



The Antarctic Ice Sheet

Global distribution of glaciers

Significance of the Antarctic glaciers

Topography, ice thickness and sub-ice maps

Flow rates: ice-streams, ice divides

Floating ice shelves

Sub-glacial lakes

Climate change and melting in Antarctica



from USGS

Significance of the Antarctic Glaciers

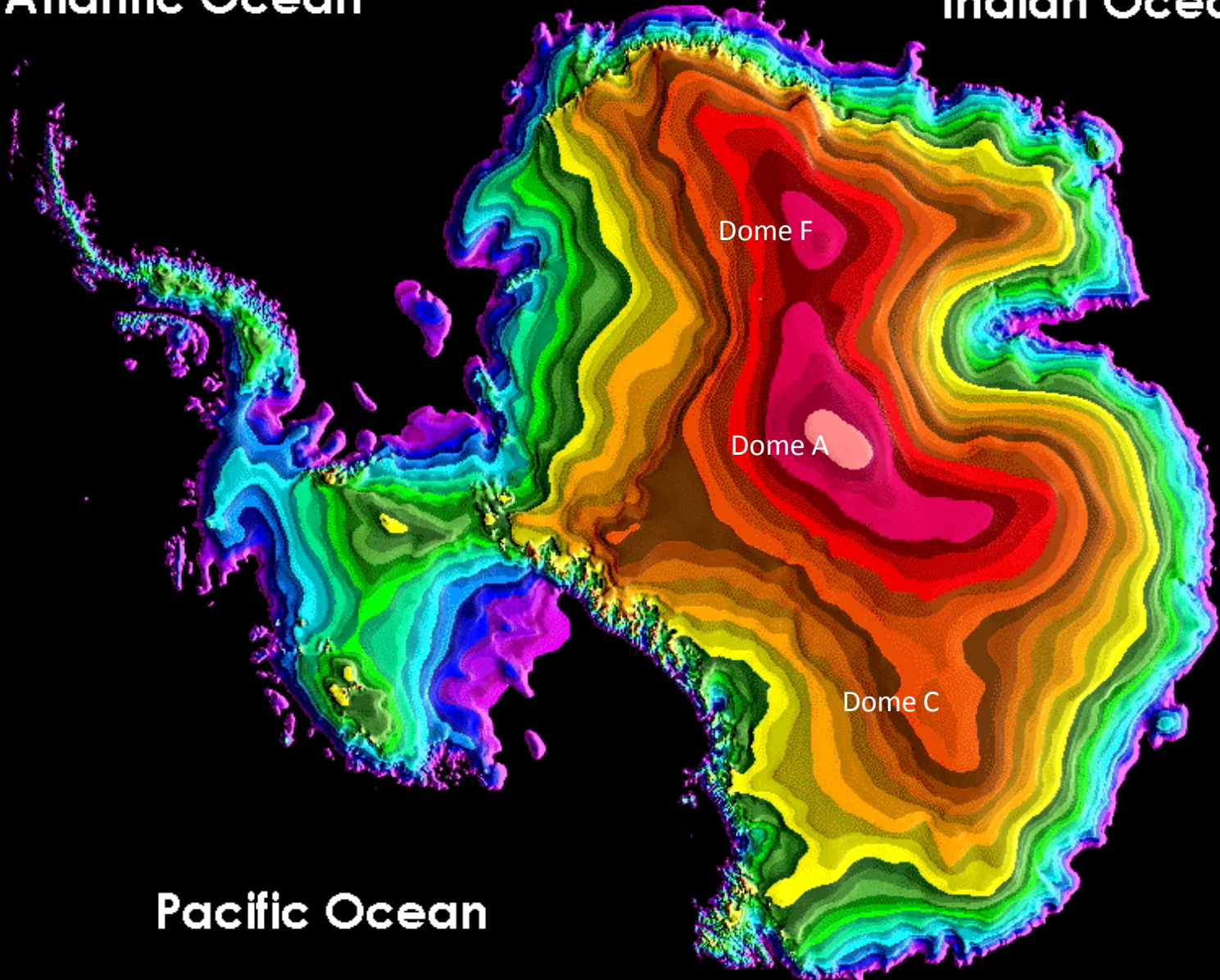
Antarctica: 90% of world's ice volume (~10 x greater than Greenland). If it all melts sea level will rise by 60 to 70 m.

The ice sheet is much thicker than Greenland's. It is considerably colder on Antarctica, with lower snow-fall rates.

The Antarctic ice sheet is divided into eastern and western components. The eastern ice sheet is several times larger than the western one, and about twice as thick.

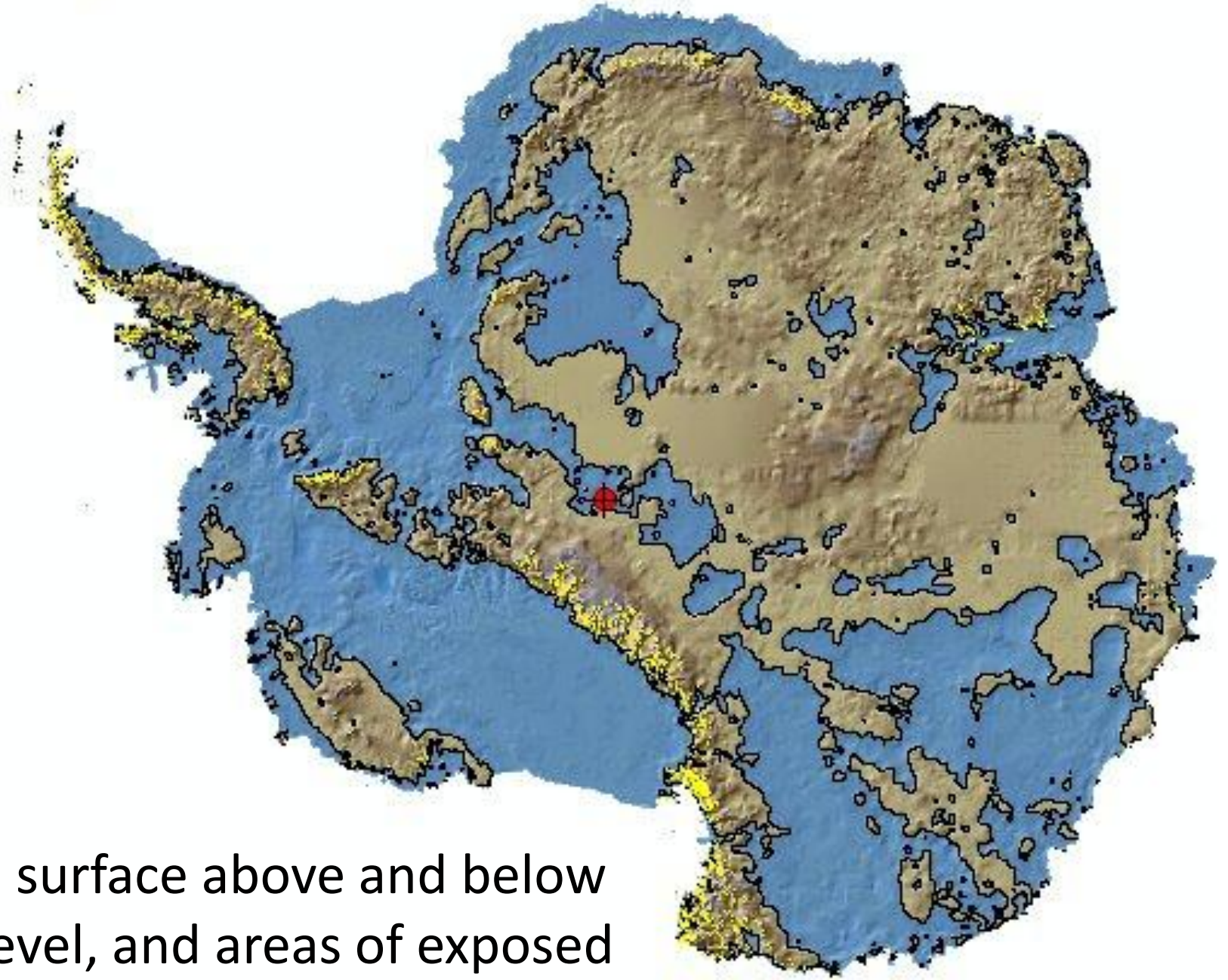
Atlantic Ocean

Indian Ocean

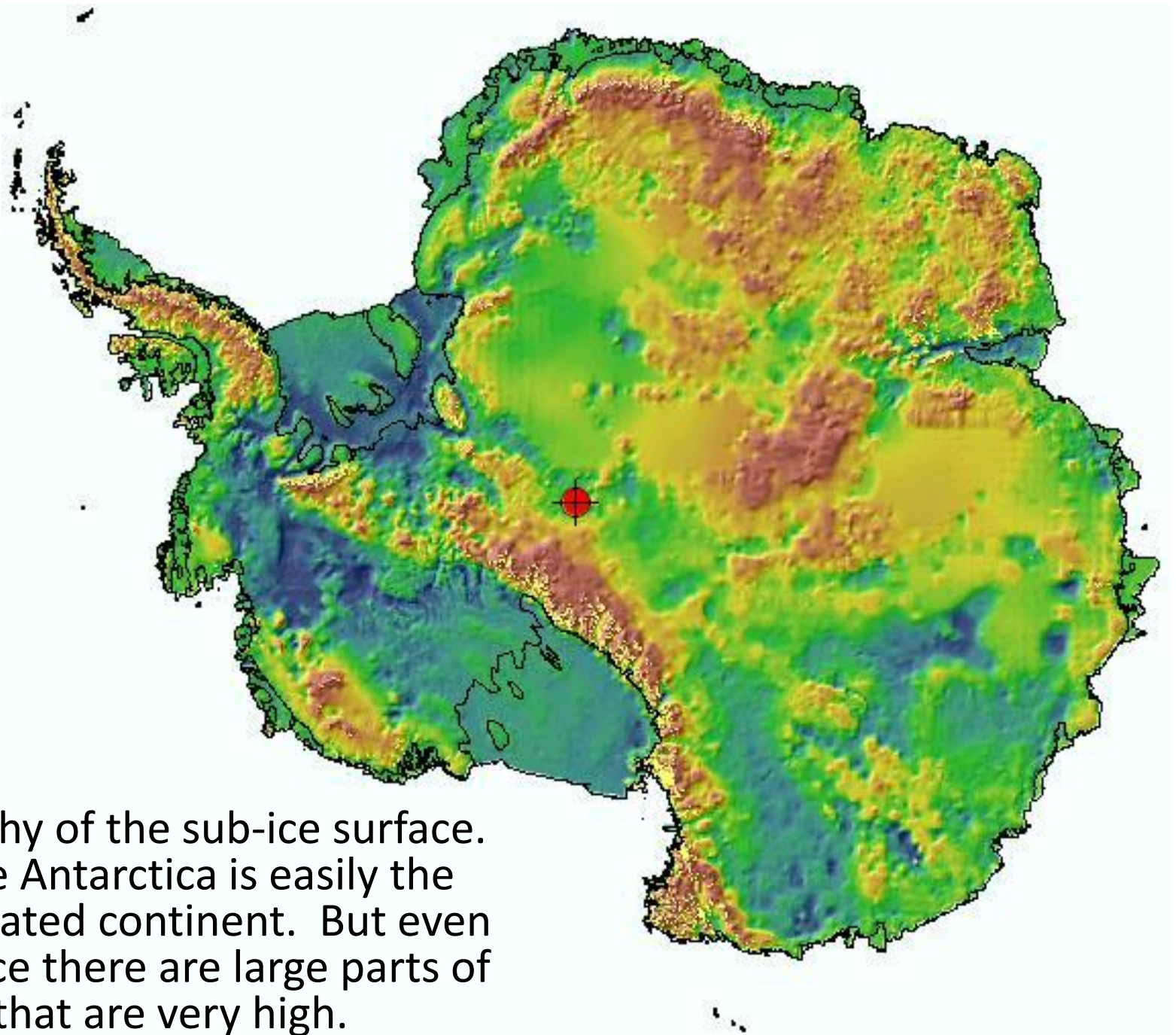


Pacific Ocean

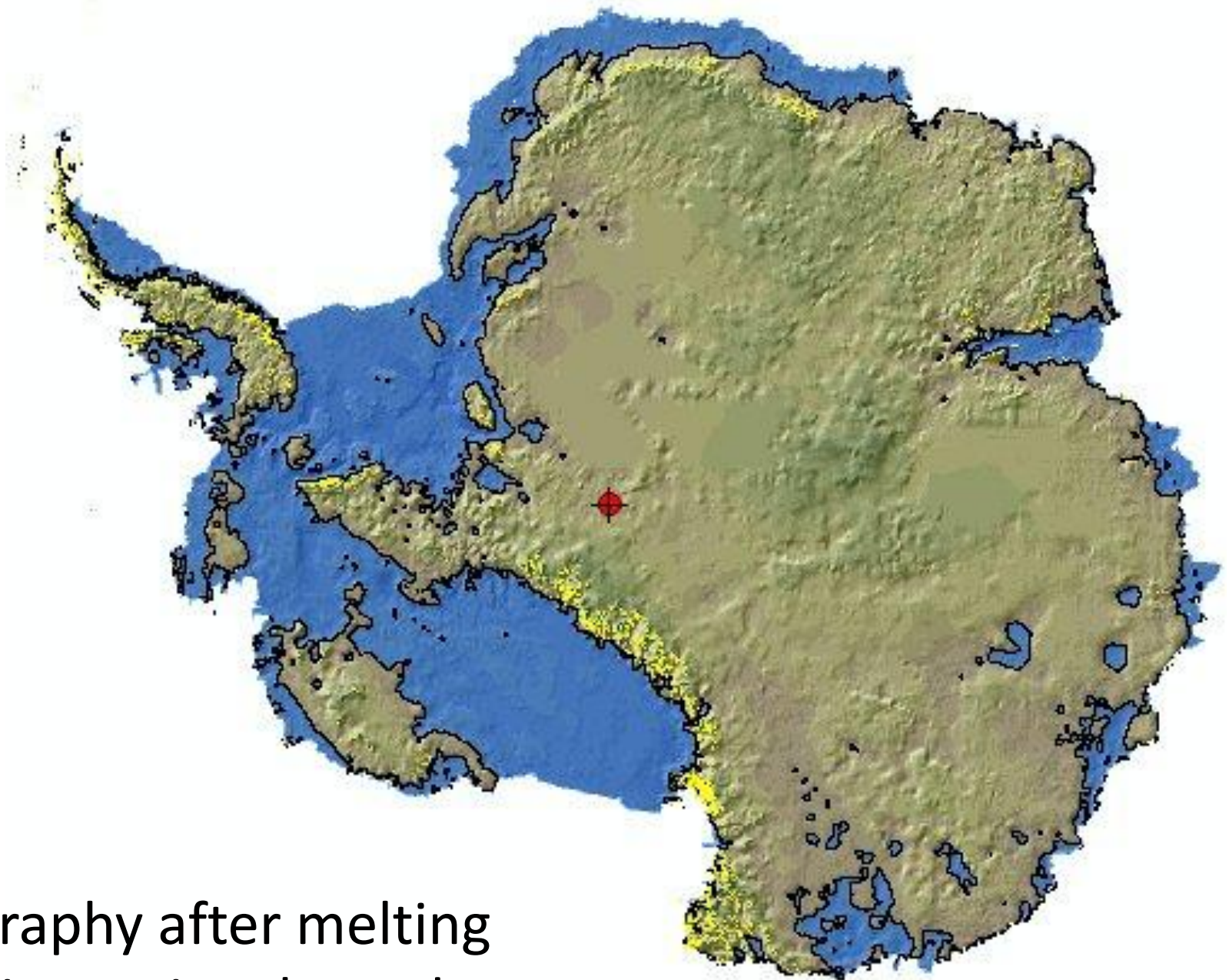




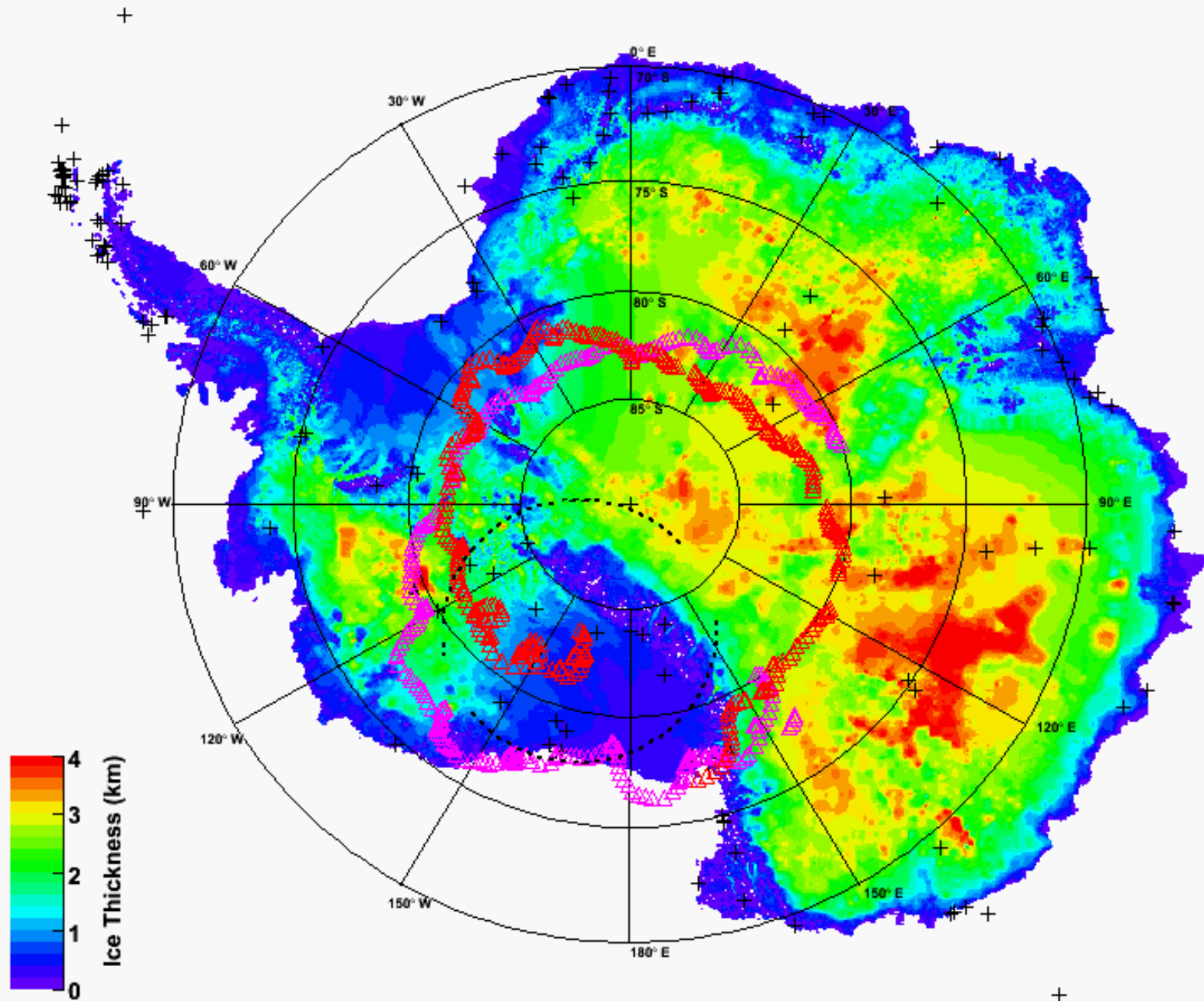
Land surface above and below sea level, and areas of exposed rock (yellow)



Topography of the sub-ice surface.
With ice Antarctica is easily the most elevated continent. But even without ice there are large parts of it that are very high.



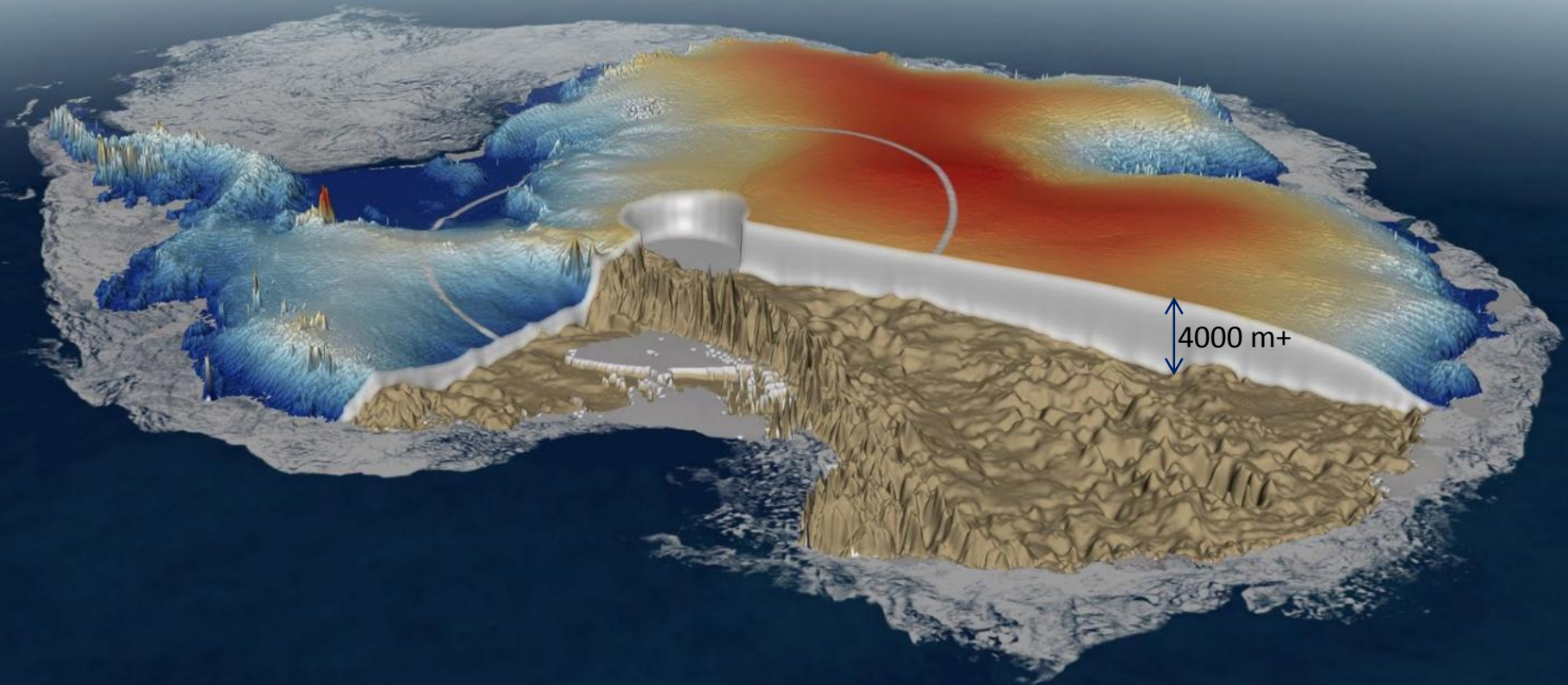
Topography after melting
and isostatic rebound



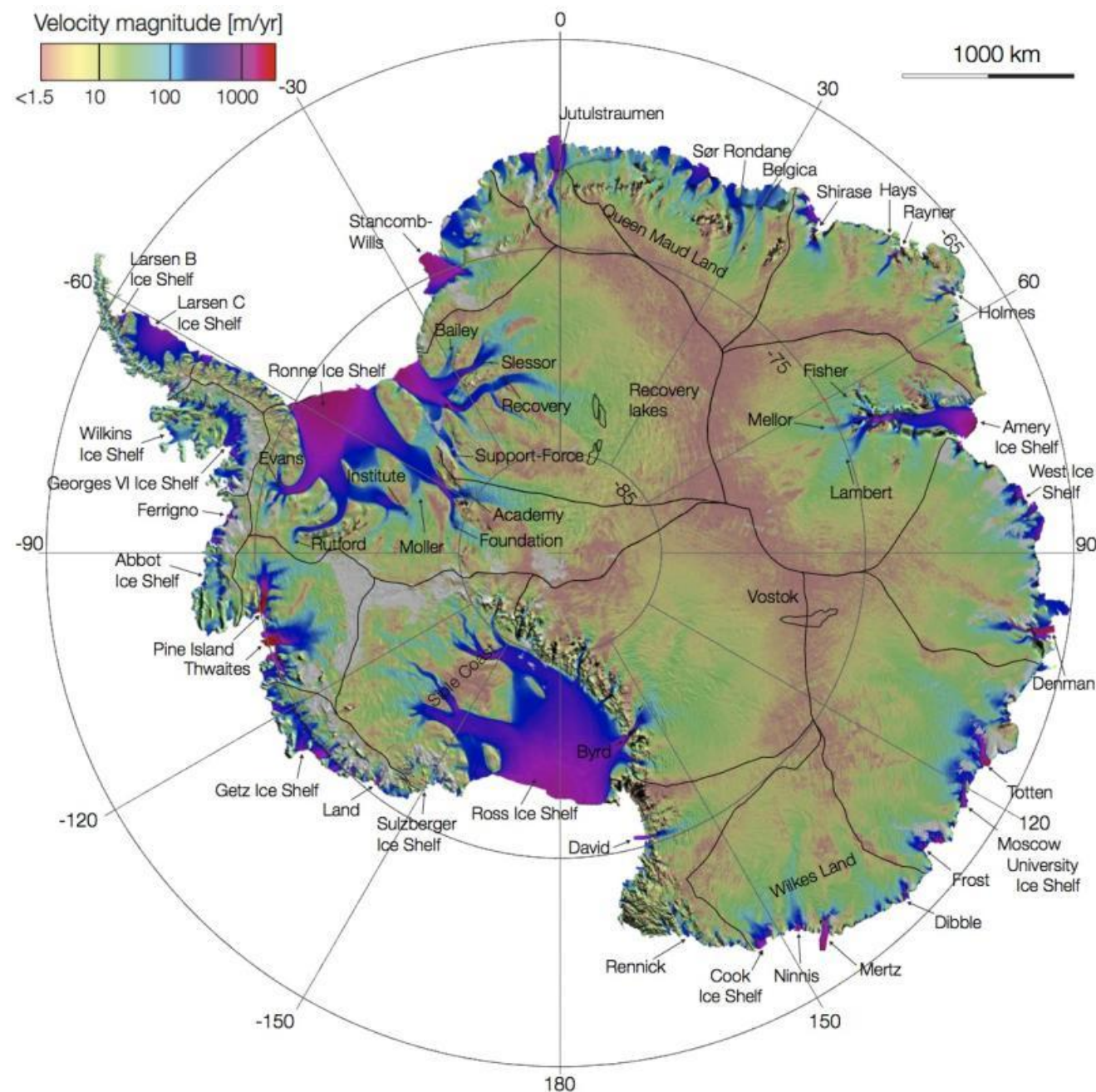
Ice thickness (from British Antarctic Survey)

Exaggerated topography and ice thickness

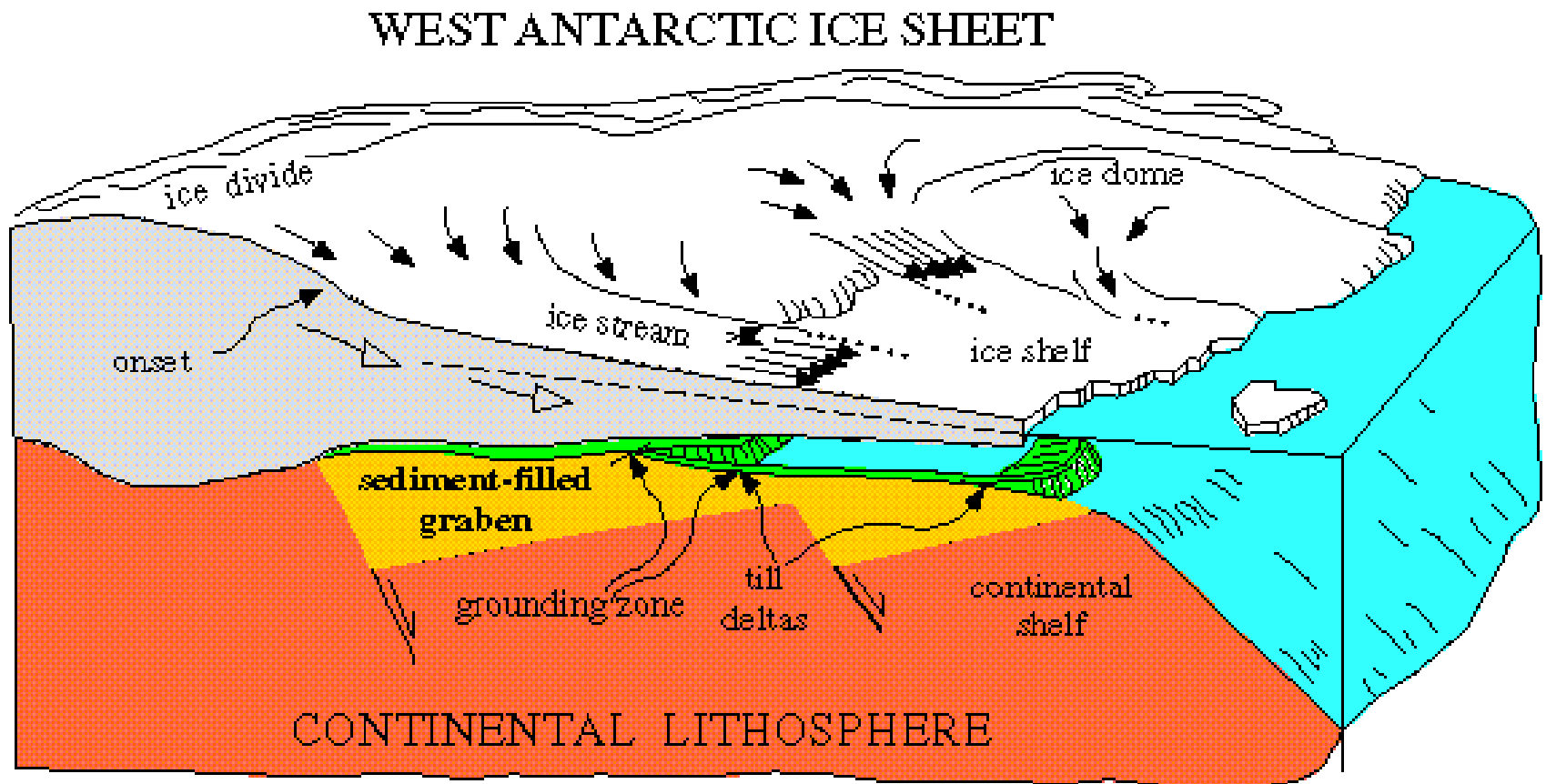
(The thickest ice is over 4000 m)



There are many orders of magnitude of difference in the rate of flow of Antarctic ice, from less than 1.5 m/y along the ice divides, to over 1000 m/y in some of the ice-stream areas and on the ice shelves.

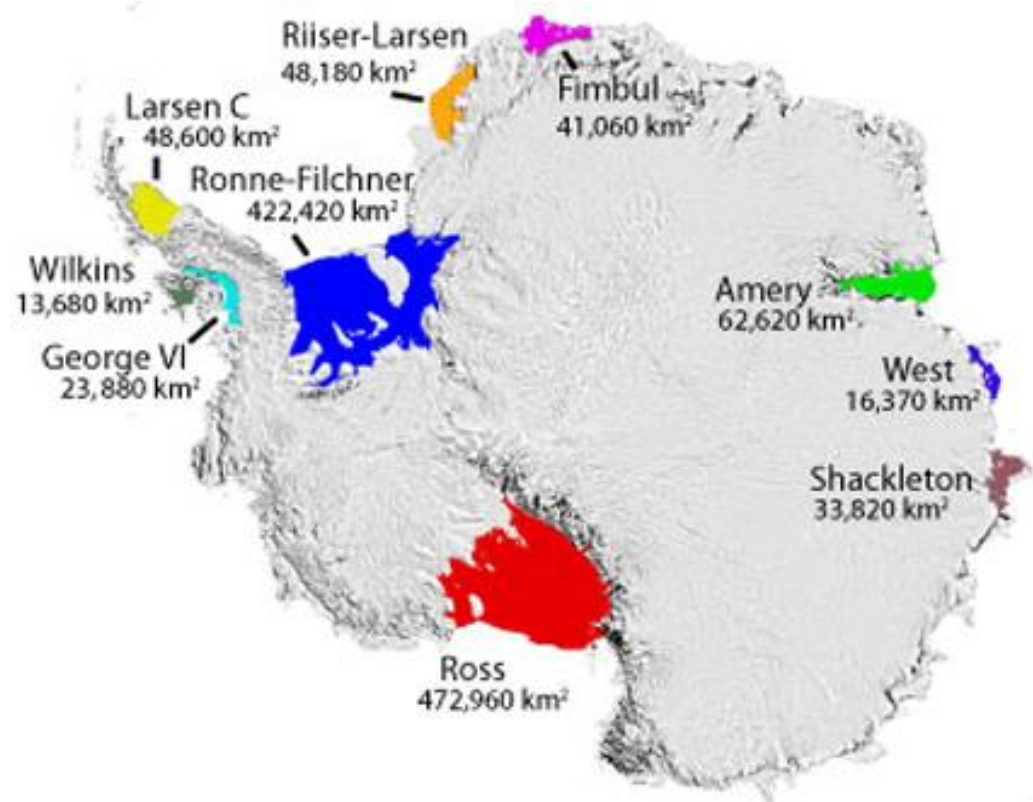


Some ice streams are situated over areas of soft sedimentary rock, the postulated connection being that the ice can slide faster if the underlying material will deform.

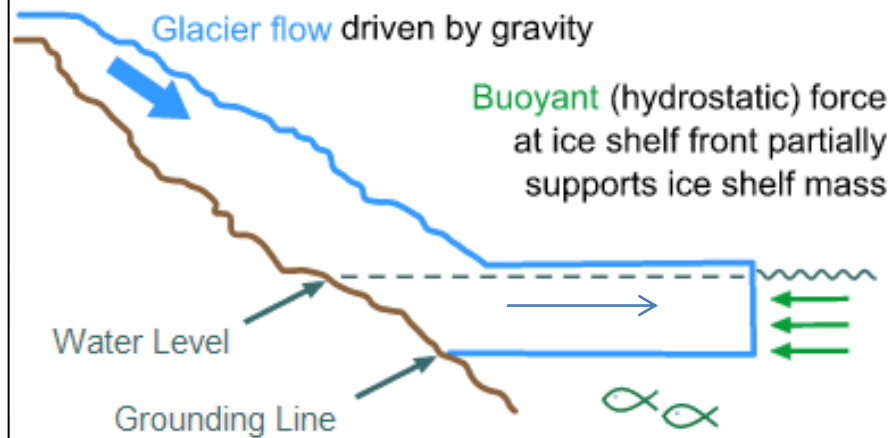


Ice shelves

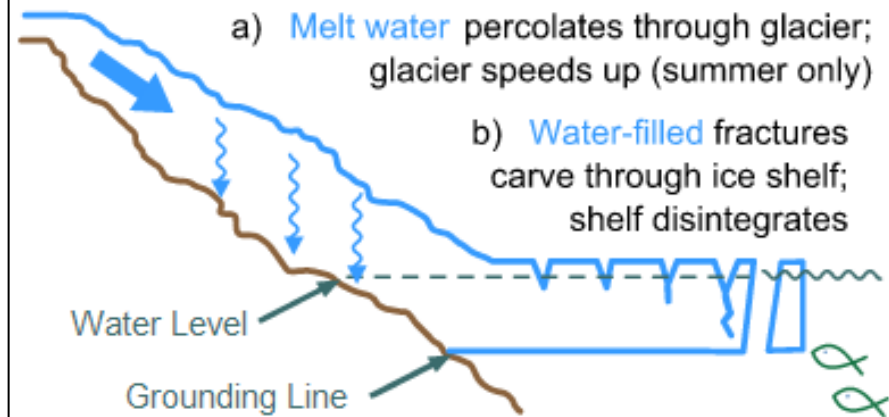
- Antarctica has extensive floating ice shelves on almost all of its coasts
- The largest (Ross) is about $\frac{1}{2}$ the size of British Columbia
- The shelves range in thickness from a few tens of m to around 750 m



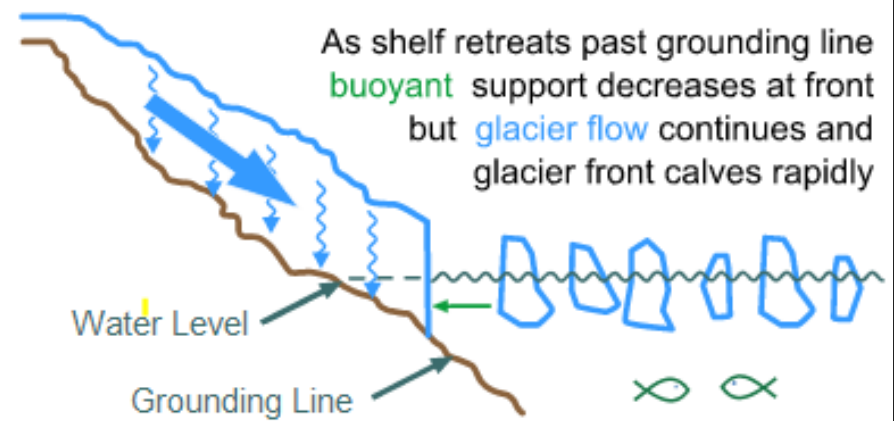
1. Stable glacier and ice shelf



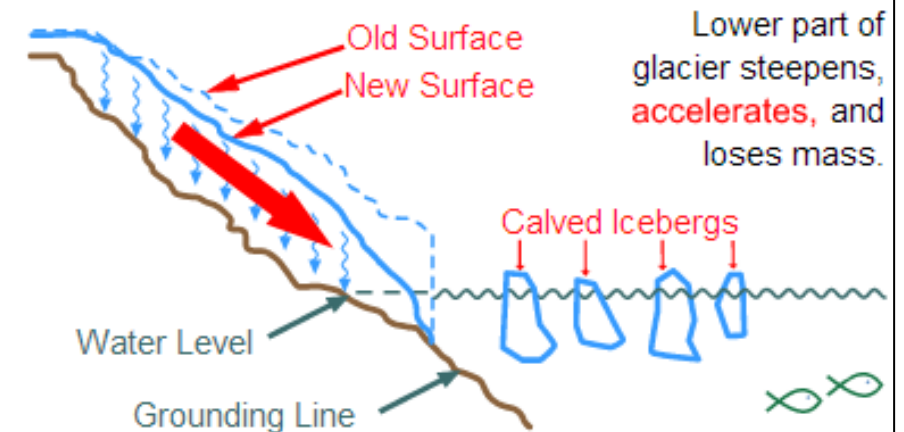
2. Two effects of warmer temperatures

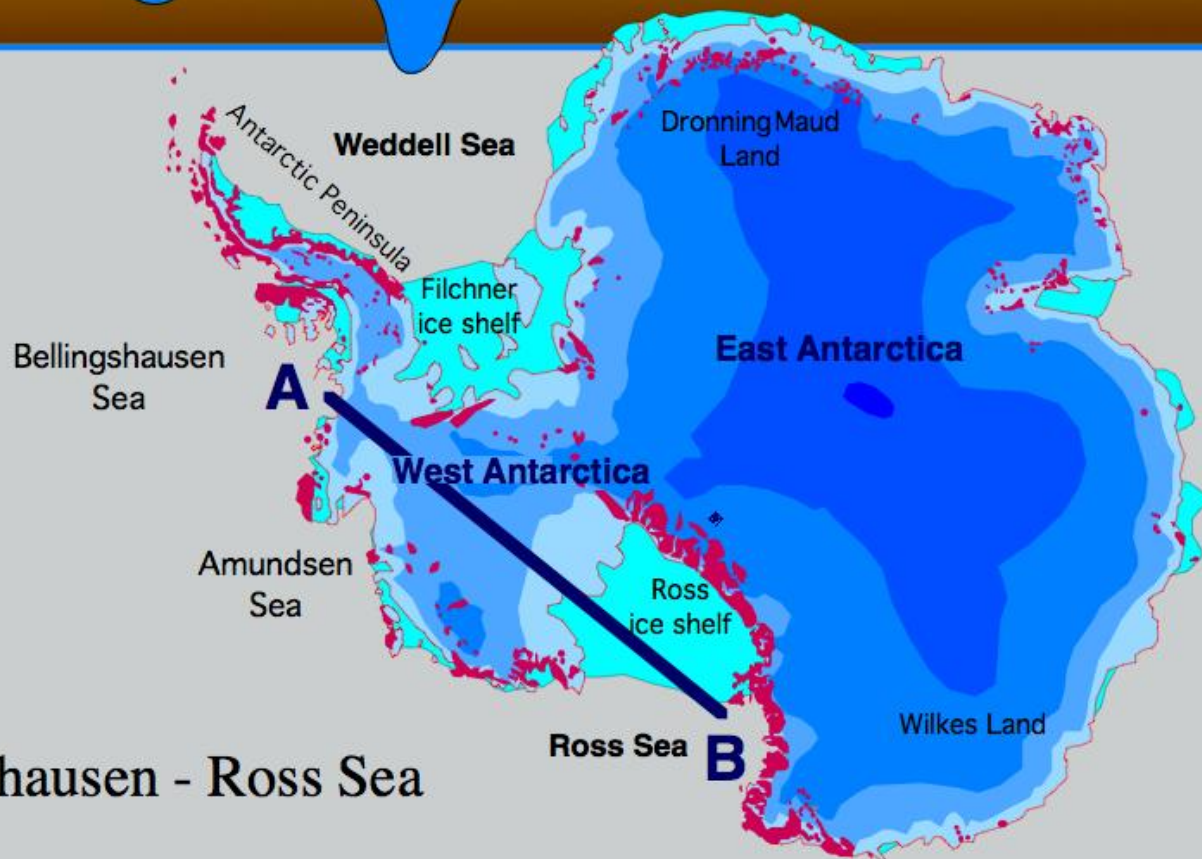
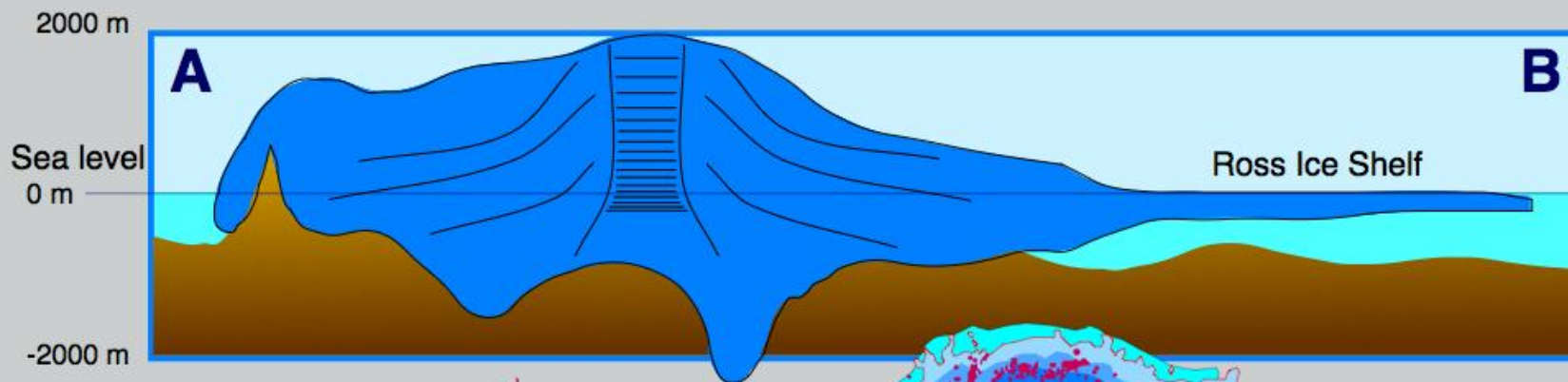


3. Unstable glacier front after ice shelf collapse



4. Glacier acceleration





Profil Bellingshausen - Ross Sea

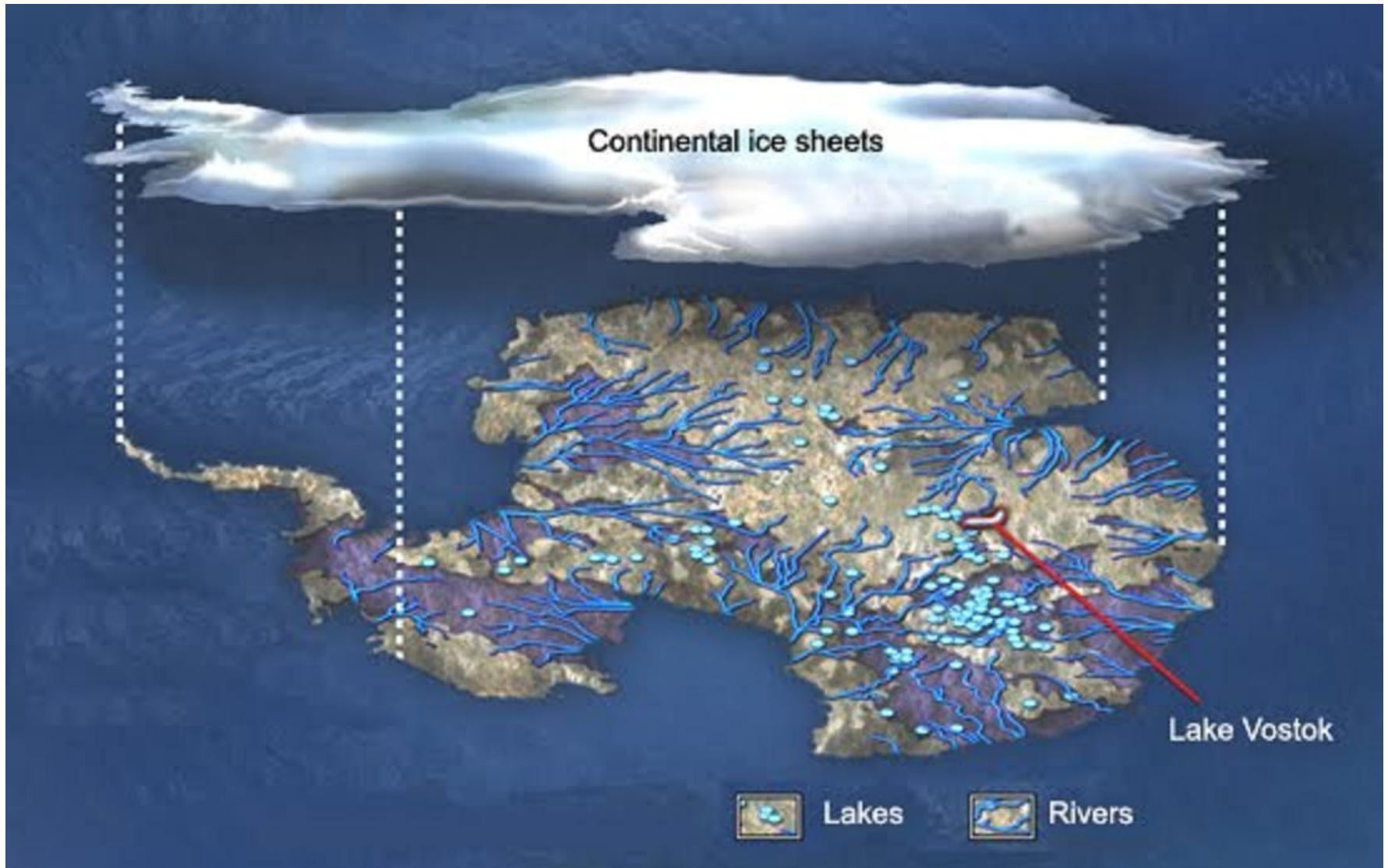


Larsen Ice Shelf (NSIDC)

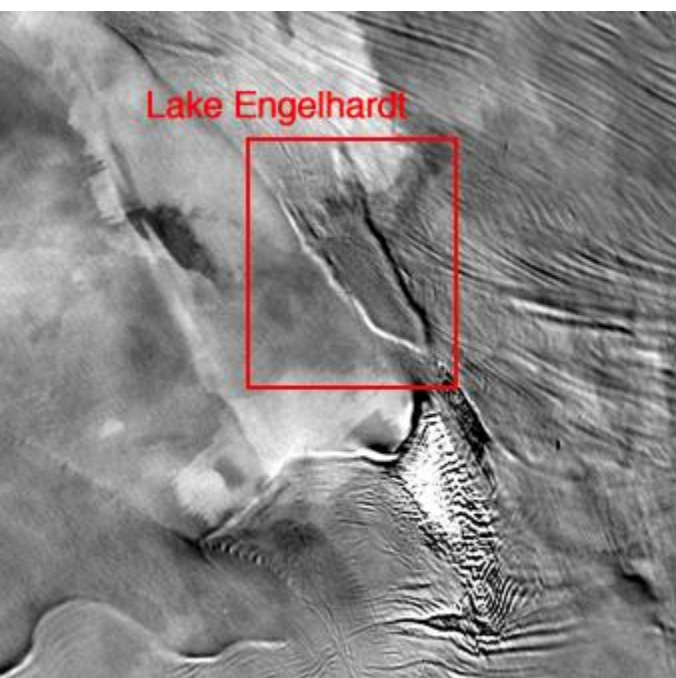


<http://earthobservatory.nasa.gov/Features/WorldOfChange/larsenb.php>

Sub-glacial lakes

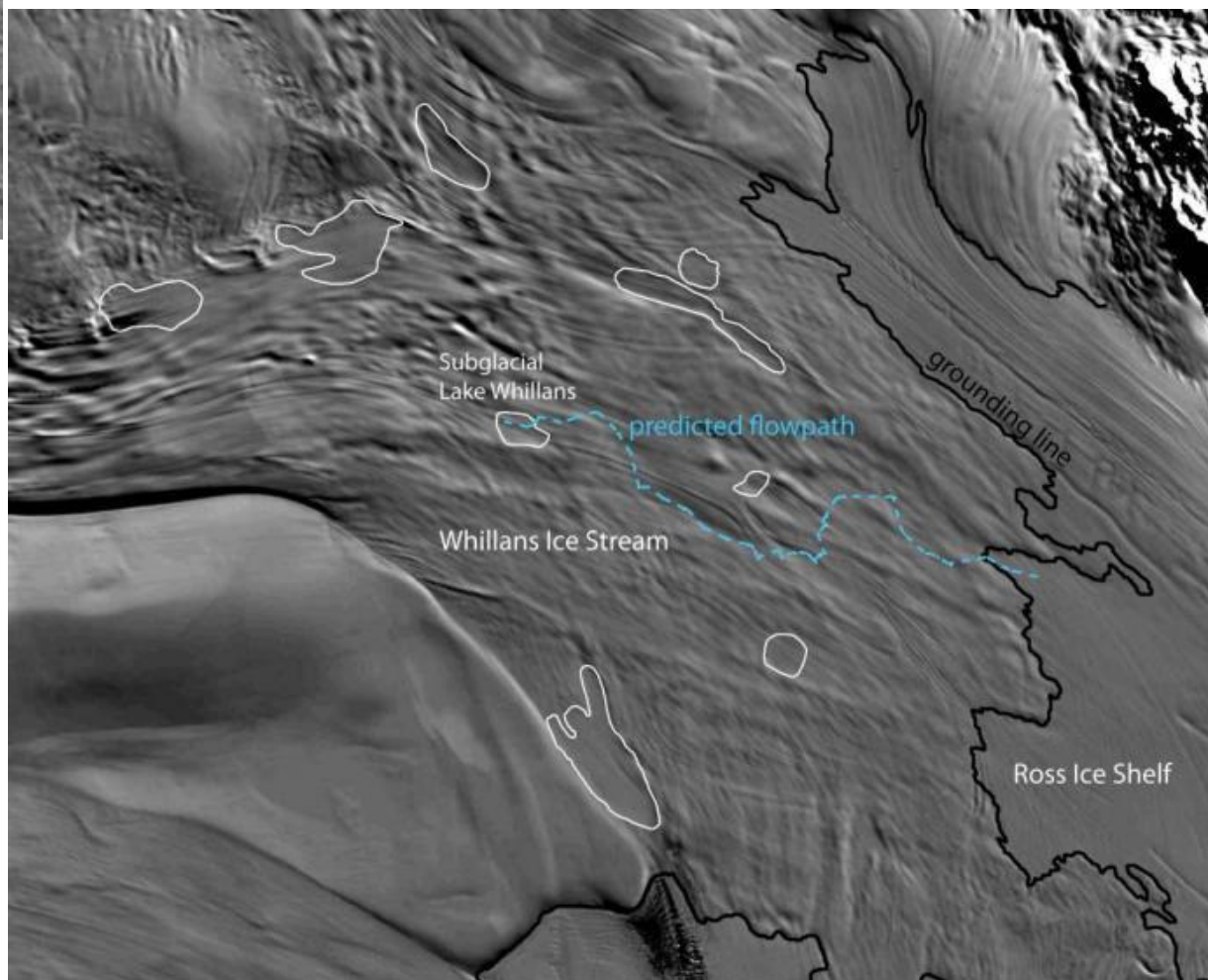


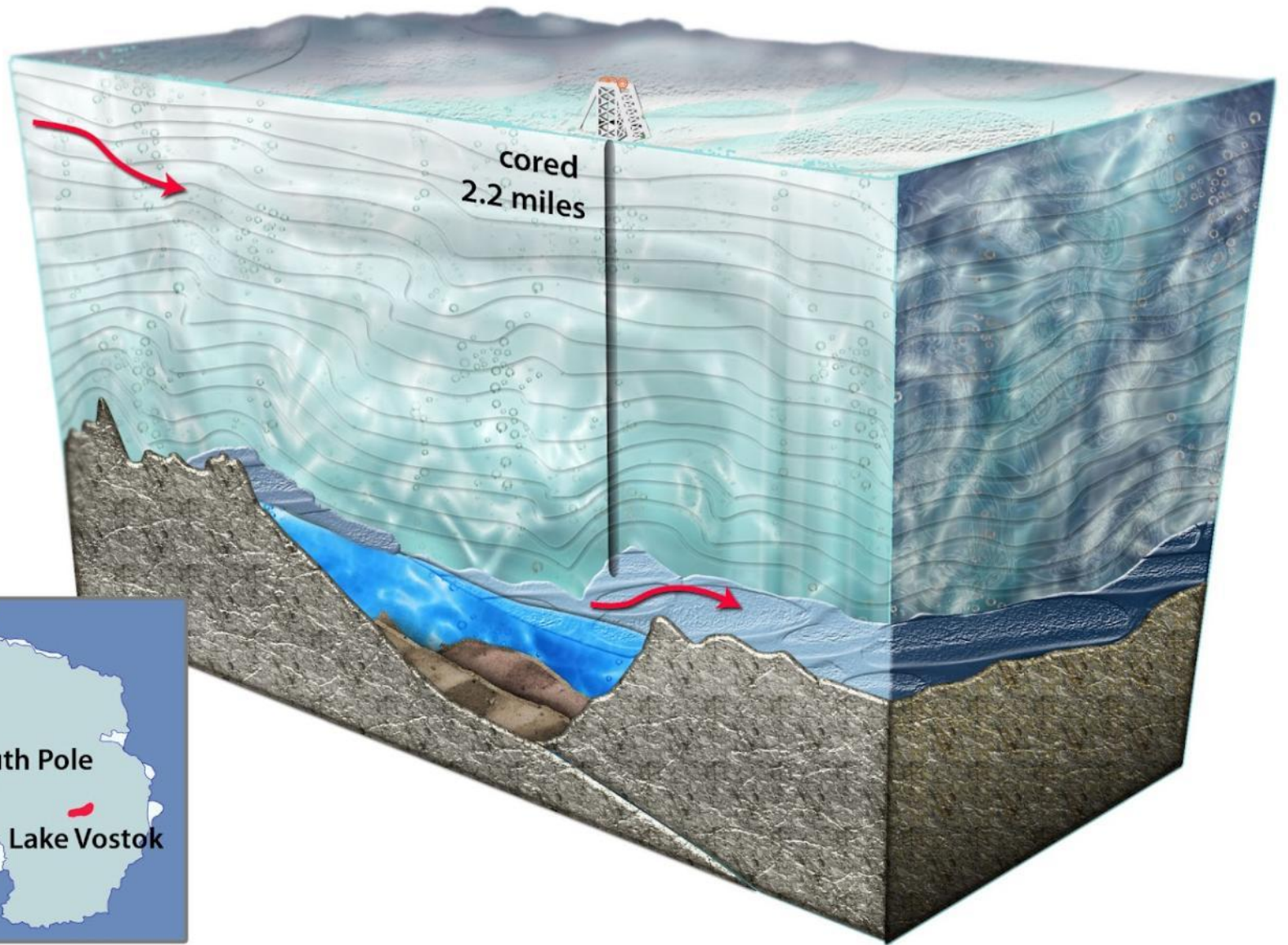
Locations of approx. 150 subglacial lakes in Antarctica



NSIDC

Scambos et al. 2007





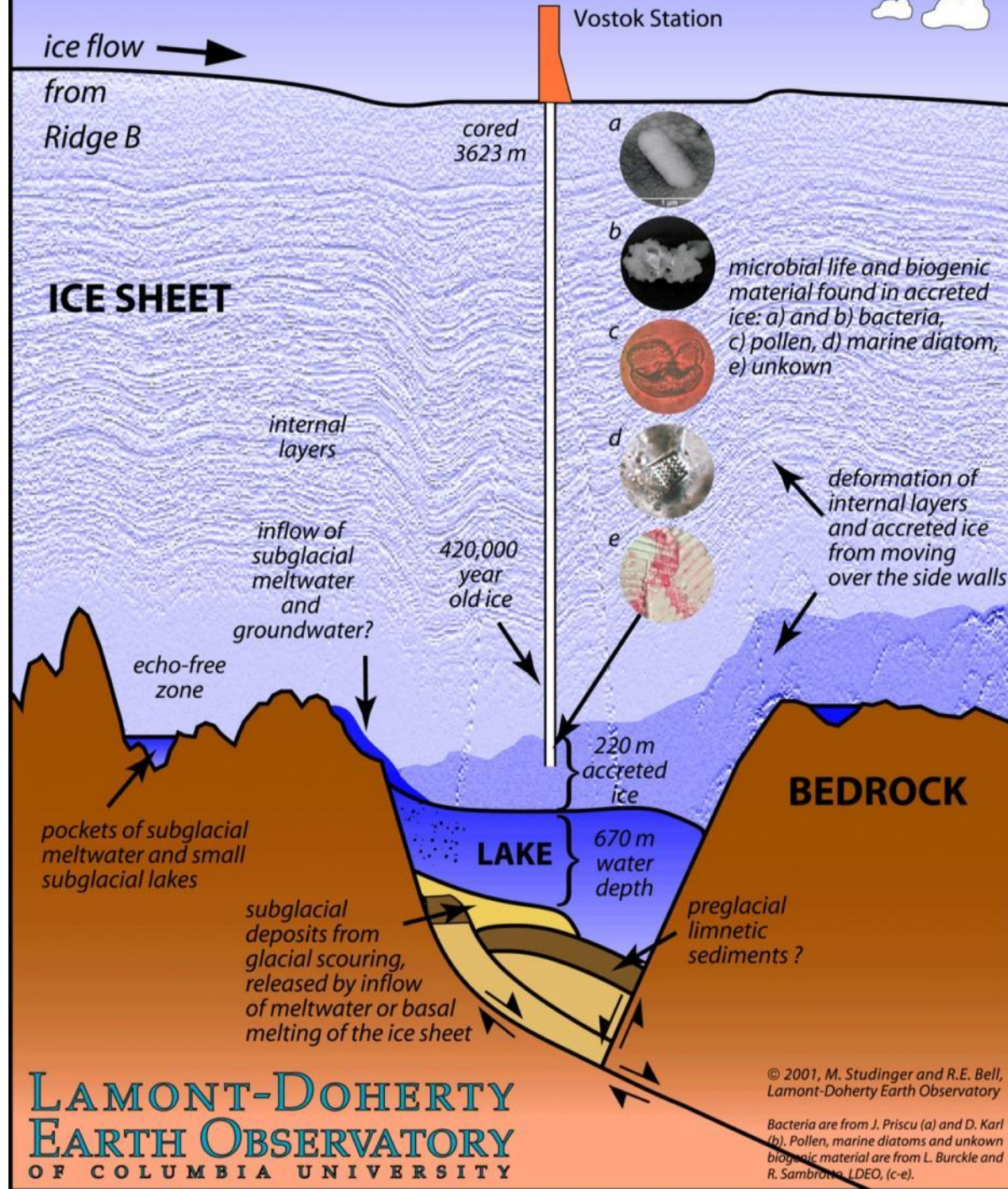
cored
2.2 miles



ANTARCTICA

South Pole

Lake Vostok

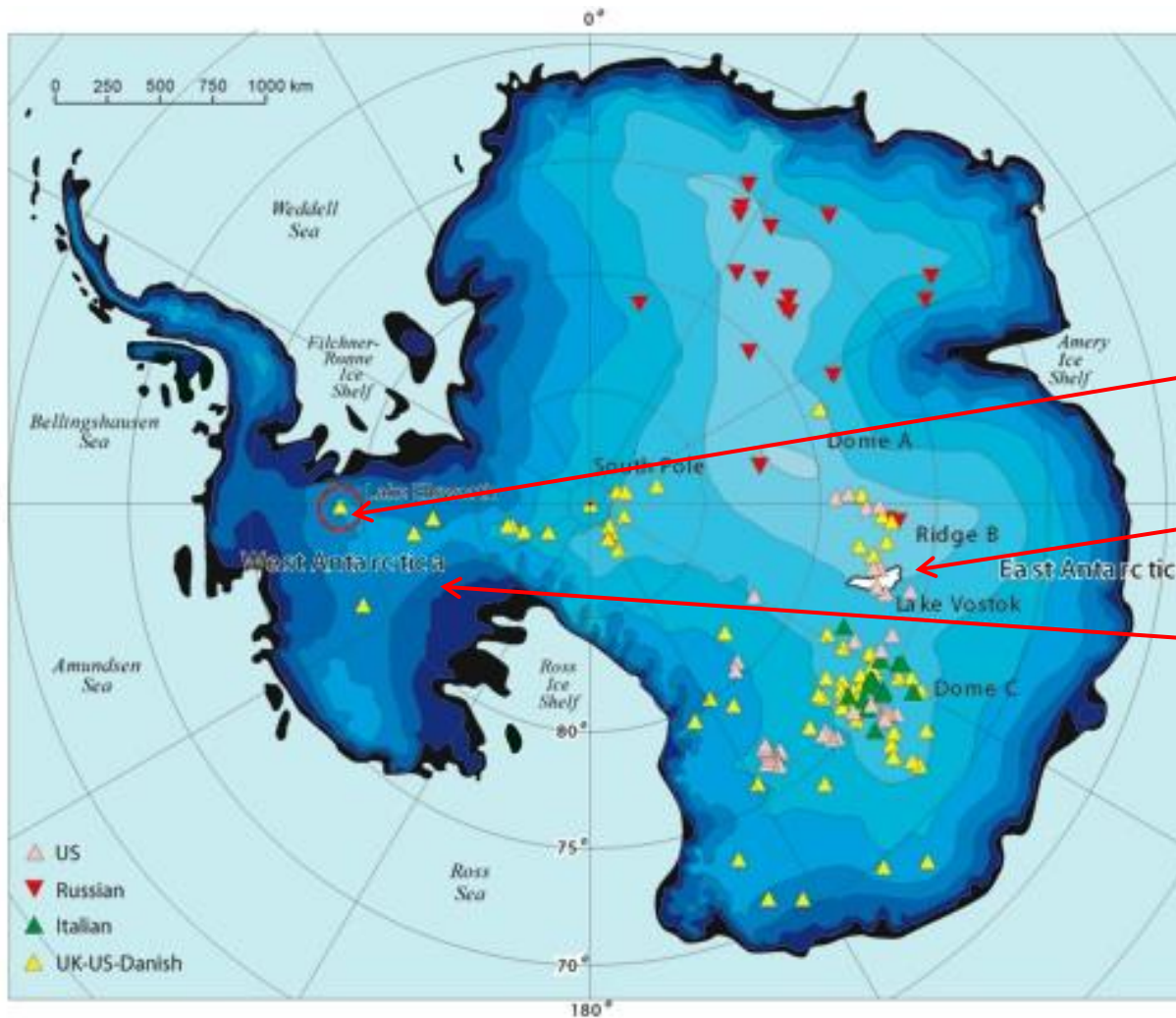


Three projects to collect samples from subglacial lakes:

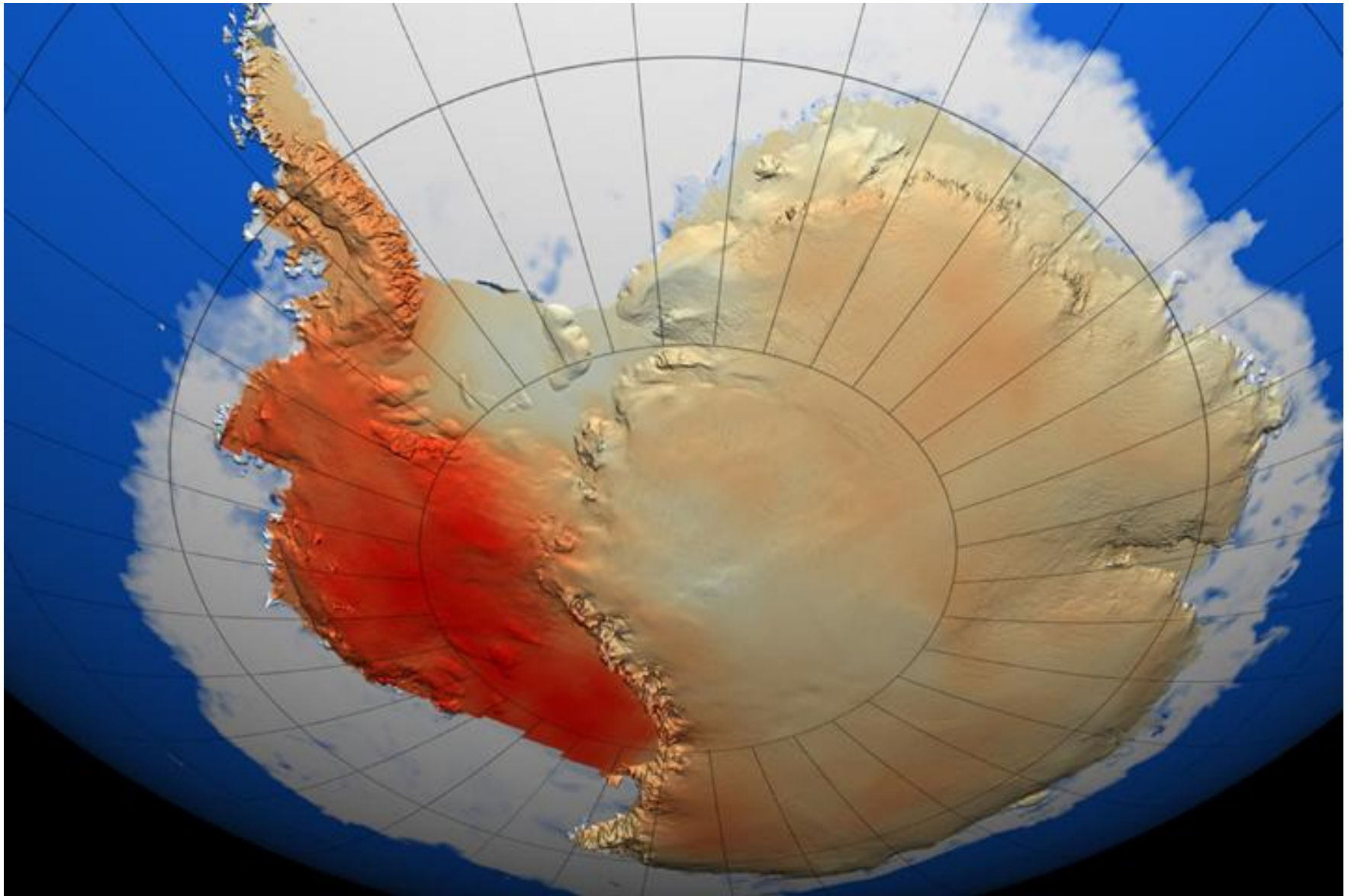
Ellesmere (UK)

Vostok (Russia)

Whillans (USA)

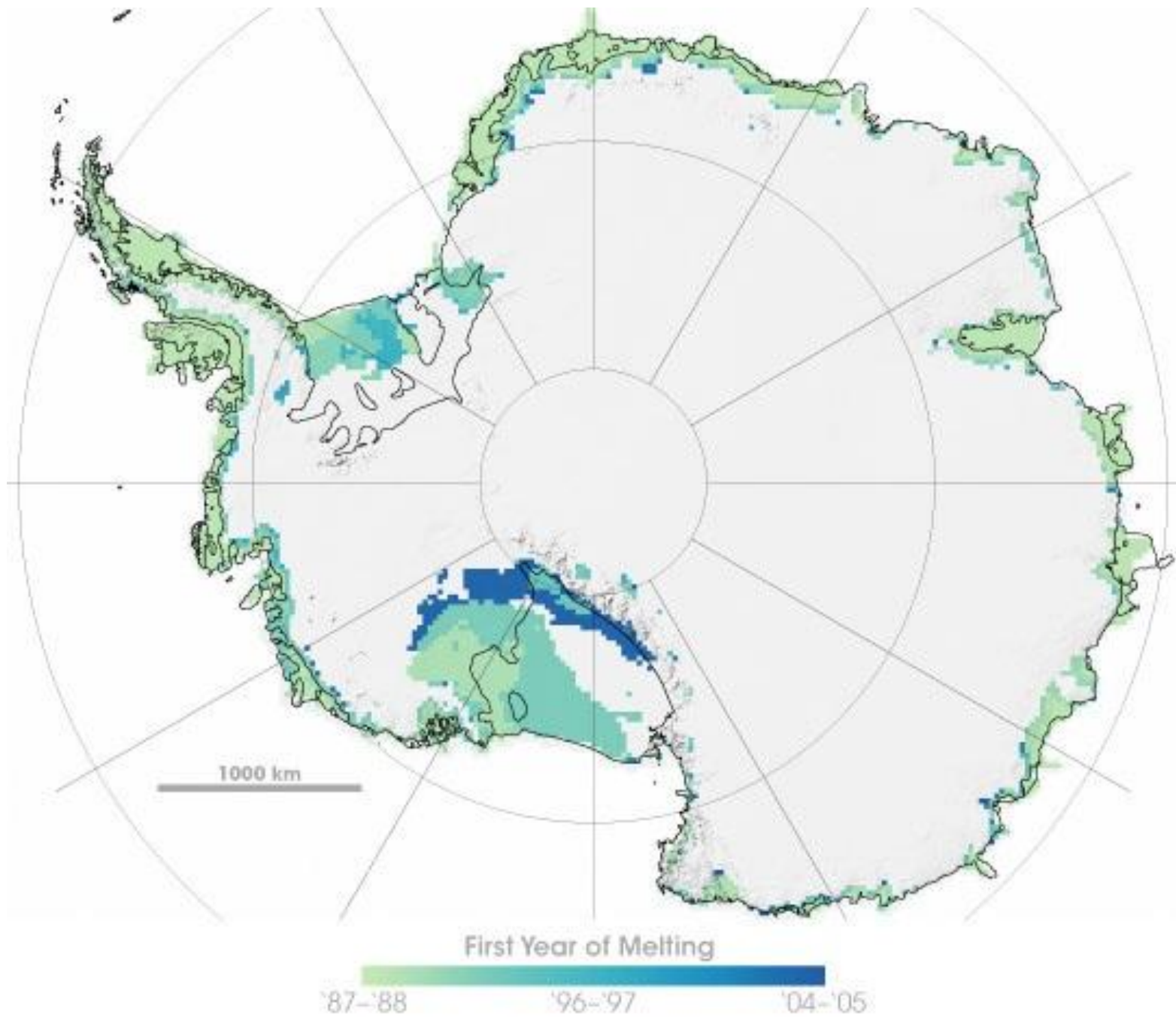


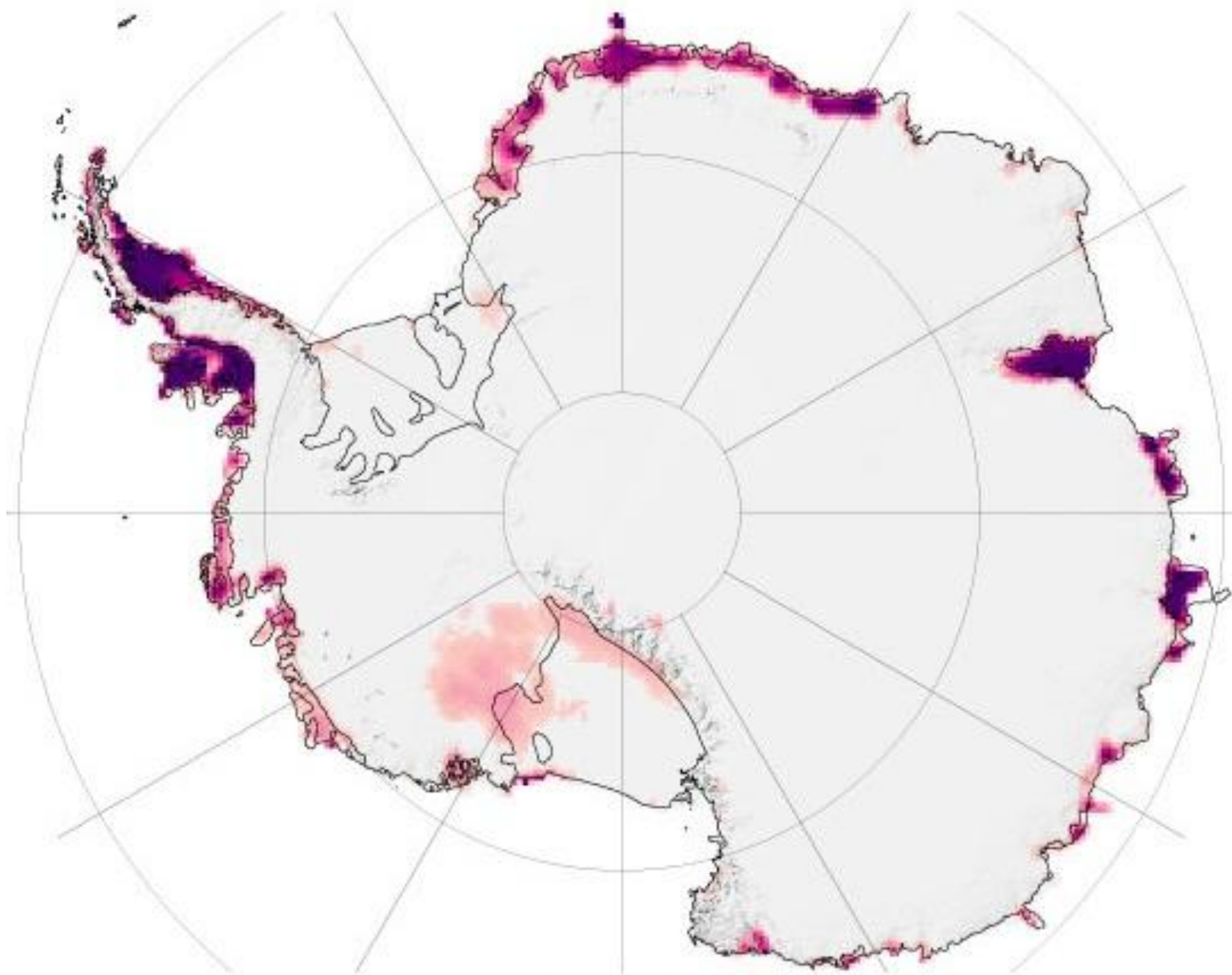
Climate change in Anarctica



Temperature change per decade (degrees Celsius)







Number of Days of Melting (2005)

