P1.7 Advanced Atmosphere Workshop for Certified GLOBE Teachers

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1. INTRODUCTION

In July 2005, certified Global Learning and Observations to Benefit the Environment (GLOBE) teachers in West Virginia were invited to attend an Advanced Atmosphere Magnet Training Workshop. The participants reviewed the principal Atmosphere protocols, while learning about important advanced protocols in atmospheric pressure, surface ozone, and relative humidity.

This workshop was in partnership with West Virginia State University; West Virginia State Community and Technical College; the Math, Science and Technology Consortium of North Central WV (MSTC); Fairmont State University Science and Technology Department and Science Education Department; and the NASA Independent Verification and Validation Facility Educator Resource Center (ERC).

2. BACKGROUND

2.1 GLOBE PROGRAM

The GLOBE program is a world-wide hands-on inquiry-based education and science program where students and teachers take scientifically valid measurements in the fields of atmosphere, hydrology, soils, and land cover/phenology. Introductory workshops are held by certified trainers which train teachers in the GLOBE science measurement protocols and education activities. Most introductory workshops include only the primary Atmosphere protocols, such as min/max temperature, clouds, and precipitation. Because of insufficient training time, other interesting Atmosphere protocols are missed.

2.2 WORKSHOP RATIONALE

One challenge facing education specialists and the GLOBE program is keeping the teachers engaged and interested. Follow-up sessions can be used to further motivate and excite educators. At the end of the introductory five day GLOBE sessions given in West Virginia in 2004, participants were asked to identify those areas that they would consider participating in the future. The identified areas and their relative weights can be seen in Figure 1. Further training in the Atmosphere Investigation was outlined as a relatively strongly demanded need.

There is a clear need in the state of West Virginia for on-going professional development as the West Virginia Department of Education as recently adopted new set of science content standards

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and objectives (CSO) drawn from the National Science Education Standards and the Project 2061 Benchmarks, which requires teachers to engage their students in meaningful hands-on activities that approach science as an inquiry-based process. The advanced Magnet Workshop not only provides additional content area training but also the opportunity to model inquiry-style teaching for the participants.

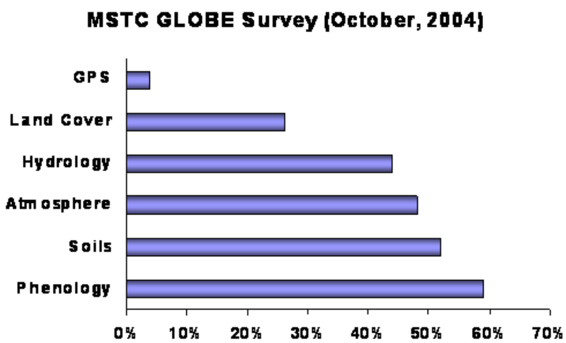

Figure 1: Survey of GLOBE teacher's need for further training.

3. WORKSHOP

3.1 INITIAL THREE DAY PROGRAM

The workshop consisted of 3 8-hour sessions, where extensive time was devoted to modeling inquiry for the teachers. A cloud bingo game was developed to bolster the teacher's confidence in classifying and identifying clouds. A Cloud dichotomous key was developed to further aid teachers and their students in identifying the 10 basic cloud types. This key can be seen in Figure 2 and also found on-line at http://www.wvclimate.org/documents/cloud/CloudID.pdf.

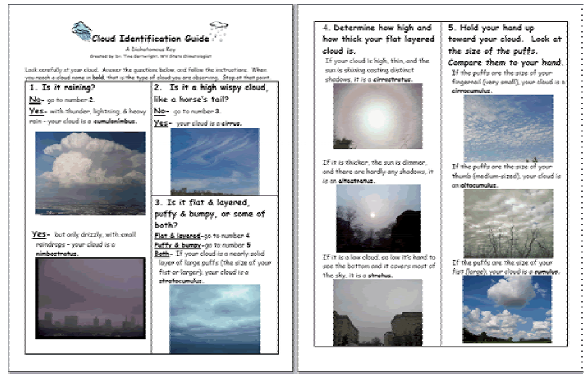

Figure 2: Cloud Dichotomous Key (Found at http://www.wvclimate.org/documents/cloud/CloudID.pdf)

Following a brief discussion on the importance and relevance of atmospheric pressure, an inquiry project was facilitated that led to the understanding of the temporal changes of pressure, temperature, and rainfall along a cold front. After examining the progression of a cold front across the central U.S. (shown in Figure 3), the teachers were divided into teams and given several days worth of data from different stations. They were then asked to identify the location of their station and make a prediction of changes in these variables over the next 24-36 hours.

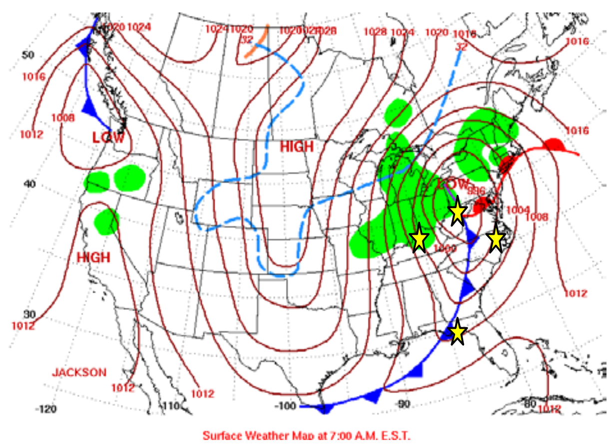

Figure 3. Surface conditions on April 23, 2005 at 7:00 am and the locations of the selected sites to demonstrate expected fluctuations in temperature, solar energy, precipitation and pressure for the activity.

This innovative activity was developed to demonstrate how weather changes associated with a cold front. Students and teachers are accustomed to visualizing weather information across the surface at one time, however, this is not the only aspect of weather variation. This activity centered on enhancing the ability of the participant to integrate data from multiple geographic locations and multiply times to pinpoint the time when the front actually passed through their location. Participants were challenged to assess how a single site's atmospheric variables change as a frontal passage occurs. The goal of the activity was two fold: 1) Identify the correct location of your city from the time series you were given and 2) Predict the time series of your data for the next 36 hours.

Four time series for weather variables recorded at the West Virginia State Climate Center weather station at WVSU during the passage of a strong cold front are shown in Figure 4. After discussion of the fluctuations of temperature, solar energy, precipitation and pressure at the weather station at the West Virginia State Climate Center, participants were given time series of the same weather variables from other locations. After plotting the data and comparing with the given data at WVSU, the participants were asked to select their location and make a prediction of the change in weather variables over the next 36 hours.

Two other optional protocols, relative humidity and surface ozone, were also examined. Following an introduction to the Relative Humidity protocol, the teachers practiced using a sling psychrometer and constructed their own dewpoint hygrometer. The teachers then turned to the GLOBE website where they created diurnal graphs in an effort to determine the diurnal variability of relative humidity (shown in Figure 5).

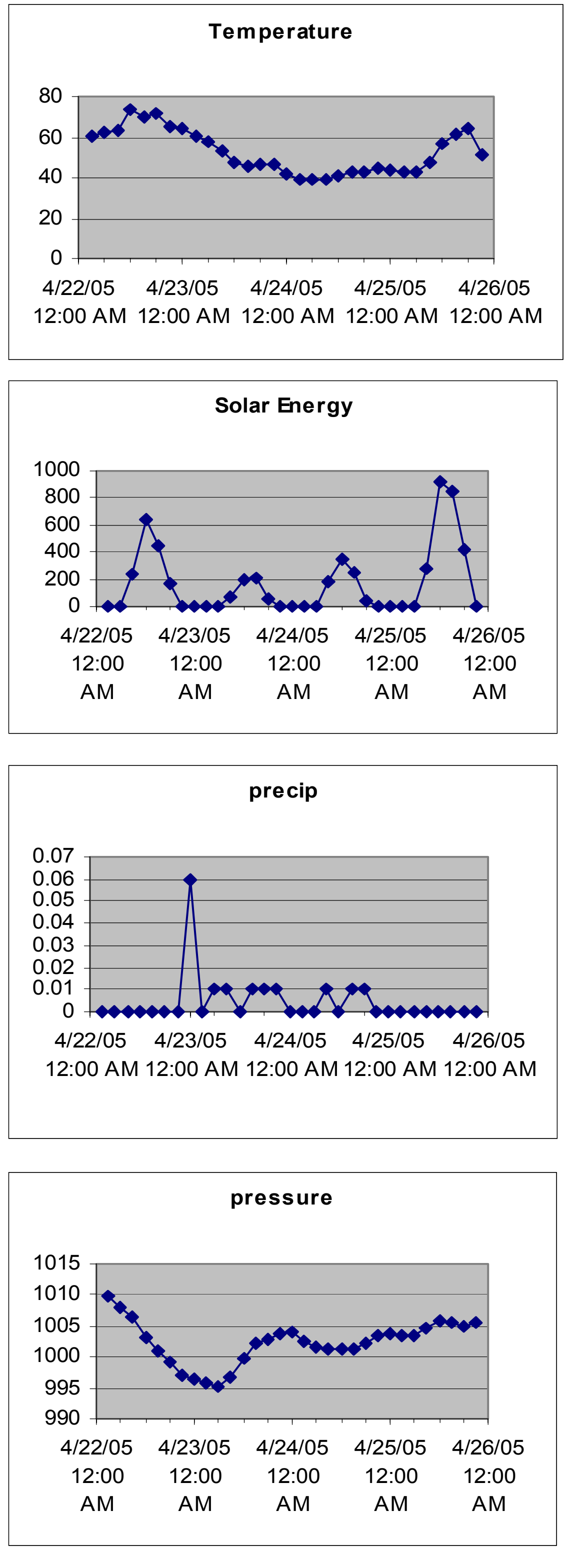

Figure 4. Fluctuations of temperature, solar energy, precipitation and pressure from April 22, 2005 to April 26, 2005 at West Virginia State Climate Center at West Virginia State University.

Figure 5. Participants working at computers creating diurnal graphs of relative humidity.

Figure 6. Parts Per Billion model used by Irene Ladd, Co-Principal Investigator of GLOBE's Surface Ozone protocol.

Figure 7. Workshop participants reading the Zikua reader for surface ozone measurements.

For training on the Surface Ozone protocol, Irene Ladd, co-Principle Investigator, was invited to train the teachers on the uses and importance of ozone data. After an overview of the Zikua reader and construction of a wind measurement device, Ms. Ladd demonstrated the relationship between measurements of surface ozone and other atmospheric variables. In Figure 6, a Parts per Billion model, made up of 12 meter sticks, was used by Ms. Ladd to demonstrate the concept of how big is a billion and the minute concentration of surface ozone. Readings of surface ozone were then taken at the facility so that participants could become familiar with the reader and how it works (Figure 7). All participants were given a Zikua reader to incorporate into their science curriculum.

On the final afternoon of the session, the teachers brainstormed on a project to be performed during the school year with their students. This project will relate the teacher's ozone measurements to weather information collected according to the other GLOBE protocols. In addition, the teachers will compare their ozone data to the other groups to determine any effects based on elevation, location to population centers, industries, or highways. The results of these inquiry projects will then be disseminated to newly certified GLOBE teachers at their follow-up session in the October and November, 2005. Through the presentations of these advanced GLOBE Magnet workshop participants, it is hoped that the newly certified teachers will be then challenged to return for further training in advanced workshops like this.

3.2 FOLLOW-UP PROGRAM

Teachers were required to return for a 1 day session where they will present their work that they have done at their home school for GLOBE. All teachers were challenged to take surface ozone measurements as this was the expensive piece of equipment given to them at the advanced workshop.

One secondary teacher was very excited to incorporate surface ozone measurements into his curriculum. In fact, he challenged 4 of his science classes to each take daily measurements and write a report on their findings. The students were split into multiple groups of 4 where each group attempted to relate their surface ozone measurements to one other atmospheric variable, i.e. wind direction, temperature, precipitation or cloud cover. His students discovered many nuisances about working with real data including outlying values where a mistake was made in the measurement and the need for a large amount of observations to guarantee a statistically significant result. The students found that their once a day measurement was not enough; they needed to utilize all measurements taken by all periods which were 4 times a day for 45 days. The teacher was able to integrate his reading CSO's through the requirement that they write up these results in a final report.

4. CONCLUSIONS

The Advanced Atmosphere Magnet Training Workshop providing training for K-12 teachers where participants reviewed the principal Atmosphere protocols, while learning about important protocols in atmospheric pressure, surface ozone, and relative humidity.

Extensive time was devoted to modeling inquiry during the 3 8-hour sessions. Several activities, including, cloud bingo weather along a cold front, provided opportunities for review of basic atmospheric principles as well as learning more advanced topics.

Two more advanced protocols, relative humidity and surface ozone, were examined in great detail including instruction from the co-Principal Investigator, Irene Ladd. To enhance these content sessions, several activities were incorporated that included analysis of real data.

The workshop concluded as teachers returned to their schools with a Zikua ozone reader and the task of taking observations and relating their observations to other atmospheric variables. This task was best suited for secondary teachers who did, in fact, implement ozone measurements and analyze the measurements in their classroom.

During the follow-up session, which was required for both introductory and magnet workshop participants, results were disseminated to the group. Introductory GLOBE participants discussed how they implemented GLOBE into their classroom and the advanced Magnet workshop participants demonstrated their ozone measurements and data analysis. Through these presentations, it is hoped that the newly certified teachers will be then challenged to return for further training in future Advanced GLOBE Workshops.