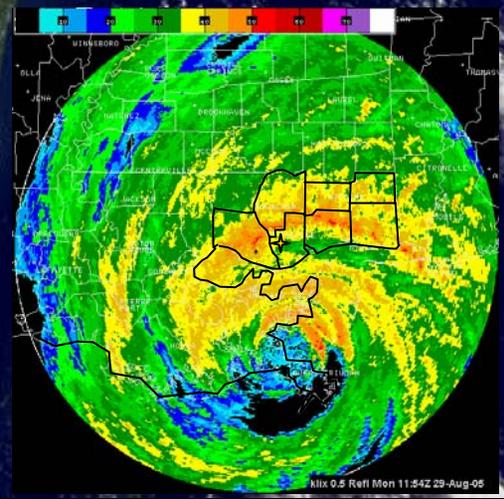
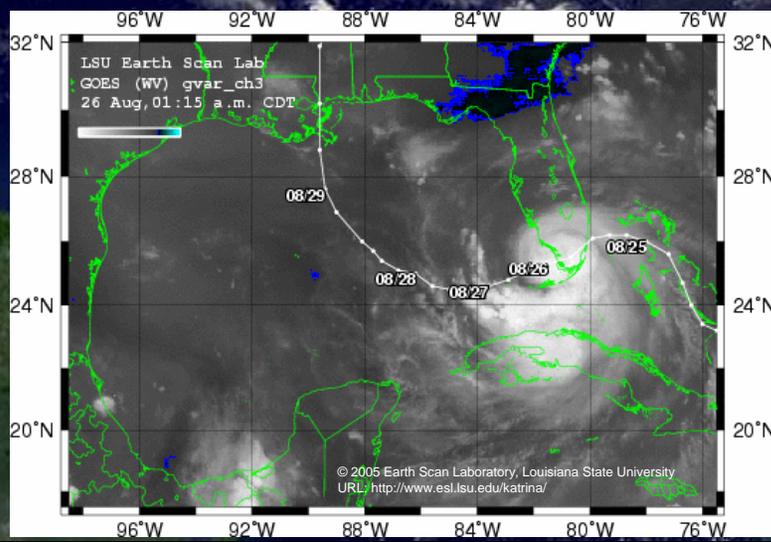
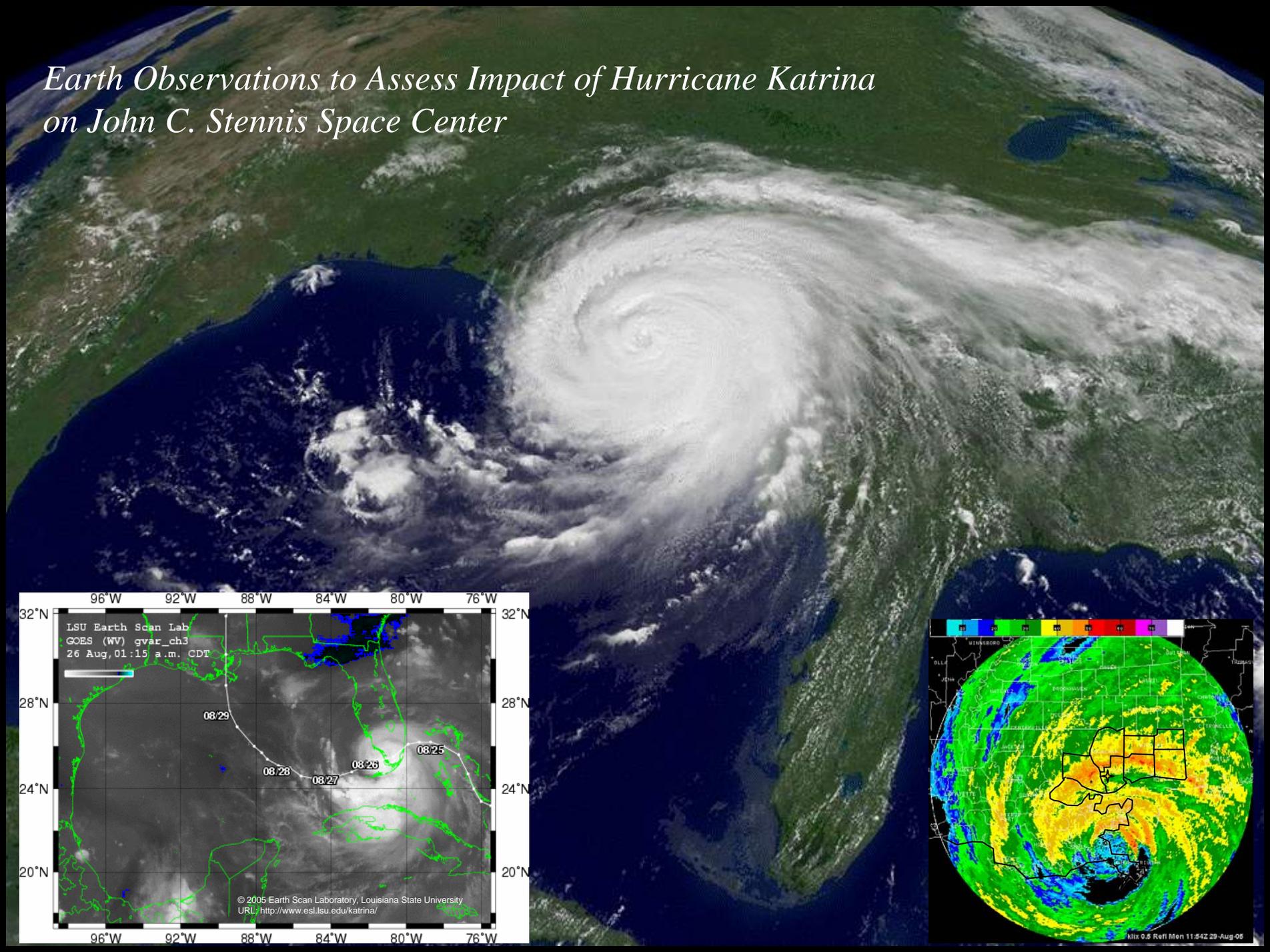


Earth Observations to Assess Impact of Hurricane Katrina on John C. Stennis Space Center





Earth Observations to Assess Impact of Hurricane Katrina on John C. Stennis Space Center

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Fairfax, VA, USA
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THE CHALLENGE

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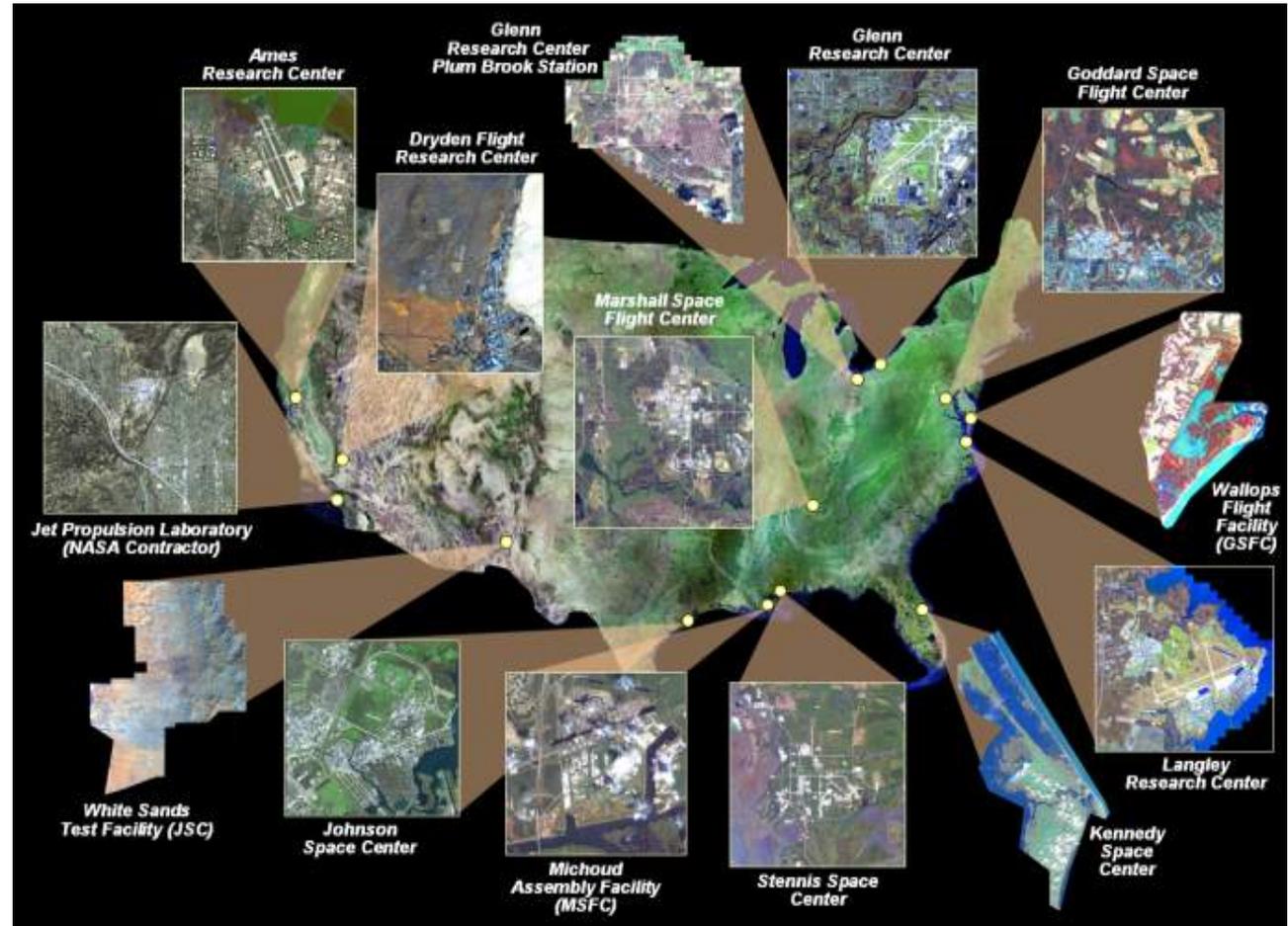
NASA infrastructure is at risk from hurricanes

NASA Space Operations Mission Directorate (SOMD)

- Johnson Space Center
- Kennedy Space Center
- Michoud Assembly Facility
- Marshall Space Flight Center
- Stennis Space Center

NASA Aeronautics Research Mission Directorate (ARMD)

- Langley Research Center
- Wallops Flight Facility



OVERVIEW

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Threat

- 4 of 5 SOMD Centers at peril
 - 2004: Charlie, Francis, Ivan, & Jeanne
 - 2005: Katrina, Rita, Wilma
 - 2006: Ernesto

Post-Event Impacts

- Power & communication lines within & beyond SSC
- Computer hardware and networks were inoperative
- Staff displaced

Incorporate site assessment information into ground processing designs and operational planning

(NASA Internal Briefing, January 2007)

Hurricane risk mitigation to SOMD critical facilities

- Hazard & vulnerability assessment
- Mitigate from vulnerability
- Topographic & climatological character

Minimize Center recovery time post hurricane

- Distributed network
- Nodal functionality



DELIVERABLES

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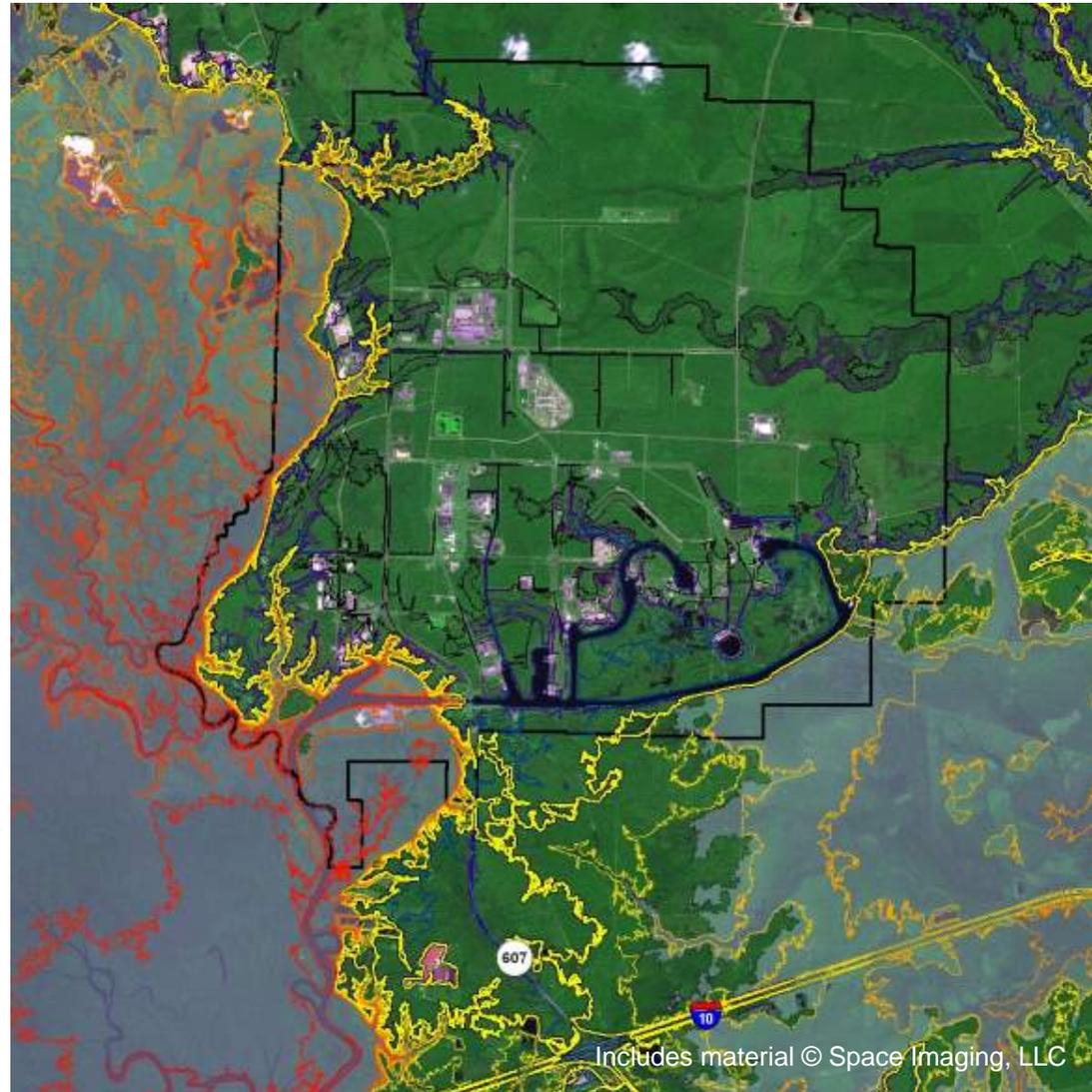


Pre-Event Hazard Assessments

- Winds and surge vulnerability
- Inundation threat & elevation mapping
- Digital infrastructure mapping
- Vegetation mapping and health assessment
- Emergency response planning maps
- Suitability surveys
 - Temporary relocation
 - Resource storage & deployment
 - Heliports

Post-Event Hazard Assessments

- Storm damage assessment
 - Forest & timber
 - Infrastructure
- Fire fuel and fire risk assessment
- Inundation, surge, and flood assessments
- Resource deployment maps
- Invasive species & public health issues
 - Natural habitats/ecosystems impacts
 - Health impacts to humans



ALL SOURCE INTEGRATION (GROUND & AIR)



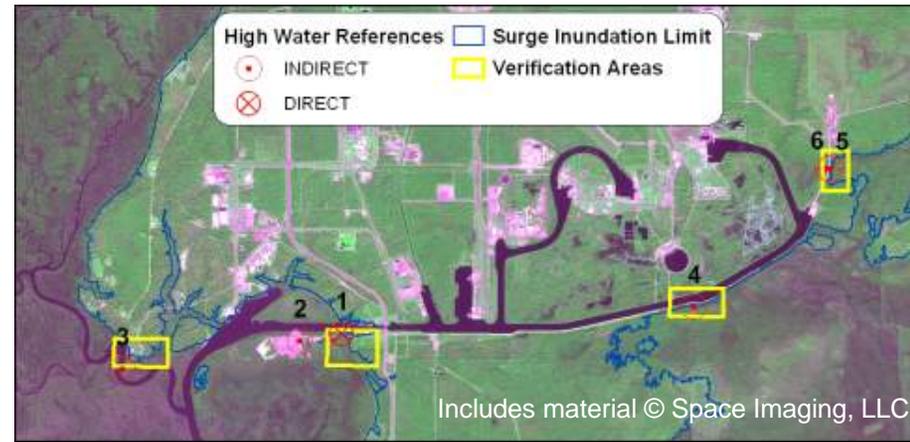
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Ground Networks/Measurements

- Conventional Weather Stations (through NOAA National Climate Data Center)
- Fire Weather Stations: WIMS (Weather Information Management System) /RAWS (Remote Automated Weather Stations)
- FEMA High Water Mark Surveys

Airborne

- Imagery: U.S. Army Corps of Engineers, NOAA Remote Sensing Division
- Lidar NOAA Coastal Services Center, other



RAWS Station photo by Phil Blakley

As demonstrated in the Hurricane Katrina response, all sources must be integrated into compatible spatio-temporal scales and coordinate systems to create effective decision support

ALL SOURCE INTEGRATION (SATELLITE)

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High Resolution Commercial Satellite

- GeoEye IKONOS & OrbView
- DigitalGlobe QuickBird

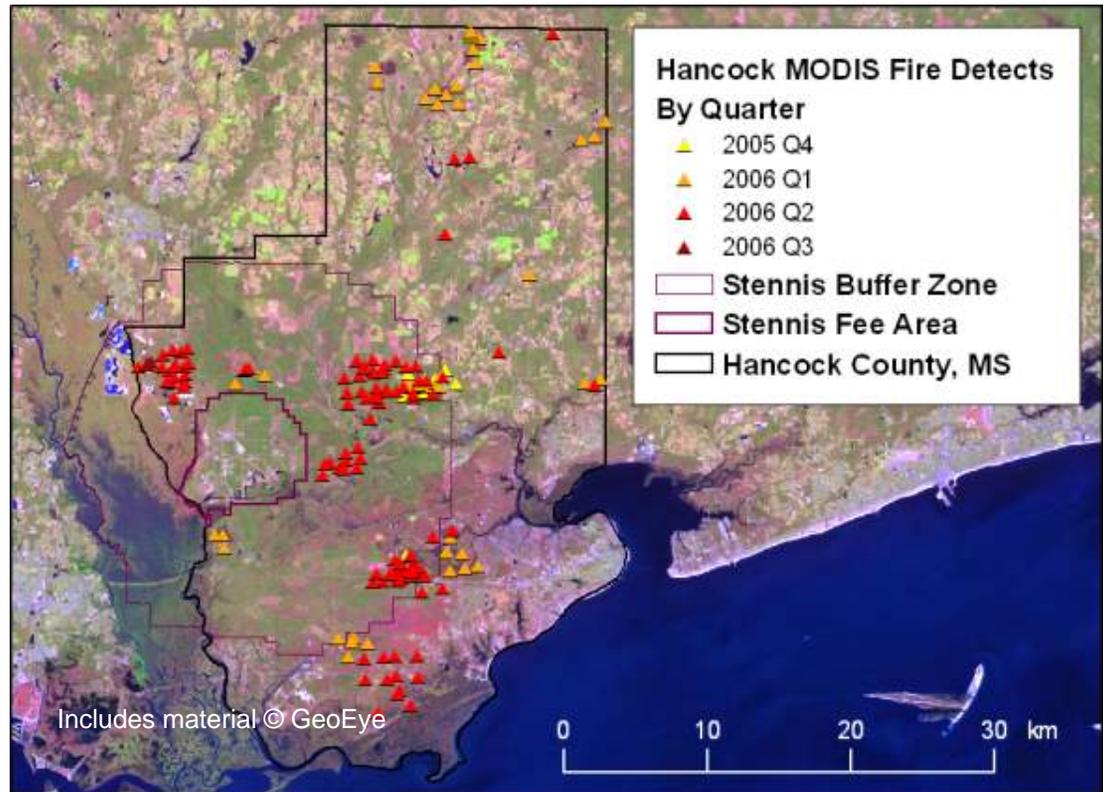
Medium Resolution (Landsat-like) Satellite

- Landsat 5/7
- AWiFS (Advanced Wide Field Sensor)
- DMC (Disaster Monitoring Constellation)

High Temporal Satellite

- MODIS (Moderate Resolution Imaging Spectroradiometer)
- GOES (Geostationary Operational Environmental Satellites)

To compare various imaging systems it is vital to normalize based on validated radiometric calibrations



ALL SOURCE INTEGRATION (ADDITIONAL)



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Surface Radar

- NEXRAD (Next Generation Radar)

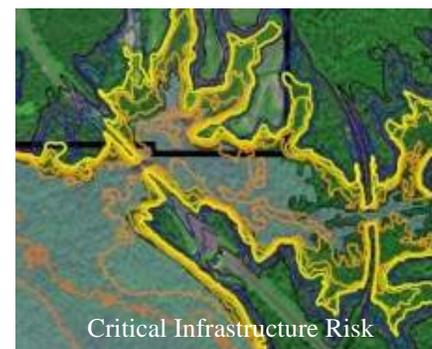
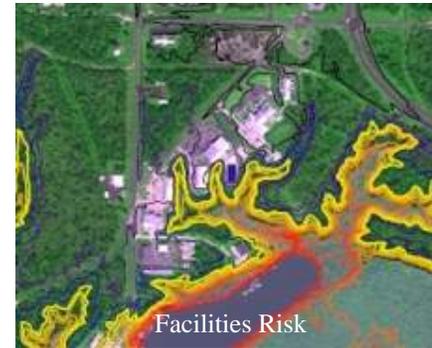
Satellite Radar

- Precipitation: TRMM (Tropical Rainfall Measuring Mission)
- Inundation: RADARSAT
- Water Levels: Jason-1, Geosat Follow-On

Passive Microwave

- Precipitation: SSM/I (Special Sensor Microwave Imager)
- Soil Moisture: AMSR-E (Advanced Microwave Scanning Radiometer - Earth Observing System)

Looking beyond the SSC Katrina experience, there are several data sources that should be integrated into future hurricane decision support efforts

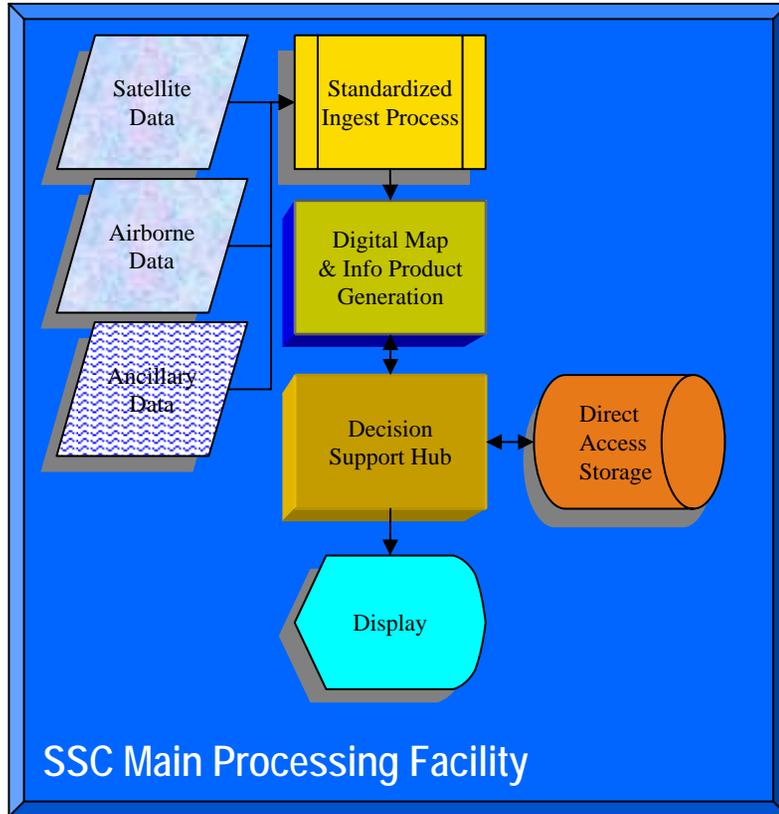


Includes material ©
Space Imaging, LLC



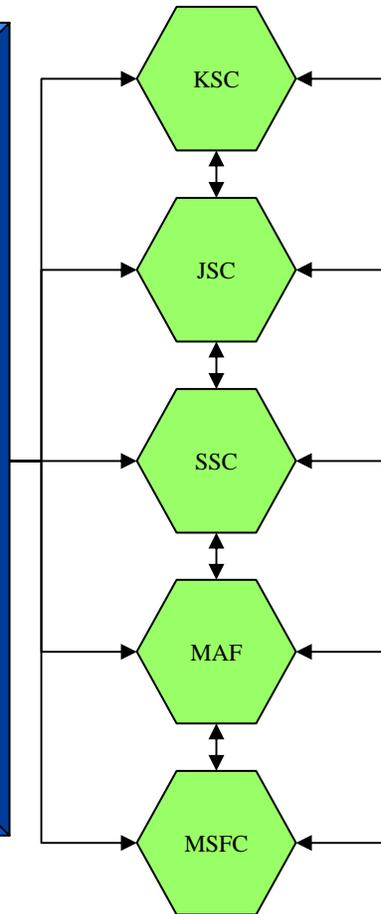
ARCHITECTURE

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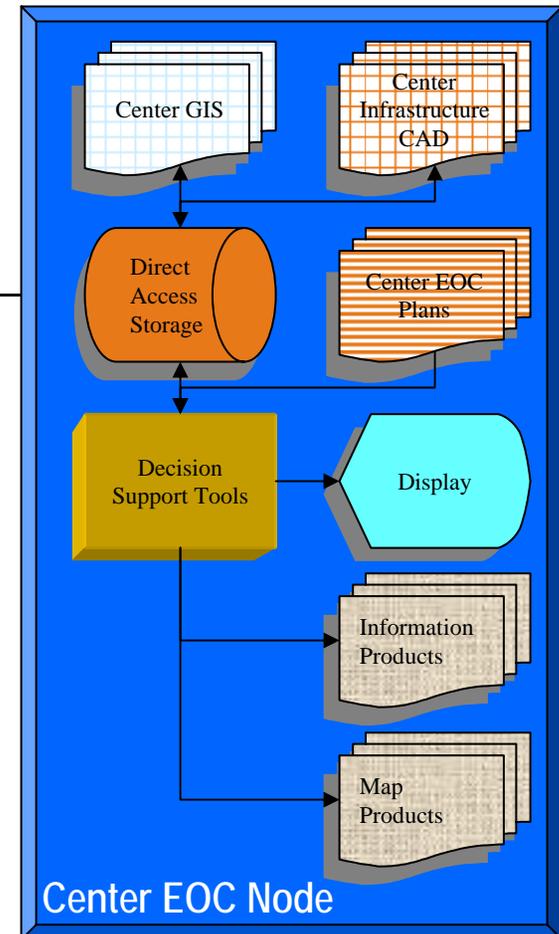
SSC Main Processing Facility

- Digital Data Ingest
- L0 To L4 Processing
- QA/QC & Storage
- Distribution



Center EOC Nodes

- Digital Data Ingest From SMPF
- Local EOC Plan Ingest
- Hardcopy Output



Center EOC Node



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