P1.52   Outreach Activities for the Naval Research Laboratory's Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS[TM])[1]

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1. INTRODUCTION

The Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS) is the latest product in a series of mesoscale (less than 100 km) weather prediction model developments at the Naval Research Laboratory (NRL) Marine Meteorology Division. The COAMPS model represents a complex state-of-the-art analysis (including the Nowcast capability) and short-term forecast tools applicable for any given region of the earth in both the atmosphere and ocean (Hodur 1997, Chen *et al.* 2003). It can be setup with grid resolutions ranging from hundreds of kilometers down to meters. The COAMPS model is used for research and operational weather forecast and it has been used to study a wide range of atmosphere and ocean problems such as air-sea interaction, hurricanes, hazardous weather, cloud and precipitation, turbulence, and terrain induced circulations. It can be initialized with idealized or real data and can be run on a wide range of computer platforms including desktop PCs, workstations, and massive parallel distributed-memory supercomputers.

The atmospheric component of COAMPS has been used to provide operational mesoscale atmospheric forecasts for the NAVY central and regional forecast centers since the winter of 1996. At the time, the distribution of COAMPS outside NRL and the NAVY forecast centers were limited to DOD agencies or Universities that had collaboration projects with NRL. To increase the COAMPS usage by a broader community for weather related research and education, the model source code was made available via the World Wide Web in 2001. Hundred of users have downloaded the COAMPS source code since then. This paper describes activities at NRL to extend its education and supporting effort regarding the outside usage of COAMPS. These efforts include providing on-site COAMPS training classes, user's workshops, and development of a new COAMPS web site.

2. TRAINING CLASSES and WORKSHOPS

NRL has been routinely providing the on-site COAMPS training classes. The three-day training class includes lecture and hands on sessions. The pre-requisite for the class is college-level math (calculus and deferential equations) and basic numerical weather prediction concepts. Usually, students with Geophysics or Meteorology majors will acquire such knowledge in their senior year or in the first year of a master's program. The lectures cover general theory and equations used in ocean and atmospheric analysis

models, and forecast model dynamics and physics. The analysis model is used to prepare the initial and boundary conditions for the forecast model and is a very important component for a continuous assimilation of the ocean and atmospheric states. The forecast model is used to predict future conditions of the ocean and atmosphere by integrating a set of dynamic and physics equations forward in time. The lectures are designed in a way that the COAMPS users will gain some insight on the analysis and forecast components of COAMPS.

Although COAMPS is a very large and complex computer code, consist of more than 10,000 lines of code written in FORTRAN and C, NRL has developed a user-friendly interface to setup, run, and output the model forecast. This streamlined system is called the COAMPS On-Scene (COAMPS-OS[TM])[1] and is used by the NAVY regional operational centers, several DOD organizations, and universities to do the real-time weather forecast. NRL also has a simpler separate user-interface for individual researcher to use. The hands on session allows the user to walk through all the procedures required to obtain a model forecast by actually setting up and running a COAMPS forecast on the NRL's super computer. How to use and display output from the COAMPS forecast is also covered in the hands on session.

A total of 136 users attended the training classes between 1996-2002. Approximately 50% of them were affiliated with the US or foreign universities.
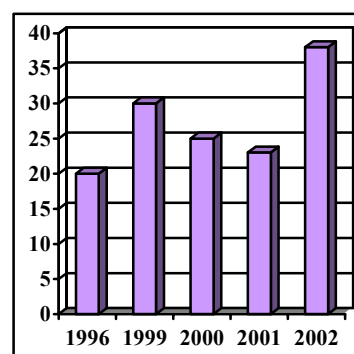

Figure 1. The number of users that attended the COAMPS training classes from 1996 to 2002.

To facilitate the communication among model developers and users, NRL hosted the first user's one-day workshop immediately after the COAMPS training class in 2002. NRL presented the COAMPS development road map and new developments. The

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[1] COAMPS and COAMPS-OS are a registered trademark of the Naval Research Laboratory.

rest of the workshop covered topics related to the user's recent COAMPS research. NRL will periodically provide the user's workshop to discuss new model improvements.

3. COAMPS WEB SITE

The COAMPS web site (http://www.nrlmry.navy.mil/~coamps/coamps) was originally launched in 1997 to include some very limited information on the COAMPS model. Major updates on the COAMPS web site were conducted in 2001 in an effort to broaden the COAMPS user base by distributing the model source code and model related information via the World Wide Web (WWW). Information about COAMPS was expanded to include the real-time forecasts, COAMPS training class materials, COAMPS related publications and research projects, procedures to download the model source code, how to register as a COAMPS user, frequently asked questions, where to obtain data to initialize COAMPS, and COAMPS forecast verifications.

The COAMPS web site is continuously to be expanded and improved upon. One area of major improvements in 2002 was the addition of the COAMPS trade mark agreement pages, modifications of the COAMPS source code download procedure, and inclusion of the COAMPS web administration pages to allow for a more efficient way of monitoring the user registration and download processes. Each registered COAMPS user was assigned a COAMPS web login account. The web login and password were automatically assigned when the user click on the "I accept" COAMPS trademark agreement. Upon receiving the user's signed fax copy of the usage agreement, NRL then activated the user's COAMPS web account. The addition of the individual user web login has laid groundwork for the subsequent developments of a new COAMPS web site in 2003 to increase the web security and enable the distribution of different information to the different user groups.

In order to have the maximum flexibility of delivering different web pages to the different users, all top layer web pages are dynamically generated. Perl is used at the front-end to create the HTML page layout and is also used to check the web security. The Cascading style sheets are used to keep the format of each page layout consistent. The UNIX shell scripts and file systems are used to serve as a database at the back-end. The UNIX tree structure is adapted for the layered web page layout. The Java script is used to handle the data insert, data verification, and mouse movement.

The four user groups were setup with different domain access permissions. These are the WWW users, COAMPS administrators, registered COAMPS users, and the NRL users. Only the WWW users do not require web login. What the user will see after login to the COAMPS web account depends on the user's

domain access permission. The WWW users can access general information such as COAMPS model overview, user registration, model initialization, and COAMPS real-time forecasts as shown in Figure 2. The registered COAMPS user and the NRL user are required to login with a password. Home page layout for each user is individually tailored and based on the user's access permission. Users in different groups have different home pages, but a user in the same group can also have different home page. The personal home page for these two groups is shown in Fig. 3.

Figure 2. The COAMPS web home page. This is the page that the WWW users can access. The access manuals are listed on the left and the top of the page.

Figure 3. The COAMPS registered user's and the NRL user's home page. The red circles highlight the access manuals that these users will see after they login to their COAMPS web account. The NRL users will be able to see more in-house related COAMPS information than the outside users.

The COAMPS web administrator's home page controls the COAMPS user and NRL user domains (Fig. 4). The COAMPS web administrator can list users in different groups, set up access permissions for each user, list current/new users, approve new users, build mail groups, and send mail to the users. The NRL user administration sub-page has the additional

functions of setting up new NRL user account and resetting the NRL user web password.

Figure 4. The COAMPS web administration page (top panel) and the COAMPS user's sub-page (bottom panel).

4. SUMMARY

The COAMPS model is a state-of-the art mesoscale ocean and atmospheric numerical prediction model that has a very wide-range of applications for research, education, and real-time forecast for both military and none military usage. It has been tested on many different regions of the world and the code runs very efficiently on a variety of computer platforms. New research results are constantly being implemented in COAMPS and transitioned to the NAVY operational forecast centers. To continue the support of outside usage of COAMPS with limited available resource, future developments will be concentrated on using the new web tech knowledge to provide the web-based tools to create COAMPS user interface, web-based training, and provide more relevant information to the users.

5. REFERENCES

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6. ACKNOWLEDGEMENTS