Naval Operations in an Iceless Arctic
17-18 April 2001

ICE- FREE ARCTIC SCENARIO

THERE IS CONSIDERABLE DEBATE OVER WHETHER RECENT CHANGES IN ARCTIC CLIMATE ARE A NATURAL FEATURE OF CYCLICAL VARIABILITY OR WHETHER A PERMANENT CHANGE IS BEING OBSERVED DUE TO GLOBAL WARMING. THE FOLLOWING SCENARIO IS ONE PLAUSIBLE OUTCOME WITH AN APPRECIABLE PROBABILITY OF OCCURRING.

- Over the next 20 years, the volume of Arctic sea will further decrease approximately 40%, and the lateral extent of sea ice will be sharply reduced (at least 20%) in summer:
  - Polar low pressure systems will become more common and boundary layer forced convection will increase mixed (ice-water) precipatation. Cloudiness will increase, extending the summer cloudy regime with earlier onset and later decline. The likelihood of freezing mist and drizzle will increase, along with increased vessel and aircraft icing.
  - Sonar operations in the Arctic will experience increased ambient noise levels and the surface duct will be diminished or lost. Ice keels will be shallower and less abundant and the area in which they can be expected to occur will be reduced. Active sonar detection of submarines will become more feasible

- Within five years, the Northern Sea Route (aka the Northeast Passage) will be open to non-ice-strengthened vessels for at least two months each summer
  - The Russian Arctic is a treasure trove of natural resources. Changing climate will spur and increase in exploitation of energy, mineral and forest resources, especially by or for the benefit of resource-poor Asian nations.

- Within 5-10 years, the Northwest Passage will be open to non-ice-strengthened vessels for at least one month each summer
  - Both Russia and Canada assert policies holding navigable straits in the NSR and Northwest Passage under their exclusive control. The United State differs in its interpretation of the status of these straits, with a potential for conflict

- Within 5-10 years, the Sea of Okhotsk and the Sea of Japan will remain ice-free throughout the year

SYMPOSIUM OBJECTIVES

- Given a projection of the estimated retreat of the Arctic ice cap due to global warming, document potential effects on future naval operations and establish baseline capabilities for operating in a warmer – but still harsh – Arctic environment.

- Document the National issues that could elicit a strategic (military) response due to the Arctic being ice-free during a portion of the year.

- Document the impacts to near, mid and long-term readiness issues for current and future weapons systems and sensors designs, and logistics, METOC, and intelligence capabilities; and to doctrine and training issues associated with an ice-free Arctic.

- Forum will be a 2-day symposium. The first day will contain three structured panels based on community: Surface; Subsurface; Aviation. The second day will recombine the participants into four panels: Integrated Ops; Strategy/Policy; Acquisition/S&T; Campaign Plan. In addition to the warfare communities, METOC, Intel, and other communities will be represented on each panel. Training and R&D initiatives will be discussed during each panel.

- Funding: CNO(N096), ONR, and the Arctic Research Commission.

The Canadian Department of National Defense has already investigated this issue with an Arctic capabilities study and a follow on briefing to the Defense Minister. In recent years Canada has recently experienced infringements on Canadian sovereignty. A Chinese vessel armed with a number of machine guns and a passport that could not be accounted for that arrived in an Inuvialuit community. An unknown for submarine was spotted in Cumberland Sound. An unannounced IL-76 landed in Manitoba, picked up a helicopter, and returned to a site that intelligence sources say is a known Russian Mafia base.

Recent news articles have highlighted the decreasing thickness and coverage of the Arctic ice cap due to global warming. These changes have been picked up by the media and have the potential to drive U.S. Arctic Policy. Some examples are listed below.

Time magazine featured an article by Eugene Linden Churchill on Sept. 4, 2000 entitled "The Big Meltdown."

New York Times science writer William K. Stevens also discussed simulated sea ice trends in his 7 Dec. 1999 article, Arctic Thawing May Jolt Sea's Climate Belt. (Registration may be required)

A New York Times article by James Brooke from Oct. 10, 2000 describes Arctic warming in Even in Frigid North, Hints of Warmer Temperatures (Registration may be required)

James Brooke also wrote Through Northwest Passage in a Month, Ice-Free for the New York Times Sept. 5, 2000 edition. (Registration may be required)

New York Times science writer Walter Gibbs discussed implications of Arctic warming in his 10 July 2000 article, "Research Predicts Summer Doom for Northern Icecap." (Registration may be required)

Washington Post staff writer Curt Suplee wrote about arctic warming in his Sep. 8, 2000 article Historical Records Provide a Growing Sense of Global Warmth.

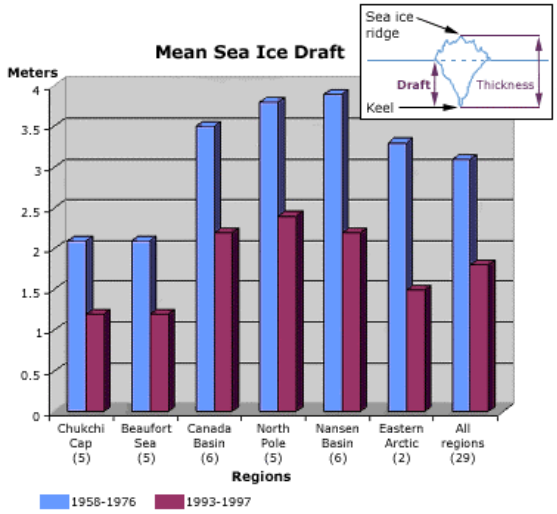
Curt Suplee also wrote about changes in sea ice extent for the Washington Post in a 3 Dec. 1999 article entitled Study: Arctic Sea Ice Is Rapidly Dwindling - Global Warming Called Likely Cause.

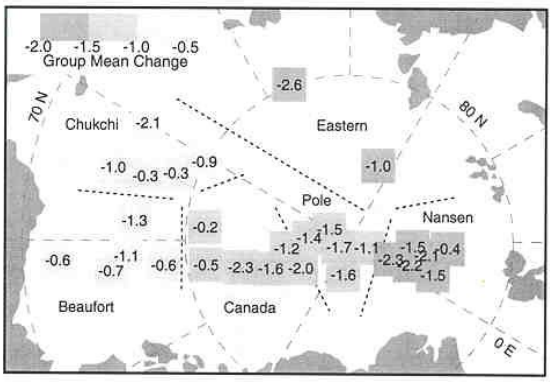
The Wall Street Journal Staff reporter Joel Bagole wrote an article picked up by the Early Bird that addressed potential security threats in "As Global Warming Opens Arctic, Canada, U.S. See Security Threats."

The Times Colonist discussed Canadian sovereignty in the 12 Nov. 2000 article by Ed Struzik, "Sovereignty slips as Arctic ice melts."

SCIENTIFIC BACKGROUND

- Data acquired on U.S. submarine cruises reveal that the sea ice has thinned by 42%. The mean ice draft at the end of the melt season in the Arctic has decreased by about 1.3 meters (4.3 feet) over the past 30 to 40 years.

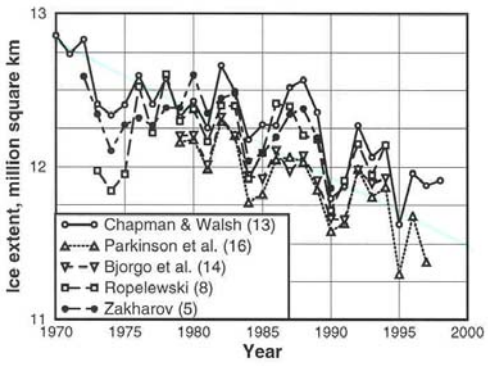




Graphs derived from Rothrock et al. 1999

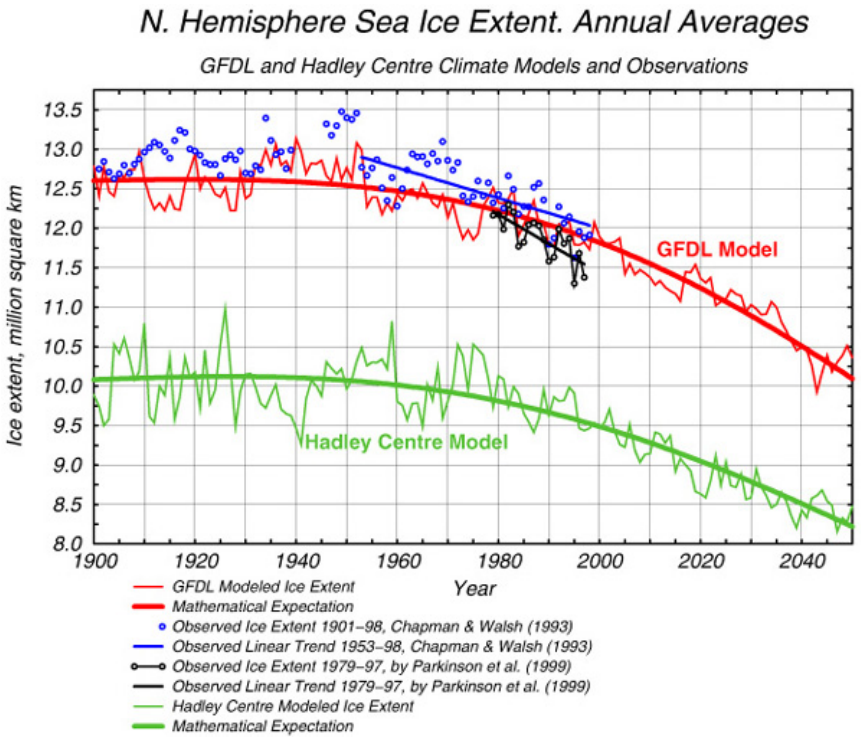
- Satellite data suggest a net decrease in Arctic ice extent of about 2.9 percent per decade. Satellite data also indicate record reductions in regional ice cover in recent years.

Observed Sea Ice Extent Decrease



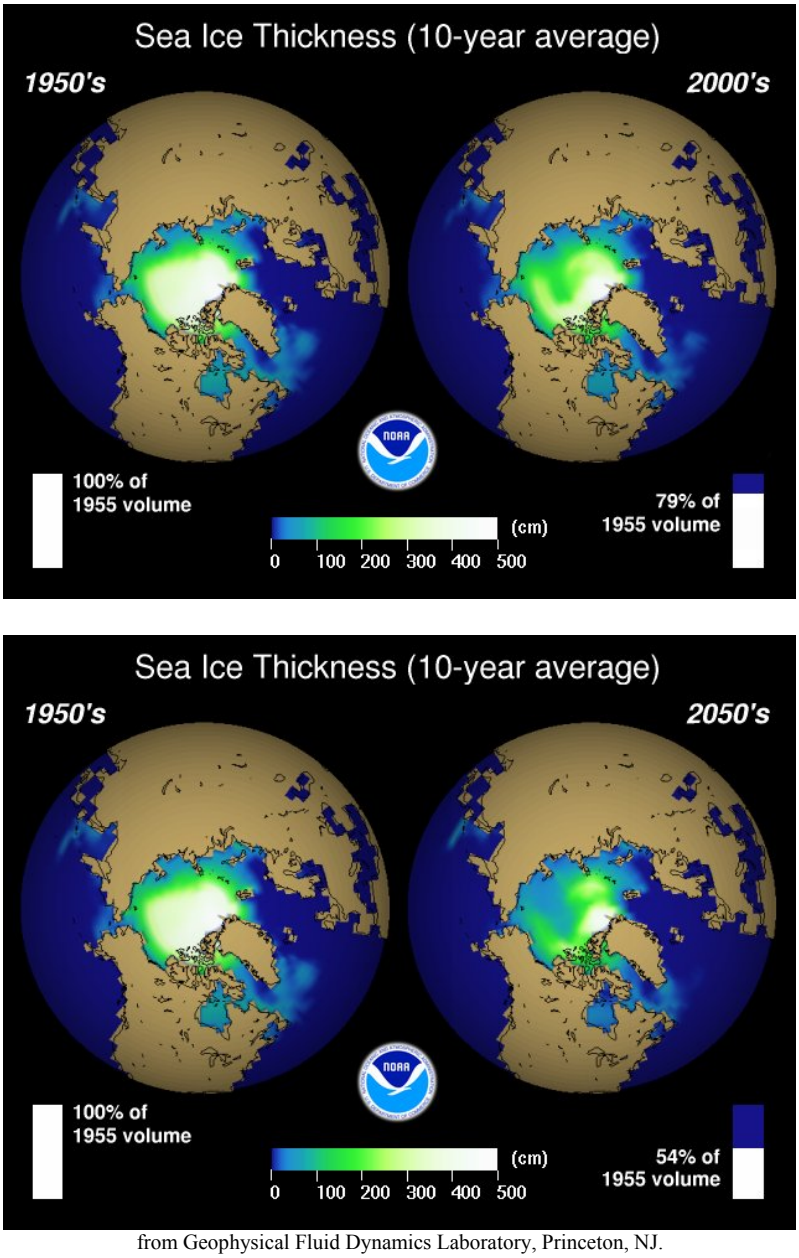
from Vinnikov et al., 1999

- Models are consistently suggesting summertime *disappearance* of the Arctic ice cap by 2050.



from Vinnikov et al., 1999

The Geophysical Fluid Dynamics Laboratory model agrees with the observed linear trends and projects a rapid decrease in Arctic ice extent.



from Geophysical Fluid Dynamics Laboratory, Princeton, NJ.

The uppermost figure shows how the total volume of Arctic sea ice (i.e., sea ice poleward of 67N) decreased by about 20% over the 50-year period extending from the 1950s to the 1st decade of the 21st century. The lower panel depicts how the simulated loss of Arctic sea ice continued so that almost one-half of the Arctic sea ice volume has been lost at the end of the 100-year period from the 1950s to the 2050s.

POSSIBLE IMPLICATIONS

- Model studies indicate that surface air temperatures in the Arctic region will increase

- The Sea of Okhotsk and the Sea of Japan will remain ice-free throughout the year. The Northern Sea Route (NSR) along the Russian coast and the Northwest Passage (NWP) through the Canadian Archipelago will be ice free and open to navigation by non-ice-strengthened ships in summer. Both Russia and Canada assert policies holding navigable straits in the NSR and the NWP under their exclusive control. The US differs in their interpretation of the status of these straits. As these routes become more available for international traffic, conflicts are likely to arise.

- The Russian Arctic is a storehouse of natural resources. Changing climate may spur an increase in exploitation of energy, mineral and forest resources, especially by or for the benefit of resource poor Asian nations.

- The exploration, development, production and transportation of petroleum in the Arctic will expand with or without climate change as prices continue to rise due to the decreasing rate of discovery of reserves elsewhere. Climate warming and reduction in ice cover will facilitate and perhaps accelerate the process.

- Climate warming is likely to bring extensive fishing activity to the Arctic, particularly in the Barents Sea and Beaufort/Chukchi region where commercial operations have been minimal in the past. In addition, Bering Sea fishing opportunities will increase as sea ice cover begins later and ends sooner in the year.

- In the atmosphere, the Arctic boundary layer will be warmer and wetter. Cloudiness will increase, extending the summer cloudy regime into earlier onset and later decline. The likelihood of freezing mist and drizzle will increase as a result. Polar low-pressure systems will become more common. Vessel and aircraft icing will be more common. Weapons systems will also be affected by icing conditions.

- Underwater installations including propellers, rudders, fin stabilizers, sea chests and especially thin-skinned sonar installations must be redesigned for Arctic operations.

- Sonar operations in the Arctic will experience increased ambient noise levels and the surface duct will be diminished or lost. Ice keels will be shallower and less abundant and the area in which they can be expected to occur will be reduced. Active sonar detection of submarines will become more feasible.

- Changes in timing and composition of river runoff will affect surface seawater. Increased sediment loads in spring runoff will spread out at sea affecting optical transparency.

REFERENCES

Arctic Research Commission. "The Arctic Ocean and Climate Change: A Scenario for the U.S. Navy," 2000.

Arctic Sea Ice Changes in GFDL Greenhouse Scenario Experiments. http://www.gfdl.gov/~kd/KDwebpages/NHice.html, 2001.

Johannessen, O.M., E.V. Shalina, and M.W. Miles. 1999. Satellite evidence for an Arctic sea ice cover in transformation. *Science.* 286:1937-39.

Rothrock, D.A., Y. Yu and G.A. Maykut. 1999. Thinning of the Arctic sea-ice cover. *Geophysical Research Letters.* 26(23):3469-72.

State of the Cryosphere. http://nsidc.org/NASA/SOTC, 2001.

Vinnikov, K.Y., A. Robock, R.J. Stouffer, J.E. Walsh, C.L. Parkinson, D.J. Cavalieri, J.F.B. Mitchell, D. Garrett, V.F. Zakharov. 1999. Global warming and Northern Hemisphere sea ice extent. *Science.* 286:1934-37.