GLOBE and ACRE: Promoting Learning and Research through Effective Data Collaborations between Students, Teachers, and Scientists

Dr. Edward Geary and Dr. Donna Charlevoix------ 5 November 2010

The GLOBE Program at UCAR Community Programs

Boulder, Colorado
Talk Outline

• GLOBE Program Overview
  – Science and Education

• GLOBE Student Research
  – Local to Global Investigations

• GLOBE Data
  – Used by GLOBE students and scientists

• ACRE “Old Weather” Data and GLOBE
  – Engaging students and teachers in ACRE

• Next Steps
OVERVIEW OF GLOBE

Global Learning and Observations to Benefit the Environment
Global Learning and Observations to Benefit the Environment

GLOBE Vision
A worldwide community of students, teachers, scientists, and citizens working together to better understand, sustain, and improve Earth’s environment at local, regional, and global scales.

GLOBE Mission
To promote the teaching and learning of science, enhance environmental literacy and stewardship, and promote scientific discovery.

Goals:

- **Improve** student achievement across the curriculum with a focus on student research in environmental and Earth system science;
- **Enhance** awareness and support activities of individuals throughout the world to benefit the environment;
- **Contribute** to scientific understanding of Earth as a system; and
- **Inspire** the next generation of global scientists.
Currently 109 Active GLOBE Countries

GLOBE has trained over 54,000 teachers representing more than 23,000 schools worldwide.

111 GLOBE Partner Countries

GLOBE has reported 21 million environmental measurements to the GLOBE Database.

GLOBE Regions (Countries)
- Africa (22)
- Asia-Pacific (17)
- Europe-Eurasia (40)
- Latin America-Caribbean (18)
- Near East (12)
- North America (2)

“GLOBE is the quintessentially ideal program for involving kids in science.”  Nobel Laureate Dr. Leon Lederman
Students Learn Science By Doing Science and Working with Scientists

• GLOBE students conduct **inquiry projects**
  – **Make observations and ask questions** about the world around them;
  – **Collect research** quality environmental data using GLOBE scientific protocols;
  – **Report** their observations to the GLOBE data archive (GLOBE Web site);
  – **Analyze their data with** GLOBE visualization tools (GLOBE Web site);
  – **Seek** additional data sources from scientists and community members;
  – **Write** and **Publish** research reports; and
  – **Present** their research at local community events as well as at national, regional and international student events.

• Every GLOBE school has a least one GLOBE-trained teacher
  – **Interdisciplinary Teams of Teachers**
  – **GLOBE School and Scientist Networks**
GLOBE Student Research

Global Learning and Observations to Benefit the Environment
Local to Global
Environmental Investigations

• **Single classroom**---students investigate topics of local interest and relevance (ongoing)
• **Earth System Science Projects (ESSPs)**---students from multiple classrooms collaborate with scientists around a common topic area (e.g. Carbon cycle, Watersheds, Biomes)
• **Research Campaigns**---students from many countries and classrooms collaborate on Climate investigations (>2011)
Observations and Measurements
GLOBE Investigation Areas

Atmosphere/Climate Studies (protocols)
• Air temperature (Maximum; Minimum; Current)
• Precipitation (Rain; Snow; pH)
• Cloud Cover and Type including contrails
• Relative humidity
• Barometric pressure
• Surface ozone
• Aerosols and water vapor

Hydrology Studies (protocols)
• Water temperature
• Transparency
• Water chemistry
  • pH, dissolved O₂, alkalinity; nitrate; salinity; conductivity
• Freshwater macro-invertebrates
• Ocean GLOBE protocols
  • Coast watch; coastal biodiversity / populations; coral bleaching

Soil Studies (protocols)
• Soil temperature and soil moisture
• Soil bulk density; pH; particle size distribution; particle density; fertility
• Soil characterization
  • Structure; color; texture; consistency
Watershed Investigations

Students will engage in authentic scientific investigations of watershed dynamics
• using real-time and archival data sets
• at local, regional, and continental scales
The Power of GLOBE Student Research

Student Research Projects
Students use GLOBE measurements to answer their own research questions about their local environment.

This GLOBE school in Benin graphed cases of malaria in the community with temperature and precipitation.

Cases of Malaria
Temperature
Precipitation
Worldwide Student Climate Research Campaign: Launch September 2013
Anticipated Campaign Outcomes: Students

- Improved scientific understanding of **climate**, **weather**, biomes, ecosystems, rates of change, and natural and human influences on climate
- Enhanced problem solving, systems thinking, decision-making, data analysis, collaboration, and communication skills
- Greater interest in, and ability to do science
- Greater awareness and appreciation of other countries and cultures
- More students interested in STEM careers
GLOBE Student Data

Global Learning and Observations to Benefit the Environment
GLOBE Student Data
Currently, Students Visualize Data in Several Ways

Maps

Graphs

Mean Air Temperature

Raw Data

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Non GLOBE Data
Google Earth
Fieldscope
ACRE “Old Weather Data” and GLOBE

Global Learning and Observations to Benefit the Environment
“Old Weather”
Citizen Science Project

• Why Scientists Need you
• What is Old Weather?
• Building better models
• The power of the crowd
• Why is historical data useful?
• Why computers can’t to the job
• How the transcriptions will get used

This could easily become a Classroom Science Project
Classroom Considerations

• Technology Access
  – Computers, Internet access, Bandwidth, Power

• Subject and Grade Level
  – Science, Geography, Math, History, Technology

• Incentives to Participate
  – Fun, rewards, contributions, collaborations, learning

• Learning and Teaching Goals
  – Knowledge/Understanding (Weather vs. Climate)
  – 21st Century Skills: Systems thinking, data analysis, problem solving, cross cultural communication
Data Issues

• Access to Data
  – GLOBE Data is easy but…
  – Getting “just the right parts” of global data sets is hard

• Free, Web-based Data Visualization/Analysis Tools
  – Fun, easy to use, engaging interface
  – Student, Teacher and Citizen friendly
  – Map views for quick upload and display
  – GIS functions for more robust data analysis

• Uploading, Downloading, and Sharing Data
  – Next 2 years----Data Apps for Mobile Devices
  – School safe clones of Twitter, Facebook, YouTube, etc.
Student-Scientist Collaborations

• Can be highly motivating and inspirational
• Need to be carefully designed to be successful
• Potential collaboration activities include:
  – Virtual science fair judges
  – Virtual mentors
  – V-cast and Webinars about cool science/history/tech
  – “Ask a Scientist”--- real time, web-based Q&A
  – Asynchronous Blogs and Forums

• Incentives for Scientists to Participate?
Next Steps

• Develop/Adapt/Test/Implement easy to use, robust, Data Visualization and Analysis Tools
• Conceptualize a Student-Learning Oriented Pilot Project around Old Weather
  – Adapt/Reuse current Citizen Science materials and data entry template
• Develop Formal Partnership(s)
• Recruit Scientists to Participate
• Write Proposals to:
  – NSF, NOAA, and/or other organizations
Take Away Messages

• There is great potential to engage students and teachers in Old Weather studies and data rescue efforts
• Engaging students will require a different approach than engaging citizens
• Addressing learning goals, skills development, and connections to STEM careers will be critical for engagement of teachers and administrators
• Participation by scientists like you, who are willing and interested in connecting with students is a critical component for success
Questions