Ice Core Working Group Update to Scientific Advisory Board

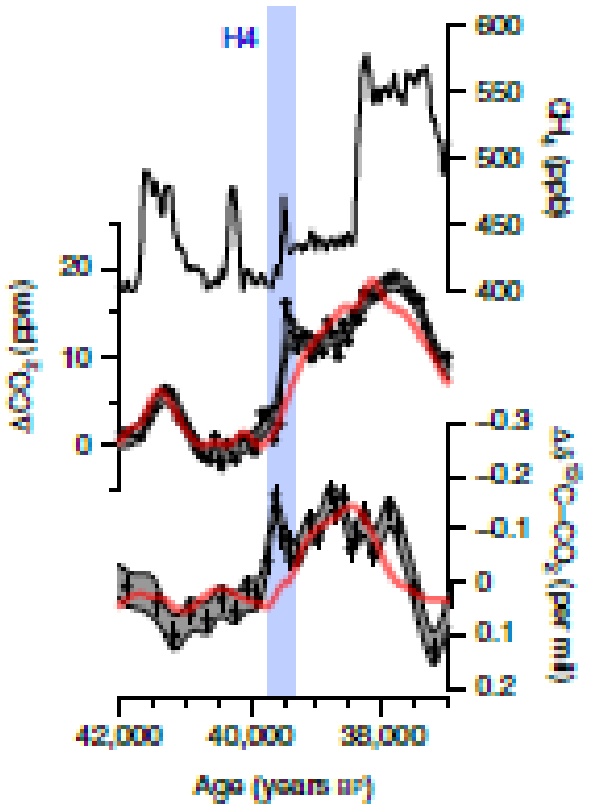
T.J. Fudge

ICWG Open Meeting
March 8
about 50 participants

participants provided updates on community projects

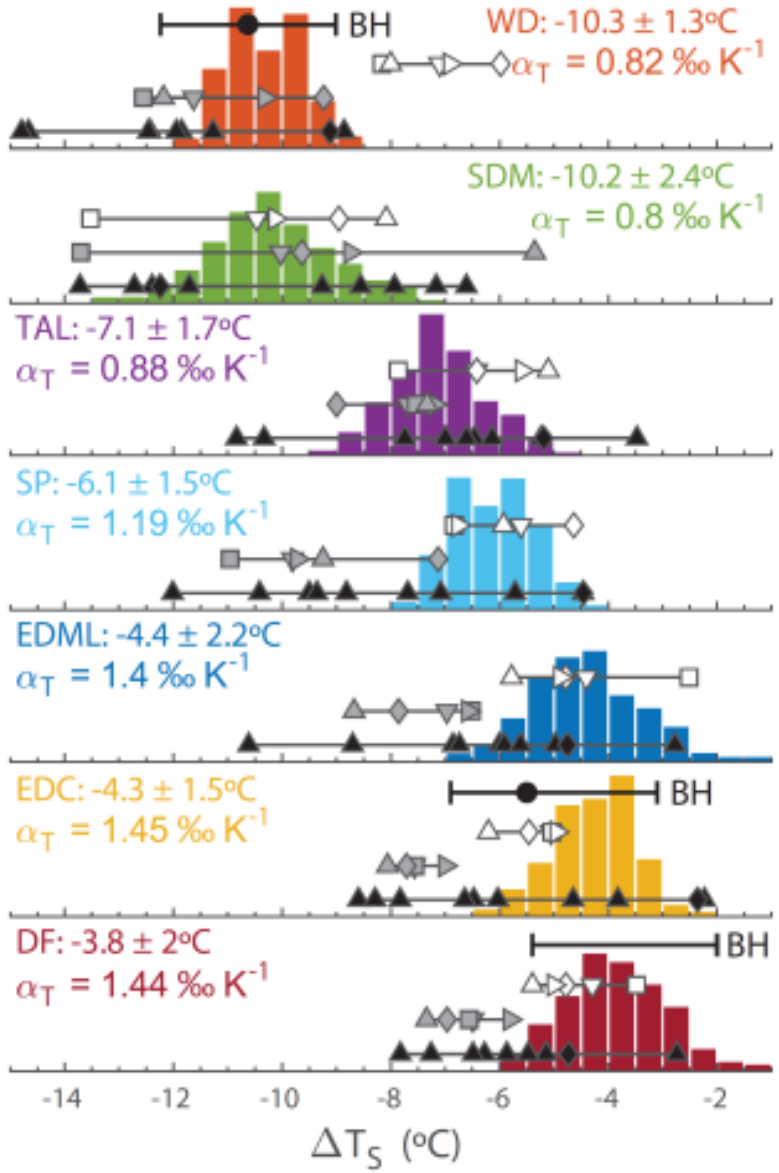
WAIS Divide

Unprecedented detail of CO2 variations



Bauska, Marcott, and Brook
Nature Geoscience 2021

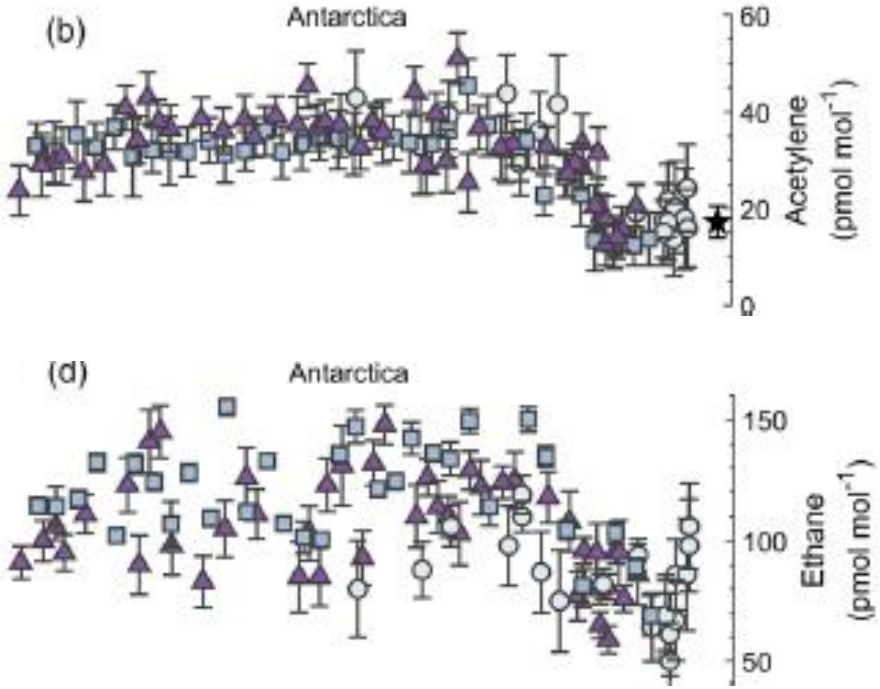
Reference timescale extended to many cores



Buizert, Fudge et al.,
Science, in review

SPICEcore

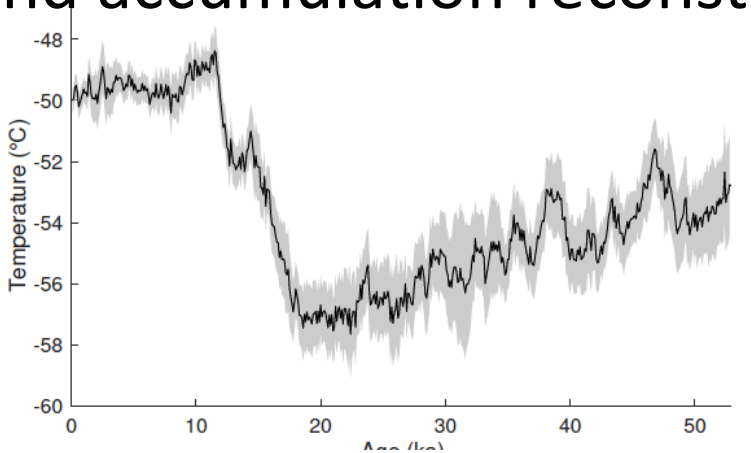
Benchmark
Trace gas records



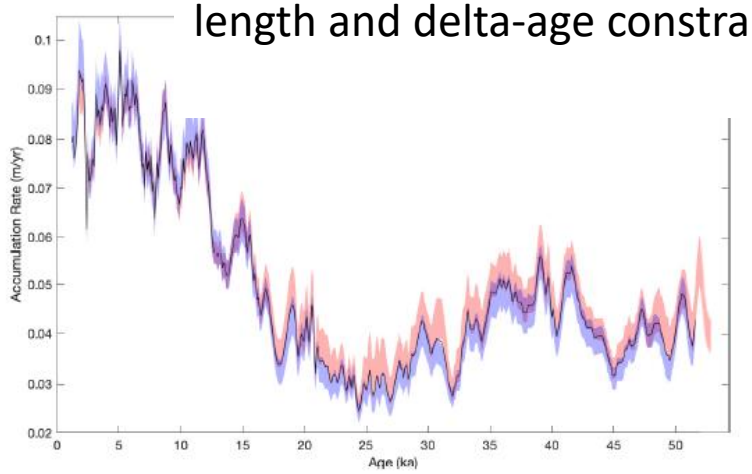
Paleofire fire trends agree,
but not quantitatively consistent

Nicewonger, Aydin, et al.
JGR 2020

New methods for temperature and accumulation reconstructions

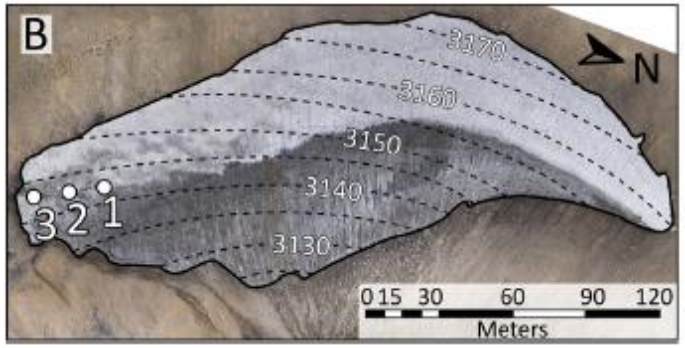


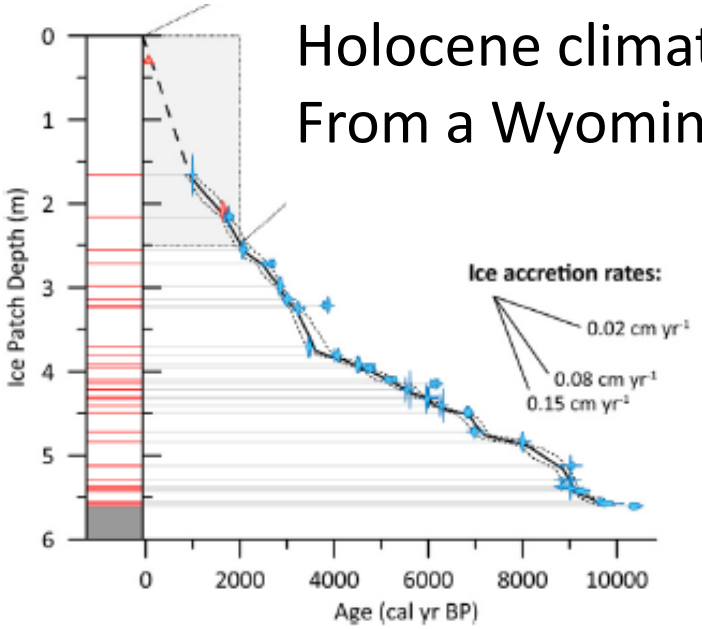
Integrating water isotope diffusion length and delta-age constraints



Kahle, Steig, et al.
JGR, in review

Many other coring projects

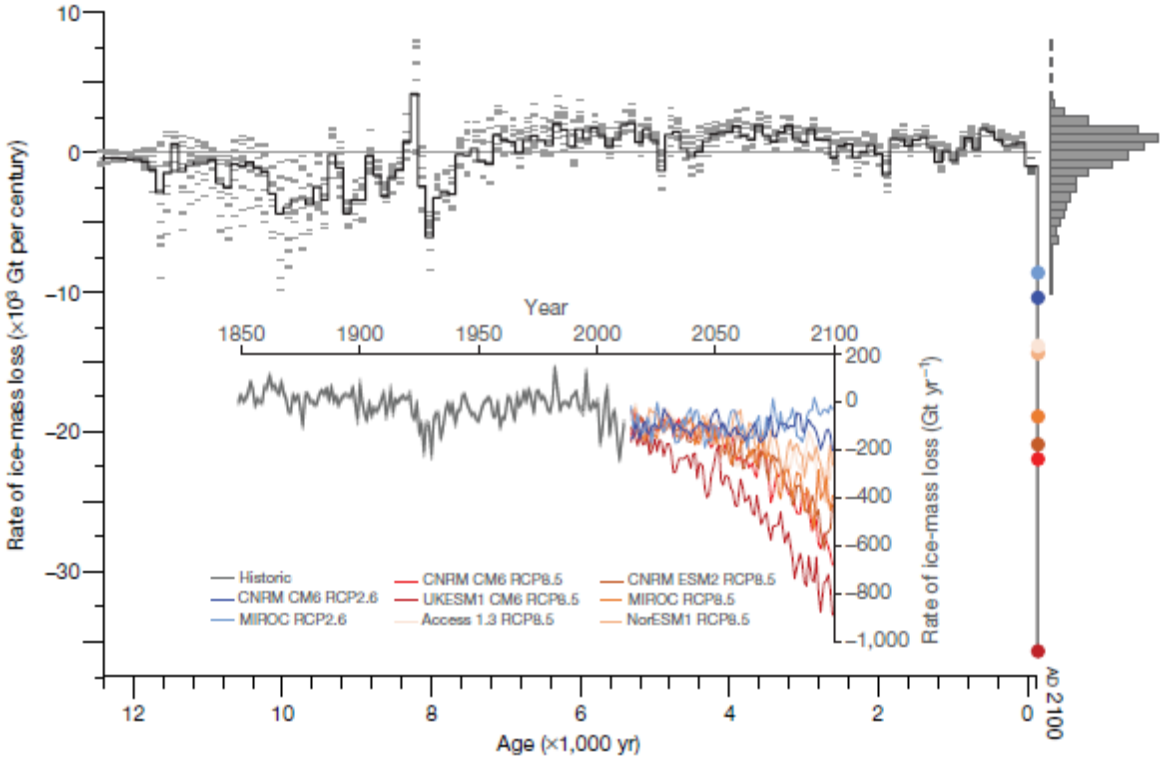




Holocene climate history
From a Wyoming ice patch

Chellman, Pederson et al.
QSR, 2021

Greenland ice cores provide climate forcing in reconstruction of past rates of ice loss



Briner, Cuzzone, Badgeley et al.
Science, 2020

White Papers

- TJ Fudge, Brent C Christner, Juliana D'Andrilli, John Fegyveresi, Andrei Kurbatov, Mark S Twickler, Community Recommendations for the NSF Ice Core Facility

- Paolo Gabrielli, Seth Campbell, Zoe Courville, Karl Kreutz, Andrei Kurbatov, Peter D Neff, Erich Osterberg, Erin Pettit, Summer Rupper, Alpine Glaciers and Ice Caps.

- Tyler R Jones, Sarah Aarons, Edward Brook, Christo Buizert, Jihong Cole-Dai, TJ Fudge, John Higgins, Kaitlin Keegan, Andrei Kurbatov, Peter D Neff, Erich Osterberg, Vasilii Petrenko, Jeffrey P Severinghaus, Eric J Steig, Paleoclimate Ice Core Research Priorities in Antarctica.

- Erich Osterberg, Jessica Badgeley, Christo Buizert, Juliana D'Andrilli, TJ Fudge, Tyler R Jones, Karl Kreutz, Vasilii Petrenko, Erin Pettit, Dominic Winski, Ice Core Research Priorities in Greenland.

NSF Ice Core Facility

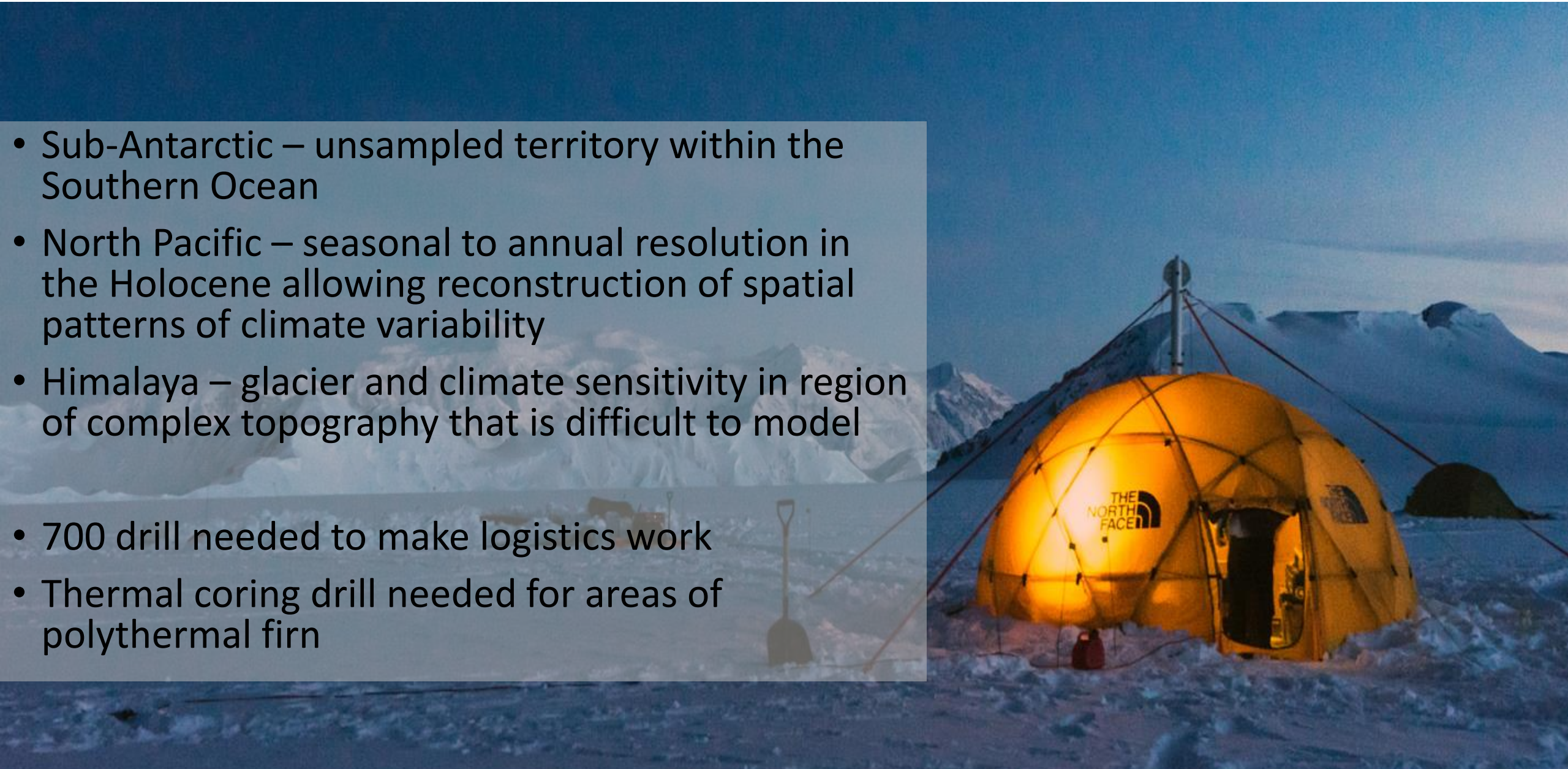
- Archive – rolling racks, large diameter core storage
- Processing – open floor concept, large diameter core processing
- Instrumentation – integrating computing with PI partnerships
- Database – coordinate with external data repositories
- Inclusivity – promote broad access to facilities and samples

- NSF-ICF 2.0 likely ready in 2025

Alpine Glaciers and Ice Caps

- Sub-Antarctic – unsampled territory within the Southern Ocean
- North Pacific – seasonal to annual resolution in the Holocene allowing reconstruction of spatial patterns of climate variability
- Himalaya – glacier and climate sensitivity in region of complex topography that is difficult to model

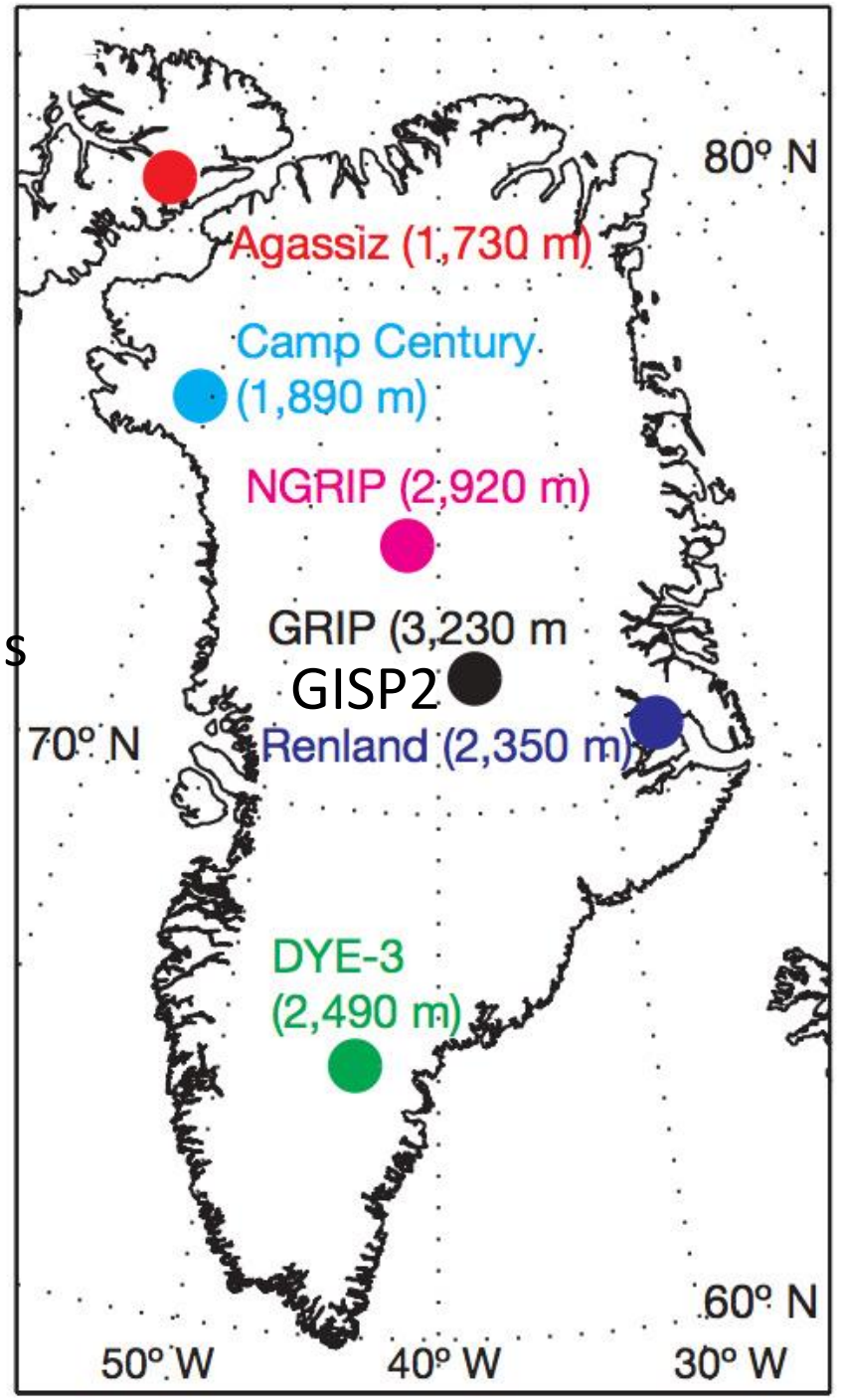
- 700 drill needed to make logistics work
- Thermal coring drill needed for areas of polythermal firn



Greenland

- Arctic Change and Greenland Ice Sheet instability in warm periods
  - ➢Holocene thermal maximum and Eemian Interglacial
- Mechanisms of Abrupt Change
  - ➢triggers, feedbacks, and instabilities to clarify fundamentals in Arctic processes
- Evolution of human impacts in the Arctic
  - ➢Clarify human/natural interactions

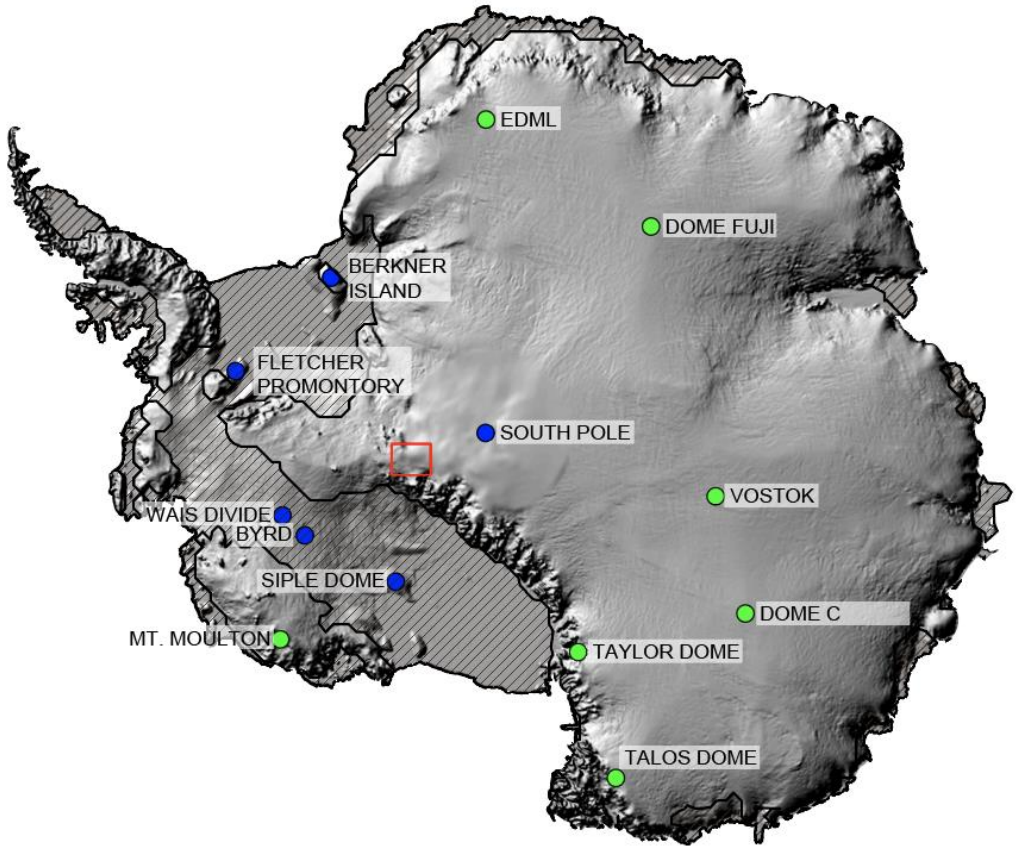
- Combine shallow/intermediate/deep drilling
- 700 drill, blue ice drill
- Combine with sub-ice sediment and rock coring



Antarctica

- Ice Sheet Stability
  - ➢ Constrain timing, speed, and magnitude of ice loss and the climate forcing in which it occurs
- Oldest Ice
  - ➢ Climate sensitivity under different boundary conditions and 40k to 100k world
- Climate dynamics and abrupt change
  - ➢ Joint ice and gas records with high time precision

- Foro3000 with 3m barrel
- Replicate coring
- 700 drill

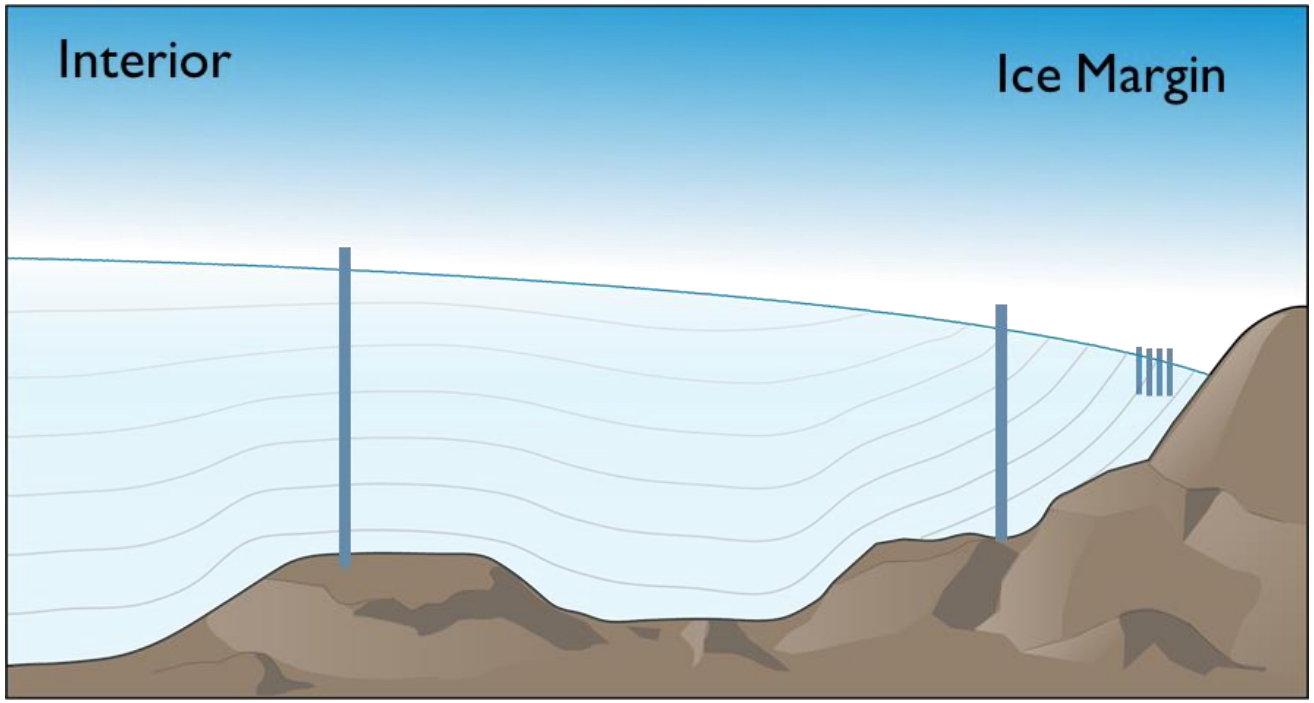


In progress, proposed, or conceived community projects

- COLDEX – Science and Technology Center
- Allan Hills
- Mt. Waddington
- Mt. Logan and Eclipse
- Greentracks 2
- Greenland Intermediate and Deep Cores
- Greenland Prudhoe Dome
- Hercules Dome

COLDEX
Center for Oldest Ice Exploration

Brook and
many, many others



- Two complementary approaches
  - Continuous 1.5 million year ice core in East Antarctic Interior
  - Older ice on the ice sheet margin and at the base of the interior ice core – likely not continuous

In final stage of review

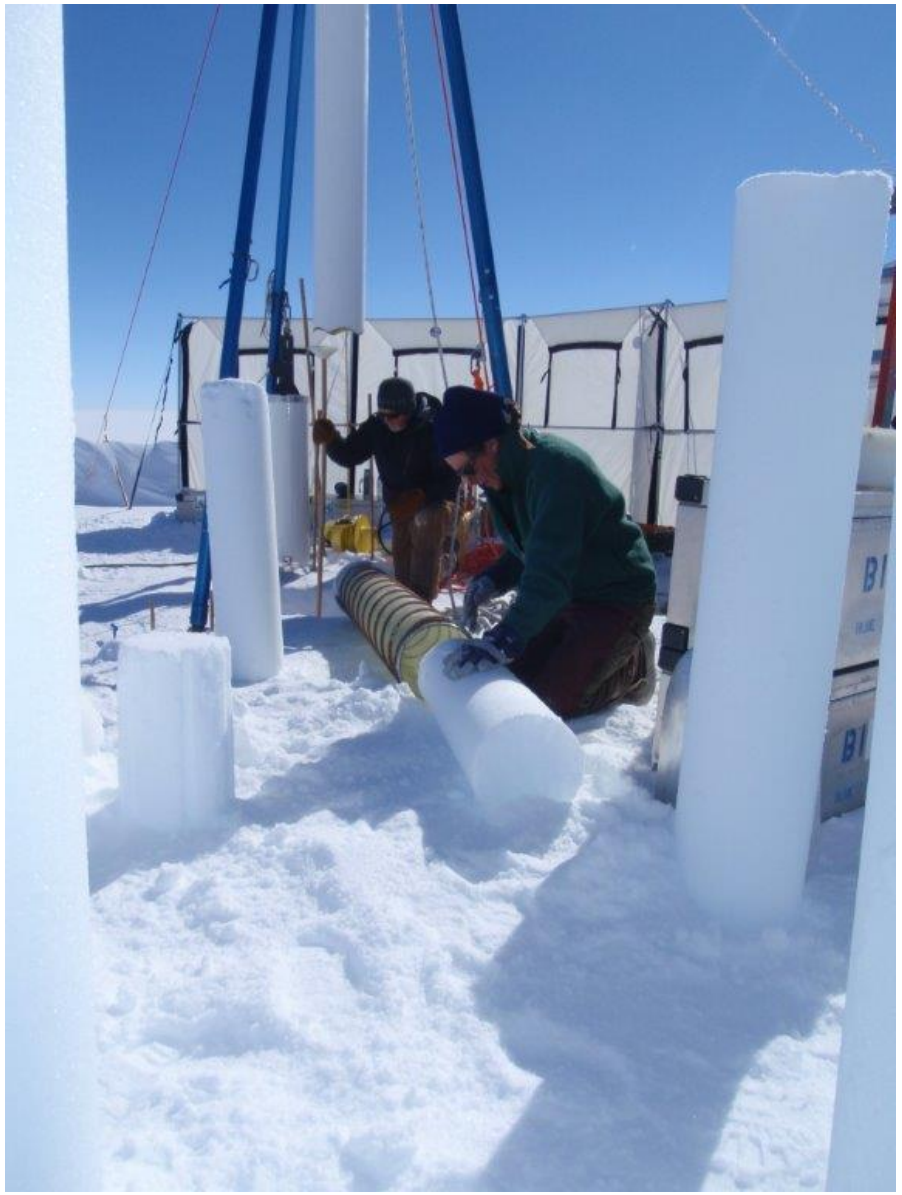
Technology: Foro 3000, IDD (Foro1500), Blue ice drill + others

Allan Hills blue ice drilling

Higgins, Brook, Severinghaus,
Mayewski, Kurbatov and others

Project is ongoing with one more field season occurring

Technology: blue ice drill, Foro400



Mt. Waddington 2.0

Neff, Steig, Christianson and others

First Mt. Waddington encountered a firn aquifer before they were cool and struggle to drill in the polythermal firn

Radar work, core collection, and measurements for time development has beer funded

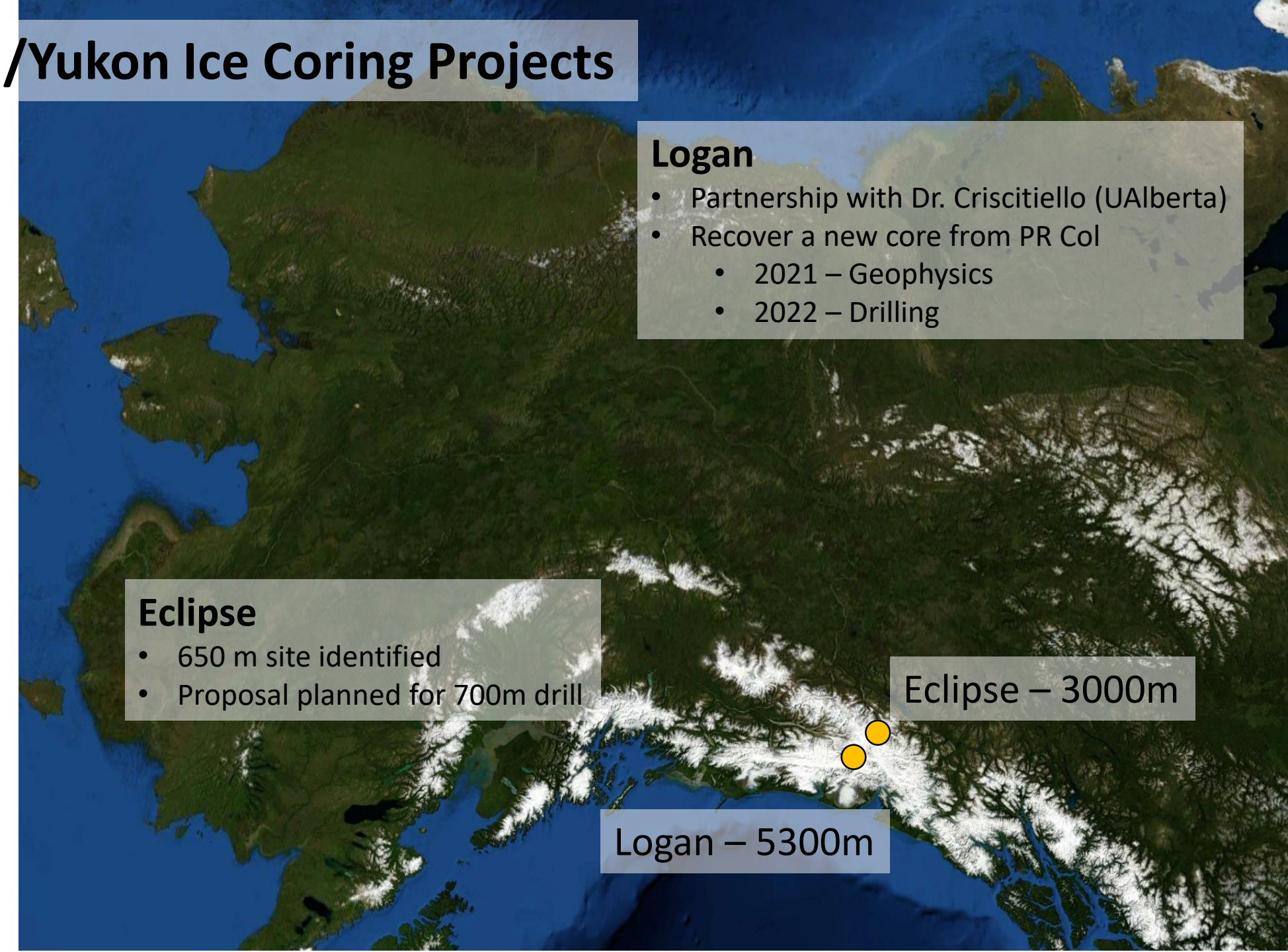
Technology: thermal drill

Alaska/Yukon Ice Coring Projects

Winski, Osterberg, Kreutz, Campbell and others

Logan
- Partnership with Dr. Criscitiello (UAlberta)
- Recover a new core from PR Col
  - 2021 – Geophysics
  - 2022 – Drilling

Eclipse
- 650 m site identified
- Proposal planned for 700m drill



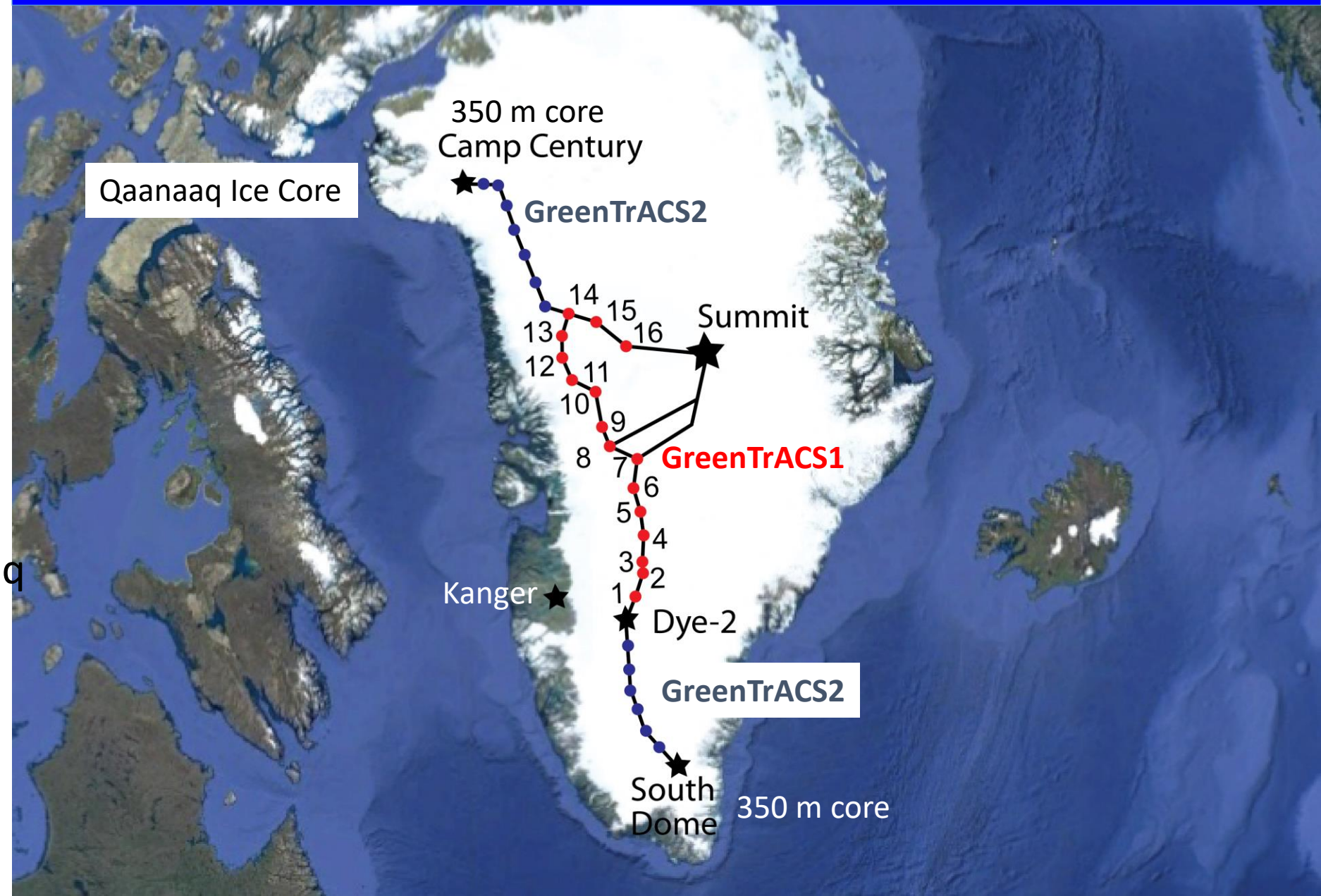
Technology: 700m drill

GreenTrACS2 Traverse Summer 2022/3?
Osterberg, Hawley, Marshall, Winski, Tedesco

Technology for GreenTracs:

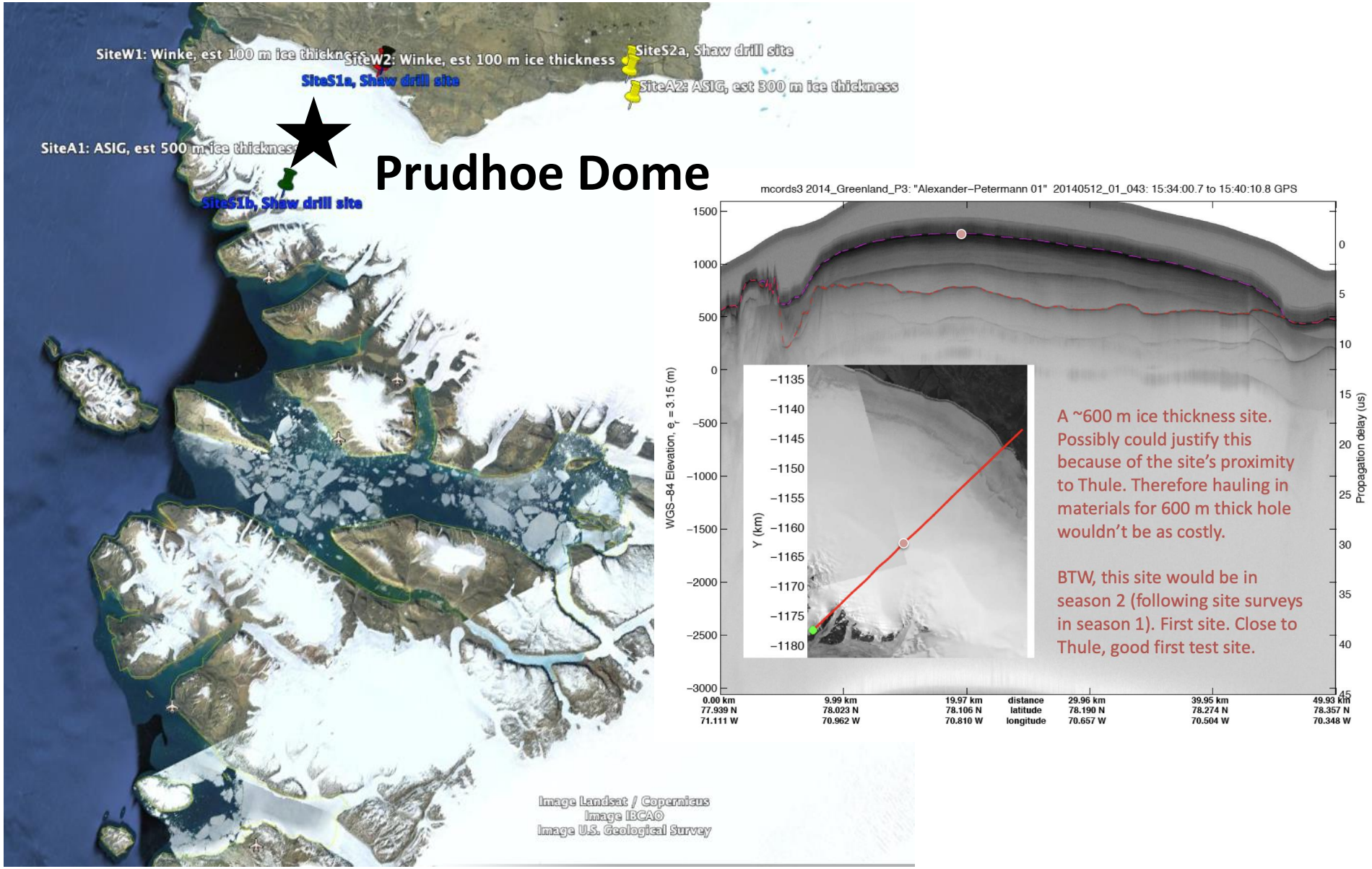
- Stampfli 50 m
- Foro 400

Technology for Qaanaaq and South Dome



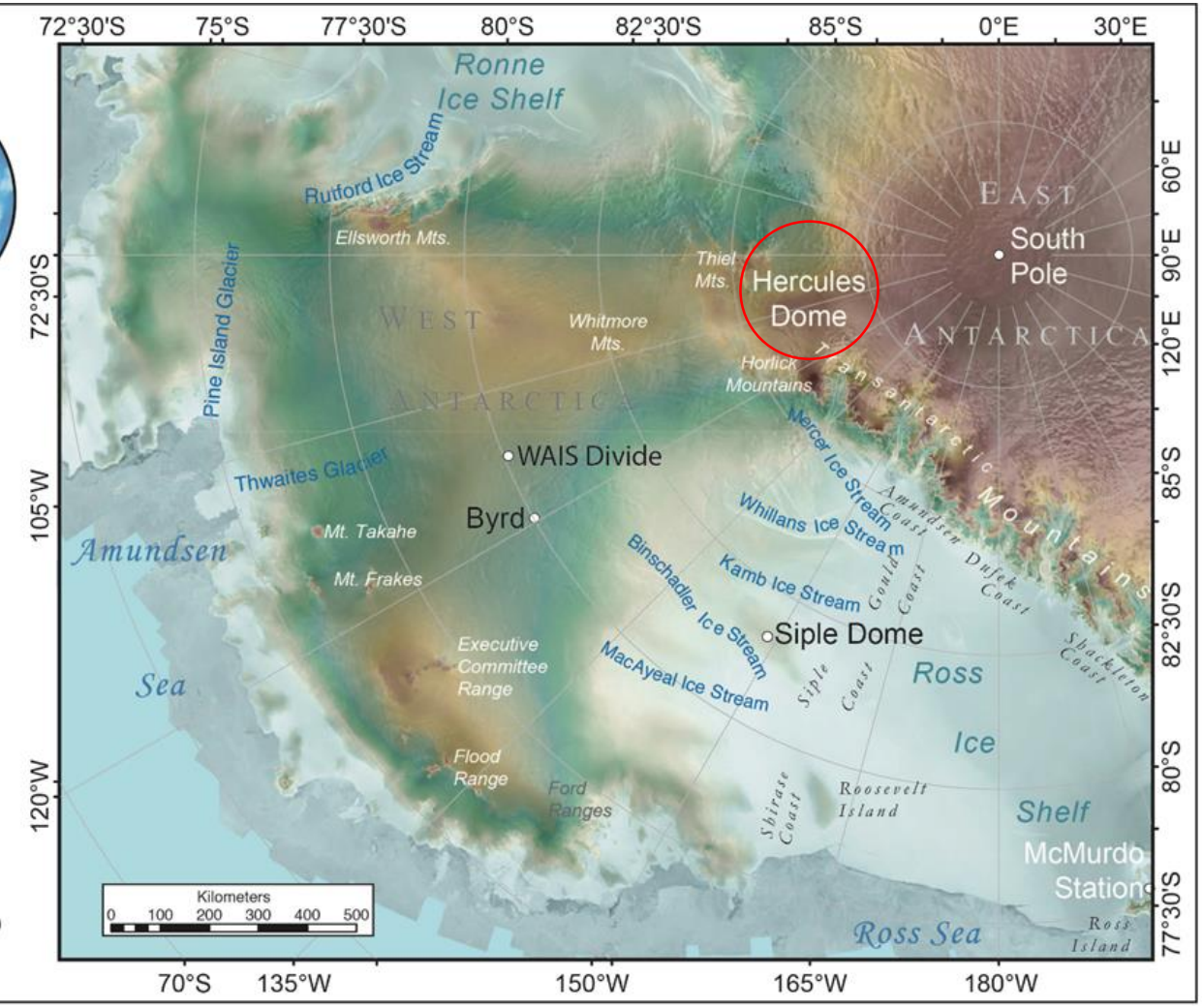
Collaborate Logistics and Science with GreenDrill project Complete, High-Res Record back to 15+ ka

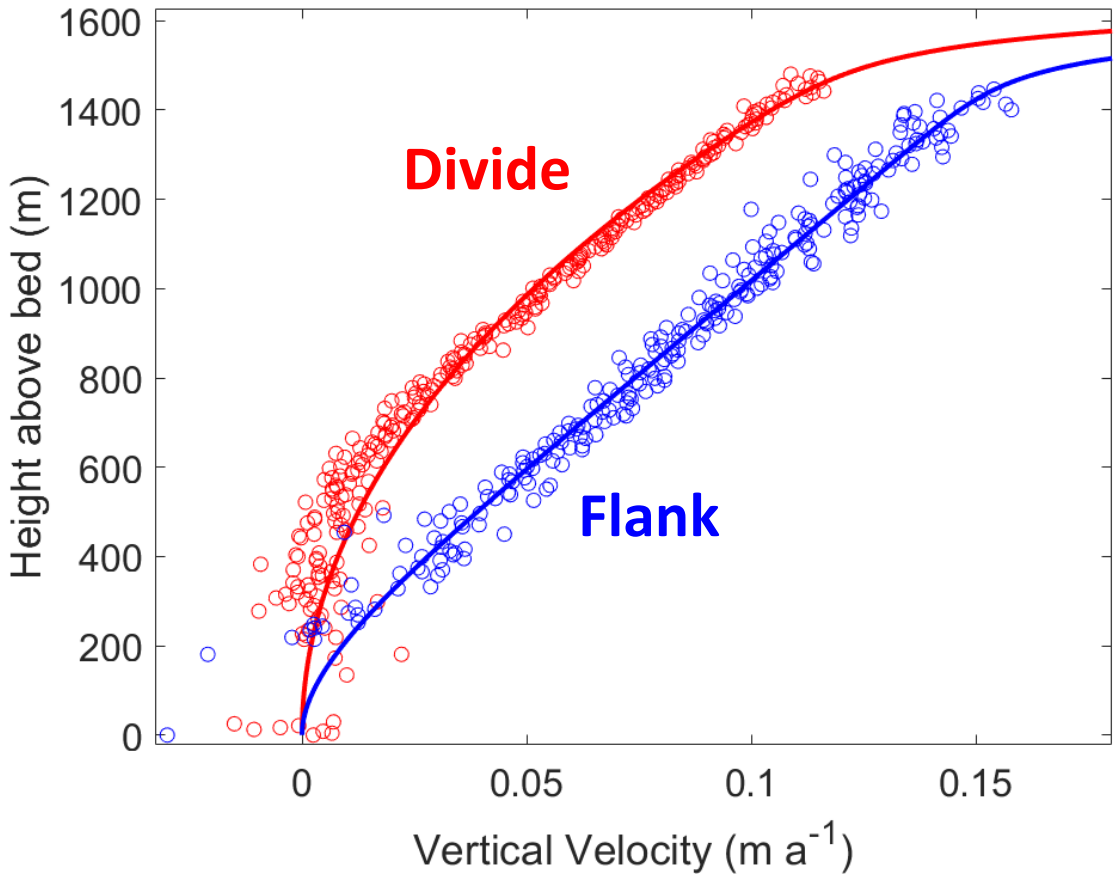
Osterberg, Winski, Koffman, Kreutz, Buizert, Alexander



Technology:
700 drill

Herc Dome Update





Site Selection: Christianson, Steig, and Fudge

One full field season remains

Herc Dome Core Drilling

Steig, Aydin, Fudge
Souney, Twickler

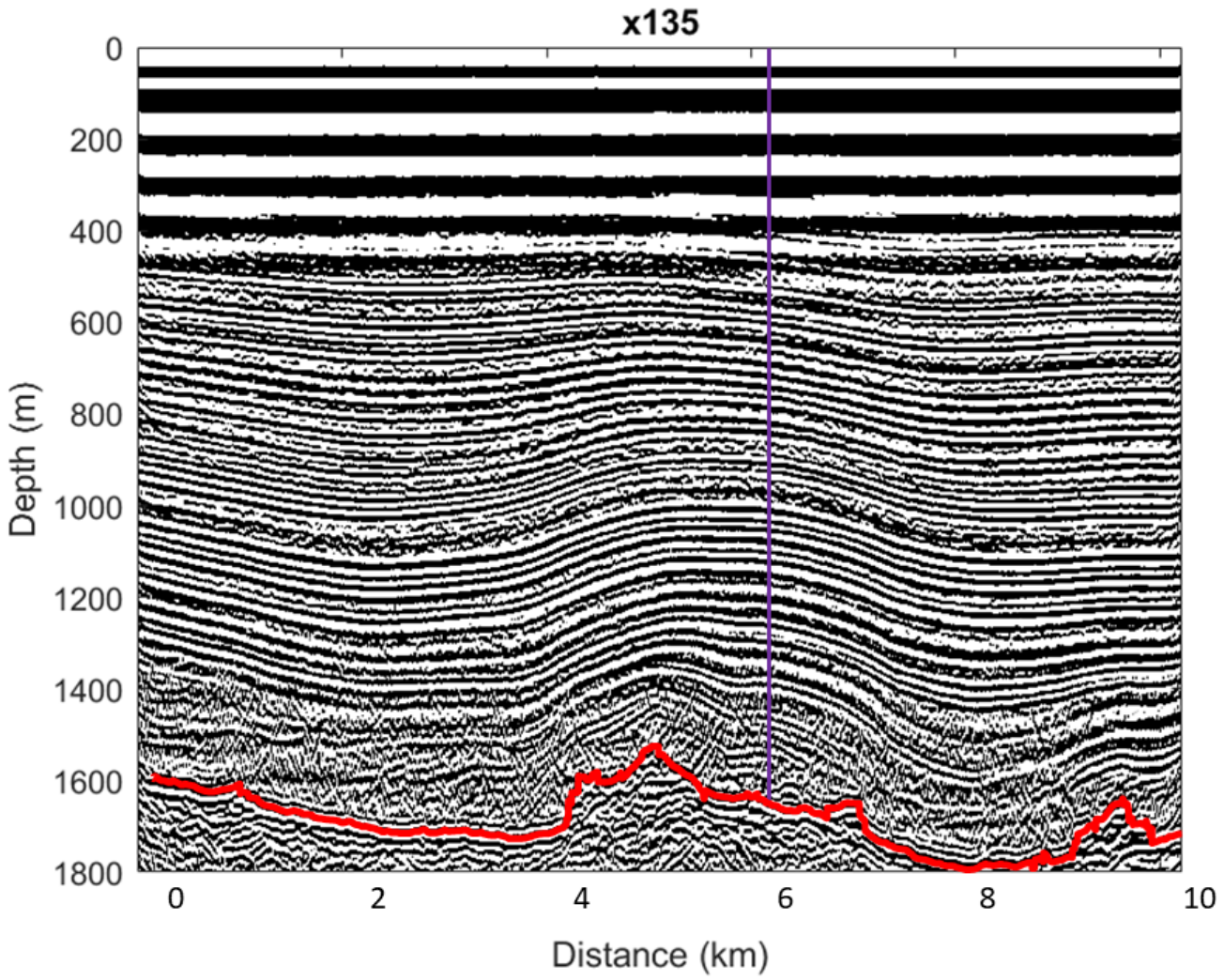
Potential First Full Drill Season in 2024-2025

First Community Planning Workshop

May 10 and 11, 2021

Announcement coming soon!

Informational Webinars on March 23 and 31



herculesdome.org

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