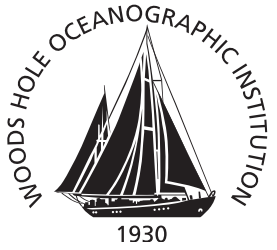
WHOI-2001-13

Woods Hole Oceanographic Institution



4DGeoBrowser: A Web-Based Data Browser and Server for Accessing and Analyzing Multi-Disciplinary Data

by

Steven Lerner

Andrew Maffei

Woods Hole Oceanographic Institution
Woods Hole, Massachusetts 02543

October 2001

Technical Report

Funding was provided by the Woods Hole Oceanographic Institution.

WHOI-2001-13

4DGeoBrowser: A Web-Based Data Browser and Server for Accessing and Analyzing Multi-Disciplinary Data

by

Steven Lerner
Andrew Maffei

October 2001

Technical Report

Funding was provided by the Woods Hole Oceanographic Institution.

Approved for public release; distribution unlimited.

Approved for Distribution:

W. Rockwell Geyer, Chair

Department of Applied Ocean Physics and Engineering

4D GeoBrowser: A Web-Based Data Browser and Server for Accessing and Analyzing Multi-Disciplinary Data

1 Background

1.1 Overview

The 4DGeoBrowser, referred to more simply as the *GeoBrowser*, is a general-purpose application environment designed to facilitate access to multi-discipline data sets within the oceanographic community. In 1997, Steven Lerner and Andrew Maffei, from the Woods Hole Oceanographic Institution, developed the *GeoBrowser* concept and implemented a prototype that aided the identification team of the M/V Derbyshire survey to access and analyze imagery collected from the underwater remotely operated vehicle Jason. Since 1997, the GeoBrowser system has grown significantly and is widely used in the oceanographic community for applications including the USGS Marine Realms Information Bank (MRIB), The Jason Virtual Control Van, Low-cost telemetry buoys, and SeaNet.

The *GeoBrowser* s capabilities include the following:

1) Provide simple access to data collected by different scientific disciplines via the worldwide web. The *GeoBrowser* fully exploits a new concept called the Electronic Index Cards (EIC).
2) EICs support multi-media - i.e., EICs can contain text, embedded images, video, URL s, etc.
3) Robust search capability including temporal, spatial, and keyword searches.
4) Interactive plots are supported, including time-series and geographical plots.
5) Real-time monitoring and access to historical data.
6) Multi-user support. Allows interactive sessions to be maintained and provides access control to protect user data.
7) Built-in tools for importing and exporting data.
8) Remote HTTP and Email communications and interfaces enabling custom user interfaces and automatic data search and plot capabilities.
9) Support for substantially large data sets (>100,000 cards) per collection with unlimited hierarchical collections support for scalability. EIC collections are user selectable.
10) External applications interface to easily extend the GeoBrowser s capabilities.
11) Designed for scientists, web-developers, data specific applications, and real-time monitoring.

This paper presents the concept of Electronic Index Cards in the next section, GeoBrowser Applications in section 2, and GeoBrowser v3.0 User Manual and Reference Guide in section 3 and section 4 respectively.

1.2 Electronic Index Card Concept

The electronic index card (EIC) is a simple, yet powerful concept to facilitate the handling of multi-disciplinary, multi-media, and multi-sensor datasets. EICs can be thought of as a digital version of the 3x5 index cards that were once found in locations such as libraries and desktop index card boxes. Electronic cards are more versatile than their paper analogy and can include not only simple text items such as a title or an author, but can contain any type of information including embedded URL links, images, audio, and video. Additionally, by taking advantage of a field naming dictionary and using standard fields for time and position, applications like the 4DGeoBrowser can provide temporal, spatial, and keyword search capabilities along with plotting capabilities including interactive time-series and geographical plots. Individual cards are group together to form Collections . A group of cards or collection can reside in a single file or span many files. User s can select a number of collections and seamlessly search for data between them.

Important characteristics of electronic index cards are:

- All the information placed on an EIC refers to a single entity (person, place, data sample, data file, image, movie, etc.).
- EICs are small and intended to hold a limited amount of information about the object. If more information is important it is typically referred to using a URL.
- EIC fields often refer to other sources for more detailed information about entities such as raw data, graphics, online metadata, etc.

- All values in an EIC are preceded by a fieldname (Title, Subject, Author, etc.) that describes the information that follows it.
- EICs are stored in a self-documenting ASCII format.
- There is support for storing EIC cards separately from its data (e.g., images and metadata)
- With the Condensed EIC format there is little or no overhead associated in turning serial data streams into cards .

Three format specifications exist for defining EICs: Fully Qualified EIC, Condensed EIC, and Text EIC. All three of these formats are ASCII and self-documenting. The fully qualified EIC is the original format and designed as self-contained data records, with each record containing all the fieldnames and values defined on a card. This format allows users to mix and match cards from different datasets, disciplines, etc. The condensed EIC format is a streamlined format design for efficiency and flexibility. This format is probably the most widely used, and it is easy to generate data in this format either manually or with scientific instrumentation. The text EIC format is designed as a verbose human readable format. Both the Condensed EIC and the Text EIC formats can be converted directly to the fully qualified EIC. The GeoBrowser provides tools for easily importing and exporting EICs to other applications. Independent of the format that is used, the EICs capabilities remain the same.

To demonstrate some of the features the GeoBrowser system and EICs, a small dataset of the NOAA New England Buoys is used to display these concepts (refer to figures 1-4). EICs can be search by keywords, date/time, location etc. and then the resulting cards can be viewed and plotted. Plotting capabilities include both time-series and geographical plots. Figure 1-1 shows a sample EIC specified in the Condensed EIC format followed by the resulting GeoBrowser display of a card. Figures 1-2 and 1-3 show that multiple cards can also be displayed as lists and as icons. Figures 1-4 and 1-5 demonstrate the geographic plotting capabilities.

Fig 1-1 (a): Sample Condensed EIC Format (2-cards)

```
#Fields: EIC.title,EIC.time,EIC.lon,EIC.lat,EIC.elev,EIC.info,EIC.cat1,EIC.key,Location,
station 44008,1997/11/13 10:00:00,-69.43,40.50,0,http://seaboard.ndbc.noaa.gov/station_page.phtml?$station=44008 Station 44008,...
station 44003,1997/11/14 11:00:00,-68.5,40.8,50,0,http://seaboard.ndbc.noaa.gov/station_page.phtml?$station=44003 Station 44003,...
```

Fig 1-1 (b): Sample GeoBrowser card view

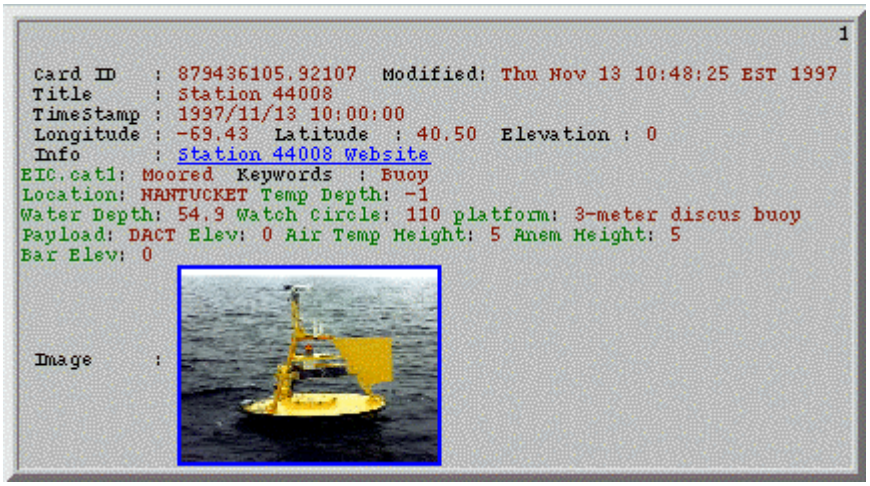


Figure 1-1: a) Sample ASCII Condensed EIC format shown containing two cards. b) GeoBrowser s integrated view of the card information from the 1st card defined in (a). The card contains known field definitions such as Latitude, Longitude (shown in black), user-defined fields (shown in green), an embedded URL link, and an embedded image. This is the default card view. The GeoBrowser also supports custom views for user-defined applications.

	Title	TimeStamp	Latitude	Longitude	Elevation	View
1.	Station 44008	1997/11/13 10:00:00	40.50	-69.43	0	Card
2.	Station 44003	1997/11/13 10:00:00	40.8	-68.5	0	Card
3.	Station BUZM3	1997/11/13 10:00:00	41.40	-71.03	0	Card
4.	Station 44011	1997/11/13 10:00:00	41.08	-66.58	0	Card
5.	Station 44025	1997/11/13 10:00:00	40.25	-73.17	0	Card
6.	Station ALSN6	1997/11/13 10:00:00	40.46	-73.83	0	Card
7.	Station 44028	1997/11/13 10:00:00	41.40	-71.08	0	Card
8.	Station 44013	1997/11/13 10:00:00	42.35	-70.69	0	Card
9.	Station 44005	1997/11/13 10:00:00	42.90	-68.94	0	Card
10.	Station IOSN3	1997/11/13 10:00:00	42.97	-70.62	13.1	Card
11.	Station 44007	1997/11/13 10:00:00	43.53	-70.14	0	Card
12.	Station MISM1	1997/11/13 10:00:00	43.78	-68.86	16.2	Card
13.	Station MDRM1	1997/11/13 10:00:00	43.97	-68.13	9.1	Card

Figure 1-2: Sample list of EICs displayed in a brief format that is useful for viewing many cards with specific fields (columns of data). Users can select which fields they wish to display.

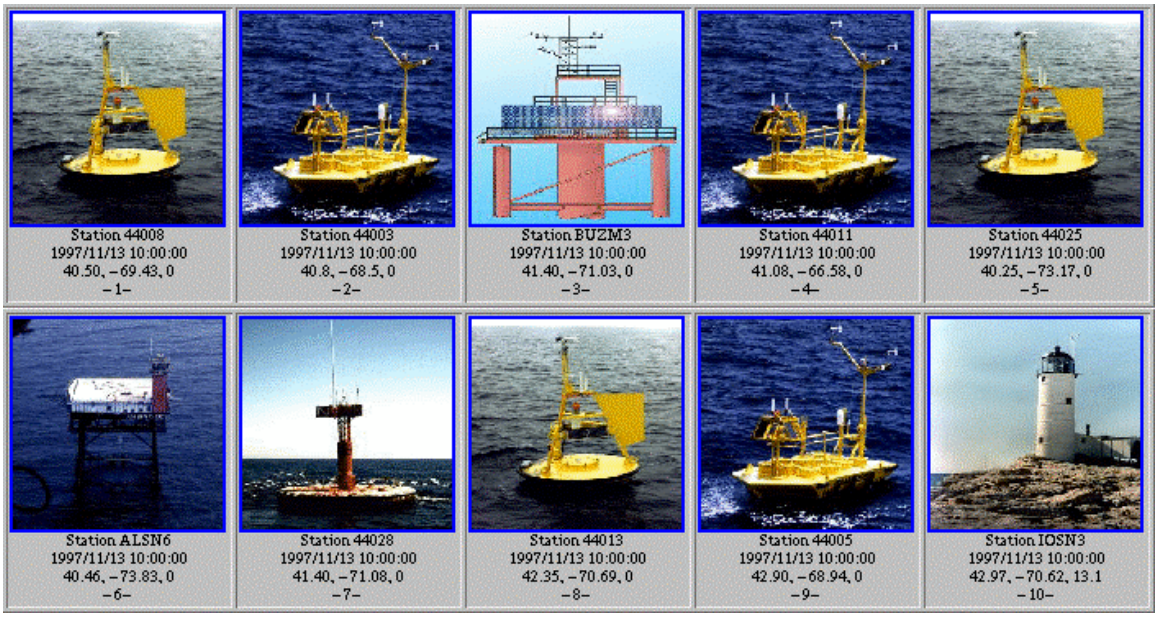


Figure 1-3: Sample EICs displayed as icons that can be useful for looking at image data sets. Each photo is selectable and depending on the user s preferences, it will either display the full EIC or will automatically go to a specific URL link defined on the card. This type of display can be tied directly to search results, so for an image data set, you could perform a keyword search for all the images that contain say a flounder, and see the resulting images.

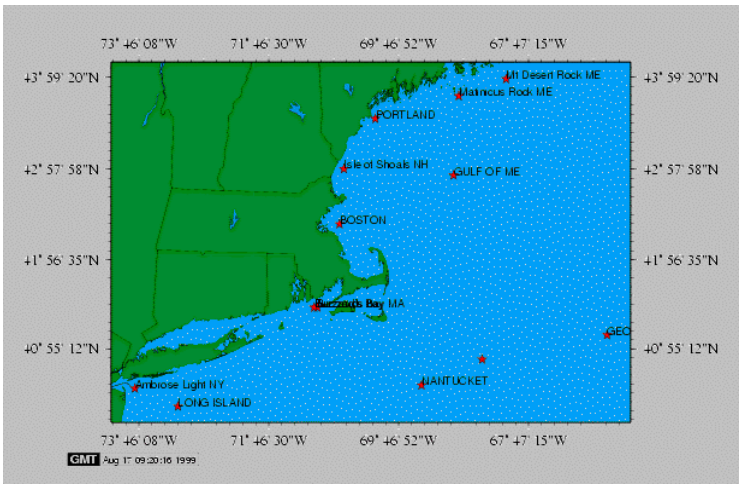


Figure 1-4: Sample EICs plotted geographically. In this example, locations of each of the New England buoys are shown as red stars and the value of the Location field within each index card is displayed as text. When you drag the mouse over the stars, information is displayed at the bottom of the web-browser. This is also an interactive plot, meaning that when an item is clicked-on, either the full EIC will be displayed or the browser will automatically go to a specific URL link defined on the card, depending on the user s plotting preferences. Note: for web-developers, interactive plots such as these can be easily stored and inserted into websites.

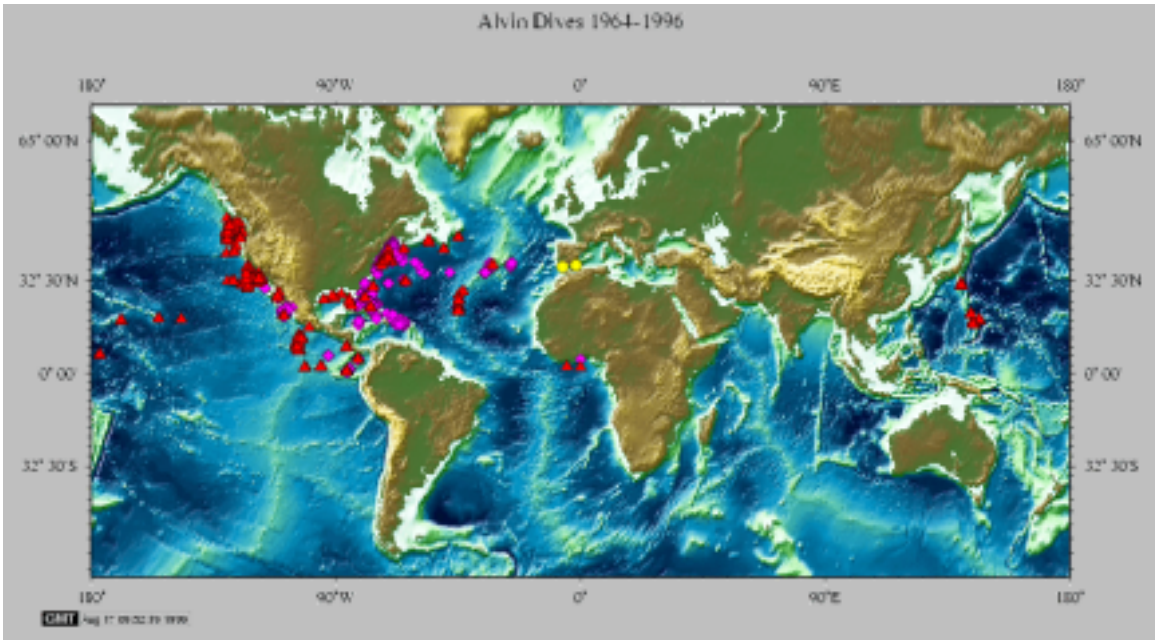


Figure 1-5: Alvin Dives from 1964-1996 colored by ships (Lulu-magenta diamonds, AtlantisII-red triangles). The dive locations are overlaid onto a shaded-relief elevation and bathymetric map. Note: as can be seen in the plot, it wasn t until after 1996 that Alvin dived below the equator. As part of the GeoBrowser output, this plot is interactive, meaning that the user can click on any of the icons and either obtain the complete index card information associated with that point or automatically go to a specific URL link defined on that card.

Here s another example of a card from a collection that contains underwater ROV Jason imagery combined with navigation, attitude, and event records (figure 1-6). From within this collection of cards, you can search for all the images that contain tube worms . With the results of your searches, you can view the images, plot the distribution or values of some variable within the cards, or save the cards for future reference.

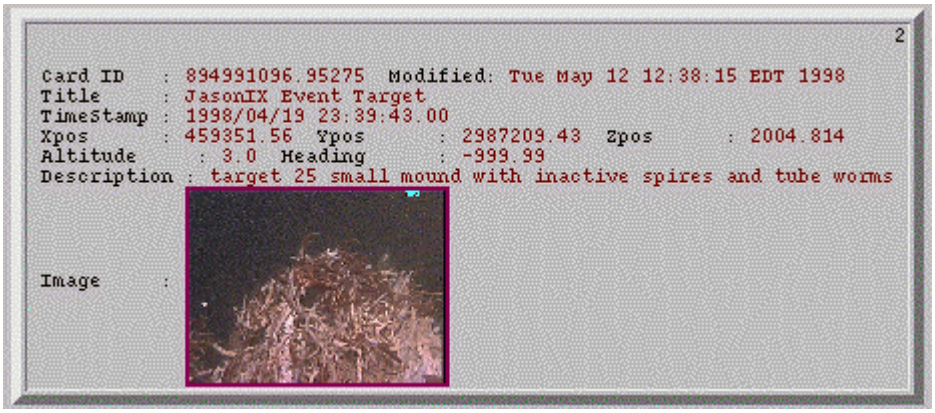


Figure 1-6: Example of underwater image combined with Jason Vehicle data and description.

Finally, the look and feel of the index card displays can be customized. Figure 1-7 shows an example of a customized card display for the Virtual Jason Control Van application. This card includes straight html and contains embedded references to the EIC fields whose values you wish to display (such as $Card{ EIC.time }). There is a field available in the EIC called EIC.df that references the name of the custom display form you wish to use.

Figure 1-7: Example of a customized display of a GeoBrowser card.

2 GeoBrowser Applications

One of the strengths of the GeoBrowser system is its ability to provide content and processing power for other web applications. GeoBrowser enabled applications call the GeoBrowser system using a url and display the results back to the user via a standard web-browser. This allows the oceanographic community to develop scientific project websites with their own look and feel that take advantage of the GeoBrowser concepts and capabilities. Several GeoBrowser applications have been developed both inside and outside of WHOI and are briefly described in this section. A snapshot of the 4dgeo website that provides pointers to these GeoBrowser Applications is shown below.

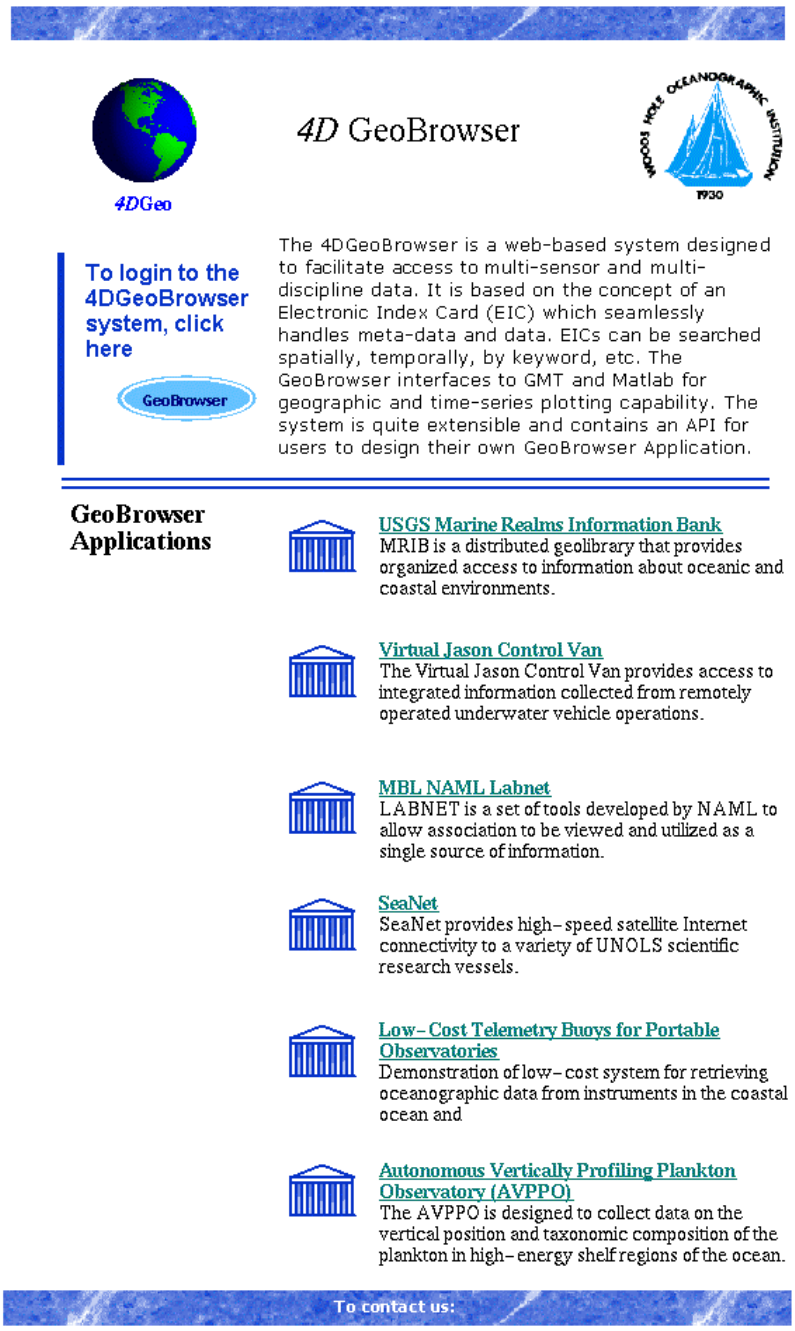
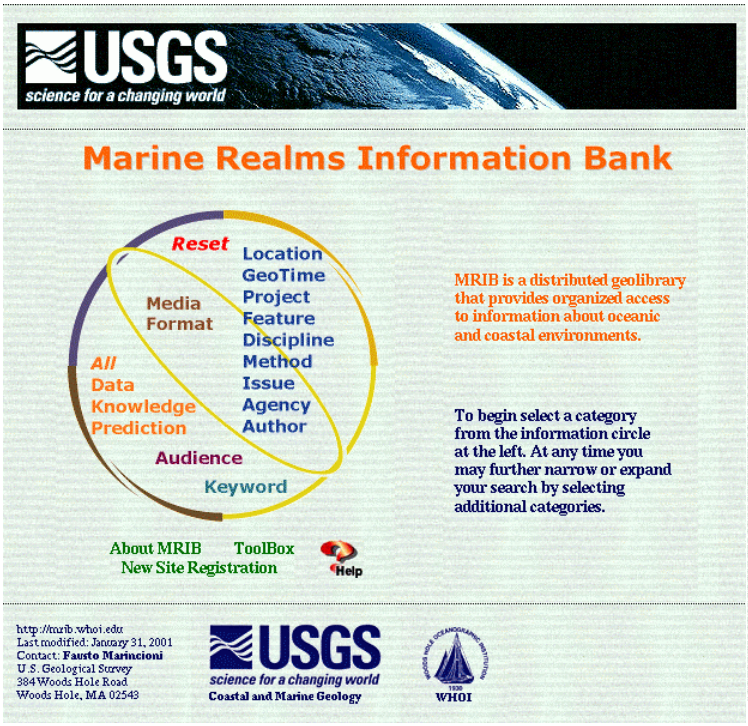


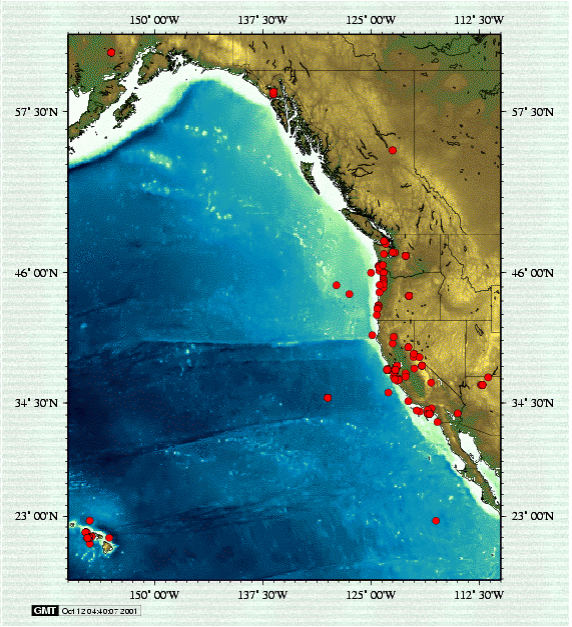
Figure 2-1: 4DGeoBrowser home page (4dgeo.whoi.edu)

2.1 USGS Marine Realms Information Bank (MRIB)

MRIB is a distributed geolibrary developed by USGS and WHOI that provides organized access to information about oceanic and coastal environments. This application demonstrates an innovative user-interface simplifying complex multi-dimensional searching. It is also an example of building and accessing data from an on-line knowledge bank. The GeoBrowser is used internally as the search-engine for keyword, spatial, and temporal searching and to generate interactive geographic plots. Sample screen snapshots from the website are shown below.



(a)



(b)

(c)

Select a title to go to website or view plot
Total of 42 matches, 1 to 20 displayed.

Item	Title	Author	Description	Data Collection
1	Open-File Report 95-0628: Preliminary Analysis of Down-core Biotic Assemblages: Bob Allen Keys, Everglades National Park, Florida Bay Translate	Brewster-Wingard,_G._Lynn Ishman,_Scott_E. Cronin,_Thomas_M. Edwards,_Lucy_E. Willard,_Debra_A. Halley,_Robert_B.	This open-file report (abstract on WWW page, full report in PDF format) interprets environmental conditions in Florida Bay from a Bob Allen Keyssediment core.(Details)	1994/05 1994/05
2	Open-File Report 96-0732: Preliminary Report on the Distribution of Modern Fauna and Flora at Selected Sites in North-central and North-eastern Florida Bay Translate	Brewster-Wingard,_G._Lynn Ishman,_Scott_E. Edwards,_Lucy_E. Willard,_Debra_A.	This open-file report (abstract on WWW page, full report in PDF format) interprets biological composition of sediment cores from Florida Bay, representative of the past 200 years of human impacts.(Details)	1995/02 1995/07

Figure 2-2: USGS Marine Realms Info Bank homepage (a), example geographic plot for all items located in the North Pacific West-Coast U.S. (b), and an example of tabular output after a multi-level search (c).

2.2 Jason Virtual Control Van

The Jason Control Van is where shipboard Pilots, Navigators, and Engineers control remotely operated vehicles (ROV) such as Jason and Argo. Scientists use these vehicles for underwater scientific research. The Virtual Van is a web-based application that captures all the information that occurs inside the Jason Control Van during vehicle operations including video snapshots, vehicle data, and events entered by Scientists. The Virtual Van data collection system has been deployed on four cruises and provides on-line access to current and previous cruises including over 40,000 control van snapshots containing more than 160,000 images. The Virtual Van application uses the GeoBrowser system to display, search, and plot the data collected. In the near future, the Virtual Van will be combined with a SeaNet satellite communication system to provide live access to remote underwater scientific expeditions for shore-side scientists and the public.

Figure 2-3: The Jason Virtual Control Van homepage (above).
A sample list of Virtual Van Cruises is shown below.

CruiseName	CruiseID	Location	Dates	Vessel	ChiefSci	View	VVan	Public
JuanDeFuca2001	tn129	Juan De Fuca Ridge	June 17 – July 2, 2001	R/V Thompson	Paul Johnson			yes
Indian Ocean 2001	kn162-13	Indian Ocean	March 27 – May 5, 2001	R/V Knorr	Cindy Van Dover			yes
EelRiver 2000	tn118	Eel River Basin, Washington	October 12 – October 17, 2000	R/V Thompson	Lisa Levin			yes
JuanDeFuca 2000	tn117	Juan De Fuca Ridge	September 29 – October 7, 2000	R/V Thompson	Paul Johnson			yes
Guaymas 1998	atlv3117	Guaymas Basin, Mexico	April 19 – April 29, 1998	R/V Atlantis	Dana Yoerger			yes
JasonProject1990	jaspro90	Lake Ontario	May 3 – May 13, 1990	Erie West	Margaret Rule/Robert Ballard			

Figure 2-4: Photograph of inside the Jason Control Van (upper image), The Jason Virtual Control Van (lower image). The Virtual Control Van enables users to play the data back and forth in time and search for items by keywords, dates/times, and events.

Figure 2-5: Sample of the Virtual Van Snapshot tool. The left image is from a cruise in the Indian Ocean and the right image is the view of the R/V Knorr as seen from Jason as it is being lowered into the water.

2.3 MBL/NAML Labnet

LABNET is a set of tools developed by the National Association of Marine Laboratories (NAML) to allow the data collected by member organizations to be viewed and utilized as a single source of information. Several applications have been demonstrated including a Grain Size Database and Harmful Algae Bloom Monitoring (see figure 2-6). The algae bloom monitoring is an interesting example of how many independent observations from individual laboratories can form together to build a gestalt picture over time. In this case, a composite time-elapsed animation was used to view and monitor algae flows.

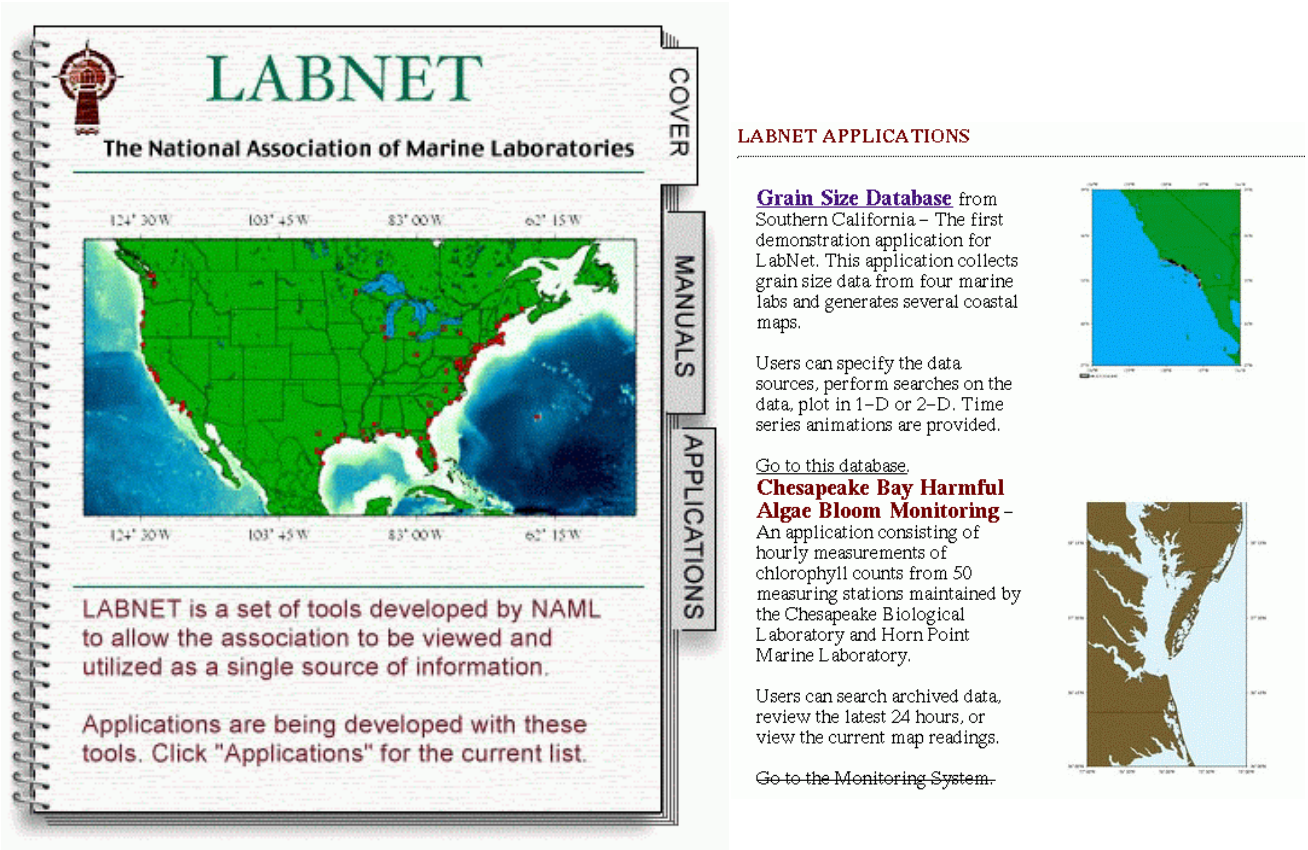


Figure 2-6: MBL/LABNET homepage (left), sample LABNET applications (right).

2.4 SeaNet

SeaNet is a wireless communications system that extends the Internet to ships at sea. SeaNet uses the GeoBrowser system to plot the positions of the ships overlaid onto an Inmarsat satellite coverage map. SeaNet also uses the GeoBrowser to view and analyze antenna statistics. Figure 2-7 shows SeaNet s www.seanet.int homepage displaying current ship locations. Figure 2-8 shows some analytical plots.

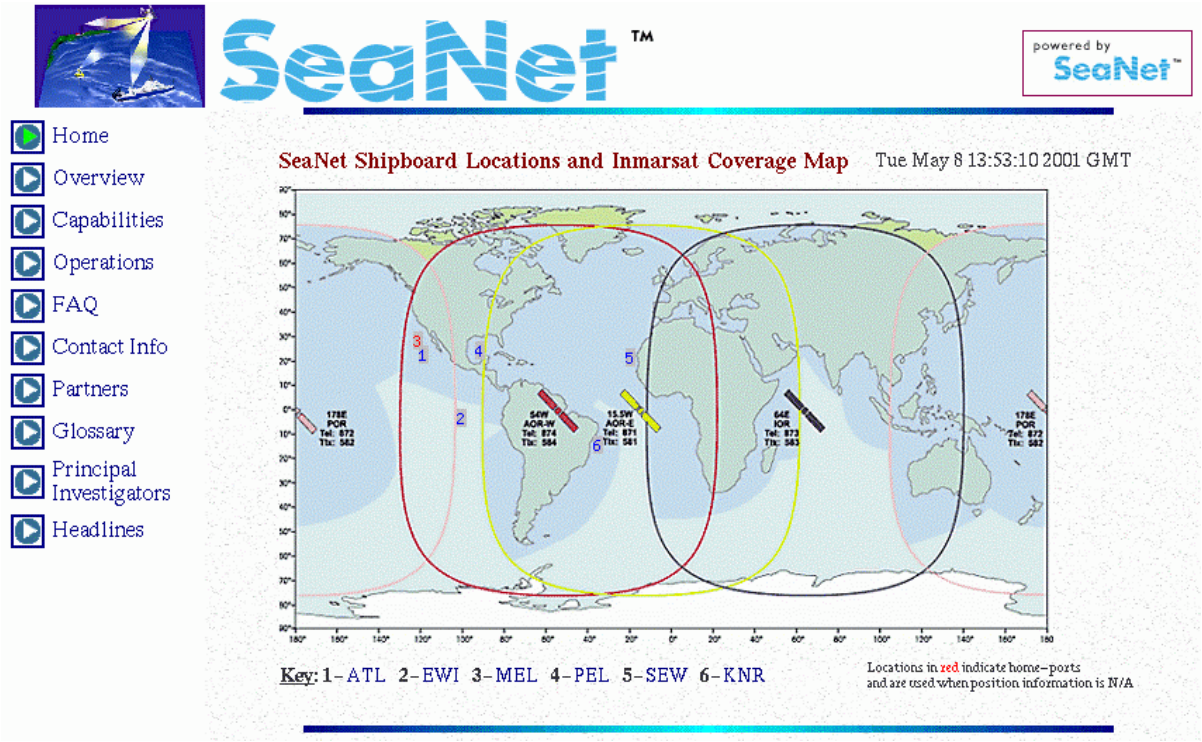


Figure 2-7: SeaNet homepage showing current ship locations

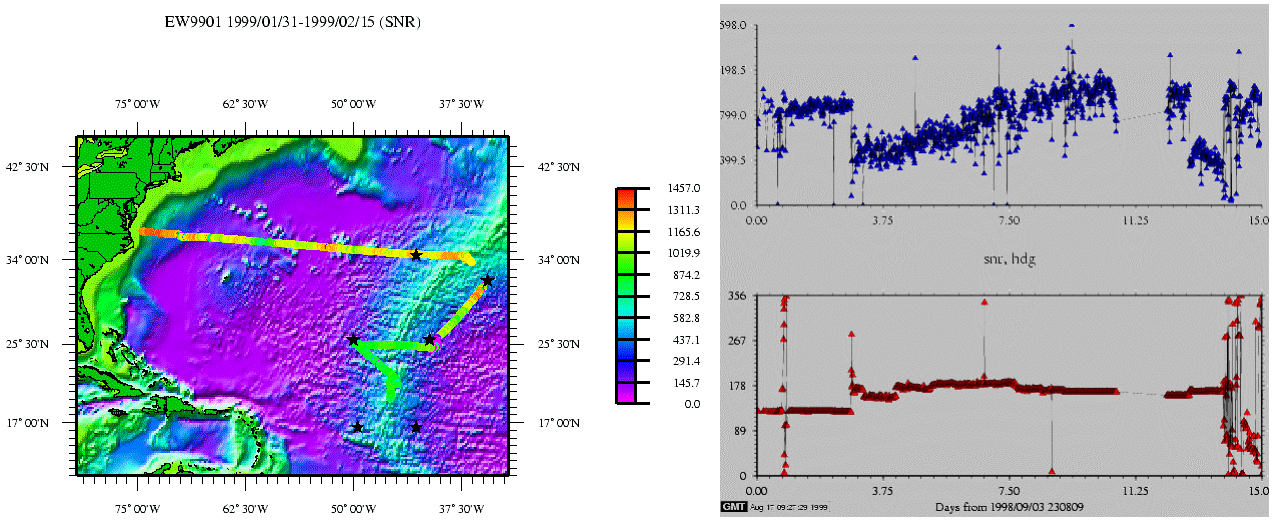


Figure 2-8: Geographic plot of SATCOM signal to noise ratio (SNR) during SeaNet testing on R/V Ewing. Color of ship track-line is based on SNR. Black stars indicate sample locations. Sample time-series plots on right.

2.5 Low-Cost Telemetry Buoys for Portable Coastal Observatories

This is a demonstration of a low-cost telemetry (LCT) buoy system for retrieving oceanographic data from instruments in the coastal ocean and delivering this data in near real-time. There are two buoys deployed, one in Boston harbor and one in Scituate each containing a variety of sensors (refer to figure 2-10). The data are recorded on the buoys and sent to the Marshfield tower shore station. From there, the data is sent to the GeoBrowser system at WHOI via email and plots are generated and made available via the world-wide-web automatically. Figure 2-11 shows example plots of data from the Scituate mooring. Note: the plots shown are generated on a USGS computer using data retrieved from the GeoBrowser.

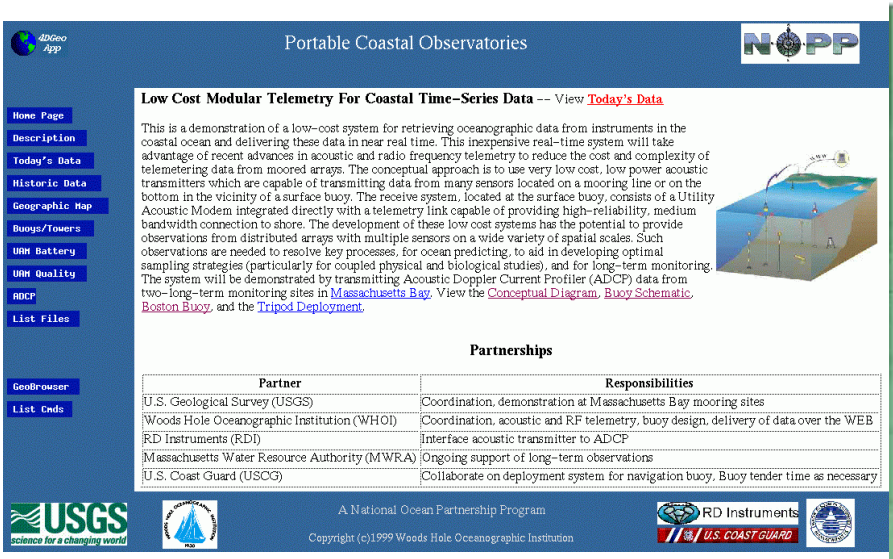


Figure 2-9: Low-cost telemetry buoy homepage

Figure 2-10: Geographic map showing buoy locations and shore station.

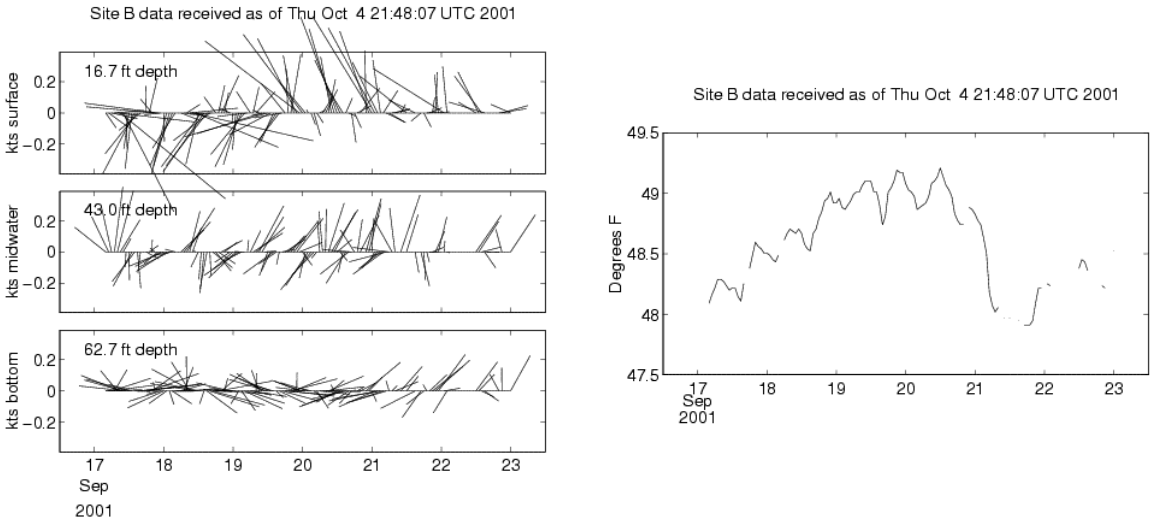


Figure 2-11: Sample time-series data plots from buoys.

2.6 *Autonomous Vertically Profiling Plankton Observatory*

The Autonomous Vertically Profiling Plankton Observatory (AVPPO) is designed to collect data on the vertical position and taxonomic composition of the plankton together with ancillary environmental data on spatial scales of microns to 100m in high-energy Shelf regions of the ocean. The two images shown below are from the AVPPO s website. The AVPPO data is streamed in a condensed EIC format via a wireless UDP link. Figure 2-13 shows an example of real-time data being displayed on the website and a sample of a near real-time plot.

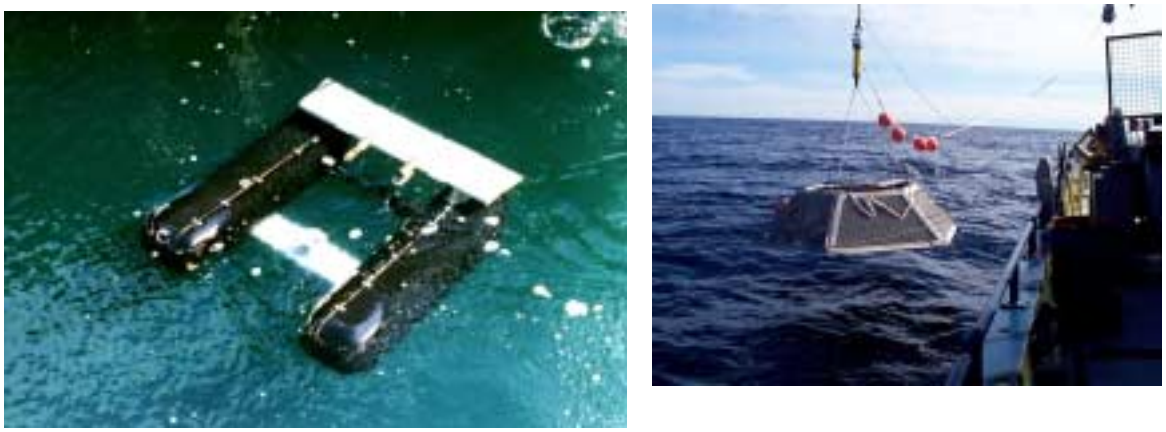


Figure 2-12: Buoyant VPR resting at surface (left). AVPPO being deployed on Georges Bank (right)

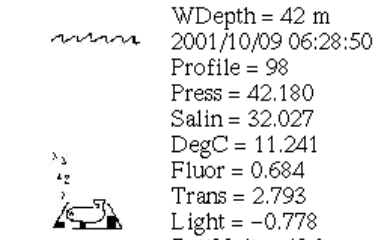
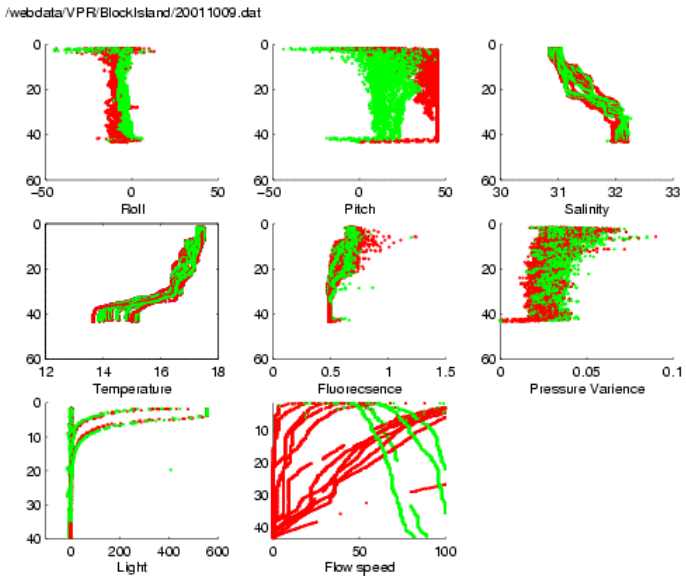


Figure 2-13: Cartoon figure of the VPR system with real-time time-series data displayed (left). When the VPR system is active, the cartoon figure moves up and down and the data is updated every second. A sample By Depth plot for several sensor values is shown below.



3 GeoBrowser v3.0 User Manual

3.1 System Requirements

The *GeoBrowser* is a web-based application and is accessible to any computer platform on the Internet capable of running either Netscape (v3.0 and higher) or Internet Explorer (v4.0 and higher). Your web-browser must be frames capable in order to use its built-in interface. GeoBrowser-enabled applications may have different requirements. Although the GeoBrowser may be accessed via a dial-up connection, a high-speed Internet connection is recommended for datasets that contain a large number of images. The server is written in Perl and is available for Unix platforms. For server plotting capabilities, GMT 3.x, Matlab 5.x, and Fly v1.6 need to be installed.

3.2 Concepts and Terminology

3.2.1 GeoBrowser Server

The GeoBrowser Server is the web server upon which the GeoBrowser applications and Electronic Index Card (EIC) collections reside. User workspaces are maintained on the server as well. GeoBrowser servers might exist on several machines at an organization. Users might install their own private GeoBrowser servers if they wish. Each server supports a number of users and usually hosts a number of different EIC card collections of particular interest to the users that use the server. In addition, each user is capable of creating their own EIC card collections on GeoBrowser servers.

3.2.2 Electronic Index Card (EIC)

The GeoBrowser is designed to process Electronic Index Cards (EICs). EICs are simple data structures. They can be thought of as digital versions of the 3x5 index cards that were once found in locations such as libraries and desktop index card boxes. These electronic cards are more versatile than their paper analogy and can include not only simple text items such as a title or an author, but can contain any type of information including embedded URL links, images, and video. By taking advantage of a field dictionary system and using standard fields for time and position, applications like the 4DGeoBrowser can provide temporal, spatial, and keyword search capabilities along with plotting capabilities including interactive time-series and geographical plots over the complete collection of index cards. There are three supported EIC format specifications for EICs: Fully Qualified EIC, Condensed EIC, and Text EIC. All three of these formats are ASCII and self-documenting. Independent of which EIC format is used, the EIC capabilities remain the same. Refer to **EIC Specification**, **Condensed EIC Specification**, and **Text EIC Specification** in the Reference Guide section.

The GeoBrowser works with any valid Electronic Index Card, but it is particularly helpful when using the GeoBrowser dictionary system that supports standard and user-defined fields (refer to **EIC Dictionaries)**. Although strongly encouraged, standard and even user-defined fields are not required (i.e.; non-dictionary fields are supported directly). However, EICs that use standard fields such as EIC.time, EIC.lat, and EIC.lon will be directly compatible with the 4DgeoBrowser features such as temporal, spatial, and keyword searching, along with plotting capabilities that include interactive time-series and geographical plots.

The GeoBrowser was first developed for oceanographic research. One example EIC could represent an event that occurred during a leg of a research cruise on a ship. In addition to an EIC field declaring the event (perhaps instrument gathering a water sample off the side of a ship) the index card could also include EIC fields indicating the latitude, longitude, water depth, and time associated with the sample taken. Refer to **EIC examples** in the **Condensed EIC Specification**.

3.2.3 EIC Collections

Individual˚Index Cards (EICs) are usually grouped together in a file. EIC Collections are groups of files containing EICs. In many cases a collection will contain cards that are all the same type. These EICs might have the same number of fields, in the same order, with the same names. EICs of many different types can also be included in the same collection. Authors of EIC collections decide which EICs to include in them. Normally, an EIC collection contains cards that˚are related to one another in some way. The quality of an EIC collection is often determined by the care with which an author has decided which fields to include on each of his or her EICs, which EICs to include in a collection, and the quality of the information in those fields. Examples of spatially and temporally located EIC collections might be "Alvin Submarine Dive Locations", "World City Populations and GNP", "Drifting Buoy Temperature Samples", etc.

3.2.4 EIC Collection Catalogs

Collections of EICs are often gathered into catalogs. Catalogs are usually "published" by some organization or represent a grouping of EIC collections that are somehow related to one another. Examples might include catalogs of important collections maintained by WHOI, a department, or some organization, etc. A GeoBrowser server often has several catalogs of EIC collections installed on it. A user can choose to examine, plot, or extract cards from one or more collections from interesting catalog(s).

3.2.5 EIC Search Box/Composite Box

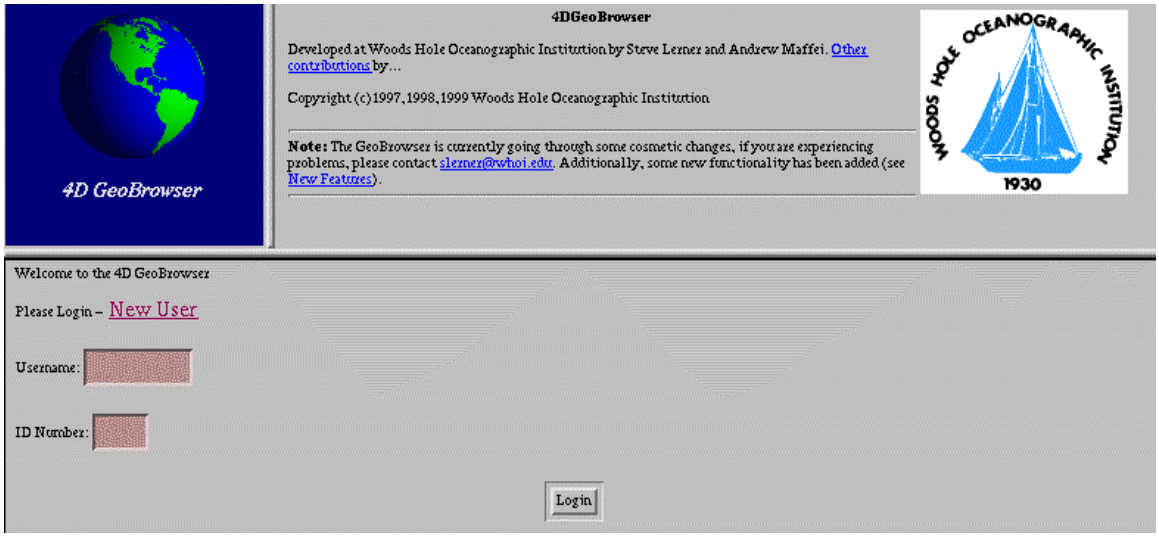
EIC Search/Composite Boxes are temporary holding places of electronic index cards. They reside in a user's workspace and are˚manipulated by the GeoBrowser during search, plot and other analytical operations. The˚**Search Box** contains the resulting index cards from the last search performed. The search could be inclusive of various EIC Collections made available on a particular GeoBrowser Server or via a search of remote resources such as another GeoBrowser server or another Z39.50 accessible server. The Search Box is emptied each time before a search is performed. A˚**Composite Box** sits in a user's workspace. The user can either add the index cards from the Search Box into the Composite Box or simply replace the index cards inside the Composite Box with the index cards from the Search Box. Typically, a user might search several different EIC collections for cards of interest and continue to add cards to her or his Composite Box. Eventually the user might choose to use the Composite Box to plot these various EICs or to generate a new collection of EICs that might be referenced during a following session or by colleagues with similar interests. Both the Search Box and Composite Box reside in the User s workspace.

3.2.6 Registered EIC Fieldnames

Registered EIC field names are unique field names that have been registered in the GeoBrowser Field Registry. Registered EIC field names are included in a dictionary of fields that have been defined by some authority and for which an uppercase prefix has been assigned. For example, the field name EIC.id is registered in the EIC dictionary. This dictionary describes the default label, data type, units, maximum, minimum, OID and other attributes related to each of the fields in the dictionary.

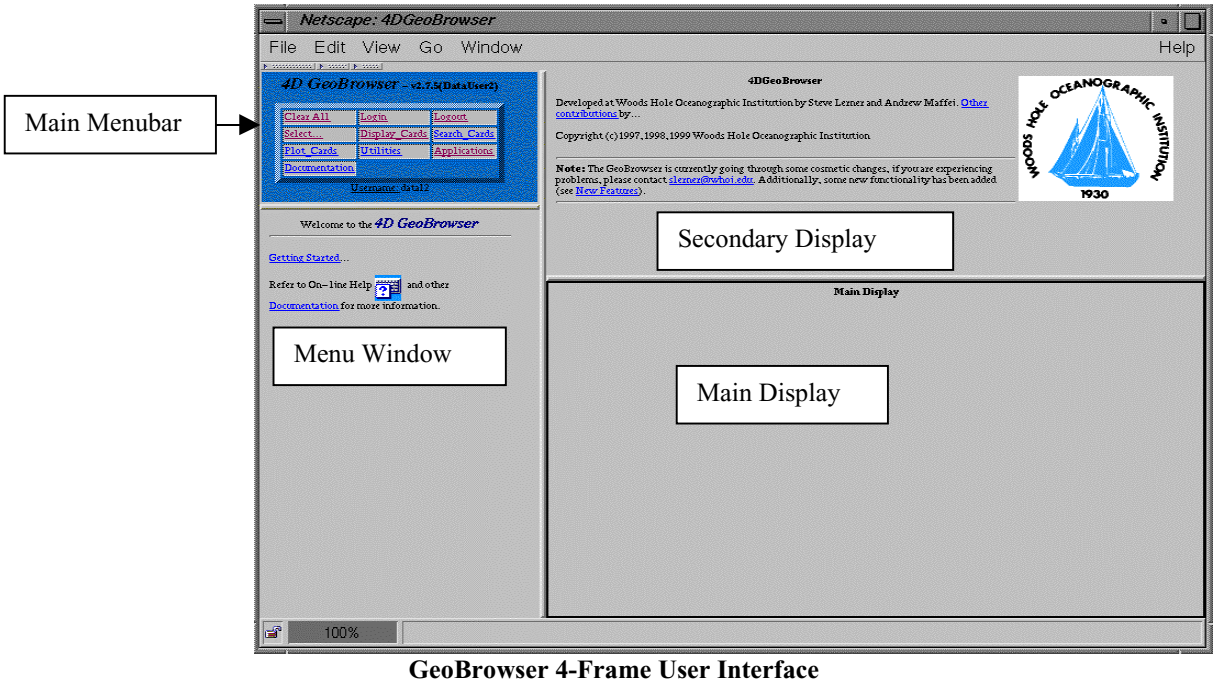
3.3 Logging into the GeoBrowser

Through your web-browser, enter the URL of the GeoBrowser that you want to connect to. The GeoBrowser welcome screen should be displayed. If you do not already have an account, click-on **New User**, otherwise enter your Username, ID, and press **Login**.



3.4 GeoBrowser Screen Layout

Below is the GeoBrowser s user interface showing the Main Menubar, Menu Frame, Main Display, and Secondary Display. The upper- left frame consists of the main menubar. This is where you select your main menu choices, such as Selecting Cards, Displaying Cards, etc. The bottom-left frame, just below the main

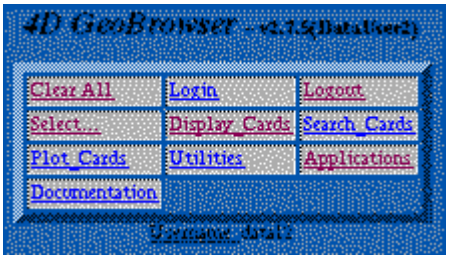


GeoBrowser 4-Frame User Interface

menubar, is the menu window. Each item that you select from the main menubar will be displayed in the menu window. Any items that you select from the menu window will be either displayed in the main display frame (bottom-right) or in the secondary display frame (top-right). The information between the different frames are setup to complement each other, making it easier to present more information in a coherent manner rather than having the user jump around throughout a single web-page window.

3.5 Main Menubar

The contents of the main menubar will vary depending on the user s user-level. An example DataUser1 and Data User2 user-levels are shown below. Supported user-levels include DataUser1, DataUser2, DataEntry, developer, and administrator. Custom user-definable menubars may be setup by the GeoBrowser administrator and are particularly useful for developers.



3.6 Getting Started

Before you get started, you should be familiar with the GeoBrowser **Concepts and Terminology**. Your workspace environment including preferences, local collections, and work in-progress is based on your username and id. Everything within your workspace will be automatically saved between sessions and will be available the next time you login to the GeoBrowser.

At this point you should be logged into the GeoBrowser and familiar with both the main GeoBrowser screen layout and the Main Menubar (refer to **GeoBrowser Screen Layout** and **Main Menubar**).

Netscape Tips:

1. To Go-Backward/Go-Forward within a frame, use Alt+Left/Alt+Right
2. To ReLoad a frame, Alt+R with cursor within frame
3. To save a link (e.g.; an exported file), use SHIFT-LeftClick
4. To abort out of any actions in which Netscape's Stop button is deactivated and some operation (e.g.; a search) is still continuing, move the cursor to the frame that initiated the operation click the left button and press Escape.
5. To display a link in a new window, use middle mouse button.

The order of operations for one getting started is as follows:

1. **Select** - Select Collections of interest. Most operations such as searching are only applicable to Selected Collections that are enabled (referred to as Selected Collections). Although you may have multiple collections selected at a time, for efficiency it is strongly recommended that you keep your Selected Collections to a minimum.
2. **Display_Cards** - At anytime you can display the index cards contained in either the Search Box, Composite Box, or from all your Selected Collections. Currently there are three display format options available: Full, Brief, and Icon. These maybe further tailored by using your Display Preferences.
3. **Search_Cards** - After you have Selected Collections, you may perform search operations to find Electronic Index Cards of interest within your Selected Collection List. For each search that is performed, the results are entered into your **Search Box**. Note: The Search Box is emptied prior to doing any search so that only the last search results are contained in the Search Box at a time. If you are interested in saving results from prior searches, you may add your Search Box index cards into a **Composite Box** by pressing **Add To Composite**. Alternative, if you wish to simply replace the

Composite Box index cards with those from your Search Box, press **Replace Composite**. You will see the options for Adding/Replace to Composite from each of the search submenus.

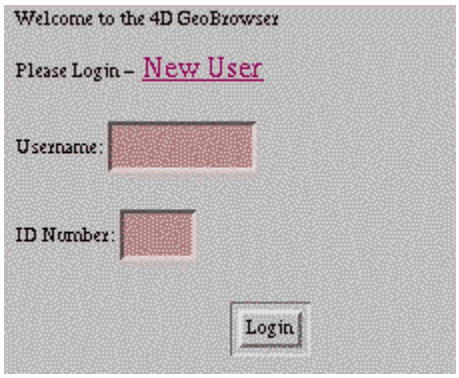
4. **Plot_Cards** - You can plot cards from your Search Box, Composite Box, or your Selected Collections. There are several different plotting programs available to generate the plots (GMT, VRML, Matlab). Currently the generic mapping tool (GMT) is used for generating interactive time-series plots (GMT-1D) and geographical plots (GMT-2D), and VRML is used for generating interactive World Globe Plots.

3.7 Clear All

The **Clear All** menu item clears all of the frames in the user's web browser. This feature is often useful when the user is confused and wishes to set the GeoBrowser environment back to a known state or wishes just to de-clutter the display.

3.8 Login

The **Login** menu item allows the user to login to an existing GeoBrowser account or to create a new account. To login to an existing account the user fills in the Username and ID Number fields and then presses the Login Button.



To create a new account, a use must go to the GeoBrowser Server and from the main login screen, click on the **New User** link. The user is presented with a simple form asking for basic information such as Full Name, Email Address, Organization, and requested Username. In addition, the user is prompted for a 4-digit ID number and asked to verify it. This 4-digit number is used as a simple password and the user must remember it for the next time she or he logs in. Pressing the New User button on the form completes the operation and the user a confirmation of the username and id is shown. Pressing the *Got It* button logs the user into the GeoBrowser for the first time.

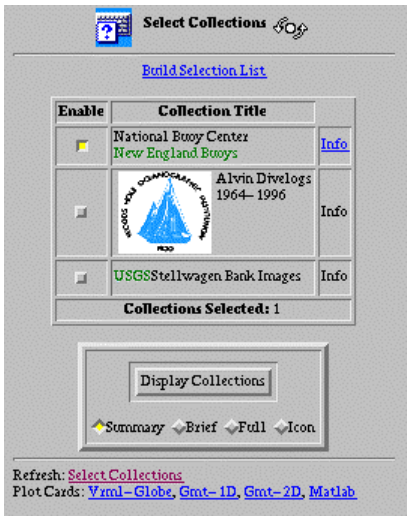
As part of account initialization the GeoBrowser creates a workspace and allocates disk space for user collections, storing preferences, holding search and composite boxes, etc. The next time that you login to the GeoBrowser you will have the same working environment as when you last logged out. It is important that users Logout of their account when they are done using it so that other users do not inadvertently modify the information in the workspace.

3.9 Logout

The Logout menu item is used to logout of the GeoBrowser environment. It is important that users logout of the system when they are done using the GeoBrowser. Otherwise, a user s workspace might be inadvertently modified by another person who sees the GeoBrowser screen. Pressing the Logout menu item returns the GeoBrowser to the login prompt.

3.10 Selecting Collections

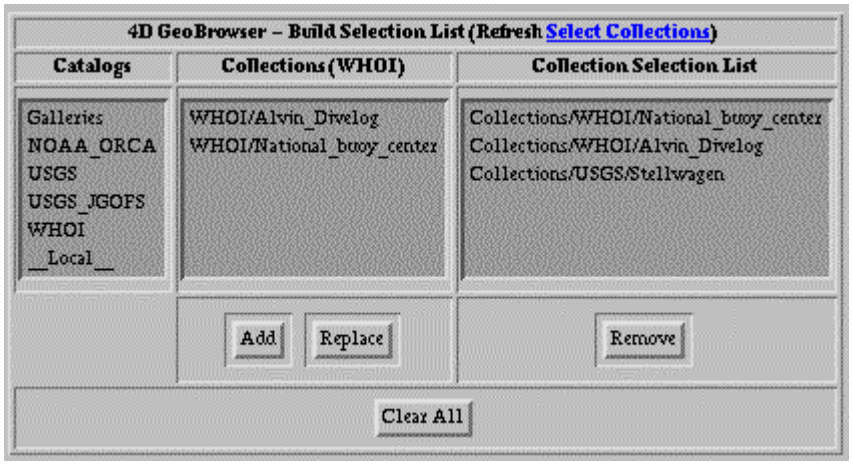
The Select menu item is used to Select Collections, which is typically the first thing that you should do. It allows you to select which collections of EICs are to be available for displaying, searching, etc. For efficiency reasons you should keep your enabled Selected Collections (referred to as just Selected Collections) small, enabling only the Collections of interest for your particular searches. Since Selecting Collections is used quite often, you will find that it is available in many different menus.



Note: The icon to the left of the Select Collections label is for on-line help. The one on the right is to reload the Select Collections menu, which is useful when the list changes.

When you press **Select Collections**, a form-based selection table containing a list of selected collections will appear in the Menu window. You may enable/disable each collection individually by clicking on the **Enable** checkbox. As mentioned earlier, it is strongly recommended that you enable as few Collections as possible at a time since this will speed up searching as only your Selected Collections enabled will be used. To view information about each Collection, press **Info** next to the collection title. If information is not available for a particular Collection, it will not be selectable.

To modify the contents of the Select Collection List, press **Build Selection List** and a form-based selection box will appear in the secondary display frame. There are three columns: Catalogs, Collections, and Selected Collection List.

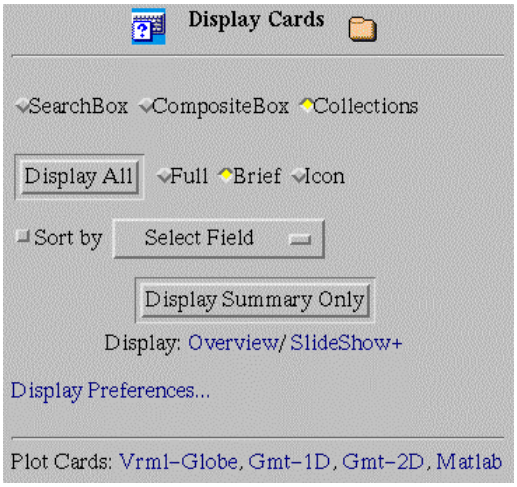


Click on the Catalogs of interest and the list of available Collections for that particular catalog will be displayed in the second column. From here, select the Collections of interest and press **Add** or **Replace**. At this point, the Selection column will be updated with the collection(s) you added. If you used the **Replace** button then all collections previously selected will be removed before the newly selected collections are added to the list. To remove collections from the selected list, simply highlight the collection(s) you want removed from the selected column and press **Remove**. At any time you can press **Refresh Select Collections** to see the changes. The __Local__ entries are for selecting your own local collections that reside in your workspace, if available. More information about creating user collections and maintaining them can be found in the help section describing **Utilities**. Note: Within a collection, the title description and the info link for a collection is specified in the Title.txt and Info.html files within the collection directory.

Note: When collections are added or removed from your Selected Collection List, all your previously enabled selected collections will be maintained, unless of course you removed those collections. If any changes were made to the selection list, be sure to refresh the **Select Collection** form to reflect those changes. Additionally, after enabling or disabling any choices, the total number of collections selected will be updated automatically on the form.

Underneath the Select Collection table is a menu form that contains a **Display Collections** button for displaying information about the selected collections. You can either select Summary information or display the Electronic Index Cards in either the brief, full, or icon format for each of the Selected Collections.

3.11 Display Cards



Display Cards is the menu selection to use for viewing index cards within the Search Box, Composite Box, or Selected Collections. It is also used for viewing log files and index files. Since Display Cards is also used quite often, you will find that it is listed in many different menus.

When you press **Display Cards**, a form-based selection box will appear in the menu frame (lower-left). Notice that you can directly **Select Collections** via the select collection s icon (the folder) from this form as well, although it will appear in the secondary display (upper-right frame).

Sometimes there may be cases where it makes sense to put the Display Card menu in the secondary display. For those instances, such as when searching cards, there will be a **Display Cards** link typically at the bottom of the menu. The choices are the same regardless of which frame the **Display Cards** form is displayed in, although the layout may be slightly different.

Below is a description of each of the items within the Display Cards form.

3.11.1 Search Box/Composite Box/Collections

Select the appropriate choice to display the index cards either from the Search Box, Composite Box, or from all of your Selected Collections. You can display the cards themselves or a summary of the cards by pressing either **Display All** or **Display Summary Only**.

3.11.2 Log Files

Select this option to display either summary information about the log files or the log files themselves. If this option is not present, press **Display Preferences** and click on the ShowHide Menu option **ShowLogFiles**. Be sure to press **Apply** for the changes to take effect.

3.11.3 Index Files

You can choose this option to display one or more of the index files (time, spatial, or keyword) associated with each of the Selected Collections. If this option is not present, press **Display Preferences** and click on the Show/Hide Menu option **ShowIndexFiles**. Be sure to press **Apply** for the changes to take effect.

3.11.4 Display Summary/Display All

The **Display Summary** button will show a summary of information about EICs contained in your Search or Composite boxes or the Selected Collections, depending on the choices you have made on the form. Summary information includes the number of cards, time range, and X, Y, and Z spatial statistics for the Search Box, Composite Box, or all the Selected Collections.

The **Display All** button shows the contents of the Search/Composite Boxes, Collections, log files, or index files that you have indicated using the buttons on the form. The information returned in the display of the EICs is determined by the choice of format (see below). If a particular menu item is not present, press **Display Preferences** and click on the appropriate ShowHide Menu Options.

Display Card Format: Full, Brief and Icon
There are three different formats that that can be used to display electronic index cards. The choice is made using the radio buttons beside the Format option in the form.

> The **Full** format displays all fields for each index card. The field names are color-coded to indicate whether the field names have been registered or not (refer to **EIC Dictionaries**). Field names displayed

in black are registered and have the same meaning in all EICs. Field names displayed in green are user-defined fields and may have a different meaning in different cards. Fields that are of URL type are displayed as links and can be activated by clicking on them. Fields that are of IMAGE type can be displayed as an embedded image.

The **Brief**˚ format shows a limited number of the index card fields in a table format. Typically the displayed fields will include Title, TimeStamp, Latitude, Longitude, Elevation (Mean Sea Level) and a link allowing the user to display the entire card in the full˚ format in the upper frame. User s can customize which fields that are displayed via **Display Preferences**.

The **Icon** format displays the cards as a table of images or icons. The icon displayed is the image referenced in the EIC.icon field. Below each icon is the title, spatial and temporal information included in each card (this can be turned off in **Display Preferences**). Clicking on the icon displays the entire card in the full format in the upper frame or will go to a specific URL link defined on the card (refer to **Display Preferences**).

3.11.5 Display Sorted Cards

The order in which cards are displayed can be determined by selecting the Sort by button and choosing the EIC field by which to sort them. The sort option is currently only available for the displaying cards in the SearchBox or the CompositeBox.

3.11.6 Display Logs

Display Logs allows the user to review the log files that are created by the GeoBrowser. The GeoBrowser keeps track of all operations performed by the user. These are kept in the user s workspace as a series of individually dated files that are purged on a regular basis. By pressing the **Display Summary** button the user is able to list the log files that are currently available along with the number of log entries in each one. By pressing the **Display All** button the user is able to display the contents of all of the log files. Preferences for logging verbosity, the number of files to keep, and whether or not logging is turned on can be found in the **Preferences** section. Log files contain time-stamped entries that describe each operation a user undertakes and the object upon which the operation was performed.

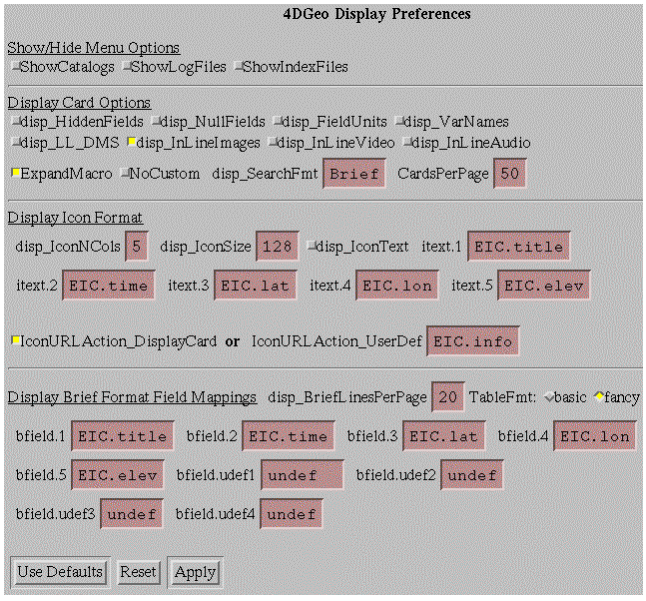
3.11.7 Display Overview/Slideshow

The **Display Overview** button will show an overview summary of selected fields contained within the specified collection. This option is only available for collections that have been setup for this feature.

The **Display Slideshow** button shows the contents of the Search, Composite, or Collections one card at a time. There is a standard control-panel that allows you to scroll through the cards or perform a keyword search.

3.11.8 Display Preferences

The user can customize many of the display options via their **Display Preferences**. Press **Apply** to apply any changes. Press **Use Defaults** to restore the system default display parameters.



Show/Hide Menu Options
These items determine whether a menu item is displayed on the main Display Card menu form.

Display Card Options
Most of these options determine how information is displayed on a card within the full format. Options include displaying Hidden Fields, Null Fields, Field Units, Variable Names, LL_DMS (instead of decimal degrees), and whether to Expand Macros. The

disp_SearchFmt field indicates which format Brief, Full, or Icon to use when displaying the results of a search.

Display Icon Format
These items relate to how the cards in an icon format are display. Options include the number of columns, image size, and whether to display text fields under the icon image. To specify the action to take when an icon is clicked-on, select either URLAction_DisplayCard to display the corresponding card or select URLAction_UserDef to display a URL that is contained in the user defined field (e.g., EIC.info).

Display Brief Format Field Mappings
These options determine what fields (columns) are displayed within the brief format. There are five standard brief fields (bfield1-bfield5) that typically include title, time, latitude, longitude, and elevation. Additionally there are four user-definable fields. These are entered as the variable names within an EIC.

3.12 Search Cards

Search Cards is the menu selection to use for searching index cards within either the Selected Collections or your Composite Box. There are many search choices including searching by time, location, and keywords. When you press **Search Cards**, a menu of all the search options appears in the menu window (lower-left). Notice that you can directly **Select Collections** via the select collections icon (the folder) from this menu, although it will appear in the secondary display (upper-right frame). It's important to know what collections are selected when searching, since only your Selected Collections will be searched.

The results of any search will replace any EICs you may have had in your Search Box. Therefore, your Search Box will only contain EICs from your last search. If you wish to do compound searches, you can either add or replace the EICs in your Composite Box with the contents of your Search Box. You can also search directly from your Composite Box.

On several of the search menus, you will see a **Display Immediately** checkbox. When selected, you will see the results of the searches immediately as matching EICs are found. **You must wait for the search to complete before adding or replacing to your Composite Box**. For searches where a large number of matching cards are found and you wish to update your Composite Box, it will be faster if you temporarily disable the **Display Immediately** checkbox. A message will be displayed indicating that the Wait Option has been set. With the Wait Option, once cards start to appear, you can stop the browser display and either Add or Replace to your Composite Box.

Finally, there may be cases where it makes sense to perform a search that matches all cards within all your Selected Collections. This option should be used with care, as unintentionally selecting all cards with substantially large collections will be extremely slow and require extra storage. To abort actions when Netscape's Stop button is deactivated (and the search is still continuing) move the cursor to the frame that initiated the operation, click to select that frame, and press Escape.

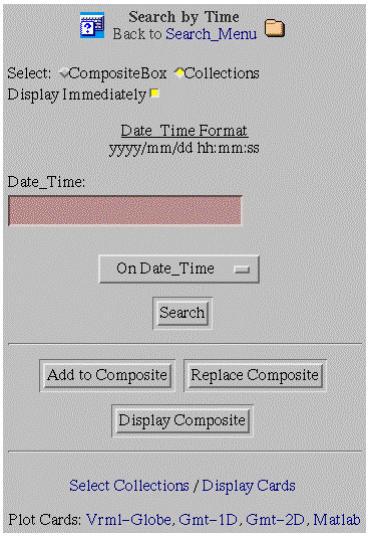
3.12.1 Search by Calendar

This option allows you to use a calendar to search for EICs within your selected collections. A calendar is displayed. Each day in the calendar is a link designed to search for all index cards for that particular day. Many times you will be able to see where you have data or don t have data at a glance, since bold-faced days have EICs associated with them. By clicking on a day with EICs associated with it will show the resulting cards in the main display and will also place the results in your Search Box.

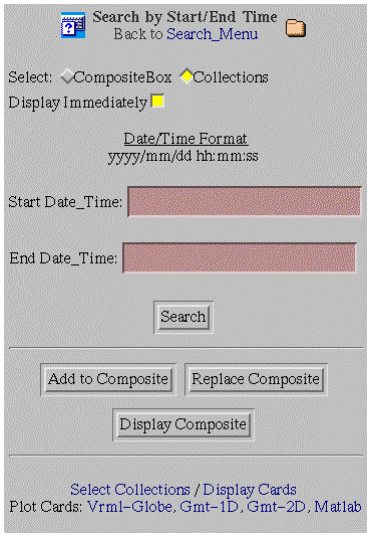
3.12.2 Search by Time

This option allows you to search your selected collections by time. You must enter the time in the format shown in the form. Any shortened version of the date and time is allowed. For example, 1992, 1968/03, and 2005/03/23 13:22 are all valid times. Note that hours are entered using 24-hour format, thus 13:00 is 1PM. The user can also use the pull down menu below the Date_Time field to choose EICs before, after, or exactly associated with the date and time indicated. Currently, if Before_Date or Afer_Date is selected, then the date_time field must only contain a date (or portion thereof).

Search By Calendar



Search By Time



Search By Start/End Time

3.12.3 Search by Start/End Time

This option allows the user to search for cards by entering a start and end time. You must enter the time in the format shown in the form. Any shortened version of the date and time is allowed. For example, 1992, 1968/03, and 2005/03/23 13:22 are all valid times. Note that hours are entered using 24-hour format, thus 13:00 is 1PM.

3.12.4 Search by Location (form)

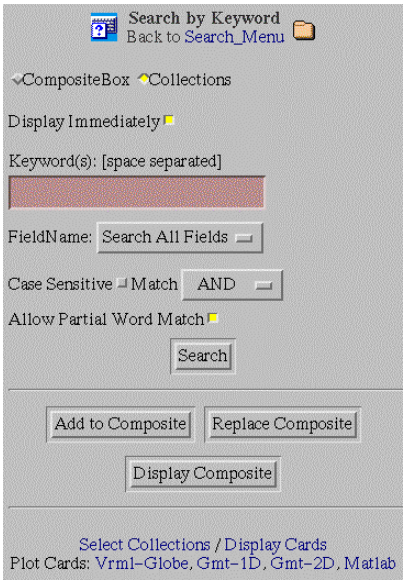
This option allows the user to search EICs by location using a form. The user uses the form to enter a center point and a radius from that center point from which to search. Two coordinate systems are currently supported, XY and Latitude/Longitude. XY coordinates are entered as floating point numbers. Latitude and longitude values are entered as decimal degrees with the convention of positive numbers representing northern and eastern hemispheres respectively. Pressing the search button displays the results in the main display and updates your Search Box. You can also choose to add to or replace the Composite Box with the contents of the Search Box.

3.12.5 Search by Location (map)

This option allows the user to search EICs by location using a digital map. The user selects and displays which map is suitable for the collections of interest. A bounding box representing the area of coverage for each of the collections selected will be displayed on the map. By clicking on the map, a search will be performed through all of the selected collections. The results will be displayed in the secondary display and copied into your Search Box. You can also choose to add or replace the Composite Box with the contents of the Search Box. Note: Two coordinate systems are currently supported, XY and Latitude/Longitude.

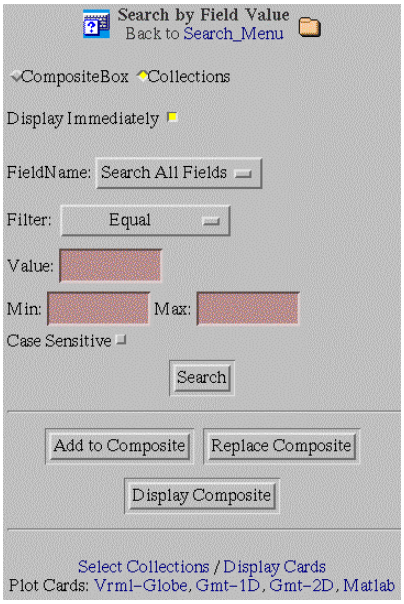
3.12.6 Search by Keyword

This option allows you to search for EICs that contain specified keyword(s). Options including specifying a specific field name, case sensitivity, and partial word matches.



3.12.7 Search by Field Value

This option allows you to search a field name within EICs that contain either a specific value or are within a specific range. Options including specifying the field name, value and min/max range.



3.12.8 Match All Cards

This menu allows the user to match ALL the cards from ALL selected collections and will copy all the cards into the Search Box. Make sure that you have selected your collection of choice via Select Collections. There is an option to match every n th card, which can be useful for testing.

3.12.9 Match by Files

Normally individual files are hidden for users as the GeoBrowser seamlessly searches multiple files. This option allows you to list the available files and then setup a mask to match specific files.

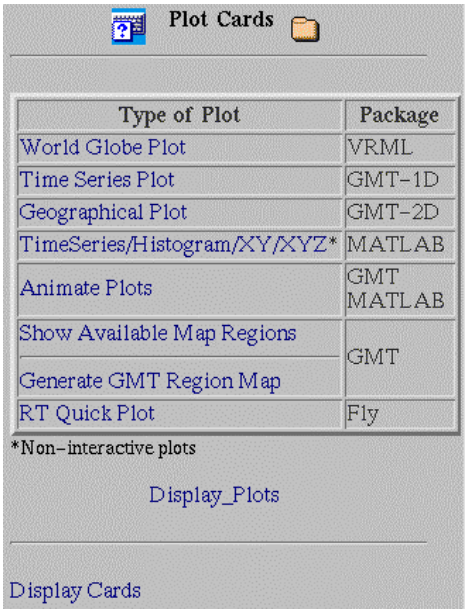
3.12.10 Adding/Replacing Composite

The results of any search will replace any items that you may have had in your Search Box with the results of the last search. Therefore, your Search Box will only contain items from your last search. If you wish to do compound searches, you can either add or replace the contents of your Composite Box with the contents of your Search Box by pressing **Add to Composite** or **Replace Composite**. Note: when you do searching, you can select **Composite Box** to search directly from your Composite Box instead of your Selected Collections.

3.13 Plot Cards

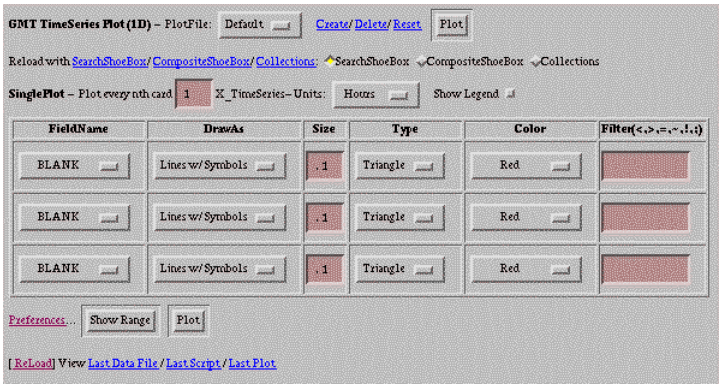
The **Plot Cards** menu item allows the user to generate a variety of plots including time-series and geographical plots. Currently, three plotting packages are used to support the plotting capabilities and include **VRML** for interactive 3D world-globe plots, Generic Mapping Tool (**GMT**) for time-series and geographical plots, and **Matlab** for time-series, histogram, xy, and xyz plots. Note: All the plots generated are interactive plots, with the exception of the Matlab plots.

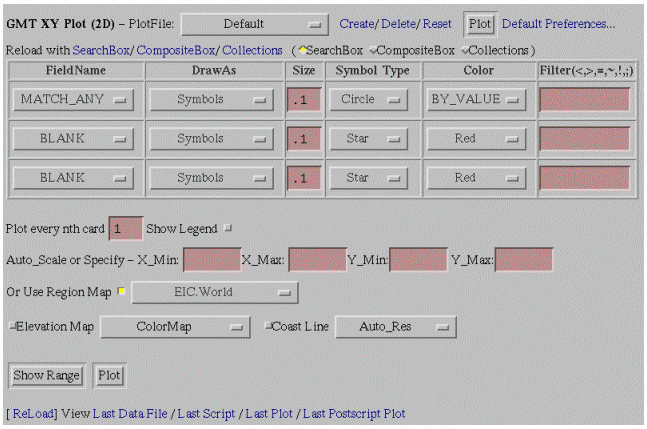
You can plot EICs contained within the Search Box, Composite Box, or all the Selected Collections. Due to the potential large number of Electronic Index Cards within Collections, it is strongly recommended to plot cards from either the Search Box or Composite Box.



3.13.1 GMT Plots

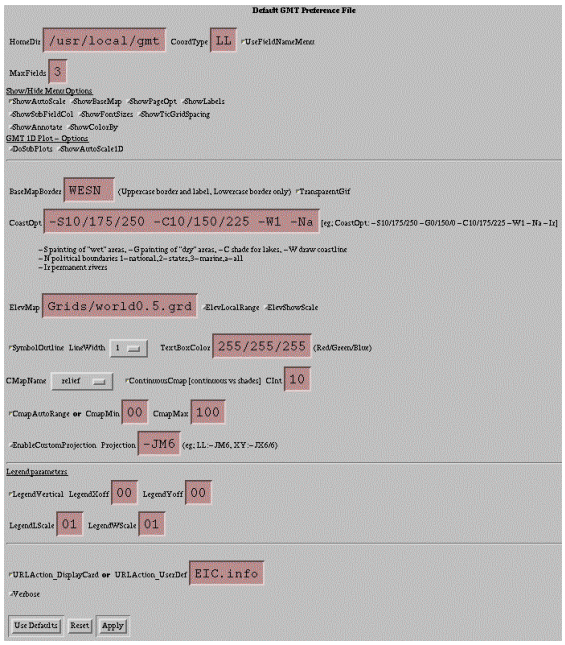
Below are the GMT plot options for time-series and geographic plots.





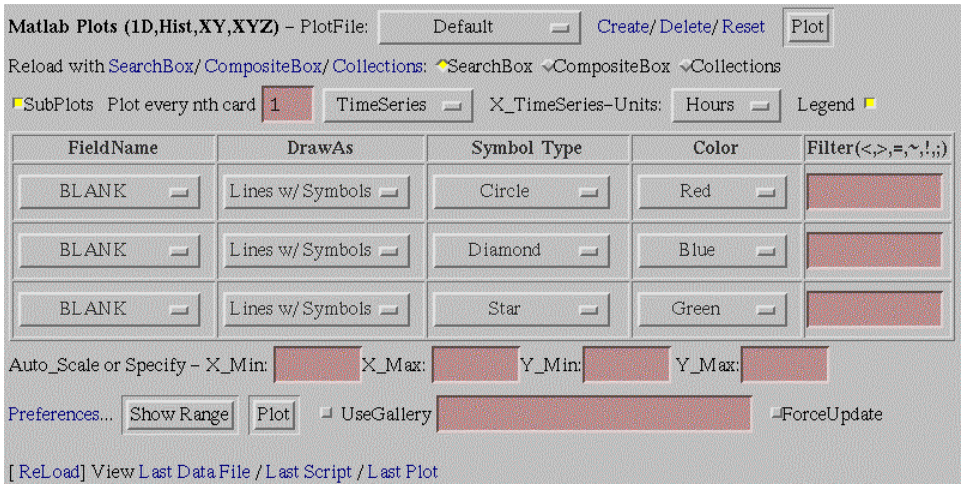
In addition to GMT options, there are GMT Preferences that generally will apply to a class of plots. Note that you can specify a specific preference file for a particular plot within the plotting options. An example of the GMT preferences is shown on the right.

Set the options you wish to change and press the Apply button to apply them. The Use Defaults button resets all the parameters to their default settings.

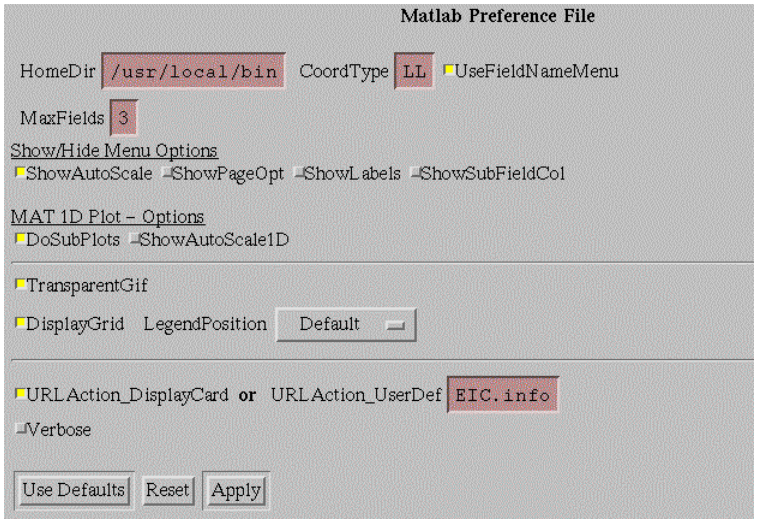


3.13.2 Matlab Plots

Below are the Matlab plot options for time-series, histogram, XY, and XYZ plots.



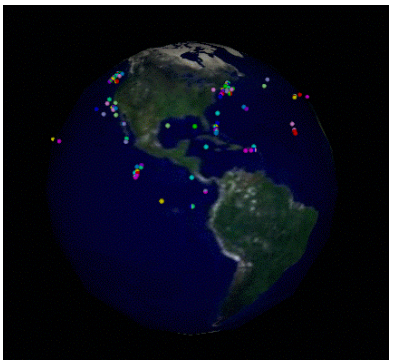
In addition to Matlab options, there are Matlab Preferences that generally will apply to a class of plots. Note that you can specify a specific preference file for a particular plot within the plotting options. An example of the Matlab preferences is shown on the right.



Set the options you wish to change and press the Apply button to apply them. The Use Defaults button resets all the parameters to their default settings.

3.13.3 VRML Plots

There are a variety of **VRML** plots to choose from. Many browsers have VRML helper applications built into them. VRML is a language specification in which the GeoBrowser uses to create three-dimensional displays of information on EICs.˚ Data points are typically plotted as "live" links that are capable of displaying the full contents of an electronic index card when the pointer is placed over them and the mouse button depressed. Currently the world-globe plot is supported.



VRML - World Globe Plot

Creates a geographic plot of cards in a selected EIC buffer. This is a special type of 3D plot. X, Y, and Z are the three spatial coordinates included on an EIC (if they exist). Typically, these are latitude, longitude, and mean sea level however the user is able to change the fields if she or he wishes. EICs are plotted on a sphere representing earth. The user can choose an image representing a map of the world˚to have superimposed on the sphere.

3.14 Preferences

The Preferences menu item allows the user to set many different parameters. These preferences are stored in the users workspace and maintained between logins.

4DGEO Preferences

The 4DGEO Preferences are related to the core functionality of the 4DGeoBrowser application itself. The following categories of preferences are found here:

- General Preferences
- Logging Preferences
- Advanced Preferences

GMT Preferences

GMT Preferences relate to options specific to the Generic Mapping Tool (GMT) program, which is used to generate time-series and geographical plots. The Preference form can be accessed directly from any GMT related form.

Application Preferences

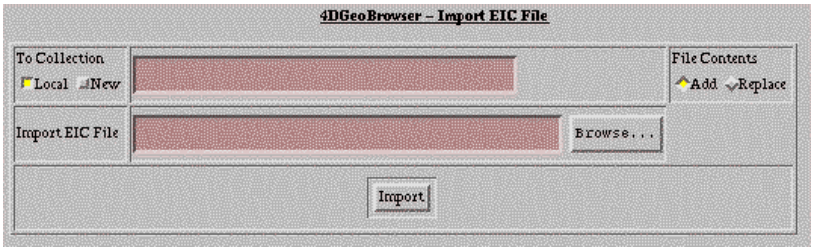
Application Preferences are related to special application modules that have been incorporated as part of the GeoBrowser. These applications call GeoBrowser functions and are designed for special purposes. The following categories of preferences are found here:

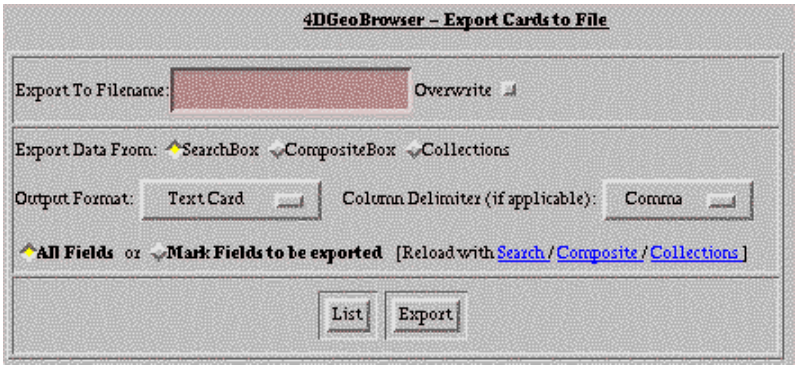
- Bookmark Application Preferences
- Datalogger Application Preferences
- Event Logger Application Preferences
- Journal Log Preferences

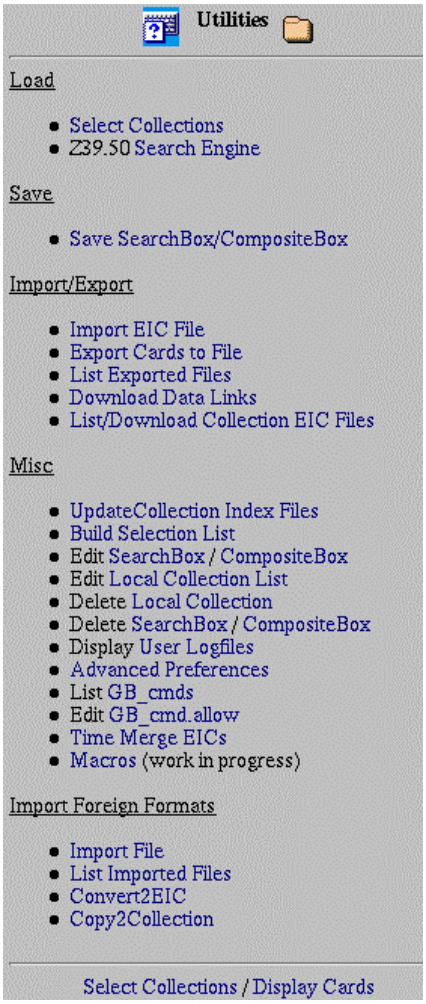
3.15 Utilities

There are several built-in utilities to the GeoBrowser especially for helping to import and export EICs. The utilities menu is shown on the right.

Example Import/Export utilities are shown in the figures below.

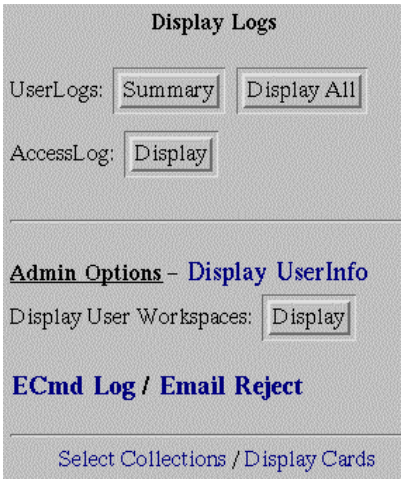






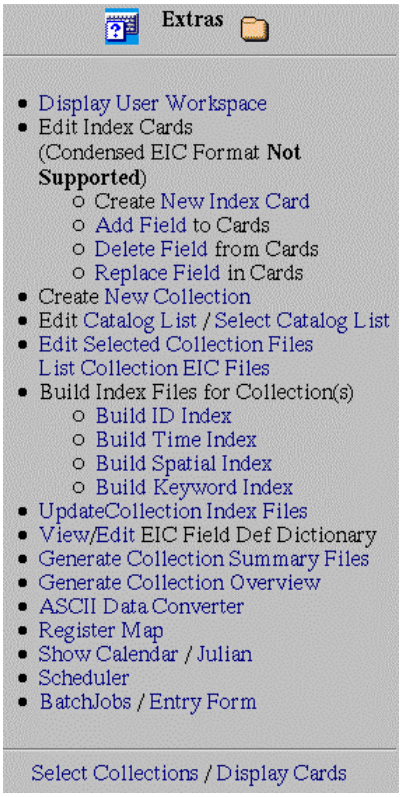
3.16 Display Logs

Displays logs allows user to view logs of their queries. For administrators, it gives access to users logs, access logs, and email command logs. A sample administrator s display log option menu is shown on the right.



3.17 Extras

The extras menu options are available for developers and the GeoBrowser administrator.



3.18 HTTP GB_cmd API

To facilitate automatic data plots and web generation using the GeoBrowser, we have developed a GeoBrowser HTTP Command Interface. Most major commands that are done interactively may be executed remotely via an HTTP command. Refer to the **HTTP GB_cmd API** section in the technical reference section of this document for a list of available commands and syntax.

3.19 Email command API

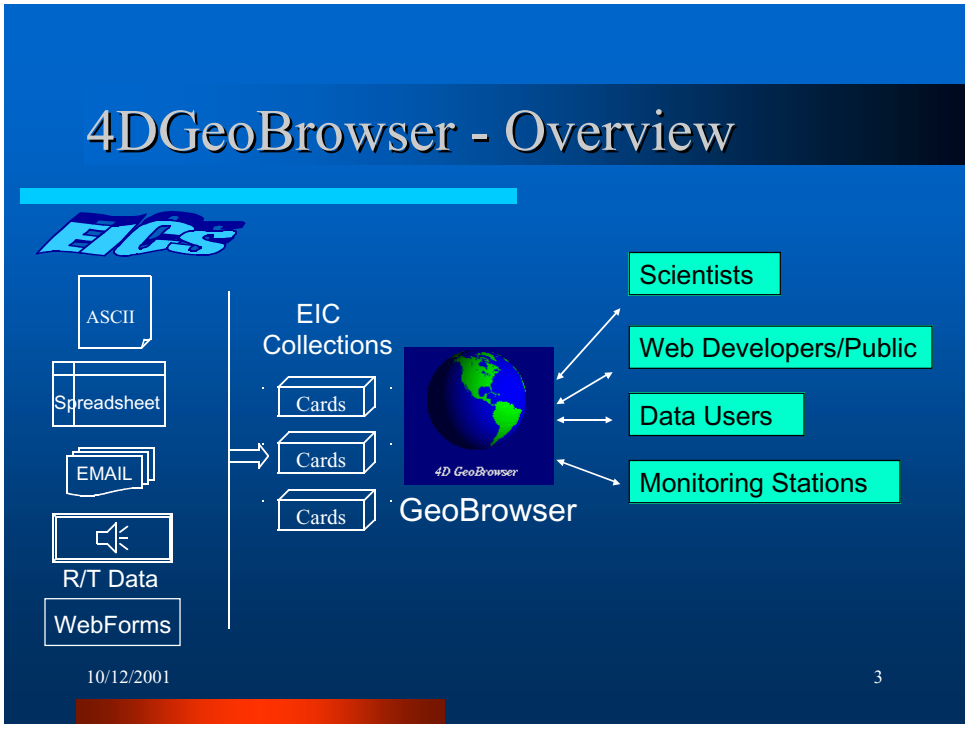
To facilitate automatic data logging into the GeoBrowser, we have developed a GeoBrowser Email Command Interface. Features of the GeoBrowser Email Command Interface include:

- Easy to upload data into the GeoBrowser via email
- Support for real-time automatic data collection and access
- Simple command interface
- Remote GeoBrowser command support

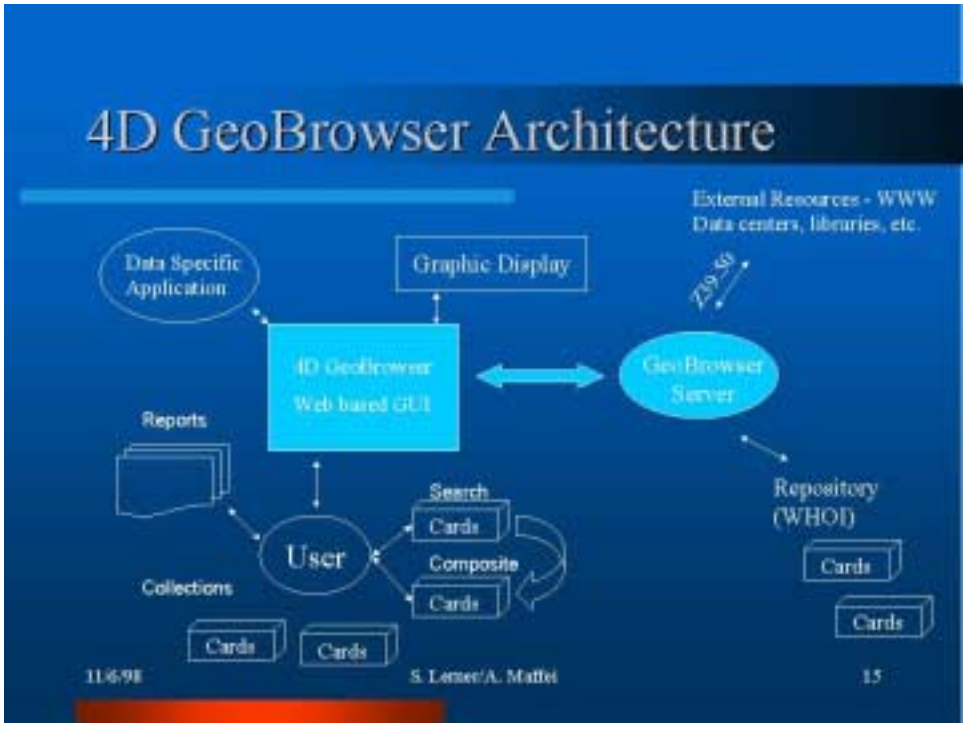
The commands are sent via the subject-line in the email message, and the body of the message typically contains data in the Condensed EIC format. Refer to the **Email Command API** section in the technical reference section. For interfacing to procmail for automatic GeoBrowser/Email command interface, the .forward file needs to be setup in geobrowser home account (refer to section 4.3.4 Setting up the GeoBrowser Server).

4 GeoBrowser v3.0 Reference Guide

4.1 GeoBrowser Overview



4.2 GeoBrowser Architecture



4.3 GeoBrowser Server Software

4.3.1 GeoBrowser Software Listing

4DGeo/GeoBrowser (v3.0.n)/

Apps/ Cmaps/ Collections/ Dforms/ Dictionary/ Doc/ GB_MENUBAR Templates/ Workspace/ cgi-bin/ html/ src/ README.copyright, README.install, README.relnotes, README.update, geo_install, geo_make_dist

Apps
Bookmark/ DataLogger/ EventLogger/ JournalLog/ MRIB/ RTMonitor/
Collections (set to ../Collections which is a link to the collections directory)
Category.list Clists/ Galleries/ Grids/ MapCategory.list Maps/ Mlists/ Regions/ WHOI/ USGS/
Dforms
DAQ.atlv3117 DAQ.jaspro90 DAQ.kn162 DAQ.tn117 DAQ.tn118 DAQ.tn129
Dictionary
daq_field.def eic_field.def fgdc_field.def dc_field.def dsl_field.def mrib_field.def
Doc
condensed_eic_sped, eic_concept, eic_dictionaries, email_cmd_interface, text_eic_spec
form_cmd_interface

GB_MENUBAR, GB_MENUBAR.dataUser1, GB_MENUBAR.dataUser2

Templates
4Dgeo.prefs, Access_E, Access_R, card_create.tpl, eic_card.fmt, email_cmd.hlp, g newuser.4Dgeoadv.prefs, newuser.4Dgeo.display.prefs, newuser.4Dgeo.download.prefs, newuser.4Dgeo.gui.prefs, newuser.4Dgeo.log.prefs, newuser.4Dgeo.search_map.prefs, newuser.4Dgeo.userlevel.prefs, newuser.Collections.sel, newuser.gmt.prefs, newuser.vrml.prefs, pfile_animate.tpl, pfile_fly.tpl, pfile_gmt_1d.tpl, pfile_gmt2d.tpl, pfile_gmt_regionmap.tpl, pfile_matlab.tpl
Workspace (set to ../Workspace which is a link to the workspace directory)
Access_Logs/ Email_Logs/ user_ids/
Cgi-bin CGI Source code
Html Misc. html source code
Src Misc. psurl source code

4.3.2 Template Files

Template files are used when creating new GeoBrowser accounts and/or collections. Newuser files are used when creating new accounts. Tpl files are used as templates when resetting to default values. Access_E and Access_R files are templates used for setting collection edit and read access protections.

4.3.3 Misc. Internal Files

The Catalog List is the main top-level catalog. For each catalog specified, there s a corresponding Clist file that points to the each collection and its corresponding directory. Note that access control is additionally specified within each collection via an Access_E and Access_R access control file. The MapCategory.list is the top-level index for the available map collections. The Mlists are the equivalent of the Clists file. Maps, Grids, etc.

Catalog List File (Catalog.list)

Below is an example catalog list file. This file resides in the main Collection directory.

```
# Catalog List - updated 6/5/98
# Title;^^^^^^^ Collection List Filename;^^^^^^ Access_Control
#
NOAA_ORCA;^^^^^ Clists/NOAA_ORCA;^^^^^^^^^^^^^^ access=all
USGS;^^^^^^^^^^ Clists/USGS;^^^^^^^^^^^^^^^^^^ access=all
USGS_JGOFS;^^^^ Clists/USGS_JGOFS;^^^^^^^^^^^^ access=all
WHOI;^^^^^^^^^^ Clists/WHOI;^^^^^^^^^^^^^^^^^^ access=all
WHOI-DSL;^^^^^^ Clists/WHOI_DSL;^^^^^^^^^^^^^^ access=all
__Local__;^^^^^ __Local__;^^^^^^^^^^^^^^^^^^^^ access=all
```

Collection List File (Clist/)

Below is an example collection list file. This file is referenced from the catalog list file.

```
# Collection List - updated 5/6/98
# Title;˚˚˚˚˚˚˚ CollectionDir
#
WHOI Alvin;˚˚˚˚ WHOI/Alvin_Divelog
Jason IX;˚˚˚˚˚˚ WHOI/JasonIX
National_Buoys; WHOI/National_buoy_center
```

MapCatalog List File (MapCatalog.list)

Below is an example catalog list file. This file resides in the main Collection directory.

```
# Catalog List - updated 7/5/98
# Title;˚˚˚˚˚˚˚ Map List Filename;˚˚˚˚˚˚ Access_Control
#
NOAA Maps;˚˚˚˚˚ Mlists/NOAA;˚˚˚˚˚˚˚˚˚˚˚˚˚˚ access=all
USGS Maps;˚˚˚˚˚˚Mlists/USGS;˚˚˚˚˚˚˚˚˚˚˚˚˚˚˚access=all
WHOI;˚˚˚˚˚˚˚˚˚ Mlists/WHOI;˚˚˚˚˚˚˚˚˚˚˚˚˚˚˚access=all
US Maps; ˚˚˚˚˚˚ Mlists/US;˚˚˚˚˚˚˚˚˚˚˚˚˚˚  access=all
__Local__;˚˚˚˚˚ __Local__;˚˚˚˚˚˚˚˚˚˚˚˚˚˚˚˚access=all
```

Map List File (Mlist/)

Below is an example collection list file. This file is referenced from the catalog list file.

```
# Map List - updated 5/6/98
# Title;˚˚˚˚˚˚˚ Map info file
#
NOAA World Map;˚˚˚˚NOAA/noaa_world.map
NOAA Small World;˚˚˚˚NOAA/noaa_world.small.map
```

Example noaa_world.map map info file within the Maps/NOAA subdirectory:

```
coord_type=LL
xorg=-180
yorg=-90
zorg=0
xscale=.25
yscale=.25
Zscale=1
image_map=NOAA/noaa_world.gif
xsize=1440
ysize=720
default_xrad=5
default_yrad=5
image_zoom_i=US/us_full.map
```

Access Control files (Access_E, Access_R in the collection directory)

```
#4DGeoBrowser – Access Control File
group=WHOI
```

user=

4.3.4 Setting up the GeoBrowser Server

The GeoBrowser server has been tested on SGI (Netscape Fasttrack Server) and Linux (Apache) computers. The main /GeoBrowser document tree should be set to ~geobrowser/4DGeo/GeoBrowser/html. The geo-bin directory should be script aliased to ~geobrowser/4DGeo/GeoBrowser/cgi-bin, and the geo-dev development top-level cgi directory should be script alias to ~geodev/GeoBrowser_Dev/cgi-bin, and the geo-app should be aliased to~geobrowser/4DGeo/GeoBrowser/geo-app. Additionally, the geobrowser directory needs to be able to follow symbolic links. These settings need to be done as root in the httpd.conf file for apache servers and the equivalent in the Netscape fasttrack server.

For interfacing to procmail for automatic GeoBrowser/Email command interface, the following .forward file should be setup in geobrowser home account.

```
| (cd ~geobrowser/4DGeo/cgi-bin && exec ./GB_proc_mail >> ~geobrowser/Workspace/Email_Logs/4DGeo.ecmd.log)
```

4.3.5 Required Environment Variables and Directory Structure

No environment variables need to be setup. The directory tree needs to be as specified in section 4.3.1.

4.3.6 Setting up New Collections

Creating new global collections is still a manual process. A new collection tree must be setup to contain the following: Access_E, Access_R, Cards/, Index/, Title.txt. The Cards and Index directories must be setup to allow nobody r/w access. Populate the Cards directory with EIC file(s) and make sure they end in .eic. Setup the Access control appropriately. Edit the Catalog.list file and insert the new collection entry and then edit the appropriate Clists file and have it point to the new collection directory. The new collection should show up within the build_selection_list from within the Select menu.

4.3.7 Updating Collection Index Cards and Index Files

There are several ways for updating index files. The most common method is the option within the Utilities menu called Update Collection Index Files . Fill-out the form and be sure to specify the Global collection option and enter the full name (without Collections/). Press Update Collection Index Files and you should see the index log in the upper-right frame. Specific indexes can be built from within the Extras menu (as developer or administrator). Select Build ID, Time, Spatial, or Keyword Index and then select the collection to be updated.

4.3.8 Moving Local Collections to Global Collections

Currently this needs to be done manually. Simply move the directory tree to the global collection and then update the Catalog.list, Clist file, and Access control files.

4.3.9 The GeoBrowser Administrator

User accounts can be setup to have different user-level access. Current supported user levels include: dataUser1, dataUser2, dataEntry, developer, and geoAdmin. Different user levels have different options available via the main menu. New accounts are automatically created with dataUser1 access. This gives access to most of the system, but does not allow importing and exporting data. DataUser2 level does. Administrators have the abilities ranging from building index files to monitor access to the geobrowser system. Administrators can change the user-level to other users and is typically used to promote dataUser1 to dataUser2 levels.

4.4 GeoBrowser Collections

4.4.1 Collection Directory Tree Overview

Top-level collection directory:

Collections (referenced via ~geobrowser/4DGeo/Collections link)

Catalog.list Clists/ Grids/ MapCategory.list Maps/ Mlists/ Regions/ USGS/ WHOI/ index.html

Catalog.list (set to ../Collections which is a link to the collections directory

Bookmark/ DataLogger/ EventLogger/ JournalLog/ MRIB/ RTMonitor/

Grids —directory of gmt bathymetric grid files used for GMT geographic elevation plotting

Maps — directory of pre-processed maps used for map searching and real-time fly plots

Regions — Pre-processed GMT region maps with region.list index file.

USGS/WHOI - individual collection hierarchy

index.html — stub html file for security

Specific Collection Hierarchy Directory Tree:

```
                WHOI/
Alvin_Divelog/          Cruises/     National_Buoy_Center/
      |
      |
Access_E  Access_R  Cards/    Index/  Overview.ctl    Overview.dat    Title.txt
                        |           |
                Collection.fields       ID/    Keyword/    Spatial/    Time/
                AlvinCards.eic
                AlvinCards.eic.s
                cards.sum
```

Access_E/Access_R

Access control files for editing and read access.

Cards

Collection.fields — automatically generated during index creation and is summary of fieldnames in collection

*.eic — electronic index card files

*.eic.s — electron index card summary files automatically generated

cards.sum — summary file automatically generated during index creation

Index — index file directory tree. Indices automatically created by Update Collection Index Files option in Utilities.

ID — id index

Keywords — keyword index although mostly predicated

Spatial — spatial index

Time — time index

Overview.[ctl,dat]— optional control file for Overview feature

Title.txt — simple title of collection and can contain html. Used in Select Collections.

4.4.2 Title

ASCII file containing the title of the collection and is used in the Select Collections menu. The title file can contain html for adding color, underlines, icon images, etc. but should be specified on one line.

4.4.3 Index Cards

Index card files can be any valid filename ending in .eic. Multiple EIC formats supported including fully qualified EIC and Condensed EIC formats. If more than one EIC file present, they will be seamlessly searched, displayed, etc. in their alphabetic order.

4.4.4 Index Files

Index files for ID, Keyword, Spatial and Time searching are stored for each collection in the Index directory. These files are generated automatically anytime the index files are updated, usually by the Update Collection Index Files option in the Utilities menu.

4.4.5 Access Control

Access control to collections is separated into Read Access and Edit Access, but the same mechanism is implemented for both. When selecting collections, there is a file called Category.list which lists all available list of collections. The category list file consists of entries containing a title, collection list filename, and access control separated by a semicolon delimiter. The access control field has the format: access=name,name,... where name may be a specific username_id, group name, or all. This access control parameter only determines whether the particular collection list will be displayed in the select collections interface. Each individual collection also contains two access control files; one for read access and one for edit access (Access_R and Access_E). These files contain two lines with the same syntax for read and edit access control. The first line specifies what have access and the second line specifies what users have access. Syntax is group=name,name,... and user=name,name, where name may be a specific username_id, group name, or all. Note: As with most configuration files within the GeoBrowser, comments are allowed and begin with # in the first column.

4.5 GeoBrowser API for External Application Development

4.5.1 GeoBrowser HTTP GB_cmd API

GB_cmd http Command List	
Valid Command	**Argument(s)**
List_Cmds	
Select_Collections	collections=Collection1[,Collection2,__Local__/collection...]
Display_Cards	fmt=Brief|Full|Icon|Summary bfield[1-5]=FieldName bfieldU[1-4]=FieldName Display_What=Search|Composite|Collections page=
Search_Cards	type=ByTime|ByTimes|ByLocation|ByKeyword|ByFieldValue arg=[search type dependent arguments] **ByTime**: time=yyyy/mm/dd+hh:mm:ss Filter=on_date|before_date|after_date Search_What=Collections|Composite **ByTimes**: start_time=yyyy/mm/dd+hh:mm:ss end_time=yyyy/mm/dd+hh:mm:ss Search_What=Collections|Composite **ByLocation**: xctr= yctr= xrad= yrad= Coord_Type=LL|XY ***ByMap***: xctr= yctr= map= showboxes=[off|on] **ByKeyword**: keywords=word1[+word2...] Field= And_Or=AND|OR Case_Sensitive=off|on Allow_Partial_Word=off|on Search_What=Collections|Composite **ByFieldValue**: Field= Value=word1[+word2...] Filter=Equal|Less+Than|Greater+Than|Range|Not+Equal|Contains Case_Sensitive=off|on MinVal= MaxVal= Search_What=Collections|Composite **ByCalendar**: yr= mon= title= win= url= *Search_What=Collections|Composite* **ByMatchAll**: Select_Every= *Search_What=Collections|Composite*
Sort_Cards	sfield=FieldName sdir=normal|reverse Sort_What=Search|Composite display=on verbose=on
Plot_Cards	type=GMT-2D|GMT-1D|MATLAB|ANIMATE|FLY pfile= Plot_What=Search|Composite|Collections verbose=[off|on]
Add2Composite	
ReplaceComposite	
Export_Cards	fmt=Text|ASCII|HTML|EIC delim=Tab|Comma|Semi|Colon|Pipe Export_What=Search|Composite|Collections srec= nrecs= [ExportFields=USER_SELECT EXPORT__<fieldname>=on...]
List_CollectionFiles	
SlideShow	Show_What=Collections|Search|Composite title= widgets=[on] refresh=[on] loop=[on]
Run_Macro	mfile=
Optional argument for all commands: collections=, user_id=, silent=on	

Syntax: http://.../geo-bin/GB_cmd?cmd=COMMAND&arg1=ARG1&arg2=ARG2...
Multiple cmd support within url - optional silent=on arg available
Required arguments are underlined
Note: For any multi-word arguments or values, use '+' in place of spaces
Italicized commands are not currently available
Access control to GB_cmd is available via GB_cmd.allow file

Examples:

Example 1: Display cards in brief format from within a collection
http://server/geo-bin/GB_cmd?cmd=Display_Cards&fmt=brief&Display_What=Collections&collections=WHOI/National_buoy_center

Example 2: Search for a particular start/end time and export specific fields. Note: multipart search is broken down for descriptive purpose— i.e., all this needs to be specified on one line.

Specify the machine, GB_cmd, user_id, and database

http://geobrowser-server/geo-bin/GB_cmd?user_id=UName_xxxx&collections=WHOI/

Add the Search command type and parameters

&cmd=Search_Cards&type=ByTimes&start_time=2001/08/01&end_time=2001/08/03&silent=on

Add the Export command

&cmd=Export_Cards&Export_What=Search&fmt=ASCII&delim=Comma
&ExportFields=USER_SELECT&EXPORT__EIC.title=on&EXPORT__EIC.time=on

4.5.2 GeoBrowser Email command API

The email command interface is sent via an email message containing a subject and a body within the message. The subject line is where the commands are specified, and the body of the message typically contains data in the Condensed Electronic Index Card (EIC) format. Refer to Condensed EIC Specification.
A list of the supported subject commands follows. Note the syntax of the subject commands are as follows: command1=xxx&command2=yyy

Email Subject Command

```
uid:  Description: GeoBrowser username and id of the
                     login account for this transaction.
      Syntax : uid=user_id
      Example: uid=joeshmoe_1234

type: Description: Type of information to follow in message body.
                     Note EIC requires one or more of the collection
                     params in the subject line, and GB_cmd requires
                     GM_cmd=xxx in the message body. Help lists available
                     email subject commands. Default EIC.
      Syntax : type=EIC|GB_cmd|Help
      Example: type=Help

ack:  Description: Send acknowledge of Email Cmd received. Default
                   is not to acknowledge (ack=no)
      Syntax : ack=yes|no
      Example: ack=yes

collection:
      Description: Specifies collection name. Require if type is EIC.
      Syntax : collection=collection_name
      Example: collection=WHOI/BuoyData

c_fname:
      Description: Specifies individual filename within collection.
                     Optional. If not specified, filename defaults to
                     convention specified in c_fconven.
      Syntax : c_fname=fname
      Example: c_fname=buoy1.eic

c_fconven:
      Description: Specifies filename naming convention used within collection.
                     Ignored if c_fname is specified. Default to daily.
      Syntax : c_fconven=daily|hourly
      Example: c_fconven=hourly

c_fprefix:
      Description: Specifies filename prefix when used with c_fconven.
                     Ignored if c_fname is specified. Default to ECmd.
      Syntax : c_fprefix=prefix
      Example: c_fprefix=A1
```

```
c_fsizelim:
      Description: Specifies record limit for collection file. When limit
                   is exceeded, another file using same naming convention
                   is created with a counter file extension. Default unlimited.
      Syntax : c_fsizelim=nnn_records
      Example: c_fsizelim=3000

c_action:
      Description: Specifies collection action to take. Add adds records
                   to an existing collection filename. Will work for
                   new files as well. Replace should be used with caution
                   and may have unpredictable if c_fname is not specified
                   or if messages arrive out of sequence. Default is add.
      Syntax : c_action=add|replace
      Example: c_action=add

c_local:
      Description: Specifies that collection is local to uid specified.
                     Default is global collection (c_local=no).
      Syntax : c_local=yes|no
      Example: c_local=yes

c_create:
      Description: Specifies new collection path name. Only local
                     collections are supported.
      Syntax : c_create=collection_name&c_title=&c_prot=
      Example: c_create=WHOI/Buoy2Data

c_rindex:
      Description: Re-generate collection index files. Default is
                     to re-generate collection index files (c_rindex=yes).
      Syntax : c_rindex=yes|no
      Example: c_rindex=no

GB_cmd:         Description: support for built-in GeoBrowser cmd support.
        Commands go in message body. New line for each command.
      Syntax : GB_cmd=[http geobrowser command]
      Example: GB_cmd=List_Cmds

Future Subject Commands
c_exe=hold (hold in queue)
type=URL|Webdata|Gallery
```

Examples:

Example #1

Simple example to list available email commands and to verify that the GeoBrowser received the command.

```
mail GeoBrowser@geobrowser_host
Subj: uid=joeshmoe_1234&type=Help

message body not required
```

Example #2

Simple example to add electronic index card (EIC) formatted data to a collection. Note: This example takes advantage of several default command values to simplify the subject line.

```
mail GeoBrowser@geobrowser_host
Subj: uid=joeshmoe_1234&collection=WHOI/BuoyData

#global:EIC.title=BuzBay Buoy&EIC.lat=40.43&EIC.lon=-70.23&EIC.elev=-5.2
#fields:EIC.time,id,sstmp,wind
1998/10/22 10:00:05,01,20.250,2.43
1998/10/22 10:00:10,01,20.262,3.12
1998/10/22 10:00:15,01,20.264,3.10
1998/10/22 10:00:20,01,20.265,3.08
...
```

Example #3

Similiar to example #2 with the addition of specifying a collection filename. The EIC formatted data also illustrates use of variable macros ({'_imdir'}) and url labels.

```
mail GeoBrowser@geobrowser_host
Subj: uid=joeshmoe_1234&collection=WHOI/BuoyImages&c_fname=buoy1.eic

#global:EIC.title=http://hostname/desc.html Buoy Images&_imdir=http://hostname/images
#fields:JPGID,EIC.lat,EIC.lon,EIC.depth,EIC.desc,EIC.image
IMG0003.JPG,-70.348,42.29177,79,Mud bottom,{'_imdir'}/img0003.jpg
IMG0005.JPG,-70.35811,42.32535,82,Muddy sand,{'_imdir'}/img0005.jpg
IMG0008.JPG,-70.32572,42.32558,48,Medium sand,{'_imdir'}/img0008.jpg
```

Example #4

Simple example to list GB_cmds

```
mail GeoBrowser@geobrowser_host
Subj: uid=joeshmoe_1234&type=GB_cmd
GB_cmd=List_Cmds
```

4.5.3 GeoBrowser HTTP Form-Based API

To facilitate automatic data logging into the GeoBrowser, we have developed a GeoBrowser HTTP Form-Based Command Interface. This interface specification was built from the GeoBrowser s Email command interface.

Features of the GeoBrowser HTTP Form-Based Command Interface include:

- Easy to upload data into the GeoBrowser via user-defined html form
- Forms can be developed independently and reside on any computer
- Simple API

The GeoBrowser form-based interface specification consists of several special form elements that must be specified. These will have names that begin with 4DGeo_. Note that these elements can be defined as hidden if the intent is to keep this information hidden from users. All other form elements not beginning with 4DGeo_ will simply be appended to the collection filename specified as an electronic index card (EIC) fields. Note: Feedback of the GeoBrowser s form-based interface will be returned in the form window unless the form action has a target set.

A list of the supported HTTP form-based commands follows. The name of the form element should be 4DGeo_< cmd >. Required commands begin with *. Commands in *italics* are not fully implemented.

HTTP Form-Based Command

```
*uid:       Description: GeoBrowser username and id of the
                 login account for this transaction.
  Syntax : NAME=uid VALUE=user_id
  Example: NAME=4DGeo_uid VALUE=joeshmoe_1234

type:       Description: Type of information to follow in message body.
                 Note EIC requires one or more of the collection
                 params in the subject line, and GB_cmd requires
                 GM_cmd=xxx in the message body. Help lists available
                 email subject commands. Test simply returns an
                 acknowledgement. Default EIC.
  Syntax : NAME=4DGeo_type VALUE=EIC|GB_cmd|Help|Test
```

```
  Example: NAME=4DGeo_type VALUE=Help

submit:
  Description: Name to be used on submit button in form. If used,
               will not show up as a field on the generated index card.
  Syntax : NAME=4DGeo_submit VALUE=button-name
  Example: NAME=4DGeo_submit VALUE=SUBMIT

ack:        Description: Send acknowledge of Email Cmd received. Default
              is not to acknowledge (ack=no)
  Syntax : NAME=4DGeo_ack VALUE=yes|no
  Example: NAME=4DGeo_ack VALUE=yes

collection:
  Description: Specifies collection name. Required if type is EIC
               unless creating a new collection (refer to c_create).
  Syntax : NAME=4DGeo_collection VALUE=collection_name
  Example: NAME=4DGeo_collection VALUE=WHOI/BuoyData

c_fname:
  Description: Specifies individual filename within collection.
                 Optional. If not specified, filename defaults to
                 convention specified in c_fconven. If low-volume
                 data per day, it's recommended to specify a filename.
  Syntax : NAME=4DGeo_c_fname VALUE=fname
  Example: NAME=4DGeo_c_fname VALUE=buoy1.eic

c_fconven:
  Description: Specifies filename naming convention used within collection.
                 Ignored if c_fname is specified. Default to daily.
  Syntax : NAME=4DGeo_c_fconven VALUE=daily|hourly
  Example: NAME=4DGeo_c_fconven VALUE=hourly

c_fprefix:
  Description: Specifies filename prefix when used with c_fconven.
                 Ignored if c_fname is specified. Default to ECmd.
  Syntax : NAME=4DGeo_c_fprefix VALUE=prefix
  Example: NAME=4DGeo_c_fprefix VALUE=A1

c_fsizelim:
  Description: Specifies record limit for collection file. When limit
               is exceeded, another file using same naming convention
               is created with a counter file extension. Default unlimited.
  Syntax : NAME=4DGeo_c_fsizelim VALUE=nnn_records
  Example: NAME=4DGeo_c_fsizelim VALUE=3000

c_action:
  Description: Specifies collection action to take. Add records
               to an existing collection filename. Will work for
               new files as well. Replace should be used with caution
               and may have unpredictable if c_fname is not specified
               or if messages arrive out of sequence. Default is add.
  Syntax : NAME=4DGeo_c_action VALUE=add|replace
  Example: NAME=4DGeo_c_action VALUE=add

c_local:
  Description: Specifies that collection is local to uid specified.
                 Default is global collection (c_local=no).
  Syntax : NAME=4DGeo_c_local VALUE=yes|no
  Example: NAME=4DGeo_c_local VALUE=yes

c_create:
  Description: Specifies new collection path name. Only local
                 collections are supported.
  Syntax : NAME=4DGeo_c_create VALUE=collection_name&c_title=&c_prot=
  Example: NAME=4DGeo_c_create VALUE=WHOI/Buoy2Data

c_rindex:
  Description: Re-generate collection index files. Default is
                 to re-generate collection index files (c_rindex=yes).
  Syntax : NAME=4DGeo_c_rindex VALUE=yes|no
```

```
  Example: NAME=4DGeo_c_rindex VALUE=no

DEBUG:
  Description: For debugging form submissions. Will echo all
               input parameters and will not submit card entry.
  Syntax : NAME=4DGeo_DEBUG VALUE=1|0
  Example: NAME=4DGeo_DEBUG VALUE=1

cc_enable:
  Description: Enables CC to another GeoBrowser server. See
               cc_geobrowser. Default: 0.
  Syntax : NAME=4DGeo_cc_enable VALUE=1|0
  Example: NAME=4DGeo_cc_enable VALUE=1

cc_geobrowser:
  Description: Copy form submission to another GeoBrowser server
               providing cc_enable is set to 1.
               Caution: any items such as collection names and profiles
               may need to be pre-defined on the second geobrowser
               server. Uses email command interface.
  Syntax : NAME=4DGeo_cc_geobrowser VALUE=geobrowser@hostname
  Example: NAME=4DGeo_cc_geobrowser VALUE=geobrowser@somewhere.whoi.edu

cc_urlPrefix:
  Description: Translate image/video url prefixes to this one on
               the cc_geobrowser. Default: blank.
  Syntax : NAME=4DGeo_cc_urlPrefix VALUE="URL"
  Example: NAME=4DGeo_cc_urlPrefix VALUE="http://www.somehost/dir/"

profile:
  Description: Specifies email cmd profile name w/in uid to use.
               This can be useful for defining global variables,
               collection and filenames. Be careful if you use
               cc_geobrowser as that server will need to have
               the same profile defined. Refer to email cmd document
               for more information on using profiles.
  Syntax : NAME=4DGeo_profile VALUE=profile_name
  Example: NAME=4DGeo_profile VALUE=DD_Form1A

Future Subject Commands
GB_command interface
c_exe=hold (hold in queue)
type=URL|Webdata|Gallery
```

Examples:

Note you will see many field names that start with EIC (e.g.; EIC.title, EIC.lat,EIC.lon,EIC.elev...). These fields take advantage of the GeoBrowser dictionary system that supports 'standard' and user-defined fields. Although strongly encouraged, standard and even user-defined fields are not required (i.e.; unregistered fields are supported directly). Refer to the Condensed EIC Specification. If standard fields such as EIC.time, EIC.lat, and EIC.lon are used, then the data files will be directly compatible with the 4DGeoBrowser which provides temporal, spatial, and keyword searching along with plotting capabilities that include interactive time-series and geographical plots. The forms-based processor of the GeoBrowser system also accepts alternate field formats for time and latitude/longitude. Alternate fields are automatically converted into standard EIC fields upon receipt of the form information. This allows web-form developers greater flexibility in developing user-friendly forms. The _ALT.ll_fmt_id field needs to be set and then the appropriate variables need to be set. Supported alternate Lat/Lon fields (_ALT.< fieldname>) are listed below. Note: latitude range is -90-90 and longitude range is -180 - 180 degrees for formats when direction is specified as positive/negative numbers. Negative degrees by convention represent southern and western hemispheres.

```
ll_fmt_id=[1,2,3,4,5,6,7]
          where: 1-strfmt1, 2-strfmt2, 3-strfmt3,4-strfmt4
                 10- +/-dd mm.mmm, 11-dd mm.mmm Dir,12-dd mm ss Dir
          #String Format #1 Lat: +/-dd mm.mmm   Lon: +/-ddd mm.mmm
          #String Format #2 Lat: dd mm.mmm N|S  Lon: ddd mm.mmm E|W
          #String Format #3 Lat: dd mm ss N|S   Lon: ddd mm ss E|W
          #String Format #4 Lat: +/-ddmm.mmm    Lon: +/-dddmm.mmm
```

```
lat_str    Used if ll_fmt_id=1,2,3,4
lon_str    Used if ll_fmt_id=1,2,3,4
lat_deg    Used if ll_fmt_id=10,11,12
lat_min    Used if ll_fmt_id=10,11,12
lat_sec    Used if ll_fmt_id=12
lat_dir    Used if ll_fmt_id=11,12
lon_deg    Used if ll_fmt_id=10,11,12
lon_min    Used if ll_fmt_id=10,11,12
lon_sec    Used if ll_fmt_id=12
lon_dir    Used if ll_fmt_id=11,12
```

Example #1

Simple example to list available http form-based commands and to verify that the GeoBrowser received the command.

```
<HTML>
<HEAD></HEAD>
<BODY>
<FORM METHOD= POST  ACTION= /geo-bin/GB_proc_form >
<INPUT TYPE= HIDDEN  NAME="4DGeo_uid" VALUE="joeshmoe_1234">
<INPUT TYPE= HIDDEN  NAME= 4DGeo_type  VALUE= Help >
<INPUT TYPE= SUBMIT  NAME= 4DGeo_submit  VALUE=TEST_HELP>
</FORM>
```

TEST_HELP

Example #2

Simple example to add electronic index card (EIC) formatted data to a collection. Where possible, take advantage of EIC defined fields. Note that the order of the fields EIC.title, EIC.time, EIC.lat, and EIC.lon match the order in the EIC dictionary, which is recommended. Note that you can hide certain parameters from the user by setting the type to hidden. This can reduce the complexity of the form for items where you want static data sent without either the user filling-out the form or where you simply wish to hide the fields from the user (eg; TestForm field in the example below). Finally, names that begin with an underscore '_' will appear as hidden fields within a card on the GeoBrowser.

```
<HTML>
<HEAD></HEAD>
<BODY>
<FORM METHOD="POST" ACTION="/geo-bin/GB_proc_form">
<INPUT TYPE="HIDDEN"  NAME="4DGeo_uid" VALUE="joeshmoe_1234">
<INPUT TYPE="HIDDEN"  NAME="4DGeo_type" VALUE="EIC">
<INPUT TYPE="HIDDEN" NAME="4DGeo_collection" VALUE="WHOI/BuoyData">
<INPUT TYPE="HIDDEN" NAME="4DGeo_c_fname VALUE="BuzBay.eic">
Buoy Name: <INPUT TYPE= TEXT  NAME= EIC.title  VALUE= BuzBay Buoy ><br>
TimeStamp: <INPUT TYPE= TEXT  NAME= EIC. time  VALUE= 1999/12/04 10:05:18 >
Latitude: <INPUT TYPE= TEXT  NAME= EIC.lat  VALUE= 40.43  SIZE=6>
Longitude: <INPUT TYPE= TEXT  NAME= EIC.lon  VALUE= -70.23  SIZE=6> (Units: Decimal Degrees)<br>
Sea-Surface Temperature: <INPUT TYPE= TEXT  NAME= EIC.sstmp  VALUE= 20.250 >
Wind Speed: <INPUT TYPE= TEXT  NAME= wind  VALUE= 2.43 >
<INPUT TYPE= HIDDEN  NAME= TestForm  VALUE= FormEx2 ><br>
<INPUT TYPE= SUBMIT  NAME= 4DGeo_submit  VALUE= SUBMIT >
</FORM>
```

Buoy Name: BuzBay Buoy TimeStamp: 1999/12/04 10:0

Latitude: 40.43 Longitude: -70.23 (Units: Decimal Degrees)

Sea-Surface Temperature: 20.250 Wind Speed: 2.43

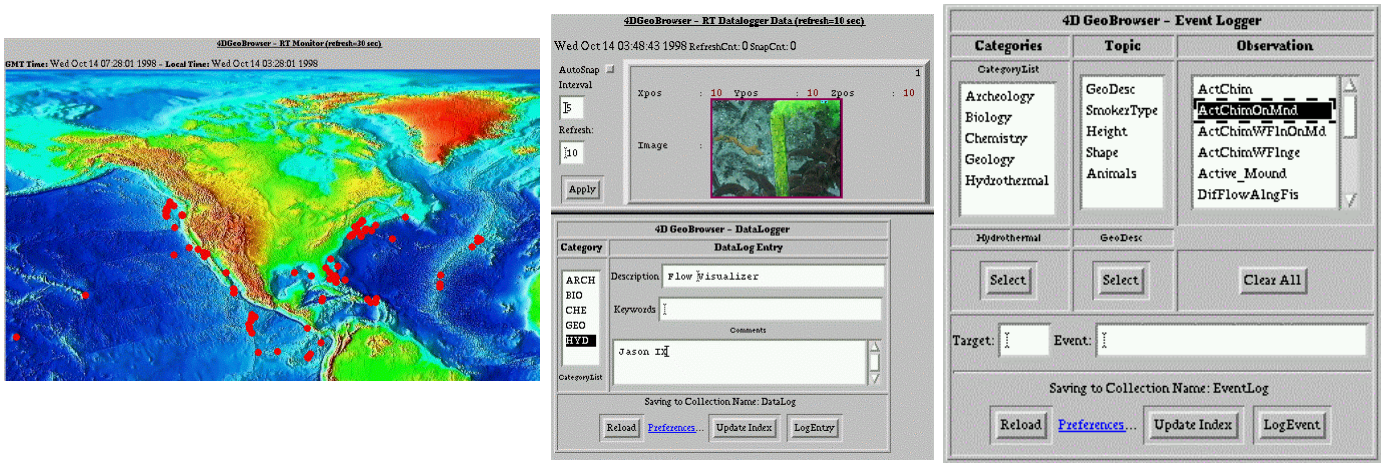
SUBMIT

4.6 Debugging the GeoBrowser

For GeoBrowser server problems, refer to the http server access and error logs. GMT plotting can occasionally result in errors. These may show-up on the system http error logs. If not, to help debug the GMT plotting problem, select the Verbose setting on the GMT preference file and re-generate the plot. This options shows debugging information that can be used to isolate and fix the problem.

4.7 GeoBrowser Sample Applications

Several sample internal applications have been built to show potential capabilities of the GeoBrowser system including applications such as a R/T Monitor, Data Logger, Event Logger, Journal Logger, etc. Since the advent of the GeoBrowser s APIs, we strongly encourage external application development. This gives the users and developers full control of their applications, and at the same time it enables independent development of the GeoBrowser system. Figures below show examples of a R/T Monitor (left), Data Logger (middle), and Event Logger (right). Both the data logger and event logger are example applications of merging observational data with real-time data and generating EIC cards automatically.



5 Acknowledgements

The *GeoBrowser s* development effort was initially funded in 1997 by George Moss. Thanks to Roger Goldsmith for his technical contributions with the interactive GMT plots. Significant enhancements were made to support the USGS MRIB project with direction from Tom Aldrich, Fausto Marincioni, Fran Hotchkiss, and technical contributions from Mike Caruso. Acknowledgements to David Remsen for his work on Labnet; Dan Frye, Brad Butman, Marinna Martini, Jon Ware, and Keith von der Heydt for the Low-Cost Telemetry project; Scott Gallager, Cabell Davis, Keith von der Heydt, and Ken Peal for the Autonomous Vertically Profiling Plankton Observatory project; Jon Howland for technical feedback and Jason data interface discussions; and Danielle Fino for her help designing the Jason Virtual Control Van web interface. Development of the GeoBrowser system has spanned several years and had been supported in part through multiple sources including George Moss, USGS 00HQAG001, The Keck Foundation, and NOPP OCE-9810641.

6 Appendix

6.1 EIC Specification

S. Lerner/A. Maffei
Last Updated: 09/24/2001

Overview

The electronic index card (EIC) is a simple self-documenting ASCII data format designed to facilitate the handling of multi-disciplinary datasets. There are currently three supported formats, the fully specified EIC (described here), the condensed EIC format (described in section 6.2), and the text EIC format (described in section 6.3). The fully qualified EIC format has many capabilities including the ability to seamlessly mix and match different types of records since each record contains fully qualified attribute and value pairs. This format, however, is inefficient in terms of disk storage and is not optimum for real-time data streams from scientific instruments, which may be more suited for the Condensed EIC format. Internally, the GeoBrowser converts EIC data records into the fully qualified EIC format thus allowing multiple input formats while still using a standard set of routines for searching, displaying, and plotting the EICs.

The fully qualified EIC format is a simple URL specification. All records have the format of attribute=value&attribute=value Each record is one line delimited by a carriage return. Each record must start with the attribute EIC.id and end with the attribute EIC.end. Refer to section 6.4 Electronic Index Card Field Definition Dictionaries for precise description and formats of the EIC fields.

Attributes of the fully qualified EIC format include:

- Simple ASCII data format
- Self-documenting (field names and comments)
- Each record is independent and may contain an arbitrary number of attribute value pairs.
- Support for multiple real-time independent data streams
- Meta data support via url references
- Automatically interfaces to real-time monitoring and historical data display with 4DGeoBrowser via any WWW browser.

Examples:

Note you will see many field names that start with EIC (eg; EIC.title, EIC.lat,EIC.lon,EIC.elev...). These fields take advantage of the GeoBrowser dictionary system that supports 'standard' and user-defined fields. Although strongly encouraged, standard and even user-defined fields are not required (ie; unregistered fields are supported directly). Refer to the Conventions Section below. If standard fields such as EIC.time, EIC.lat, and EIC.lon are used, then the datafiles will be directly compatible with the 4DGeoBrowser, which provides temporal, spatial, and keyword searching along with plotting capabilities that include interactive time-series and geographical plots.

Example #1

Simple example of EIC file containing two cards (records), each followed by a carriage-return. For readability in this document, each record is described in multiple lines with indentations.

```
EIC.id=933872146.00001&EIC.title=Buoy Data&EIC.time=1998/10/22 10:00:00&EIC.end=933872146
    EIC.lat=40.43&EIC.lon=-70.23&EIC.elev=-5.2&sstmp=20.250&wind=2.43
EIC.id=933872146.00002&EIC.title=Buoy Data&EIC.time=1998/10/22 10:00:05&
    EIC.lat=40.43&EIC.lon=-70.23&EIC.elev=-5.2&sstmp=20.262&wind=3.12&EIC.end=933872146
...
```

Example #2

Example of EIC record containing embedded URL and images. Again, for readability in this document, the EIC record is described in multiple lines with indentations, but in practice, this would be 1 line in a data file.

```
EIC.id=933867116.00004&EIC.title=http://hostname/desc.html Sample Images&
     JPGID=IMG003.JPG&EIC.lon=-70.31018&EIC.lat=42.32527&EIC.depth=28&
     EIC.desc=Medium rippled sand&EIC.image=http://hostname/images/img003.jpg&
     EIC.end=933867116.00004
```

GeoBrowser Electronic Index Card Examples: (Note: green labels identify unregistered fields)

Here are a couple of examples of how the GeoBrowser would display the records contained within a datafile as a "card". Since these are simply records in the datafile, there is no additional overhead to turn these into "cards". The GeoBrowser can display, search, and plot fields within these cards easily via a web-browser. In addition to the web front-end, there is a GeoBrowser http command interface as well as export capabilities for user-defined applications.

From Example #1

1

Card ID : 933872146.00001 Modified: Thu Aug 5 12:55:46 1999
Title : Buoy Data
TimeStamp : 1998/10/22 10:00:00
Latitude : 40.43 Longitude : -70.23
sstmp: 20.250 wind: 2.43

From Example #2

4

Card ID : 933867116.00004 Modified: Thu Aug 5 11:31:56 1999
Title : Sample Images
JPGID: IMG0010.JPG
Latitude: 42.32527 Longitude : -70.31018 Depth : 28
Description : Medium rippled sand
Image : 

Conventions

Where possible, we would like to take advantage of the 4D GeoBrowser web technology including the concept of the EIC field definition dictionary and other user defined field definition dictionaries. The field definition dictionary defines common or standard fields within a discipline, class of instruments, sensors, etc. By either using pre-defined field names or defining appropriate fields names for datasets, we can take advantage of the current conventions and systems in place. One major advantage will be that we can access and analyze the data between multiple systems automatically since the variable types and units will be common.
Some examples of common and useful EIC fields include EIC.title, EIC.time, EIC.lat, EIC.lon. If these fields are used then the values must adhere to the field definition format and convention. In this case, EIC.title is simple ASCII text, EIC.time format is in the form yyyy/mm/dd hh:mm:ss[.s], lat/lon format is decimal degrees

with East and North hemispheres being positive. The field definition dictionary is extensible and it is encourage that users within a community create their own field definition dictionary, which would define the fields, formats, valid ranges, and conventions of common variables in a simple ASCII based dictionary file.

6.2 Condensed Electronic Index Card (EIC) - Specification v1.2

S. Lerner/A. Maffei
Last Updated: 09/24/2001

Overview

The electronic index card (EIC) is a simple self-documenting ASCII data format designed to facilitate the handling of multi-disciplinary datasets (refer to the EIC specification documentation). Although the fully qualified EIC format has many capabilities, it is inefficient in terms of disk storage and is not optimum for real-time data streams from scientific instruments.

The Condensed Electronic Index Card format maintains all the advantages of the fully qualified EIC format, and at the same time, it is designed for both efficiency and flexibility. Note: There is a direct one-for-one mapping from the Condensed EIC format to the fully qualified EIC format. Attributes of the Condensed EIC format include:

- Simple, efficient ASCII data format
- Self-documenting (field names and comments)
- Meta data support via global variables and url references
- Support for multiple real-time independent data streams
- Automatically interfaces to real-time monitoring and historical data display with 4DGeoBrowser via any WWW browser.

Condensed EIC Format

The condensed EIC format is a simple ASCII tabular format. Each record consists of one line with a carriage-return delimiter. The fields are delimited with either a comma, tab, semicolon, space, or pipe(|). Comments begin with a # in column 1. In addition, there are several *#commands* or directives which are understood. These include #fields, #global, #delim, #fsub, #id, etc. Note that the #commands may be interspersed throughout the file. When used during real-time data streaming, the #commands typically will appear at the start of a transmission. In the Condensed EIC format, fieldnames must be defined before the first data record appears. The only #command required is the #fields command, unless the file is in an ASCII spreadsheet format in which the first line contains the fieldnames separated by tab and the data is itself tab delimited values. In this case, no #commands are necessary since the data fields are defined by convention.

A list of the #commands are described below.

#Command

```
#baseid:
  Description: Specifies the EIC.id base id which normally defaults
       to "unixtime" of the condensed EIC file. Using baseid overrides
       this convention and guarantees that the generated EIC.id field
       will not change even if the condensed EIC file is modified.
       Standard generated EIC.id convention is unixtime.rec_number.
  Syntax : #baseid:large_integer
  Example: #baseid:123456789

#fields:
  Description: Defines field names. Number of field names should
                match the number of fields within the records following
                the #fields command. Remains in effect until the
                next #fields command.
  Syntax : #fields:fname1,fname2,fname3...
  Example: #fields:id,EIC.time,EIC.lat,EIC.lon,sstmp
```

```
#fields-c:
  Description: Continuation of fields command above. Appends to
               previously defined fields command.
  Syntax : #fields-c:fname1,fname2,fname3...
  Example: #fields-c:wind,temperature

#field-last:
  Description: Optional. If specified and there are more columns (fields)
               than field names, all columns beyond the number of field
                 names will be assigned to the last field name.
                 Default (off) is to ignore extra columns.
  Syntax : #field-last:on|off
  Example: #field-last:on

#global:
  Description: Defines global field name/value pairs. Globals remain
               in effect until next #global command.
  Syntax : #global:fname1=fvalue1&fname2=fvalue2&fname3=fvalue3...
        Example: #global:buoyid=123&EIC.lat=42.5&EIC.lon=-70.2

#global-c:
  Description: Continuation of global command above. Appends to
               previously defined global command.
  Syntax : #global-c:fname1=fvalue1&fname2=fvalue2&fname3=fvalue3...
        Example: #global-c:buoy_location=buzzard bay&EIC.

#delim:
  Description: Defines field delimiter. Default field delim is a comma.
                 Remains in effect until next #delim.
  Syntax : #delim:delimiter [valid delimiters: comma, tab, space, semicolon, pipe]
  Example: #delim:comma

#fsub:
  Description: Substitute field names with new field names. Useful for
                 converting previous datasets with slightly different
                 field names.
  Syntax : #fsub:fname1=new_fname1&fname2=new_fname2...
  Example: #fsub:lon=EIC.lon&lat=EIC.lat

#peic:
  Description: Partial EIC format data follows
  Syntax : #peid:attr1=val1&attr2=val2...
  Example: #peic:EIC.title=Atlantis&EIC.lat=42.5&EIC.lon=-70.2

#id:
  Description: Required for real-time datastream in which multiple data
               streams are coming into one collection data file and where
                 ID's must be part of the datastream to identify source. By
                 convention, the first fieldname and first field would be the id.
                 All #commands would be preceeded with #id:id. Thus all lines
                 within datastream have an id associated with it.
  Syntax : #id:id:[#command]   [where id is identification string]
  Example: #id:123:
             #id:123:#fields:id,field2,field3...
             123,data1,data2,...
             123,data1,data2,...

#module:
  Description: User defined modules
  Syntax : #module:modname:attr1=val1&attr2=val2...
  Example: #module:logger:filename=test.dat&logint=hourly

Future #commands
/* in-line data streaming */
#data:bytes=40&file=file1.dat&type=ascii|binary&mime=app/app-type
   203,2098,23,2983,2389,92383,34...(40bytes ascii)
#enddata:file=file1.dat
/* automatic data conversion */
#convfmt:type=time|latlon:var1:fmt1:var2 (fmt2 spec in dictionary)
   ex1: #convfmt:type=time:time_field:dd/mm/yy:EIC.time
   ex2: #convfmt:type=latlon:lat_field:ddmmss:EIC.lat
```

```
#crc:fieldname=fname&type=type
#sdsver:1.0
```

Examples:

Note you will see many field names that start with EIC (eg; EIC.title, EIC.lat,EIC.lon,EIC.elev...). These fields take advantage of the GeoBrowser dictionary system that supports 'standard' and user-defined fields. Although strongly encouraged, standard and even user-defined fields are not required (ie; unregistered fields are supported directly). Refer to the Conventions Section below. If standard fields such as EIC.time, EIC.lat, and EIC.lon are used, then the datafiles will be directly compatible with the 4DGeoBrowser which provides temporal, spatial, and keyword searching along with plotting capabilities that include interactive time-series and geographical plots.

Example #1

Simple example of field definition followed by carriage-return, comma-delimited records.

```
#fields:id,EIC.lat,EIC.lon,EIC.elev,sstmp,wind
01,40.43,-70.23,-5.2,20.250,2.43
01,40.43,-70.23,-5.2,20.262,3.12
...
```

Example #2 - Addition of global field definition.

```
#global:EIC.title=BuzBay Buoy&EIC.lat=40.43&EIC.lon=-70.23&EIC.elev=-5.2
#fields:EIC.time,id,sstmp,wind
1998/10/22 10:00:05,01,20.250,2.43
1998/10/22 10:00:10,01,20.262,3.12
...
```

Example #3 - Example of different record types within one file using multiple #fields and #global commands.

```
#global:EIC.title=Athena Data atl12v3&EIC.auth=A. Maffei&cruise=atl12v3
#fields:id,EIC.time,EIC.lat,EIC.lon,sstmp,wind
ATL,1998/10/22 10:00:00,41.2342,-119.3325,23.22,14.883
ATL,1998/10/22 10:00:05,41.2342,-119.3325,23.22,14.883
ATL,1998/10/22 10:00:10,41.2342,-119.3325,23.22,14.883
ATL,1998/10/22 10:00:15,41.2342,-119.3325,23.22,14.883
#global:
#fields:EIC.time,EIC.lat,EIC.lon,hdg,pitch
1998/10/22 10:00:20,41.2342,-119.3325,131.0,2.3
```

Example #4 - Interleaved multiple-source real-time data. Note all the #commands can be declared at the top of the file.

```
#id:Buz1:#global:EIC.title=Buzzards Bay 01&EIC.lat=40.43&EIC.lon=-70.23&EIC.elev=-5.2
#id:Buz1:#fields:id,EIC.time,sstmp,wind
Buz1,1998/10/24 10:00:00,20.250,2.43
Buz1,1998/10/24 10:00:10,20.262,3.12
#id:MV2:#global:buoy=Marthas Vineyard 02&lat=40.43&lon=-72.23&elev=-2.3
#id:MV2:#fields:id,EIC.time,sstmp,wind,winddir
MV2,1998/10/24 10:00:10,20.240,4.23,175.23
MV2,1998/10/24 10:00:20,20.242,4.25,176.30
Buz1,1998/10/24 10:20:25,20.251,2.43
Buz1,1998/10/24 10:20:35,20.261,3.12
...
```

Example #5 (Spreadsheet Example - tab delimited)

```
id       EIC.time  EIC.lat   EIC.lon   sstmp     wind
ATL      1998/10/22 10:00:00 41.2342   -119.3325 23.22     14.883
ATL      1998/10/22 10:00:00 41.2342   -119.3325 23.22     14.883
ATL      1998/10/22 10:00:00 41.2342   -119.3325 23.22     14.883
ATL      1998/10/22 10:00:00 41.2342   -119.3325 23.22     14.883
```

Example #6 (space separated)

Space delimited data has an exception if one wishes to take advantage of the EIC.time field, which cannot be used directly since it contains a space. To avoid this problem, specially defined fields _date and _time may be used separately, and the GeoBrowser will build the EIC.time field from those fields. The date and time format must match the specification for EIC.time. Note: _edate and _etime may be used to build the EIC.etime field as well.

```
#global:EIC.title=BuzBay Buoy&EIC.lat=40.43&EIC.lon=-70.23&EIC.elev=-5.2
#fields:_date,_time,id,sstmp,wind
#delim:space
1998/10/22 10:00:05 01 20.250 2.43
1998/10/22 10:00:10 01 20.262 3.12
```

Example #7 (variable macros and url labels)

Variable macros and url labels used within the GeoBrowser are directly supported in the condensed EIC format. Variable macros are useful for items like directory names where you only want to define the directory once and use a variable reference every else. The variable macro syntax is {'variable_name'}. Note: variable macro names should begin with '_' as these are hidden by default on a GeoBrowser Electronic Index Card. The url labels are tags that when clicked go to the specified url. Syntax is http://... [space] label. If a label is not specified, the url itself will be displayed and clickable. The example has a url label in the EIC.title field and uses a variable macro _imdir to define the image directory once.

```
#global:EIC.title=http://hostname/desc.html Sample Images&_imdir=http://hostname/images
#fields:JPGID,EIC.lon,EIC.lat,EIC.depth,EIC.desc,EIC.image
IMG0003.JPG,-70.348,42.29177,79,Mud bottom,{'_imdir'}/img0003.jpg
IMG0005.JPG,-70.35811,42.32535,82,Muddy sand,{'_imdir'}/img0005.jpg
IMG0008.JPG,-70.32572,42.32558,48,Medium sand,{'_imdir'}/img0008.jpg
IMG0010.JPG,-70.31018,42.32527,28,Medium rippled sand,{'_imdir'}/img0010.jpg
```

GeoBrowser Electronic Index Card Examples: (Note: green labels identify unregistered fields)

Here are a couple of examples of how the GeoBrowser would display the records contained within a datafile as a "card". Since these are simply records in the datafile, there is no additional overhead to turn these into "cards". The GeoBrowser can display, search, and plot fields within these cards easily via a web-browser. In addition to the web front-end, there is a GeoBrowser http command interface as well as export capabilities for user-defined applications.

From Example #3

```
                                                                    1

Card ID   : 933872146.00001  Modified: Thu Aug  5 12:55:46 1999
Title     : Athena Data atl12v3
Author    : A. Maffei
cruise: atl12v3 id: ATL
TimeStamp : 1998/10/22 10:00:00
Latitude  : 41.2342  Longitude : -119.3325
sstmp: 23.22 wind: 14.883
```

From Example #7

```
                                                                    4
Card ID : 933867116.00004 Modified: Thu Aug 5 11:31:56 1999
Title   : Sample Images
JPGID: IMG0010.JPG
Latitude : 42.32527 Longitude : -70.31018 Depth : 28
Description : Medium rippled sand
Image :
```

Depending on the application, all the data or meta-data may be represented in the condensed EIC format. A complimentary approach that works quite well with the EIC concept is the idea of separating out the meta-data from sensor-data. For instance, if you have a vehicle that is doing an image survey, the images are usually being collected separately from the meta-data. The meta-data about the images [time, location, title, description,...] can be stored as index cards with fields containing pointers (url links) to the real image data. The images themselves can be stored in whatever hierarchy that makes sense (even on a different computer). The GeoBrowser along with the EIC concept, allows the user to simply access all the information as a card, that is, the meta-data information with an embedded image. And now that everything is logically linked together, you can do meaningful searches and see the results.

Conventions

Where possible, we would like to take advantage of the 4D GeoBrowser web technology including the concept of the EIC field definition dictionary and other user defined field definition dictionaries. The field definition dictionary defines common or standard fields within a discipline, class of instruments, sensors, etc. By either using pre-defined field names or defining appropriate fields names for datasets, we can take advantage of the current conventions and systems in place. One major advantage will be that we can access and analyze the data between multiple systems automatically since the variable types and units will be common.

Some examples of common and useful EIC fields include EIC.title, EIC.time, EIC.lat, EIC.lon. If these fields are used then the values must adhere to the field definition format and convention. In this case, EIC.title is simple ASCII text, EIC.time format is in the form yyyy/mm/dd hh:mm:ss[.s], lat/lon format is decimal degrees with East and North hemispheres being positive. The field definition dictionary is extensible and it is encourage that users within a community create their own field definition dictionary, which would define the fields, formats, valid ranges, and conventions of common variables in a simple ASCII based dictionary file.

EIC Field Definition Dictionary

Although under development, here is an example of the EIC field definition dictionary. Note: discipline specific groups may define their own field definition dictionaries. An example Marine Realms Information Bank (MRIB) field definition dictionary is shown below the EIC definition dictionary. Variables must be unique within a specific dictionary. Use the UniqueCode dictionary prefix to reference the variables (ie; EIC.title, MRIB.agencies...) within a condensed EIC datafile.

```
################################################################################
#       4D GeoBrowser Field Definition Dictionary - v1.0
#       A few notes:
#          1) Comments begin with # in column 1
#          2) Fields within this file are semicolon deliminated
#          3) Variable names must be unique within a category
#          4) Keep variable names to a minimum size
#
# Supported Types: string, url, float, integer, enum, image, lat, lon, addr
# Supported Formats:
# Supported Units
#
# History:
#       Date       Who      Description
#       ----       ---      -------------------------------------------
#       6/98       SL       Create
################################################################################
#
# Contact Information
#ContactName; Steve Lerner
#ContactEmail; slerner@whoi.edu
#ContactURL;
#Organization; Woods Hole Oceanographic Institution


# Category Definition Entry
# _Define CategoryName UniqueCode OID
#   Var   Label   Type   Units   Min   Max   Null  Format  Notes
# _End_Define
#
_Define; ElectronicIndexCard ; EIC ; 1.2.1233.7
  id          ; Card ID   ; string ; ; ; ; ; ;
  ver         ; Ver;        string ; ; ; ; ; ;
  mod         ; Modified;   string ; ; ; ; ; ;
  title       ; Title     ; string ; ; ; ; ; ;
  auth        ; Author    ; addr ; ; ; ; ; ;
  pi          ; Investigator ; addr ; ; ; ; ; ;
  poc         ; Contact   ; addr ; ; ; ; ; ;
  org         ; Organization ; string ; ; ; ; ; ;
  desc        ; Description ; string ; ; ; ; ; ;
  key         ; Keywords  ; string ; ; ; ; ; ;
  cat         ; Category  ; string ; ; ; ; ; ;
  subj        ; Subject   ; string ; ; ; ; ; ;
  time        ; TimeStamp ; string ; ; ; ; ; ; yyyy/mm/dd hh:mm:ss
  etime       ; EndTime   ; string ; ; ; ; ; ; yyyy/mm/dd hh:mm:ss
  lat         ; Latitude  ; lat    ; deg ; -90.0; 90.0; ; ; N is positive
  lon         ; Longitude ; lon    ; deg ; -180.0; 180.0; ; ; E is positive
  elev        ; Elevation ; float  ; m ; ; ; ; ;
  depth       ; Depth     ; float  ; m ; ; ; ; ;
  latmin      ; Min Lat   ; lat    ; deg ; ; ; ; ;
  latmax      ; Max Lat   ; lat    ; deg ; ; ; ; ;
  lonmin      ; Min Lon   ; lon    ; deg ; ; ; ; ;
  lonmax      ; Max Lon   ; lon    ; deg ; ; ; ; ;
  elevmin     ; Min Elev  ; float  ; m ; ; ; ; ;
  elevmax     ; Max Elev  ; float  ; m ; ; ; ; ;
  bb_llr      ; BB Rotation; float ; ; ; ; ; ;
  t           ; TimeStamp ; string ; ; ; ; ; ;
  x           ; Xpos      ; float  ; ; ; ; ; ;
  y           ; Ypos      ; float  ; ; ; ; ; ;
  z           ; Zpos      ; float  ; ; ; ; ; ;
  coord       ; xyz_coord ; string ; ; ; ; ; ;
```

```
  x_min      ; Min X     ; float  ; ; ; ; ; ;
  x_max      ; Max X     ; float  ; ; ; ; ; ;
  y_min      ; Min y     ; float  ; ; ; ; ; ;
  y_max      ; Max y     ; float  ; ; ; ; ; ;
  z_min      ; Min Z     ; float  ; ; ; ; ; ;
  z_max      ; Max Z     ; float  ; ; ; ; ; ;
  bb_xyr     ; BB Rotation; float ; ; ; ; ; ;
  info       ; Info      ; url    ; ; ; ; ; ;
  data       ; Data      ; url    ; ; ; ; ; ;
  image      ; Image     ; image  ; ; ; ; ; ;
  icon       ; Icon      ; url    ; ; ; ; ; ;
  cmts       ; Comments  ; string ; ; ; ; ; ;
  geom       ; Geometry  ; array  ; ; ; ; ; ; point,linear,poly etc.
  ta         ; TimeArray ; array  ; ; ; ; ; ; comma separated
  xa         ; XArray    ; array  ; ; ; ; ; ; comma separated
  ya         ; YArray    ; array  ; ; ; ; ; ; comma separated
  za         ; ZArray    ; array  ; ; ; ; ; ; comma separated
  end        ; End ID    ; string ; ; ; ; ; ;
_End_Define
```

```
########## Marine Realms Information Bank Attributes Definition ##########
###############################################################################
#       4D GeoBrowser Field Definition Dictionary - v1.0
#       A few notes:
#          1) Comments begin with # in column 1
#          2) Fields within this file are semicolon deliminated
#          3) Variable names must be unique within a category
#          4) Keep variable names to a minimum size
#
# Supported Types: string, url, float, integer, enum, image, lat, lon, addr
# Supported Formats:
# Supported Units
#
# History:
#       Date       Who      Description
#       ----       ---      -----------------------------------------------
#       6/98       SL/FM    Create for Marine Realms Info Bank
###############################################################################
#
# Contact Information
#ContactName; Fausto Marincioni
#ContactEmail; fmarincioni@usgs.gov
#ContactURL;
#Organization; USGS


# Category Definition Entry
# _Define CategoryName UniqueCode OID
#   Var   Label   Type   Units   Min   Max   Null  Format  Notes
# _End_Define
#
_Define; MarineRealmsInfoBank ; MRIB ; 1.2.1233.999
  website    ; WebSite     ; url    ; ; ; ; ; ;
  agencies   ; Agencies    ; string ; ; ; ; ; ;
  projects   ; Projects    ; string ; ; ; ; ; ;
  piaddr     ; PI Email    ; addr ; ; ; ; ; ;
  sum        ; Summary     ; string ; ; ; ; ; ;
  wsmod      ; WebSite Last Modified; string ; ; ; ; ; ;
  geotime    ; GeoTime     ; string ; ; ; ; ; ;
  disc       ; Disciplines ; string ; ; ; ; ; ;
  themes     ; Themes      ; string ; ; ; ; ; ;
  methods    ; Methods     ; string ; ; ; ; ; ;
_End_Define
```

6.3 Text Electronic Index Card (EIC) — Specification v1.0

S. Lerner/A. Maffei
Last Updated: 08/14/99

Overview

The electronic index card (EIC) is a simple concept designed to facilitate the handling of multi-disciplinary datasets (refer to the EIC concept documentation). There are three supported EIC formats: Fully Qualified EIC, Condensed EIC, Text EIC.

The fully qualified EIC is the original format and designed as self-contained data records, with each record containing all the fieldnames and values defined on a card. This format allows users to mix and match cards from different datasets, disciplines, etc.

The Condensed Electronic Index Card format maintains all the advantages of the fully qualified EIC format, and at the same time, it is designed for both efficiency and flexibility. Note: There is a direct one-for-one mapping from the Condensed EIC format to the fully qualified EIC format.

The Text Electronic Index Card format is designed as a verbose human readable format as compared to both the fully qualified EIC and Condensed EIC formats. Like the Condensed EIC format, there is a direct one-for-one mapping from the Text EIC format to the fully qualified EIC format.

Text EIC Format

The Text EIC format is itself quite simple. Each card is a block of fieldname value pairs. There is one fieldname-value pair per line and they are in the form fieldname=value. Cards are separated with a blank line between each block. Note: field names must be unique within a card. Comments can be included in the file with a # in column one.

Syntax - (two cards shown)

```
fieldname1=value1
fieldname2=value2
fieldname3=value3
fieldname4=value4

fieldname1=value1
fieldname2=value2
fieldname3=value3
fieldname4=value4
```

Examples:

Note you will see many field names that start with EIC (eg; EIC.title, EIC.lat,EIC.lon,EIC.elev...). These fields take advantage of the GeoBrowser dictionary system that supports 'standard' and user-defined fields. Although strongly encouraged, standard and even user-defined fields are not required (ie; unregistered fields are supported directly). Refer to the Conventions Section below. If standard fields such as EIC.time, EIC.lat, and EIC.lon are used, then the datafiles will be directly compatible with the 4DGeoBrowser which provides temporal, spatial, and keyword searching along with plotting capabilities that include interactive time-series and geographical plots.

Example #1 - simple example consisting of three cards

```
EIC.title=Athena Data atl12v3
```

```
EIC.auth=A. Maffei
cruise=atl12v3
id=ATL
EIC.time=1998/10/22 10:00:00
EIC.lat=41.2342
EIC.lon=-119.3325
sstmp=23.22
wind=14.883

EIC.title=Athena Data atl12v3
EIC.auth=A. Maffei
cruise=atl12v3
id=ATL
EIC.time=1998/10/22 10:00:05
EIC.lat=41.2342
EIC.lon=-119.3325
sstmp=23.22
wind=14.883

EIC.title=Athena Data atl12v3
EIC.auth=A. Maffei
cruise=atl12v3
id=ATL
EIC.time=1998/10/22 10:00:10
EIC.lat=41.2342
EIC.lon=-119.3325
sstmp=23.22
wind=14.883
```

Example #2

Two cards from the National Buoy Center Collection as exported from the GeoBrowser in Text EIC format.

```
EIC.id=879436105.92107
EIC.ver=v1
EIC.mod=Thu Nov 13 10:48:25 EST 1997
EIC.title=Station 44008
EIC.time=1997/11/13 10:00:00
EIC.lon=-69.43
EIC.lat=40.50
EIC.elev=0
EIC.info=http://seaboard.ndbc.noaa.gov/station_page.phtml?$station=44008 Station 44008
Website
EIC.cat1=Moored
EIC.cat2=
EIC.cat3=
EIC.key=Buoy
Location=NANTUCKET
zone=
Temp Depth=-1
Water Depth=54.9
Watch Circle=110
str=
ufields=
platform=3-meter discus buoy
Payload=DACT
Elev=0
Air Temp Height=5
Anem Height=5
Bar Elev=0
EIC.cmts=
EIC.image=/webdata/National_Buoy_Center/images/44008_mini.jpg
EIC.icon=/webdata/National_Buoy_Center/images/44008_mini.jpg

EIC.id=879436105.83590
EIC.ver=v1
EIC.mod=Thu Nov 13 10:48:25 EST 1997
EIC.title=Station BUZM3
EIC.time=1997/11/13 10:00:00
EIC.lon=-71.03
EIC.lat=41.40
```

```
EIC.elev=0
EIC.info=http://seaboard.ndbc.noaa.gov/station_page.phtml?$station=BUZM3 Station BUZM3
Website
EIC.cat1=C-MAN
EIC.cat2=
EIC.cat3=
EIC.key=Buoy
Location=Buzzards Bay MA
zone=
Temp Depth=
Water Depth=
Watch Circle=
str=
ufields=
platform=C-MAN station
Payload=VEEP
Elev=0
Air Temp Height=24.5
Anem Height=24.8
Bar Elev=17.4
EIC.cmts=
EIC.image=/webdata/National_Buoy_Center/images/buzm3_mini.jpg
EIC.icon=/webdata/National_Buoy_Center/images/buzm3_mini.jpg
```

GeoBrowser Electronic Index Card Examples: (Note: green labels identify unregistered fields)

Here are a couple of examples of how the GeoBrowser would display the text EIC "card". The GeoBrowser can display, search, and plot fields within these cards easily via a web-browser. In addition to the web front-end, there is a GeoBrowser http command interface as well as export capabilities for user-defined applications.

From Example #1

```
                                                                        1

 Card ID   : 933872146.00001  Modified: Thu Aug  5 12:55:46 1999
Title      : Athena Data atl12v3
Author     : A. Maffei
cruise: atl12v3 id: ATL
TimeStamp  : 1998/10/22 10:00:00
Latitude   : 41.2342  Longitude : -119.3325
sstmp: 23.22 wind: 14.883
```

From Example #2

```
Card ID   : 879436105.92107  Modified: Thu Nov 13 10:48:25 EST 1997
Title     : Station 44008
TimeStamp : 1997/11/13 10:00:00
Longitude : -69.43  Latitude  : 40.50  Elevation : 0
Info      : Station 44008 Website
EIC.cat1: Moored  Keywords  : Buoy
Location: NANTUCKET Temp Depth: -1
Water Depth: 54.9 Watch Circle: 110 platform: 3-meter discus buoy
Payload: DACT Elev: 0 Air Temp Height: 5 Anem Height: 5
Bar Elev: 0
```

```
Image     :
```

Depending on the application, all the data or meta-data may be represented in the condensed EIC format. A complimentary approach that works quite well with the EIC concept is the idea of separating out the meta-data from sensor-data. For instance, if you have a vehicle that is doing an image survey, the images are usually being collected separately from the meta-data. The meta-data about the images [time, location, title, description,...] can be stored as index cards with fields containing pointers (url links) to the real image data. The images themselves can be stored in whatever hierarchy that makes sense (even on a different computer). The GeoBrowser along with the EIC concept, allows the user to simply access all the information as a card, that is, the meta-data information with an embedded image. And now that everything is logically linked together, you can do meaningful searches and see the results.

Conventions

Where possible, we would like to take advantage of the 4D GeoBrowser web technology including the concept of the EIC field definition dictionary and other user defined field definition dictionaries. The field definition dictionary defines common or standard fields within a discipline, class of instruments, sensors, etc. By either using pre-defined field names or defining appropriate fields names for datasets, we can take advantage of the current conventions and systems in place. One major advantage will be that we can access and analyze the data between multiple systems automatically since the variable types and units will be common.

Some examples of common and useful EIC fields include EIC.title, EIC.time, EIC.lat, EIC.lon. If these fields are used then the values must adhere to the field definition format and convention. In this case, EIC.title is simple ASCII text, EIC.time format is in the form yyyy/mm/dd hh:mm:ss[.s], lat/lon format is decimal degrees with East and North hemispheres being positive. The field definition dictionary is extensible and it is encourage that users within a community create their own field definition dictionary, which would define the fields, formats, valid ranges, and conventions of common variables in a simple ASCII based dictionary file.

EIC Field Definition Dictionary

An example of the EIC field definition dictionary is shown below. Note: discipline specific groups may define their own field definition dictionaries. An example Marine Realms Information Bank (MRIB) field definition dictionary is shown below the EIC definition dictionary. Variables must be unique within a specific dictionary. Use the UniqueCode dictionary prefix to reference the variables (ie; EIC.title, MRIB.agencies...) within a condensed EIC datafile.

```
##############################################################################
#       4D GeoBrowser Field Definition Dictionary - v1.0
#       A few notes:
#          1) Comments begin with # in column 1
#          2) Fields within this file are semicolon deliminated
#          3) Variable names must be unique within a category
#          4) Keep variable names to a minimum size
#
# Supported Types: string, url, float, integer, enum, image, lat, lon, addr
# Supported Formats:
# Supported Units
#
# History:
#       Date       Who      Description
#       ----       ---      -----------------------------------------------
#       6/98       SL       Create
##############################################################################
#
# Contact Information
#ContactName; Steve Lerner
#ContactEmail; slerner@whoi.edu
#ContactURL;
#Organization; Woods Hole Oceanographic Institution


# Category Definition Entry
# _Define CategoryName UniqueCode OID
```

```
#   Var   Label   Type   Units   Min   Max   Null  Format  Notes
# _End_Define
#
_Define; ElectronicIndexCard ; EIC ; 1.2.1233.7
  id          ; Card ID   ; string ; ; ; ; ; ;
  ver         ; Ver;        string ; ; ; ; ; ;
  mod         ; Modified;   string ; ; ; ; ; ;
  title       ; Title     ; string ; ; ; ; ; ;
  auth        ; Author    ; addr ; ; ; ; ; ;
  pi          ; Investigator ; addr ; ; ; ; ; ;
  poc         ; Contact   ; addr ; ; ; ; ; ;
  org         ; Organization ; string ; ; ; ; ; ;
  desc        ; Description ; string ; ; ; ; ; ;
  key         ; Keywords  ; string ; ; ; ; ; ;
  cat         ; Category  ; string ; ; ; ; ; ;
  subj        ; Subject   ; string ; ; ; ; ; ;
  time        ; TimeStamp ; string ; ; ; ; ; ; yyyy/mm/dd hh:mm:ss
  etime       ; EndTime   ; string ; ; ; ; ; ; yyyy/mm/dd hh:mm:ss
  lat         ; Latitude  ; lat    ; deg ; -90.0; 90.0; ; ; N is positive
  lon         ; Longitude ; lon    ; deg ; -180.0; 180.0; ; ; E is positive
  elev        ; Elevation ; float  ; m ; ; ; ; ;
  depth       ; Depth     ; float  ; m ; ; ; ; ;
  latmin      ; Min Lat   ; lat    ; deg ; ; ; ; ;
  latmax      ; Max Lat   ; lat    ; deg ; ; ; ; ;
  lonmin      ; Min Lon   ; lon    ; deg ; ; ; ; ;
  lonmax      ; Max Lon   ; lon    ; deg ; ; ; ; ;
  elevmin     ; Min Elev  ; float  ; m ; ; ; ; ;
  elevmax     ; Max Elev  ; float  ; m ; ; ; ; ;
  bb_llr      ; BB Rotation; float ; ; ; ; ; ;
  t           ; TimeStamp ; string ; ; ; ; ; ;
  x           ; Xpos      ; float  ; ; ; ; ; ;
  y           ; Ypos      ; float  ; ; ; ; ; ;
  z           ; Zpos      ; float  ; ; ; ; ; ;
  coord       ; xyz_coord ; string ; ; ; ; ; ;
  x_min       ; Min X     ; float  ; ; ; ; ; ;
  x_max       ; Max X     ; float  ; ; ; ; ; ;
  y_min       ; Min y     ; float  ; ; ; ; ; ;
  y_max       ; Max y     ; float  ; ; ; ; ; ;
  z_min       ; Min Z     ; float  ; ; ; ; ; ;
  z_max       ; Max Z     ; float  ; ; ; ; ; ;
  bb_xyr      ; BB Rotation; float ; ; ; ; ; ;
  info        ; Info      ; url    ; ; ; ; ; ;
  data        ; Data      ; url    ; ; ; ; ; ;
  image       ; Image     ; image  ; ; ; ; ; ;
  icon        ; Icon      ; url    ; ; ; ; ; ;
  cmts        ; Comments  ; string ; ; ; ; ; ;
  geom        ; Geometry  ; array  ; ; ; ; ; ; point,linear,poly etc.
  ta          ; TimeArray ; array  ; ; ; ; ; ; comma separated
  xa          ; XArray    ; array  ; ; ; ; ; ; comma separated
  ya          ; YArray    ; array  ; ; ; ; ; ; comma separated
  za          ; ZArray    ; array  ; ; ; ; ; ; comma separated
  end         ; End ID    ; string ; ; ; ; ; ;
_End_Define
```

```
########## Marine Realms Information Bank Attributes Definition ##########
###############################################################################
#       4D GeoBrowser Field Definition Dictionary - v1.0
#       A few notes:
#          1) Comments begin with # in column 1
#          2) Fields within this file are semicolon deliminated
#          3) Variable names must be unique within a category
#          4) Keep variable names to a minimum size
#
# Supported Types: string, url, float, integer, enum, image, lat, lon, addr
# Supported Formats:
# Supported Units
#
# History:
```

```
#       Date       Who      Description
#       ----       ---      -------------------------------------------
#       6/98       SL/FM    Create for Marine Realms Info Bank
################################################################################
#
# Contact Information
#ContactName; Fausto Marincioni
#ContactEmail; fmarincioni@usgs.gov
#ContactURL;
#Organization; USGS


# Category Definition Entry
# _Define CategoryName UniqueCode OID
#   Var   Label   Type   Units   Min   Max   Null  Format  Notes
# _End_Define
#
_Define; MarineRealmsInfoBank ; MRIB ; 1.2.1233.999
  website    ; WebSite     ; url    ; ; ; ; ; ;
  agencies   ; Agencies    ; string ; ; ; ; ; ;
  projects   ; Projects    ; string ; ; ; ; ; ;
  piaddr     ; PI Email    ; addr ; ; ; ; ; ;
  sum        ; Summary     ; string ; ; ; ; ; ;
  wsmod      ; WebSite Last Modified; string ; ; ; ; ; ;
  geotime    ; GeoTime     ; string ; ; ; ; ; ;
  disc       ; Disciplines ; string ; ; ; ; ; ;
  themes     ; Themes      ; string ; ; ; ; ; ;
  methods    ; Methods     ; string ; ; ; ; ; ;
_End_Define
```

6.4 Electronic Index Card Field Definition Dictionaries

December 18, 1998 - version 0.7
S. Lerner/A. Maffei

Overview

Electronic Index Cards (EICs) might be though of database records except that they have one important difference. A database uses a single database schema to define the characteristics of each field (or row) contained in a record (or column). EICs are different in that every field in every record contains both the name and the value associated with the field.˚ This means that individual EICs (records), with different information in them can be combined to create a composite collection of EICs. This mix of electronic index cards can be searched, plotted, and manipulated even though the cards have different types of values on them. In most cases, however, the cards would contain some fields with common meanings.

In discussing Electronic Index Cards (EICs) we use the term *attribute name* to refer to the fieldname used for a value included on the card, we use the term *attribute value* to refer to the value itself, and we use the term *attribute* or *attribute-value pair* to refer to them both.

It is sometimes useful to use common attributes in two different cards. The EIC design supports this feature by using a simple naming convention to identify attribute names which have a common meaning and can be shared on different types of Electronic Index Cards. These attribute names start with any number of capital letters followed by a period and the rest of the name in lowercase characters (eg. EIC.title). Attribute-value pairs with attribute names following this convention are called *registered attributes.* Registered attributes are then defined in an *EIC Attribute Dictionary.*

EIC attribute dictionaries are used to provide users with a concise description of an attribute so that all users will employ them in the same way. Dictionaries are made publicly available so that the common definition is known to everyone who might use them. It is very important to note that users do not need to use registered attributes when creating electronic index cards. They are free to use any attribute names they wish for their data. Some EIC-enabled applications, however, expect to see certain registered attributes in the EICs they manipulate.

Existing Dictionaries

The **EIC** dictionary contains registered attribute names that are used by many EIC utilities. This dictionary has been used extensively by the 4DGeoBrowser project.

Other dictionaries currently under consideration include (1) a **GEO** dictionary derived from the Federal Geospatial Data Committees (FGDC) metadata standard, (2) a˚ **MRC** dictionary derived from the US MARC standard often used by libraries for storing information about books and other publications, (3) a˚ **DC** dictionary derived from the Dublin Core standard which is another metadata standard similar to the FGDC standard, and (4) a˚ **DSL** dictionary used in the WHOI DSL group for the remotely operated vehicles (ROVS) which it operates.

Characteristics of Registered Attributes

When an attribute is registered in an EIC attribute dictionary the dictionary author defines several characteristics of the attribute. Those who create EICs with registered attribute names contained in them are expected to ensure that the values associated with those attribute names meet the criteria set forth in the dictionary definition of the attribute name. The characteristics used in defining the attribute are as follows:
Type

The type of a registered attribute can be one of **string**, **addr**, **url**, **float, image, harray** or **array**. Array is a space separated list of values. Harray is a space separated list of hierarchical names or categories

Label

The label of a registered attribute is the label that is often used when the electronic index card is displayed in a form or a report of some type

Format

The format of a registered attribute is used to show the syntax that is used in the ASCII representation of the value held in the attribute. The format may be expressed as a Perl-based regular expression.

Validation Rules

These are used to represent the validation rules used to determine if the attribute value is within the allowable limits associated with the attribute. Validation rules may be expressed as Perl-based logical expressions.

Units

These are the units that are used when expressing the value associated with an attribute.

Description

This is a terse description or comment that informs the user of any other important information about the data contained within the attribute.

Translations

In the future we hope to provide a way for dictionary authors to define translations of values from other registered attribute names into the attribute being defined.

˚

EIC Registered Templates

EIC templates are planned for the future. Templates would provide a way to define which attributes might typically be found on an electronic index card. Associated with each template would be a list of attributes to be included in a card, the order in which they are typically found, and some formatting information for displaying the cards. Templates might be used to create data entry forms for EICs in the future.

The EIC˚ Dictionary

The EIC dictionary contains a set of registered attribute names that are used for both EIC bookkeeping and geospatial related information. Although an attempt is made to keep the number of attributes in this dictionary to a minimum, attribute names are sometimes placed here simply because they are considered "important".

Three ways to represent spatial and temporal coordinates in an EIC

The EIC dictionary provides for three different sets of attributes to represent the spatial and temporal coordinates associated with a card. It is up to the user to decide which is most appropriate for their EICs. Although the EIC author will normally choose to use only one of these sets of attributes they are free to use more if they wish.

IMPORTANT NOTE: At this time the 4DGeoBrowser application only fully supports the geographic attributes of EIC.time, EIC.lat, EIC.lon, and EIC.elev. Support for other spatial and temporal attributes will be added in the future.

The most commonly used attributes are the geographic attributes: **EIC.time, EIC.lat, EIC.lon and EIC.elev.** These are used to represent a single point in an earth coordinate system. EIC.lat and EIC.lon are represented in decimal degrees. EIC.elev is represented in meters above or below mean sea level.

Attribute Definitions

```
EIC.id
       Label:˚˚˚˚˚˚ Id
       Type:˚˚˚˚˚˚˚ string
       Format:˚˚˚˚˚ nnnnnn.nnnnn
```

```
        Description: A unique value within a single collection of index cards. Although both
        sides of the period can be any integer the convention is to have "unixtime" on the
        left hand side and either a large random number or an index count on the right hand
        side.
        Examples:˚˚˚ 982343.00001
        ˚˚˚˚˚˚˚˚˚˚˚ 982343.29874
EIC.ver
        Label:˚˚˚˚˚˚ Ver
        Type:˚˚˚˚˚˚˚ string
        Format:˚˚˚˚˚ float
        Description: Version number of the EIC dictionary being used for the EIC attributes in
        this card. If no EIC.ver attribute occurs in a card the EIC.ver is assumed to be 1.0.
        Examples:˚˚˚ 1.0
EIC.mod
        Label:˚˚˚˚˚˚ Modified
        Type:˚˚˚˚˚˚˚ string
        Format:˚˚˚˚˚ yyyy/mm/dd hh:mm:ss
        Description: Modification time of the EIC. Should be updated every time the card is
        modified.
        Examples:˚˚˚ 1998/11/01 12:23:34
EIC.title
        Label:˚˚˚˚˚˚ Title
        Type:˚˚˚˚˚˚˚ string
        Format:˚˚˚˚˚ freeform
        Description: Short string that descibes the nature of the information contained on the
        card. It is common for all EICs in a single collection to have the same title.
        Examples:˚˚˚ North Atlantic Drifting Buoy
EIC.auth
        Label:˚˚˚˚˚˚˚ Author
        Type:˚˚˚˚˚˚˚˚ addr
        Format:˚˚˚˚˚˚ freeform
        Description:˚ Contains ASCII text and/or email address or a url which can be used to
        contact the person who created the EIC.
        Examples:˚˚˚˚ amaffei@whoi.edu
EIC.pi
        Label:˚˚˚˚˚˚˚ Investigator
        Type:˚˚˚˚˚˚˚˚ addr
        Format:˚˚˚˚˚˚ freeform
        Description:˚ Contains the name and/or email address or a url pointing to a principle
        investigator.
        Examples:˚˚˚˚ Andy Maffei amaffei@whoi.edu
EIC.poc
        Label:˚˚˚˚˚˚˚ Contact
        Type:˚˚˚˚˚˚˚˚ addr
        Description:˚ Point of contact for the values and information represented in the EIC.
        This might be a name and/or email address or other URL.
        Examples:˚˚˚˚ postmaster@whoi.edu
EIC.org
        Label:˚˚˚˚˚˚˚ Organization
        Type:˚˚˚˚˚˚˚˚ string
        Format:˚˚˚˚˚˚ freeform
        Description:˚ Contains the name of an organization of either the author, investigator,
        or point of contact.
        Examples:˚˚˚˚ Andy Maffei
EIC.desc
        Label:˚˚˚˚˚˚˚ Description
        Type:˚˚˚˚˚˚˚˚ string
        Description:˚ Short description of the data contained in the EIC.
        Examples:˚˚˚˚ This photo shows a small larvae in the bottom right hand corner.
EIC.key
        Label:˚˚˚˚˚˚˚ Keywords
        Type:˚˚˚˚˚˚˚˚ string
        Description:˚ List of space separated keywords related to the information represented
        in the EIC.
        Examples:˚˚˚˚ Larvae North_Atlantic Net_Collected
EIC.cat
        Label:˚˚˚˚˚˚˚ Category
        Type:˚˚˚˚˚˚˚˚ harray
        Description:˚ List of space separated single words or hierarchical strings
        representing the categories that an EIC belongs to.
        Examples:˚˚˚˚ Animal.Pony.Breed.Shetland Animal.Pony.Color.White
```

```
EIC.subj
        Label:˚˚˚˚˚˚˚ Subject
        Type:˚˚˚˚˚˚˚˚ string
        Description:˚ Subject of an EIC.
        Examples:˚˚˚˚ Hydrothermal Vents
EIC.time
        Label:˚˚˚˚˚˚˚ TimeStamp
        Type:˚˚˚˚˚˚˚˚ string
        Format:˚˚˚˚˚˚ yyyy/mm/dd hh:mm:ss
        Description:˚ Timestamp associated with the data collected. If time is being
        represented as a range of time then this represents the start of that range.
        Examples:˚˚˚˚ 1998/11/03 12:23:23
EIC.etime
        Label:˚˚˚˚˚˚˚ EndTime
        Type:˚˚˚˚˚˚˚˚ string
        Format:˚˚˚˚˚˚ yyyy/mm/dd hh:mm:ss
        Description:˚ If the EIC represets information over a range of time this attribute
        represents the time that the data collection ended.
        Examples:˚˚˚˚ 1998/11/04 12:22:20
EIC.lat
        Label:˚˚˚˚˚˚˚ Latitude
        Type:˚˚˚˚˚˚˚˚ float
        Units:˚˚˚˚˚˚˚ decimal degrees
        Rules:˚˚˚˚˚˚˚ greater than -90.0 and less than 90.0
        Description:˚ Decimal degree representation of the spatial coordinate latitude for the
        information included in the EIC. North is represented as a positive value. South is
        represented as negative. If using something other than a geographic coordinate system
        use EIC.x, EIC.y, EIC.z, and EIC.coord to represent a point.
        Examples:˚˚˚˚ -89.402
EIC.lon
        Label:˚˚˚˚˚˚˚ Longitude
        Type:˚˚˚˚˚˚˚˚ float
        Units:˚˚˚˚˚˚˚ decimal degrees
        Rules:˚˚˚˚˚˚˚ greater than -180.0 and less than 180.0
        Description:˚ E is positive, W is negative
        Examples:˚˚˚˚ 170.45
EIC.elev
        Label:˚˚˚˚˚˚˚ Elevation
        Type:˚˚˚˚˚˚˚˚ float
        Units:˚˚˚˚˚˚˚ meters
        Description:˚ EIC.elev is used to identify the elevation (mean sea level) associated
        with the information in the card. Thus a negative value is below sea level and a
        positive value is above sea level. Typically mutually exclusive with EIC.depth.
        Examples:˚˚˚˚ -23.2
EIC.depth
        Label:˚˚˚˚˚˚˚ Depth
        Type:˚˚˚˚˚˚˚˚ float
        Units:˚˚˚˚˚˚˚ meters
        Description:˚ EIC.depth is used to identify the depth associated with the information
        in the card. Typically mutually exclusive with EIC.elev.
        Examples:˚˚˚˚ 2503.2
EIC.latmin
        Label:˚˚˚˚˚˚˚ Min Lat
        Type:˚˚˚˚˚˚˚˚ float
        Units:˚˚˚˚˚˚˚ decimal degrees
        Description:˚ Minimum Latitude coordinate for bounding box. North is represented as a
        positive value. South is represented as negative.
        Examples:˚˚˚˚ 14.0
EIC.latmax
        Label:˚˚˚˚˚˚˚ Max Lat
        Type:˚˚˚˚˚˚˚˚ float
        Units:˚˚˚˚˚˚˚ decimal degrees
        Description:˚ Maximum Latitude coordinate for bounding box. North is represented as a
        positive value. South is represented as negative.
        Examples:˚˚˚˚ 14.0
EIC.lonmin
        Label:˚˚˚˚˚˚˚ Min Lon
        Type:˚˚˚˚˚˚˚˚ float
        Units:˚˚˚˚˚˚˚ decimal degrees
        Description:˚ Minimum Longitude coordinate for bounding box. E is positive, W is
        negative
```

```
        Examples:°°°° 12.0
EIC.lonmax
        Label:°°°°°°° Max Lon
        Type:°°°°°°°° float
        Units:°°°°°°° decimal degrees
        Description:° Maximum Longitude coordinate for bounding box. E is positive, W is
        negative
        Examples:°°°° 12.0
EIC.elevmin
        Label:°°°°°°° Min ELEV
        Type:°°°°°°°° float
        Units:°°°°°°° meters
        Description:° Minimum elevation (Mean Sea Level). Positive values are above sea-level,
        negative below.
        Examples:°°°° 5.0
EIC.elevmax
        Label:°°°°°°° Max ELEV
        Type:°°°°°°°° float
        Units:°°°°°°° meters
        Description:° Maximum elevation (Mean Sea Level). Positive values are above sea-level,
        negative below.
        Examples:°°°° 5.0
EIC.bb_llr
        Label:°°°°°°° BB Rotation
        Type:°°°°°°°° float
        Units:°°°°°°° decimal degrees of rotation
        Rules:°°°°°°° >= 0 and <=180
        Description:° Bounding Box rotation. Represents the rotation of a bounding box defined
        by EIC.lon, EIC.lat, EIC.lon_r and EIC.lat_r.
        Example:°°°°° 120.0
EIC.t
        Label:°°°°°°° TimeStamp
        Type:°°°°°°°° string
        Units:°°°°°°° dependent on EIC.coord
        Description:° Timestamp related to the information in the EIC card. If the point is a
        geographic reference it might be better off using EIC.time, EIC.lat. EIC.lon and
        EIC.elev for temporal and spatial coordinates. If other than a single point it might
        be better to use EIC.xa, EIC.ya, EIC.za, and EIC.geom to represent the area.
        Examples:°°°° 1998/11/02 12:00
EIC.x
        Label:°°°°°°° Xpos
        Type:°°°°°°°° float
        Units:°°°°°°° dependent on EIC.coord
        Description:° X position related to the information in the EIC card. If the point is a
        geographic reference it might be better off using EIC.time, EIC.lat. EIC.lon and
        EIC.elev for temporal and spatial coordinates. If other than a single point it might
        be better to use EIC.xa, EIC.ya, EIC.za, and EIC.geom to represent the area.
EIC.y
        Label:°°°°°°° Ypos
        Type:°°°°°°°° float
        Units:°°°°°°° dependent on EIC.coord
        Description:° Y position related to the information in the EIC card. If the point is a
        geographic reference it might be better off using EIC.time, EIC.lat. EIC.lon and
        EIC.elev for temporal and spatial coordinates. If other than a single point it might
        be better to use EIC.xa, EIC.ya, EIC.za, and EIC.geom to represent the area.
EIC.z
        Label:°°°°°°° Zpos
        Type:°°°°°°°° float
        Units:°°°°°°° dependent on EIC.coord
        Description:° Z position related to the information in the EIC card. If the point is a
        geographic reference it might be better off using EIC.time, EIC.lat. EIC.lon and
        EIC.elev for temporal and spatial coordinates. If other than a single point it might
        be better to use EIC.xa, EIC.ya, EIC.za, and EIC.geom to represent the area.
EIC.coord
        Label:°°°°°°° xyz_coord
        Type:°°°°°°°° string
        Description:° Coordinate system used for EIC.x, EIC.y, EIC.z, and EIC.t. Coordinate
        systems can be registered elsewhere. Currently supported coordinate systems include
        ...
EIC.x_min
        Label:°°°°°°° Min X
```

```
        Type:˚˚˚˚˚˚˚˚ float
        Description:
EIC.x_max
        Label:˚˚˚˚˚˚˚ Max X
        Type:˚˚˚˚˚˚˚˚ float
        Description:
EIC.y_min
        Label:˚˚˚˚˚˚˚ Min Y
        Type:˚˚˚˚˚˚˚˚ float
        Description:
EIC.y_max
        Label:˚˚˚˚˚˚˚ Max Y
        Type:˚˚˚˚˚˚˚˚ float
        Description:
EIC.z_min
        Label:˚˚˚˚˚˚˚ Min Z
        Type:˚˚˚˚˚˚˚˚ float
        Description:
EIC.z_max
        Label:˚˚˚˚˚˚˚ Max Z
        Type:˚˚˚˚˚˚˚˚ float
        Description:
EIC.bb_xyr
        Label:˚˚˚˚˚˚˚ BB Rotation
        Type:˚˚˚˚˚˚˚˚ float
        Description:˚ EIC.bb is
EIC.info
        Label:˚˚˚˚˚˚˚ Info
        Type:˚˚˚˚˚˚˚˚ url
        Description:˚ URL related to the information included in the EIC. EIC.info is often
        used in the generation on IMAPS so that when a cursor is activated over an icon
        representing the EIC this is the URL that is normally accessed.
EIC.data
        Label:˚˚˚˚˚˚˚ Data
        Type:˚˚˚˚˚˚˚˚ url
        Description:˚ URL pointing to data that the metadata contained in the EIC is referring
        to. The format or type of data is undefined and left up to the user.
EIC.image
        Label:˚˚˚˚˚˚˚ Image
        Type:˚˚˚˚˚˚˚˚ url
        Description:˚ The attribute contains url pointing to an image that is representative
        of the information contained in the EIC.
EIC.icon
        Label:˚˚˚˚˚˚˚ Icon
        Type:˚˚˚˚˚˚˚˚ url
        Description:˚ URL pointing to an icon that can be used when representing the EIC in a
        geographic or other plot of EICs.
EIC.cmts
        Label:˚˚˚˚˚˚˚ Comments
        Type:˚˚˚˚˚˚˚˚ string
        Description:˚ Comments about the EIC. May be comments included by the EIC author or
        other person.
EIC.geom
        Label:˚˚˚˚˚˚˚ Geometry
        Type:˚˚˚˚˚˚˚˚ array
        Description:˚ Geometry of the data contained in EIC.ta, EIC.xa, EIC.ya, and EIC.za.
        Geometries can be registered or unregistered. Examples might include point,linear,poly
        etc. NOTE: This feature is not yet supported in the 4DGeobrowser.
EIC.ta
        Label:˚˚˚˚˚˚˚ TimeArray
        Type:˚˚˚˚˚˚˚˚ array
        Units:˚˚˚˚˚˚˚ dependent on EIC.geom
        Description:˚ Comma separated list of times corresponding to array elements contained
        in EIC.xa, EIC.ya, and EIC.za.
EIC.xa
        Label:˚˚˚˚˚˚˚ XArray
        Type:˚˚˚˚˚˚˚˚ array
        Units:˚˚˚˚˚˚˚ dependent on EIC.geom
        Description:˚ Comma separated list of x values corresponding to array elements
        contained in EIC.ta, EIC.ya, and EIC.za.
EIC.ya
```

```
        Label:˚˚˚˚˚˚˚ YArray
        Type:˚˚˚˚˚˚˚˚ array
        Units:˚˚˚˚˚˚˚ dependent on EIC.geom
        Description:˚ Comma separated list of y values corresponding to array elements
        contained in EIC.ta, EIC.xa, and EIC.za.
EIC.za
        Label:˚˚˚˚˚˚˚ ZArray
        Type:˚˚˚˚˚˚˚˚ array
        Units:˚˚˚˚˚˚˚ dependent on EIC.geom
        Description:˚ Comma separated list of z values corresponding to array elements
        contained in EIC.ta, EIC.xa, and EIC.ya.
EIC.end
        Label:˚˚˚˚˚˚˚ End ID
        Type:˚˚˚˚˚˚˚˚ string
        Format:˚˚˚˚˚˚ nnnnnn.nnnnn
        Description: Used to indicate the end of the EIC. A unique value within a single
        collection of index cards. Although both sides of the period can be any integer the
        convention is to have "unixtime" on the left hand side and a large random number on
        the right hand side. Matches EIC.id.
```

DOCUMENT LIBRARY

Distribution List for Technical Report Exchange – *July 1998*

University of California, San Diego
SIO Library 0175C
9500 Gilman Drive
La Jolla, CA 92093-0175

Hancock Library of Biology & Oceanography
Alan Hancock Laboratory
University of Southern California
University Park
Los Angeles, CA 90089-0371

Gifts & Exchanges
Library
Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, NS, B2Y 4A2, CANADA

NOAA/EDIS Miami Library Center
4301 Rickenbacker Causeway
Miami, FL 33149

Research Library
U.S. Army Corps of Engineers
Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Marine Resources Information Center
Building E38-320
MIT
Cambridge, MA 02139

Library
Lamont-Doherty Geological Observatory
Columbia University
Palisades, NY 10964

Library
Serials Department
Oregon State University
Corvallis, OR 97331

Pell Marine Science Library
University of Rhode Island
Narragansett Bay Campus
Narragansett, RI 02882

Working Collection
Texas A&M University
Dept. of Oceanography
College Station, TX 77843

Fisheries-Oceanography Library
151 Oceanography Teaching Bldg.
University of Washington
Seattle, WA 98195

Library
R.S.M.A.S.
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149

Maury Oceanographic Library
Naval Oceanographic Office
Building 1003 South
1002 Balch Blvd.
Stennis Space Center, MS, 39522-5001

Library
Institute of Ocean Sciences
P.O. Box 6000
Sidney, B.C. V8L 4B2
CANADA

National Oceanographic Library
Southampton Oceanography Centre
European Way
Southampton SO14 3ZH
UK

The Librarian
CSIRO Marine Laboratories
G.P.O. Box 1538
Hobart, Tasmania
AUSTRALIA 7001

Library
Proudman Oceanographic Laboratory
Bidston Observatory
Birkenhead
Merseyside L43 7 RA
UNITED KINGDOM

IFREMER
Centre de Brest
Service Documentation - Publications
BP 70 29280 PLOUZANE
FRANCE

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. WHOI-2001-13	2.	3. Recipient's Accession No.

4. Title and Subtitle
4DGeoBrowser: A Web-Based Data Browser and Server for Accessing and Analyzing Multi-Disciplinary Data

5. Report Date
October 2001

6.

7. Author(s) Steven Lerner, Andrew Maffei

8. Performing Organization Rept. No.
WHOI-2001-13

9. Performing Organization Name and Address

Woods Hole Oceanographic Institution
Woods Hole, Massachusetts 02543

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address

Woods Hole Oceanographic Institution

13. Type of Report & Period Covered
Technical Report

14.

15. Supplementary Notes
This report should be cited as: Woods Hole Oceanog. Inst. Tech. Rept., WHOI-2001-13.

16. Abstract (Limit: 200 words)

This report describes the 4DGeoBrowser software system. The GeoBrowser is a web-based application developed at the Woods Hole Oceanographic Institution by Steven Lerner and Andrew Maffei. It has been designed with the goal of creating, accessing, and analyzing repositories of oceanographic datasets that have been generated by investigators in differing scientific disciplines. Once the information is loaded onto a Geobrowser server the investigator-user is able to login to the website and use a set of data access and analysis tools to search, plot, and display this information. GeoBrowser servers are also capable of processing commands that are submitted remotely via HTTP URLs or email. Scientists are able to use this capability to make calls to the GeoBrowser server and generate click-able maps, tables of urls, and customized HTML pages. These can then be used to enhance websites associated with scientific projects. Examples of supporting scientific website functionality that includes time series plotting, data delivery by email, geo-spatial plotting of interdisciplinary data, map-based search capabilities and other functionality are presented in this report. The report includes examples of GeoBrowser application websites, a user manual, and a reference guide. In addition, the concept of Electronic Index Cards (EICs) is presented.

17. Document Analysis a. Descriptors
multi-discipline data access
geospatial
web data browser

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement
Approved for public release; distribution unlimited.

19. Security Class (This Report)
UNCLASSIFIED

21. No. of Pages
71

20. Security Class (This Page)

22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* **OPTIONAL FORM 272 (4-77)**
(Formerly NTIS-35)
Department of Commerce