



## Outline

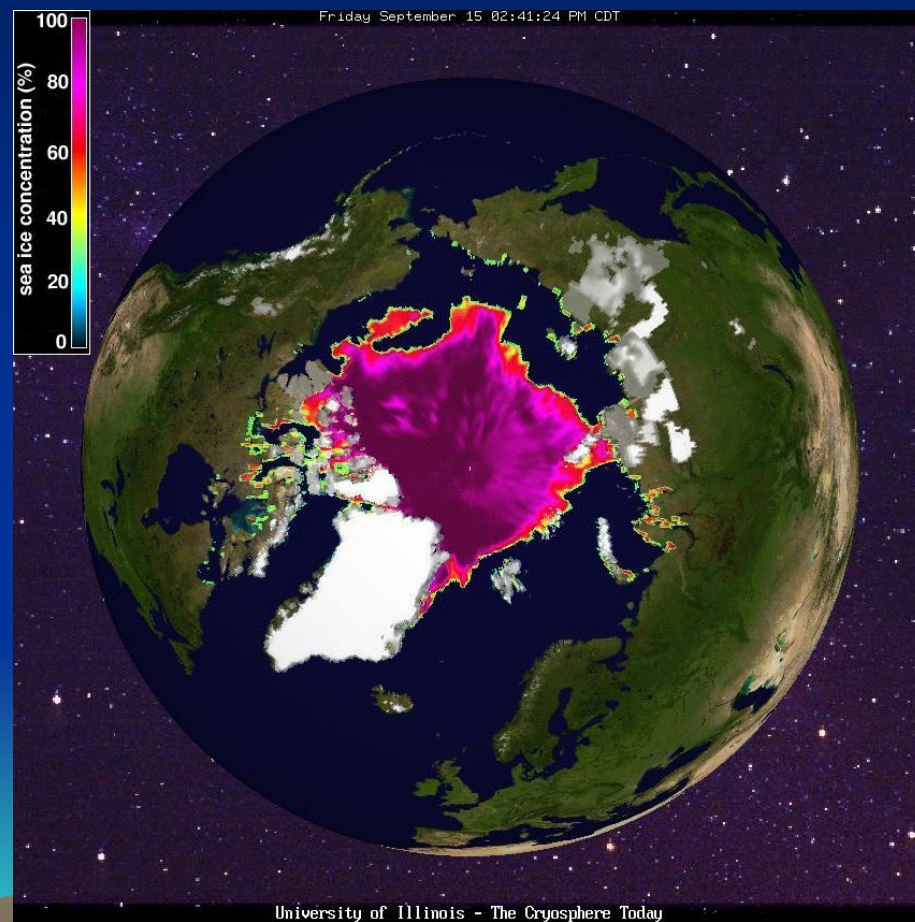
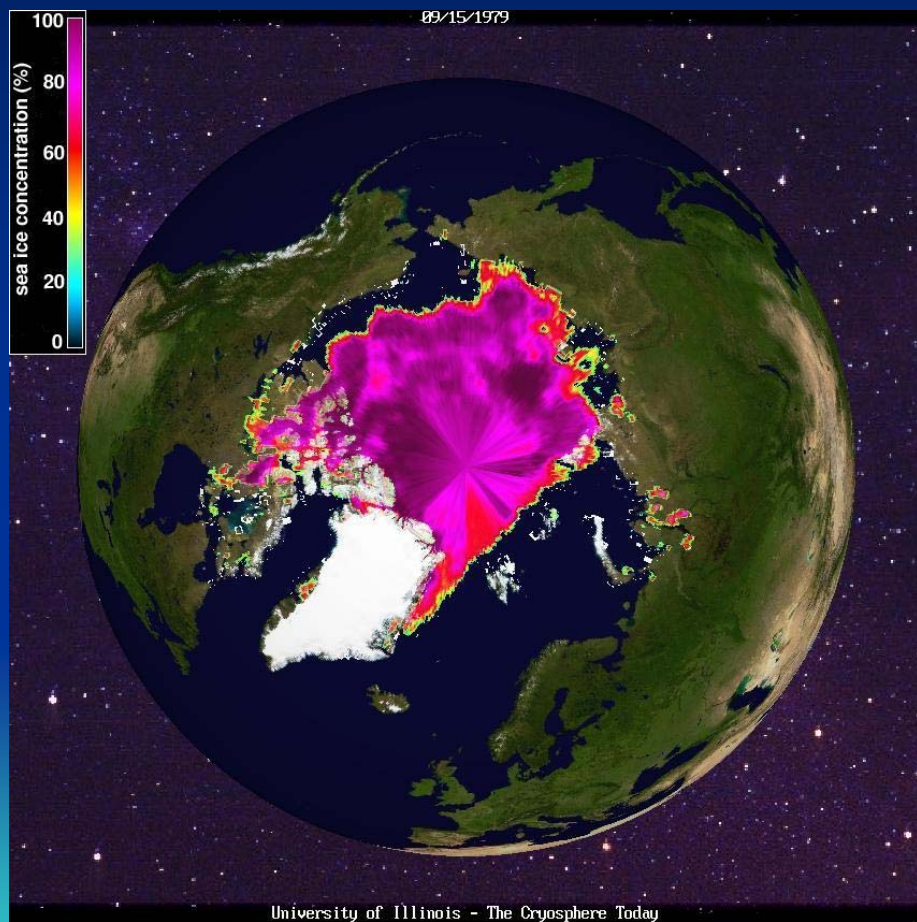
Scientific understanding of climate change  
Understanding Impacts in Arctic  
Implications for Arctic change  
Ongoing Federal Efforts



# Arctic Ice Extent – September 15

1979, 7.2 million sq km

2006, 5.9 million sq km



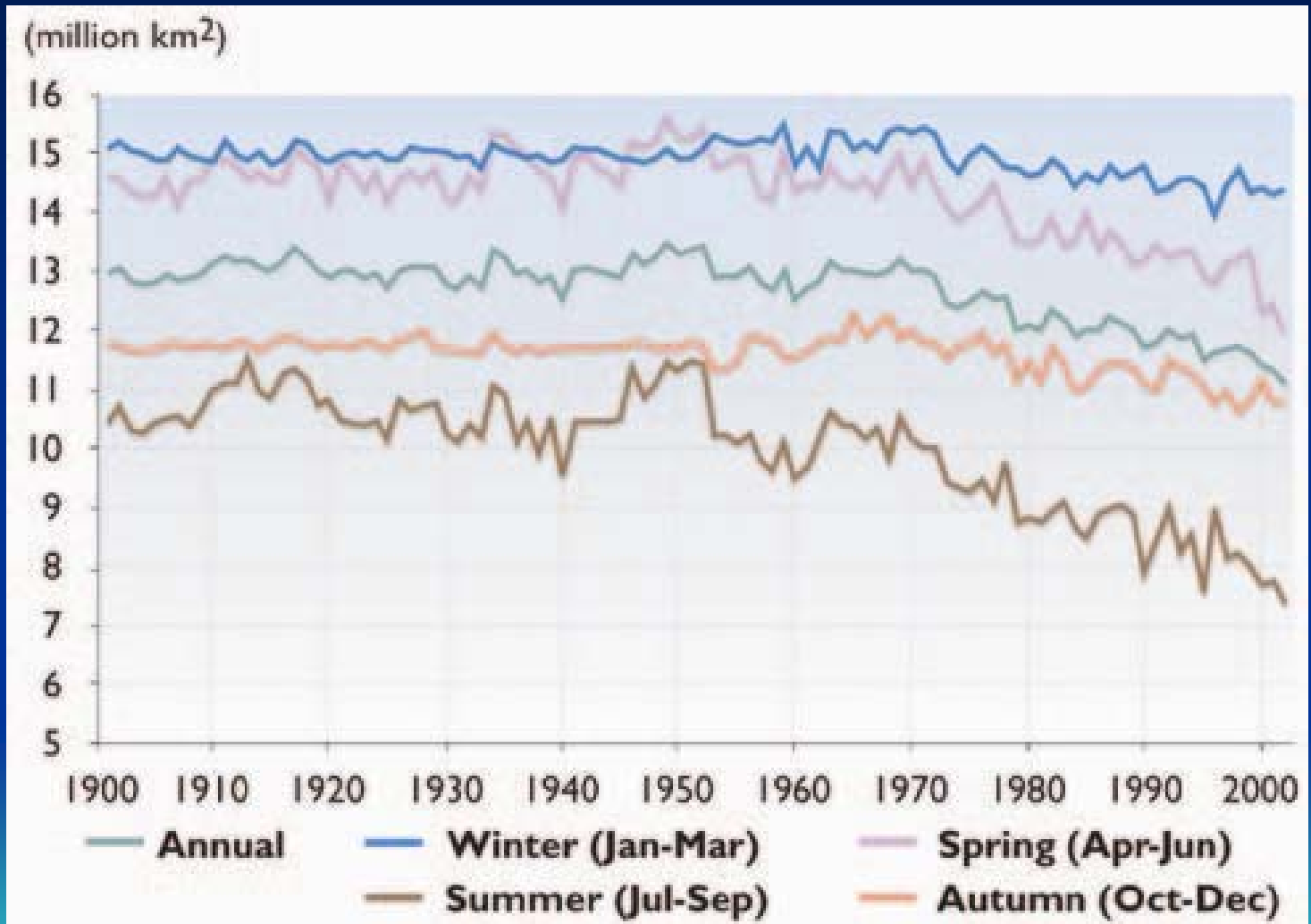


# Observed Seasonal Arctic Ice Extent

**1900-1952**  
Climatology w/  
Increasing  
Observations

**1953-1971**  
Observations  
w/ Complete  
Coverage

**1972-Present**  
Satellite Data





# Climate Change and its Implications for Arctic Policy

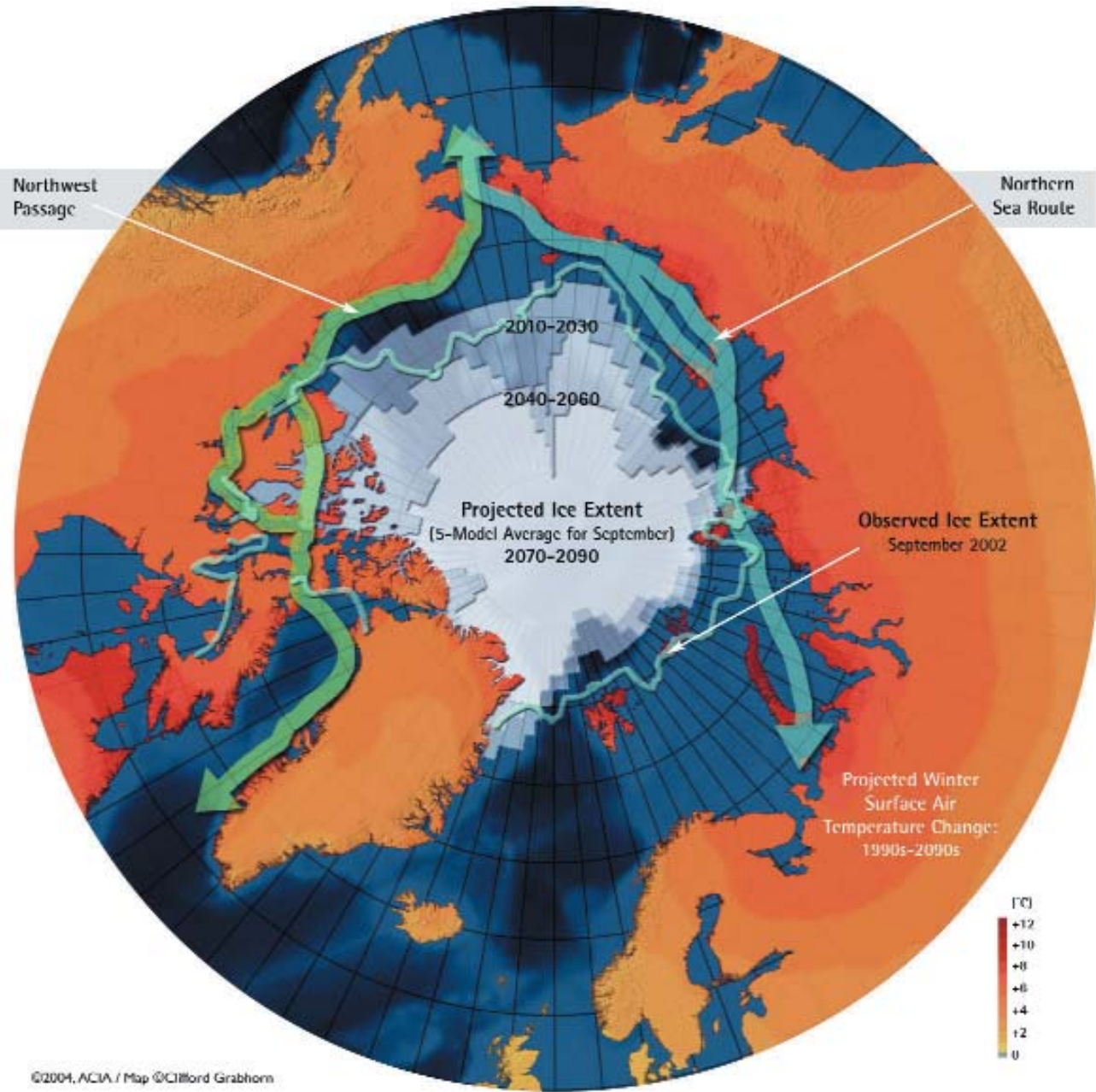
Dr. Sharon Hays  
White House  
Office on Science and Technology Policy

June 5, 2008



# Projected Arctic Ice Extent

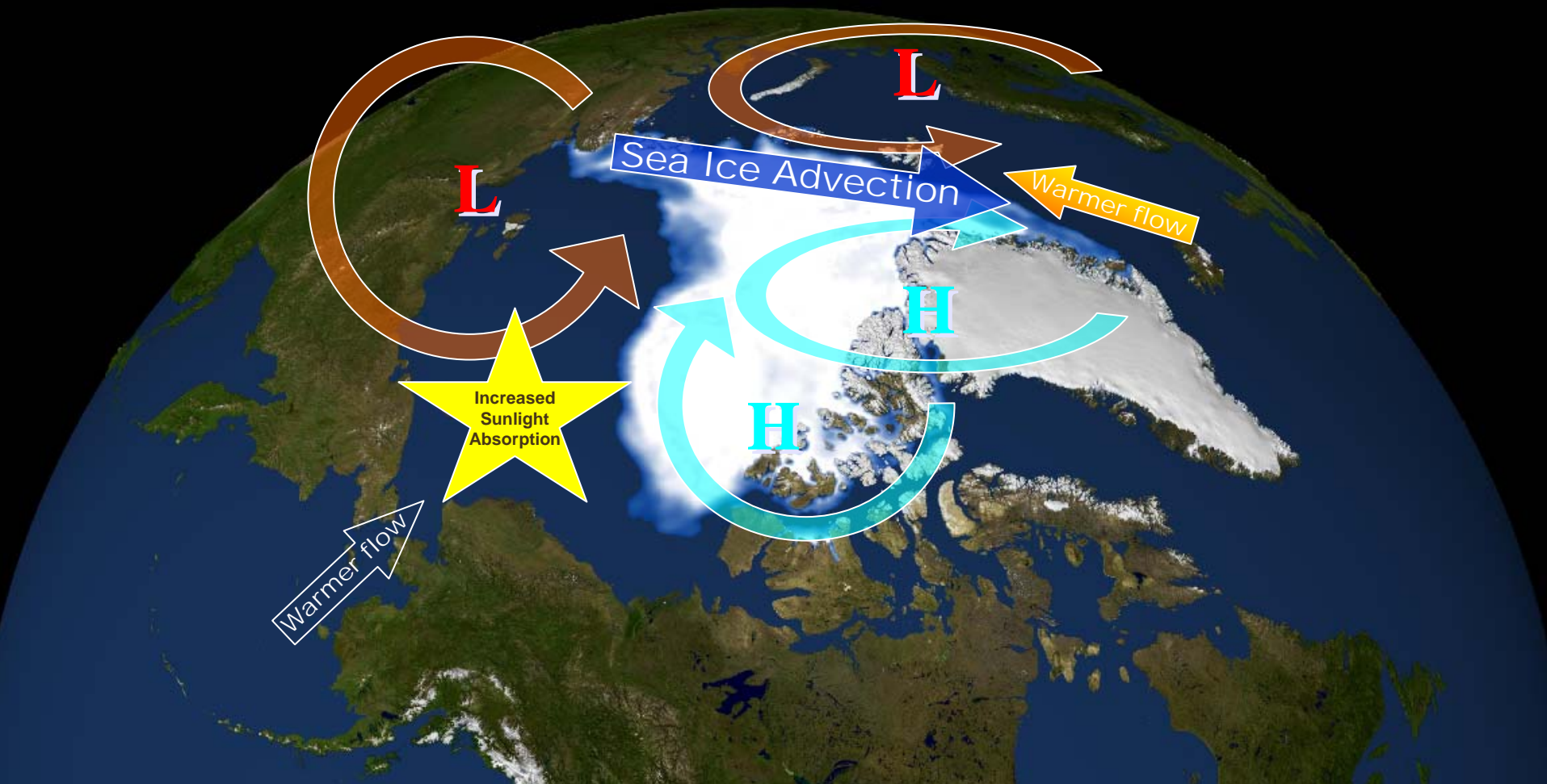
IPCC **B2 TAR**  
Emissions  
Scenario,  
5-Model Average





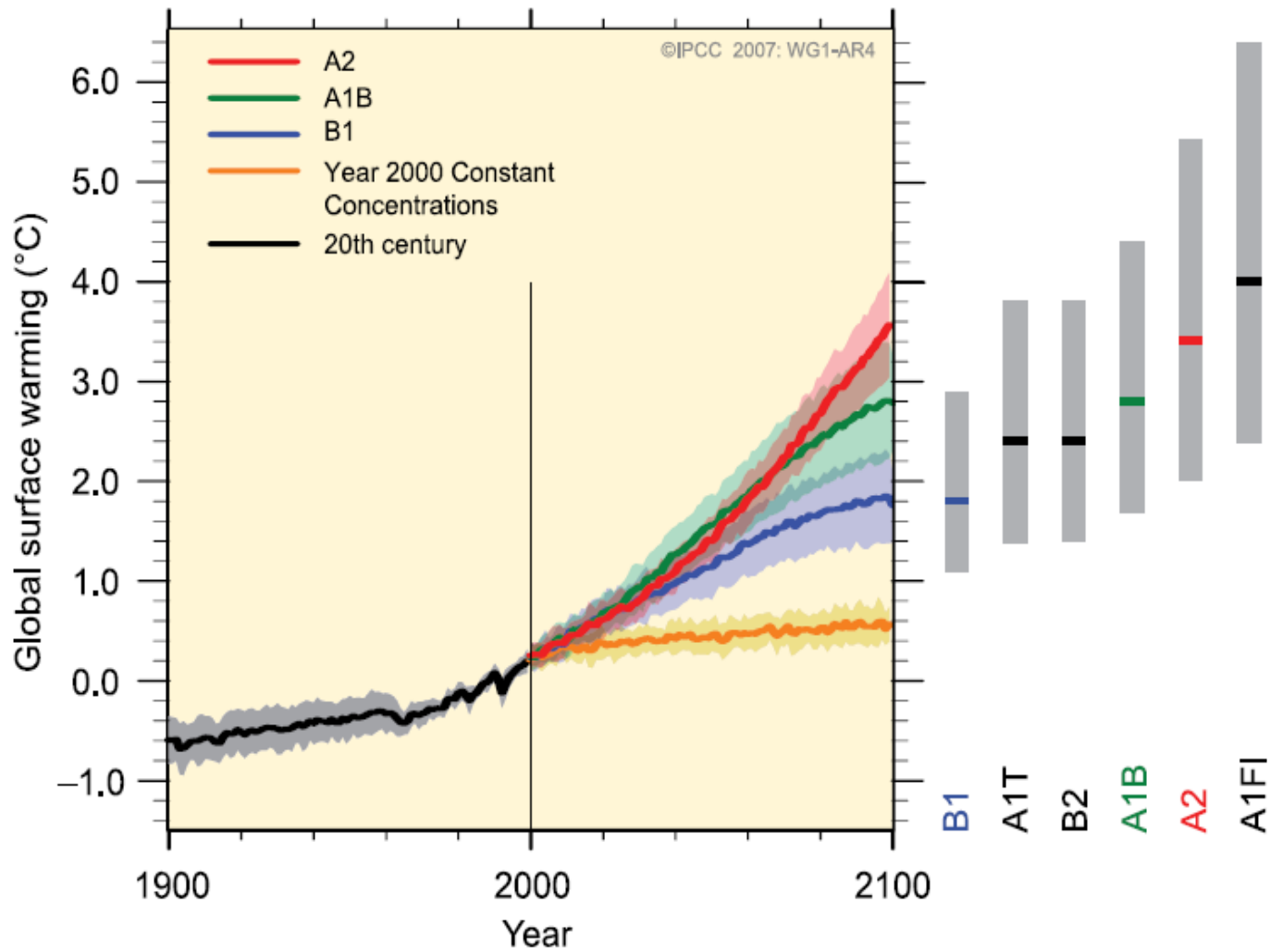
# Dominant forcing functions

- Overall Arctic Temperature Increase
- Enhanced Advection by Atmospheric patterns
- Insolation (Solar energy input) positive feedback
- Oceanic warm water intrusions





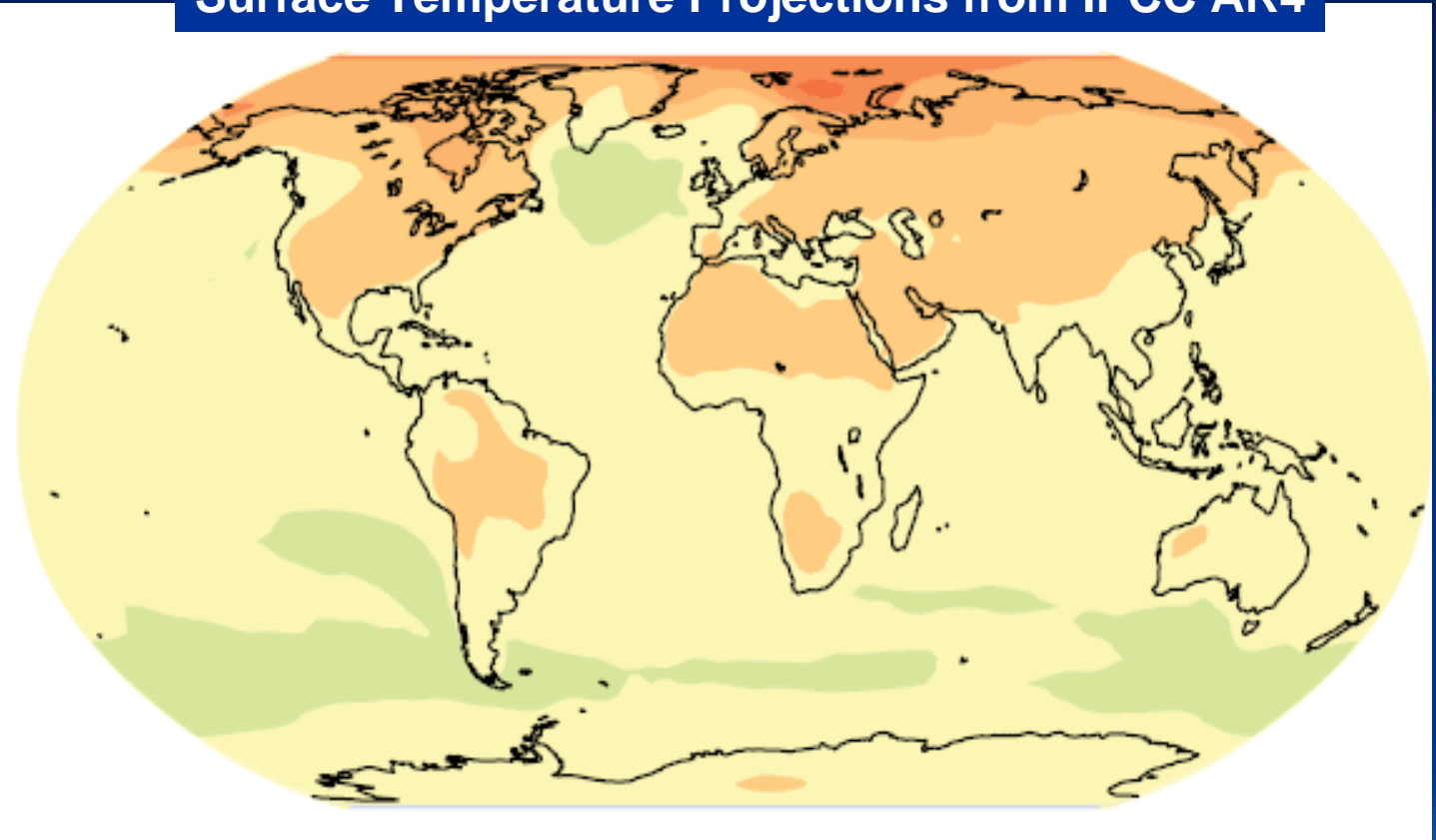
### MULTI-MODEL AVERAGES AND ASSESSED RANGES FOR SURFACE WARMING



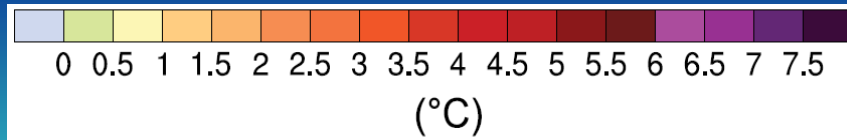
From  
IPCC AR4  
2007



## Surface Temperature Projections from IPCC AR4



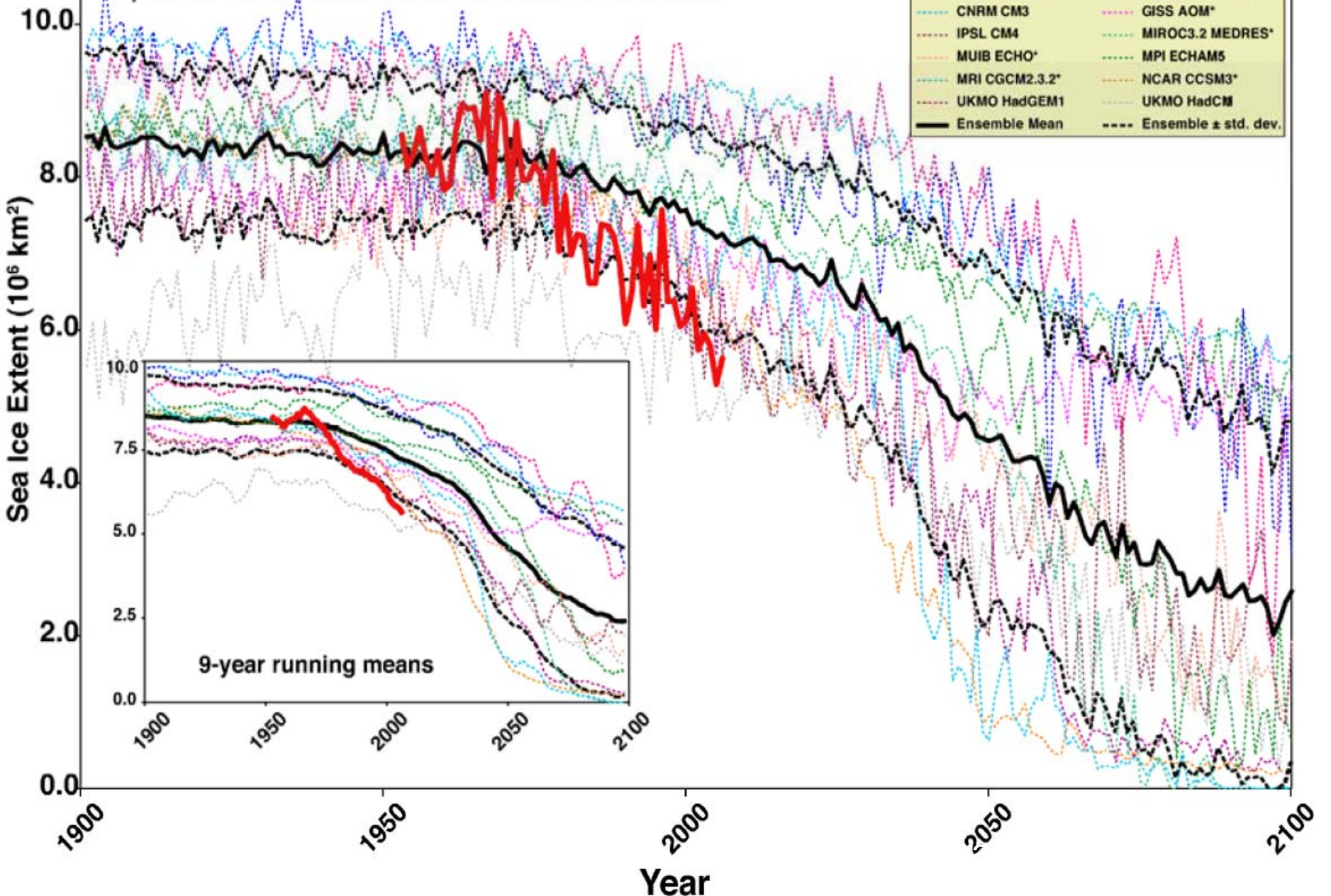
2020-2029  
A1B





# Arctic September Sea Ice Extent: Observations and Model Runs

- Observations
- CCCMA CGCM3\*
- CNRM CM3
- IPSL CM4
- MUIB ECHO\*
- MRI CGCM2.3.2\*
- UKMO HadGEM1
- Ensemble Mean
- BCCR BCM2.0
- CCCMA CGCM3.1(T63)
- GISS AOM\*
- MIROC3.2 MEDRES\*
- MPI ECHAM5
- NCAR CCSM3\*
- UKMO HadCM
- Ensemble  $\pm$  std. dev.

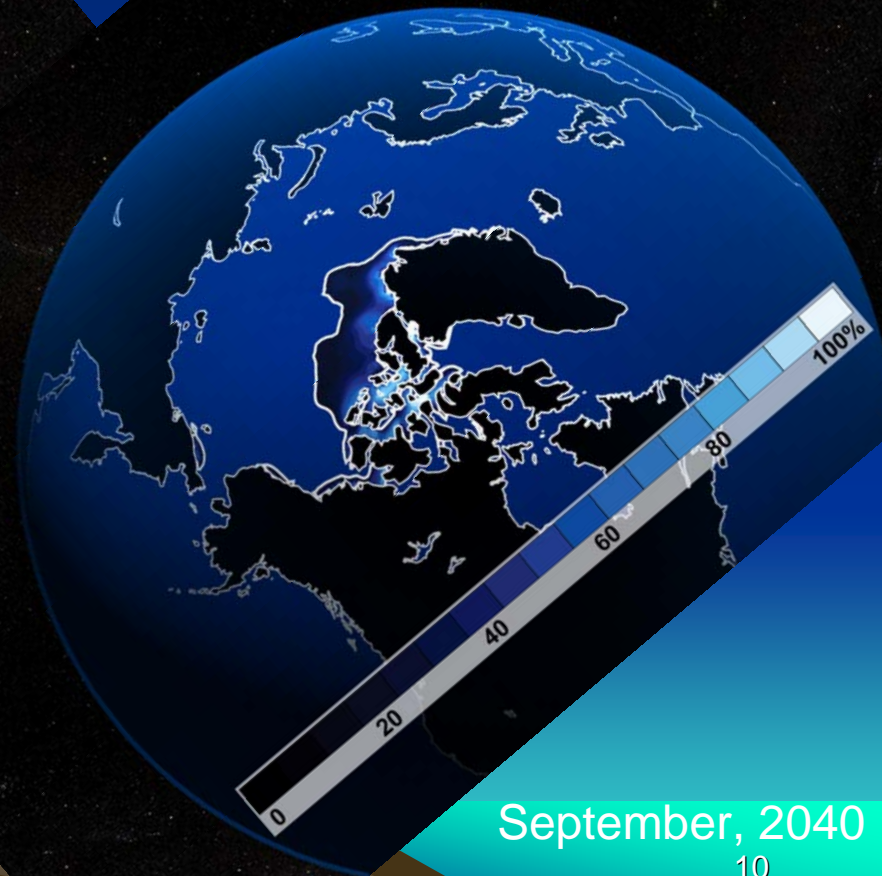


# Alternative Projection

## Arctic Minimum Ice Extent

IPCC **A1B** Emissions  
Scenario,  
NCAR Climate Model  
(**MOVIE**)

September, 2000



September, 2040



# Impacts of Climate Change in the Arctic

Impacts to Marine and Terrestrial ecosystems

Increased Marine Shipping

- Potential Disputes Regarding Access
  - Northern Sea Route (Russia)
  - Northwest Passage (Canada)
- Increased Responsibility for Safety at Sea
- Increased Potential for Oil Spills

Increased Access to Resources

- Extended Continental Shelf (ECS)

Reduction of Permafrost and Geotechnical Properties

Increased Shore Exposure to Storms/Waves

- Coastal Erosion Affecting Infrastructure

# Relevant Federal interagency policy bodies and related activities

**U.S. Arctic Research Commission (ARC)**, *Mead Treadwell, Chair*  
<http://www.arctic.gov/>

**Interagency Arctic Research Policy Committee (IARPC)**,  
*Arden Cement, Chair*, [www.nsf.gov/od/opp/arctic/iarpc/start.jsp](http://www.nsf.gov/od/opp/arctic/iarpc/start.jsp)

**Interagency Committee on Ocean Science and Research Management Integration (ICOSRMI)**, *Sharon Hays and Martin Hall, Co-Chairs*,  
<http://ocean.ceq.gov/about/icosrmi.html>

**Coordinating Board of the Committee on the Marine Transportation System (CMTS)**, *Helen Broehl, Director*, <http://www.cmts.gov/index.htm>

**National Security Council Policy Coordinating Committee on International Affairs, Energy, and the Environment**

**National Security Council and Homeland Security Council Joint Policy Coordinating Committee on Maritime Security**



# Summary

**Broad scientific consensus that that the Earth is warming and its due largely to human activity**

**Observed changes in Arctic can be expected to continue, probably accelerate**

**Robust predictions of change in next 20 to 30 years not possible now**

**Arctic resources suggest many nations will pursue exploitation or claim authority**

**Reduced sea ice extent will likely increase marine access and activity levels**

**Number of Federal policy efforts underway**