

**Theme 3:**

**Linkages and Feedbacks between the Arctic system and the Earth system.**

Rapporteur Jean-Claude Gascard

**Two plenary session talks by John Walsh and Oran Young**

### **John Walsh's talk: Five main linkages**

Warming amplification in the Arctic during Fall and Winter  
related to a strong negative phase of the AO  
(cold air in the lower troposphere)

+ strong El Nino reinforcing storm tracks at mid latitudes

Methane release on the Siberian shelves enhancing GHG effect  
Greenland and Arctic glaciers retreating due to accelerated melting  
enhancing fresh water flux to the Ocean, increasing sea level rise  
and disturbing the global ocean thermohaline circulation  
(longer time scale)

Global Ocean circulation advecting warm water masses from subtropical regions  
to the high Arctic. (I. Polyakov, C. Mauritzen, Kjell Arild Orvik)

David Lawrence indicated the profound influence of Arctic sea ice retreat  
on thawing permafrost over Siberia due to the displacement  
of the polar front towards the north.

This also influenced the vegetation all over the subarctic region  
(Donald Walker)

### **Jim Overland's talk:**

Positive feedback loop: warming melting more sea ice, creating more open ocean,  
warming up the lower atmosphere and perturbing the upper atmosphere and stratosphere  
Several talks discussed the atmospheric components involved in the linkages

“The impact of Arctic feedback processes like snow and sea ice albedo and interactive stratospheric chemistry of the polar vortex, were investigated and it was shown that these processes influence global atmospheric teleconnection patterns”.  
(Invited talk by Klaus Dethloff)

Interesting comparisons were made with the Antarctic polar vortex more robust and less disturbed than the Arctic polar vortex.  
During IPY the Arctic stratospheric vortex was disrupted being displaced in 2007-2008 and split in 2009-2010.

Polar cap geopotential height seems to be an excellent index for predicting mid latitude atmospheric perturbation.  
Many other indices were proposed during this conference that need more validation  
SAT winter index, Arctic Rapid Change Pattern ARP,  
Normalised difference vegetation index,  
The Arctic Species trend index (besides the AO/NAO index)

Shifts in northern hemisphere wind patterns (and precipitation) in autumn are directly connected to the current loss of summer sea ice and subsequent ocean warming. Arctic highs developing in the lower troposphere of the Arctic regions during the winter, are important phenomenon for the mid latitudes. Arctic outbreaks are responsible for a large portion of severe winter weather in densely populated centers of the eastern US, Europe and East Asia.

Significant Polar amplification of the global warming in winter can be explained in the absence of ice albedo feedback due to atmospheric heat transport by transient and stationary waves (V. Alexeiev).

## **The Arctic in the balance (Oran Young's talk)**

Climate change, Globalisation, opening of the Arctic to outside interests, new economic interests, growing prominence of outside actors, geopolitical considerations.

Need for new regulatory arrangements such as mandatory polar code for Arctic shipping (UNCLOS?)

Politization of the Arctic policy agenda “ High politics”

Integration of the Arctic in global economy

Limited capacity of the Arctic Council

While the changes afflicting the Arctic impact the every day lives of northerners, they remain on the periphery of decision making for the region.

The role of Science “framing the issues” and certainly contributing actively to the education at all levels (youngsters and seniors) including media (journalists)

North by 2020: a Forum to explore responses and adaptation to Arctic Change.

“The Inuit Knowledge center”

### **Communication problems**

The Clivar leaflet that circulated in Venice during the last Ocean Obs 09 last September included all the Oceans and Continents except the Arctic. Why?

This audience and the SoA should take initiatives to correct this deep fault.