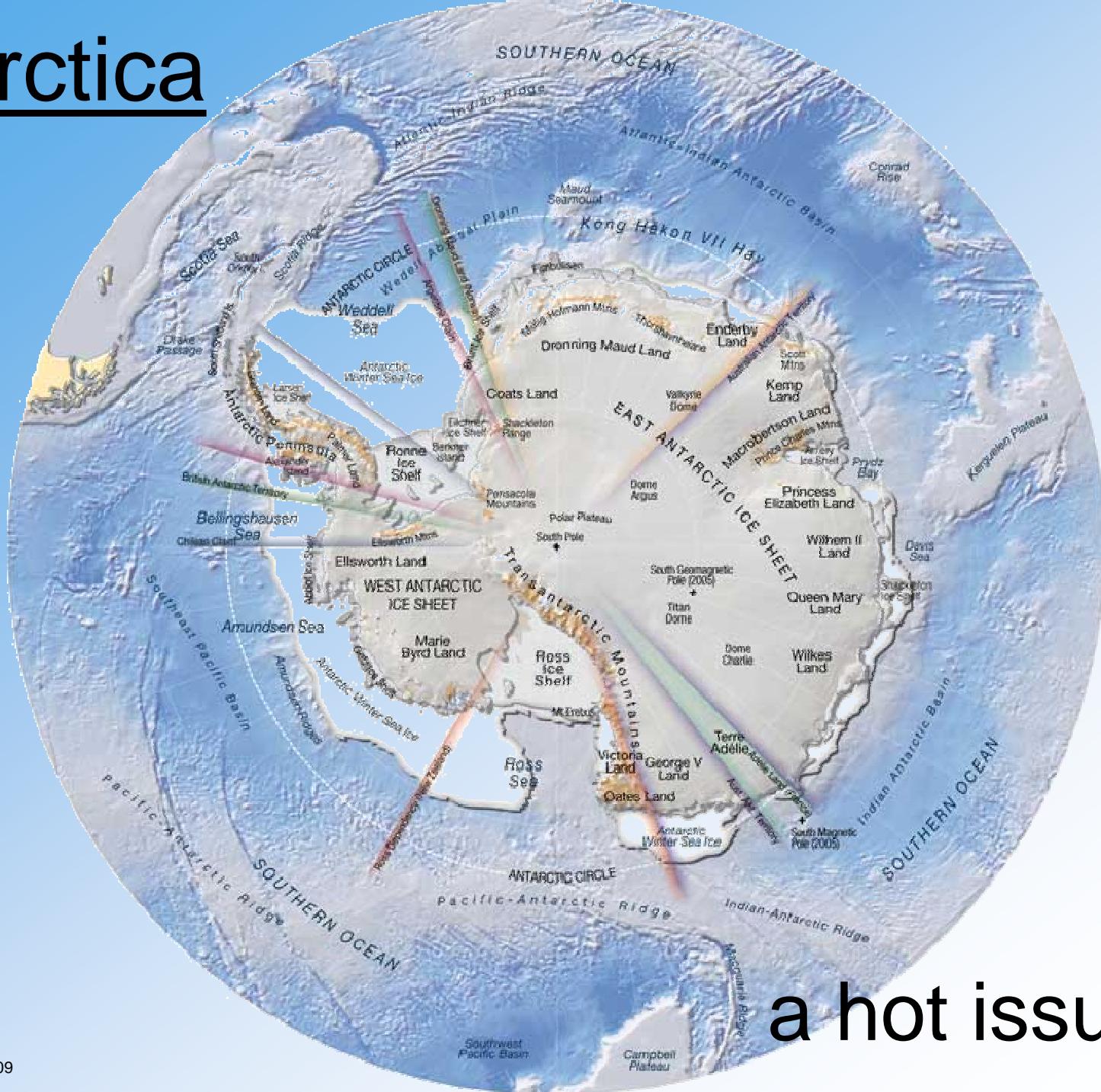


# Antarctica

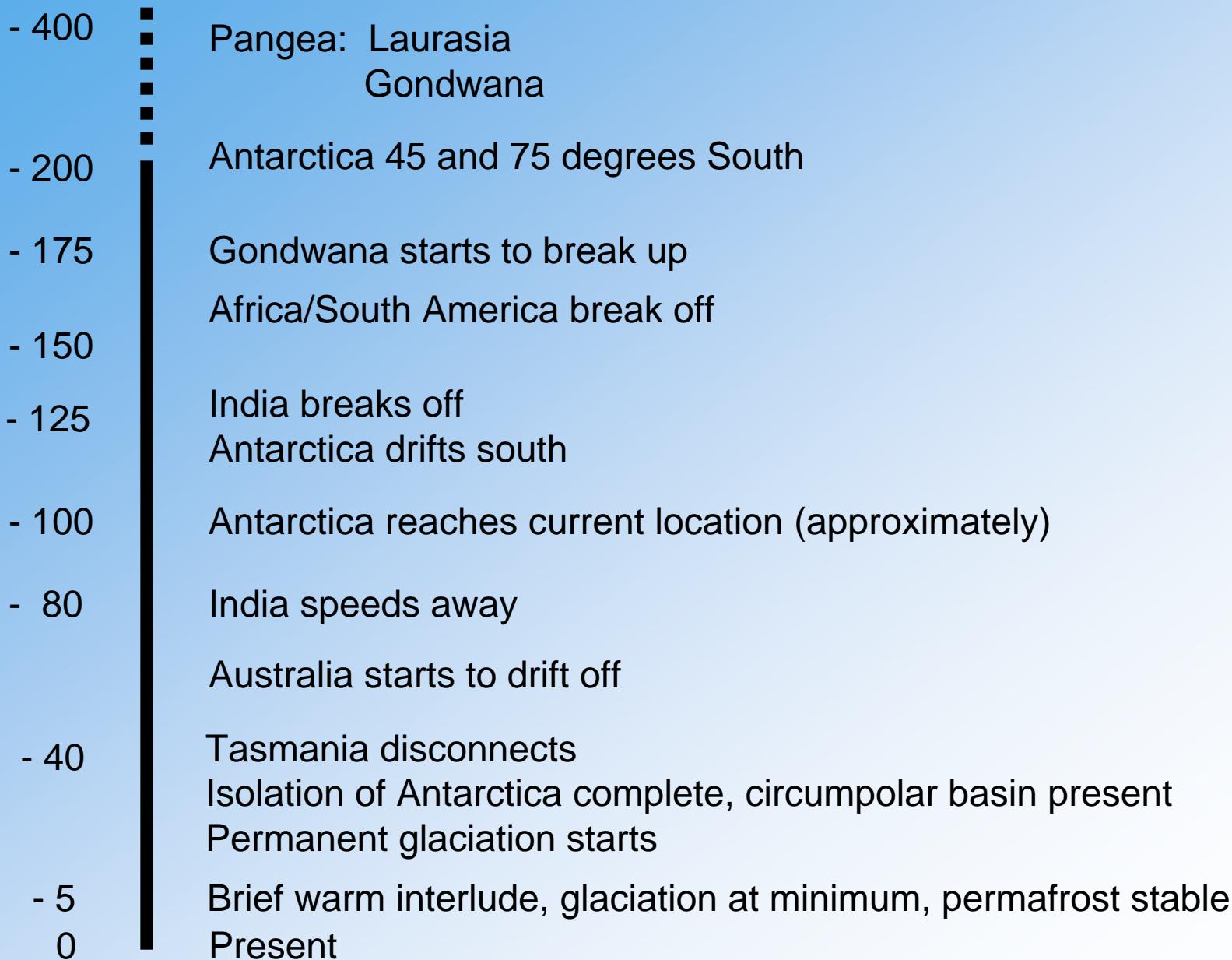


a hot issue...

# Topics

- Antarctica:
  - Origins
  - Geography
  - Relation to environment
- Antarctica and Climate Change
  - Visible change
  - Projected change
- Antarctica:
  - Visit
  - Photographic impression

# Geologic history of Antarctica



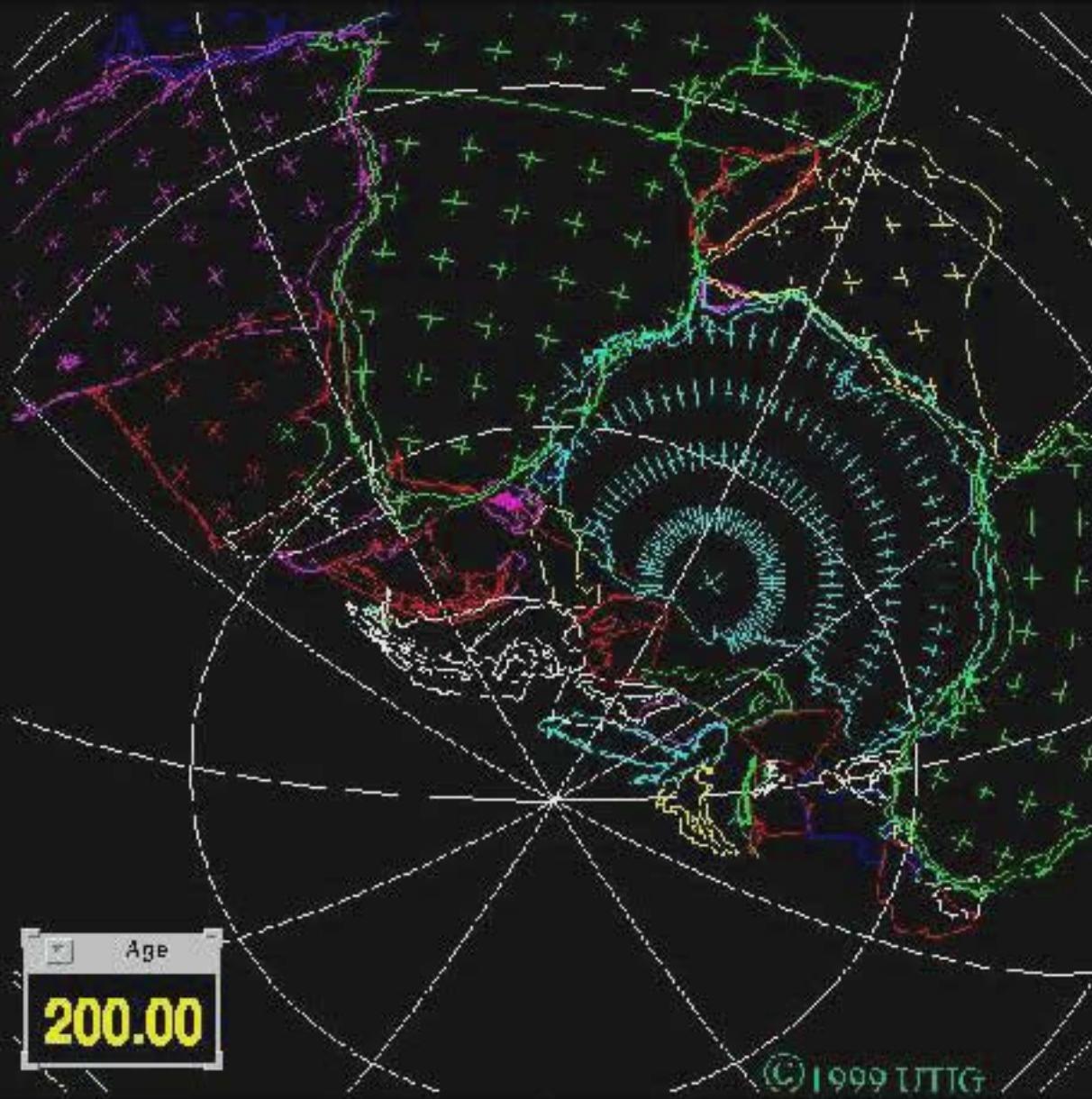
Rodinia => Gondwana => Laurentia => Pangaea

Rodinia assembly

1100 Ma

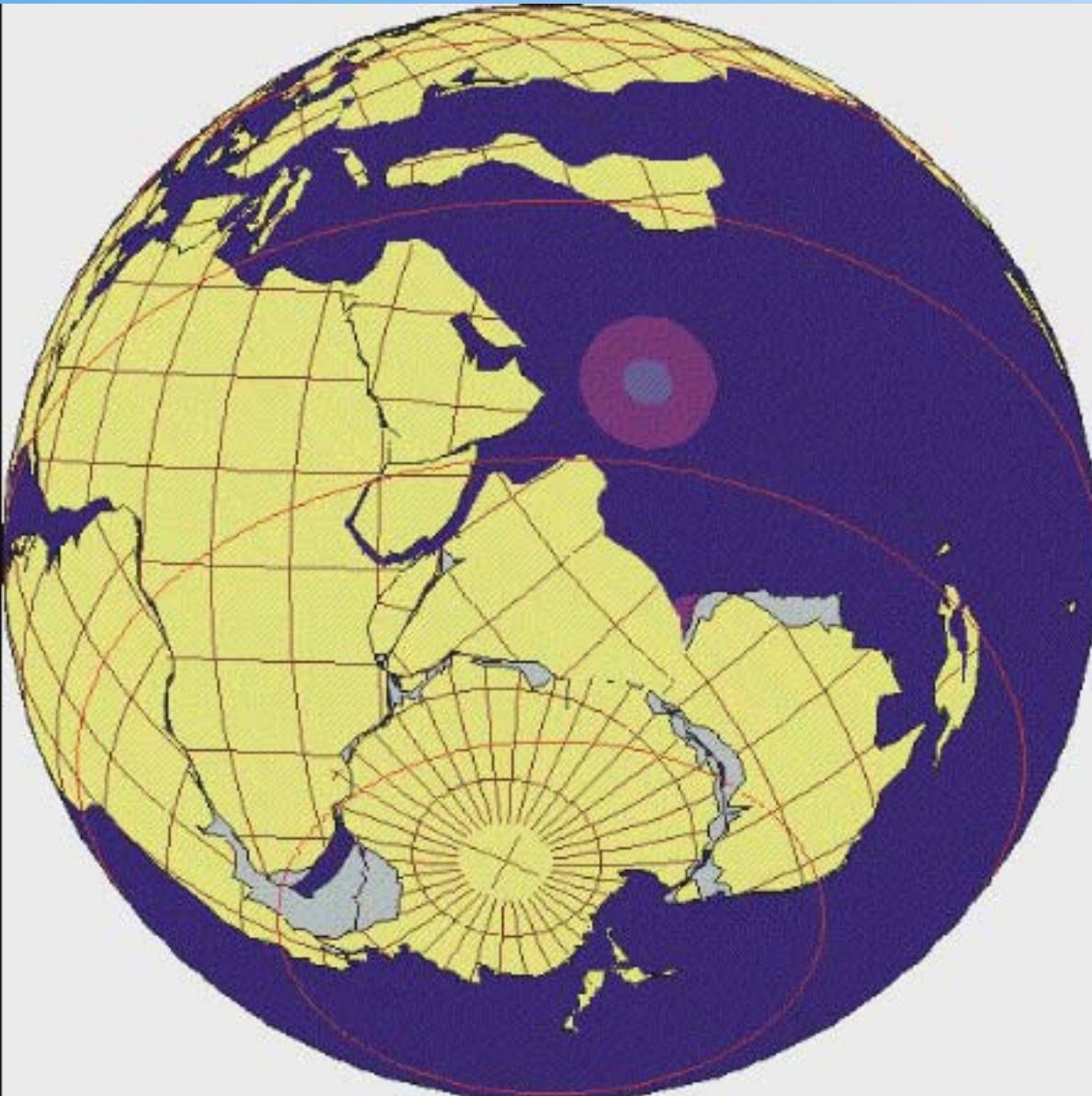


# 200 million year plot with increments of 1 Myr

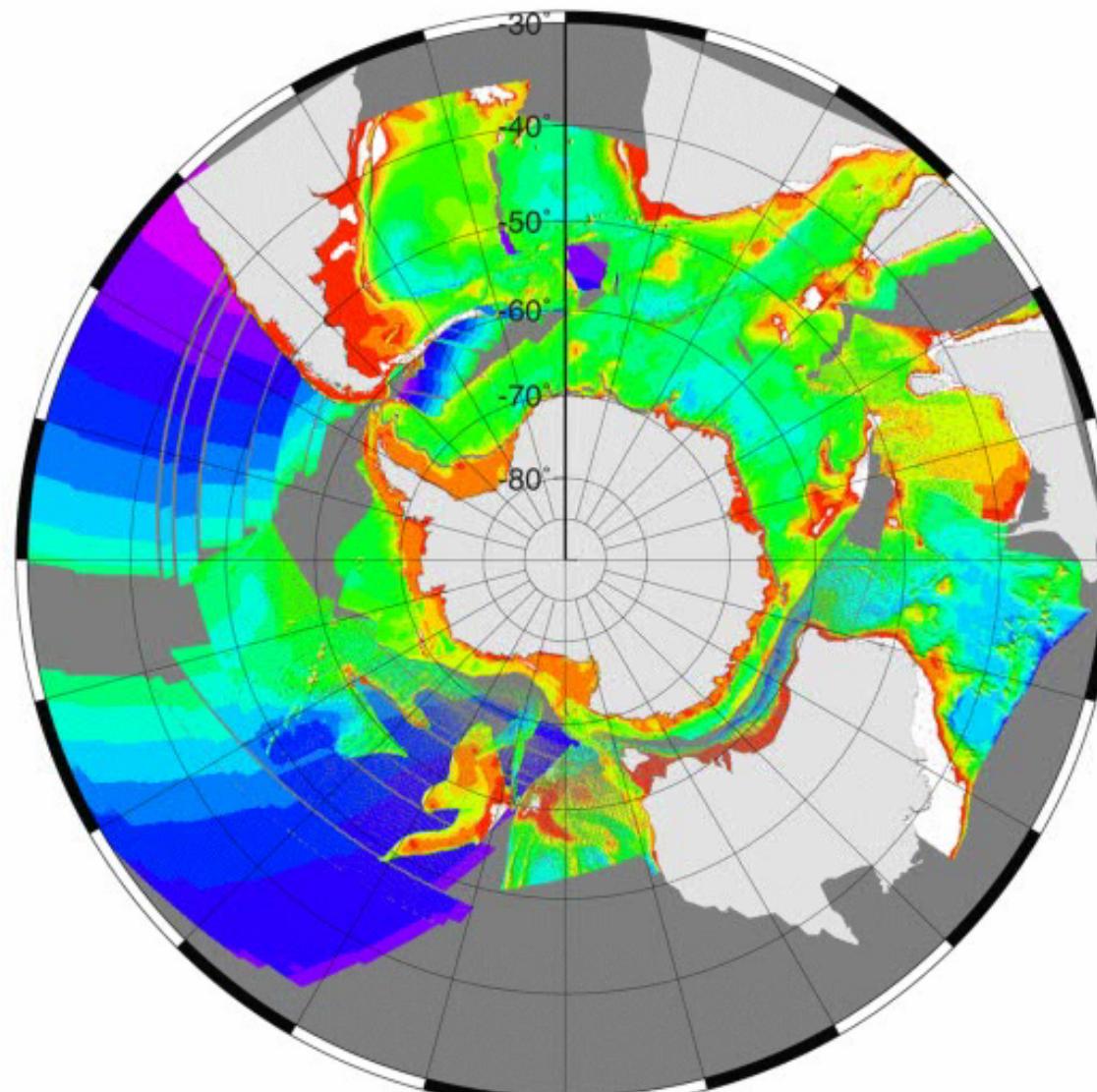


# Break-up of Gondwana during the last 150 million years

## Motion is relative to earth's axis of rotation

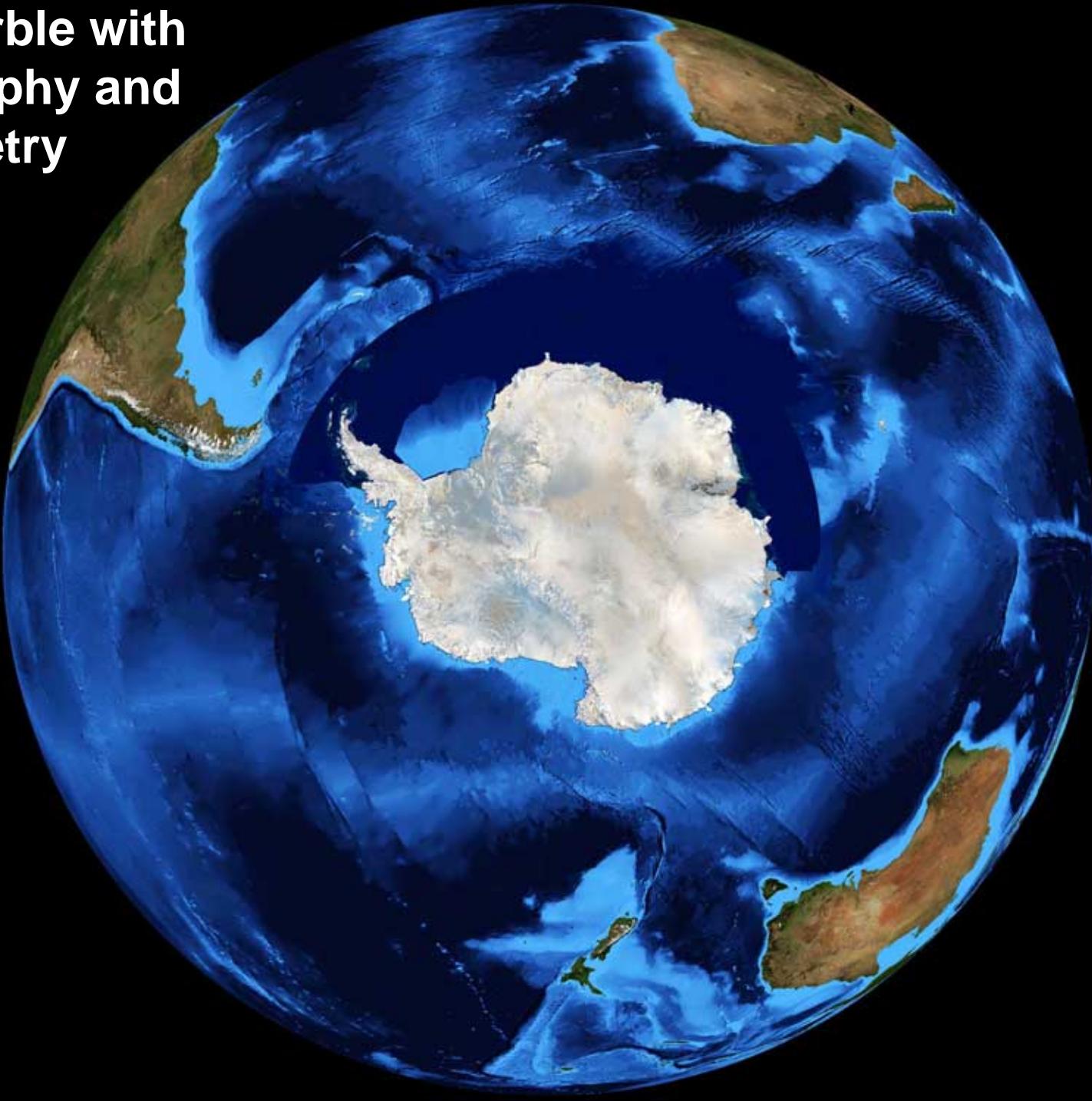


# Paleobathymetry at 75 Ma

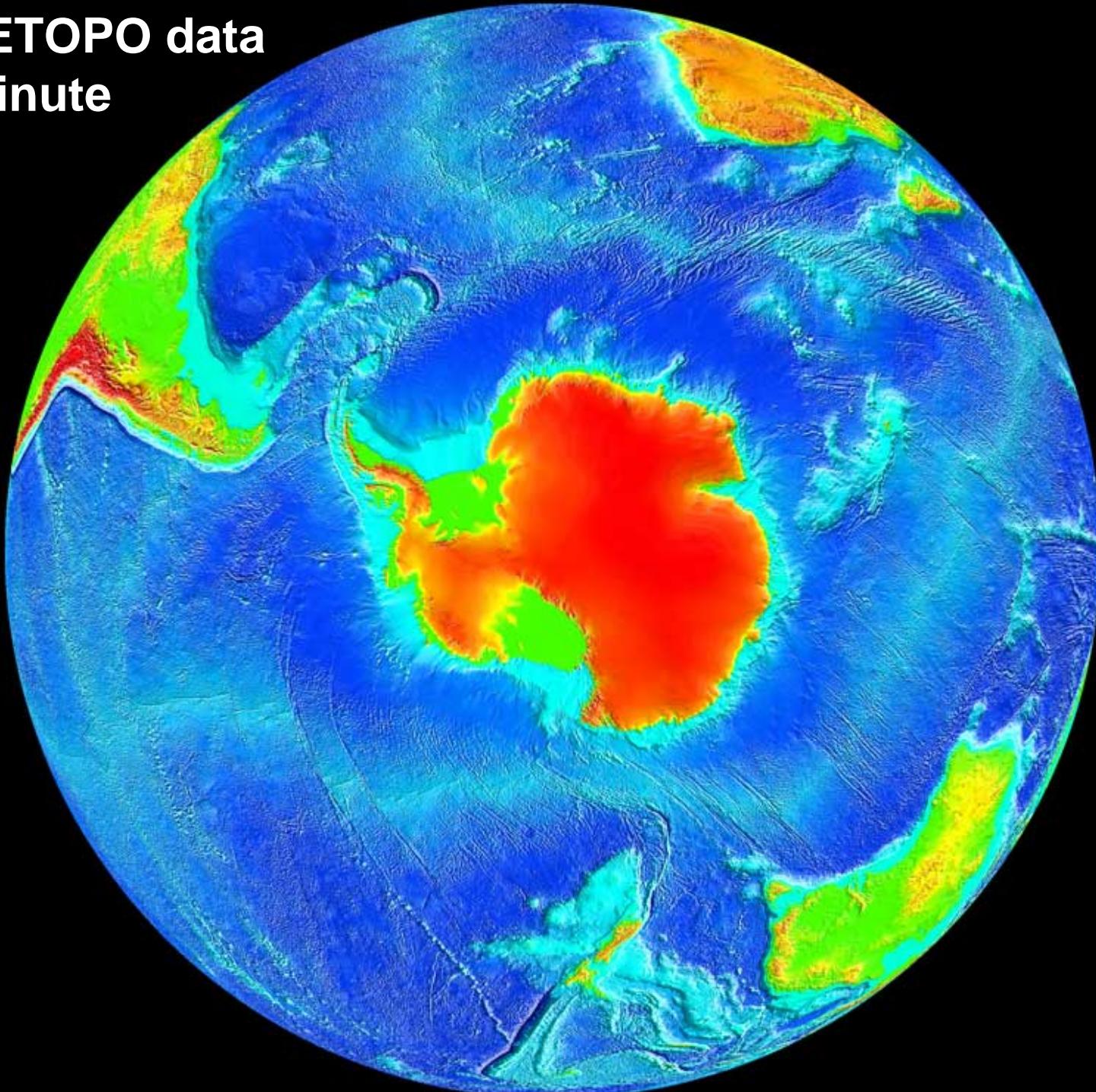


Depth in Meters

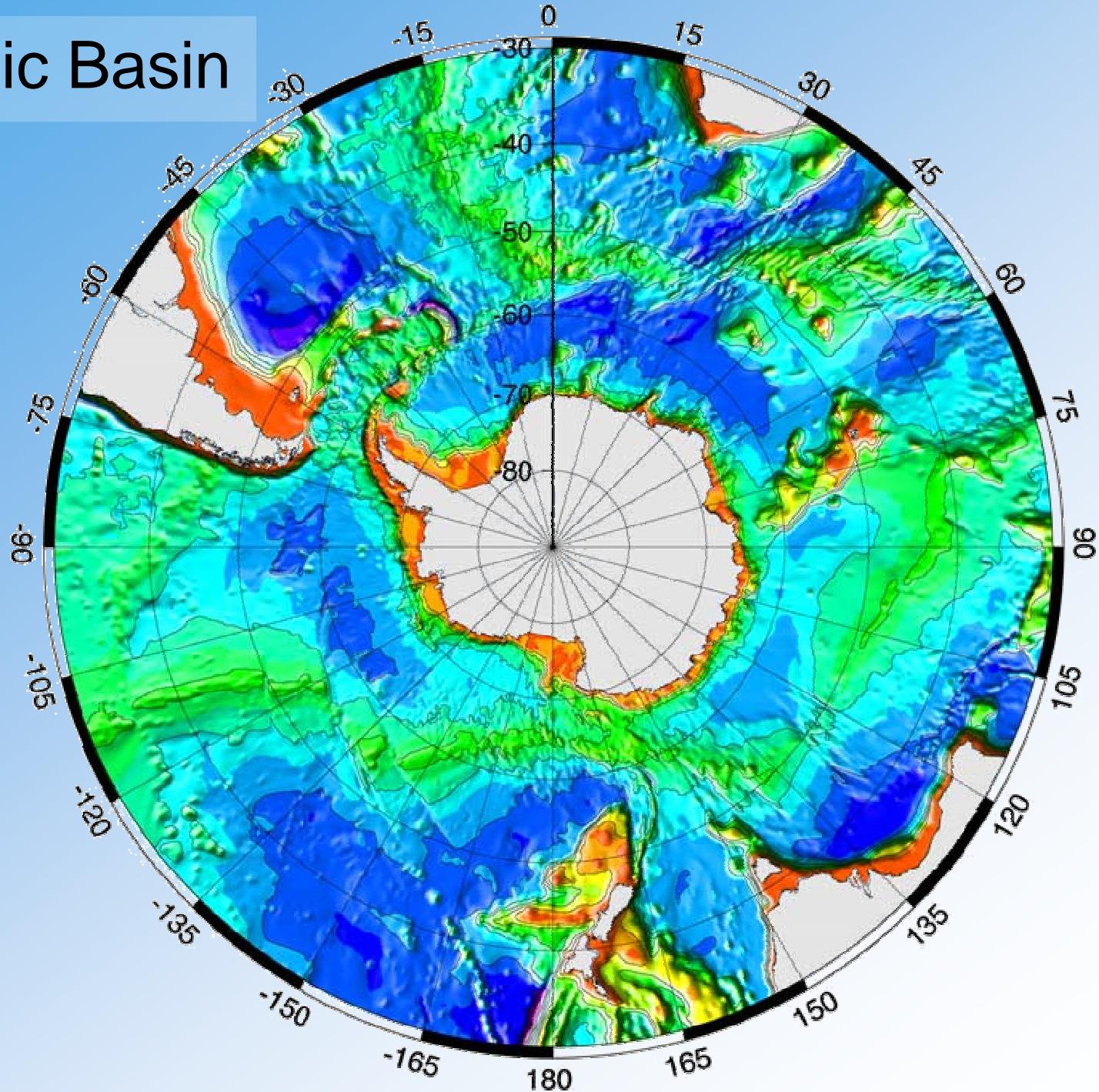
# Blue Marble with Topography and Bathymetry



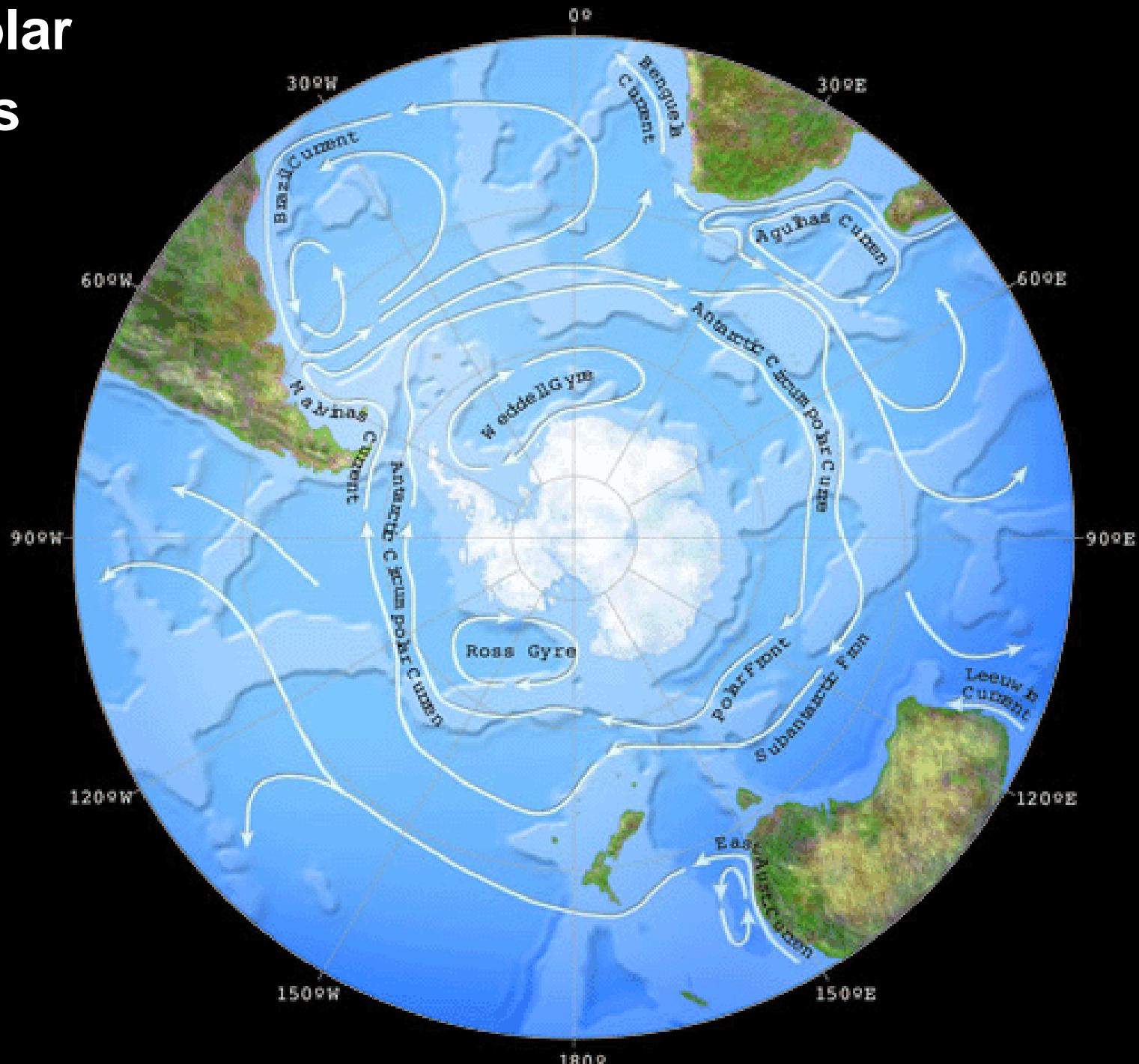
Latest ETOPO data  
1 arc minute  
(NGDC)



# Antarctic Basin

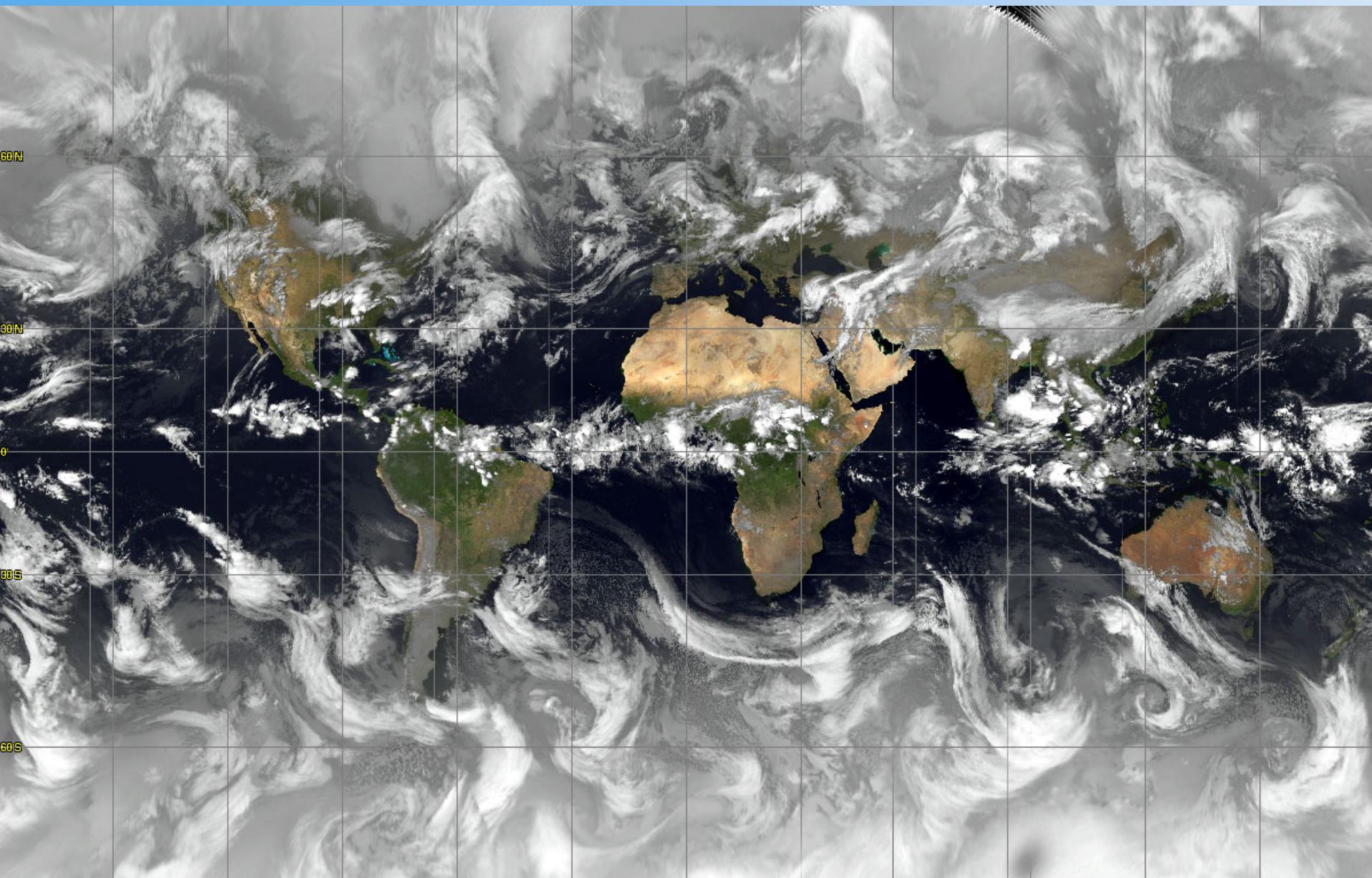


# Circumpolar currents

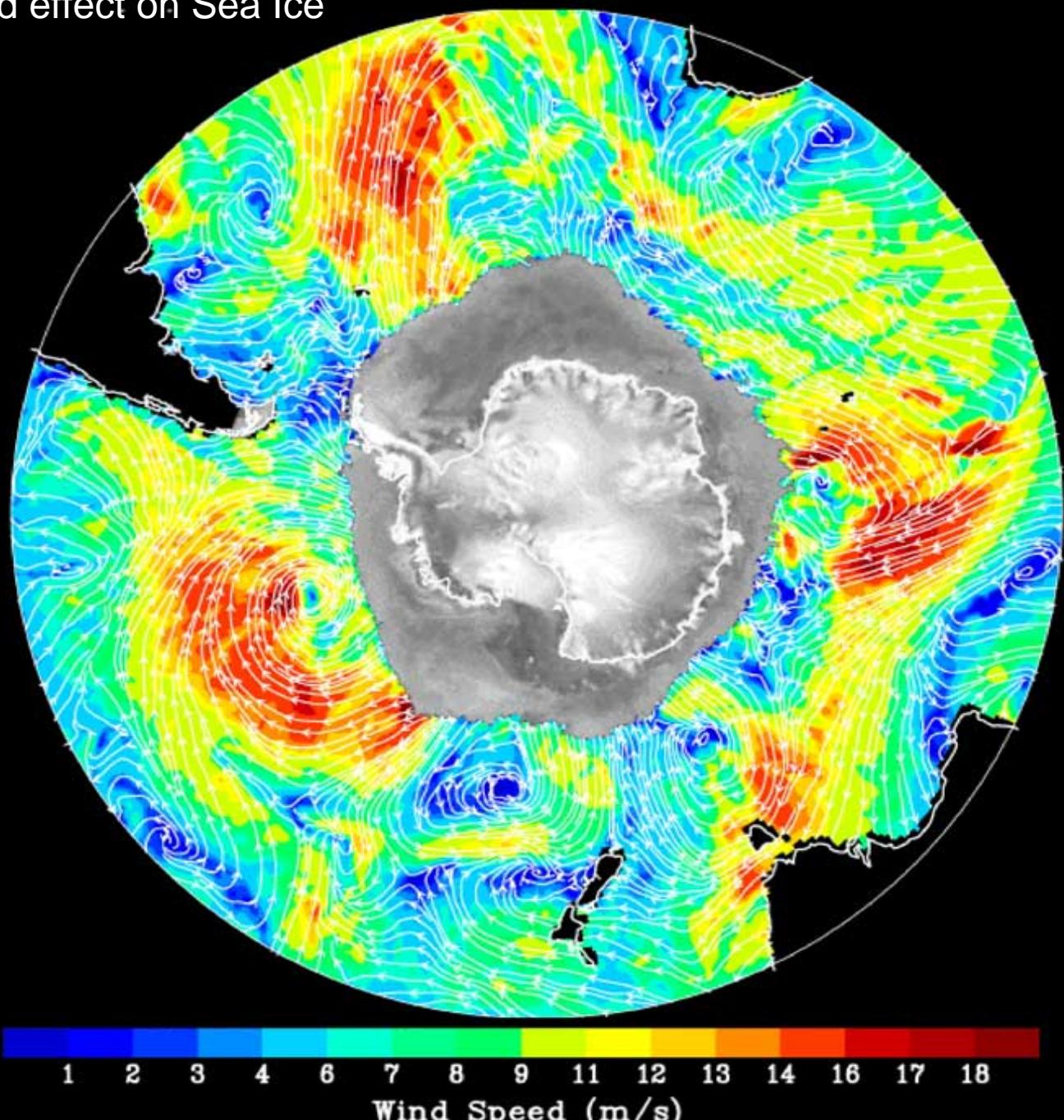


# Antarctica's influence on the atmosphere

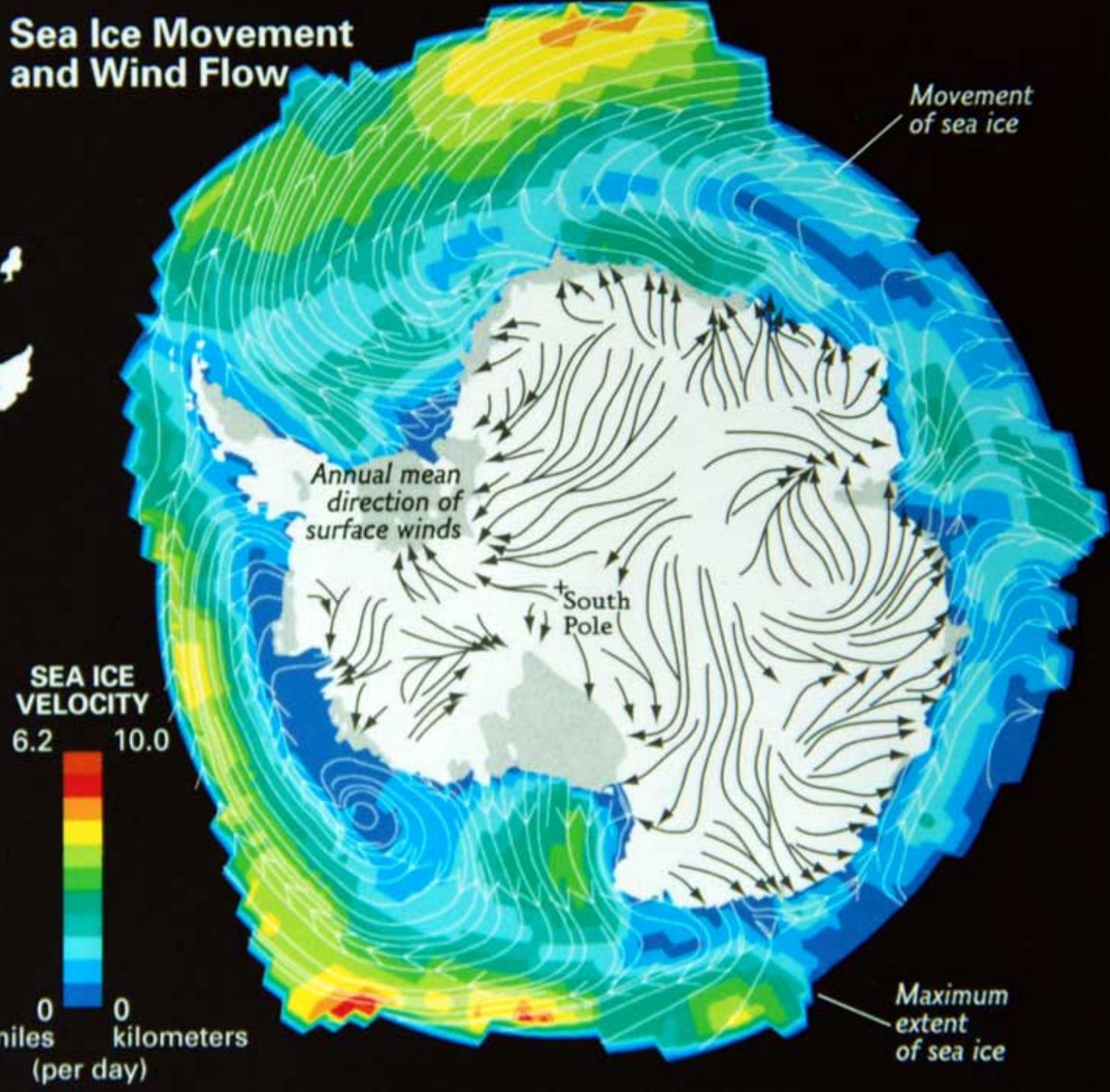
(World view GeoSatSignal)



## Wind speed and effect on Sea Ice

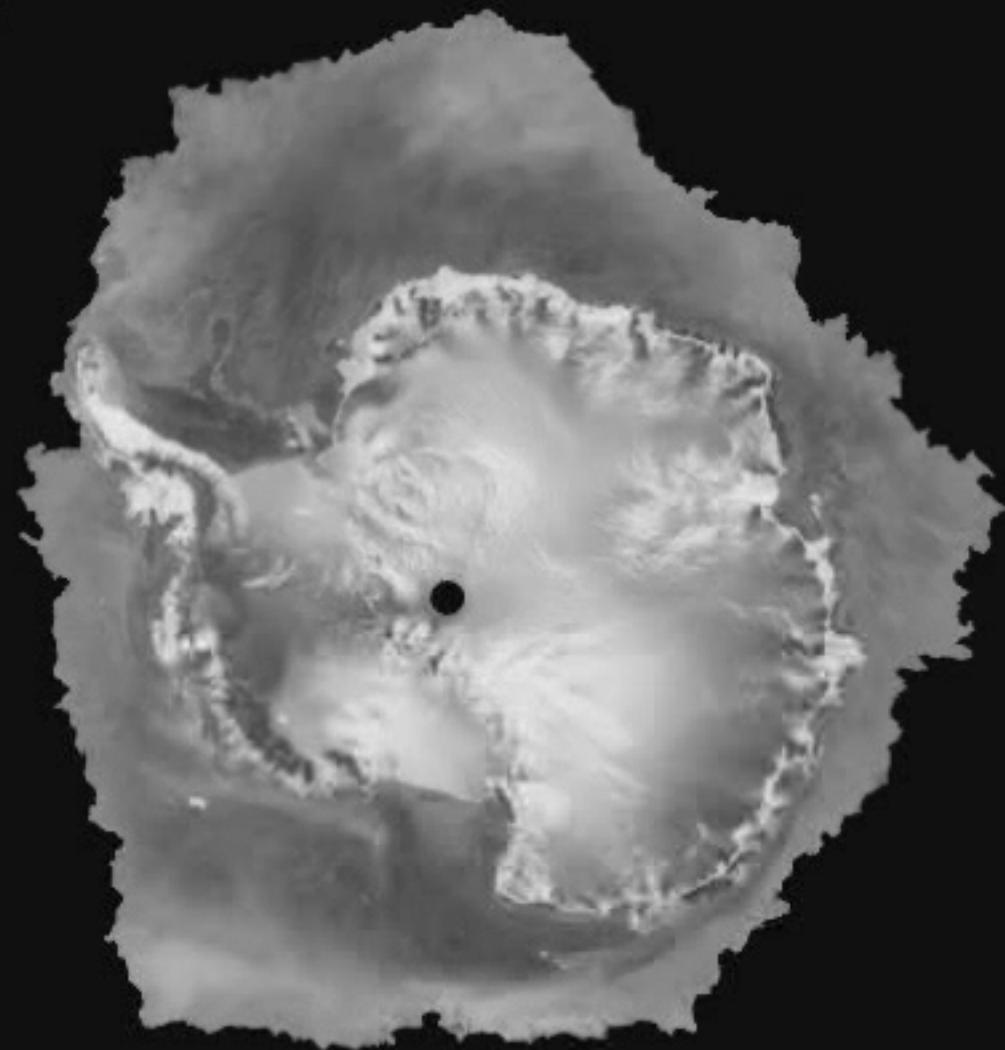


Sea Ice  
velocity  
as a  
consequence  
of the  
katabatic winds



BYU

v

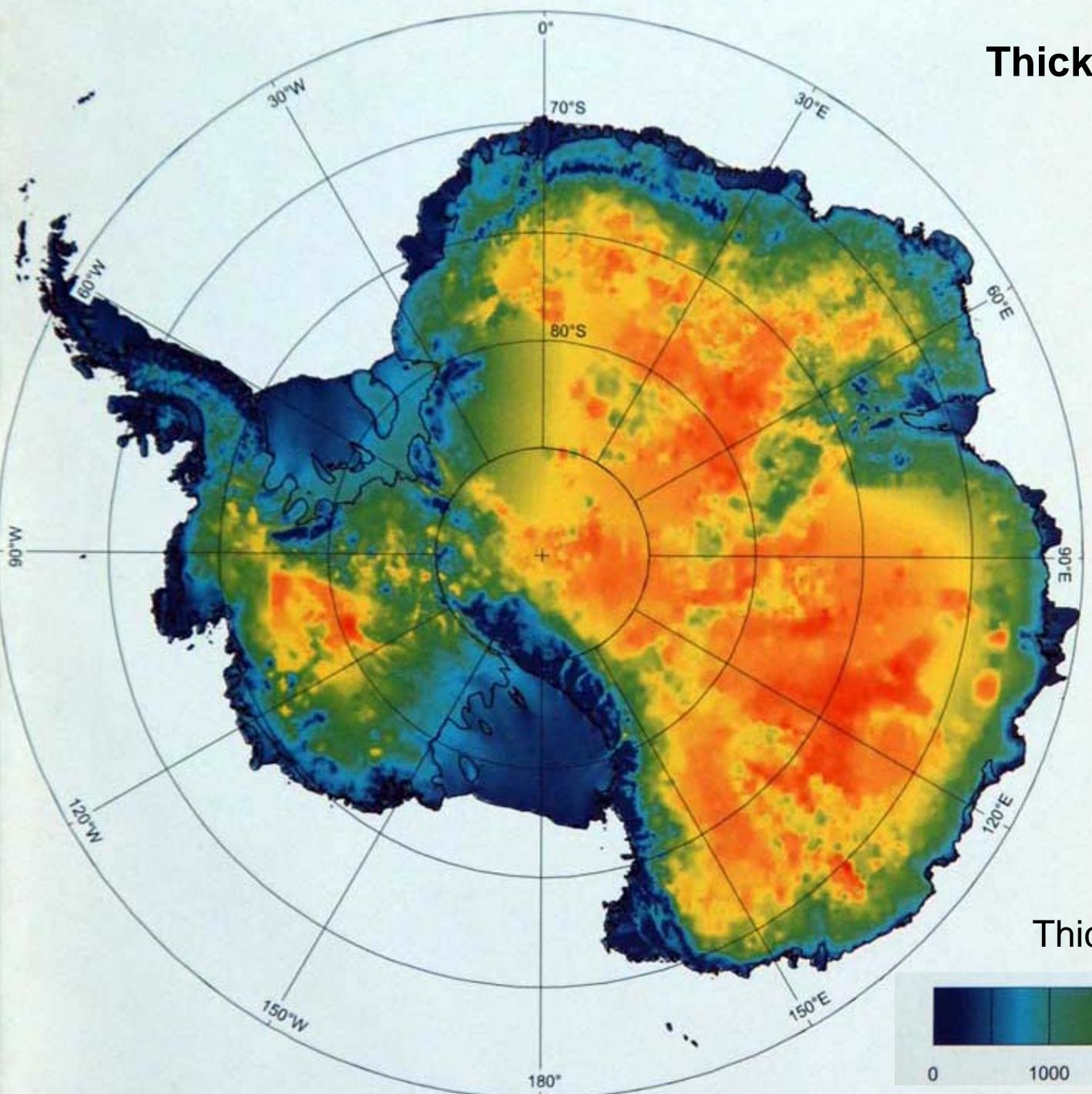


96

262

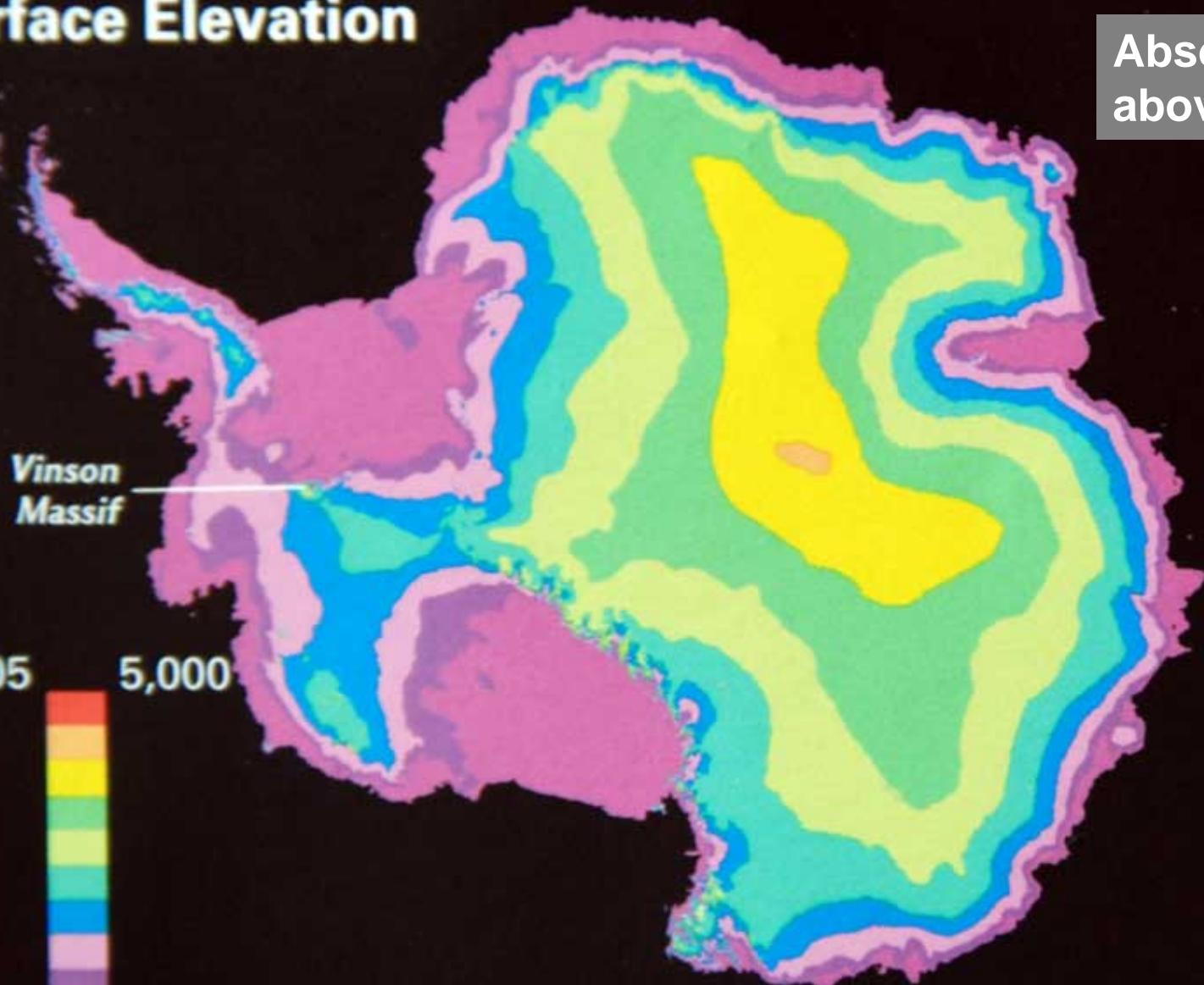


# Thickness of ice cap

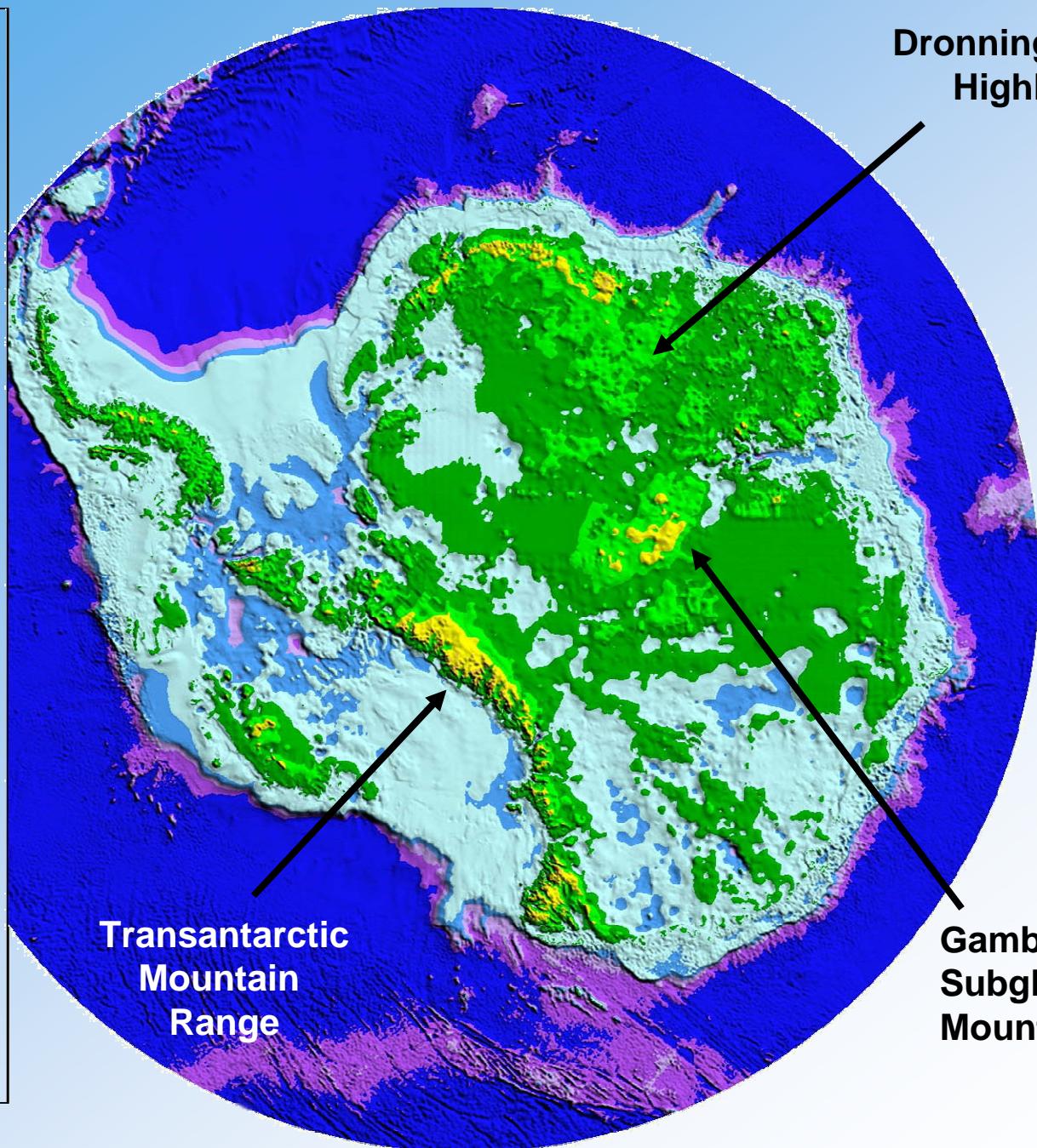
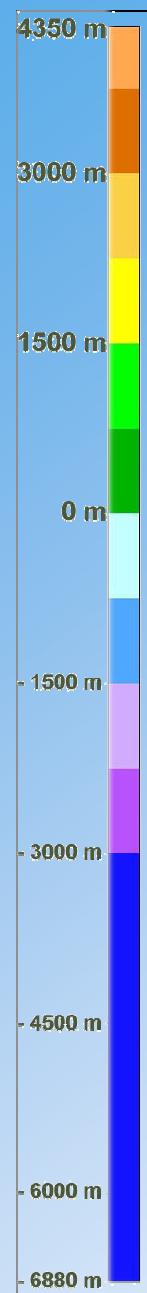


# Surface Elevation

Absolute height  
above sea level



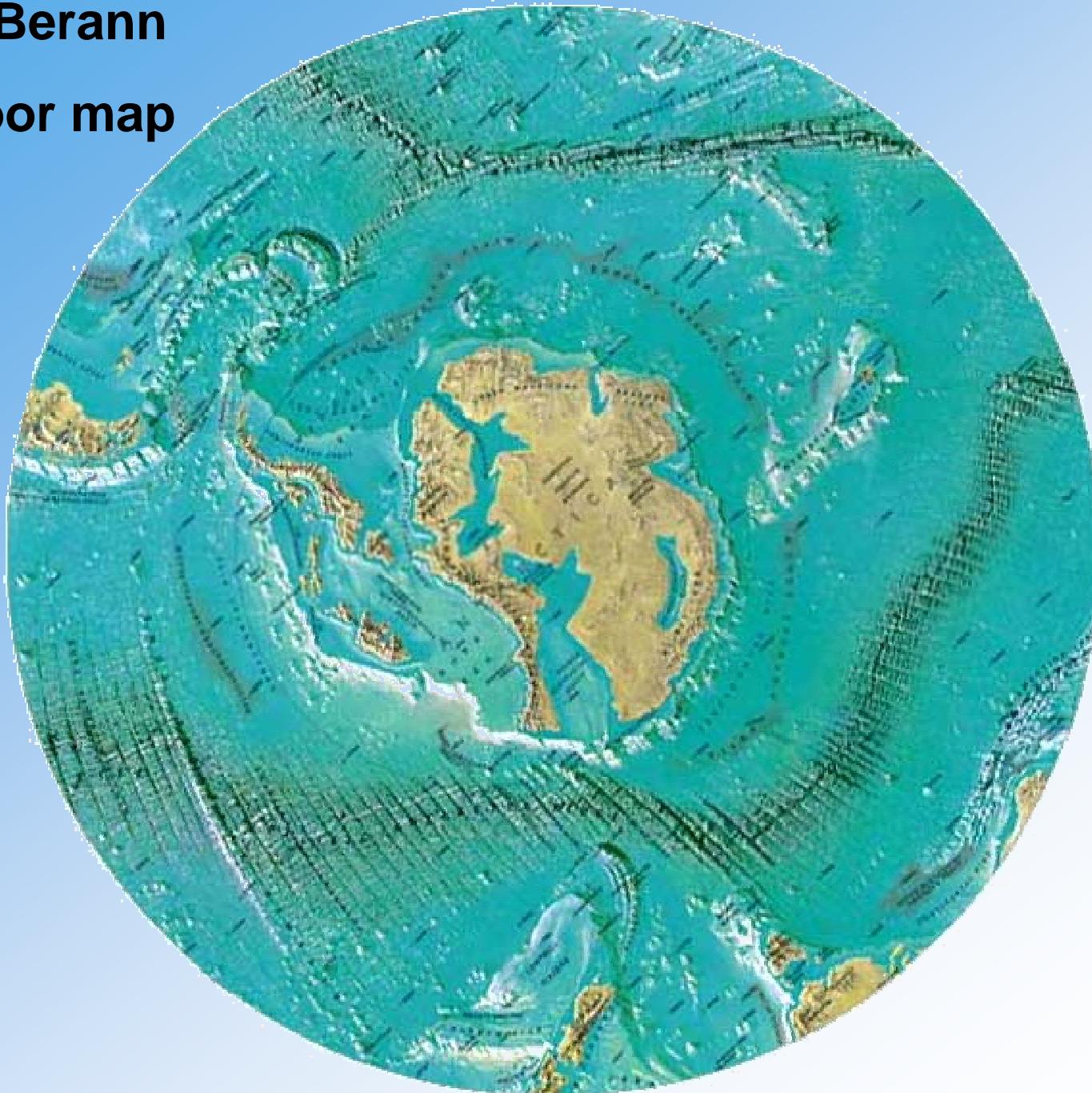
16,405  
feet  
0  
meters



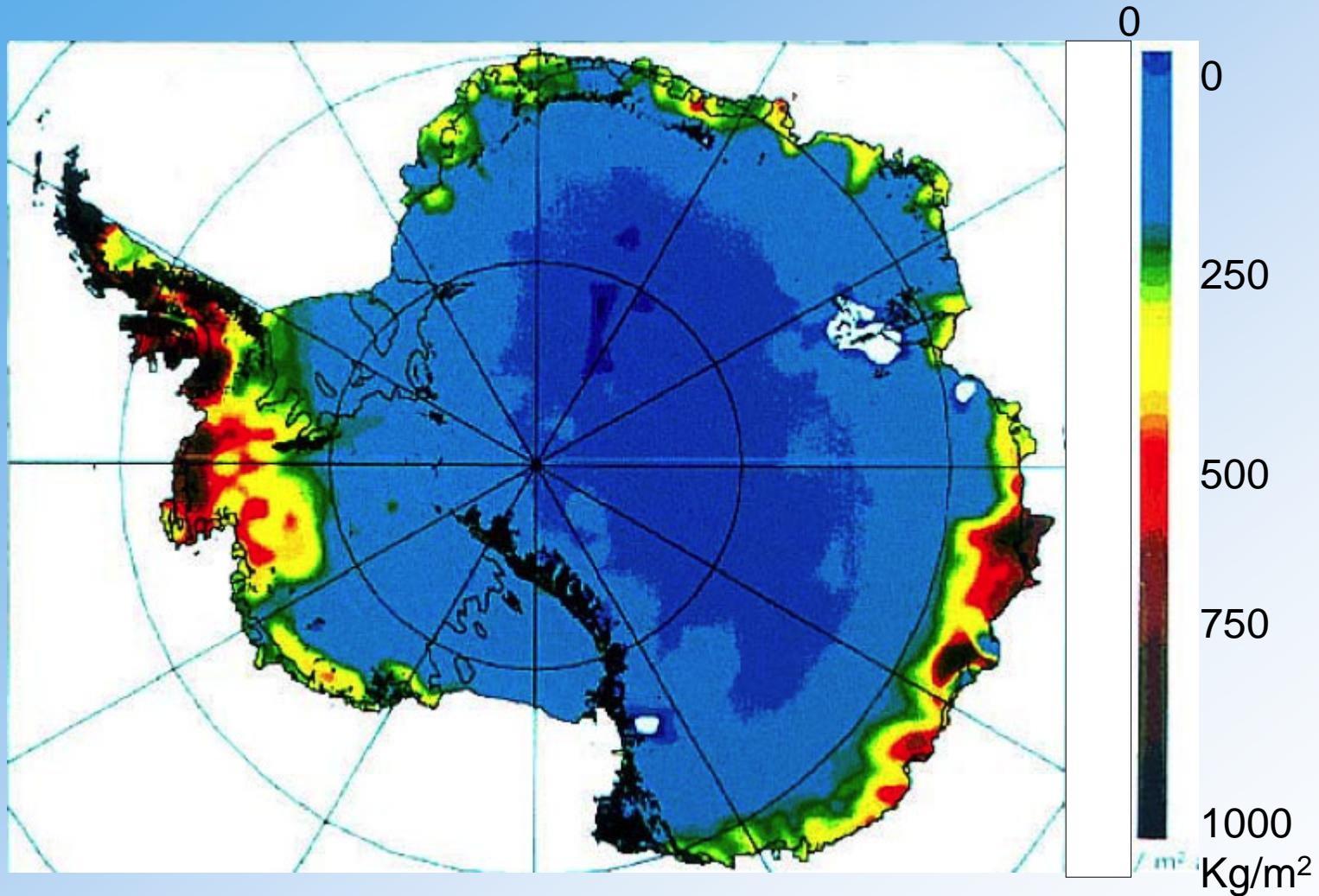
**Heinrich Berann**

**Ocean floor map**

**1966**

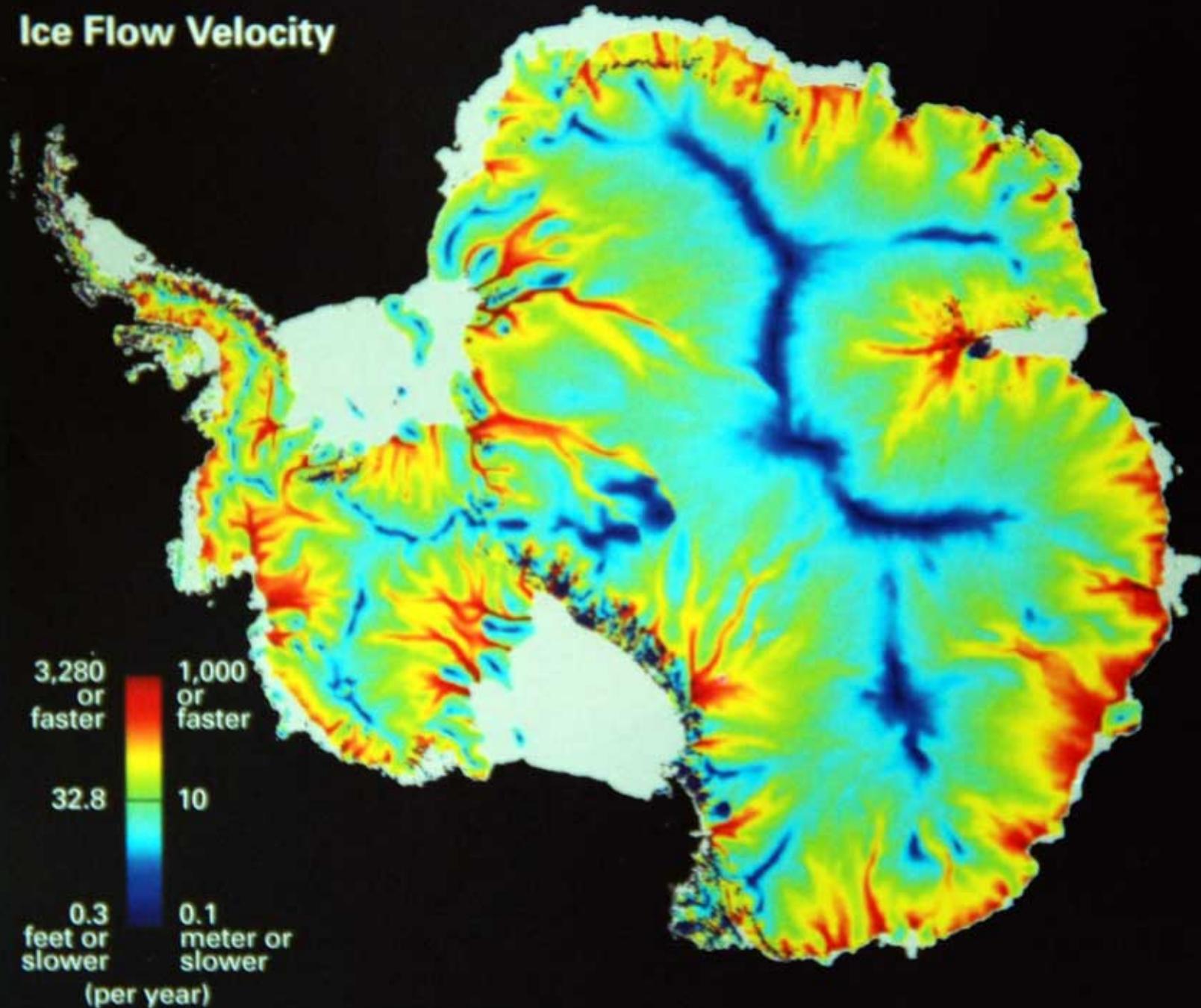


# Annually accumulated snow

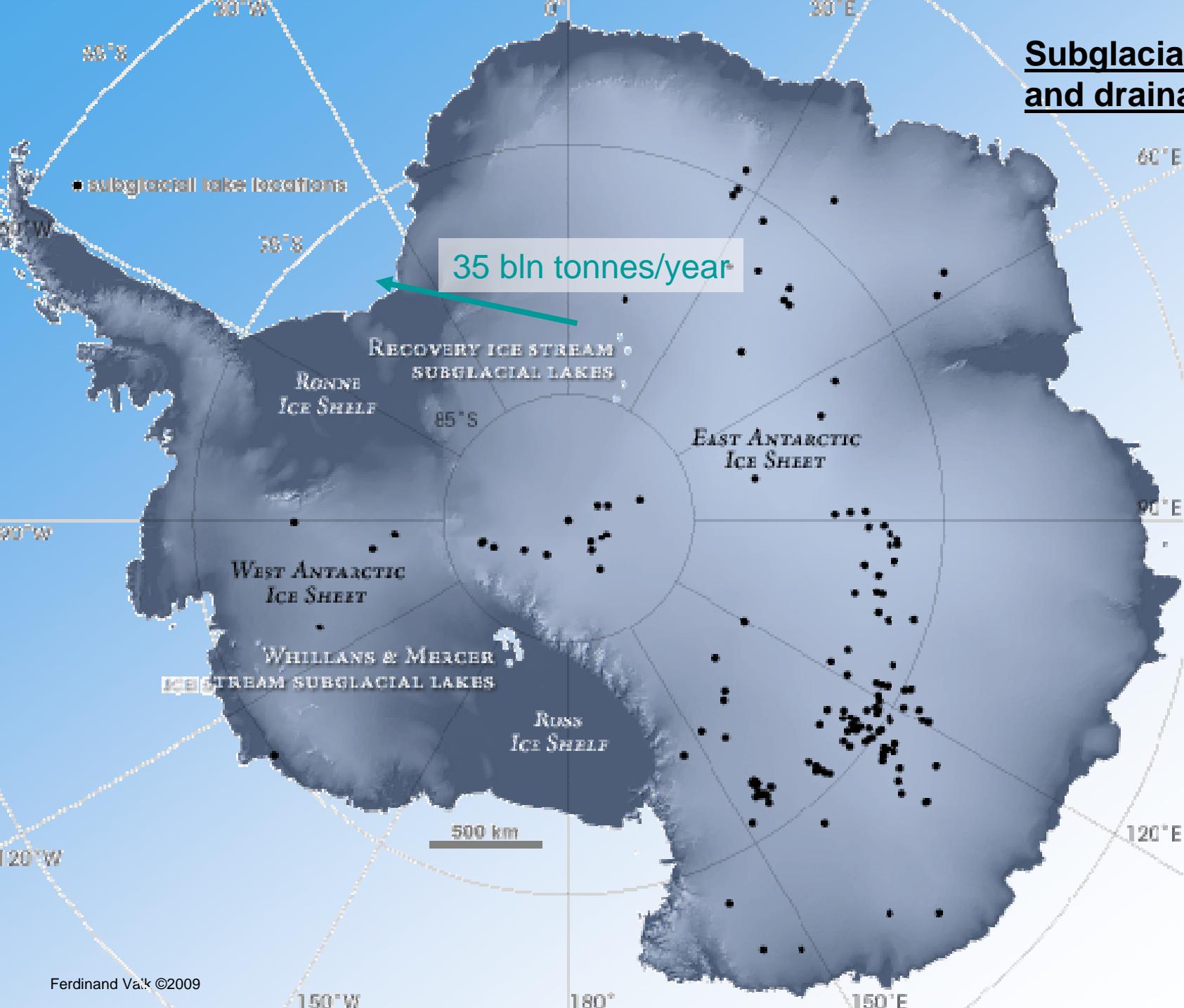


This is equivalent to 2 cm up to 2 meters of snow

# Ice Flow Velocity



## Subglacial lakes and drainage



# Antarctica and Climate Change

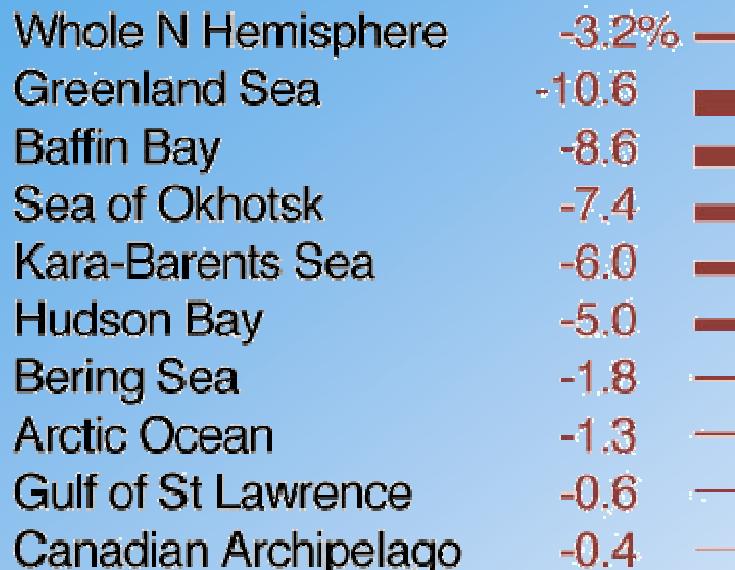
- Visible change
- Projected change

# Factors

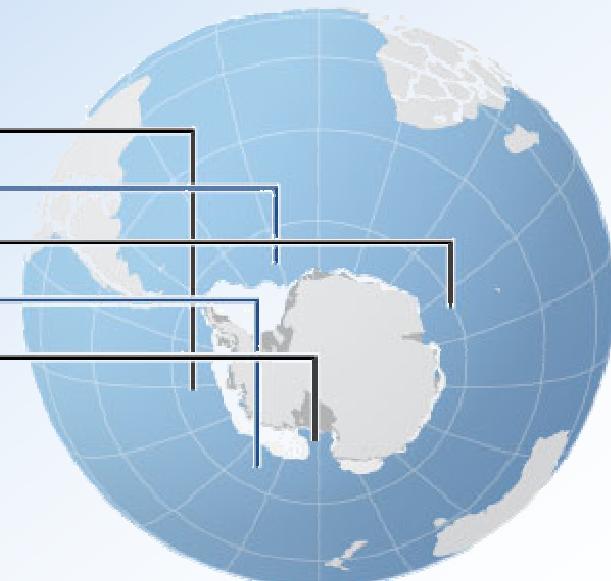
- Fresh snow/ice added/accumulated
- Drainage from glaciers
- Drainage from sub glacial lakes
- Summer melt
- Sublimation
- Breaking up of shelves
- Temperature ocean water
- Temperature air circulation
- Global sea level

# Change in annual mean sea ice extent since 1975

## Northern Hemisphere



## Southern Hemisphere

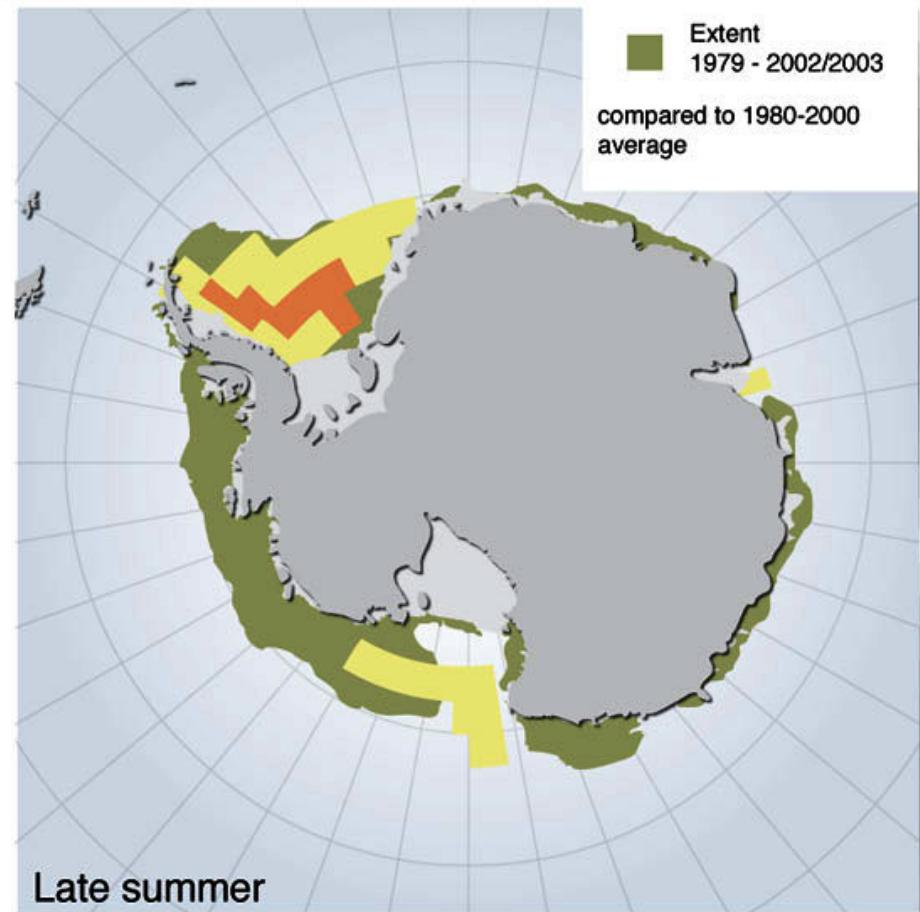
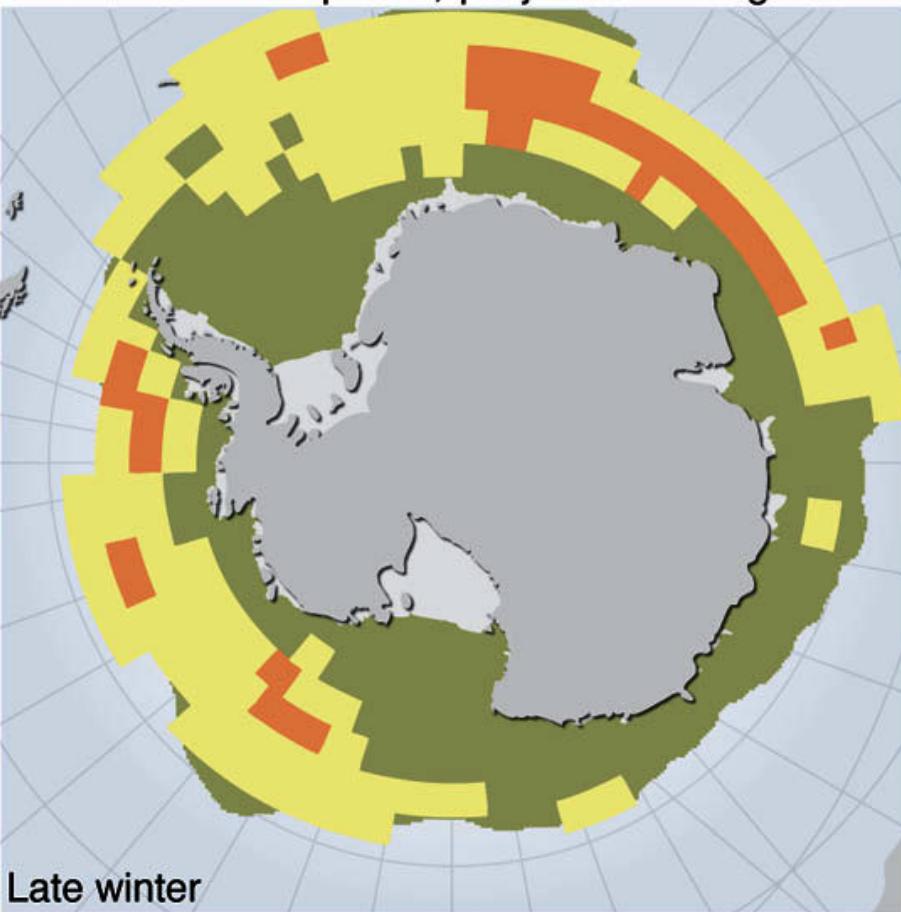


Change in annual mean sea ice  
extent (% per decade)

# Extrapolated decrease in sea ice extent

1980-2000 average compared to 2080-2100 average

Southern Hemisphere, projected changes in sea ice concentration 2080-2100



Decrease in sea ice concentration 2080-2100

■ 40% - 50%

■ 30% - 40%

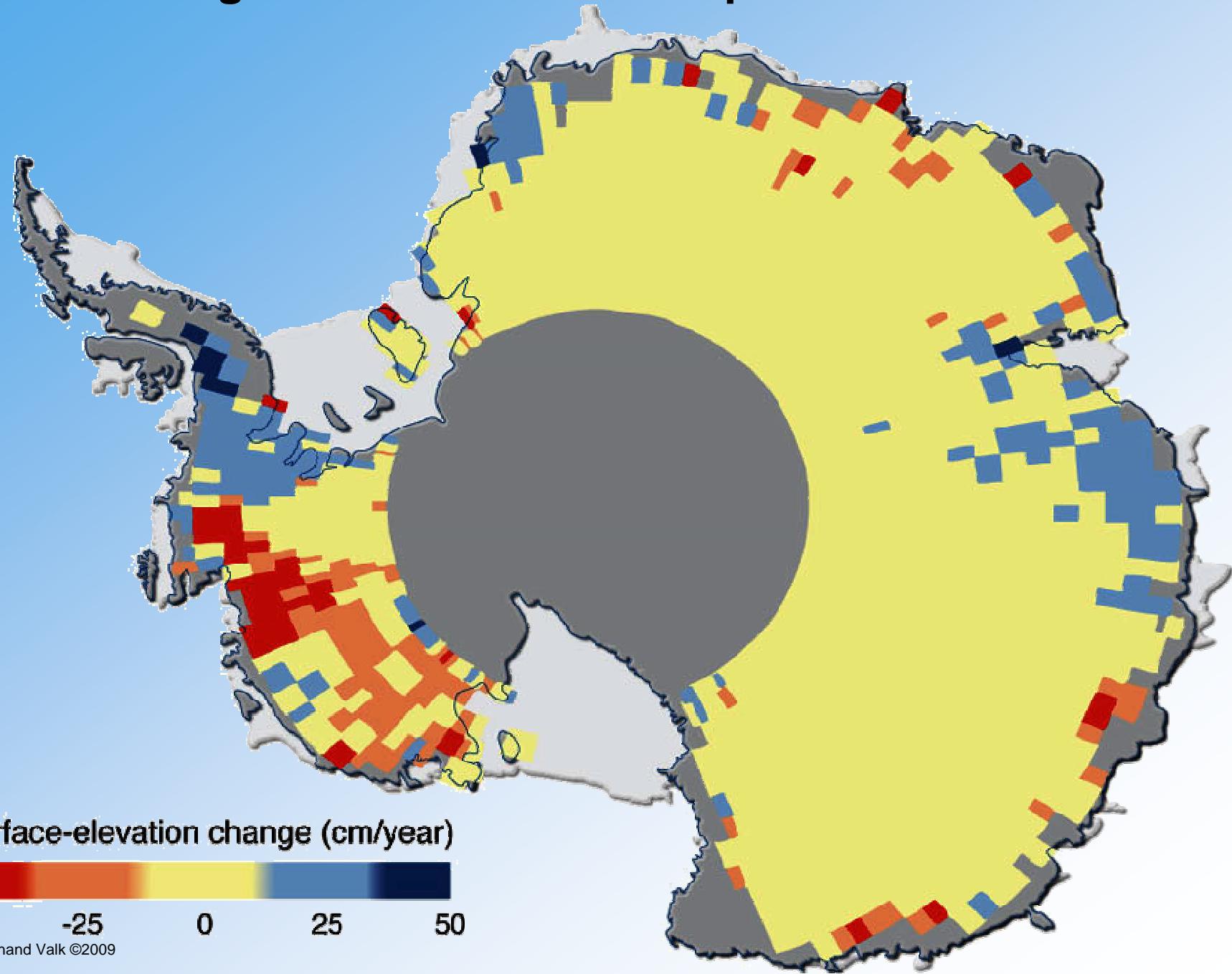
■ 20% - 30%

■ 10% - 20%

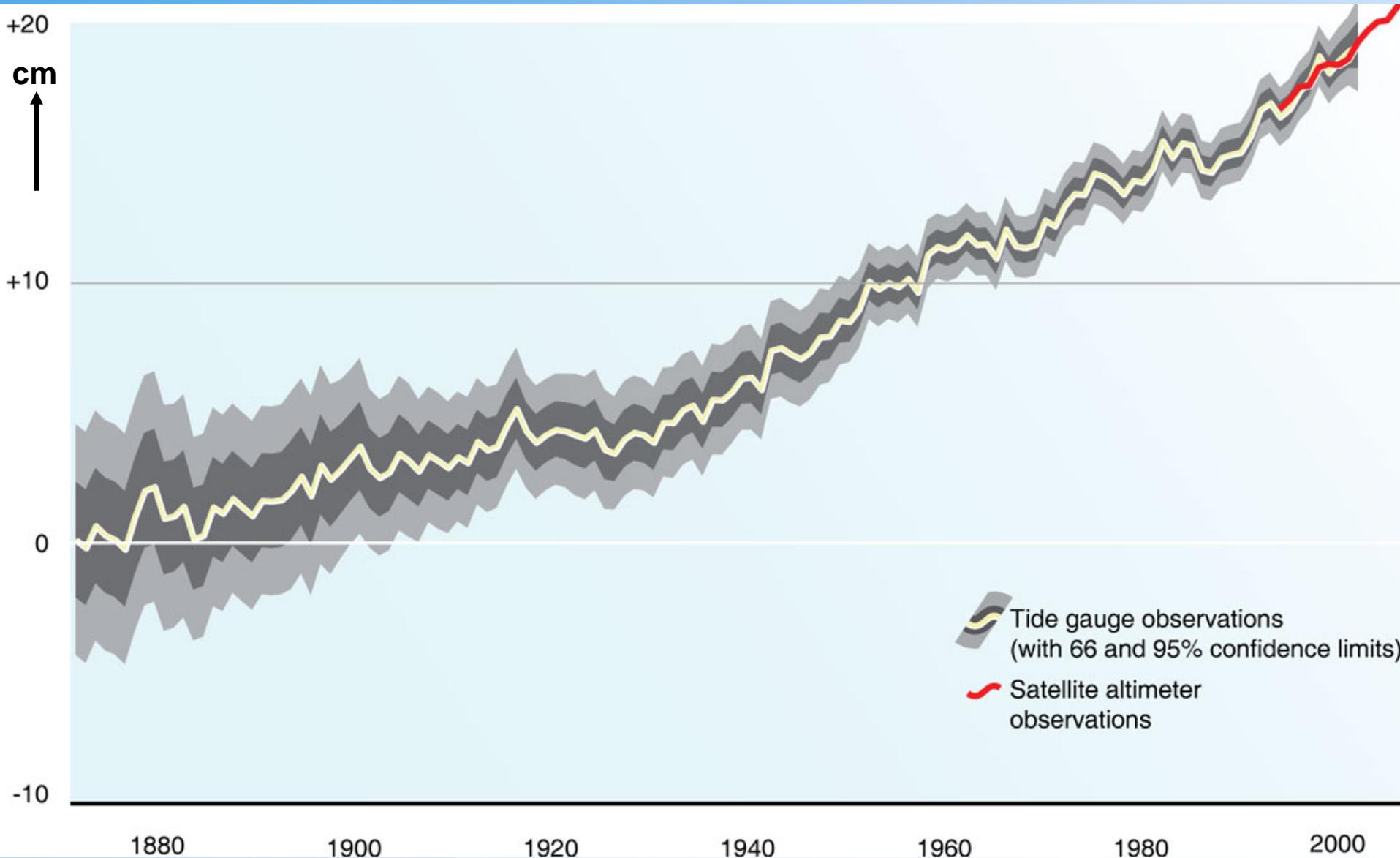
■ Extent  
1979 - 2002/2003

compared to 1980-2000 average

# Change in surface elevation period 1992 - 2004



# Global Mean Sea Level to-day



# Sea level rise: calculated vis-à-vis Measured

**Greenland Ice sheet**  
0.2 +/- 0.1 mm/yr

**Antarctic Ice sheet**  
0.2 +/- 0.4 mm/yr

**Glaciers/Ice caps**  
0.8 +/- 0.2 mm/yr

**Thermal expansion  
of Ocean**  
1.6 +/- 0.5 mm/yr

**Estimated contributions  
to Sea Level Rise**  
**2.83 mm/yr**



**Satellite and tide  
Gauge observations**  
3.1 +/- 0.7 mm per year

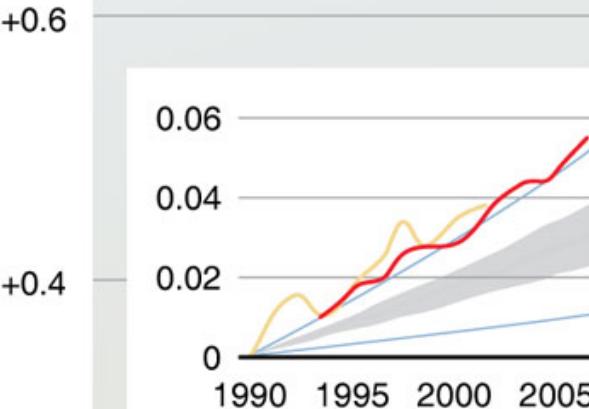
**Observed Sea Level Rise**  
**3.1 mm/yr**

# Global Mean Sea Level model projections

Sea-level  
rise (m)

IPCC AR4  
(90% confidence limits)

+0.8  
 IPCC 2001 Third Assessment  
Report projections



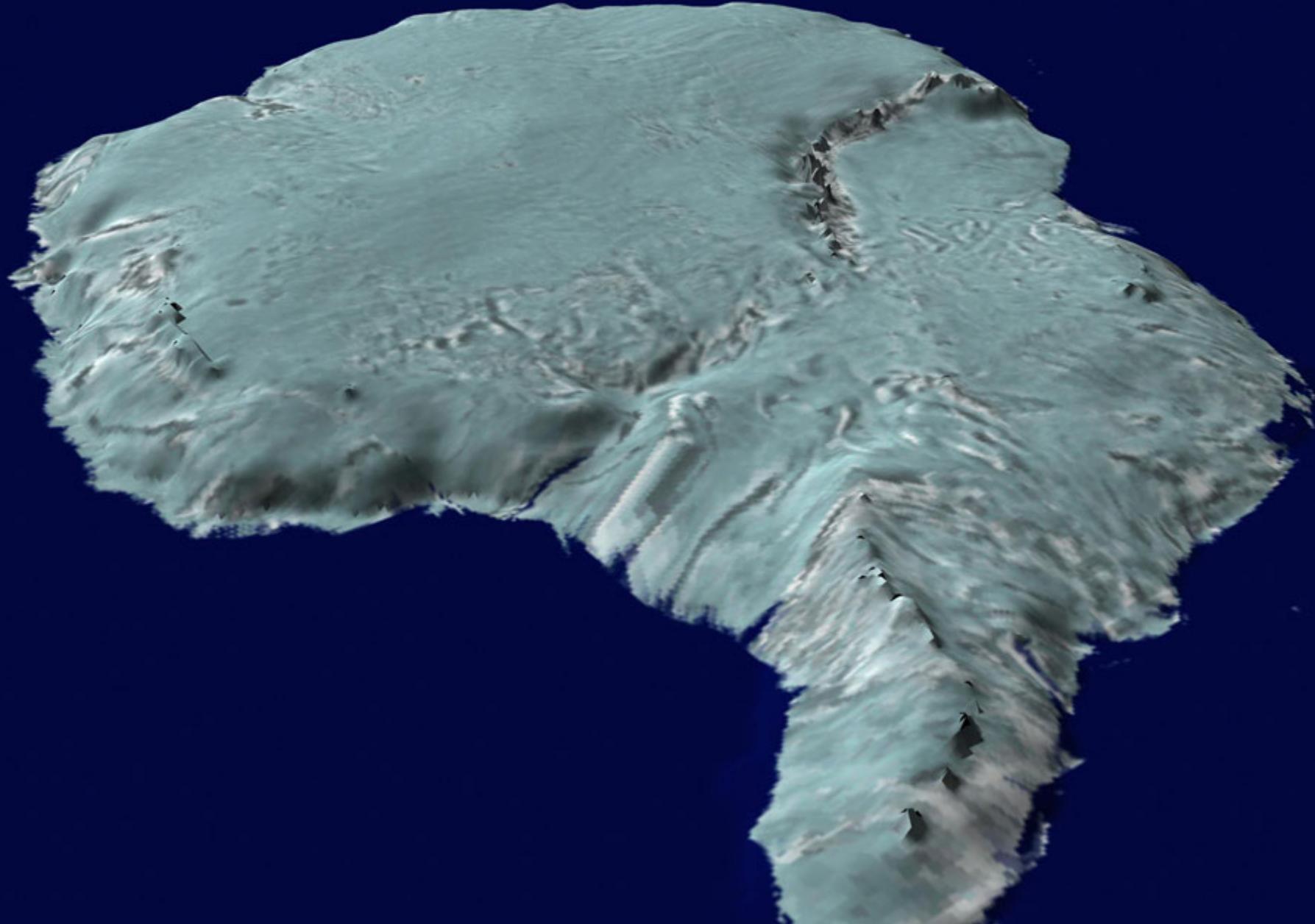
0.06  
0.04  
0.02  
0  
1990 1995 2000 2005  
Tide gauge  
observations  
Satellite  
observations  
IPCC TAR  
projections

model projections,  
including Ice sheet  
dynamic processes

model  
projec-  
tions

1990 2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100

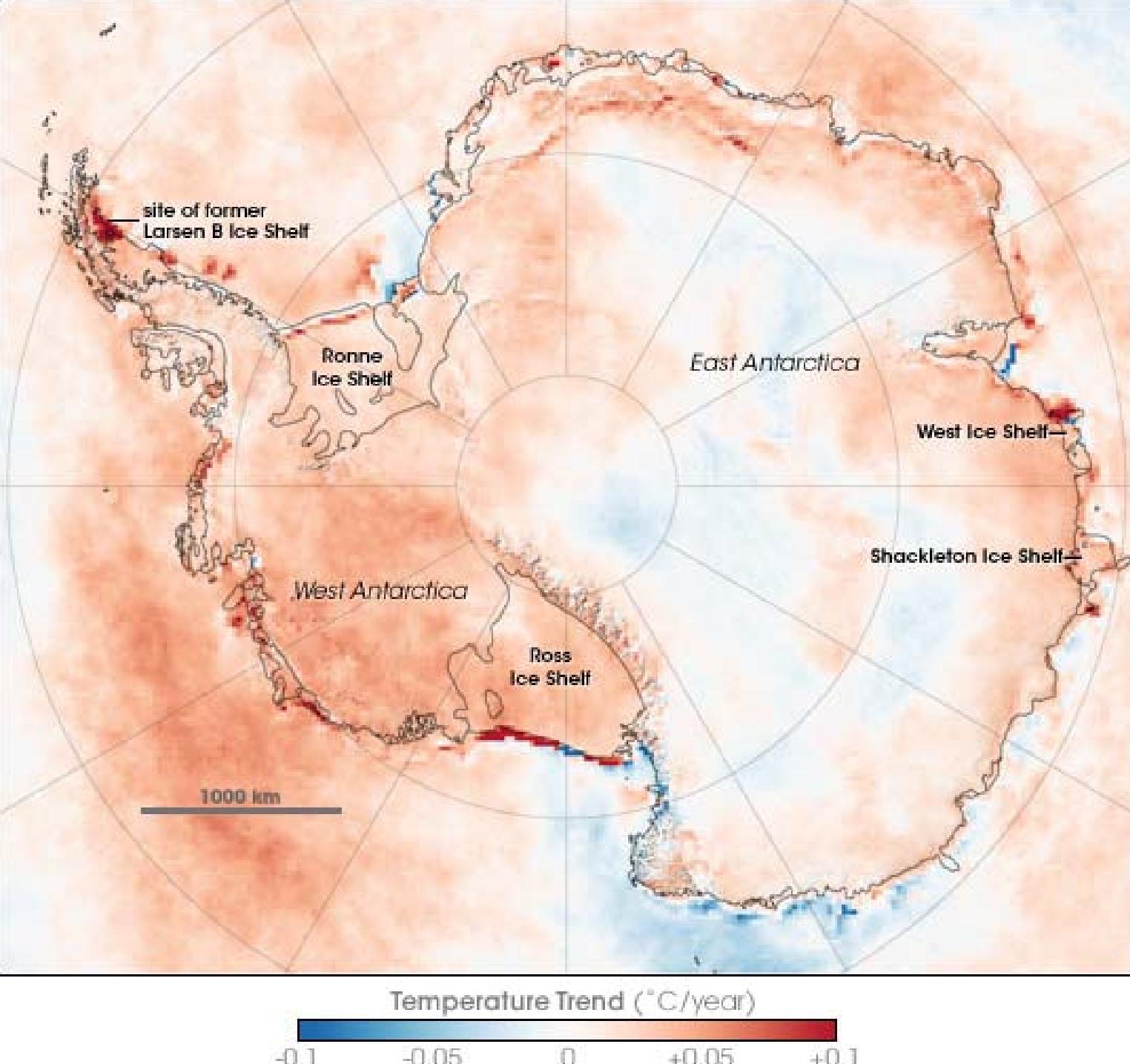
# Ice cover 20,000 years ago



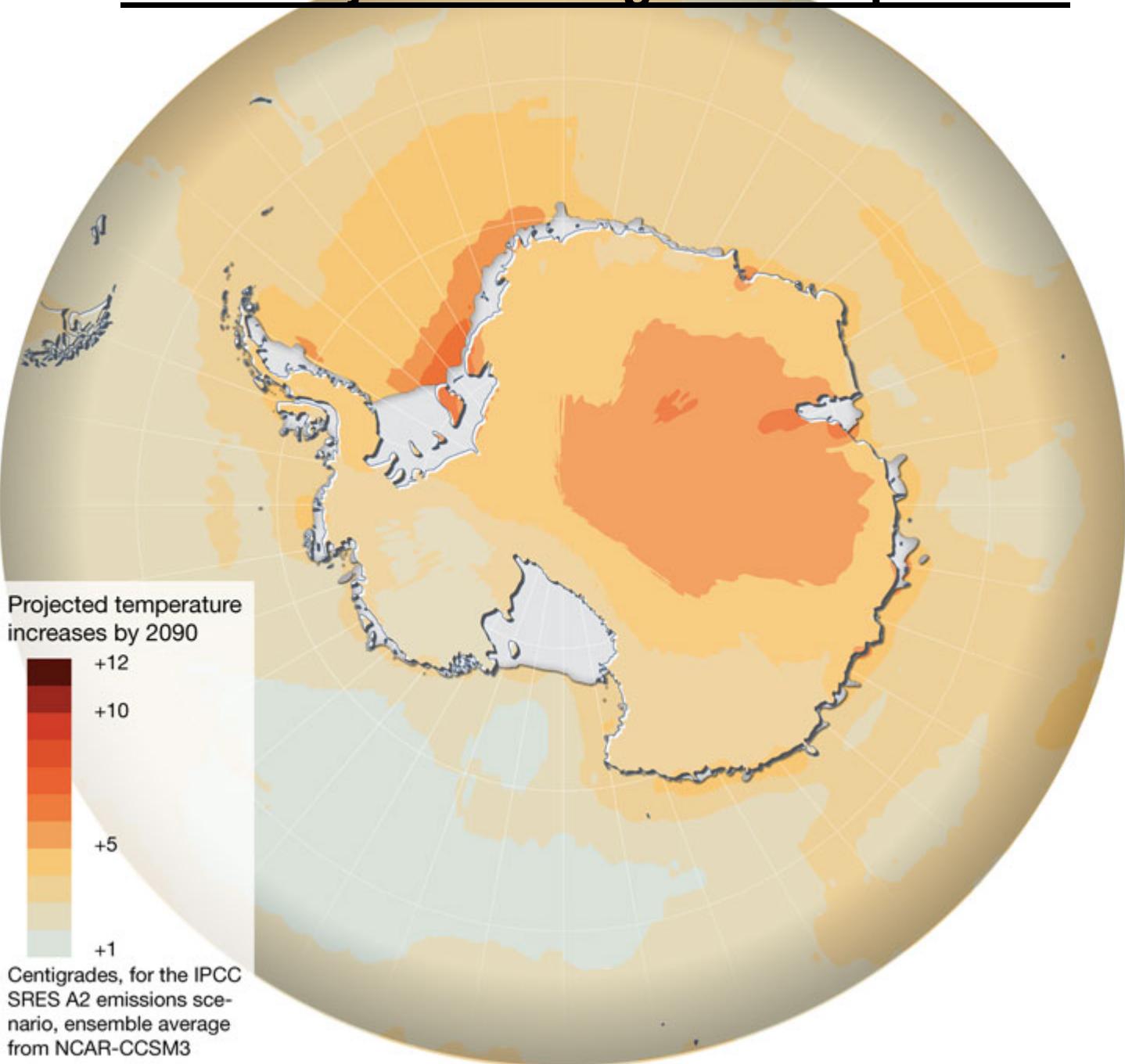
# Ice cover today



**Warming /  
Cooling  
Antarctica  
Period  
1981 - 2007**



# 2090: Projected changes in temperature

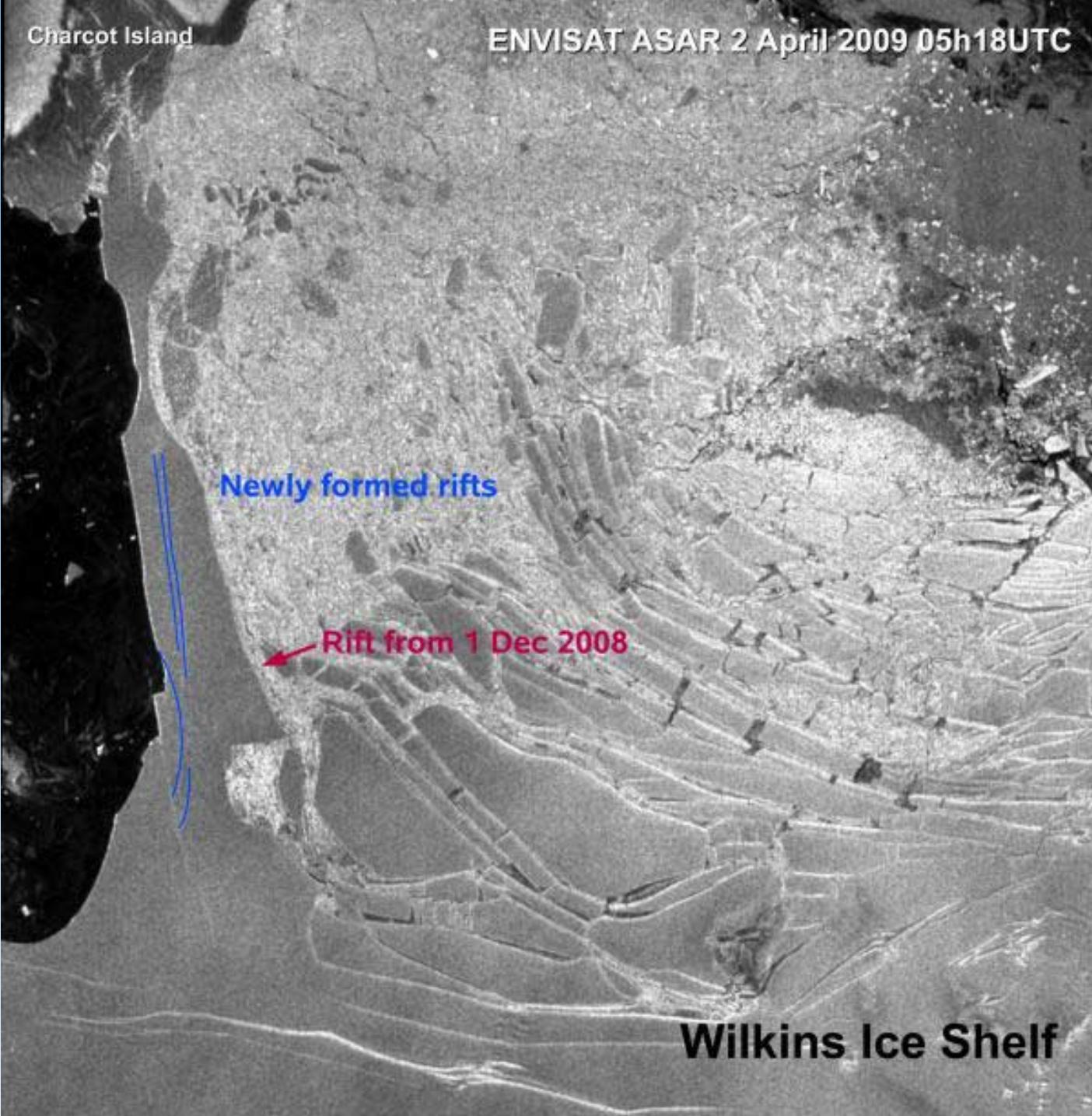


# Wilkins Shelf 2008



# Wilkins Shelf

## April 2, 2009

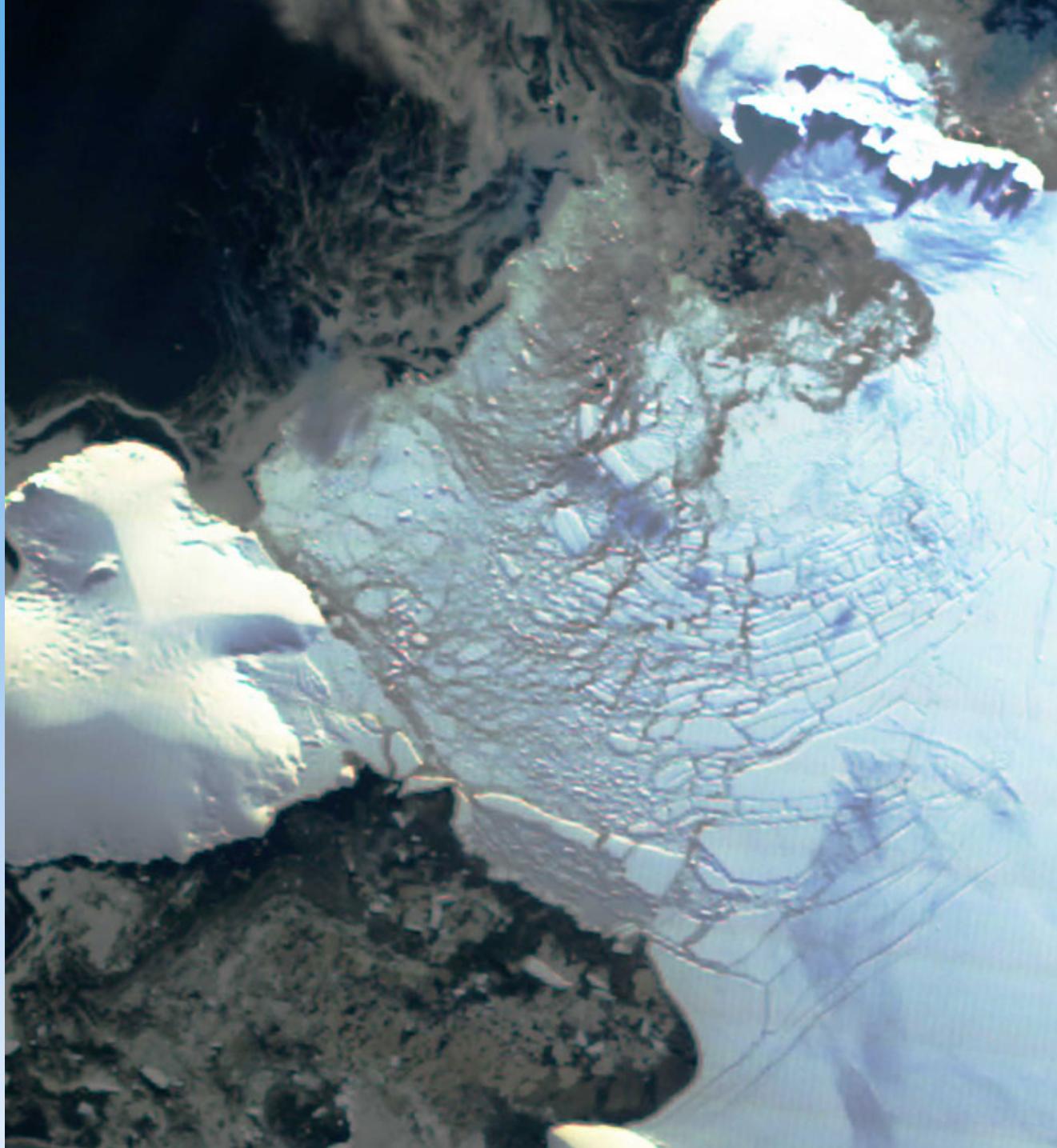


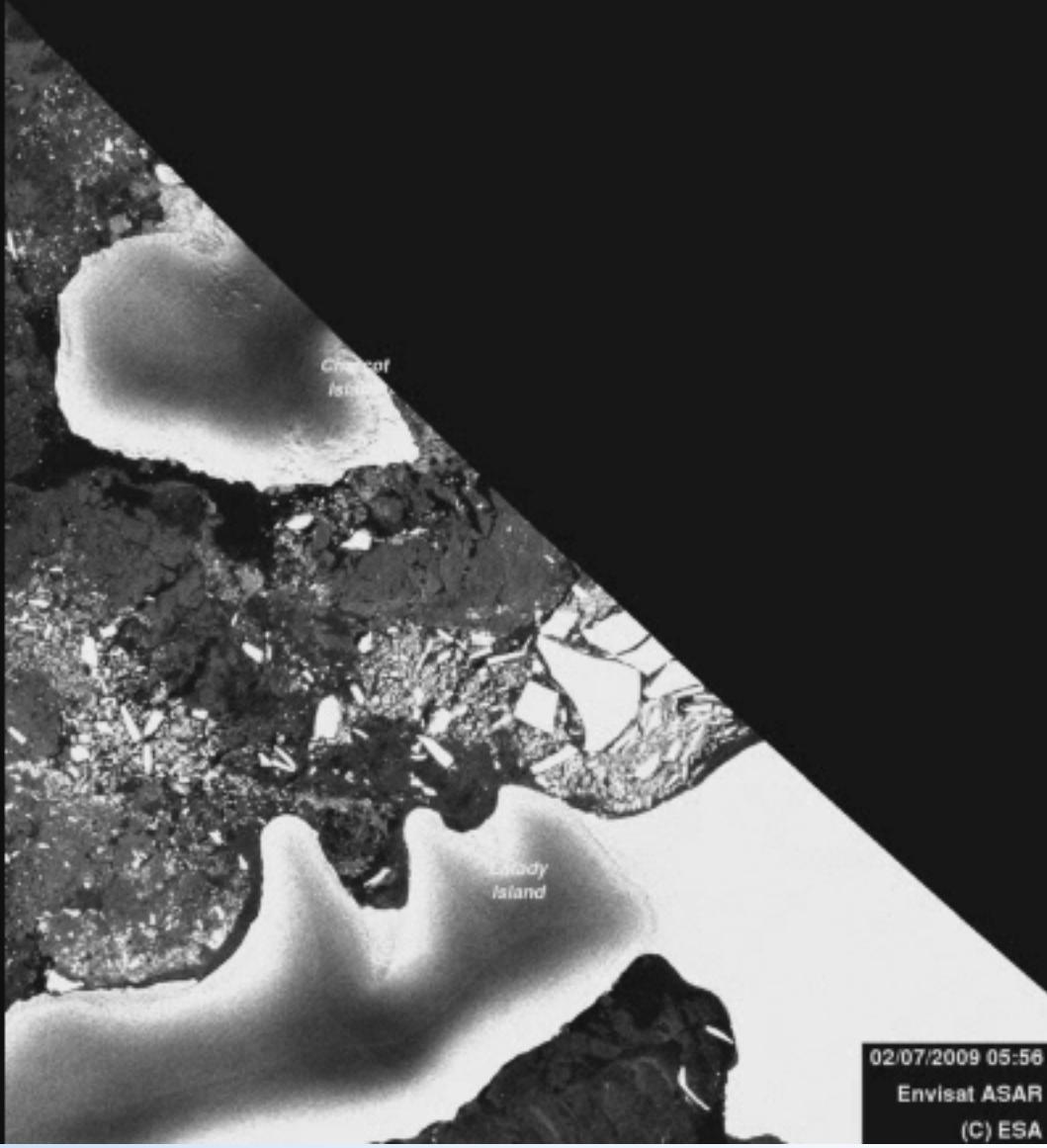
**Wilkins Ice Shelf**

# Wilkins Shelf

## Image date

### 10 April 2009





02/07/2009 05:56  
Envisat ASAR  
(C) ESA

## Envisat animation 3-5 July 2009

# Antarctica:



## Impression of a visit





Ushuaia









SkyEye USB  
APT receiver

Green  
White  
Red  
Black  
screen  
Antenna



NOAA Satellite Receiver  
Interface Unit  
**USB**

<http://www.xaxero.com/skyeye.htm>  
+64 9 412 7580

Model USB 2.2 Ser# 7235

**USB port Computer**

# SkyEye Antenna



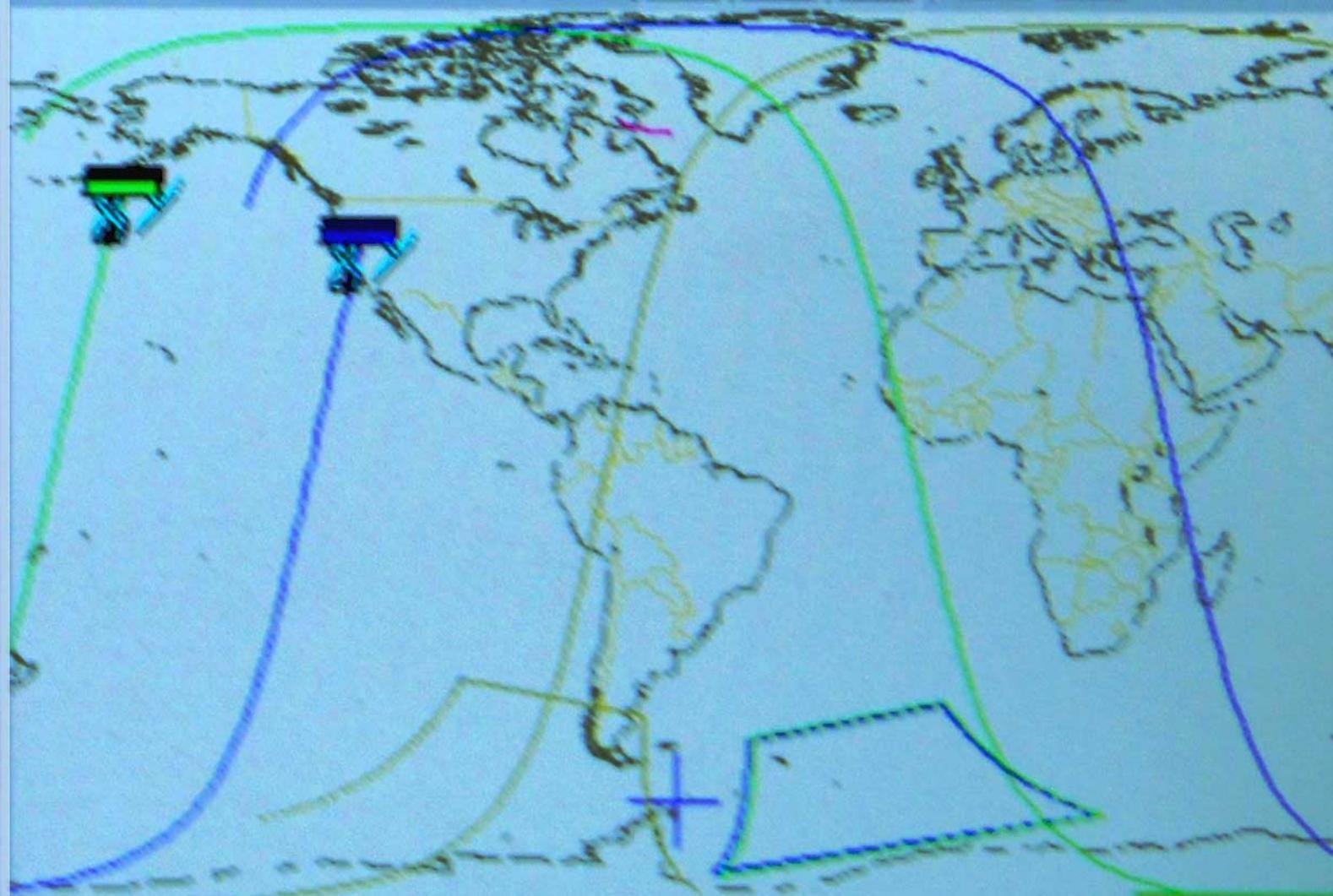


APT terminal at the Bridge

# SkyEye Tracker 8.37 SER. 007166 Next picture at 14:...



File View Capture Satellite Help



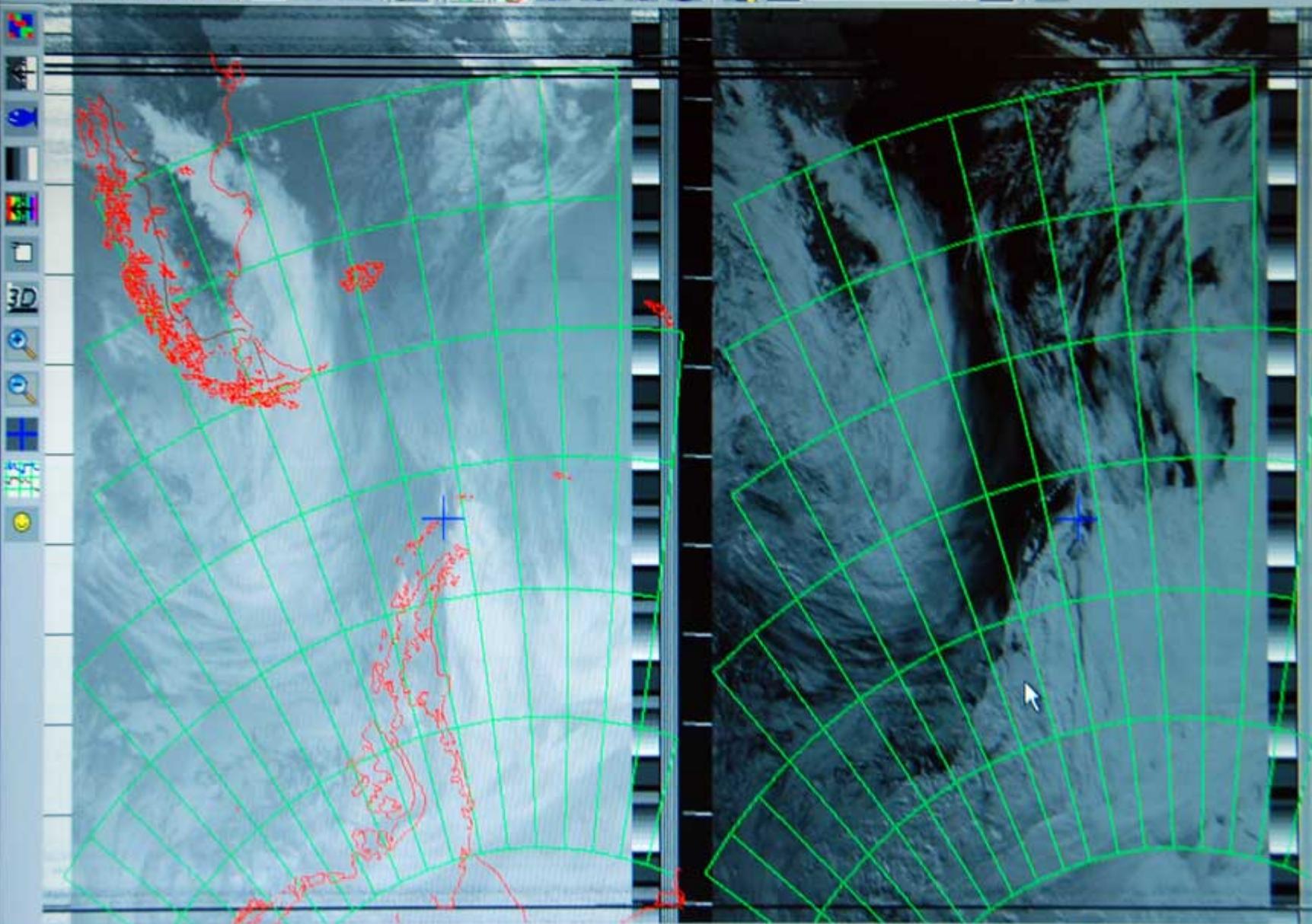
Pass has ended -- Waiting

13:15:54

DUB 8.35

401.225

File View Edit Image Channel Configuration Window Help



















КАПИТАН ХЛЕБНИКОВ

FESCO

КАПИТАН ХЛЕБНИКОВ



























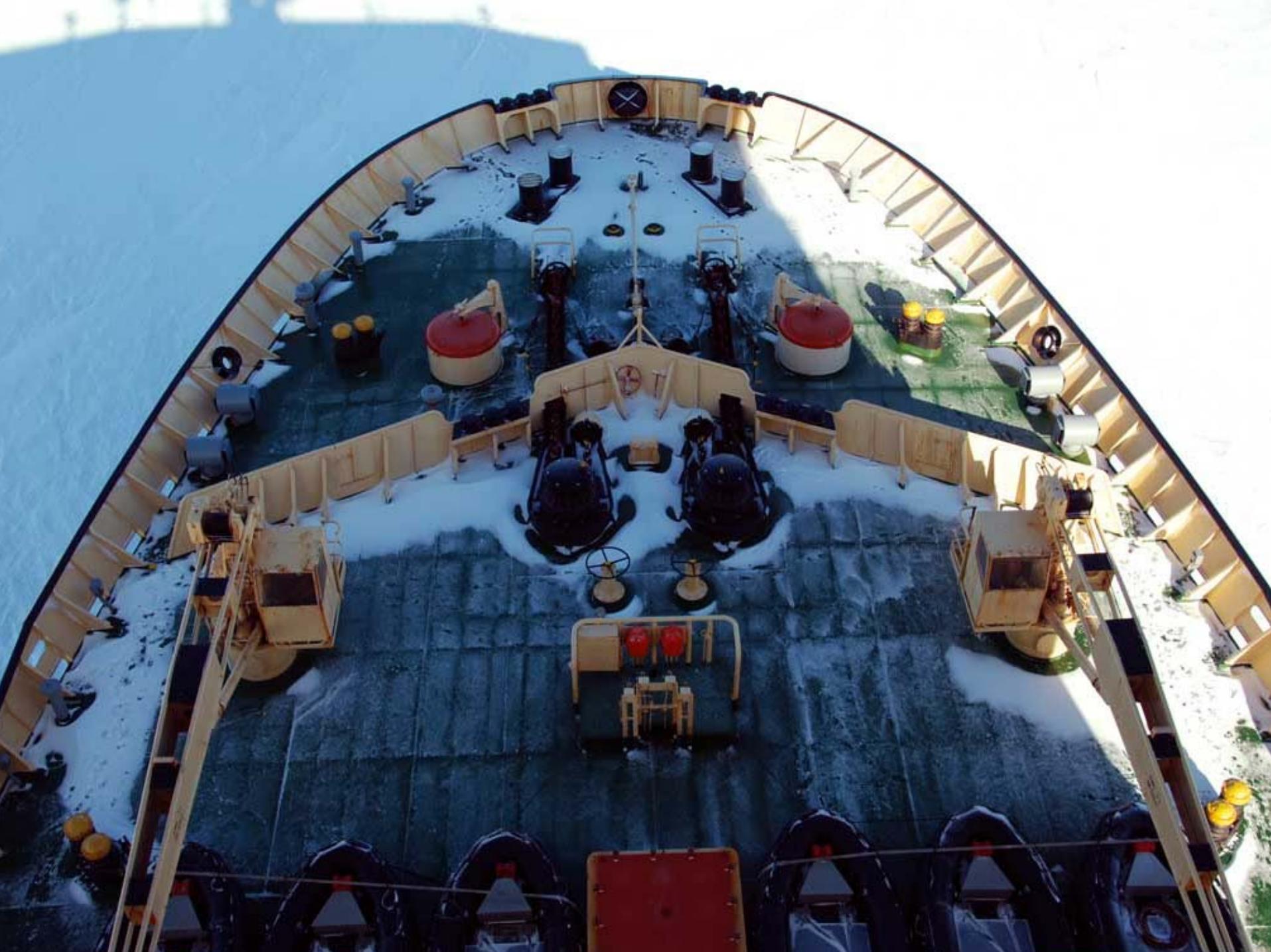


































































УСТИНОВ































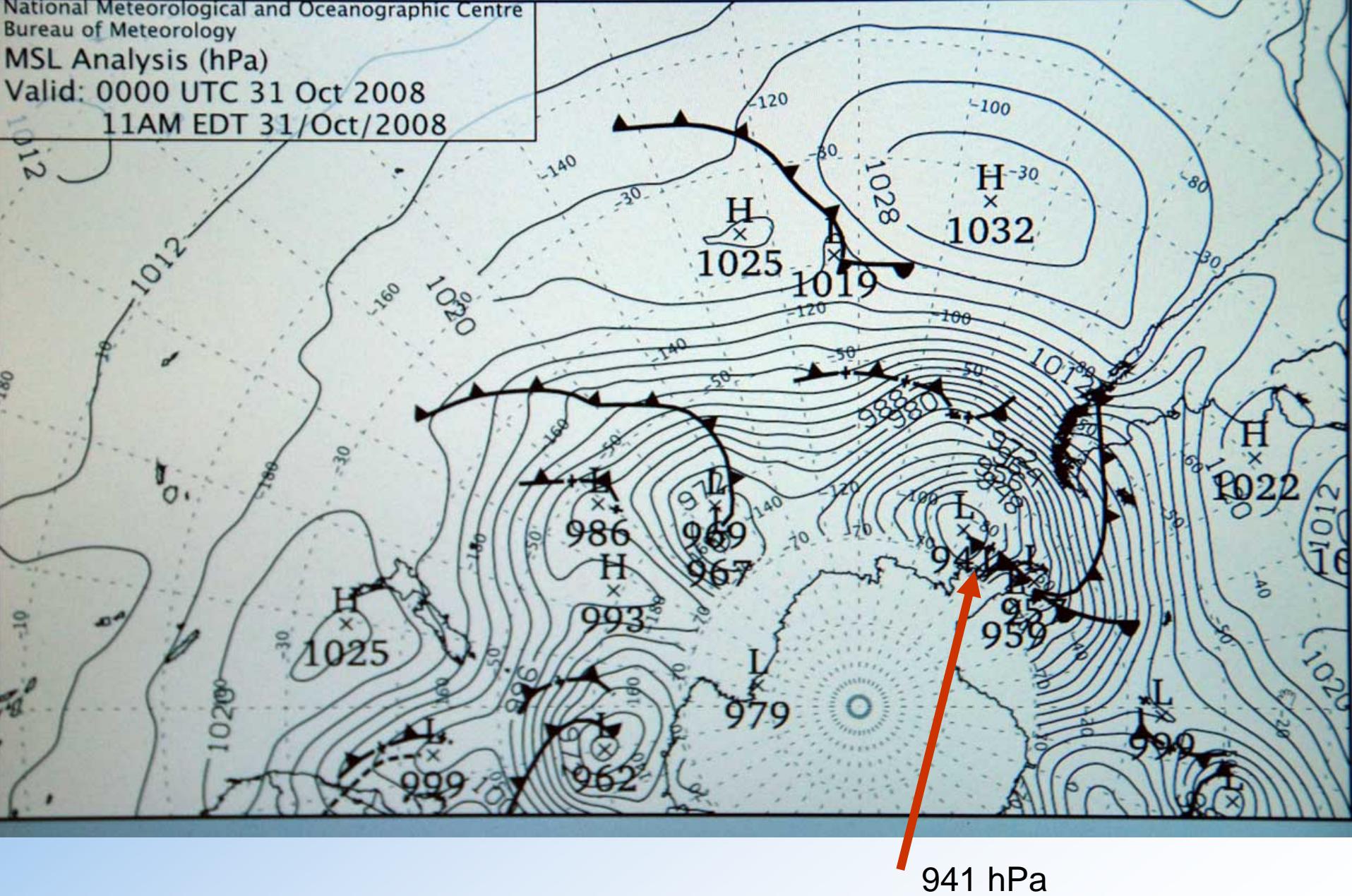






Ferdinand Valk ©2009

Valid: 0000 UTC 31 Oct 2008  
11AM EDT 31/Oct/2008



941 hPa











# Thanks