

The LSU Earth Scan Laboratory A Description and Brief History

The LSU Earth Scan Laboratory (ESL), founded by Dr. Oscar Huh, Coastal Studies Institute in collaboration with other CSI faculty, is a receiving and processing facility for environmental data from earth orbiting satellites. The Louisiana Education Quality Support Fund (LEQSF) provided initial funding for its establishment on 29 June 1988. On that day, the ESL received its first satellite image of Louisiana and the Gulf of Mexico from one of the NOAA Polar Orbiting Environmental Satellites (AVHRR) (Table 1). The ESL was the first university-based satellite data receiving station in the nation to be established wholly by state funds. Since that time, it has evolved into one of the leading U.S. university facilities with capabilities for the capture, analysis, and archiving of data from ten satellites. From the rooftop of



the LSU Howe-Russell Geoscience Complex, three antennas capture over 40 Gigabytes (GB) of telemetry data in real-time each day for research, teaching and emergency response for the state of Louisiana. The measurements are rapidly decoded, calibrated, and converted into geophysical measurements and images. A remote sensing/image processing laboratory on the 4th floor of Howe-Russell houses dedicated computer servers and workstations that are used for the processing, visualization, and interactive analysis of the satellite imagery and measurements.

In 1995, the capability to capture and process GOES GVAR data (Table 1) was obtained with funding from the Louisiana Office of Homeland Security and Emergency Preparedness (LOHSEP). This addition provided LSU and Louisiana with the ability to track and study hurricanes, tropical storms, and high velocity currents in the Gulf of Mexico. The GOES measurements are repeated every 15 minutes over a large region encompassing the Gulf of Mexico, enabling the study of atmospheric and ocean features that move rapidly. Additional equipment enhancements were obtained from the Board of Regents in 1995 and 1999. These funds were used to purchase needed hardware and software for the capture and analysis of the Orbview-2 SeaWiFS ocean color data (Table 1), for the surveillance and study of chlorophyll-a in the water and vegetation changes on land.

In 2001, with funding from the Louisiana Technology Innovation Fund (LTIF), the ESL obtained a 4.4m X-Band tracking antenna system to enable real-time reception of satellite data at very high data rates, 150 times faster than the other ESL antennas. This exciting new capability has given Louisiana direct and timely access to new and future advanced high-resolution earth environmental satellites. A whole new generation of sensors, transmitting at high data rates, is being built and launched into orbit to help deal with a wide range of environmental and societal issues. The new sensors are providing significant advancements in spatial, temporal, spectral, and radiometric resolution. For example, the Terra-1 and Aqua-2 satellites, carrying the MODIS sensor, provide daily coverage of the Gulf of Mexico region using 36 channels, at 250m to 1000m spatial resolution, with 12-bit precision (Table 1). These new sensors were designed to enable researchers to detect and quantify, with greater accuracy and frequency, the components of the atmosphere, oceans, and land masses. The Radarsat-1 SAR sensor (Table 1) makes high resolution microwave measurements through clouds, day and night. Technological advances continue to deliver more detailed, reliable, and responsive data streams for research, education, and emergency management activities.

Today, six unique data streams are received daily with ESL antennas (Table 1). These include: NOAA AVHRR (four satellites); GOES GVAR; Orbview-2 SeaWiFS; Terra-1 and Aqua-1 MODIS; Oceansat-1 OCM; and Radarsat-1 SAR (Table 1). In addition, the ESL has amassed a large archive of environmental satellite data over Louisiana and the southeastern U.S. From its central location, the ESL captures data covering the Gulf of Mexico, the western Atlantic region, the eastern Pacific region, Central America, the Caribbean region, and the land mass from Hudson Bay to northern South America. The ESL provides a wide range of environmental satellite measurements that have applications in many fields of research and education including emergency response and management, coastal studies, oceanography, meteorology and air pollution, geography, geology, veterinary medicine, public health, and environmental engineering. Since 1988, the ESL facility has helped to leverage more than \$12 million in research funding for LSU and Louisiana. In addition, assistance to the LOEP during hurricane events may have saved the state of Louisiana millions of dollars. Much of the satellite image data that we receive is offered on the ESL web site only minutes after receiving it. In September and October 2002, over 500,000 hits were received on the ESL web site when Tropical Storm Isidore and Hurricane Lili were bearing down on coastal areas of the northern Gulf of Mexico.

<i>Satellite</i>	<i>Sensor</i>	<i>Acronym</i>	<i>No. of Channels</i>	<i>Pixel Size (km²)</i>
NOAA-12, 14, 15, 16, 17	Advanced Very-High Resolution Radiometer	AVHRR	5	1.2
GOES-12	GOES Variable	GVAR	5	16
Orbview-2	Sea-viewing Wide Field-of-View S	SeaWiFS	8	1.2
Terra-1	Moderate Resolution Imaging Spectro-radiometer	MODIS	36	0.06 – 1.0
Aqua-1	Moderate Resolution Imaging Spectro-radiometer	MODIS	36	0.06 – 1.0
Oceansat-1	Ocean Color Monitor	OCM	8	0.13
Radarsat-1	Synthetic Aperture Radar	SAR	1	0.01

Table 1: Satellite Sensor specifications for data currently received at the ESL