GLOBE Training for Preservice and Inservice Teacher Education at Elizabeth City State University

2016 – 2017 PiMERS Mathematics Team
Principal Investigator: Dr. Linda B. Hayden
Mentor: Dr. Darnell Johnson
Members: Jessica Hathaway, Joselyn Hathaway, Dana Chandler, Dana Poole, and Heaven Tate

2017 PiMERS Mathematics Education Team

Mentor: Dr. Darnell Johnson

Jessica Hathaway

Joselyn Hathaway

Dana Poole

Heaven Tate

Dana Chandler

Abstract

Global Learning and Observations to Benefit the Environment (GLOBE) is a K-12 environmental education program supported by National Aeronautics Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), and National Science Foundation (NSF). GLOBE is a powerful teaching tool that enables students to use hands-on, inquiry-based methods to gather and interpret scientific data. *Pathways in Mathematics Education and Remote Sensing (PiMERS)* represents a joint effort between Elizabeth City State University (ECSU) and NASA Langley Research Center (LaRC) which held a hybrid regional teacher inservice and student preservice workshop on GLOBE Protocols at on the campus of ECSU located in Elizabeth City, North Carolina in the northeastern region of the state.

Abstract cont.

A Protocol eTraining took place in January 2017 and the face-to-face workshop was held in February 2017. Over a two-week period, students and teachers learned basic GLOBE protocols and formed questions concerning each of the assigned GLOBE topics. During the face to face workshop participants collected data in the field, performed data/laboratory analyses, and compared data submitted by various schools around the world on the GLOBE website. The participants learned about remote sensing and viewed/manipulated images using image-processing software, and were introduced to the study of GLOBE Protocols as applied in northeastern North Carolina as well. Teachers and preservice students were excited about this hands-on experience in GLOBE and stated that this new learning prepared them to pass on this newly acquired knowledge. GLOBE protocols used in the workshop were recommended for incorporation into the current preservice teacher education program at ECSU.

Abstract cont.

As a result of the GLOBE training, the 2017 PiMERS Mathematics Team at ECSU established three environmental sites on the campus of ECSU. With these three established sites, the research team conducted investigations for the following GLOBE protocols: Clouds, Air Temperature, and Surface Temperature. For atmosphere investigations of air and surface thermometers; minimum, and maximum temperatures were recorded from the area located near the front of the Dixon/Patterson Hall building and the softball field on the campus of Elizabeth City State University. With the newly installed weather station loaned by LaRC, IRT207 Infrared Thermometers and digital multi-day max/min/current thermometers were used to record measurements of air and soil temperatures. For cloud investigations, the total cloud/contrail cover, sky color and visibility, cloud levels: high, mid, and low, and surface conditions were observed and recorded from the open area located near the front of Burnim Fine Arts Complex on the campus of Elizabeth City State University. All cloud observations were done visually.

Abstract cont.

The collection of environmental data from these three sites around the ECSU campus that encompass these protocols were conducted by four preservice mathematics education students and one university mathematics instructor from the General Studies Program. The team gained a better understanding of Earth System Science, its relationship to mathematics, and interrelated cycles which comprise an integrated system. The mathematics team uploaded the collected environmental data to the GLOBE website and provided environmental data that enabled scientists to help in the study the earth's system. The PiMERS Mathematics Team collected and evaluated obtained data, and created graphical models to express data quantitatively using the GLOBE website data resources.

Keywords—Teacher Inservice Training, Preservice Education, GLOBE Protocols, Atmosphere, Clouds, Surface Temperature, Air Temperature, Remote Sensing, Chi Square Test

Statement of Purpose

- This research was to teach the importance of GLOBE
- GLOBE training was provided for preservice education students and inservice teachers
- GLOBE training showed how to utilize protocols

Research Questions

- How can preservice and inservice teachers utilize the GLOBE protocols?
- What are the benefits of GLOBE enhance critical thinking skills?
- In what role does GLOBE enhance critical thinking skills?
- Why is GLOBE important for global community?

What is GLOBE?

Global Learning and Observations to Benefit the Environment

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.*

Mission:

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




GLOBE Training Part I

- Conducted at ECSU with 14 participants and consisted of two sessions
- The first session was lead by Dr. Jessica Taylor from NASA-LaRC
- 3 inservice teachers and 4 preservice students participated in this workshop session

GLOBE Training Part I Curriculum

K-5 Teachers	6-8 Teachers	9-12 Teachers	Pre-Service Teachers (ECSU Students)
Create GLOBE Teacher Account at: http://www.globe.gov/join/become-a-globe-teacher/create-a-globe-teacher-account	Create GLOBE Teacher Account at: http://www.globe.gov/join/become-a-globe-teacher/create-a-globe-teacher-account	Create GLOBE Teacher Account at: http://www.globe.gov/join/become-a-globe-teacher/create-a-globe-teacher-account	Create GLOBE Pre-Service Teacher Account at: http://www.globe.gov/join/become-a-globe-teacher/create-a-globe-teacher-account
Conduct online GLOBE eTraining at: http://www.globe.gov/get-trained/protocol-etraining	Conduct online GLOBE eTraining at: http://www.globe.gov/get-trained/protocol-etraining	Conduct online GLOBE eTraining at: http://www.globe.gov/get-trained/protocol-etraining	Conduct online GLOBE eTraining at: http://www.globe.gov/get-trained/protocol-etraining
• Introduction to GLOBE	• Introduction to GLOBE	• Introduction to GLOBE	• Introduction to GLOBE
• Introduction to Atmosphere	• Introduction to Atmosphere	• Introduction to Atmosphere	• Introduction to Atmosphere
• Clouds	• Clouds	• Clouds	• Clouds
• Surface Temperature	• Surface Temperature	• Surface Temperature	• Surface Temperature
Review Elementary GLOBE Teacher Implementation Guide: http://www.globe.gov/documents/348830/348842/ElementaryGLOBE_ImplementationGuide_en.pdf	• Air Temperature	• Air Temperature	• Air Temperature
Read Elementary GLOBE Aerosols Storybook: http://www.globe.gov/web/elementary-globe/overview/aerosols/story-book	Read Dr. C's latest blog post on Urban Heat Islands and his Surface Temperature Measurement Campaign: http://bit.ly/2hnbLOs	Read Dr. C's latest blog post on Urban Heat Islands and his Surface Temperature Measurement Campaign: http://bit.ly/2hnbLOs	Read Elementary GLOBE Aerosols Storybook: http://www.globe.gov/web/elementary-globe/overview/aerosols/story-book
Review Elementary GLOBE Aerosols Learning Activities: http://www.globe.gov/web/elementary-globe/overview/aerosols/learning-activities	Watch Recorded Webinar on X, helping students and teachers prepare for the GLOBE Science Symposium:	Watch Recorded Webinar on X, helping students and teachers prepare for the GLOBE Science Symposium:	Watch Recorded Webinar on X, helping students and teachers prepare for the GLOBE Science Symposium:

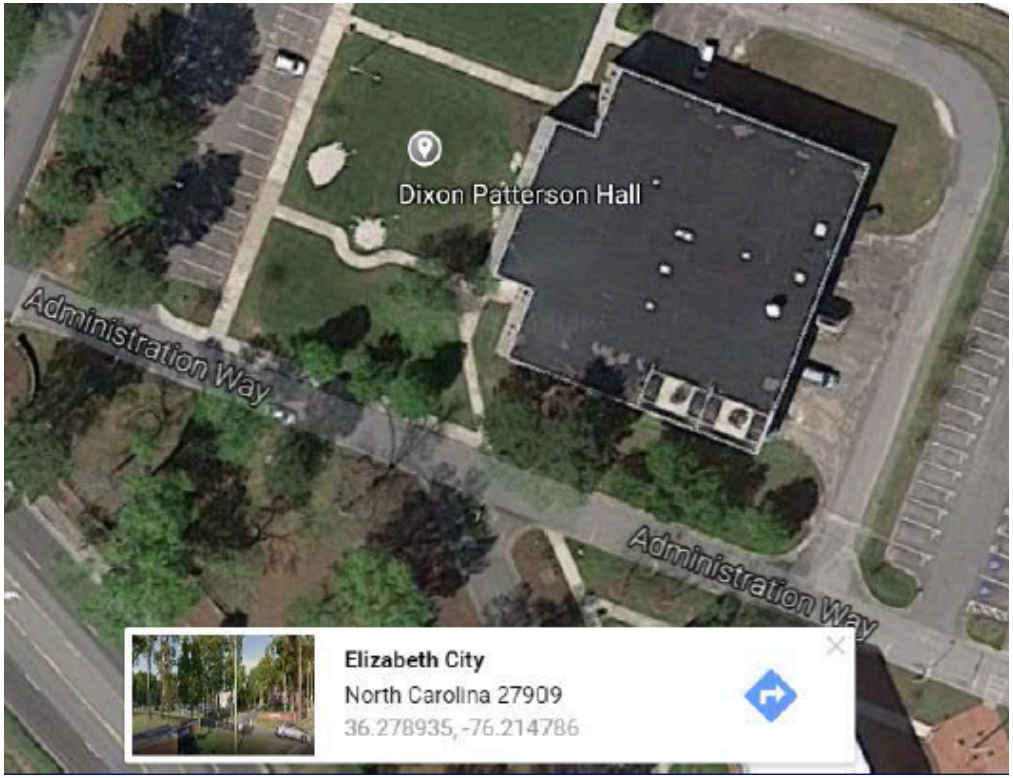
GLOBE Training Part II

- A GLOBE certified PiMERS Mathematics Education Team hosted a second session
- A total of 6 student and 1 professor participated in this workshop

Researched Protocols

- Atmosphere
  - Air temperature
  - Surface temperature
- Clouds
  - Types of clouds (i.e. high level, mid level)
    - Fog
    - Nimbostratus
    - Cumulonimbus
    - Stratus
    - Cumulus
    - Stratocumulus

Site Location



Instruments Used for Each Protocol

Air Temperature

- Measures the heat in the air
- Varies; warmest at the surface and decreases with height
- Impacts the types of plants and animals that live in a certain location
- Impacts soil formation

What is Needed to Collect Air Temperature?

Instruments	**Max/Min Digital Thermometer or Alcohol-filled Thermometer***
Data Sheets	Atmosphere Investigation Data Sheet
When	Within one hour of local solar noon
Where	Instrument Shelter
Other	Log book for data collection; Computer with internet connection to enter data
*Use only for current air temperature	

Digital Thermometer

Air Temperature

Digital Multi-Day Minimum/ Maximum Thermometer

Data Sheet

* Required Field

School Name: ECSU Group 2 Study Site: Dixon Hall, Thorpe

Observer names: _____

Date: Year 2017 Month 3 Day 7 Universal Time (hour:min): _____

Your *Time of Reset* in Universal Time (hour:min): _____

Note: If Min/Max Air and Soil Temperatures are being collected after your *Time of Reset* (e.g., if your *Time of Reset* is 12:00 and you are reading the thermometer at 12:15) then the date of D1 will be the same as the date you read your thermometer.

If Min/Max Air and Soil Temperatures are being collected before your *Time of Reset* (e.g., if your *Time of Reset* is 12:00 and you are reading the thermometer at 11:50) then the date of D1 will be the same as the date prior to when you read your thermometer.

Multi-Day Min/Max Air Temperature

Label on Thermometer Display	Corresponding Date	Minimum Temperature (°C)	Maximum Temperature (°C)
D1	Dixon(front)	18	21
D2	Thorpe	19	20
D3	Dixon(back)	19	22
D4			
D5			
D6			

~~***Multi-Day Min/Max Soil Temperature***~~

~~| Label on Thermometer Display | Corresponding Date | Minimum Temperature (°C) | Maximum Temperature (°C) |~~
~~|---|---|---|---|~~
~~| D1 | | | |~~
~~| D2 | | | |~~
~~| D3 | | | |~~
~~| D4 | | | |~~
~~| D5 | | | |~~
~~| D6 | | | |~~

Importance of Recording Air Temperature

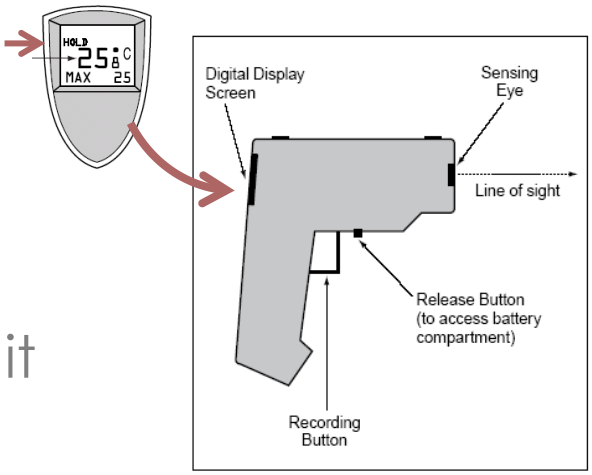
- To observe patterns in temperature change
- To understand seasonal changes in Earth's air temperatures
- To compare temperature changes from year to year
- To provide climate change models data to predict future conditions
- To better understand Earth's weather and changing climate over time

Surface Temperature

- Is the radiating temperature emitted as electromagnetic energy of the Earth's surface including vegetation, paved surfaces, and the ground, etc.
- Varies depending on the ground cover and the time of day
- Affects all aspects of the Earth's Energy Budget

Surface Temperature

- Instrument: Infrared Thermometer
- Measures infrared (heat) radiation emanating from a surface and converts it to temperature
- Surface temperature can be observed by sensing the infrared part of the electromagnetic spectrum



Importance of Recording Surface Temperature

To help verify surface temperature readings collected by NASA

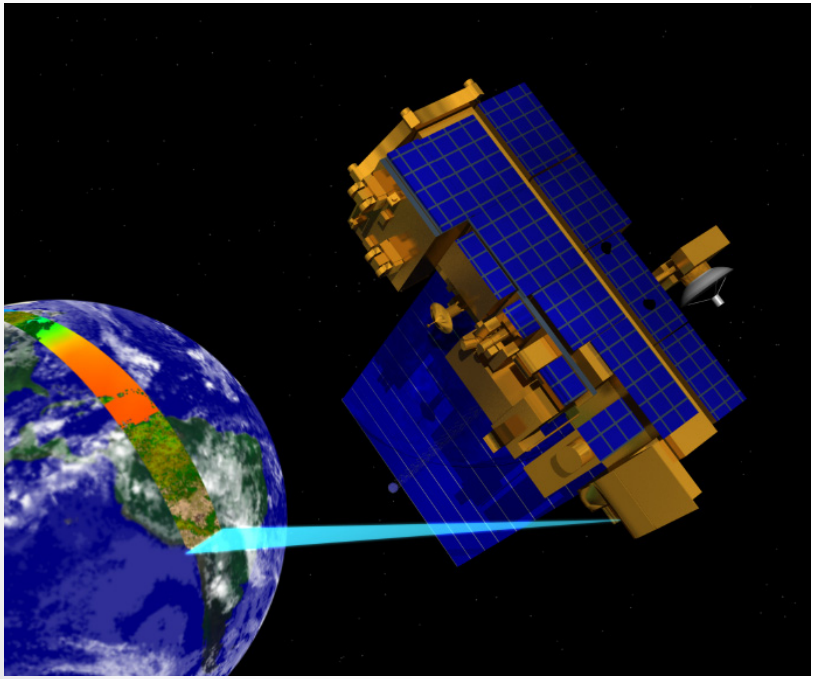


Image: NASA

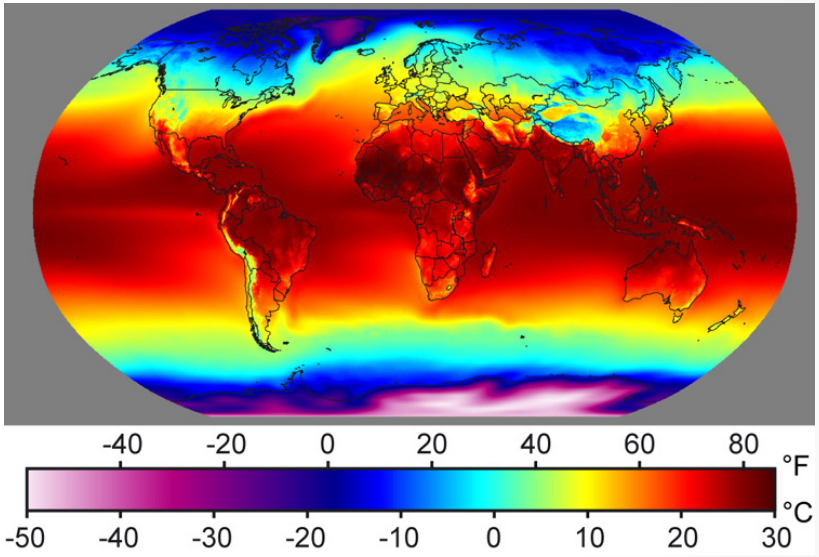


Image: Windows to the Universe

Image: Kevn Czajkowski

Importance of Recording Surface Temperature

To help understand seasonal changes in Earth's surface

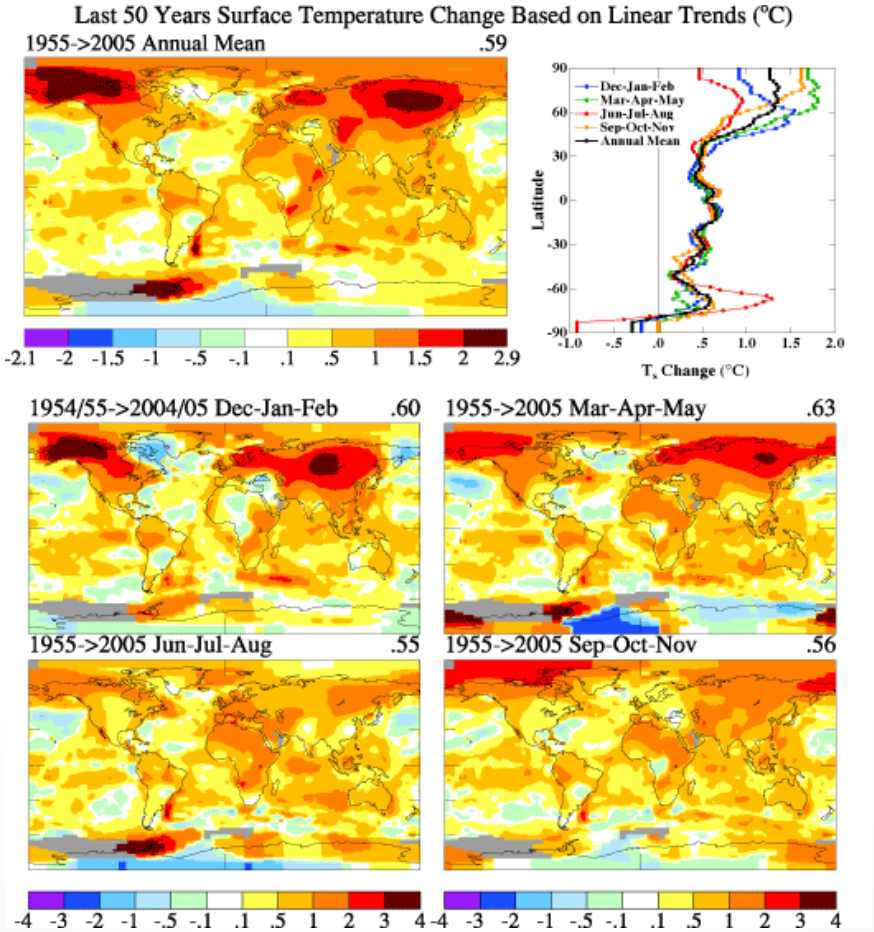


Image: NASA GISS

Importance of Recording Surface Temperature

To help understand the rate of heat and moisture exchange between the atmosphere and Earth

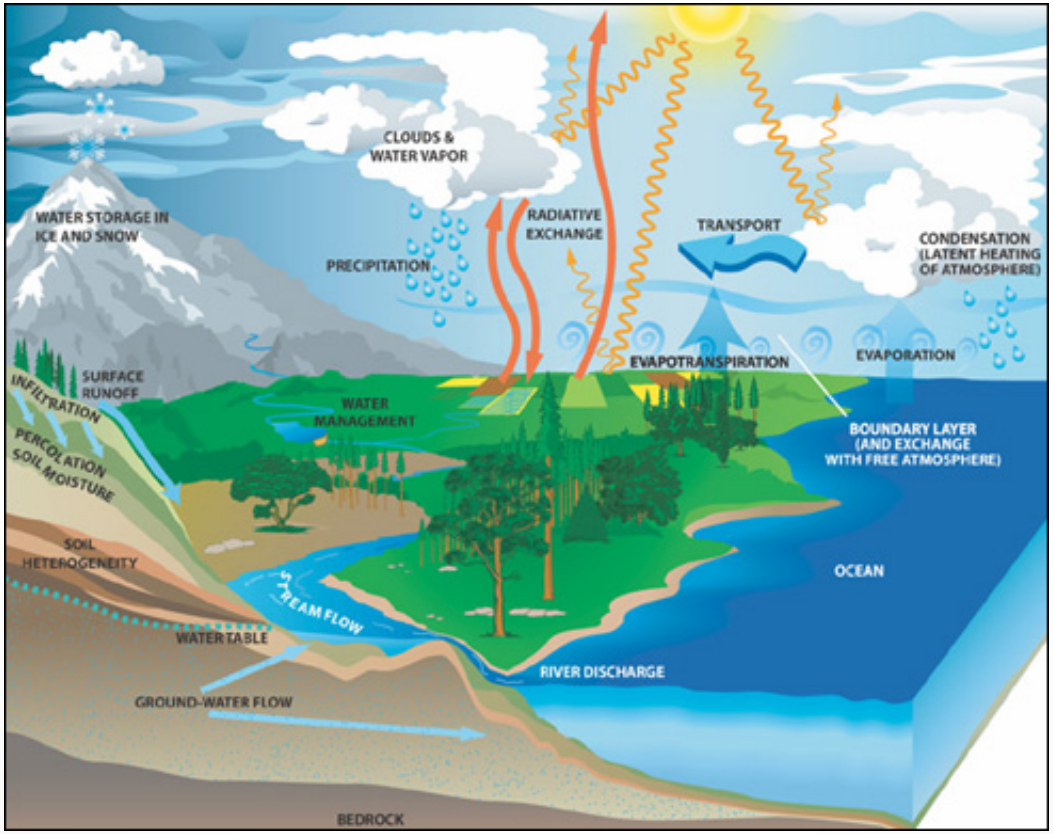
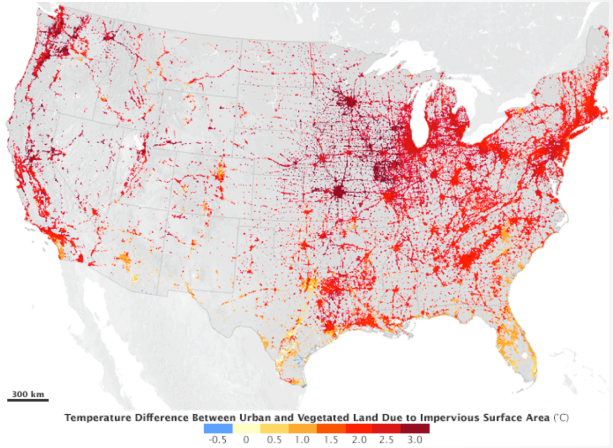
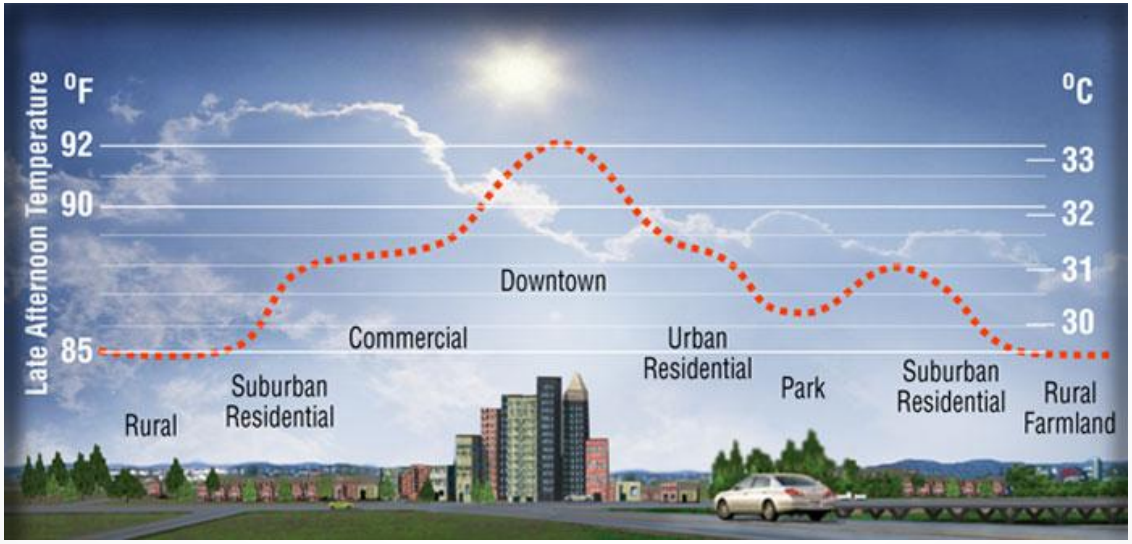


Image: NASA

Importance of Recording Surface Temperature

To assist in urban planning and to help understand the Urban Heat Island Effect





Surface Temperature

Atmosphere Investigation

Surface Temperature Data Sheet

* Required Field

School Name: ECSU Group 2 Study Site: Dixon Hall, Thorpe

Observer names:

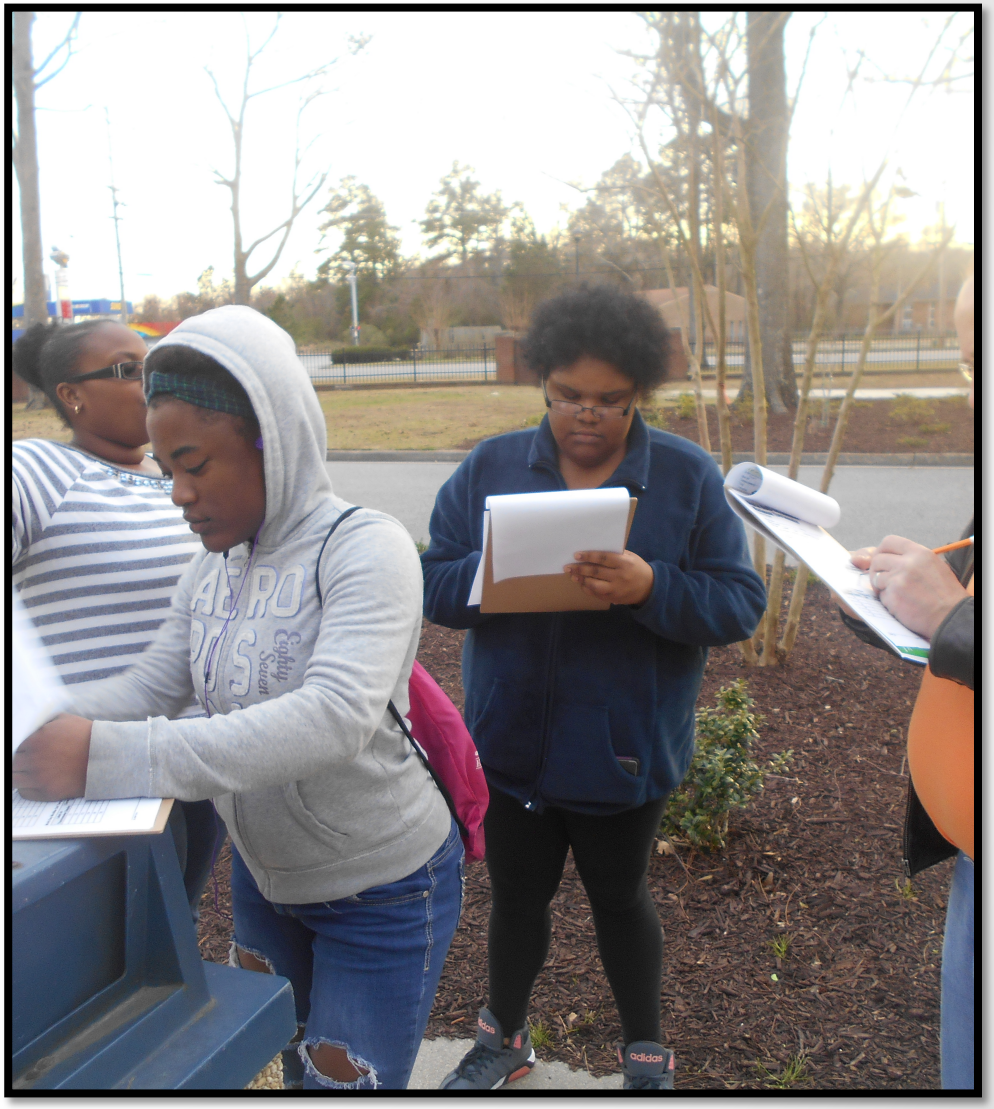
Date: Year 2017 Month 3 Day 7 Universal Time (hour:min):

***Surface Temperature**

Site's Overall Surface Condition (Select One): ❑ Wet ☒ Dry ❑ Snow

Sample	Temperature Measurement (°C)	Snow Depth (mm) (*if snow selected above)
1	Dixon(front): Grass-14.7	☒ zero ❑ Trace (<10 mm) ❑ Measureable (>10mm) ____ mm
2	Dixon(front): Concrete-17.2	☒ zero ❑ Trace (<10 mm) ❑ Measureable (>10mm) ____ mm
3	Thorpe: Grass-16.9	☒ zero ❑ Trace (<10 mm) ❑ Measureable (>10mm) ____ mm
4	Thorpe: Concrete-17.5	☒ zero ❑ Trace (<10 mm) ❑ Measureable (>10mm) ____ mm
5	Dixon(back): Grass-13.7	☒ zero ❑ Trace (<10 mm) ❑ Measureable (>10mm) ____ mm
6	Dixon(back): Concrete-16.8	☒ zero ❑ Trace (<10 mm) ❑ Measureable (>10mm) ____ mm
7		❑ zero ❑ Trace (<10 mm) ❑ Measureable (>10mm) ____ mm
8		❑ zero ❑ Trace (<10 mm) ❑ Measureable (>10mm) ____ mm
9		❑ zero ❑ Trace (<10 mm) ❑ Measureable (>10mm) ____ mm

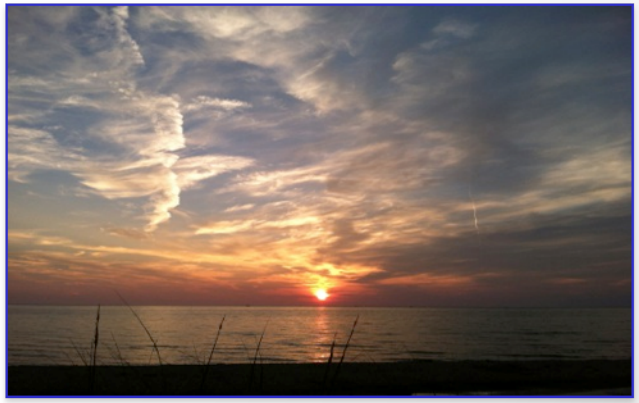
Comments:



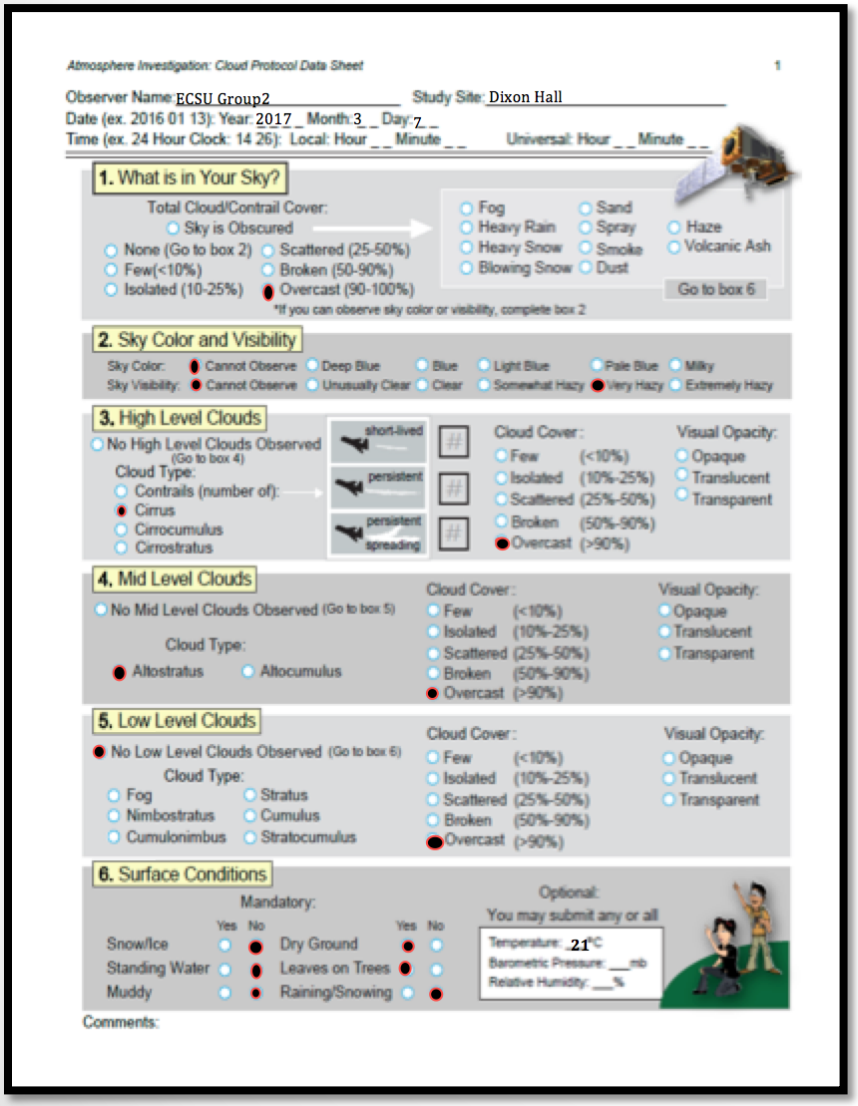
What are Clouds

When a large number of water drops or ice crystals are present, and they scatter enough light for us to see them, they form visible clouds.

At any given time, over half of Earth's surface is covered by clouds.



Cloud Instruments



Atmosphere Investigation: Cloud Protocol Data Sheet 1

Observer Name: ECSU Group2 Study Site: Dixon Hall

Date (ex. 2016 01 13): Year: 2017 Month: 3 Day: 7

Time (ex. 24 Hour Clock: 14 26): Local: Hour Minute Universal: Hour Minute

1. What is in Your Sky?

Total Cloud/Contrail Cover:

- Sky is Obscured
- None (Go to box 2)
- Few(<10%)
- Isolated (10-25%)
- Scattered (25-50%)
- Broken (50-90%)
- Overcast (90-100%)

*If you can observe sky color or visibility, complete box 2

- Fog
- Heavy Rain
- Heavy Snow
- Blowing Snow
- Sand
- Spray
- Smoke
- Dust
- Haze
- Volcanic Ash

Go to box 6

2. Sky Color and Visibility

Sky Color: Cannot Observe, Deep Blue, Blue, Light Blue, Pale Blue, Milky

Sky Visibility: Cannot Observe, Unusually Clear, Clear, Somewhat Hazy, Very Hazy, Extremely Hazy

3. High Level Clouds

No High Level Clouds Observed (Go to box 4)

Cloud Type: Contrails (number of): Cirrus, Cirrocumulus, Cirrostratus

short-lived, persistent, persistent spreading

Cloud Cover: Few (<10%), Isolated (10%-25%), Scattered (25%-50%), Broken (50%-90%), Overcast (>90%)

Visual Opacity: Opaque, Translucent, Transparent

4. Mid Level Clouds

No Mid Level Clouds Observed (Go to box 5)

Cloud Type: Altostratus, Altocumulus

Cloud Cover: Few (<10%), Isolated (10%-25%), Scattered (25%-50%), Broken (50%-90%), Overcast (>90%)

Visual Opacity: Opaque, Translucent, Transparent

5. Low Level Clouds

No Low Level Clouds Observed (Go to box 6)

Cloud Type: Fog, Stratus, Nimbostratus, Cumulus, Cumulonimbus, Stratocumulus

Cloud Cover: Few (<10%), Isolated (10%-25%), Scattered (25%-50%), Broken (50%-90%), Overcast (>90%)

Visual Opacity: Opaque, Translucent, Transparent

6. Surface Conditions

Mandatory:

	Yes	No		Yes	No
Snow/Ice		●	Dry Ground	●	
Standing Water		●	Leaves on Trees	●	
Muddy		●	Raining/Snowing		●

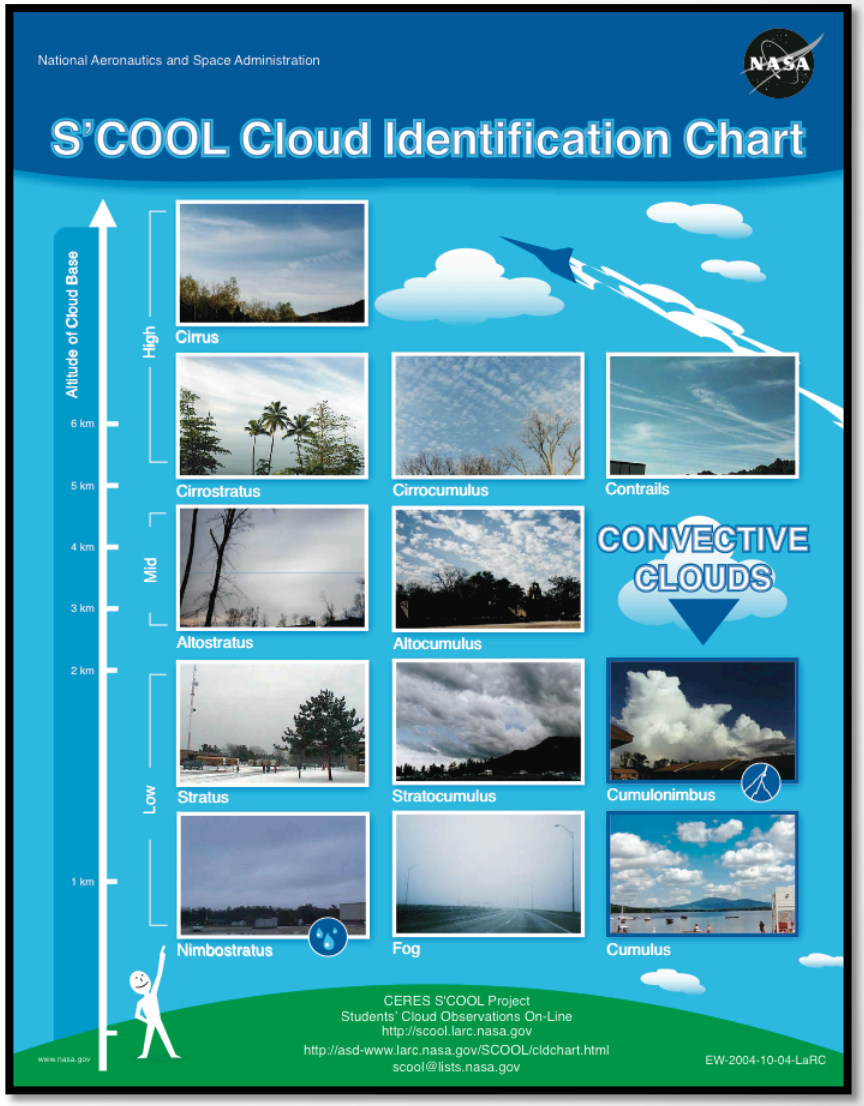
Optional: You may submit any or all

Temperature: 21 °C

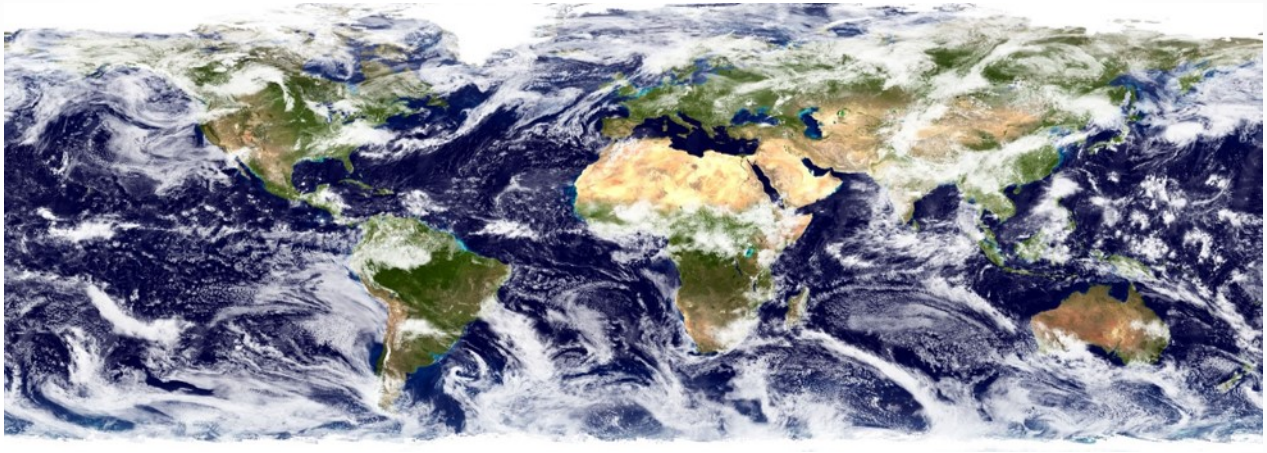
Barometric Pressure: ___ mb

Relative Humidity: ___ %

Comments:



Why Collect Cloud Data?



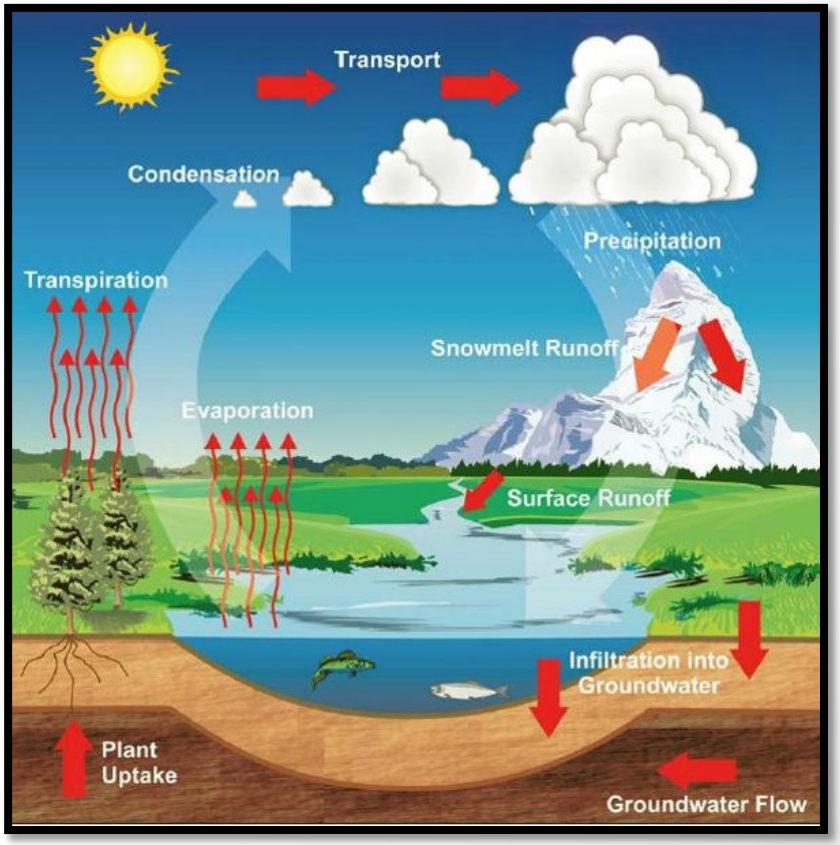
One of the most interesting features of Earth, as seen from space, is the ever-changing distribution of clouds. They are as natural as anything we encounter in our daily lives. As they float above us, we hardly give their presence a second thought. And yet, clouds have an enormous influence on Earth's energy balance, climate, and weather.

Even small changes in the abundance, location, or cloud type can impact Earth's climate and weather. This is why collecting data on clouds is important.

Role of Clouds in the Water Cycle

The water on Earth is always on the move, changing from liquid to vapor and back to liquid and snow and ice near the poles and mountains. The process is called the water cycle, or hydrologic cycle.

Clouds are a key element of our Earth's hydrologic cycle, bringing water from the air to the ground and from one region of the globe to another.



GLOBE Survey

- The survey was completed by both groups of participants in the February and March workshops.
- The survey consisted of a series of 12 questions and was used to gauge what participants experienced from the workshop sessions.
- Responses were monitored using a 5 point likert scale from strongly disagree to strongly agree.

GLOBE Survey cont.

THE GLOBE PROGRAM
A Worldwide Science and Education Program

GLOBE Workshop 2017
Evaluation Survey

Grade Level Currently Teaching: E M H C (circle one)

Gender: M F (circle one)

Teaching Experience: ___< 10 years; ___< 15 years; ___< 20 years___< 30 years
Pre-Service Teacher: ____
Face to Face Session: ____

Indicate the extent to which you agree or disagree by using the Likert items provided. Please address your response based on the items which range from "1" Strongly Disagree to "5" Strongly Agree as they represent a degree across the continuum. ***Please respond based on your experience with the presentation.***	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The GLOBE learning objectives of the workshop/presentation were clear.	①	②	③	④	⑤
The content of the presentation on GLOBE protocols were relevant.	①	②	③	④	⑤
I can apply what I have learned from this GLOBE workshop.	①	②	③	④	⑤
The facilitator was knowledgeable on the subject.	①	②	③	④	⑤
The facilitator exemplified commitment on the subject.	①	②	③	④	⑤
The facilitator kept me interested and attentive during the face-to-face activities.	①	②	③	④	⑤
The facilitator seemed prepared and well organized during the face-to-face activities..	①	②	③	④	⑤
The GLOBE presentation setting was conducive to learning.	①	②	③	④	⑤
The GLOBE presentation facility was clean and comfortable.	①	②	③	④	⑤
The use of technology and visual aids made the instruction easier to remember.	①	②	③	④	⑤
I plan on using GLOBE Training information from this session in my classes.	①	②	③	④	⑤
The GLOBE Training raised my awareness in the STEM field.	①	②	③	④	⑤

Please share your comments on <u>strengths</u> and/or <u>weaknesses</u> below.

Strengths

_____
_____
_____

Weaknesses

_____
_____
_____

Table I

Survey Question	In what role does GLOBE enhance critical thinking?		
	Strongly Disagree/ Disagree	Neutral	Strongly Agree/ Agree
The learning objectives of the workshop/ presentation were clear.	0	0	14
The content of the presentation was relevant.	0	0	14
The presentation setting was conductive to learning.	0	0	14
The presentation facility was clean and comfortable.	0	1	13

Chart I

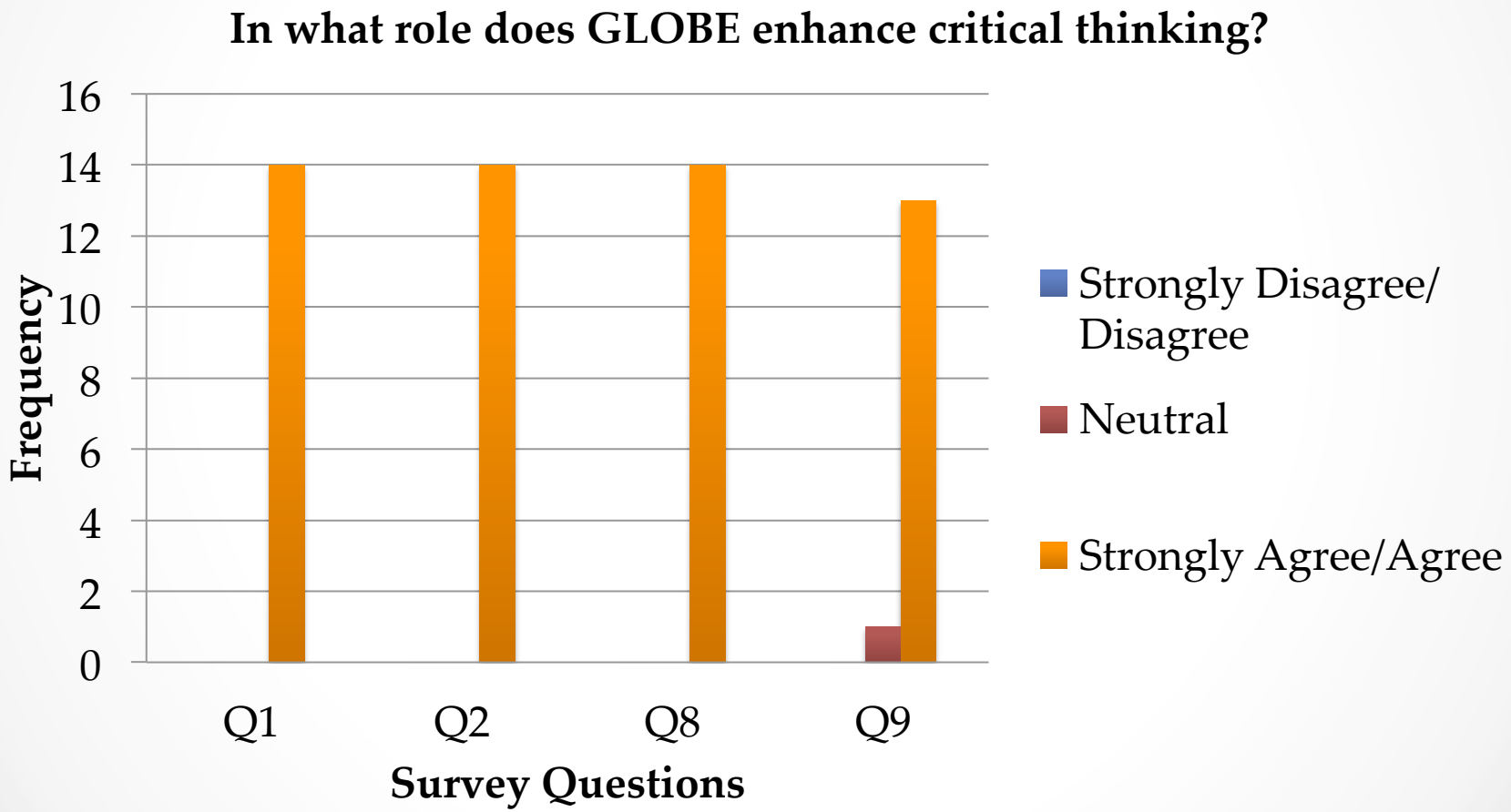

In what role does GLOBE enhance critical thinking?
16
14
12
10
8
6
4
2
0
Frequency
Q1
Q2
Q8
Q9
Survey Questions
Strongly Disagree/ Disagree
Neutral
Strongly Agree/Agree

Table II

Survey Question	What are the benefits of GLOBE in the classroom ?		
	Strongly Disagree/ Disagree	Neutral	Strongly Agree/ Agree
I can apply what I learned from this presentation	0	0	14
The use of technology and visual aids made the instruction easier to remember	0	0	14
I plan on using information from this session in my classes	0	1	13
The session raised my awareness in the STEM field	0	0	14

Chart II

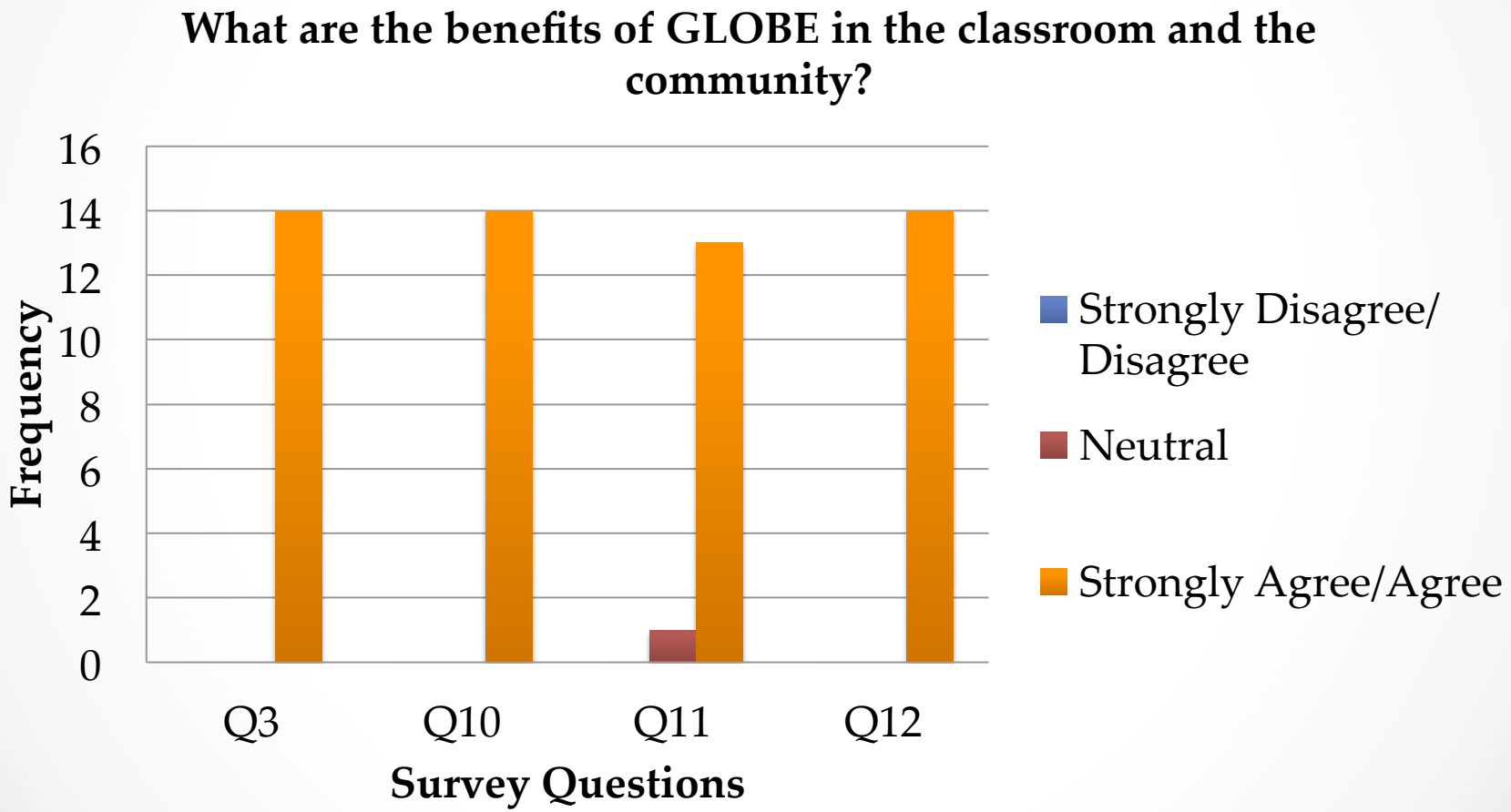
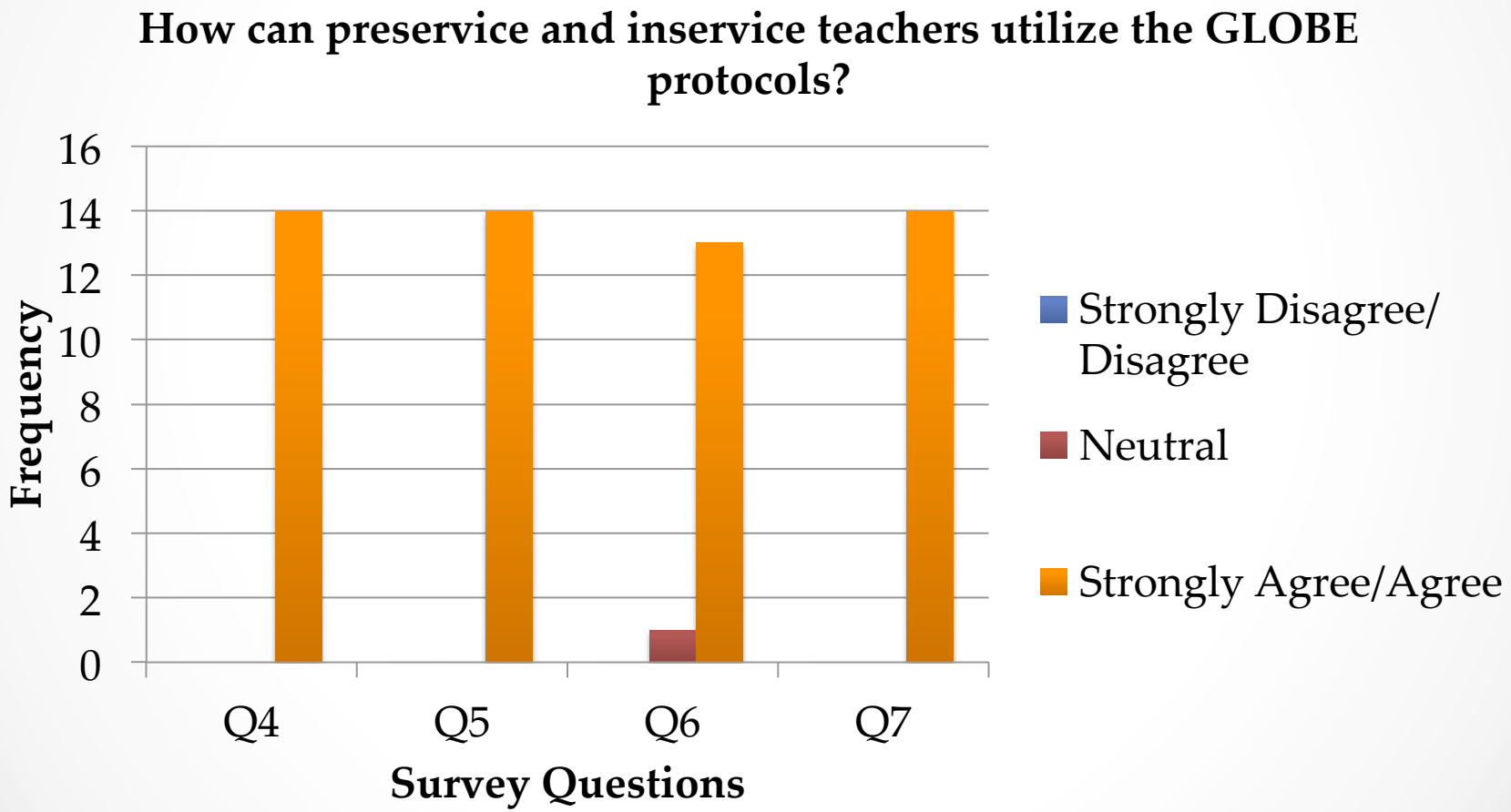

What are the benefits of GLOBE in the classroom and the community?
Frequency
16
14
12
10
8
6
4
2
0
Q3
Q10
Q11
Q12
Survey Questions
Strongly Disagree/ Disagree
Neutral
Strongly Agree/Agree

Table III

Survey Question	How can preservice and inservice teachers utilize the GLOBE protocols?		
	Strongly Disagree/ Disagree	Neutral	Strongly Agree/ Agree
The facilitator was knowledgeable on the subject.	0	0	14
The facilitator exemplified commitment on the subject.	0	0	14
The facilitator kept me interested and attentive.	0	1	13
The facilitator seemed prepared and well organized.	0	0	14

Chart III


How can preservice and inservice teachers utilize the GLOBE protocols?
Frequency
16
14
12
10
8
6
4
2
0
Q4
Q5
Q6
Q7
Survey Questions
Strongly Disagree/ Disagree
Neutral
Strongly Agree/Agree

Chi-Square Test

$$\text{Chi} - \text{square} = \text{Sum of} \frac{(observed \times frequency - expected \times frequency)^2}{(expected \times frequency)}$$

8.31529E-07	8.131529E-07	8.131529E-07
8.131529E-07	8.131529E-07	8.131529E-07
8.131529E-07	1.34802E-05	1.34802E-05
1.34802E-05	8.131529E-07	8.131529E-07

Conclusion

- Participants in the GLOBE workshops and training sessions stated that GLOBE training tended to be beneficial to both preservice students and inservice teachers.
- GLOBE is not only for K-12 science classrooms, but for the purpose of educating the global community as well.
- This program has a variety of lessons that are flexible enough to be used on all grade levels. The online training aids provided a detailed description of each protocol on the GLOBE website.
- Participants of the GLOBE workshops were allowed to conduct research in activities associated with protocols with a positive insight to science, science education, mathematics education, and research techniques.

Future Works

- The PiMERS Mathematics Education Team will use a weather station loaned from NASA LaRC to collect data that can be added to the GLOBE database.
- The weather station will be placed in a permanent location to conduct continual research.
- Annual events such as the PiMERS Middle School summer program, local school division training, and inservice teacher training will be conducted.
- The PiMERS Mathematics Team and other researchers will be able to monitor the local environment and observe seasonal or monthly changes.
- Presentation this research will be shared to the education department with the recommendation of GLOBE as a part of the curriculum.

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Questions?