

Coastal Marine Demonstration of Forecast Information to Mariners for the U.S. East Coast

Leonard J. Walstad
Horn Point Laboratory
University of Maryland Center for Environmental Science
PO Box 775
Cambridge, MD 21613-0775
410.221.8477 fax:410.221.8490 walstad@hpl.umces.edu

George L. Mellor
Program in Atmospheric and Oceanic Sciences
Department of Geosciences
Princeton University
Princeton, NJ 08544-0710
609.258.6570 fax:609.258.2850 glm@splash.princeton.edu

Isaac Ginis
Graduate School of Oceanography
University of Rhode Island
215 South Ferry Road
Narragansett, RI 02882
401.874.6484 fax:401.874-6728 ig@cone.gso.uri.edu

Glenn J. Szilagyi
Litton-TASC
4801 Stonecroft Blvd.
Chantilly, VA 20151
703.633.8300 x4875 fax:703.449.1080 gjszilagyi@tasc.com

Joseph S. D'Aleo
Weather Services International
4 Federal Street
Billerica, MA 01921
508.670.5165 fax:508.670.5100 jsdaleo@wsicorp.com

Frank Aikman III
Coast Survey Development Laboratory
NOAA/NOS
N/CS13, Rm 7821, SSMC3
1315 East-West Highway
301.713.2809 x101 fax:301.713.4501 frank.aikman@noaa.gov

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Laurence C. Breaker
Environmental Modeling Center
NOAA/NCEP
5200 Auth Road
Camp Springs, MD 20748
301.763.8133 fax:301.763.8545 lbreaker@sun1.wwb.noaa.gov

Jeffery T. McQueen
Air Resources Laboratory
NOAA/OAR
SSMC3, Room 3152
Silver Spring, MD 20910
301.713.0295 x135 jeffery.mcqueen@noaa.gov

Award N00014-98-1-0837
<http://cmdp.wsicorp.com>
<http://atlantic.hpl.umces.edu/CMDP>

LONG-TERM GOAL

Our long-term goal is to develop the capability to estimate and predict the coastal and estuarine environment and deliver these estimates to mariners, managers, and scientists. Relevant atmospheric variables include wind, temperature, humidity, precipitation, and visibility. Oceanic variables of interest include waves, currents, temperature, salinity, and water level.

OBJECTIVES

This collaboration will (1) demonstrate our current capability to estimate and predict the marine environment of Chesapeake Bay and the coastal ocean of the Mid-Atlantic Bight, (2) develop and apply new techniques for delivering marine information to users, and (3) continue to improve our ability to estimate the marine environment. Chesapeake Bay and the neighboring coastal ocean are heavily used for military, commercial, and recreational purposes. Marine environmental information is needed for safe and efficient operation in these waters. This is also a region for which there have been efforts to develop estimation and prediction capabilities. The Coastal Ocean Forecast System (COFS) (Aikman et al., 1996) has been applied to the East Coast of the United States for several years. The atmosphere over Chesapeake Bay is being modeled at fine resolution by the Regional Atmospheric Modeling System (RAMS) (Cotton et al., 1994). The Chesapeake Area Forecast Experiment (CAFE) (Bosley and Hess, 1997) has been developed and evaluated as well. Other tools are now available including the Local Analysis and Prediction System (LAPS) (Albers, 1996) and the mesoscale ETA model (Black, 1994). At the same time, regional real-time observational systems are expanding and providing the data necessary for mesoscale forecasts.

APPROACH

We are conducting two demonstration periods. The first was June 17, 1999 through July 31. During this period, estimates and forecasts were delivered to participating users. New methods for the delivery of these products were developed as a significant component of this collaboration. While new communications channels are attractive, most users will want information delivered through existing channels. We are exploiting the web for land based users and providing tools for accessing the products from shipboard. When necessary, products are faxed. The volume of information emanating from analysis and forecast systems is overwhelming. Delivered information must be customized and synthesized. Users are asked to assess the product during and after the demonstration period and in post-demonstration interviews.

Our analysis and forecast suite includes the COFS, LAPS, RAMS, CAFE, and meso-ETA. A significant component of this project is the connecting of data streams between these systems. The GLERL (Schwab, 1984) and SWAN (Holthuijsen et al., 1993) models are being applied to estimate the surface wave field. The output of these models and analyses was delivered to the users as described above.

WORK COMPLETED

Our primary objective for this year was the completion of the end-to-end system that incorporated the coupling of model systems as shown in Figure 1 and the delivery of data and model output to our user-partners. This objective was successfully completed and has stimulated substantive participation by our partners including the regional weather offices, the Marine Prediction Center, the Coast Guard and the Navy. The web interface is seen in Figure 2. Substantial improvements have been made to the models including: 1) the addition of satellite data assimilation to the COFS, 2) increasing the resolution and coverage of the COFS, and 3) forcing the Chesapeake Bay model with winds from the CBRAMS and CBLAPS systems. The new system is now called the Chesapeake Bay Estuarine Forecast System (CBEFS). In addition, we have conducted a survey of our users, and we are evaluating the accuracy of the model forecasts.

RESULTS

While the impact of model improvements is still being evaluated, user evaluations have been assessed. The ratings of four quality criteria were good or better for the following percentage of evaluations: accessibility – 87%, accuracy – 86%, display/format – 65%, and needs met – 62%. The models and delivery have been and continue to be improved based upon the input of our users and our assessment of model performance.

IMPACT/APPLICATION

Users found that these products have substantial utility. The real-time application and analysis of these models is leading to an acceleration of model improvements. We anticipate that these products will be requested for the entire coastal United States within the next few years. As models mature and are combined with biological models, there may be additional applications beyond the scope of this project. Specifically, there are opportunities for important contributions to water quality and fisheries/recruitment models.

TRANSITIONS

The transition process is ongoing. An important result of the Demonstration is that end users are developing an understanding of the utility of these products and learning to improve forecasts by applying the information contained in these predictions. This process is developing the knowledge base needed to effectively improve forecasts. Our final report will include suggestions for transition of the system to operational status.

RELATED PROJECTS

Each PI is conducting a research program that is supporting and benefiting from participation in this project.

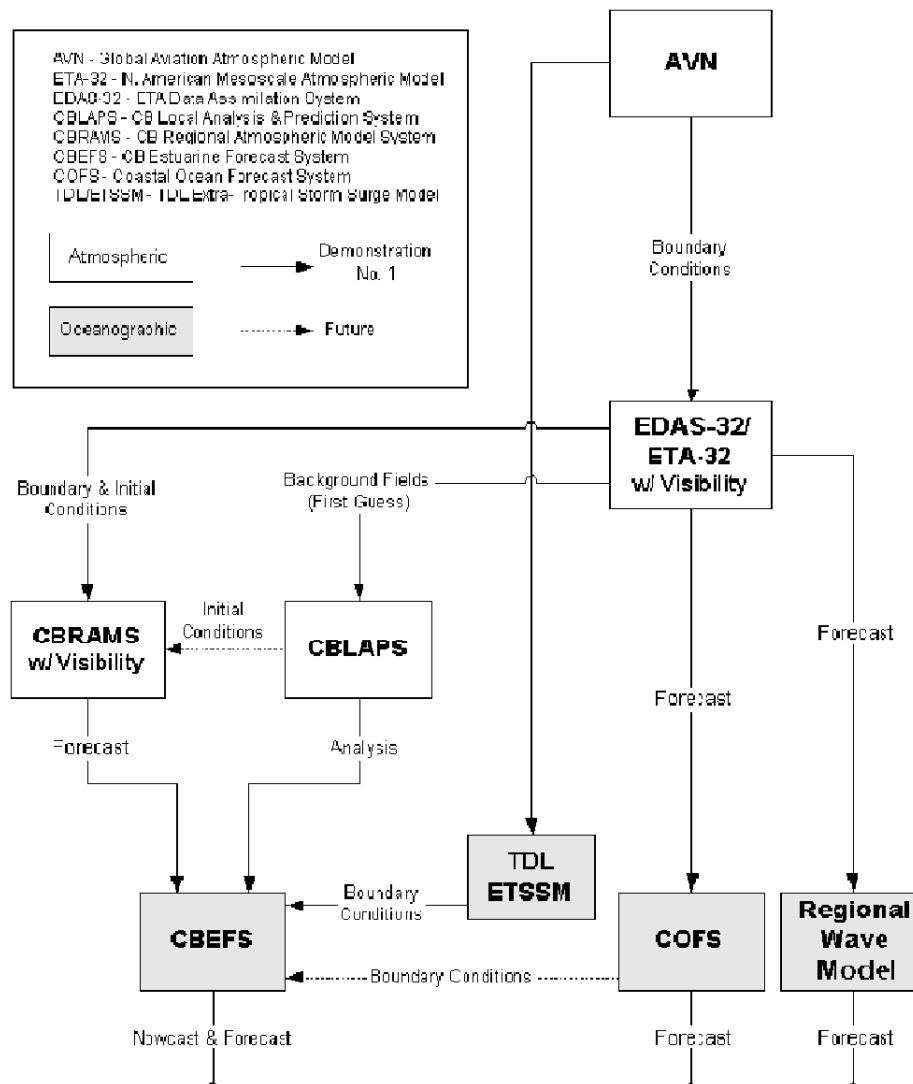


Figure 1 Summary of model connections. Output from this model system is collected by the display system and delivered to customers as shown in Figure 2. CBRAMS and CBLAPS are the Chesapeake Bay configurations of the RAMS and the LAPS respectively.

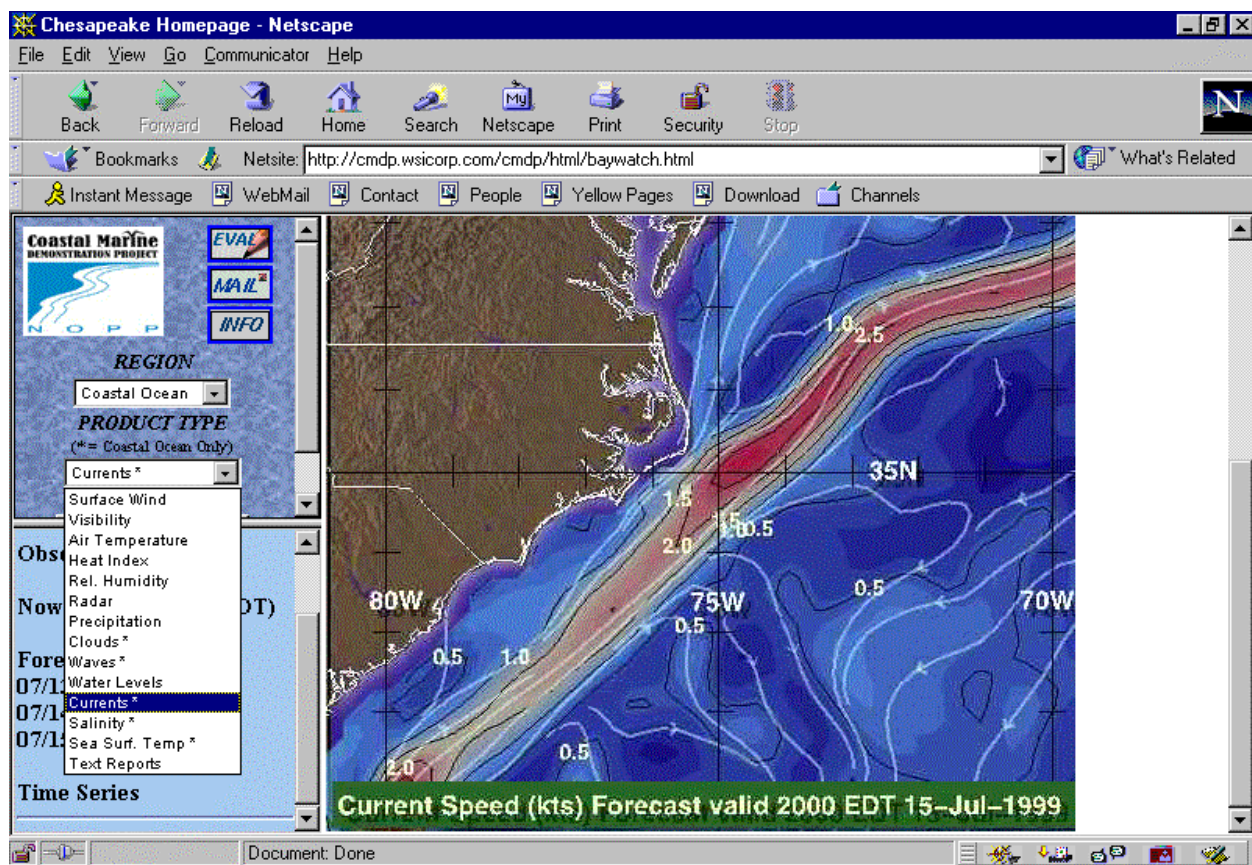


Figure 2. Coastal Marine Demonstration Project web based interface to CMDP products. Image shown is the surface current from the Coastal Ocean Forecast System near Cape Hatteras for July 15, 1999. Streak-lines indicate the direction of flow.

REFERENCES

- Aikman, F., G. L. Mellor, T. Ezer, D. Shienin, L. C. Breaker, K. Bosley, P. Chen, and D. B. Rao, 1996. Toward an Operational Nowcast/Forecast System for the U. S. East Coast. In *Modern Approaches to Data Assimilation in Ocean Modeling*, Elsevier Oceanography Series, Ed. P. Malanotte-Rizolli and D. Halpern, **61**, 347-361.
- Albers, S. 1996. The LAPS wind analysis. *Weather and Forecasting*, **10**, 342-352.
- Black, T. L. 1994. The new NMC ETA model: description and forecast examples. *Weather and Forecasting*, **9**, 265-278.
- Bosley, K. T. and K. W. Hess. 1997. Development of an experimental nowcast/forecast system for Chesapeake Bay water levels. Proceedings, 5th International Conference on Estuarine and Coastal Modeling, Alexandria, VA, October 22-24, 1997.
- Cotton, W.R., G. Thompson, and P.W. Mielke, Jr., 1994. Real-time mesoscale prediction on workstations. *Bull. Amer. Met. Soc.*, **75**, 349-362.
- Holthuijsen, L. H., N. Booij, and R. C. Ris. 1993. A Spectral Wave Model for the Coastal Zone. Proceedings, Second International Conference on Ocean Wave Measurement and Analysis, 630-641.
- Schwab, D. J., J. R. Bennett, P. C. Liu, and M. A. Donelan. 1984. Application of a Simple Numerical Wave Prediction Model to Lake Erie. *J. Geophysical Research*, **89**, (C3), 3586-3592.

PUBLICATIONS

- Aikman, F, J.G.W. Kelley, J. McQueen, T.F. Gross, K. Fuell and G. Szilagyi, 1999: Atmospheric and Oceanographic Analyses and Forecasts for the Chesapeake Bay Region During the Coastal Marine Demonstration. Preprints, Third Conference on Coastal Atmospheric and Oceanic Prediction and Processes, New Orleans, LA, Amer. Meteor. Soc., x-xx.
- Breaker, L.C., L.D. Burroughs, Y.Y. Chao, D.M. Feit and D.B. Rao, 1999: NCEP Participation in the Coastal Marine Demonstration Project. Preprints, Third Conference on Coastal Atmospheric and Oceanic Prediction and Processes, New Orleans, LA, Amer. Meteor. Soc., x-xx.
- Breaker, L.C., B. Balasubramanian, A. Brown, L.D. Burroughs, Y.Y. Chao, R. Kelly, H.J. Thiebaux, P. Vukits and K. Waters, 1999: Results from Phase 1 of the Coastal Marine Demonstration Project: The Coastal Ocean. NOAA Office Note xx, 21 pp.
- Fuell, K.K, J.G.W. Kelly and J. McQueen, 1999: The Development of High Resolution Analyzed Wind Fields for the Chesapeake Bay Region. Preprints, Third Conference on Coastal Atmospheric and Oceanic Prediction and Processes, New Orleans, LA, Amer. Meteor. Soc.
- Gross, T.F., F. Aikman, J. McQueen, K.K. Fuell, K. Hess, J.G.W. Kelley, 1999: Water Level Model Response to Wind Forcing Over the Chesapeake Bay During the Coastal Marine Demonstration Project. Proceedings, Sixth International Conference on Estuarine and Coastal Modeling, New Orleans, LA, American Society of Civil Engineers.
- McQueen, J.T., G.D. Rolph, F. Aikman, J.G.W. Kelley, T. Gross, G. Szilagyi, K.K. Fuell, C. Tremback and J. Titlow, 1999: Development and Evaluation of a Non-hydrostatic Atmospheric Prediction System for the Chesapeake Bay Region. Preprints, Third Conference on Coastal Atmospheric and Oceanic Prediction and Processes, New Orleans, LA, Amer. Meteor. Soc.
- Richardson, S. and Szilagyi, G.J., 1999: User Evaluation of Coastal Marine Demonstration No. 1, Litton-TASC Technical Report, 37 pp.
- Titlow, J. and McQueen, J.T., 1999: On the Use of a Coastal Mesonet as a Tool for Mesoscale Model Evaluation. Preprints, Third Conference on Coastal Atmospheric and Oceanic Prediction and Processes, New Orleans, LA, Amer. Meteor. Soc.
- Walstad, L, G.J. Szilagyi, F. Aikman, L.C. Breaker, J.S. D'Aleo, F.C. Klein and J.T. McQueen, 1999: Coastal Marine Demonstration of Forecast Information to Mariners for the U.S. East Coast. Proceedings, Sixth International Conference on Estuarine and Coastal Modeling, New Orleans, LA, American Society of Civil Engineers.