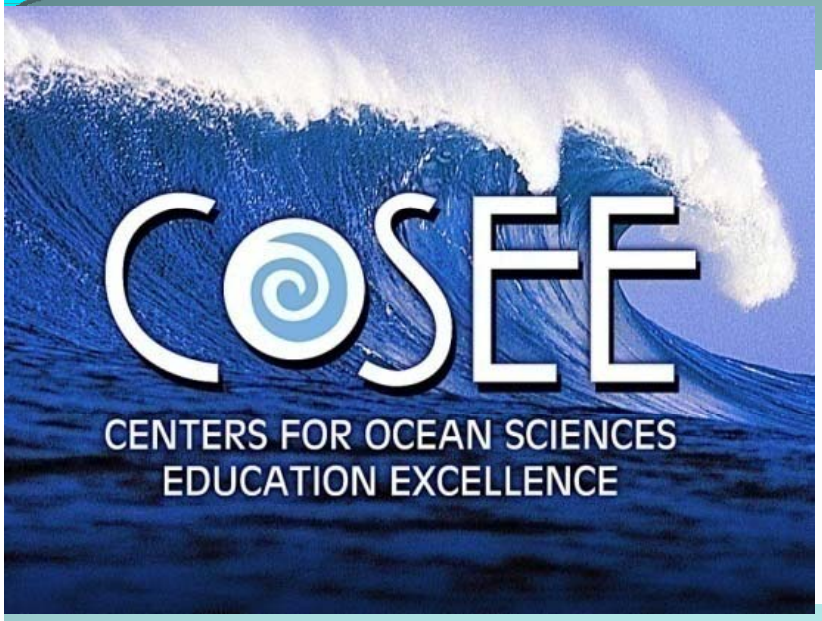


ALASKA

PEOPLE, OCEANS AND CLIMATE CHANGE
WWW.COSEEALASKA.NET

Marilyn Sigman
COSEE-Alaska
Center for Ocean Science Education Excellence
School of Fisheries and Ocean Science
University of Alaska Fairbanks

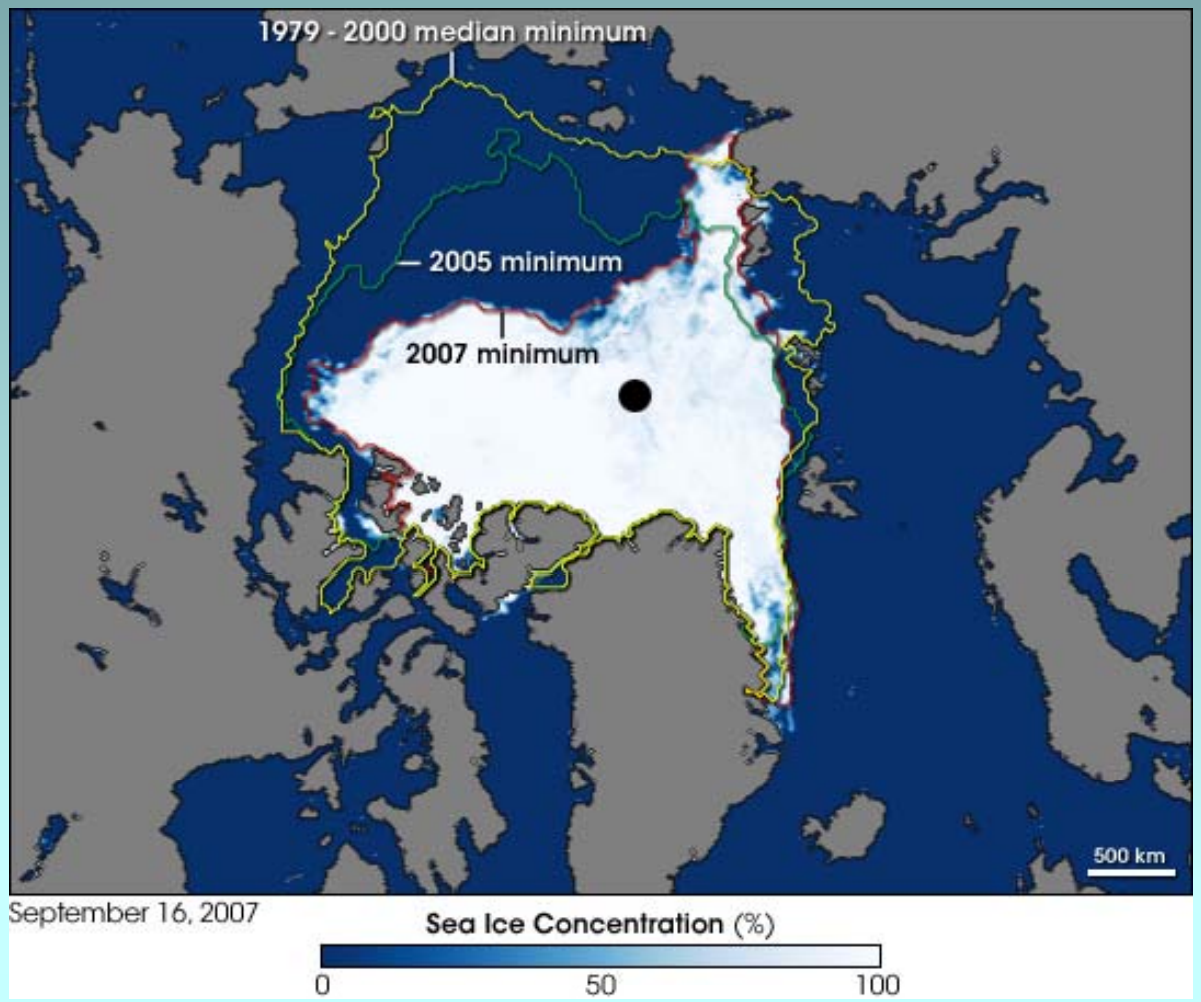
3-2-1

Alaska's Ocean & Climate Change

Alaska's Ocean (and Rivers)

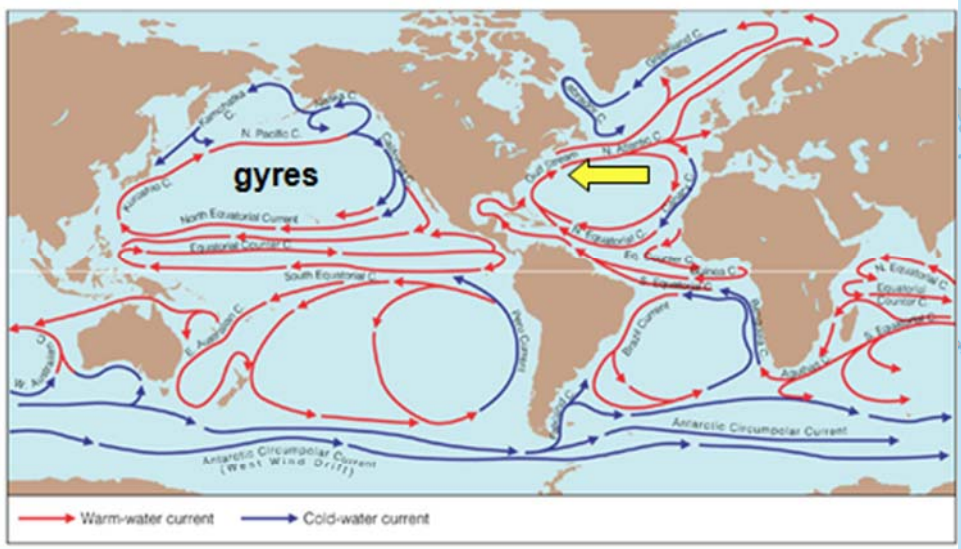
- 44,500 linear miles of coastline
- 2/3 of the nation's coastline
- 50% of the nation's offshore waters
- 40% of the nation's surface waters
- > 50% of the wetlands
- > 50% of the total fish harvest
- Yukon-Kuskokwim River Delta is the size of Oregon

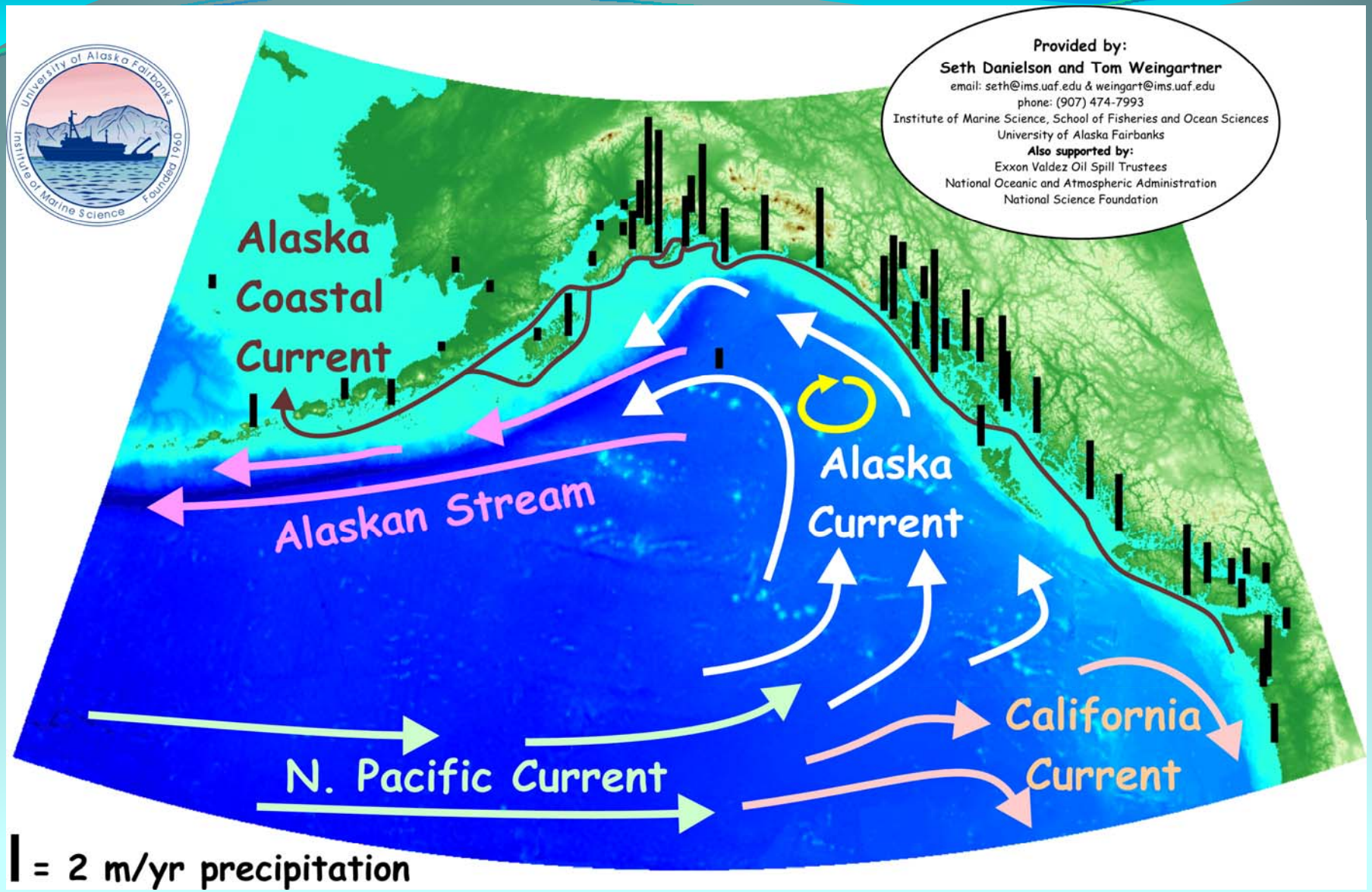
Three Words: Ice Melting Fast



Three More Words: Altered Circulation Patterns

Surface Current Systems

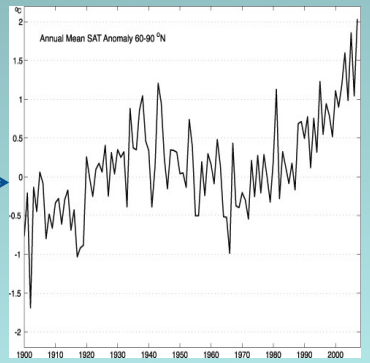



Provided by:
Seth Danielson and Tom Weingartner
email: seth@ims.uaf.edu & weingart@ims.uaf.edu
phone: (907) 474-7993
Institute of Marine Science, School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
Also supported by:
Exxon Valdez Oil Spill Trustees
National Oceanic and Atmospheric Administration
National Science Foundation
Alaska Coastal Current
Alaskan Stream
Alaska Current
N. Pacific Current
California Current
= 2 m/yr precipitation

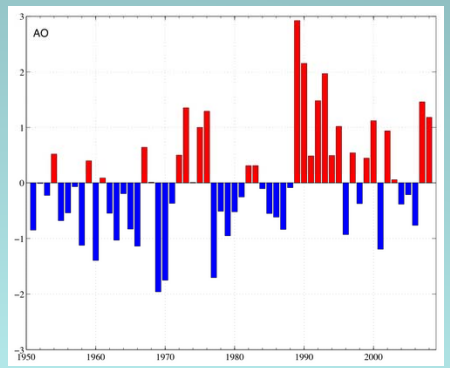
Two Words: Ground Zero (for Climate Change)

Warming Temperature Trend since 1960's

O
Ann. Mean
Temperature



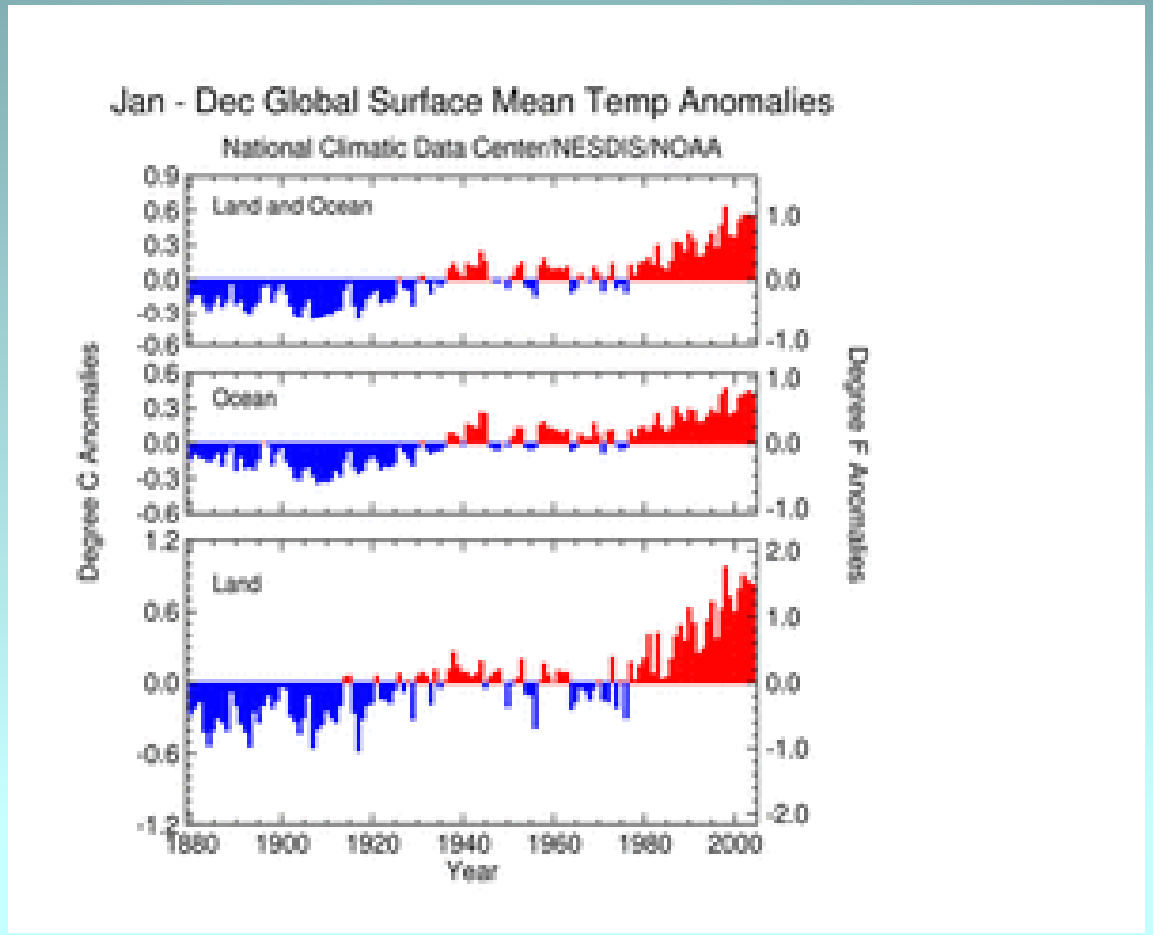
1900 - 2008



1950 - 2000

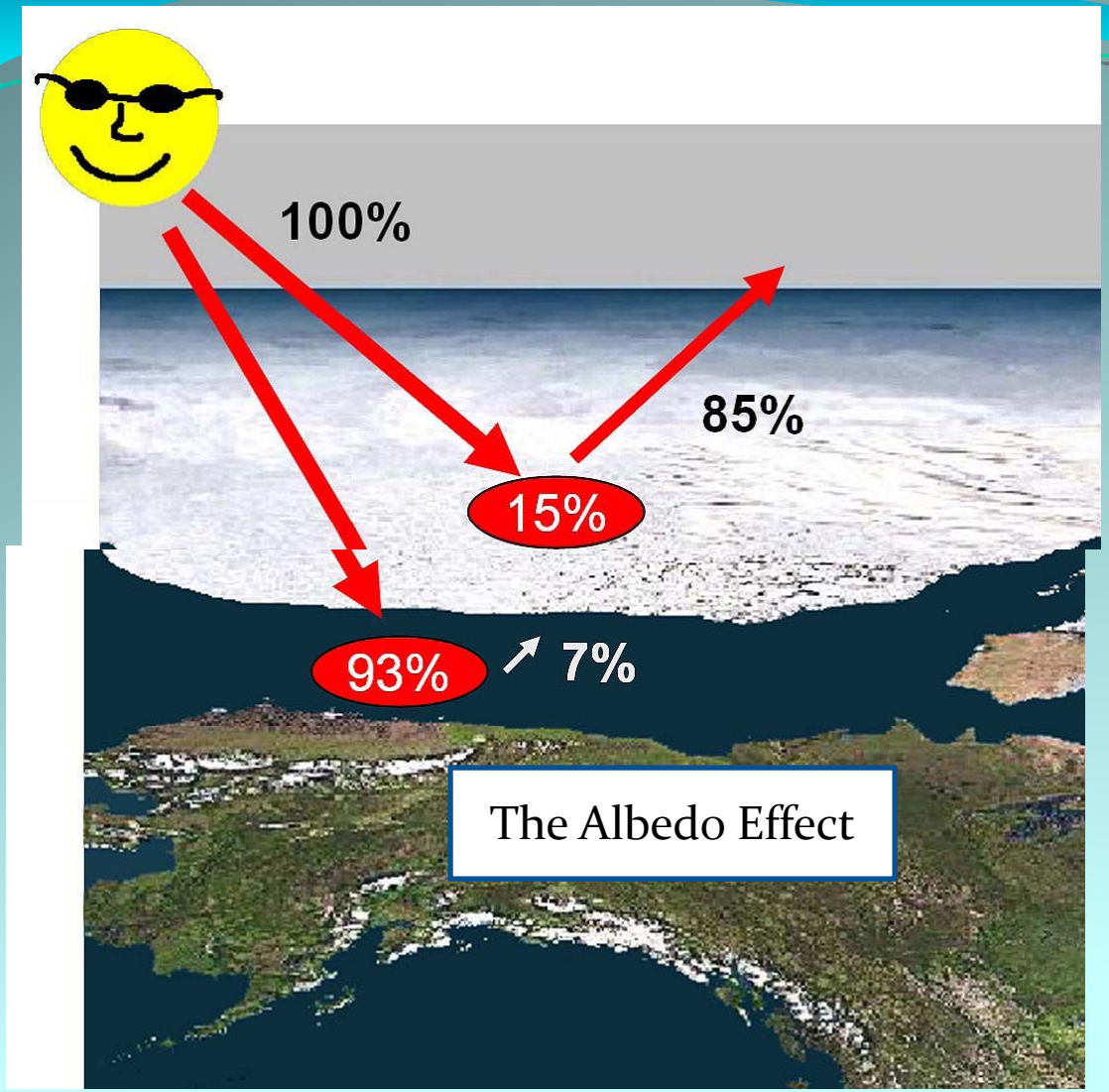
- Warmest year on record in 2007
- + 5 degs. above average in fall, 2007
- The Arctic is warming at twice the rate of the average global temperature

Source: NOAA's 2008 Arctic Report Card


Jan - Dec Global Surface Mean Temp Anomalies
National Climatic Data Center/NESDIS/NOAA
Land and Ocean
Ocean
Land
Degree C Anomalies
Degree F Anomalies
0.9
0.6
0.3
0.0
-0.3
-0.6
1.2
-1.2
1.0
0.0
-1.0
2.0
-2.0
1880
1900
1920
1940
1960
1980
2000
Year

A warmer ocean

More frequent, more intense storms



Sea Water Temperature and the Extent of Ice Melt are Interrelated

One Word

- **Agggggggghhhhh!**
- **Panic**
- **Understand**

First response to climate change: Observe and understand the changes in the ecosystem.

COSEE

CENTERS FOR OCEAN SCIENCES EDUCATION EXCELLENCE

COSEE CENTERS FOR OCEAN SCIENCES EDUCATION EXCELLENCE

- **Leadership:** Nora L Deans, director
- **Location:** COSEE Alaska is based in Anchorage, Alaska
- **Website:** http://www.coseealaska.net
- **Collaborators/Partners:** Alaska Ocean Observing System, Alaska Sea Grant, University of Alaska Fairbanks, Alaska SeaLife Center, Anchorage School District, North Pacific Research Board
- **Co-Principal Investigators, and Key Project Partners:** Molly McCammon (Alaska Ocean Observing System), Michael Castellini (University of Alaska Fairbanks, School of Fisheries and Ocean Sciences), Ray Barnhardt (University of Alaska Fairbanks, Center for Cross-Cultural Studies), Paula Cullenberg (Alaska Sea Grant), Jessica Ryan (Alaska SeaLife Center), Texas Gail Raymond (Anchorage School District) Nora Deans, Director (Alaska Ocean Observing System, North Pacific Research Board), Andrea Anderson (Soundview Evaluation) Ruth Post, (University of Alaska Fairbanks), Alan Dick (Curriculum Consultant)

COSEE ALASKA

Mission: To help ocean scientists achieve their broader impacts and share place-based knowledge of ocean climate change with the COSEE network.

What We Do: Work closely with ocean scientists, educators and coastal community members to enhance ocean and climate change literacy in formal and informal audiences and the public:

- **Weave:** Link scientists, educators and coastal communities in Alaska and nationwide with emphasis on ocean climate change.
- **Bridge:** Communicate western science and traditional knowledge about ocean climate change to Alaska and the nation.
- **Invite:** Increase participation in ocean sciences by underrepresented and under-served audiences.
- **Pathfind:** Provide tools and services to ocean scientists for effective outreach with focus on ocean climate change literacy.
- **Share:** Enhance teacher capabilities for incorporating ocean climate change and place-based knowledge into curricula.

Why We Were Established: : COSEE Alaska was established as both a regional (Alaska) and thematic center (People, Oceans and Climate Change) to weave together traditional knowledge and western science about ocean climate change in the north.

THEME: People, climate, and oceans

Weave **– link scientists, educators, and coastal communities in Alaska And nationwide with emphasis on ocean climate change.**

Bridge **western science and traditional knowledge about ocean climate Change to Alaska and the nation.**

COSEE-Alaska Partners

- UAF/Alaska Sea Grant
- UAF/School of Fisheries & Ocean Sciences
- UAF/Center for Cross-cultural Education; Alaska Native Knowledge Network
- Alaska Ocean Observing System
- Alaska SeaLife Center
- Anchorage School District

Three Strategies

- Connecting Alaska Ocean/Climate Change Scientists and Alaska Educators – Formal and Informal
- Integrating Traditional Native Knowledge and Western Science
- Storytelling: Alaska & Beyond

Connecting Alaska Ocean/Climate Change Scientists and Alaska Educators – Formal and Informal

The Landscape of the Scientists

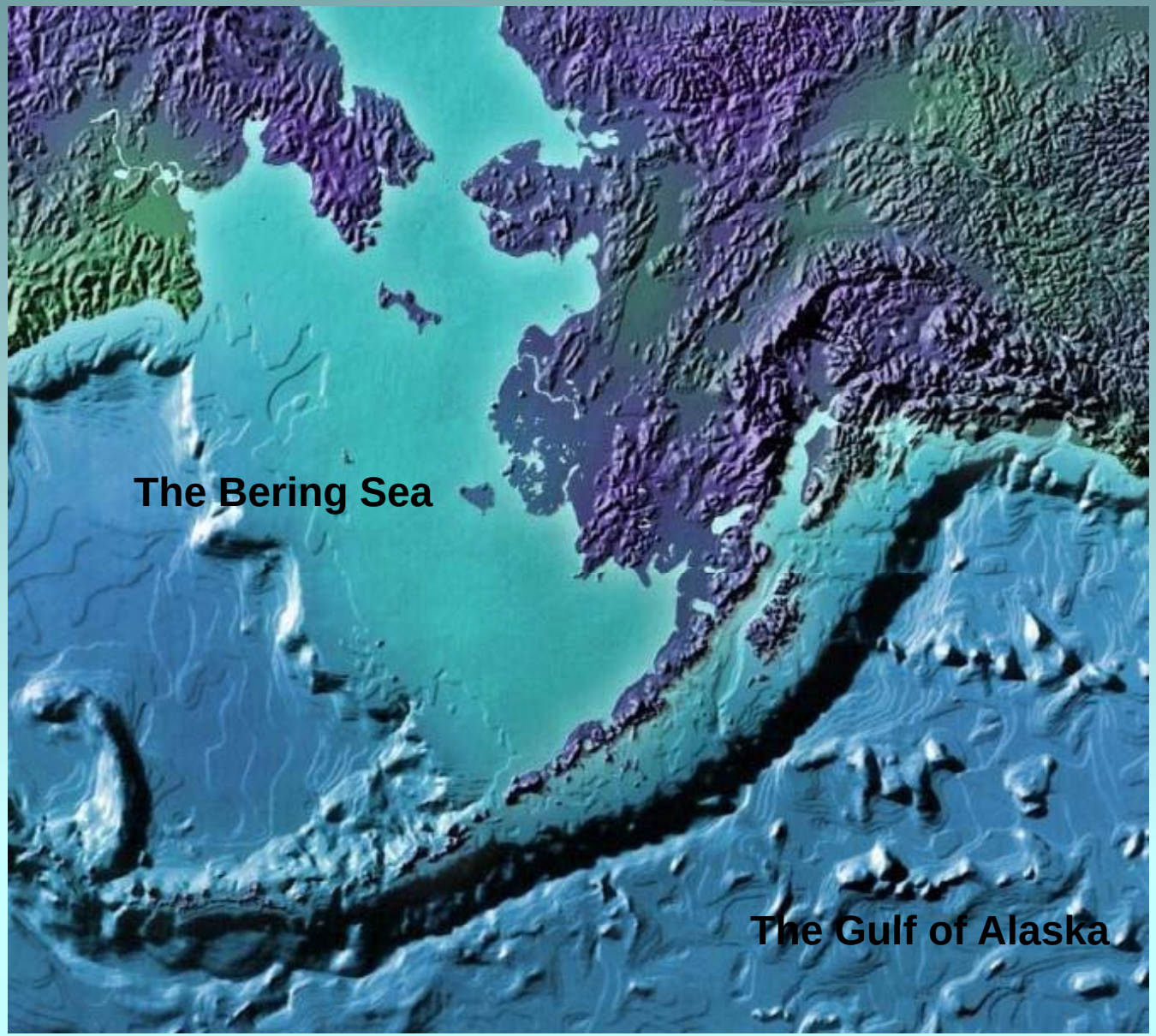
- More climate science is happening
- Science is taking place with integrated ecosystem and biome research approaches; on international and global scales.
- More science outreach and education is happening – scientists are being encourage to "tell their stories"
- Professional incentives are lacking for effective education and outreach

Scientist Outreach and Education

- Required by grantors
- Training opportunities, especially for young scientists
- Science stories
- Instruction at teacher workshops
- Science-teacher-student Partnerships
- Curriculum resources and media
- Websites
  - Data sets
  - Real-time data
  - Visualizations
  - Real-time expedition outreach
  - Scientist blogs
  - Google Earth and Google Ocean

Lisa Munger, Scripps Inst.

The Arctic Ocean



INTERNATIONAL 2007 2008 POLAR YEAR

- March, 2007 – March, 2008 (2 full cycles)
- 200 projects
- Thousands of scientists
- More than 60 nations
- Biological, physical, and social research


North Pacific Research Board
Building a clear understanding of the North Pacific, Bering Sea and Arctic Ocean ecosystems that enables effective management and sustainable use of marine resources
UNDERSTANDING ECOSYSTEM PROCESSES IN THE
Bering Sea
NSF
AN HISTORIC PARTNERSHIP BETWEEN THE NORTH PACIFIC RESEARCH BOARD AND THE NATIONAL SCIENCE FOUNDATION
AT A GLANCE
General Program Information
Meet the Scientists
Study Region Map
Photo Gallery
NEWS + UPDATES
In the News
Scientific Cruises
Media
Teachers + Students
OUR FOCUS
An Ecosystem Approach
Human Communities
Ecosystem Modeling
Animal Stories
FOUNDATIONS
History
Bering Sea Ecosystem Research:
An unprecedented scientific effort between NPRB and NSF
SIX YEARS
93 SCIENTISTS
MILLIONS
OF CREATURES
ONE STORMY SEA
In the News
PROGRAM UPDATES
SAB Election Results
The votes for the Scientific Advisory Board have been tallied. Terms were randomly determined per the Program Management Plan. Congratulations to:
Kerim Aydin, Rolf Gradinger, Phyllis Stabeno (1-year term)
Carin Ashjian, Rodger Harvey, Mike Sigler (2-year term)
JOB OPPORTUNITY
OSU College of Oceanic + Atmospheric Sciences Research Associate (Postdoctoral)
Study the distribution and

BSIERP!!

The Bering Sea Integrated Ecosystem Research Program

.

ONE BIG QUESTION:
WHAT HAPPENS
WHEN THE ICE MELTS?

The Landscape of the Educators

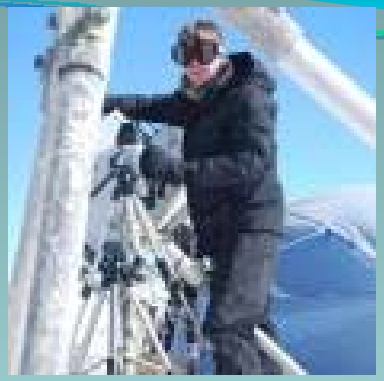
- K-12 educators coping with No-Child-Left-Behind requirements.
- Alaska science standards are general with no requirement to teach about the ocean or watersheds.
- Upper-level science standards are specific about climate change.
- Informal educators are isolated and scattered.
- The amount of information about climate change is staggering and not always at appropriate scales.

Opportunities and Challenges

COSEE-Alaska Activities for Scientists and Educators

- Assist scientists with planning and executing exemplary science outreach and education efforts
- Scientists and Educators in Alaska Network (SEANET)
- Annual Communicating Ocean Science workshops
- Skills training for scientists in communicating in formal (K-16) and informal settings
- Skills training for educators through professional development
- High-quality resources for use in education and outreach

International Polar Year



POLAR TREC

TEACHERS & RESEARCHERS EXPLORING & COLLABORATING

POLAR PLANET PALOOZA!

BSEIRP

Icebreaker Healy
Cruise logs now on
Google Earth

K-8 Curriculum
Revision of Alaska SeaWeek

Alaska Seas and Rivers Curriculum

NEW!

Standards based marine/aquatic science units for K-8

Primary Grades (K-2)
- Discovering Our Blue Planet
- Plants and Animals of Seas and Rivers
- At Home in the Water

Intermediate (3-5)
- Rivers to the Sea and Back Again
- The Case of the Missing Sea Otter
- Humans and the Ocean

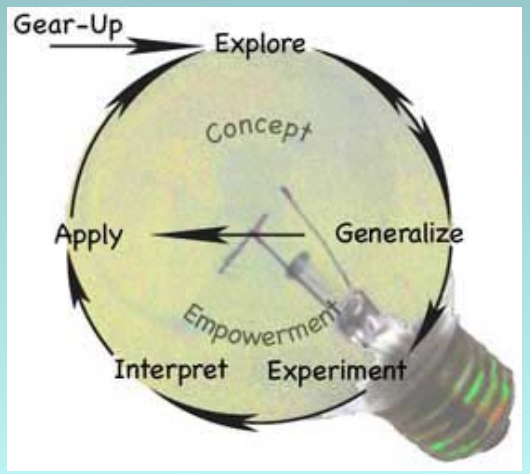
Upper (6-8)
- Exploring the Ocean
- Ocean in Motion
- Our Changing World

1980's Technology
Pre-No Child Left Behind

Technology of 2007: Web-based
Standards-based
Inquiry-based

The Learning Cycle Model
"The five E's"

Engagement
Gear-up



Evaluation

Exploration

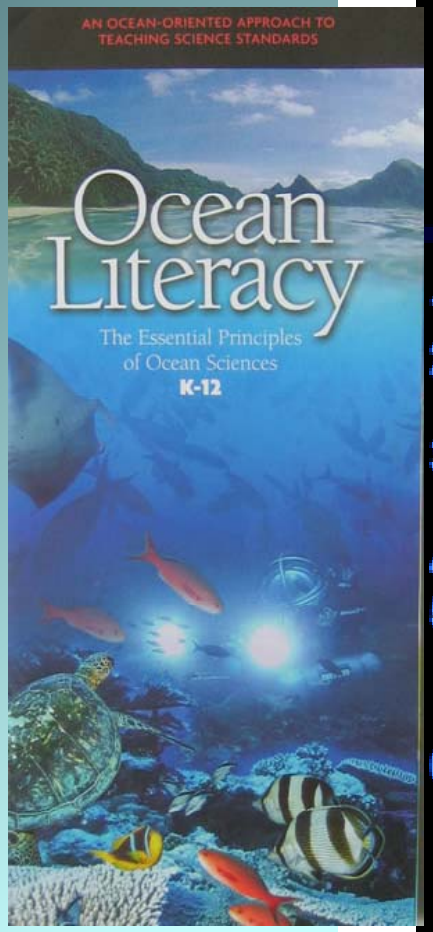
Explanation

Elaboration

Gear-up/engage for each unit: an Alaskan science story

Grade 7
Where did the Rubber Bath Toys Go?

Grade 8
Our Changing World



Ocean Literacy Essential Principles and Fundamental Concepts, 2005

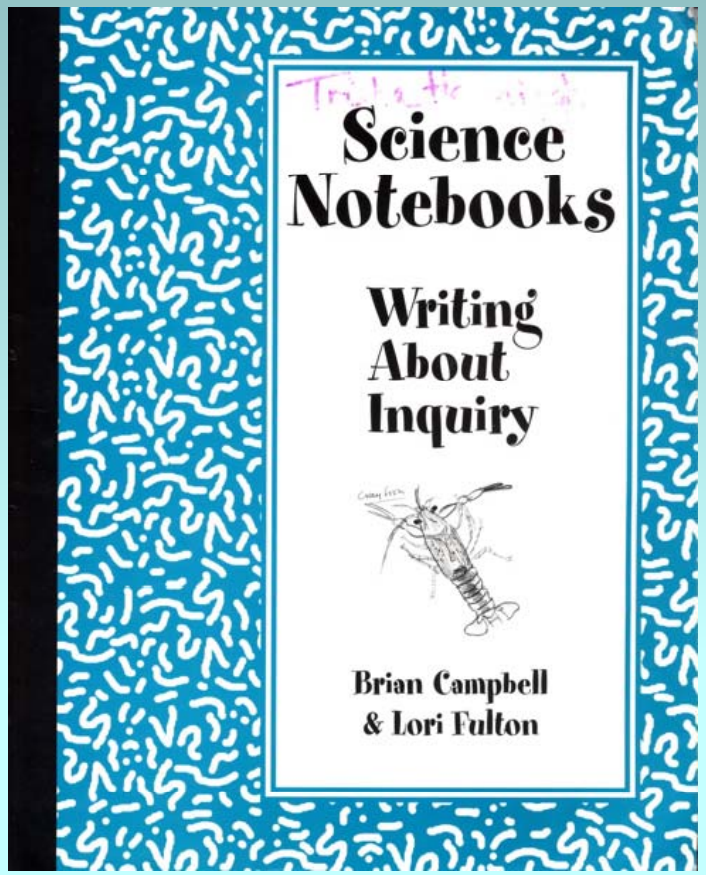
1. The Earth has one big ocean with many features.
2. The ocean and life in the ocean shape the features of the Earth.
3. The ocean is a major influence on weather and climate.
4. The ocean makes Earth habitable.
5. The ocean supports a great diversity of life and ecosystems. The ocean and humans are inextricably interconnected.
6. The ocean is largely unexplored.

EXPLORE

Grade Level	Title	Essential Question(s)	Enduring Understandings
Application of Knowledge 6 - 8			
6	**Exploring the Ocean**	How can technology help us explore the ocean? Why do we want to explore the ocean?	• The ocean is largely unexplored. • Humans must use ingenious ways to study the ocean. • Science and technology can be used to detect and solve problems.
7	**Ocean in Motion**	What are the patterns of physical changes in aquatic environments? How do they affect us? What are the major weather and ocean circulation systems in Alaska?	• Physical changes in the aquatic environment occur on a daily, seasonal, and long-term basis. • Weather systems and ocean systems have major influences on one another and the dynamics of matter and energy. • Science and technology can be used to detect and solve problems.
8	**Our Changing World**	How do changes in physical environment affect our ecosystems? What impacts will climate change have on our water resources in our community and in Alaska?	• Climate patterns cause physical changes in the environment. • Physical changes in the environment can change the conditions for life. • Science and technology can be used to detect and solve problems.

Alignment with ocean literacy principles and Alaska Grade Level Expectations

Science Notebooks, Science Literacy



Created by teachers working with scientists

Sheryl Sotelo, grade 5/6 teacher,
Homer, Alaska

Tania Spurkland, retired teacher,
University of Alaska Fairbanks
Graduate student

Field trips at every grade level

On-site professional development, including local field trip sites

Continuing the celebration!

Physical Change	Will Contribute To	Will not contribute to
Warmer ocean water		
Accelerated sea ice melt		
Change in extent of sea ice		
Accelerated glacial melt		

Predicted Effects of Climate Change on Oceans:

Sea level rise

Freshening in areas that were more saline (salty)

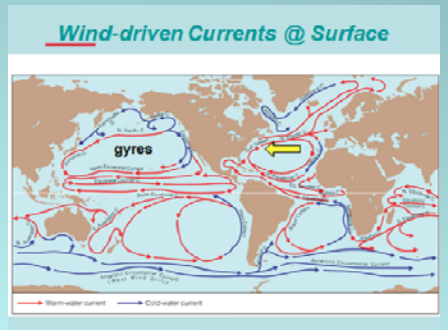
Changes in current patterns

Changes in distribution of organisms adapted to marine or brackish conditions

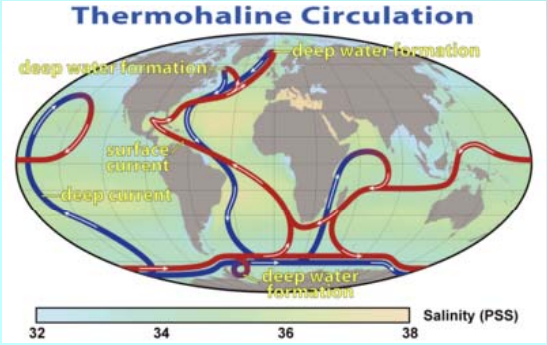
Extending the Learning

Beginning with Rubber Duckies

+ **Measure wind patterns and predict current patterns**
  Dataset of wind direction and speed for Gulf of Alaska
  NOAA buoy datasets – record wind direction and speed

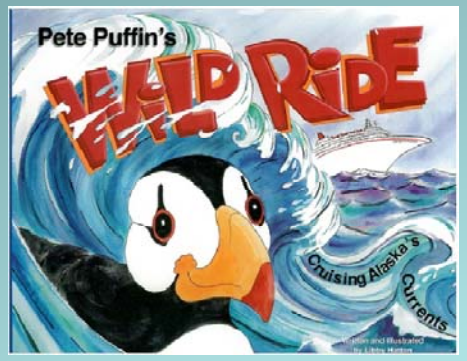


+ **Experiments about water temperature , density, and ice melt**



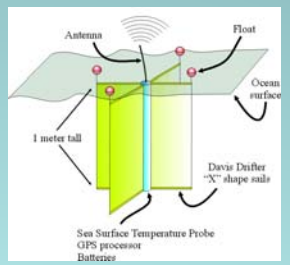
Extending the Learning

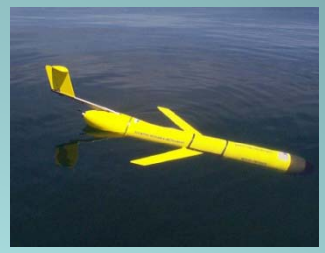
Quinhagak School
& Alaska Sea Grant
Online animation set to music



Pete's Wild Ride
Book & Lesson Plans
Grades 4-6

Rubber Ducky Data Set
Alaska Seas and Rivers
Grade 7 Unit





Drifter & AUV Data
Real-time and
Near-real Time Data
Grades 7-12

Alaska Ocean Observing System

Alaska Ocean Observing System
Prince William Sound Field Experiment

Physical Change	Will Contribute To	Will not contribute to
Warmer ocean water	Sea level rise thru thermal expansion	
Accelerated sea ice melt		Sea level rise
Change in extent of sea ice	Change in extent of freshening	
Accelerated glacial melt	Sea level rise Freshening of nearshore areas	

Predicted Effects of Climate Change on Oceans:

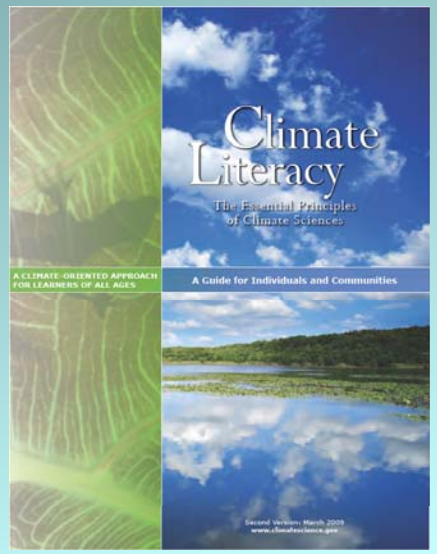
Sea level rise

Freshening in areas that were more saline (salty), thus:

Changes in current patterns

Changes in distribution of organisms adapted to marine or brackish conditions

In addition to ocean literacy - a national "topic" focus on climate change literacy



Climate is regulated by complex interactions among components of the Earth system (Sun, ocean, atmosphere, clouds, ice, land, and life).

Human activities are impacting the climate system.

Climate change will have consequences for the Earth System and human lives.

Developed by the National Oceanic and Atmospheric Administration (NOAA), the American Association for the Advancement of Science (AAAS), and multiple science agencies, non-governmental organizations, and numerous individuals.

Integrating Traditional Native Knowledge and Western Science

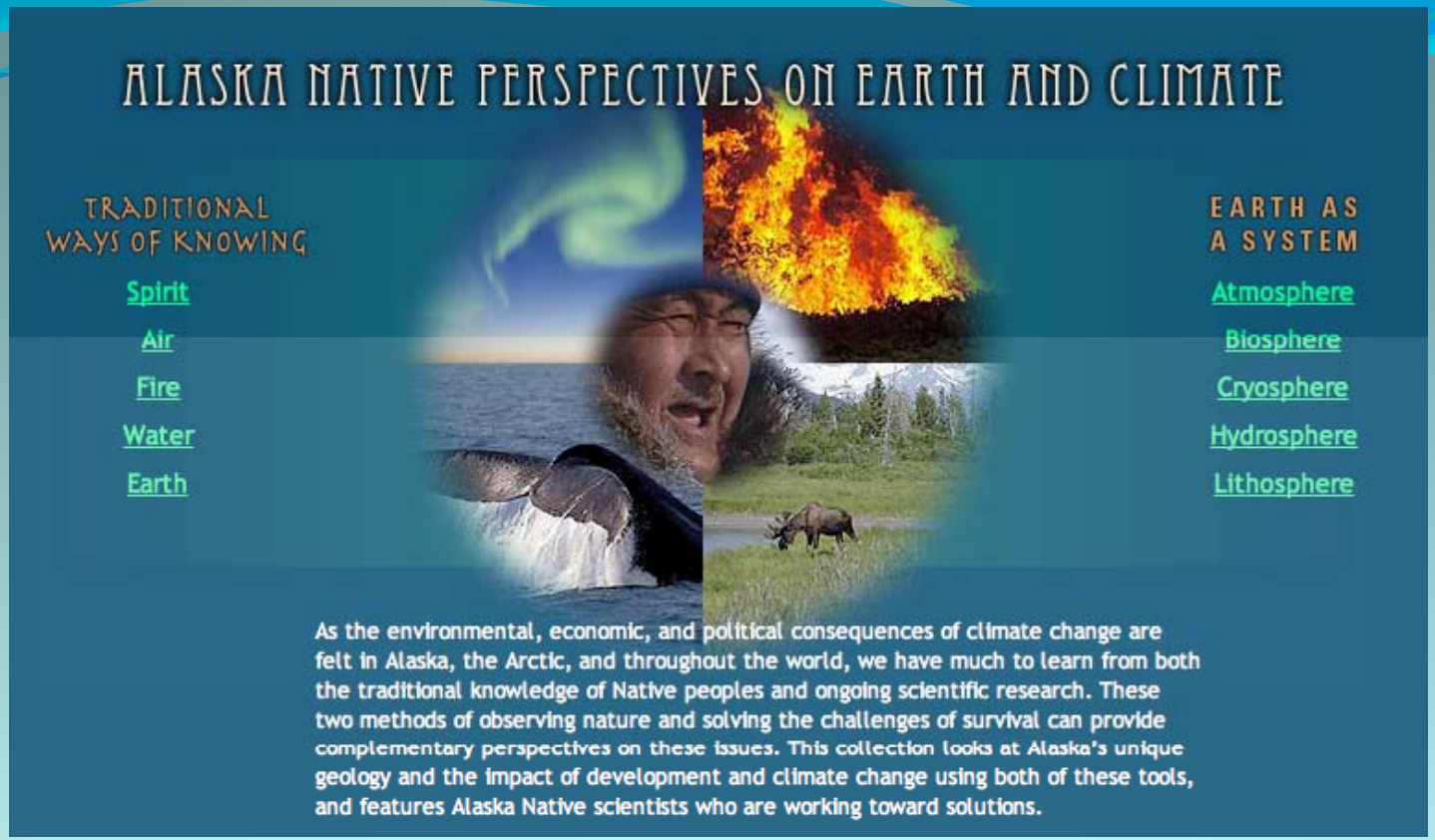
The Landscape

- Alaska Native culture and ways of knowing is increasingly being integrated into K-12 education to provide culturally-relevant education in Alaska.

- At the same time, Alaska science is becoming more inclusive of local and traditional ecological knowledge (LTEK)

COSEE-Alaska Activities

- Rural Ocean Science Fairs
- Professional Development Workshops
- Showcasing Successful Integration to Scientists, Educators, and Communities
- Resources



"Special Collection" Resource from WGBH Boston TeacherDomain.org
Videos from Native Perspective and Lesson Plans

Professional Development Training

Potential for new videos

Storytelling: Alaska & Beyond

The Landscape

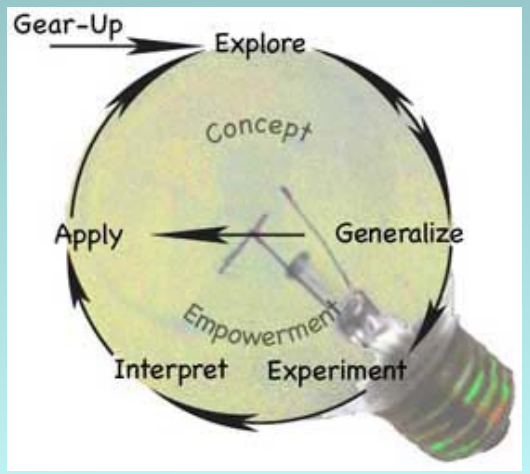
- Visitors to Alaska's museums, aquaria and other visitor destinations (the ferry and cruise ship routes)
- The COSEE Network
- The NAME and NMEA Network
- Global issues; global networks; the World Wide Web

COSEE-Alaska Activities

- Facilitating the storytelling by Native Alaskans about how climate change is affecting their communities and cultures.
- Interpretive messages and media at visitor destinations and on cruise ships
- NMEA/NAME conference in Alaska in 2012
- Website http://coseealaska.net

The Learning Cycle Model
"The five E's"

Engagement
Gear-up



Evaluation

Exploration

Explanation

Elaboration

Community Learning Cycle
Story-telling about Environmental Change

Share
Explain
Elaborate

Share

Brainstorm ideas and questions
Discover what students know

Interview local people

Analyze Data
Review information from multiple sources (local experts, existing research, etc.)

Lake Ice

Green-up

Engage → Explore → Generalize → Experiment
Decide what will be observed or measured and how it will be recorded

Date the Salmon Return

Observation Networks

Tundra Snow Cover

Snow and Ice

Lake Ice, ALISON

Permafrost, Boreholes

Freeze-up

Break-up

Phenology
GLOBE
Seasons & Biomes

Green-up

Brown-down

Mosquito Hatch

Temperature

Weather
GLOBE

Wind

Precip

Sea Water pH

Sea Water Temperatures

"We cannot change nature, our past, and other people for that matter, but we can control our thoughts and actions and participate in global efforts to cope with these global climate. That I think is the most empowering thing we can do as individuals."

- George Noogwook, Savoonga

The Earth is Faster Now

More Information?

http://coseealaska.net

Sign up for the SEANET listserve