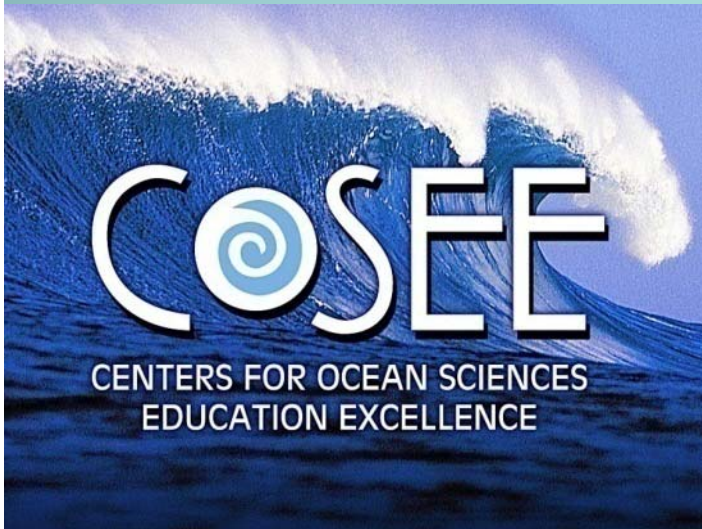


COSEE-Alaska: people, ocean, and climate change



**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

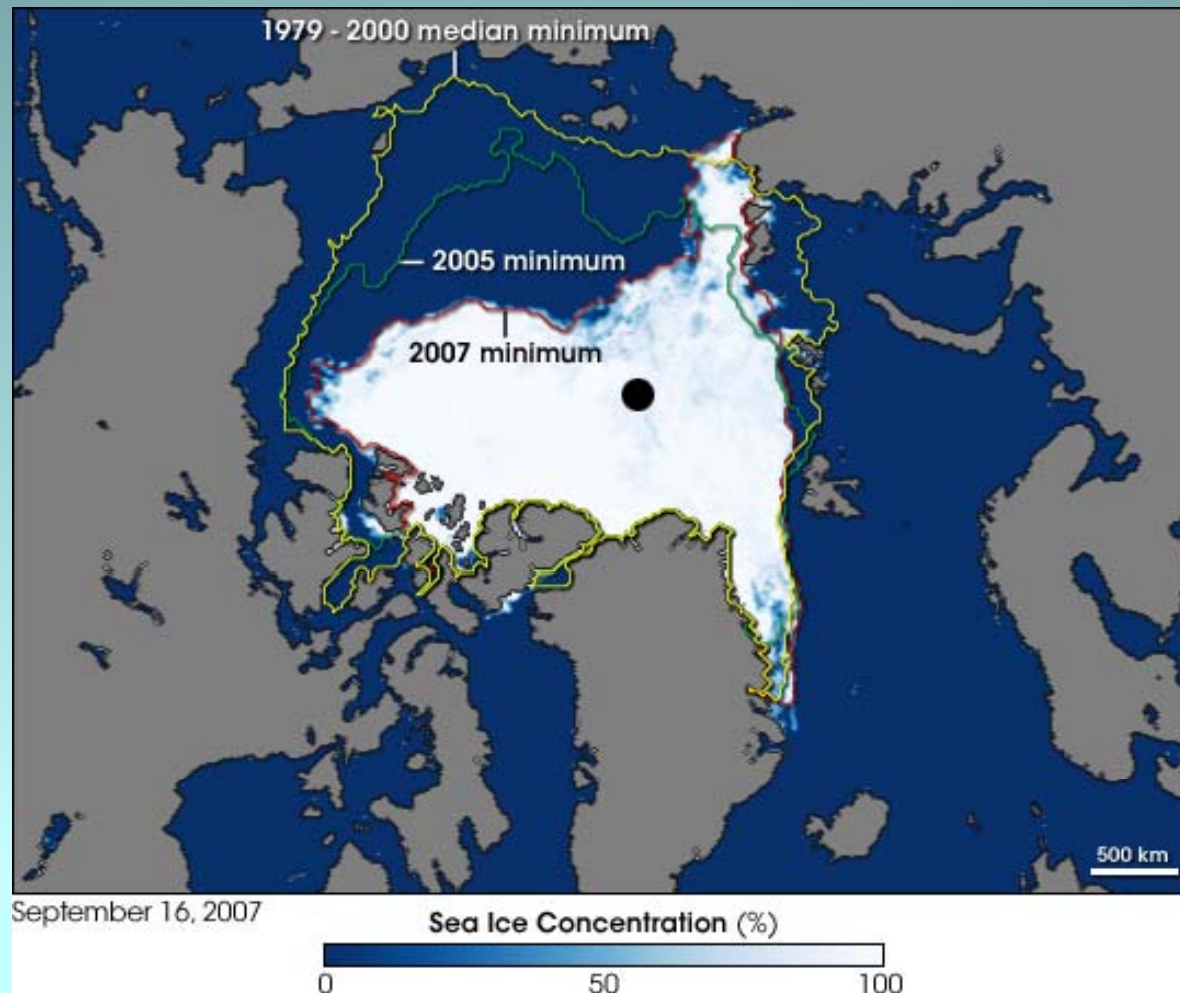




Alaska's Ocean (and Rivers)

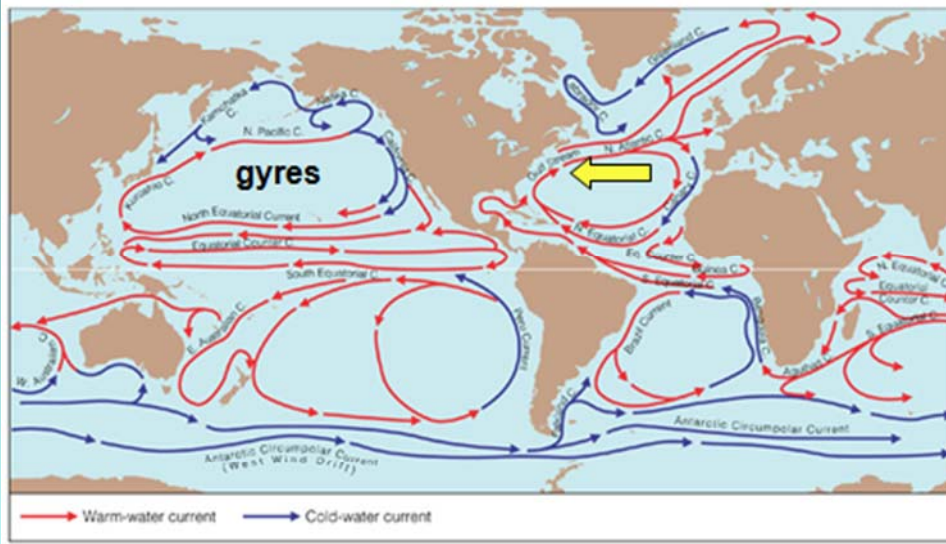
- 44,500 linear miles of coastline
- 2/3 of the nation's coastline
- 50% of the nation's offshore waters
- 40% of the nation's surface waters
- > 50% of the wetlands
- > 50% of the total fish harvest
- Yukon-Kuskokwim River Delta is the size of Oregon

Three Words: Ice Melting Fast



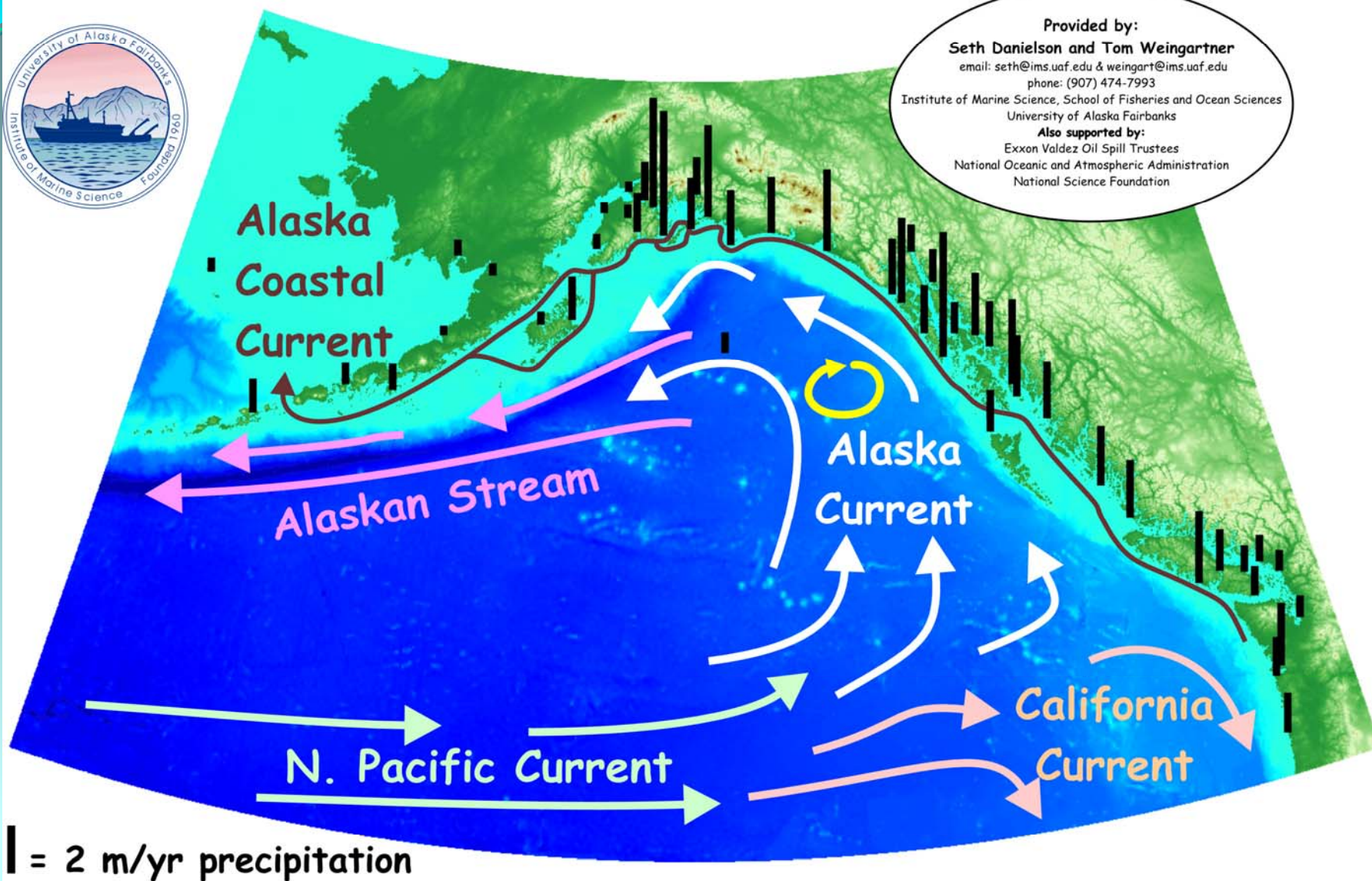
Three More Words: Altered Circulation Patterns

Surface Current Systems





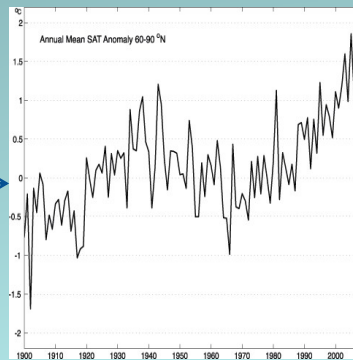
Provided by:
Seth Danielson and Tom Weingartner
email: seth@ims.uaf.edu & weingart@ims.uaf.edu
phone: (907) 474-7993
Institute of Marine Science, School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
Also supported by:
Exxon Valdez Oil Spill Trustees
National Oceanic and Atmospheric Administration
National Science Foundation



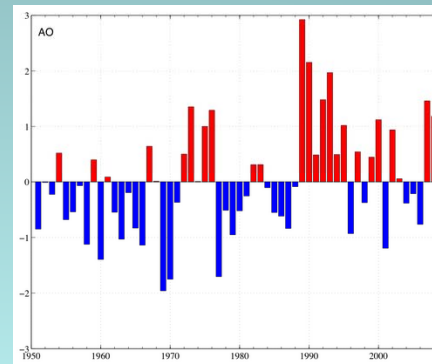
Two Words: Ground Zero (for Climate Change)

Warming Temperature Trend since 1960's

○ →
Ann. Mean
Temperature



1900 - 2008



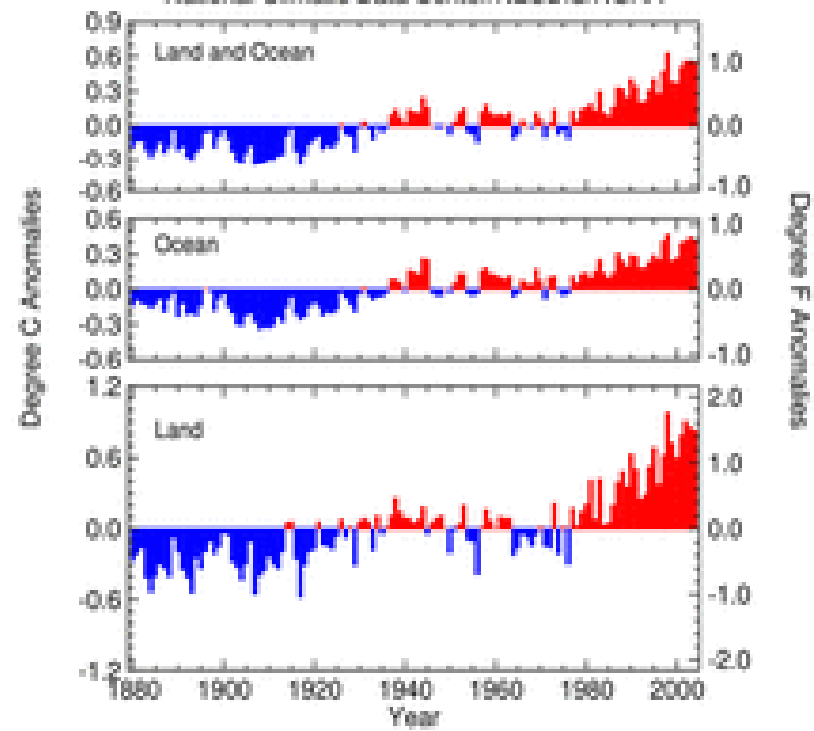
1950 - 2000

- 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





A warmer ocean



More frequent, more intense storms



100%

85%

15%

93%

↗ 7%

The Albedo Effect

**Sea Water
Temperature
and the
Extent of Ice
Melt are
Interrelated**

One Word

- Agggggggggghhhhh!
- Panic
- Understand

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



CENTERS FOR OCEAN SCIENCES
EDUCATION EXCELLENCE





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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



Strand 1: The Scientists

- More climate science
- Integrated ecosystem and biome research; working internationally
- More science outreach and education – “telling their story”

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



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?**

Scientist Outreach and Education To Strand 2: Educators

- 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.**



Resources for Teaching about Alaska Ocean Climate Change!

- **Scientist Education & Outreach**
- **Curriculum Resources**
- **National Literacy Principles**
- **Integration of Western Science and Indigenous Knowledge**

International Polar
Year

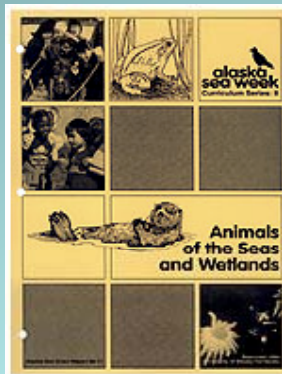


BSEIRP



Icebreaker Healy
Cruise logs now on
Google Earth

K-8 Curriculum Revision of Alaska SeaWeek



Alaska Seas and Rivers Curriculum



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

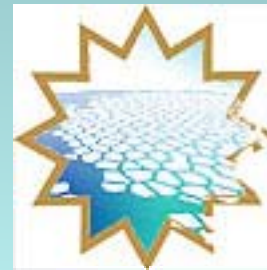


Elaboration

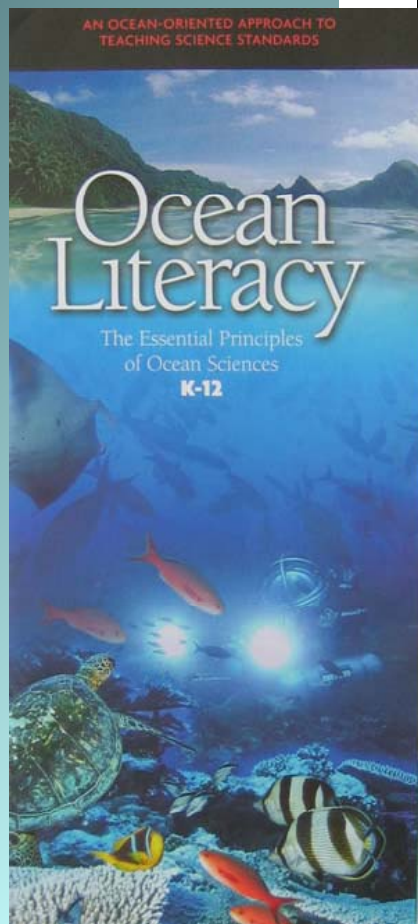
Gear-up/engage for each unit: an Alaskan science story



Grade 7
Where did the
Rubber Bath Toys
Go?

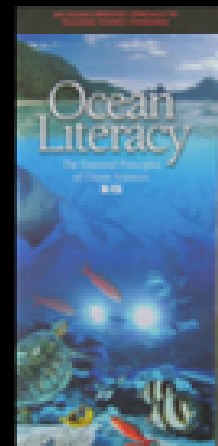


Grade 8
Our Changing
World



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.

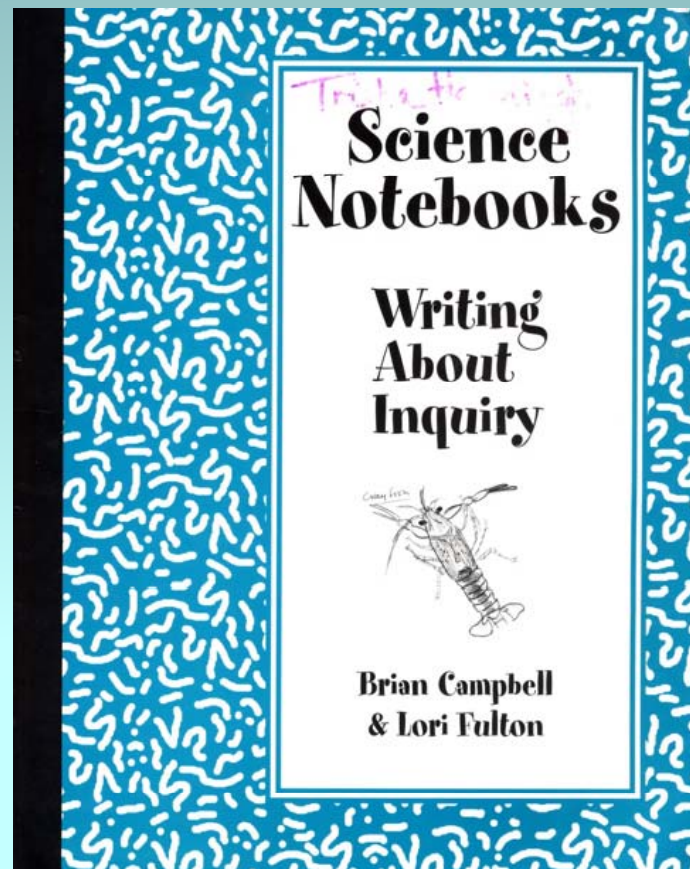


EXPLORE

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?	<ul style="list-style-type: none"> • 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?	<ul style="list-style-type: none"> • 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?	<ul style="list-style-type: none"> • 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





**Field trips at
every grade level**

**On-site professional
development, including
local field trip sites**



Continuing the celebration!



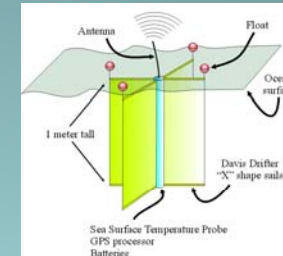
1. Map Currents with Things that Float



Rubber Ducky Dataset
Alaska Seas and Rivers
Grade 7 Unit



Drifter Buoy dataset:
Quinhak
Prince William Sound Experiment



2. Measure wind patterns and predict current patterns

Dataset of wind direction and speed for Gulf of Alaska

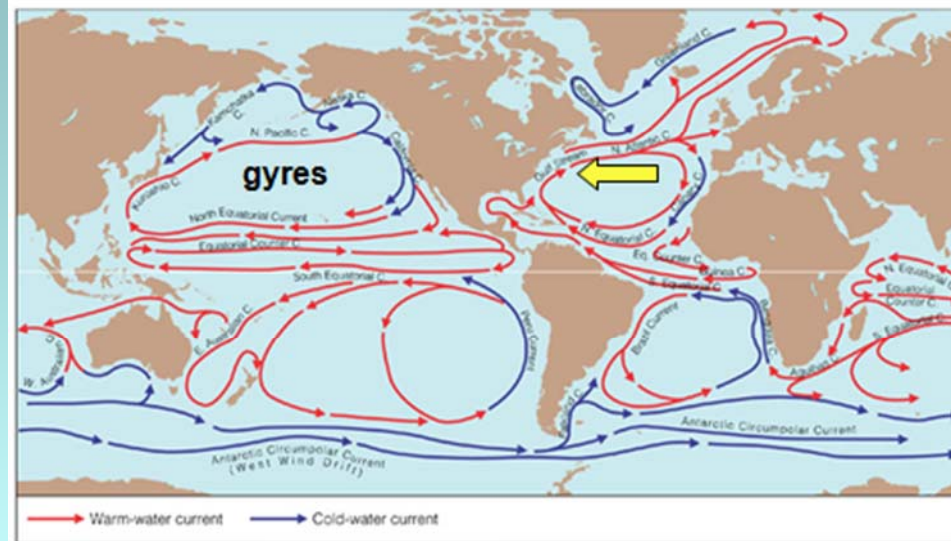
NOAA buoy datasets – record wind direction and speed

Information in Alaska Seas and Rivers Grade 7 unit

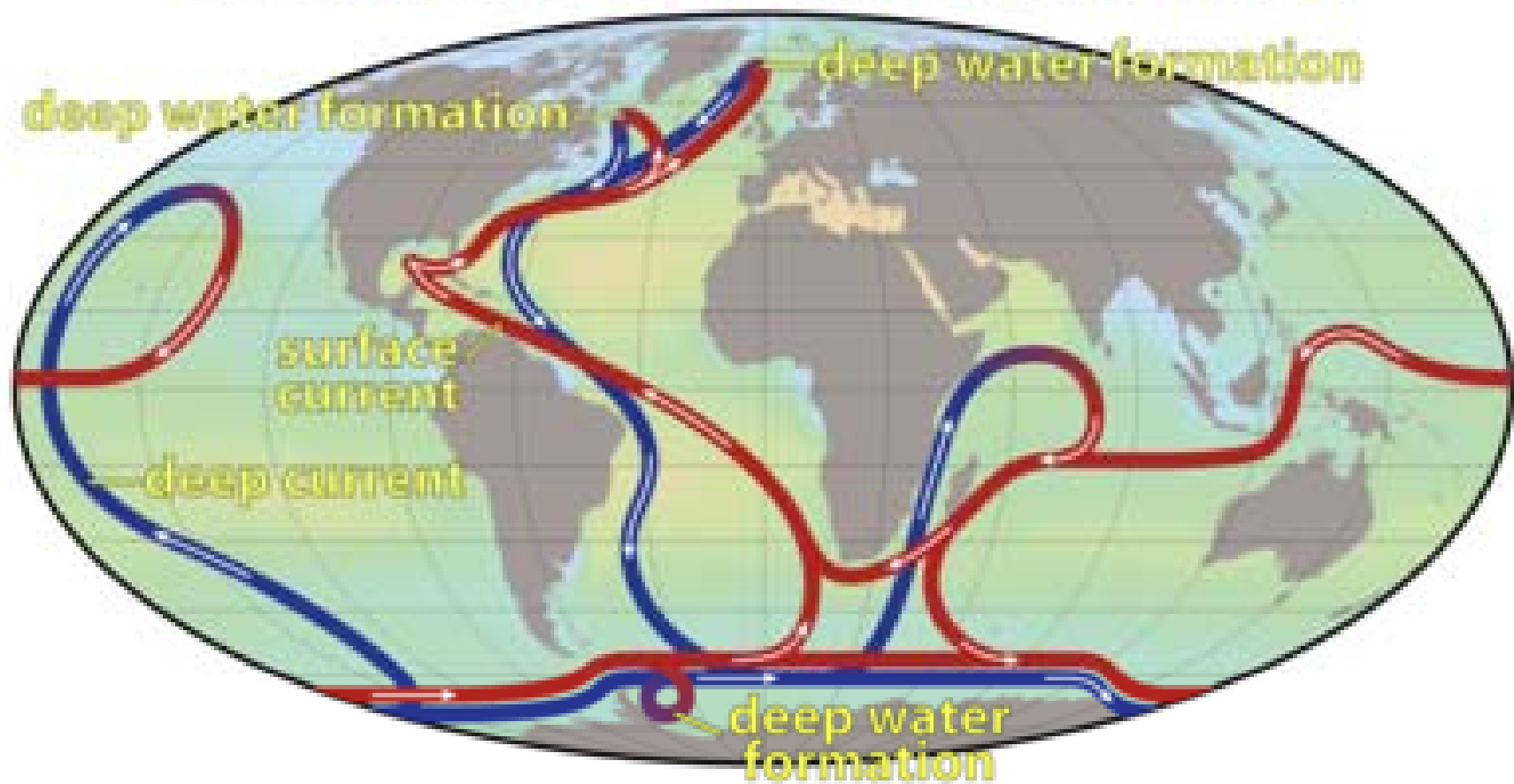
3. Ask people who depend on knowing the currents;

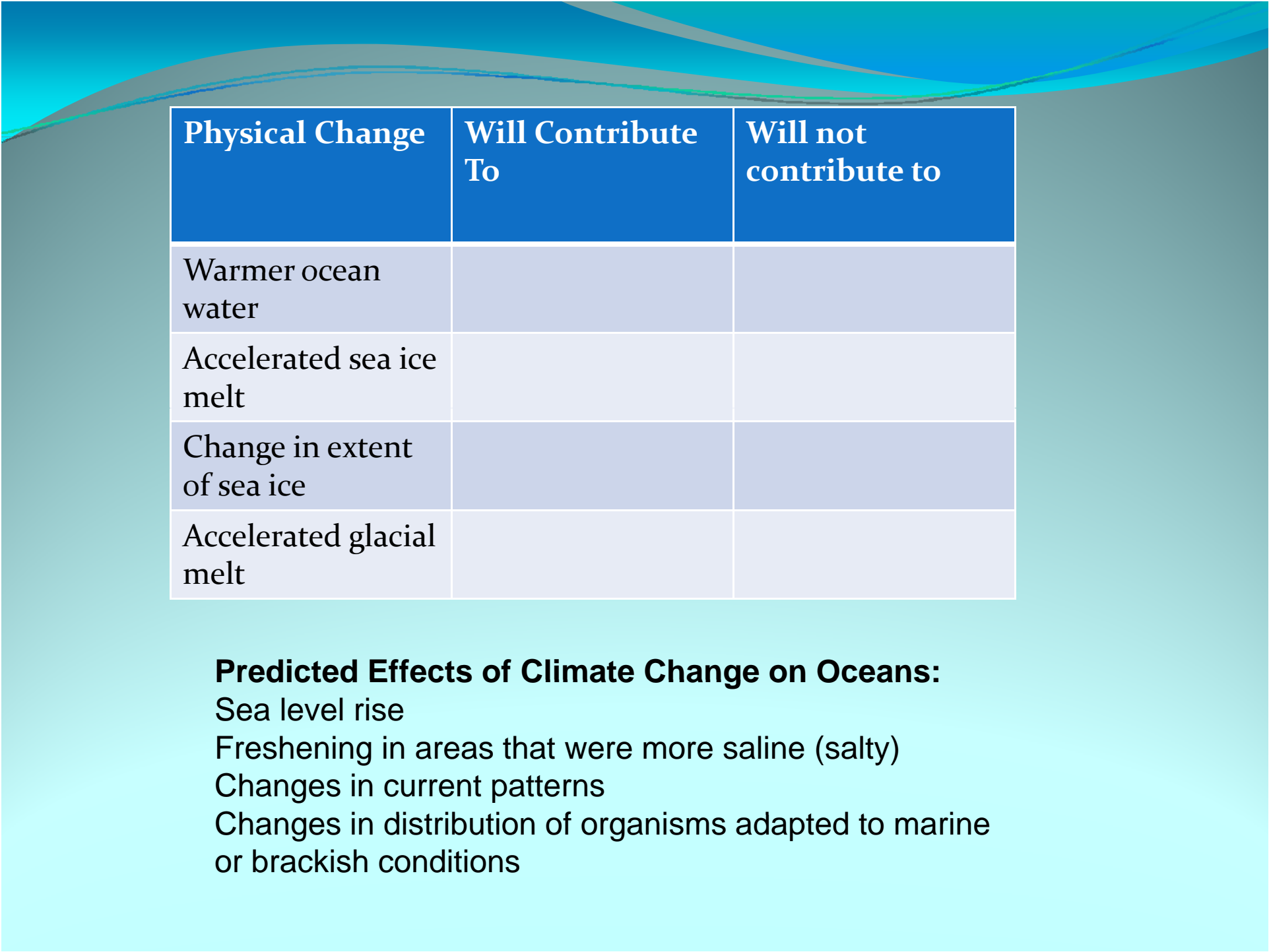
use local and traditional knowledge

Wind-driven Currents @ Surface



Thermohaline Circulation





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		

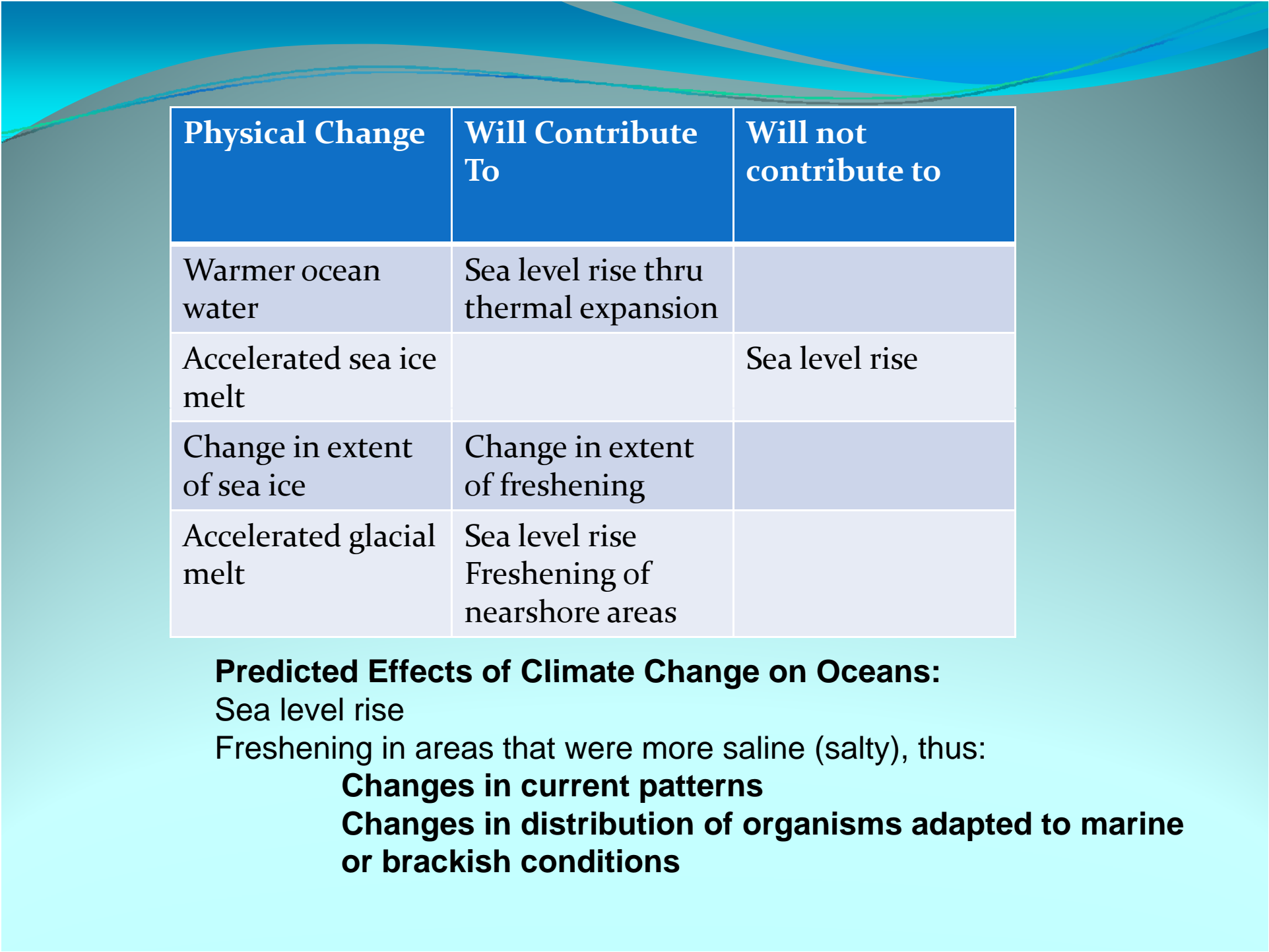
Predicted Effects of Climate Change on Oceans:

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



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.



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Strand 3: Alaska Native Knowledge

- 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)

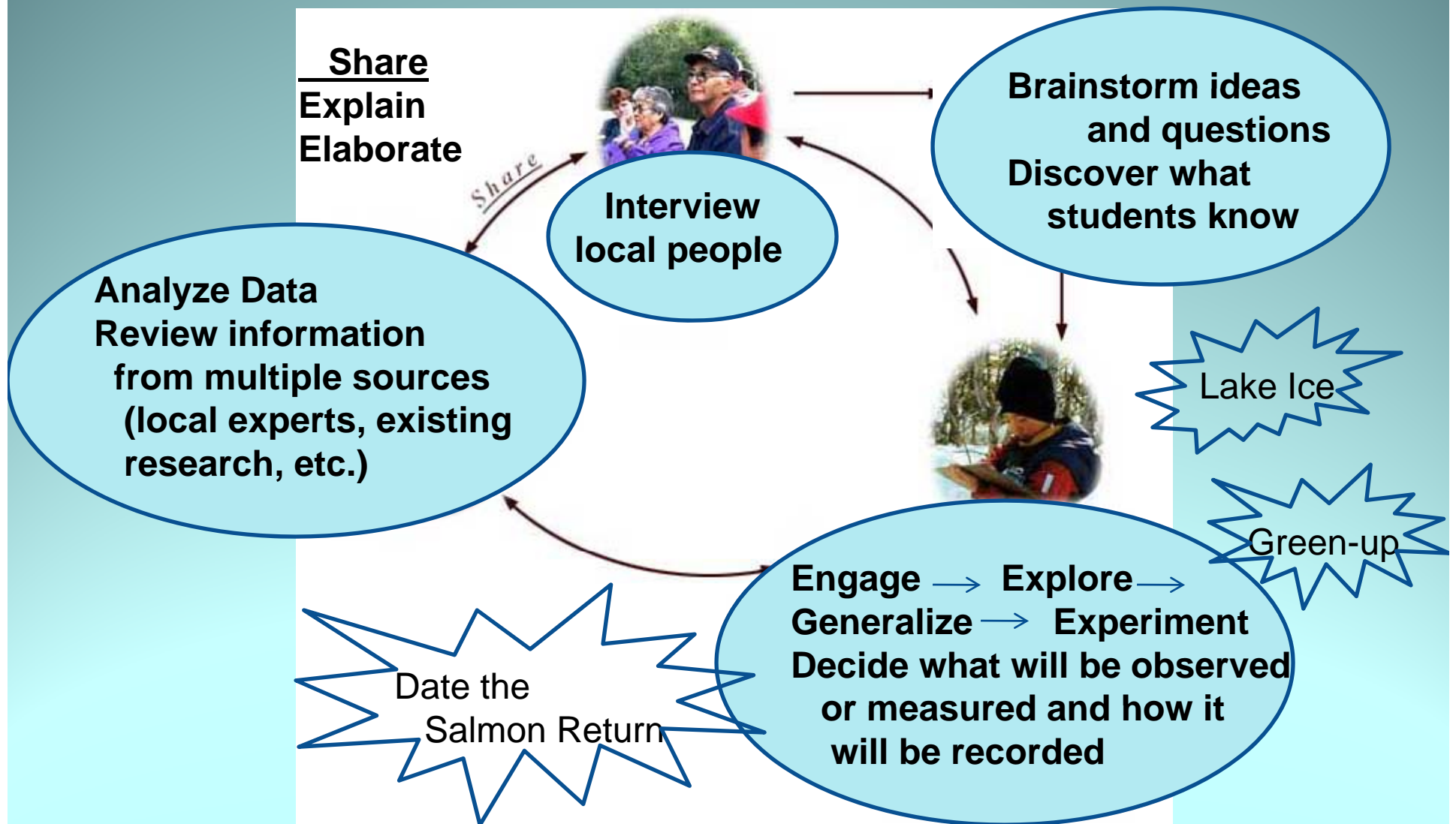


Responses to Climate Change: Learn, Understand, Adapt, and Mitigate!

- Observe Locally - join observation networks or create ones for your own place
- Connect Globally - Tell your own individual and community stories
- Audit your energy use and lifestyle (e.g., EPA Global Warming Wheel)
- Reduce the carbon footprint of your school and home.
- Recycle.
- Re-use.

Community Learning Cycle

Story-telling about Environmental Change



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

Sea Water
pH

Temperature

Weather GLOBE

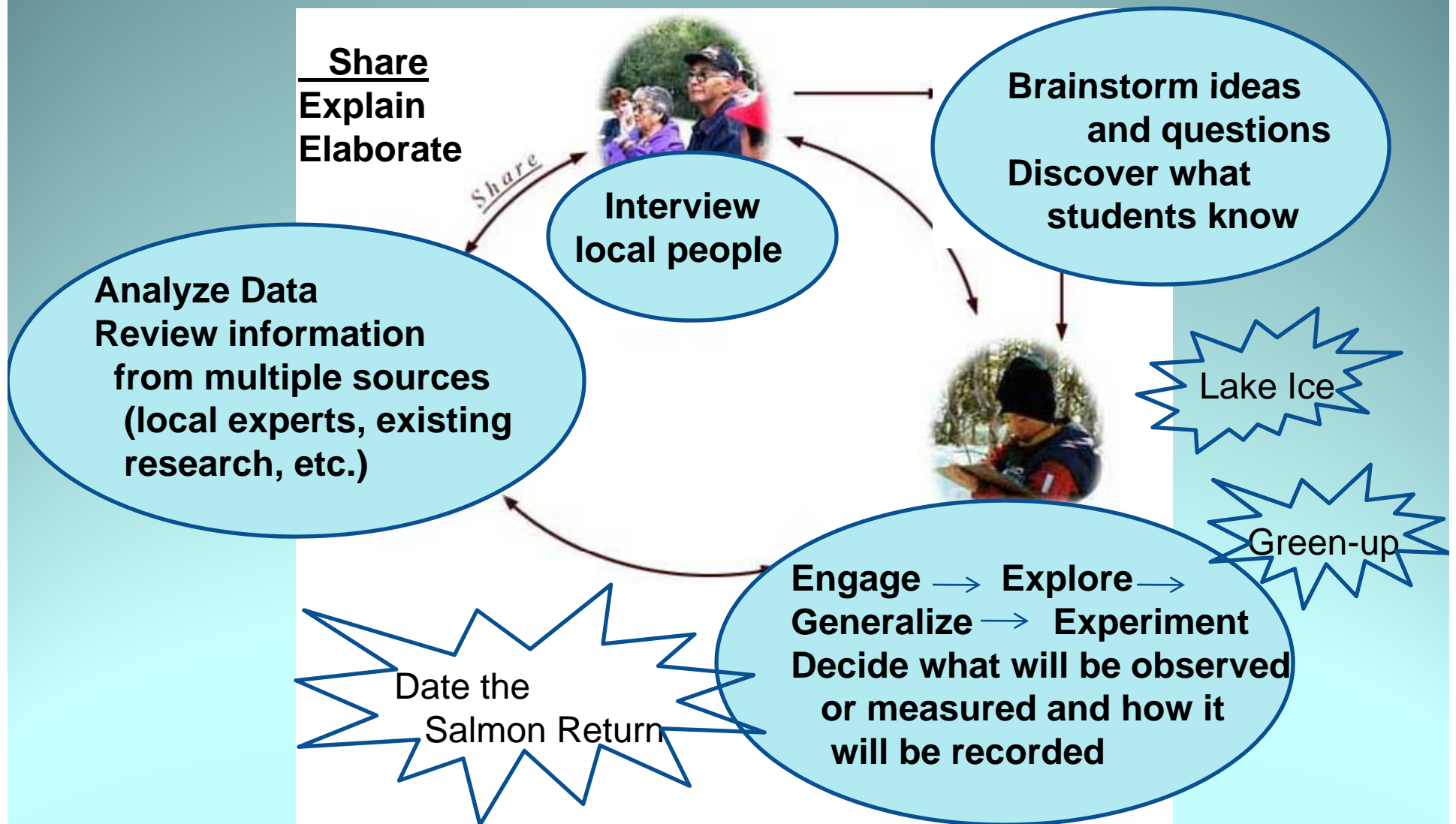
Wind


Precip

Sea Water
Temperatures

Community Learning Cycle

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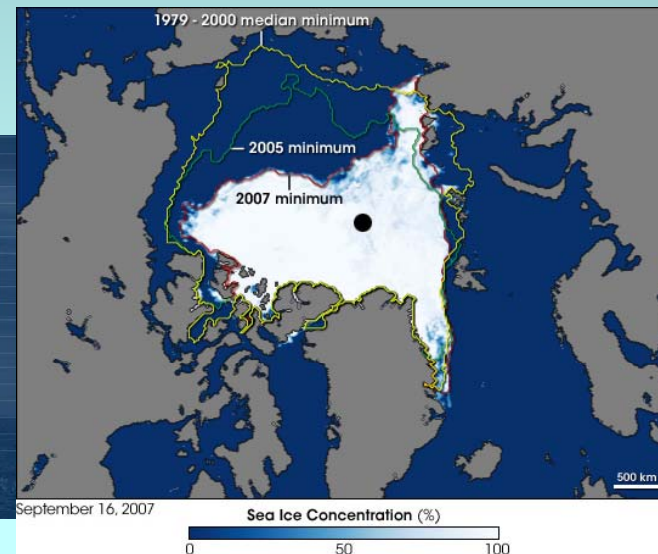
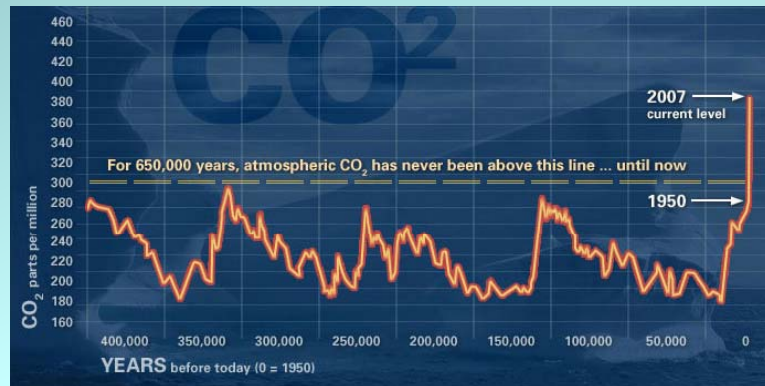
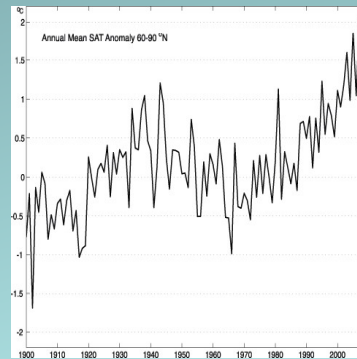


“We cannot change nature, our past, and other people for that matter, but we can control our thoughts and actions and participate in global efforts to cope with these global climate changes. That I think is the most empowering thing we can do as individuals.”

- George Noogwook, Savoonga

The Earth is Faster Now

There are Many Ways to Scare Your Students about Climate Change





And many
ways to
inspire them
to be part of
the solution



<http://coseealaska.net>

SEANET listserve

<http://seagrant.uaf.edu/marine-ed/curriculum/>

<http://ak-aoos.org/fieldexp/index.html>

[http: seagrant.uaf.edu/marine-ed/curriculum/](http://seagrant.uaf.edu/marine-ed/curriculum/)

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