

Distributed Integrated Ocean Prediction System (DIOPS) / SWAN Rapid Transition Program

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Document Number: N0001402WX20654
<http://diops.spawar.navy.mil>

LONG-TERM GOALS

Transition an integrated wave, tide and surf prediction system to all MEOC Regional Centers. Environmental inputs (e.g., wind forcing, high-resolution bathymetry) will be provided via the Tactical Environmental Data Server (TEDS). The GUI must be easy to understand and straightforward to set up and run the suite of models so an AG3 can operate the system.

OBJECTIVES

Provide state-of-the-art high-resolution wave forecasts that are rapidly relocatable and can be operated at the METOC centers or shipboard via the TEDS server. This will be accomplished by (1) the acceleration of the DIOPS effort using the Naval Pacific Meteorology and Oceanography Center San Diego (NPMOC-SD) as a Beta-test site and (2) of the transition of the SWAN model by incorporating it into DIOPS.

APPROACH

ONR and SPAWAR have joined as a team to direct their SWAN and DIOPS efforts to produce the new capability. NPMOC-SD provides a site where ONR and SPAWAR have set up a beta versions of DIOPS and SWAN and provide an on-site scientist/programmer to assist in the set up and transition of the combined system. NPMOC-SD users provide feedback to the developers so that the model job-stream, inputs, outputs, diagnostics and products can provide maximum added value to their wave and surf products, yet, be operated by the staffing at a typical Regional METOC Center. Training and documentation requirements for the operational system will be developed based on the scientist/user interactions. After a demonstration and validation, the system can then be transferred to the operations floor.

Report Documentation Page

Form Approved
OMB No. 0704-0188

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1. REPORT DATE 30 SEP 2002		2. REPORT TYPE		3. DATES COVERED 00-00-2002 to 00-00-2002	
4. TITLE AND SUBTITLE Distributed Integrated Ocean Prediction System (DIOPS) / SWAN Rapid Transition Program				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Research Laboratory,,Stennis Space Center,,MS, 39529				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT Transition an integrated wave, tide and surf prediction system to all MEOC Regional Centers. Environmental inputs (e.g., wind forcing, high-resolution bathymetry) will be provided via the Tactical Environmental Data Server (TEDS). The GUI must be easy to understand and straightforward to set up and run the suite of models so an AG3 can operate the system.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Key Personnel:

Mr. Richard Allard (NRL Stennis) : PI on DIOPS/SWAN RTP. Ensure that milestones are met in timely manner. Interacts closely with Argonne National Laboratory, developers of the object-oriented framework behind DIOPS, and Anteon Corp. which is adding TEDS functionality into DIOPS.

Mr. Dean Wakeham (Neptune Sciences Inc.): Full-time DIOPS/SWAN scientist resident @ NPMOC-SD. Mr. Wakeham runs the DIOPS model suite (WAM, SWAN, PCTIDES & SURF3.0) on a daily basis. Develops and provides training for NPMOC personnel and operator feedback to developers.

Mr. Steve Williams (Anteon, Inc. Newport, RI) : TEDS PI responsible for setting up and installing DIOPS @ NPMOC-SD, tracking down bugs fixes and providing TEDS support, development of DIOPS visualization GUI.

Mr. John Christiansen (Argonne National Laboratory): Responsible for porting SWAN version 40.11 into DIOPS; develop SWAN GUI and model controllers and perform full system testing.

WORK COMPLETED

A DIOPS Beta-test site was established at NPMOC-SD in April 2001. ONR funding was used to purchase hardware (Ultra SPARC 80 dual processor and Dell Pentium PC) and hire a full-time scientist (who started April 2001) to learn how to operate the system. DIOPS2.0 (WAM, SWAN, PCTIDES and SURF) was installed at NPMOC-SD in December 2001. The DIOPS scientist met with NPMOC-SD personnel during the winter 2001/2002 and identified areas where the GUI could be improved to ensure that setting up a DIOPS scenario could be performed by an AG-2/AG-3. As a result, a GUI redesign effort began in April 2002. A new functionality was added to DIOPS by allowing the system to be initialized with directional wave spectra from WaveWatch3 obtained from FNMOC via METCAST Channels. As DIOPS prepares for a FY04 transition to operations at METOC Centers, a DIOPS CONOPS was prepared and delivered to CNMOC in September 2002. A DIOPS website is located at <http://diops.spawar.navy.mil>

RESULTS

The Distributed Integrated Ocean Prediction System (DIOPS), beta-test program was established at NPMOC-SD on 23 April 2001. The present system consists of the deep-water wave model WAM, a relocatable tide model PCTIDES, SWAN and the Navy Standard Surf Model. DIOPS is run on a daily basis for the area that includes San Diego. TEDS provides access to bathymetric data (for input to WAM and coarse resolution SWAN) as well as atmospheric model data from FNMOC to force the DIOPS models.

During FY02, DIOPS supported NATO Exercise Strong Resolve during the Crisis Response Operation in Poland 1-15 March 2002. DIOPS was run out of the Navy European Meteorology and Oceanography Command (NEMOC). High-resolution bathymetry collected by the Dutch ship Tydeman during a Rapid Environmental Assessment (REA) in February 2002, was fused with existing bathymetry to generate a high-resolution bathymetric grid for the inner-most nest of the SWAN wave model. DIOPS was run daily generating a triple-nested SWAN, two-nested PCTIDES and 48-hr surf forecasts for 4 target beaches. An amphibious landing occurred on 10 March 2002 without incident. The complete end-to-end DIOPS 48-hr forecasts were generated in a 3.5 hour timeframe. This was an

ideal opportunity to demonstrate the system at NEMOC. Comments from Mr. Rob Mason (NEMOC Science Officer) included: “DIOPS performed well during the entire exercise... The wave, swell, surf and current information was particularly valuable as the on-scene GF MPL system was not working well. The Remotely prepared DIOPS products posted to the NEMOC Mobile Team was the most accurate information available.” Comparisons of SWAN wave height and period versus a Swedish wave buoy during the period March 1-15, 2002 showed excellent agreement. DIOPS also provided forecasts for the Naval Special Warfare Group 1 (NSWG1) Mission Support Center (MSC) as well as amphibious forces of the USS BOXER Amphibious Ready Group (ARG) in support of the joint exercise MILLENNIUM CHALLENGE 2002.

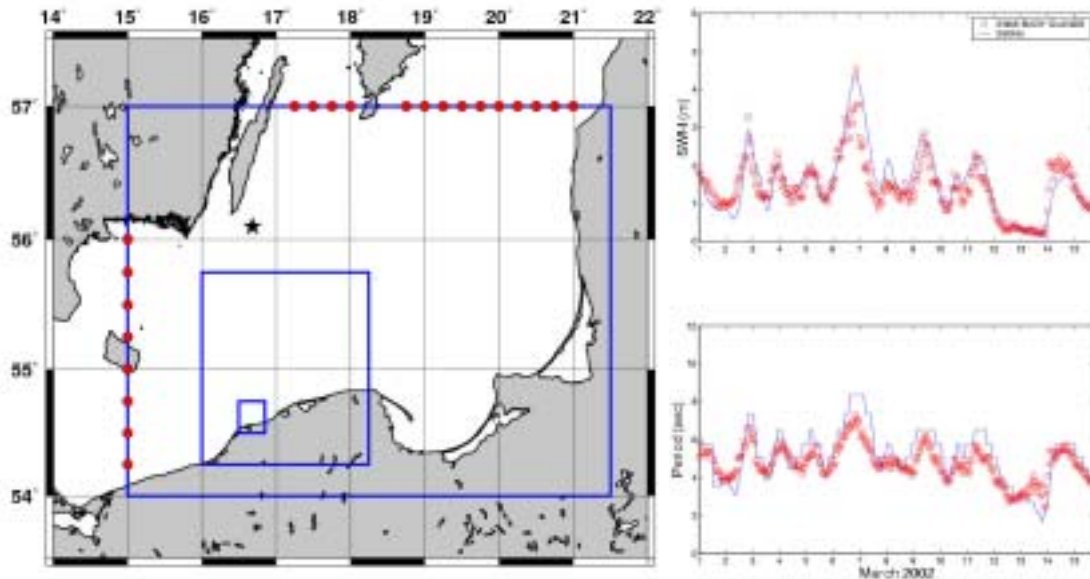


Figure 1. (left) Location where three SWAN nests (blue boxes) were run in support of NATO Exercise Strong Resolve in the Baltic Sea March 1-15, 2002. Circles denote location of WAM directional spectra applied on SWAN coarse nest boundary. Star denotes location of Swedish wave buoy. (right) Comparison of SWAN wave height (meters) and wave period (seconds) versus a Swedish wave buoy near 56.1°N 16.8°E.

Several improvements were made to DIOPS during FY02. The Graphical User Interface (GUI) was redesigned eliminating pop-up boxes with “OK” and “Cancel”. The New GUI is more intuitive to use by dividing the screen into 3 major areas using “window pane” technology. The task area on the left provides a visual outline of the operator tasks and is designed to walk the operator through the steps required to set-up a DIOPS scenario. A DIOPS display area provides the user a map of the region being modeled with overlays of model boundaries and nests. The bottom third of the display area contains the Analysis Area which provides information about model parameters, status of model runs and graphical output. DIOPS began a port over to Java during FY02. The benefits to this should be realized in FY03 when it is anticipated that DIOPS will be platform independent (capable of running on Unix, Windows, and Linux platforms). A SWAN *restart* option was added to DIOPS for initialization of subsequent SWAN model runs. Additionally, coordination with FNMOC allowed the distribution of WaveWatch3 directional wave spectra via TEDS. DIOPS now has the ability to initialize SWAN with WW3 wave spectra. This ability allows DIOPS to be run much faster than previously. Plans call for extending this capability to NAVO.

IMPACT/APPLICATIONS

Upon successful completion of this project on 30 Sept 2003, it is anticipated that DIOPS will be transitioned to METOC regional Centers, providing the capability to generate shallow-water wave, tide and surf forecasts for their areas of interest. Directional wave spectra from production centers (e.g., FNMOG, NAVOCAENO) will be distributed via TEDS enabling quicker turnaround times for model forecasts at METOC Centers.

TRANSITIONS

DIOPS1.0 was installed at NPMOC-SD in April 2001 on a dual-processor Sun Ultra 80 with 2 GB memory. DIOPS2.0 (SWAN wave model added) was installed at NPMOC-SD in December 2001. Visualization software and the Tactical Environmental Data Server were installed on a Dell 800 GHz Pentium PC. Daily wave, tide and surf forecasts are being made with DIOPS by a full-time scientist.

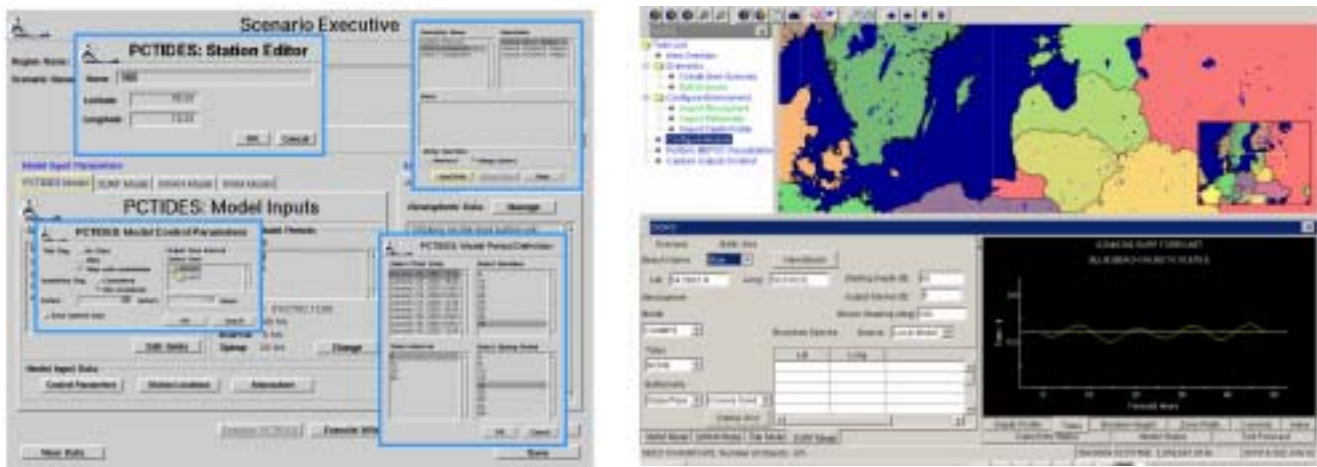


Figure 2. (left) Original DIOPS GUI includes “Pop-up” windows that can clutter the screen. (right) Redesigned GUI is more intuitive to use.

RELATED PROJECTS

TEDS: TEDS is a Defense Information Infrastructure (DII) Common Operating Environment (COE) compliant set of database, data, and software segments that serve as the primary repository and source of METOC data and products for the Navy Integrated Tactical Environmental Subsystem (NITES). The dynamic data server portion of TEDS is composed of the METOC database and a set of Application Program Interfaces (APIs) that provide storage for and access to dynamic METOC data (e.g. analysis/forecast grid field data, observations, text observations and bulletins). The TEDS web page can be accessed at <https://teds.navy.mil>.

SWAN is a third generation wave model which computes random, short-crested wind-generated waves in coastal regions and inland waters. Much of the recent work on SWAN was performed under ONR’s Advanced Wave Prediction Program. The SWAN web page can be accessed at <http://swan.ct.tudelft.nl/home.htm>

PUBLICATIONS

The Distributed Integrated Ocean Prediction System (DIOPS), R. Allard, J. Christiansen, T. Taxon, S. Williams, and D. Wakeham, submitted to Proceedings of the MTS Oceans 2002, Biloxi, MS, October 2002.

The Distributed Integrated Ocean Prediction System (DIOPS), D. Wakeham, R. Allard, J. Christiansen, T. Taxon and S. Williams, submitted to Proceedings of 7th International Conference on Wave Hindcasting and Forecasting, Banff, Alberta, Canada, October 2002.