

**AGU ARCTIC SYSTEM SCIENCE PRESS BRIEFING**  
**Monday, December 11th at 10:00AM**  
**Associated with Union Sessions U21D/U22A/U23A/U24A**  
**VENUE: Room 232 Moscone South**

The Arctic is an integral component of the larger Earth system and is itself a complex system. The Arctic's cryospheric, biological, climatological, hydrological, atmospheric, oceanographic, and terrestrial regimes are fully coupled and cannot be completely understood individually. No single piece of the system is independent. To fully understand even a portion of the system, requires coordinated synthesis studies of the individual processes, their linkages and their contributions to variability in the Arctic water, energy, and biogeochemical cycles. Because the Arctic is a vast and sparsely populated area, where integrated system studies are relatively new, there is much we do not know. Developing a sound predictive capability of climatic change and system level responses, despite sparse data and the region's severe climate, is challenging. The complexity and sensitivity of the arctic terrestrial and marine system responses to change yield broad, yet consistent evidence of rapidly changing physical, biological and social systems. The only viable approach to understanding the complicated linkages within the arctic biological, physical, and social systems is through collaboration across disciplines with integration and synthesis across the national and international arctic research community.

Scientists representing the largest group of arctic research in the U.S. will present information on recent and significant findings with regard to a broad array of geophysical and biological indicators of arctic system change.

Recent studies indicate that within the next 50 years, the Arctic Ocean may be ice-free in summer, while corresponding changes on land include melting permafrost and the expansion of trees and shrubs across the tundra. Changes in the Arctic are linked to one another, with potentially magnified cumulative effects. As warming continues, impacts on industrial development and arctic residents will become more apparent and widespread. Among the key changes:

- **Arctic air temperatures are increasing:** Average air temperatures have risen strongly in recent decades and are now higher than they have been in at least six centuries. In 2005, large portions of the Arctic were 2 to 4 °C (4 to 7 °F) warmer than the average temperatures over the previous 26 years.
- **Sea ice is diminishing:** Arctic sea ice has progressively diminished over the past thirty years; in September 2005 scientists observed the least amount of sea ice ever recorded by satellites. In 2006, refreezing of sea ice in November lags recovery of previous years.
- **Permafrost is warming and thawing:** Over the last 25 years, permafrost has warmed dramatically and is thawing in places throughout the Arctic, putting ecosystems and human infrastructure at risk.
- **Woody shrubs are expanding across the tundra:** Shrubs are becoming larger and more abundant throughout the arctic tundra, potentially altering ecosystem function and interfering with oil exploration and caribou migration.

- **The Greenland Ice Sheet is melting:** If global temperatures continue to increase as projected by models, continued melting of the Greenland Ice Sheet would contribute to a rise in global sea level of 13–19 feet or more over the next several centuries.
- **Arctic rivers are discharging more freshwater into the oceans:** Freshwater flowing into the Arctic Ocean through rivers is increasing and may alter global ocean circulation patterns, which would have significant impacts on global climate, ocean ecosystems, and global food production. A general hemispheric-scale redistribution of moisture is moving freshwater northward.

While many of these changes have already been documented, it is their recent persistence, interactions, and coherence that today underpins an emerging science that considers the Arctic system as a whole.

- **The Arctic system for the past five years is markedly different from the 20th century.**
- **Despite the fact the Arctic is a moving target, the scientific community is meeting the challenge of understanding how the system functions as a whole.**
- **New advances in arctic system science show that changes in sea ice, temperature, and freshwater cycles, are coordinated, link the Arctic to the global system and have potential tipping points.**

These changes are already affecting policy debate. While there is much debate regarding how to best manage the negative impacts of climate change, we also see an emerging dialogue on how climate change could stimulate economic enterprise from the private sector, such as the opening of trade routes across the Arctic Ocean. Increased extraction and use of resources is likely to accompany these biogeochemical changes, ushering in economic opportunity and environmental and social changes in the Arctic and beyond. New research is taking aim at understanding the linkages --including those associated with human systems-- within the arctic system as a whole, and of the Arctic's connections with the broader Earth system.

**MODERATOR**

**Dr. Larry Hinzman**

Professor and Deputy Director of the International Arctic Research Center  
University of Alaska, Fairbanks

**PRESENTERS**

**Dr. Charles J. Vörösmarty**

Research Professor, University of New Hampshire

*To present on: large-scale freshening of the high northern latitudes and broader policy implications*

**Dr. Mark Serreze**

Senior Research Scientist, National Snow and Ice Data Center

*To present on: arctic climate variability and change, numerical weather prediction in high latitudes, and arctic atmosphere-ocean-ice interaction*

**Dr. James E. Overland**

NOAA Pacific Marine Environmental Laboratory

*To present on: 'State of the Arctic' report and indicators show the importance of natural variability*

**Additional Presentation Materials Will Be Made Available**

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**Experts Present to Answer Questions**

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