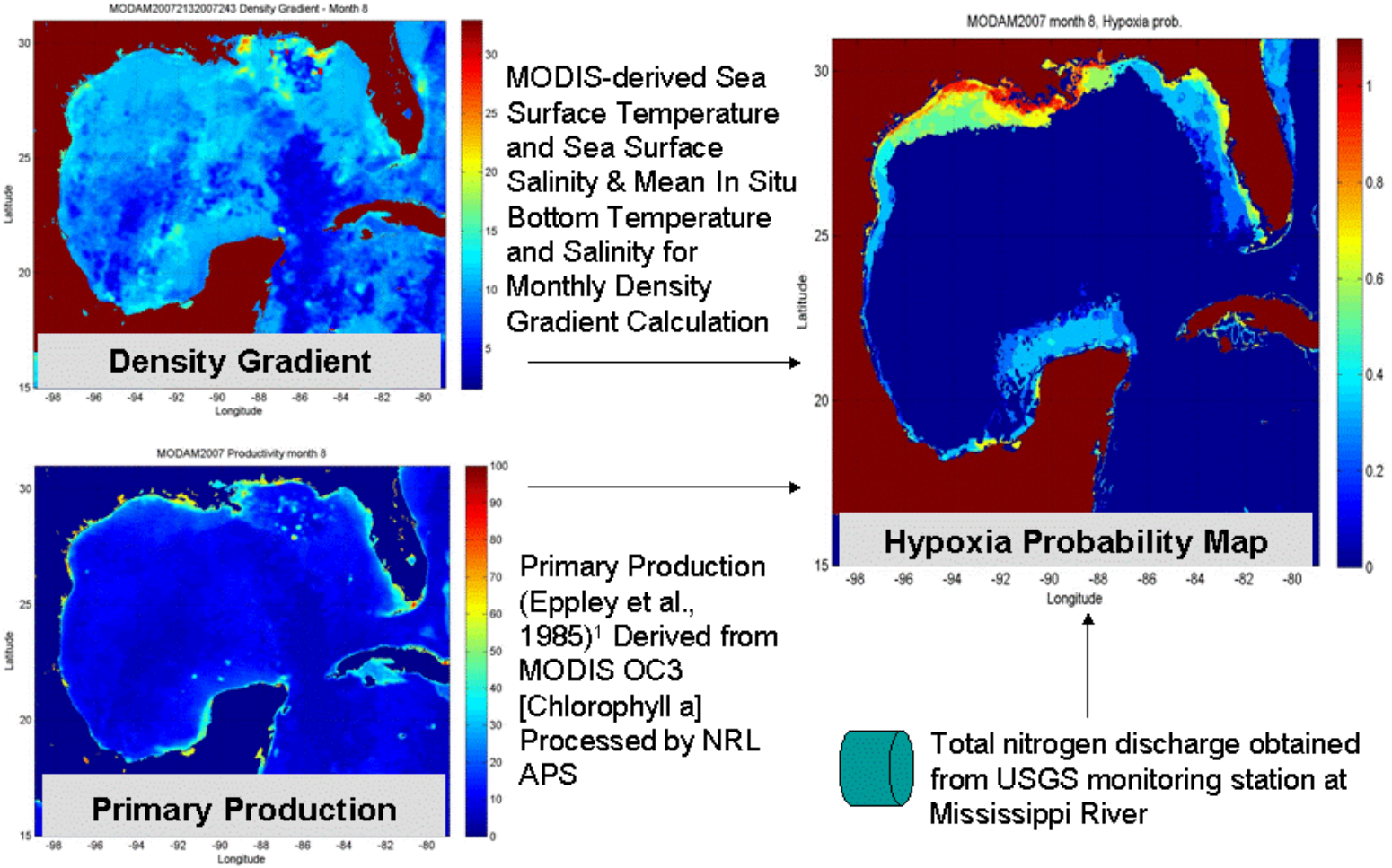
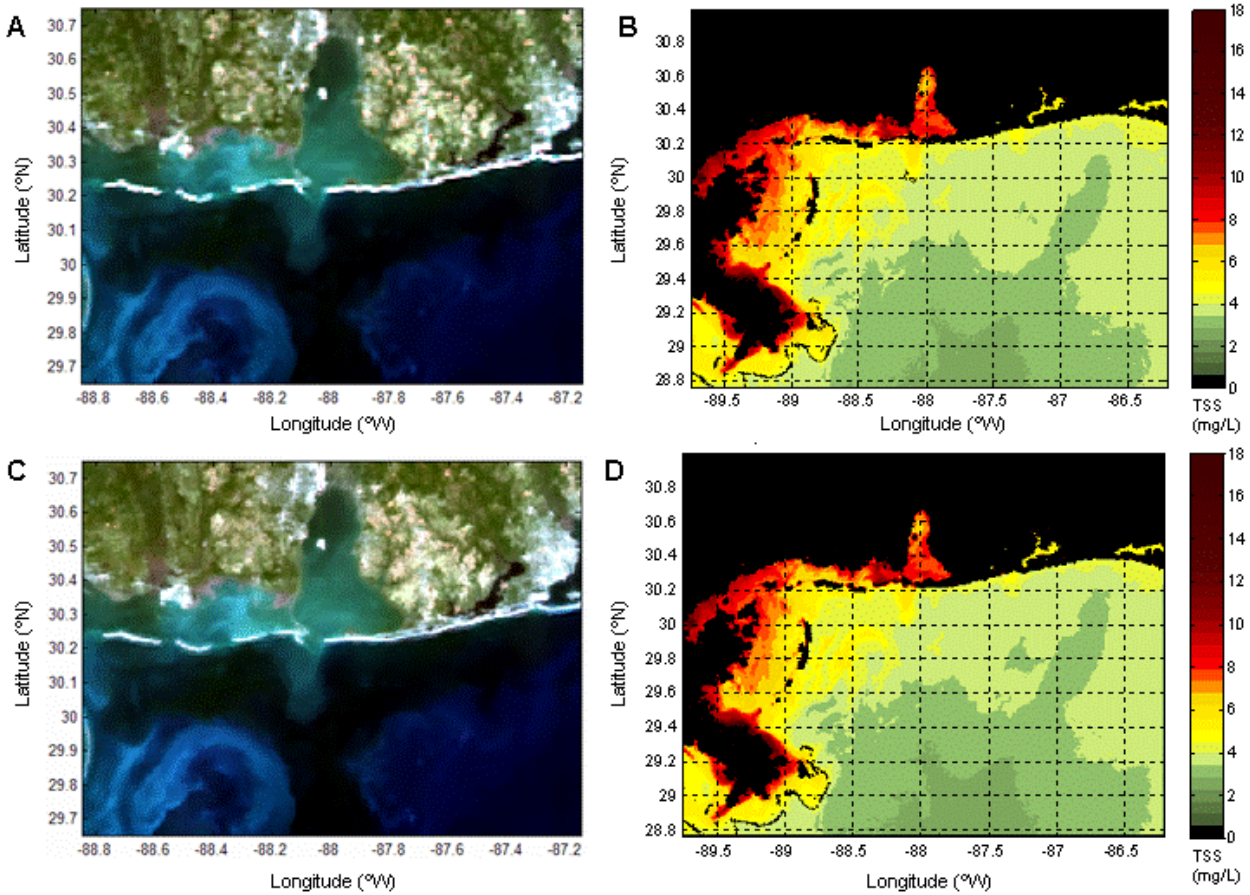
Hypoxia Probability Map



[1]Eppley, R.W., E. Stewart, M.R. Abbott, and U. Heyman. 1985. Estimating ocean primary production from satellite chlorophyll. Introduction to regional differences and statistics for the southern California Bight. *Journal of Plankton Research* 7:57-70

Mobile Bay Sediment Plume Mapping Using MODIS and VIIRS

Purpose: Identify the Mobile Bay sediment plume using MODIS and simulated VIIRS data



MODIS images (A&B, 1000m, 9 Nov 2007) are calibrated and validated using in situ data collected in collaboration with Mississippi State University and Dauphin Island Sea Lab. VIIRS simulations (C&D, 750m, 9 Nov 2007) are based on MODIS data.

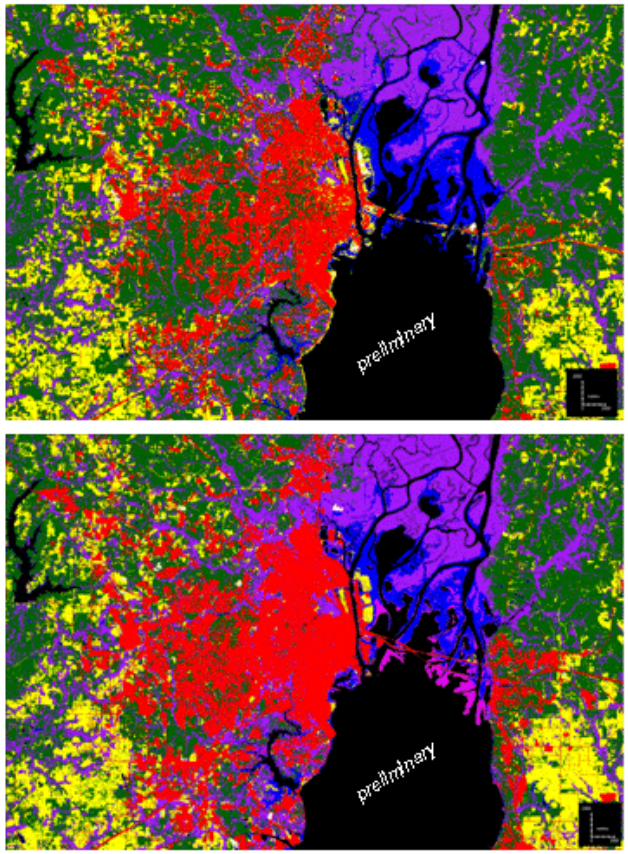
Chalky, white colored waters in A&C indicate higher total suspended sediments (TSS). Higher TSS is evidenced by darker red shades in B&D. TSS concentrations in excess of 8 mg/L are found inside Mobile Bay.

This project demonstrates VIIRS maybe used to detect TSS in coastal waters.

Project Leads: Jean Ellis (NASA, Stennis Space Center) and Maria Kalcic (SSAI, Stennis Space Center)

Gulf of Mexico Alliance Application Pilot: Land-Use and Land-Cover (LULC) Change from 1972-present around Mobile Bay, AL

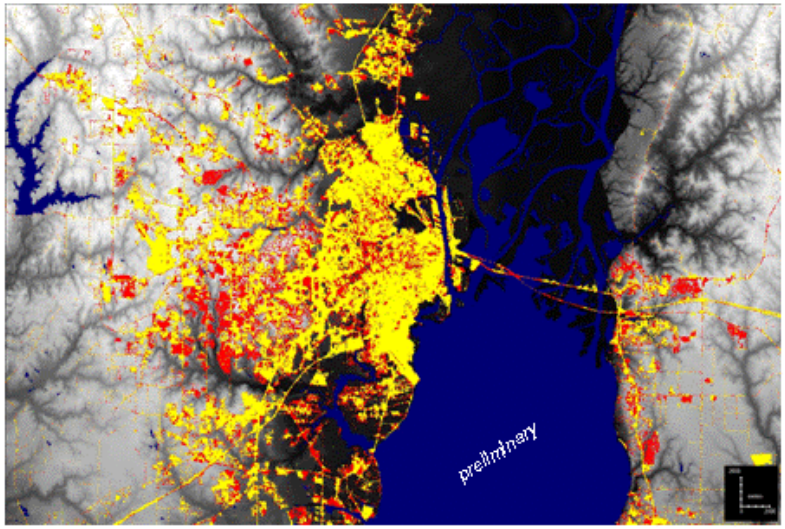
***Purpose*: Assess LULC changes of Mobile and Baldwin counties, AL for 1972-present**



(Top) Landsat MSS (11/12/1974); (Bottom) Landsat TM, reclassified C-CAP image (3/24/2005)

Seven LULC classes in Mobile and Baldwin counties to assess change:
Agriculture - yellow
Barren - white
Open water - black
Upland forest (includes scrub/shrub) - green
Urban - red
Wetland/non-woody - pink
Wetland/woody - purple

Urban Growth, 1974-2005

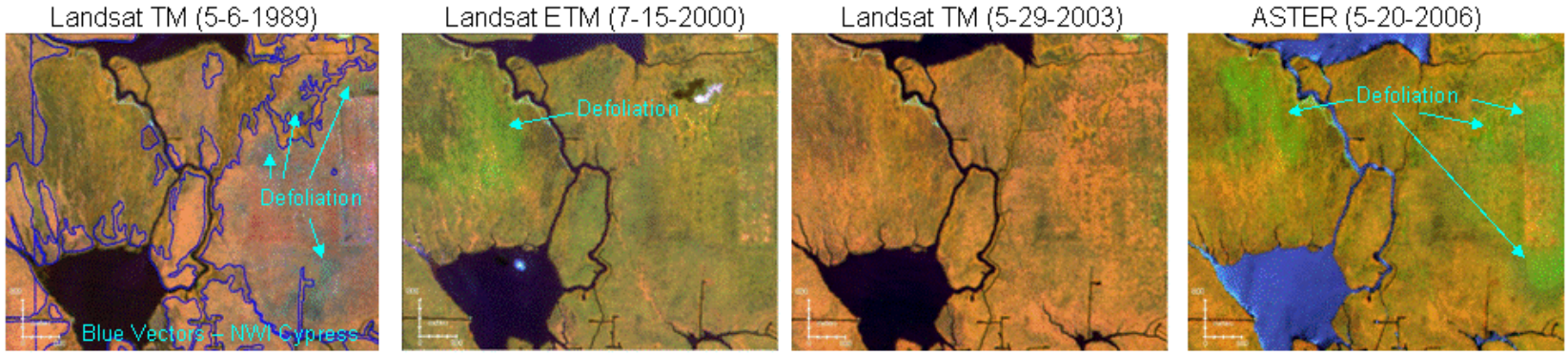


Yellow – 1974 urban extent (Landsat MSS, 11/12/1974); Red – 2005 urban extent (Landsat TM, reclassified C-CAP image, 3/24/2005); Backdrop – USGS DEM, darker grey shades indicate lower elevations

Project Leads: Jean Ellis (NASA, Stennis Space Center), Joseph Spruce (SSAI, Stennis Space Center), Terry McPherson (NASA, Stennis Space Center)

Use of NASA Satellite Data in Monitoring Gulf Coast Forest Conditions

- **Purpose - assess potential of Gulf Coast forest monitoring products derived from NASA satellite data**
  - **Regional monitoring of forest damage from hurricanes**
  - **Stand specific monitoring of baldcypress forest (example below)**
- **Satellite data - MODIS, Landsat, and ASTER**
- **Study areas - coastal Mississippi and Louisiana**
- **Status - acquiring and preparing needed data for preliminary products**
- **GOMA relevance - community resilience, wetland restoration, habitat characterization, and water quality management**



Project Leads: Joseph Spruce (SSAI, Stennis Space Center) and Joseph Grant (NASA, Stennis Space Center)

A.1. NASA Stennis Applied Science Gulf of Mexico Initiative Project Brochures (2 brochures)

Mapping the Data: Data sources and accessibility for COAST

Applicable sources of online data are being compiled and submitted for consideration for inclusion into the COAST project interface. Access methodologies of various types (WMS (Web Mapping Service), online data/product directory, FTP (file transfer protocol), KML (Keyhole Markup Language), OPENDaP, etc.) are being identified for each data source and appropriate tools are being tested for integration into COAST to allow flexible data input options.
Sources of data identified as useful for inclusion in COAST that are accessible through one of COAST's data inclusion tools (TVT, Image Overlay Tool, WMS to Layer Tool, KML Import) will be mapped and stored as accessible layers within the UI. Data access tools are being modified/created as needed to allow ease of mapping to the data as well as user control over class and temporal mapping of the data.

Sharing and Showing: Developing presentation formats within COAST

Techniques/tools are being developed to allow for manual and scripted presentations of data analysis sessions to be shared by users and also to allow for an easily shared collaborative capability within COAST. Initial efforts will focus on creating a capability similar to Dapple's (Geosoft) Worldwind-based "Export Scene" function that allows a project session state to be saved with all data layers, mappings, and viewshed in a single definition file. As an example, this small file could then be shared or posted online to allow a collaborative common reference between project principals.

Exploration and Testing: COAST as project data integrator for Coastal data

COAST capabilities are being tested/demonstrated with ongoing Hypoxia and Regional Sediment modeling studies data that has been identified for investigation and integration into COAST data layers. Modifications or additions to the COAST capability toolset for use with these projects will be identified, tested through user groups, and integrated if proven value added to the community. The SSC development team will also be investigating the possibility of including COAST project definition files as links from ARTPO Web site project description pages and hub sites. If proven feasible, this would take on a similar functionality to the KML Google Earth link schema that would launch a COAST viewer (after download) from the Web site for immediate online project data discovery by individuals. It is hoped that this functionality would provide a significant value-added capability for the current subject data user community.

For more information please contact the following at Stennis Space Center:

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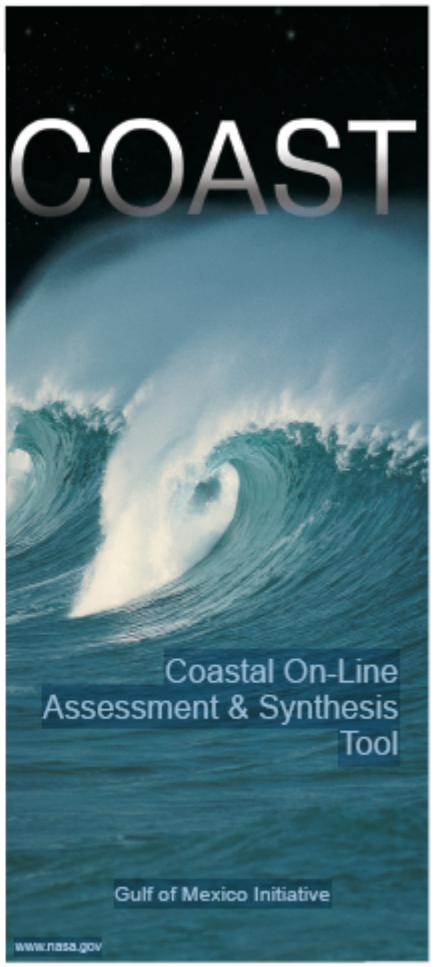
Gulf of Mexico Initiative

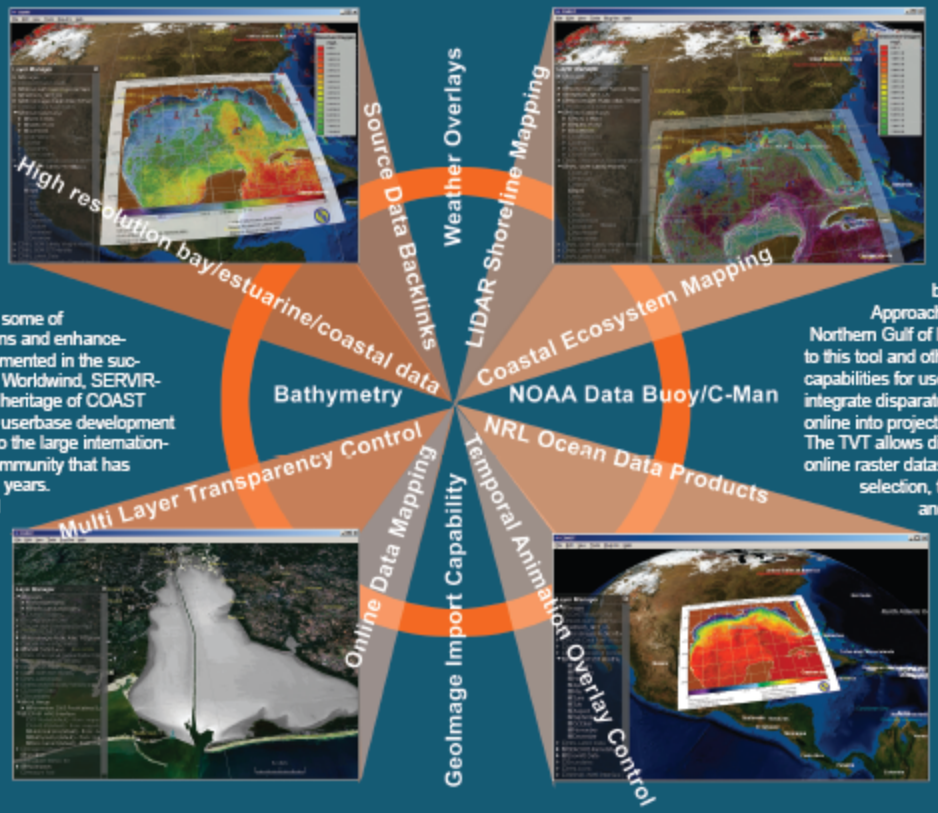
National Aeronautics and Space Administration



COAST: NASA OpenSource Heritage Leveraged for Scientific Insight

The Coastal Online Assessment and Synthesis Tool (COAST) geobrowser is being developed at NASA SSC for use in integrating previously disparate NASA and other agency coastal data sets into a common desktop tool that will provide insightful new data visualization and analysis capabilities for the coastal researcher. COAST is built upon the immensely successful NASA opensource 3D geobrowser, Worldwind, developed at NASA Ames Research Center. COAST also has integrated some of the value-added modifications and enhancements that have been implemented in the successful MSFC versioning of Worldwind, SERVIR-Viz. The NASA opensource heritage of COAST from Worldwind lends great userbase development leverage and usability due to the large international opensource developer community that has grown over the past several years.

COAST is being developed to make maximum use of open source data access, viewing, and data manipulation software tools for a low-cost, widely installable base of potential users upon completion of the initial COAST release. Because COAST is a developmental tool, subsequent changes/enhancements to its core capabilities will be reflected in regular incremental reports that coincide with major lifecycle modification points.

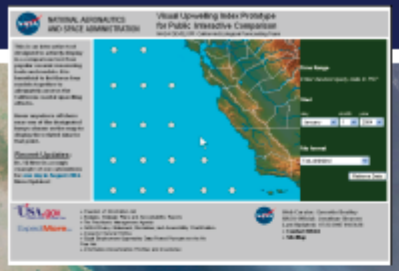


Discovery and Fusion: User Interface and Additional Tools

An optimal user interface (UI) is being prototyped and tested by the SSC development team. This interface will provide a user-friendly, yet data-robust and efficient means for users to discover, visually analyze, and access imagery and related data layers from within COAST and allow for linkage back to the raw data source if available online for further analysis outside of the UI. The interface will be built upon the initial developmental Temporal Visualization Tool (TVT) UI for COAST begun in the 2007 Integrated Approach to Monitoring Hypoxia in the Northern Gulf of Mexico project. Modifications to this tool and others will be targeted to allow capabilities for users to connect to and map/integrate disparate datasets located locally and online into project sessions for COAST users. The TVT allows direct data listing of accessible online raster datasets and subsequent multi-selection, temporal overlay animation, and transparency control over the animated layer within COAST.

Initial efforts are focusing on smarter data access and sorting by classification and temporal range within the UI and also on developing techniques for establishing look-back connections to origin data to allow for direct linkage to external data analysis and processing tools from within COAST that are germane to the parent project.

California Ecological Forcasting Project
Determining Coastal Upwelling Indices



Mexico Air Quality Project
Tracking Pollutant Pathways

- DEVELOP has awarded internship opportunities to students from across the nation since 1998
- DEVELOP has extensive publications including press articles, abstracts, poster presentations, and radio interviews
- DEVELOP has a national impact with projects, student participation, and leveraged resources
- DEVELOP projects have been utilized by community policy and decision makers

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http://develop.larc.nasa.gov

National Aerospace and Space Administration
www.nasa.gov

NP-2008-03-66-LaRC

National Aeronautics and Space Administration

NASA

Community Benefits of Applied Sciences

DEVELOP

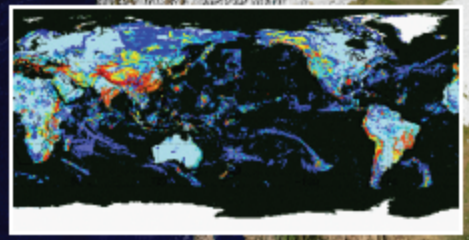
DEVELOP

http://science.hq.nasa.gov

Community Benefits of Applied Sciences

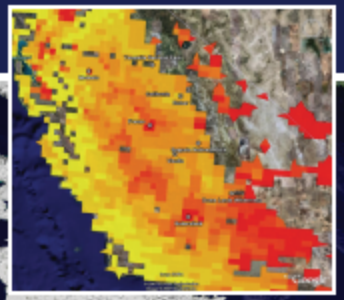
The DEVELOP Program fosters human capital development to extend NASA Earth science research to local, state, and scientific communities. Advisors and mentors from NASA and partner organizations assist students to incorporate NASA science measurements and predictions into projects that address local policy and environmental concerns.

DEVELOP students initiate projects in response to community demand. A recent project example was to detect and map hurricane damage to identify forest fire risk in states along the U.S. Gulf Coast. NASA's ICESat Earth Observing System detected changes in forest canopy height indicating hurricane damage. Projects such as this enable students to build relevant work skills while increasing the collective understanding of complex environmental issues.



Global Disaster Management Project
Mapping Thermal Anomalies

California Air Quality Project
Measuring Airborne Pollutants



DEVELOP is sponsored by NASA's Science Mission Directorate, Applied Sciences Program. DEVELOP activity is located at five NASA centers including Ames Research Center, Goddard Space Flight Center, Langley Research Center, Marshall Space Flight Center, and Stennis Space Center. Several regional locations also support DEVELOP nationwide activity.

Internship opportunities are available during the spring, summer, and fall. Applications are encouraged from high school, undergraduate, and graduate students with strong interests in science, technology, and policy.

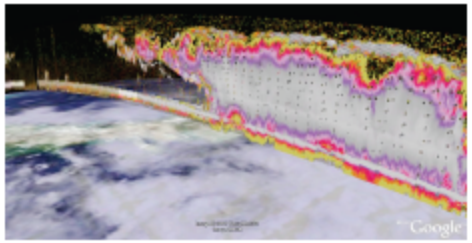
Additional information about DEVELOP can be found at http://develop.larc.nasa.gov.

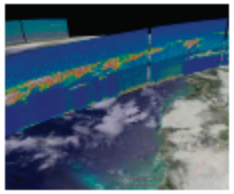
Gulf Coast Coastal Management Project

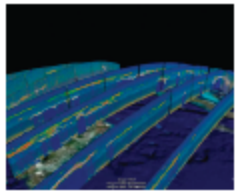
Assessing Hurricane Forest Damage

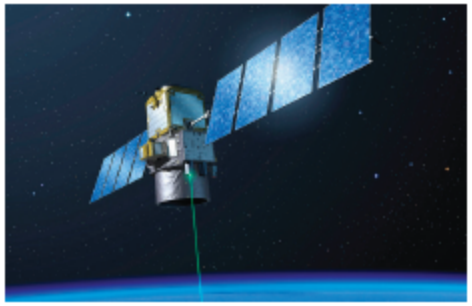
CALIPSO Data Visualization Project

The DEVELOP CALIPSO Data Visualization team developed a multi-platform, deployable tool which enables the CALIPSO science team to visualize data recorded by CALIPSO's active lidar instrument, CALIOP in 3-D. The tool is composed of three sub-elements, the geometric parameter model, an image-rendering model, and a KML builder. The result was an effective CALIPSO visualization tool, which creates KML files that can be uploaded into Google Earth. Using this tool, researchers and the public can view scientific data concerning the Earth's atmosphere in a three dimensional format.









http://develop.larc.nasa.gov

A.2. NASA Stennis Applied Science Gulf of Mexico Initiative, Mobile Bay Flyer

NASA EARTH SCIENCE

Gulf of Mexico Alliance Applications Pilot

A collaboration between NASA Applied Sciences Program and the Gulf of Mexico Alliance

In response to the U.S. Ocean Action Plan, representatives from thirteen federal agencies convened to form the Gulf of Mexico Regional Partnership Federal Workgroup to provide support to the Gulf of Mexico Alliance in addressing priority coastal and ocean issues facing the Gulf of Mexico region. Working through this Federal Workgroup, NASA will work to apply NASA remote sensing data products to regional management requirements defined by the Alliance partnership.

THE GULF OF MEXICO ALLIANCE

The Gulf of Mexico Alliance is a partnership of the five U.S. Gulf States – Alabama, Florida, Louisiana, Mississippi, and Texas – with the goal of significantly increasing regional collaboration to enhance the environmental and economic health of the Gulf of Mexico. The Alliance also works to facilitate collaboration with the six Mexican Gulf States. The Alliance has identified six priority issues that are regionally significant and can be effectively addressed through increased collaboration at state, local, and federal levels. These priorities represent a focus for initial action through the Alliance:

- Water quality for healthy beaches and shellfish beds;
- Wetland and coastal conservation and restoration;
- Coastal community resilience;
- Environmental education;
- Identification and characterization of Gulf habitats; and
- Reducing nutrient inputs to coastal ecosystems.

The five U.S. Gulf State Governors released the Governors' Action Plan for Healthy and Resilient Coasts in March 2006. The plan challenges the Alliance partnership to make tangible progress over 36 months on 73 specific activities, setting the stage for a long-term partnership that can address an expanded suite of issues, culminating in a healthier Gulf of Mexico ecosystem and economy.

FEDERAL SUPPORT TO THE ALLIANCE

The Bush Administration's U.S. Ocean Action Plan (USOAP) recognizes the leadership that the five U.S. Gulf States have demonstrated in forming the Alliance and identifying regional priorities, and calls for increased integration of resources, knowledge, and expertise to address these priorities. As a result, NOAA and EPA co-chair a thirteen agency Federal Workgroup to support Gulf State leadership and coordinate an integrated federal response to priority regional issues identified by the Alliance. As a member of this Federal Workgroup, NASA will work to apply NASA remote sensing data products to regional management requirements defined by the Alliance partnership.

PILOT OVERVIEW AND OUTCOMES

NASA Applied Sciences Program will research and develop specific applications of NASA remote sensing data products based on the requirements and input of state and local coastal resources managers. During the first year of this effort, NASA will work within the regional collaboration network of the Gulf of Mexico Alliance to evaluate the utility of NASA data products in enhancing the decision-support capabilities of coastal resource managers. Ultimately, NASA will lead the deployment of an Internet-based desktop capability to deliver to these managers NASA remote sensing data products in a decision-support tool. Recognizing that NASA is a research mission agency, it will be necessary for NASA's federal agency partners to transition the final pilot product to an operational capability and host the decision-support tool. NASA will work within the Gulf of Mexico Alliance Federal Workgroup to secure the necessary partnerships.

This effort will be piloted in the Mobile Bay and Weeks Bay, Alabama, and Grand Bay, Mississippi study area, preeminent examples of dynamic estuarine ecosystems in the northern Gulf of Mexico. In addition, Grand Bay and Weeks Bay are components of NOAA's National Estuarine Research Reserve System and Mobile Bay is a component of EPA's National Estuary Program. NASA will investigate, through future efforts, the transferability of pilot project products to the rest of the Gulf of Mexico region and other coastal regions of the U.S.

NASA will proactively coordinate with other related efforts in the Gulf of Mexico region and specifically in the study area, including:

- NASA's Gulf of Mexico Regional Collaborative (www.gomrc.org)
- USGS, USACE, and NOAA's Priority Habitat Information System, or PHINS (ecowatch.ncddc.noaa.gov/habid_public)
- NOAA's Integrated Ecosystem Assessment (IEA) in the Gulf of Mexico region, where NOAA seeks to improve the operational management of coastal and marine ecosystems by integrating physical, biological, and social information.

INITIAL MILESTONES

October 2007 to March 2008 – NASA and its Federal partners will conduct interviews to develop, evaluate, and validate candidate applications of NASA remote sensing data products to state and local coastal resource management requirements.

For More Information Please Contact Initial Federal Pilot Partners

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A.3. Satellite Information for Coastal Applications

NASA Satellite Utility: 2007 Core Mission Review

	CoMRP Ranking	NOAA	USGS	Navy	Other DOD
Aqua	**Very High**	Very High	Very High	Very High	Very High
MODIS	*Very High*	*Very High*	*Very High*	*Very High*	*Very High*
AIRS	*Very High*	*Very High*	*NA*	*Very High*	*Very High*
AMSR-E	*Very High*	*High*	*NA*	*Very High*	*Very High*
CERES	*NA*	*NA*	*NA*	*NA*	*NA*
Terra	**Very High**	Very High	Very High	Very High	Very High
MODIS	*Very High*	*High*	*Very High*	*Very High*	*Very High*
ASTER	*High*	*NA*	*High*	*NA*	*High*
CERES	*NA*	*NA*	*NA*	*NA*	*NA*
MISR	*NA*	*NA*	*NA*	*NA*	*NA*
MOPITT	*NA*	*NA*	*NA*	*NA*	*NA*
TRMM	**Very High**	High	Some Utility	Very High	Very High
QuikSCAT	**Very High**	Very High	NA	Very High	Very High
Jason	**Very High**	Very High	NA	Very High	High
CloudSat	**High**	Some Utility	NA	High	Very High
SORCE	**High**	High	NA	NA	High
GRACE	**High**	NA	NA	NA	High
ICESat	**Some Utility**	NA	Some Utility	NA	High
EO-1	**Some Utility**	NA	NA	NA	Very High
ACRIMSAT	**NA**	NA	NA	NA	NA

Current Missions: Direct Coastal Applications

Jason-1
Ocean Surface Topography
Ocean Circulation

GRACE
Ocean Circulation

QuikSCAT
Wind speed and direction over the Earth's oceans

Terra and Aqua
MODIS (harmful algal blooms, etc.)

NPP → **2009**
VIIRS (harmful algal blooms, etc.)

OSTM → **2008**
Ocean Surface Topography

Aquarius
Sea surface salinity

Decadal Survey Missions: Direct Coastal Applications

SMAP (Soil Moisture Active Passive) **2010-13**

- Algal Blooms
- Water-Borne Infectious Disease
- Surface water and ocean topography

2013-16

SWOT (Surface Water/Ocean Topography)

- Ocean circulation
- Algal Blooms
- Water-Borne Infectious Disease
- Surface water and ocean topography

GEO-CAPE (Geostationary Coastal and Air Pollution Events)

- Coastal Water Quality
- Algal Blooms
- Water-Borne Infectious Disease

ACE (Aerosol/Cloud.Ecosystem)

- Algal Blooms
- Water-Borne Infectious Disease

PATH (Precipitation and All-weather Temperature and Humidity)

- Algal Blooms
- Water-Borne Infectious Disease

2016-20

GRACE II

- Ocean Circulation
- Sea surface height