



# 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**



U.S. Department  
of State



# 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.



The **GLOBE** Program

# GLOBE Around the World



## GLOBE Regions (Countries)

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

## 111 GLOBE Partner Countries

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

**21 million**  
environmental  
measurements  
have been  
reported to the  
GLOBE  
Database

***“GLOBE is the quintessentially ideal program for involving kids in science.” Nobel Laureate Dr. Leon Lederman***



The **GLOBE** Program

# 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 O<sup>2</sup>; 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

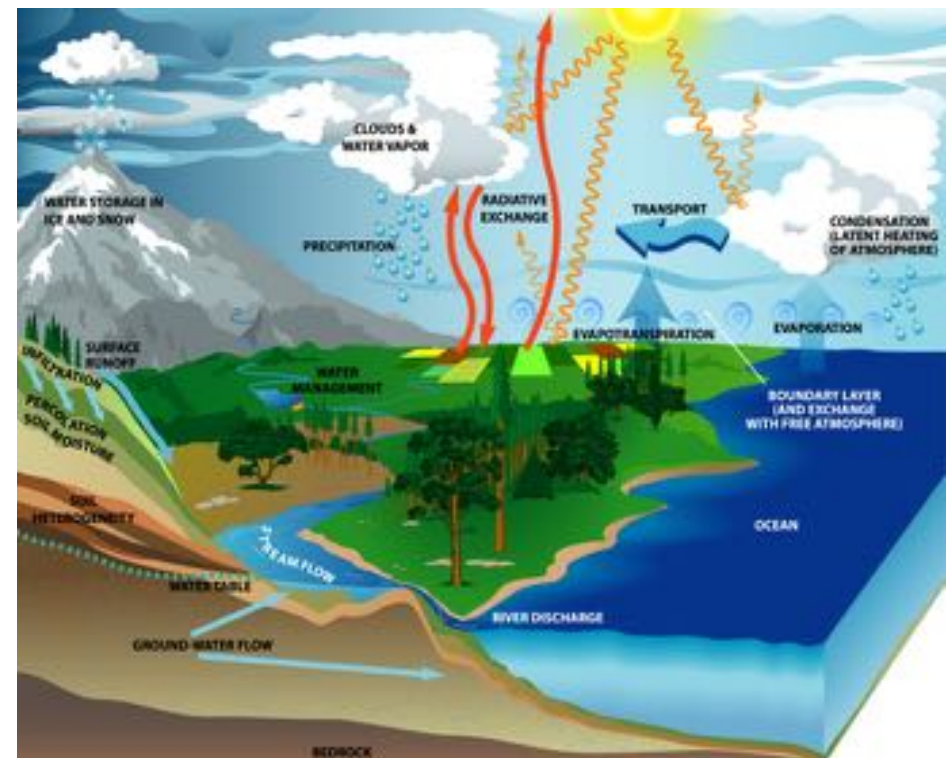




## Watershed Investigations

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

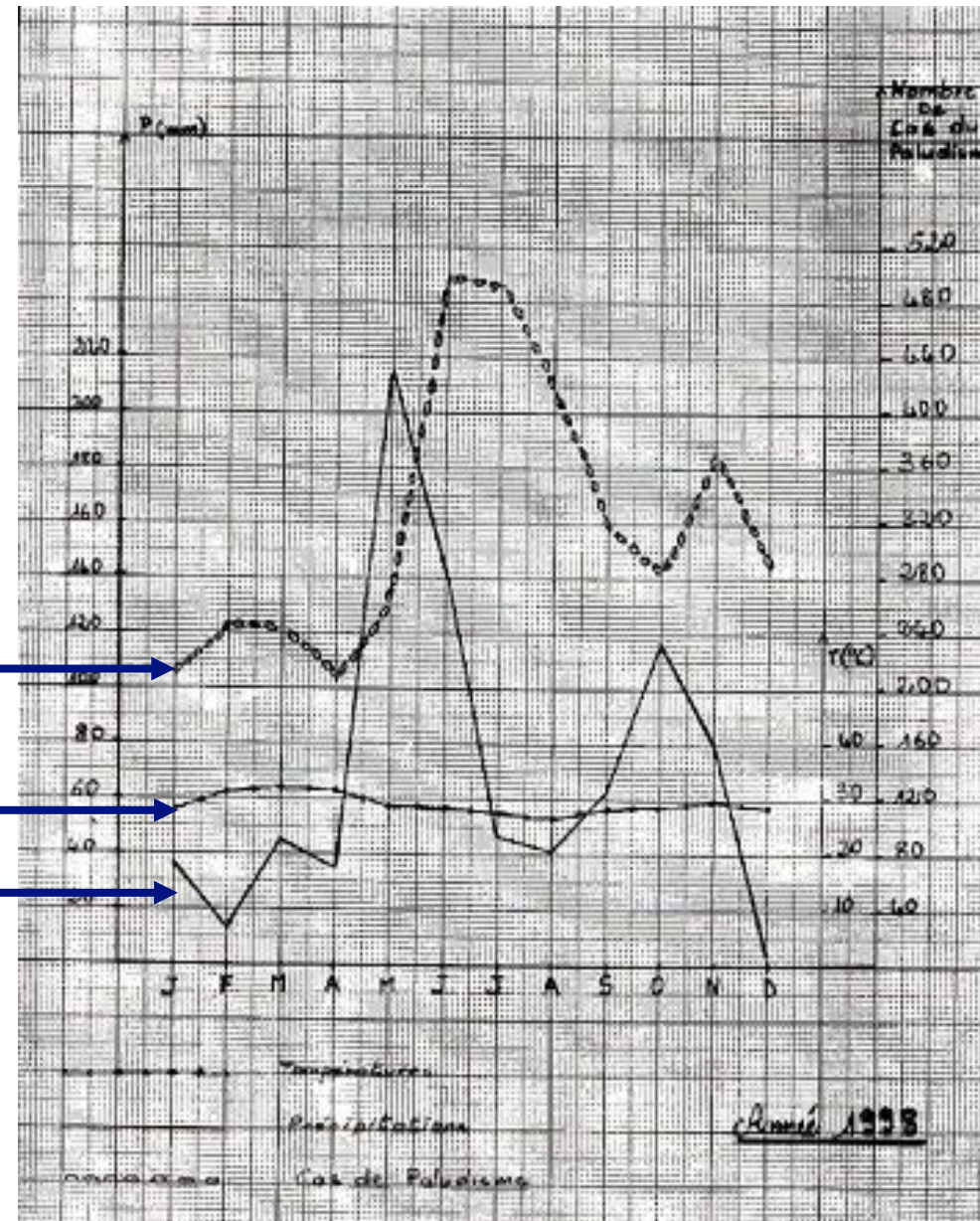
Students use GLOBE measurements to answer their own research questions about their local environment.

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**

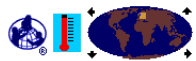


**Global Learning and Observations  
to Benefit the Environment**

# GLOBE Student Data

Currently, Students Visualize Data in Several Ways

## Maps



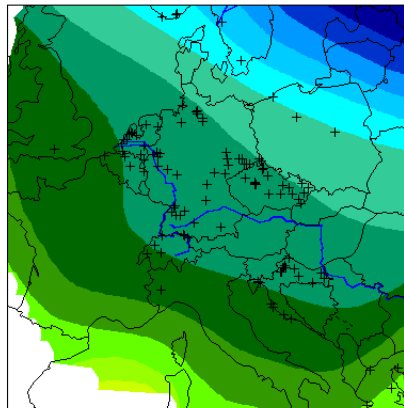
Maximum Temperature

29 January 1999

49°N 11°E  
(2174 x 2174 km)

1 2 4 8 16 32 64 128 256 512

-40 0 40  
Temperature (°C)



GLOBE Student Data  
581 total sites, 116 on map  
As of 2001-01-29 08:40 UT

## Raw Data

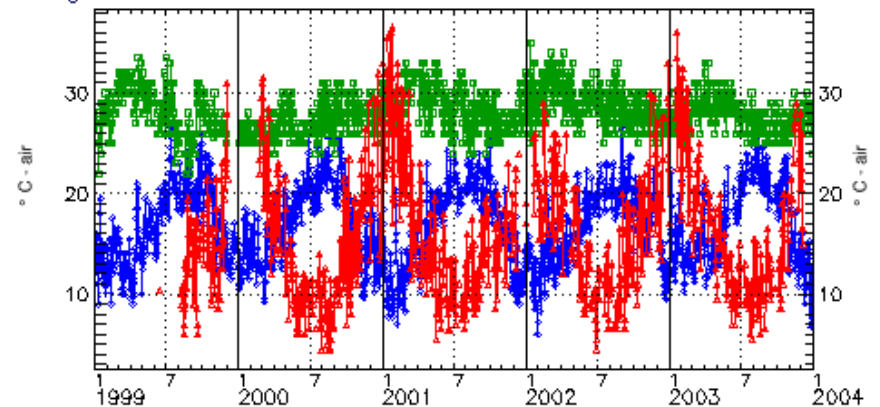
### Air Temperature

YYYYMMDD	LATITUDE	LONGITUDE	ELEVATN	SITEID	CTTMP	NXTMP	MNTMP
20000819	64.8497	-147.8268	133.0	ATM-01	10.0	-99.0	-99.0
20000819	64.8618	-147.7217	203.0	ATM-01	10.0	12.0	4.0
20000819	38.7777	-120.8897	454.0	ATM-02	32.0	34.0	24.0
20000819	32.1832	-110.9775	836.0	ATM-01	40.5	40.5	22.5
20000819	36.5197	-119.5463	27.0	ATM-02	30.5	32.0	-99.0
20000819	33.7769	-118.0386	7.0	ATM-01	27.0	29.5	14.0
20000819	39.1167	-105.0167	1647.0	ATM-02	31.0	31.0	18.0
20000819	31.7535	-106.4733	1165.0	ATM-02	36.0	37.0	20.0
20000819	31.7694	-106.5066	1154.0	ATM-01	30.0	31.0	20.0
20000819	48.5467	-117.9044	774.0	ATM-01	20.5	28.0	7.0
20000819	36.0612	-90.9550	84.0	ATM-02	31.0	33.0	18.0
20000819	29.0892	-97.2763	68.0	ATM-01	36.5	39.0	22.5
20000819	36.0906	-94.9200	280.0	ATM-01	29.0	29.0	19.0
20000819	29.0382	-82.6903	5.0	ATM-01	39.0	39.0	23.0
20000819	36.3720	-109.6243	1658.0	ATM-02	26.0	31.0	15.0
20000819	35.9510	-97.2358	278.9	ATM-01	36.0	36.0	19.0
20000819	35.2969	-94.0361	198.0	ATM-01	32.5	38.5	21.5
20000819	36.0000	-93.0032	834.0	ATM-01	32.0	38.0	21.0
20000819	28.1390	-82.5071	8.0	ATM-01	30.0	34.0	23.0
20000819	34.8982	-96.1000	239.0	ATM-01	35.0	-99.0	-99.0

## Graphs



### Mean Air Temperature



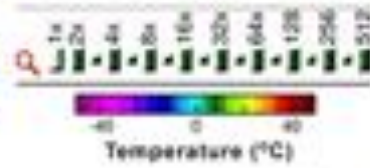
- ▲ Gladstone High School-Gladstone, SA, AU  
ATM-01 School Location
- EPP Mandina/A-Parakou, BORGO, BJ  
ATM-01 School Location
- ◆ Rossmoor Elementary School-Los Alamitos, CA, US  
ATM-01 School Location



The GLOBE Program

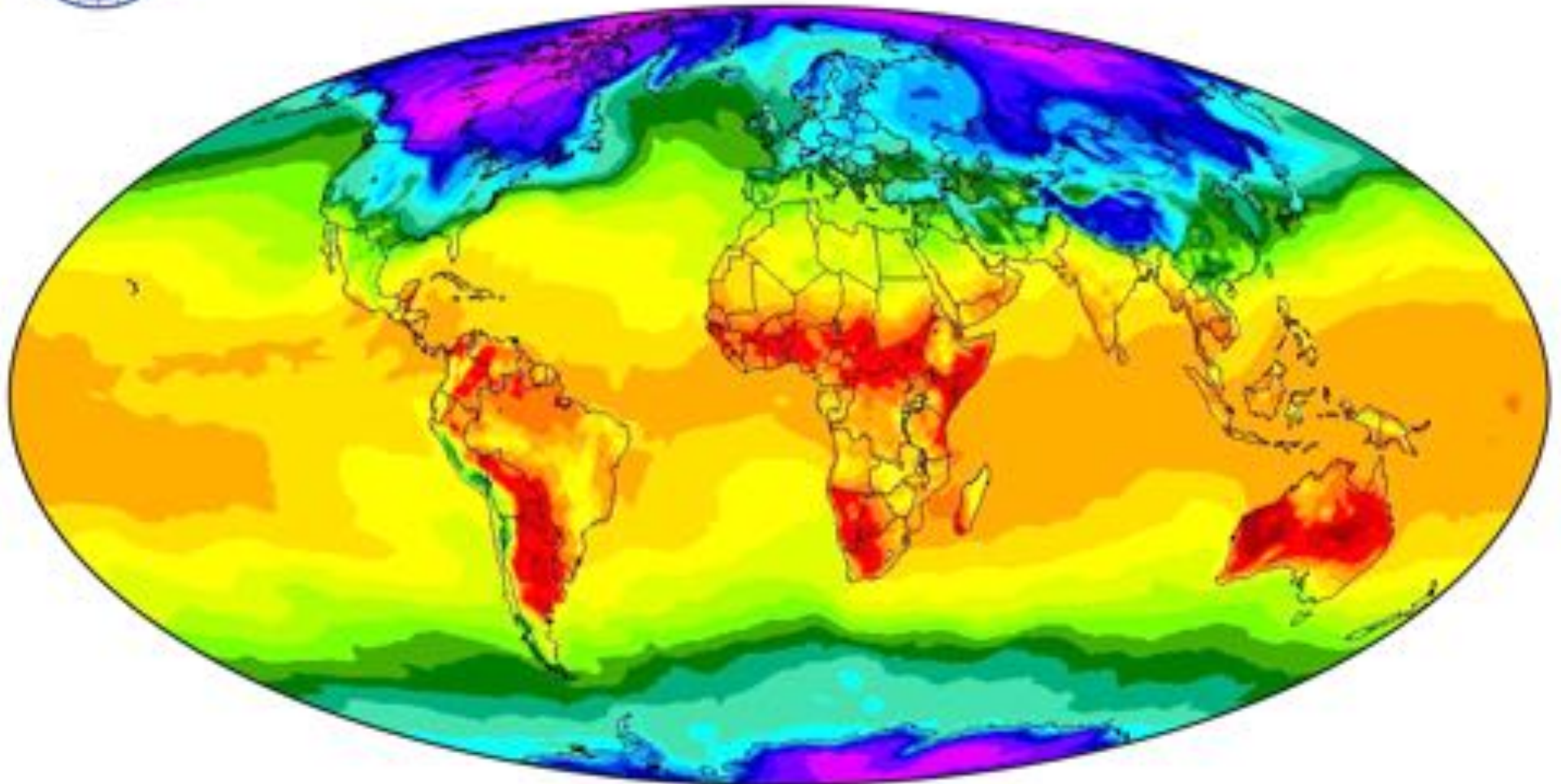


# Non GLOBE Data



Maximum Temperature

24 hour maximum from the  
NOAA Environmental Modeling Center



# Google Earth

The screenshot displays a web browser window with the URL <http://www.globe.gov/schools/map>. The page features the GLOBE Program logo and navigation tabs for HOME, ABOUT GLOBE, EXPLORE SCIENCE, and WHAT'S NEW?. A search bar and a language selection dropdown are also visible. The main content is a world map titled "Exploring Science through the GLOBE Science Network" with a legend for Country, Province, City, and School. The map is populated with many blue location pins, each containing a number, representing GLOBE schools worldwide. The map interface includes a compass, a vertical scale bar, and map style controls (Map, Satellite, Hybrid, Terrain). The footer contains copyright information for 2010 and a legend for the map markers.

GLOBE: Exploring Science through the GLOBE Science Network

<http://www.globe.gov/schools/map>

**THE GLOBE PROGRAM**  
Connecting the next generation of scientists **BETA**

Search Select Language

Powered by Google Translate

HOME ABOUT GLOBE EXPLORE SCIENCE WHAT'S NEW?

GLOBE Program Schools People Help Policies

### Exploring Science through the GLOBE Science Network

Map Satellite Hybrid Terrain

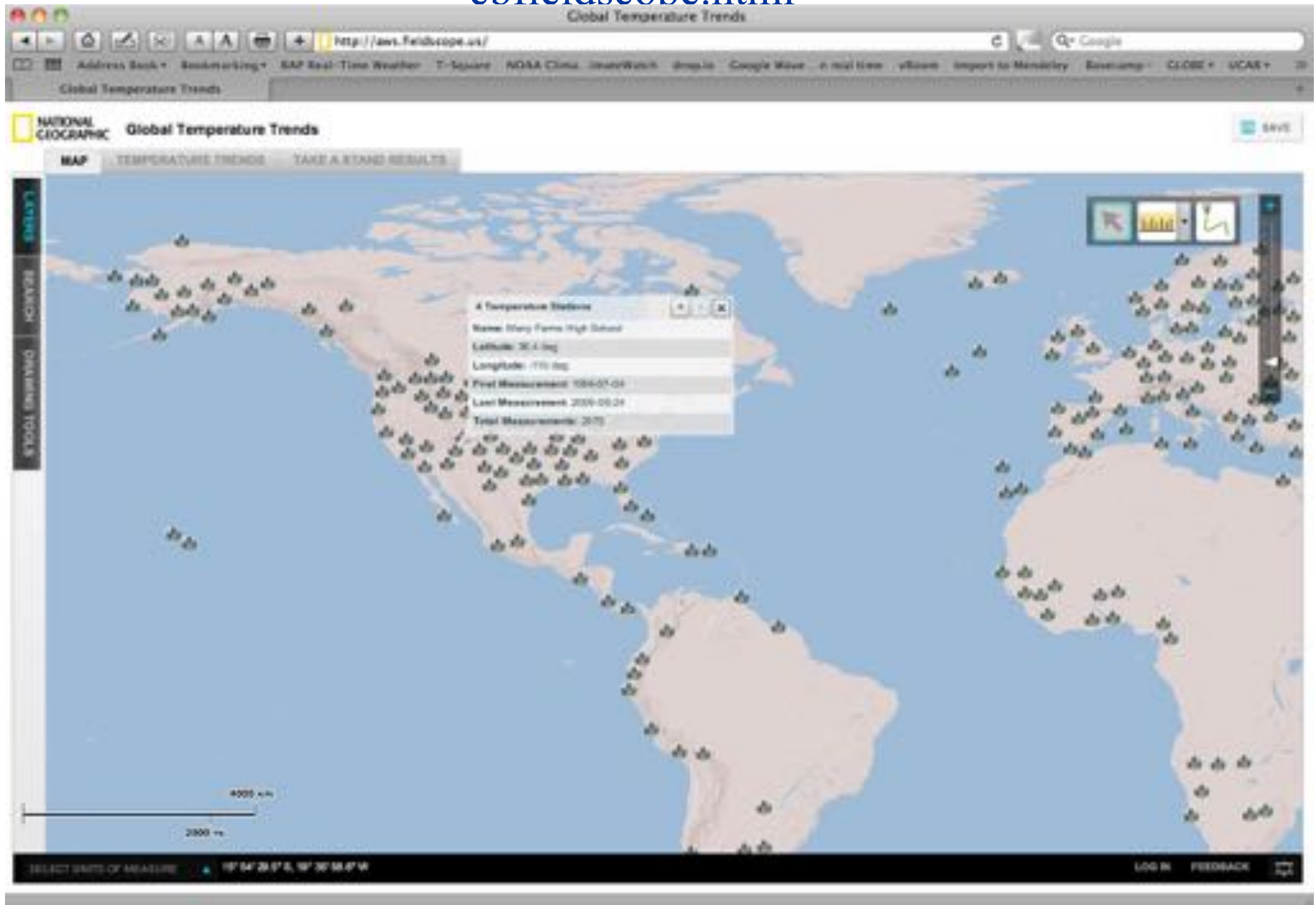
Map data ©2010 AND, Geocentre Consulting, MapData Sciences Pty Ltd, PSMA, MapLink, Tele Atlas - [Terms of Use](#)

Country Province City School

Transferring data from [chart.apis.google.com](http://chart.apis.google.com)

# Fieldscope

<http://www.nationalgeographic.com/field/projects/cbfieldscope.html>



# ACRE “Old Weather Data” and GLOBE

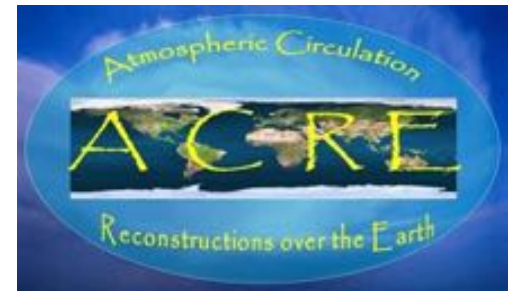


**Global Learning and Observations  
to Benefit the Environment**

# “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 do 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)
  - 21<sup>st</sup> 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

