THE SAGA OF CLIMATE CHANGE

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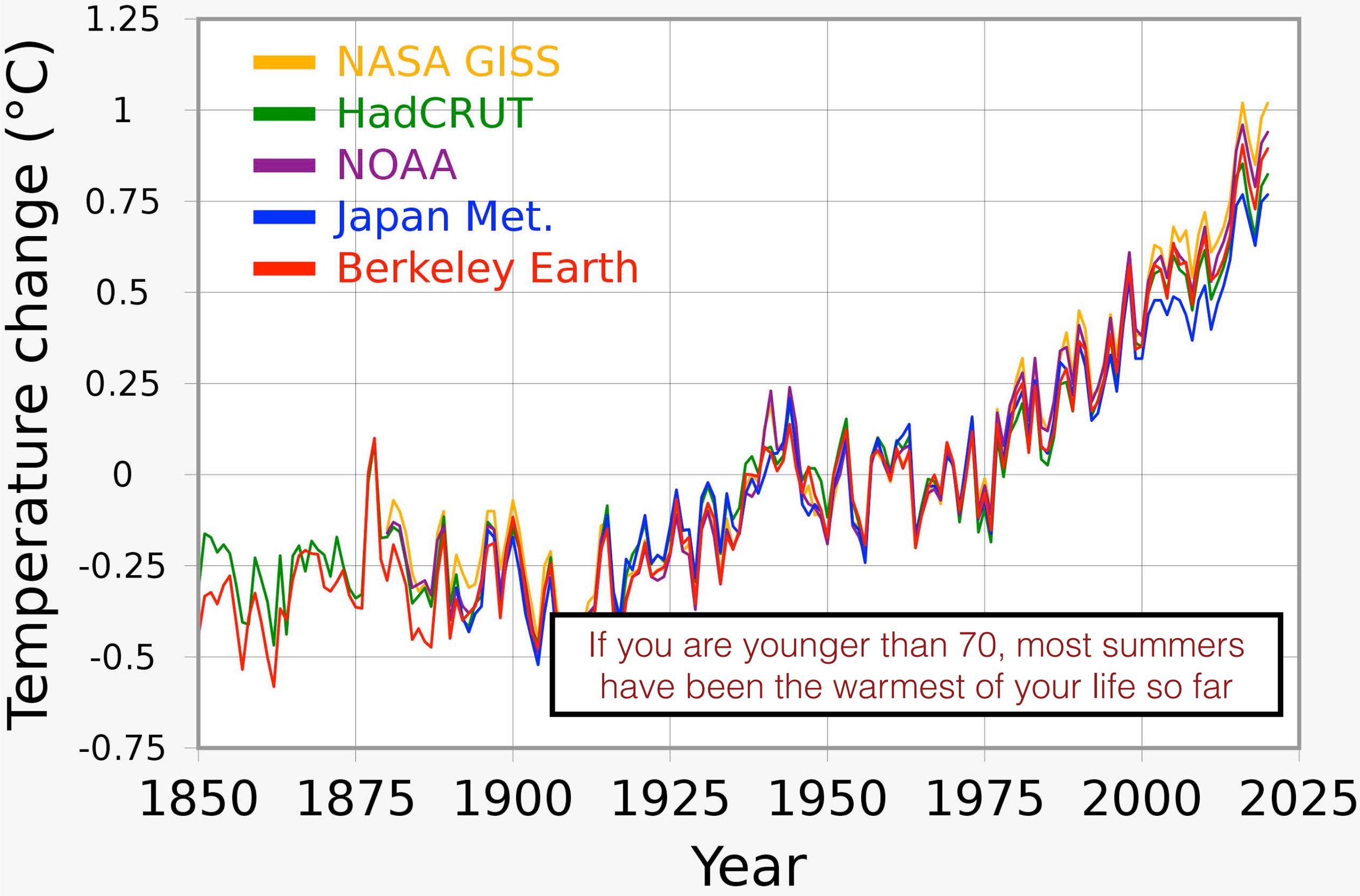
The New York Times

By Soumya Karlamangla

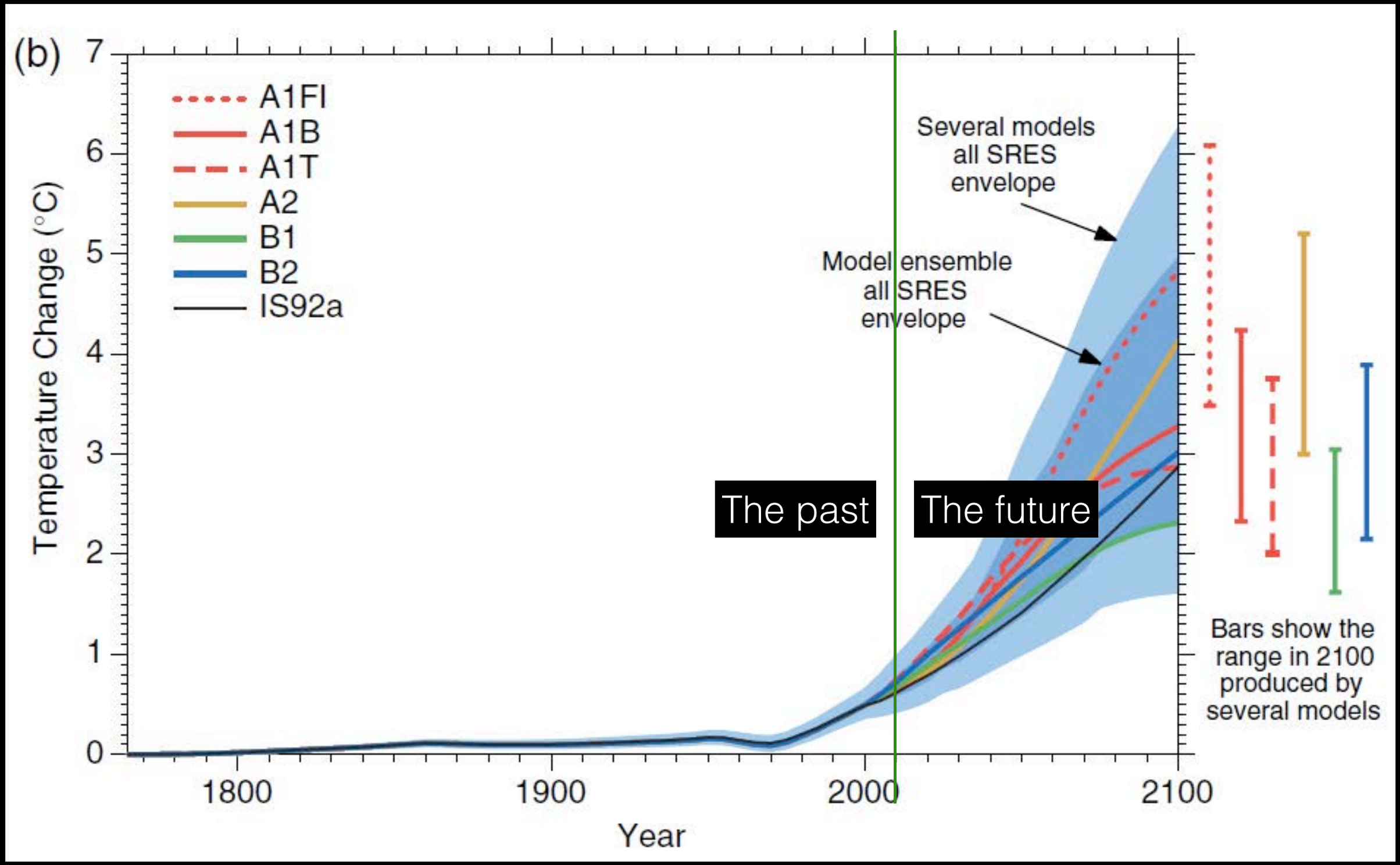
Aug. 30, 2021

Is This the Coldest Summer of the Rest of Our Lives?

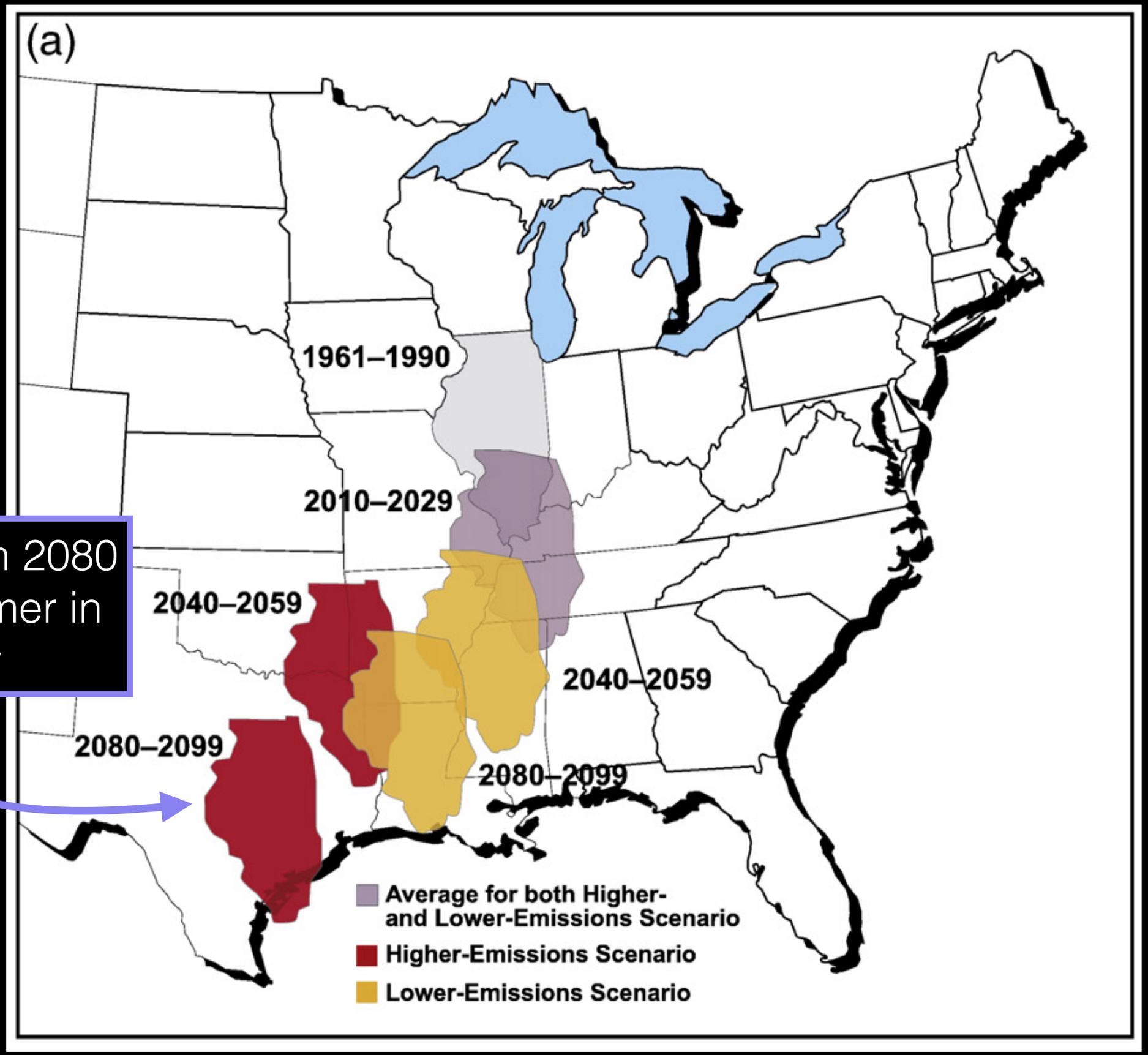
Global average temperature change



This pattern is not likely to change…

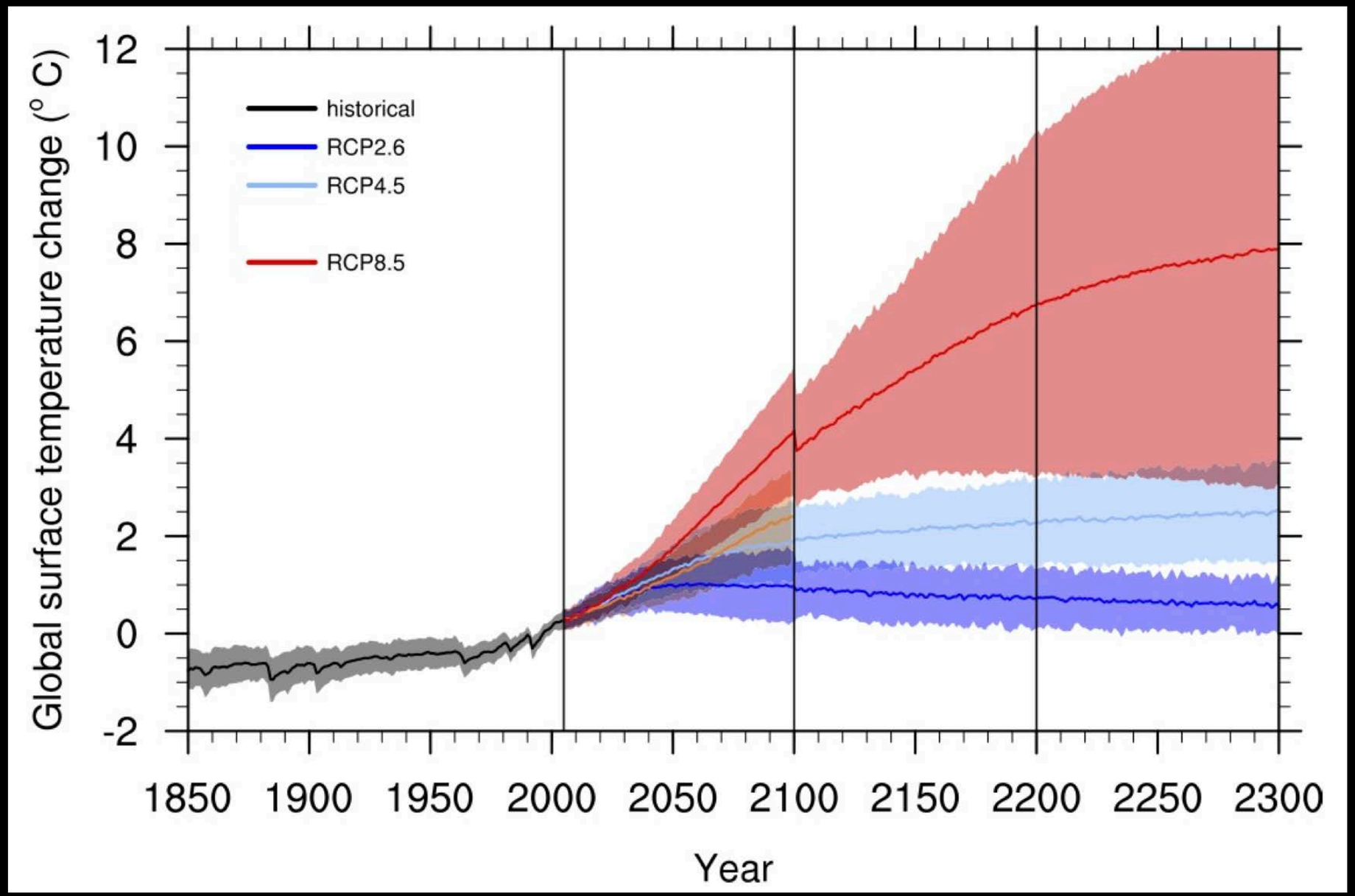


Illinois summers in 2080 will feel like summer in Texas today



From Hayhoe et al., 2010

However, the future is uncertain

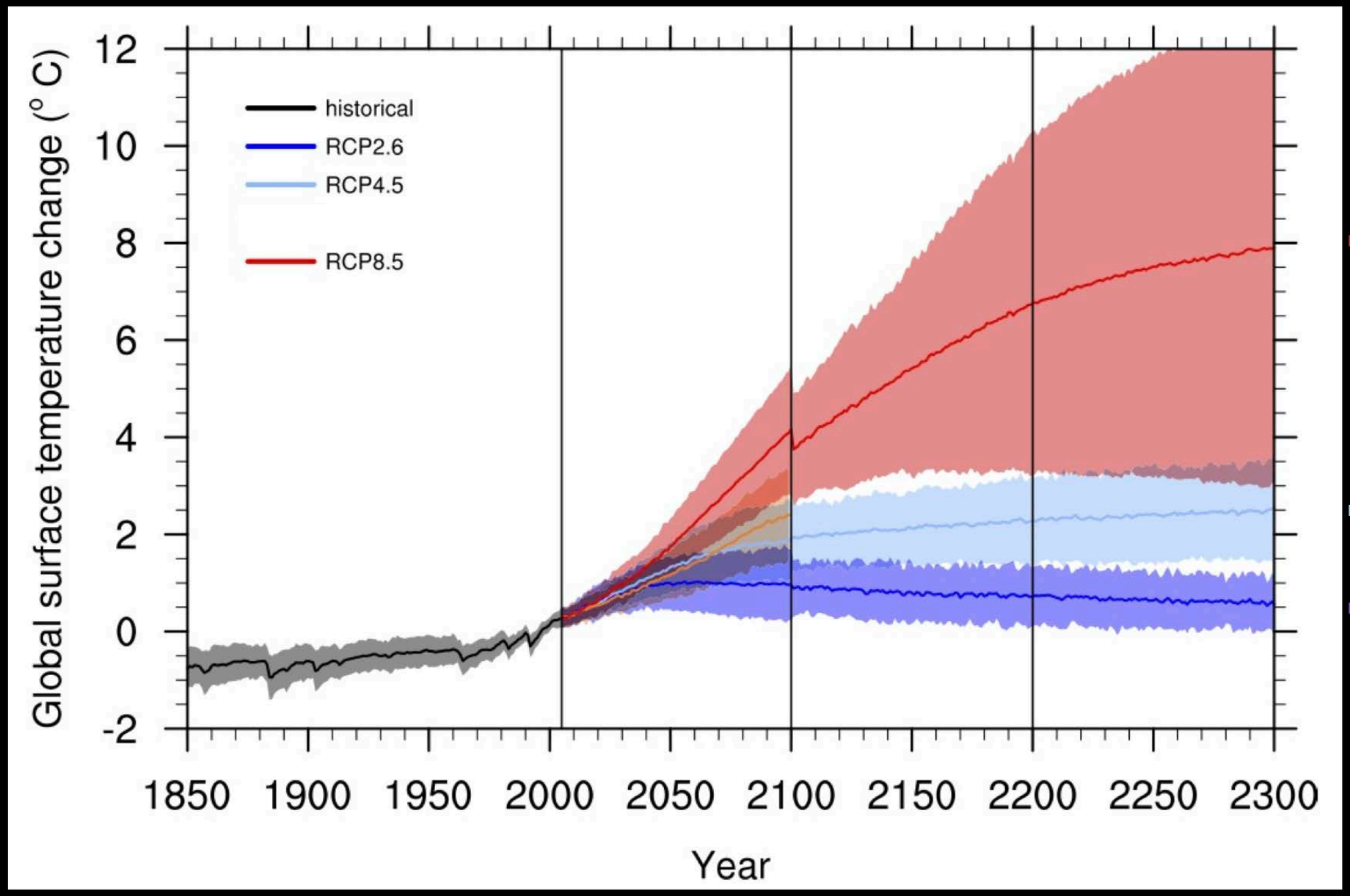


“Business as usual”

Fossil fuel use peaks in 2040

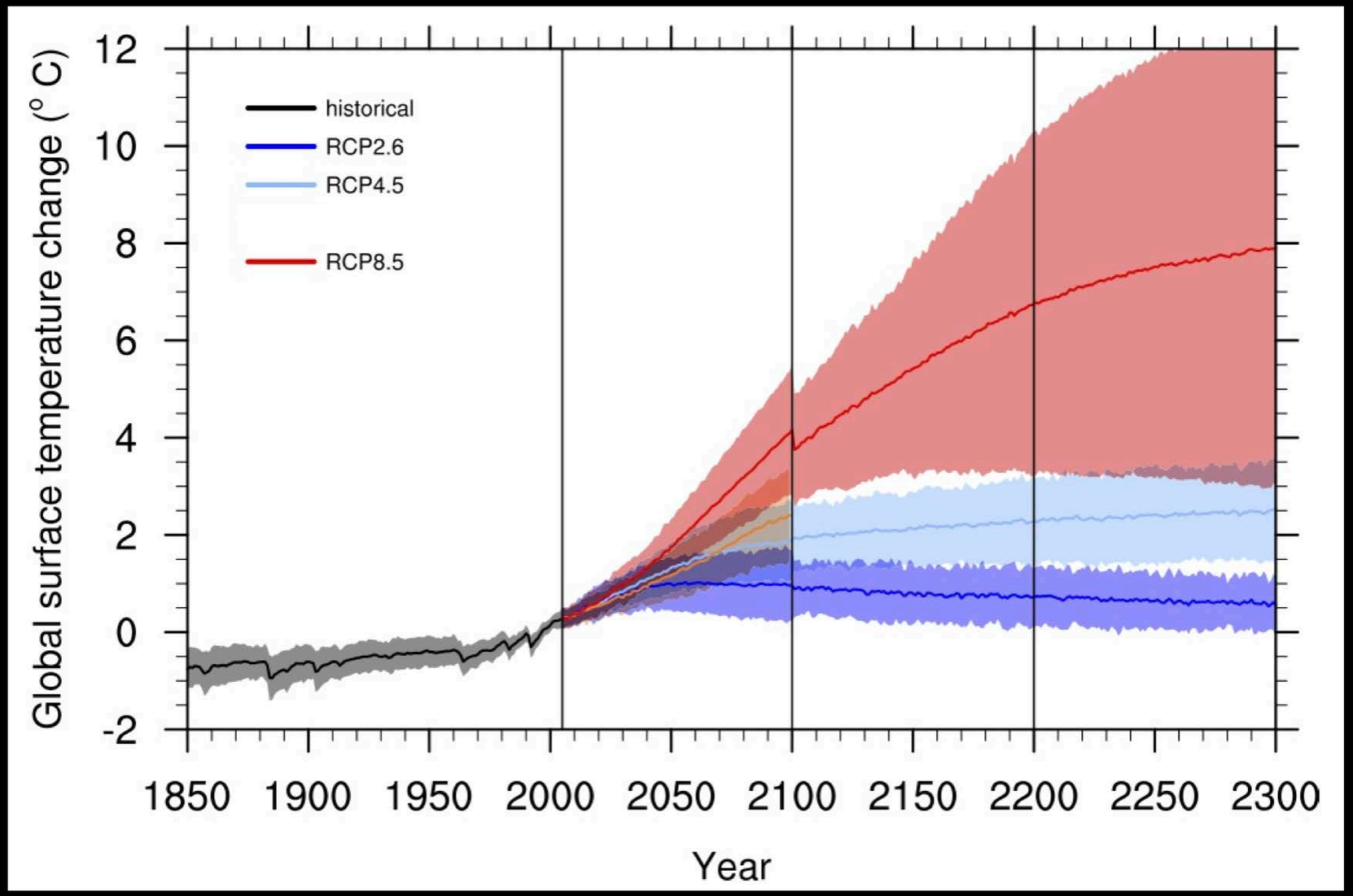
Fossil fuel use has already peaked

However, the future is uncertain



The different lines capture the *uncertainty* of human behavior

Why is it so uncertain?

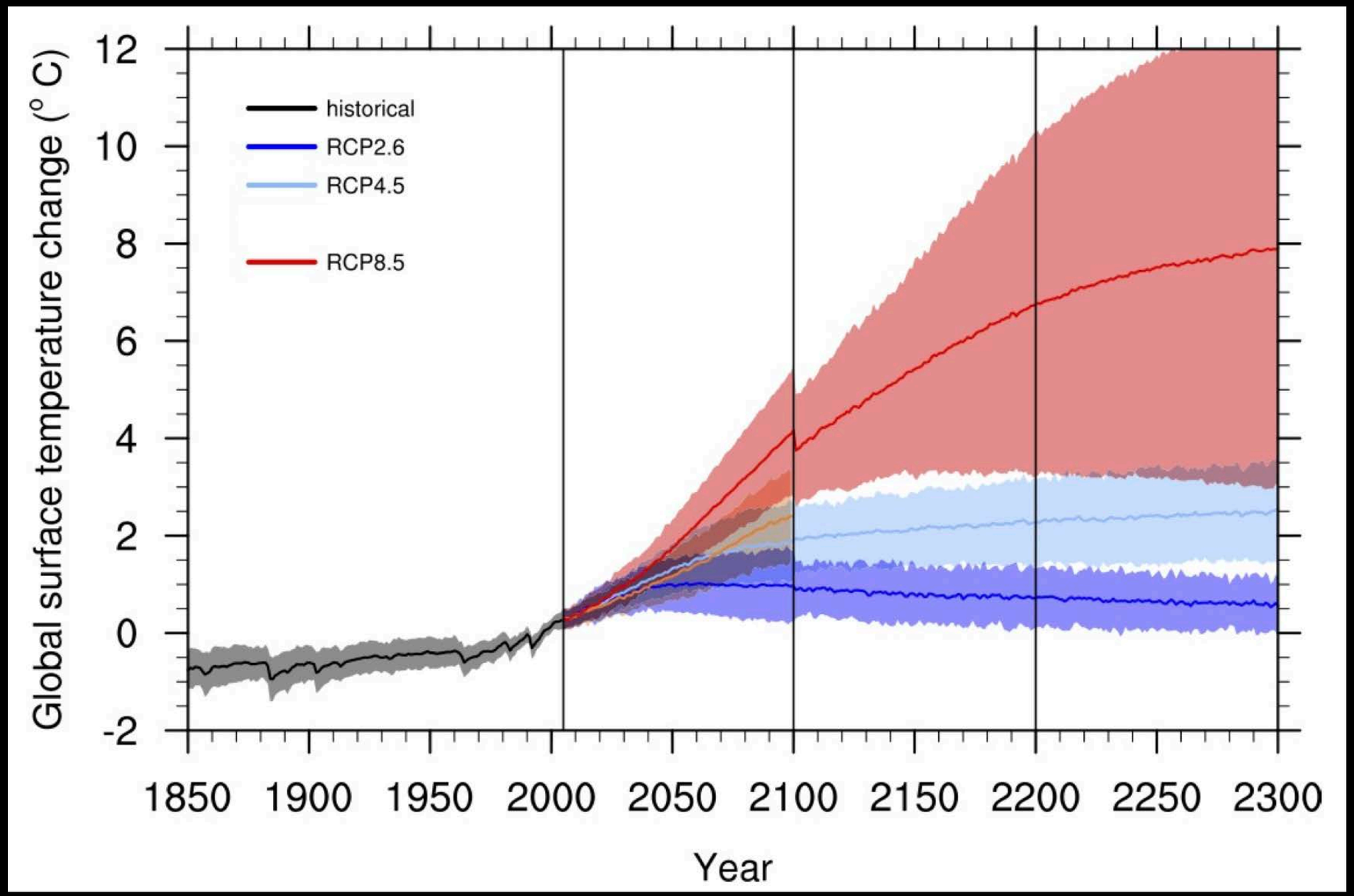


Will new energy technologies make greenhouse gases obsolete?

Will new oil discoveries make fossil fuels cheaper?

Will governments subsidize or tax certain types of energy use?

But there is another source of uncertainty



This cloud is our *uncertainty* in the climate system

Why is the climate's future so uncertain?

Why is the climate's future so uncertain?

The receding edge of the Greenland Ice sheet

Why is the climate's future so uncertain?

Light colored ice reflects sunlight and cools the climate

New plants absorb CO_2

Darker surface warms the climate

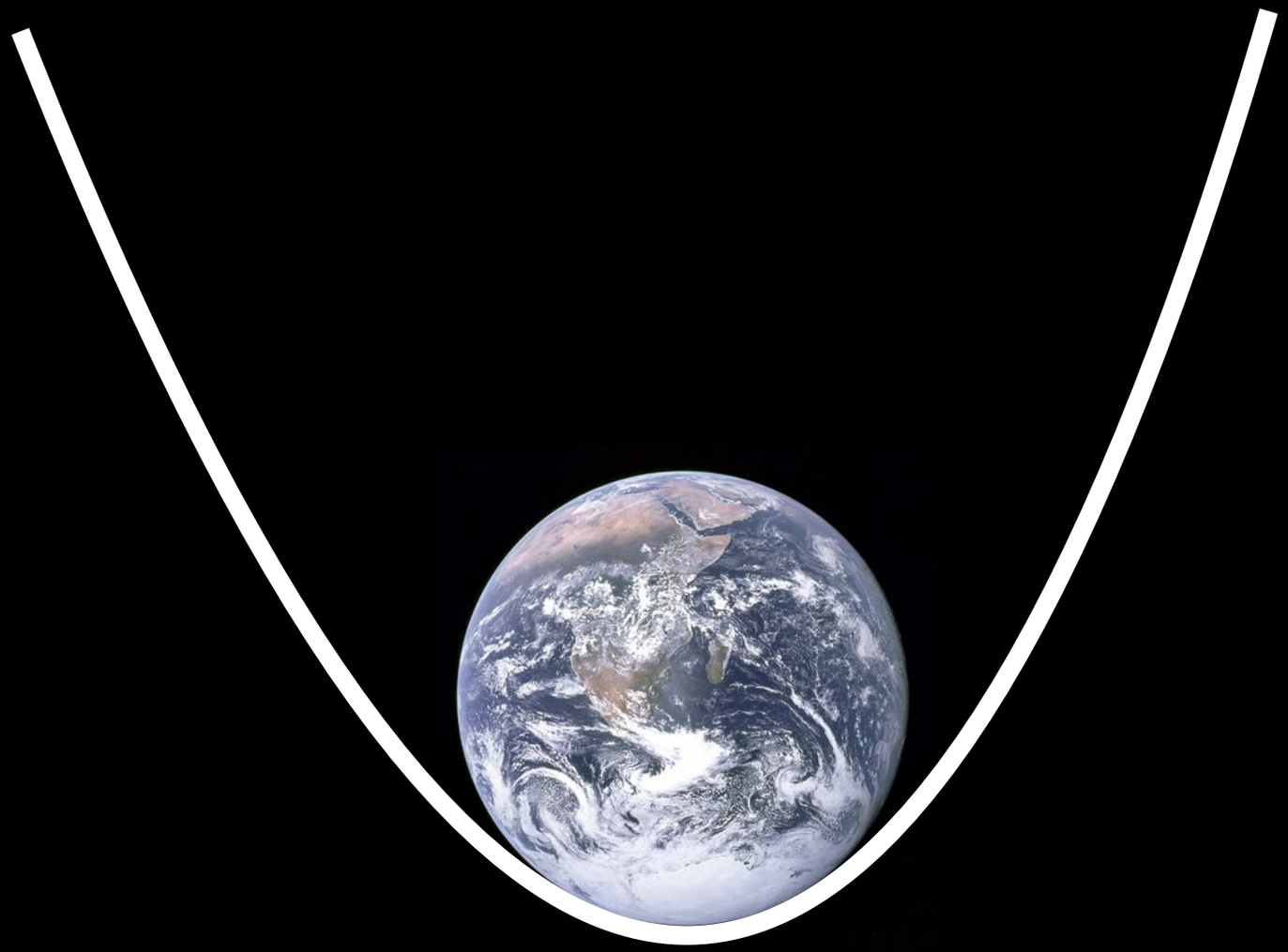
Why is the climate's future so uncertain?

As temperatures rise

Will these new lands become forests and reduce atmospheric carbon dioxide?

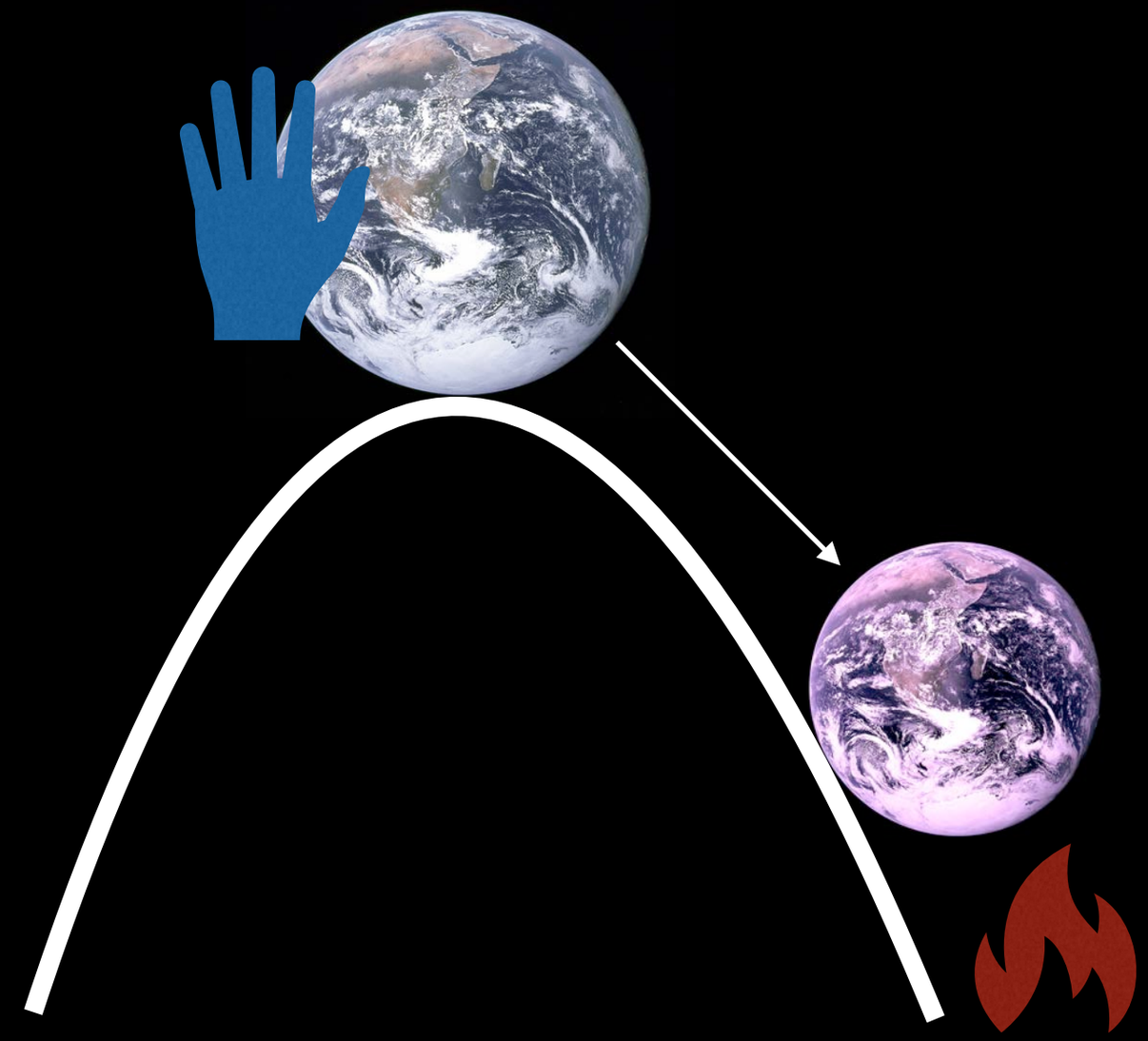
Will these new lands remain unproductive and warm the climate?

Complex systems like Earth's
climate can be **resilient** to change



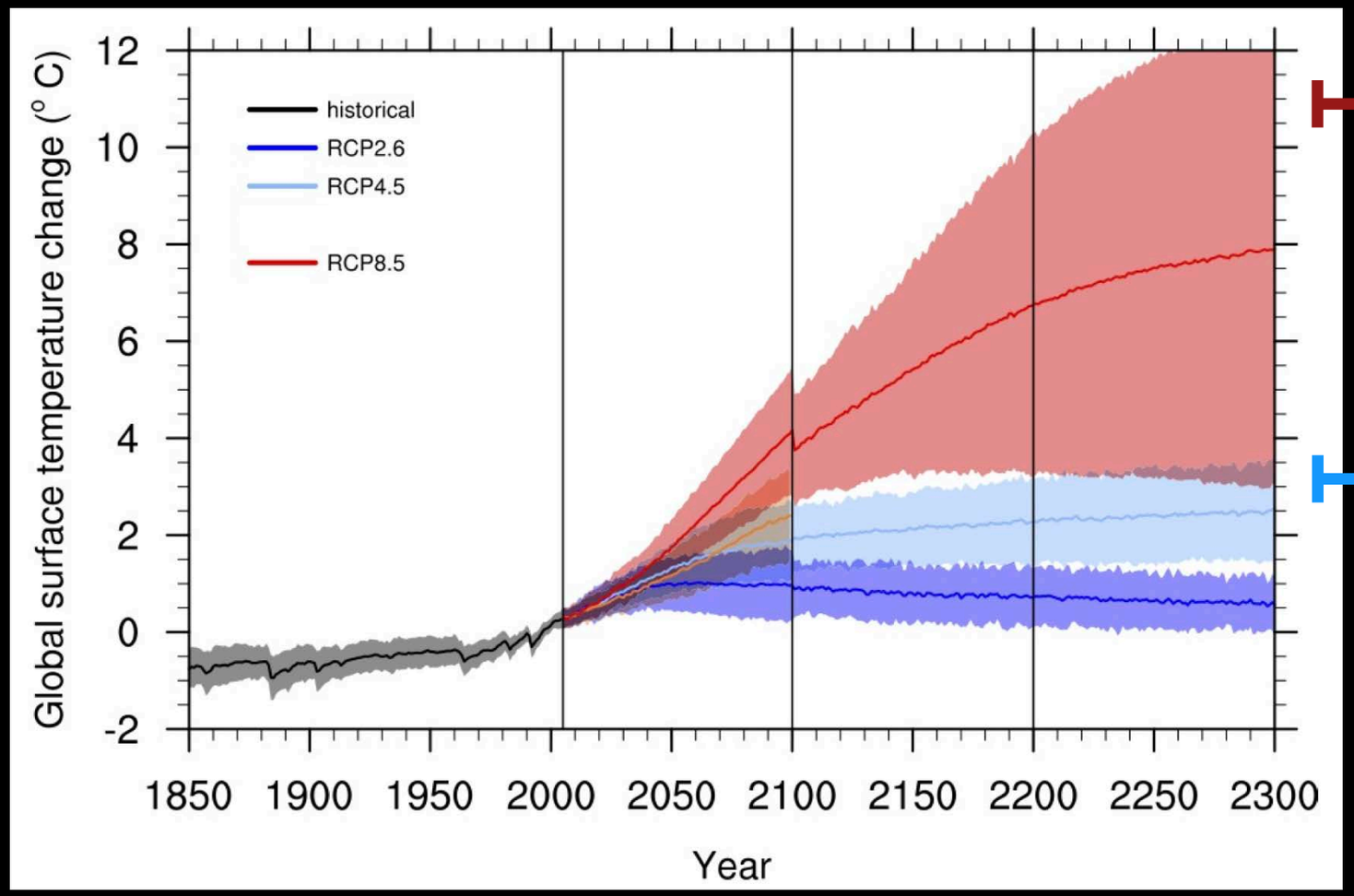
Meaning: *The system can be poked and prodded but stays more or less the same*

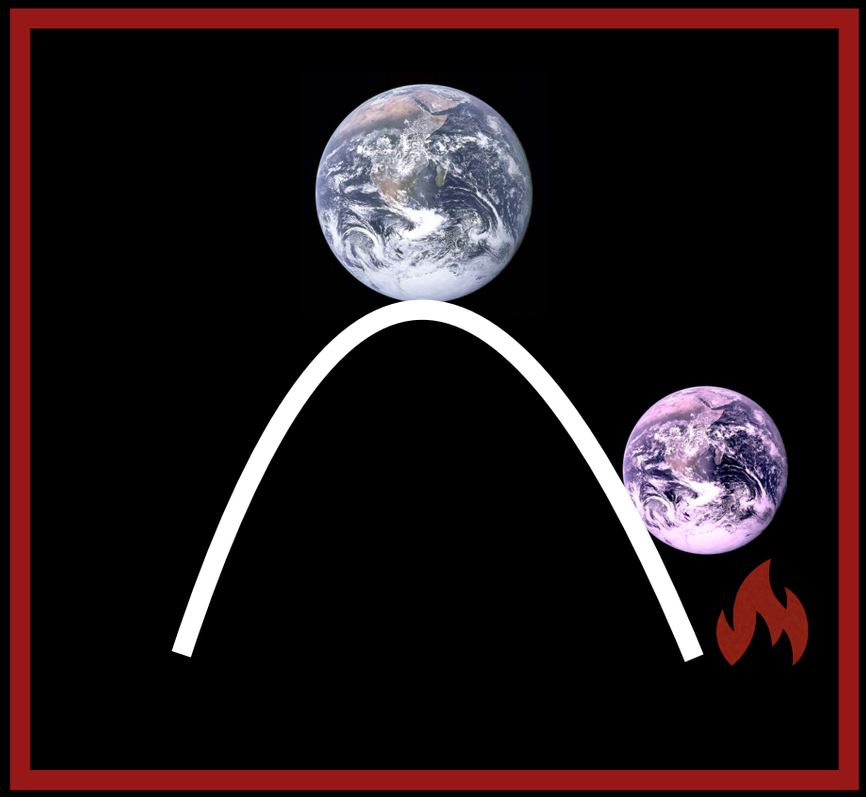
Complex systems like Earth's climate can be **very sensitive**

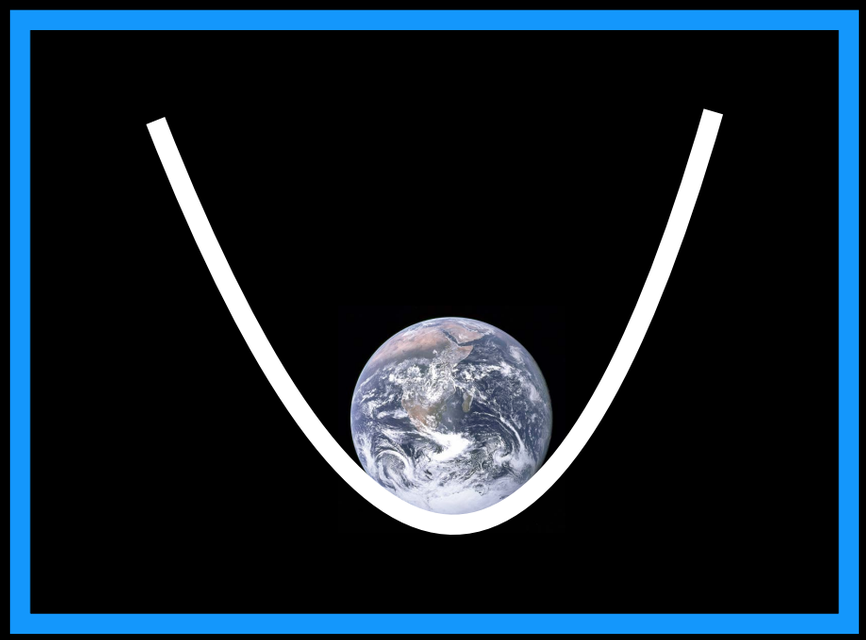


Meaning: *The system can be nudged a little and change a lot!*

Hot futures come from models that assume a sensitive climate system





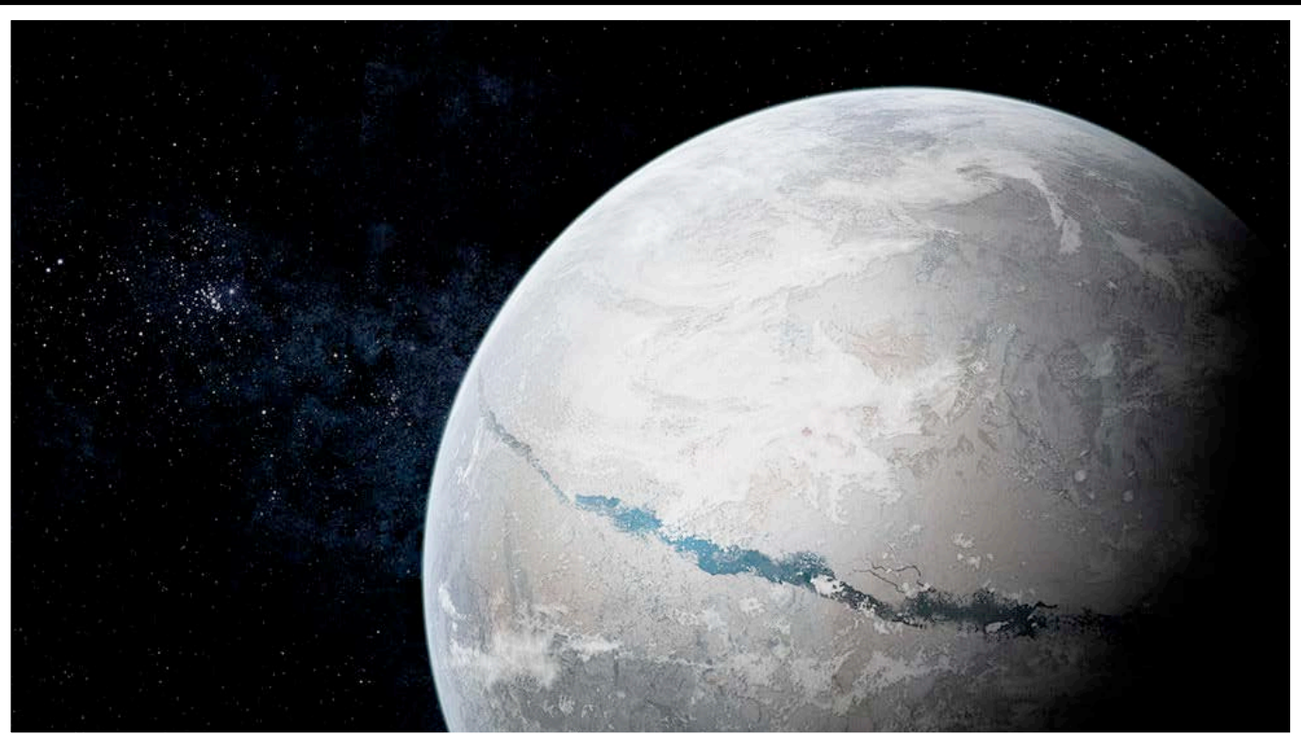


Colder futures come from models that assume a stable climate system

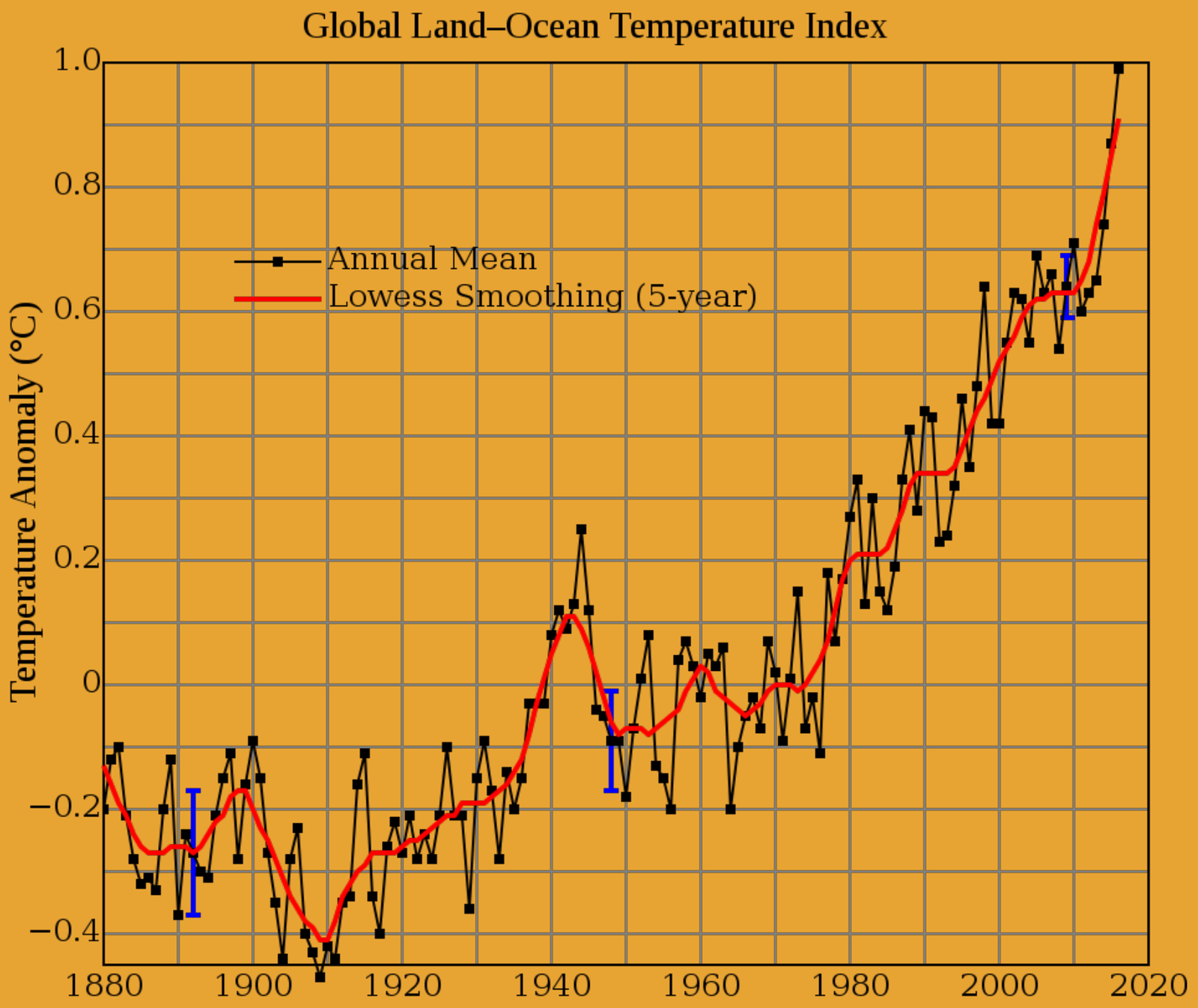
Earth scientists use history to understand the ***sensitivity*** of the Earth's climate

50 million years ago, the arctic was a thriving forest

500 million years ago the Earth was covered pole to pole with glaciers

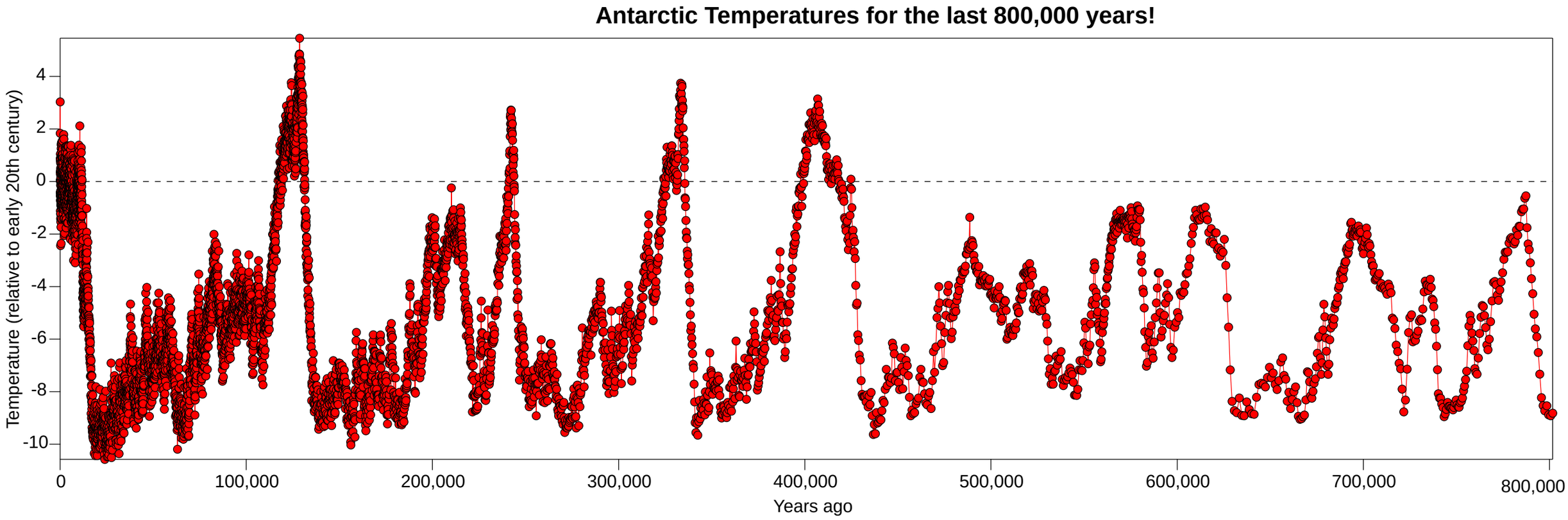


Humans have been quantitatively tracking climate for only ~100 years, which is not enough time to understand the behavior of the climate



Earth Scientists rely on “proxies” to understand the full range of behavior of the climate.

The Saga of Climate Change



When you step back, and look at climate through a historical lens, you see that it has undergone massive reorganizations - often abruptly.

- **Civilizations have been forced to migrate or collapse**
- **Animals have gone extinct**
- **Landscapes become unrecognizable (buried under ice or flooded by rising seas).**


Youngest
Oldest

Let’s say you didn’t take the trash out for a whole year

Let's say you didn't take the trash out for a whole year

Bulls Jersey*

Bears Jersey*

Christmas stuff

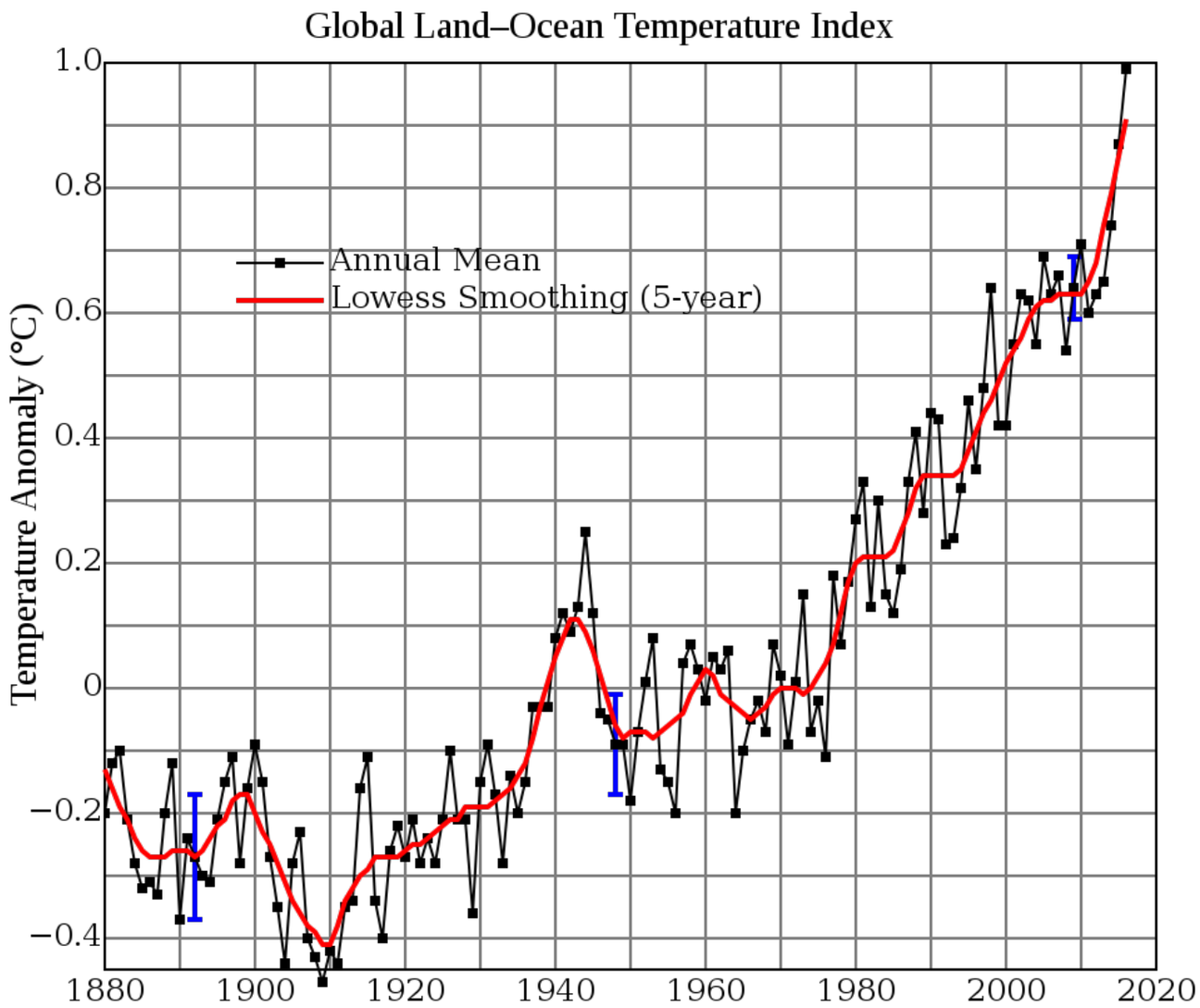
Dead leaves

Halloween candy

Sunscreen container

*Save your Sky Jersey

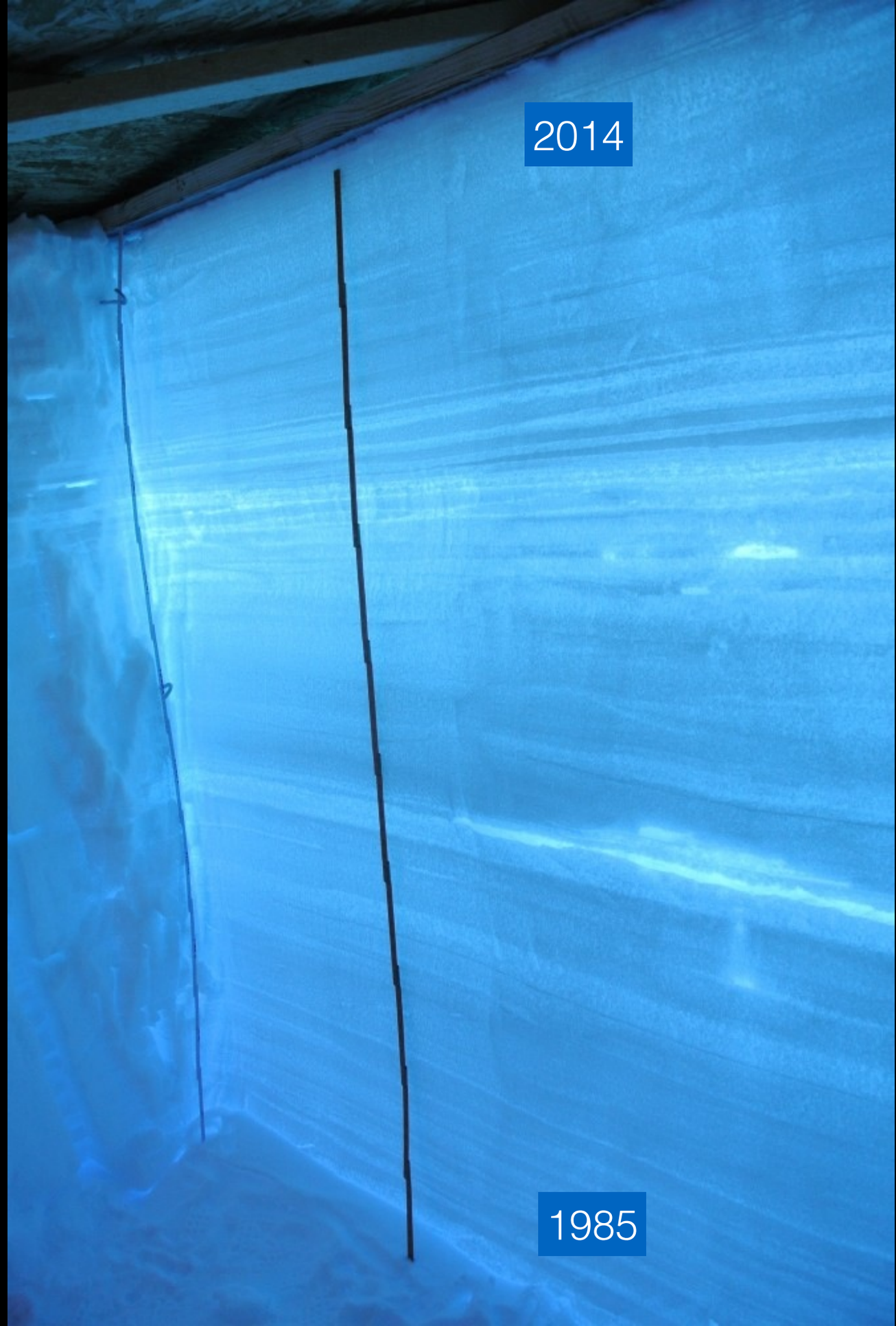
Let's say you didn't take the trash out for 140 years



What clues might you look for to see if the temperatures used to be colder?

Glaciers build up ice for 1000’s or millions of years

These are layers of ice



Greenland has at least 150,000 years of ice

Antarctica has at least 2 million years of ice!

To the top of the ice sheet

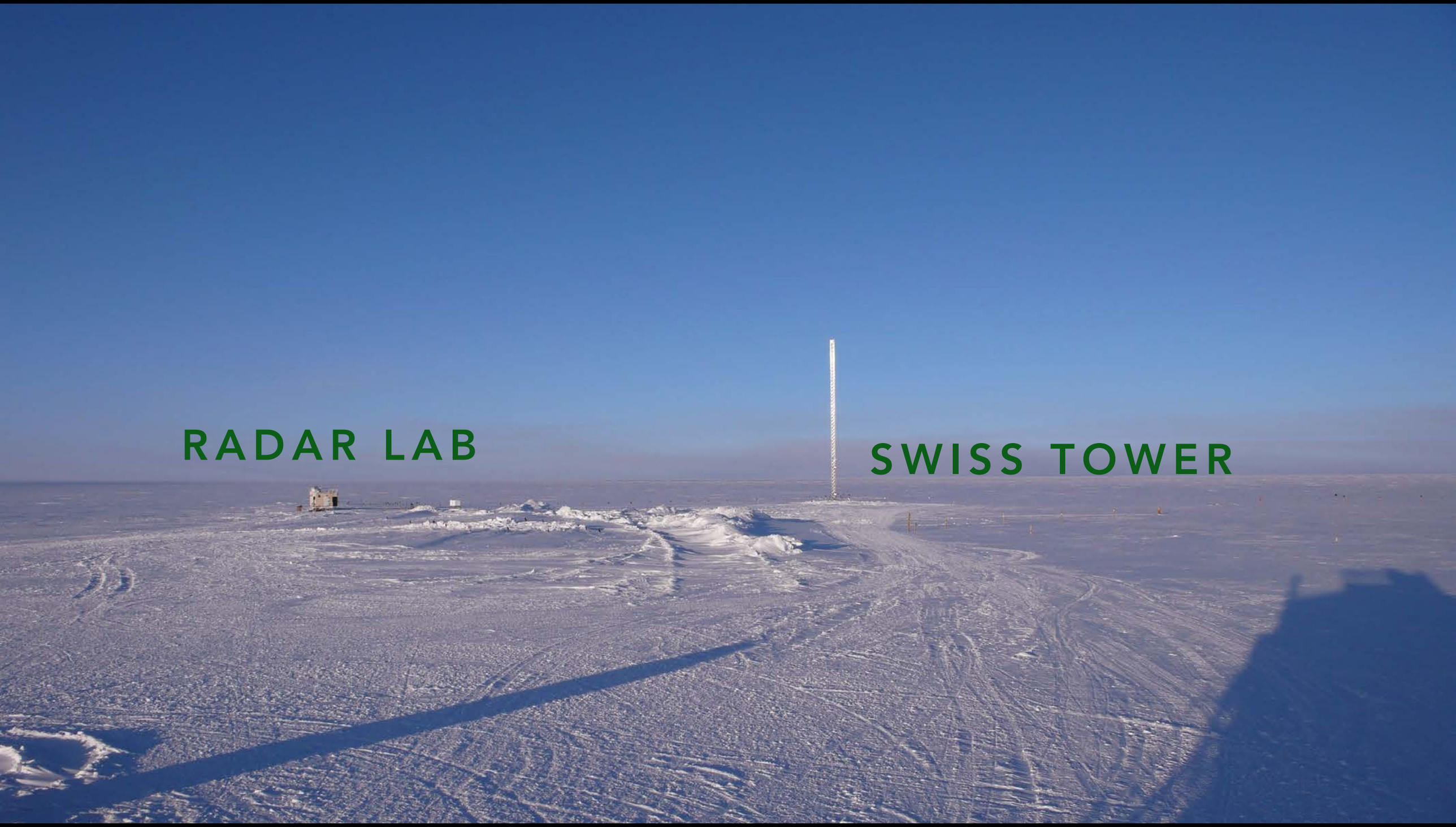

U.S. AIR FORCE

View of Summit Camp from above

TENT CITY

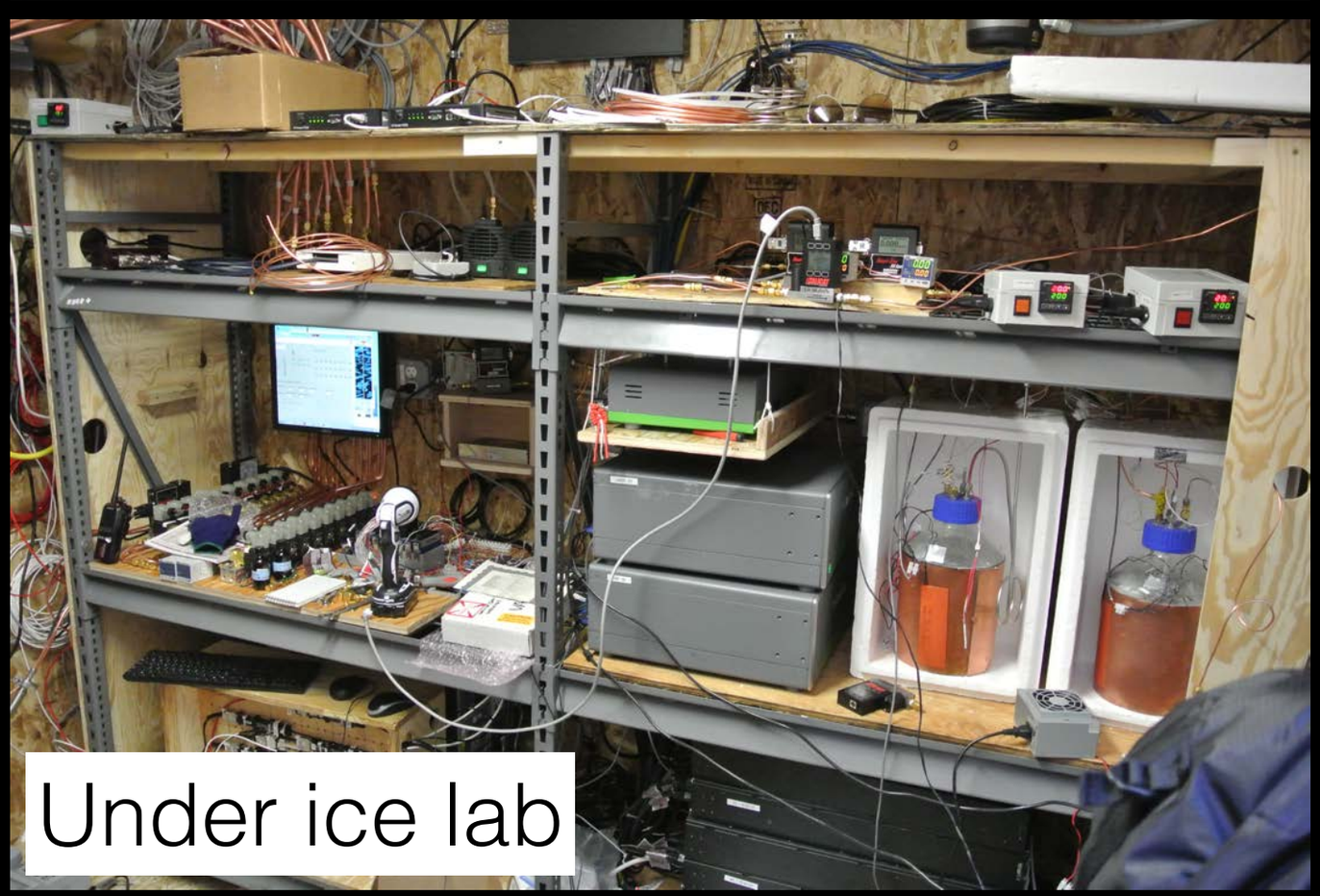

big house
green house

GARAGE


RADAR LAB
SWISS TOWER

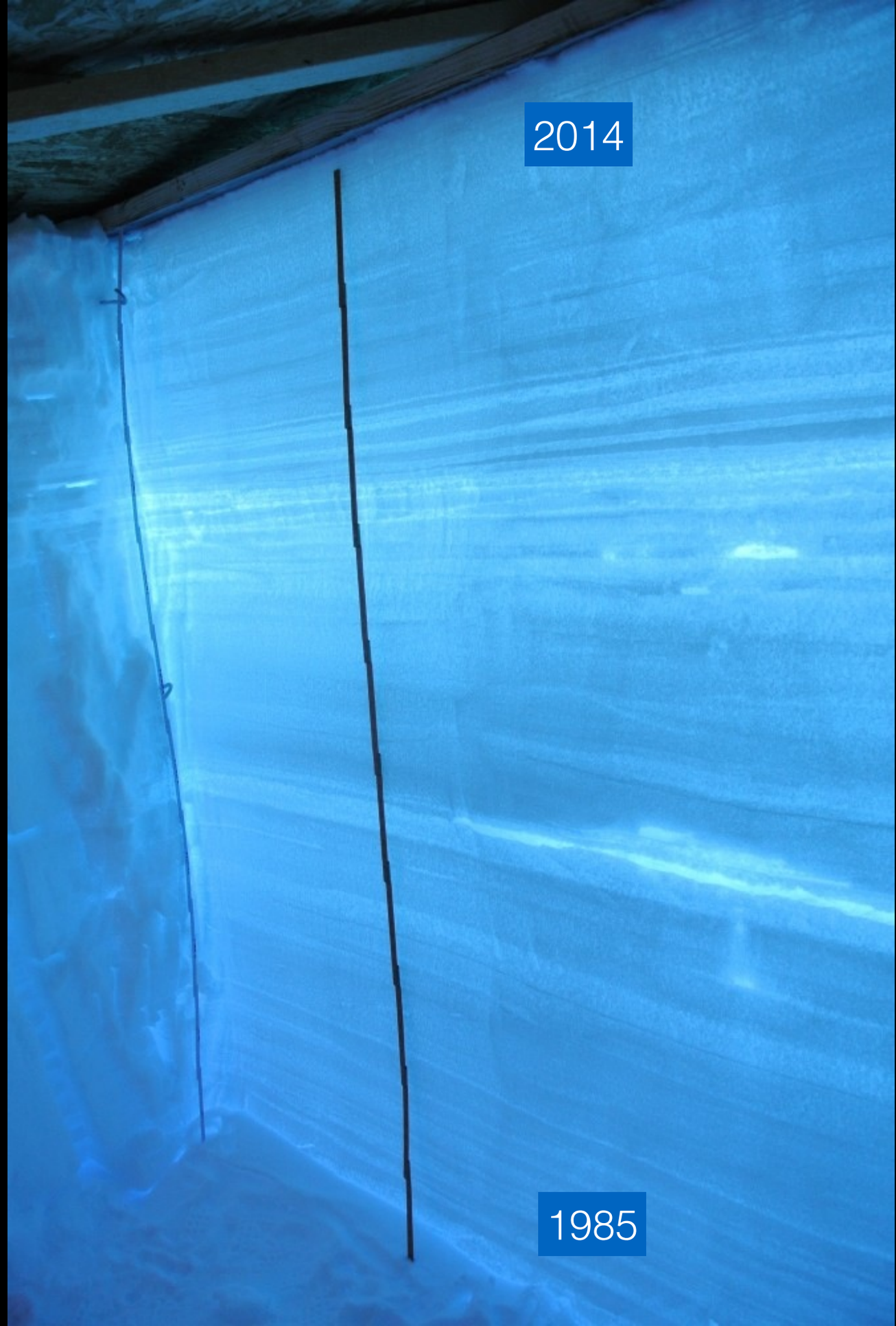
Research tower

Hatch

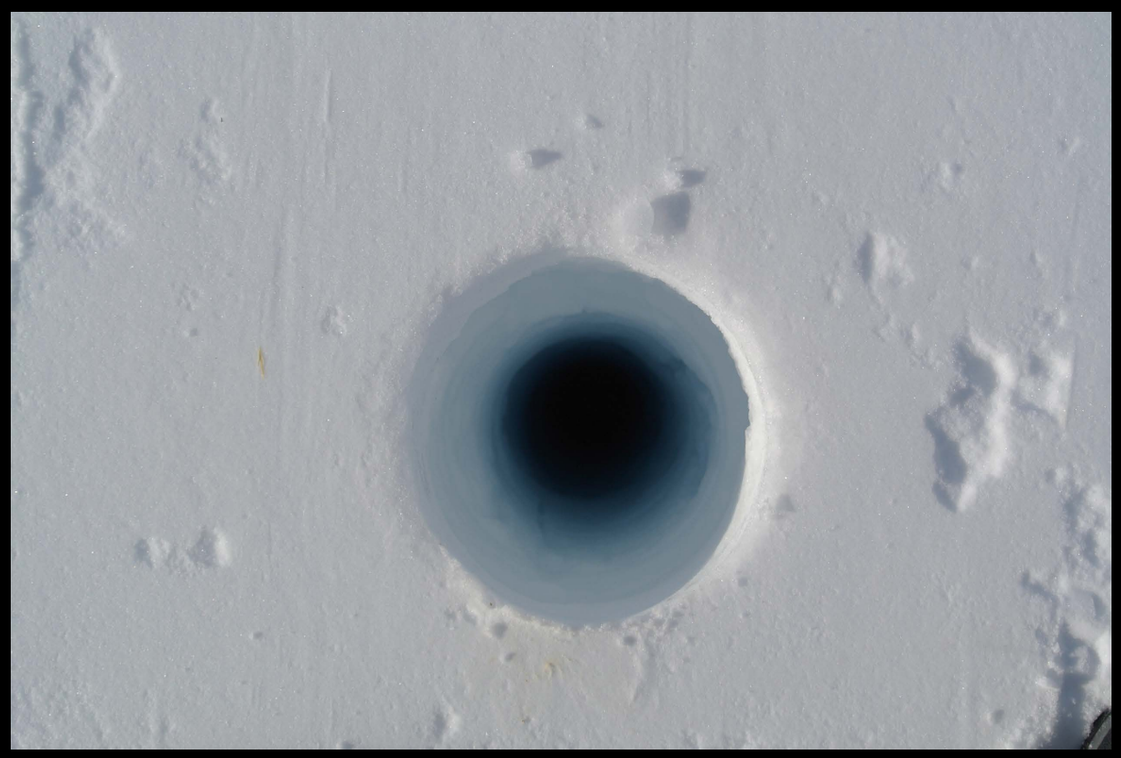


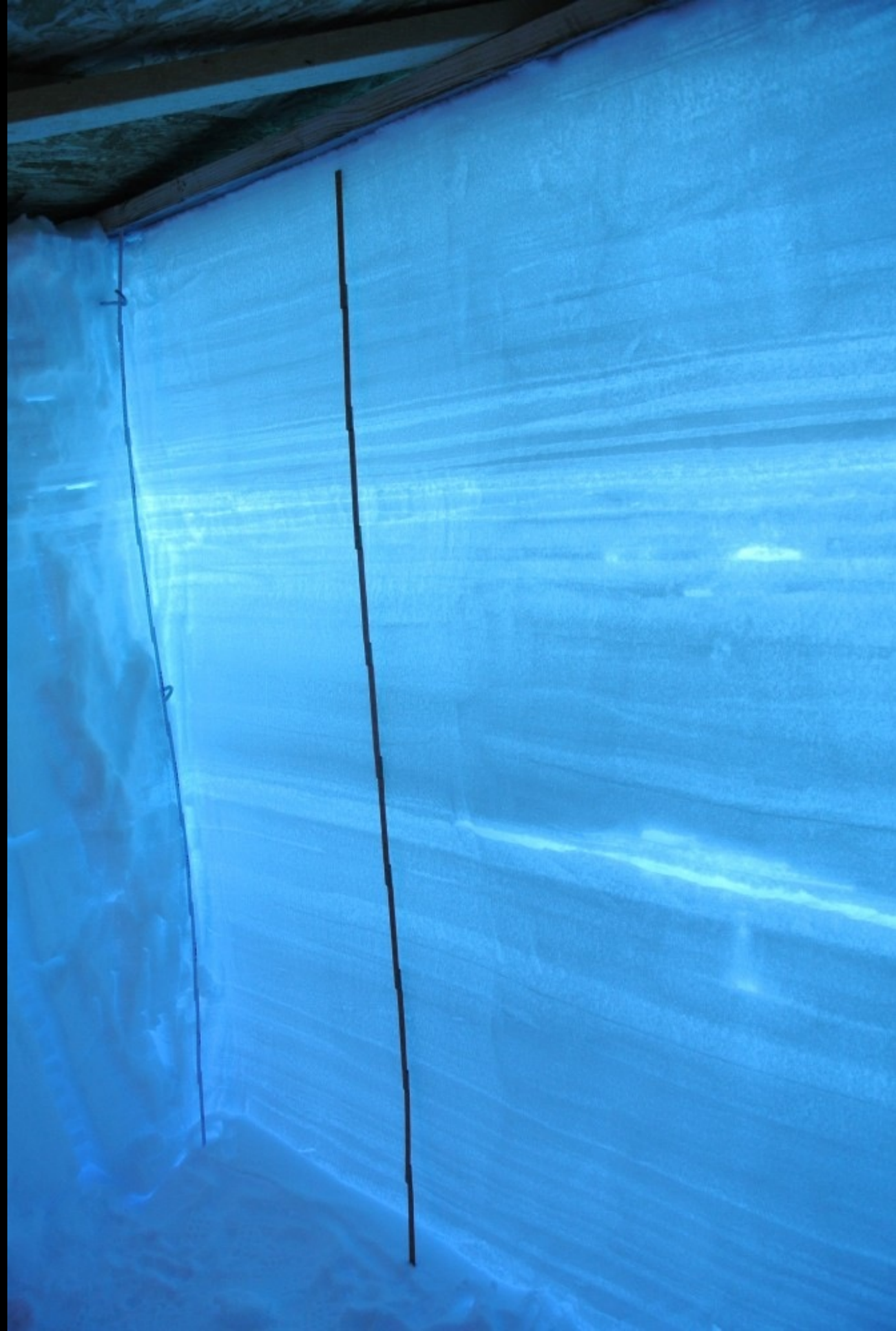
Under ice lab

Recent history in the ice



ICE CORES = TIME MACHINE

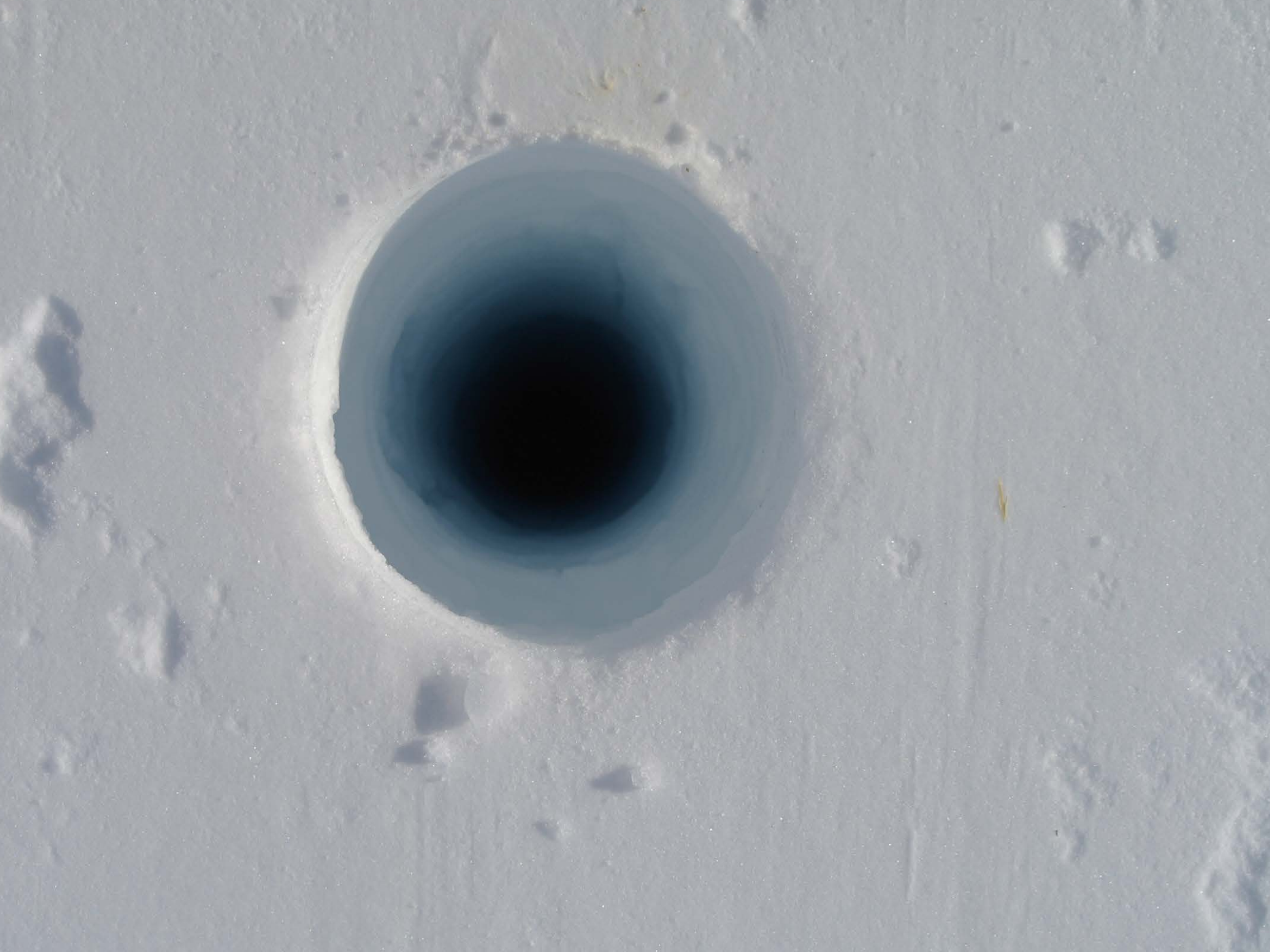




PICKING A SITE

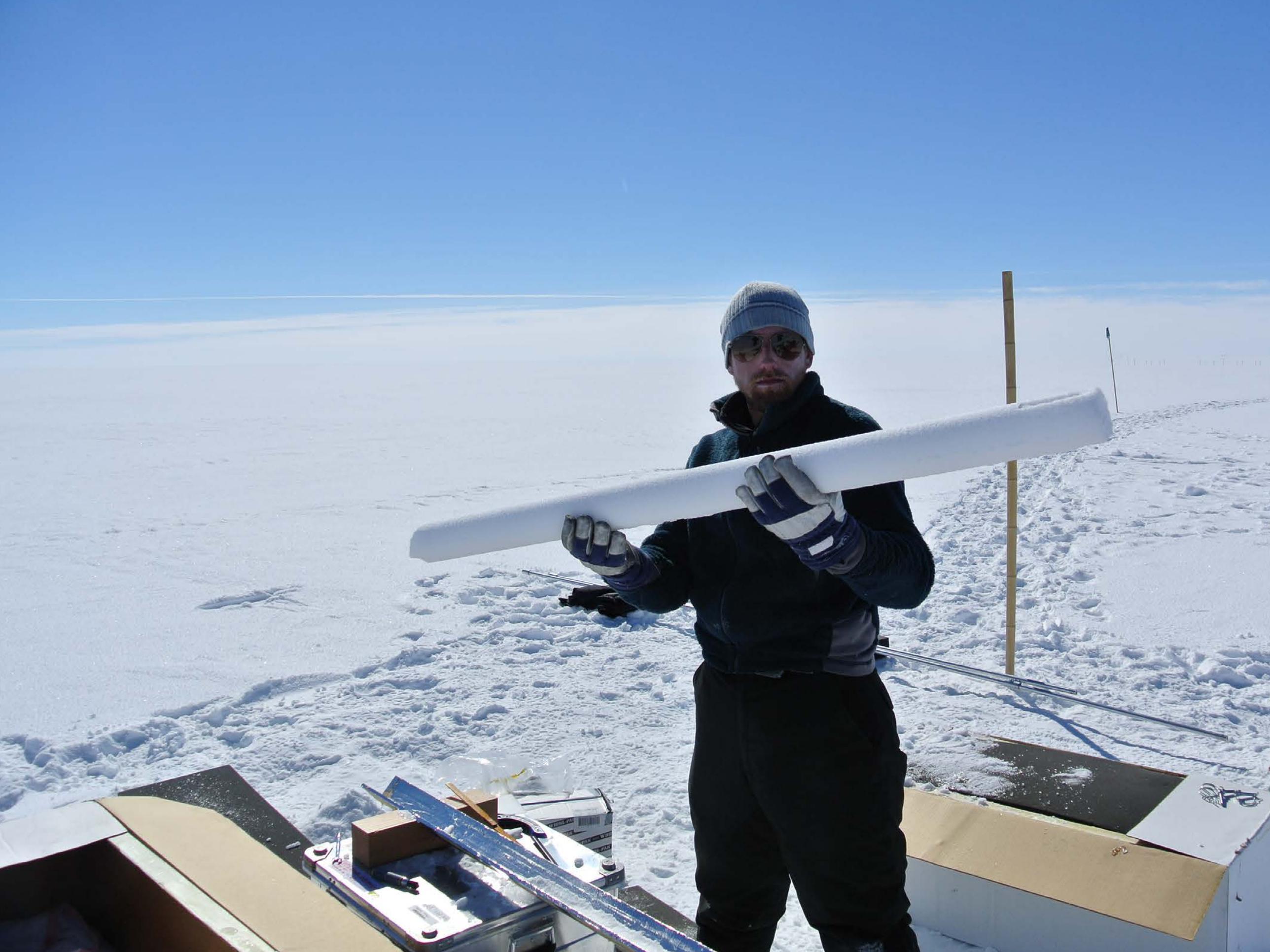
ESTABLISHING DRILL CAMP

DRILLING....



"CUTTER"

GREENLANDIC HIGH SCHOOLER

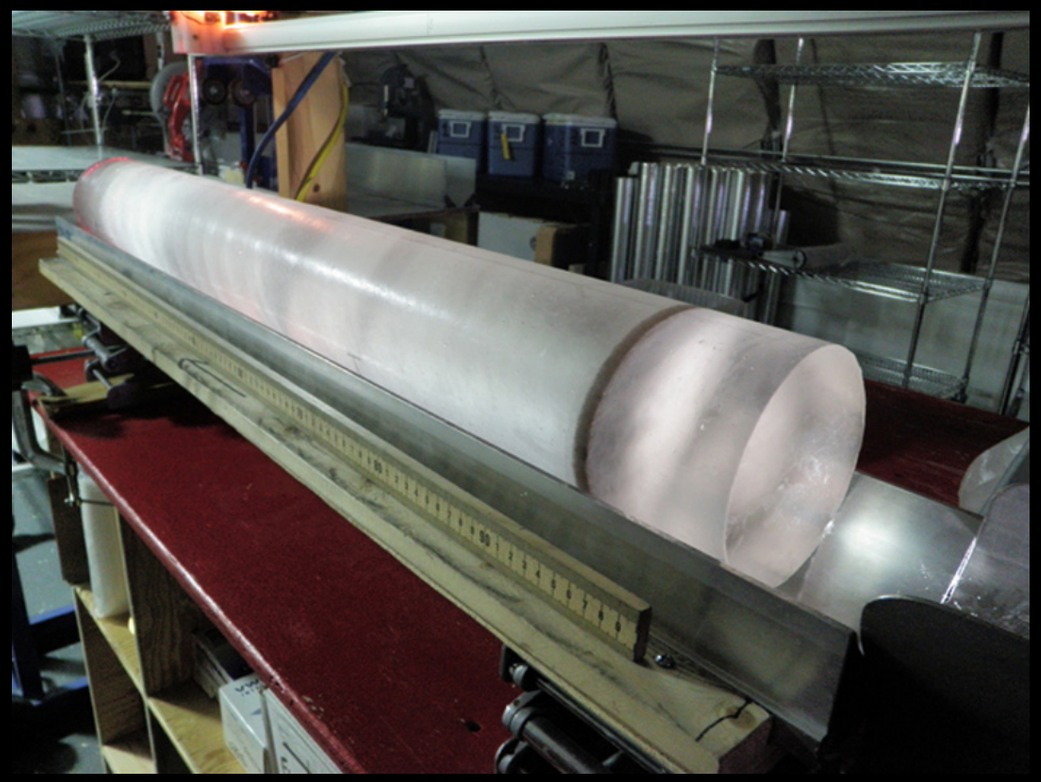


HOW DEEP IS 125,000 YEAR OLD ICE?

HOW DEEP IS 125,000 YEAR OLD ICE?

6 SEARS TOWERS!

ICE CORE LIBRARY



Each layer of ice represents a different period of time all the way back ~million years ago

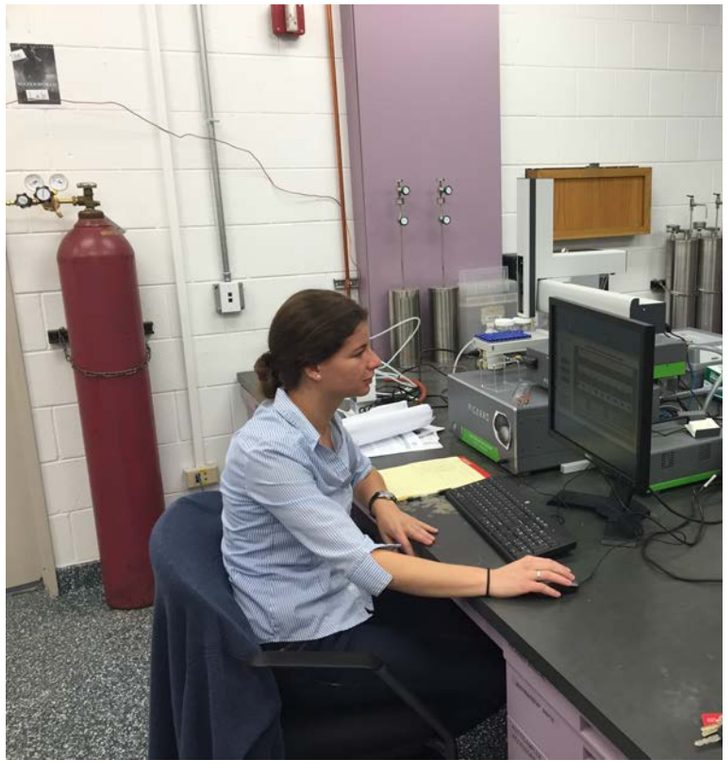
CORE PROCESSING

SENDING THE ICE HOME TO CHICAGO

Back to the lab:

Individual ice samples

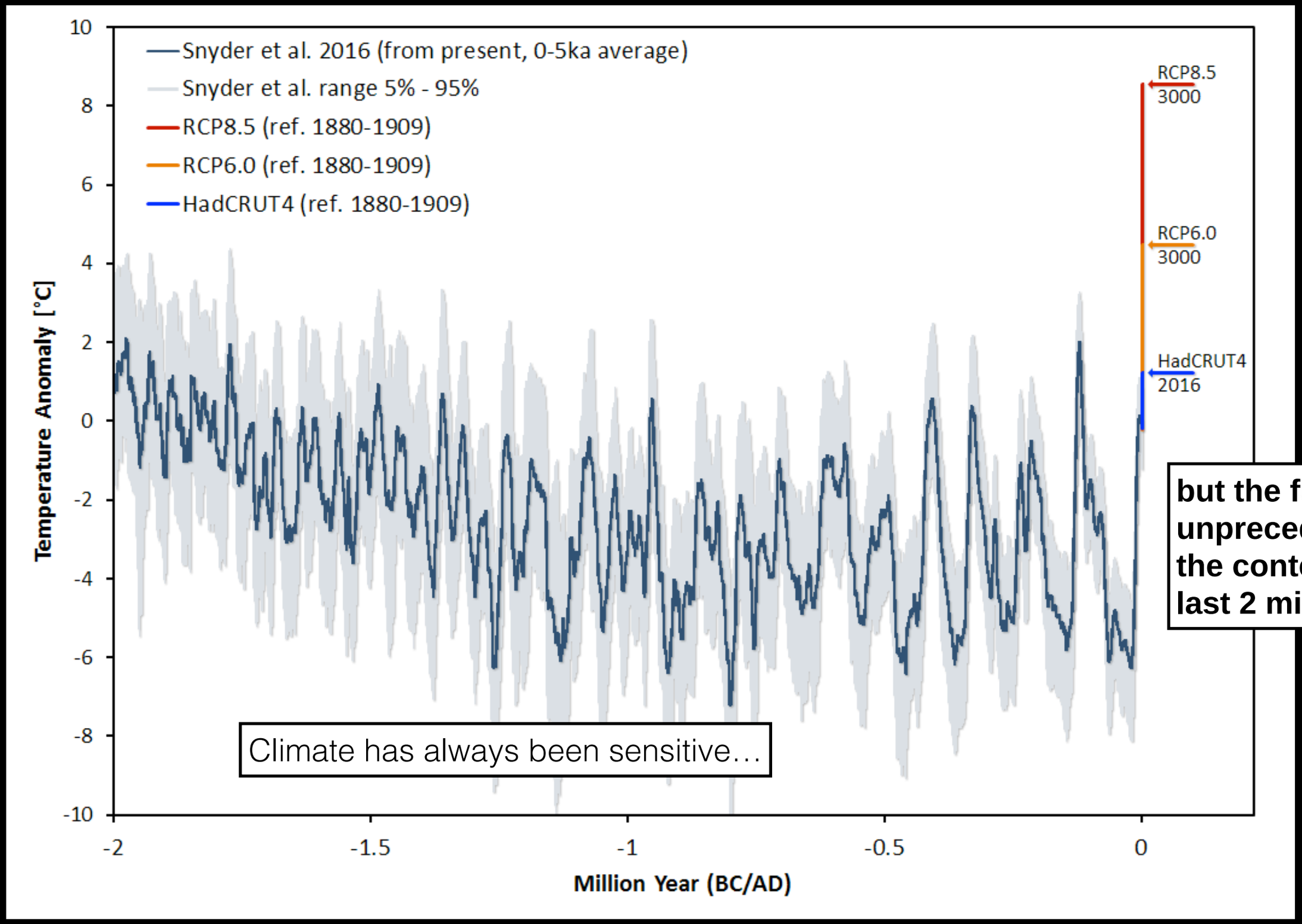
Laser Absorption Spectrometer



Ioana:
undergraduate researcher

Dariusz:
undergraduate researcher

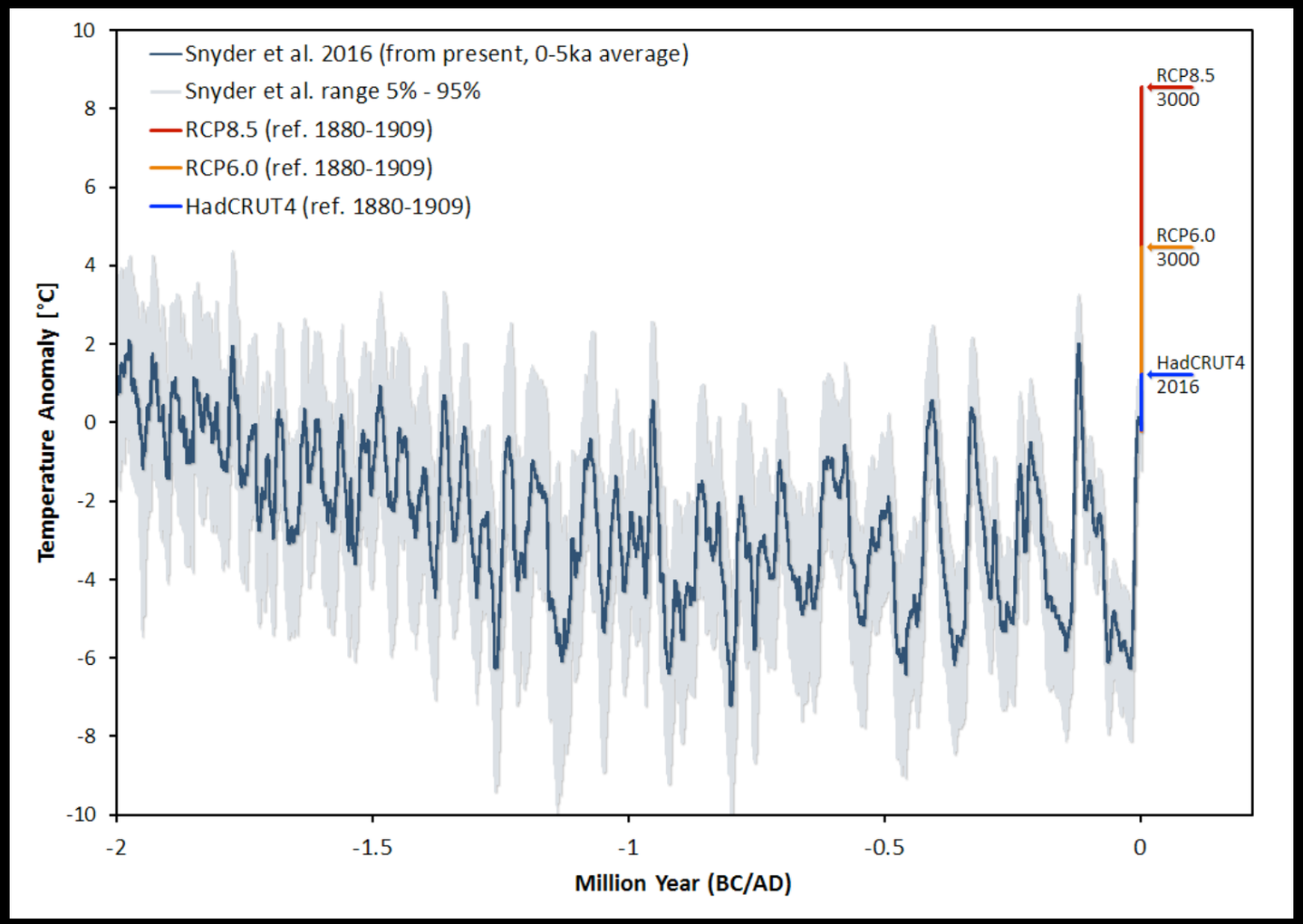
2 million year history of Earth's climate

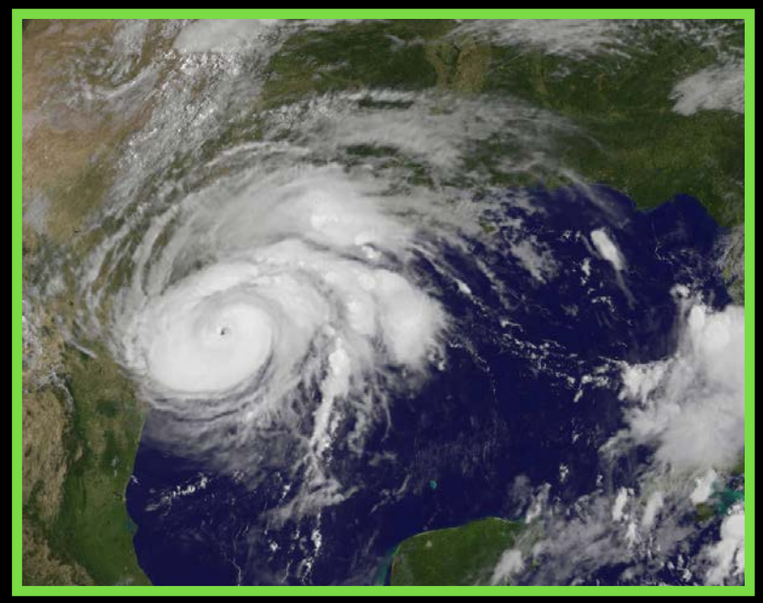


Not that long ago Chicago was under a mile of ice

You don’t have to go that far back in time to when sea levels would have been high enough to erase Florida.

Climate projections can seem abstract until they are viewed through the lens of history.





Thank you for your attention!