6.7 A COLLABORATION TOOL TO SUPPORT MODELING GROUPS

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1. INTRODUCTION

Modeling consortia within NOAA involve research partners from multiple government agencies and academic institutions. These close collaborations involve frequent discussions of specific data and model results. Given the geographic distribution of the investigators and the time and financial costs of frequent face-to-face meetings, a collaboration tool that utilizes the Next Generation Internet (NGI) for exploration and annotation of data and model results, enabling colleagues in other locations to see those annotations in real time, is vital. The collaboration tool will utilize OPeNDAP standards for data access, and will be built by leveraging from existing components. The initial testbed will be the Carbon Modeling Consortium.

Science requirements include real-time (synchronous) collaboration features allowing collaborators to interactively introduce and graph data from each of the collaborating sites, or from other remote network sites (e.g. DODS/OPeNDAP sites), point to a specific feature in the data while conducting a conference call, and have collaborators immediately see the item of interest and/or point out other features in the data is extremely powerful and beneficial for these collaborations. The tool will also include delayed mode (asychronous) collaboration features that include the ability to establish a longer-term topic of discussion online, where individual participants may participate in a “networked conference session” to discuss a topic of interest, and then save the session, work off-line to investigate various aspects of this topic, and then rejoin the session later to post results for comment.

2. DESIGN GOALS - REQUIREMENTS

The general requirements for this project are based on those needs model development, testing, and validation require.

Synchronous collaboration: Given the geographic distribution of the investigators and the time and financial costs of frequent face-to-face meetings, a tool designed to allow a user to explore and annotate data and model results and have colleagues in other locations see those annotations in real time is vital. The ability to interactively introduce and graph data from each of the collaborating sites, or from other remote network sites (e.g. DODS/OPeNDAP sites), point to a specific feature in the data while conducting a conference call, and have collaborators immediately see the item of interest and/or point out other features in the data is extremely powerful and beneficial for these collaborations. *A fast NGI network is required for this functionality, and in fact, tools such as this are part of the justification for the existence of the NGI.*

Asychronous collaboration: Another useful aspect of this tool will be the ability to establish a longer-term topic of discussion on-line, where individual participants may participate in a “networked conference session” to discuss a topic of interest, save the session, work off-line to investigate various aspects of this topic, and then rejoin the session later to post results for comment. This session could then be saved to document the range of analyses that were investigated and the resulting decision that was made regarding that topic. At a future date, when a question arises about why a particular decision was made regarding that topic or a similar topic of interest is raised, one can log into the specific “conference session” and see the notes and plots that helped resolve that issue.

The following itemizes features that are required in the final tool. Checked (✔) items are features that already exist in either ncBrowse or OceanShare.

2.1 *Required scientific features.*

- Flexible, interactive graphical displays of data and metadata (attributes) from a wide range of netCDF data file conventions. ✔
  - Parametric plots (e.g., temp-salinity) ✔
  - Flexible mapping of independent variables to axes.✔
  - Vector plots, Animations, 3D visualizations ✔
  - Publication quality graphics ✔
- Remote netCDF file access with simple HTTP or DODS/OPeNDAP ✔
- Supported on Unix, Linux, Windows and Mac OS. ✔
- Support ocean/atmospheric model vertical coordinate systems, e.g., sigma, hybrid, and isopycnal.
- Extract arbitrary sections from ocean model results, not just east-west and north-south, for comparison with observations. WOCE hydrographic sections do not all lie on east-west or north-south lines. Coastal hydrographic sections are often parallel or perpendicular to the coast.

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- Support for statistical and graphical comparisons between station data and gridded model results. Statistics should include correlations and Taylor diagrams (comparison of 2-d fields both by pattern and magnitude).
- Import and export data to local files. These files should be readable by external analysis tools, e.g., Ferret, Matlab, etc.

2.2 *Required collaboration features.*

- Work with all collaborators on-line simultaneously (synchronous collaboration). ✔
- Prior sessions can be saved; re-entered later (asynchronous collaboration) ✔
- Access to local and remote data in a networked collaborative tool environment ✔
  - Group access to local and remote data files, graphics ✔
  - Standard collaboration tool features (annotation, whiteboard, etc.) ✔
- Import of model output and data sources being collected for model initialization, assimilation, and validation. ✔
- Secure Document Repository ✔
  - Secure location for sharing documents, e.g., proposals, papers in progress, data, images ✔
  - Access control list for individual documents and/or folders ✔
- Locally remove a graphics window from the current session, edit the graphics, and then put the window back into the session.
- Delete a graphics window from the session.
- Bookmarks. Tagging the session so that new actions added after you have logged out of the collaborative session are indicated once you have re-logged in.
- Retain participant activity logs by session.
- Session replay: fast forward to bookmark, then single step.
- Enable new logins to a secure session after the session creator has logged out.
- Restrict a session to specific individuals.
- Date/Time stamp all actions. List date-time in the chat window.
- Session editing: remove specific or redundant objects
- Archive a session. Save/restore a session from JavaSpaces to a local directory.

3. APPROACH

To meet the collaborative needs, we will build upon existing projects: OceanShare (Denbo, 2002; Denbo and Windsor, 2000) (http://www.epic.noaa.gov/collab), a collaborative tool based on the CORBA, Java, and JavaSpaces technologies, the Climate Data Portal (Soreide, et al., 2002) (http://www.epic.noaa.gov/cdp), a powerful, flexible and extensible Data Server (recently extended to serve data using the OPeNDAP protocol), ncBrowse (Denbo and Osborne, 2003; Denbo, 2001) (http://www.epic.noaa.gov/java/ncBrowse), a desktop Java application a netCDF and netCDF compatible OPeNDAP resource browser, and SGT Beans (Denbo, 2003; Denbo, 2001) (http://www.epic.noaa.gov/java/sgt), an easy-to-use graphical application development system. The new collaborative tool expands OceanShare by integrating the above technologies into a flexible and powerful tool for model development and analysis.

4. ARCHITECTURE

The architecture of the collaborative tool consists of a main application, OceanShare, and four major subsystems, data access, computation, graphics, and collaboration (Figure 1).

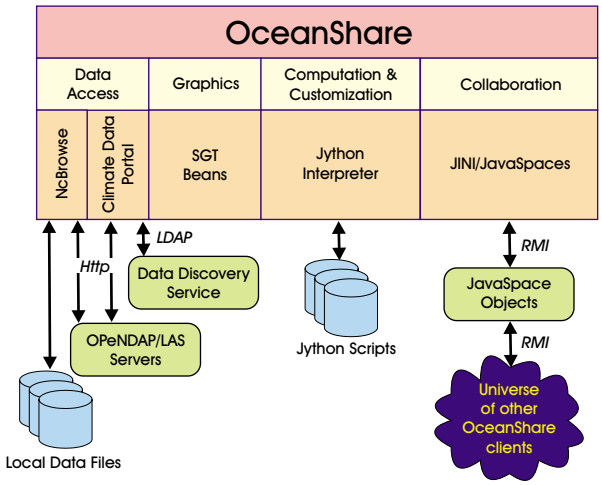

Figure 1. The OceanShare application consists of four major subsystems.

OceanShare: The main application, OceanShare, has responsibilities that include coordinating between the subsystems, providing a mechanism for saving user preferences, printing, and handling user interactions. The main application consists of a “chat” area (Figure 2) and dialogs for system messages and current user lists (Figure 3).

Data Access: The data access subsystem is designed so that additional data resources can be easily be added at a later time. Presently, access to local netCDF files and remote OPeNDAP resources that can be accessed using the Java-netCDF API are provided.

Computation: Jython, a high-level, dynamic, object-oriented Java implementation of Python (http://www.jython.org), provides a scripting environment for user defined computation and customization. Custom

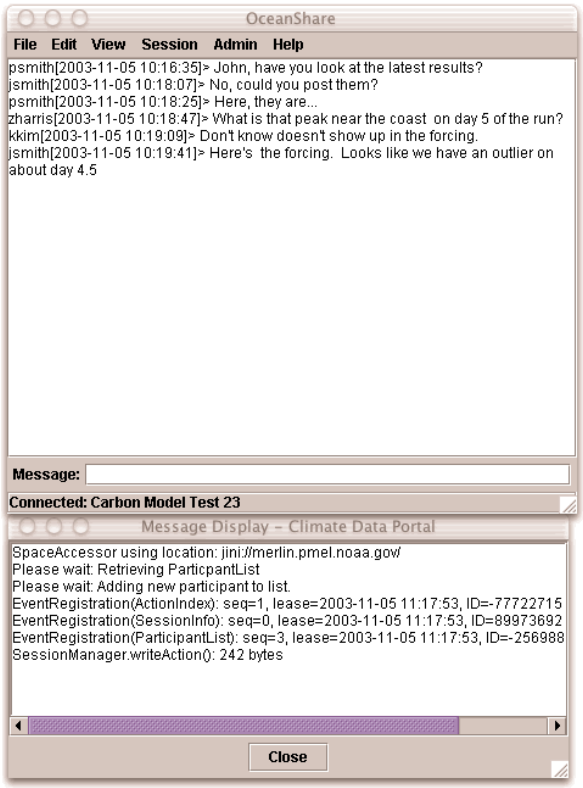

Figure 2. OceanShare chat and message display windows.

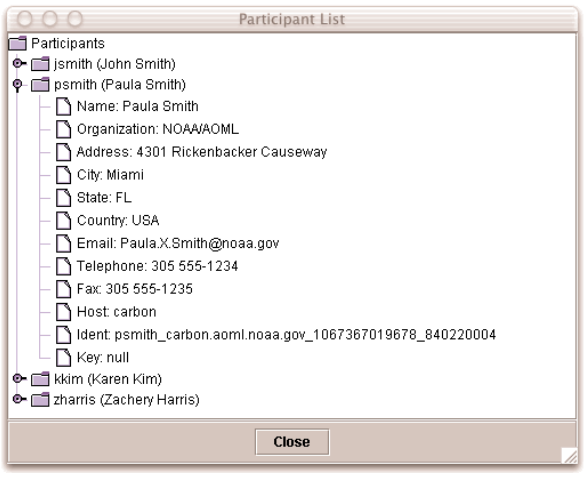

Figure 3. Dialog that displays the sessions current participants.

Jython scripts can be used to perform grid transformations, compute statistics, and create custom graphical presentations.

Graphics: SGT Version 3.0 provides basic graphics support and includes the easy-to-use SGT Beans. SGT Beans are easier for an expert programmer to utilize, and includes a wizard to enable a user to easily modify the layout of panels in a graph. These modifications can be saved in an XML text file which can used with Jython to create graphical displays. SGT enables a user to annotate line (Figure 4) and raster (Figure 5) graphics.

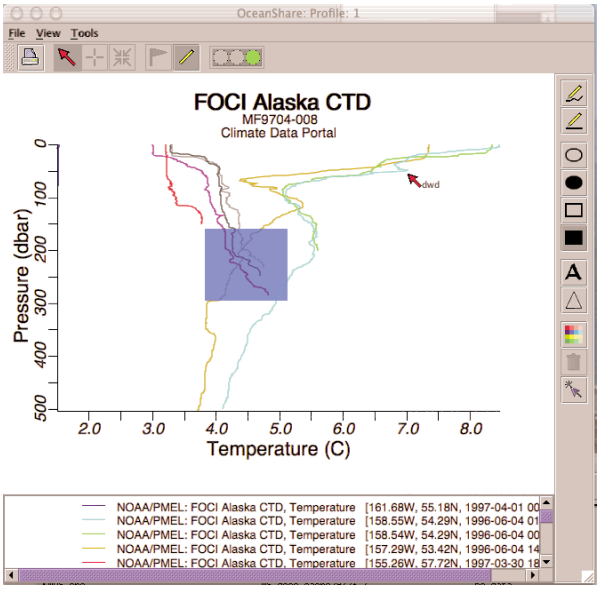

Figure 4. Profile plot of FOCI Alaska CTD data showing the annotation tools.

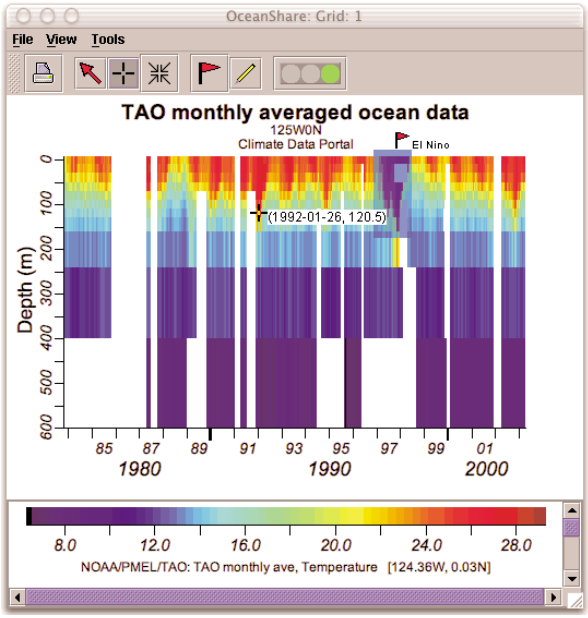

Figure 5. TAO monthly averaged temperature at 125W 0N. Plot also includes a Note, annotation, and an icon that shows the current location.

Collaboration: Collaboration is provided by using the Jini/JavaSpaces toolkit (http://www.jini.org). Jini is a distributed computing environment. A Jini system or federation is a collection of clients and services all

communicating by the Jini protocols. OceanShare uses Outrigger, a Jini service that implements the persistent JavaSpaces service, to provide collaboration services. Outrigger provides an simple interface to create, read, delete, and manage objects in JavaSpaces.

5. FUTURE DIRECTIONS

The design for the new collaboration tool is finished and implementation of the new collaboration features using Jini/JavaSpaces has begun. The integration of ncBrowse and SGT Beans into OceanShare will begin soon. We plan to have the Jython scripting capabilities available in the first release. When completed, the collaboration tool will be freely provided on our website at http://www.epic.noaa.gov/collab.

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