SGER: Analysis of the Arctic Climate Oscillations

Project Participants

Senior Personnel

Name: Proshutinsky, Andrey
Worked for more than 160 Hours: No
Contribution to Project:

Post-doc

Graduate Student

Name: Dukhovskoy, Dmitri
Worked for more than 160 Hours: Yes
Contribution to Project:
Data processing and analyses. Report and presentation preparations, meeting and workshop participation.

Undergraduate Student

Organizational Partners

Other Collaborators or Contacts

Activities and Findings

Project Activities and Findings:
The primary goal of this project is to identify robust oscillations of the arctic climate, and to identify the major factors that maintain these oscillations based on observations and results from the 300-year run of the National Center for Atmospheric Research (NCAR) Climate System Model (CSM).

The project objectives are:

- Determine major robust oscillations of the Arctic climate and describe factors that maintain them;

- Identify interdependence of oceanic, sea ice, and atmospheric processes corresponding to the major oscillations of the arctic climate;

- Identify and recommend major directions for the NCAR CSM's improvement in the Arctic and for the design of future CSM experiments.

Arctic atmosphere oscillation (AAO) and Arctic Ocean Oscillation (AOO) were investigated using EOF and correlation analyses of the
observed and simulated sea level pressure, surface air temperature, ice conditions, sea level heights, precipitation, river run-off and permafrost data. Observed data are from different sources and are partially reconstructed to cover period 1899-1997. The simulated results are from the 300-year run of the National Center for Atmospheric Research (NCAR) Climate System Model (CSM), and from a two-dimensional barotropic coupled ice-ocean model forced by winds calculated from the observed and simulated SLPs.

**Project Training and Development:**
1. Variability of reconstructed and observed climate parameters in the Arctic during 1899-present is consistent with the process of arctic warming:
   - the surface air temperature increases (0.8 degree C/100 years);
   - the sea level atmospheric pressure decreases in the central Arctic (10mb/100 years);
   - the sea ice area shrinks (1 mln. square km/100 years);
   - the precipitation increases (30mm/100 years);
   - and sea level rises (10cm/100 years).

2. The observed and reconstructed arctic atmospheric, ice, and ocean circulations are characterized by decadal-scale variability (period is 10-15 years) with two major climate states: anticyclonic and cyclonic circulation regimes.


3. The NCAR CSM results reveal the AAO which first mode pattern is similar to the observed pattern of the AAO but the simulated magnitude of variability and simulated spatial gradients of the SLP are smaller than in observations. The NCAR CSM wind-driven ice and water circulation is very stable and is always anticyclonic. The decadal variability in the 300-year model results does not have two circulation regimes. This is probably because the arctic ice and ocean models do not reproduce sea-ice and oceanic parameters correctly.

**Research Training:**
Dmitri Dukhovskoy, graduate student of the Institute of Marine Science University of Alaska Fairbanks has been involved in this project since June 1998. He has significantly improved his scientific and technical skills during this work. He has taken statistics and hydrodynamics classes, attended the 5th NCAR CSM workshop, Brekenridge, Colorado, June, 2000 and 2000 AGU Fall Meeting.

**Outreach Activities:**

**Journal Publications**


Proshutinsky, A., T. Proshutinsky, D. Dukhovskoy, "Arctic climate oscillation from observations
We think that our publications, oral, and poster presentations at the national and international scientific meetings related to investigation of 'arctic atmosphere and ocean oscillations' (see list of presentations below) have influenced polar climate science. For example, the First Wadati Conference on Global Change and Polar Climate (Tsukuba, Japan, November 1995) did not have any 'climate oscillation' presentations but during the Second Wadati Conference (Tsukuba, Japan, March 2001) more than 20% of presentations have had topics or discussions related to the Arctic Atmosphere or Arctic Ocean or Arctic Ice Oscillations.

List of presentations:


Proshutinsky A., Arctic atmosphere and ocean oscillations, poster presentation at the 1999 AGU Spring meeting

Proshutinsky A., Studying the Arctic climate variability, Talk at the 4th annual CSM meeting, Breckenridge, Colorado, June, 1999.

Proshutinsky A., Decadal variability of the Arctic climate, IUGG-99, Birmingham, United Kingdom, July 18-31, 1999, invited

Proshutinsky A., Arctic climate oscillation from observations and model results (European Geophysical Society Meeting, Nice, France, April 25-27, 2000)


Contributions to Other Disciplines:

Contributions to Human Resource Development:

Contributions to Science and Technology Infrastructure:

Beyond Science and Engineering:
Categories for which nothing is reported:

Organizational Partners
Activities and Findings: Any Outreach Activities
Any Book
Any Product
Contributions: To Any Other Disciplines
Contributions: To Any Contributions to Human Resource Development
Contributions: To Any Science or Technology Infrastructure
Contributions: Beyond Science or Engineering