Interim report on the NASA funding for
Pilot Applications of the Chesapeake Bay Forecast System

Submitted September 28, 2009
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This report details the effort to solicit and fund relevant projects for the effort known as the Pilot Applications of the Chesapeake Bay Forecast System.

History

On August 11, 2008 a proposal in the amount of $309,554 was submitted to the National Aeronautics and Space Administration, Earth Science Division, Science Mission Directorate:

"We propose a one-year project aimed at demonstrating the value and utility of applications of the Chesapeake Bay Forecast System (CBFS), a prototype regional integrated Earth System Model being developed and implemented at the University of Maryland Earth System Science Interdisciplinary Center. This pilot effort will develop several Pilot User Collaborations aimed at identifying and testing methods for applying CBFS forecast products to sector-specific needs."

"Each Pilot User Collaboration (PUC) will include an Application Specialist (AS), a scientist with appropriate academic expertise to enable them to interface between the CBFS team and the user groups. The PUC will also include suitable representatives from the selected application user groups."

On December 5, 2009, Dr. Richard Hartle/GSFC approved a new task on the ESSIC Master grant with Goddard and $305,000 was allocated to the task by Faye Richardson.

On December 5, 2009, various organizations in Maryland were contacted and asked to submit mini-proposals for this effort. Among those organizations contacted were:

The NOAA Cooperative Oxford Lab (COL)
The Chesapeake Biological Lab (CBL)
The Maryland Department of Natural Resources (DNR)
The UMCES Horn Point Laboratory
The Chesapeake Research Consortium (CRC)
The University of Maryland Institute for Advanced Computer Studies (UMIACS)
Oceanographers, modelers, and land-surface scientists at Goddard (GSFC)
The University of Maryland Center for Smart Growth
The University of Maryland Institute for Applied Environmental Health

On January 14 a meeting of interested parties was held at ESSIC, and a presentation was given my Prof. Ragu Murtugudde.

On May 13, 2009 (and again on June 3, 2009), prior approval for issuance of sub-contracts under the Master Grant was requested of Paula Martin, NASA Shared Services by UMD Office Research Administration and Advancement (ORAA).

On July 24, 2009, approval was granted by the NASA Grant Office, Paula Martin, and 6 successful proposers (at 4 institutions) were awarded sub-contracts (see below).

A budget for this project is appended at the end of this report. Note that other than funding a Results Workshop and subsequent publication, ESSIC and its researchers derive no monetary benefit from this award.

Future plans

Preliminary Results Teleconference, January 2010
"Results Workshop" at ESSIC, April 2010
A journal publication submission describing the effort and results, May 2010.
Final report, September 2010

Funded Projects

Applications of the Chesapeake Bay Forecast System: Forecasting Future Drinking Water in an Urbanizing Warmer World
Dr. Sujay Kaushal
Chesapeake Biological Laboratory
University of Maryland Center for Environmental Science (UMCES)

A pilot application with Baltimore City Department of Public Works is proposed to forecast changes in Baltimore's drinking water supplies, where extensive historical data is available and there have been previous observations of the importance of extreme hydroclimatic events on unprecedented changes in drinking water quantity and quality.

Changes in withdrawals from 3 different reservoirs that supply Baltimore City are conducted daily based on fluctuations in water quality; forecasting the effects of extreme events and future land-use change would provide important information in managing drinking water to a large number of residents in Baltimore City and Baltimore County.

Forecasting Young-of-the-Year Production of Striped Bass in Chesapeake Bay
Dr. James Pierson
Horn Point Laboratory
University of Maryland Center for Environmental Science (UMCES)

We propose to produce and validate a forecast model of striped bass recruitment that will provide an earlier projection of striped bass reproductive success, in terms of young-of-the-year (YOY) production, than is currently available to managers, other decisions makers, and the general public. Our model will be based on mechanistic relationships

between YOY, environmental conditions, and the prey field. There are well-established relationships between environmental variables and zooplankton in Chesapeake Bay, and we will evaluate the array of links connecting the environmental conditions to zooplankton and ultimately to fish by testing specific hypotheses about the relationships. To do this we will include estimates of food quantity as well as food quality available to YOY, based on empirically derived and validated relationships. Forecasts could be available that would provide this information in April, which would provide YOY recruitment estimates 4-6 months earlier than the current YOY sampling program is able to provide

Pilot User Collaboration for Harmful Algae Forecasts in MD Chesapeake Bay
Catherine Wazniak
Maryland Department of Natural Resources

The objectives of this study are to assess the skill of the Chesapeake Bay Forecast system, CBFS, model in regards to harmful algae blooms, HABs, and to refine the habitat suitability model for *Karlodinium* associated with cryptophyte abundance.

The primary objective is to assess the skill of predictions of the likelihood of blooms of the harmful algal species *Karlodinium micrum* and *Microcystis* in the Chesapeake Bay. We will leverage results from the MERHAB project entitled "Development and implementation of an operational harmful algal bloom prediction system for Chesapeake Bay" that is developing and generating nowcasts and 3-day forecasts for *Prorocentrum minimum*, *Microcystis sp*. and *K. micrum*. DNR proposes to estimate the skill score with increasing forecast time (nowcast, 3 day, 7 day (if available), and 14 day forecasts).

Chesapeake Community Modeling Program proposal for CBFS applications
David Jasinski
The Chesapeake Community Modeling Program (CCMP)
Chesapeake Research Consortium

Our goal is to communicate with several watershed associations throughout the Bay region, including Riverkeepers of the Patuxent, Rhode/West, South, Severn and James Rivers. During this process, we will inform them of the output available from the CBFS and then determine what products will be most helpful in their efforts to protect, restore and educate

The James River Association (JRA) has indicated that they are interested in developing a James River Recreational User Information System for the tidal waters of the James River. This system would provide forecasts of potential elevated bacteria and harmful algal bloom (HAB) concentrations for the river/estuary. These forecasts would be used to inform the general public about potential water quality issues and dangers to human health from recreational use (swimming, fishing, boating, etc.) of the beaches and waters of the James.

**A habitat suitability forecasting model for
Chesapeake Bay's striped bass population**
Dr. Robert J. Wood
Dr. Xinsheng Zhang
NOAA Cooperative Oxford Laboratory
via the Chesapeake Research Consortium

We will provide produce a forecasting model for the resident striped bass
population of Chesapeake Bay. This model will be built upon peer-reviewed and
published habitat preferences for striped bass and a hindcast model that will utilize a
quarter century of hydrographic, plankton, and fisheries data available for Chesapeake
Bay. This framework will be used to focus on how seasonal, interannual, and decadal
scale climate variability drives differences in striped bass quality and quantity, especially
in the summer when the population is vulnerable to stress from warm temperatures and
low dissolved oxygen. Forecasts will rely upon the CBFS's coupled regional atmosphere,
ocean, biogeochemical, and land dynamical models and produce forecasts that range
from 14 days, to decadal scale projections pertinent to assess the potential effects of land
use and climate changes.

Baltimore-Washington Partnership for Forest Stewardship
Dr. Molly E. Brown
NASA/Goddard Space Flight Center

This project focuses on using this existing partnership with the Baltimore Washington
Partners for Forest Stewardship (BWPFS) to distribute and disseminate high frequency,
high resolution weather forecasts as well as downscaled IPCC model scenarios providing
climate information years to decades into the future. The pilot proposed here will enable
the Chesapeake Bay Forecast System to become a key player in providing weather and
climate information for forest management at the Federal and State level.

The project's main objective is to integrate climate data focused on climate change and
variability at the years to decades scale generated by the Chesapeake Bay Forecast
System using the IPCC land use scenarios created by various groups.