T129. Teaching Climate Change and Energy Issues in the Classroom
An Imperative for Educated Citizens and Geoscientists
Geological Society of America, Oct 28, 2007

Glacier Surface Field Experiences & GIS Training provide Alaska's Science Teachers with Climate Change Assessment tools for use in Middle School and High School classrooms

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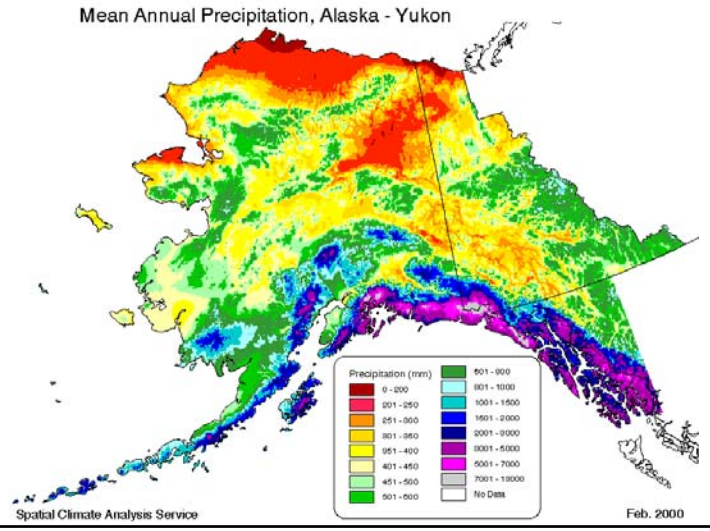
GIS & ESS Training For Alaska's High School & Middle School Teachers and their students 2005-2008

Experiential Discoveries EDGE in Geoscience Education

Area=> 1 million km^2
12/54 school districts
50 teachers, >600 Students
AK Grades 6-12
Student pop in 2006
72,506 (~1% EDGE)

Where the Glaciers Are: Alaska, No BC & Yukon



UAS UNIVERSITY OF ALASKA SOUTHEAST

Mendenhall Glacier And Lake

~ 6 km

UAS Auke Lake Campus

The Mendenhall "Iceshed" is an Alaskan glacial system with moderately easy logistics. It serves as the outdoor laboratory for Middle School & High School teachers & their students.
Here they are introduced to Earth Systems Science and Climate Change.

Experiential Discoveries EDGE in Geoscience Education

The EDGE Project: Experiential NSF Funded GEOSCIENCE Education

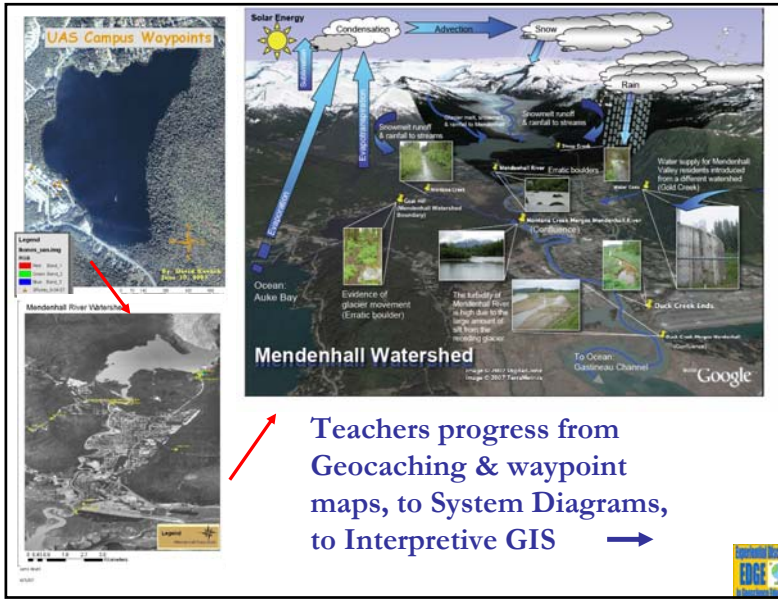
http://www.uas.alaska.edu/envs/edge

- June 2005, 2006, 2007 (10 day workshops-3 Credits)
- 10 hrs Earth System Science Lectures
- 25 hrs GIS Lectures-Using Spatial data
- 25 hrs ArcGIS 9.2 Lab – applications, map production
- 10 hrs Field Data Collection and earth process exploration

1. Watershed delineation component identification
2. Glacier Mass Balance
3. River Hydrology
4. Isostatic Rebound in estuarine wetlands-vegetation mapping

Silva compasses and Garmin Etrex GPS receivers

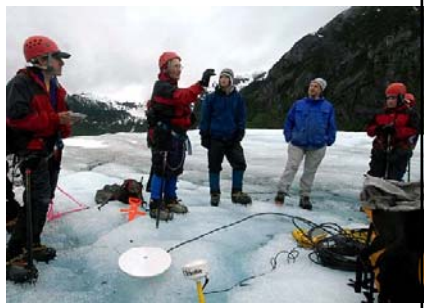
Teachers receive ArcGIS training to create glacier terminus change maps from teacher GPS waypoints & other geo-spatial data sources

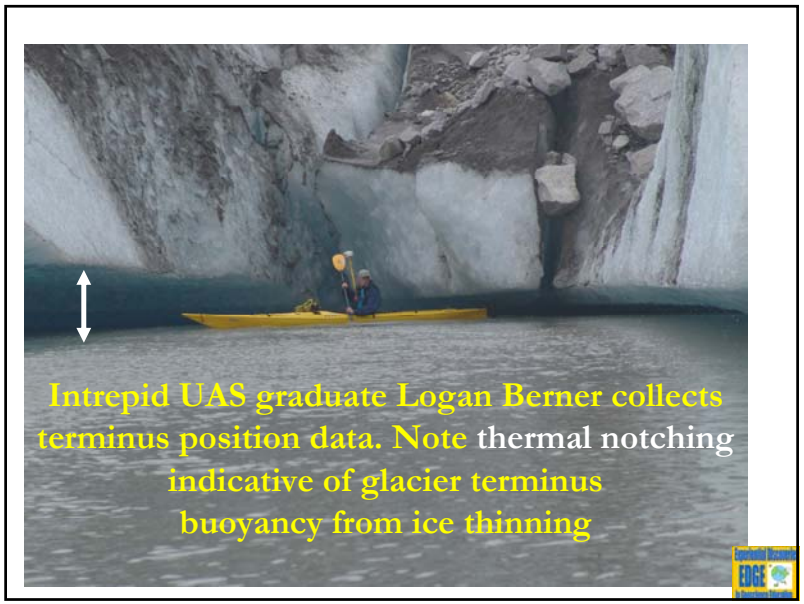


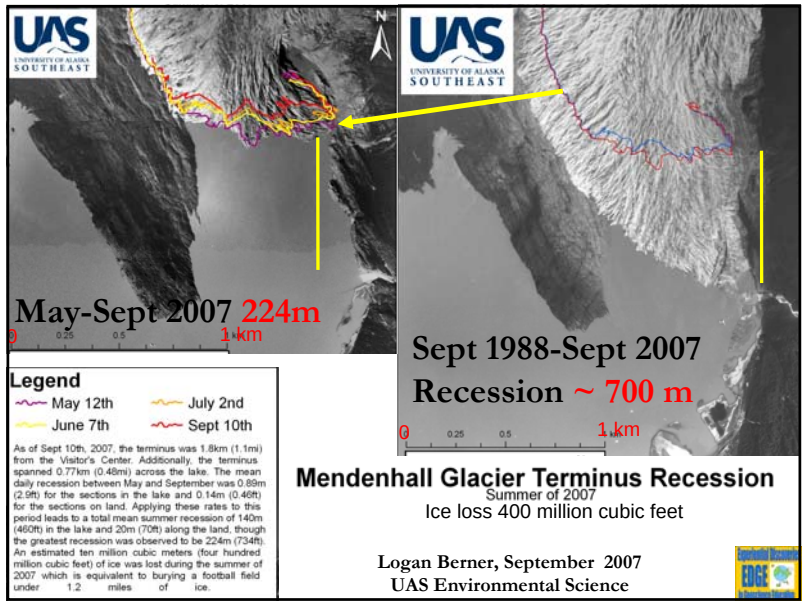
Teachers progress from Geocaching & waypoint maps, to System Diagrams, to Interpretive GIS →

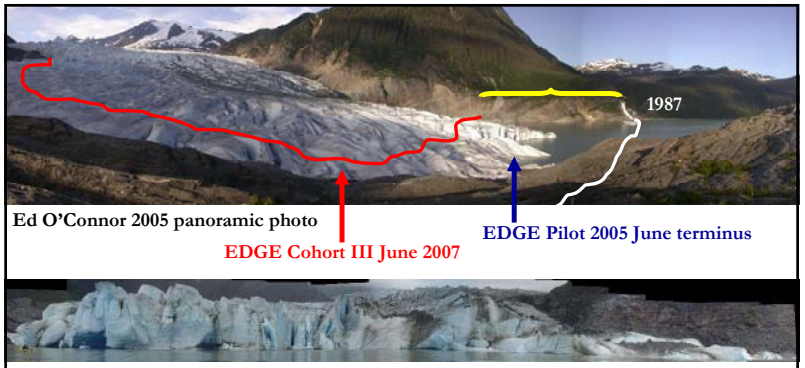
Using Locally Collected GIS glacier-related data

- Glacier Terminus positions (USGS, UAS Undergraduates 1750 to 2007)
- EDGE Teacher Waypoints
- UAS terminus data
- USGS Surficial Geology Maps
- USFS Bear Collar data









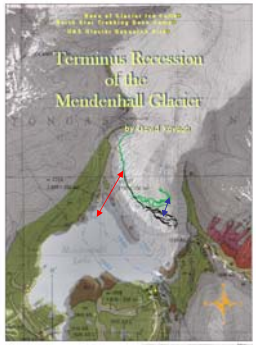
Kayaker's view of September 2007 Mendenhall glacier terminus

Over the duration of the EDGE program between 2005 and 2007 the Mendenhall Glacier has retreated ~0.5 km (500 m)

"The Mendenhall Glacier data above indicates that the most recent time period May-June 2007 has the greatest recession rate. The staggering difference (583 m/year vs. 65 m/year) is probably due primarily to a large calving event of late May. However, the trend is clear that present 10 year period has experienced the greatest glacier retreat. According to (Motyka et al, 2002), this is primarily due to climatic changes which have led to less snow build up on the ice field which feeds Mendenhall Glacier. Warmer temperatures in the summer cause melting and glacier advance. The relatively warmer temperatures of recent winters have led to less snowfall accumulation to feed the summer melting. In the publication "A Century of Thinning on the Mendenhall Glacier", Motyka points to a secondary reason for the steady advance of the past 100 years as being the creation of Mendenhall Lake. The lake has led to the front edge of the glacier experiencing a somewhat buoyant state which speeds calving (and glacier retreat)."

Juneau Teacher David Kovach Dzanti'ki Heeni Mid.Sch.

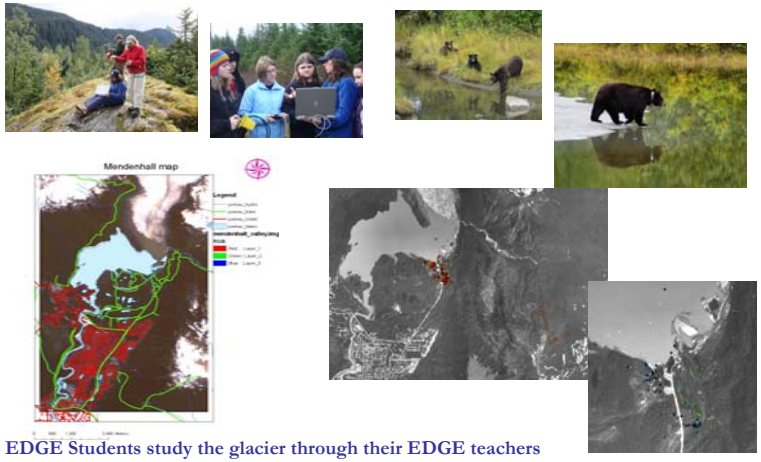
Time Period	Recessional Distance	Rate (*meters/year*)
1769-2007	4,315 meters	18 m/year
1835-2007	4,035 meters	24 m/year
1908-2007	3815 meters	39 m/year
1942-2007	1740 meters	32 m/year
1949-2007	1145 meters	25 m/year
1962-2007	860 meters	19 m/year
1996-2007	550 meters	50 m/year
1998-2007	375 meters	41 m/year
2004-2007	195 meters	65 m/year
May 2007-June 2007	70 meters	583 m/year



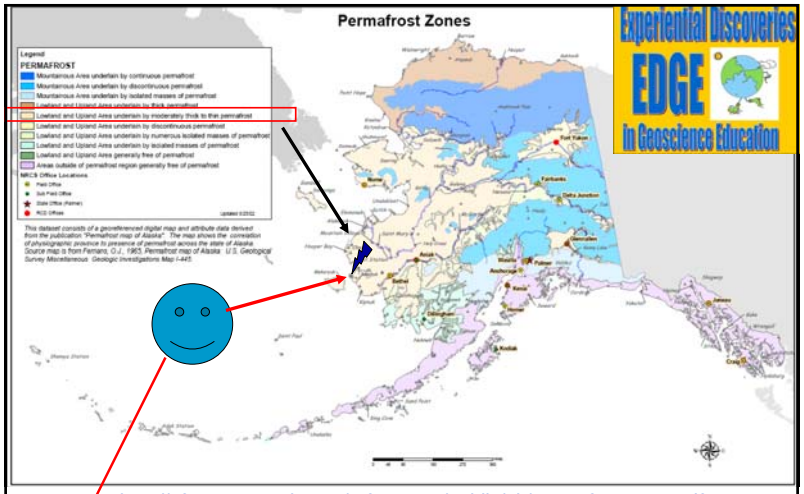
Follow-up Fall Online Course
EDGE teacher earn 3 additional credits

- Fall Semester 15 week 3 credit online ESS and mentoring course
- Yr -Essentials of Geology
- Yr 2-Visualizing Geology
- Teacher Mentor Training:Following INTEL Science Fair Student Project Preparation Protocols with EDGE student project guidance

>500 Juneau Middle School students now learn basic GPS GIS skills and are mentored by AK Fish and Game researchers (Glacier recession, Plant Succession, Bear use of new habitat)



EDGE Students study the glacier through their EDGE teachers



http://efotg.nrcs.usda.gov/references/public/ak/permafrost8_02.pdf

Kwigillingok, Western Alaska, EDGE SCHOOL
Population 383, Yup'ik Eskimo village on Bering Sea coast

Permafrost Studies by Kwig, AK student scientists

EDGE Teacher Jennifer Bacus
EDGE HS Students
Colin Atti & Charlie Evon
Leading the students of
Kwigillingok K-12 School in monitoring local changes

EDGE Symposium

March

EDGE Students

- Present their projects to
- University undergraduate and faculty judges, and peers
- HS students compete in SE AK regional Science
- Fair-winners to INTEL

EDGE teachers

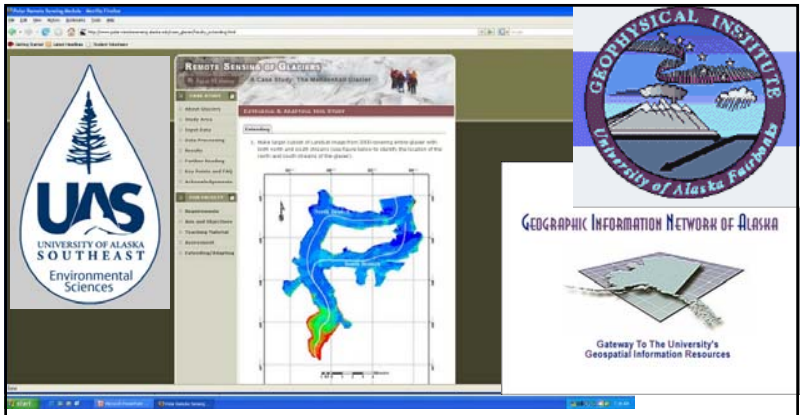
- Mentor Students
- Serve as judges at HS Science Fair

Southeast Alaska Regional Science Fair

Southeast Alaska Regional HS Science Fair
Juneau-Douglas HS
University Alaska Southeast
March 28, 29, 2008

Science Fair Awards
UAS Ceremony 2007

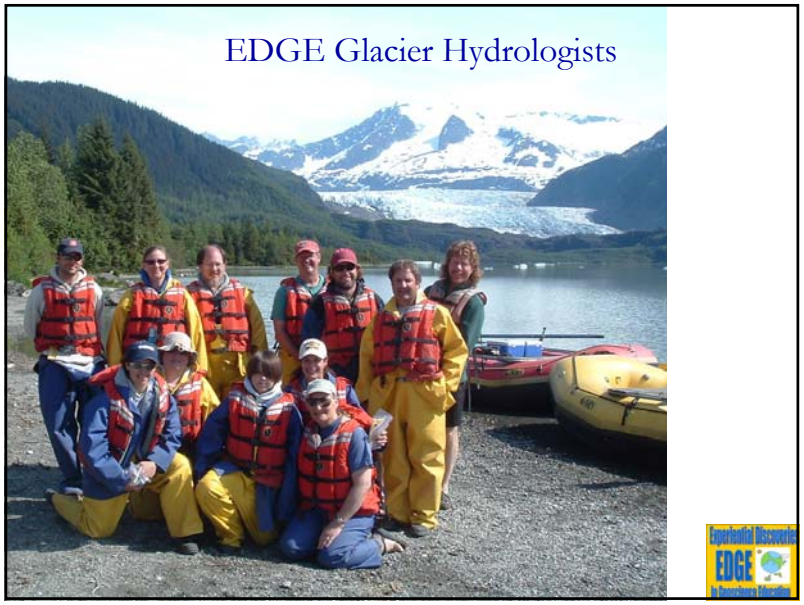
May 11-14, 2008
Atlanta, GA



Mendenhall Glacier GIS datasets available at:

www.uas.alaska.edu/spatialdata

www.polar-remotesensing.alaska.edu



GIS will provide Alaska's students with important skills for the states's future workforce

ABSTRACT

As part of the Experiential Discoveries in Geoscience Education (EDGE http://www.uas.alaska.edu/envs/edge), an NSF-funded geoscience enrichment program, Alaska secondary science teachers don crampons and utilize ice-axes to explore the dynamic surface of the Mendenhall Glacier near Juneau. In June 2007, the teachers collected their own GPS data from ablation wires, ice surface velocity monitoring sites and erratic boulders along medial moraines.

Back in the classroom the teachers created individual GIS maps, by importing the GPS data points and combining them with 1999-2007 terminus positions collected by University Alaska undergraduate and graduate students. They also imported geospatial information from published and digitized maps of 18th -20th century, post-Little Ice Age terminus recessional moraines, USGS topographic maps, LANDSAT and IKONOS imagery. The teachers were able to compare 2006-2007 retreat rates with the 238 years of previously determined glacier position data. Instructor-provided knowledge of glacier processes and the use of historic weather records allowed them to differentiate between ice loss caused by accelerated glacier lake-calving processes and ice loss caused by warming climate.

Teachers will use these data and GIS maps in their secondary science classrooms to teach about Earth system science and changing climate, and train their middle and high school students in the use of GIS software. These Alaskan students will in turn develop their own science fair style, semester-scale research projects and will collect data to better understand ongoing landscape and community infrastructure changes resulting from rapid warming across the state. The Mendenhall Glacier datasets and interpretation will soon be available on the University Alaska Southeast node of the Geographical Information Network of Alaska (http://www.gina.alaska.edu