

## **ADVANCING SCIENTIFIC COOPERATION ON ARCTIC CLIMATE CHANGE ISSUES BETWEEN NORWAY AND THE UNITED STATES**

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The Polar Environmental Centre, located in Tromsø, Norway (69° N) is a new focal point for international Arctic scientific cooperation. Anchoring institutes in the Centre (Norwegian Polar Institute, Akvaplan-niva), together with the University of Tromsø, provide a broad foundation of research expertise in the environmental sciences of the polar areas, with emphasis in the Barents and North Atlantic region (European Arctic). Recently, there has been an increasing emphasis on climate change issues related to the Barents input region to the Arctic basin. For example, researchers at Akvaplan-niva are involved in a cross-Arctic intercomparison of benthic community structure to assess possible trajectories of ecosystem shifts in response to climate change (Carroll et al., submitted). The University of Tromsø is involved in climate change projects focusing on physical-biological coupling of carbon flux in the Barents Sea and adjacent areas, in particular in the marginal ice zone. The Norwegian Polar Institute (NP) supplies the Norwegian administration with information and recommendations on issues related to the Norwegian areas of the Arctic. The Institute's main scientific focus areas are climate change, biodiversity, and ecotoxicology. NP maintain several long data series such as sea ice thickness and extent, oceanographic data, and meteorological data that can support environmental studies in a broader context.

Research activities are supported through a variety of logistical and infrastructural systems. Both the University of Tromsø and Norwegian Polar Institute operate ice-capable research vessels in polar waters. Accredited chemical and biological laboratories exist within the Polar Environmental Center. The Norwegian Polar Institute, coordinates year-round operations at the Ny-Ålesund scientific research station on Svalbard (79° N). This station is currently being expanded through the European Union's program for large-scale facilities and offers substantial international research resources.

The global change issue has reinvigorated the interest in Arctic research. There is a realization among the scientific establishment in Norway that solutions to common Arctic-wide environmental issues require interdisciplinary approaches and/or extensive international collaboration. The community of international researchers and national resources in Tromsø provide opportunities for collaborative activities with U.S. institutes and programs. This year a formal linkage was established with the United States through a cooperative agreement between the National Science Foundation Office of Polar Programs and Norwegian Polar Institute. Additional attention was focused on stronger U.S. - Norwegian collaboration on Arctic Ocean climate during the H.U. Sverdrup Symposium in Tromsø 21-24 September 2000

(<http://www.npolar.no>). The development of scientific and political interest, and its translation into a strategic plan from the Norwegian side is under current consideration. These various avenues can be utilized to support the goals of the SBI program, to the benefit of both U.S. and Norwegian researchers.

The Barents Sea is the gateway to the Arctic from the North Atlantic and the Chukchi Sea is an intermediate region separating the Pacific Ocean from the Arctic. The most important factor influencing the Barents Sea is the North Cape Current which enters the Barents Sea along the Scandinavian coastline and carries relatively warm Atlantic water into the sea from the southwest. The North Cape Current prevents ice formation in most of the southern Barents Sea in normal winters and in southwest Barents in even the most severe winters. Like the North Cape Current in the Barents Sea, a relatively warm surface current flowing from the Bering Sea greatly affects climate characteristics in the Chukchi Sea.

Long-term global climate change most likely will lead to vastly different conditions in the western and eastern Arctic areas. In the western Arctic, changes caused by global warming predicted in oceanic features are: increasing sea-surface temperatures, decreasing sea ice extent, decreasing freshwater inflow and decreasing nutrient fluxes onto the shelf (Weller and Anderson, 1998). In contrast, global circulation models for the eastern Arctic show that the inflow of warm water via the North Atlantic is extremely sensitive to changes in salinity and temperature (Manabe and Stouffer 1995). The large-scale currents driven by thermohaline circulation in the North Atlantic may significantly weaken or abruptly shut off completely in response to the byproducts of global warming (Broecker 1994, 1997), resulting in a significantly colder Barents Sea region.

Our scientific focus is on knowing more about the specific bio-physical links that relate atmospheric forcing to marine ecosystems and the inter-regional pattern of ecosystem responses. Connecting Norwegian programs in the Barents Sea region with the SBI program on the western shelf, offers the potential to achieve a greater understanding of the (a)synchronies among processes occurring on opposite sides of the Arctic Basin. For example, field experiments can be planned during similar investigative time frames. Our approach would be to examine spatial and temporal patterns in various ecosystem components and to link these to specific Arctic climatic phenomena via physical variables. Tracing ocean-atmosphere regime shift signals to identical ecosystem components in two important marginal seas on opposite sides of the Arctic Basin (Bering/Chukchi and Barents Seas) allows inferences as to the possible trajectories of ecosystem shifts in response to climate change. Specific hypotheses to be tested will be developed through the use of existing 2-D (Wassmann & Slagstad (1993) and 3-D (Slagstad and Wassman (1997) coupled biological-physical models of the Barents region. At the same time, field experiments will lead to improvements in model capabilities.

## References

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The development of cross-Arctic intercomparison studies are being planned in order to achieve a greater understanding of the (a)synchronies among processes occurring on opposite sides of the Arctic Basin.

