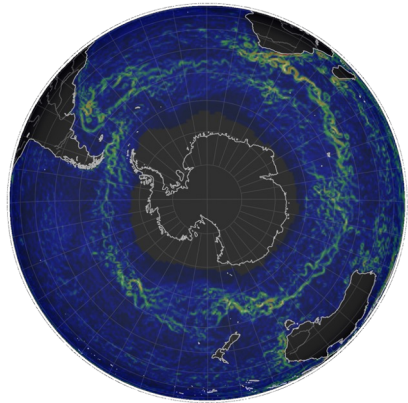


Hello and thank you for looking at my display material!
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THE EFFECTS OF MESOSCALE EDDIES ON SOUTHERN OCEAN BIOGEOCHEMISTRY



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Veronica Tamsitt, Yassir Eddebbbar, and Nicola Guisewhite

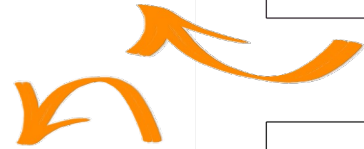


WHAT WE KNOW

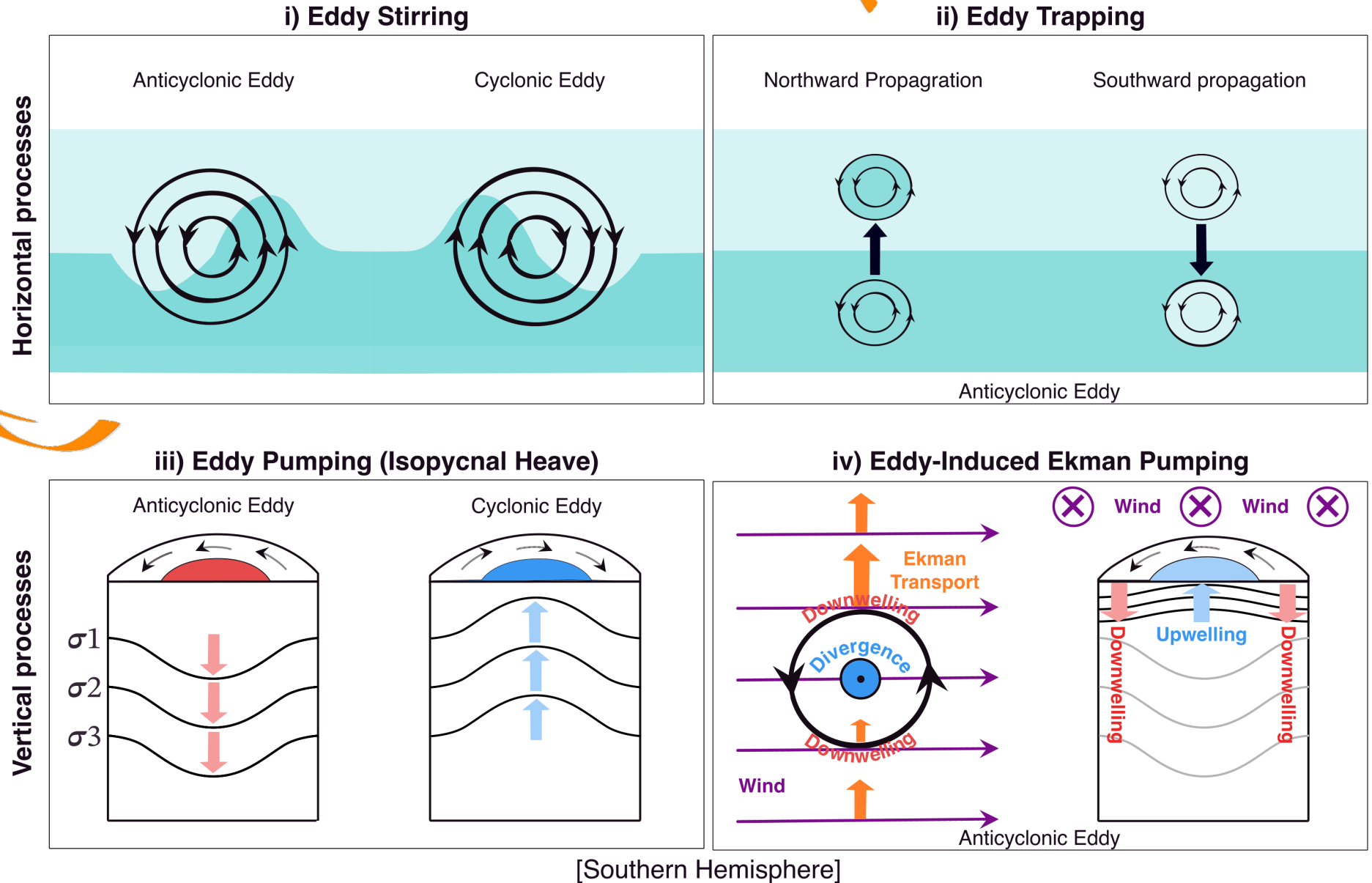


Eddies trap and transport nutrients across S.O. fronts (Patel et al., 2019).

Eddy stirring, trapping, and pumping contribute to anomalies in the S.O., depending on the region and season (Dawson et al., 2018; Frenger et al., 2015; Frenger et al., 2018).



Both eddy pumping and eddy-induced Ekman pumping modulate chlorophyll in the S.O. (Su et al., 2021).



Horizontal processes

Vertical processes

WHAT WE DON ' T KNOW (UNTIL NOW)

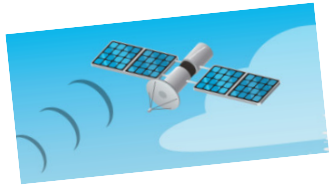
To what vertical extent do eddies affect the S.O. biogeochemistry?

What are the dominant processes?

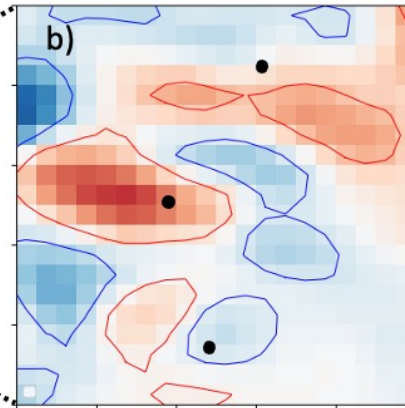
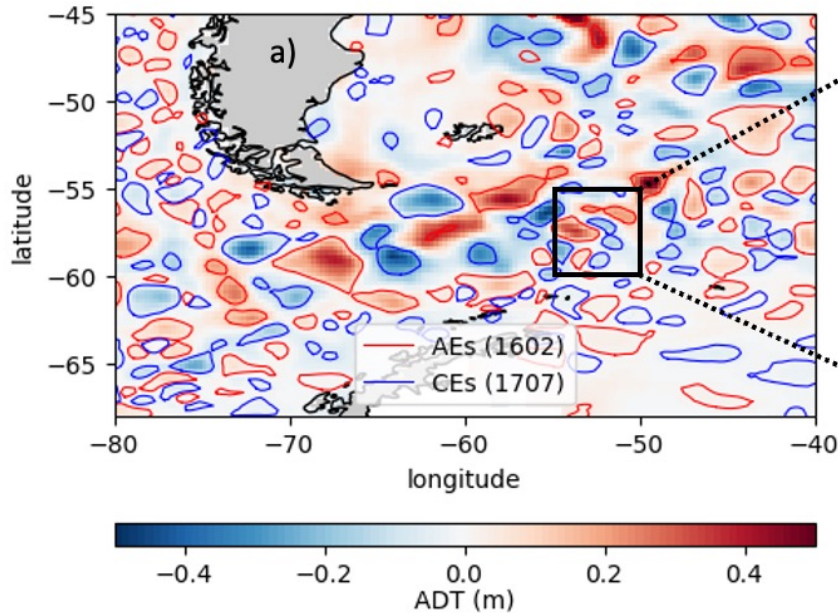
What's the impact of the eddy mechanisms on air-sea CO₂ fluxes and the carbon budget?

How does this differ between different regions and seasons?

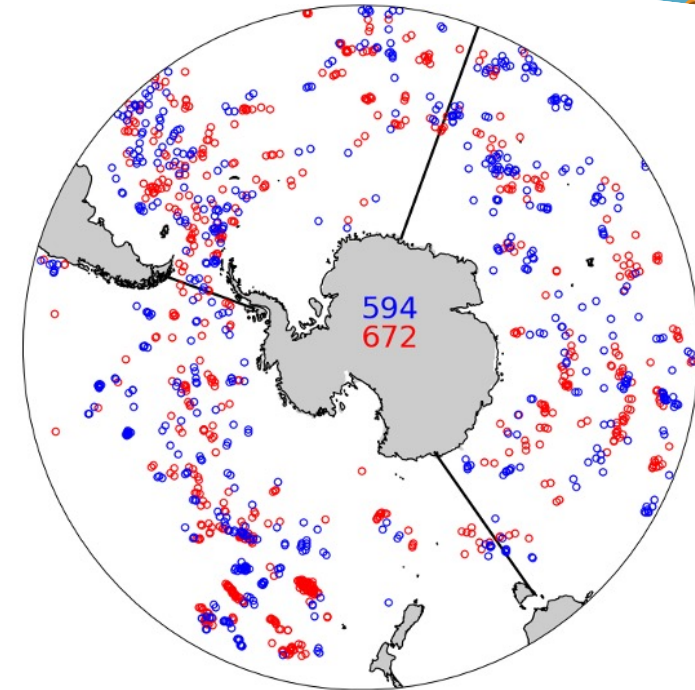
LET ' S FIND OUT!



CO-LOCATING EDDIES WITH BGC-ARGO FLOATS



Cyclonic eddies (CEs)
Anticyclonic eddies (AEs)



Satellite-detected eddies from AVISO
(Meta3.2DT)

Chelton et al. (2011); Pegliasco et al. (2022)

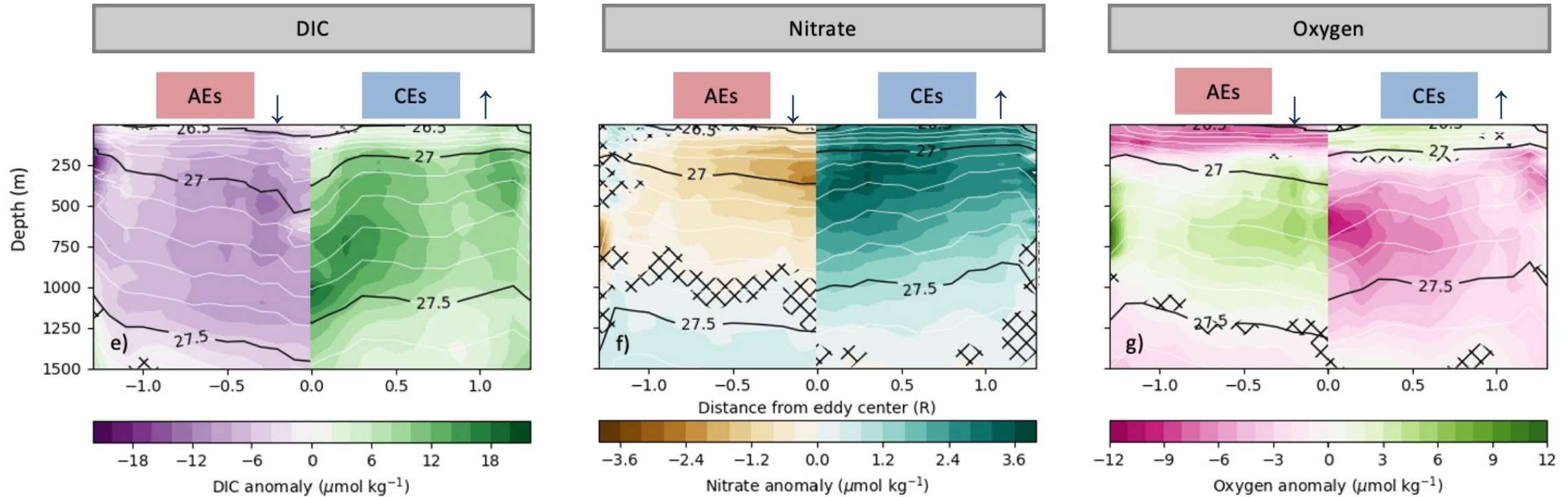
Dissolved oxygen and nitrate from BGC Argo;
DIC indirectly estimated from BGC float parameters
(pH measurements, alkalinity estimate from LIAR algorithm)

Data from April 2014 to February 2022

<https://socom.princeton.edu/>; Carter et al. (2017)

VERTICAL COMPOSITES (WHOLE SOUTHERN OCEAN)

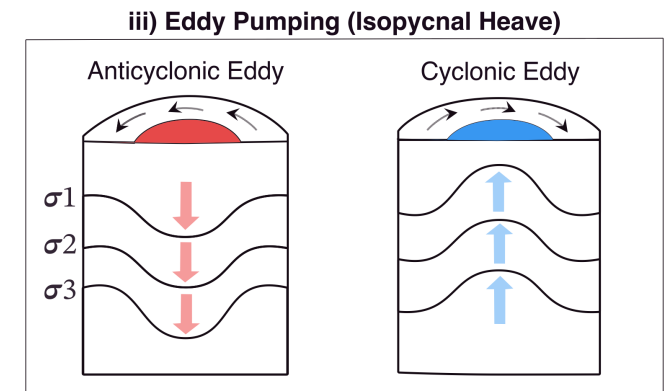
Anomalies relative to monthly climatologies
 (MOBO-DIC, Keppler et al., 2023;
 WOA18, Boyd et al., 2018;
 GOBAI-O2, Sharp et al., 2022)
 Argo climatology, Roemmich & Gilson 2009)



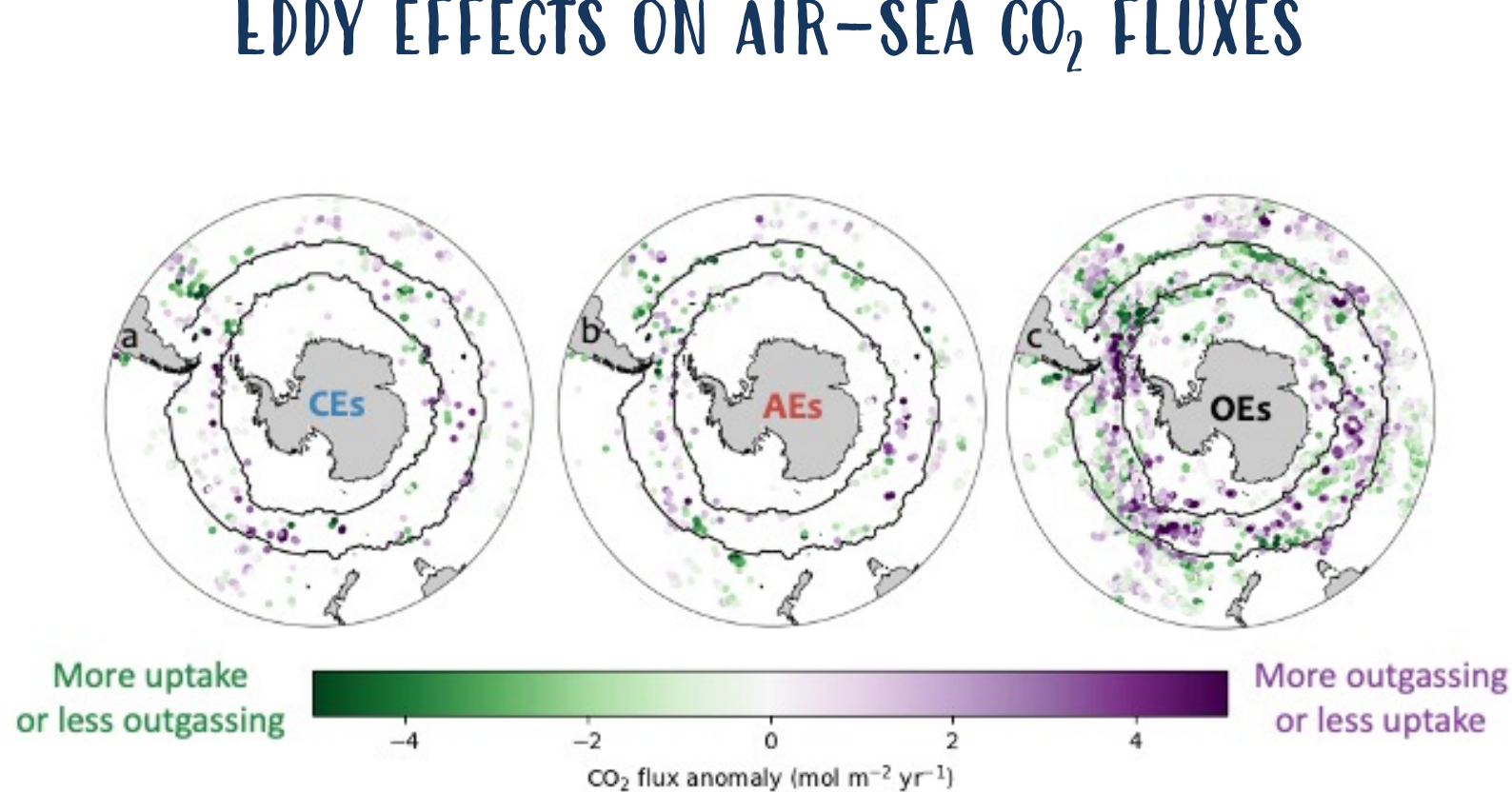
↓ **pumping in AEs:** surface water (low DIC and nutrient concentration) moves down, leading to **less DIC and nutrients**

↑ **pumping in CEs:** deep water (high DIC and nutrient concentration) moves up, leading to **more DIC and nutrients**

→ **Eddy pumping is the most dominant signal (and not eddy-induced Ekman pumping)**



EDDY EFFECTS ON AIR-SEA CO₂ FLUXES

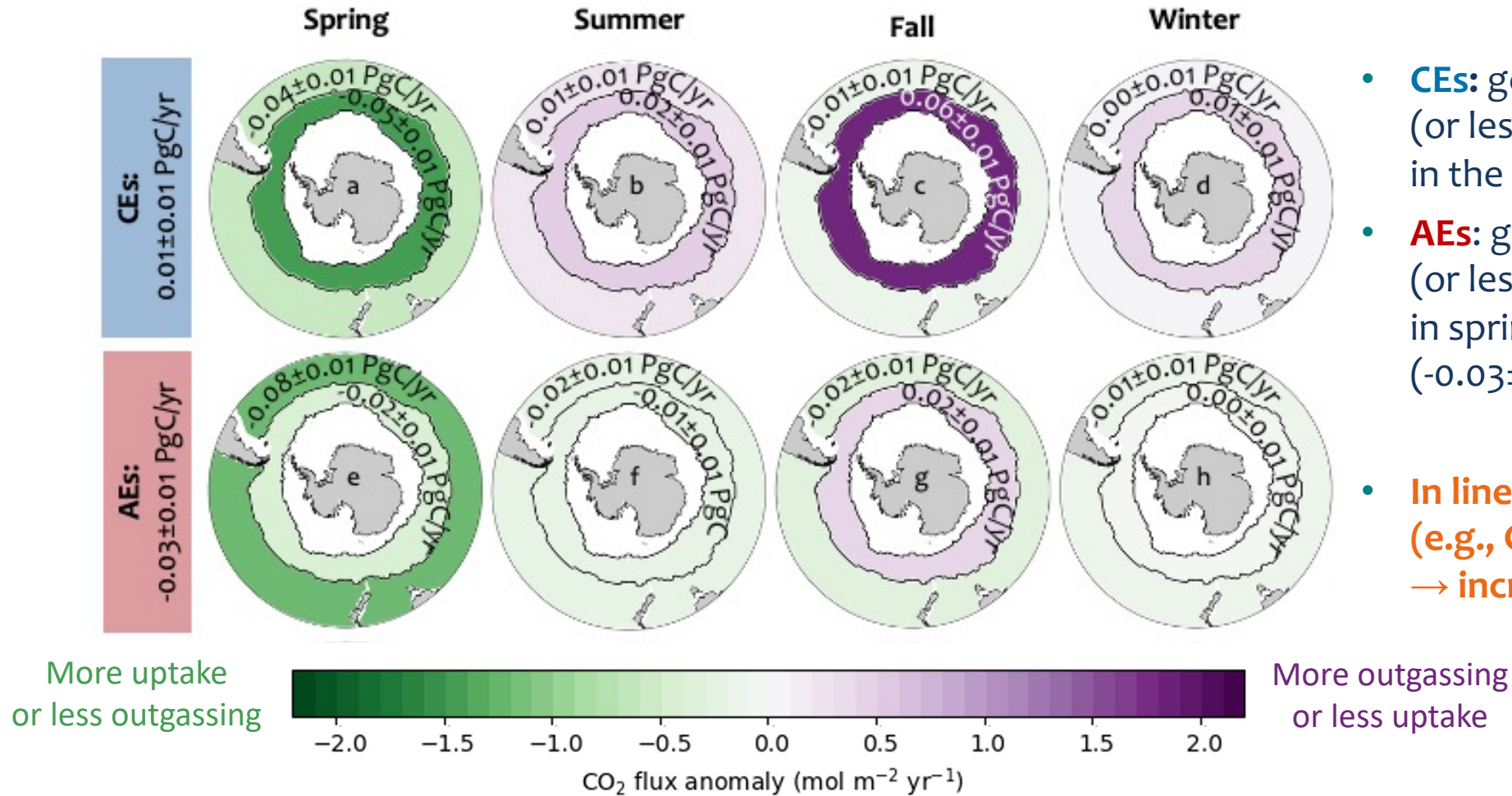


Air-sea CO₂ flux anomalies from floats in cyclonic eddies (CEs), anticyclonic eddies (AEs), and outside of eddies (OEs).

→ **When considering all seasons, we don't see a clear signal**

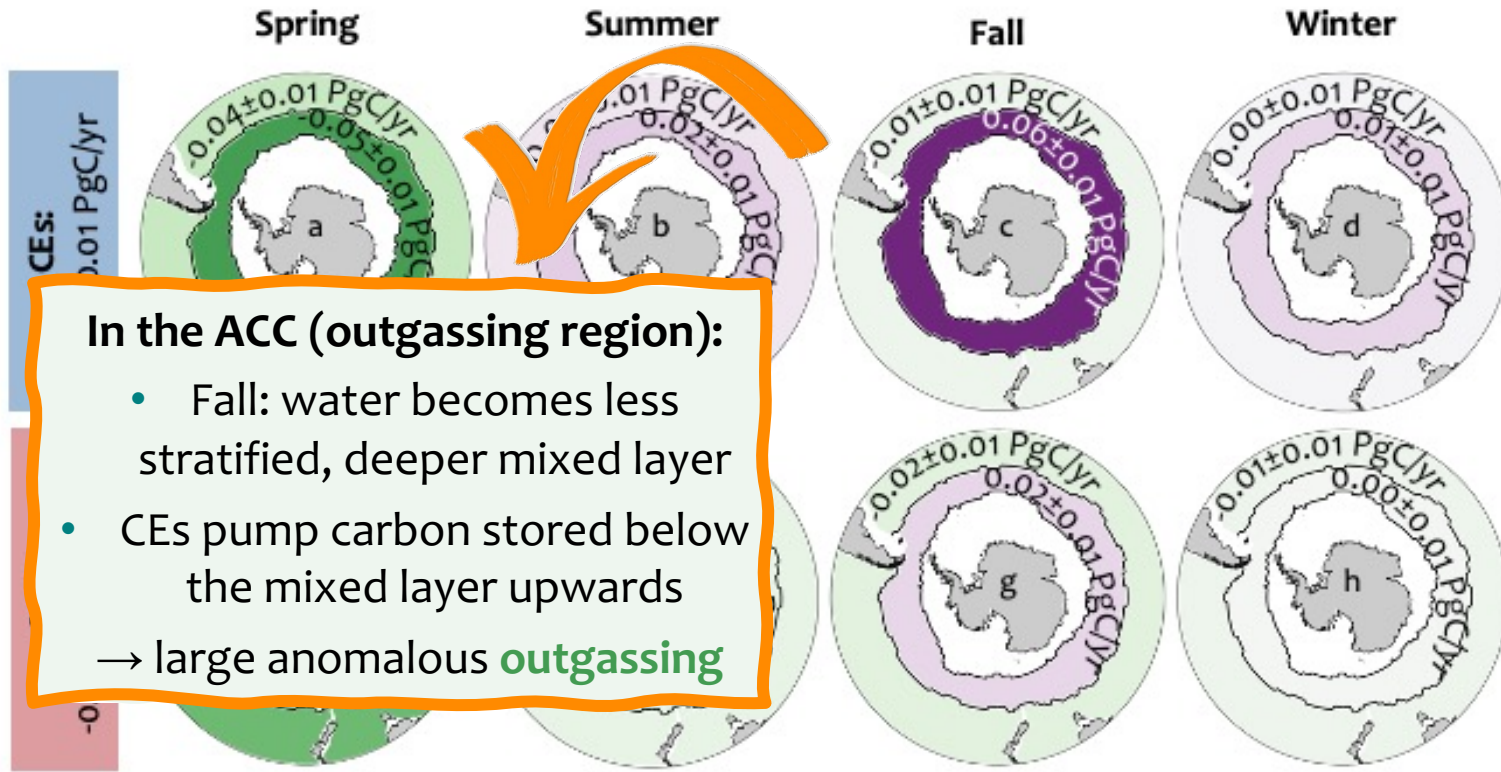
For the following analysis (integrated eddy effects on air-sea CO₂ fluxes), we consider the mean flux anomalies in different regions and seasons

INTEGRATED EDDY EFFECTS ON AIR-SEA CO₂ FLUXES



- **CEs:** generally **more outgassing** (or less uptake), especially in fall in the ACC (0.01 ± 0.01 PgC/yr)
- **AEs:** generally **more uptake** (or less outgassing), especially in spring north of the ACC (-0.03 ± 0.01 PgC/yr)
- **In line with our other findings** (e.g., CE upwards pumping → increased DIC)

INTEGRATED EDDY EFFECTS ON AIR-SEA CO₂ FLUXES

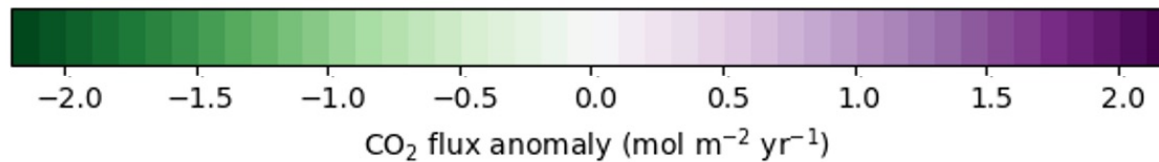


In the ACC (outgassing region):

- Fall: water becomes less stratified, deeper mixed layer
- CEs pump carbon stored below the mixed layer upwards
→ large anomalous **outgassing**

- **CEs**: generally **more outgassing** (or less uptake), especially in fall in the ACC (0.01 ± 0.01 PgC/yr)
- **AEs**: generally **more uptake** (or less outgassing), especially in spring north of the ACC (-0.03 ± 0.01 PgC/yr)
- **In line with our other findings** (e.g., CE upwards pumping → increased DIC)

More uptake
or less outgassing



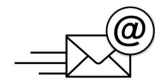
More outgassing
or less uptake

SUMMARY

- 1) In our results, eddy pumping is the dominant vertical process affecting S.O. BGC in the water column (consistent with what we expect)
- 2) Cyclonic eddies: 0.01 ± 0.01 PgC/yr more outgassing
- 3) Anticyclonic eddies: 0.03 ± 0.01 PgC/yr more uptake
- 4) Look out for our upcoming paper (planned submission this spring)

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EXTRA:

WHAT IZEA (AI-IMAGE CREATOR)
THOUGHT THIS WOULD BE ABOUT 😊

[key words: mesoscale eddies,
Southern Ocean, biogeochemistry]

