

The Importance of Cultural Contexts in Climate Education

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Climate education for indigenous students in Alaska



Studying Earth's Systems

Earth systems research is naturally synchronous with indigenous ideology.



Alaska State Library - Historical Collections

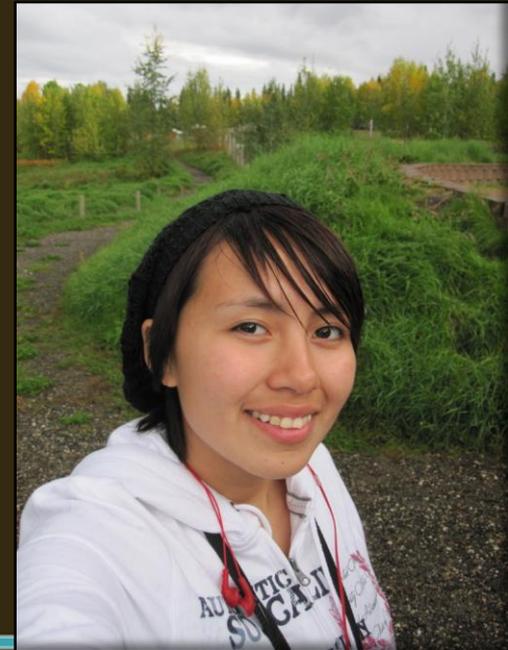
Indigenous ideology is grounded in examining the interconnectedness of all things, a worldview that involves studying each part of our environment in relationship to Earth's system as a whole.



The Statistics

The Alaska Native and American Indian population is the least represented of all minorities in science, technology, engineering and math (STEM) careers.

- ✓ Earth System Science and geophysics suffer from the lowest minority representation of all STEM disciplines.
- ✓ Less than .001% of the nationwide Alaska Native or American Indian population is pursuing geoscience graduate degrees.



GI Climate Education Programs



(2005-2011) *National Science Foundation*
Arctic Climate Modeling Program, with education extension focused on climate impacts on permafrost

(2012-2017) *National Science Foundation*
Preparing Responsive Educators using Place-based Authentic Research in Earth Systems (PREPARES)



(2009-2012) *National Aeronautics & Space Administration*
The Cryospheric Connection to Understanding Climate Change (Cryospheric Connection)

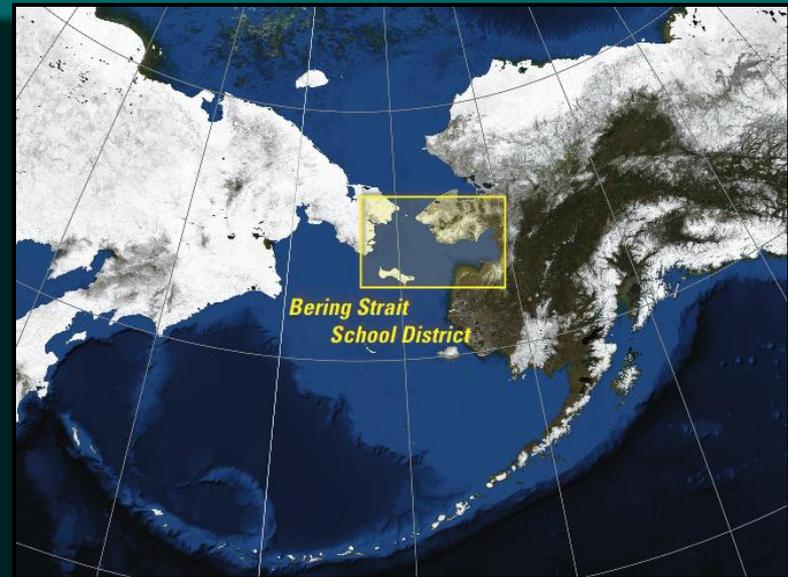


(2009-2013) *U.S. Department of Education*
Uniting Native Indigenous Traditional Education and University Science (UNITE US)

The Arctic Climate Modeling Program



ACMP was created for teachers in the Bering Strait School District, an 80,000 sq. mile area supporting 15 schools in rural Alaska.



ACMP emphasized instruction in a suite of STEM skills that mirror those practiced by Arctic climate researchers.



Arctic Climate Modeling Program scientists installed weather stations at schools in Bering Strait villages so students could collect data useful to university research.

In many of these remote areas of Alaska, scientists had never before been able to collect weather data.



S.N.O.W.

Teachers and students entered local weather and frost depth data into

S.N.O.W., an online portal accessible from the ACMP Website.

Online graphs and charts compare data from 15 Bering Strait villages.

Arctic Climate Modeling Program

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Multimedia

Scientists

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Student Network for Observing Weather (S.N.O.W)

Weather Data Entry

Observe and report the weather

ENTER DATA

Grids and graphs of weather data

VIEW DATA

ENTER DATA PREVIEW

Date & Time

December 10, 2008
10:24 a.m.

Temperature

Select

Precipitation

None

Clouds



Clear



Cumulus



Stratus



Cirrus

Frost Depth

Select

Centimeters



Frost depth

Wind Direction

(True North)

FROM

NW N NE

W E

SW S SE

TO

Spin and drag

Wind Speed



Drag

Snow depth

Snow Depth

Feet Select

Inches Select

More on measuring snow.

Sea Ice

Please Select

No Ice Selected

Press & hold



Sea State

Unfrozen

Select

Visibility

Select

Report weather once a day if possible (around noon).

Help



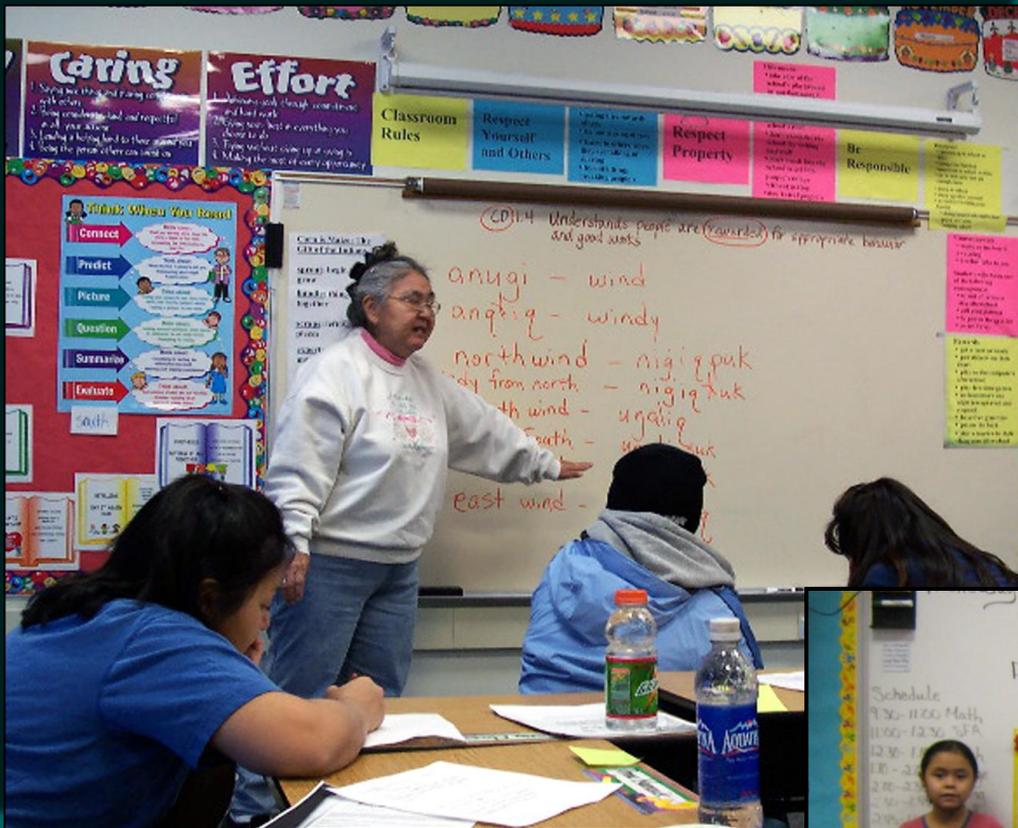
Student Network for Observing Weather

One unanticipated outcome was the value village residents placed on locally collected student data.

Local residents retrieved data from school weather stations and made it available for the entire community.

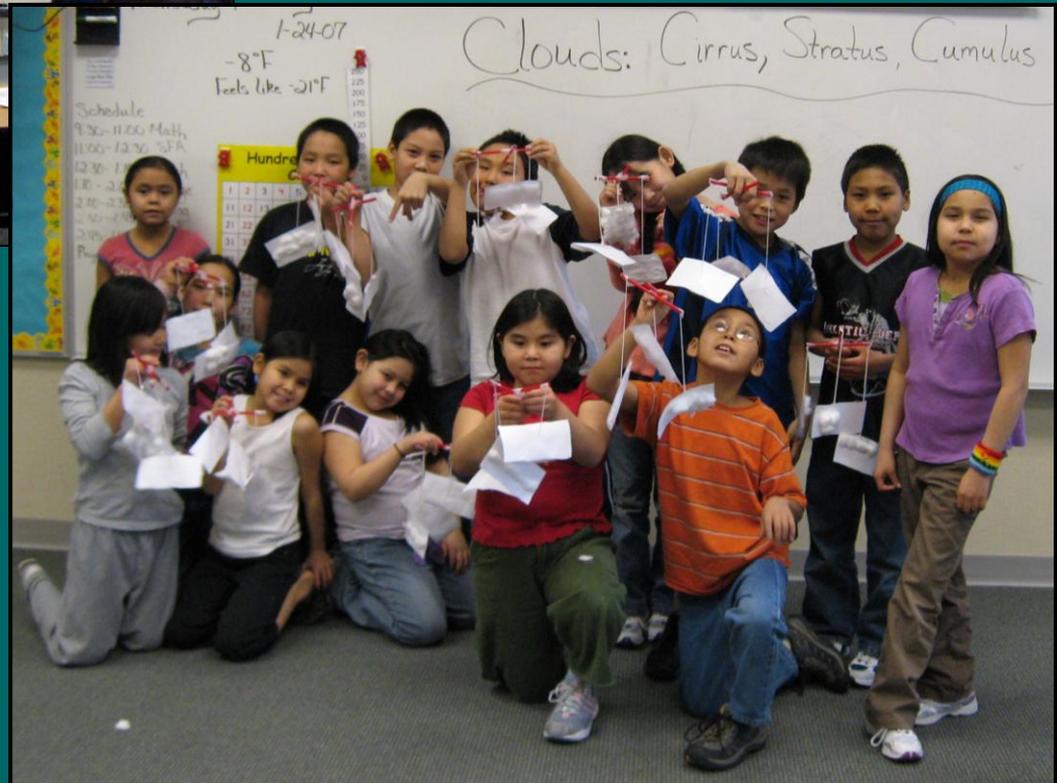


They also downloaded near-real time satellite imagery from the ACMP website to help others in the community determine when local weather and sea ice conditions were favorable for subsistence hunting.



Indigenous languages often contain action words that reveal cause-and-effect relationships offering insight into Earth's geophysical processes.

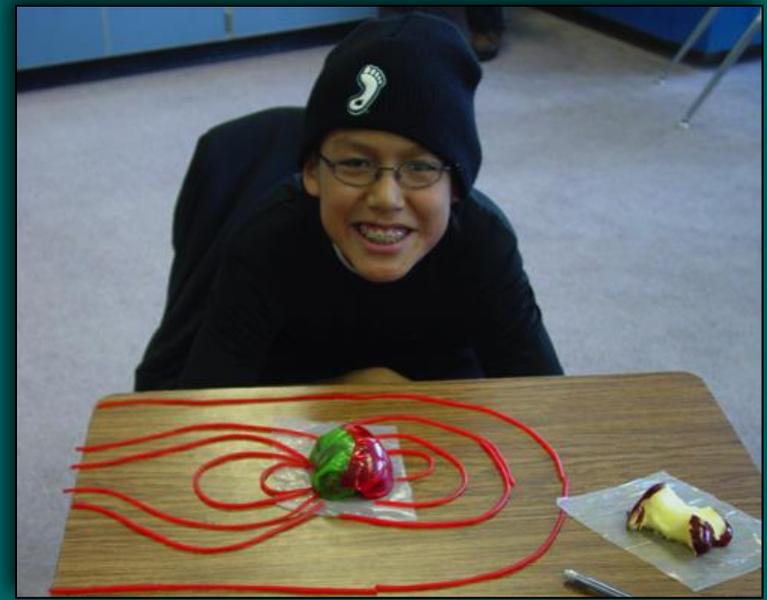
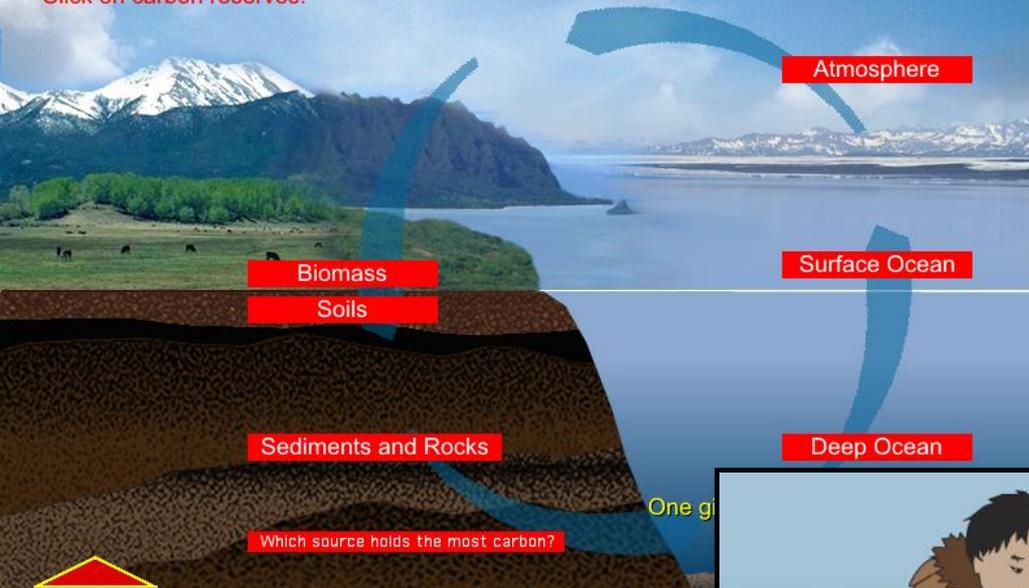
Including Native language terms for weather and climate in classroom lessons increased student understanding of Earth system science.



Carbon Cycle

Carbon dioxide is made of two very common elements: carbon and oxygen. Through the Carbon Cycle, Earth's carbon is stored and recycled among six major reserves.

[Click on carbon reserves.](#)



Methane combustion in a lake, Fairbanks, Alaska

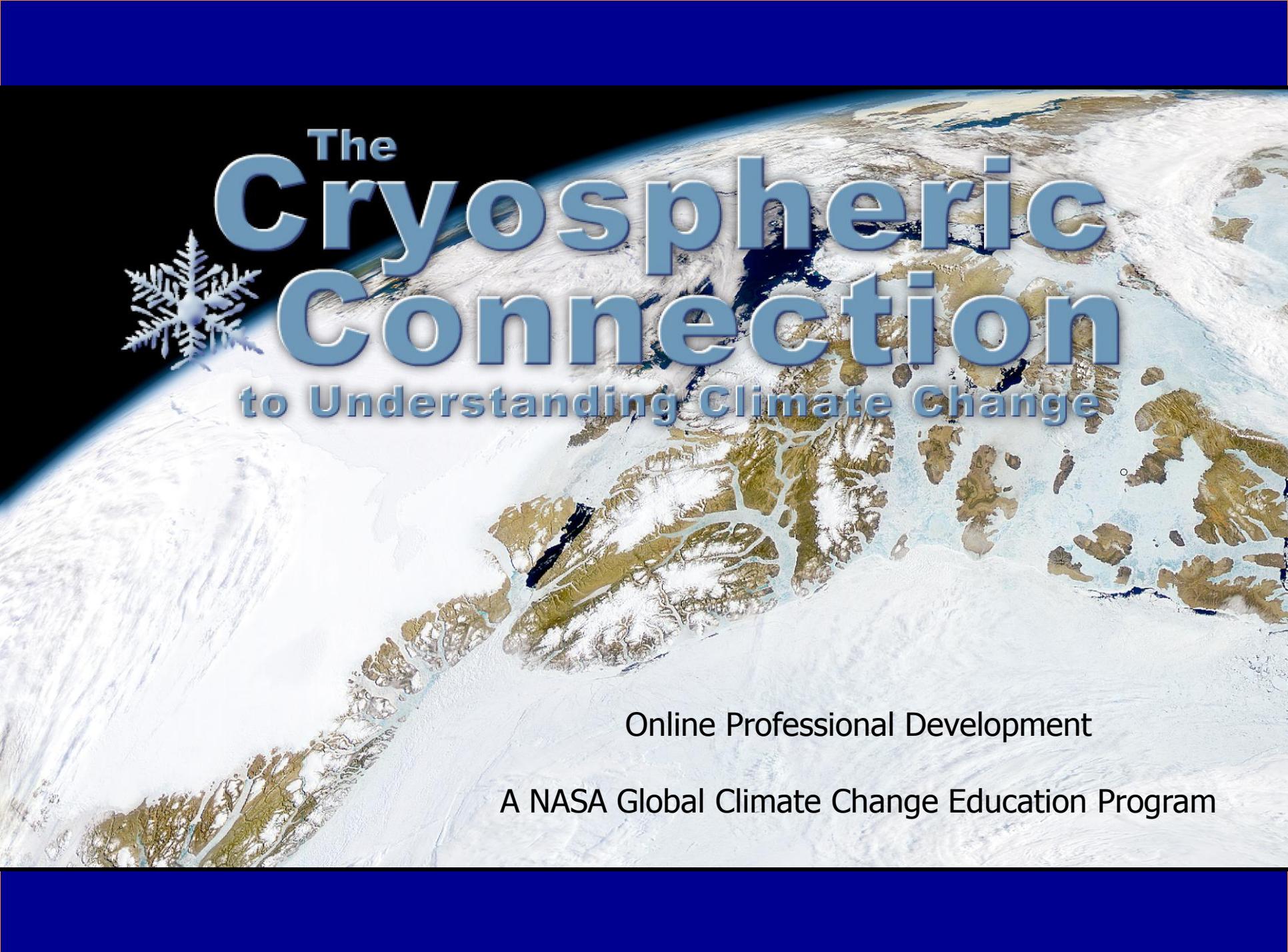
Katey Walter Anthony video

Don't Sleep There

[Back](#)

Scientists studying landscape processes in Alaska's Arctic Coastal Plain interviewed many Iñupiat elders and hunters. Many pointed to a site where people were warned not to spend the night. They warned them, "If you go to sleep there, you will never wake up."

Several elders and hunters told them that these sites, "are often places where shamans are buried or where spirits dwell." Iñupiaq culture bearer Ron Brower, Sr. suggested that these areas are places where methane or carbon dioxide escapes, called seeps. They are dangerous when there is no wind.

A satellite view of Earth's cryosphere, showing a vast expanse of white ice and snow covering the northern hemisphere. The landmasses are visible in shades of brown and tan, partially obscured by the white ice. The curvature of the Earth is visible on the left side, with a dark blue background representing space.

The Cryospheric Connection

to Understanding Climate Change

Online Professional Development

A NASA Global Climate Change Education Program

The Cryospheric Connection

Scientists believe the cryosphere is a key indicator of climate change.



Parts of the cryosphere (permafrost, sea ice, and snow cover) are undergoing dramatic change as a result of recent climate changes.

Teachers incorporate NASA data on permafrost collected from space, sky and underground to paint a picture of how climate changes affect the cryosphere.

Introduction to Permafrost

How is Climate Change Affecting the Arctic?

Stronger Sun

Traditional observations of the weather also include reports of the sun feeling stronger. A reduction in the ozone layer over the Arctic allows more ultraviolet radiation to reach Earth. As a result, skin cancer, cataracts and immune system disorders are on the rise.

Temperature

Society

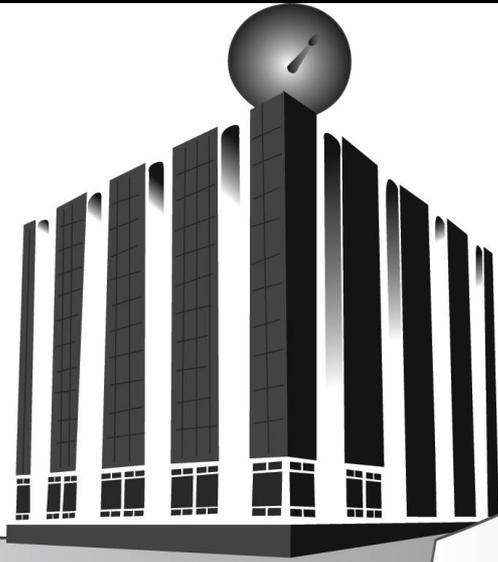
Stronger Sun

Permafrost

Permafrost Extent

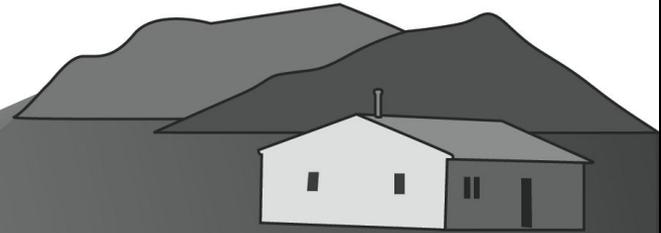
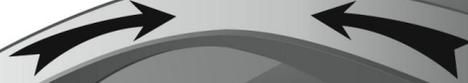


The Indigenous Knowledge Database of Native observations of climate-induced change helps triangulate the dramatic changes occurring in the Arctic.



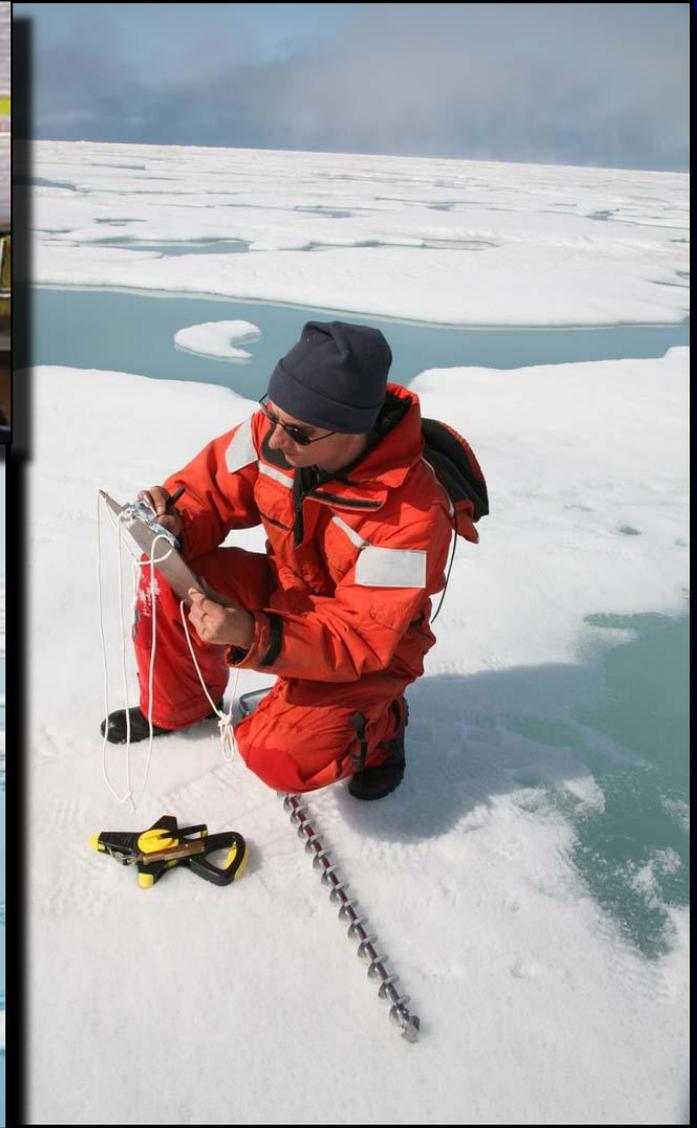
Scientific
Community

Knowledge Exchange



Indigenous
Community

Scientists and Elders Working Together

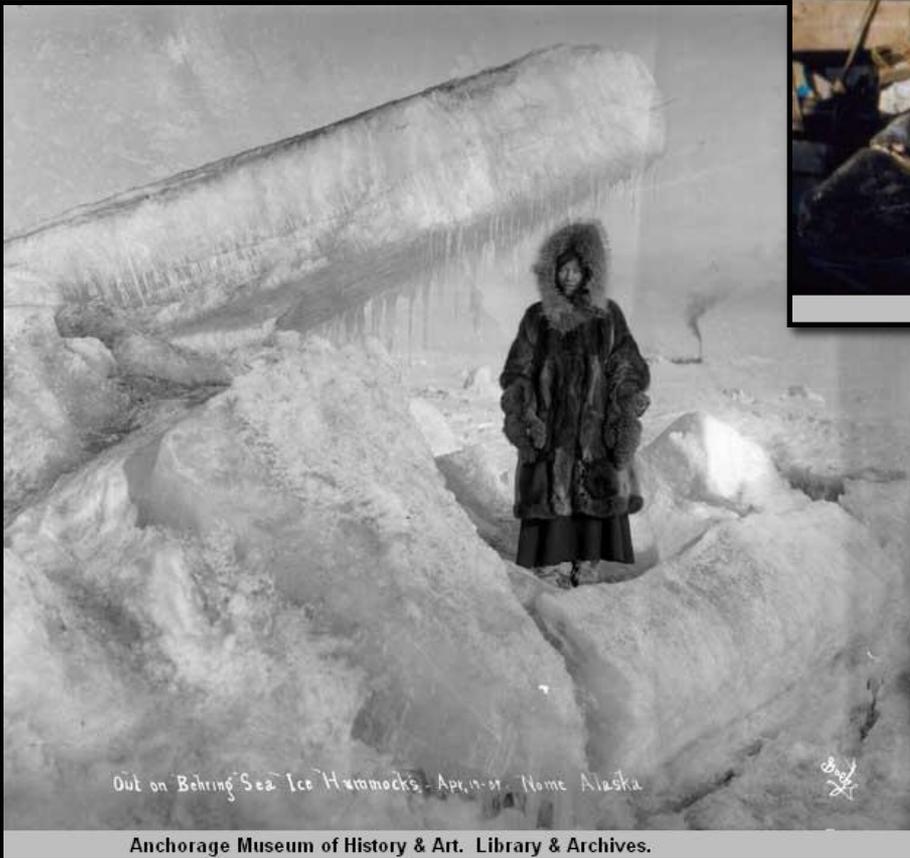




UNITE US



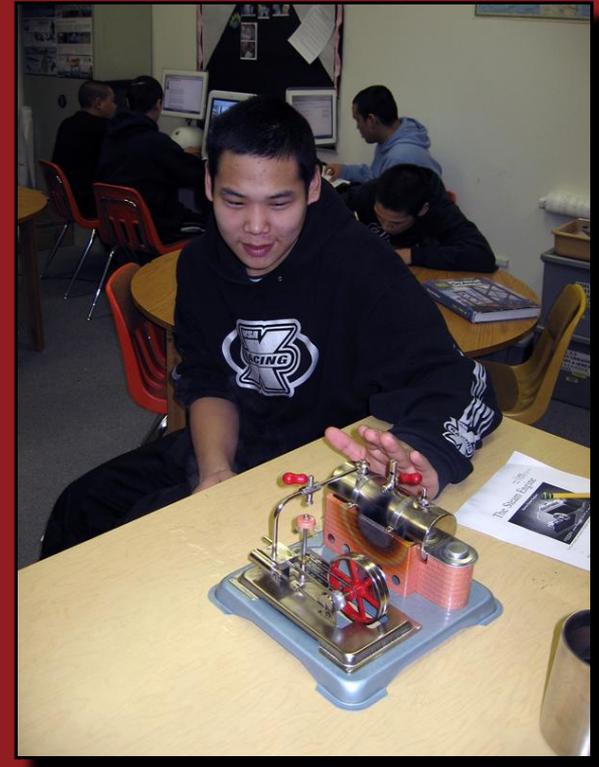
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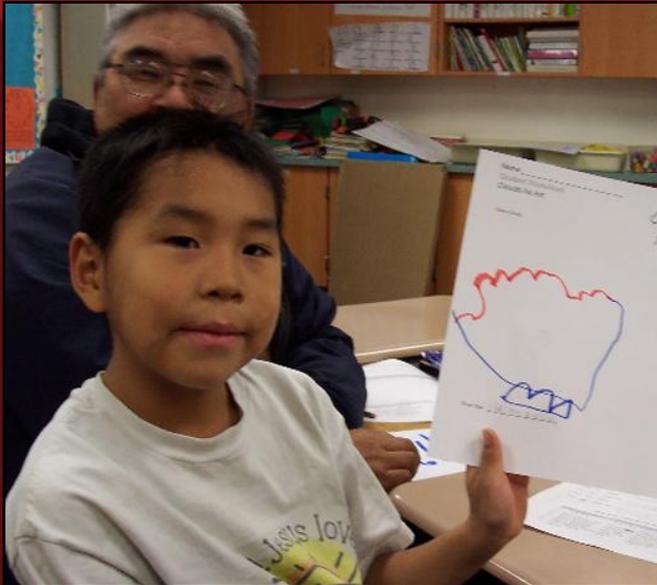
Out on Behring Sea Ice Hummocks - April 1901 - Nome Alaska

Anchorage Museum of History & Art. Library & Archives.

Native Alaskans have made observations of the Arctic, and interpreted and adapted to changes in climate for thousands of years.



After working with standard-aligned, culturally relevant, place-based instruction on weather and climate, K-12 students look for solutions to local problems resulting from climate changes in the Arctic.



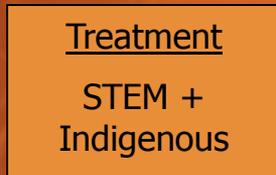
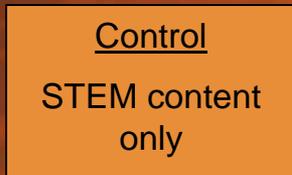
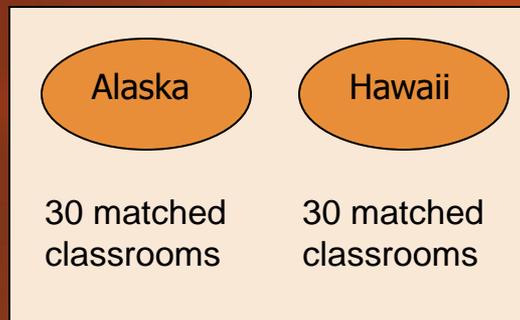
PREPARES

Preparing Responsive Educators using Place-based Authentic Research in Earth Systems

An NSF-ITEST Nationwide Scale-up of
the Arctic Climate Modeling Program



In PREPARES, Yupik Alaska Native students will work with Native Hawaiian students to analyze and share climate data unique to their locations, model future climate scenarios, and devise plans for adapting to forecasted changes.



PREPARES Core Curriculum is being created with scientists and industry experts in both Alaska and Hawaii.





Dancing Spirits

Yupik Elders dancing with the Northern Lights.

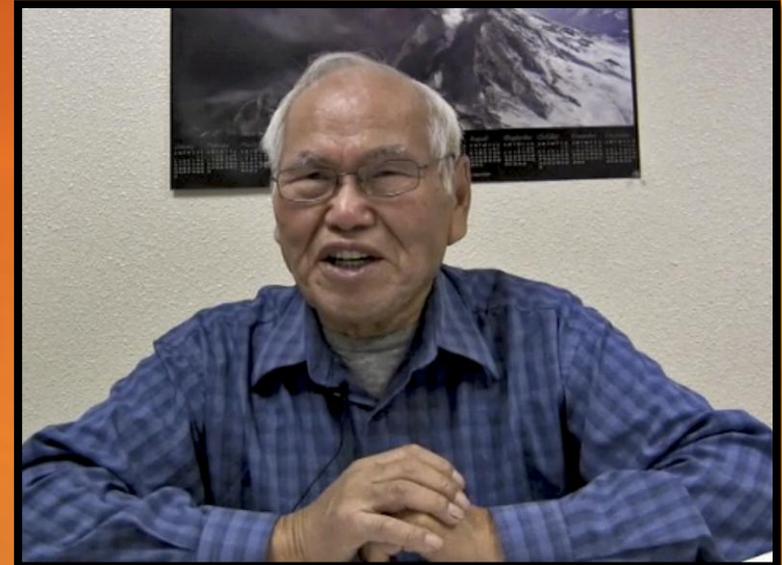
In the Treatment Group, students will learn Alaskan Yupik and Native Hawaiian language terms for a variety of climate processes and then share them with each other. Students also will compare and contrast their cultural beliefs, and come to understand how the community of their heritage conducts climate research.



Namakaokaha'i

Culturally Responsive Climate Education

- Relies on place-based, standard-aligned and culturally relevant instruction
- Involves students in research that is relevant to their local communities
- Creates pathways for knowledge exchange among scientists, Elders, and students
- Interweaves western and indigenous practices and language terminology
- Incorporates skills used in STEM careers
- Encourages students to share research results with broader audiences and fosters local-to-global stewardship
- Rests on evidence-based methods for engaging indigenous students in STEM study (tactile lessons, visual activities)
- Infuses cultural methods of instruction, such as story telling, dance, and art with data collection, graphing, and inquiry



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All photos courtesy of the UAF Geophysical Institute, unless otherwise noted.