

ARM THUMBNAIL BROWSER – A NEW WAY TO BROWSE AND ORDER ARM DATA FILES

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ABSTRACT

The Thumbnail Browser user interface provides users with a graphical view of the ARM data files before they request them or download them for additional use. The interface provides the user with various strategies (novice, power and catalog interfaces) to specify general criteria for “data of interest”. Users are shown thumbnail views of graphs containing many of the primary measurements from ARM data streams. The thumbnail view includes many options for customizing the display within two thematic arrangements: “date range” and “day at a time.” One arrangement allows the user to quickly see consecutive time ranges or days in a sequence while the other allows the user to control arrangement of thumbnails for a single day. From the thumbnail view, users can directly access larger-scale data plots called “quick looks”, review Data Quality Reports, or select data files to be requested for retrieval and download. Graphical check boxes allow users to request data files by day, by multiple days, or by data stream. The selected thumbnail arrangements can also be saved for future reference or emailed as a link to other users.

INTRODUCTION

A new browser application, the Thumbnail Browser, has been developed by the ARM (Atmospheric Radiation Measurement) Archive to enable users to browse and order ARM data files. The thumbnail browser user interface provides users with a graphical view of the ARM data files before they make requests or download data for additional use. This interface provides a graphical preview to a data collection that include millions of data files, terabytes of data, and is stored off line. The Thumbnail Browser supplements other types of Archive user interfaces which only provide information about the availability of data based on the number of files (or list of files) per category or query result. Thumbnail Browser can be accessed at: <http://www.archive.arm.gov/cgi-bin/arm-archive?rmode=tnb>. The browser was developed using Java (JDK 1.4.2) and Java Server Pages (JSP). Sybase is used as a backend data base and IDL (visualization software from RSI) is used for generating thumbnails and data plots.

The ARM data collection is very large which makes communicating specific information about its content to potential users a challenge. A new view of the archive, the Thumbnail Browser, was developed for finding and selecting data on the ARM Data Archive website based on graphical views of the data files. The users can select and download data based on these graphical views.

The new view of the ARM data archive offers the following advantages: the images are small enough to be stored online and dynamically displayed for each user; the time needed to display dozens of images within the user interface is reasonable; and the data plots, called “quicklooks”, show features in the data that are easily recognized graphically but are very difficult to represent in other forms. This graphical view of measurement contents will enable a broader user community to evaluate the potential usefulness of data from the Archive for their research.

The interaction between the browser and user consists of the following 4 usage phases: 1) Selecting data of interest, 2) Browsing data plots and data quality information, 3) Saving and emailing interesting thumbnail views, and 4) Selecting and ordering the ARM data files.

USAGE PHASE 1: SELECTING DATA OF INTEREST

The Thumbnail Browser starts by providing the user with various forms to specify general criteria for “data of interest.” Users are then shown thumbnail views of graphs containing many of the primary measurements from ARM data streams. The Thumbnail browser allows users to specify data of interest using three pathways: Novice Interface, Power Interface and Catalog Interface. Appendix 1 provides a schematic overview of the selection criterion for each interface.

I) Novice User Interface:

In this pathway, the user answers a sequence of questions and these answers control the display of thumbnails and allow users to select files from data streams. This pathway consists of the following selections.

Sites: The user is asked to select one or more sites from the displayed list of ARM sites. A world map showing the ARM sites is displayed as a reference (Figure 1).

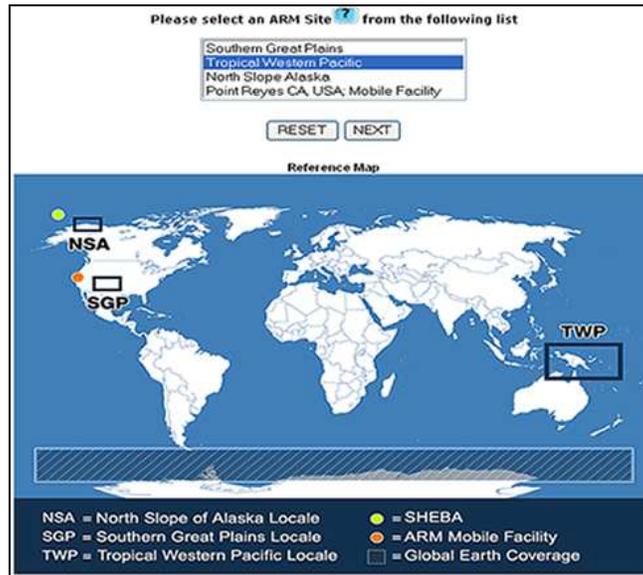


Figure 1. An example of site selection

Facilities: List of facilities available for the selected site(s) are displayed on this page. The user can select one or more facilities from this list (Figure 2).

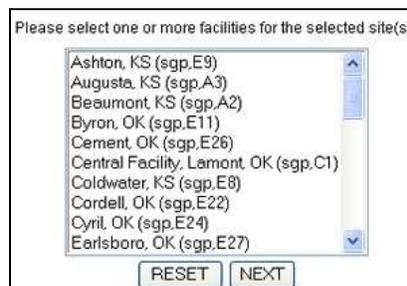


Figure 2. An example of list of facilities

Data Range: This page allows the user to select a date range or a specific date: a date range will allow the user to view thumbnails over a period of time, whereas, selecting a specific date will allow the user to view thumbnails for various measurements for a specific day (Figure 3).

The screenshot shows two sections for date selection. The top section, titled "Date Range View", includes a sub-header "(Select a date range; multiple measurements can be selected for a date range.)" and two date input fields: "Start Date: 01/01/2005" and "End Date: 08/20/2005", both with "NEXT" buttons. Below this is an "OR" separator. The bottom section, titled "Day at a time view", includes a sub-header "(Select a date; multiple measurements can be selected for a specific date.)" and a "Date: 08/20/2005" input field with a "NEXT" button. At the bottom of the entire form is a "RESET FORM" button.

Figure 3. Date selection options

Instrument Categories: This page lists available instrument categories for the selected facilities and date or date range, user can select one or more instrument categories from this list (Figure 4).

The screenshot shows a window titled "Select one or more instrument categories". It contains a list box with the following items: "Aerosols", "Atmospheric Profiling", "Clouds", "Radiometers", and "Surface Meteorology". The "Radiometers" and "Surface Meteorology" items are highlighted in blue. Below the list box are two buttons: "RESET FORM" and "NEXT".

Figure 4. Instrument categories list

Instruments and data streams: The user then selects specific instruments from the instrument categories for the selected sites, facilities, and date or date range. The user can select up to twenty instruments from this list. The corresponding data streams for the selected instruments are displayed on the same page. The user can select up to twenty data streams from this list (Figure 5).

The screenshot shows a window titled "Select up to 20 data streams". At the top, it lists three instrument categories: "Ground radiation sensor: 60-second upwelling radiation data", "Microwave Radiometer (MWR): 5-minute average integrated vapor and liquid water", and "Microwave Water Radiometer (MWR): water liq. & vapor along line of sight (LOS) path". Below this list are "RESET FORM" and "NEXT" buttons. A section titled "You have selected following Base Instruments" contains a scrollable list box. The list box is divided into two sections: "Clouds" and "Radiometers". Under "Clouds", the items are "Total Sky Image", "Microwave Radiometer", "Millimeter Wavelength Cloud Radar", "Vaisala Ceilometer: cloud base heights", and "Micropulse Lidar (MPL): cloud base and top heights". Under "Radiometers", the items are "Microwave Radiometer", "Ground radiation sensor", and "Short Wave Flux Analysis (Long)". At the bottom of the list box is a "Reselect Data Streams" button.

Figure 5. Instruments and data streams list

Measurements: Displayed on this screen is a master list of the available primary measurements which have quicklook plots for the selected data streams and a sub-list of measurements for each selected data streams. Selecting any measurement from the master measurement list will automatically select the corresponding measurements from the sub list. The user can also pick measurements directly from the sub-list (Figure 6).

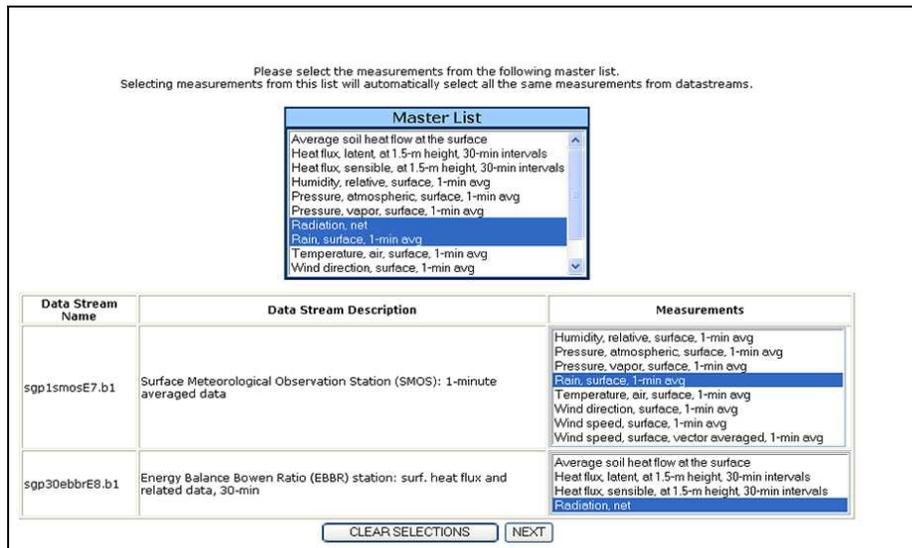


Figure 6. An example of measurements selection function

II) Power User Interface:

In this pathway, the user can drill down quickly to view the thumbnails and data plots by first selecting the sites, then selecting the date or date range and finally selecting data streams. This pathway is mainly for users who are already familiar with the ARM data streams and data file structures.

III) Catalog User Interface:

This interface allows the user to make selections from a hierarchical summary of tables. The first summary table shows the number of quicklook plots available for each site by year, the next selection table displays the number of available quicklook plots by instrument category and facility.

At the next level, a table is displayed of the instrument and data level, from which the user makes a selection. From the final table the user selects the facility and month. After making the above selections, the user is given an option to save this selection and go to previous pages to make additional selections. After finishing the above selections, the user must select a date or date range and measurement to view the thumbnails and quicklook data plots (Figure 8).

An advantage of this approach is that at each level of the hierarchy the user knows how many datastreams are available for the specified search criterion. Thus there are no dead end queries; if there are no datastreams available this is indicated (as shown in Fig. 7). Thus the Thumbnail Catalogue User Interface effectively displays the irregular structure of the quicklook plots and data collection.

Number of Quick Look Files in Archive by Year and Site													
<i>(Click on a non-zero cell in the table to choose a Site/Year and proceed to the next level of detail)</i>													
Site	Years Available												
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Southern Great Plains	375	1256	2829	11480	18674	26794	28174	28848	65068	75086	75832	80182	36346
North Slope Alaska	0	0	0	0	0	21	247	316	6084	7603	7870	5701	2465
Tropical Western Pacific	0	0	0	0	0	93	203	188	4315	7872	8141	6790	3568

Figure 7. An example of Level 1 catalog table (year by site)

USAGE PHASE 2: BROWSING DATA PLOTS AND DATA QUALITY INFORMATION

After selecting the data of interest, users are shown thumbnail views of graphs containing many of the primary measurements from the ARM data streams. The thumbnail view includes many options for customizing the display within two thematic arrangements referred to as “date-range” and “day-at-a-time”.

- i) The date range view allows the user to quickly see thumbnails for consecutive time ranges or days in a sequence. The user can customize the number of days in the display and also navigate to next set of thumbnails using the navigation option found on the page (Figure 8).

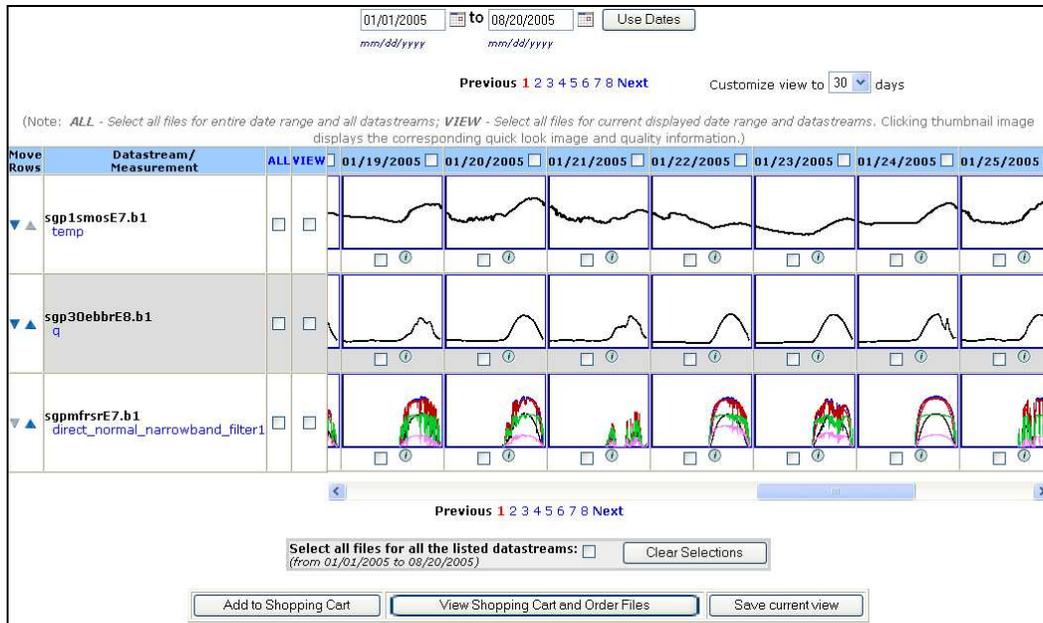


Figure 8. An example of thumbnail page (date range view)

- ii) The day at a time view allows the user to control the arrangement of thumbnails for a single day. The user picks a position for a thumbnail within a display matrix. User can also navigate to previous or next day from the thumbnail view (Figure 9).

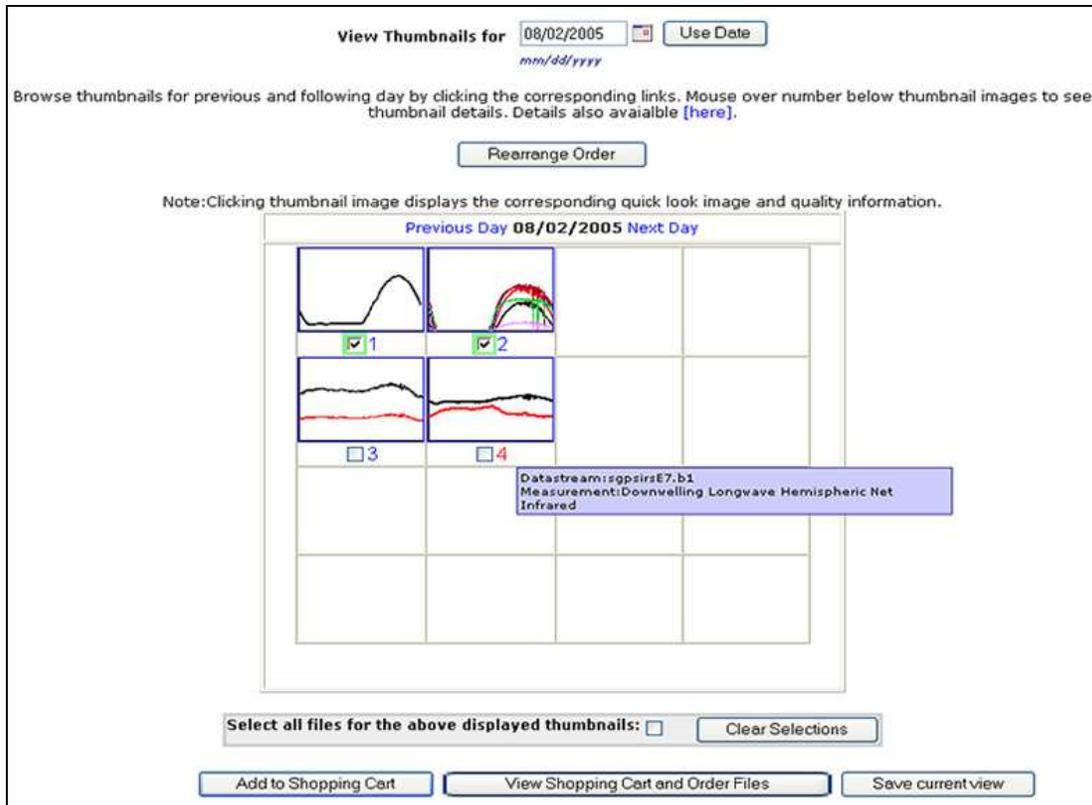


Figure 9. An example of thumbnail page (date at a time view)

USAGE PHASE 3: SAVING AND EMAILING INTERESTING THUMBNAIL VIEWS

The application allows the user to save thumbnail arrangements, retrieve a saved thumbnail view, and send a saved view to other researchers via e-mail. The “Save current view” button allows the user to save an interesting thumbnail view, while the “Retrieve view” button found on the top menu will list previously saved thumbnail views. Users can view or modify the saved thumbnail views, delete the saved view, or email the saved view to others. The reuse of thumbnail views may help the user to see different patterns in the data from different times or locations. It is also a mechanism that allows data users to quickly and explicitly share graphic discoveries with their peers.

From the thumbnail view, users can directly access large-scale data plots by clicking a thumbnail image. This will open a data quality pop-up page, which contains primary measurements for the selected data streams, their auto QC (Quality Control) color values, and DQR (Data Quality Report) color if any. Links to Data Quality Color is displayed here. This page also has the large-scale data plot of the corresponding quicklook of the data stream (Figure 10).

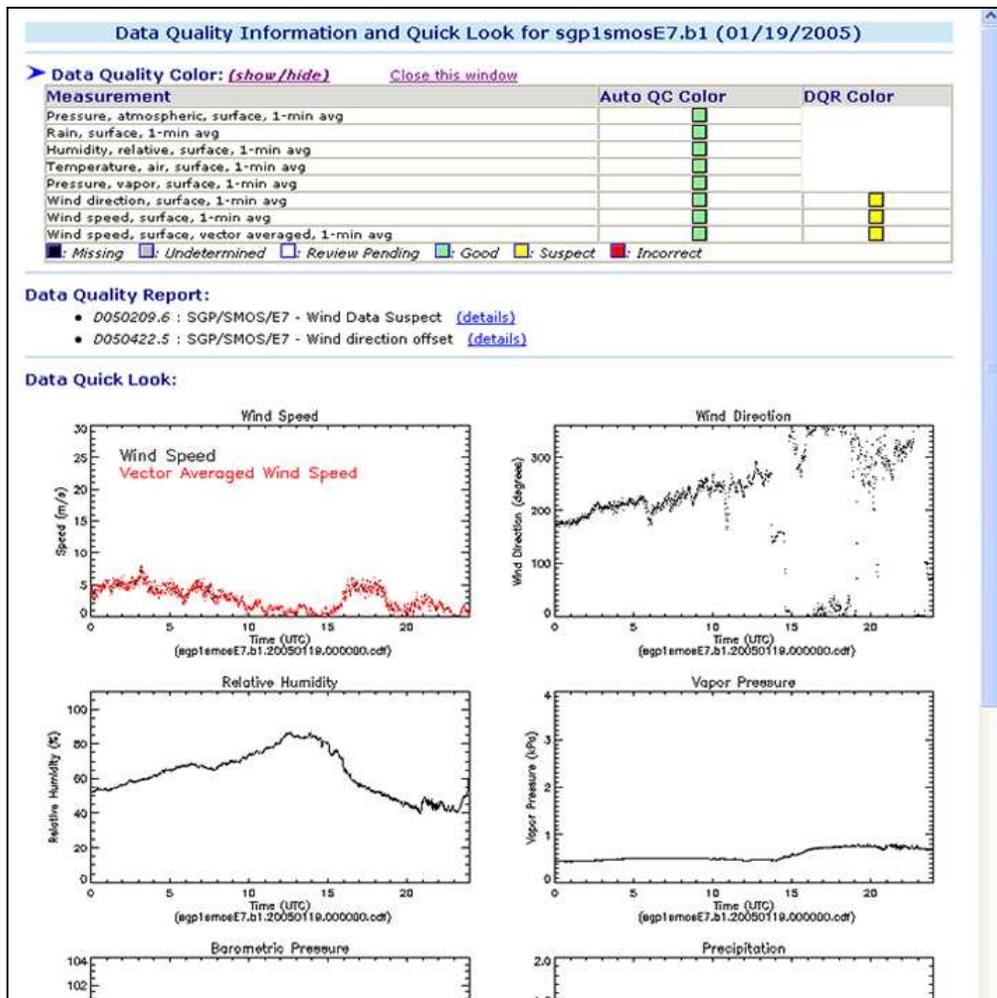


Figure 10. An example of data quality information - data plot page.

USAGE PHASE 4: SELECTING AND ORDERING THE ARM DATA FILES

There are many ways for selecting the “interesting” associated data files and data streams from the thumbnail display. These include: graphical check boxes that allow users to select data files by day, by multiple days, by data streams for the selected date range, and a “select all” option for selecting all the data streams for a date range of interest. After making the selections the user adds the selections to a shopping cart by clicking the “Add to shopping cart” button. The application allows the user to view their shopping cart from any page by clicking the “Shopping cart” button found on the top menu.

The shopping cart page lists all the selected data streams and selected dates. The user may remove selections from the shopping cart, continue for additional selections, or proceed to place an order.

The order page displays the resulting list of data file names and allows the user to make final selections before placing the order. The user can also sort the data files names list by file name, date or data level. When an order is submitted, the user will see a confirmation id for future reference. When the retrieval process is completed, the user will receive an email with details on downloading the ordered ARM data files.

SUMMARY

A new view of the ARM Archive data, the Thumbnail Browser, was developed for finding and selecting data based on graphical views of the data files. This interface provides an alternative means to select and download data from the ARM data collection. This new view offers a number of advantages over previous views, notably that the quicklook data plots show users features in the data that are more easily recognized graphically.

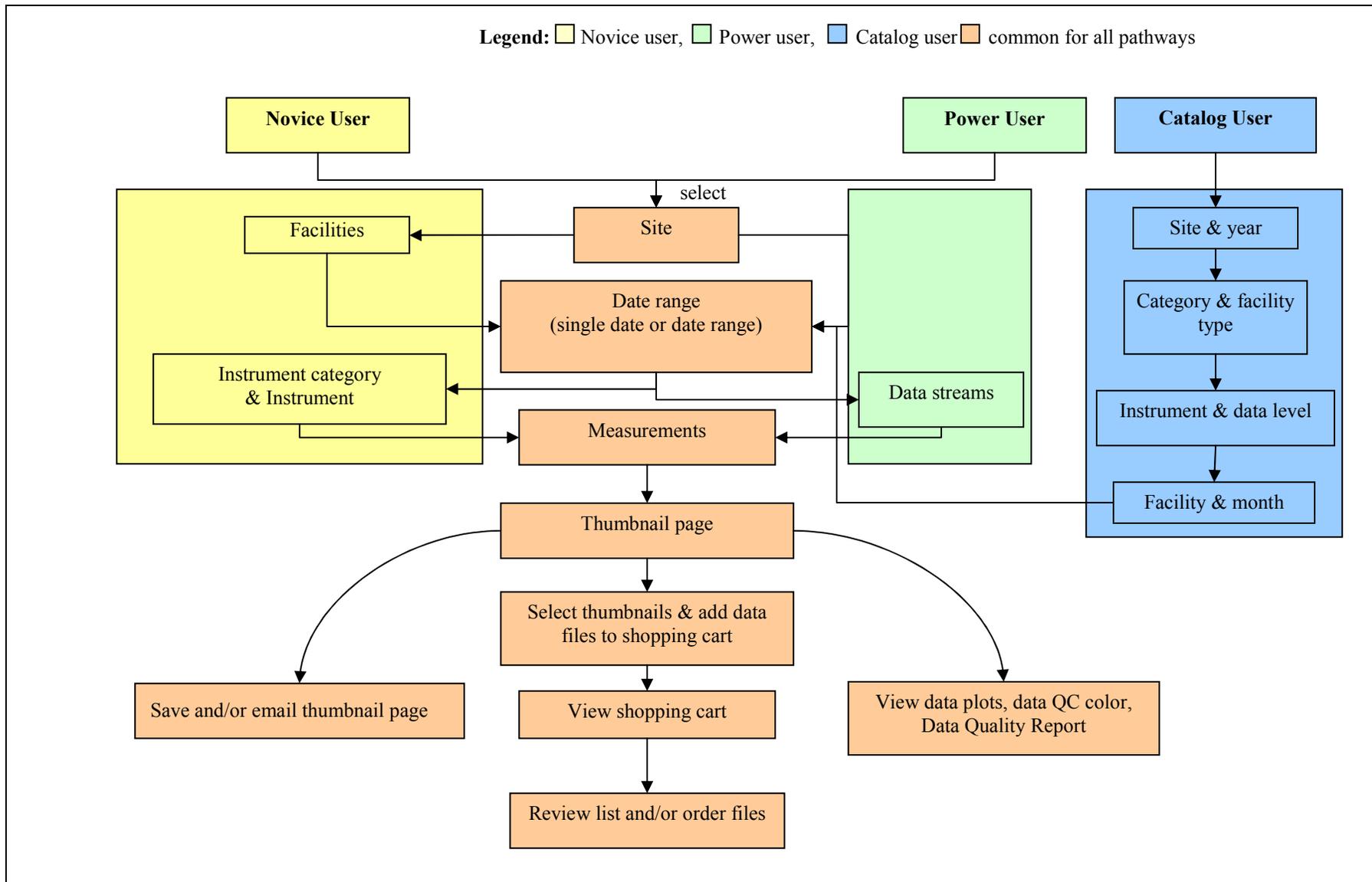
This paper describes the process of selecting data using three available pathways: the Novice User Interface, the Power User Interface, and the Catalogue Interface. The Novice User Interface is designed for those unfamiliar with the ARM data structure while the Power User Interface provides those experienced with the data structure a list of data streams for the selected site. The Catalogue Interface allows the user to make selections from a set of hierarchical tables which summarize the number of data streams with quicklook data plots for the selected criterion. At each level of the hierarchy of the Catalogue Interface, the user knows how many data streams are available. If there are no data plots available, that is clear before an order is placed.

The graphical-based view of the measurement contents of a very large archive provided by the Thumbnail Browser will facilitate the process of ordering ARM data and enable a broader user community to evaluate the potential usefulness of data from the Archive for their research.

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Appendix 1. ARM Thumbnail Browser logical Flow Chart