

# How SEARCH Fits into the Larger Scheme of U.S. Climate Change Science

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**US Climate Change  
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[www.climatescience.gov](http://www.climatescience.gov)



# Significant Focuses for Evaluating Climate Variability and Change

- High latitudes
- High elevations
- Transition/discontinuity zones



# U.S. Climate Change Science Program – History

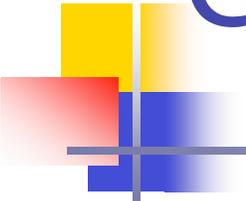
- U.S. Global Change Research Program (USGCRP): 1989 and 1990
- President Bush announced Climate Change Research Initiative (CCRI) and Climate Change Technology Initiative (CCTI) – June 11, 2001
- President Bush announced new cabinet-level management responsibilities for climate science and technology programs – February 14, 2002



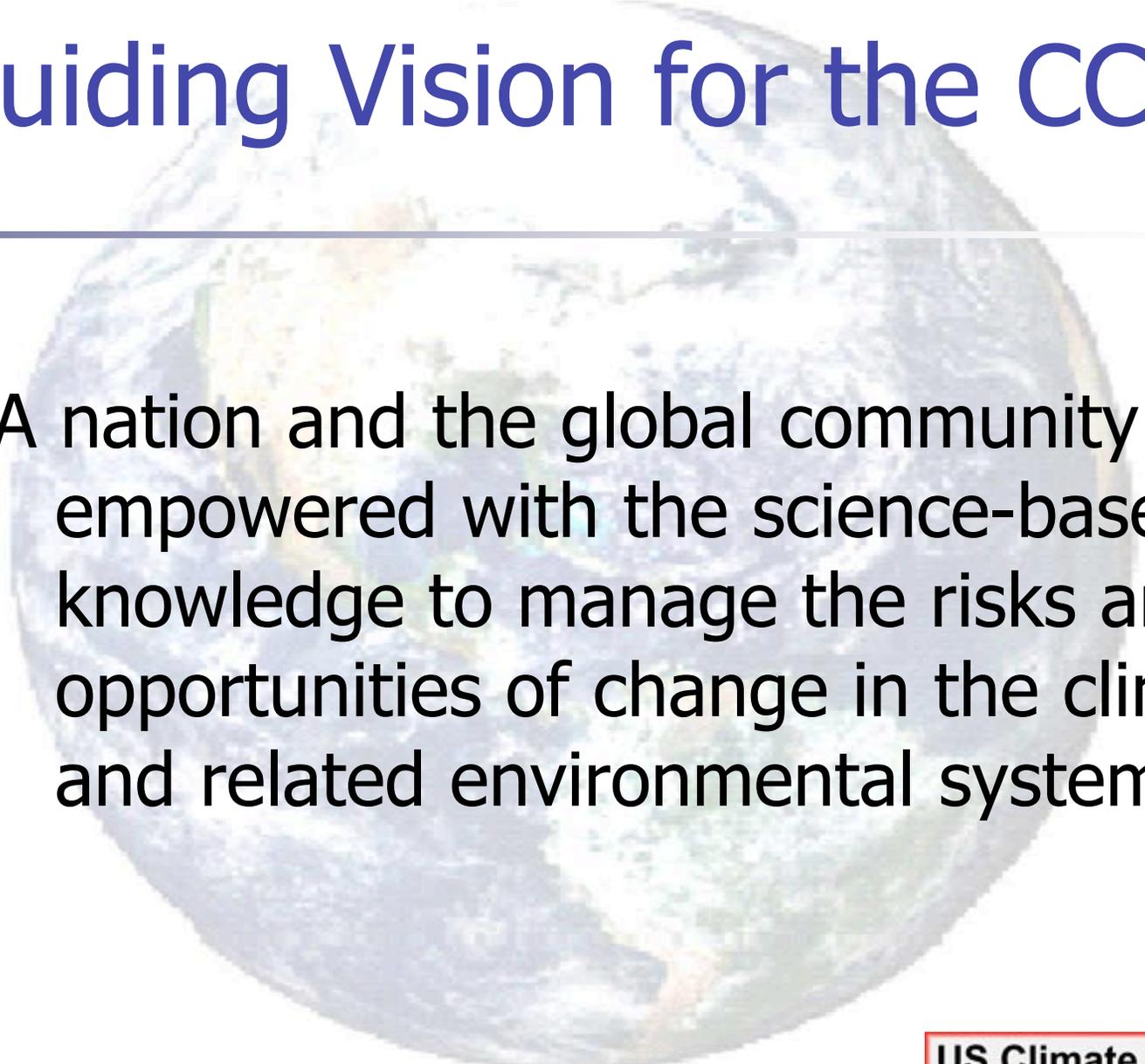
# U.S. Climate Change Science Program – Principles

- Goal and question-oriented strategic plan
- Integration of USGCRP and CCRI
- Transparency and comprehensiveness standards in assessment and decision support
- Combined scientific community and stakeholder review
- Policy neutral standards
- Reporting of degree of confidence in findings



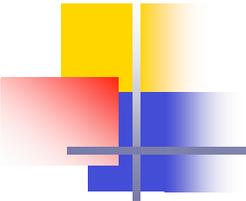


# Guiding Vision for the CCSP



A nation and the global community empowered with the science-based knowledge to manage the risks and opportunities of change in the climate and related environmental systems.





# CCSP Mission



Facilitate the creation and application of knowledge of the Earth's global environment through:

- **research**
- **observations**
- **decision support**
- **communication**



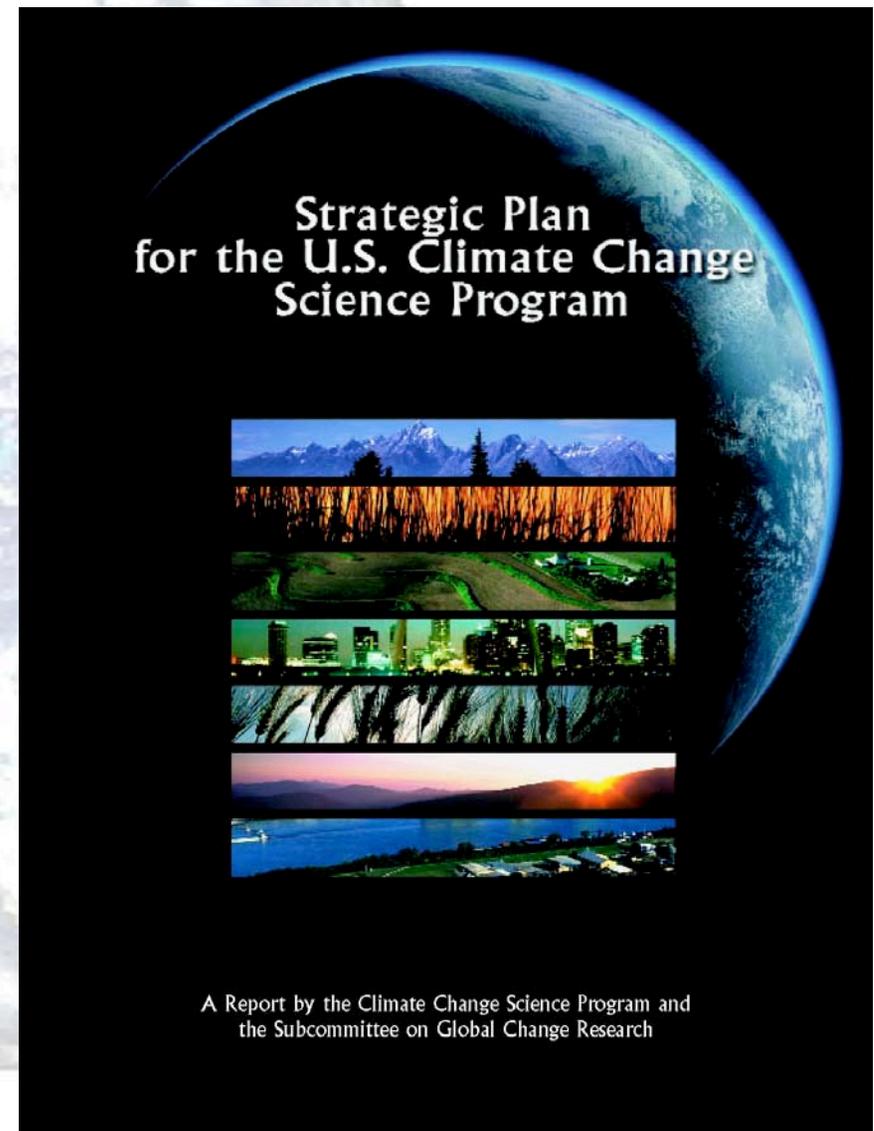
# CCSP Strategic Plan - Development

- Draft Strategic Plan – November 2002
- Broad community review of Strategic Plan at Workshop – December 2002
- National Academy of Sciences review of Draft Plan – February 2003
- Revised Strategic Plan published – July 2003
- National Academy of Science review of Revised Strategic Plan – in progress



# Strategic Plan for the U.S. Climate Change Science Program

- Adopts 4 broad approaches reflecting 5 CCSP goals
- Responds to both President's directives and NRC (Pathways) recommendations for more focus
- Commits to continuing long-term research
- Short-term implementation includes 21 synthesis and assessment products



# U.S. CCSP Strategic Plan – Table of Contents

- Chapter 1. Introduction
- Chapter 2. Integrating Climate and Global Change Research
- Chapter 3. Atmospheric Composition
- Chapter 4. Climate Variability and Change
- Chapter 5. Water Cycle
- Chapter 6. Land-Use/Land-Cover Change
- Chapter 7. Carbon Cycle
- Chapter 8. Ecosystems
- Chapter 9. Human Contributions and Responses to  
Environmental Change
- Chapter 10. Modeling Strategy
- Chapter 11. Decision Support Resources Development
- Chapter 12. Observing and Monitoring the Climate System
- Chapter 13. Data Management and Information
- Chapter 14. Communications
- Chapter 15. International Research & Cooperation
- Chapter 16. Program Management and Review



# Five Goals for the U.S. Climate Change Science Program

- Goal 1:** Improve knowledge of the Earth's past and present climate and environment, including their natural variability, and improve understanding of the causes of observed variability and change
- Goal 2:** Improve quantification of the forces bringing about changes in the Earth's climate and related systems
- Goal 3:** Reduce uncertainty in projections of how the Earth's climate and related systems may change in the future
- Goal 4:** Understand the sensitivity and adaptability of different natural and managed ecosystems and human systems to climate and related global changes
- Goal 5:** Explore the uses and identify the limits of evolving knowledge to manage risks and opportunities related to climate variability and change



# Moving from Planning to Implementation

- Ongoing research, observations, decision support, and communication
- 21 synthesis and assessment products within 2 to 4 years
- Decision Support Resources
- Earth Observation System

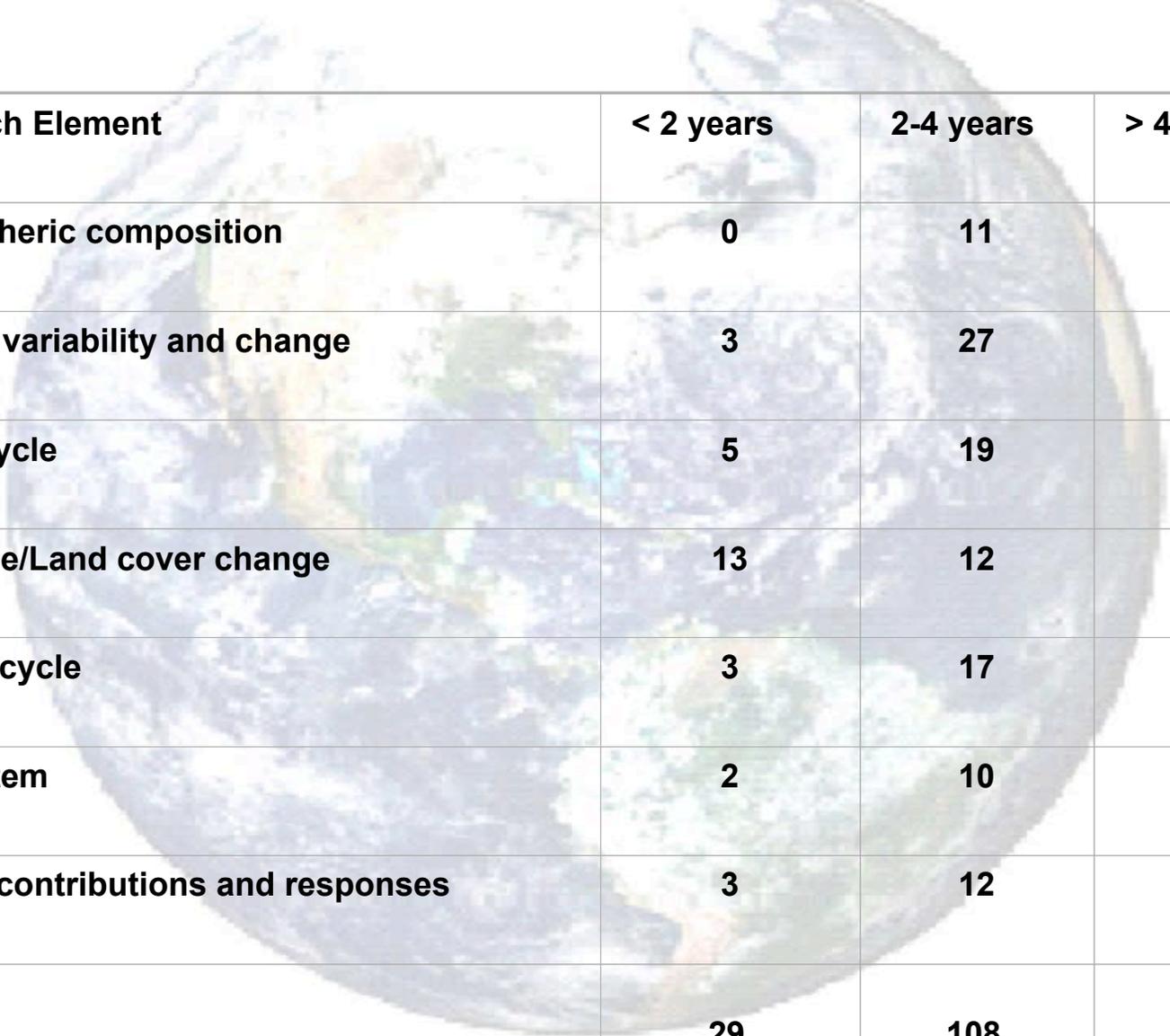


# Purpose of Synthesis and Assessment Reports

- Convey the most up-to-date information available, drawing on the evolving body of climate and global change research
- Address the full range of scientific issues, from past/present conditions to evaluation of options for response
- Evaluate and report on levels of confidence



# Identified Products for Research Elements:



<b>Research Element</b>	<b>&lt; 2 years</b>	<b>2-4 years</b>	<b>&gt; 4 years</b>
<b>Atmospheric composition</b>	<b>0</b>	<b>11</b>	<b>5</b>
<b>Climate variability and change</b>	<b>3</b>	<b>27</b>	<b>5</b>
<b>Water cycle</b>	<b>5</b>	<b>19</b>	<b>14</b>
<b>Land use/Land cover change</b>	<b>13</b>	<b>12</b>	<b>17</b>
<b>Carbon cycle</b>	<b>3</b>	<b>17</b>	<b>22</b>
<b>Ecosystem</b>	<b>2</b>	<b>10</b>	<b>7</b>
<b>Human contributions and responses</b>	<b>3</b>	<b>12</b>	<b>4</b>
<b>TOTAL</b>	<b>29</b>	<b>108</b>	<b>74</b>

# Potential Interactions Between SEARCH and CCSP

- Forcings
- Feedbacks
- Abrupt changes
- Sensitive ecosystems and habitats
- Observations – global and regional
- Adaptation



Time Frame	Topic	Lead (L) / Supporting (S) Agencies
<b>CCSP Goal 1</b> <i>Improve knowledge of the Earth's past and present climate and environment, including its natural variability, and improve understanding of the causes of observed variability and change</i>		
within 2 years	Temperature trends in the lower atmosphere—steps for understanding and reconciling differences.	NOAA (L) NASA (S)
<b>within 2 years</b>	<b>Past climate variability and change in the Arctic and at high latitudes.</b>	<b>USGS/NSF (L) NOAA/NASA (S)</b>
2-4 years	Re-analyses of historical climate data for key atmospheric features. Implications for attribution of causes of observed change.	NOAA/NASA (L) DOE (S)
<b>CCSP Goal 2</b> <i>Improve quantification of the forces bringing about changes in the Earth's climate and related systems</i>		
within 2 years	Updating scenarios of greenhouse gas emissions and concentrations, in collaboration with the CCTP. Review of integrated scenario development and application.	DOE (L) NOAA/NASA (S)
2-4 years	North American carbon budget and implications for the global carbon cycle.	DOE/NOAA/NASA (L) USDA/USGS (S)
2-4 years	Aerosol properties and their impacts on climate.	NOAA/NASA (L)
<b>2-4 years</b>	<b>Trends in emissions of ozone-depleting substances, ozone layer recovery, and implications for ultraviolet radiation exposure and climate change.</b>	<b>NOAA/NASA (L)</b>

Time Frame	Topic	Lead (L) / Supporting (S) Agencies
<b>CCSP Goal 3</b> <i>Reduce uncertainty in projections of how the Earth's climate and environmental systems may change in the future</i>		
<b>within 2 years</b>	<b>Climate models and their uses and limitations, including sensitivity, feedbacks, and uncertainty analysis.</b>	<b>DOE (L) NOAA/NASA/NSF (S)</b>
2-4 years	Climate projections for research and assessment based on emissions scenarios developed through the CCTP.	NOAA (L) NSF/DOE (S)
2-4 years	Climate extremes including documentation of current extremes. Prospects for improving projections.	NOAA (L) NASA/USGS (S)
<b>2-4 years</b>	<b>Risks of abrupt changes in global climate.</b>	<b>NSF (L) NOAA/USGS/EPA (S)</b>
<b>CCSP Goal 4</b> <i>Understand the sensitivity and adaptability of different natural and managed ecosystems and human systems to climate and related global changes</i>		
<b>within 2 years</b>	<b>Coastal elevation and sensitivity to sea level rise.</b>	<b>USGS/EPA/NOAA (L) NASA (S)</b>
2-4 years	State-of-knowledge of thresholds of change that could lead to discontinuities (sudden changes) in some ecosystems and climate-sensitive resources.	NSF (L) EPA/NOAA/USGS (S)
2-4 years	Relationship between observed ecosystem changes and climate change.	USGS/USDA (L) EPA/NOAA/NASA/NSF/ USGS/ USAID (S)
<b>2-4 years</b>	<b>Preliminary review of adaptation options for climate-sensitive ecosystems and resources.</b>	<b>USDA/EPA (L) NOAA/NASA/USGS/ USAID (S)</b>

Time Frame	Topic	Lead (L) / Supporting (S) Agencies
<b>CCSP Goal 4 continued</b>		
2-4 years	Scenario-based analysis of the climatological, environmental, resource, technological, and economic implications of different atmospheric concentrations of greenhouse gases.	Special CCSP mgmt. structure; topical leads among agencies NASA/USGS/EPA (S)
2-4 years	State-of-the-science of socioeconomic and environmental impacts of climate variability.	EPA (L) NOAA/NASA/USAID (S)
2-4 years	Within the transportation sector, a summary of climate change and variability sensitivities, potential impacts, and response options.	DOT (L)
<b>CCSP Goal 5 Explore the uses and identify the limits of evolving knowledge to manage risks and opportunities related to climate variability and change</b>		
within 2 years	Uses and limitations of observations, data, forecasts, and other projections in decision support for selected sectors and regions.	NASA (L) EPA/NOAA/USGS (S)
<b>within 2 years</b>	<b>Best practice approaches for characterizing, communicating, and incorporating scientific uncertainty in decisionmaking.</b>	<b>NSF/NASA (L)</b> <b>EPA/NOAA/USGS (S)</b>
within 2 years	Decision support experiments and evaluations using seasonal to interannual forecasts and observational data.	NOAA (L) NASA/EPA/USAID (S)

# CCSP Plan Chapter 4: Climate Variability and Change

- 4.2.6 How do current and projected climate changes compare with past changes and variations in climate in terms of pattern, magnitudes, and regional manifestations? For example, is the magnitude and time scale of the observed 20<sup>th</sup> century warming of the Arctic unprecedented in the last 1,000 to 10,000 years?
- 4.3.6 What is the potential for high-impact climate changes such as much drier and warmer summers over the mid-continents of North America and Eurasia, accelerated Arctic warming, and more intense coastal storm surges and coastal erosion due to rising sea levels?
- 4.3.7 What would be the environmental consequences of extreme warming in the Arctic, and what would be the expected feedbacks on global climate?



# Quote from the CCSP Strategic Plan

“Advances will require improvements in paleoclimatic data as well as modern observational data systems, because in general the latter have been present for too short a time to extract robust features of climate variability on decadal or longer time scales. For example, in the Arctic, few climate stations have records extending back beyond 50 years, but paleoenvironmental analyses indicate that both the magnitude and spatial extent of 20th century Arctic warming maybe unprecedented over the past 400 years.” [Ch. 4]



# Quote from the CCSP Strategic Plan

“Efforts should be focused on key regions or phenomena that may be especially vulnerable or contribute most strongly to abrupt climate change, such as the tropics, the Arctic and Antarctic regions, and the ocean thermohaline circulation.” [Ch. 4]



# Quote from the CCSP Strategic Plan

"Milestones, Products, and Payoffs....Online database of annual-to-decadal resolution paleoclimatic time series and maps of Arctic climate variability over the past 2,000 years...Climate model results also indicate that temperature increases will be amplified in the Arctic due to feedbacks involving permafrost, snow, and ice cover."  
[Ch. 4]



# Quote from the CCSP Strategic Plan

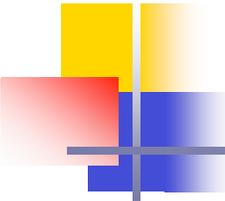
“Reports describing the potential consequences of global and climatic changes on selected arctic, alpine, wetland, riverine, and estuarine and marine ecosystems; selected forest and rangeland ecosystems; selected desert ecosystems; and the Great Lakes based on available research findings, to alert decisionmakers to potential consequences for these ecosystems .” [Ch. 8]



# Quote from the CCSP Strategic Plan

“The United States actively promotes global change research in the Antarctic and Arctic... Regarding the Arctic, the United States works through the Arctic Council, the International Arctic Sciences Committee (IASC), and the Arctic Ocean Sciences Board (AOSB). Work with these organizations will advance fundamental knowledge of the polar regions as well as provide observations that are critical to our understanding of climate. The Arctic Climate Impact Assessment (ACIA), conducted under the auspices of the Arctic Council and IASC, is assessing the consequences of climate change on the circum-Arctic environment, its resources, economy, and peoples.” [Ch. 15]





# In Conclusion

- The SEARCH long-term observations, modeling, process studies, and application analyses will be major contributions to the essential improvements needed for the comprehensive understanding and response to global climate change.



