

Climate Change

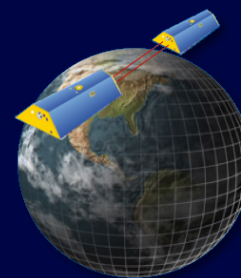
Jianli Chen

(陈剑利)

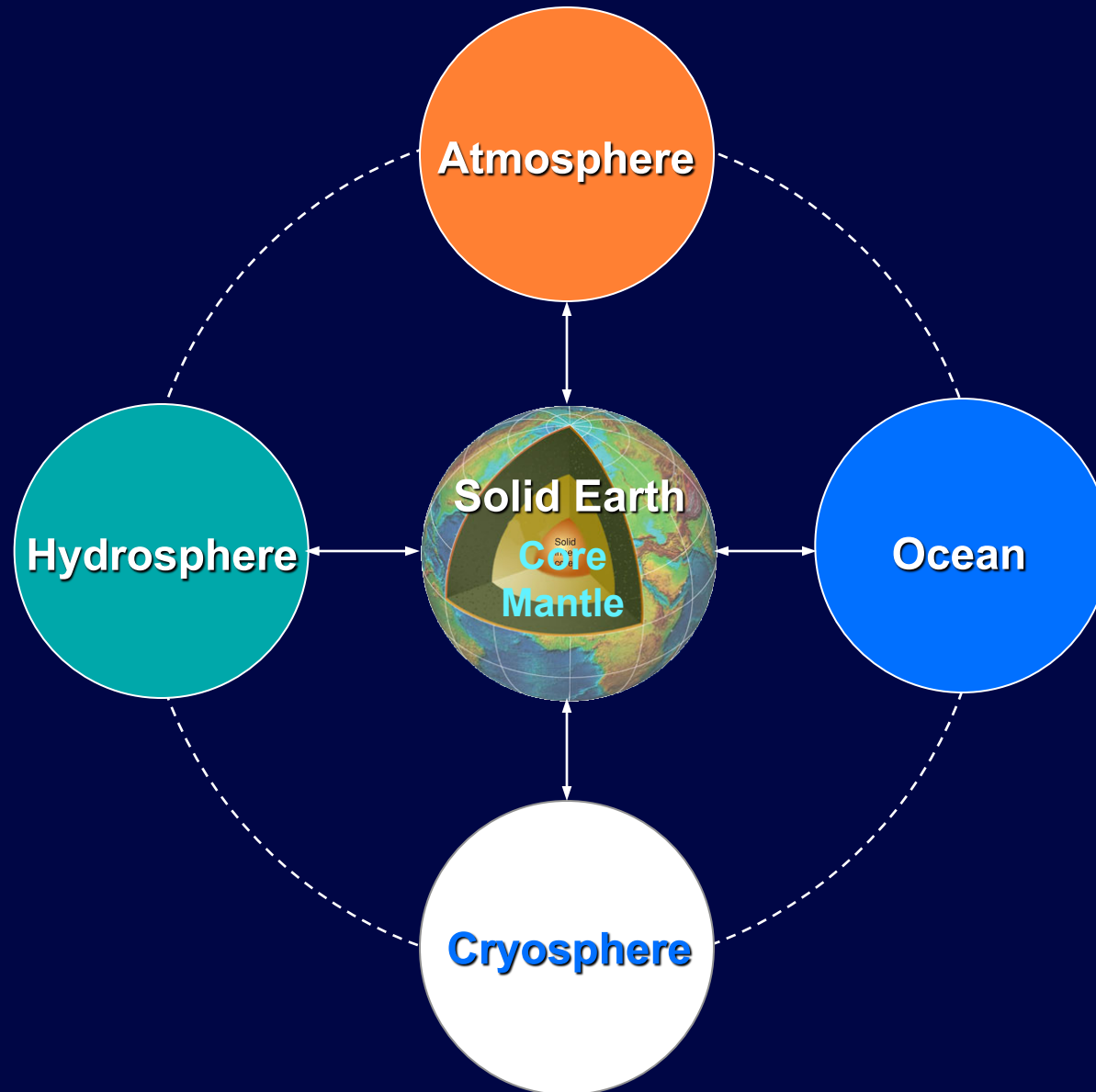
Ph.D., Senior Research Scientist

Center for Space Research, University of Texas at Austin

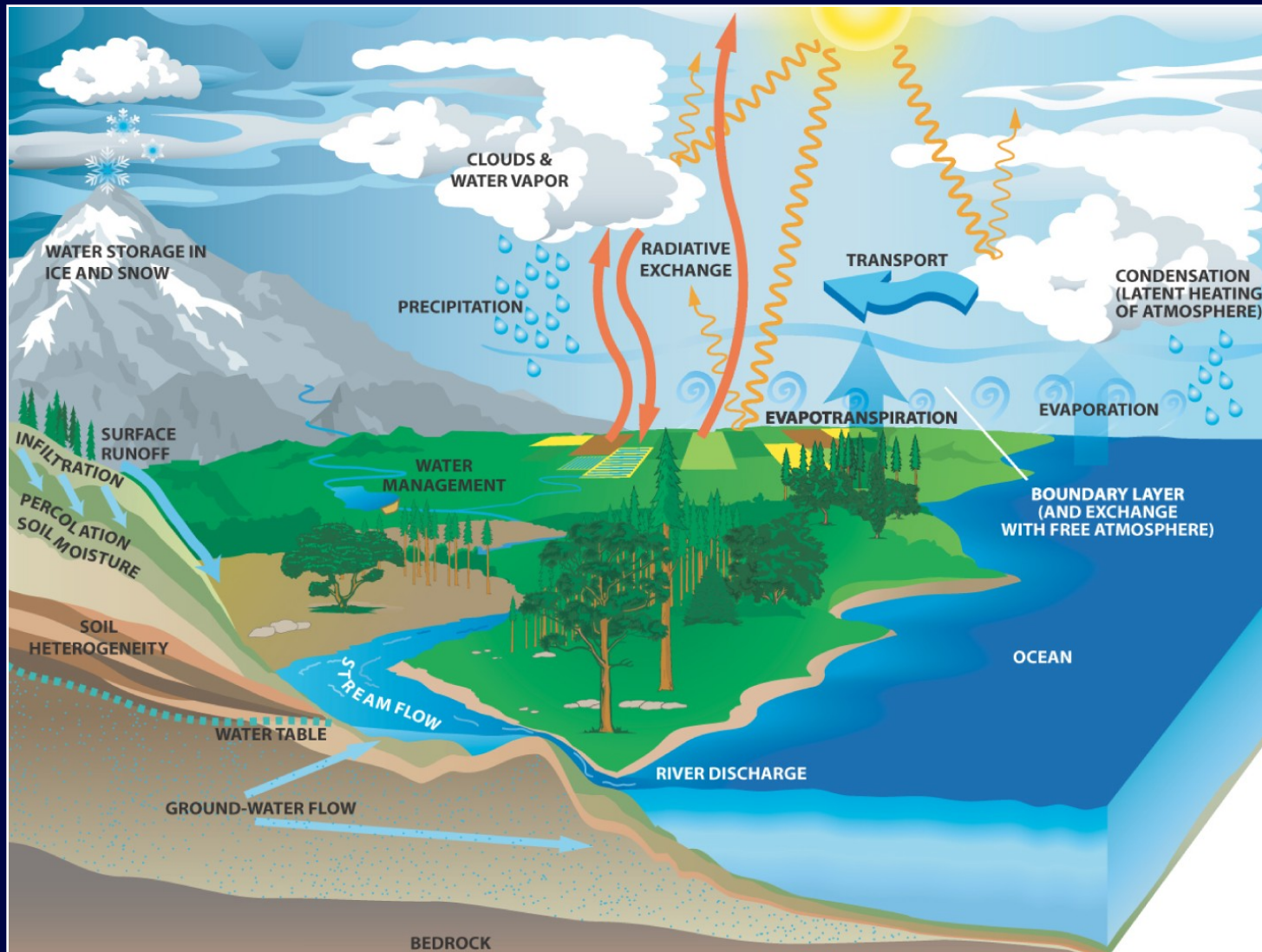
上海天文台天文空间技术应用及全球变化实验室



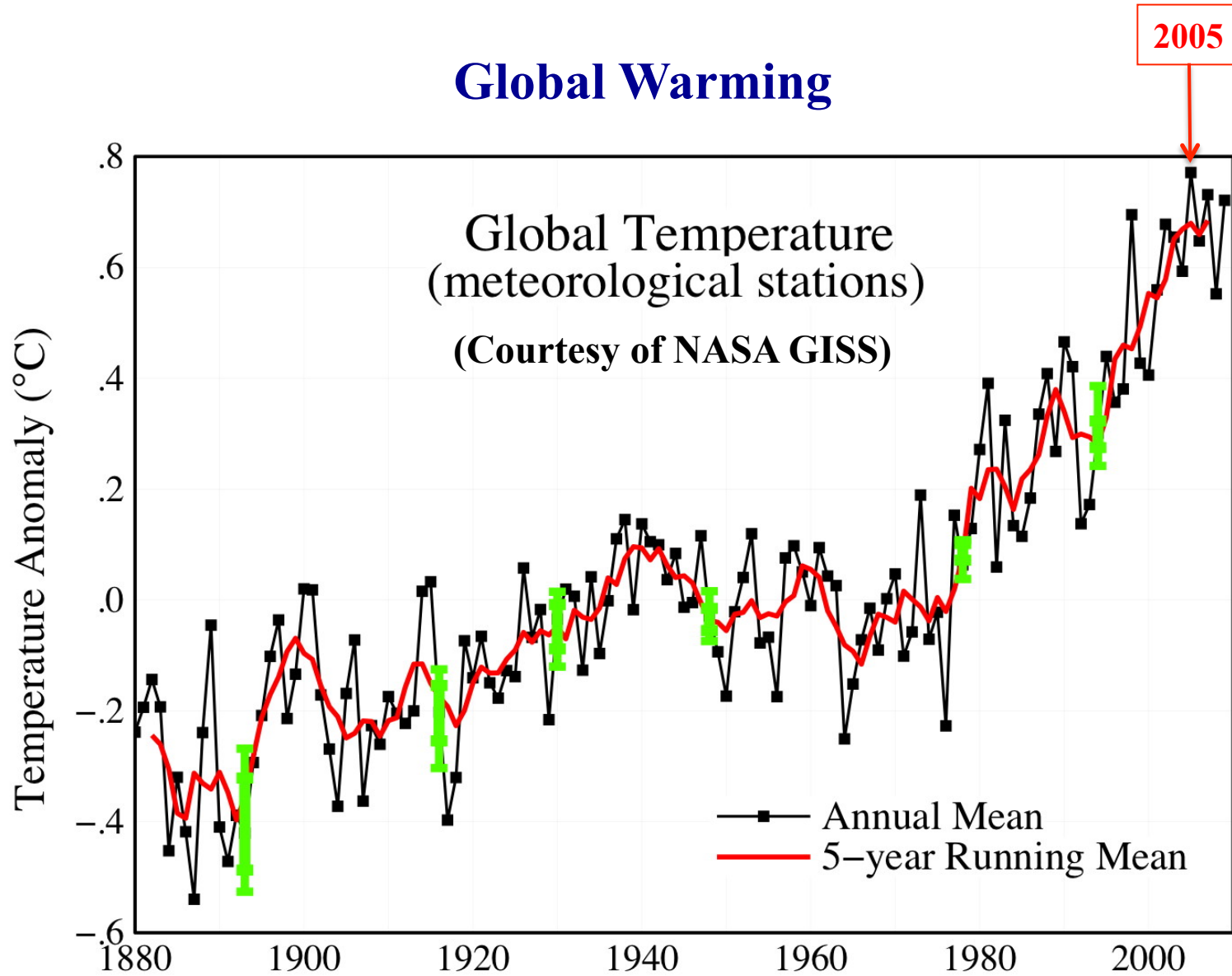
The Earth System



Climate System and Global Water Cycle



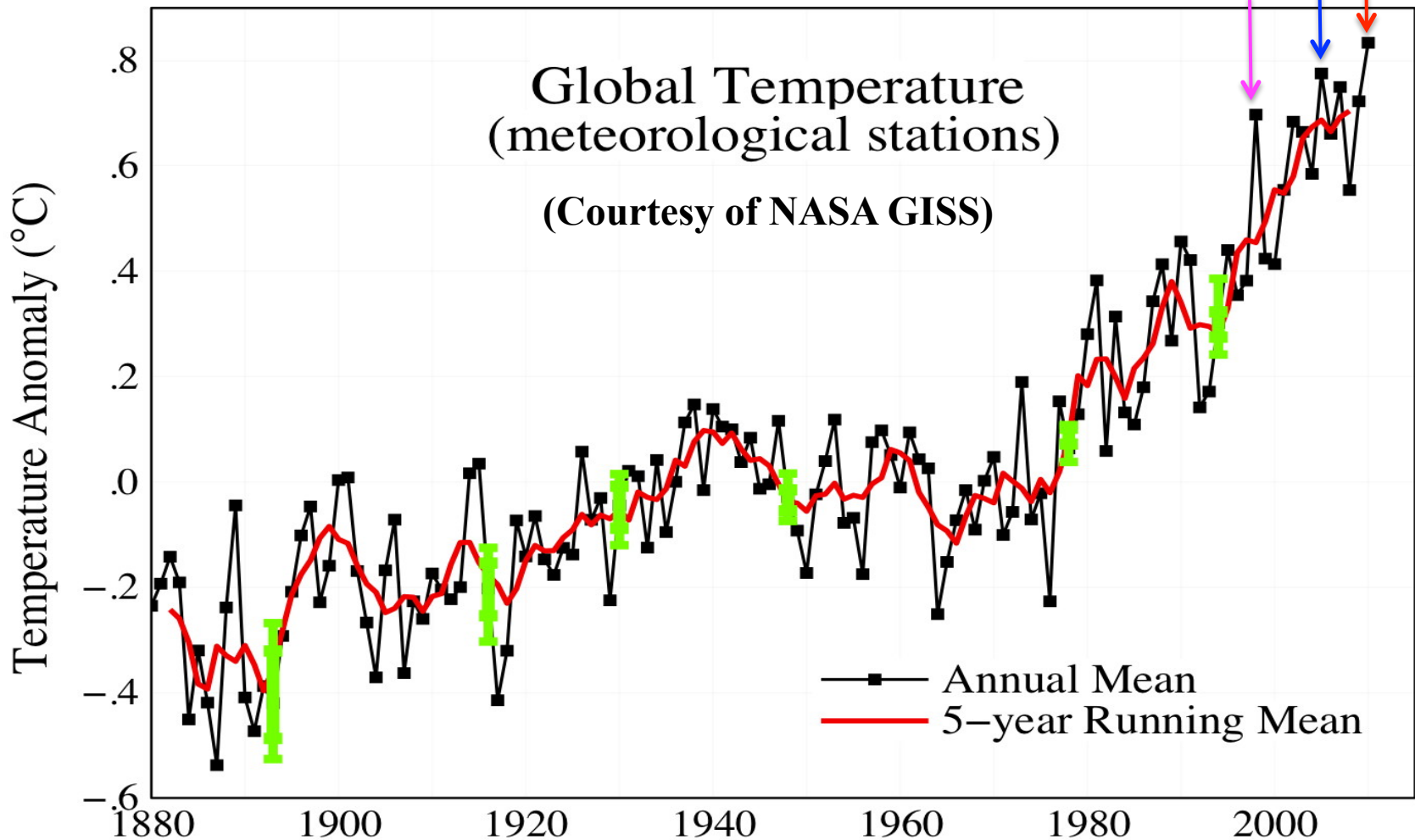
Global Warming



2005 was recorded as the warmest year in history.

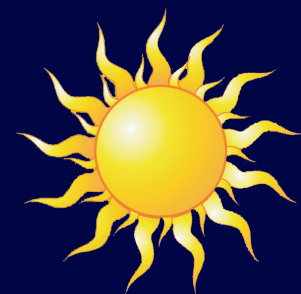
(slide used in 2010)

Global Warming



2010 was recorded as the warmest year in history.
(2005 as the 2nd warmest year in history)

Many places in the world are on the pace to break various records again this summer.

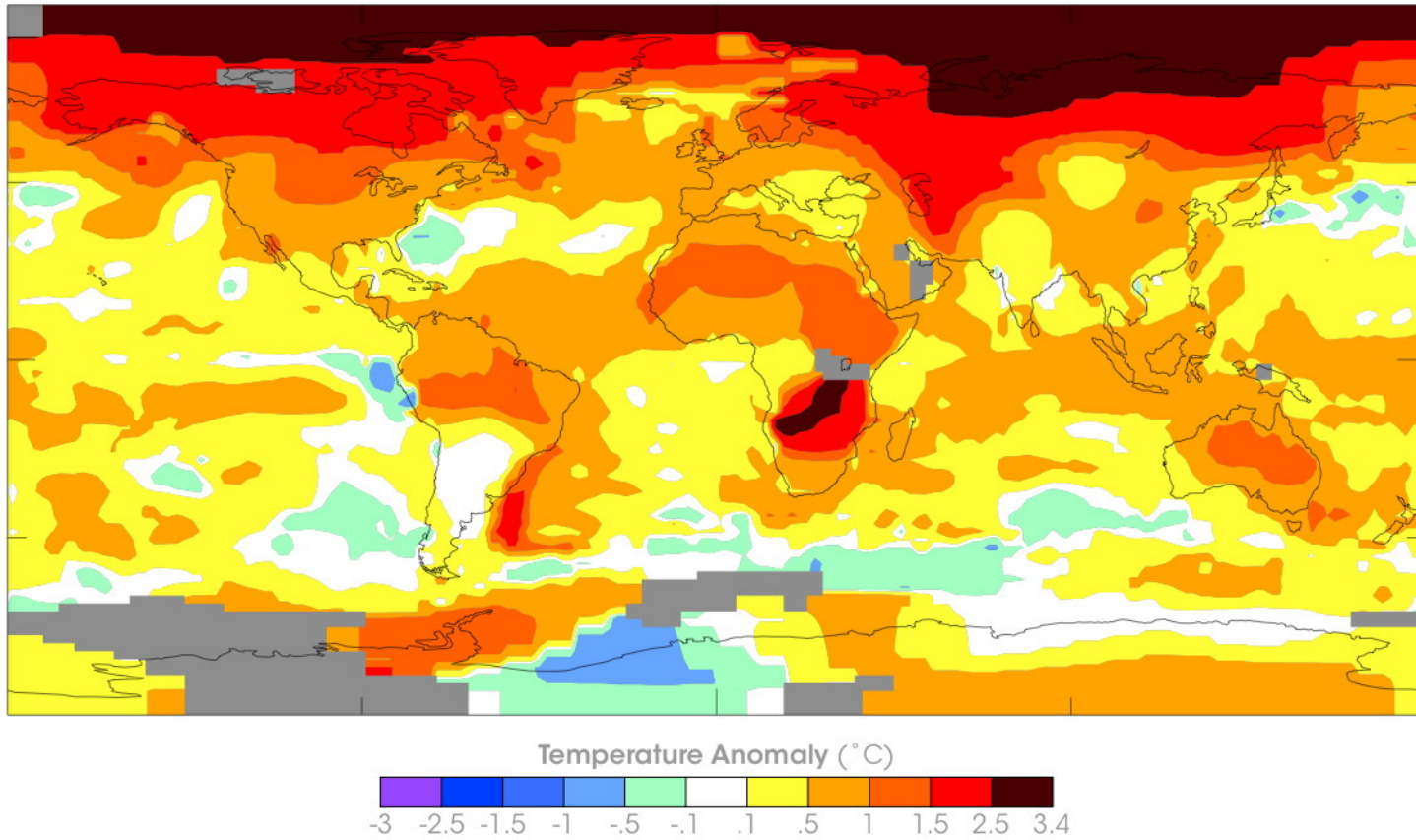


- ❖ The month of June was the hottest recorded for Texas since 1895, according to the US National Weather Service. (CNN)
- ❖ Heatwave brings warmest UK April for more than 100 years. (BBC)
- ❖ UK Set for Record Breaking Summer - we had the hottest May in 350 years, so it looks like there is more of this hot weather to come. (wordpress.com)
- ❖ Spring drought brings Yangtze driest season since 1961. (CCTV)
- ❖ Florida experiencing the driest season ever on record. (WPTV)



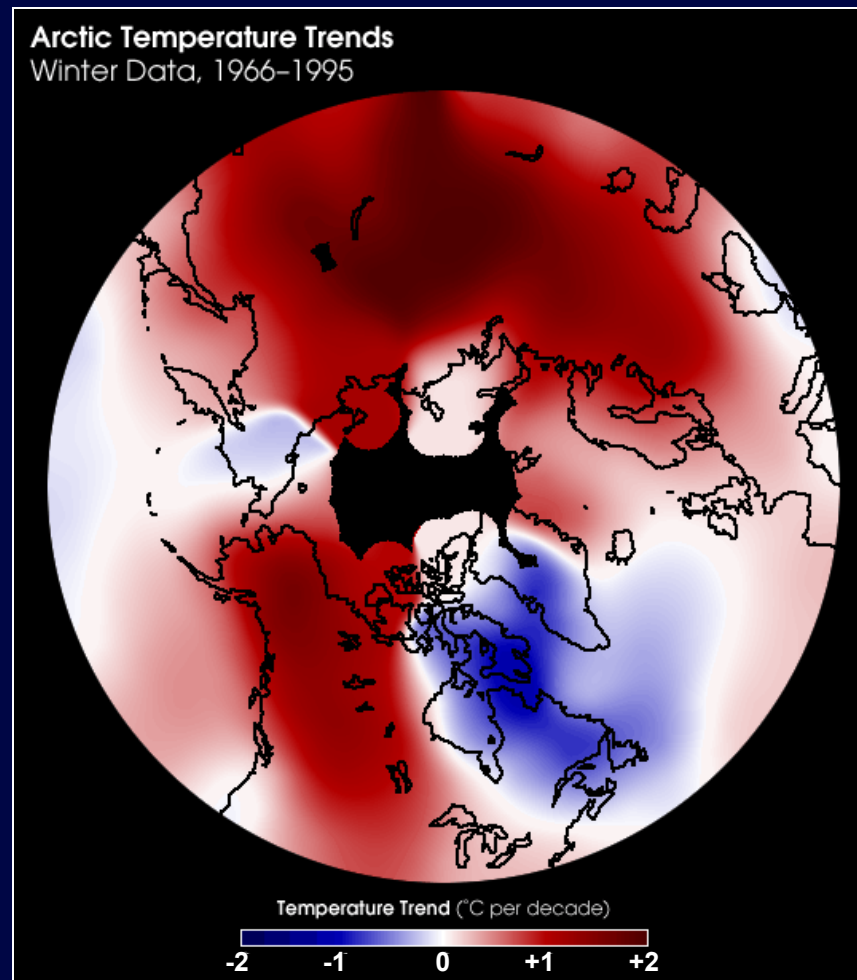
Global Temperature Anomalies in 2005

(Featured by the Arctic Warming)



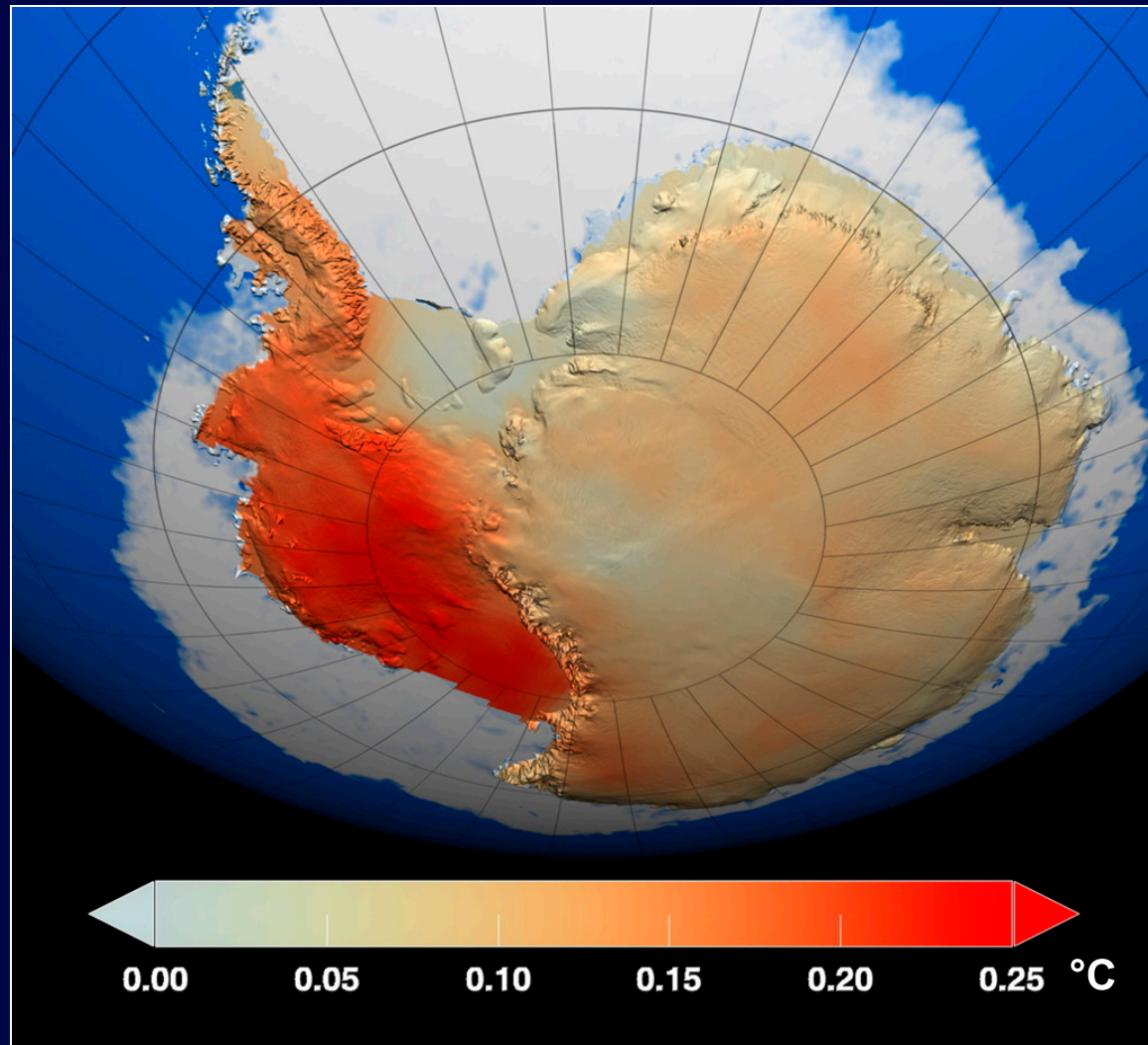
Year 2005 was **2nd** warmest on record.

Global Warming



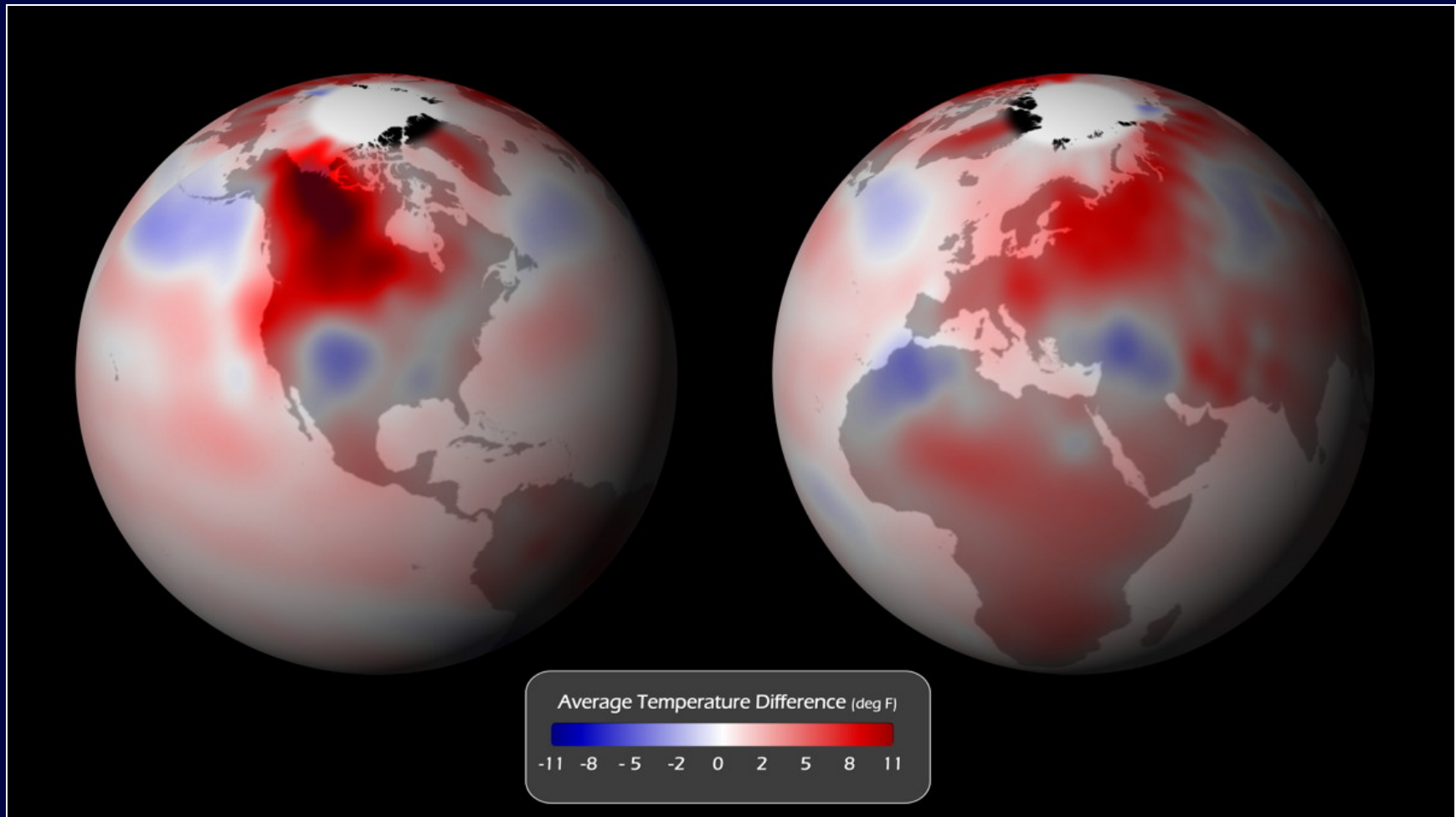
**Arctic Winter Temperature Trends
(1966-1995, °C per decade)**

Global Warming



Antarctic temperature change per decade over the past 50 years.

**Global Temperature Anomalies in September, 2009
(second warmest on record, behind 2005)**



2005 Melt
Extent

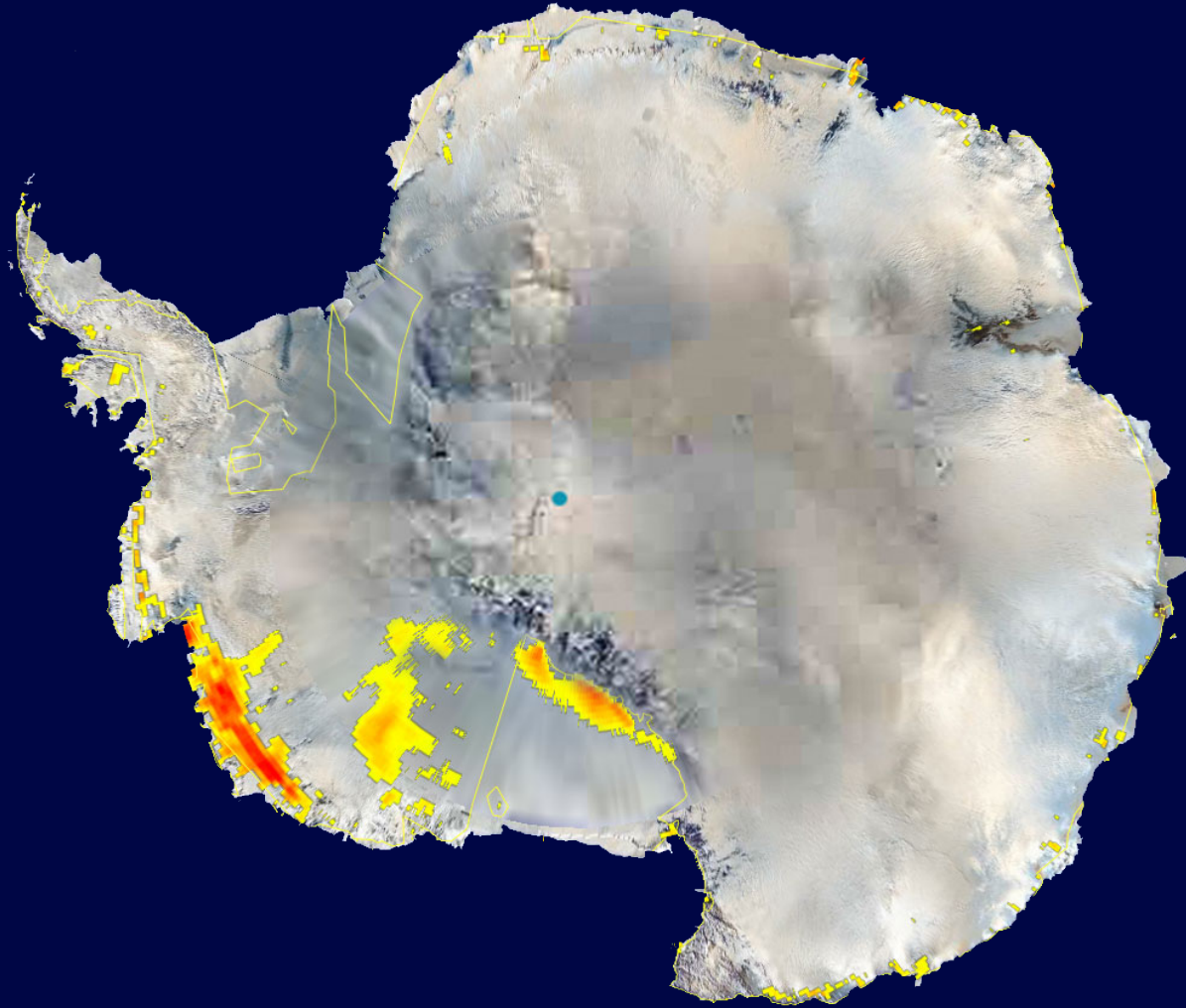
Ice Sheets and Glaciers Melting

- Melted in 2005
- 1st Recorded Melt
- 2,000m Elevation

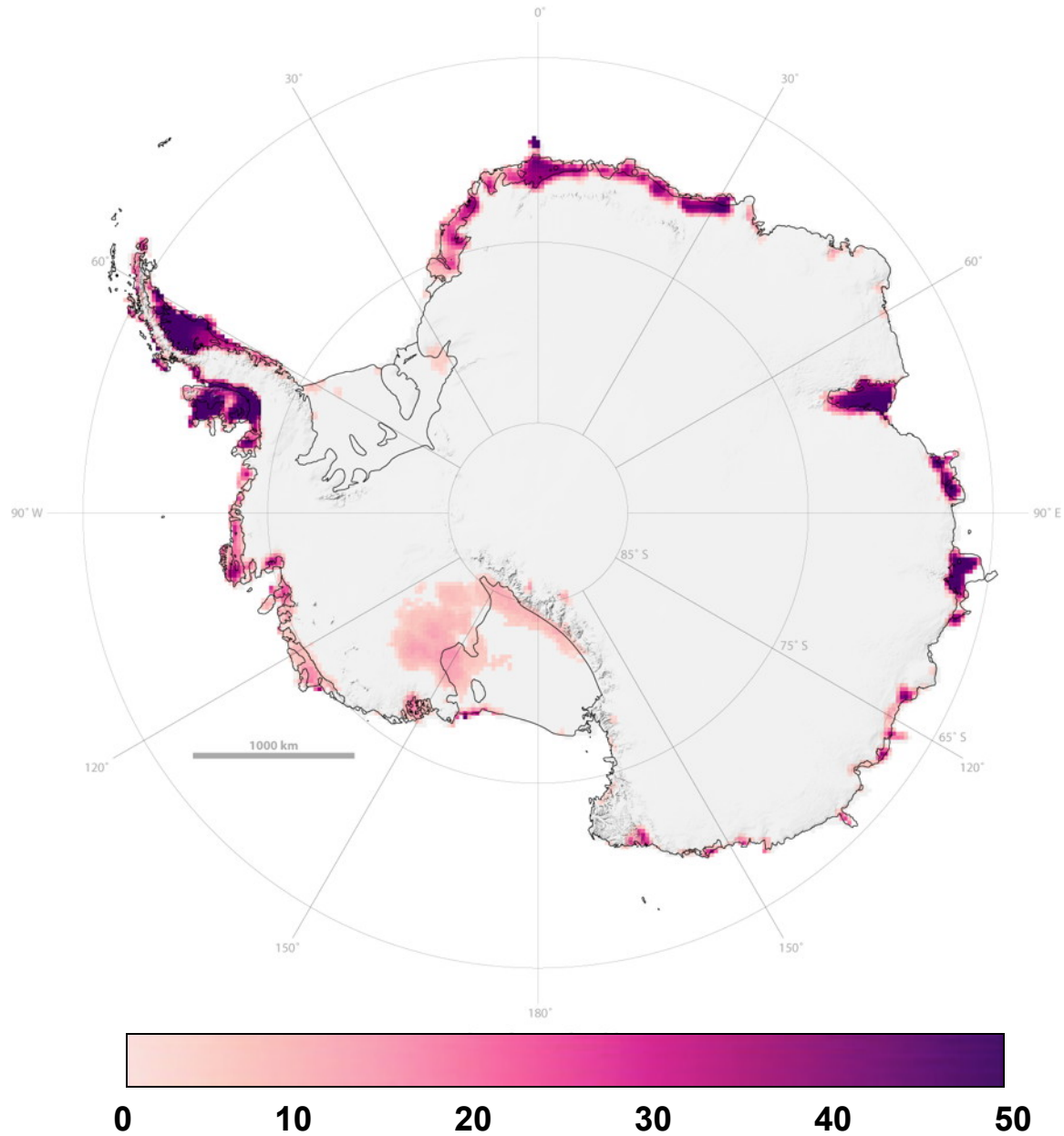
University of Colorado CIRES

Courtesy Russell Huff and Konrad Steffen

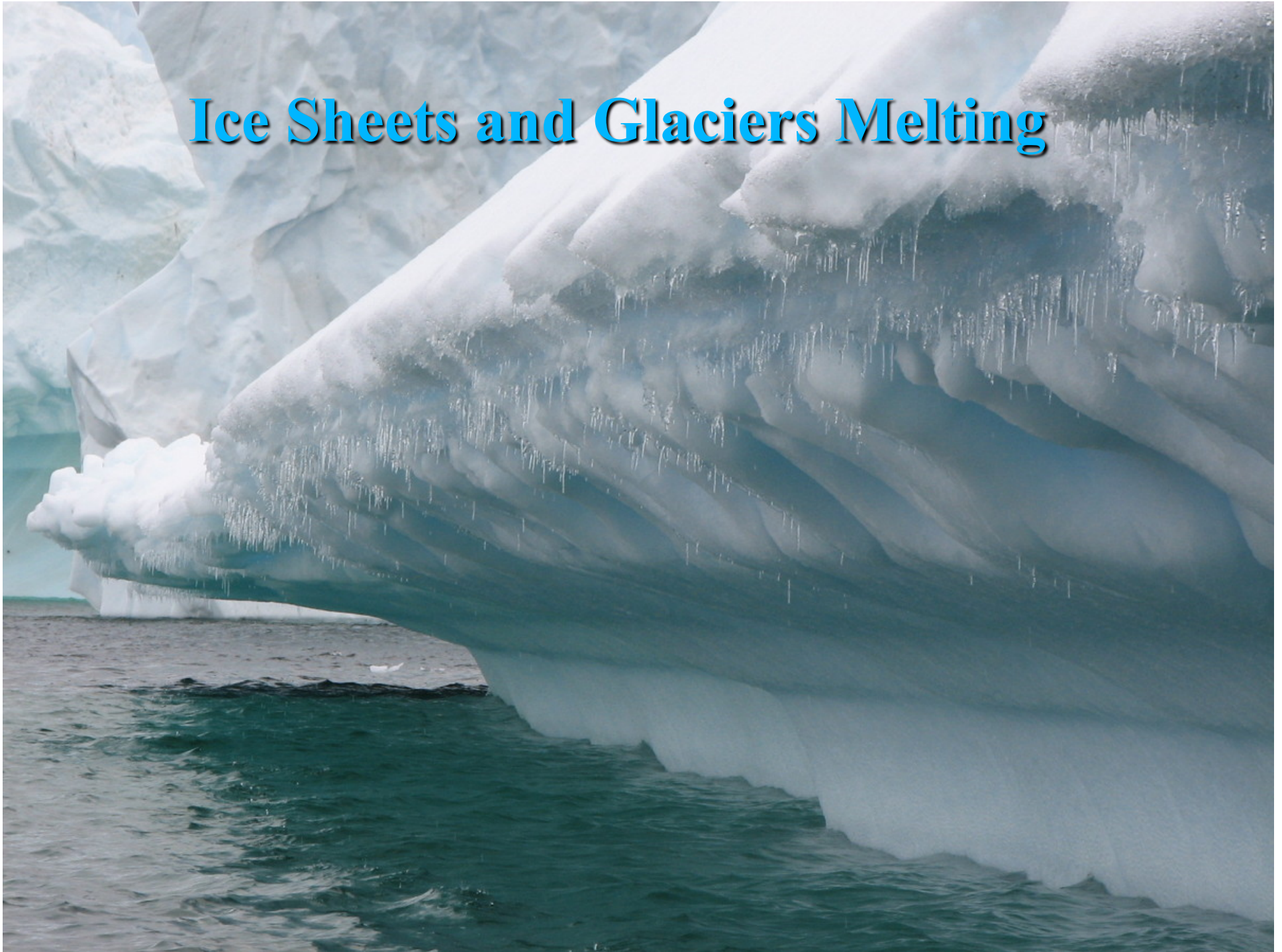
Antarctic Ice Sheet Melting



Antarctic Melting Days in 2005



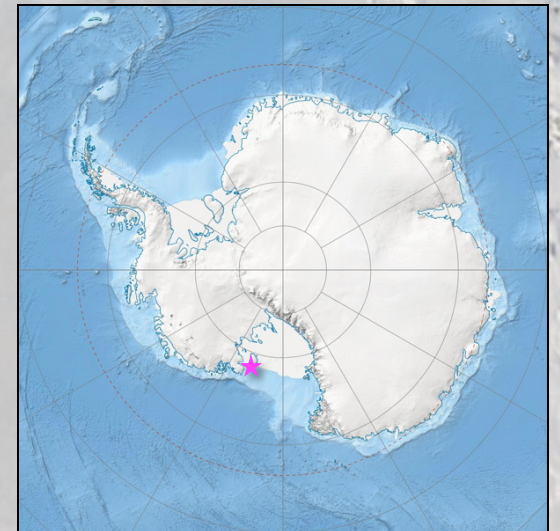
Ice Sheets and Glaciers Melting

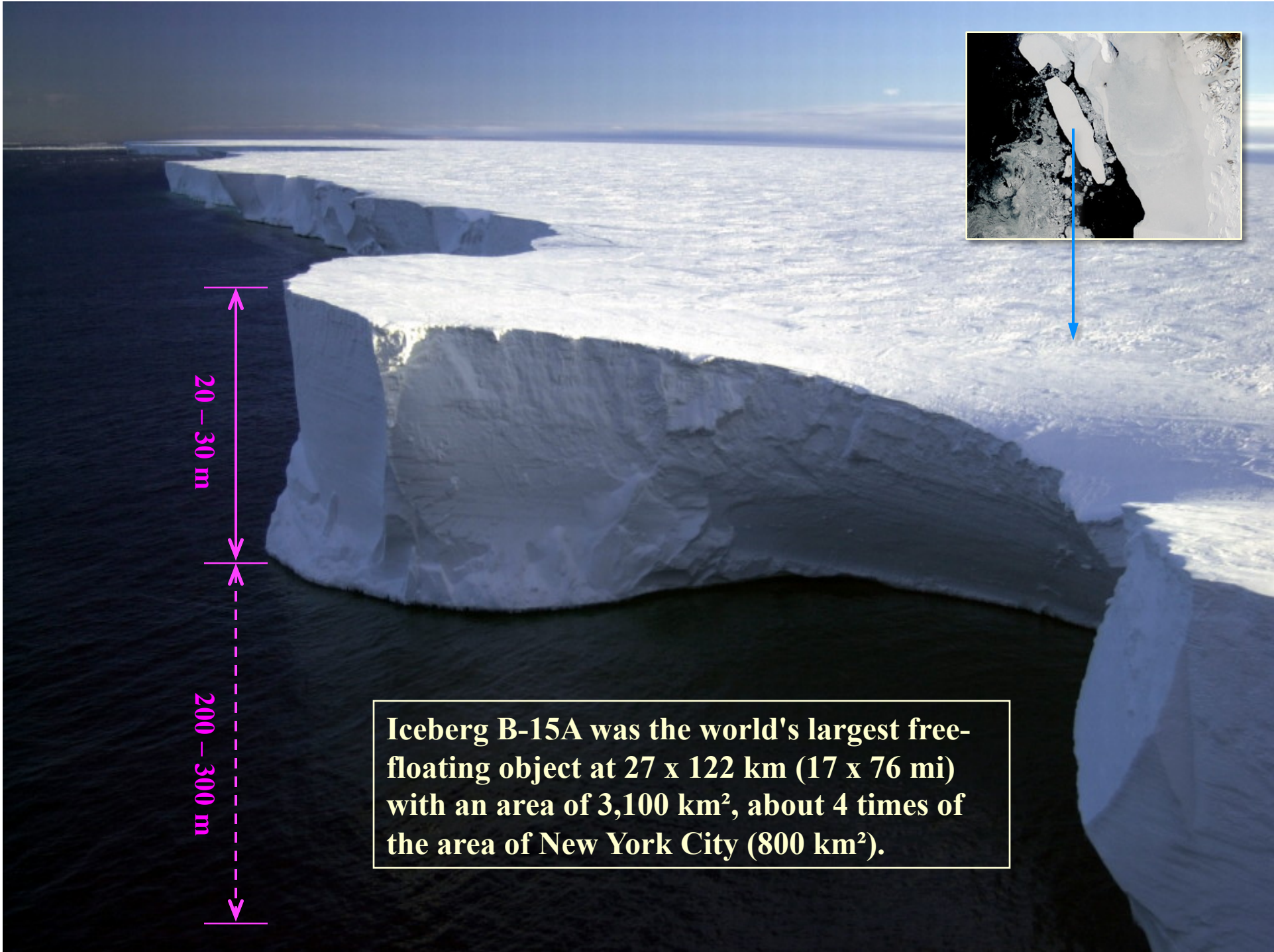


Ice Calving (Breaking Up)

Originally calved from the Ross Ice Shelf near Roosevelt Island in March 2000, Iceberg B-15A was the world's largest free-floating object at 27 x 122 km (17 x 76 mi) with an area of 3,100 km².

122 km



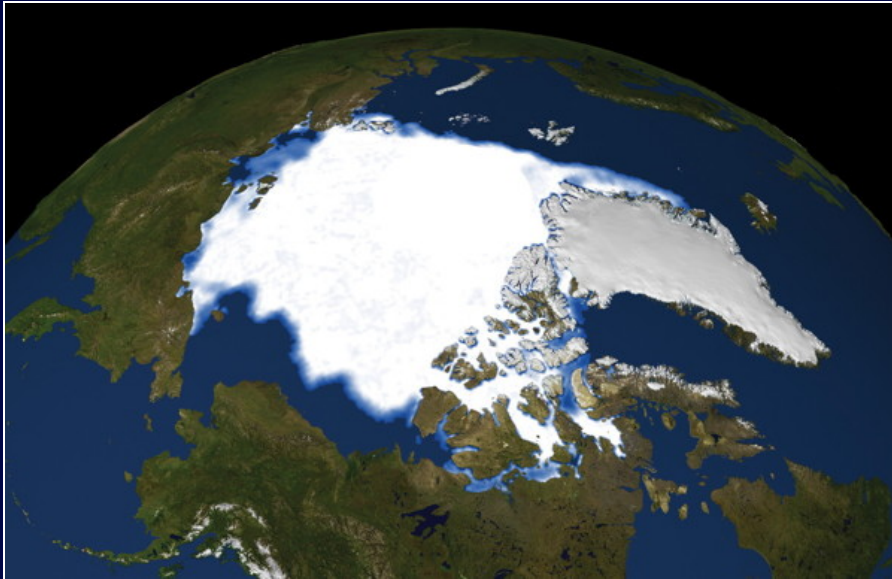


20 - 30 m

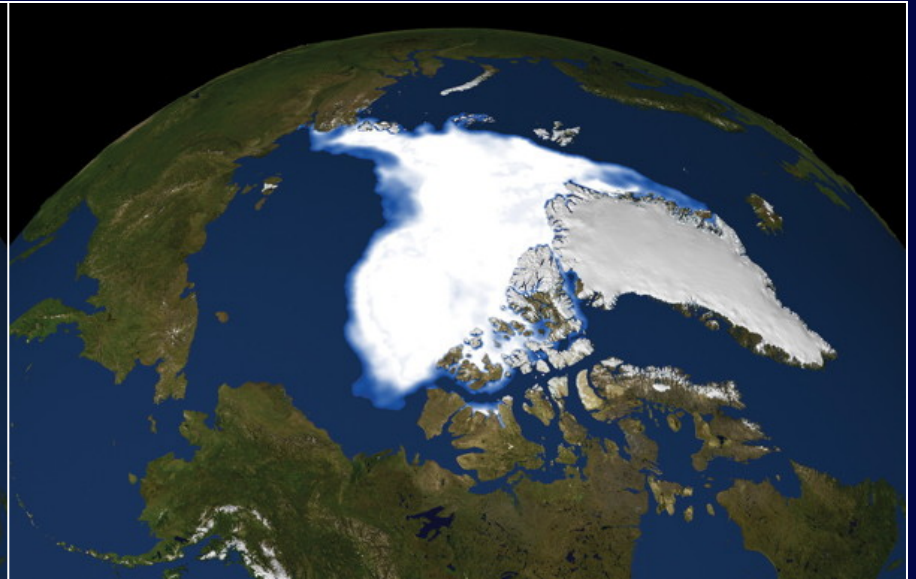
200 - 300 m

Iceberg B-15A was the world's largest free-floating object at 27 x 122 km (17 x 76 mi) with an area of 3,100 km², about 4 times of the area of New York City (800 km²).

Decreased Arctic Sea Ice Coverage

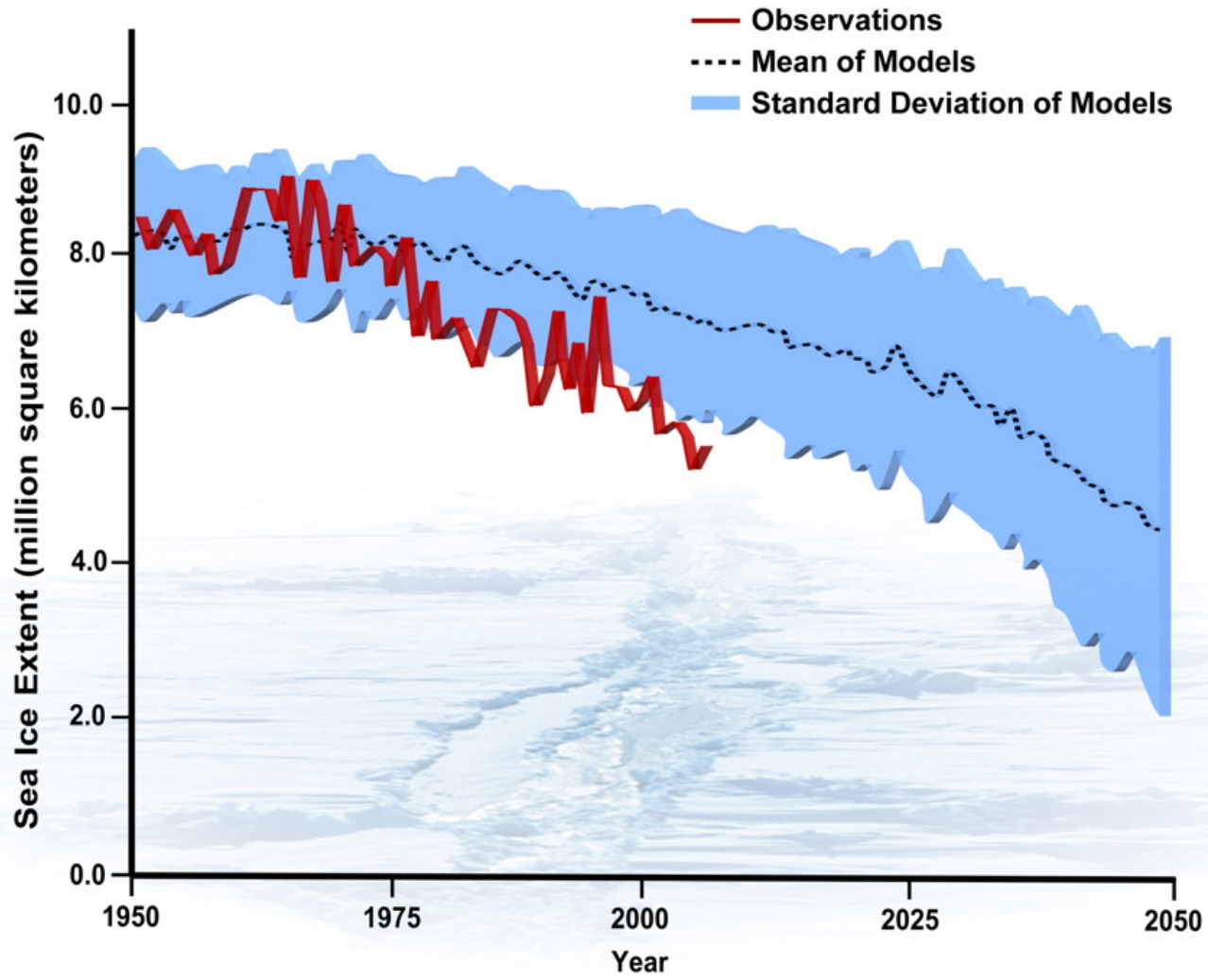


September 1979



September 2007

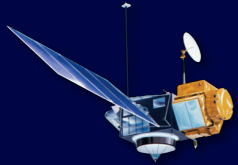
Arctic September Sea Ice Extent: Observations and Model Runs



Sea Level Rise

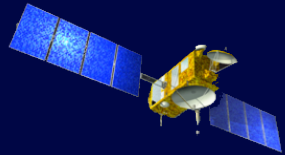
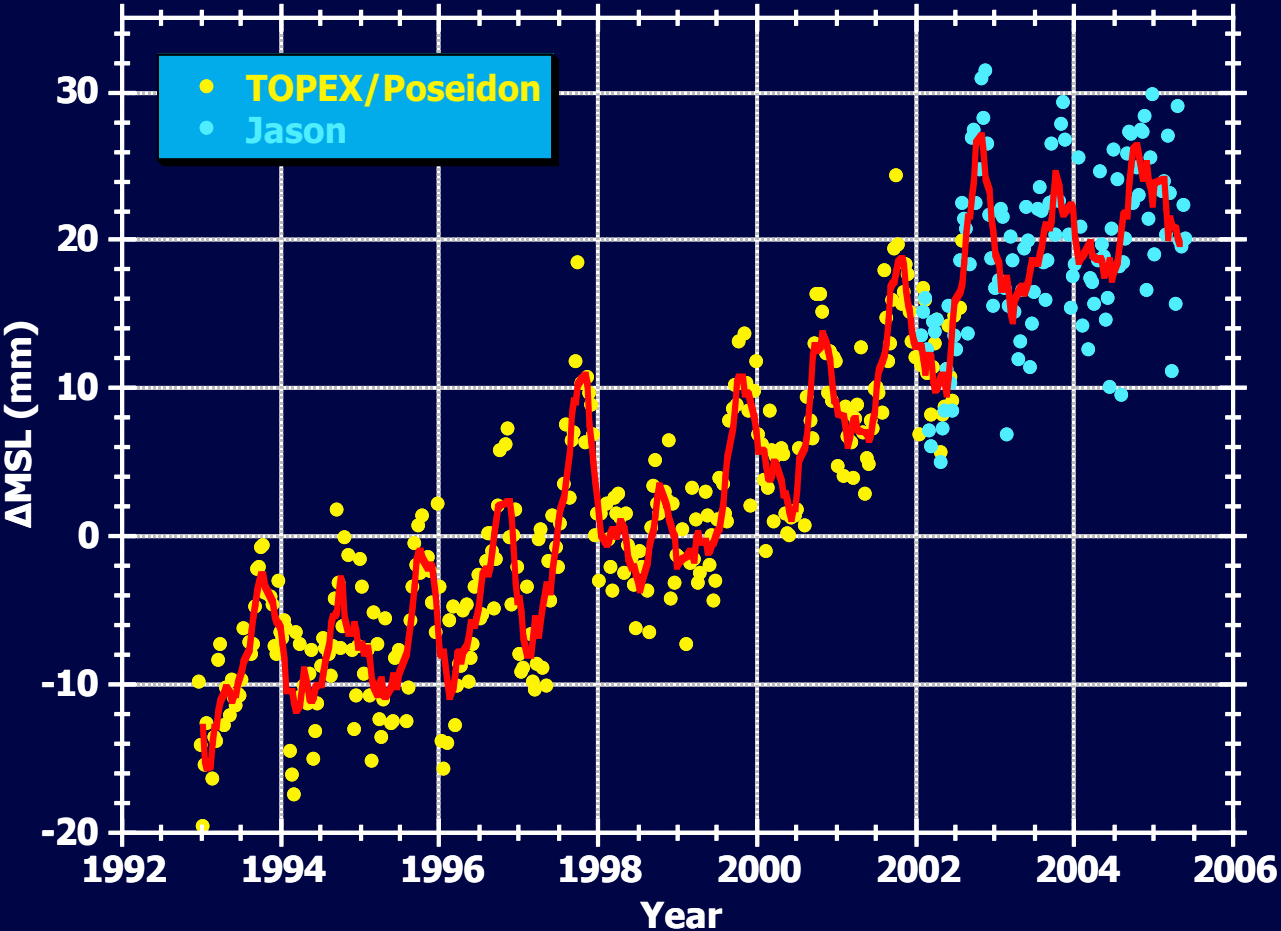
Manhattan Skyline





Global Mean Sea Level Rise

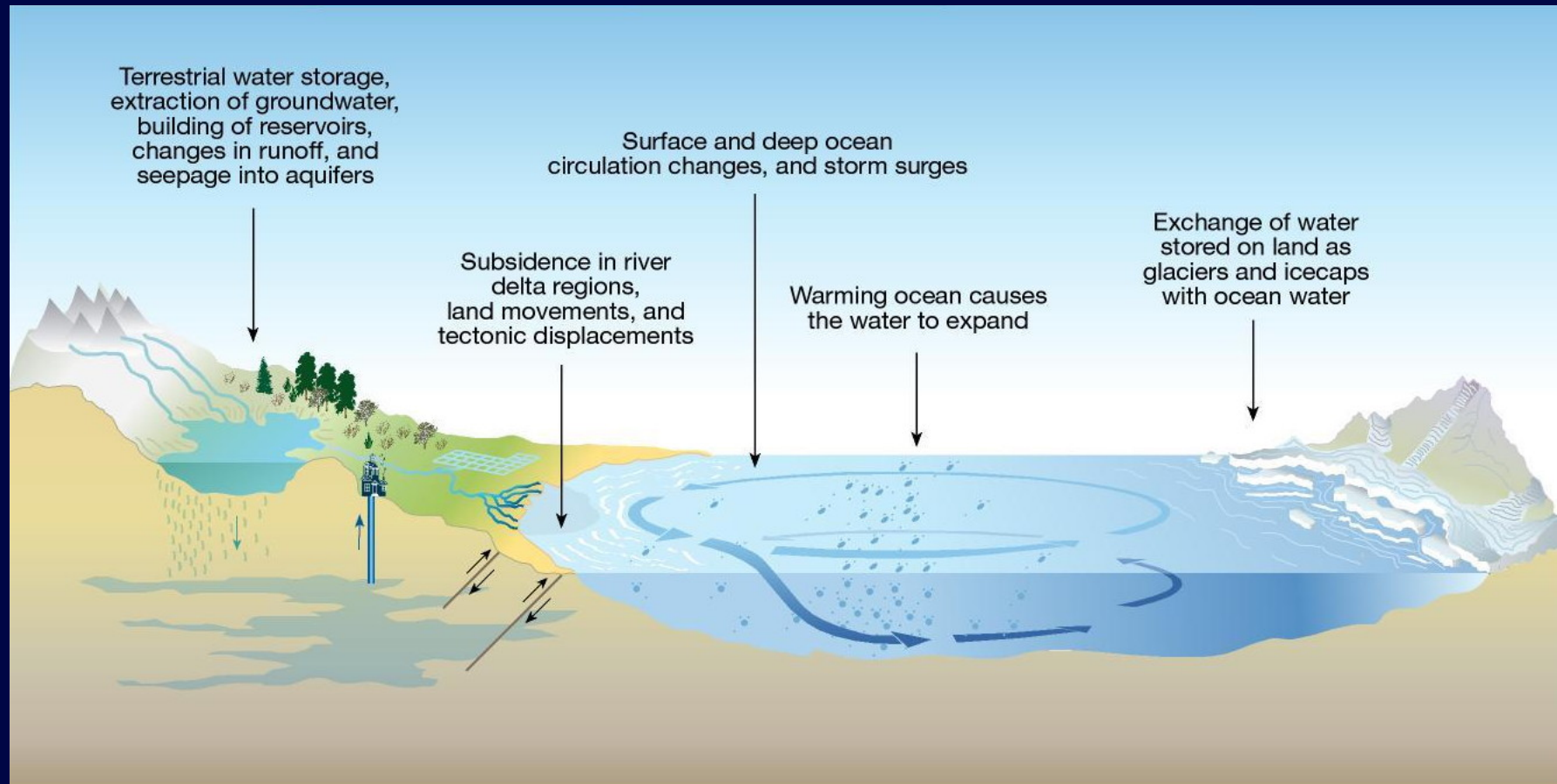
From Satellite Altimetry



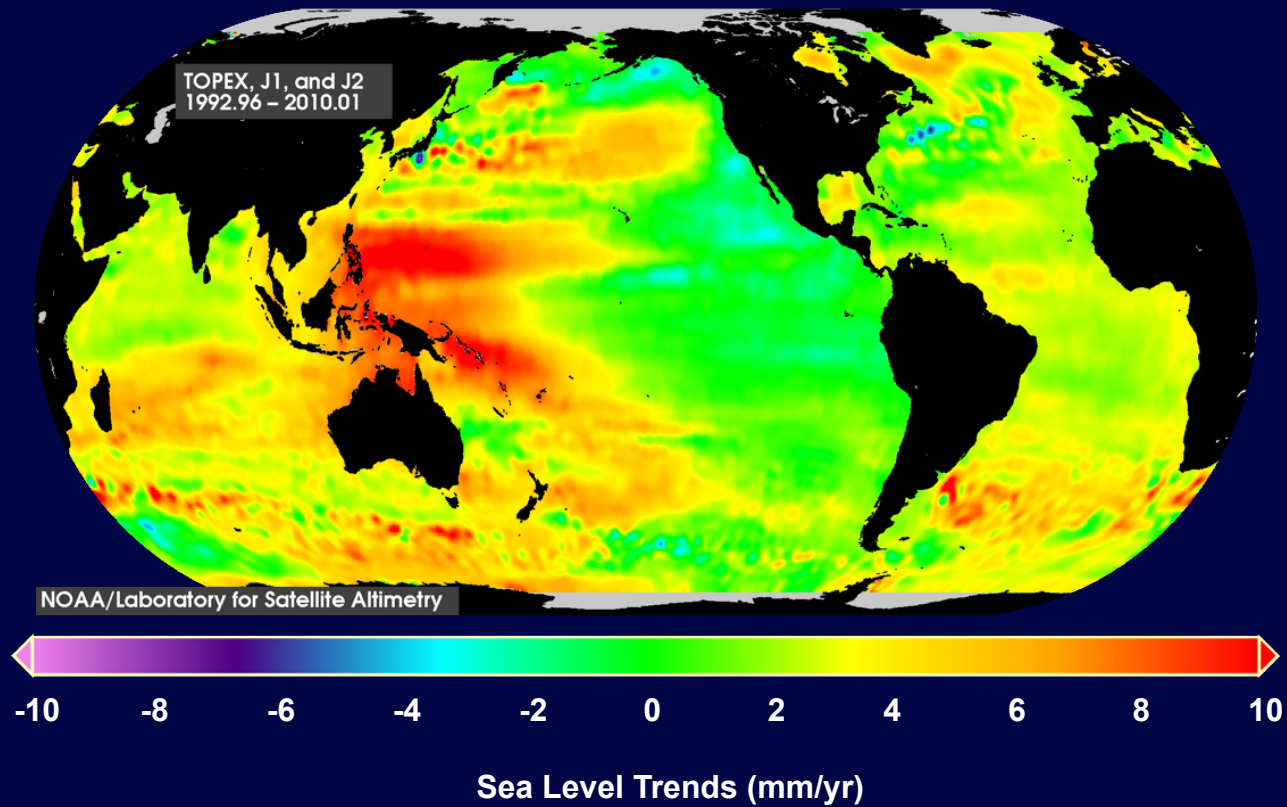
Why Does Sea Level Rise?



Why Does Sea Level Rise?



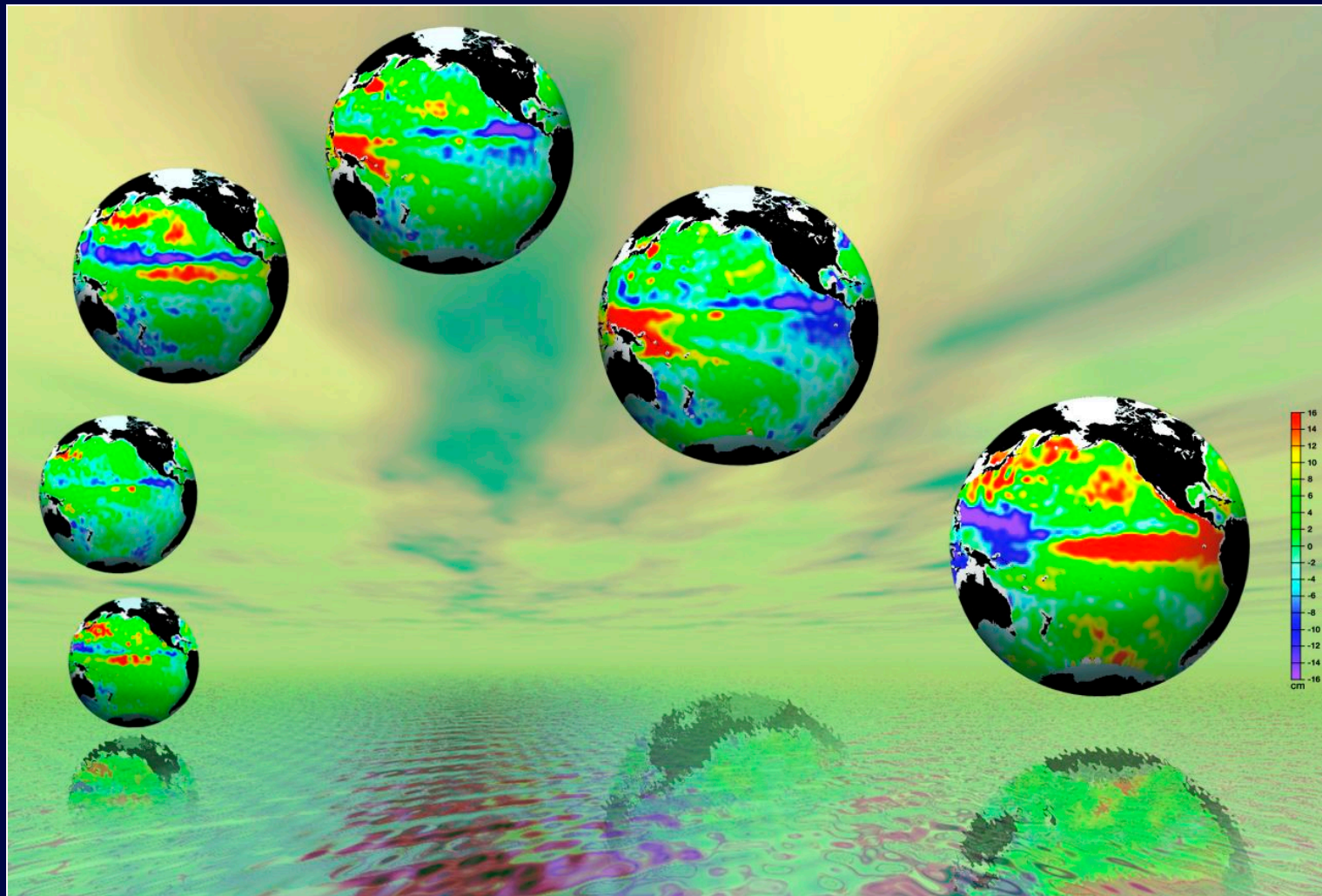
Global Mean Sea Level Rise From Satellite Altimetry



Impacts of Global Warming & Climate Change

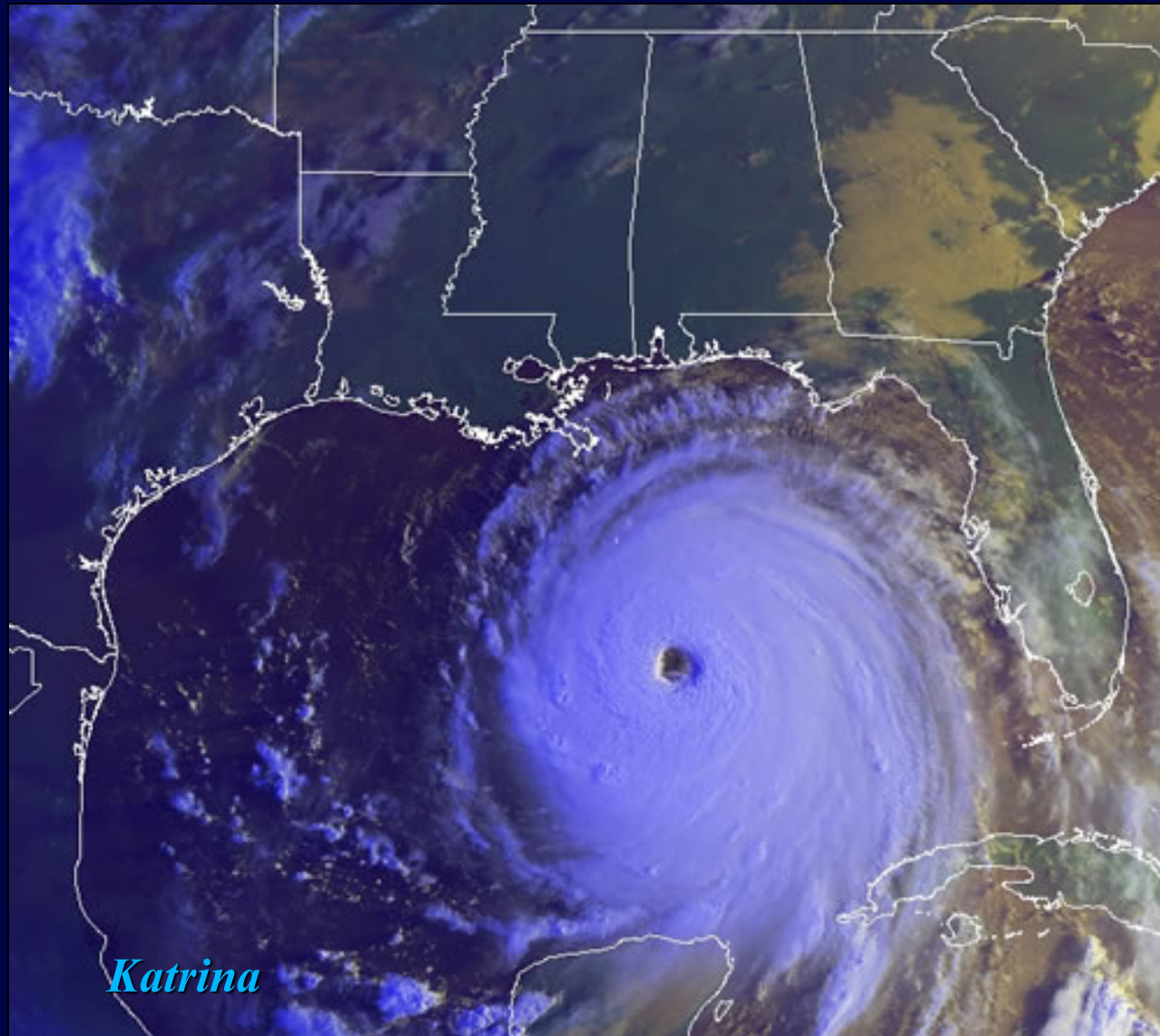


El Niño/La Niña



By courtesy of NASA

Increasing Number and Strength of Hurricanes



Katrina

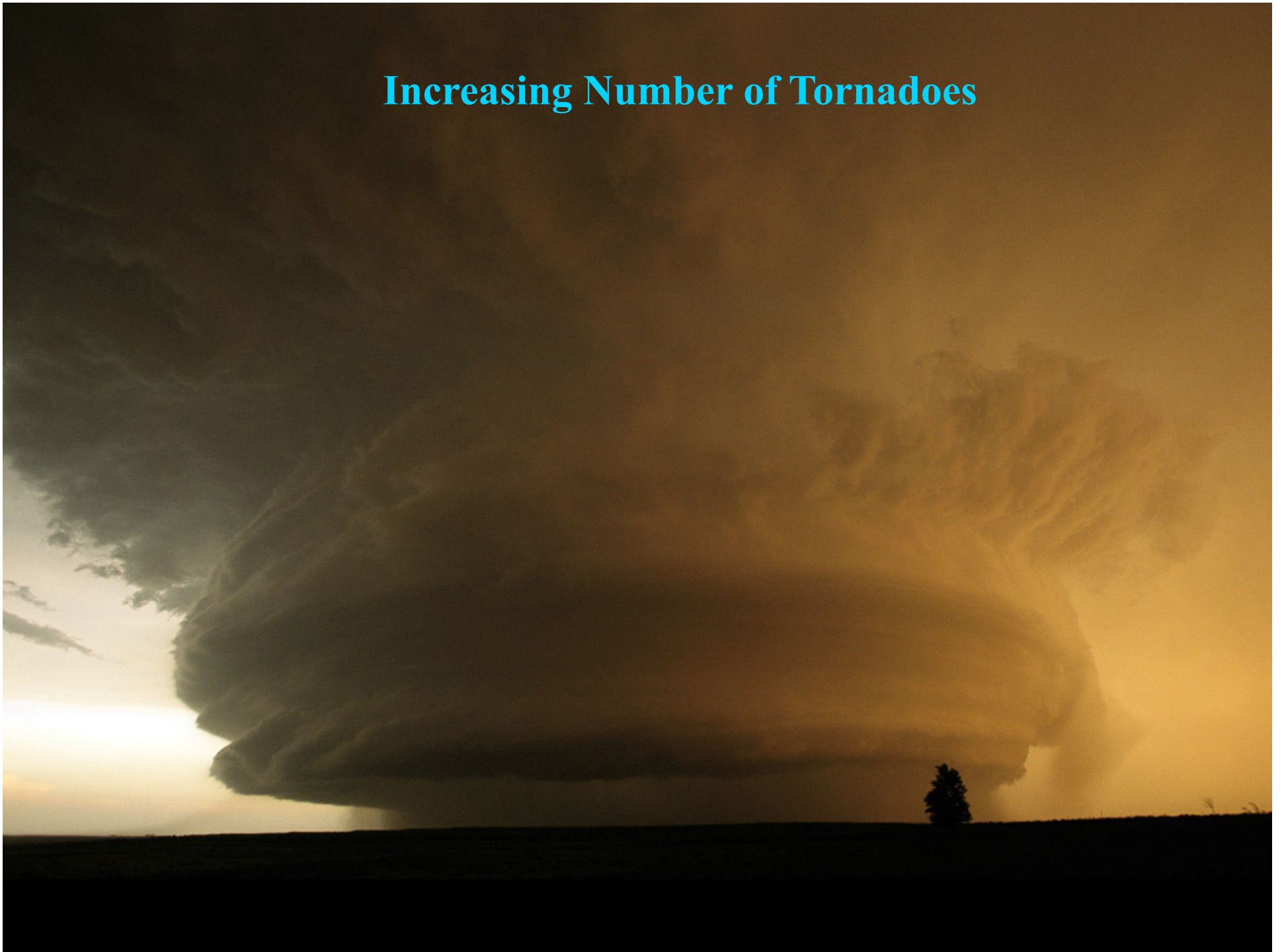
By courtesy of NOAA

Table 1. Change in the number and percentage of hurricanes in categories 4 and 5 for the two 15-year periods 1975–1989 and 1990–2004 for the different ocean basins.

Basin	Period			
	1975–1989		1990–2004	
	Number	Percentage	Number	Percentage
East Pacific Ocean	36	25	49	35
West Pacific Ocean	85	25	116	41
North Atlantic	16	20	25	25
Southwestern Pacific	10	12	22	28
North Indian	1	8	7	25
South Indian	23	18	50	34

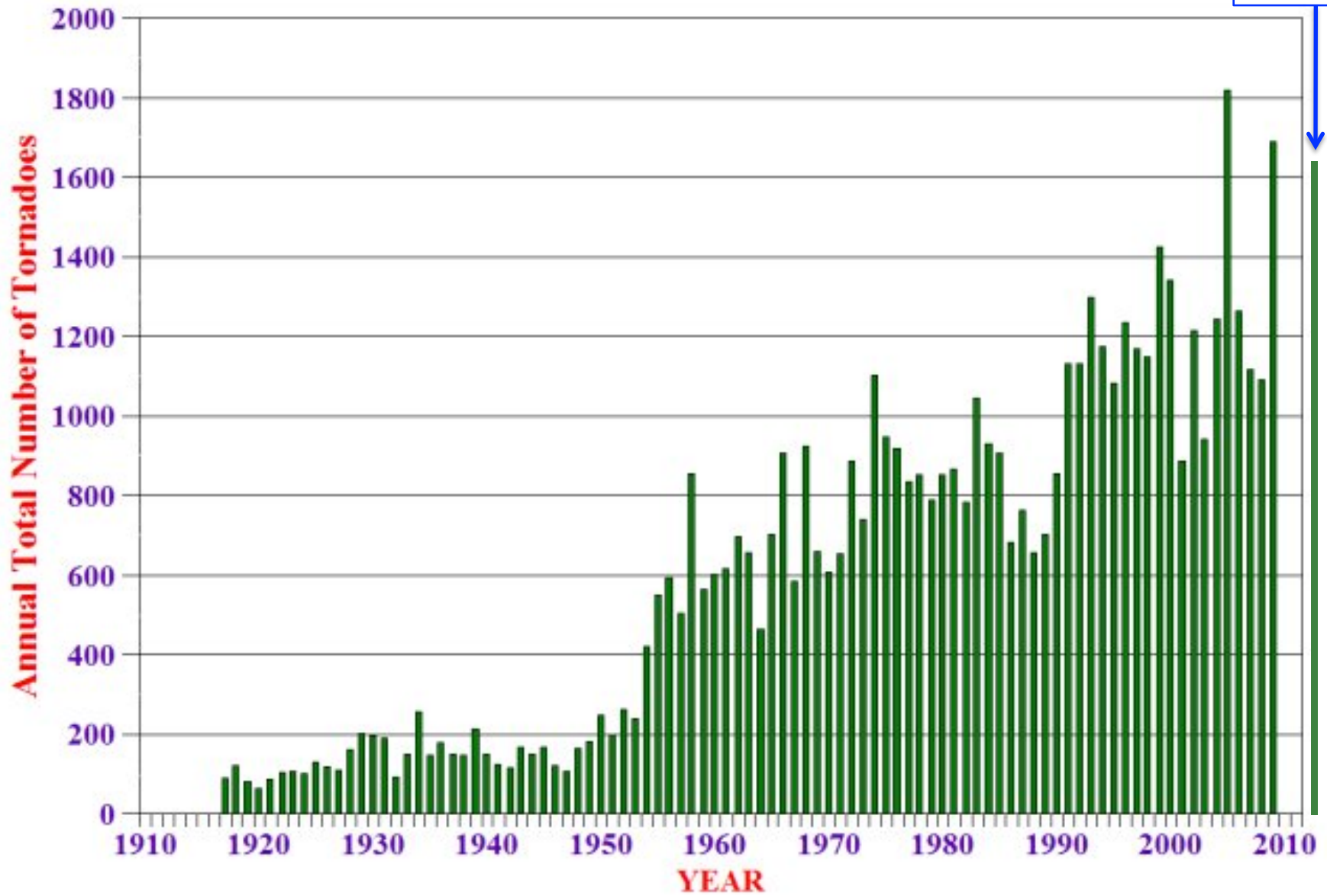
Webster et al., 2005

Increasing Number of Tornadoes



UNITED STATES TORNADOES 1916-2008

2011 to date
1641
(07/13/11)

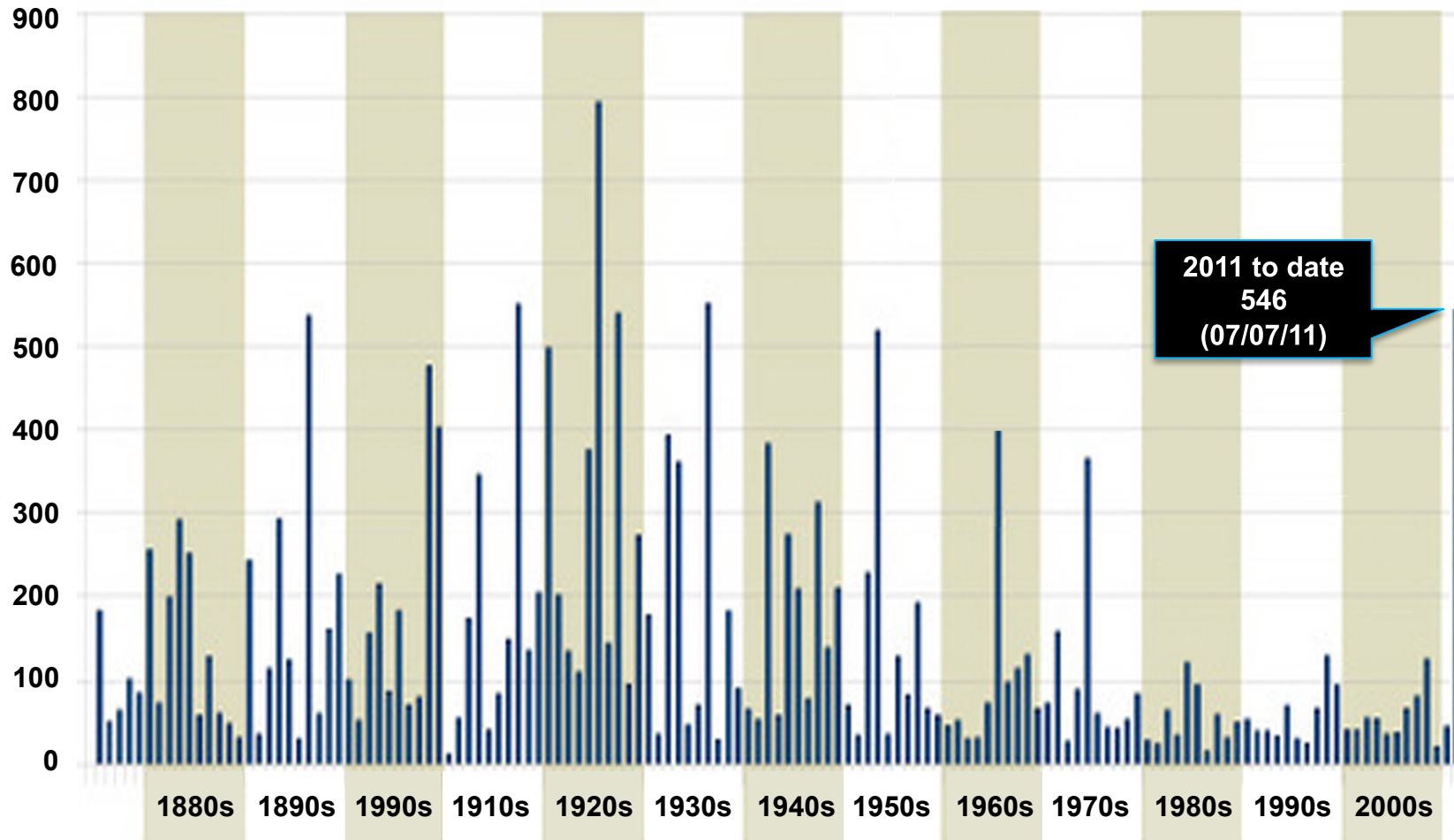


2011 Tornadoes Outbreaks in the US

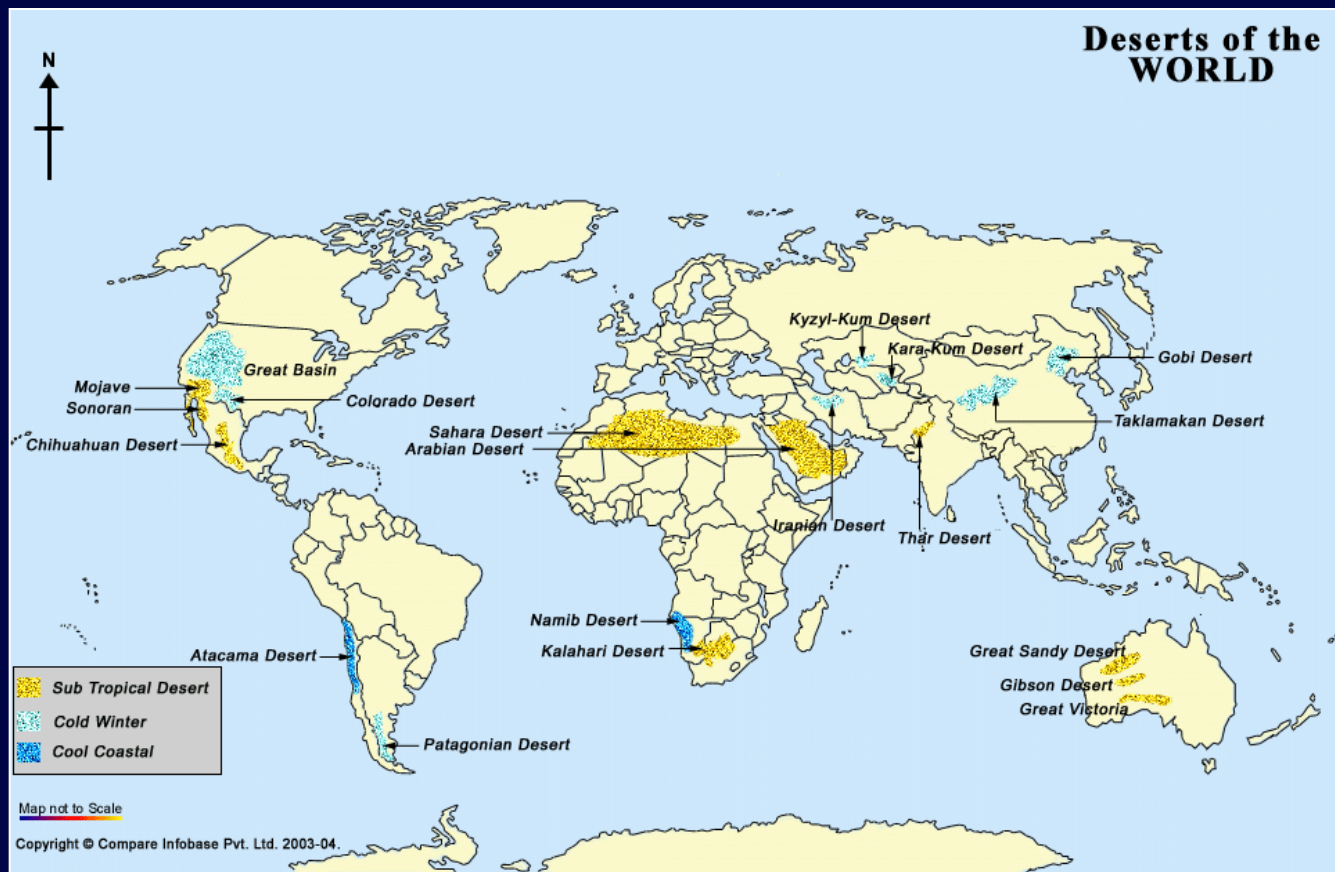
As of July 7, there have been 1,621 tornadoes reported in the US in 2011 (of which at least 1,149 were confirmed). 2011 has been an exceptionally destructive and deadly year for tornadoes; worldwide, at least 559 people perished due to tornadoes: 12 in Bangladesh, one in New Zealand, one in the Philippines and an estimated 546 in the United States (compared to 564 US deaths in the 10 years prior).

Due in large part to several extremely large tornado outbreaks in the middle and end of April and in late May, the year is currently on near-record to record pace, with six EF5 tornadoes as of July 6. It is also the deadliest year for tornadoes in the United States since 1936, due mostly to the 324 tornadic deaths that occurred during the April 27 outbreak across the Southeastern United States and the 158 tornadic deaths in the 2011 Joplin Tornado.

Tornado Deaths in the United States, 1875 to present



Desert & Desertization



Desert can be beautiful.

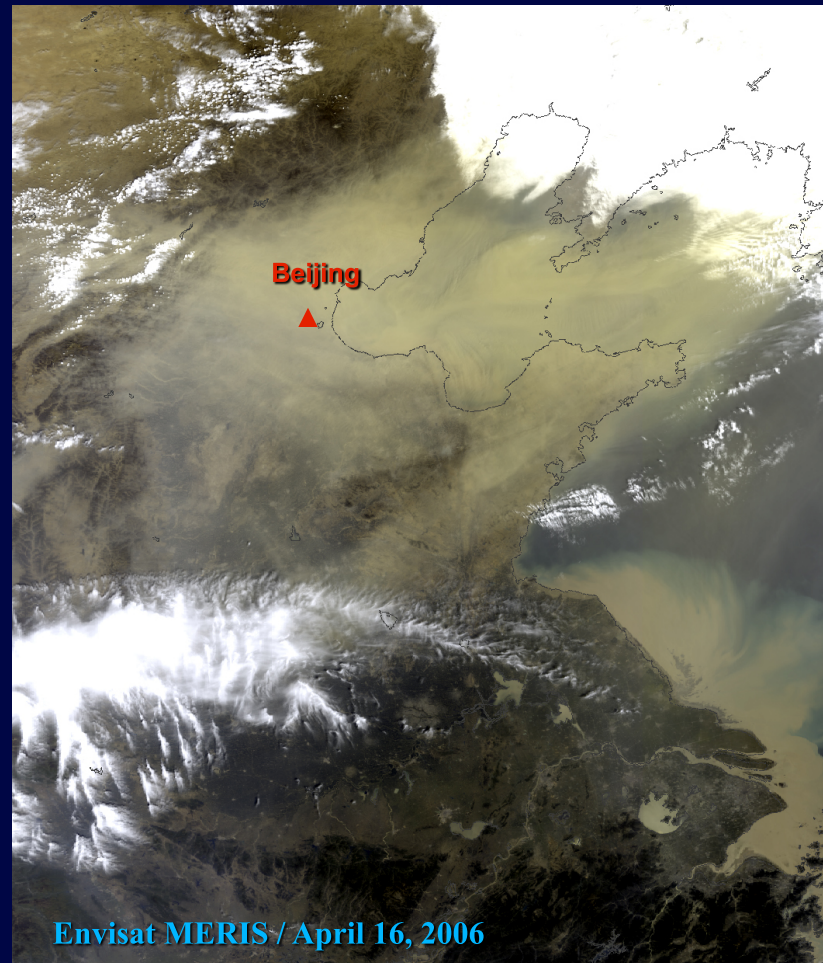


Desert can be ugly as well.



The Infamous Sand Storm

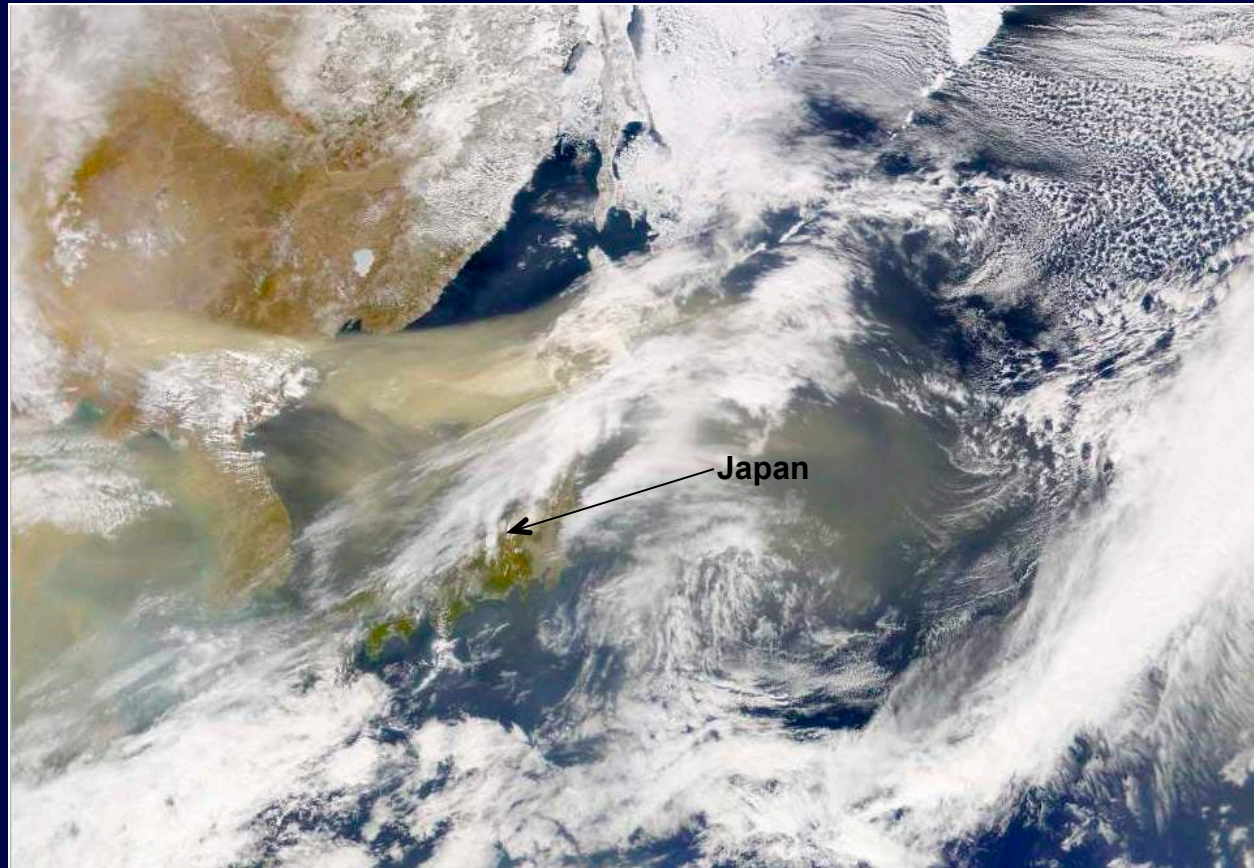
Desert & Sand Storm



Envisat MERIS / April 16, 2006

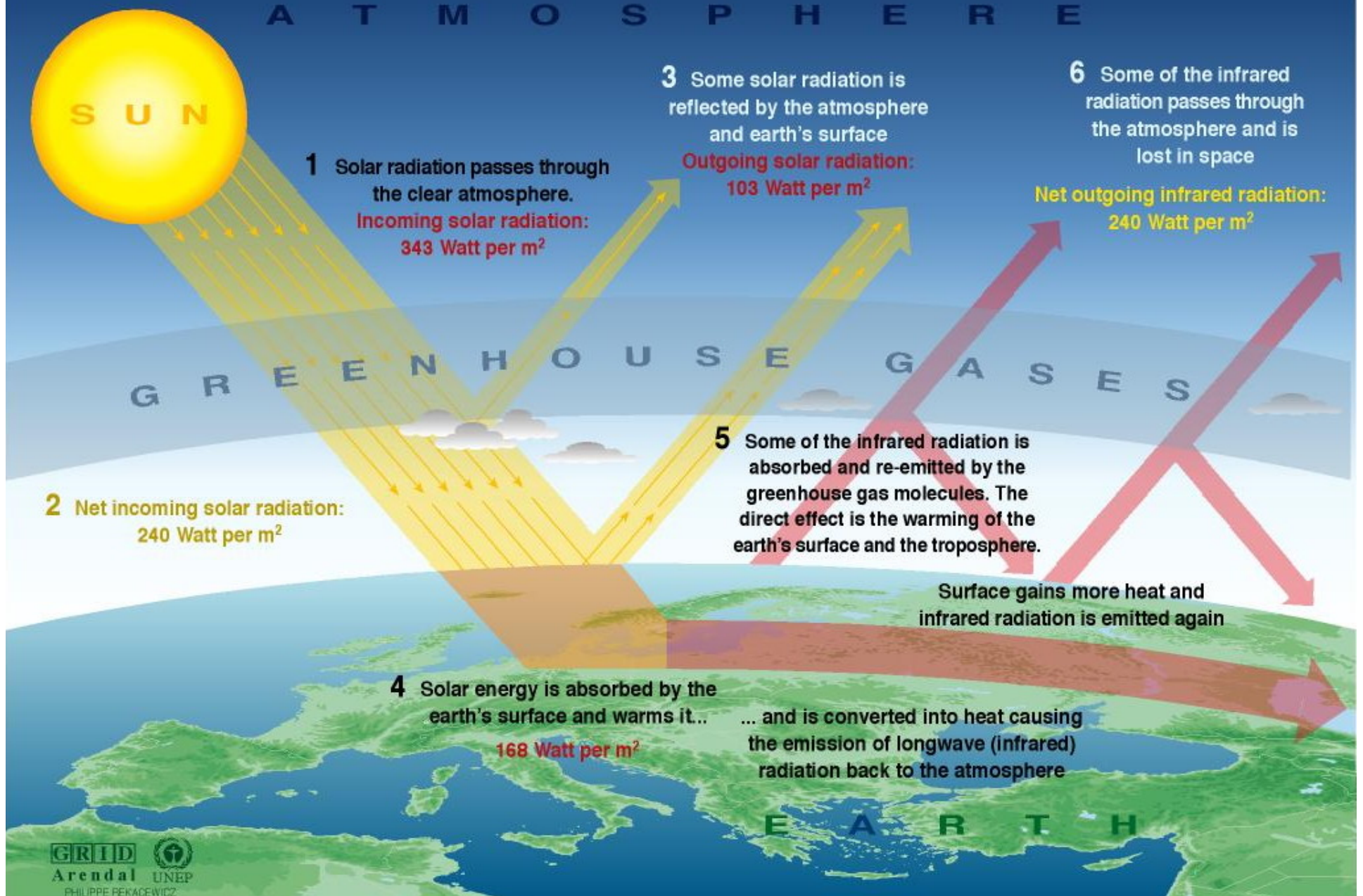
By courtesy of ESA

Sand Storm into the Ocean



**Who is to Blame for Global Warming
and Climate Change ?**

The Greenhouse Effect



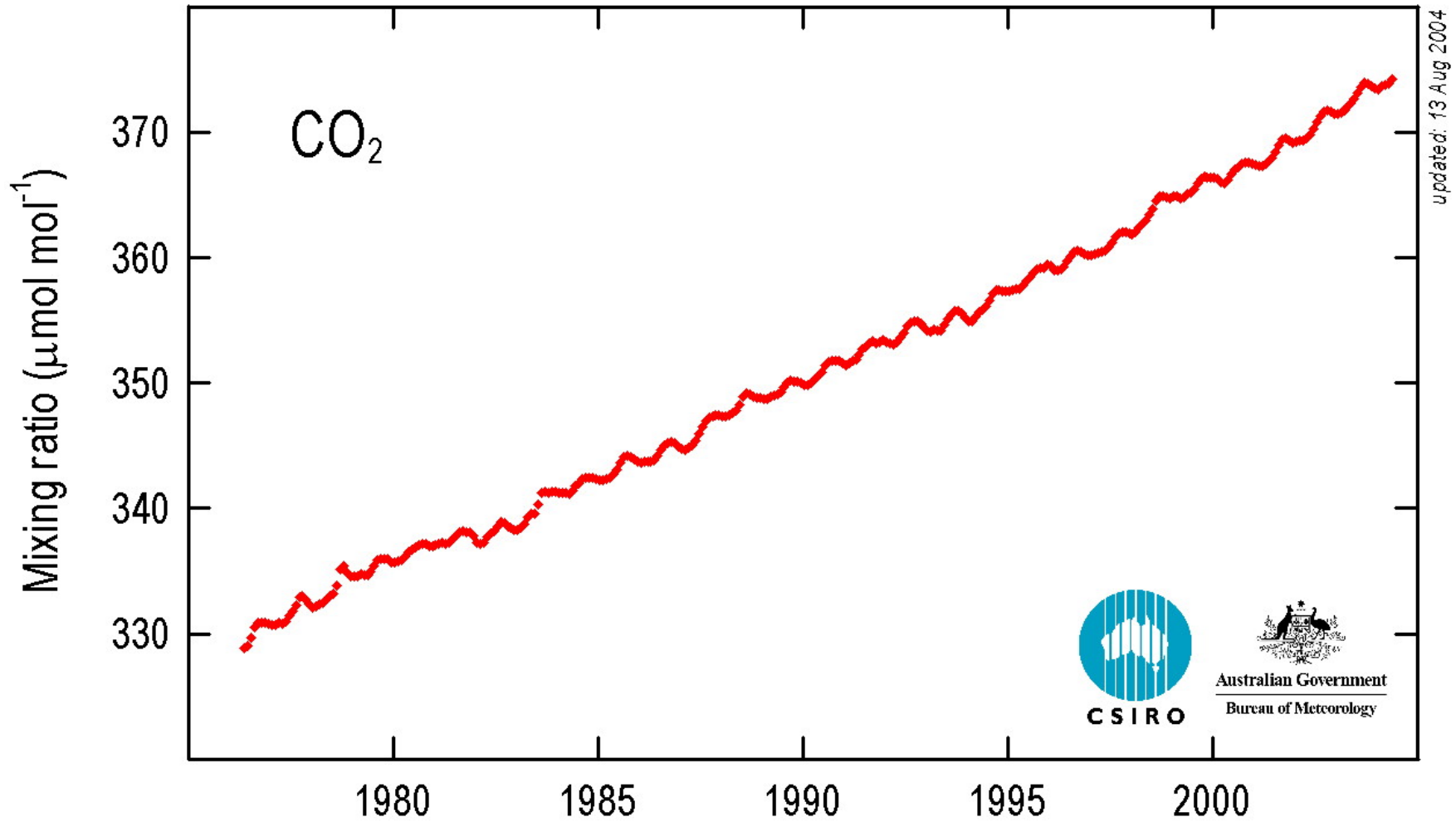
温室效应 - Greenhouse Effect



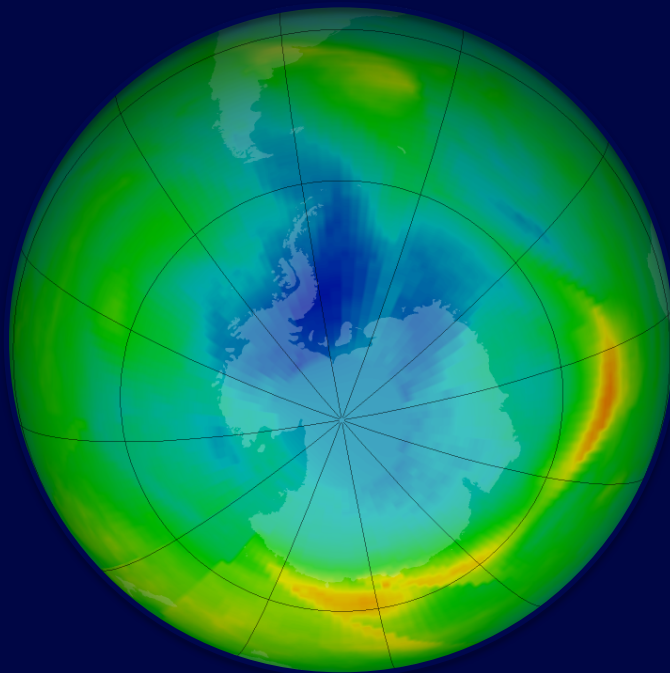
Carbon Dioxide (CO₂)



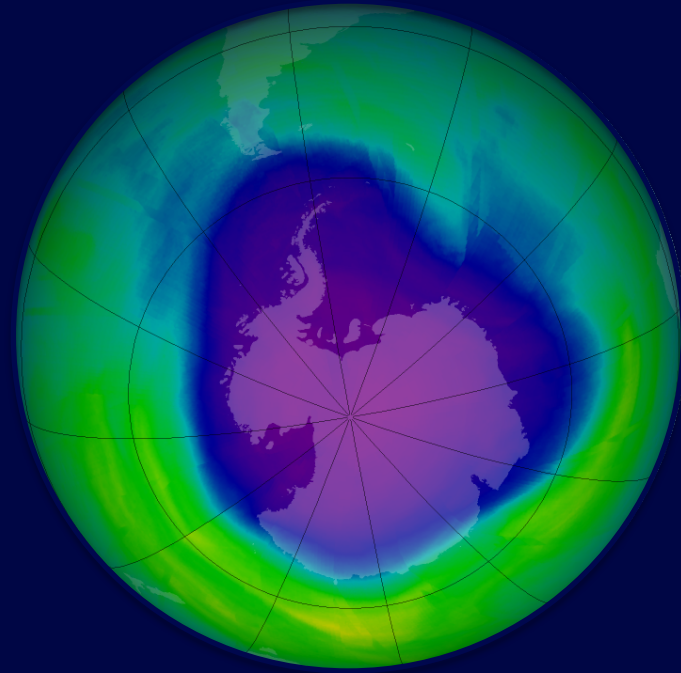
Carbon dioxide at Cape Grim, Tasmania



Ozone Hole Over the Antarctic Continent

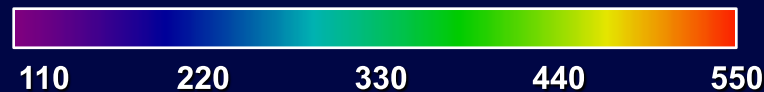


(1979)



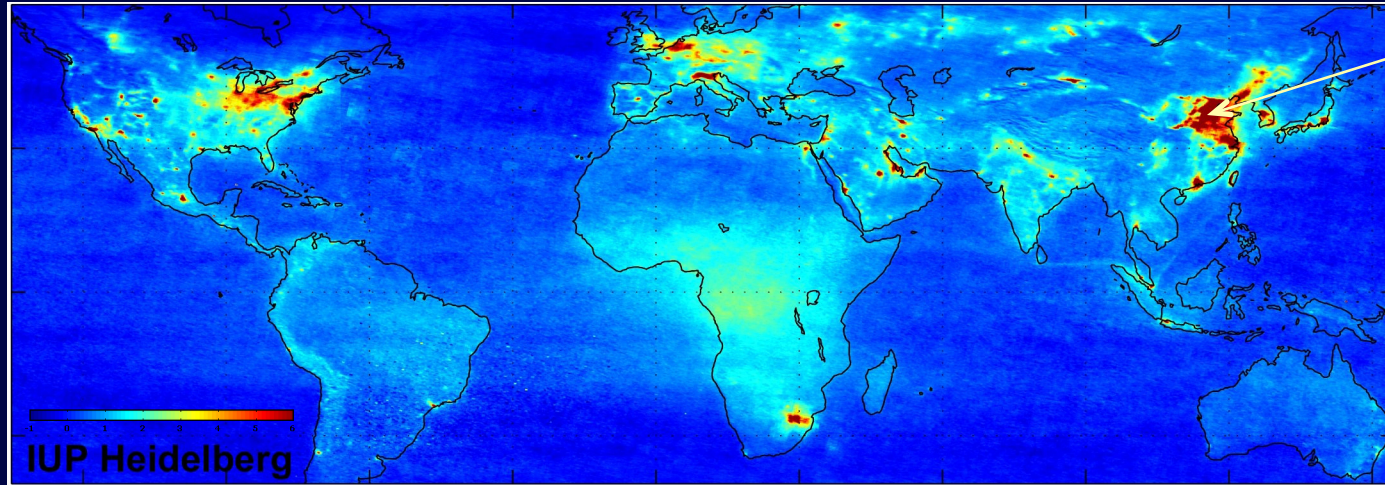
(2008)

Ozone (Dobson Units)



The ozone (O₃) layer, 15 - 50 km above the Earth, protects us from harmful ultraviolet rays.

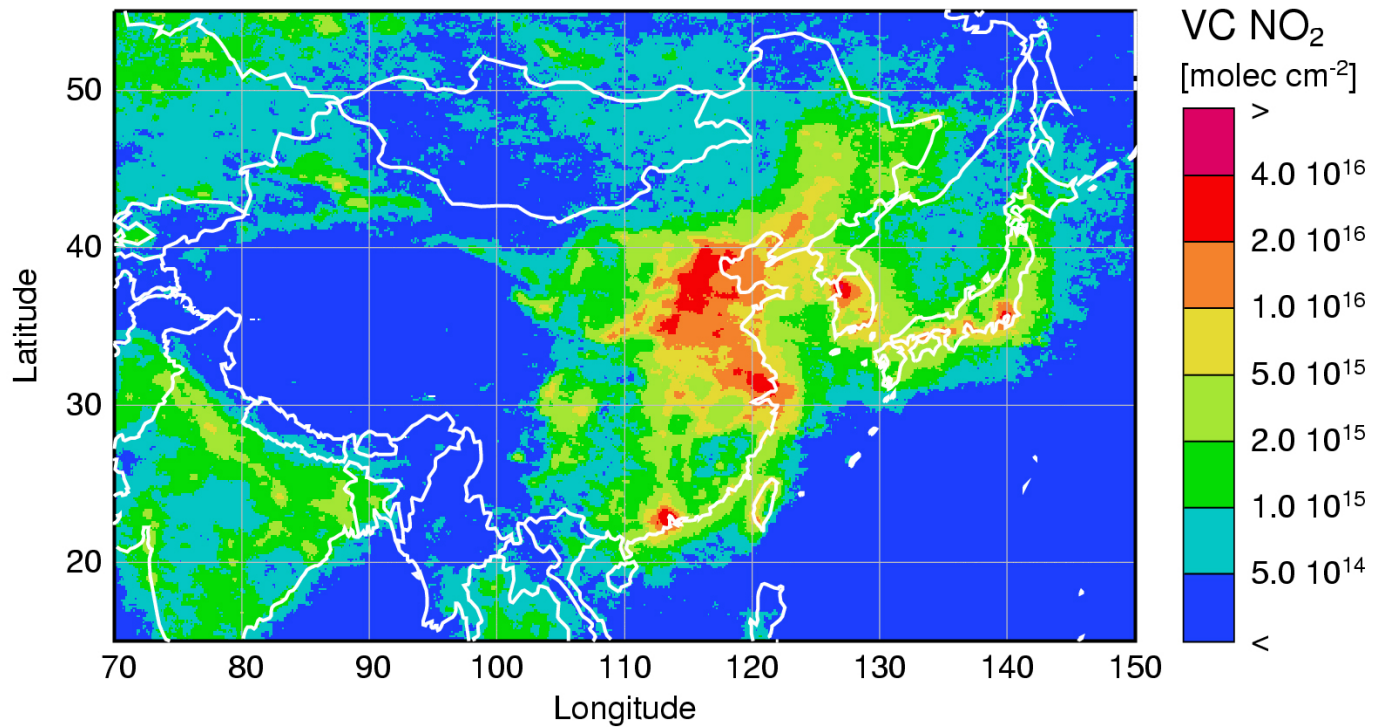
Global Air Pollution Map Produced by Envisat's SCIAMACHY



By courtesy of ESA

Nitrogen dioxide (NO₂) is a mainly man-made gas, excess exposure to which causes lung damage and respiratory problems. It also plays an important role in atmospheric chemistry, because it leads to the production of ozone in the troposphere – which is the lowest part of the atmosphere, extending up to between 8 and 16 kilometers high.

Air Pollution Map Over China & East Asia



Natural challenges:

- ☑ Global warming
- ☑ Polar ice sheet and glacial melting
- ☑ Global sea level rise
- ☑ El Niño/La Niña
- ☑ Hurricane/tornado/flooding
- ☑ Earthquake & tsunami
- ☑ Desert/desertization/sand storm
- ☑ & many others ...

Enough or not?!

Man-made Environmental Hazards:

- ❑ Green house effect & global warming
- ❑ Water pollution
- ❑ Air pollution
- ❑ Soil pollution
- ❑ Marine pollution
- ❑ Groundwater Scarcity
- ❑ Desertization
- ❑ Deforest
- ❑ Ozone hole
- ❑ Many others

We are feeling about them everyday.



Save Our Home!

Thank You!

The Magic Blue Marble