COAMPS™ High-Resolution Weather Forecasts for Mississippi and Louisiana Coasts

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Thanks to the recent development of software tools by the National Oceanic and Atmospheric Administration (NOAA) and UNIDATA, researchers at the Mississippi State University (MSU) Computational Geospatial Technologies Center, Stennis Space Center, MS, have been able to develop and release a powerful nested operational version of the Coupled Ocean/Atmosphere Mesoscale Prediction System™ (COAMPS) that covers the Louisiana and Mississippi coast using a Multivariate Optimal Interpolation (MVOI) Scheme.

This version of COAMPS runs twice daily at a 14-km and 42-km resolution and displays high-resolution wind forecasts. In developing this version of COAMPS, MSU modelers had to overcome three major hurdles:

- Sophisticated software that can handle continuous transmission of weather data. The Local Data Manager (LDM) software, written by UNIDATA [1] in Boulder, CO, facilitates the dissemination of weather observation in near-real time and so overcomes this first hurdle.
- Weather observations that are in a format easily incorporated into mesoscale models. In the past, this has been difficult, as the University had to perform much post-processing, making data assimilation in real-time weather modeling almost impossible. However, in the past year, the NOAA Forecast System Laboratory (FSL) has developed the Meteorological Assimilation Data Ingest System (MADIS) [2] that organizes weather observations into easy-to-use databases in a common format (i.e., netCDF).
- Quality control on the data so that model initial conditions do not become corrupted. Observations sometimes contain bad or incorrectly reported measurements, and these must be removed from the model initialization; however, automating this procedure is difficult. This, normally, is a task requiring the dedication of huge resources that only organizations like FSL can provide. Fortunately, the FSL providers headers to identify probable bad data, thereby allowing MSU programmers to remove this data before it gets into COAMPS.

With these new tools, and the support of Navy projects such as Northern Gulf of Mexico Littoral Initiative (NGLI) and Distributed Marine Environment Forecast System (DMEFS), the High Performance Computing Modernization Program (HPCMP) Programming Environment and Training Program (PET), and the Mississippi Space Commerce Initiative (MSCI), MSU was able to fund a staff of expert mesoscale modelers to write software to handle the COAMPS front end.

Mesoscale initial conditions are provided by using a previous 12-hour first guess of COAMPS that is then updated using optimal interpolation of FSL data. Boundary conditions are provided by either the FNMOC NOGAPS model or the NCEP AVN

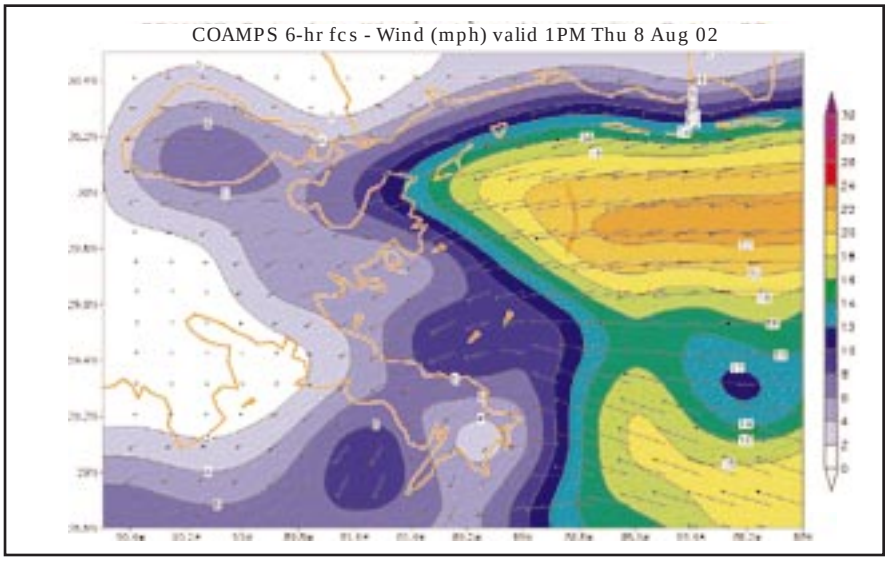


Figure 1. COAMPS 10-meter 6-hour wind forecast for the Louisiana and Mississippi coasts, initialized 9 August 2002 at 12Z. Note the mesoscale variation captured by COAMPS in the wind field, with weak winds off Louisiana coast and strong winds off the Mississippi coast, due to a high pressure system moving into the southeastern US.

model. The results are 14-km operational runs, typically available by noon and midnight each day, which show high-resolution wind forecasts. These forecasts show a remarkable detail of land and ocean differences, as well as the influence of the land and sea breeze.

An example is shown in Figures 1-3 for a 24-h forecast initialized 8 August 2002 at 12Z (7AM). On this day, the pressure gradient increased due to a high pressure system moving into the southeast US. The result was that northeast winds increased throughout the day, with winds increasing westward with time.

As shown in Figure 1, winds were initially weak at 18Z (1PM) over Louisiana and the southern coast of Louisiana. In contrast, winds were strong south of Mississippi. With time, these strong winds expanded into Louisiana and its southern coast as shown in Figures 2 and 3.

The model shows this progression, and validated well against buoy and METAR data. Such information, showing the big change in wind speed that afternoon, would have been useful to boaters on the coast of Louisiana and Mississippi. Also, note the difference in wind speeds over land compared to water. COAMPS is developed for marine applications, and shows such differences of inland and marine winds clearly. These forecasts are being made available to the general public and, in particular, should be useful to the maritime community.

The other motivation for the operational runs is the insight they provide in mesoscale modeling research. Typically, parallel runs are performed to study the sensitivity of COAMPS to different physics packages, model resolution, etc., culminating in journal

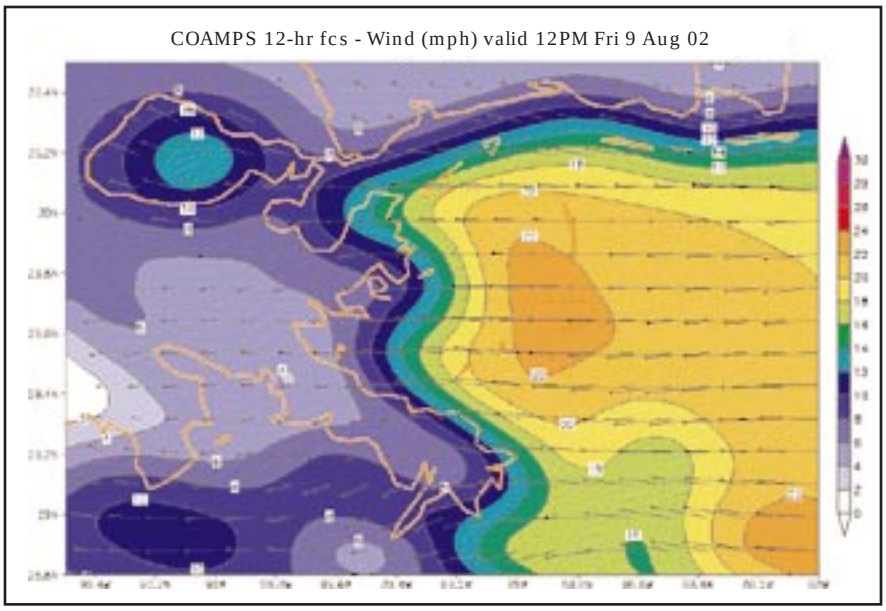
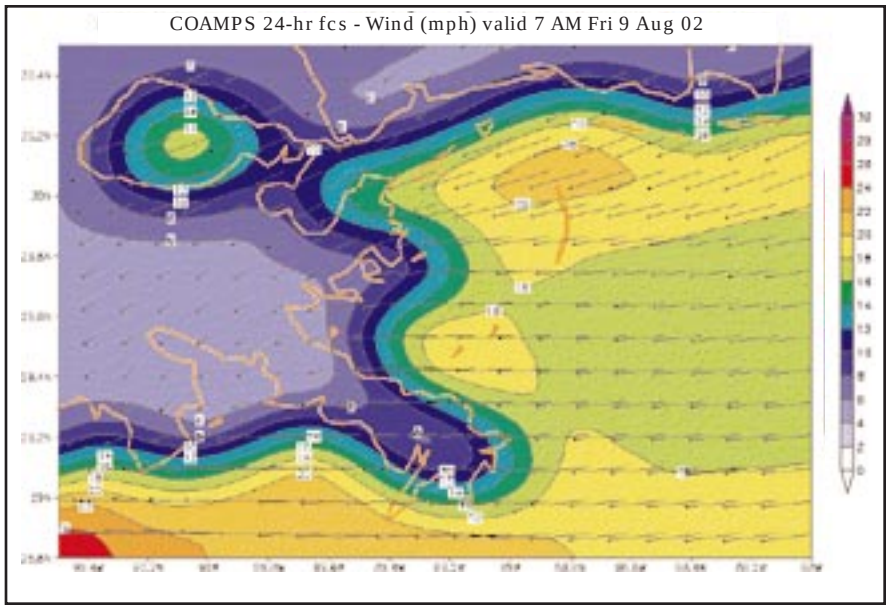


Figure 2. (Above) 12-h COAMPS forecast, showing the westerly progression of the fast winds into Louisiana.

Figure 3. (Below) As in Figs. 1 and 2, but for a 24-h forecast, showing the transition to windy conditions throughout the forecast region. The ability of COAMPS to predict such wind changes and coastal variations, as well as the distinctly different wind regimes over land and water, should be useful to mariners and coastal residents.



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papers such as the soon-to-be submitted article "Validation Of Coastal Wind Forecasts - A Sensitivity Study Of COAMPS 2.0 at 9- And 27-Km Resolution" to the Monthly Weather Review.

Other research includes the development of coupling scheme between wave models and COAMPS. This PET project has funded applied research towards incorporating the NCEP wave model Wavewatch into COAMPS, as well as improving the wave growth parameterization physics.

References

1. www.unidata.ucar.edu
2. www-sdd.fsl.noaa.gov

Contacts

To access the forecasts generated by COAMPS, go to http://www.ssc.erc.msstate.edu/NGLI/coamps_DA/coamps_new.html.

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Nicholas Green worked with his mentor Randy Becnel, Lead of the NAVO MSRC Network group of Northrop Grumman Information Technology. His internship work dealt with the troubleshooting of dial-in problems, making and installing a cat-5 or fiber gigabit Ethernet cable, configuring V-LAN and V-LAN Trunking ports on the switches.

Nicholas also had a chance to configure and install three Cisco 2900 XL switches, along with troubleshooting on the Crays and SGIs, to participate in the crash test of the IBM SP4 and to help install the Voice-Over Internet Protocol (IP) telephone system at the NAVO MSRC.

Nicholas said of his experience, "I feel that the summer internship was very informative and definitely beneficial to me. It gave me the opportunity to see what working in a HPC center is like. I was exposed to, and given the opportunity to work on many types of networking related materials. Throughout the entire internship I felt as though I accomplished a lot."

Feedback from Terry Jones, mentor to Joel, was very positive. "The intern program helped us achieve goals that we would have otherwise been unable to achieve. Having such a high caliber individual as Joel participating made the experience rewarding and one that far exceeded my expectations. If the opportunity presented itself again, I would eagerly participate again, and would definitely like to have Mr. Konkle-Parker work with us."

Equally positive was the feedback received from Randy Becnel, Nicholas' mentor. "Nicholas was a valuable contributor to the NAVO/MSRC mission during his internship. As lead of the networking group, I found the intern program to be extremely beneficial to both the intern and NGIT's mission at the NAVO/MSRC and would welcome the opportunity to participate in future intern programs."

We look forward to the 2003 Summer Intern Program. We will be looking for mentors again - the sooner you let us know you're interested, the better able we are to match an intern to your needs.