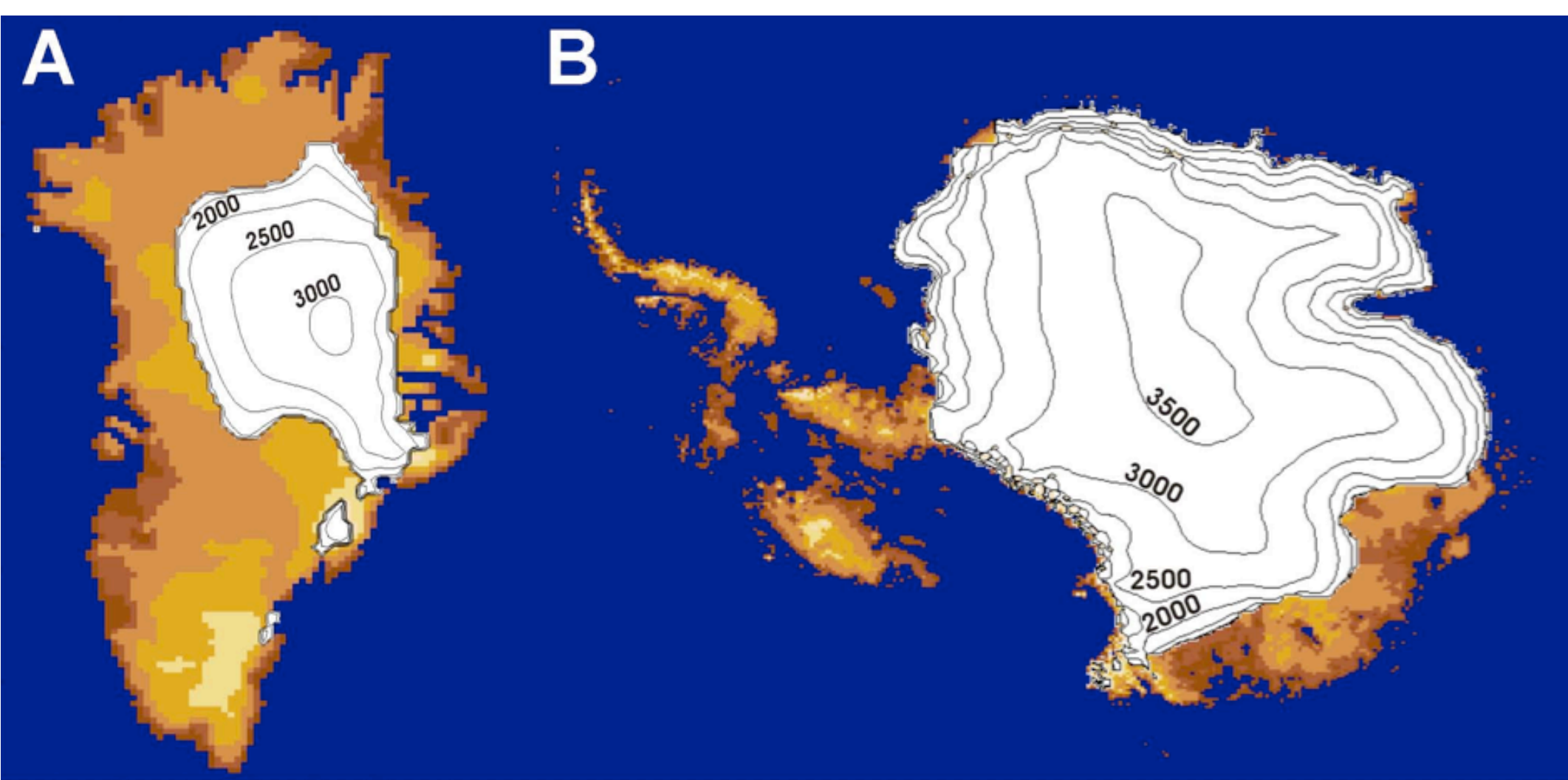


estimated annual mean T at Beaver Pond, Ellesmere Island: about -0.5°C (Pliocene, 3Ma). today about -20°C



Antarctica had an ice cap, Greenland a bit (uncertain)

But was there summer sea ice in the Arctic?

Nobody knows. Big arguments! Mostly about IRD

3 Ma ago Earth's continents & oceans were like today.

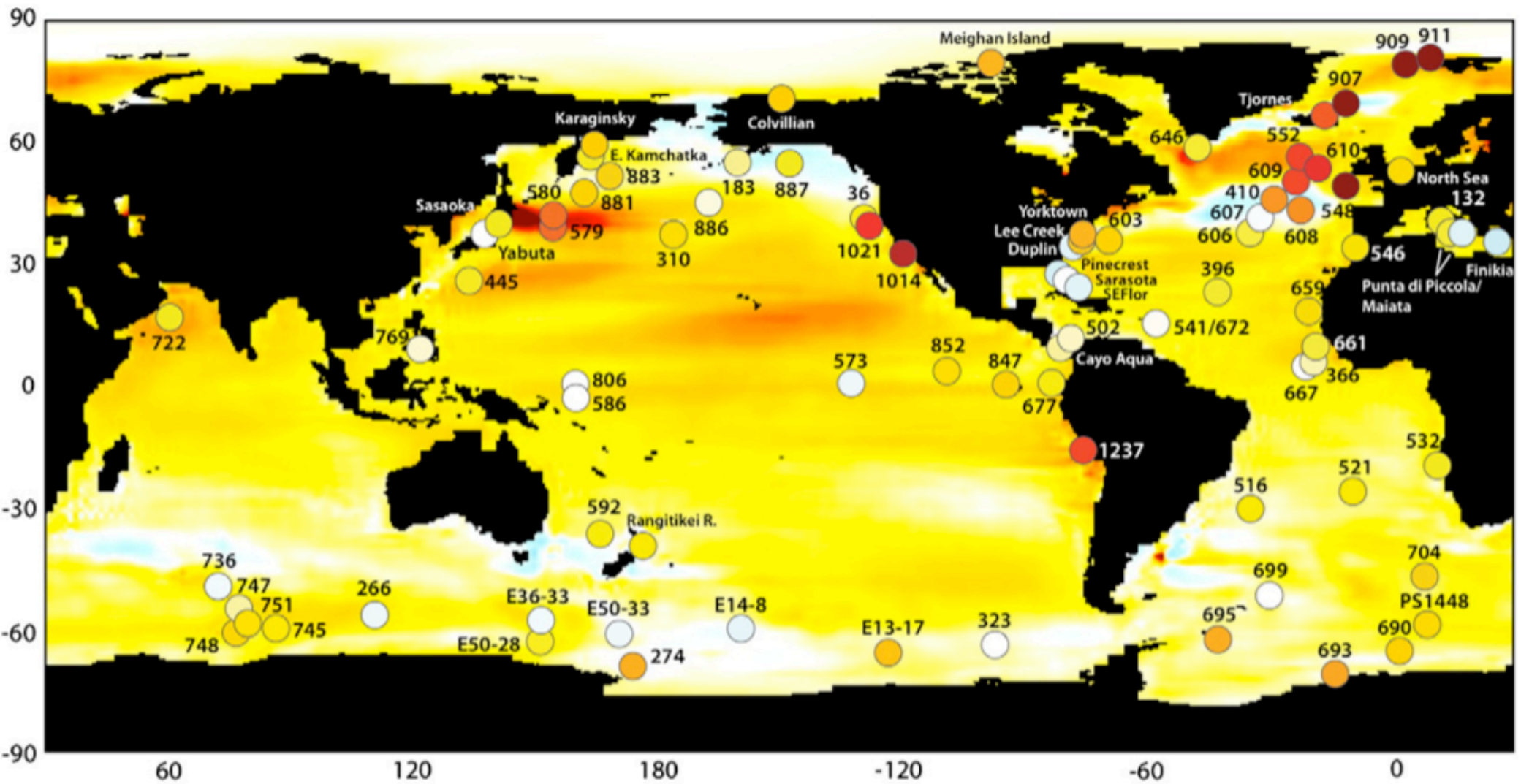
Mountains were (approx) as today.

The sun shown as brightly, and orbital were like today.

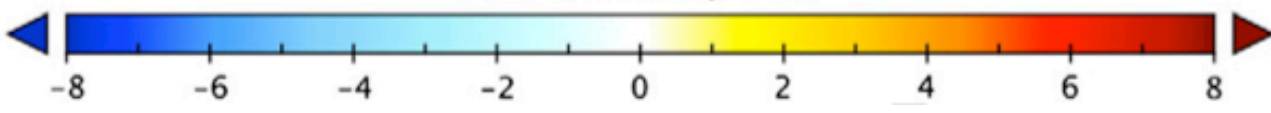
So how come Earth was 2~3C warmer on average
and Arctic (and N Atl) may have been 10~15C warmer?

More CO₂? Perhaps barely, hard to tell.

Or wait longer, Pliocene will return? Maybe?!!!!!!!!!!

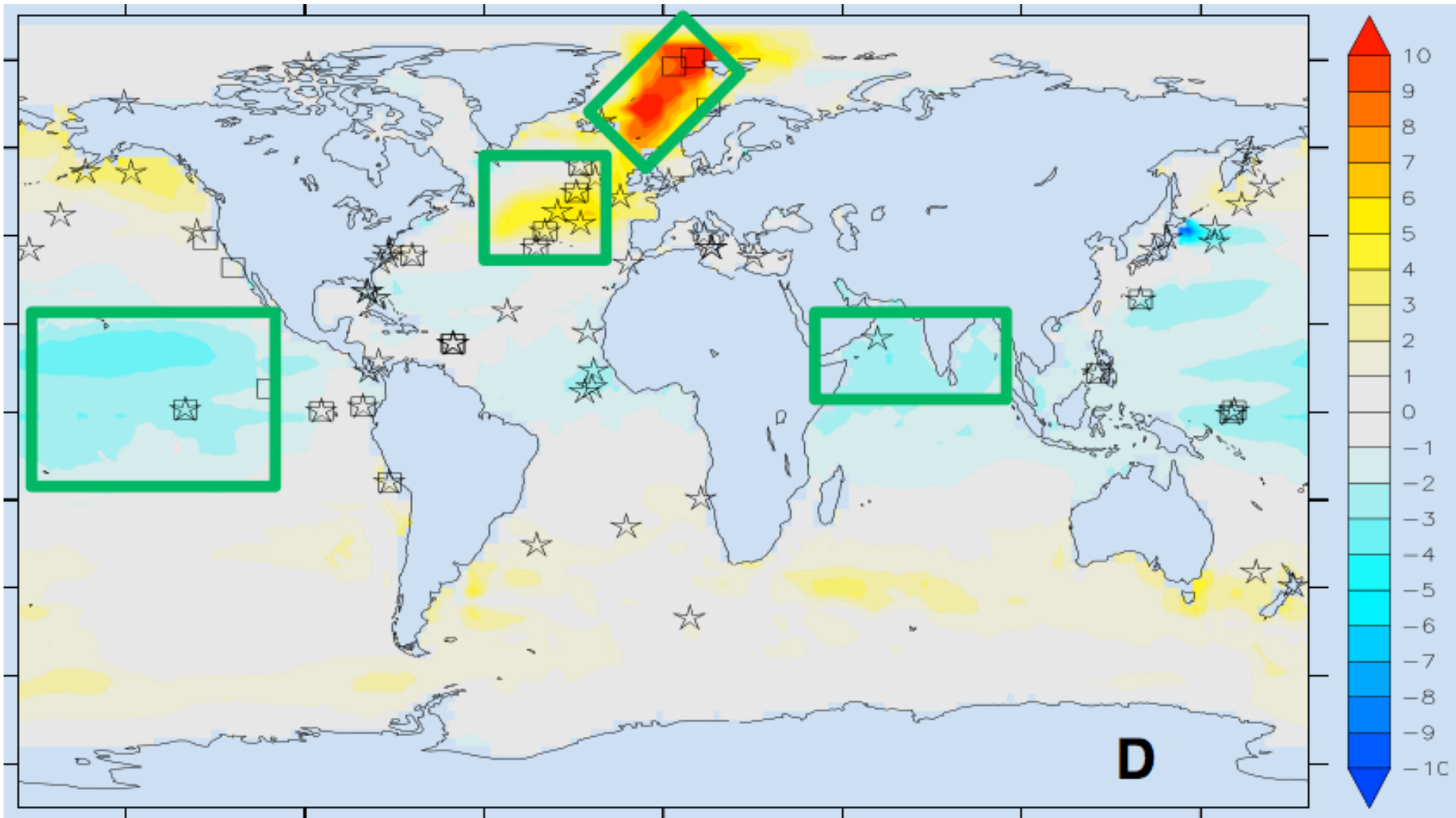


SST Anomaly (°C)

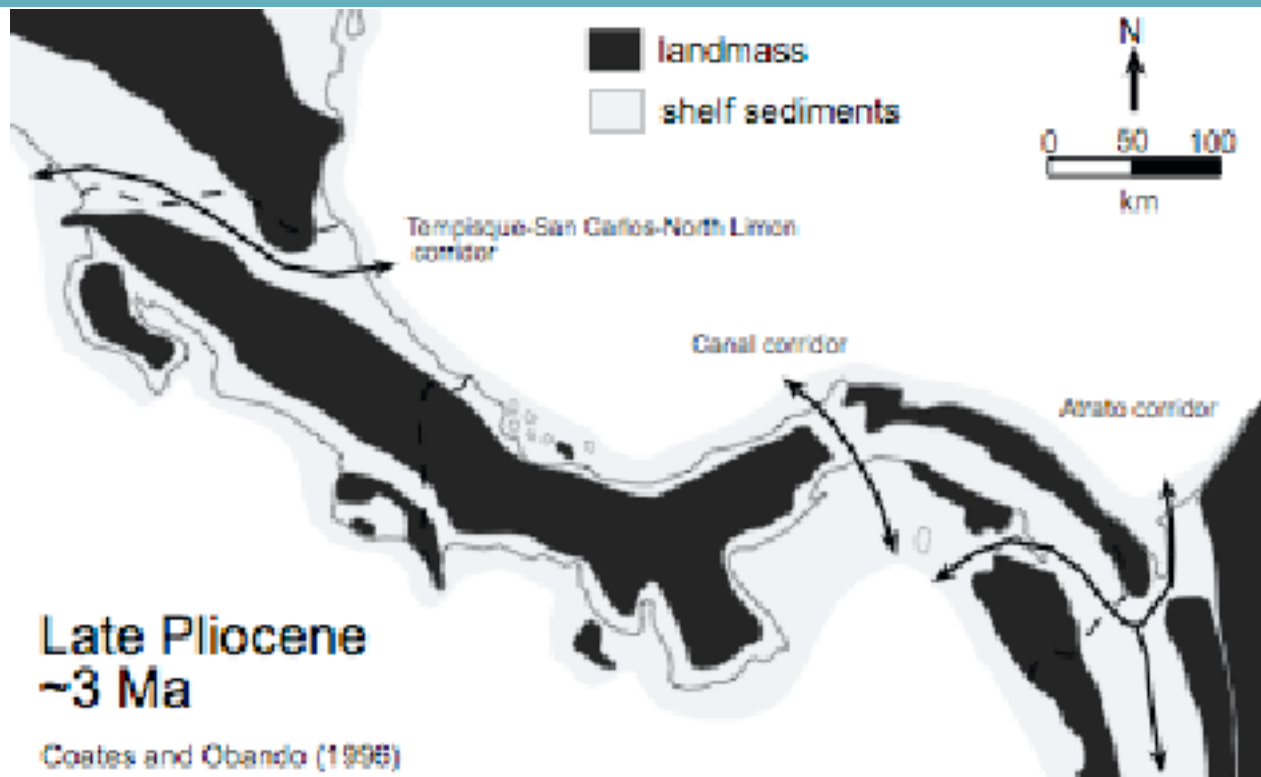


Idea! Why not just retune the model?

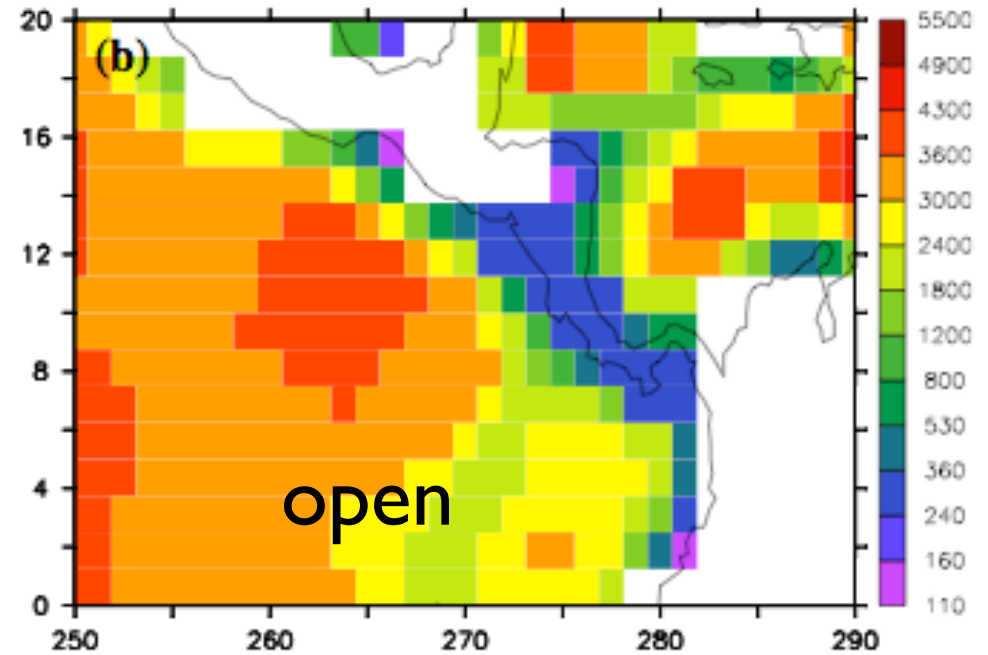
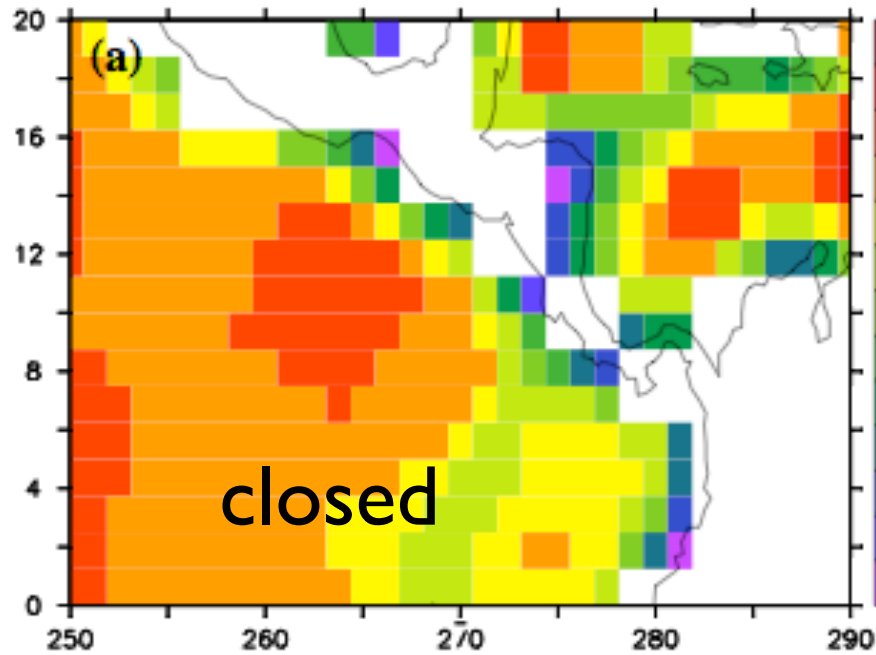
With 32 fudge factors to tune, it still doesn't work!



Idea! How about Panama?

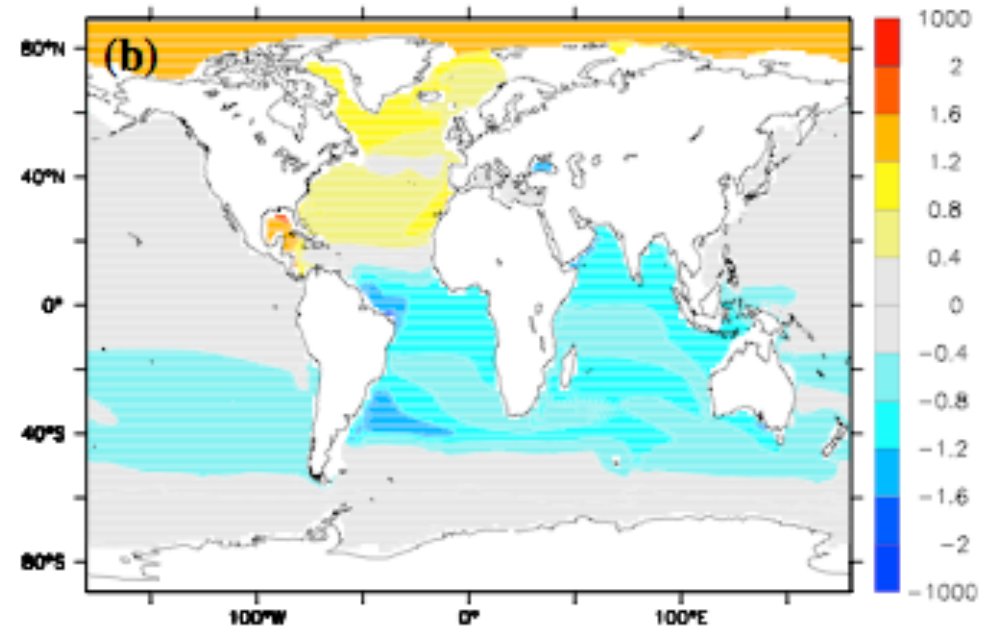
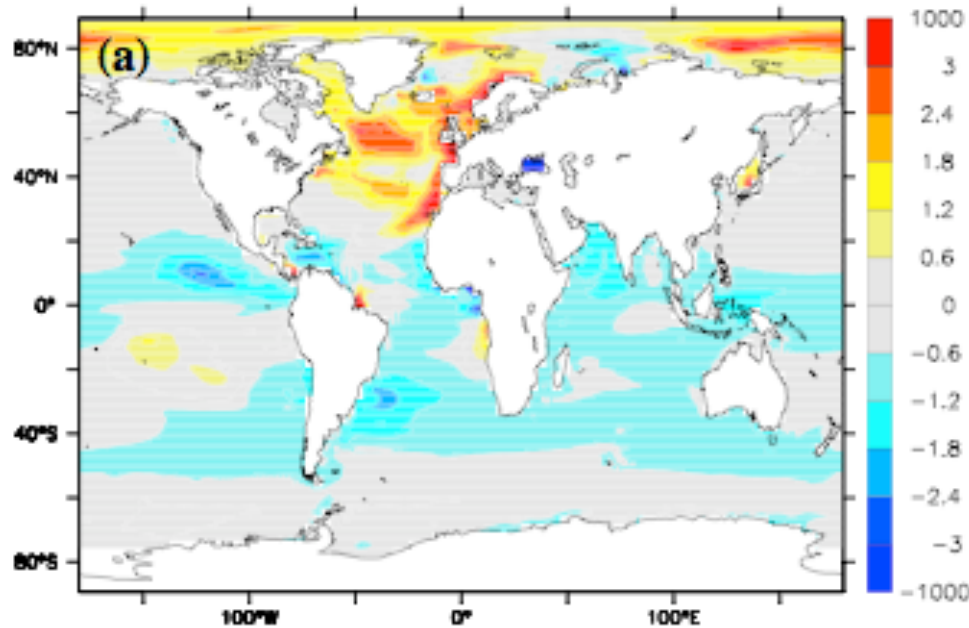


Let the modelers try it.



closed-open: SSS

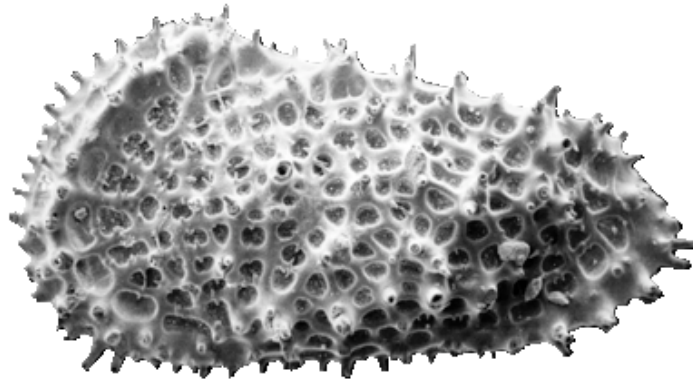
S at 450m



Although closing Panama can help export heat to high lat, it doesn't seem to bring on NHG. Besides, the timing isn't right. Or is it? Meet the cast:



Gastropod



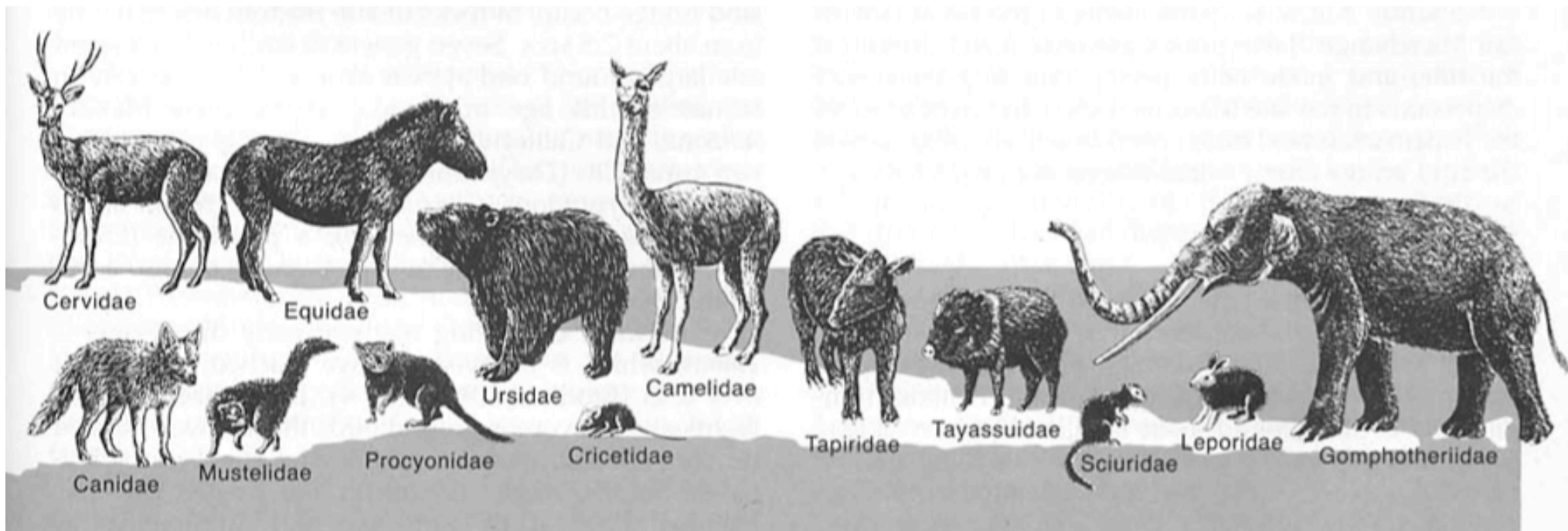
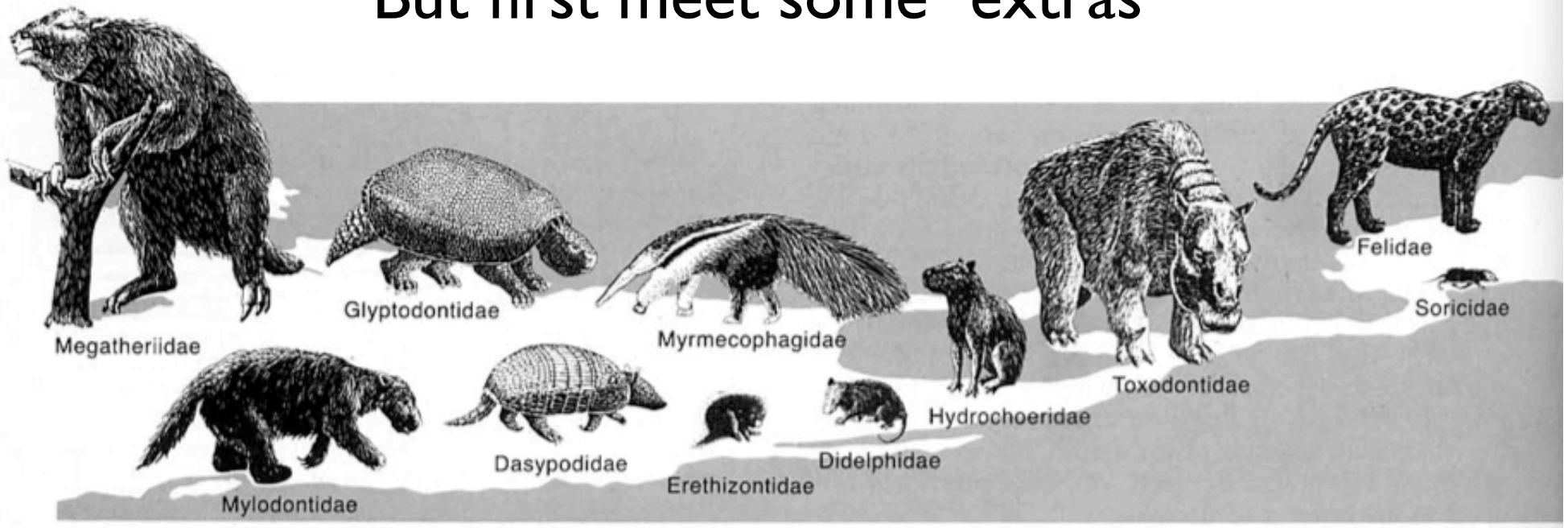
Ostracod



Astarte borealis

Maybe “final” closure isn't until after 3 Ma. Maybe 2.7?
Or maybe not until Pleistocene (< 2 Ma). Why should
“final” (shallow) closure be so important?

But first meet some “extras”

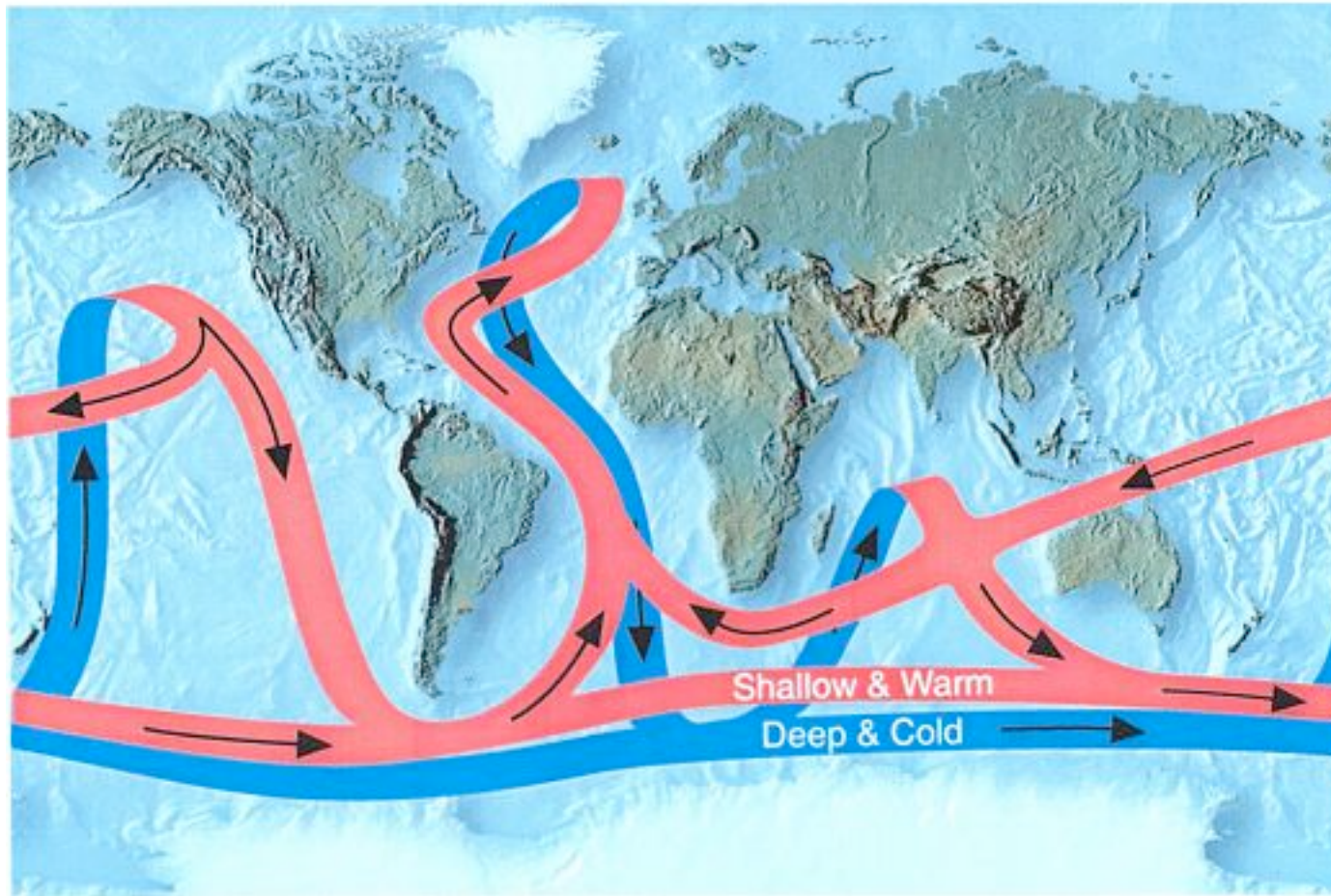


And ...



Understanding modern climate includes understanding

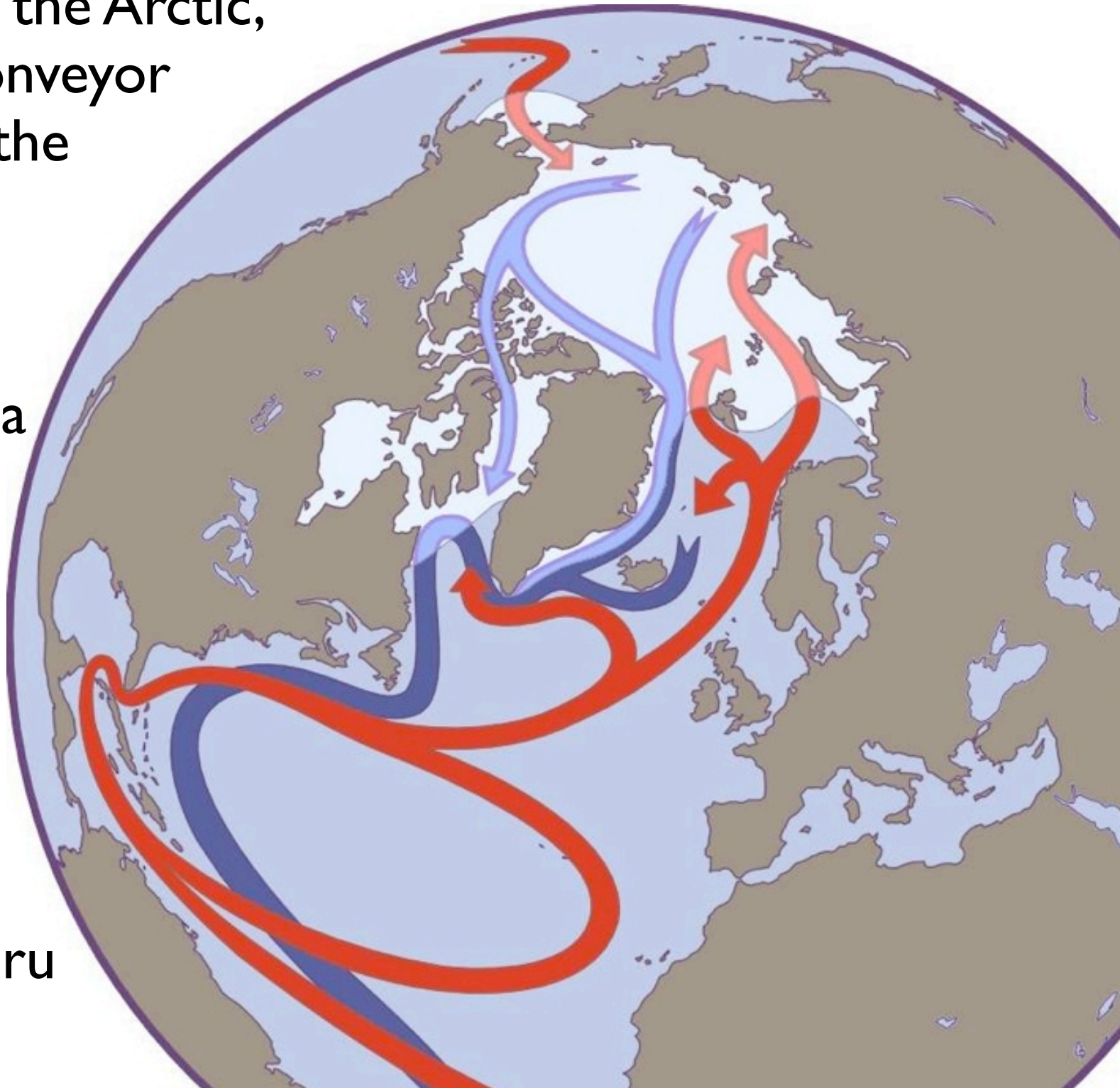
The Global Ocean Conveyor Belt



But maybe we've got this wrong in an important way.

We overlook the Arctic, including a conveyor branch from the Pacific via Bering Strait.

When Panama closed, FWV carried by tradewinds “pools” in N Pac, raises sea level, forcing flow northward thru Bering Strait.

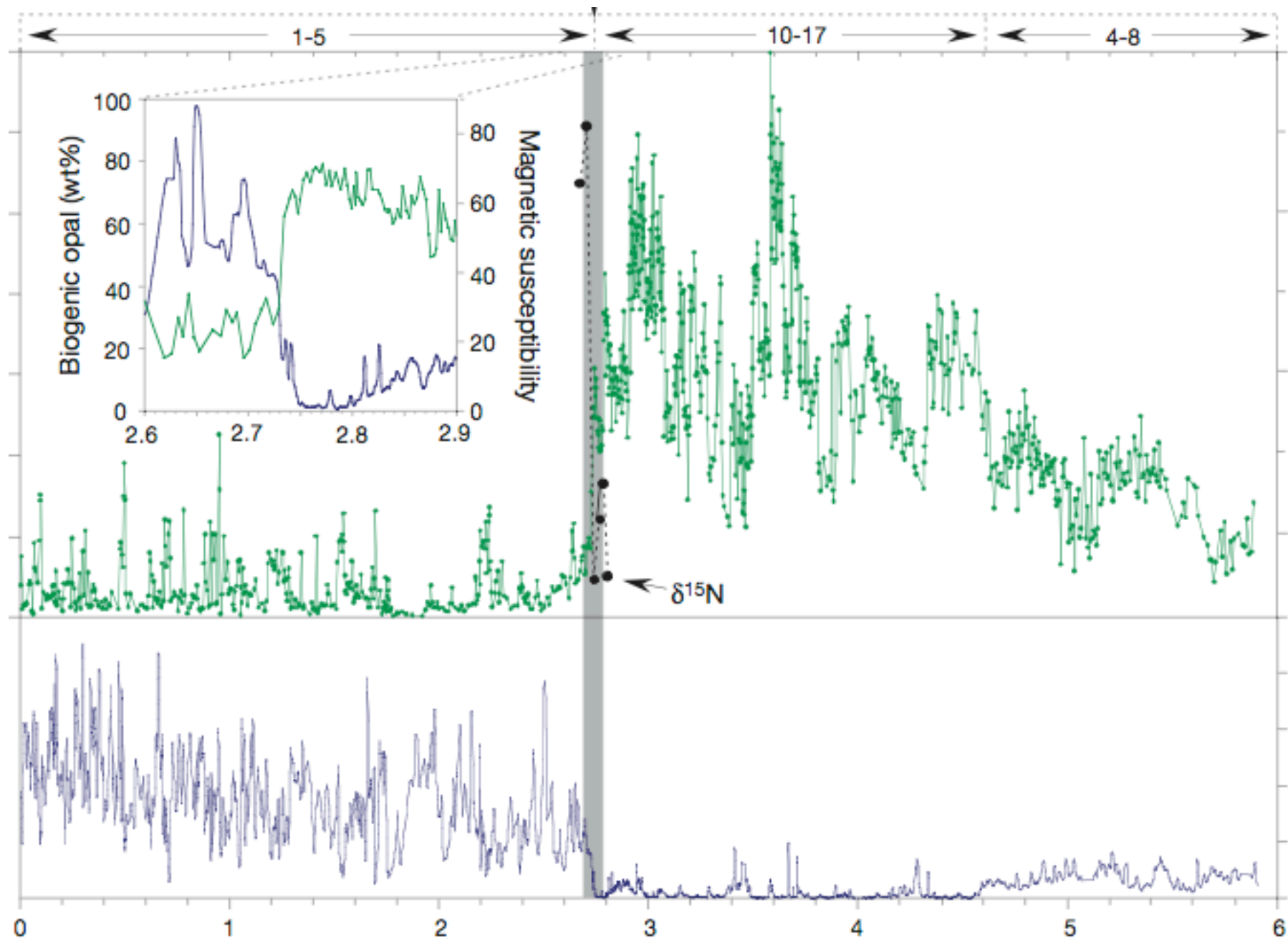


Dec 12, 2010: **Bering Sea was ice-free and full of life during last warm period, study finds**

"If the ocean was actually overturning more during a period when it was warmer than today, then we may need to change our thinking about ocean circulation."

-- Christina Ravelo, UCSC, lead scientist

modern outlook: warmer and wetter at high lats
=> stronger pycnocline => less nutrients => less fish

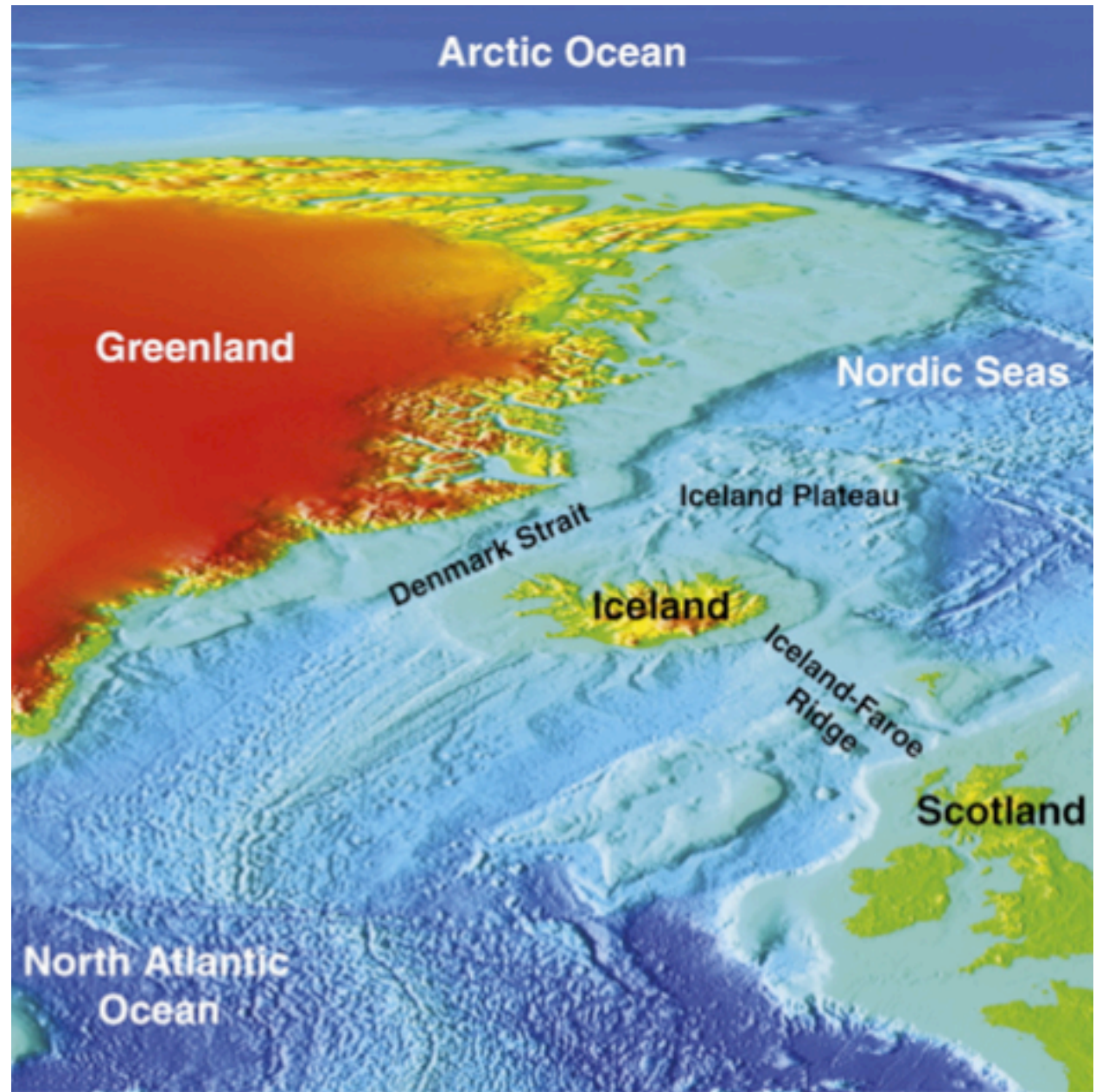


Caveats:

GSR shoaled?

Indonesia
restricted?

El Padre?



Summary:

Gradual closure promoted stronger N Atl => warmth
Shallow open => low lat FW return => super conveyor
Final closure => Pac halocline
=> N Pac productivity crashed (*except EB upwelling*)
=> Pac rose, northward Bering Str, high lat FW return
=> opposed N Atl overturning => ice ages

Aside: what happens when Pleistocene glacial close Bering?

Conclusions:

Return-to-Pliocene not analogue for future warming
Models might be OK after all (*or maybe not*)
We might better understand present Earth (*conveyor*)

!!! It's all about FW budget of the Arctic !!!

Questions?



