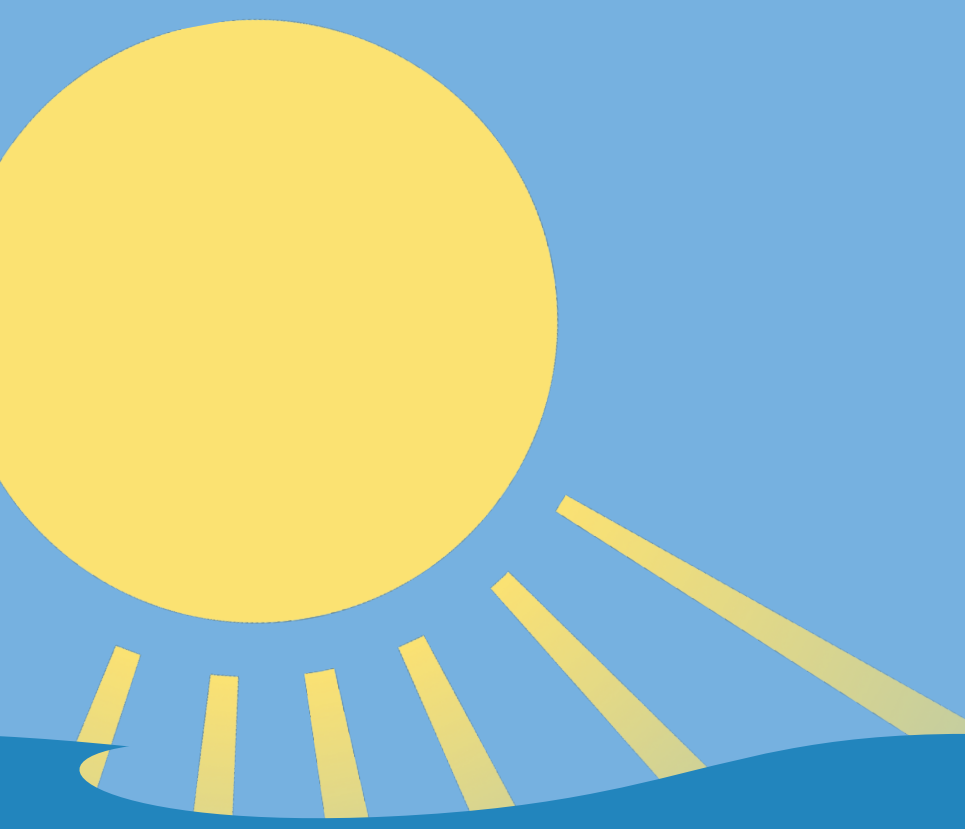


Connecting phytoplankton taxa distributions to air-sea CO₂ fluxes in the Southern Ocean

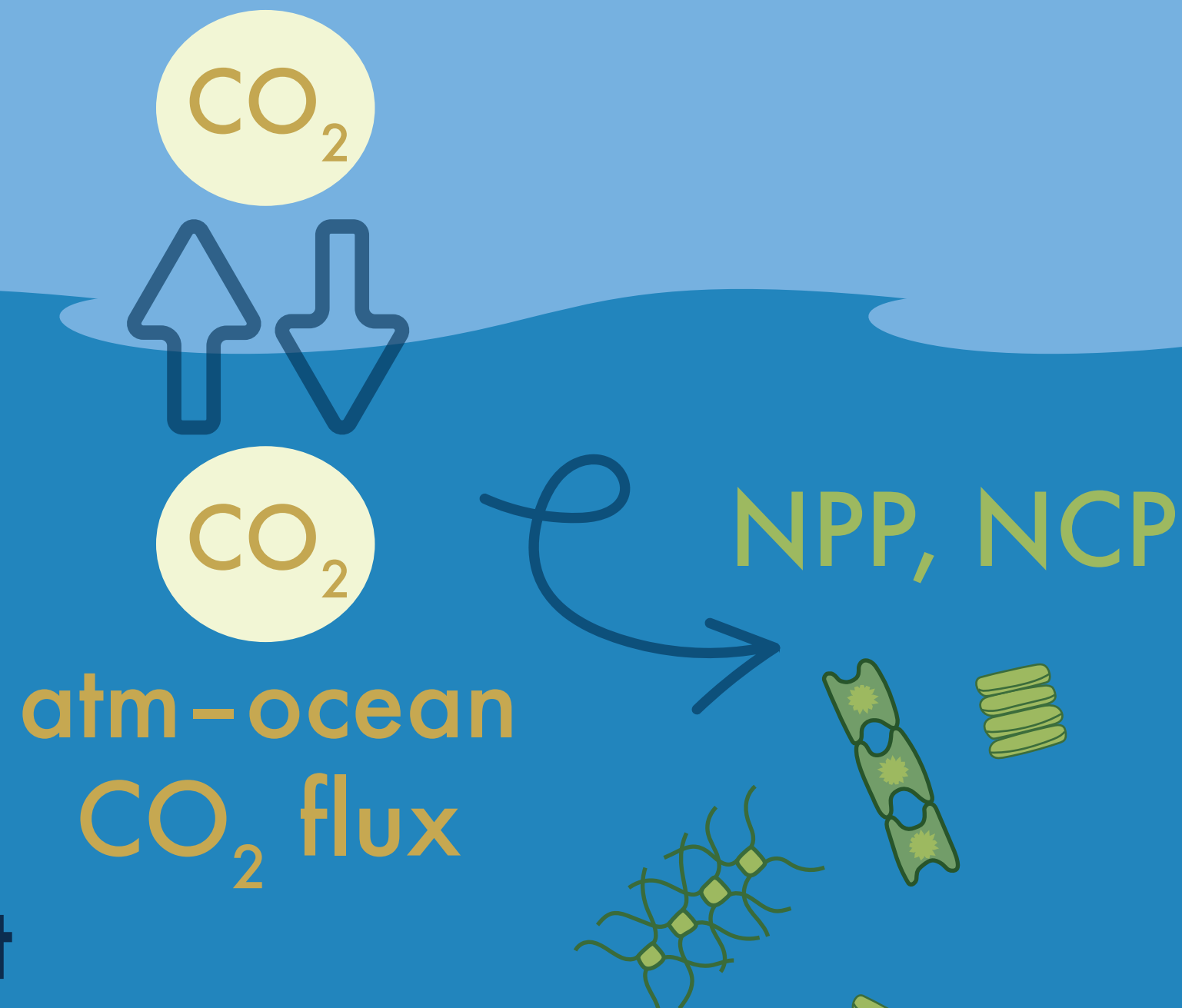
Hannah Joy-Warren,^{1,2,3} Ayush Nag,⁴ Dan(i) Jones,⁵ Alison Gray,² and Andrea Fassbender³

1. Applied Physics Laboratory, University of Washington; 2. School of Oceanography, University of Washington; 3. NOAA Pacific Marine Environmental Lab; 4. Paul G. Allen School of Computer Science and Engineering, University of Washington; 5. Cooperative Institute for Great Lakes Research (CIGLR), University of Michigan

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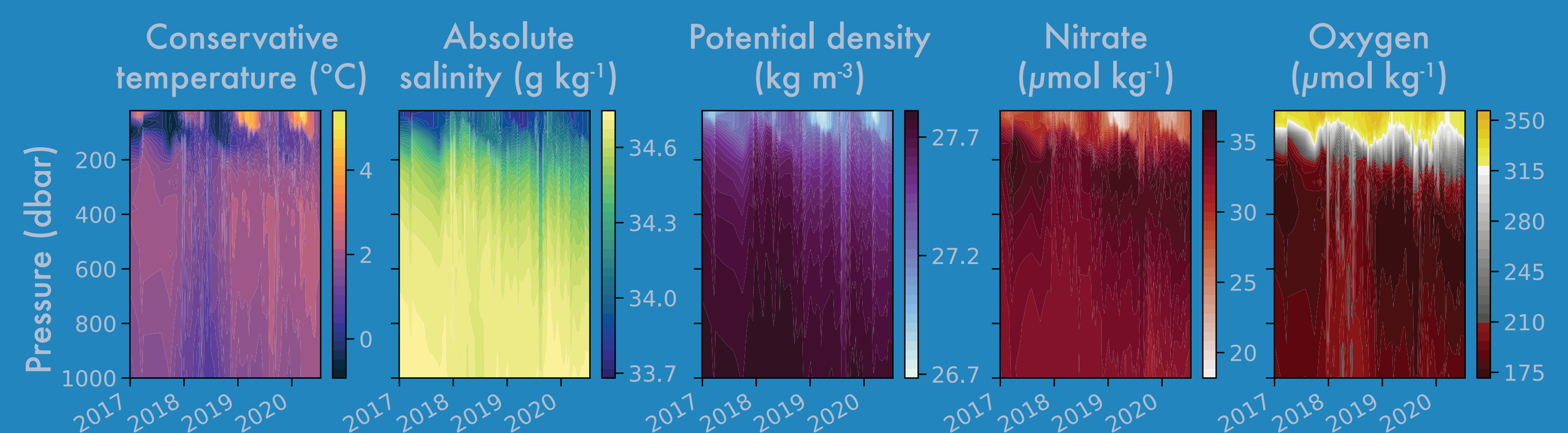
Goal 1: Trace carbon flow from the atmosphere through export



Goal 2: Connect atm-ocean CO₂ flux variability to phytoplankton community composition

- float measurements → estimated parameters
- pH → pCO₂
- fluorescence → NPP
- NO₃⁻ → NCP
- backscatter → POC flux
- O₂ → respiration

Gaussian mixture modeling methods

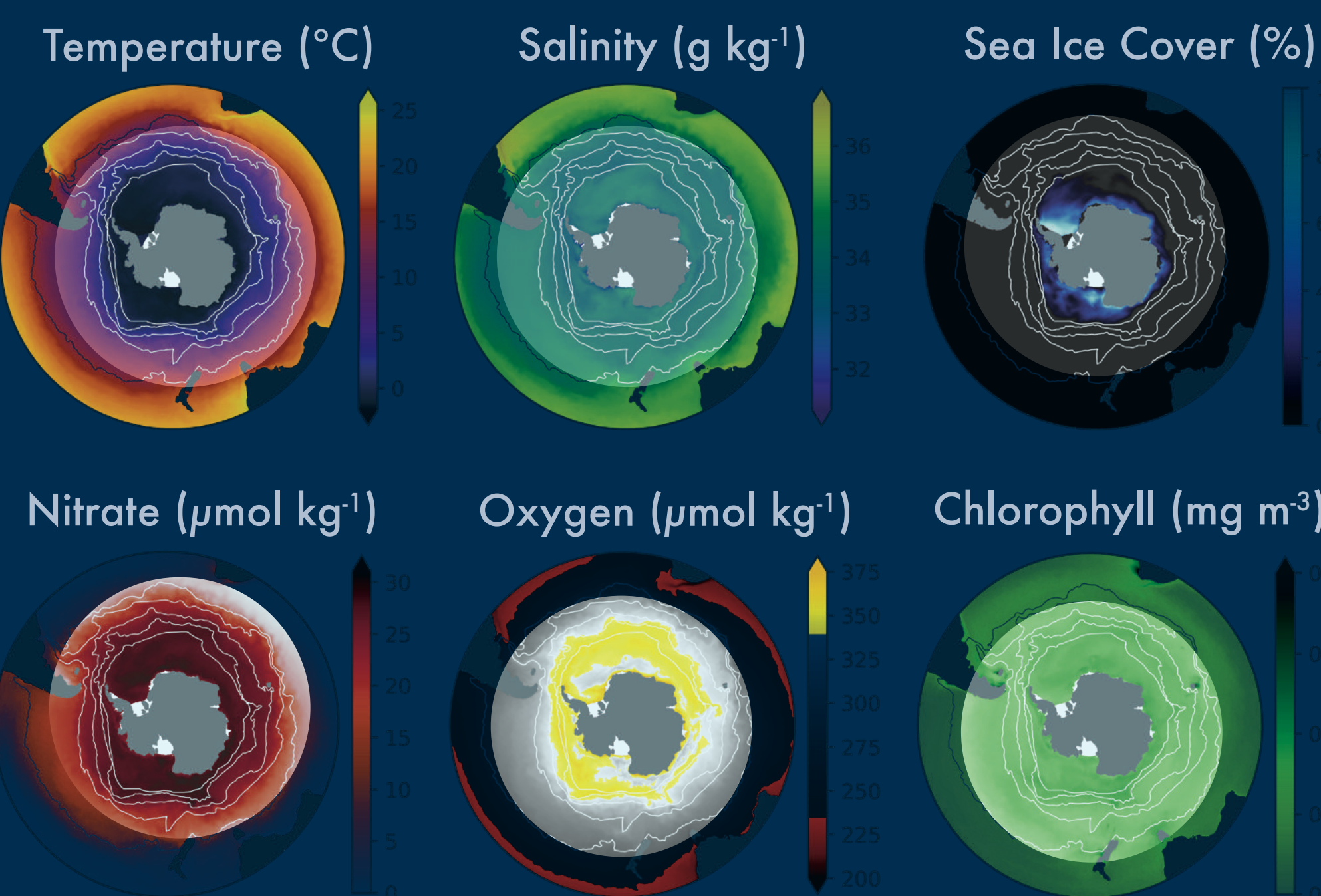


- ▶ pressure levels from 20–1000 db in 20 db intervals
- ▶ each pressure level is treated as a “dimension”
- ▶ 50 dimensions per variable
- ▶ dimensionality reduction via Principle Component Analysis (5 dimensions explained 96% of variance)

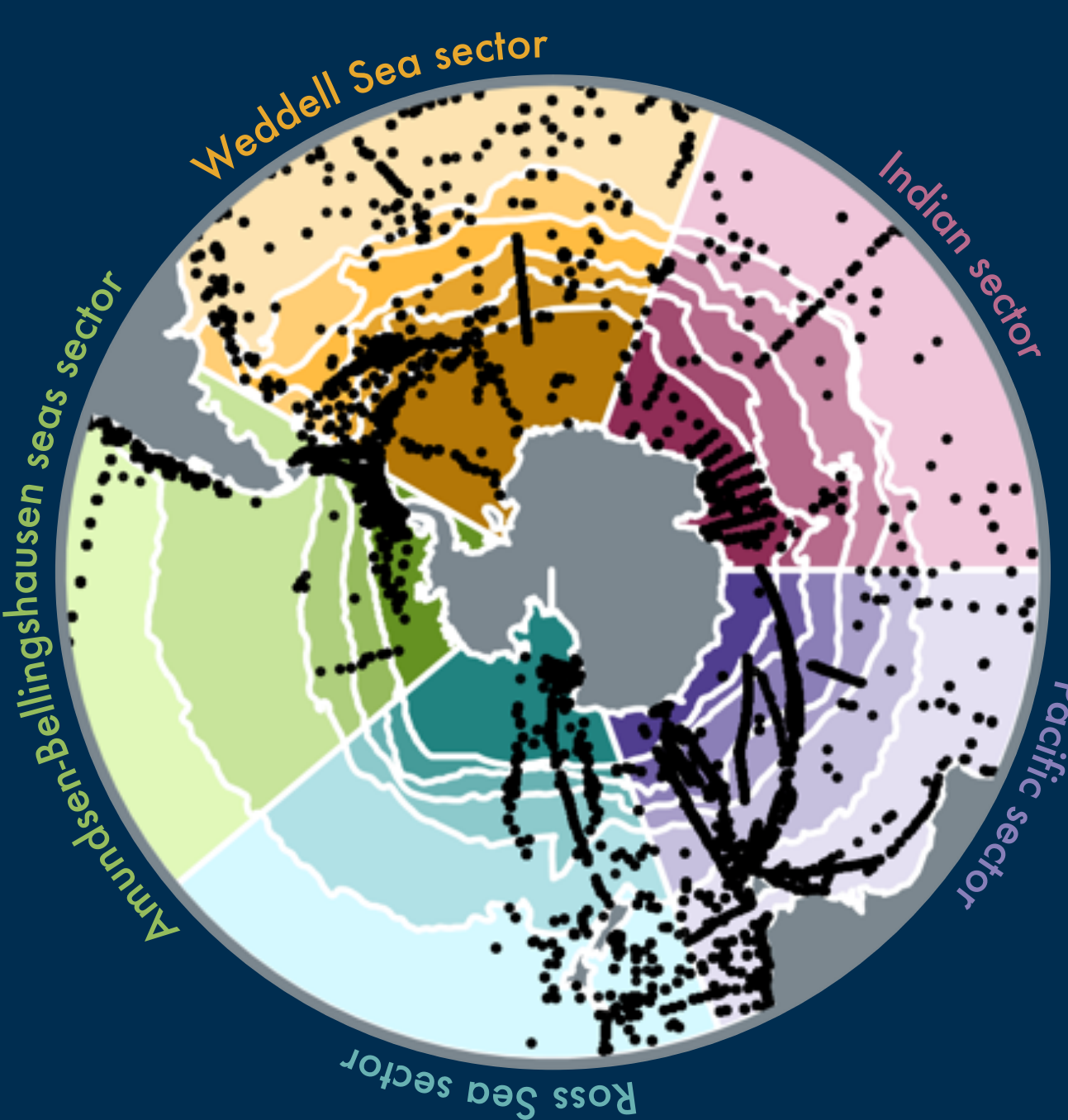


Modeling Southern Ocean phytoplankton taxa

Biogeochemical Southern Ocean State Estimate (B-SOSE; Verdy and Mazloff 2017)

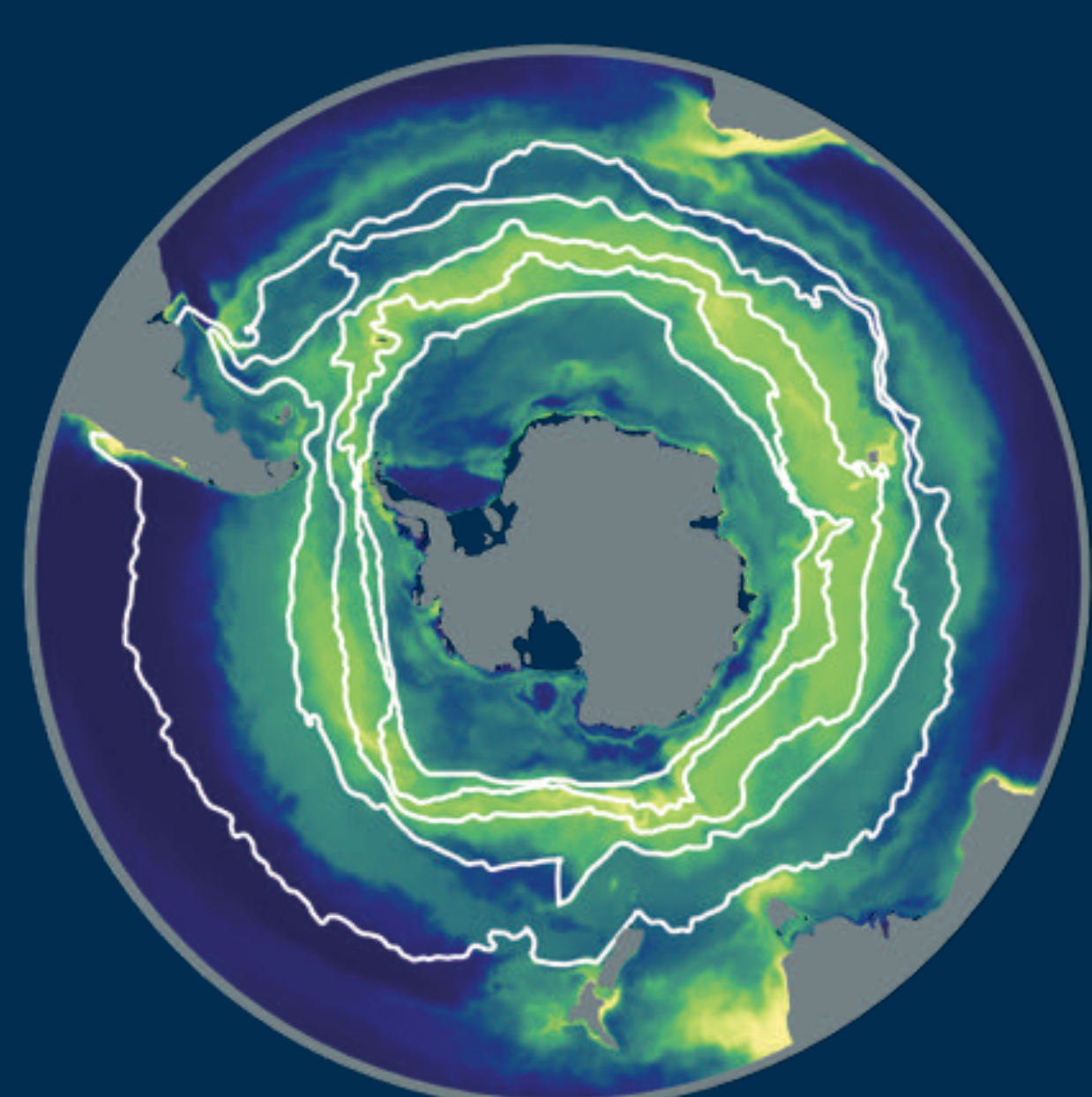


Southern Ocean phytoplankton database
dots show locations of phytoplankton community composition observations compiled from literature

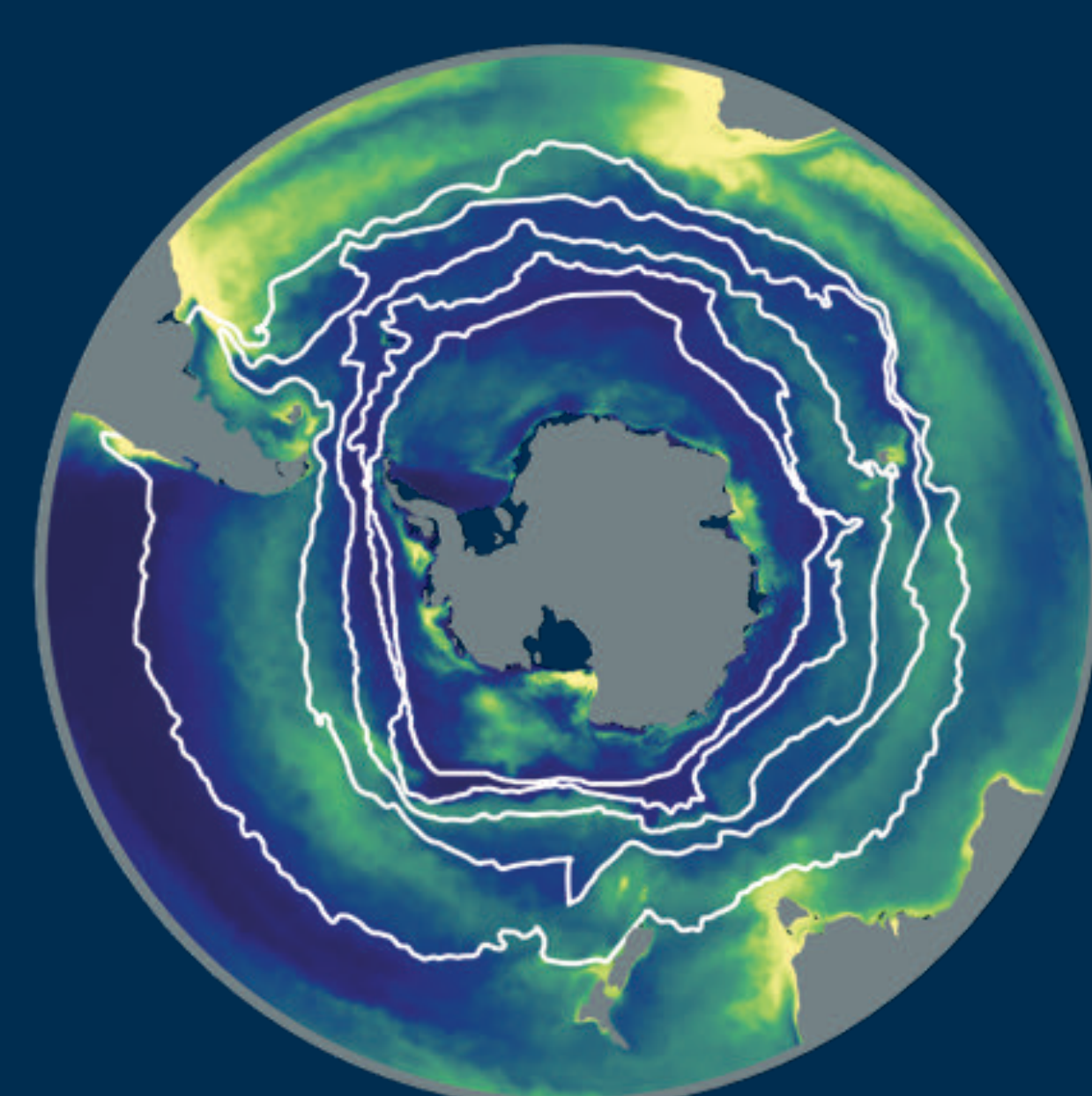


MaxEnt species distribution model (Phillips et al, 2006)

Bacillariophyceae (diatoms)
Probability of presence in summer

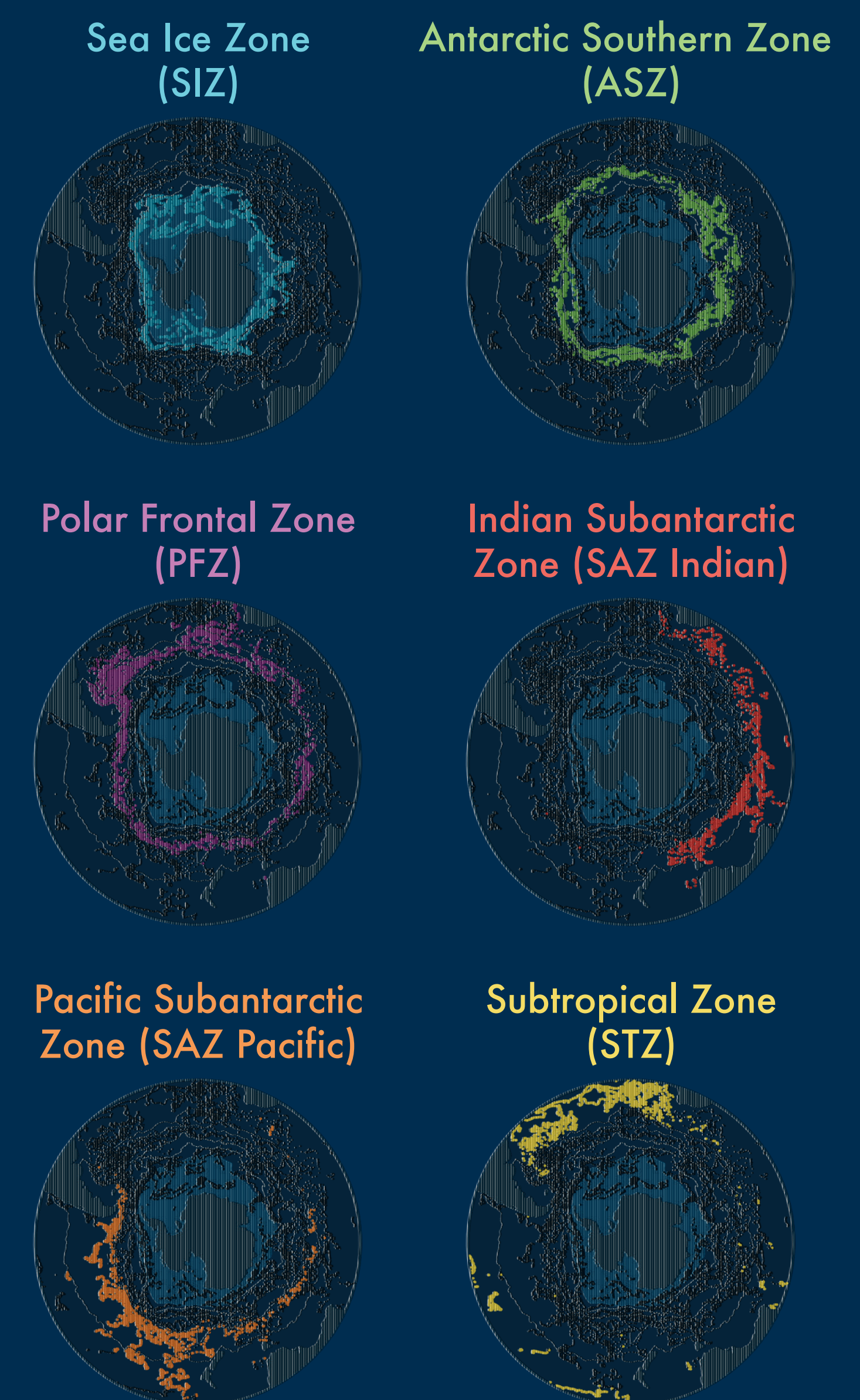
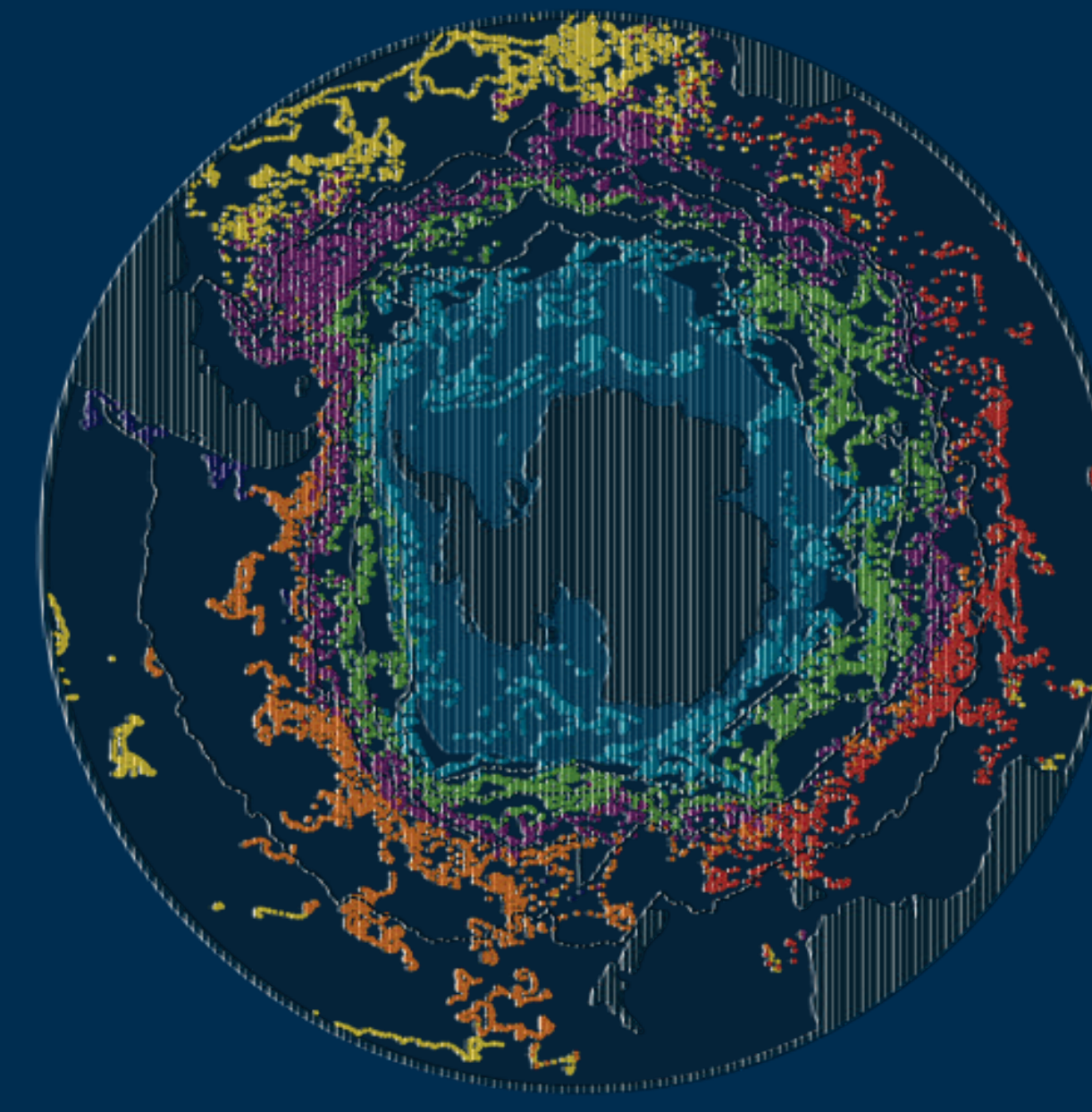


Primnesiophyceae (*Phaeocystis*)
Probability of presence in summer



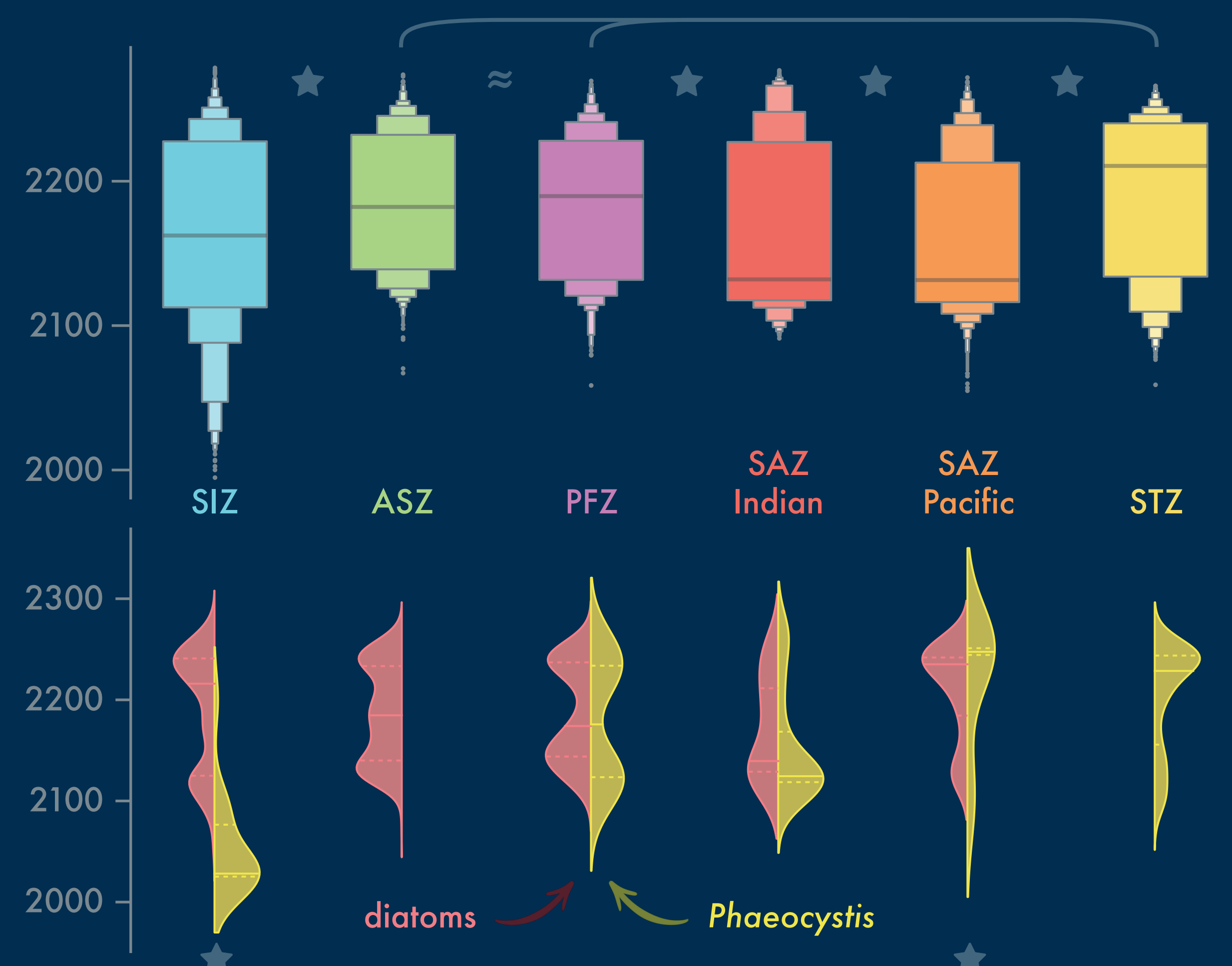
BGC-Argo float profiles clustered into biophysically similar regions

Application of Gaussian mixture modeling, an unsupervised learning method



Biophysical regions have different DIC concentrations

Mean DIC in the mixed layer (mmol C m⁻² d⁻¹)



Kruskal-Wallis analysis of variance; Dunn post-hoc test