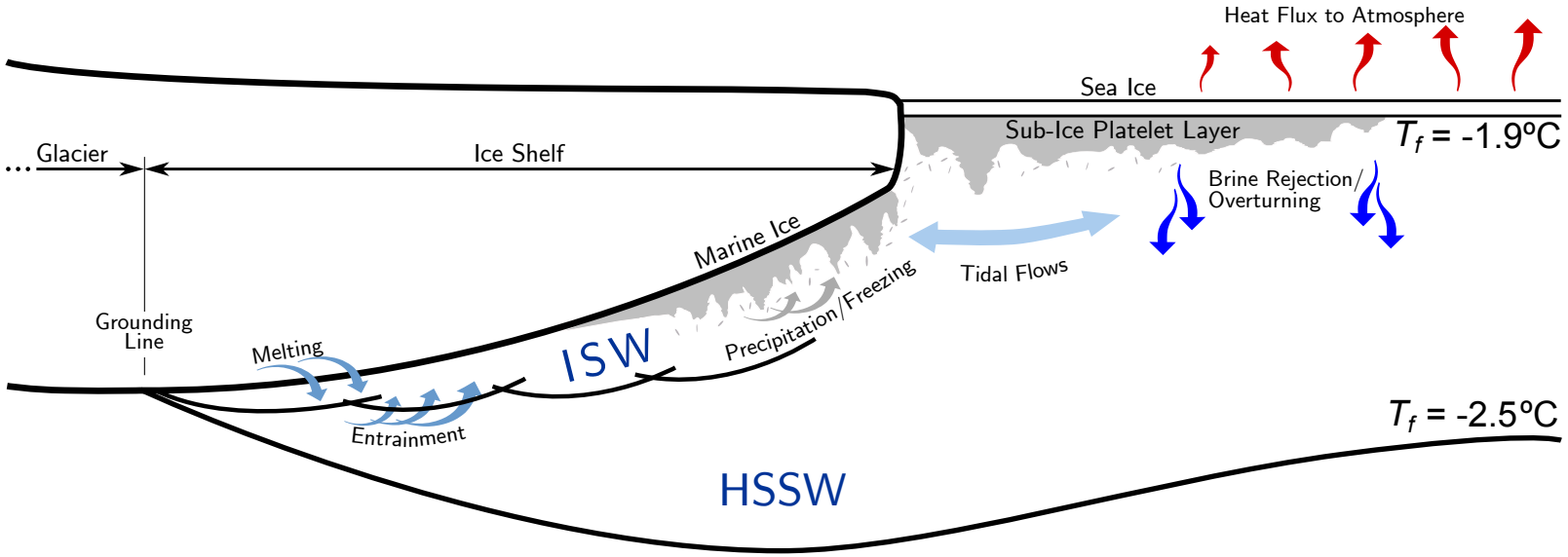
Propagation of Ice Shelf Water beneath McMurdo Sound Sea Ice

Ken Hughes

Otago University

Physical Processes



Location

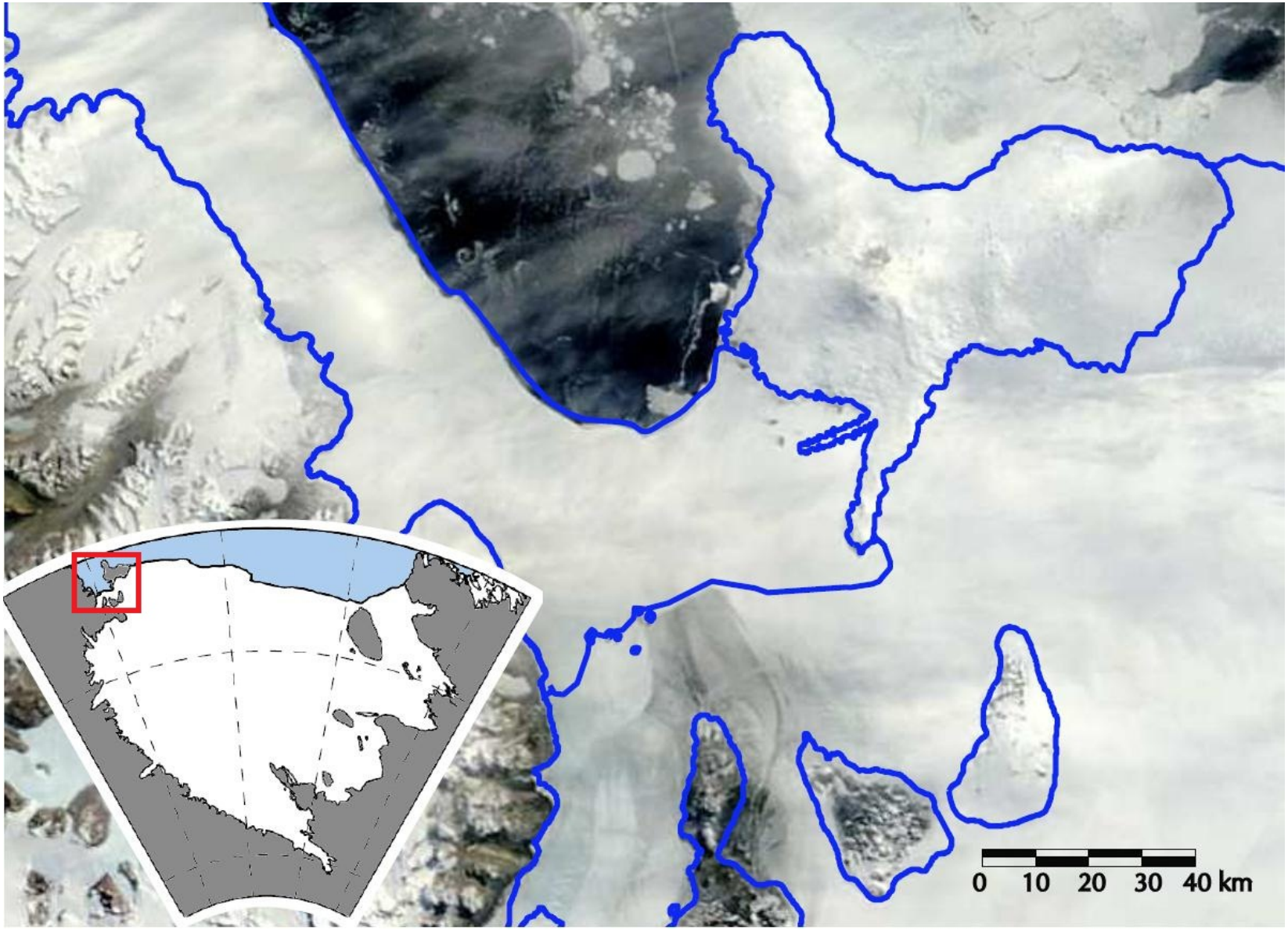
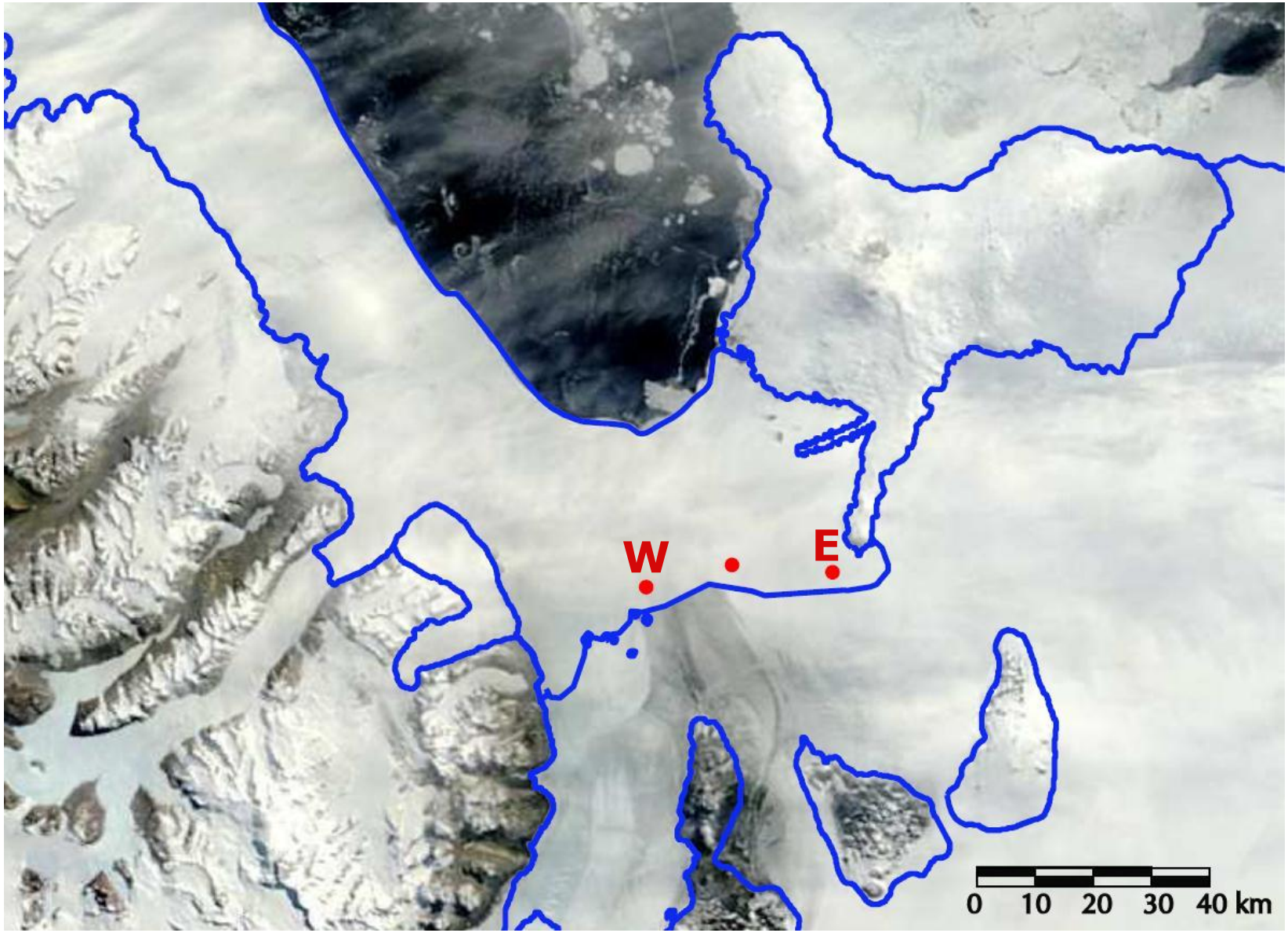


Image Source – NASA Rapid Response MODIS Subsets

Location



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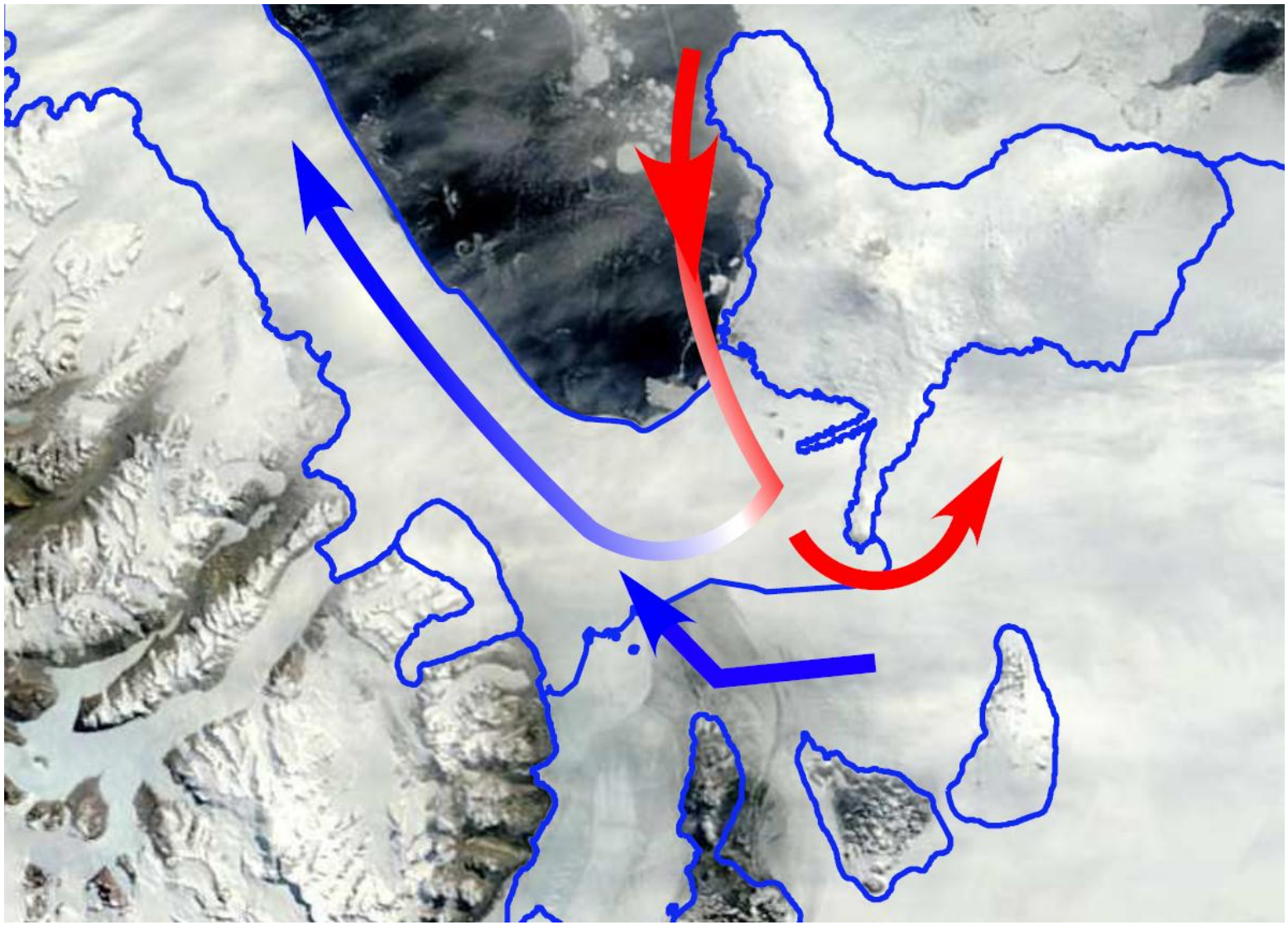
Location

Spring/Summer Circulation



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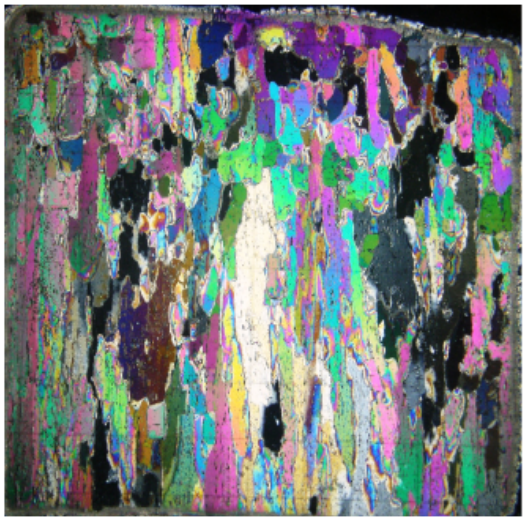
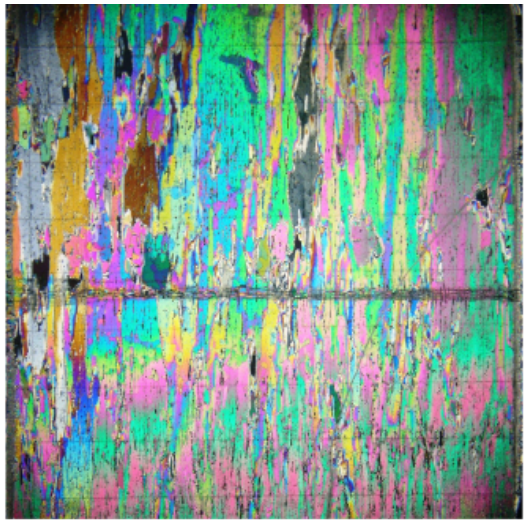
East Core

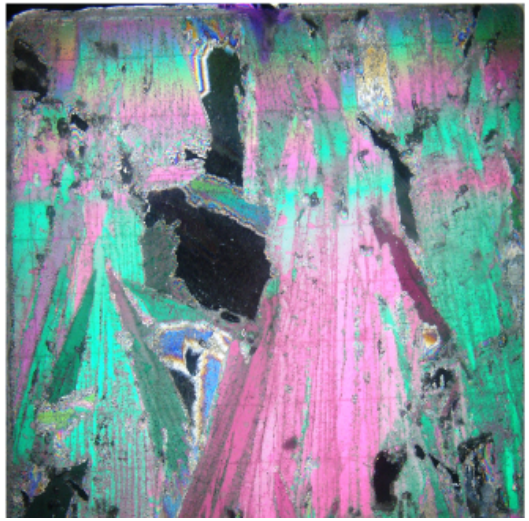
9-18 cm





31-40 cm

62-71 cm



202-bottom

West Core

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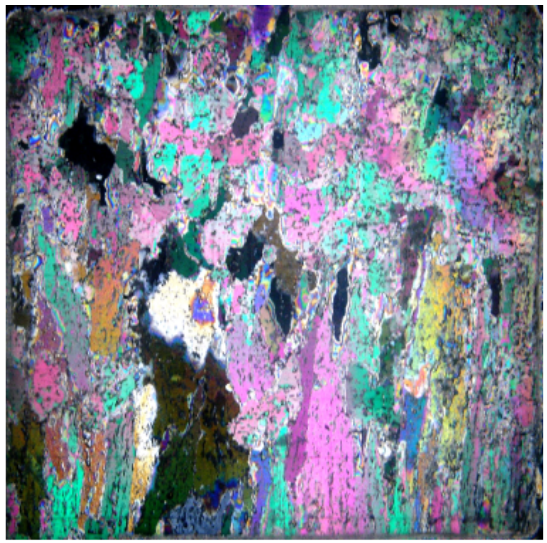
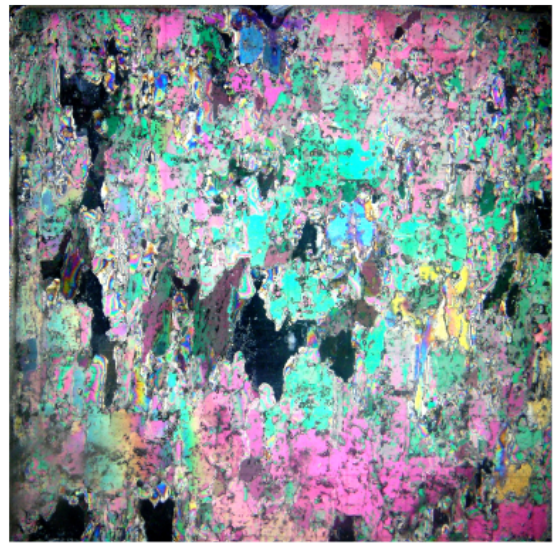
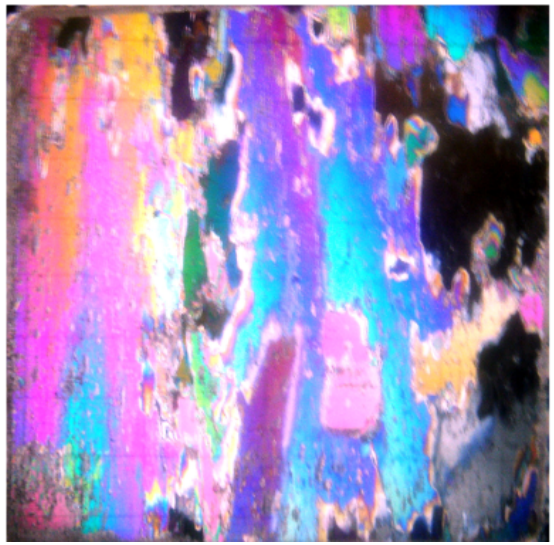
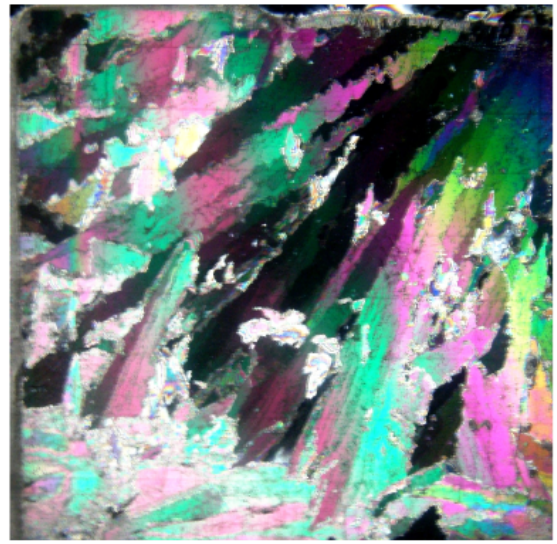




22-31 cm

172-181 cm

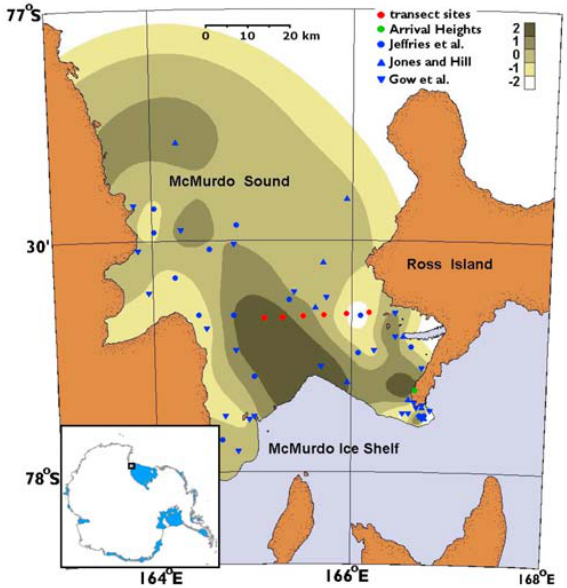




228-bottom

What does this mean?

- Percentage of platelet ice greater than other studies
  - We found 70-90% platelet ice



Dempsey (2010)

- Platelet ice formation driven by oceanic processes

Can we model the supercooled water in McMurdo Sound?

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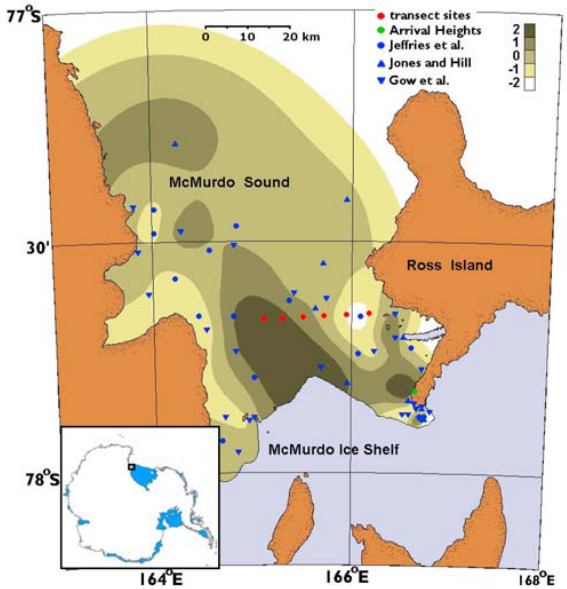

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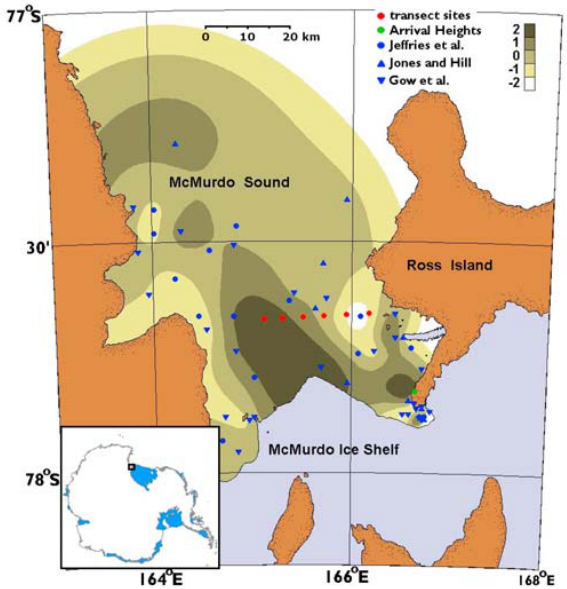

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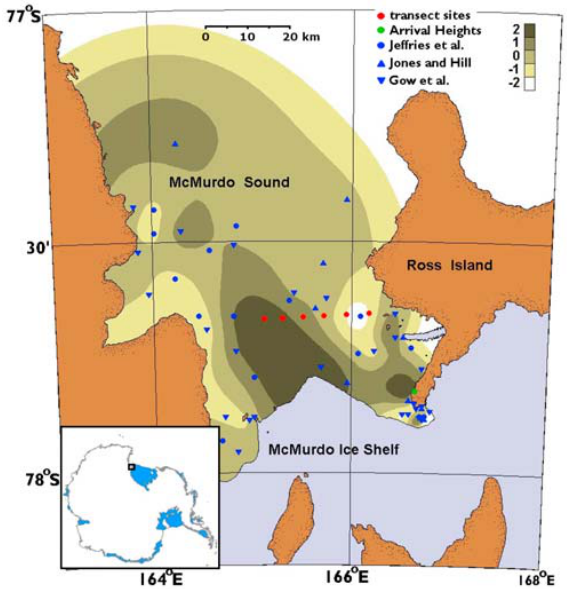

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Numerical Plume Model

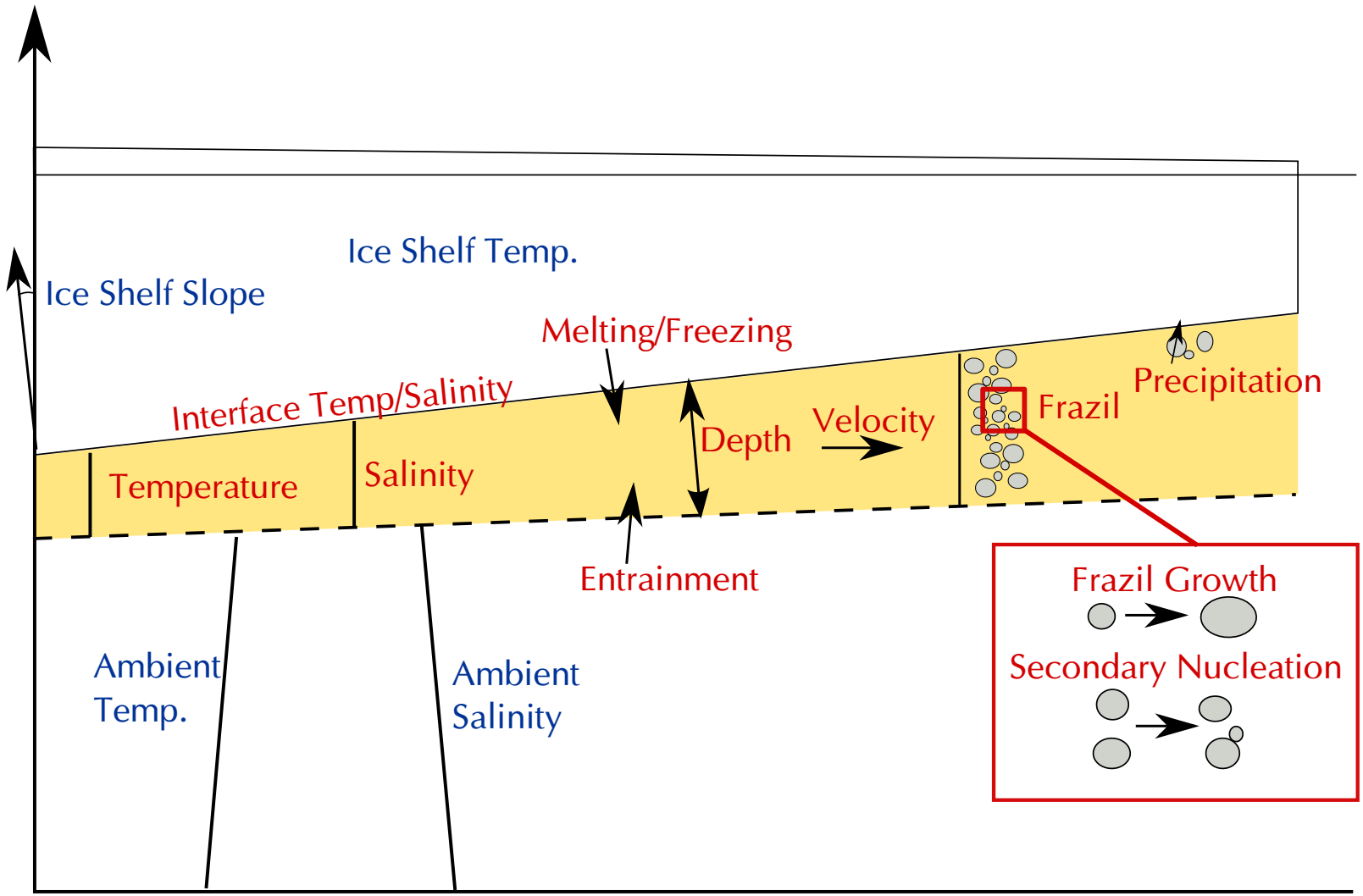
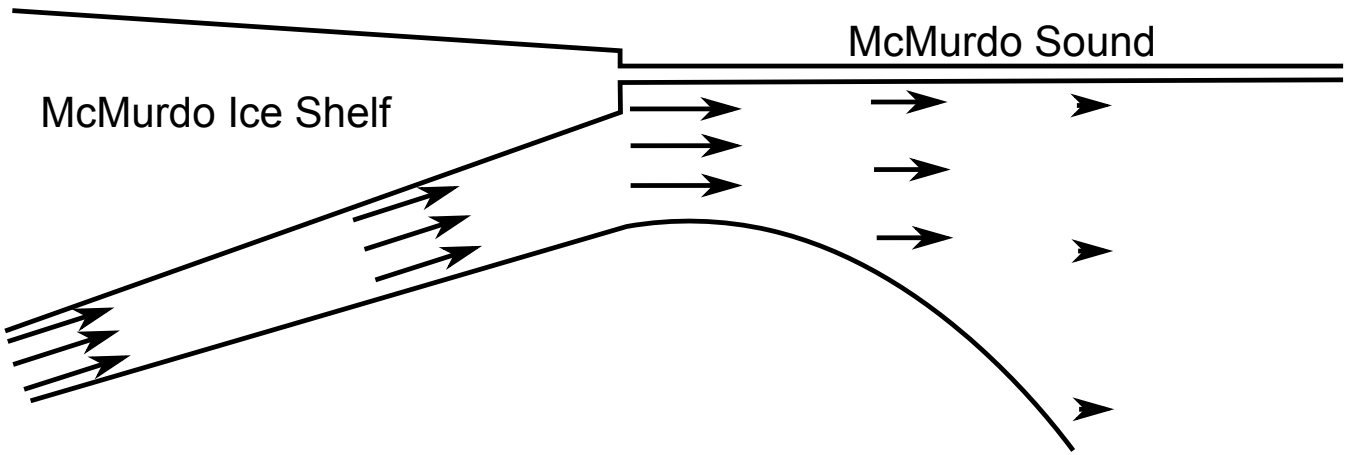


Image adapted from Smedsrud and Jenkins (2004)

Extension to Sea Ice



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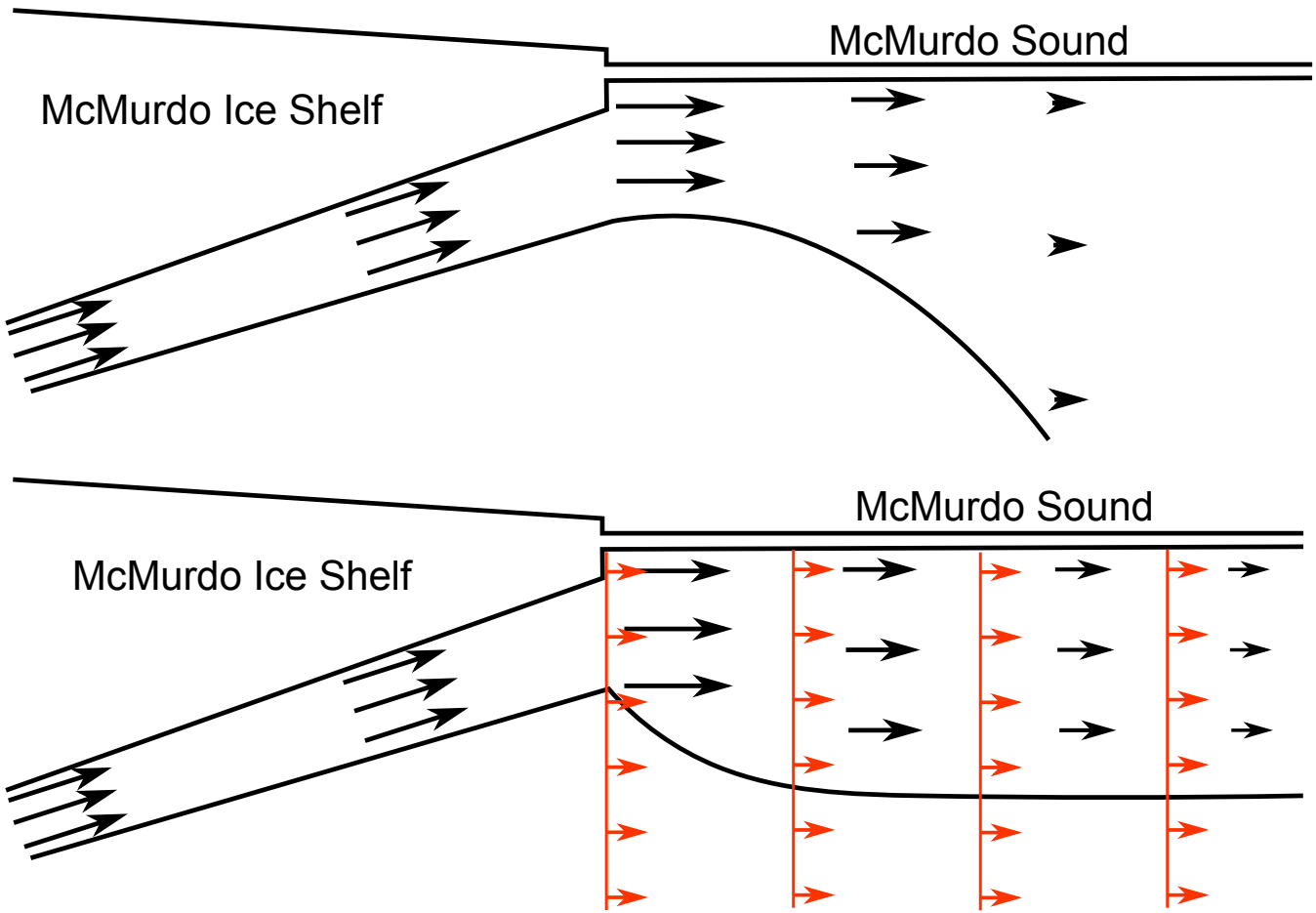

Ambient current
(wind-driven circulation, geostrophic currents, tidal rectification, topographic effects)

Sea Ice Processes

- Significant heat flux
- Freezing (not melting) regime
- Rougher basal surface

But we have Salinity and Temperature measurements below the sea ice

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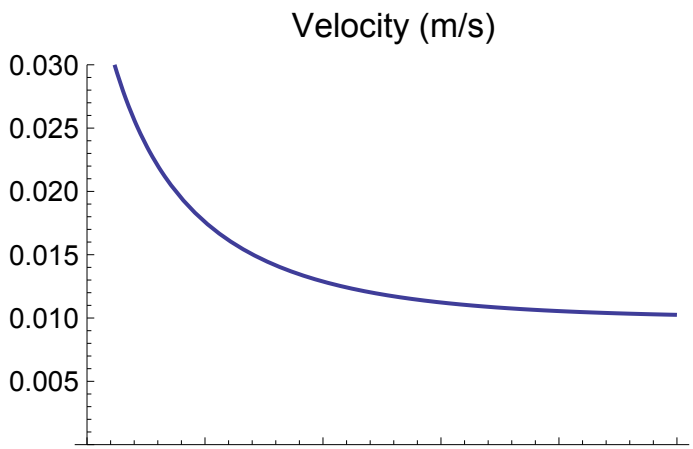
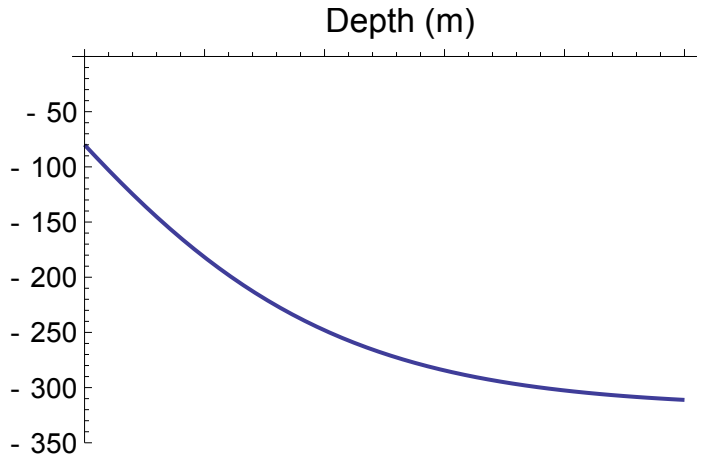
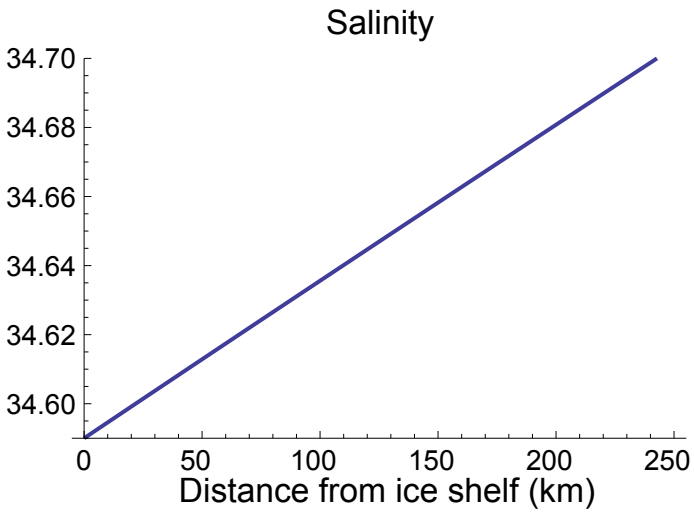
Preliminary Results

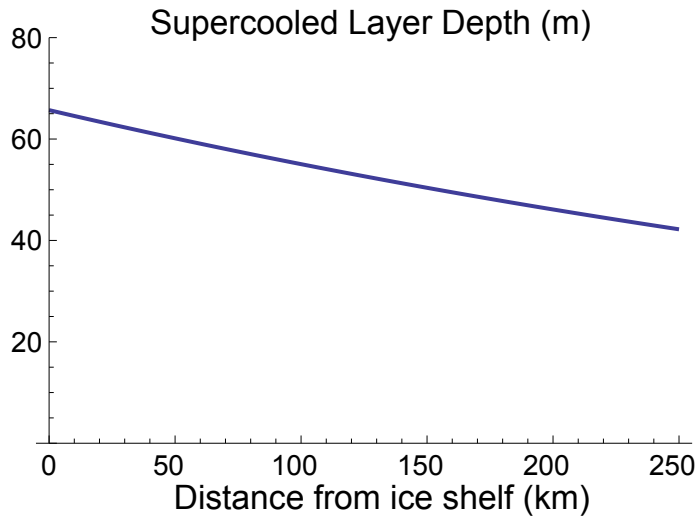
Heat flux ✔, ambient current ✔, freezing regime ✔

no frazil ice yet





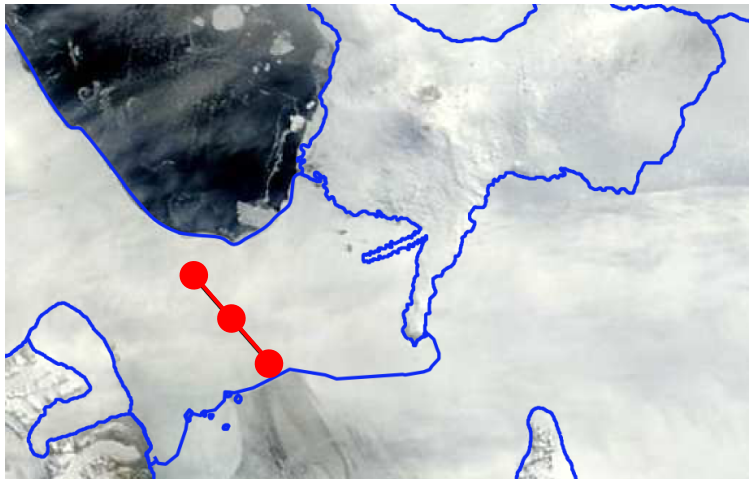


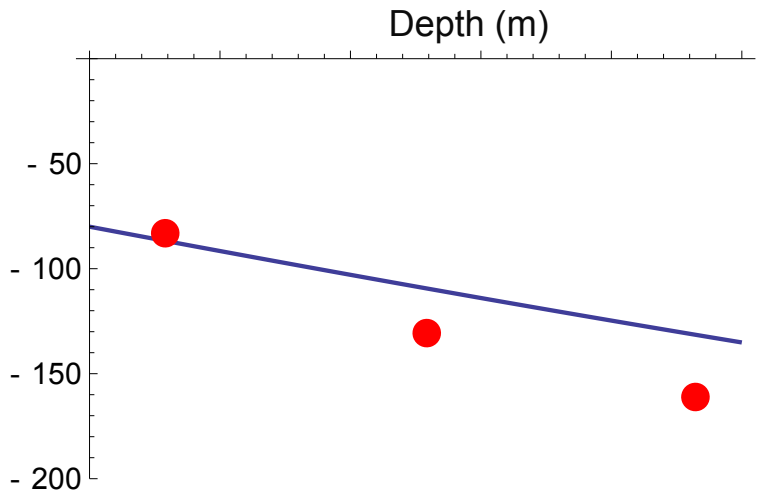


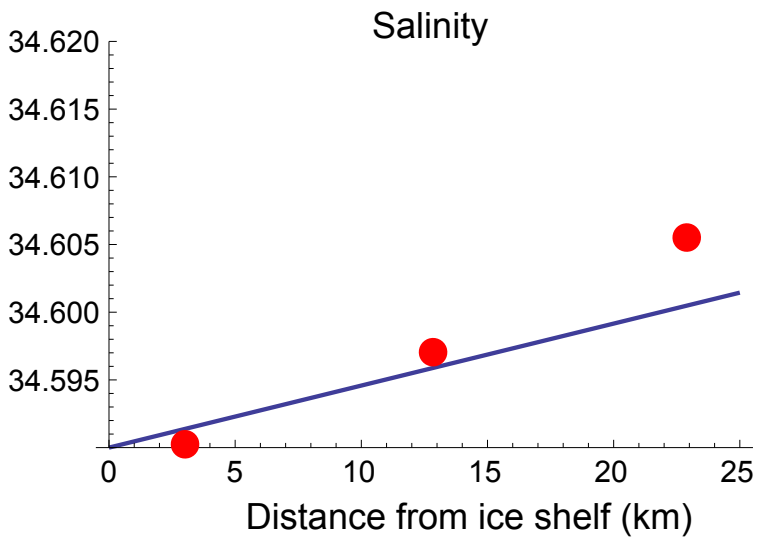
Preliminary Results

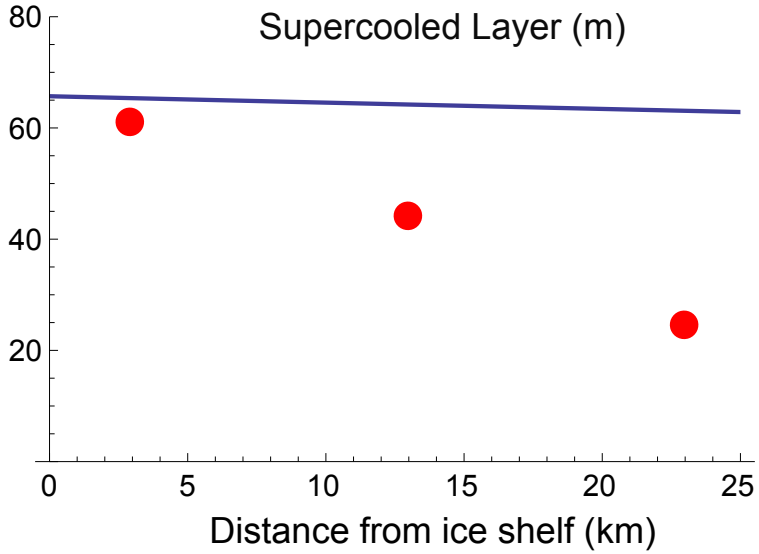
Do we see this happen?

Observation and Results









Goals

- Reproduce field measurements, and extrapolate to predict the evolution of the supercooled water
- Compare with other predictions e.g.
  - Stevens et al. (2009) – Supercooled water can persist 250 km from edge of McMurdo Ice Shelf
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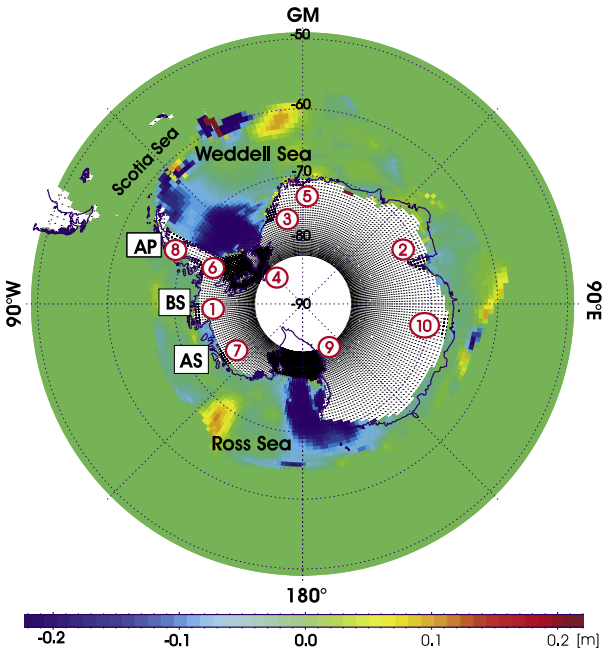

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