BOEM ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Adaptation of Arctic Circulation Model (NT-08-02)

BOEM Information Need(s) to be Addressed: Oil spill trajectory analysis for impact assessment is needed for the Beaufort and Chukchi Planning Areas. Oil Spill Risk Analysis (OSRA) is a cornerstone foundation for evaluating alternatives in OCS oil and gas leasing EIS preparation and for evaluating mitigation, such as oil spill contingency plans. Development and application of state-of the-art circulation models are essential to future OSRA-based EIS analyses. This study addresses aspects of USGS Recommendations 3.01, 3.02, 4.01 and 7.04.

Total Cost: $350,000 **Period of Performance:** FY 2011-2012

Conducting Organization: Rutgers University

Principal Investigator: Dr. Enrique Curchitser, Dr. Katherine Hedstrom, Dr. Thomas Weingartner, Seth Danielson

BOEM Contact: Dr. Walter Johnson

Description:

Background: The BOEM proposes to lease within the Beaufort and Chukchi Sea Planning Areas. To maintain its state-of-the-art in oil-spill-risk analysis, BOEM seeks to take advantage through time of the increasing skill of circulation models supported by more and better data. A coupled ice/ocean model can be modified and expanded to capture provide multi-year circulation, ice, and forcing fields for use in BOEM NEPA oil-spill-risk analysis and post-sale oil spill response planning.

Objectives: Adapt and maximize the utility of an existing, coupled ice-ocean circulation model to represent the physical processes, especially circulation, within the Chukchi and Beaufort Sea Planning Areas. Provide BOEM with ten-to-twenty years of relevant modeled fields, such as gridded wind, surface water, and ice velocity, ice cover; and limited other modeled fields as agreed on between contractor and BOEM.

Methods: A coupled ice/ocean model will be modified to maximize utility in the Chukchi and Beaufort seas and to capture the agreed upon model fields. Three-hour gridded velocity fields (wind, surface water, ice) and ice cover will be provided to BOEM in agreed format for a ten-to-twenty year hindcast simulation. Sensitivity testing and validation of the model and results will be conducted. The BOEM anticipates providing HF-radar results for Beaufort and Chukchi coasts to aid in validation. Documentation would be through the model manual, final report, and submittal of a peer-reviewed journal article.

BOEMRE ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

Region: Headquarters

Planning Area(s): North Atlantic and Mid-Atlantic OCS

Title: Acoustic/Thermographic Monitoring of Temporal and Spatial Abundance of Birds Near Structures on the Atlantic OCS (AT-10-01)

Total Cost: $3,959,940 **Period of Performance**: FY 2010 - 2012

Conducting Organization: Pandion Systems

BOEMRE Contact: Dr. James R. Woehr

Description:
Background: BOEMRE has identified impacts to birds from alternative energy development as a primary concern and has been seeking additional data to describe bird use of the OCS. With the publication of the BOEMRE Framework for Renewable Energy Development on the U.S. Outer Continental Shelf, significant interest in leases for wind energy development on the OCS has developed, creating a critical need for information on bird use of the OCS. Monitoring birds offshore has been limited worldwide due to difficulty of access and high cost. Boat transect surveys and "ships of opportunity" are subject to potentially large sampling error and are too slow and too limited in scope to provide sufficient information. Traditional aerial surveys are expensive and also subject to substantial sampling error. An effective and economical way to monitor bird presence offshore would be to use specially designed, strategically positioned and remotely operated acoustic/thermographic detection devices attached to offshore structures such as meteorological towers or wind turbines. Acoustic/thermographic devices could monitor vocalizations of birds both day and night at all seasons of the year and in any weather conditions, including periods of low visibility that would prevent effective visual monitoring. They would also detect via thermal imaging birds which pass by silently without vocalizing. This study would test the technology for remote digital recording of birds offshore. It will provide three years of information on seasonal, annual, and weather-related variation in bird species presence on the Atlantic OCS in all seasons and weather conditions. This technique can monitor birds on the OCS during both daytime and night and in both good and poor visibility conditions, but only at point locations where offshore structures are available. Thermographic cameras positioned to obtain stereoscopic images will enable the determination of bird flight heights, information which is critical to assessment of risk to birds from wind turbines. Once the specifics of this technique are worked out, acoustic/thermographic surveys used in combination with high definition aerial surveys, which are useful only in daylight and good visibility conditions but which can cover wide areas of the OCS, can yield a robust data set which will elucidate the annual, seasonal and diurnal variation in bird species use of the OCS.

Objectives: The objectives of the study are to:

1) Determine the optimal positioning of acoustic/thermographic detectors on meteorological towers and wind turbines to minimize background ocean noise while effectively detecting bird vocalizations.
2) Determine the number of such devices needed at each type of structure to determine the spatial position of a vocalizing bird.
3) Document the date and time of recorded bird vocalizations for each species detected.
4) Estimate, to the maximum extent feasible, the seasonal, annual, and weather-related abundance and/or passage rates for each bird species detected.

Methods: Acoustic/thermographic detection devices will be arrayed on a meteorological tower and a wind turbine to determine the optimal positioning for detecting bird vocalizations offshore while minimizing background ocean noise. Continuous recordings will be made over extensive sampling periods in all seasons, times of day and weather conditions for three years, with special emphasis on spring and fall migration periods and breeding season.

Importance to BOEMRE: With the publication of the BOEMRE Framework for Renewable Energy Development on the U.S. Outer Continental Shelf, significant interest in leases for wind energy development on the OCS has developed. Information on bird use of the OCS is now critically needed for environmental analyses of proposed sites. This study would provide new information on seasonal and annual variation in bird species presence on the Atlantic OCS.

Current Status: Awarded September 22, 2010

Final Report Due: September 21, 2014

Publications:

Affiliated WWW Sites:

Revised Date: November, 19 2010

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BOEMRE ENVIRONMENTAL STUDIES PROGRAM PROFILE

Region: Headquarters

Planning Area(s): All Atlantic

Title: Compendium of Avian Information and Comprehensive GIS Geodatabase (NT-08-03)

Cost: $200,000 ($100,000 BOEMRE/$100,000 USGS)

Period of Performance: FY 2011-2012

Conducting Organization: U. S. Geological Survey

BOEMRE Contact: Dr. Sally Valdes

Description:

Background: With the passage of the Energy Policy Act of 2005, the BOEM was delegated responsibilities for alternative energy activities on the Outer Continental Shelf. This new responsibility includes offshore wind energy projects. Experience from onshore wind development suggests that the siting of facilities is critical to minimize impacts to bird species, particularly migratory birds. While the BOEM and other Federal and State Agencies and others collect and/or compile data on many coastal and marine birds, this data is widely dispersed and of varying quality. Since 2008 USGS and BOEM have had an interagency agreement to compile, synthesize and incorporate into a comprehensive GIS Geodatabase seabird and shorebird data along the Atlantic coast to assist BOEM scientists and decision-makers regarding potential impacts from wind energy development on the OCS. The need for this information was identified during the BOEM Alternative Energy workshop and in the Worldwide Synthesis and Analysis of the Existing Information Regarding Environmental Affects of Alternative Energy Uses on the OCS.

To support modeling efforts of seabirds in the western Atlantic, USGS has assembled >250,000 seabird occurrence records that include scientific surveys as well as general observations from 1906 to the present. However, models are only as good as the data that goes into them and much of the data currently in the Seabird database is more than 20 years old, making it increasingly difficult to use for predictive modeling due to the limited occurrence data for many species, ad hoc sampling approach used on many historical surveys, and the paucity of environmental data available to use as model variables. Modeling is a data-intensive process and the more data available, the better the predictions and inferences that can be made. Recently, major strides have been made towards collecting new seabird survey data in the form of improved survey design (e.g., US Fish and Wildlife Service Atlantic Seaduck Survey). As a result, our collection of recent knowledge about seabirds is growing steadily. In addition, several states (RI, DE,

NJ) have been sponsoring seabird surveys offshore of their respective states while the federal funded work continues on NOAA ships-of-opportunity. Some projects have just completed or are near completion. As new information becomes available, the data can be folded into the existing database once work is completed. New data will be very important for improving the accuracy of model output and improve our ability to understand distributions under different environmental and anthropogenic forces. Especially important may be models that predict future seabird distributions under various climate change scenarios.

Finally, by compiling a comprehensive collection of existing data sets it will be possible to identify geographic, temporal and species data gaps to help identify future research needs.

Objectives: The objectives of the study are to: augment the comprehensive Geodatabase populated with data on seabird and shorebird species that are potentially at risk from offshore wind facility development with data from major new survey efforts; to model seabird occurrence relative to physical, chemical and biological factors; and to provide maps that illustrate the modeling results in a way that is understandable to decision-makers and the public.

Methods: The data search and synthesis will focus on new major data sources for birds in the Atlantic offshore environment that are now, or will soon, become available. The information will be integrated, when appropriate, into the GIS Geodatabase. The augmented data base will be used to model issues of importance to decision-making concerning future wind facilities, for example, how habitat affects distribution, whether distributions have changed over time (effect of climate change or other factors), and how distance from shore might affect distributions of different species of concern.

Importance to BOEM**:** Development of offshore alternative energy facilities, particularly wind turbines, have the potential to impact bird species. Knowledge about the numbers and distribution of bird species that are at risk would greatly assist the BOEM in identifying locations that are preferred for wind energy development and those that should be avoided.

Current Status: Ongoing interagency agreement with U.S. Geological Survey.

Final Report Due: Various reports. Interagency agreement ends January 2011. Have requested no-cost extension until April 2011. New final report would be due April 2013.

Publications from current project:

Zipkin, E. F., B. Gardener, A. T. Gilbert, A. F. O'Connell, Jr., J. A. Royle, and E.D. Silverman. 2010. Distribution patterns of wintering sea ducks in relation to the North Atlantic Oscillation and other local environmental characteristics. Oecologia 163:893-902.

Presentations scheduled for World Seabird Conference, September 7-11, 2010:

Garner, Beth. 2010. Estimating occupancy and detection of multiple species from repeated aerial count data.

Gilbert, Andrew. 2010. Increasing our knowledge of seabird distributions in the U.S. Atlantic: Development of a relational seabird occurrence and survey effort.

O'Connell, Allan. 2010. Hierarchical models for estimating seabird distribution in the Northwest Atlantic.

Revised Date: November 12, 2010

ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

BOEM OCS Region: National

Title: OCS Renewable Energy and Space-Use Conflicts and Related Mitigation

Total Cost: $824,872 **Period of Performance:** FY 2009-2012

Conducting Organization: Industrial Economics, Inc. (IEC)

BOEM Contact: John Primo

Description:
Background: The Ocean accommodates a variety of uses that are separated by time of day, season, location, and/or zones set aside for specific users. Alternative energy development offers the potential for new use space conflicts with other existing uses of the OCS. Management of ocean space and resources have been addressed by a number of state, regional, and federal organizations – fisheries management councils, state task forces, and coastal zone management agencies, for example – but information on the various uses of these spaces and the potential conflicts as they pertain to alternative energy development are not well documented nor are they understood in terms of type of activity, duration, and timing.

Space use conflicts were identified as a social, economic, and cultural concern in the synthesis of existing information on the environmental effects of alternative energy development on the OCS. Avoidance and mitigation measures have not been fully developed for space use conflicts of alternative energy development, but need to be.

Objectives: The purpose of the study is to identify space use conflicts on the OCS between alternative energy development and existing and potential other uses of the OCS and ways to mitigate those conflicts.

Methods: The study will develop a geospatial database that is compatible with the BOEM mapping system to assist in determining multiple uses offshore. Through a literature search and key informant discussions, including lessons learned from the European experience, the study will identify mitigation and avoidance measures as well as conflict resolution strategies to address potential conflicts between alternative energy sites and other space-uses present on the OCS. In addition, the study will explore the possibilities for creating or revising institutional linkages that might facilitate communication and cooperation between the various entities involved.

Importance to BOEM: Siting issues are extremely important in determining areas of possible alternative energy development. BOEM decisions on lease sales must consider potential space-use conflicts on the OCS and consider how these conflicts differ during construction and operations. BOEM needs to identify potential space use conflicts of OCS alternative energy development with other activities (e.g., fishing, navigation, sand and gravel extraction etc.), develop criteria for evaluating those conflicts, and identify mechanisms to mitigate existing conflicts and avoid future ones. This study will engage other Federal and state agencies to promote institutional and cross cutting thinking about multiple uses. Information from the study will be used in BOEM decision making on siting and monitoring alternative energy development.

Current Status: The contractors are writing the ‘draft’ final report, and are completing the final version of the geospatial database.

Completion: June, 2012

Publications: None

Affiliated WWW sites: None

Updated: January 17, 2012

BOEM ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

REGION: National

PLANNING AREA: 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 Information Need(s) to be Addressed: 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.

Total Cost: (in thousands) $900 **Period of Performance**: FY 2011-2014

Conducting Organization: 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.

BOEM contact: Dr Guillermo Auad

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.

Revised Date: September 1st, 2011

BOEMRE ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

Region: National

Planning Area(s): All

Title: **(**a) Improving Wind Wave Forecasting and Hindcasting: Global to Regional Scales

(b) Improving Tropical Cyclone Intensity Forecasting (NT-09-x15)

Total Cost: $1,000,000 **Period of Performance:** FY 2009-2013

Conducting Organization: ONR**,** US Dept of the Navy (NOPP Program)

BOEMRE Contact: Dr. Ronald Lai

Description:

Background: (a) Several of the U.S. Federal Agencies operate wind wave prediction models either in the forecast, hindcast, simulation or analyses for a variety of mission specific purposes ranging from protection of human life and safety, to design of engineered structures, to assessment of environmental conditions, etc. In general these prediction models consist of a series of science-based routines which contains the basic principles of air-sea interaction and wave evolution, a propagation routine that moves the wave energy across the ocean, and supporting infrastructure unique to the agency missions and prediction scenario. Much of the basic science contained in the physics core is more than a decade old. A group of federal agencies including the National Weather Service, the U.S. Army Corps of Engineers, the Office of Naval Research and the Bureau of Ocean Energy Management, believe that sufficient research has been accomplished in the last decade to allow a significant upgrade of the models. These new routines could be tested and shared amongst the Federal Agencies, who would then embed them within the mission-specific prediction systems and produce hindcast data. The partnership of four federal agencies is formed under NOPP (National Oceanographic Partnership Program) to carry out the missions.

(b) During the past 15-20 years, tropical cyclone track forecasts have steadily improved. During this same timeframe tropical cyclone intensity forecasts have shown little to no improvement because interactions with the large scale environment and between the ocean and atmosphere are critical to improving intensity forecasts. Statistical-dynamical models indicate that approx. half of intensity change is dependent on the large-scale environment while the remainder is dependent on inner core dynamics and upper ocean interactions. Better forecasts of intensity and intensity change rely on the ability to predict these details, some of which are dominated by more chaotic processes, such as convection, that may limit predictability. More importantly, recent cases of rapid intensity changes at or near coastlines have occurred, but were not well forecast. Tropical cyclone structure, size and intensity are also rapidly modified by interaction with ocean mesoscale features such as eddies, currents and thermal density gradients. Improved understanding of this interaction is critical to resolving relevant features and evolution.

Objectives: The goals are: (a)-1 to develop new physics packages that perform demonstrably better across a range of environments and conditions than existing packages, and (a)-2 include a seamless transition from deep to shallow water (outside the surf zone) to be

included in the source and sink terms for the community of wave modelers at the end of the study;

(b)-1 to understand the physical processes that control the air-sea interaction and their impacts on rapid intensity changes in tropical cyclone, and (b)-2 to develop a physically based and computationally efficient coupling at the interface for use in next generation models.

Methods: (a) The goal of this NOPP solicitation is support the scientists from academia, private industry and government laboratories to work in partnership with the funding agency production centers to produce a new set of source and sink terms for the Federal models including many or all of the following: wind input, breaking, nonlinear wave-wave interaction, bottom friction, wave-mud interaction, and wave-current interaction.
Given the existence of operational codes, the additions to the partnership to be funded with the NOPP funds will join with personnel drawn from the operational groups (NOAA, Navy, Army) to build a new set of source terms representing advances in understanding of the source and sink terms. These will need to be constructed in a modular manner to be retrofitted into existing models, will need to reproduce classical wave growth studies, and will have to be tested within the operational systems.

(b) As for tropical cyclone intensification study, the proposed research shall builds on results from the prior ONR, NSF, and NOAA supported projects (e.g., CBLAST, RAINEX, HYCOM Consortium for Data Assimilative Ocean Modeling, Battlespace Environments Institute Coupled Modeling, COAMPS-TC, Joint Hurricane Testbed) to develop wind-wave and air-sea flux couplers, and testing parameterizations in both research and operational models (e.g., COAMPS, HWRF, NCOM, HYCOM, and WAVEWATCH III). The focus shall be the implementation a new, unified air-sea interface module for fully coupled atmosphere-wave-ocean modeling systems with a general coupling framework that can transition from research to operations.

Importance to BOEM: Wind wave prediction models either in the forecast, hindcast, simulation or analyses provide information to design of engineered structures, to assessment of environmental conditions, and to protect human life and safety in the nearshore region. The improved models will advance the knowledge and support the Sand and Gravel Program and the development of fast growing hydrokinetic energy conversion devices in the coastal ocean.

Understanding the physical processes that control air-sea interaction and their impacts on environment are important not only used in forecasting the rapid intensification of tropical cyclone for safe operation but also important to tracking the distribution of pollutants in both ocean and atmosphere.

Final Report Due: 8/15/13
Publications:
Revised Date: January 11, 2012

BOEMRE ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

Region: National

Planning Area(s): All

Title: OSRA Modeling Review Board (NT-09-X13)

Total Cost: (in thousands) $5-$15 annually **Period of Performance:** FY 2009-2014

Conducting Organization: Dr. C. J. Beegle-Krause, Dr. Jerry Galt, Dr. David Amstutz, Dr. Dong-Ping Wang

BOEMRE Contact: Dr. Walter R. Johnson

Description:
Background: The Modeling Review Board is a panel of recognized national experts on physical oceanography and oceanographic modeling. BOEMRE is responsible for analysis of potential oil-spill impact to the environmental resources prior to the lease sales for the oil and gas exploration on the Outer Continental Shelf (OCS). The Oil Spill Risk Analysis (OSRA) in BOEMRE uses ocean modeling results and the Modeling Review Board will provide expertise to improve the accuracy of the OSRA in areas of OCS operations. The Board provides advisory services in ocean modeling to the BOEMRE in order to better direct and use the limited funds and results from ongoing and planned research in physical oceanography. The MRB provides BOEMRE with state-of-the-art guidance on issues related to ocean circulation modeling and independent evaluations of technical aspects of ongoing and planned procurements related to ocean circulation modeling. The board has served to advise BOEMRE on draft statements of work and proposal evaluation. The board serves as a contract-independent "quality review board" on ocean modeling studies. They also participate in workshops, such as regional physical oceanography workshops.

The results of the ocean circulation modeling studies support improvements in an improvement in the OSRA for all future sales following the study completion. The results of the ocean circulation modeling studies are also vital to improvements to oil spill contingency planning and other operational requirements.

Objectives: The objective of this study is to support a Board to provide supplemental physical oceanographic expertise in the area of ocean modeling. The BOEMRE has felt increasing urgency from coastal states, as well as from scientific and public review of these efforts, to model the offshore circulation at ever finer spatial and temporal scales. This requires the use of state-of-the art techniques in numerical modeling.

Methods: Board members will meet with BOEMRE staff and contractors to review progress of on-going modeling studies. Members will submit review comments which will be used by BOEMRE staff to improve contract results.

Importance to BOEMRE: The Board members advise BOEMRE on on-going studies, draft final reports, draft statements of work, evaluate proposals for ocean circulation modeling, and plan research in physical oceanography. The services are needed annually for ongoing and new modeling studies designed to improve OSRA.

Final Report Due: None, individual review reports submitted for Task Order.

Publications: None

Revised Date: April 6, 2011

Current Status: Ongoing

Final Report Due: June 2013

Publications Completed: None

Affiliated WWW Sites: http://www.boem.gov/Environmental-Stewardship/Environmental-Studies/Alaska-Region/Index.aspx

Revised Date: December 2011