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TEACHING ONLINE WEATHER STUDIES AS A HYBRID COURSE IN TRADITIONAL CLASSROOM SETTING

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1. INTRODUCTION

The University of Texas at Brownsville (UTB) is located in the City of Brownsville, Cameron County, Texas approximately 300 yards from USA/Mexico border. In this paper background information about the University, local weather, and the teaching methods and tools implemented for the online weather studies course at UTB are discussed.

2. BACKGROUND

2. 1. The University of Texas at Brownsville

UTB offers baccalaureate degrees in liberal arts and sciences and a variety of professional programs. UTB offers graduate programs at the master's level designed primarily to meet the needs of practicing professionals. Recently The University of Texas system has sent UTB a preliminary approval to offer Ph.D.

UTB provides the only educational opportunity for low income, educationally disadvantaged, and underrepresented Hispanic students in the college service area. In fact, due to economic marginality and great distances to Texas centers of higher education, UTB/TSC is the only higher education option for most residents.

2. 2. Student Enrollment

In the Fall of 2004, over 11,000 students were enrolled in lower and upper division classes at UTB/TSC. The student body is 92.0 percent Hispanic and average 26.0 years of age. While UTB serves many traditional students, a significant number of non-traditional students are first generation college students. The university estimates an enrollment of 20,000 by 2010.

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2. 3. Geoscience Education at UTB/TSC

Geoscience education and research is conducted in the Department of Chemistry and Environmental Science at UTB/TSC. Currently there are five fulltime Geology/Geography faculty and five fulltime Chemistry faculty. The department offers a Bachelor of Science in Chemistry and Environmental Science, and minor in Chemistry, Environmental Science, Geoscience and Geography.

2. 4. LOCAL WEATHER

The climate of the Brownsville region is classified as humid subtropical. The climate here is dominated by proximity to the Gulf of Mexico and characterized by prevailing southeasterly winds. Summers are usually hot and humid, while winters are often mild and dry. The hot weather is rather persistent from late May through September, accompanied by prevailing southeasterly winds. There is little change in the day-to-day summer weather except for the occasional thunderstorm or a tropical system (**Table 1**), which produces much of the annual precipitation within the region. The cool season, beginning about the first of November and extending through March, is typically the driest season of the year as well. Winters are typically short and mild, with most of the precipitation falling as drizzle or light rain. Polar air masses, which penetrate the region in winter, bring northerly winds and sharp drops in temperature resulting in freezing for short periods of time. The region experienced a historical snowfall of 1.5 to 6" on December 25, 2005 (**Figure 1**).

Figure 1. Snow covered foreground infront of UTB building, December 25, 2004

Table 1. Tropical systems that affected Brownsville area from 1980 to present (From National Weather Service, 2003 and Hurricane city, 2004)

Date	Description
1880 August 13	Major hurricane.
1887 September	14 killed; 10.78" of rain.
1933 September	Category 3 Hurricane; A storm surge of 13 ft; 40 dead; Heavy damage reported up to Corpus christi.
1967 September 20, **Beulah**	Landfall at mouth of Rio Grande river; 136mph winds; Gusts of 80 mph; 15 inches of rain; 13 dead; Estimated 95 tornadoes associated with Beulah; 2 of 3 local T.V stations knocked off the air; about 15ft storm surge; up to 30 inch rain in some areas.
1980 September 9, **Allen**	Category 3 Hurricane; Landfall near Port Mansfield; 115mph winds dumping 15 inches of rain; Moderate damage; 2 dead.
2003 August 16, **Erika**	Category 1; Landfall 45 miles to the south of Brownsville; Winds of 75 mph; 2 dead in Montemorelos, Mexico; Minor coastal flooding in South Texas.
2005 July 20, **Emily**	Category 3; Landfall 75 miles to the south of Brownsville; 1 death and $310 million dollar damage in Mexico.

3. COURSE DEVELOPMENT

Author has participated in the online weather studies course implementation workshop organized by the American Meteorological Society (AMS) during the summer of 2004 in Kansas City, MO and attended the 85th Annual Meeting of American Meteorological Society held in San Diego, CA during January 9-13, 2005. Online weather studies course was developed with two components: 3 hour lecture and 1hour lab (co-requisite). This course satisfies general education requirement.

4. ENROLLMENT

At the beginning of the fall semester of 2005, 30 students were enrolled in online weather studies course (figure 2). After first week of classes the enrollment dropped to 25. After the last day to withdraw with 'W' grade, the enrollment dropped to 23 (figure 3).

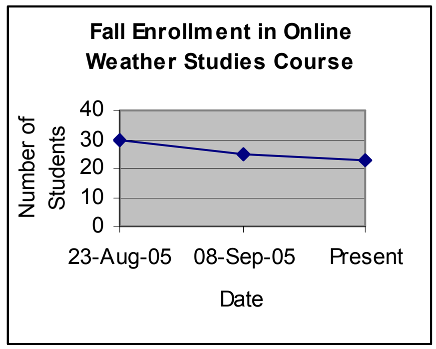

Figure 2. Fall enrollment trends in online weather studies course

Figure 3. Students of fall 2005 meteorology class at UTB

5. COURSE FORMAT

5. 1. Course Requirements

Students are required to take 3 tests, 4 quizzes and 1 final comprehensive exam during the semester. They are required to work on a weather project (section 6. 2) and participate in two field trips (section 6.5).

5. 2. Grading
The following grading system is being utilized for the course: **3** Tests (**45**%); **4** Quizzes, lowest grade dropped (**10**%); Comprehensive Final (**20**%); Weather Project (**20**%); Attendance (**5**%); *Letter Grading*: A >= **90**%; B **80**-**89**%; C **70**-**79**%; D **60**-**69**%; F < **60**%.

6. TEACHING TOOLS AND METHODS

In this section some of the teaching tools and methods developed and/or implemented for this course are discussed.

6. 1. Lectures and Laboratories

Author developed Powerpoint presentations for the chapters discussed in the Online Weather Studies Text Book. Two lecture seminars are planned in order to complement the classroom lectures. During the first seminar Mr. Kurt Van Speybroeck, Science and Operations Officer, NOAA Brownsville Forecast Office, delivered a presentation on "Monitoring Weather". The second seminar is scheduled during the last week of the classes.

The laboratories utilize lab manual and online exercises. A recent addition to the laboratory activities involves weather analysis of the hour at the beginning of each laboratory session. The following data documents are being utilized for this activity: a. Forecast page for Brownsville at the website - http://www.srh.noaa.gov/ifps/MapClick.php?CityName=Brownsville&state=TX&site=BRO
b. Isobars, Fronts, Radar, & Data map for that day from the Online Weather Studies course website. Students are asked to relate the weather parameter, radar and frontal data to the observed weather and cloud patterns just outside the classroom building.

6. 2. Weather Project

For weather project students are asked to collect weather parameter and weather summary data for two cities twice a day, three days per week for 3 months. Brownsville is the common city for all the students. As a second location students selected a city of their choice from a list prepared by the instructor. Students are required to analyze the collected data and to write a report. They were asked to address the following questions in their reports:

a. Changes in the weather parameters due to the change in the time of the day.
b. Changes in the weather parameters due to the change in the month.
c. Changes in the weather parameters due to the change in the latitude.
d. Changes in the weather parameters due to the change in the elevation.
e. Changes in the weather parameters due to any specific weather event such as thunderstorm, snowstorm or any other phenomena.
f. Any other criteria.

6. 3. Hurry, Hurry, It is a Hurricane- A case study

In the month of July on 20th Brownsville area was hit by hurricane Emily. Author collected satellite and radar imagery for Emily published by NOAA-Brownsville Forecast Office on their websites. Selected images were utilized to develop the following case study. This case study is appropriate to be used for classroom discussion or as a homework assignment.

6. 3. 1. Goals, concepts and tools: This case study is designed to introduce students to the weather elements (temperature, pressure, humidity, wind), tropical weather systems (hurricane), and application of satellite imagery in understanding weather. It centers around the following **concepts**: Lows or cyclones, water vapor and cloud formation, temperature conditions within an active tropical storm system, variation in air moisture within an active tropical storm system, rainfall due to tropical storm system. The **tools** utilized for the case study are: Online satellite and radar imagery for active hurricanes published by NOAA.

6. 3. 2. Description
"Watch out for Hurricane Emily, I think it might hit the Brownsville area next week" read the e-mail from my friend, meteorology professor, Tom, sent to me on July 13, 2005. Emily made landfall as a category 3 hurricane a week later on wednesday, July 20 at around 6:30 am 75 miles south of Brownsville. Two days before Emily hit this area my friend Andy at the NOAA Brownsville Forecast Office told me that Emily will make a landfall about 75 miles to the south of Brownsville. Hurricanes are known for the destruction they cause. Emily came and dissipated without affecting Brownsville area much. But it caused extensive damage in Mexico. Katrina and Rita followed Emily and devastated certain areas along the Gulf coast. But then what is the main

factor behind the destruction? I wanted to know more about the hurricane. So, I collected NOAA satellite and radar imagery (figures 4, 5 and 6) (NWS/BRO, 2005) for Emily.

Figure 4 is showing visible, infrared and water vapor images (top to bottom) of Emily at the landfall. Figures 5 and 6 are showing radar images of Emily. I would like to extract information from these images and better understand the atmospheric processes associated with the hurricanes.

I made the following observations on these images:

a. Bands within the hurricane system both on the satellite (figure 4 and 5) and radar images.

b. Bands in the rain fall radar images (figure 5) differ in structure from those seen in the satellite images (figure 4)

c. The color coding on infrared and water vapor images indicates heterogeneity (middle and bottom images, figure 4)

d. Internal structure of Emily appears different on infrared and water vapor images (middle and bottom images, figure 4)

e. Eye of Emily is discernible on visible, infrared and water vapor images but not on the radar images for storm total and rainfall (figures 4 and 5)

To explain these observations answers for the following are needed:

a. How are satellite and radar images obtained?
b. What is recorded on the visible light, infrared, water vapor and radar images?
c. What do the dark and bright areas on visible light satellite image represent?
d. How to read the color code on infrared and water vapor images?
e. What are the applications of the satellite images? How are these applications different from those of radar images?
f. How do bands in the radar images compare with the bands on the satellite images?
g. Why are the color coded areas on radar storm total and rainfall images not symmetrical around the eye of the hurricane?
h. Where are the most intense rainfall areas with respect to the position of the eye?
i. What type of atmospheric circulation the hurricanes are associated with?

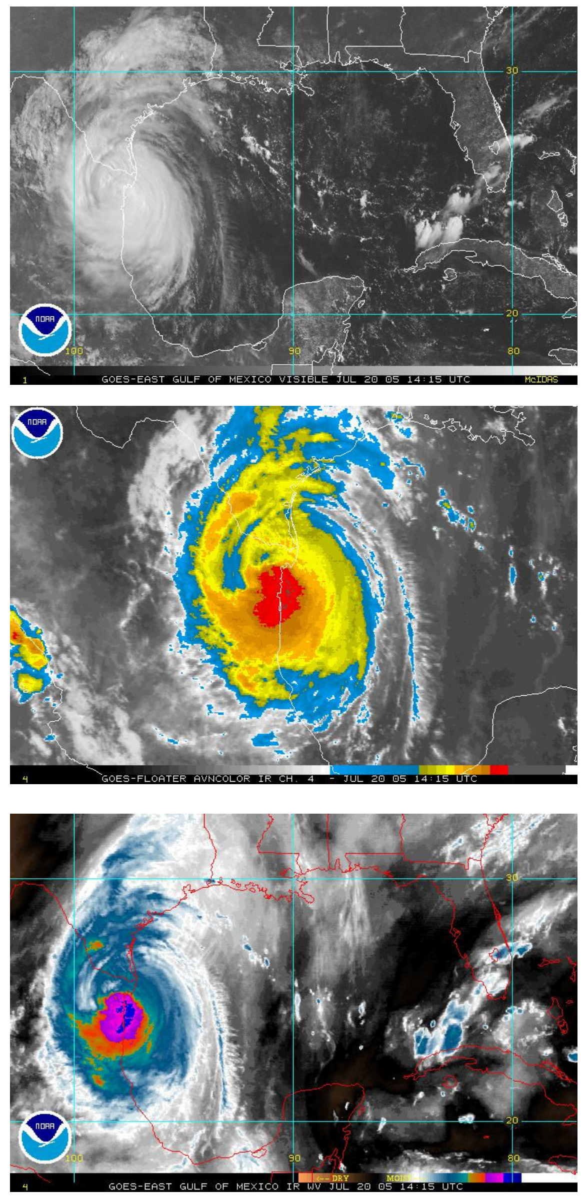

Figure 4. Visible, infrared and water vapor images of Emily at the landfall 75 miles to the south of Brownsville

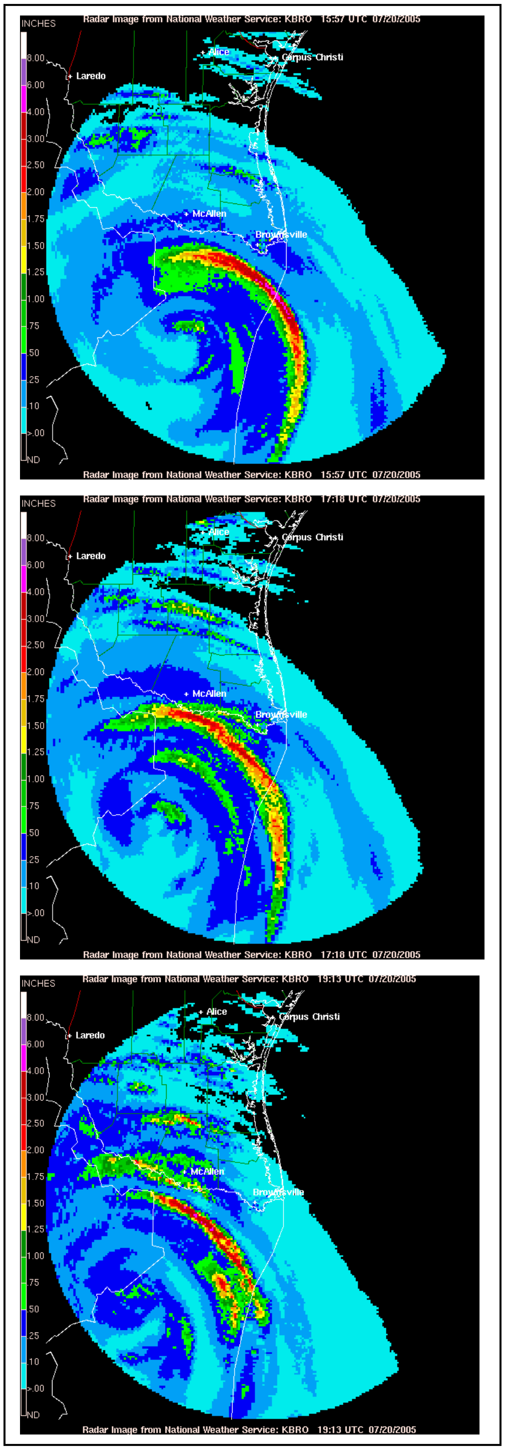

Figure 5. NOAA Rainfall radar images of Emily as it ploughed through Mexico

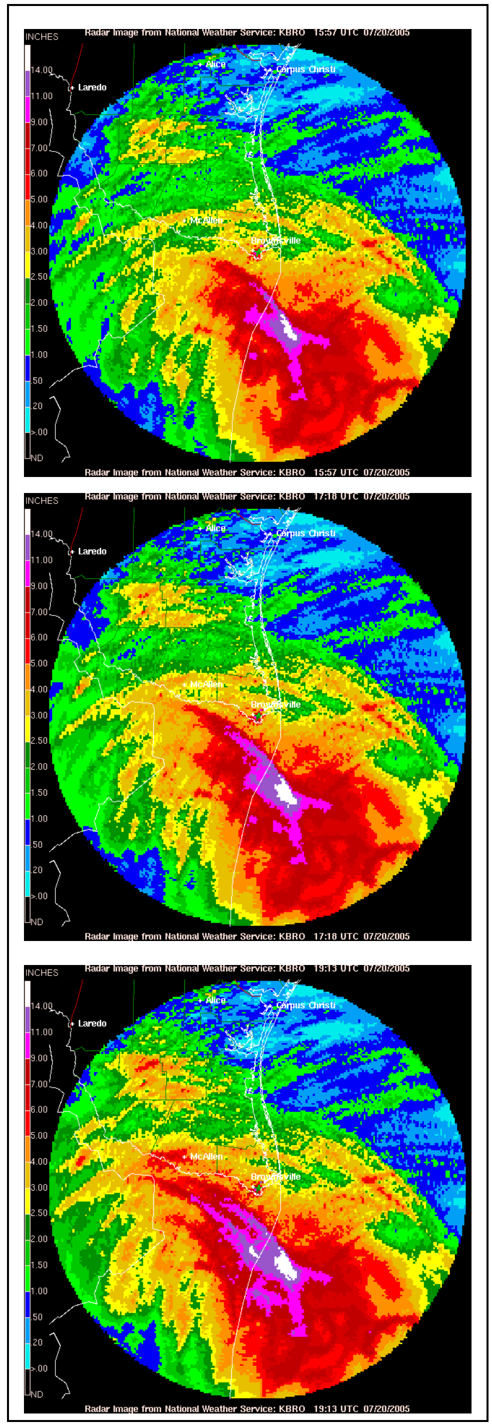

Figure 6. NOAA Storm total radar images of Emily as it ploughed through Mexico

6. 4. Tutoring

Tutoring services for the Online Weather Services course are available to the students at the Learning Assistance Center, UTB (figure 7). Students are encouraged to participate in the tutoring sessions.

Figure 7. Students from fall 2005 online meteorology class participating in tutoring session conducted by Dave Smith (certified meteorologist and tutor) in the Learning Assistance Center, UTB.

6. 5. Field Trips

Two field trips, one to the NWS Brownsville forecast office and another to the Channel 5 Weather Studio, are part of the course requirements. During the recent field trip to the NWS office students had a chance to learn about the weather operations run by the office and about the forecasting methodology (figure 8.).

7. REFERENCES

Hurricane city, 2004, Website on Brownsville history with tropical systems; http://www.hurricanecity.com/city/brownsville

National Weather Service, 2003; Website on Hurricane Data for Southern Texas; http://www.srh.noaa.gov/bro.htm

Figure 8. Students from fall 2005 online meteorology class with meteorologists (Jim Campbell and Kurt Van Speybroeck) from NWS Brownsville forecast office infront of radome.

8. ACKNOWLEDGEMENTS

I am thankful to Elizabeth Mills and Ira Geer for the opportunity to participate in the Online Weather Studies project. I am thankful to UTB for the encouragement. Online weather studies listserv discussion was useful in improvising the course.