

The Ends of the Earth: Studying the Polar Regions

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The Discovery/Discoveries of Antarctica

- Many islands in southern waters were discovered during the 16th – 18th centuries
- Sealing began there in the 1790s
- In 1820 & 1821, ships from Russia, UK, and US sight the continent and eventually set foot on it



Early Antarctic explorer US Navy Lt. Charles Wilkes and his ship, *Vincennes*

Reaching the South Pole

- Many attempts were made to reach the South Pole before Roald Amundsen succeeded in 1911
- The most famous unsuccessful attempt was Robert Scott's fatal journey. Arriving at the Pole soon after Amundsen's team, Scott's group all died on the return trip.



Amundsen



← Scott's party at Amundsen's tent

For those of us in the US and most of the Northern Hemisphere, the Southern Hemisphere is largely “Terra Incognita”

We can look at maps and see shapes and unfamiliar names. We tend to think of the Southern Ocean and surrounding land masses merely as the bottom half of maps or globes.

New techniques are beginning to allow us to learn more about this interesting portion of our planet:

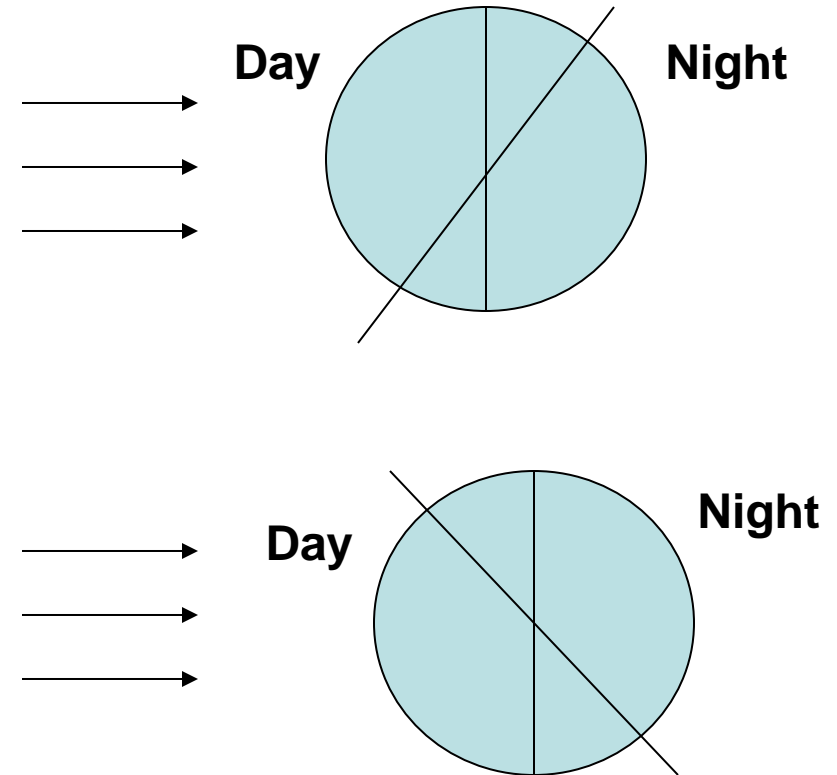
<http://www.ngdc.noaa.gov/mgg/image/predict.gif>



http://tea.armadaproject.org/activity/demello/ICE_CONTINENT_ENCOUNTER.doc#AntarcticMaps

Some useful background information: The most important fact about Antarctica: it is now very cold!

Located at Earth's southern pole means that little or no solar energy is received during half the year, and although the sun shines for long day lengths in the other half, not much energy is absorbed

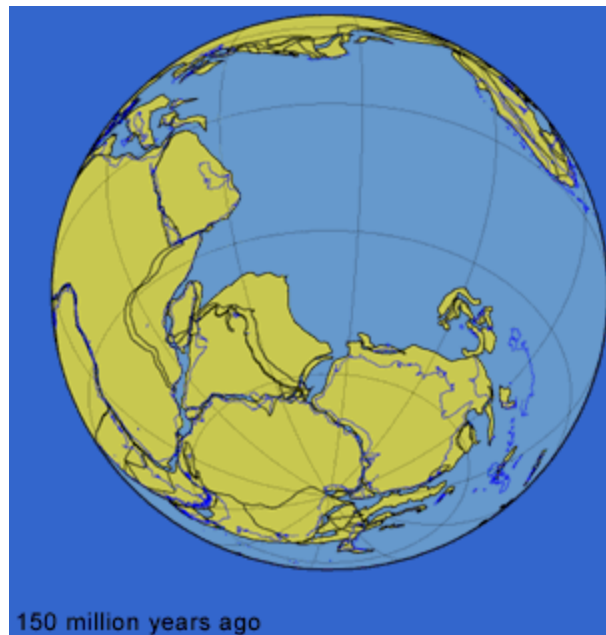


But it wasn't always this way!

- 200 mya, what was to become Antarctica was at the center of Gondwanaland, the southern supercontinent created as Pangaea began to split apart
- It was connected to Australia, Africa, South America, India, and New Zealand
- Fossils provide evidence that climate was much warmer and lush vegetation covered much of the surface
- Any polar ice cap was much smaller, so sea level was much higher

You can study an animation from a PBS
“NOVA” program showing the breakup of
Gondwanaland at

<http://www.pbs.org/wgbh/nova/eden/media/stt.html>



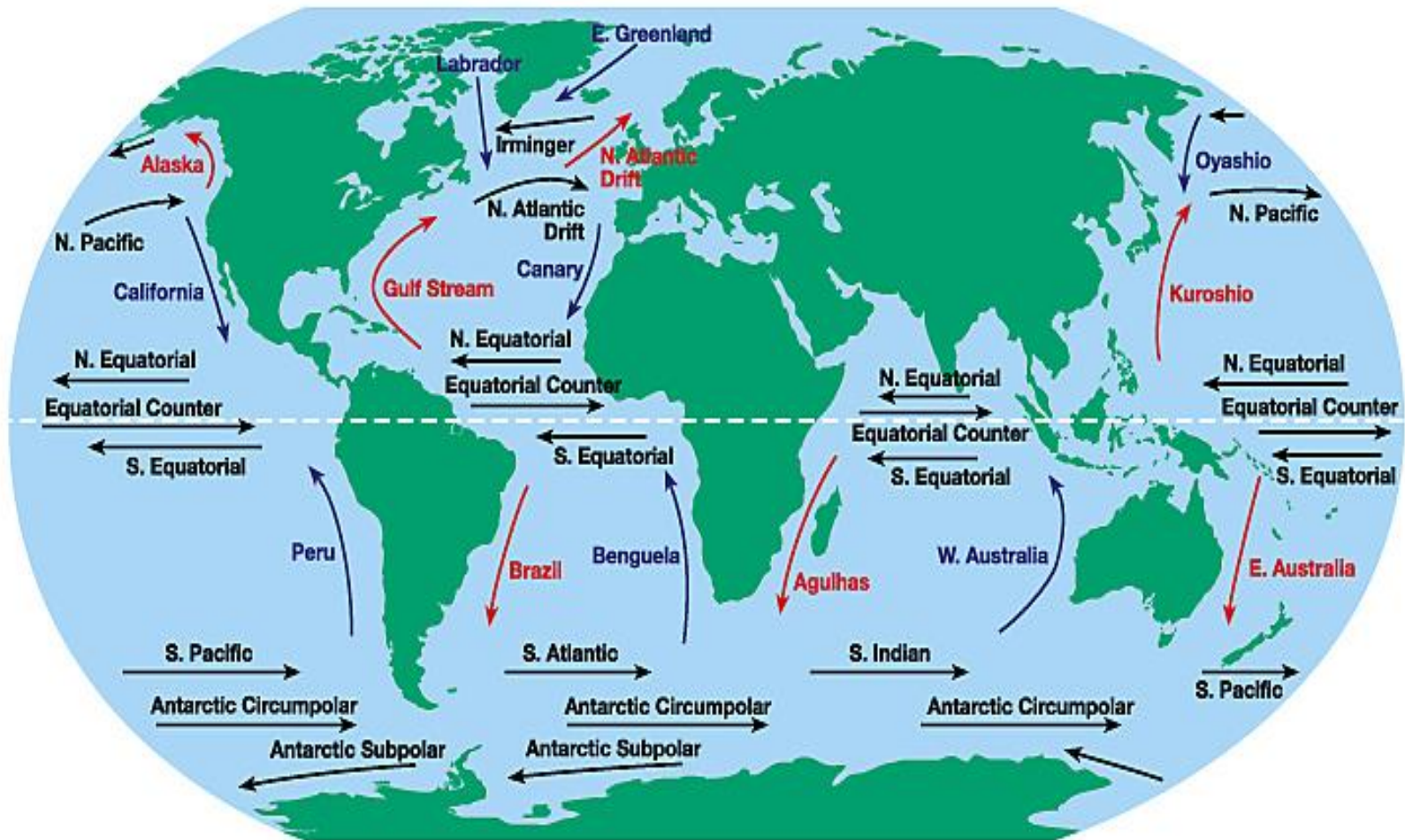
Becoming Antarctica

- Formation of the Circumpolar Current (West Wind Drift) played a major role in isolating and cooling Antarctica
- Changes in ocean circulation had major effects on energy transfer on the globe, which will be explored in the next few slides
- Consequently, the ice cap grew and sea level was lowered, and Antarctica became “Earth’s ice box”

What did you notice about these currents?

- The Southern Ocean is the only area of the world with flow uninterrupted by land
- General current movement is west-to-east
- There are connections with other surface currents to the north and poleward
- These involve both wind-driven surface currents and density-driven deeper circulations

Modern Antarctica results largely from its isolation at the pole and the ocean currents that surround it.



International Polar Years

- [IPY 2007 – 2008](#) was the 4th international research event focused on the Poles
- The first was in 1882 – 1883, even before anyone had reached the South Pole
- The second, in 1932 – 1933, was hindered by the Great Depression and lack of technological advances available later
- The third, 1957-1958, was a component of the highly successful [IGY \(International Geophysics Year\)](#)

IGY—International Geophysical Year

1957 – 1958

- Sputnik, Van Allen Belts, exploration of Antarctica
- Large-scale international cooperative investigations
- Led to ratification of the Antarctica Treaty (1961) which has protected the continent from commercial exploitation up till now

IPY – International Polar Year

- [What is IPY?](#)
- [IPY Timeline](#)
- [IPY Draft Themes](#)
- [Education and Outreach](#)

IPY “Focus on ...”

- [Land](#)
- [Oceans](#)
- [Atmosphere](#)
- [Ice](#)
- [Space](#)
- [People](#)



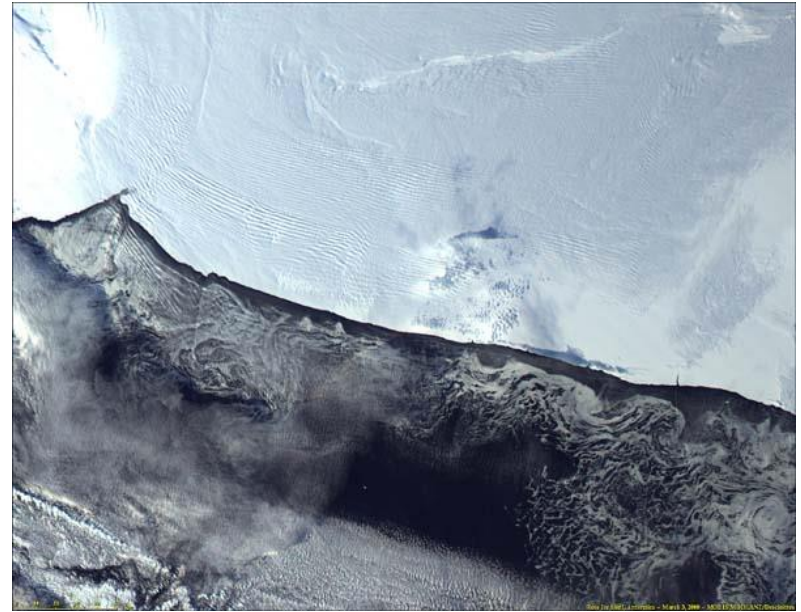
Satellite Studies of Polar Regions

- Making accurate observations in polar regions is difficult and dangerous
- One of the most important advances during the last 50 years has been widespread use of satellite observations
- Several polar-orbiting satellites with a variety of instrument packages now routinely observe winds, ice, and other conditions

NASA's Earth Observing System

TERRA

- “ASTER” Advanced Spaceborne Thermal Emission and Reflection Radiometer
- “CERES” Clouds and the Earth's Radiant Energy System
- “MODIS” Moderate-resolution Imaging Spectroradiometer



Ross Ice Shelf, Antarctica

http://veimages.gsfc.nasa.gov/245/MODIS1000029_md.jpg

“A Tour of the Cryosphere”

NASA recently released an 8-minute multimedia DVD, which is also available on the Internet at

<http://www.nasa.gov/vision/earth/environment/cryosphere.html>

This video briefly provides an overview of important geographic and logistical challenges when working and living in polar regions.

Polar Aircraft

Getting to and around Antarctica has posed logistical challenges that frequently have been met through specialized aircraft to operate in extreme conditions.

Michael Studinger, formerly of LDEO and a frequent presenter at E2C, and colleagues are involved in [testing some of these](#).

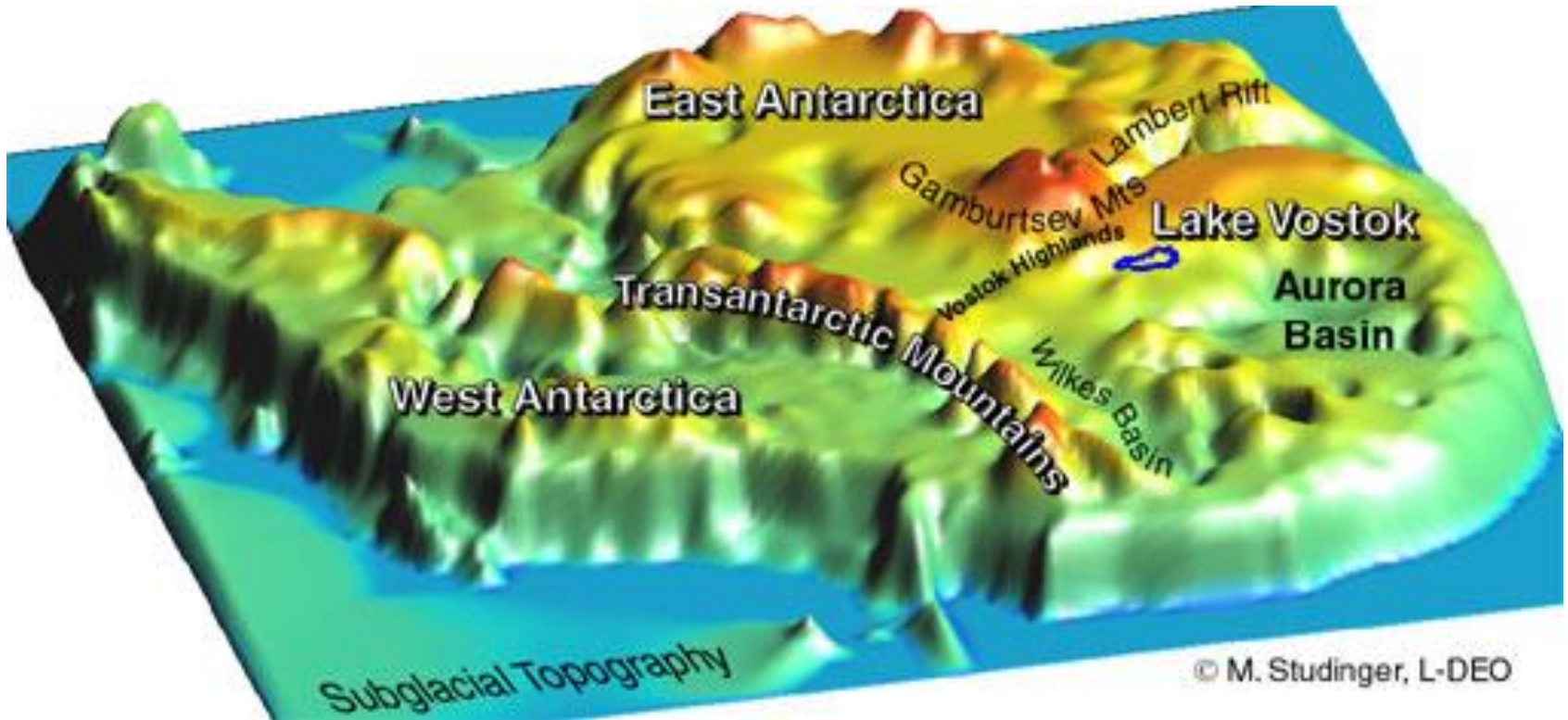
Also, the Alfred Wegener Institute for Polar and Marine Research recently acquired [new research capabilities](#).

Probing Beneath the Ice Cap

Between 1988 – 1997, NASA's [RADARSAT](#) program studied our planet using [SAR](#) ([Synthetic Aperture Radar](#)) techniques.

NASA's Scientific Visualization Studio has created an [animation](#) using these data.

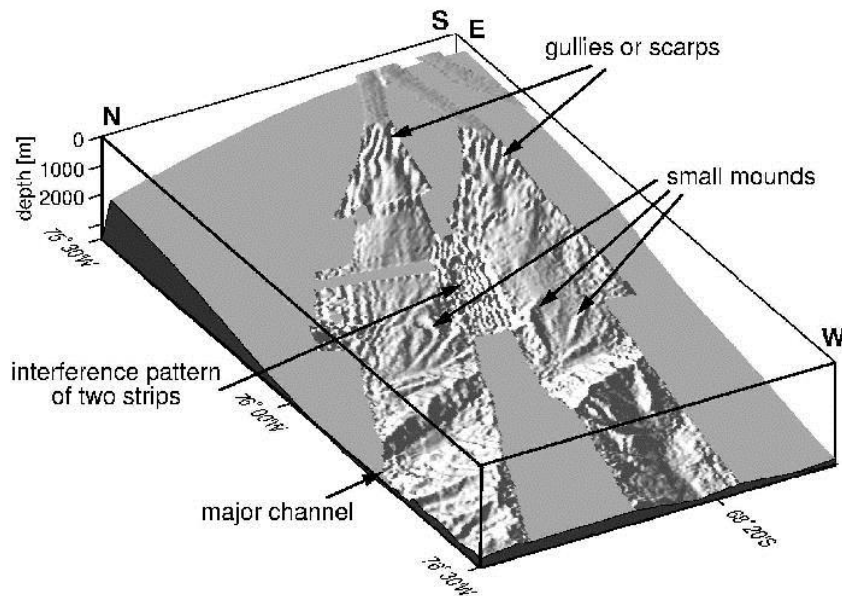
What lies on land beneath Antarctica's Icecap?



http://www.earthinstitute.columbia.edu/news/story3_2_01.html

Probing Beneath the Ocean Surface

- Frank Nitsche and colleagues use **multibeam bathymetry** and other technologies to reveal features hidden beneath the water and ice





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