Annual Progress Report Form - Oil Spill Recovery Institute

This report may be submitted by mail, fax or e-mail
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Deadline for this report: This report is due within 45 days of the anniversary of the effective date of the grant.

Today's date: 18 October 2005

Name of awardee/grantee: University of Miami, Rosenstiel School of Marine and Atmospheric Science, PI: Professor Christopher N.K. Mooers

OSRI Contract Number: 04-10-17

Project title: Nowcast/Forecast Ocean Circulation System

Dates this progress report covers: 04/01/04-09/30/05

PART I - Progress Report on Activities

ABSTRACT. The purpose of this project is to design, develop, test, and implement a real-time ocean nowcast/forecast system (NFS) for Prince William Sound (PWS). The 4D ocean circulation and stratification model implemented as the backbone (PWS-POM and EPWS-POM) for PWS/NFS and EPWS/NFS is the Princeton Ocean Model (POM), which is the most widely utilized ocean model in the world, especially for the coastal ocean, and which continues to be upgraded year-by-year by colleagues at Princeton University. PWS-POM covers PWS and depends upon specification of the inflow/outflow and water mass properties at Hinchinbrook Entrance (HE) and Montague Strait (MS). PWS/NFS utilizes a comprehensive set of forcing functions: high resolution bottom topography and coastline, tides, synoptic winds and atmospheric pressure with mesoscale space-time resolution from RAMS, seasonal heating and cooling from climatology, distributed runoff from climatology and a terrain model, precipitation, and throughflow from HE to MS, linking PWS and the Alaska Shelf, from historical flow and hydrographic data. Emphasis has been placed on model validation with SEA Program, EVOS, and OSRI data, while real-time verification is performed with NOS tide gauge coastal sea level (CSL) data and NDBC buoy and C-MAN station surface wind (CSW) and surface temperature (CST) data. The backbone model PWS-POM, and its upgrade EPWS-POM, have proven effective in process studies and are ready for ecosystem models to be nested in them. At the computational price of covering a larger domain that extends south to 59^{o} N in the Gulf of Alaska, EPWS-POM has the advantage of allowing for unconstrained exchange between PWS and the Alaska Shelf. With the availability of Global NCOM (Navy Coastal Ocean Model) data (from NAVO (Naval Oceanographic Office) via NCDDC (National Coastal Data Development Center)) since 23 February 2005, EPWS/NFS is forced by Global NCOM temperature, salinity, and velocity at the open boundary and Global NCOM temperature and salinity at the surface

along with PWS-RAMS wind. A tidal model that encompasses the EPWS-POM domain provides tidal forcing for EPWS/NFS.

STATUS OF OBJECTIVES. Objectives from the fifth-year, and their status, are summarized below:

Implement fully EPWS/NFS as soon as possible and conduct several tests to evaluate and upgrade it. (Accomplished. See below)

Utilize the OSRI CTD and ADCP data for model evaluation purposes. (Accomplished, but there are more data yet to be utilized.)

Hope to hindcast the EXXON Valdez oil spill scenario, if the atmospheric forcing data can be found. (Deferred until appropriate data are found.)

Prepare and submit a few mss (e.g., description of PWS/NFS and EPWS/POM, more model PWS-POM evaluation, and PWS response to atmospheric forcing) to refereed journals. (Partially accomplished; see discussion below.)

ROADBLOCKS ENCOUNTERED. Smooth and uninterrupted data flow of Global NCOM is critical for the timely running of EPWS/NFS, but during the summer of 2005 there were time periods when the whole system, both at NAVO and NCDDC in Mississippi and at UM in Miami, had to shutdown due to power outages, etc., caused by hurricanes such as Katrina and Rita. Even when the system was backed up immediately after a hurricane passage, it took almost a month to recover the missing days so that EPWS/NFS had to stop during that period and catch-up later.

HIGHLIGHTS OF ACCOMPLISHMENTS. During the 2004 PWS Lagrangian Field Experiment, model products, from both PWS/NFS and EPWS/NFS, were provided for input to the oil spill models of NOAA/HAZMAT and SINTEF/OSCAR. Comparisons with observational data obtained during the experiment were described in the final report of the experiment. Failure of PWS/NFS in the reproduction of the observed cyclonic eddy in the central Sound, which was the most dominant feature during the experiment, revealed the inadequate open boundary forcing of PWS/NFS at HE, and thus the importance of a larger-scale model as a provider for synoptic open boundary forcing. On the other hand, EPWS/NFS, despite non-synoptic, climatological forcing at the open boundary, was able to produce a cyclonic eddy in the central Sound, although its characteristics were not exactly the same as the observed ones.

PWS/NFS operation has continued and Mr. Xinglong Wu, OSRI Student Fellow, has taken over routine operation of PWS/NFS from Dr. Inkweon Bang.

Dr. Inkweon Bang, Research Scientist/Co-PI, has been downloading Global NCOM data products from NAVO via NCDDC and posting figures of sea level height, sea surface temperature, surface current, and transports at PWS/NFS as well as EPWS/NFS Web sites beginning from 23 February 2005. As part of the daily tasks, velocity, temperature, salinity, and sea level are extracted from Global NCOM at EPWS open boundary points to be used as

boundary forcing for EPWS/NFS. Also, a large-domain, barotropic tidal model that includes EPWS domain is run separately to provide tidal forcing for EPWS/NFS. As in PWS/NFS, PWS-RAMS provides atmospheric forcing at the surface for EPWS/NFS. After one month spin-up with open boundary forcing from Global NCOM data of the 23 February 2005, forward integration of EPWS/NFS was initiated. Surface temperature and salinity are relaxed to Global NCOM values with a 1-day restoring time scale. Available observational data, such as, coastal sea level and water temperature at NOS stations and water temperature at NDBC buoys, are utilized for daily real-time verification of model results, and salinity and velocity at NDBC 46060 are utilized for delayed-mode verification. Important attributes of EPWS/NFS are as follows:

ATTRIBUTES OF FIRST GENERATION EPWS/NFS (http://pws-nfs-osri.rsmas.miami.edu/epws)

RESOLUTION

- HORIZONTAL: 1.1 KM
- VERTICAL: 26 SIGMA LEVELS
- TEMPORAL: EXTERNAL (INTERNAL) MODE = 2 SEC (1 MIN)

FORCING

- EIGHT TIDAL CONSTITUENTS, FROM MIKE FOREMAN, IOS
- ATMOSPHERIC
  - WINDS FROM RAMS
  - HEATING/COOLING FROM COADS MONTHLY CLIMATOLOGY
- OPEN BOUNDARY
  - VELOCITIES, TEMPERATURE, AND SALINITY FROM GLOABAL NCOM
- SURFACE TEMPERATURE AND SALINITY
  - RELAXATION TO GLOBAL NCOM WITH 1-DAY TIME SCALE

VERIFICATION

- THREE (46060, 46061, 46081) NDBC MET BUOYS (SSW, SST, SSS, ETC.)
- THREE NDBC C-MAN STATIONS (Valdez Arm: Bligh Reef Light, Middle Rock Light, Potato Point) (CST, CSW, ETC.)
- CORDOVA AND VALDEZ NOS TIDE GAUGES (CSL, CST)

Paper publications

Bang, I., S.L. Vaughan, and C.N.K. Mooers, 2005. Initial steps toward validation of a seasonal cycle simulation for Prince William Sound circulation (flow and mass) fields. Cont. Shelf Res., 25 (7-8), 901-934. doi:10.1016/j.csr.2004.09.023.

Paper presentations

Prof. Chris Mooers presented a talk entitled “Comparisons of Numerical Simulations of the Circulation and Stratification of Prince William Sound with Observations” at the Eastern Pacific Ocean Conference 2004 at Vancouver Island, 22 to 25 September, 2004.

Prof. Chris Mooers presented a poster entitled “Lessons learned with nowcast/forecast systems for Prince William Sound, Alaska (PWS/NFS and EPWS/NFS)” in a special session on “Scientific Assessment of Coastal Ocean Information Systems” he convened at the AGU Fall Meeting at San Francisco, 13 to 17 December, 2004.

CONCLUSIONS TO DATE. PWS/NFS continues its existence, but the focus has shifted to

EPWS/NFS, which is one-way nested within Global NCOM. Preliminary results from EPWS/NFS indicate better performance than PWS/NFS. Operation of EPWS/NFS will be maintained at University of Miami and verification/validation effort will be continued.

Part II - Annual Financial Statement

Budget Category	Budget	Year-to-date Expenses	Balance Remaining
Direct Costs			
Personnel	88,035	92,722.65	-4,687.65
Travel	7,000	5,456.38	1,543.62
Contractual	0	0	0
Commodities	5,965	1,820.92	4,144.08
Equipment	0	0	0
Subtotal Direct Costs	**101,000**	**99,999.95**	**1,000.05**
Indirect	24,000	24,999.98	-999.98
Project Total	**125,000**	**124,999.93**	**0.07**