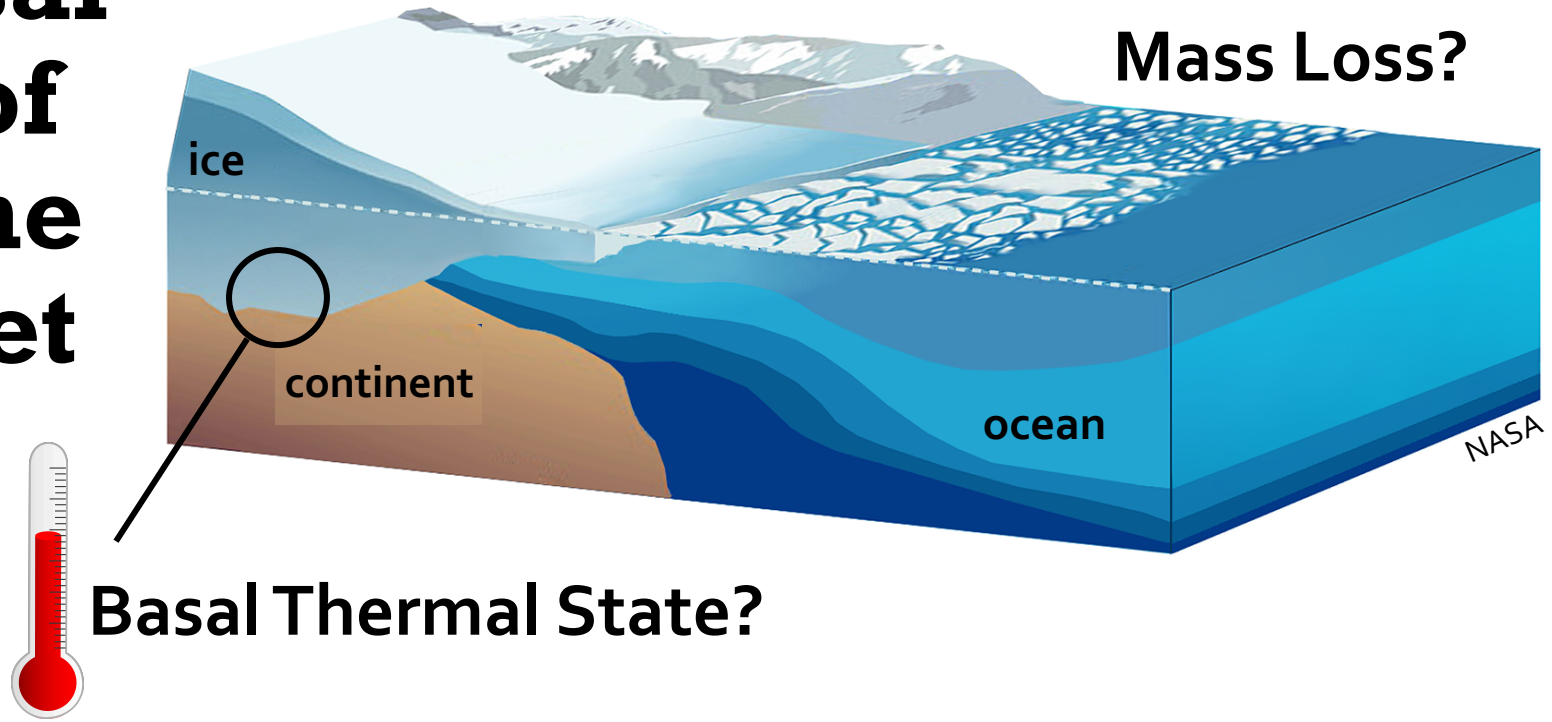
Investigating basal thaw as a driver of mass loss from the Antarctic ice sheet



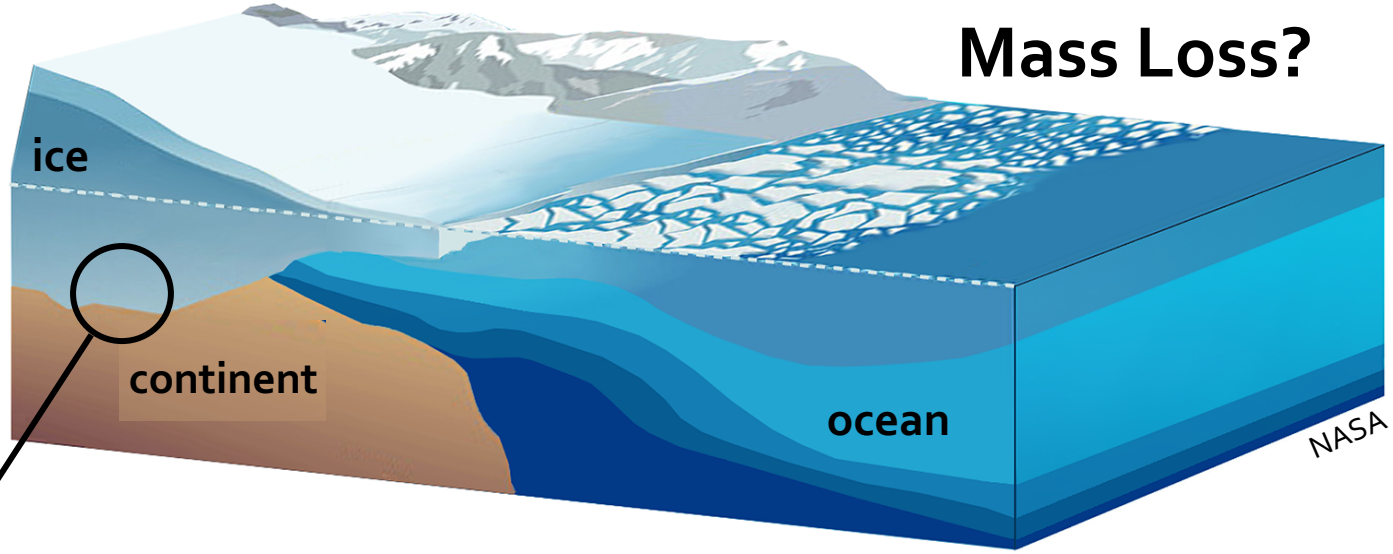
Eliza Dawson (ejdawson@stanford.edu),

Dustin Schroeder, Winnie Chu, Elisa Mantelli, Helene Seroussi

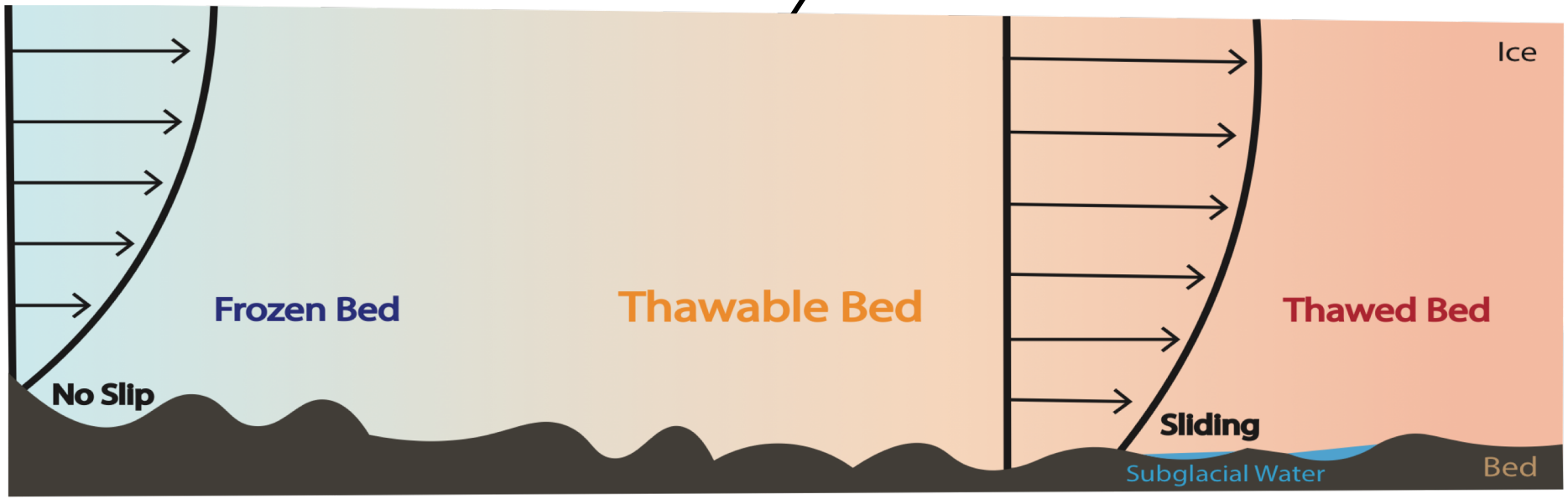
Stanford University

NSF

Patches of the ice sheet bed could be thawable

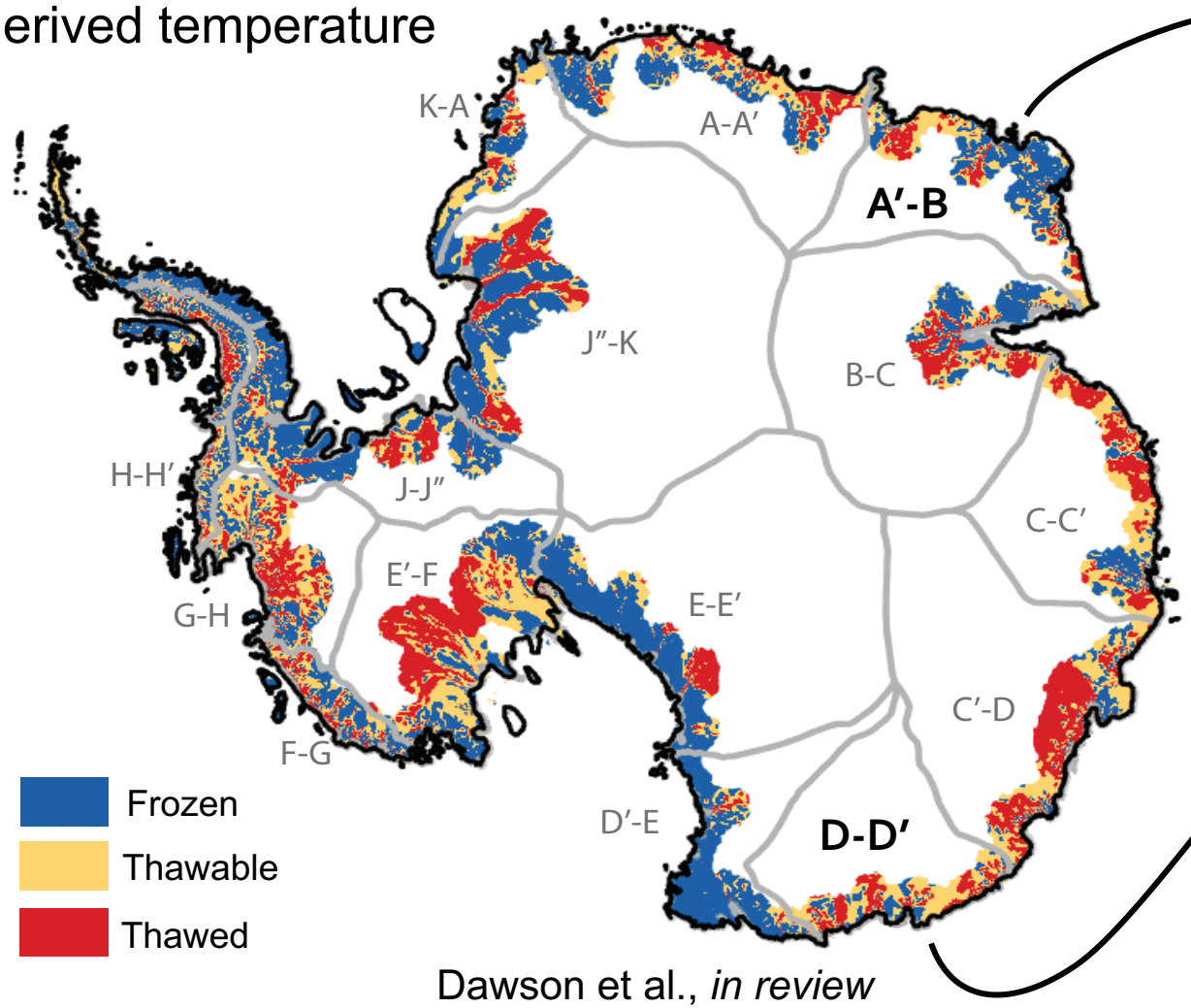


Basal Thermal State

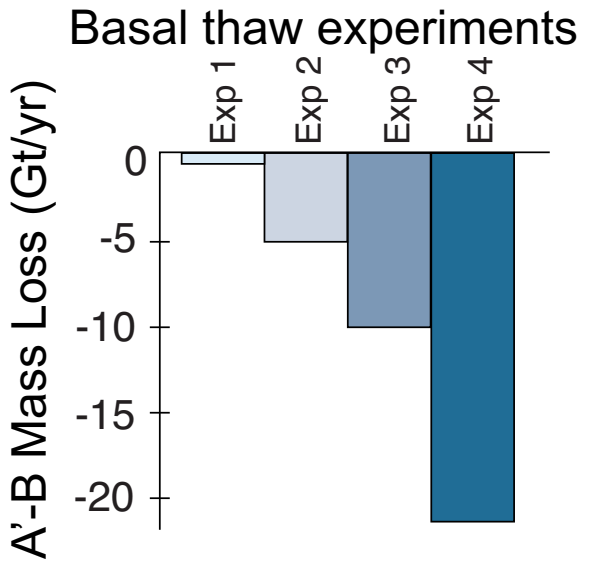


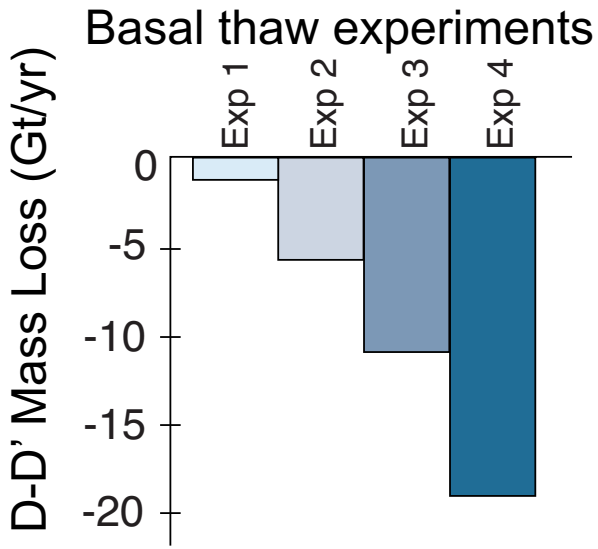
Ice sheet model simulations of basal thawing show mass loss

Basal thermal state classifications based on ISSM derived temperature



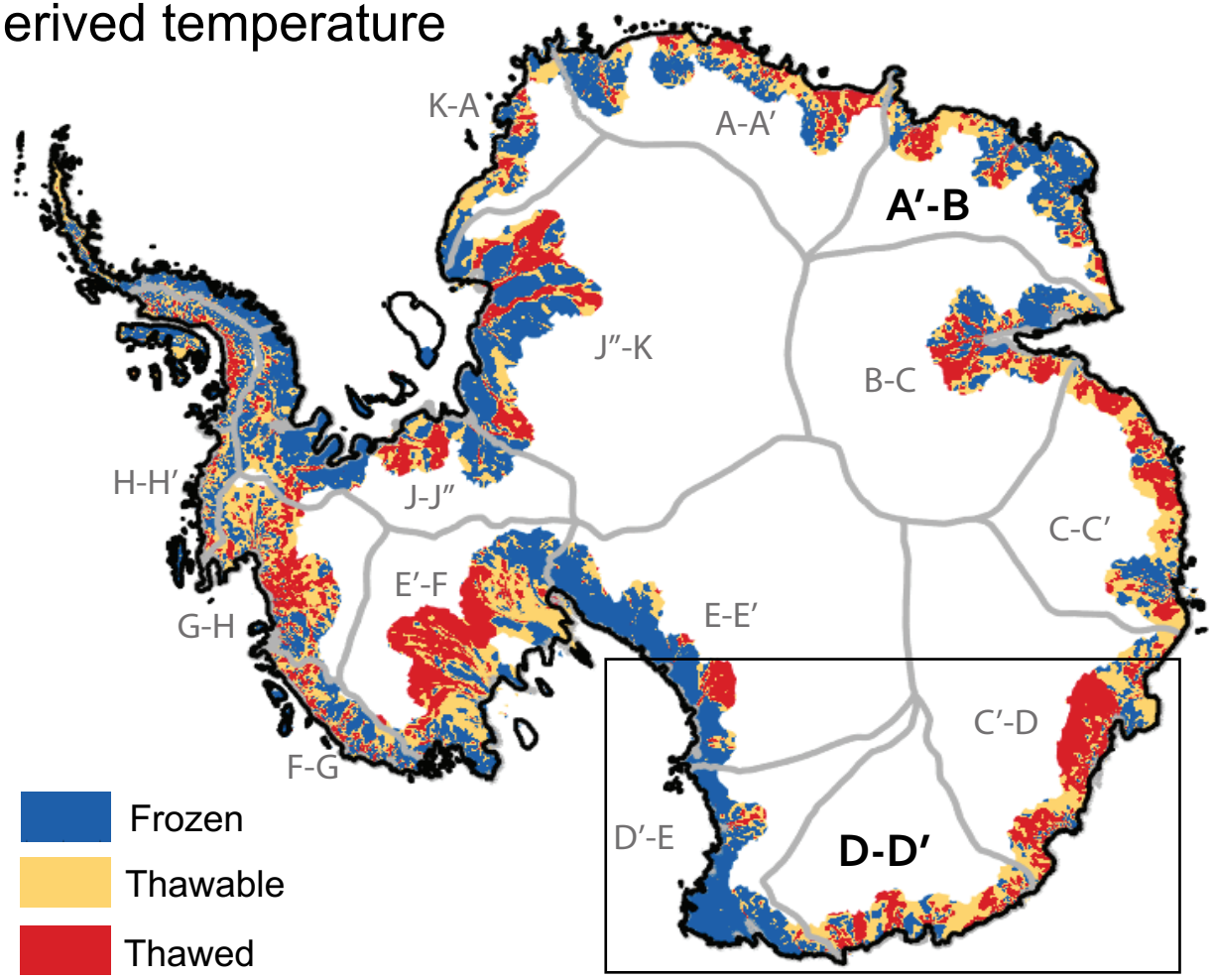
Dawson et al., *in review*





Extensive airborne ice-penetrating radar surveys in D-D′ region

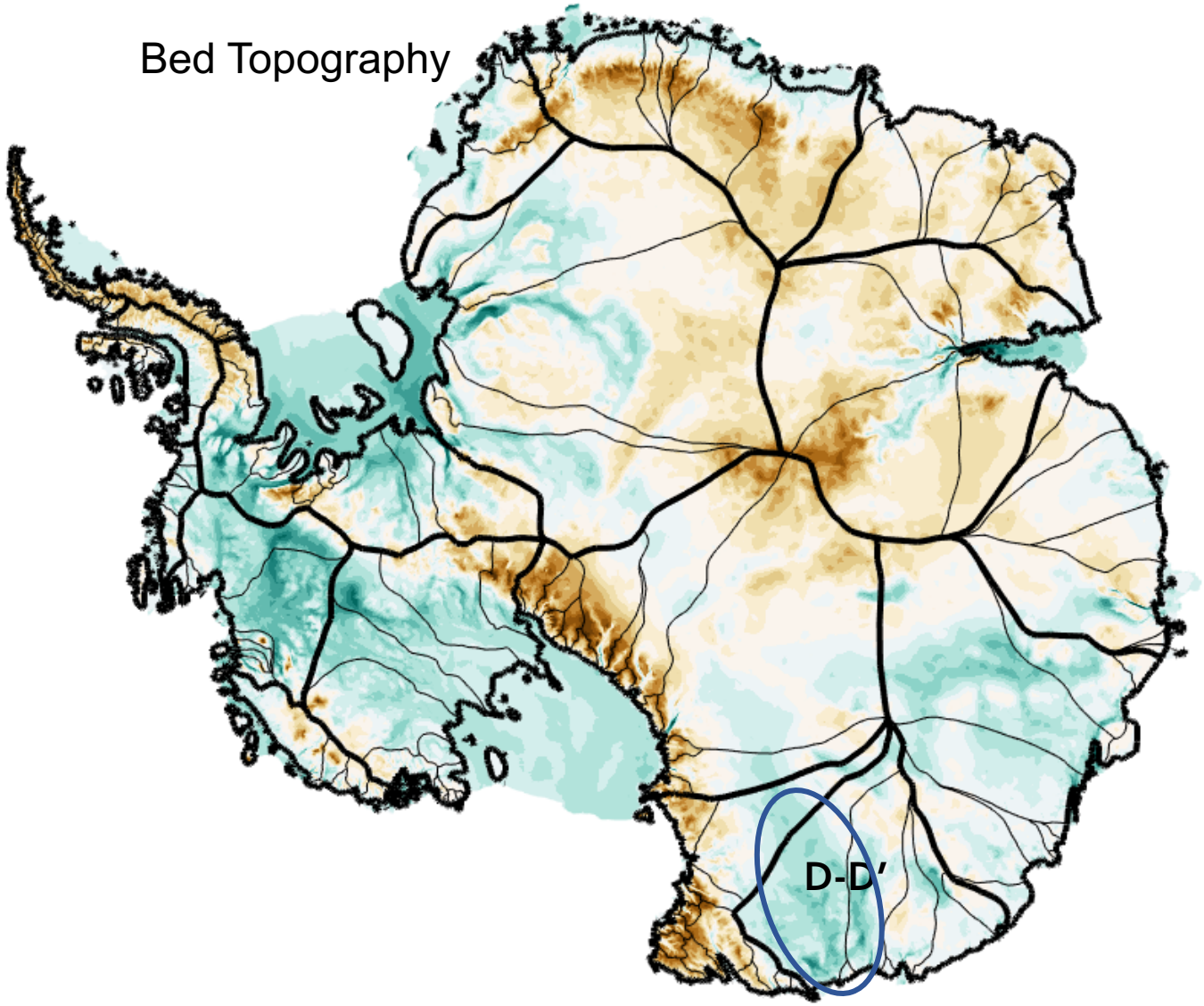
Basal thermal state classifications based on ISSM derived temperature



Dawson et al., *in review*

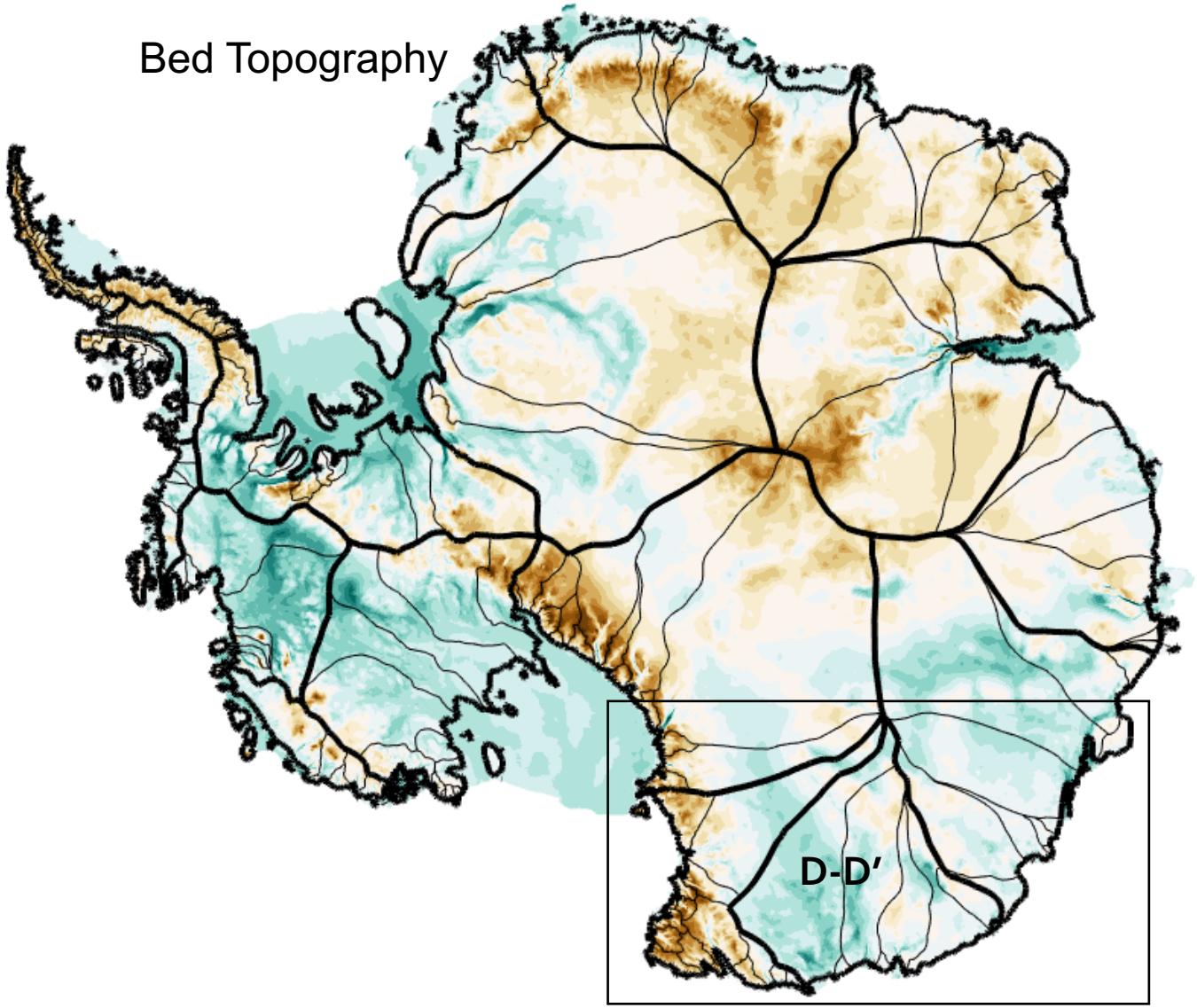
- Operation Ice Bridge HiCARS flights from 2010-2011
- BAS/Italian flights from 2005-2006

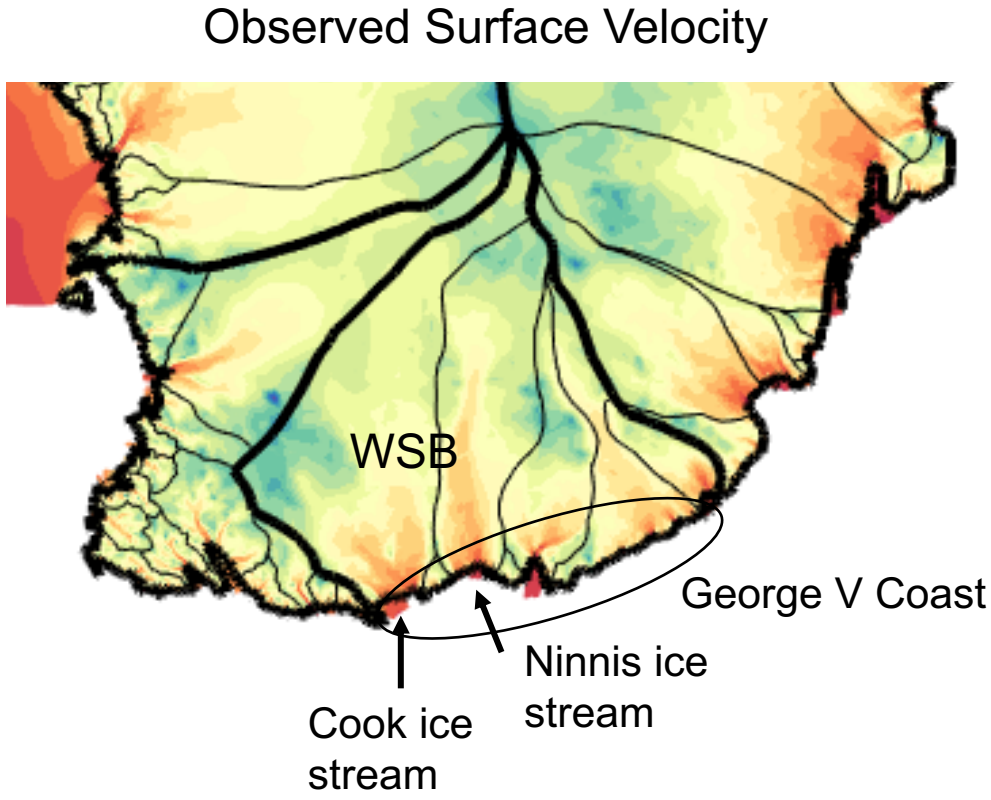
D-D′ contains the Wilkes Subglacial Basin (WSB)



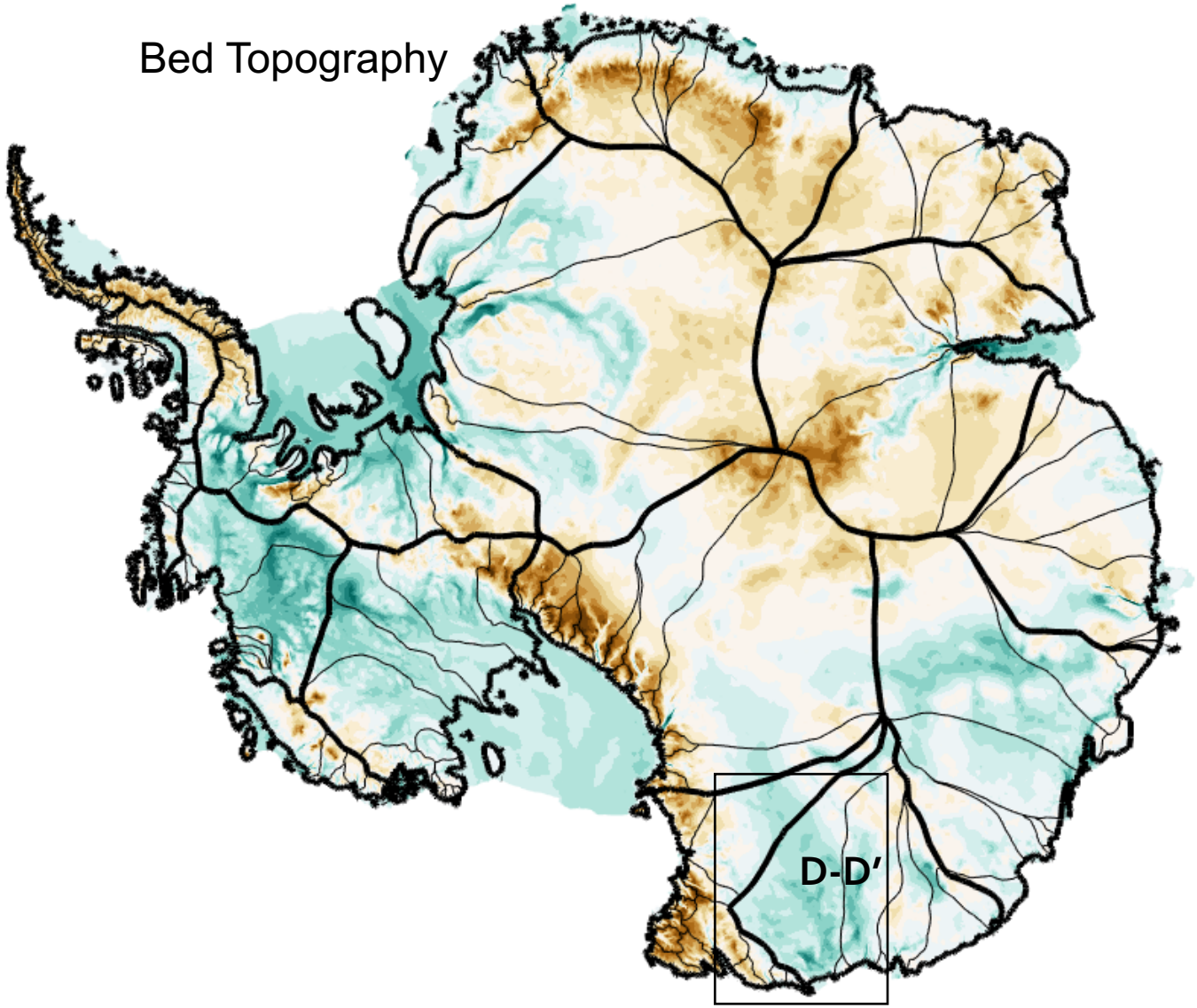
- Similar ice volume to Thwaites
- Retrograde slopes

WSB is drained via two ice streams along the George V Coast

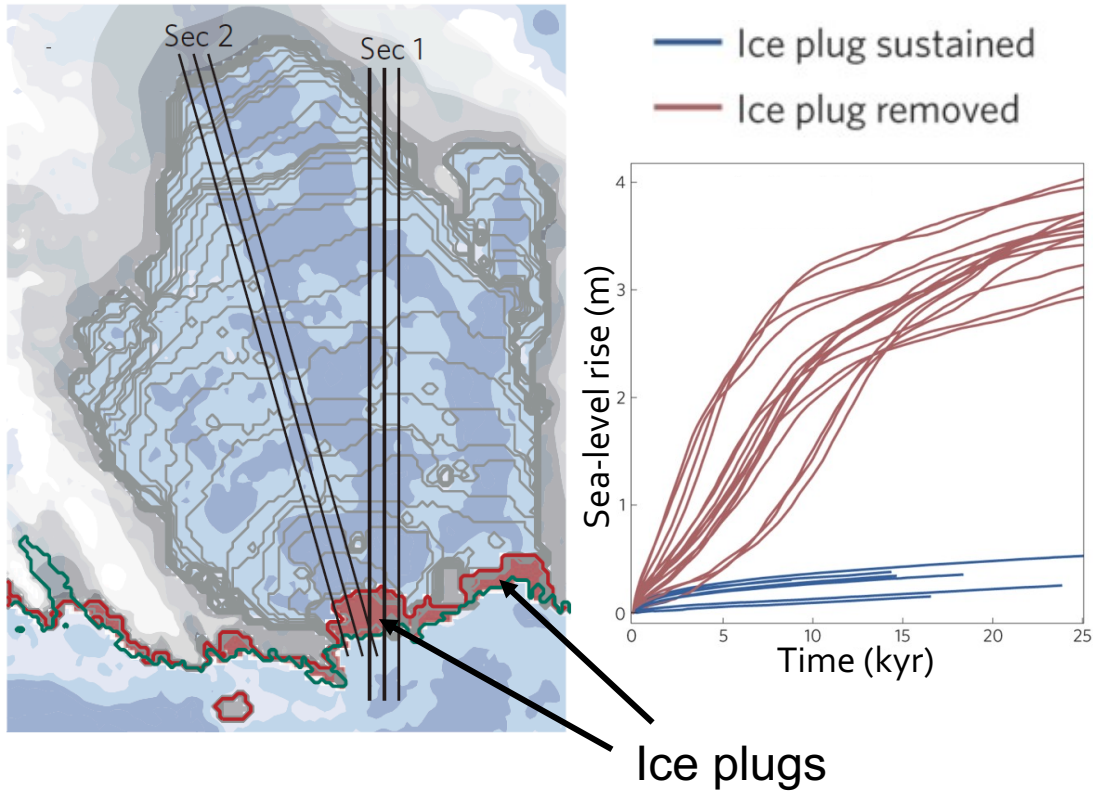




WSB could become an important contribution to sea level rise



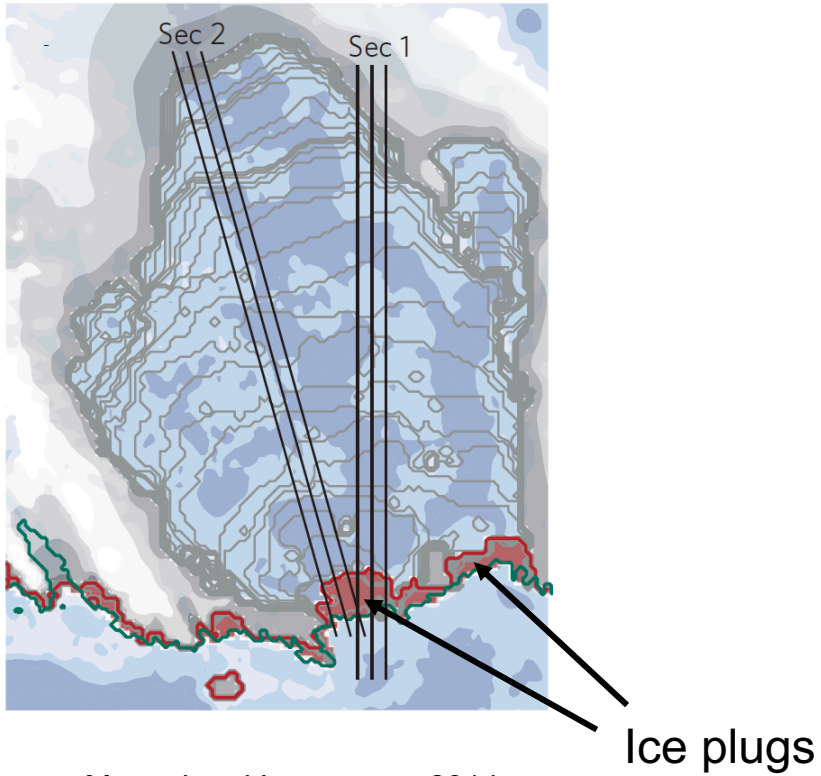
… if "Ice plugs" are removed



Mengel and Levermann 2014

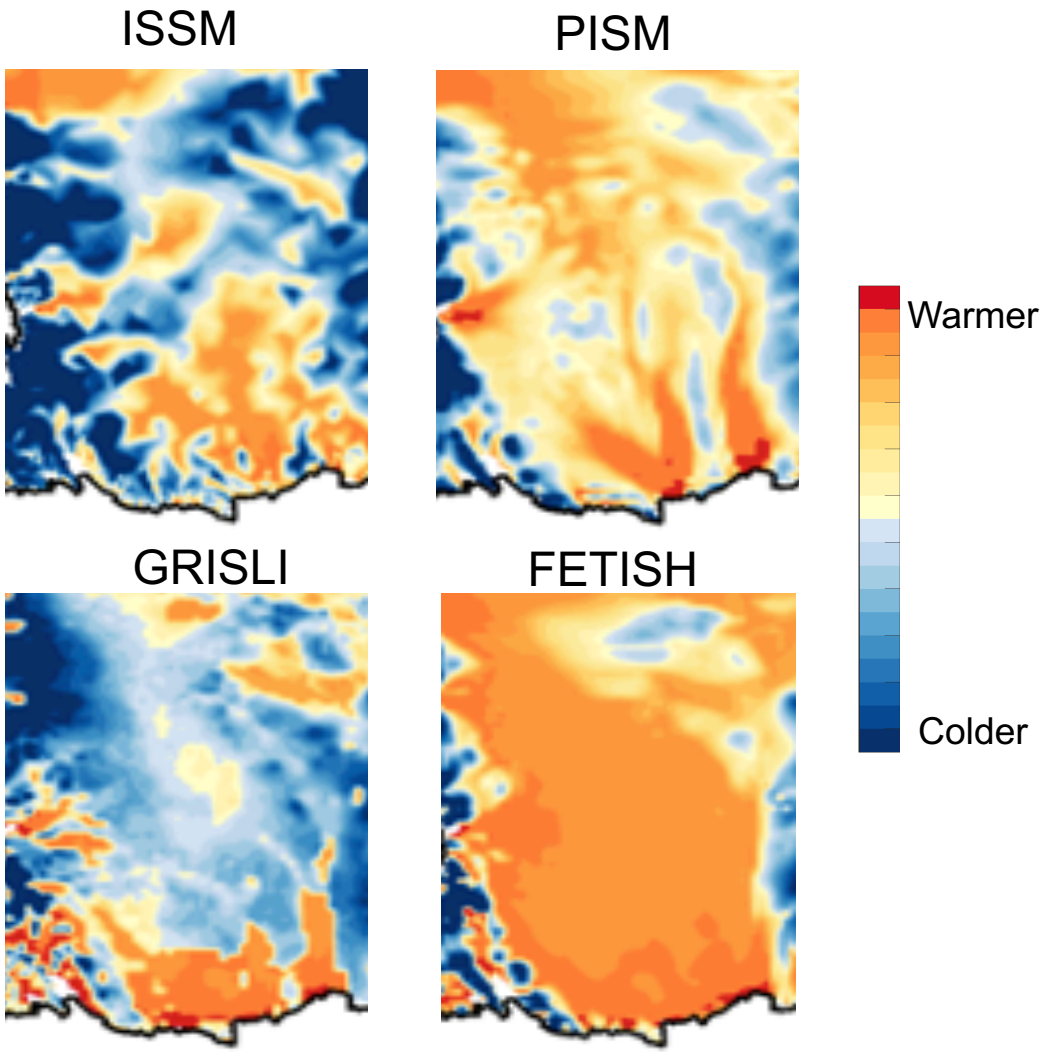
What is the basal thermal state of the ice plugs?

- **Ice sheet models don't agree**
- We don't have direct observations



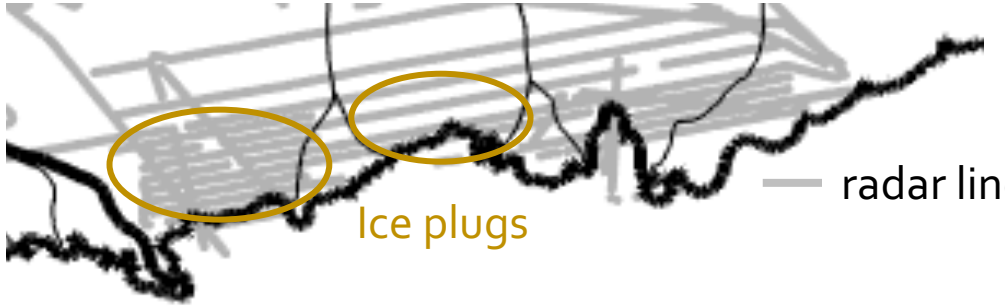
Mengel and Levermann 2014

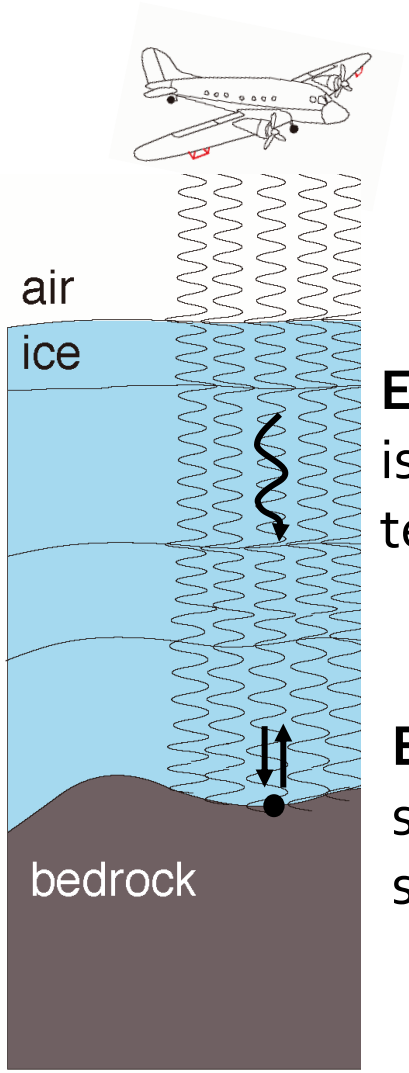
Basal Temperature Comparison for a few ISMIP6 Models



Data from Seroussi et al., 2019

Ice-penetrating radar data can tell us about the thermal state of the ice plugs

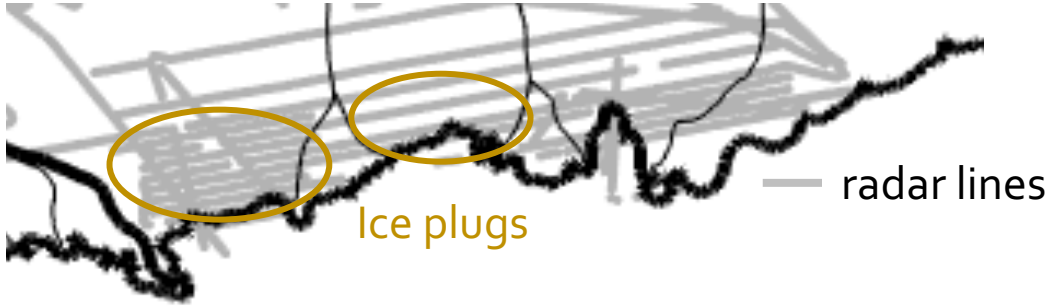




Englacial Attenuation is sensitive to the ice temperature

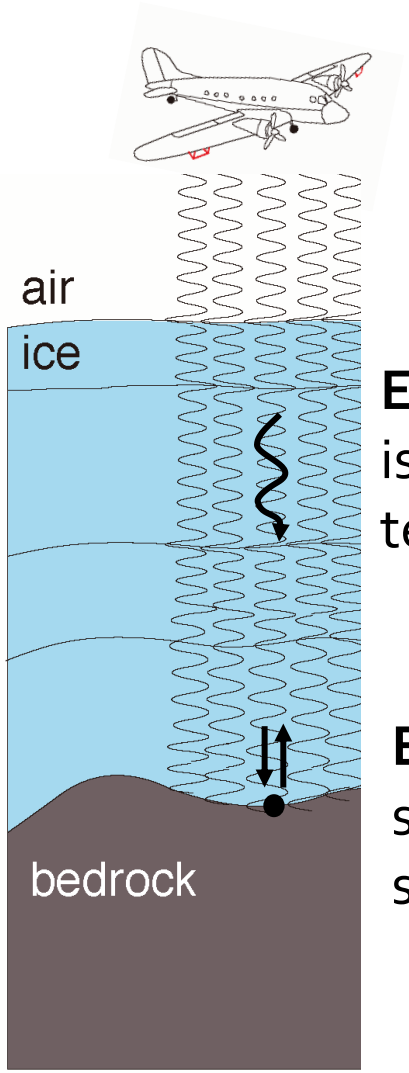
Bed Reflectivity is sensitive to the subglacial environment

Ice-penetrating radar data can tell us about the thermal state of the ice plugs



Categories

- Frozen bed
- Thawed bed
- Ice shelves
- Ice plugs



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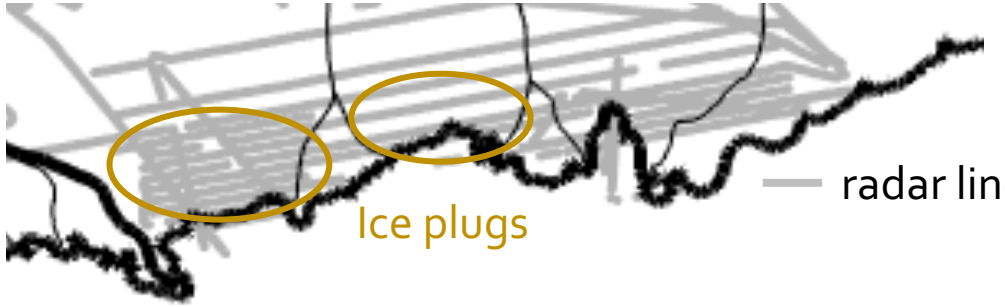
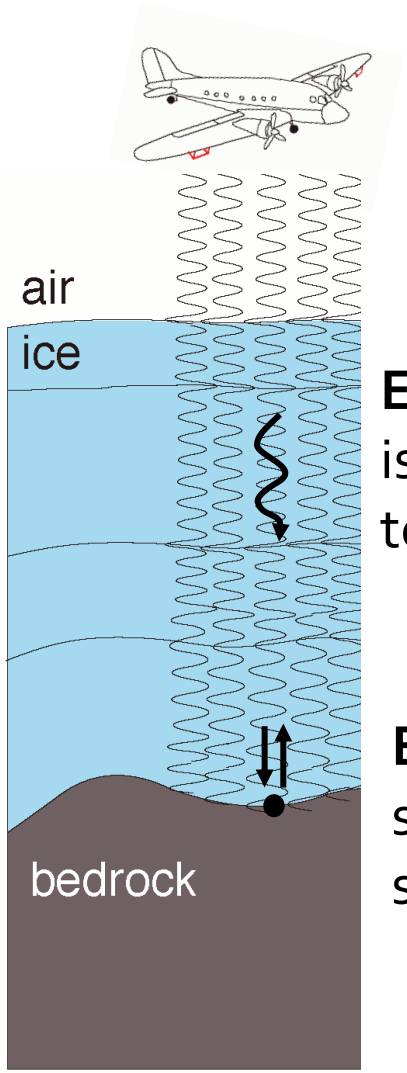


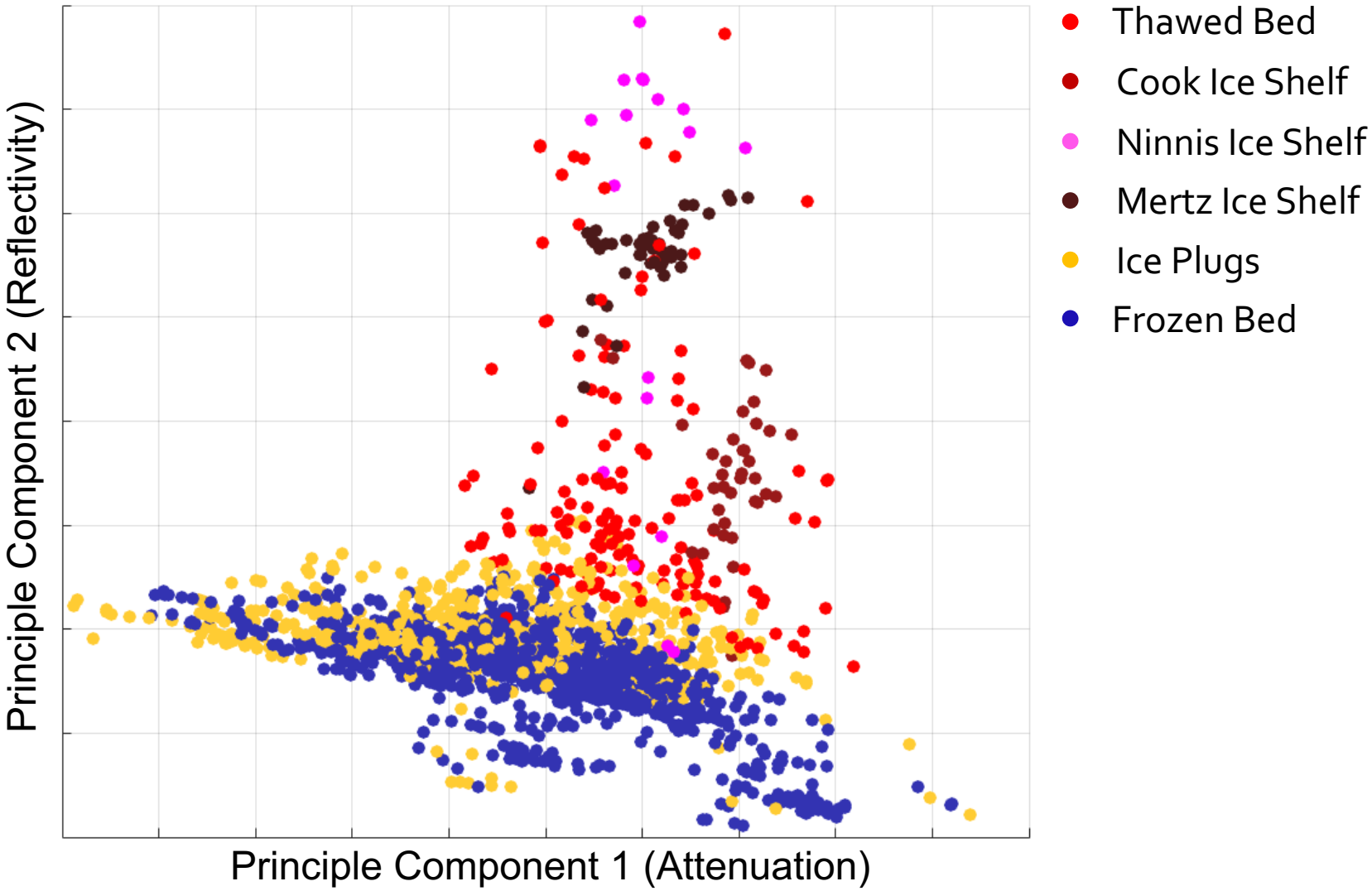


Englacial Attenuation is sensitive to the ice temperature

Bed Reflectivity is sensitive to the subglacial environment

Categories	Observations
• Frozen bed	• Radar Attenuation
• Thawed bed	• Radar Relative Reflectivity
• Ice shelves	• Surface Velocity
• Ice plugs	• Ice Thickness

Parts of the ice plugs appear to be close to thawing



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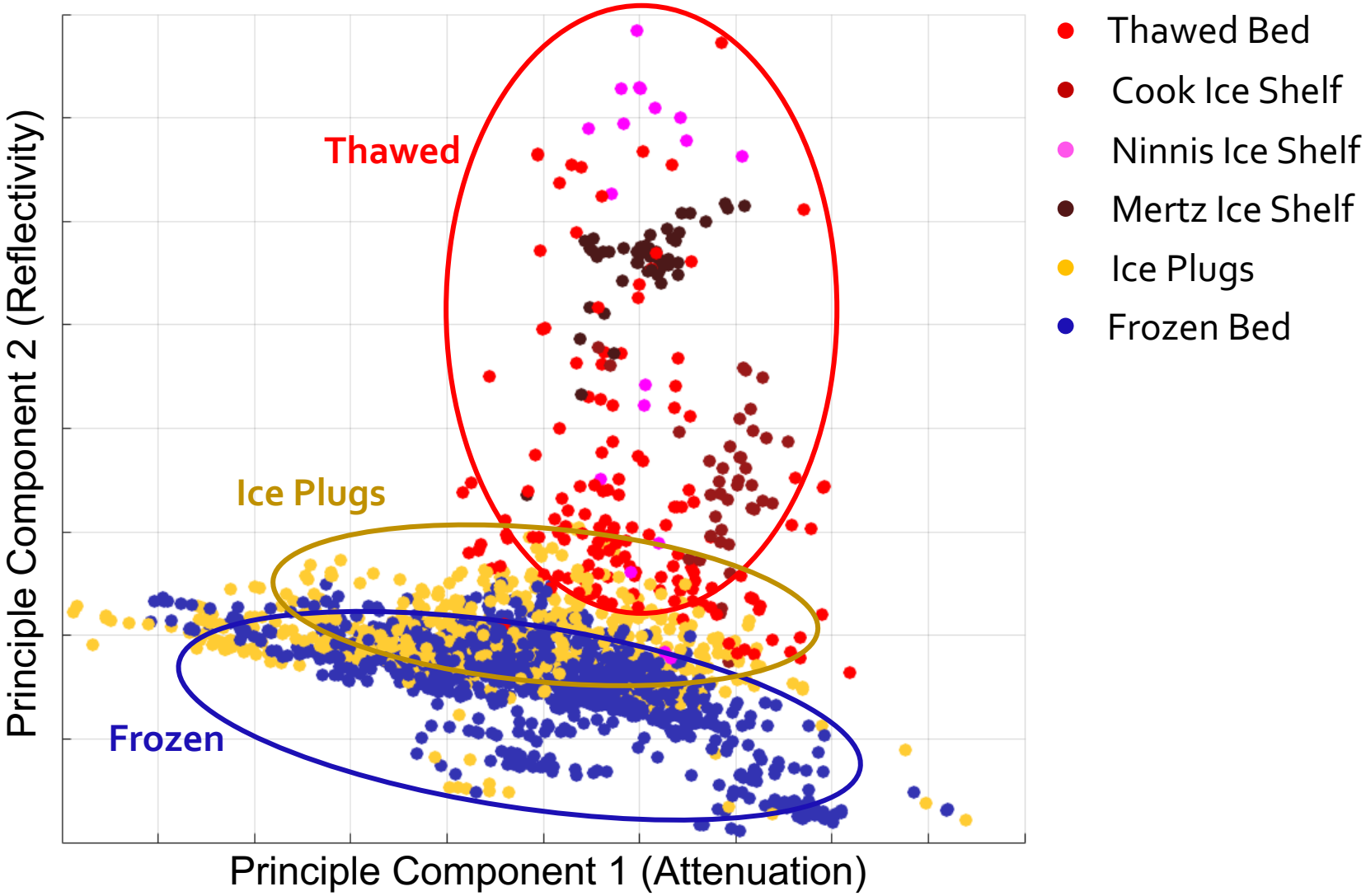

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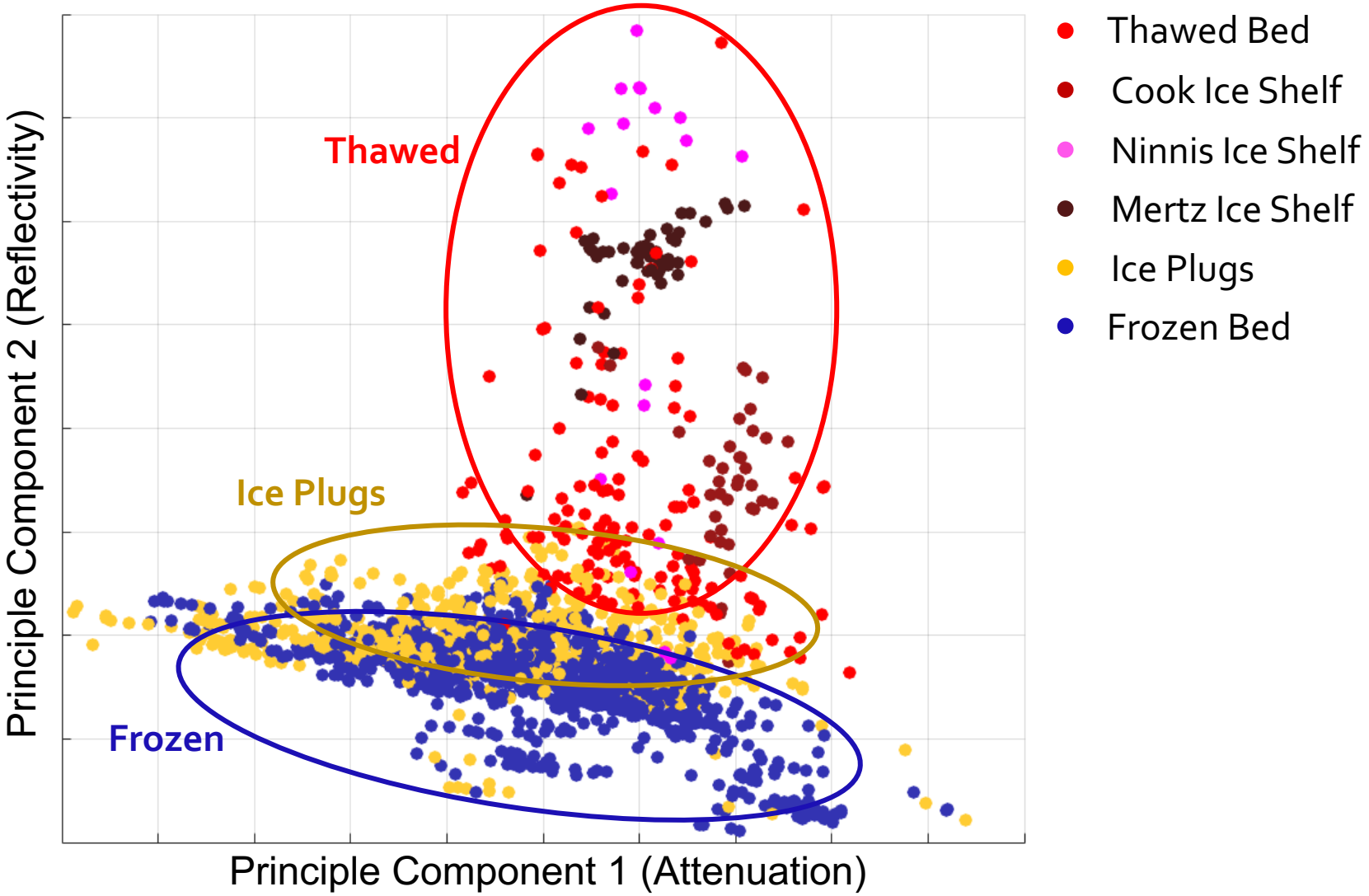

What's Next?

Ice plugs

- What would it take to thaw?
- How much mass loss could result from thawing?

Drainage basin scale analysis

- Model constrained by radar to better resolve thermal state and assess vulnerability

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