

**An X-Band Satellite Ground Station for the State of Louisiana  
Coastal Studies Institute Earth Scan Laboratory (ESL)**

**Annual Report: March 24, 2006**

**Highlights:**

The X-band project has provided Louisiana researchers direct access to advanced earth observing satellites including NASA's MODIS sensor, the high resolution Oceansat-1 OCM ocean color sensor, and Radarsat-1 SAR data. Atmospheric, ocean, and land products derived from X-band satellite data are produced in near real-time and accessible from the ESL home page <http://www.esl.lsu.edu>. Several major milestones were achieved this year and include (1) the launch of a totally revised and expanded web page (2) completion of the ESL training lab and (3) facility enhancement of the operations area and training lab with furniture and carpeting. The second and third were funded by a LA Board of Regents Enhancement Grant with matching funds for facility enhancement provided by the LSU School of the Coast and Environment, Dept. of Oceanography and Coastal Sciences and the Coastal Studies Institute.

**Emergency response activities in support of the State of Louisiana**

Earth Scan Lab faculty, staff and students were very involved in emergency response activities during the 2005 hurricane season. Approximately 70 man-days were spent on emergency activities associated with Hurricanes Katrina and Rita. Since 1992, our support to LOHSEP has been provision of real-time satellite imagery for tracking hurricanes and tropical storms and for evaluating changes in track and intensity in support of hurricane evacuation. In the LOHSEP EOC, the ESL currently has a direct feed of satellite data which enables display of real-time images (10 minutes old) with updates as often as every 5 minutes. This gives Louisiana the most timely access to information on changes in hurricane track and intensity. The ESL imagery and animations, with overlays of the predicted track, are continuously displayed on one of the four large screens for all to see.

After Katrina, the X-band satellite data was useful in detecting flooding of New Orleans as well as coastal circulation and oil spills along the coast. The University of Miami CSTARs lab and NOAA NESDIS sent us high resolution SPOT and SAR imagery which provided more details on New Orleans flooding than provided by our own antenna farm. As soon as we could process these data, we provided image products and analyses to LOHSEP, state and federal agencies, the American Red Cross, the LSU Hurricane Center, the LSU FEMA data archive, the LSU ESL web page and the media (B.R. Morning Advocate, WAFB, Time Magazine, and National Geographic, as examples).

In recent years, new atmosphere and ocean products have been developed which are helping to predict both track and intensity. Dr. S.A. Hsu has shown that dry air advection into hurricanes along the western margin can significantly decrease their intensity (Hurricane Lili and Hurricane Ivan are good examples). Dr. N. Walker has shown how

Gulf of Mexico currents and eddies affect hurricane intensity. For example, both Hurricanes Katrina and Rita intensified in less than 24 hours from category 2 to 5 hurricanes as they passed over the Loop Current and its eddies; which provided unlimited heat and moisture to the developing hurricane.

### **Training and Public Outreach**

Undergraduate and graduate students at LSU receive hands-on training in the Earth Scan Laboratory on uses and applications of satellite data from the X-Band antenna system including Terra-1 and Aqua-1 MODIS, Oceansat-1 Ocean Color Monitor, and Radarsat-1 Synthetic Aperture Radar (SAR) data. In 2005, the Earth Scan Lab staff participated in LSU Ocean Commotion, a K-8 educational event held annually in the Assembly Center. Numerous demonstrations were also given to visiting scientists. In 2005, faculty and staff were interviewed and featured on Baton Rouge TV stations, Time Magazine, NPR National radio, National Geographic CD and many others.

A recent BOR enhancement grant has provided workstations for undergraduate and graduate student training. Eight dedicated workstations are available to students for their research and are also used extensively in graduate level classes to give hands-on experience in satellite data processing and analysis.

### **Current and recent LSU research projects that use the Earth Scan Laboratory X-Band facility capabilities**

The Center for Coastal Zone Assessment and Remote Sensing, NASA Group 3 HBCU University Research Centers, (LSU Earth Scan Laboratory is university partner to Southern University-N. Walker P.I.), April 2003-April 2008, LSU budget \$960,000, total award, \$ 6,000,000.

New remote sensing methodologies for the surveillance of ocean features and improved understanding of circulation processes in the Gulf of Mexico, Minerals Management Service Coastal Marine Institute, (Walker, P.I.), September 2002-August 2005, \$346,383.

Assessment and remediation of public health impacts due to hurricanes and major flooding events, LA Board of Regents (Walker, Co-P.I.), April 2002-March 2007, \$107,810.

Rawinsonding of the atmospheric structure over the Baton Rouge area in the summer 2003, Louisiana Dept. of Environmental Quality, (S.A. Hsu, P.I.), \$49,719.

Rawinsonding of the atmospheric structure over the Baton Rouge area in the summer 2004, Louisiana Dept. of Environmental Quality, (S.A. Hsu, P.I.), \$49,741.

Simultaneous measurements of atmospheric visibility, particulate matter, and mixing heights at the Breton area IMPROVE site, Louisiana, Minerals Management Service (S.A. Hsu, P.I.), \$299,979, September 2003- September 2006.

Determining overwater visibility and mixing height using satellite and in-situ measurements over the Gulf of Mexico, Minerals Management Service (S.A. Hsu, P.I.), October 2000-June 2004, \$294,102.

Advancing the training capabilities and satellite data access within the LSU Earth Scan Laboratory, LEQSF Traditional Enhancement: Earth/Environmental Sciences, (Walker, P.I.), July 1, 2004-June 30, 2005, \$70,000.

Deep Water Currents at 92W (Walker, P.I.), Minerals Management Service, 7/99-10/06, \$553,286.

Hypoxia Studies in the Northern Gulf of Mexico (Walker, co-P.I., with Nancy Rabalais, Eugene Turner and Greg Stone), NOAA Center for Sponsored Coastal Ocean Research, May 2003-April 2006, \$ 508,469.

### **Papers published, accepted, or submitted for publication in 2005/6**

Blanchard, B. W. and Hsu, S. A., On the radial variation of the tangential wind speed outside the radius of maximum wind during Hurricane Wilma (2005). *National Weather Association Electronic Journal*, submitted.

Hsu, S. A. and Babin, A., Estimating the radius of maximum wind via satellite during Hurricane Lili (2002) over the Gulf of Mexico. *National Weather Association Electronic Journal*, available online at [http://www.nwas.org/ej/hsu/hsu\\_babin\\_2005.pdf](http://www.nwas.org/ej/hsu/hsu_babin_2005.pdf), 2005.

Walker, N.D., A. Haag, S. Balasubramanian, R. Leben, I. van Heerden, P. Kemp. H. Mashriqui, Hurricane prediction: A century of advances, *Oceanography*, in press.

Kiage, L., N.D. Walker, S. Balasubramanian, J. Barras, Applications of Radarsat-1 Synthetic Aperture Radar imagery to assess hurricane related flooding of coastal Louisiana, *International Journal of Remote Sensing*, 26, 5359-5380, 2005.

Walker, N.D., R.R. Leben, S. Balasubramanian, Hurricane-forced upwelling and chlorophyll a enhancement within cold-core cyclones in the Gulf of Mexico, *Geophysical Research Letters*, 32, L18610, doi:10.1029/2005GL023716, 2005.

Stone, G., N. Walker, S.A. Hsu, A. Babin, B. Liu, B. Keim, W. Teague, D. Mitchell, R. Leben, What have we learned about Hurricane Ivan and its impacts along the northern Gulf of Mexico, *EOS, Transactions, American Geophysical Union*, 86, 497-508, 2005.

Walker, Nan D., William J. Wiseman, Lawrence J. Rouse, Jr., and Adele Babin, Seasonal and wind-forced changes in surface circulation, suspended sediments, and temperature fronts of the Mississippi River plume, Louisiana, *Journal of Coastal Research*, 21, 1228-1244, 2005.