Hot spots in the ice: revealing relationships between marine ecosystems and sea ice in coastal Antarctica

NASA BEF Team Meeting – September 21, 2022

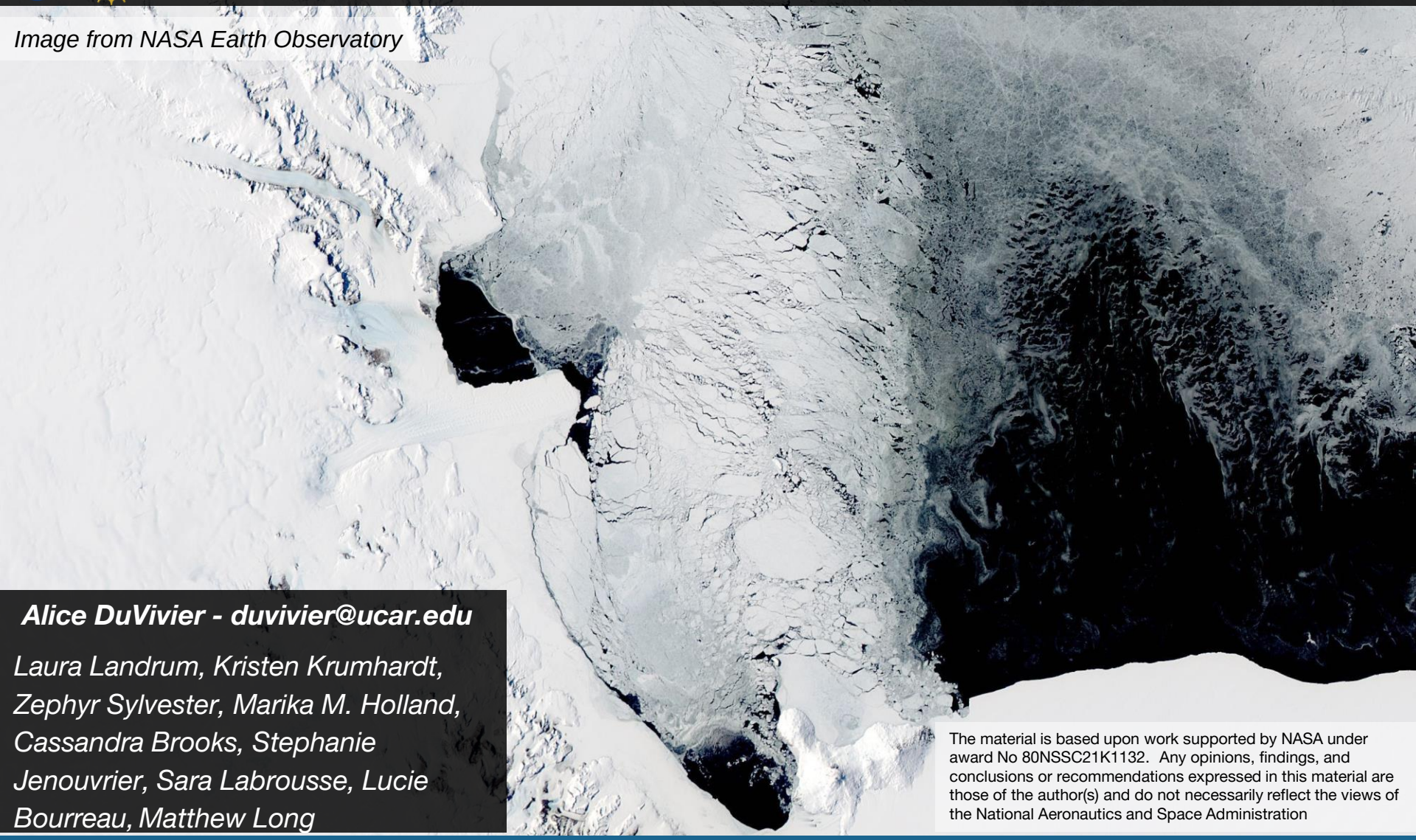

Image from NASA Earth Observatory

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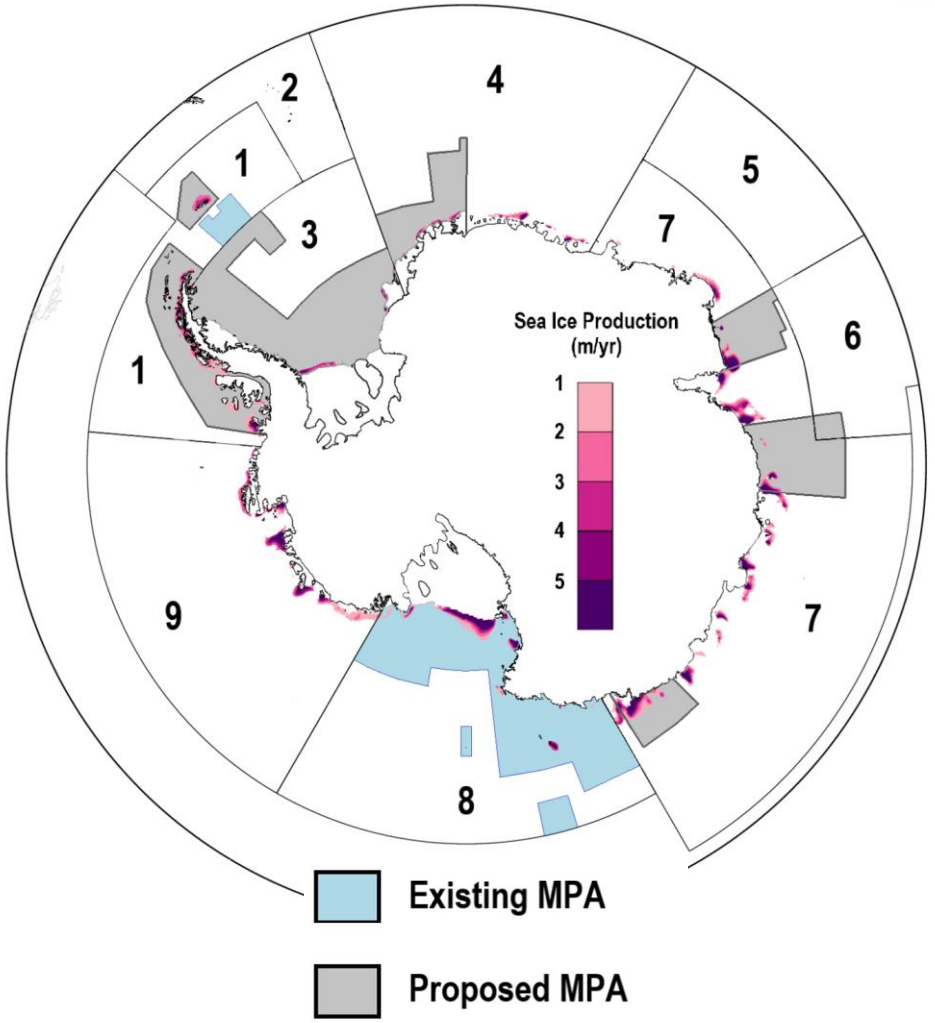
Project goal:

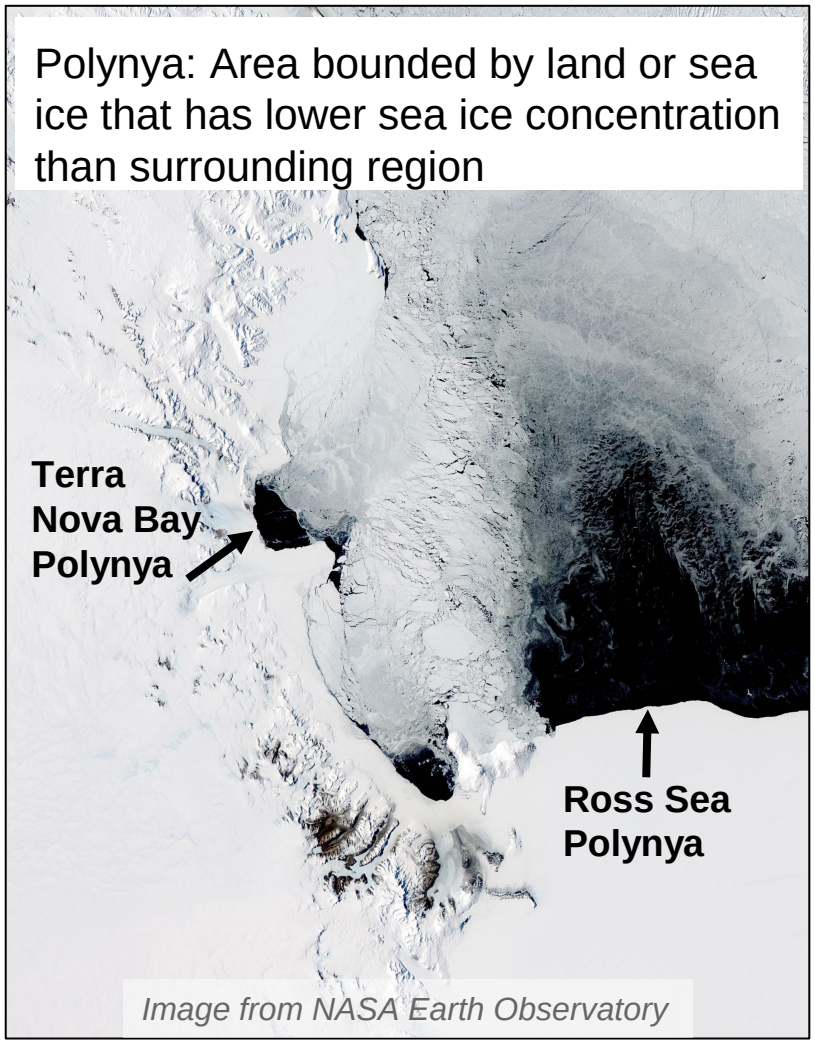
Provide maps of polynyas at a circum-Antarctic scale and create information about the conservation value of polynyas in different Antarctic regions.



MPA = Marine Protected Area

What is the impact of polynyas on the Antarctic ecosystem?

Polynya: Area bounded by land or sea ice that has lower sea ice concentration than surrounding region



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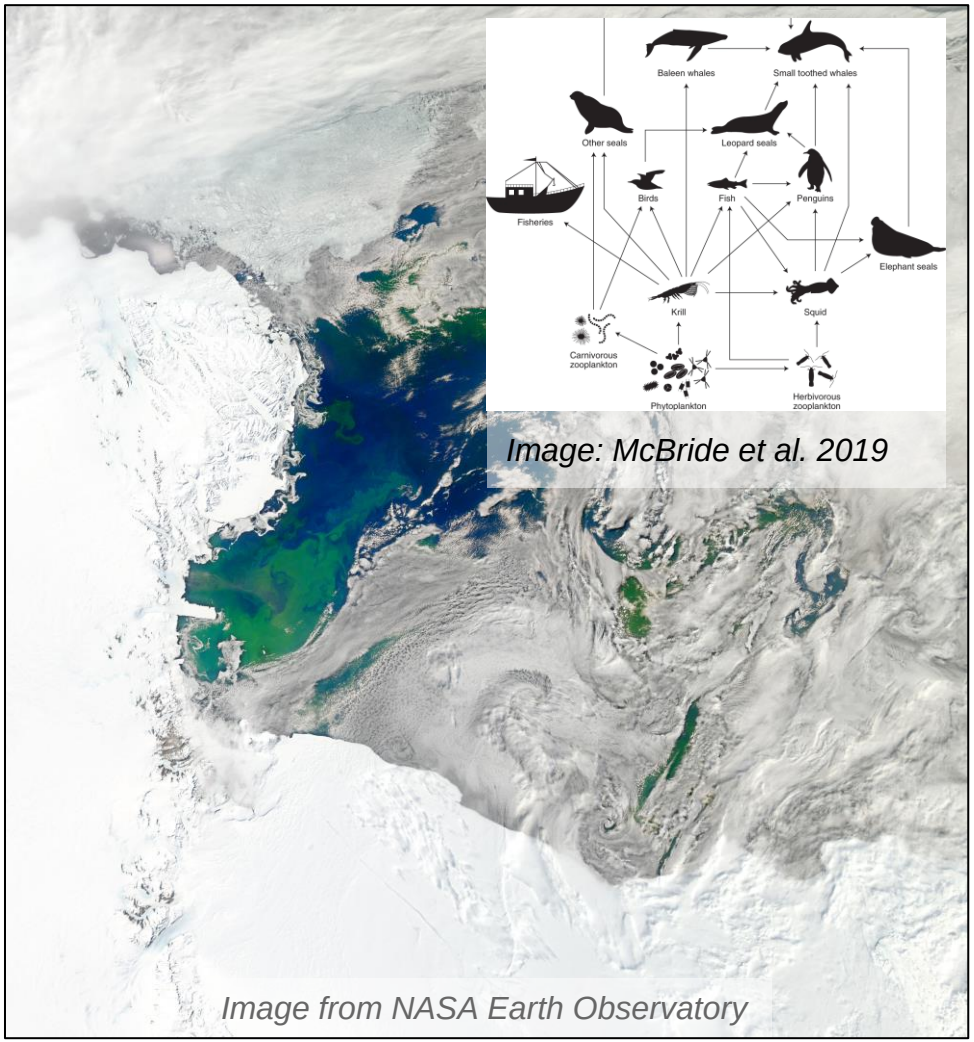
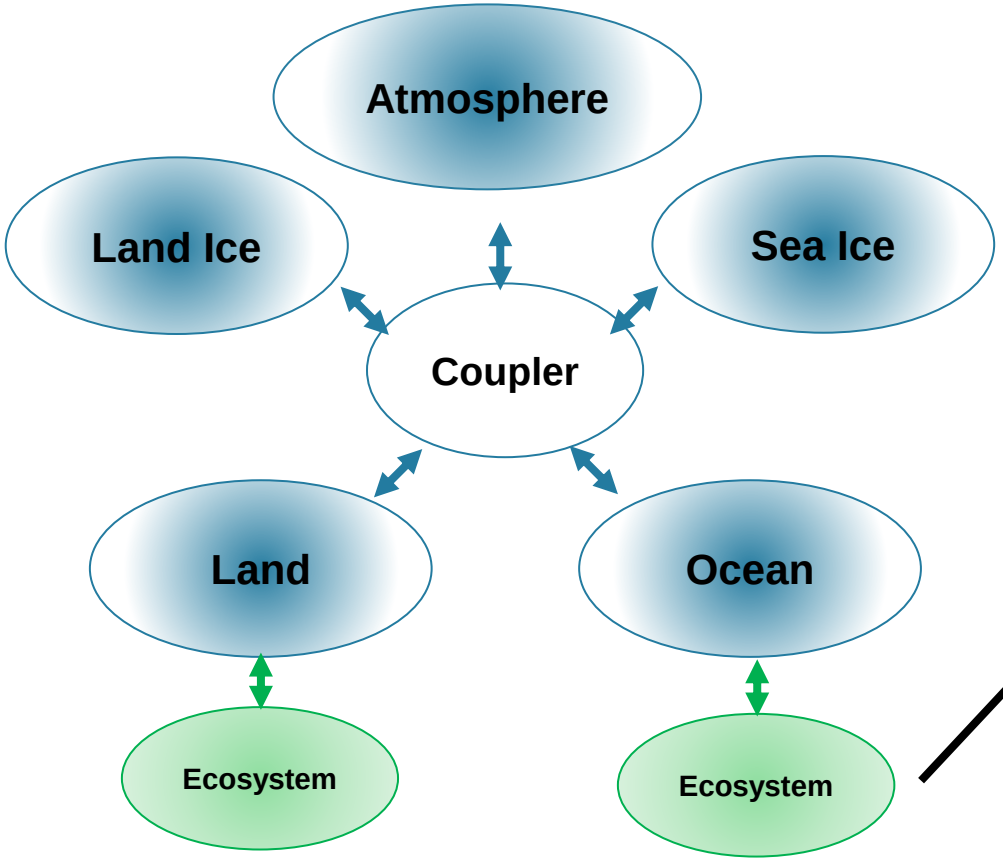


Image: McBride et al. 2019

Image from NASA Earth Observatory

Earth System Models are a tool to understand future physical and ecosystem changes

Community Earth System Model (CESM)



CESM2-MARBL: 4phyto/4zoo ecosystem

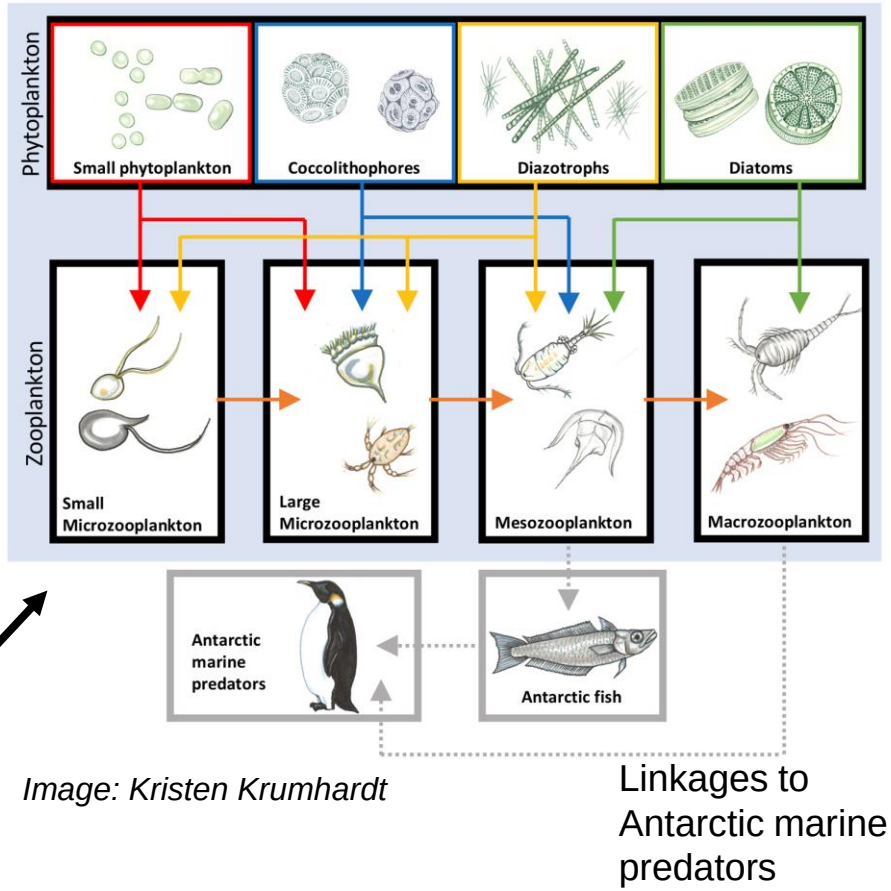


Image: Kristen Krumhardt

Linkages to Antarctic marine predators

Identifying polynyas

Laura Landrum
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Alice DuVivier,
NCAR

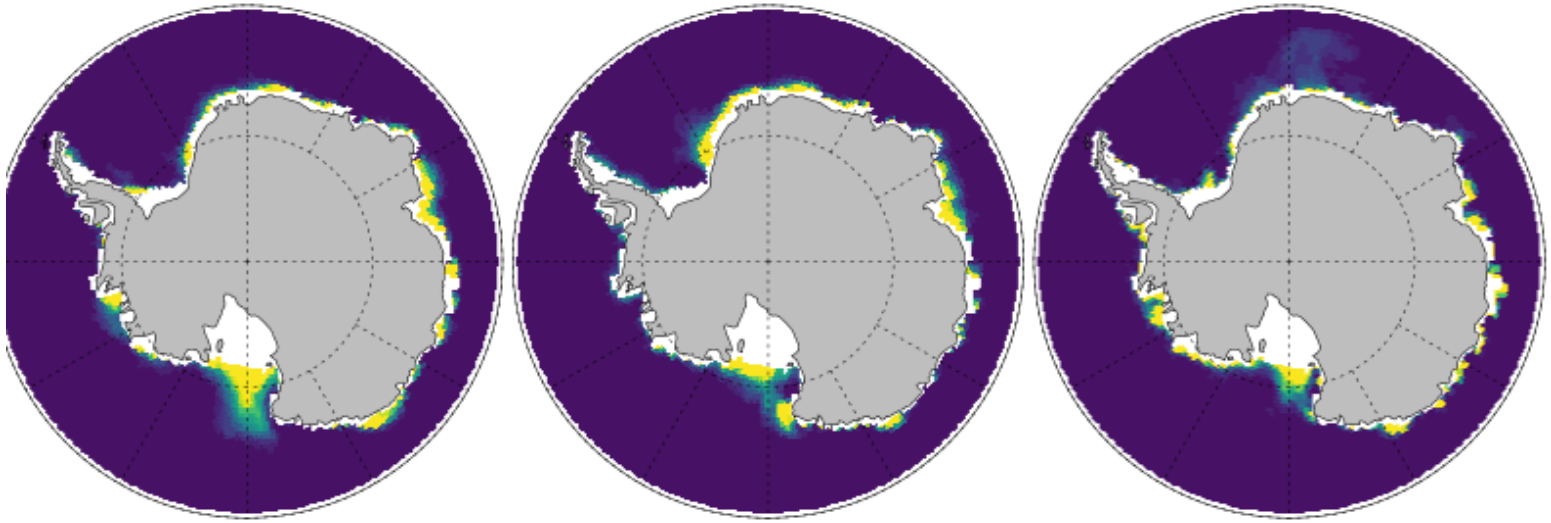
Marika Holland,
NCAR

- Developed a polynya identification tool that is reproducible, verifiable, and applicable to gridded data (satellite or model) using sea ice concentration or thickness.

ESM
Threshold → ice thickness = 40cm

ESM
Threshold → ice concentration = 85%

Satellite
Threshold → ice concentration = 85%

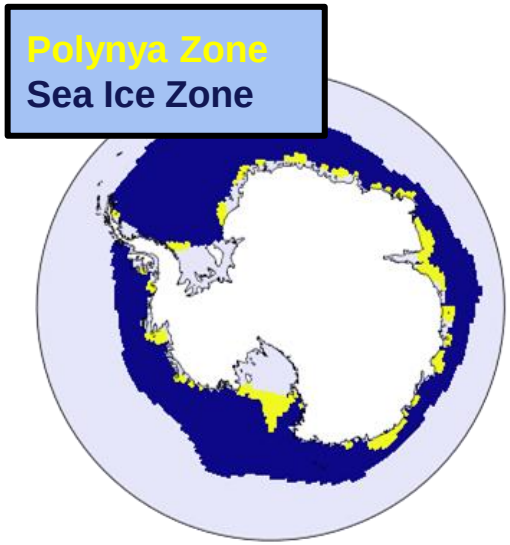


Modeled productivity in polynyas

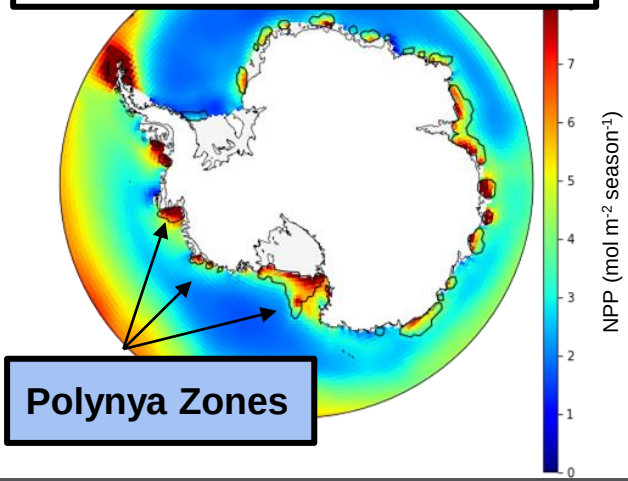
Zephyr Sylvester, CU Boulder

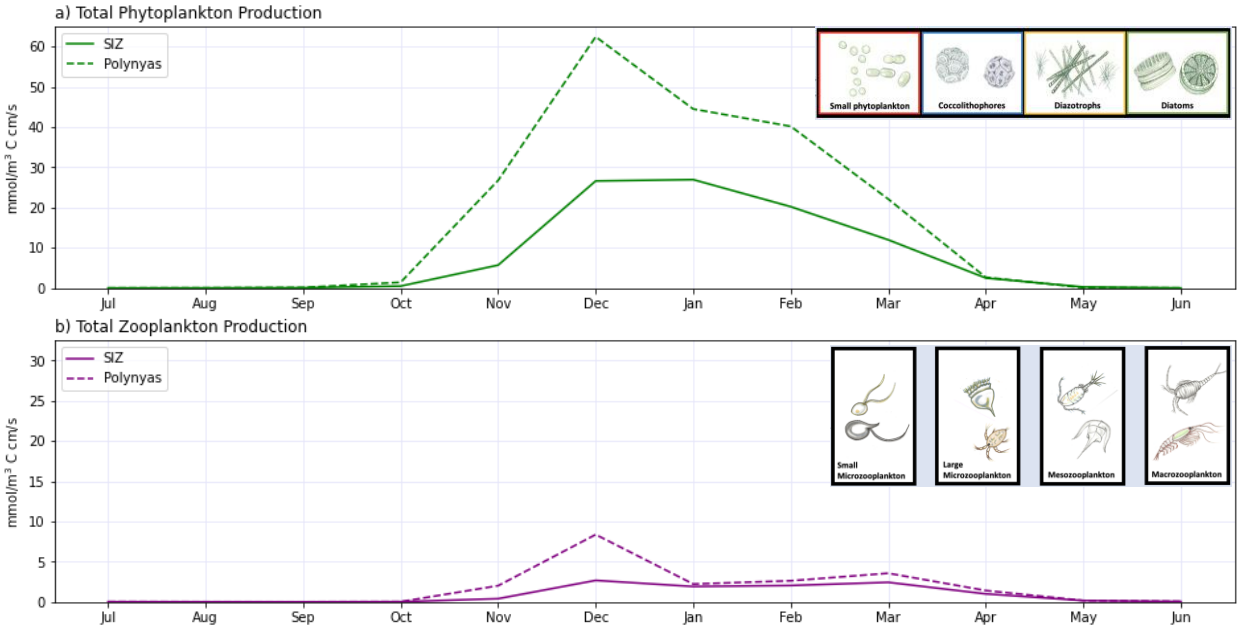
Kristen Krumhardt, NCAR

Alice DuVivier, NCAR



CESM simulated Annual Net Primary Production (NPP)





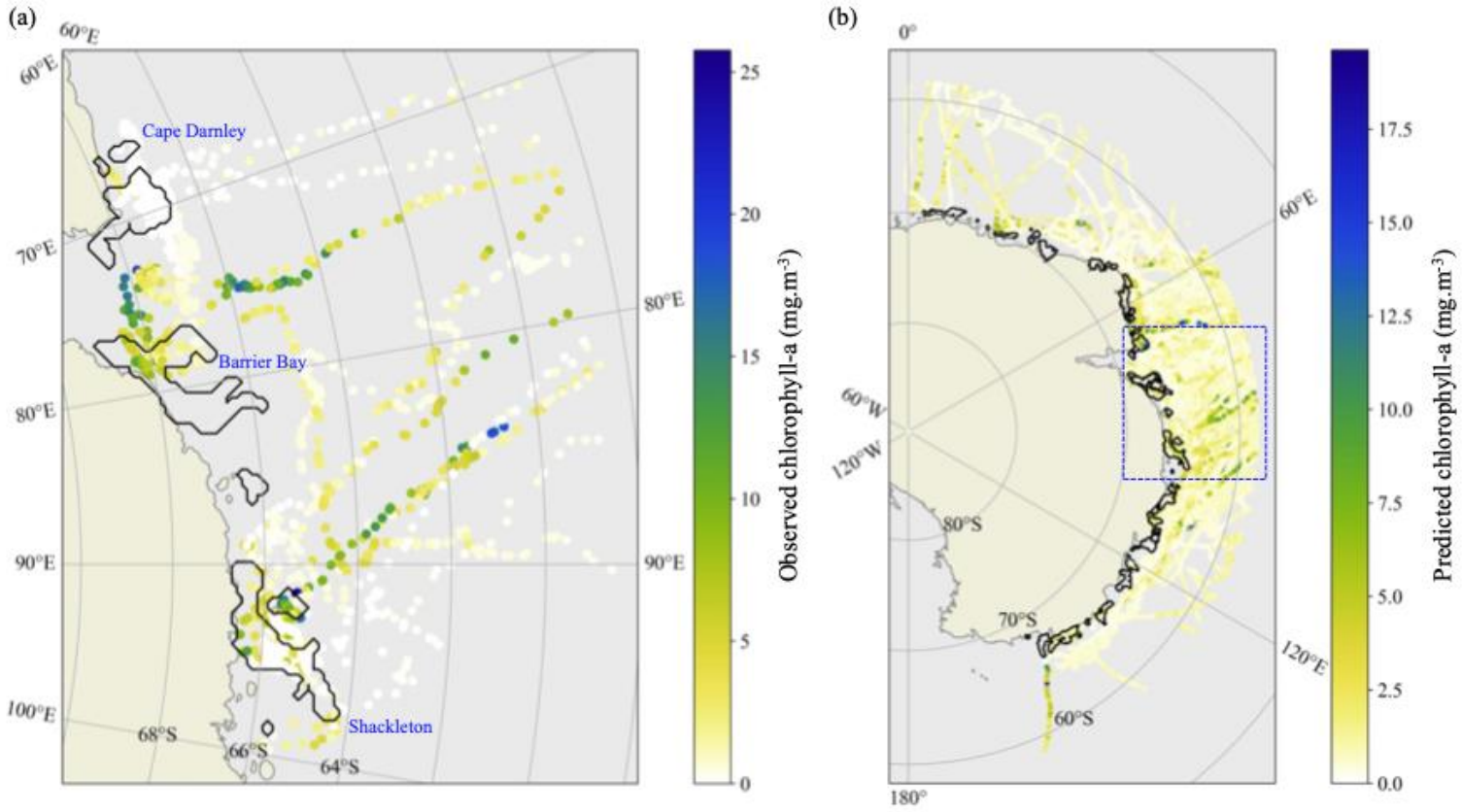
East Antarctic in-situ productivity

Lucie Bourreau, WHOI

Sara Labrousse, LOCEAN

Stephanie Jenouvrier, WHOI

- In-situ biotags with fluorescence sensors reveal productivity in East Antarctic polynyas.
- Used machine learning with environmental conditions to predict productivity from biotags without fluorescence measurements.



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End user interactions

Cassandra Brooks, CU Boulder

Zephyr Sylvester, CU Boulder

Science-Policy-Public Interface

End Users

THE PEW CHARITABLE TRUSTS

Antarctic and Southern Ocean Coalition

Only One

CCAMLR

The general public

Thanks for your attention!

Questions?

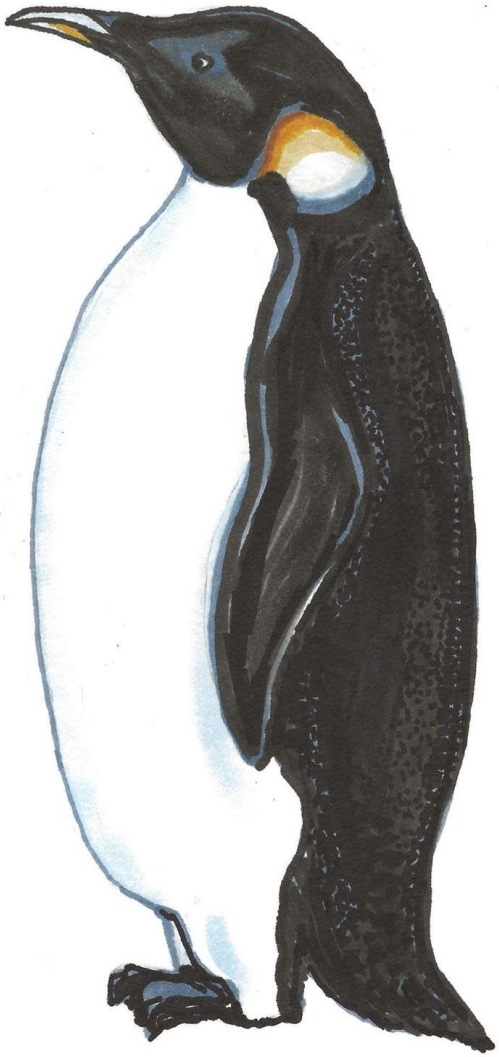

Image: Kristen Krumhardt

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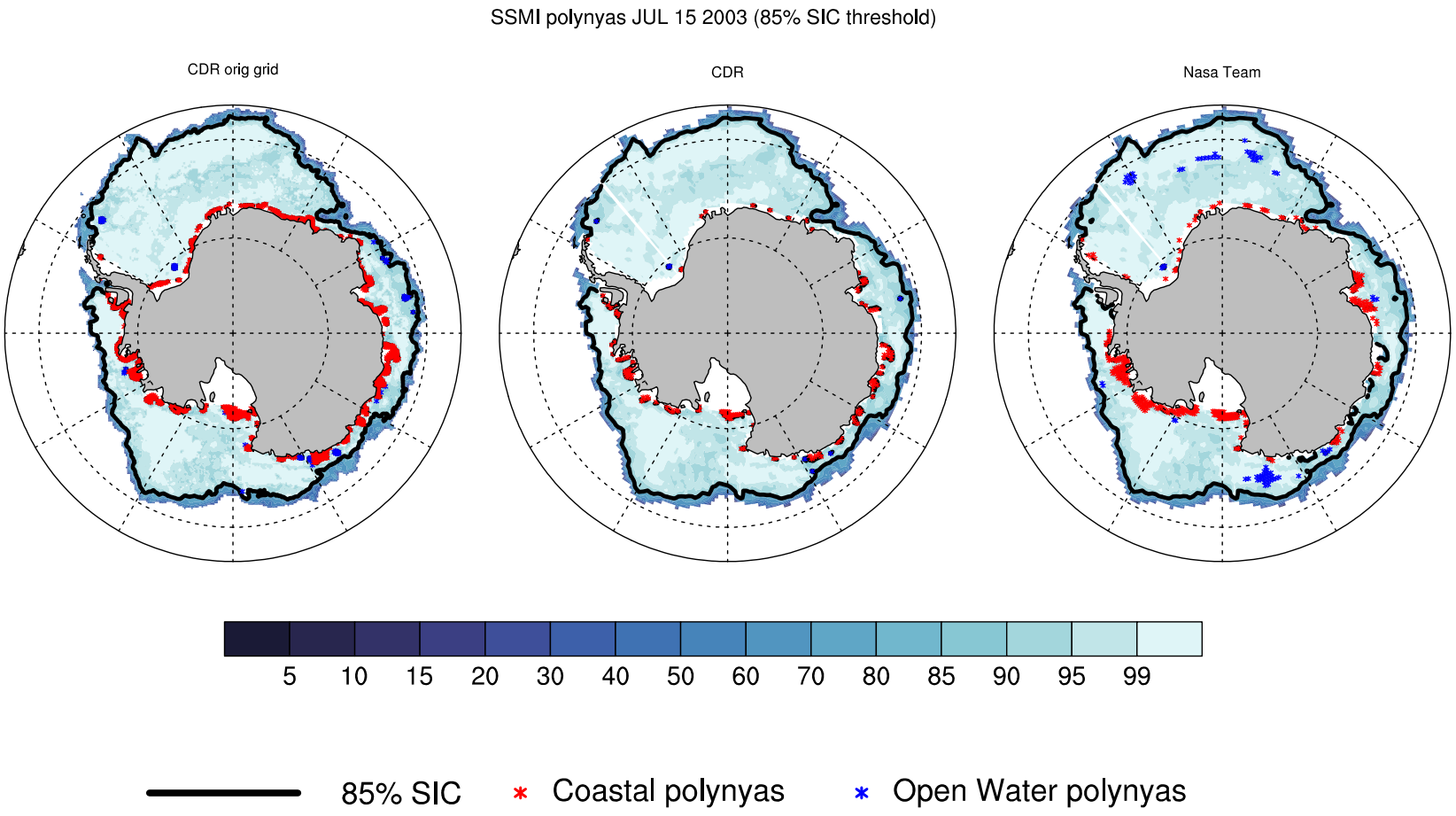
SSMI polynyas JUL 15 2003 (85% SIC threshold)
CDR orig grid
CDR
Nasa Team
5
10
15
20
30
40
50
60
70
80
85
90
95
99
85% SIC
Coastal polynyas
Open Water polynyas