Climate Change Education – What works and why?

Frank R. Rack

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Abstract for DBER Group Discussion on 2012-09-06

Presenter, Department(s):
Dr. Frank R. Rack
Associate Professor, Department of Earth and Atmospheric Sciences and
Executive Director, ANDRILL Science Management Office, University of NE-Lincoln

Title:
Climate Change Education – What works and why?

Abstract:
Over the past six years, more than 10,000 middle school and high school teachers and students have been introduced to the ANDRILL-related “Antarctica’s Climate Secrets” activity modules and the “Environmental Literacy Framework (ELF) with a focus on climate change” activity modules (funded by grants from NSF and NOAA, respectively). This presentation will provide an overview of the outcomes of these two projects and discuss the lessons learned with respect to different stakeholder groups. The development of the ELF hands-on activity modules is continuing and all ELF activity modules are currently being submitted to the CLEAN (Climate Literacy and Energy Awareness Network) Pathway for review and adoption into that collection. The hands-on activity modules developed as part of the “Antarctica’s Climate Secrets” project have already been accepted into the CLEAN Pathway collection.

The NSF-funded “Antarctica Climate Secrets” project (led by Judy Diamond at the Nebraska State Museum of Natural History, and Luanne Dahlman, an ARISE (ANDRILL Research Immersion for Science Educators) Program participant and curriculum developer at TERC, who is currently at the NOAA Climate Project Office), developed resources that were closely related to the ANDRILL (ANTarctic geological DRILLing) Program’s geoscience research activities in Antarctica. These resources were used for teacher professional development and by teachers working with their students to create Flexhibits (FLEXible exHIBITs), where students teach other students and the general public about what they’ve learned about Antarctica and climate change after participating in the hands-on activities and learning the information in the five themes of “Antarctica’s Climate Secrets,” which relate to Antarctica and climate change.

During each year of the three year NOAA-funded Environmental Literacy grant to UNL, two professional development workshops for teachers/educators have been conducted at each of 4-10 sites across the United States to (1) introduce the Environmental Literacy Framework (ELF), (2) provide inquiry-based activities with a focus on climate change, and (3) collect data for research and evaluation. Following the workshops, teachers interact with other teachers and with scientists as they deepen their knowledge about climate change science and pedagogy. Teachers work with students who conduct their own research and present their project outcomes to new audiences in local Flexhibit events, and at a capstone Climate Change Student Summit, where the students from each state are gathered together and connected to the other C2S2 sites via videoconference, and to interact in person with attending geoscientists.

The focus of the NOAA-funded Environmental Literacy (EL) resources has been to build educators’ background knowledge about climate change science while helping them to integrate ocean, climate, and environmental literacy concepts into existing science courses. Teachers implement hands-on and inquiry-based learning activities with their students, and the students develop projects that
demonstrate concepts of ocean, climate and environmental literacy. Student activities culminate in a Climate Change Student Summit (C2S2) capstone event, held at museums and other public venues, where students present the outcomes of their own scientific inquiries. More than 800 students have been directly involved in the NOAA-funded Climate Change Student Summits (C2S2), and more than 200 teachers and 5,000 students are currently using the ELF modules in their classrooms in 10 U.S. States.
Climate Change Education: What Works and Why

Dr. Frank R. Rack
Associate Professor, Department of Geosciences
Executive Director, ANDRILL Science Management Office

Acknowledgement of Substantial Contributions to this Talk from Many Others, Including:

ANDRILL Science Management Office staff and UNL Faculty - Louise Huffman, Rita Thomas, Katia Kontar, Megan Berg (now at UNAVCO), David Harwood, Richard Levy (now at GNS Science in New Zealand);

Judy Diamond, Angie Fox (Nebraska State Museum of Natural History) and their evaluator, Amy Spiegel (UNL Center for Instructional Innovation);

Luanne Dahlman (NOAA Climate Projects Office)

ARISE (ANDRILL Research Immersion for Science Educators) Program participants;

Jean Pennycook (recent NSF Einstein Fellow and curriculum developer), Susan Lynds (our evaluator from UC-Boulder), Betsy Youngman (TERC curriculum developer) and the many participants in the NOAA Environmental Literacy project, through the Teacher Professional Development Workshops and the Climate Change Student Summits.
Dr. Frank Rack – Research Cruises – Field Experience

ODP Leg 105 – D/V JR – N. Atl. Transiti; Baffin Bay and the Labrador Sea (marine technician)
ODP Leg 113 – D/V JR – Weddell Sea (marine technician)
ODP Leg 129 – D/V JR – central Kerguelen Plateau (physical properties scientist)
ODP Leg 132 – D/V JR – Engineering Tests - Shatsky Rise (staff scientist, physical properties)
ODP Leg 144 – D/V JR – Atolís and Guayas II (staff scientist, physical properties)
ODP Leg 151 – D/V JR – North Atlantic-Arctic Gateways I (physical properties scientist - CANADA)
IMAGES 101 – R/V Marion Dufresne – Nordic Seas and Canadian Margin (physical properties)
ODP Leg 162 – D/V JR – North Atlantic-Arctic Gateways II (physical properties scientist – CA)
SafeStat – R/V Thomas Thompson – SubAntarctic – South Atlantic (physical properties scientist – CA)
ODP Leg 204 – D/V JR – Hydrate Ridge, Oregon Margin (staff scientist, project manager)
ANDRILL McMurdo Ice Shelf Project – McMurdo Station, Antarctica
ANDRILL Coulman High Project – site surveys – Ross Ice Shelf and McMurdo Station, Antarctica

Dr. Frank Rack – Current Research Interests

- Physical and geotechnical properties of marine sediments and rocks;
- Non-invasive measurements of sediments (gamma density, magnetic susceptibility, acoustic velocity, thermal IR, x-ray CT, etc.);
- Cenozoic paleoceanography – particularly focused on high-latitudes;
- Characterizing marine methane hydrate deposits through scientific drilling;
- Program/project management, strategic planning, science policy.

Dr. Frank Rack – Employment History

2006 – Present: Exec. Dir., ANDRILL SMO, Associate Professor, E&AS, UNL
2003-2006: Director, ODP/IODP, Joint Oceanographic Institutions, Washington, DC
1998-2003: Asst./Assoc. Director, ODP and USSSP, JOI, Washington, DC
1993-1998: Research Scientist, University of New Brunswick, Canada
1979-1983: Navigator, Seismic Surveys; Commercial Fisherman & Processor
1974-1978: B.S., Natural Resources, University of Rhode Island

Scientific Ocean Drilling:
Understanding Earth’s Dynamic Processes

D/V Glomar Challenger
Deep Sea Drilling Project (1968-1983)

96 Legs
624 Sites

Image courtesy of Roy Davis, Deep Sea Drilling Project, Scripps Institution of Oceanography

R/V JOIDES Resolution
Ocean Drilling Program

110 Legs
650 Sites

Image courtesy of John Beck, Ocean Drilling Program, Texas A&M University
Sedimentary Components: Environmental Indicators

- Volcanic ash
- Atmospheric dust carried by winds
- Continental source streaked material
- Pelagic biogenic component: calcium carbonate silt
- Benthic biogenic component: calcium carbonate
- Glacial debris
- Ice
- Oceanic crust

Recovering proximal records of ice sheet and climate history to complete the global climate puzzle

http://andrill.org
ANDRILL McMurdo Sound Portfolio

“Drilling Back...to the Future”
ANDRILL McMurdo Ice Shelf (MIS) Project

From “Illuminating Earth’s Past, Present, and Future, IODP Science Plan for 2013-2023”
Core-Ref Viewer
http://coreref.org

- The Core-Ref Viewer has been developed to explore the ANDRILL McMurdo Ice Shelf (MIS) Project and Southern McMurdo Sound (SMS) cores by displaying both whole-round core and split-core images along with graphical core description information and multi-sensor data. This technique has been expanded to ODP and ICDP core data.

- Descriptive annotations on core images enhance the amount of information provided to users about sediment composition, structures and other features of the core.

- This software enables the exploration of more than 40 years of core images and data from scientific drilling legacy archives as well as new acquisitions.
IPY Search Terms - APECS - 2008

APECS = Association of Polar Early Career Scientists

IPY Search Terms – APECS - 2009

APECS = Association of Polar Early Career Scientists
**IPY Search Terms – APECS - 2010**

APECS = Association of Polar Early Career Scientists

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**ANTARCTICA’S CLIMATE SECRETS**

**SUMMATIVE EVALUATION OF YOUTH ACTIVITIES**

Judy Diamond (PI)
Luanne Dahlman (Co-PI)
Angie Fox (NSMNH)
Megan Berg (ANDRILL)
Louise Huffman, & Others

**NSF-funded Project**

“Secrets Beneath the Ice”

Flexhibit (Flexible Exhibit)
- Museum-quality Banners
- Podcasts
- Activity Booklet
McMurdo Premier Showing of

“NOVA: Secrets Beneath the Ice”

Thursday, January 20, 2011

Starting at 20:15 in the Galley

Following the showing there will be a Q&A and Discussion Session with:

Dr. Frank R. Rack
Executive Director
ANDRILL Science Management Office
University of Nebraska-Lincoln

Along with some highlights of this year’s ANDRILL Coulman High Project (G-049).

Judy Diamond (Nebraska State Museum of Natural History) and LuAnn Dahlin (TERC), with Angie Fox, Megan Berg and others.

http://www.andrill.org/flexhibit/

ANTARCTICA’S CLIMATE SECRETS
Number of Youth Participating in Evaluation by Gender and Age

Figure 1. Number of youth participating in evaluation by gender and age (N=346).

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011. Antarctica’s Climate Secrets: Summative Evaluation of Youth Activities.
Percentage of Educators Reporting *Using the Flexhibit Activities with Youth*

![Percentage of Educators Reporting *Using the Flexhibit Activities with Youth*](image)

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011. Antarctica’s Climate Secrets: Summative Evaluation of Youth Activities.

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Percentage of Educators Reporting *Use of Different Podcasts with Youth*

![Percentage of Educators Reporting *Use of Different Podcasts with Youth*](image)

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011. Antarctica’s Climate Secrets: Summative Evaluation of Youth Activities.)
Percentage of Educators Reporting How They Used the Flexhibit Resources

Table 1. Percent of educators indicating how they used the banners, activities and/or podcasts.

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I combined these materials with other resources</td>
<td>26</td>
<td>59% (26)</td>
</tr>
<tr>
<td>I used these materials to help youth prepare for a Flexhibit event</td>
<td>24</td>
<td>55% (24)</td>
</tr>
<tr>
<td>I used these materials at a Flexhibit Event</td>
<td>19</td>
<td>43% (19)</td>
</tr>
<tr>
<td>I used these materials at an International Polar Year (IPY) event</td>
<td>11</td>
<td>25% (11)</td>
</tr>
<tr>
<td>I attended professional development for youth leaders/educators that used these materials</td>
<td>10</td>
<td>23% (10)</td>
</tr>
<tr>
<td>I coordinated or led professional development with youth leaders/educators using these materials</td>
<td>5</td>
<td>11% (5)</td>
</tr>
<tr>
<td>Other: e.g., “to enhance my science curriculum,” “shared with teachers;” “for permanent display;” “Climate Change Student Summit”</td>
<td>15</td>
<td>34% (15)</td>
</tr>
</tbody>
</table>

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011.
Antarctica’s Climate Secrets: Summative Evaluation of Youth Activities.

Estimated Age Groups of Youth Involved in Hosting Flexhibit Events

Figure 4. Estimated age groups of youth involved in Flexhibit Events

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011.
Antarctica’s Climate Secrets: Summative Evaluation of Youth Activities.
Teacher’s Ratings on the Effectiveness of the Flexhibit Activities

How effective were these activities...

- 1 (Not at all) 2 (Somewhat) 3 (Fairly) 4 (Very)

- In helping youth learn how changes in Antarctica’s climate could affect the entire globe: 15% 43% 47% 67%
- In helping youth learn how scientists study sick trees: 40% 47% 50% 64%
- In helping youth learn about Antarctica in cold, remote and unique place: 55% 55% 50% 60%
- In getting youth interested in Antarctica: 9% 33% 51% 60%
- In preparing youth for Flexhibit: 17% 40% 47% 65%
- In actively engaging youth: 15% 22% 40% 60%
- In teaching how scientists learn about Antarctica’s past climate: 8% 14% 43% 65%
- In teaching similarities and differences between rice, ice, snow, & ice shelves: 19% 23% 47% 63%
- In teaching the importance of Antarctica to students’ lives: 43% 50% 44% 64%

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011. Antarctica’s Climate Secrets: Summative Evaluation of Youth Activities.

Pre- and Post-test Means for the Eight Flexhibit Groups

Figure 6. Pre- and post-test means for the eight Flexhibit groups (N=333)²

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011. Antarctica’s Climate Secrets: Summative Evaluation of Youth Activities.
Overall Pre- and Post-Test Scores for Flexhibit and Control Groups

Figure 7. Overall pre- and post-test scores for Flexhibit and control groups.

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011. Antarctica’s Climate Secrets: Summative Evaluation of Youth Activities.

Student Descriptions of Antarctica – Percentages by Categories

Figure 8. Percentage of students whose descriptions of Antarctica fell into different identified categories.

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011. Antarctica’s Climate Secrets: Summative Evaluation of Youth Activities.
Pre- and Post-Test – Students Identifying Animals Living in Antarctica

Figure 9. Pre- and post-test percentages of participating students (n=333) correctly identifying which animals "live in and around Antarctica."

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011. Antarctica's Climate Secrets: Summative Evaluation of Youth Activities.

Pre- and Post-Test: Percentage of Students Correctly Responding to Statements about Antarctica’s Climate

Table 4. Pre- and post-test percentages of participating students (n=333) who correctly responded to statements about Antarctica's climate.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Antarctica gets a lot of precipitation. (False)</td>
<td>43%</td>
<td>54%</td>
</tr>
<tr>
<td></td>
<td>disagreed</td>
<td>disagreed*</td>
</tr>
<tr>
<td>b) Understanding Antarctica’s past climate helps us understand Earth’s future climate. (True)</td>
<td>53%</td>
<td>81%</td>
</tr>
<tr>
<td></td>
<td>agreed</td>
<td>agreed*</td>
</tr>
<tr>
<td>c) If all the ice on Antarctica melts, then sea levels around earth will rise. (True)</td>
<td>78%</td>
<td>89%</td>
</tr>
<tr>
<td></td>
<td>agreed</td>
<td>agreed*</td>
</tr>
<tr>
<td>d) Climate conditions in Antarctica only affect the climate around Antarctica itself. (False)</td>
<td>62%</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>disagreed</td>
<td>disagreed*</td>
</tr>
<tr>
<td>e) In its history, Antarctica has had huge shifts in climate, switching many times between cold and warm climates. (True)</td>
<td>32%</td>
<td>78%</td>
</tr>
<tr>
<td></td>
<td>agreed</td>
<td>agreed*</td>
</tr>
<tr>
<td>f) Antarctica has always been extremely cold and covered with ice. (False)</td>
<td>62%</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>disagreed</td>
<td>disagreed*</td>
</tr>
</tbody>
</table>

*Significant difference found between pre and post percentages

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011. Antarctica's Climate Secrets: Summative Evaluation of Youth Activities.
**Pre- and Post-Test: Percentage of Students Correctly Identifying Information that tells Scientists about the History of Antarctica’s Climate**

Figure 10. Percentage of students identifying information that tells scientists about the history of Antarctica’s climate.

<table>
<thead>
<tr>
<th>Types of microscopic marine fossils*</th>
<th>Pre-Test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>46%</td>
<td>60%</td>
<td>14%</td>
</tr>
<tr>
<td>Mixtures of rocks of all sizes*</td>
<td>41%</td>
<td>66%</td>
</tr>
<tr>
<td>Layers of fine-grained sediment*</td>
<td>45%</td>
<td>71%</td>
</tr>
<tr>
<td>Condition of microscopic marine fossils*</td>
<td>46%</td>
<td>55%</td>
</tr>
<tr>
<td>Number of microscopic marine fossils</td>
<td>39%</td>
<td>46%</td>
</tr>
<tr>
<td>None of the above*</td>
<td>16%</td>
<td>9%</td>
</tr>
</tbody>
</table>

*Significant difference found between pre and post percentages

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011. Antarctica’s Climate Secrets: Summative Evaluation of Youth Activities.

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**Pre- and Post-Flexhibit: Student Responses to: How Important is Antarctica to your Life?**

Figure 11. Students’ responses to “How important is Antarctica to your life?”

- Pre-Flexhibit Mean(SD)= 2.7(1.1)
- Post-Flexhibit Mean(SD)= 3.7(1.1)

*significant difference between pre- and post-test means (matched t-test), t(330), p < .05

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011. Antarctica’s Climate Secrets: Summative Evaluation of Youth Activities.
Pre- and Post-Flexhibit: Student Responses to:
How Much Do You Know About Antarctica?

Figure 12. Students' responses to "How much do you know about Antarctica?"

*significant difference between pre- and post-test means (matched t-test), t(331), p < .05

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011.
Antarctica's Climate Secrets: Summative Evaluation of Youth Activities.

Pre- and Post-Flexhibit: Percentage of Students Agreeing/Disagreeing
About How Their Flexhibit Experiences Impacted Them

Figure 13. Percentage of students agreeing/disagreeing with statements about how their Flexhibit experiences impacted them.

Amy Spiegel (Center for Instructional Innovation, UNL, June 2011.
Antarctica's Climate Secrets: Summative Evaluation of Youth Activities.
Acknowledgements

Thanks to all of the USAP, RPSC, NANA and ANZ staff, and the communities at McMurdo Station and Scott Base who have helped to implement this project and contribute to its success. We are all very grateful for your efforts and your continuing support.

The development of this video and supplementary educational materials was funded by NSF Grant No. ESI-0632175 to Michael Farrell, Gary Hochman, Judy Diamond and WGBH/NOVA.

This work was based on research funded through the NSF-OPP (Grant No. ANT-0342484) and the other international partners of the ANDRILL Program (NZ, Italy, Germany).

Pilot Project in 2008;
Proposal to NOAA Environmental Literacy Grant solicitation in 2008;
Three-Year Project Funded in 2009 (2009-2012)
NOAA approved a No-Cost Extension until August 31, 2013.
Antarctic Circumpolar Current System

Rintoul, 2010 (adapted from Rintoul et al., 2001)
How Do Disciplinary Literacy Principles Lead to Systems Literacy Principles?

NOAA Education - Definitions and Standards

**Education:** a process of engaging audiences to build knowledge on topics relevant to the world’s atmosphere, climate, ocean, and coastal ecosystems in order to achieve greater environmental literacy, personal safety, and an improved economy.

NOAA’s education program activities will:
- be based on NOAA sciences and services;
- include goals and measurable objectives;
- be aligned with appropriate national or state science education standards;
- be replicable, consistent in quality, and designed to be sustainable;
- include an evaluation component; and,
- be managed by NOAA employees who have satisfied NOAA’s education training requirement.
NOAA’s Environmental Literacy Program

NOAA’s environmental literacy program seeks…

• to educate present and future generations about the changing Earth and its processes;
• to inspire our nation’s youth to pursue scientific careers;
• to improve the public’s understanding and appreciation of NOAA’s missions; and also….
• to improve the public’s understanding of the natural environment and human response to natural hazards;
• to assist state and local natural resources managers and ensure that decision makers have access to, and the knowledge to use, the information they need to reduce significant human impacts on the environment and to respond to storm warnings and environmental change.

The NOAA Environmental Literacy Grants (ELG) program provides support to improve environmental literacy among our Nation’s citizens and promotes a diverse workforce in ocean, coastal, Great Lakes, weather, and climate sciences, with the goal of encouraging stewardship and increasing informed decision making for the Nation.

ELG funds a broad range of education projects implemented on regional to national scales, with a focus that alternates between informal and formal education. The program aligns with NOAA’s mission goals and Education Strategic Plan and supports the President’s “Educate to Innovate” campaign.

ELG competitions also require robust project evaluation; promote best practices; complement other federal granting programs; emphasize partnerships that facilitate the integration of NOAA assets into education programs; and promote climate, ocean, and atmospheric literacy. For FY 2012, NOAA requests $5.0 million for Environmental Literacy Grants.

Since 2005, 76 competitive awards totaling $40.6M have been granted, supporting a wide range of project types. Demand for these awards is very high, and in FY 2010, 357 letters of intent and 95 full applications were reviewed. With the available funding, 17 new awards were made. In addition, NOAA also funded nine continuing awards initiated in FY 2009.
Attendance at C²S² Events, 2008-2012
A changing climate leads to changes in the frequency, intensity, spatial extent, duration, and timing of extreme weather and climate events, and can result in unprecedented extreme weather and climate events.

Changes in extremes can be linked to changes in the mean, variance, or shape of probability distributions, or all of these.

800,000 Year Record of Carbon Dioxide Concentration


Earth’s Changing Environment – Observational Data from Time Series

Observed Sea Level Rise from Satellite Altimeter Data

Rate = 3.2 ± 0.4 mm/yr
Seasonal signals removed
Inverse barometer applied, GIA corrected


FEMA 100-Year Flood Zone for New York City

The area of the city that is expected to be flooded every 100 years.

Landmarks
A. West Side Highway
B. Battery Park
C. Brooklyn Battery Tunnel
D. South Ferry Subway Station
E. Ferry Terminals
F. Franklin D. Roosevelt Drive
G. Wall Street
H. South Street Seaport

National Phenology Networks Observer Stations

Phenology is a scientific term for the timing of activity of plants and animals (Nature’s Calendar).

Regional Global Change Change Impacts in the U.S.

Global Climate Change Impacts in the United States describes current and future impacts of climate change on various U.S. regions and sectors.

There are both important commonalities and important differences in the climate-related issues and consequences faced around the country. For example, water is a key issue in all regions, but the specific changes and impacts vary. Regional perspectives are thus critical to thinking through responses to the changes that will be faced around the nation.

Regional Global Change Change Impacts in the U.S.

While the impacts of climate change clearly vary among the regions, there are issues of national importance that transcend regional boundaries. Seven such “sectors” (shown below) are considered in this report, providing a more integrated national picture of impacts, although one with regional differences.
Focal Areas for Interagency Cooperation  
from “Our Changing Planet”, 2011

<table>
<thead>
<tr>
<th>Focus Areas</th>
<th>Participating Agencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving the knowledge of Earth’s past and present climate variability and change</td>
<td>DOC*, DOE, DOI, NASA, NSF, SI, USDA</td>
</tr>
<tr>
<td>Improving the understanding of natural and human forces of climate change</td>
<td>DOC, DOE, DOI, DOT, EPA, NASA, NSF, USDA</td>
</tr>
<tr>
<td>Improving the capability to model and predict future conditions and impacts</td>
<td>DOC, DOE, DOI, HHS, NASA, NSF, SI, USAID, USDA</td>
</tr>
<tr>
<td>Assessing the Nation’s vulnerability to current and anticipated impacts of climate change</td>
<td>DOC, DOE, DOI, DOT, EPA, NASA, NSF, USDA</td>
</tr>
<tr>
<td>Providing climate information and decision support tools</td>
<td>DOC, DOI, DOT, EPA, NASA, NSF, SI, USAID, USDA</td>
</tr>
<tr>
<td>Climate change communication and education</td>
<td>DOC, NASA, NSF, SI, USDA</td>
</tr>
</tbody>
</table>

* USGCRP participating organizations from the Department of Commerce (DOC) are the National Institute of Standards and Technology (NIST) and the National Oceanic and Atmospheric Administration (NOAA).

Federal Investment in STEM Education

FY 2009 STEM Funding

*Source: Executive Office of the President, Office of Science and Technology Policy, Preparing Our Children for the 21st Century Economy: Science, Technology, Engineering, and Mathematics Education in the 2010 Budget (May 2009)

FY2010 U.S. Global Climate Change Research Program Budget by Focus Area

- Improving our knowledge of Earth’s past and present climate variability and change
- Improving our understanding of natural and human forces of climate change
- Improving our capability to model and predict future conditions and impacts
- Assessing the Nation’s vulnerability to current and anticipated impacts of climate change
- Providing climate information and decision support tools
- Climate change communication and education

Download Booklet from: http://andrill.org/publications

ANTARCTICA
A JOURNEY OF DISCOVERY

Educational Booklet for NSF-OPP Division of Arctic Sciences
QUESTIONS?