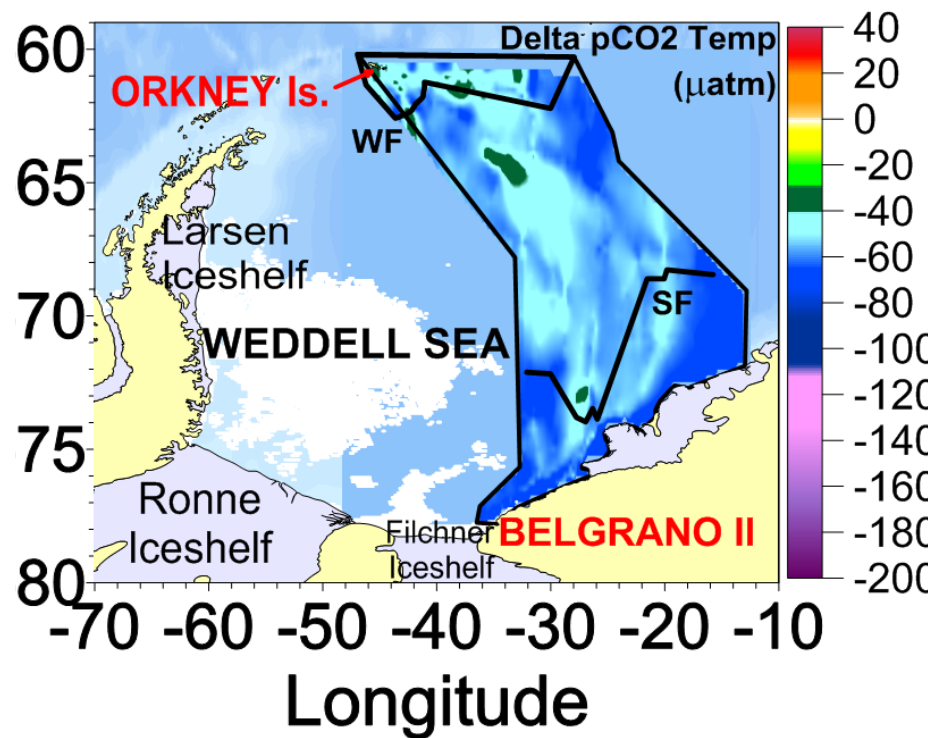
DpCO₂ Areal mean: -60 µAtm
-5/-60 51%, -60-196 37%
11% > 196 !

CO₂ Flux - 9.5 mmol.m⁻².day⁻¹

Comparative percentage of pCO₂ for the ARGAU project from the Patagonian Sea to the Weddell Sea



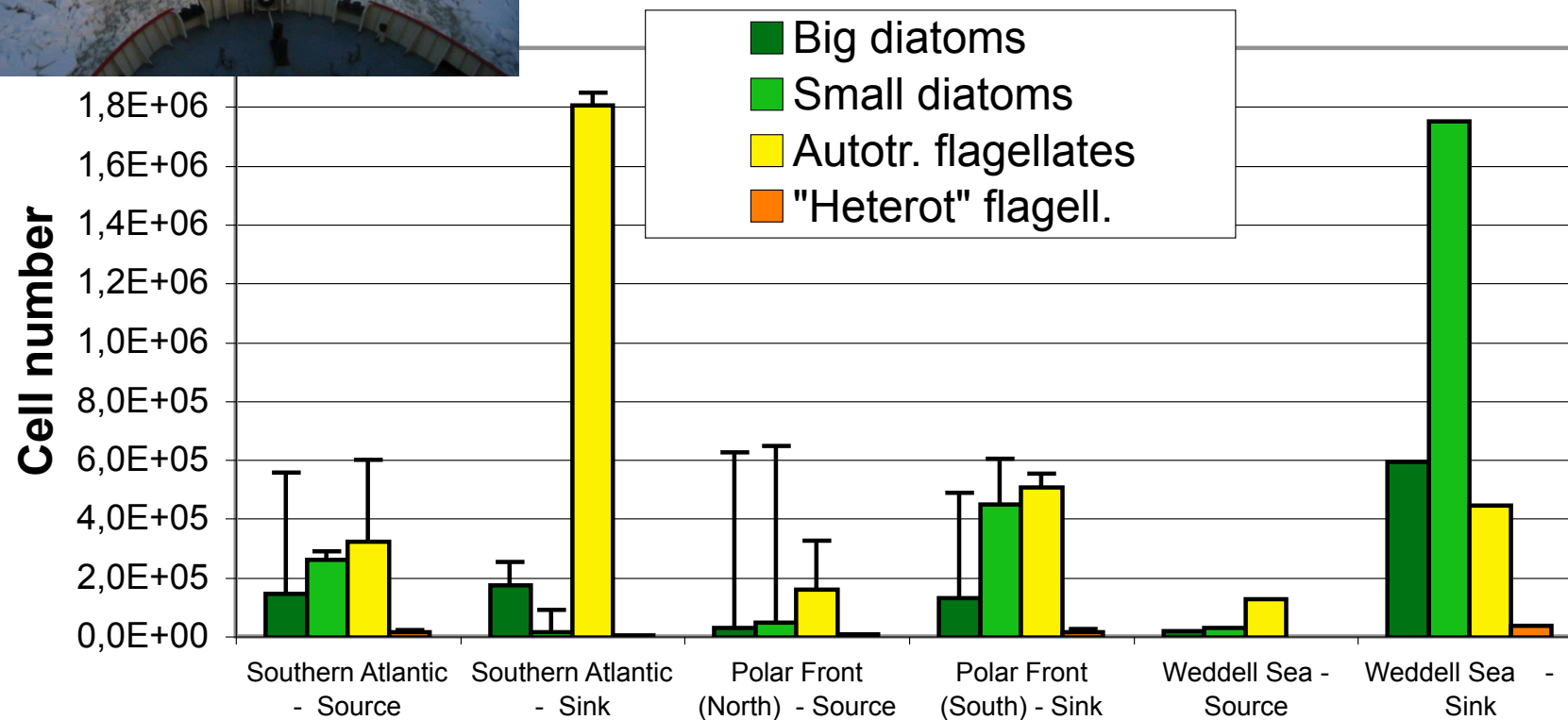






Does the phytoplankton pumps CO₂ in the Weddell Sea ?

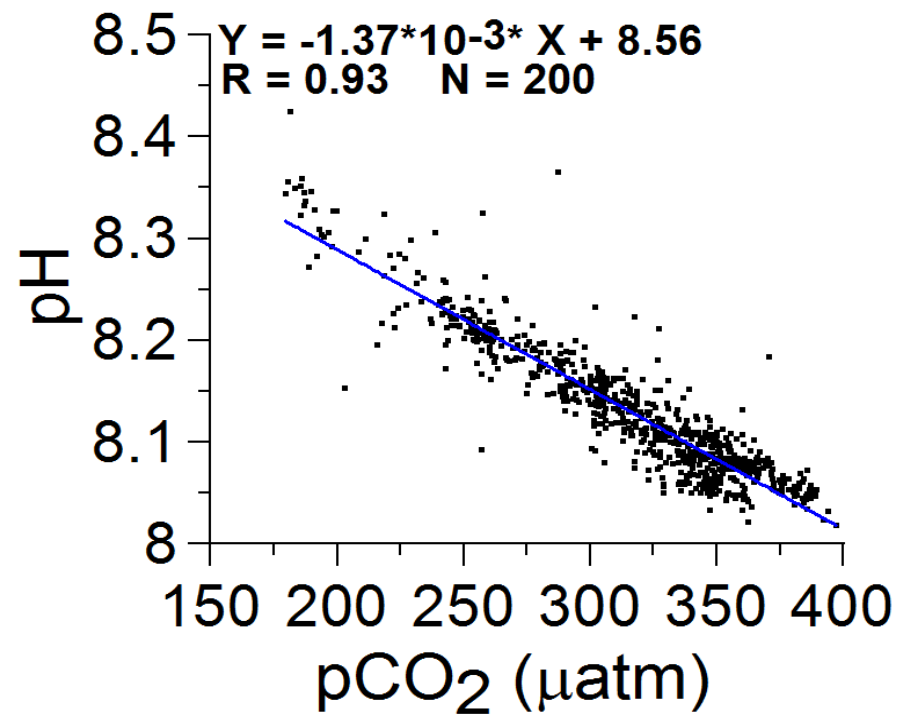
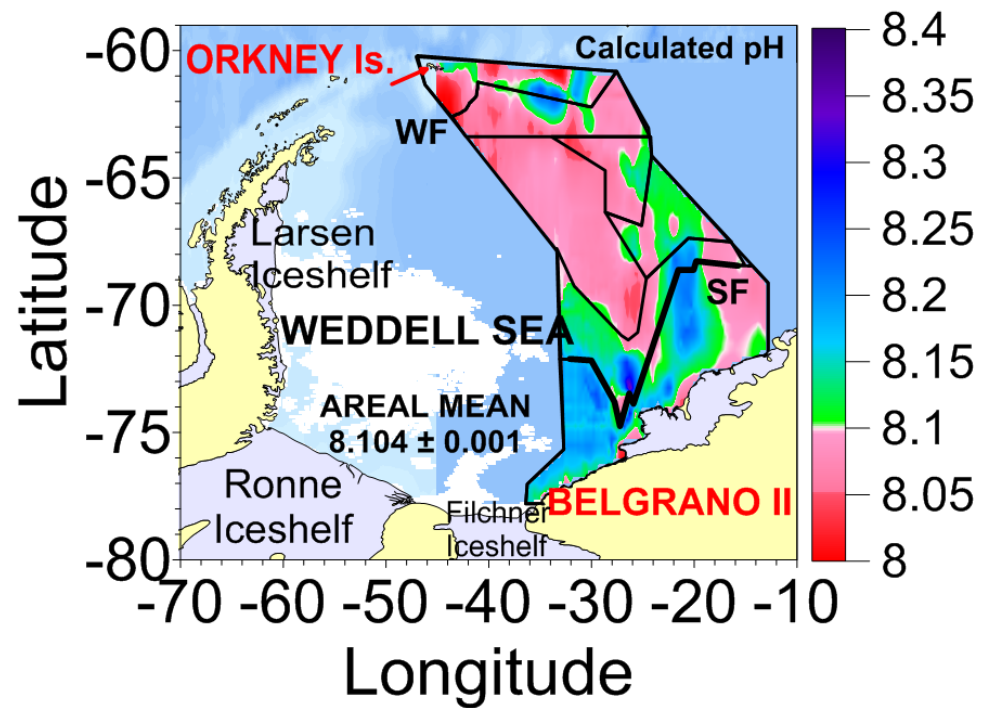
Phytoplankton species
(Bio-Microscope)



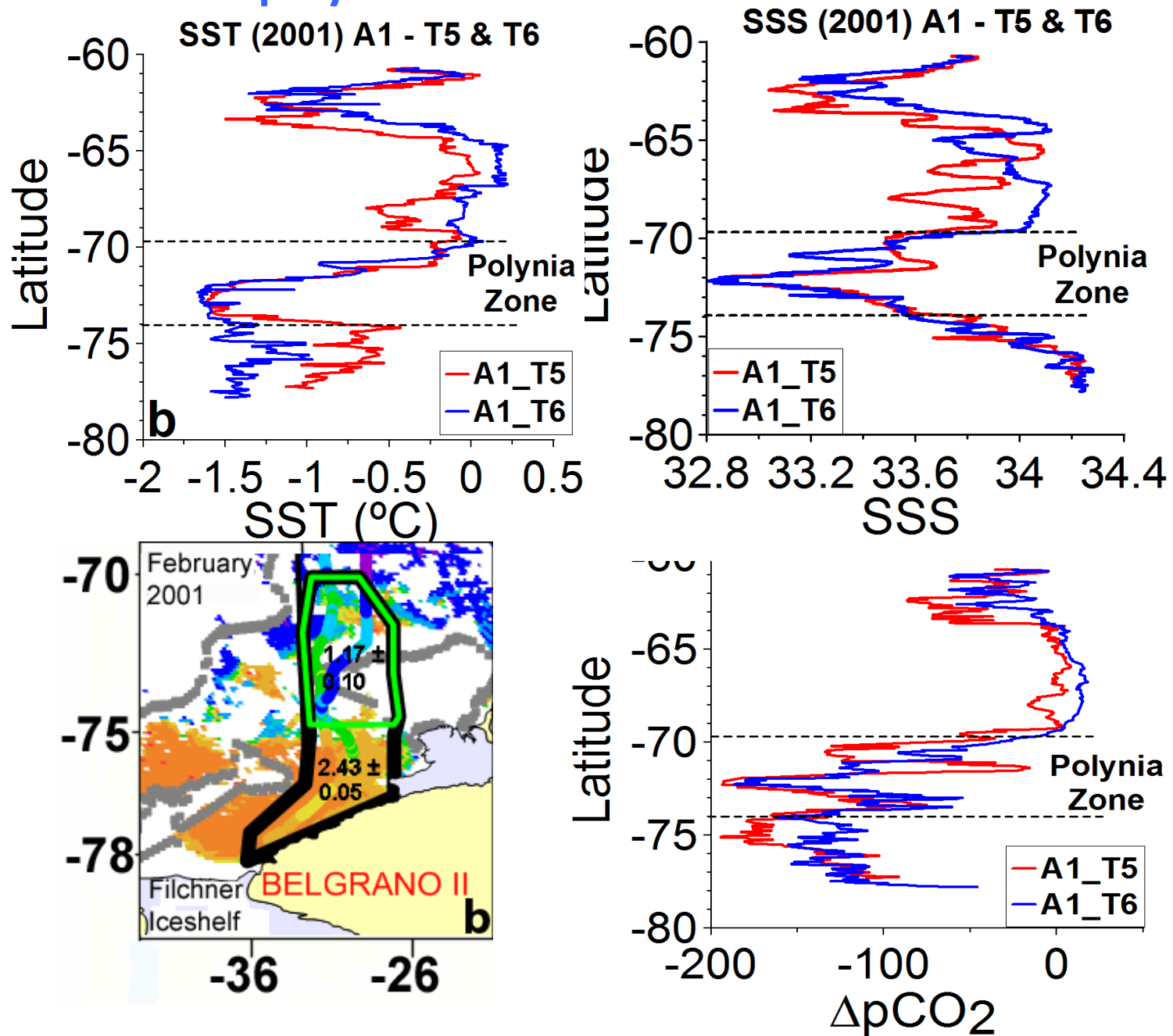
Antarctic Phytoplankton is working for us : correlation Big diatom and PCO₂
R²=0.9

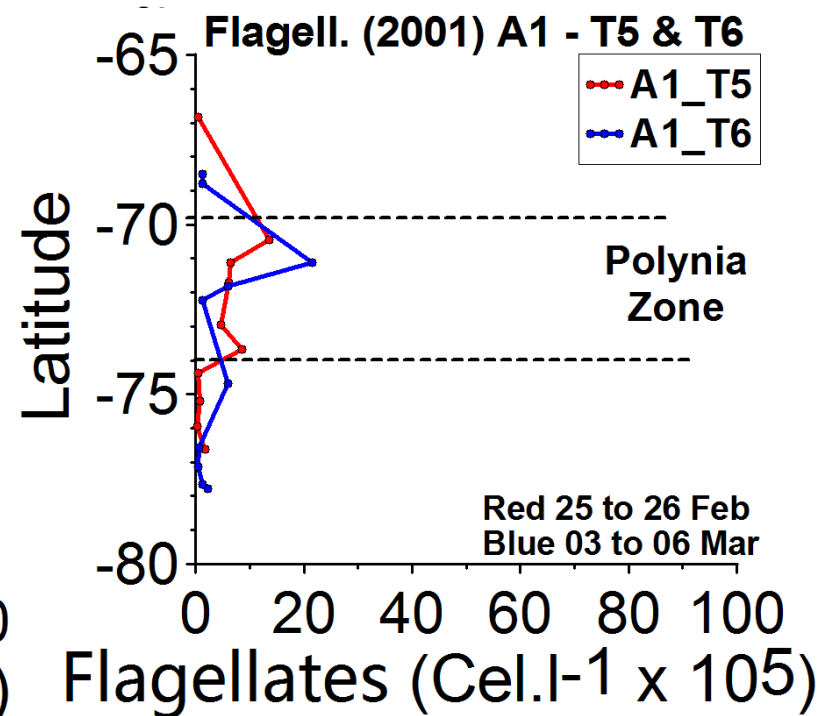
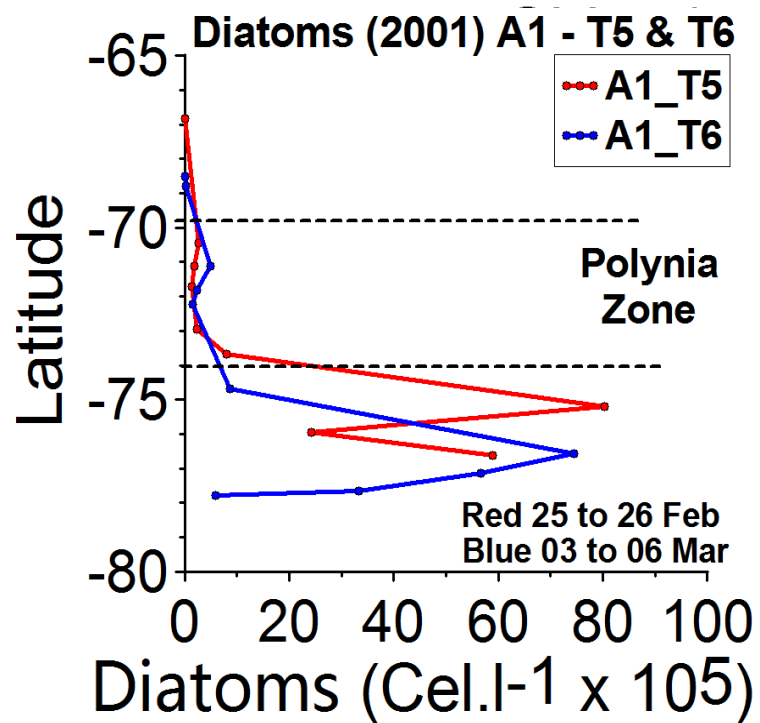
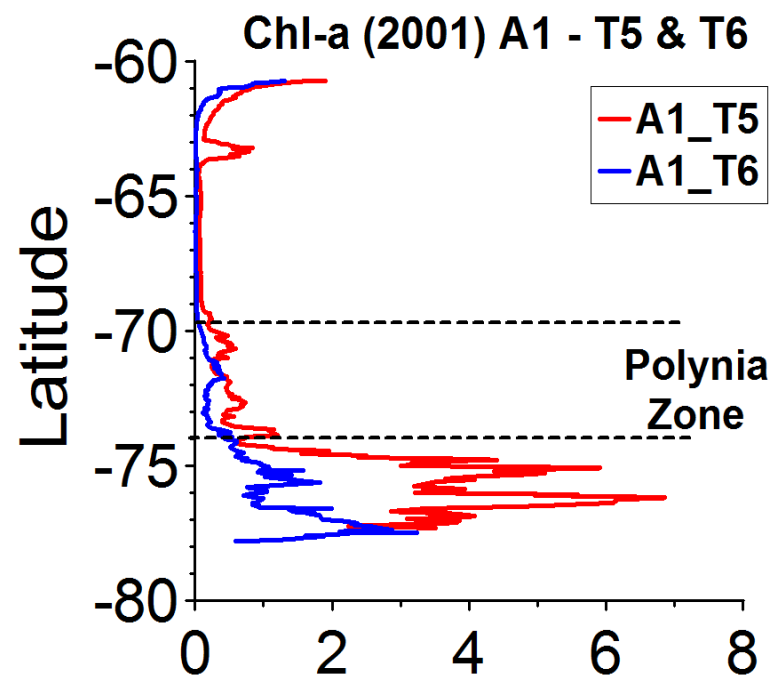
M. Ferrayro (U de La Plata), Almandoz et al 2012)

Acidification in the Weddell Sea

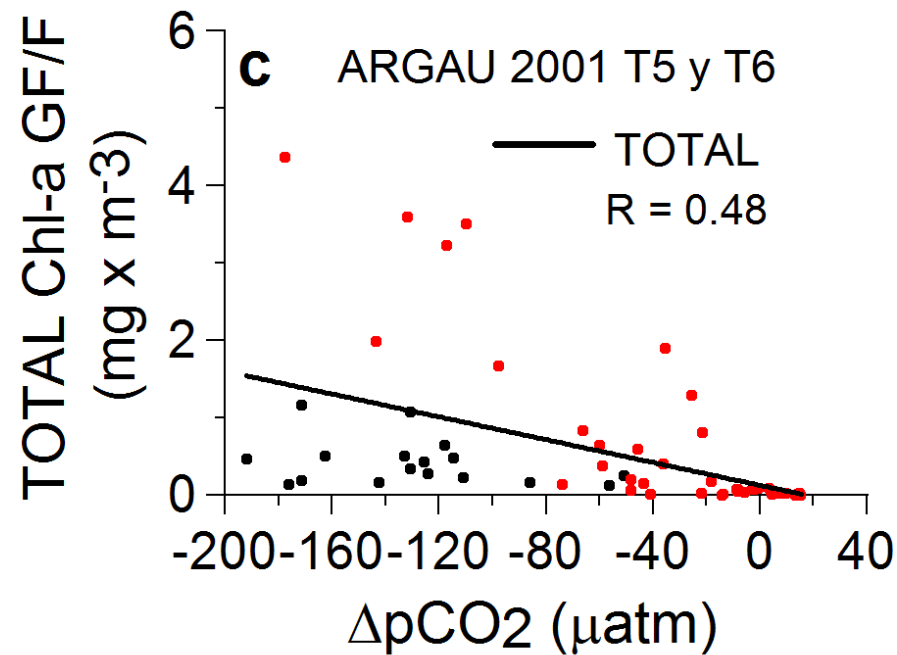


CO2 Sink around a polynia

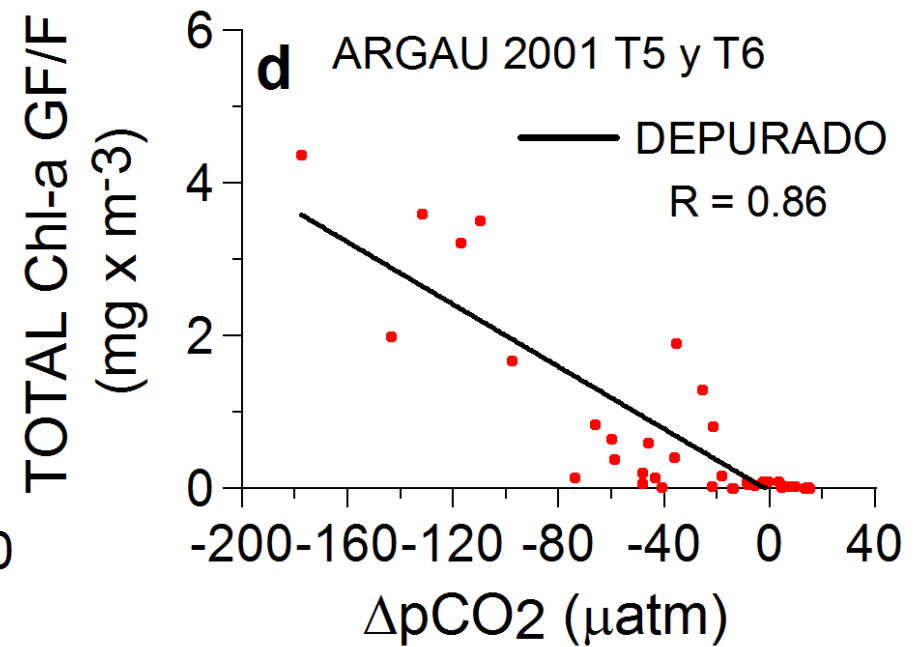




Biological pump is not enough to explain CO₂ sink in the polynia



With polynia



Without polynia

Anthropogenic pH in the Weddell sea summer 2014 (WAPITI, JCR-UK)

