Education and Outreach at the National Center for Atmospheric Research

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UCAR Education and Outreach Mission

**Mission:** In partnership with the university community, UCAR promotes science literacy and advances all levels of education and training in subjects related to Earth’s atmosphere.

**Goals:**

- Support Students and Professionals: From Pre-K through Post Graduate
- Foster an informed public through science literacy
- Promote the involvement of diverse and historically under-represented populations in the geosciences
UCAR Education and Outreach Programs

Formal Education

• K-12 Students
  – Mesa Lab Classroom Tours
• K-12 Teachers
  – Climate and Global Change Workshop
  – Modeling in the Geosciences Workshop
  – Curriculum Development
  – Distance Learning
  – GLOBE
• Undergraduate
  – SOARS
  – Unidata
  – COMET
  – Undergraduate Leadership Workshop
  – Internships
• Graduate/Postgraduate Study
  – ASP, VSP, Graduate Fellowships, COMET, SOARS, Early Career Faculty
• Digital Libraries
  – DLESE, NSDL

Informal Science Education

• Events
  – Super Science Saturday, Public Lectures, Conferences
• Tours ~ 15,000 people/yr
  – Customized Visits, Guided and Self-guided (Audio Tour)
• Exhibits ~ 90,000 visits/yr
  – Mesa Lab Lobby, Teacher’s Guide
• Web-Based Resources
  – Windows to the Universe
  – Web Weather for Kids
  – NCAR EO web site
  – Divisional EO web sites
  – Roberts’ Forum
  – Skymath, LEARN
• Outreach Resources
  – Scientist Outreach, Science Now
Our strategies for bringing geoscience to diverse learning communities

• Focus on strengths and collaborate
• Focus activities on science/content knowledge and technology-based solutions, where appropriate
• Focus on building community
• Focus on developing resources and venues that can be multi-purposed:
  – Websites that support informal and formal education, multilevel, multilingual
  – Multi-purposed graphics, activities, interactives
  – Professional development - in person and distance learning
K-12 Professional Development

- **Climate and Global Change for Geoscience Educators**: Science content, activities, field work, standards, technology, and training support

- **Modeling in the Geoscience Workshop**: Funded by NASA through ESMF - Focus on the use of models in geoscience education (e.g. STELLA, ArcView)

  - Online courses in development

- **GLOBE**: Creating the next generation of environmental leaders and scientists by teaching children in 107 countries how to take environmental measurements, report them via the Internet, and address challenging environmental problems

2002-04, 450 applicants, 99 teachers trained
Online Climate and Global Change Professional Development Experiences for Educators from UCAR Education and Outreach

• A Primer of Global Change
  – The introductory course in the Climate and Global Change series. Participants are introduced to basic concepts that are critical to understanding climate and global change and look at methods for incorporating climate into the classroom. (7 weeks)

• Music of the Spheres
  – Participants explore the interactions between the various components of the Earth System and how they influence climate. Climate serves as a model for the teaching of Earth System Science in middle and high school classrooms. (7 weeks)

• Climate Change Today
  – A capstone course in the Climate and Global Change series, participants explore the impacts of climate and global change, the challenges faced when modeling and predicting climate, and methodologies for exploring these topics with students. (7 weeks)

• Courses will be offered for graduate credit, in collaboration with university Teacher preparation programs
Web-Based Outreach and Distance Learning

Educational resources supporting formal and informal education for students, teachers, and science professionals around the world

- Windows to the Universe
- Web Weather for Kids
- NCAR EO websites
- Online Climate and Global Change and Modeling in the Geosciences Distance Learning
- GLOBE Distance Learning
- COMET Training Modules

Professional development program trains ~1600 teachers/year
Curriculum, Interactives, and Games Development

- UCAR EO develops resources for educators to use in the classroom as well as interactives and games for the public through numerous projects focused on topics such as:
  - Space Weather
  - Planetary science
  - Earth system science
  - Climate/Global Change
  - Bio-complexity
  - Weather
  - Modeling
Windows to the Universe Website
www.windows.ucar.edu

Comprehensive geoscience education website and professional development program; >12 million users per year
  – Formal and informal
  – Science in interdisciplinary context, links to humanities
  – 3 levels of content
  – Bilingual, toggle allows users to switch on the fly (language acquisition)
  – Classroom activities, interactives, journal, games
  – Professional development workshops reach ~1400 educators per year
  – Global community of ~3400 educators
  – Coordinated with NCAR education program and other initiatives
  – Scientific community education and outreach program

• Some Metrics:
  – ~65% of users are K-12 students
  – 46% once per week or more
  – 2-5000 visits to Teacher Resources per day during work week
  – ~55,000 users per day, including ~15-20,000 to Spanish website
Actividades...

Educatores! - Asistan a la Séptima Conferencia Internacional acerca de escuelas y meteorología popular y educación océanográfica (EWOC 2008) en Boulder, Colorado!
- Impact of US academic schedule
- Overall strong growth in use
  - ~50% increase over past year
Attendance at W2U sessions at NSTAs

- Literacy & Writing
- Making Rocks Relevant
- Cut it, Stab it, Slice it
- More Than a Few Cents'
- In a New Light
- W2U Presentation
- Spanish W2U
- Climate Change
- Magnetism & Space Weather
- What's Below the Surface
- WALLSI
- Share-a-Thon(s)
Earth, our home planet, is a beautiful blue and white ball when seen from space. The third planet from the Sun, it is the largest of the inner planets. Earth is the only planet known to support life and to have liquid water at the surface.
CLIMATE AND GLOBAL CHANGE

What Is Climate?
What Controls the Climate System?
Climates of the Past (Paleoclimates)
Effects of Climate Changes Today
Modeling the Future
Atmospheric Missions
Climate News
Climate Images
Climate Web

Warm near the equator and cold at the poles, our planet is able to support a variety of ecosystems because of its diverse climates. Earth's climates have changed incredibly during its 4.6 billion year history. Today, the changes are happening more quickly as natural processes are combined with the affects of human actions.
We are continually updating this page, and welcome your suggestions of topics and resources you'd like to see included. We are pleased to announce that Windows to the Universe and its educational resources have been reviewed by NASA's Office of Space Sciences, receiving exemplary status, and the Earth Science Enterprise (ESE).
Climate, Oceans, and Life

- Climate and Global Change
  - Carbon Dioxide - Sources and Sinks Experiment with the carbon cycle!
  - Thermal Expansion and Sea Level Rise Discover how thermal expansion of water might affect sea level!
  - Mapping Ancient Coastlines Explore bathymetric contour lines and sea level change!
  - Paleoclimates and Pollen Conduct a classroom paleoclimatic study!
  - Making Sedimentary Rocks! Students make a model of sedimentary rock layers to understand how rocks form layers and represent ancient environments.
  - The Geography of Land Planning Students plan towns and learn how planning affects the environment and the larger community.
  - The Difference Between Weather and Climate Students graph weather and climate data to learn the difference.
  - Natural Records of Climate Change: Working With Indirect Evidence Students play a game to learn about indirect evidence, like those that record ancient climate changes.
  - Living During the Little Ice Age Discover how modest climatic cooling changed life for Europeans during the Little Ice Age.
  - Where Have All the Glaciers Gone? compare "then and now" photographs to see how much glaciers have changed over the last century.
  - Trees: Recorders of Climate Change Collect and analyze tree ring data to discover when the Little Ice Age occurred.
  - Blooming Thermometers A graphing activity that allows students to discover how the timing of blooming has changed as climate changed.
  - Sunspots and Climate Students investigate data to discover how Earth's climate is affected by changing quantities of sunspots.
  - Dark Skies: Volcanic Contributions to Climate Change Discover how volcanic eruptions can alter the Earth's climate.
  - The Little Ice Age Students investigate multiple pieces of data to learn about the Little Ice Age.
  - Albedo and Earth's Energy Cycle Students investigate how color affects heat absorption.

- Oceans
  - Exploring Density of Salt and Fresh Water: Par 5 A fun activity that involves the interaction between fresh water and salt water.
  - Thermal Expansion and Sea Level Rise Discover how thermal expansion of water might affect sea level!
  - Mapping Ancient Coastlines Explore bathymetric contour lines and sea level change!

- Life
  - The Evidence of Evolution Exploratorium An in-depth examination of the science of evolution.
  - The Nitrogen Cycle Game Become a nitrogen atom and travel through the cycle!
A Snapshot of our Educator Community

• ~3350 members to date from 116 countries
  – ~2350 in US
• ~evenly distributed across K-12 grade levels
• Includes Educators teaching a wide range of subjects
• ~ 550 educators are teaching bilingual classes, in Spanish, or another language
Windows to the Universe Educators Around the World
September 2005 – March 2006
Windows to the Universe Educators in the US
September 2005 – March 2006
Tours and Events

- **Mesa Lab Visitors Center ~90,000 visitors/yr**
  - Theater, Interactive exhibits, Weather Trail, Science Store,
- **Tour Program**
  - Tours 7 days/week serve ~15,000 visitors/year
  - Customized to interests of public, students, scientists
  - Science inquiry experiences
  - Bilingual Audiotour
- **Super Science Saturday**
  - ~4000 children and parents
- **Supporting Science Fairs**
  - Student exhibits and awards
Mesa Lab Exhibits

- Guided by NCAR scientists
- Climate Discovery Exhibit just completed
- First floor Weather Gallery upgrade planned in 2006-2008
- Increasing use of video media, interactives, and games
- Building collaborations with museums and broadcasters
- Interest in promoting CURRENT RESEARCH
- Exhibits relate to other EO resources – e.g., teachers’ guide
The Climate Discovery Teacher’s Guide

Designed for use in middle school classrooms

Multi-lesson instructional units include:

- Sun-Earth Connection
- Investigating Climate Present: Cycles of the Earth System
- Investigating Climate Future (Coming soon!)
- Investigating Climate Past: The Little Ice Age Case Study

All classroom activities are available online:  
http://eo.ucar.edu/educators/ClimateDiscovery/
Summary

• Integrated strategy to reach diverse formal and informal audiences through events, exhibits, tours, websites, professional development, research-based education seems to work.

• Emphasis on
  – science/content knowledge and technology-based solutions, where appropriate
  – building community

• Resources that can be multi-purposed:
  – Websites that support informal and formal education, multilevel, multilingual
  – Multi-purposed graphics, activities, interactives
  – Professional development - in person and distance learning

• Collaboration with Scientists in development and implementation