



A Science Perspective

Climate Change and The Arctic

World Environment Day



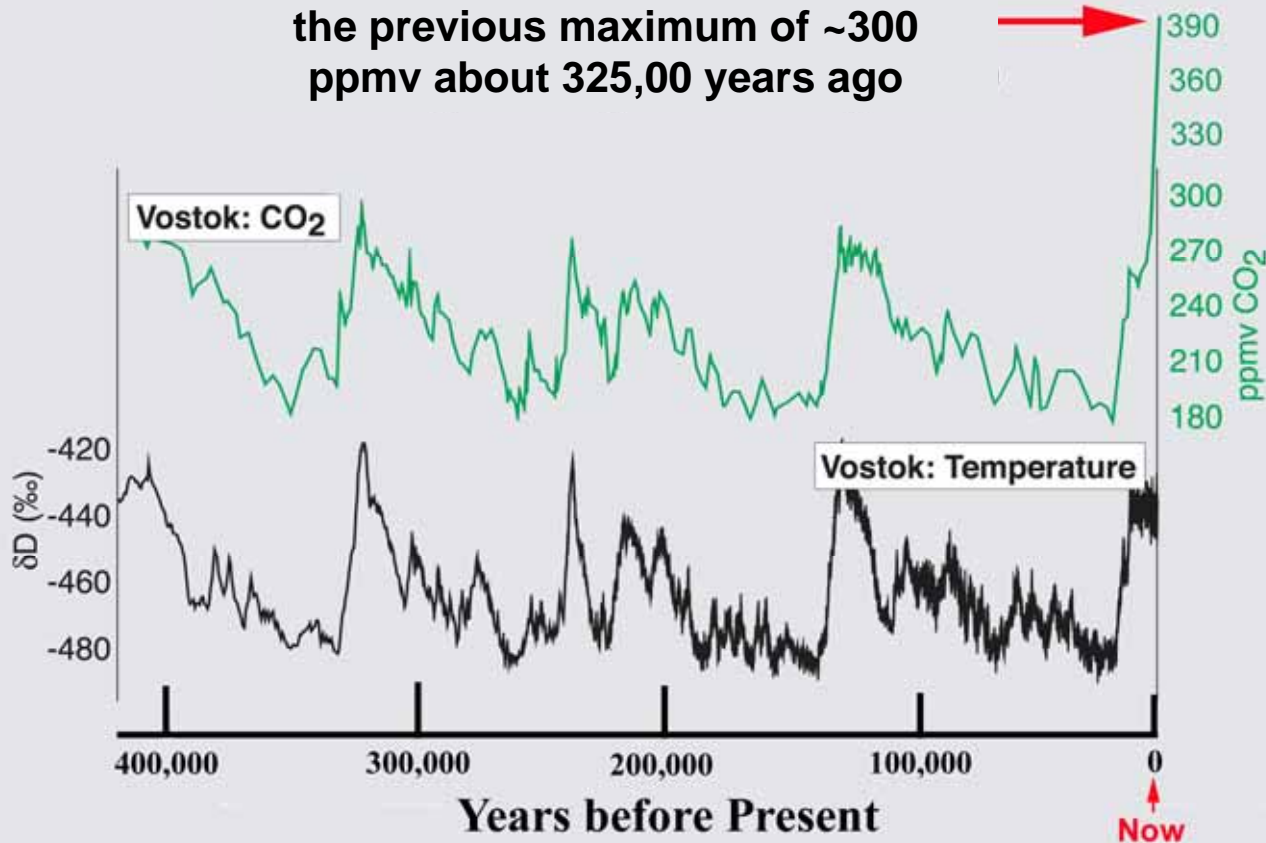
Melting Ice -- Hot Topic?



Let's begin with a focus on current scientific understandings of climate change at global scales and across hundreds of thousands of years, then a short summary of what is happening to sea ice and the Greenland Ice Sheet

CO₂ Concentrations and Proxy Temperatures from the 400,000⁺ years Vostok Ice Core Data Set.

CO₂ levels now almost 30% above the previous maximum of ~300 ppmv about 325,000 years ago

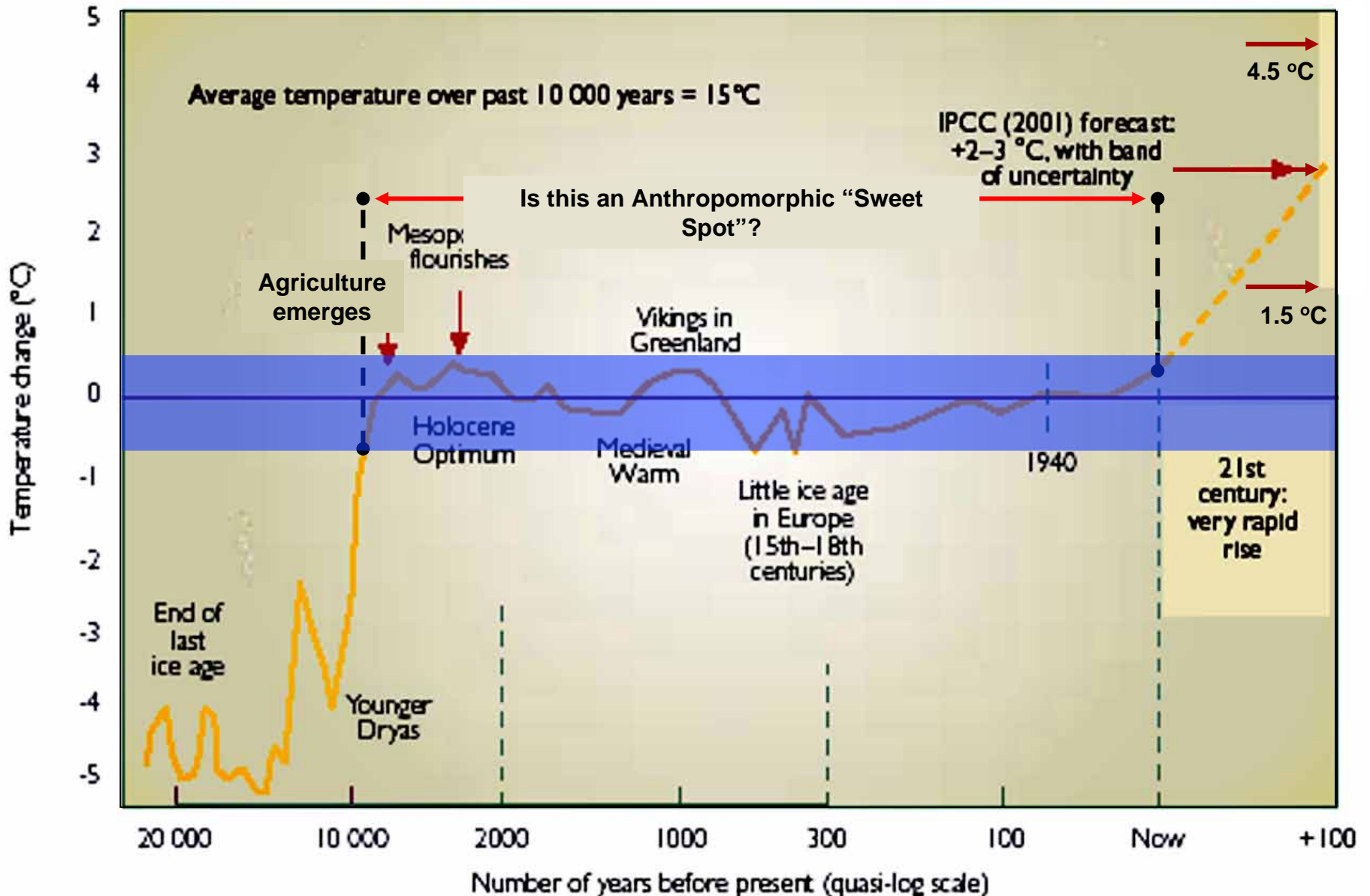


Tiny Hollow Spheres with Captured Air



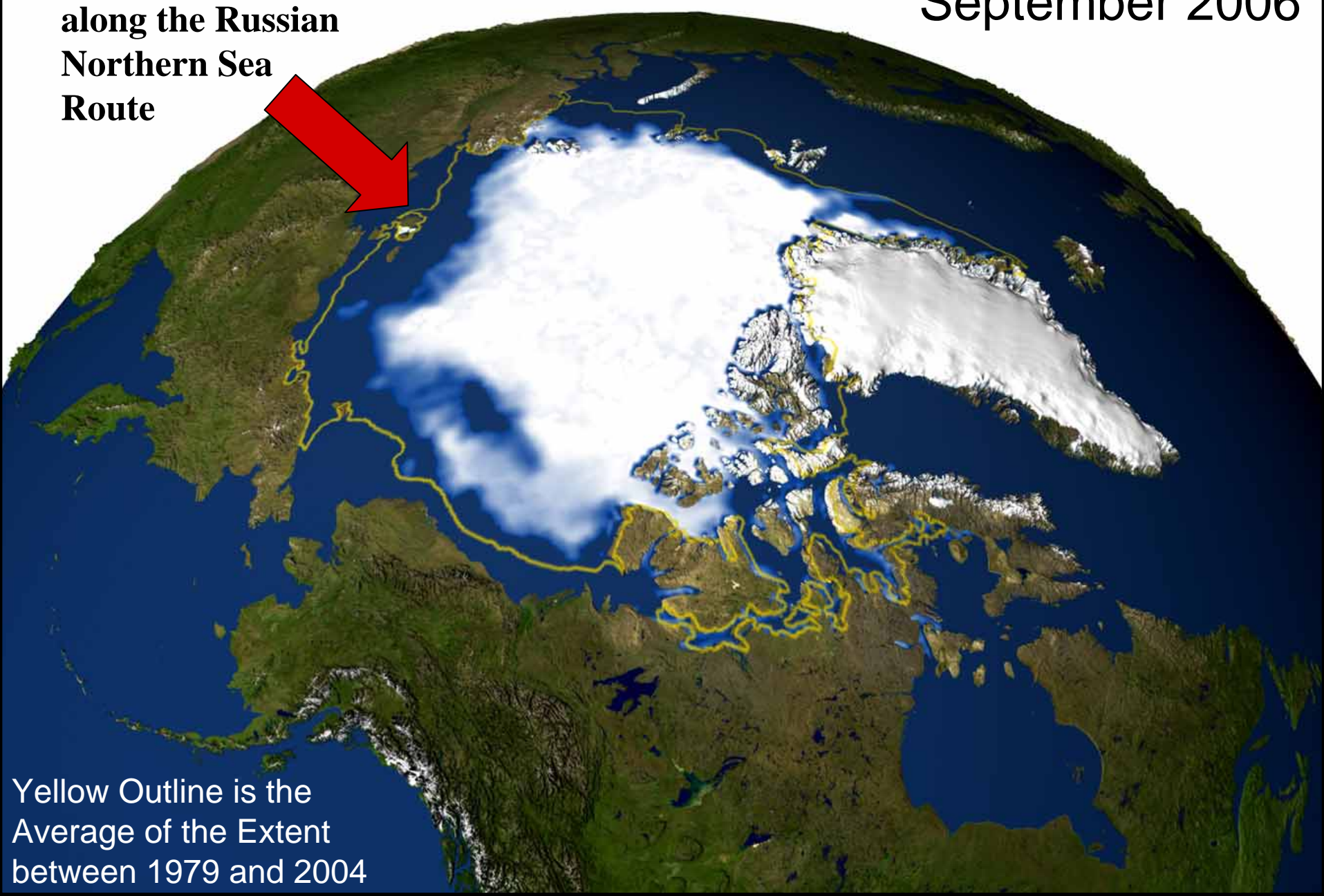
Cross-Section of an Ice Core

The Last 20,000 Years seems to have been Ideal for the Development of Human Societies. Is this a Historic “Sweet Spot” that Enabled Humans to Flourish?



Sea Ice Extent September 2006

**Note: Opening
along the Russian
Northern Sea
Route**

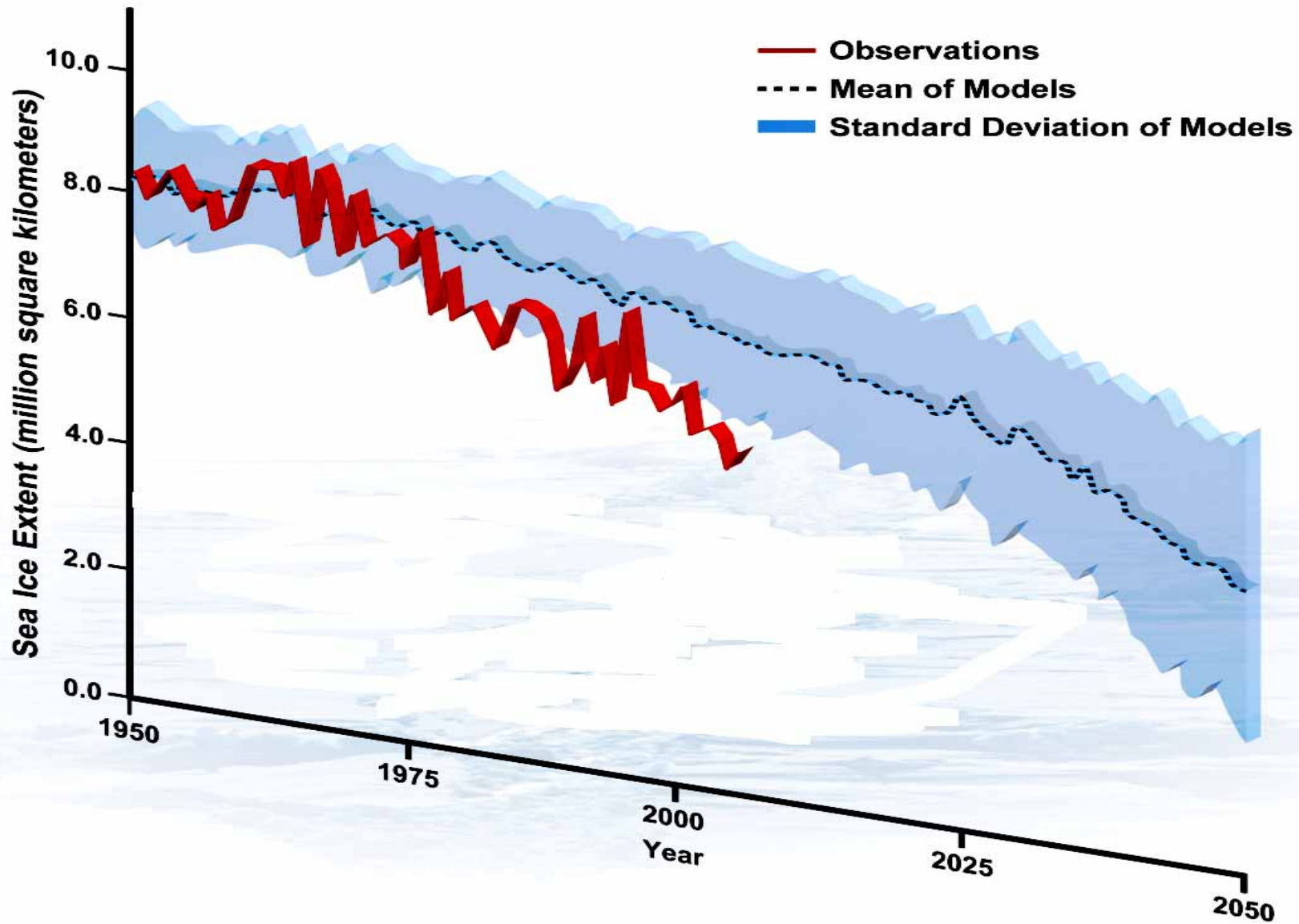


Yellow Outline is the
Average of the Extent
between 1979 and 2004



Sea Ice Changes from 1979 to 2005

Arctic September Sea Ice Extent: Observations and Model Runs





Models Project Sea Ice Extent for Mid-September

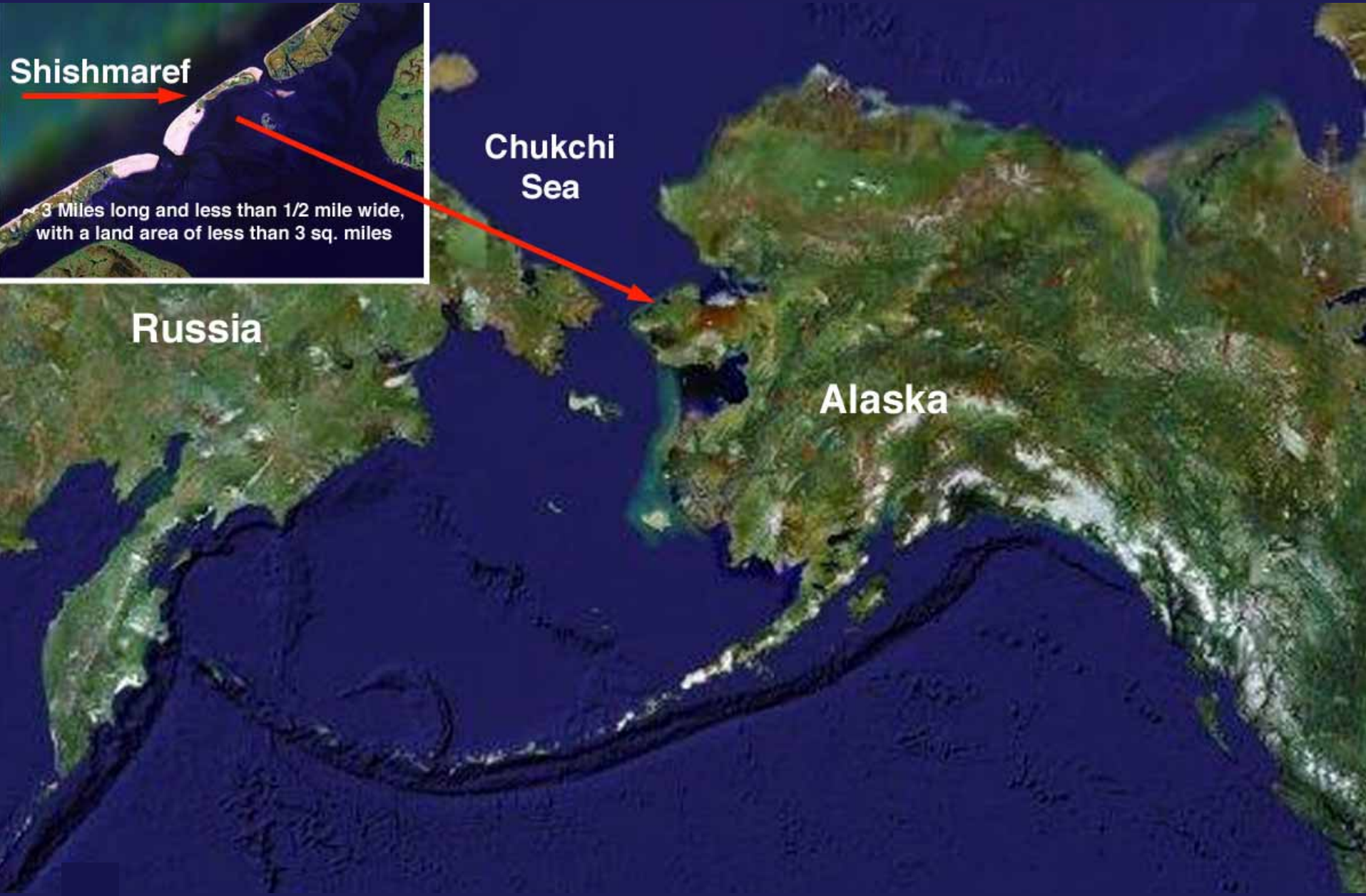
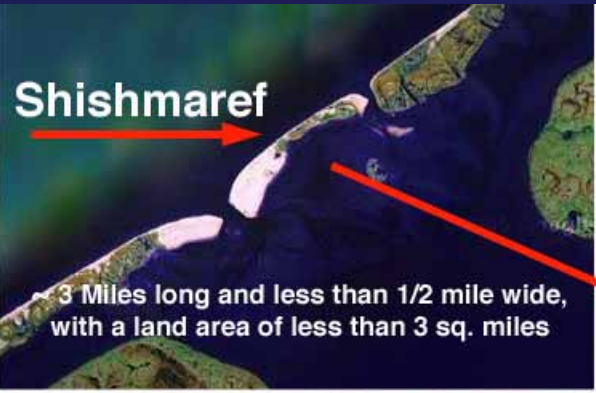
Five ACIA Model Projections
2070 - 2090



Recent Model Runs Suggest this by
2030 - plus or minus a decade



Loss Sea Ice in Spring & Fall Increases Coastal Erosion



Shishmaref, Alaska 2005



**125 Ft. in
One Storm**

Many coastal communities and facilities face increasing exposure to storms.



Melting Ice -- Hot Topic?



**Let's look at
Greenland**

The Greenland Ice Sheet Dominates Land Ice in the Arctic

Over the past two decades, the melt area on the Greenland ice sheet has increased on average by about 0.7%/year (or about 20% from 1979 to 2005). Recent papers strongly suggest that the accumulation on the dome is less than the melting losses along the edges of Greenland.



Source: Business Week Aug. 2004



Melting Ice -- Hot Topic?



Ilulissat Glacier Retreat 1998-2007

51°W

50°30'W

50°W

49°30'W

The front has
rapid changes

Ilulissat Glacier drains ~ 7%
of the Greenland Ice Sheet

1998
7 km/y

2005
15 km/y

May 2007
13.5 km/yr

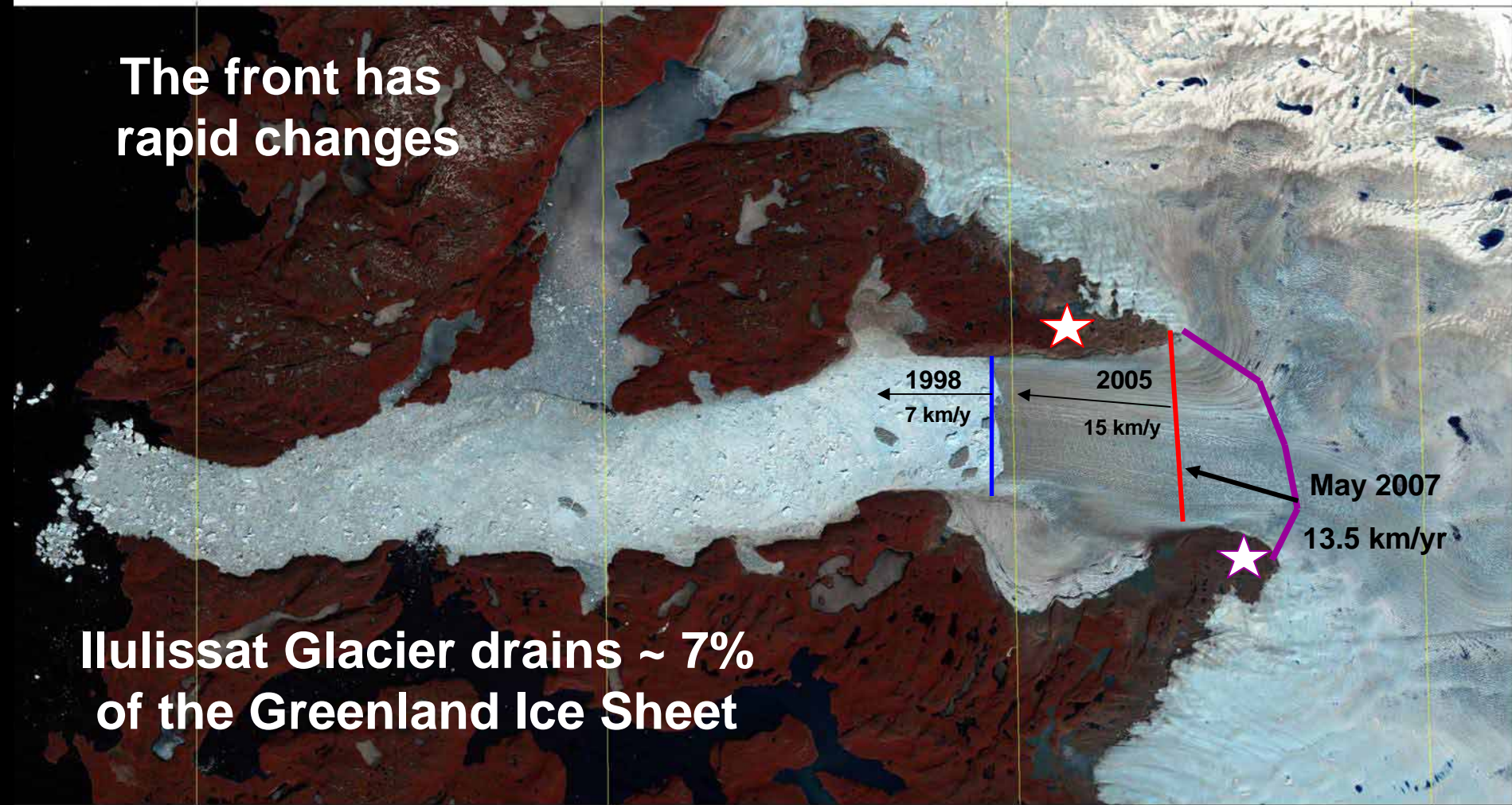
51°W

50°30'W

50°W

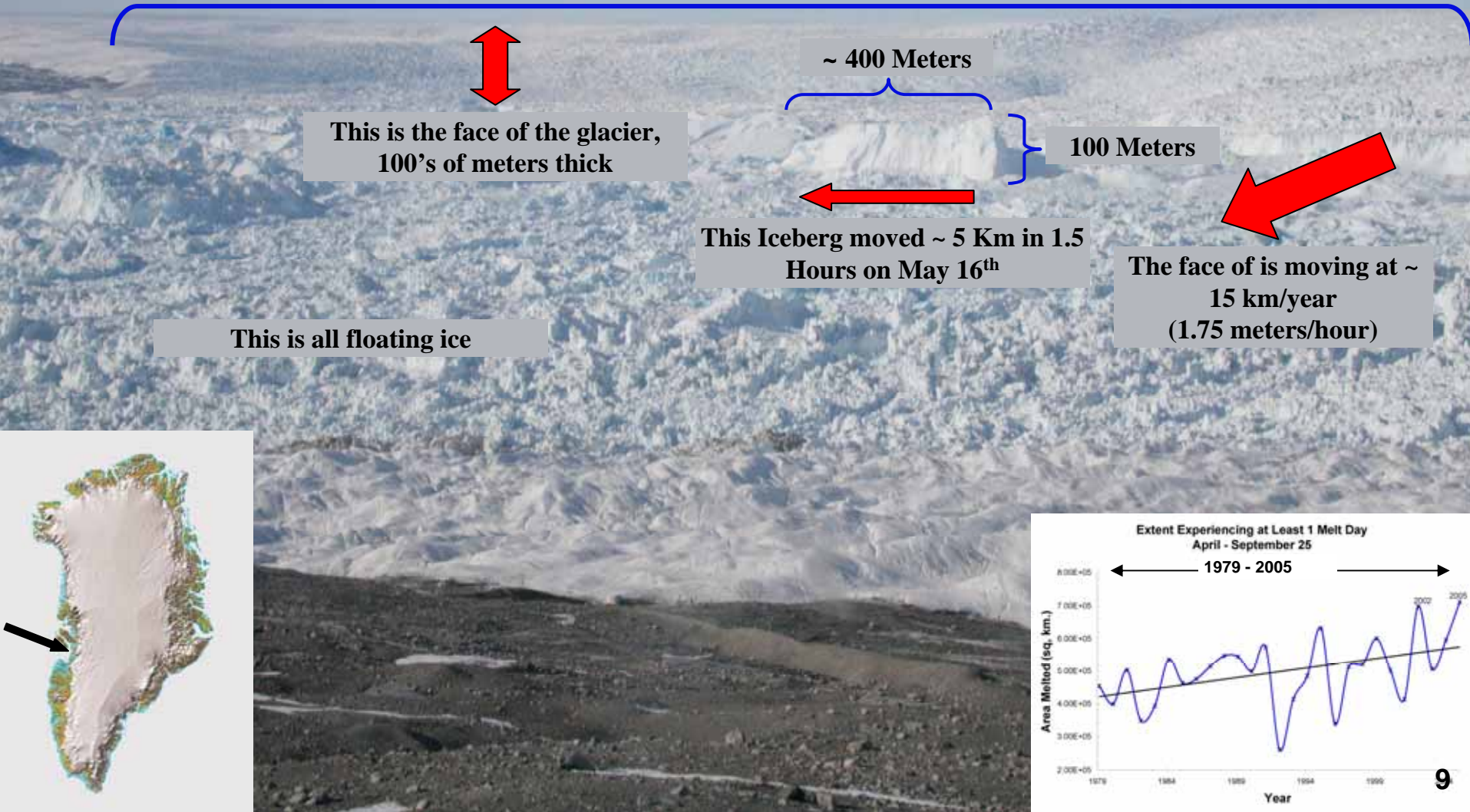
49°30'W

Landsat TM 1996



Greenland's Ilulissat glacier is one of the fastest moving glaciers in the world

The Ilulissat Glacier's face is about 5 Km across



This is the face of the glacier,
100's of meters thick

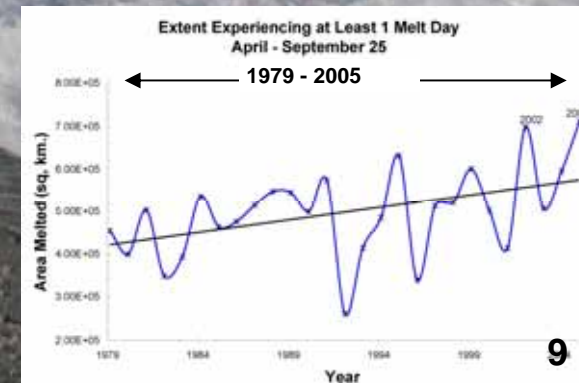
~ 400 Meters

100 Meters

This Iceberg moved ~ 5 Km in 1.5
Hours on May 16th

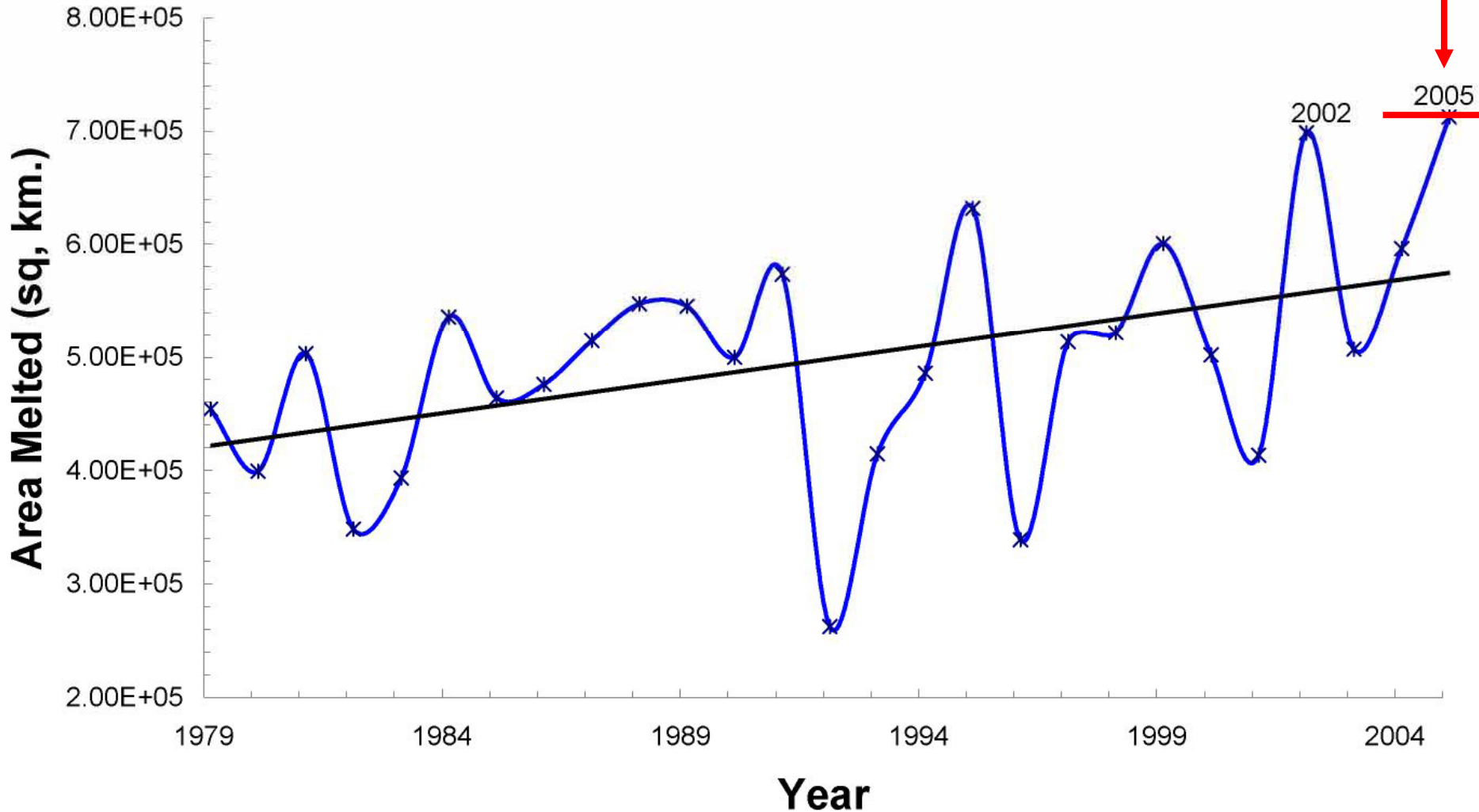
The face of is moving at ~
15 km/year
(1.75 meters/hour)

This is all floating ice



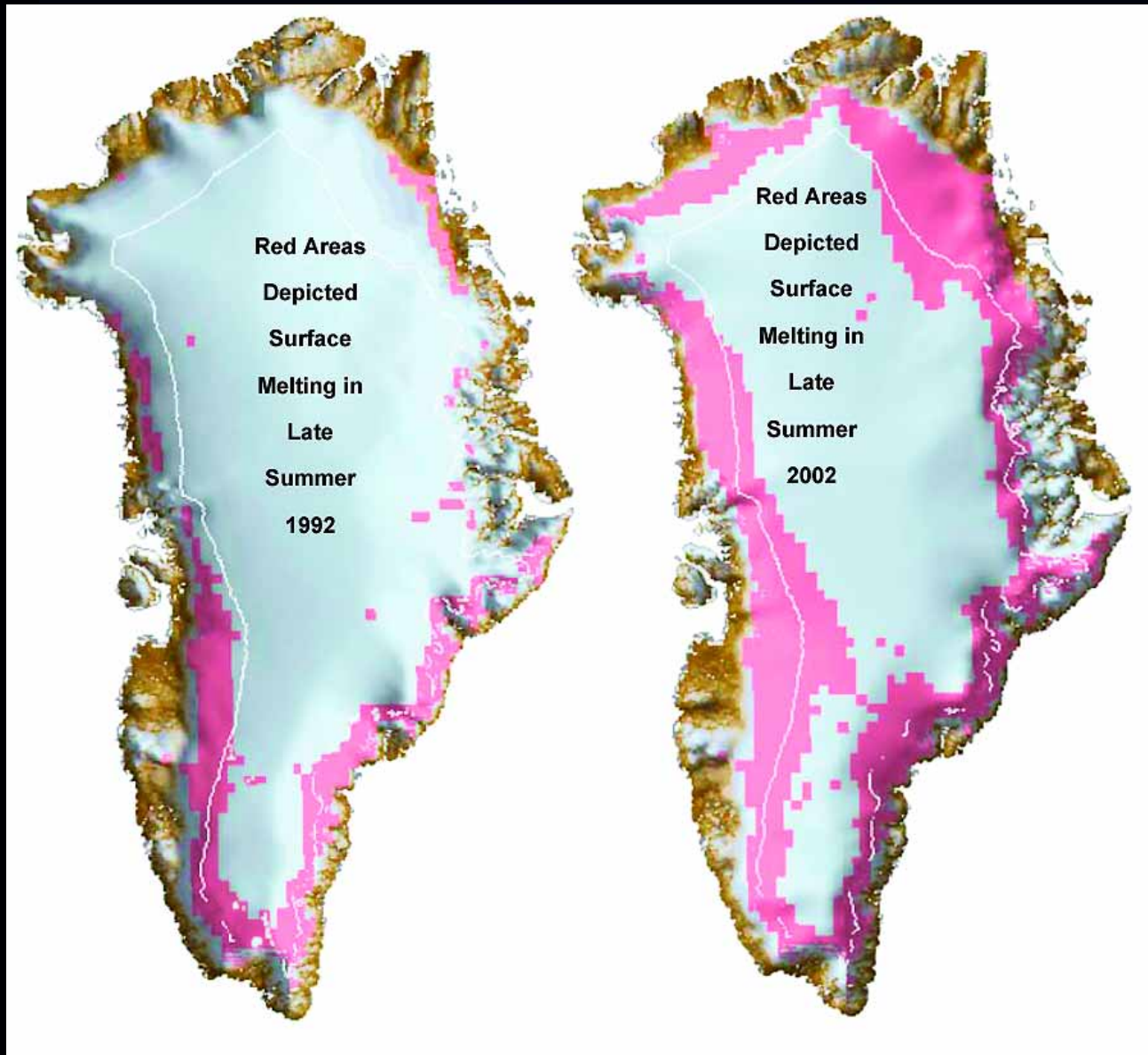
Greenland Ice Sheet Melt Rates

Extent Experiencing at Least 1 Melt Day
April - September 25



IMPACTS OF A WARMING ARCTIC

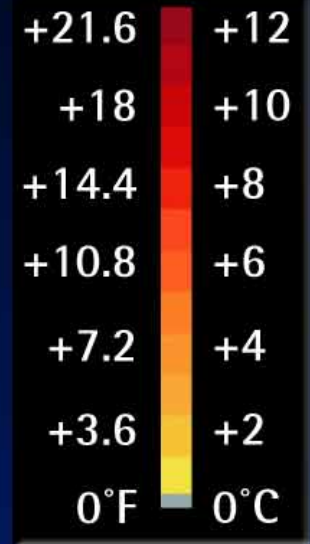
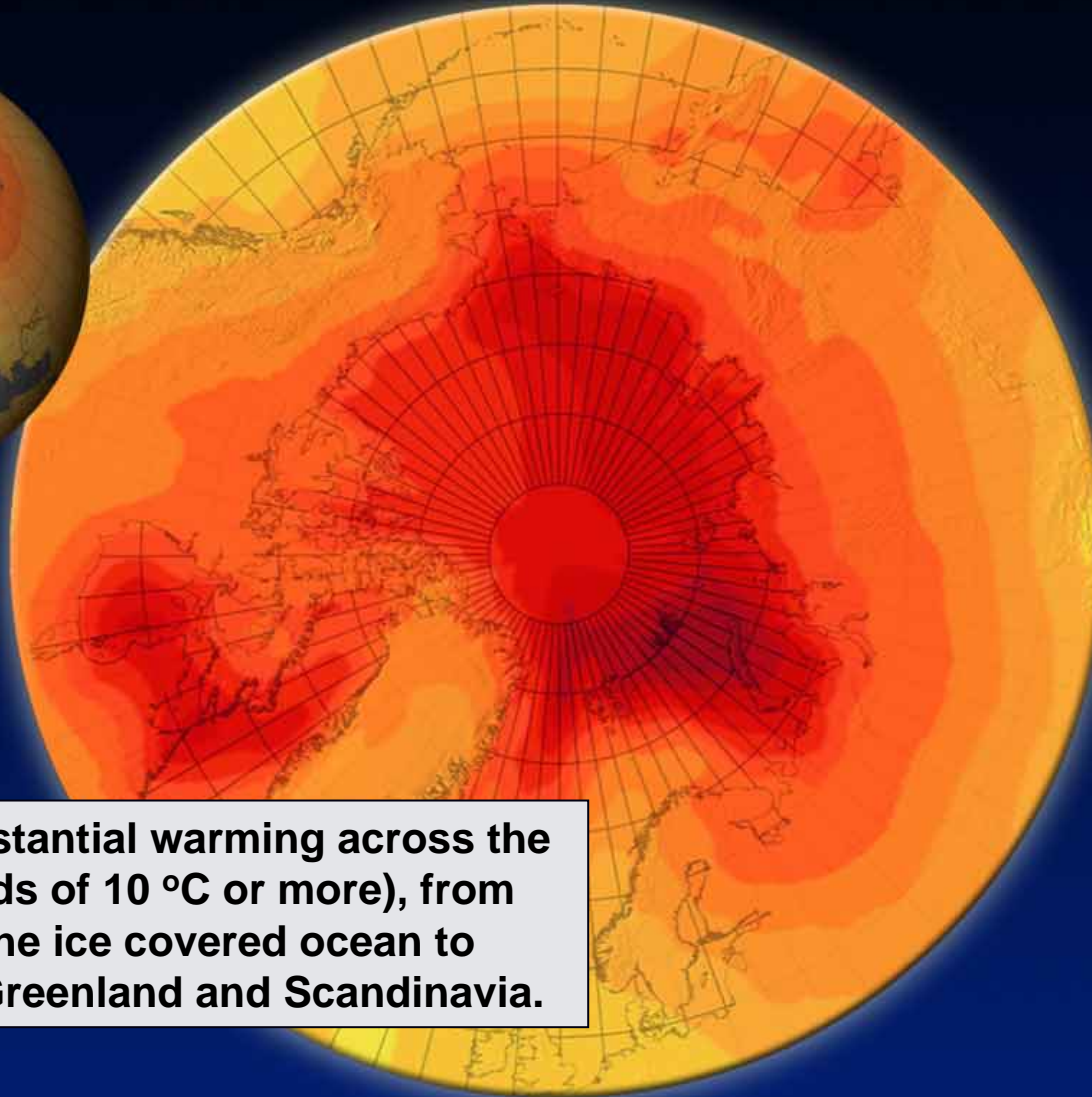
Greenland Ice Sheet Melt Extent





IMPACTS OF A WARMING ARCTIC

Projected Surface Air Temperature Change:
1990s–2090s (winter Dec–Feb)

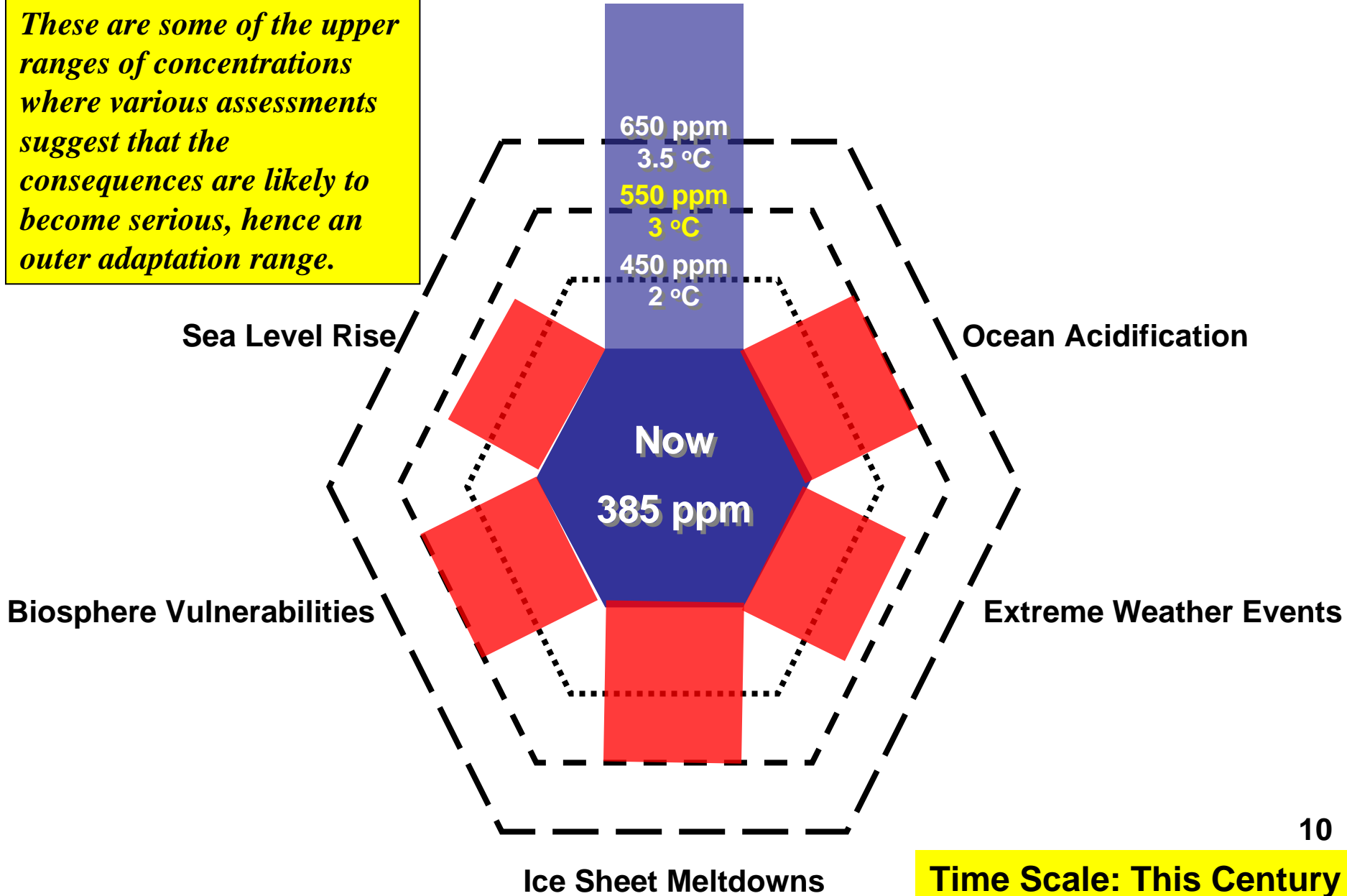


Note: The substantial warming across the Arctic, (upwards of 10 °C or more), from very warm in the ice covered ocean to less warm in Greenland and Scandinavia.

A Concept for a Mitigation/Impacts Multi-Space

A framing within which coping strategies are addressed

These are some of the upper ranges of concentrations where various assessments suggest that the consequences are likely to become serious, hence an outer adaptation range.





In Summary:

- **The Arctic Region's climate is changing very rapidly.**
- **Arctic climate is now warming rapidly and much larger changes are projected.**
- **Over the past few decades, the annual average Arctic temperatures have increased at almost twice the rate as that of the rest of the world, with Alaska warming about 6 to 8 times the global average.**

Climate change and global warming are no longer simply an environmental issue, it is an issue of economic security and human well-being !

This pale blue dot is planet Earth taken from Saturn by NASA's Cassini spacecraft looking back toward the Earth on Sept. 27, 2006. Saturn is about 800 million miles from the Earth.



Thank You