

MRC FORMULATION REPORTS SUMMARY

MISSISSIPPI STATE UNIVERSITY

MSU FORMULATION REPORT – I

1. Candidate Solution Constituents

a. Title: Evaluation of Jason 2 Poseidon-3 Altimeter Data to Enhance NOAA’s NOS (National Ocean Service) Shoreline Mapping

b. Authors: Alarcon, V. J., O’Hara, G. G., and Lalitha Dabbiru, GeoResources Institute, Mississippi State University

c. Identified Partners: NOAA (National Oceanic and Atmospheric Administration), EPA (Environmental Protection Agency)

d. Decision Support Tool / System: EFDC (Environmental Fluid Dynamics Code), ADCIRC (Advanced Circulation Model)

e. Alignment with National Application: Coastal Management

f. NASA Research Results – Table 1:

Missions	Sensors/Models	Data Product
OSTM (Ocean Surface Topography Mission) /Jason 2	Poseidon-3 Altimeter	Altimetry data

g. Benefit to Society: The benefits from science-based generation of shorelines are directly related to sea level rise

2. Abstract

The goal of Coastal management is to enable partner’s beneficial use of NASA Earth-Sun system science results, observations, models, and technology to enhance decision support capabilities serving their coastal management and policy responsibilities. This project focuses on Coastal Management in conjunction with issues of importance to the NOAA’s NOS Shoreline Mapping. The goal of this project is to utilize NASA data products to aid NOAA’s NOS Shoreline Mapping by providing enhanced and science-based shorelines using reproducible data, methods, and approaches.

MSU FORMULATION REPORT – II

1. Candidate Solution Constituents

a. Title: Landcover Dynamics for Enhanced Watershed Modeling and Conservation Monitoring

b. Authors: Alarcon, V. J., O’Hara, G. G., and Lalitha Dabiru, GeoResources Institute, Mississippi State University

c. Identified Partners: U.S. Department of Agriculture, USFWS (US Fish and Wildlife Service)

d. Decision Support Tool / System: AGNPS (AGricultural Non-Point Source)

e. Alignment with National Application: Water Management, Agricultural Efficiency

f. NASA Research Results – Table 1:

Missions	Sensors/Models	Data Product
GPM (Global Precipitation Measurement), LDCM (Landsat Data Continuity Mission)	GMI (GPM Microwave Imager), LIS (Land Information System), ETM+ (Enhanced Thematic Mapper Plus)	Precipitation measurements

g. Benefit to Society: Enhanced ability to spatially represent crop tillage practices, estimate crop distribution and crop rotation.

2. Abstract

The proposal would focus on evaluating data product types that could add significant value to the activities of the initiative including; crop residue information to enable monitoring and spatial depiction of tillage practices in watershed modeling, thermal, infrared, and other data for identification of tiled drainage areas, crop residue information for modeling and time-series meteorological data and simulated Global Precipitation Measurement (GPM) data for enhanced precipitation, ET, and soil moisture data for the area. The proposal builds upon recent advances in remote sensing science for deriving information about crop residue, soil moisture, and Land Information System modeling to deliver enhanced meteorological data for environmental simulation modeling.

MSU FORMULATION REPORT – III

1. Candidate Solution Constituents

a. Title: Existing and Simulated NASA Data Products and Model Assimilation Technologies for Enhanced Coastal Hydrologic and Water Quality Modeling

b. Authors: Alarcon, V. J., O’Hara, G. G., and Lalitha Dabbiru, GeoResources Institute, Mississippi State University

c. Identified Partners: U.S. Environmental Protection Agency (EPA)

d. Decision Support Tool: Hydrological Program Fortran (HSPF) and the Water Quality Analysis Simulation Program (WASP), Soil and Water Assessment Tool (SWAT), Gridded Surface Subsurface Hydrologic Analysis (GSSHA)

e. Alignment with National Application: Water Management, Coastal Management

f. NASA Research Results – Table 1:

Missions	Sensors/Models	Data Product
GPM (Global Precipitation Measurement), LDCM (Landsat Data Continuity Mission)	GMI (GPM Microwave Imager) VIIRS (Visible/Infrared Imager/Radiometer Suite)	Precipitation measurements

g. Benefit to Society: Reduction of pollutant inputs to water bodies in the design of Best Management Practices (BMPs)

2. Abstract

The proposal is focused in coastal watersheds to overcome current limited availability of data for watershed hydrology and water quality modeling. We propose using simulated Global Precipitation Measurement (GPM), Moderate Resolution Imaging Spectroradiometer (MODIS), simulated Visible Infrared Imager Radiometer Suite (VIIRS), and simulated Landsat Data Continuity Mission (LDCM) data, for generation of new land-use maps, and precipitation, chlorophyll-a, and water surface temperature (SST) input time-series for watershed hydrology and water quality modeling. The decision support tools (DSTs) for which the data will be generated are the Hydrological Program Fortran (HSPF) and the Water Quality Analysis Simulation Program (WASP). The introduction of new land-use maps and time series generated with simulated NASA-products will enhance the performance of water resources models in general, and HSPF and WASP models in particular, along with facilitating the design of Total Maximum Daily Loads (TMDLs) and Best Management Practices (BMPs).

MSU FORMULATION REPORT – IV

1. Candidate Solution constituents

- a. **Title:** Evaluation of Multi-Resolution NASA Data to Enhance Coastal Change Analysis Program
- b. **Authors:** Sung-Jun Kim, Charles G. O’Hara, and Lalitha Dabbiru, GeoResources Institute, Mississippi State University
- c. **Identified Partners:** NOAA Coastal Service Center
- d. **Specific DST/DSS:** C-CAP (Coastal Change Analysis Program)
- e. **Alignment with National Application:** Coastal Management
- f. **NASA Research Results (Table 1):**

Missions	Sensors/Models	Data Product
LDCM (Landsat Data Continuity Mission)	ETM+ (Enhanced Thematic Mapper Plus)	30 m multispectral, 15m panchromatic
NPOESS (National Polar-orbiting Operational Environmental Satellite System)	VIIRS (Visible/Infrared Imager/Radiometer Suite)	Visible/infrared imagery

- g. **Benefit to Society:** Enhanced C-CAP capabilities by using multi-source and multi-resolution data to respond to disaster events to provide needed change products due to the disaster.

2. Abstract

The NASA VIIRS and ETM+ data will be used to provide a solution for NOAA Coastal Service Center C-CAP in times of natural disasters. Catastrophic changes that are event-based require the acquisition of data immediately after the event to enable response and recovery activities as well as to estimate losses to the human and natural environment. This is in alignment with Coastal Management. The multi-resolution and multi-source data approach to enhance Coastal Change Analysis Program will benefit society by enhancing C-CAP to provide quick respond to natural disasters and produce change products.

INSTITUTE FOR TECHNOLOGY DEVELOPMENT

ITD FORMULATION REPORT – I

1. Candidate Solution Constituents

- a. Title: NASA’s Potential Contributions Using ASTER Data in Mitigation of Oil Spills
- b. Authors: Rose Fletcher, Science Systems and Applications, Inc., and Daniel Anderson, ITD, Stennis Space Center, MS
- c. Identified Partners: NOAA (National Oceanic and Atmospheric Administration)
- d. Specific DST/DSS: GNOME (General NOAA Oil Modeling Environment)
- e. Alignment with National Application: Coastal Management, Disaster Management, Public Health
- f. NASA Research Results – Table 1:

Missions	Sensors/Models	Data Product
Terra	ASTER *	Emissivity and Sea Surface Temperature
Terra	ASTER *	Sea Surface Roughness

* Advanced Spaceborne Thermal Emission and Radiation Radiometer

- g. Benefit to Society: Improved response to oil spills resulting in protection for the environment, for human health, and for coastal economies.

2. Abstract

The Gulf of Mexico is considered a “hot spot” for oil spills. A proactive monitoring program along the high-risk Louisiana coast using relatively cost-efficient satellite imagery capable of high-resolution detection of oil spills would provide resiliency to the coastal economy. This candidate solution proposes to use ASTER imagery to identify and characterize oil spills based on albedo, emissivity, sea surface temperature, and sea surface roughness products.

ITD FORMULATION REPORT – II

1. Candidate Solution Constituents

- a. Title: Improving NOAA's Nonpoint Source Pollution and Erosion Comparison Tool Through Enhanced Data Inputs from NASA's Global Precipitation Measurement Mission
- b. Authors: Kent Hilbert, Daniel Anderson, and David Lewis, Institute for Technology Development, Stennis Space Center, MS 39529
- c. Identified Partners: NOAA (National Oceanic and Atmospheric Administration)
- d. Specific DST/DSS: Nonpoint Source Pollution and Erosion Comparison Tool (N-SPECT)
- e. Alignment with National Application: Coastal Management, Water Management
- f. NASA Research Results – Table 1:

Missions	Sensors/Models	Data Product
GPM (Global Precipitation Measurement)	GMI (GPM Microwave Imager) DPR (Dual-frequency Precipitation Radar)	Rainfall Rate, Droplet Size

- g. Benefit to Society: Improve management decisions related to coastal water quality and, potentially, to near-shore coral health.

2. Abstract

Precipitation data acquired via NASA's Global Precipitation Measurement (GPM) Mission will be used to provide a solution for improving decisions related to coastal water quality made by resource managers and planners. More specifically, rainfall data acquired by the GPM Mission will replace data currently used by NOAA's Nonpoint Source Pollution and Erosion Comparison Tool (N-SPECT)—a tool that incorporates soil loss equation models that require precipitation data. N-SPECT is a GIS-based, spatially distributed screening tool for modeling basic hydrologic processes, including overland flow, erosion, and nonpoint-source pollution for watersheds. N-SPECT, operating on either annual or event time scales, offers the ability for users to specify land use and land management scenarios. This candidate solution is in alignment with both the coastal and water management applications of national priority. It will benefit society by assisting and educating resource managers and planners about nonpoint-source pollution and erosion by predicting the impacts of management decisions on water quality before implementing such decisions.

ITD FORMULATION REPORT – III

1. Candidate Solution Constituents

- a. Title: NASA’s Potential Contribution Using Aquarius Data in the South Atlantic Habitat and Ecosystem Tool
- b. Authors: Rose Fletcher, Science Systems and Applications, Inc., and Daniel Anderson, Institute for Technology Development, John C. Stennis Space Center
- c. Identified Partners: South Atlantic Fishery Management Council
- d. Specific DST/DSS: South Atlantic Habitat and Ecosystem tool
- e. Alignment with National Application: Coastal Management
- f. NASA Research Results – Table 1:

Missions	Sensors/Models	Data Product
Aquarius	Aquarius Radiometer/Scatterometer	Sea Surface Salinity/Temperature

- g. Benefit to Society: Better characterize the complexity of fisheries habitat and understand the impacts and consequences of different management and conservation strategies.

2. Abstract

The South Atlantic Habitat and Ecosystem managerial area encompasses Georgia, Florida, North Carolina, and South Carolina. The area of concern extends from river basins and estuaries to the seaward margins of continental shelves and the outer boundaries of the major current systems. This region includes two major features of the ocean system: the Gulf Stream and the Sargasso Sea. Both of these subregions are important to the fishing industry; they are also high-salinity features that can be mapped using Aquarius SSS (sea surface salinity) data. The Aquarius data can be incorporated into the South Atlantic Habitat and Ecosystem tool and can be used by managers to control the harvesting of seaweed beds or to guide fishermen to optimal fishing spots. Incorporation of salinity data into the management tool will allow for better characterization of fisheries habitat and sounder conservation strategies, resulting in resiliency of the coastal ecosystems and stronger coastal economies.

UNIVERSITY OF MISSISSIPPI

UM FORMULATION REPORT – I

1. Candidate Solution Constituents

a. Title: Watershed Hydrologic Monitoring in Mississippi Coastal Areas: A Case Study of the Jordan Watershed

b. Authors: Dath Mita, University of Mississippi GeoInformatics Center

c. Identified Partners:

d. Specific DST/DSS:

e. Alignment with National Application:

f. NASA Research Results – Table 1:

Missions	Sensors/Models	Data Product

g. Benefit to Society:

2. Abstract

The goal of this proposal is to test the feasibility of assessing and evaluating the hydrologic conditions in the Jordan watershed of the Mississippi coastal region using the CASA-HYDRA Land Surface Hydrology Model. Earth observation data from MODIS, LANDSAT, and ASTER will be applied to provide land cover and topography measurements for forecasting the impact of human controls over the watershed hydrological systems. This proposal is in alignment with Ecological Forecasting and Coastal Management National Applications. This candidate solution will benefit society by providing an understanding of the current status of the hydrological conditions and functional capabilities of the watershed ecosystems. The benefits can also include the possible environmental implications. This may include, but not limited to, the effects of recent natural events, man-made structures and management practices. In addition, the proposal may help to generate and test hypothesis that account for the human controls over the watershed hydrological systems.

UM FORMULATION REPORT – II

1. Candidate Solution Constituents

a. Title: Integrating Evapotranspiration Estimates from GRACE into the PECAD Decision Support System

b. Authors: Elizabeth Johnson, University of Mississippi GeoInformatics Center

c. Identified Partners:

d. Specific DST/DSS:

e. Alignment with National Application:

f. NASA Research Results – Table 1:

Missions	Sensors/Models	Data Product

g. Benefit to Society:

2. Abstract

Evapotranspiration (ET) is a very difficult parameter to measure with physical observatories, but an integral component in many global climate models. A potential alternate source of ET data is NASA's Gravity Recovery and Climate Experiment (GRACE) satellite system which can remotely sense changes in regional water storage from gravitational anomalies. Rodell et al (2004) demonstrate that GRACE water storage estimates compare favorably with both land surface models and a combined atmospheric-terrestrial water balance approach. The candidate solution proposed here is to integrate evapotranspiration (ET) measurements calculated from GRACE gravity measurements directly into global model, specifically the PECAD (Production Estimates and Crop Assessment Division) Decision Support System (DSS). PECAD is operated by the USDA to monitor global agricultural production and conditions that affect food security. It uses point source ET measurements and gridded potential ET estimates from a modified Palmer two-layer moisture model. Better ET data through remote sensing could improve crop estimates for large global regions and in areas where political instability disallows close physical observations.

UM FORMULATION REPORT – III

1. Candidate Solution Constituents

a. Title: Augmenting the SERVIR Decision support tool with Sea Surface Salinity measured by Aquarius

b. Authors: Tahmina Shirmeen, University of Mississippi GeoInformatics Center

c. Identified Partners:

d. Specific DST/DSS:

e. Alignment with National Application:

f. NASA Research Results – Table 1:

Missions	Sensors/Models	Data Product

g. Benefit to Society:

2. Abstract

Variability in sea surface salinity (SSS) is an important factor for understanding the relationship between ocean circulation and climate. Data from the Aquarius L-band radiometer and scatterometer can be used with the Mesoamerican Regional Visualization and Monitoring System (SERVIR-Spanish acronym for Regional Visualization & Monitoring System) decision support system for retrieving sea surface salinity and measuring sea surface roughness. SERVIR is a decision support system, which already includes the Sea surface temperature in the decision making process. SSS would be a valuable addition to SERVIR for the better understanding of ocean water circulation in addition with the sea surface temperature and sea surface topography. Salinity with temperature determines water density. Accurate and timely information of these variables is needed to understand their effects on coastal areas and will benefit society with improved coastal management and disaster management.