ENVIRONMENTAL STUDIES PROGRAM: Ongoing Studies

Region: National

Planning Area(s): Northern shelf and slope areas, Gulf of Mexico

Title: Shelf-Slope Sediment Exchange in the Northern Gulf of Mexico: Application of Numerical Models for Extreme Events (NT-11-06)

BOEM Cost: (in thousands) $990 **Period of Performance:** FY 2011-2015

Conducting Organization(s): Rutgers University in partnership with the Virginia Institute of Marine Sciences of the College of William & Mary, the University of California Santa Barbara and the University of Colorado at Boulder. (M11PD00256)

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Description:
Background: The displacement of sediments following extreme events has very important implications for the dispersion of pollutants and organic substances that commonly deposit on and/or are trapped in the accumulated sediments. In the northern shelf, shelf-break and slope areas of the Gulf of Mexico, there are several well known sources of pollutants: rivers, produced waters from oil rigs, and oil spills (e.g., from oil rigs, oil tankers and ruptured pipelines) among others. It is during some of these events that environmental disasters are more likely to occur. This modeling study aims to provide a comprehensive, four-dimensional view including characterization of sediment transport for a variety of extreme atmospheric and oceanic conditions, while setting the path for future observational studies. Turbidity currents are similar to snow avalanches in that they respond to both accumulation over time and a triggering event, while they are driven by gravity down a slope. The main focus area for this study is the very near
bottom level between the coastline and the continental rise areas. While historical bottom sediment studies have addressed isolated aspects/regions/instances, there are no studies that have produced a comprehensive dataset using state-of-the-art coupled models. There is also a particular vacuum of information with respect to turbidity currents in the Gulf of Mexico, especially during extreme events of annual occurrence (i.e., hurricanes).

Objectives:

1. Provide BOEM with an overall (in space and time) characterization of sediment transport, turbidity currents included, and deposition over the entire study area during extreme atmospheric and oceanic events.
2. Establish, qualitatively and quantitatively, how bottom sediment profiles are affected by extreme events in river discharge.
3. Determine the impact of hurricanes of different intensity and paths on the generation of sediment transport in the study area in general, and of turbidity currents in particular.

Methods: Due to the complexities and nature of the problem in question, a state-of-the-art very high resolution model, at least including forcing by winds, tides and rivers, in addition to a very realistic bathymetry, shall be used to reach the above mentioned objectives. Coupled to this circulation model, sediment, wave, and turbulence models must be used in order to generate realistic sediment transport and accumulation values at different locations over the study area. Due to the nature of the problem under consideration, a terrain-following vertical coordinate system is highly preferred. Innovative modeling ideas are welcomed components into the study. Historical (observed) sediment data must be used for both comparison and initialization. A final report shall document the key findings, while a comprehensive database, with all data used and generated during the project life, shall also be built for future reference and use.

Importance to BOEM: Characterization of bottom sediment transport under extreme circumstances (e.g., hurricanes, intense eddies) will expand BOEM's knowledge on pollutant and nutrient dispersion in the outer shelf and slope areas of the northern Gulf of Mexico. By characterizing bottom sediment transport this study will specifically expand and/or have important implications for BOEM's knowledge in: (a) Oil-Spill-Risk Analysis (OSRA), (b) Water quality studies (c) Benthic communities (e.g., deep sea corals). This study is aligned with the recommendations set forth in the August 16, 2010 report prepared by the White House's Council for Environmental Quality (CEQ) for BOEM.

Current Status: The PIs are focused in the last task and objective of this study, i.e., the simulation of turbidity currents using the RANS version of the TURBINS model. All previous tasks were undertaken and successfully completed.

Final Report Due: September 20th, 2015

Publications: None

Affiliated Web Sites: None

Revised Date: Nov 25, 2014

ESPIS: Environmental Studies Program Information System All *completed* ESP studies can be found here:
http://www.data.boem.gov/homepg/data_center/other/espis/espisfront.asp