

NEROC Symposium (2020): Polar Radio Science

Polar Geodesy

Pedro Elosegui, Haystack Observatory

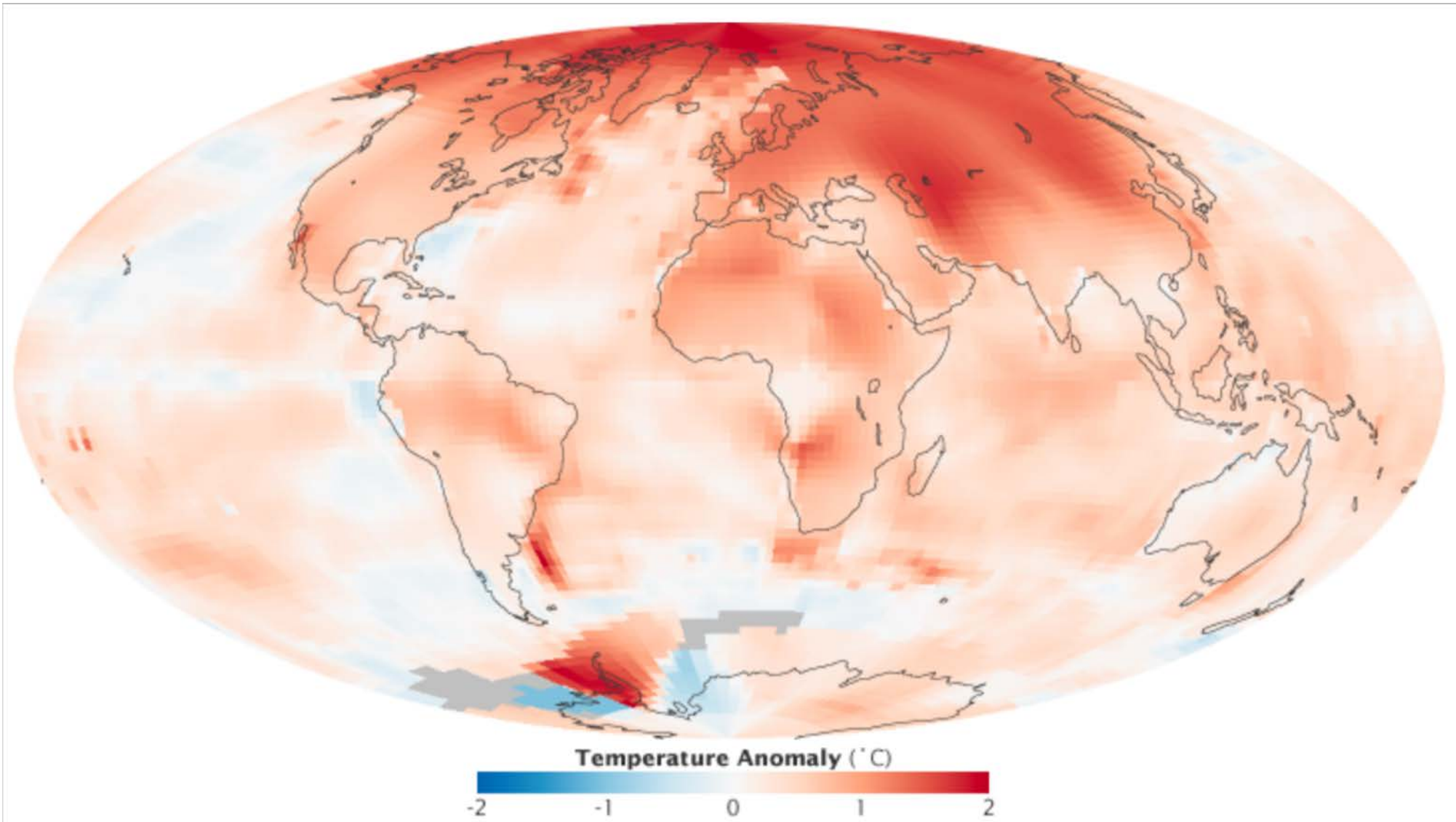


MIT
HAYSTACK
OBSERVATORY

Covering today

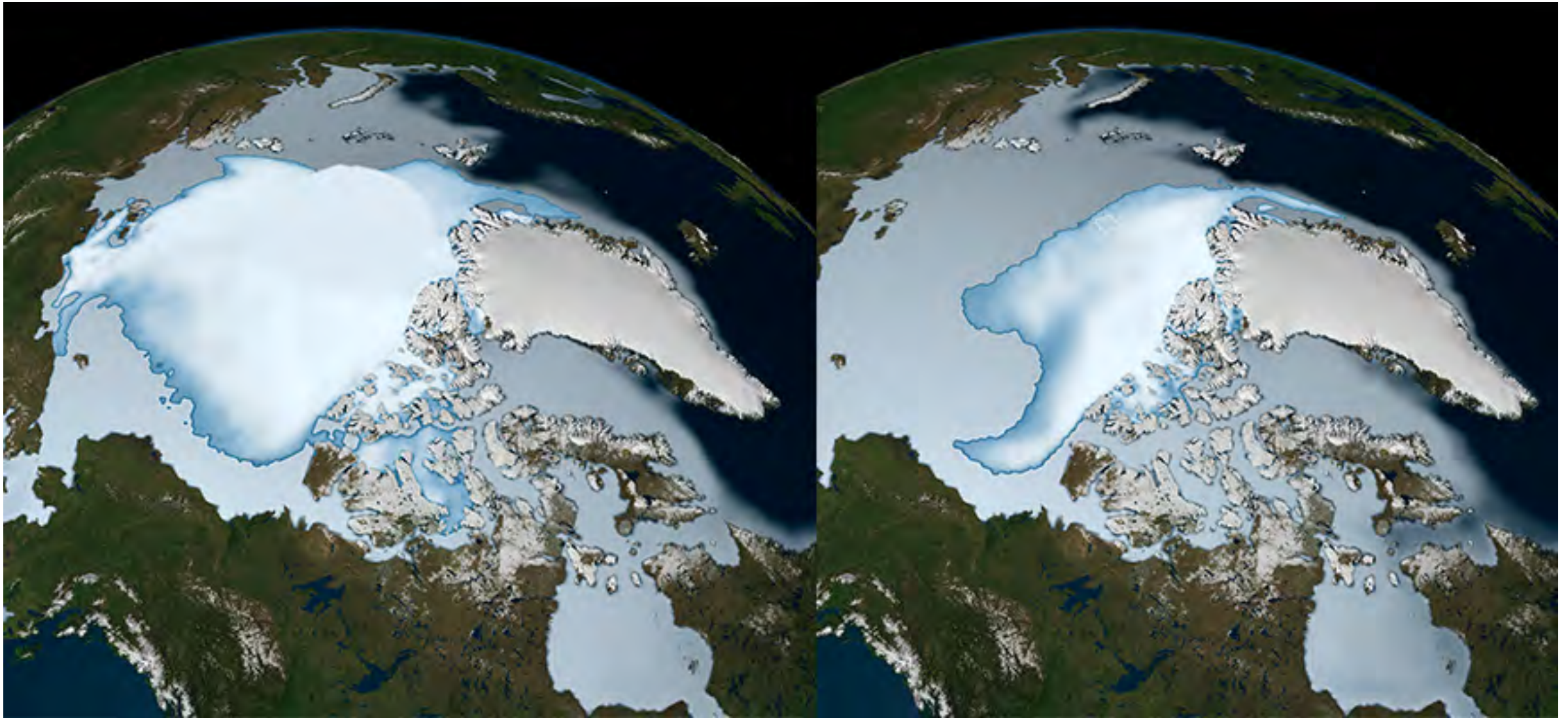
- Rapid polar change motivator
- How do we respond to a climate emergency
- Sampler of polar geodesy projects at Haystack/NEROC
- Closing thoughts/open questions

Rapid polar changes: Arctic Amplification



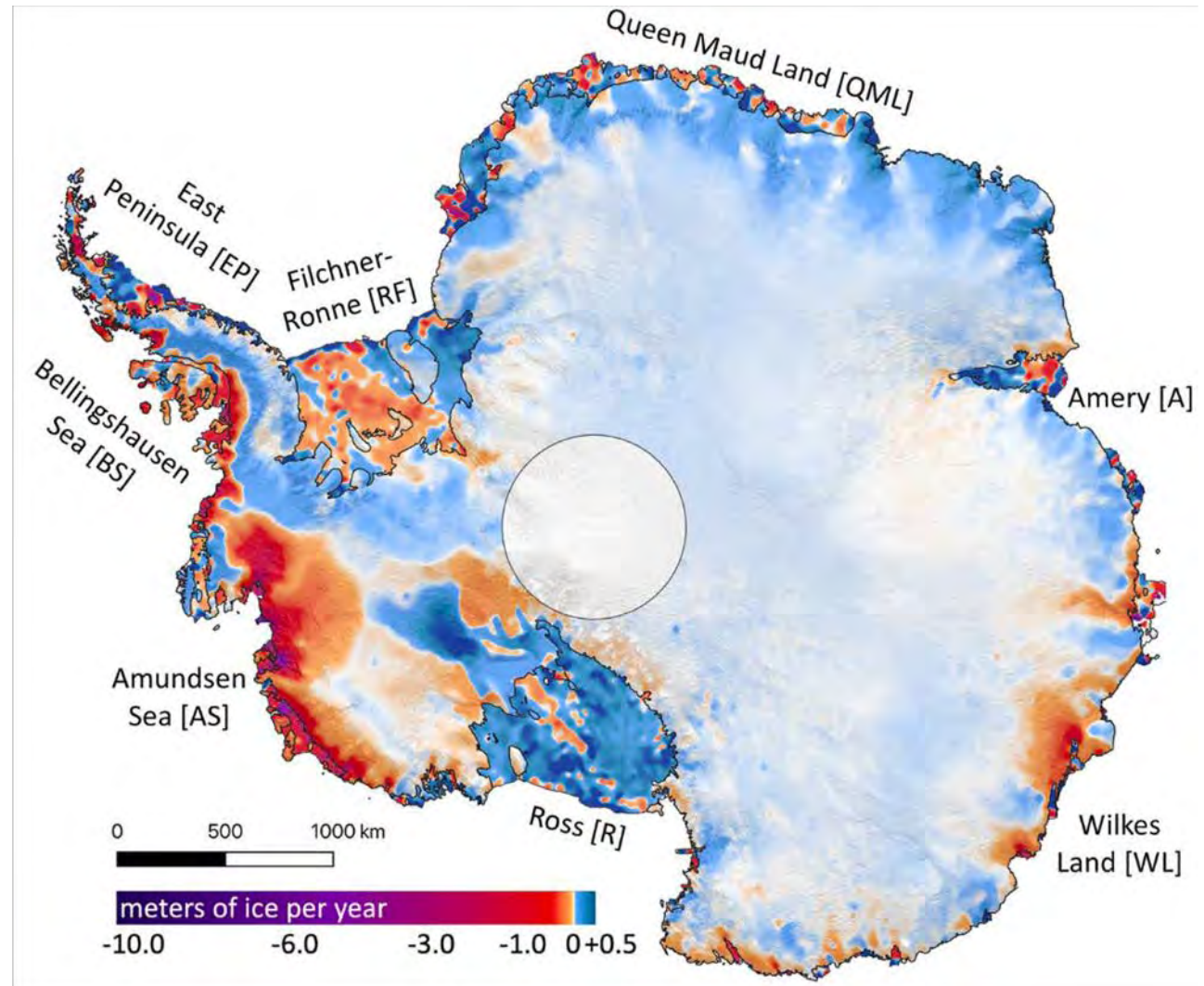
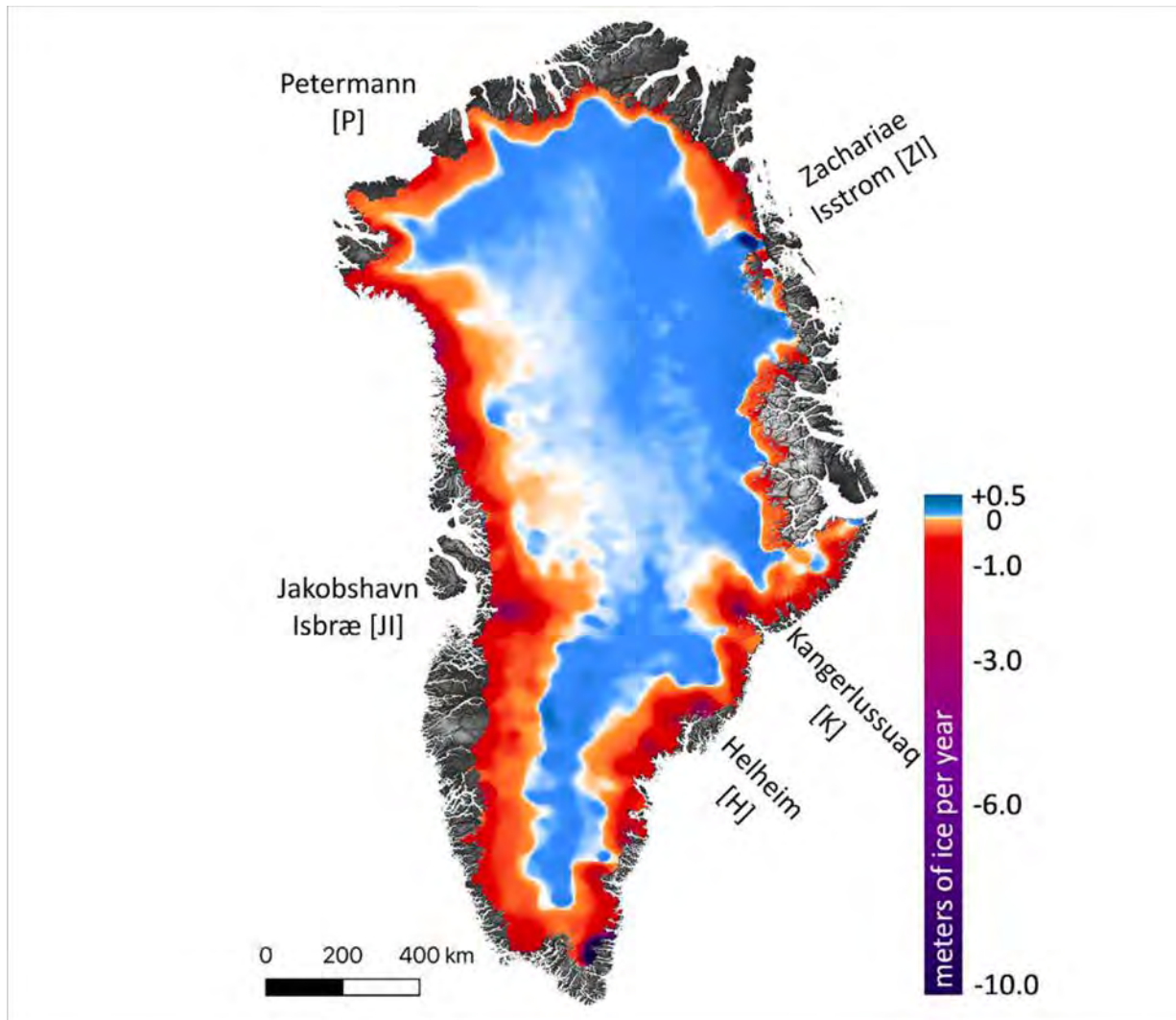
[GISS, 2020]

Rapid polar changes: Arctic sea ice loss



[NSIDC/NASA]

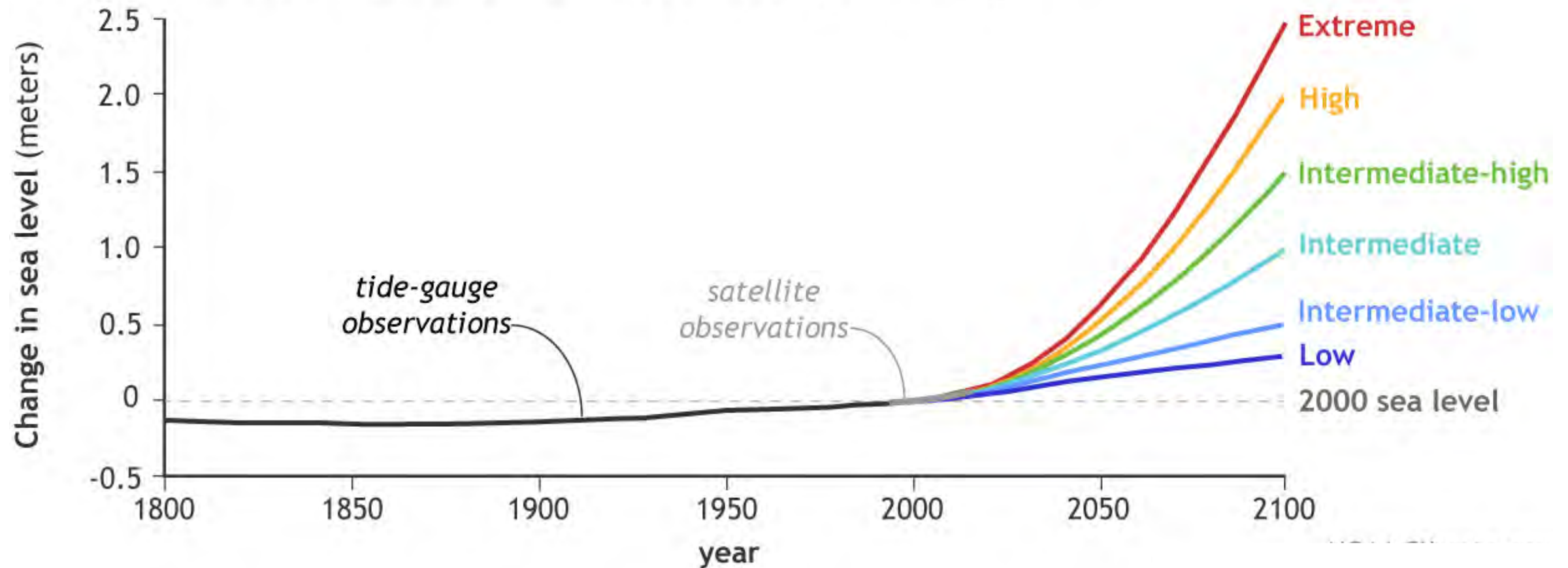
Rapid polar changes: Ice sheet mass loss



[Smith et al., 2020]

How much will sea level rise? A highly uncertain risk

Possible future sea levels for different greenhouse gas pathways



Global Temperature Rise 0.0 °C (Climate Central)
Multi-century Sea Level Increase: +0.0m

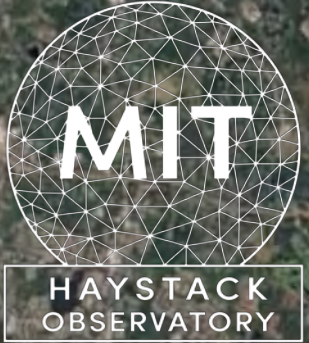
M.I.T.



2 km
2 mi

0°C

Global Temperature Rise 1.0 °C (Climate Central)
Multi-century Sea Level Increase: +2.1m



M.I.T.



HIGH

2 km
2 mi

1.0°C

Base Layer © Google

EarthTime
CMU CREATE Lab

Polar science and climate emergency

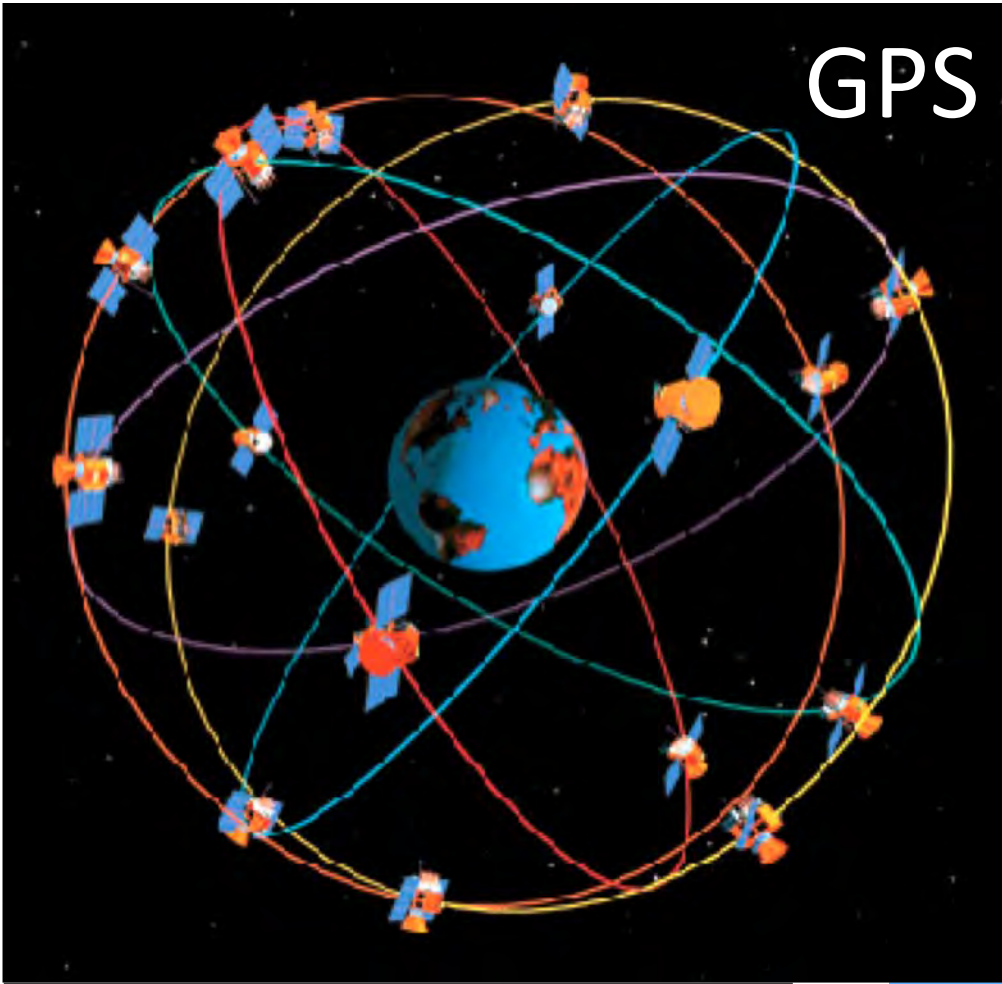
- The Arctic is warming at twice the global mean temperature, and the ice cover is experiencing dramatic changes
- The Antarctic ice sheet has the potential to raise global sea level by an order of magnitude more than any other source
- Today a year ago, the EU/UN declared a “climate emergency,” thus requiring immediate action
- How do we respond? How do we balance science discovery with social delivery?

Polar science under a climate emergency

- What are the fundamental questions and challenges regarding feedbacks between the polar regions and the rest of the Earth System?
- At Haystack, what polar technologies can be developed to best understand the relevant properties?
- At NEROC, what responsibilities, challenges, (research and education) opportunities does the polar community offer for the coming years to decades?

Polar geodesy research at Haystack/NEROC

- Fennoscandia glacial isostatic adjustment
- Greenland tidewater glacier flow and iceberg decay processes
- Arctic sea ice dynamics and ocean circulation changes
- Antarctic sea ice dynamics
- Antarctic flow dynamics of fast-moving glaciers
- Antarctic ice shelf flow and flexural response to ocean forcing



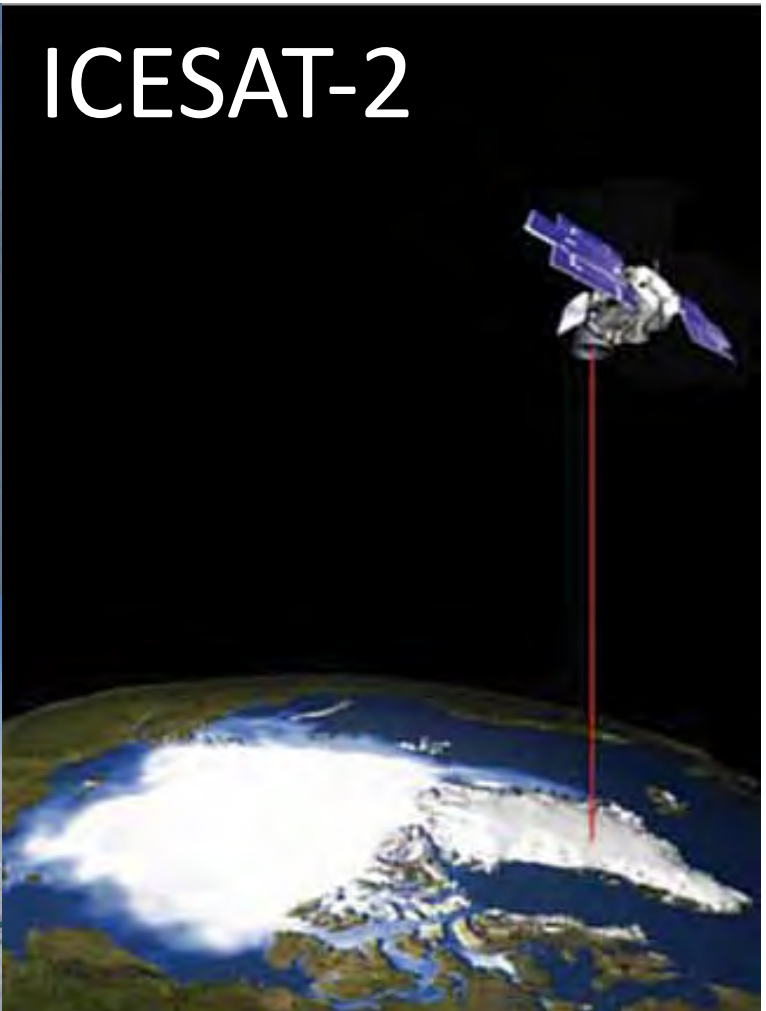
GPS



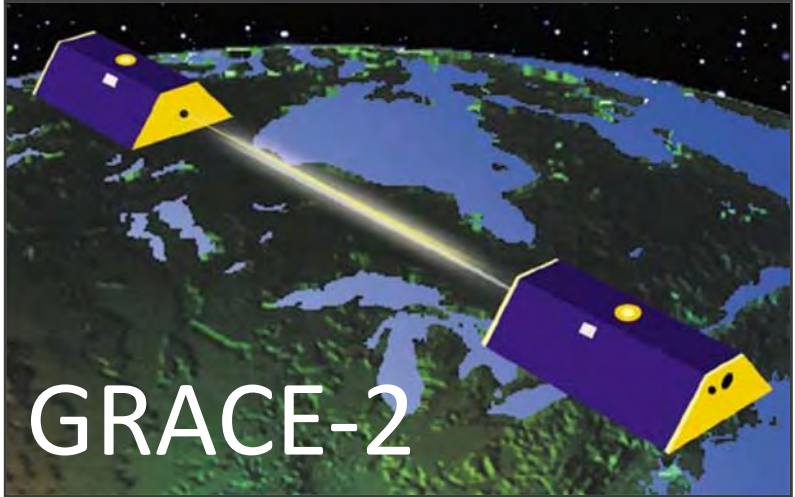
icebreaker



citizen science



ICESAT-2



GRACE-2



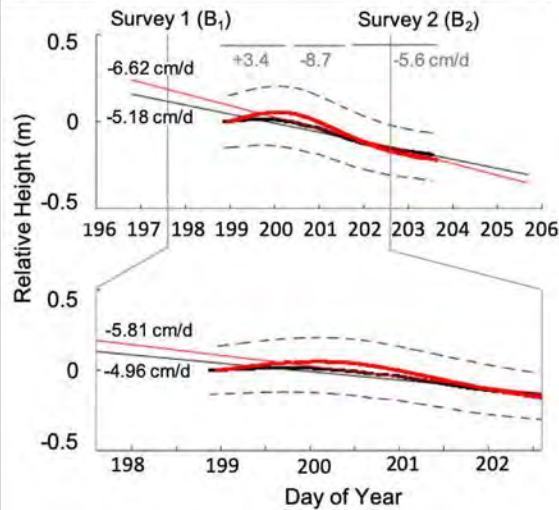
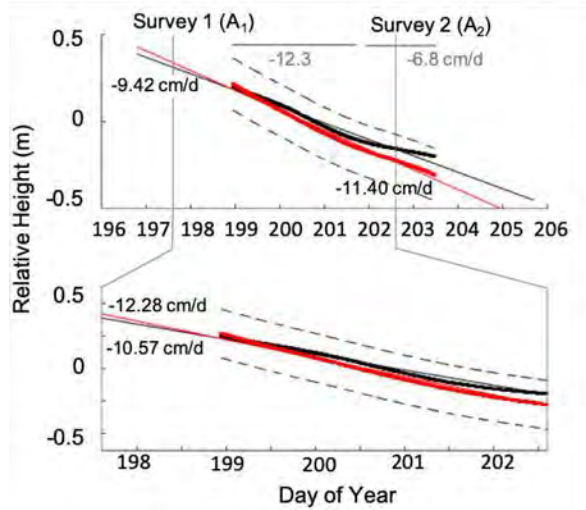
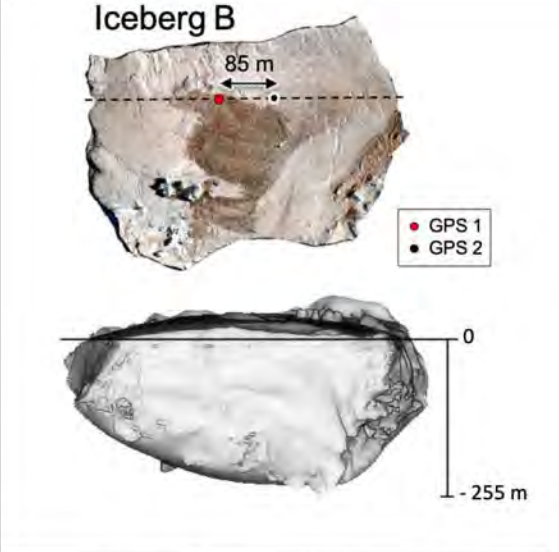
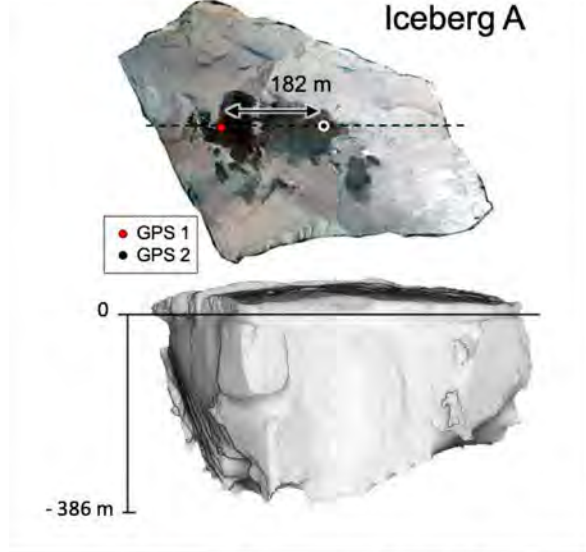
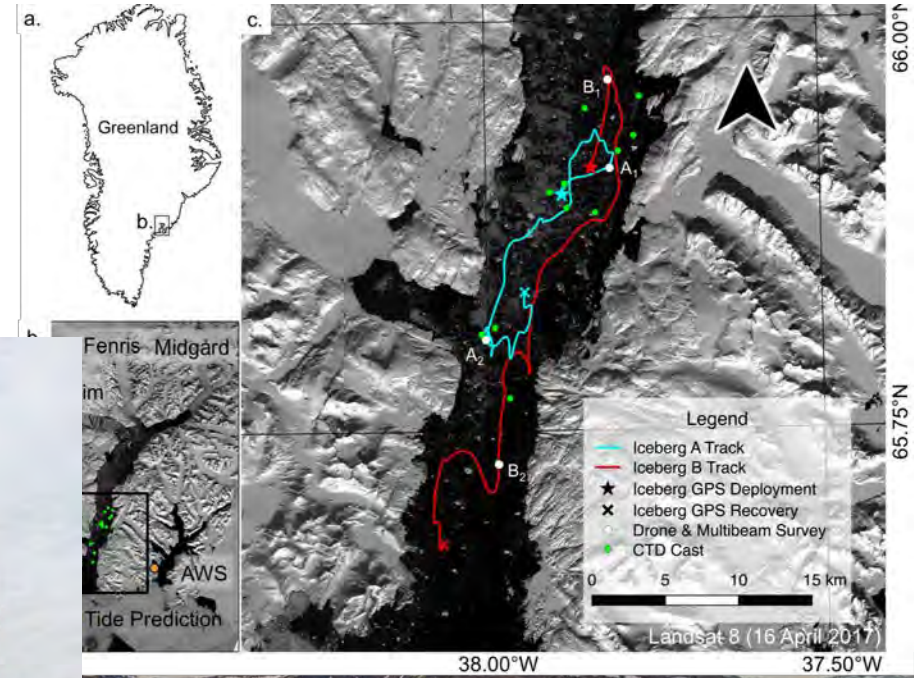
helo

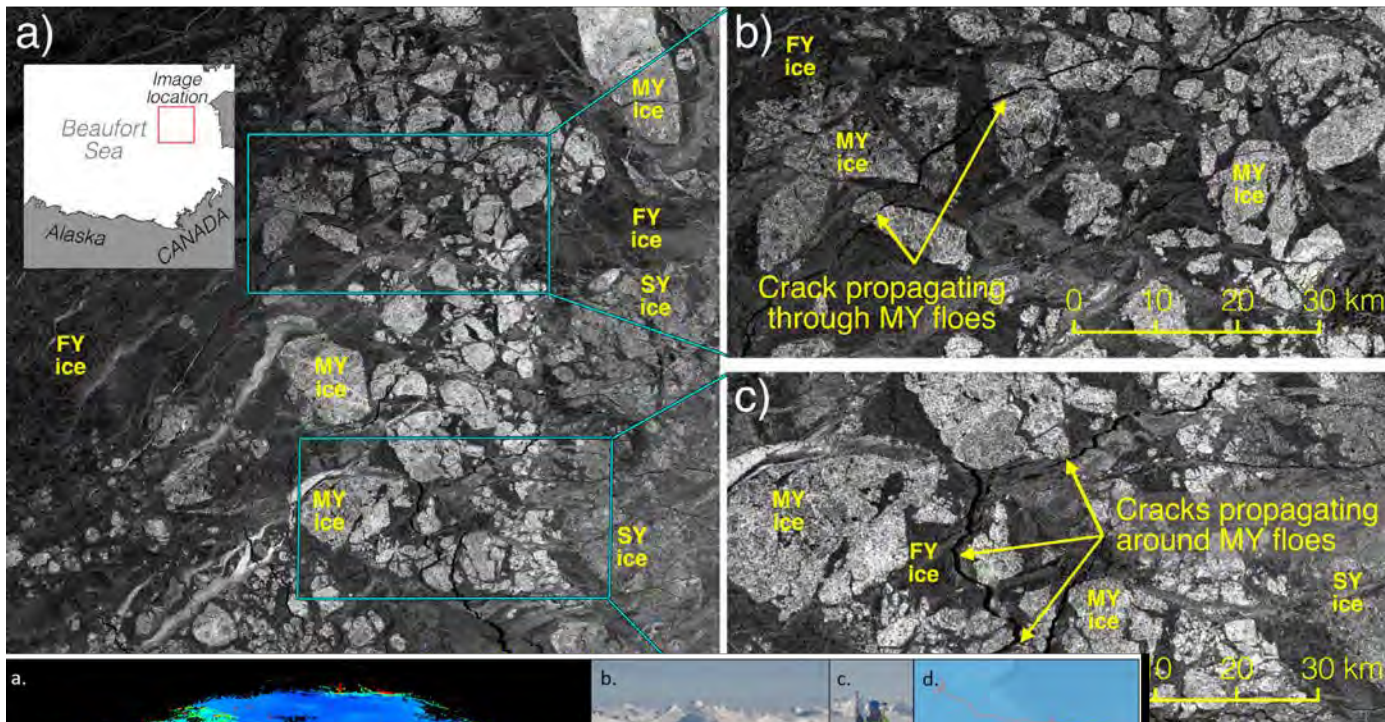


CryoSat-2

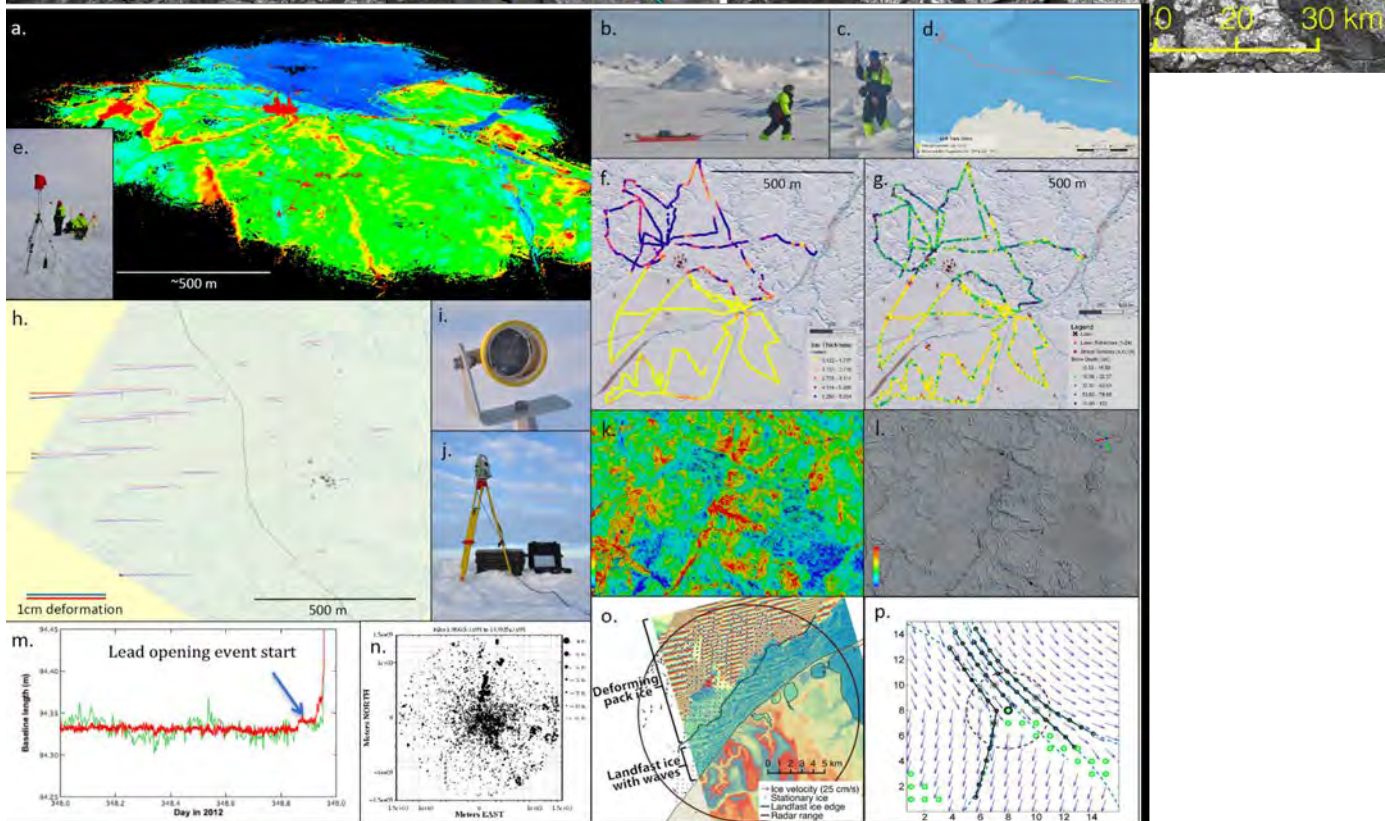
Greenland Chasing Icebergs

[Schild et al., 2020]





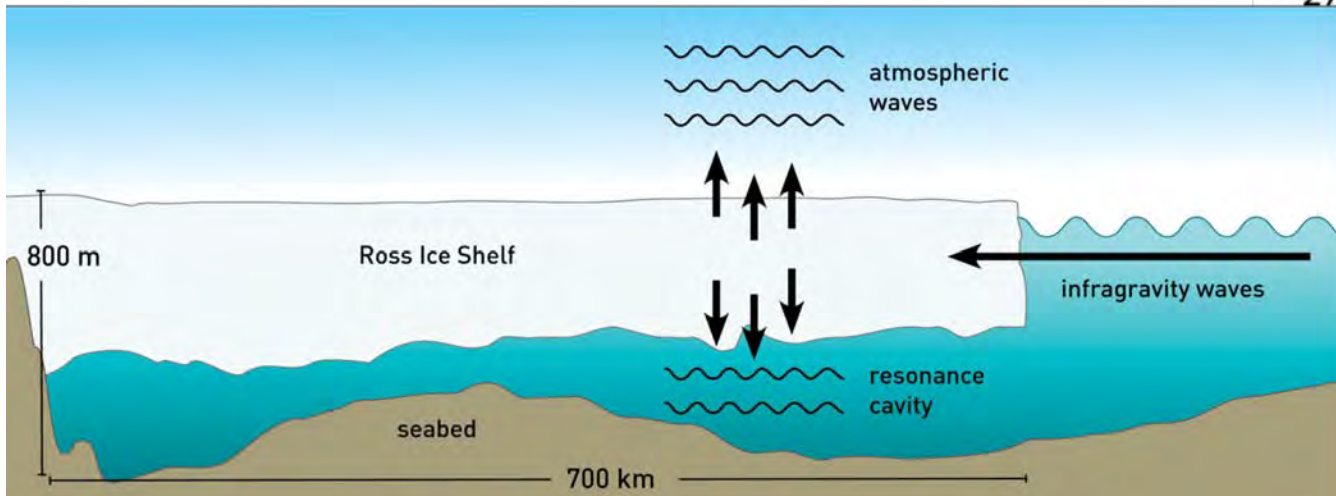
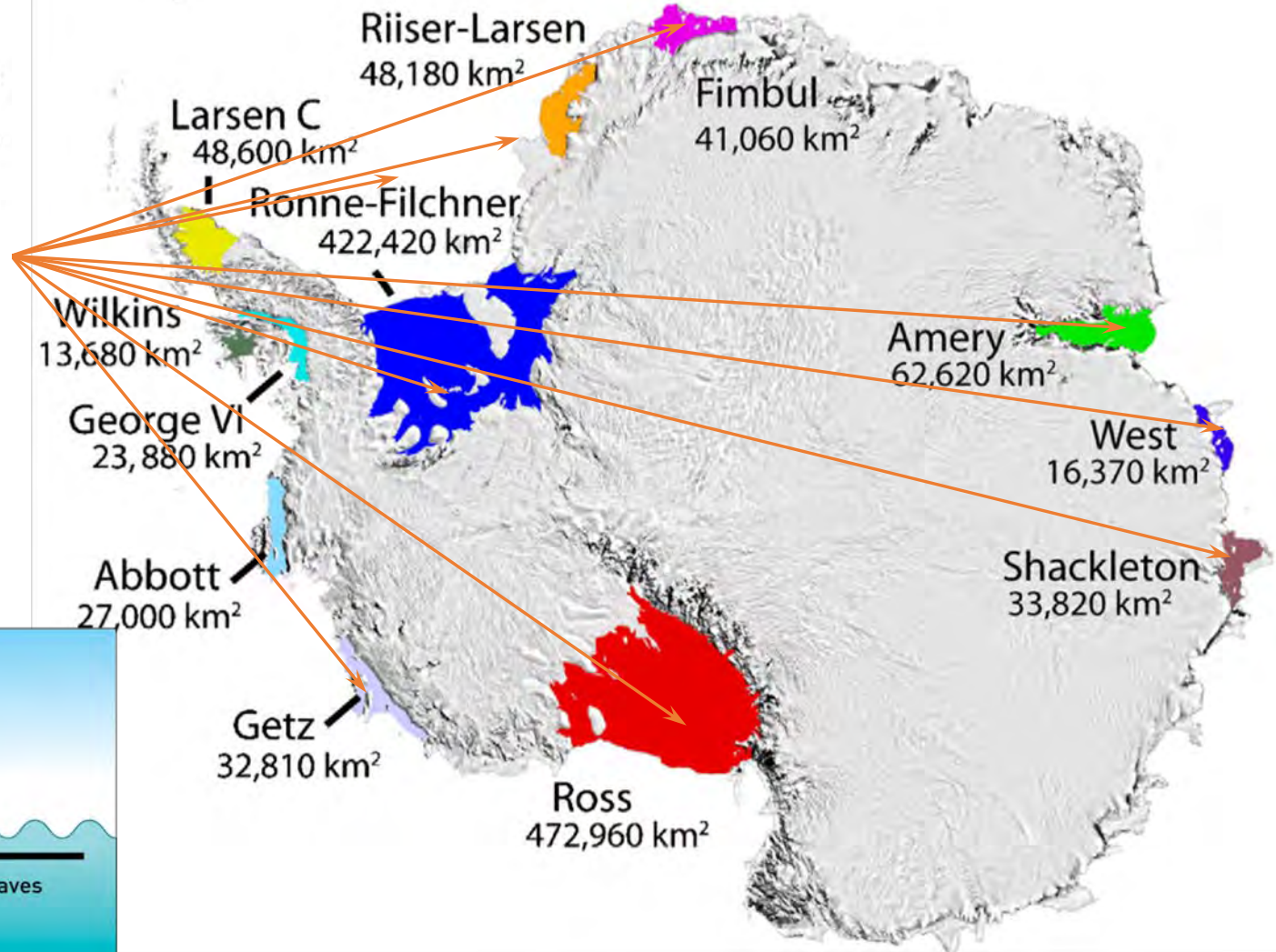
Arctic sea ice dynamics





Antarctic Ice Shelves Monitoring Observatory

Air-droppable sensors deployed across Antarctica that complement satellite and boots-on-the-ice measurements



[Scambos et al., 2007]

Polar science under a climate emergency: closing thoughts/open questions

- What are the fundamental questions and challenges regarding feedbacks between the polar regions and the rest of the Earth System?
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