

Matlab GUIs for Ocean Satellite Data Products

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Acknowledgements

- Meri Sheremet - GSO/URI
- Christian Buckingham - GSO/URI

This work has been funded by the NASA/REASoN program,
and by NOPP via the University of Miami.

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Basic Idea

Demo

Remaining
Issues

Geospatial
Datasets

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- 1 Matlab GUIs
 - Basic Idea
 - Demo: Matlab 4km Pathfinder GUIette
 - Remaining Issues

- 2 Geospatial Datasets

- 1 **Matlab GUIs**
 - **Basic Idea**
 - Demo: Matlab 4km Pathfinder GUIette
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URI, OPeNDAP, PMEL, UCAR, GSFC, JPL and RSS funded by NASA to develop

A Thematic Data Portal to Satellite-Derived Ocean Surface Properties

- Sea surface temperature
 - MODIS
 - AVHRR Pathfinder 4km
 - GOES
 - AIRS
- Surface winds and wind stress
 - NSCAT
 - QuikSCAT
- Ocean color
- Sea surface height
- Precipitation

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with particular attention on *Discovery and Access*

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(A GUI also exists for HYCOM $\frac{1}{12}^{\circ}$ North Atlantic output.)

GUI Characteristics: Basics, Look and Feel

Matlab
GUIs

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Matlab
GUIs

Basic Idea

Demo

Remaining
Issues

Geospatial
Datasets

- **Written in Matlab, with plans to port to IDL.**
- Provide for a similar look and feel across data sets.

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The screenshot shows a MATLAB GUI titled "GUI_Pathfinder4km" for the "NASA/REASON Ocean Data Portal 4km Pathfinder". The interface is organized into several sections:

- Dataset description:** A text field containing the URL "http://www.nodc.noaa.gov/sog/pathfinder4km/userguide.html".
- Selection Modes:** Two radio buttons are present: "Climatology" (unselected) and "Time Series" (selected).
- Apply mask:** Two checkboxes for "Clim_SST" and "Land mask".
- Ancillary fields:** A section with checkboxes for "Clim_StandardDeviation" and "Clim_Counts".
- Time Series Options:** Includes checkboxes for "SST", "SST anomaly", "Quality mask" (set to ">4 (good)"), and "Land mask".
- Temporal Averages:** A dropdown menu currently set to "Daily".
- Subsampling:** Four radio buttons for different time intervals: "1, Night: ~ 2 am LST (1965-2004)", "2, Day: ~ 10 am LST (2002-2005)", "3, Day: ~ 2 pm LST (1965-2004)", and "4, Night: ~ 10 pm LST (2002-2005)".
- Spatial Parameters:** Fields for "Available latitude range" and "Available longitude range" with "Min (Deg)" and "Max (Deg)" sub-labels. Below these are "Enter latitude:" and "Enter longitude:" fields. A "Spatial resolution is 4 km" label is also present.
- Select every:** Two checkboxes for "latitudinal step" and "longitudinal step".
- SAVING YOUR DATA:** A section with a radio button for "in workspace" (selected) and a "VariableName_Unique" label. Below this are fields for "Directory name:" and "File name prefix:" with a "Browse" button. The default filename is "Date-VariableName.mat".
- Get Data:** A large button at the bottom of the window.

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GUI_Pathfinder4km

NASA/REASON Ocean Data Portal 4km Pathfinder

Dataset description: <http://www.nodc.noaa.gov/og/pathfinder4km/userguide.html>

Variable Definition/Selection Region

Time Definition/Selection Region

Available latitude range: [-89.98, 89.98]
Min (Deg) Max (Deg)
Enter latitude:

Available longitude range: [-179.982, 179.982]
Min (Deg) Max (Deg)
Enter longitude:

Spatial resolution is 4 km

Subsampling

Select every latitudinal step
Select every longitudinal step

SAVING YOUR DATA

in workspace VariableName_Date
 to files Directory name: Browse
File name prefix: Date-VariableName.mat

Get Data

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- Dataset description:** A text field containing the URL "http://www.nodc.noaa.gov/og/pathfinder4km/userguide.html".
- Variable Definition/Selection Region:** A yellow panel with two main sections:
 - Climatology:** Includes an "Apply mask" button and checkboxes for "Clim_SST", "Clim_StandardDeviation", "Clim_Counts", "Land mask", and "Arbitrary fields".
 - Time Series:** Includes an "Apply mask" button and checkboxes for "SST", "SST anomaly", "Quality mask" (set to ">4 (good)"), "Land mask", "Quality (qual)", "First guess SST (BSST)", "Standard Deviation (sdev)", "Mask 1", "Number of Observations (num)", and "Mask 2".
- Time Definition/Selection Region:** A red panel for temporal selection, including an "Available time range" of [1980-01-04, 2009-12-31], "Enter time" fields, "Temporal averages" (Daily, 3 Day, 4 Night), and "Select approximate time of satellite pass" (1, 2, 3, 4).
- Space Definition/Selection Region:** A cyan panel for spatial selection, including an "Available latitude range" of [-89.98, 89.98], "Enter latitude" and "Enter longitude" fields, "Spatial resolution is 4 km", and "Select every" fields for "latitudinal step" and "longitudinal step".
- SAVING YOUR DATA:** A section with radio buttons for "in workspace" (selected) and "to files". The "to files" section includes "Directory name:" and "File name prefix:" fields, a "Date-VariableName.mat" label, and a "Browse" button.
- Get Data:** A large button at the bottom of the form.

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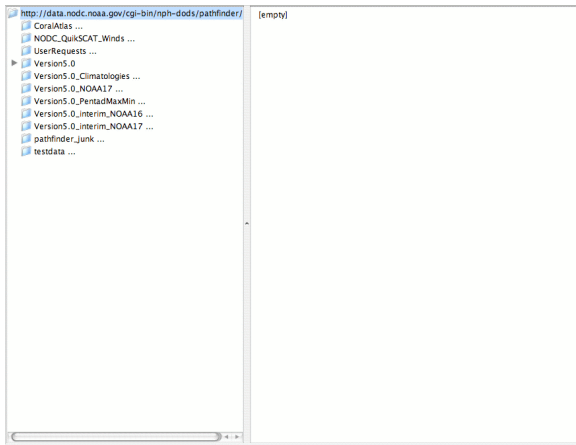
The screenshot shows the GUI_Pathfinder4km interface with the following sections:

- Variable Definition/Selection Region:** Includes radio buttons for 'Climatology' and 'Time Series'. Under 'Climatology', there are checkboxes for 'Clim_SST', 'Land mask', 'Clim_StandardDeviation', and 'Clim_Counts'. Under 'Time Series', there are checkboxes for 'SST', 'SST anomaly', 'Quality mask', and 'Land mask'. There are also input fields for 'Quality (qual)', 'First guess SST (BSST)', 'Standard Deviation (sdev)', and 'Number of Observations (num)'. A 'Mask 1' and 'Mask 2' section is also present.
- Time Definition/Selection Region:** Shows 'Available time range: [1980-01-04, 2009-12-31]'. It includes 'Enter time' fields for year, month, and day, and a 'Temporal averages' section with radio buttons for 'Daily', '3. Day', and '4. Night'.
- Space Definition/Selection Region:** Shows 'Available latitude range: [-89.98, 89.98]' and 'Spatial resolution is 4 km'. It includes 'Enter latitude' and 'Enter longitude' fields with 'Min (Deg)' and 'Max (Deg)' labels, and 'Select every' fields for 'latitudinal step' and 'longitudinal step'.
- Output Definition/Selection Region:** Features a 'SAVING YOUR DATA' section with a 'VariableName_Data' field, a 'to files' radio button, and a 'File name prefix' field. A 'Data-VariableName.mat' field is also present.

A 'Get Data' button is located at the bottom of the interface.

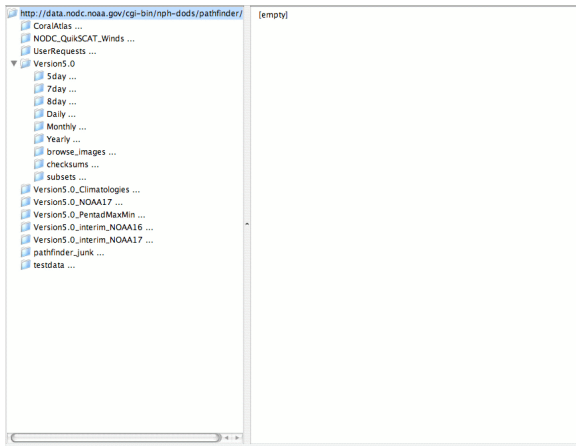
GUI Characteristics: Expose Complicated Data Sets

- Written in Matlab, with plans to port to IDL.
- Provide for a similar look and feel across data sets.
- Expose the underlying structure of the archive. (What is a data set?)



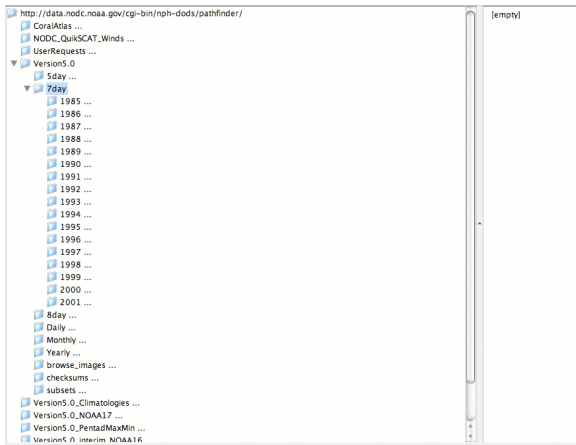
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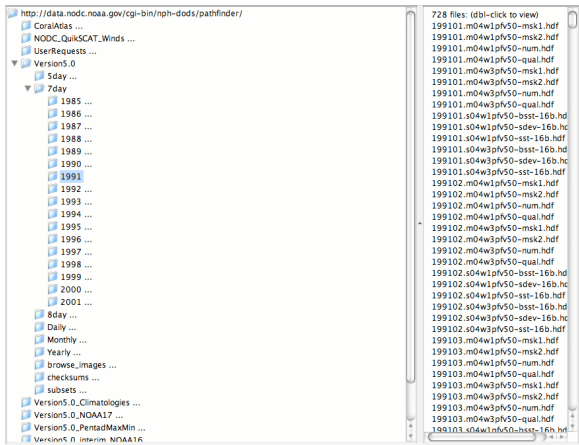
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- Selection Panels:**
 - Climatology:** Includes checkboxes for "Clim_SST" and "Land mask", and an "Apply mask" button.
 - Time Series:** Includes checkboxes for "SST" and "SST anomaly", a "Quality mask" dropdown set to ">4 (good)", and a "Land mask" checkbox. It also has an "Apply mask" button.
- Ancillary fields:** Two panels with checkboxes for "Clim_StandardDeviation", "Clim_Counts", "Quality (qual)", "First guess SST (BSST)", "Standard Deviation (sdev)", "Mask 1", and "Number of Observations (num)", "Mask 2".
- Temporal Averages:** A section for "Temporal averages" with a "Daily" dropdown and a "Select approximate time of satellite pass" section containing four radio button options:
 - 1, Night: ~ 2 am LST (1985-2004)
 - 2, Day: ~ 10 am LST (2002-2006)
 - 3, Day: ~ 2 pm LST (1985-2004)
 - 4, Night: ~ 10 pm LST (2002-2005)
- Subsampling:** A "Subsampling" section with a "Spatial resolution is 4 km" label and two "Select every" checkboxes for "latitudinal step" and "longitudinal step".
- Time and Latitude/Longitude:** Fields for "Available time range" (1985-01-04, 2005-12-31) and "Enter time" (yyyy mm dd). Fields for "Available latitude range" (-89.98, 89.98) and "Enter latitude" (Min/Max (Deg)). Fields for "Available longitude range" (-179.982, 179.982) and "Enter longitude" (Min/Max (Deg)).
- SAVING YOUR DATA:** A section with a radio button for "in workspace" and a "VariableName_Date" label. Below are fields for "Directory name", "File name prefix", and "Date-VariableName.mat", along with a "Browse" button and a "Get Data" button.

GUI Characteristics: Exposes Complicated Data Sets

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Basic Idea

Demo

Remaining
Issues

Geospatial
Datasets

- Written in Matlab, with plans to port to IDL.
- Provide for a similar look and feel across data sets.
- Expose the underlying structure of the archive. (What is a data set?)
- **The underlying programs can be called as functions.**
 - This means that the semantics used in the GUIs can be used in functions.
 - That the functions can be used in scripts.

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 - Remaining Issues

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Would Like Consistency in the Returned Data

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Geospatial
Datasets

- All of the GUIs access multidimensional data:
 - 3D - **lon, lat, time**
 - MODIS, Pathfinder, scatterometer
 - 4D - **lon, lat, altitude (or depth), time**
 - AIRS, HYCOM
- The multidimensional nature of the data gave rise to two problems:
 - Structure name in the Matlab workspace
 - Structure of these structure

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OPeNDAP_0001. { *temp* – [1024x2096x12x2000]
temp_error – [1024x2096x12x2000]
temp_count – [1024x2096x12x2000]
Longitude – [1024]
Latitude – [2096]
Depth – [12]
Time – [2000]
URL
Metadata

Options

- **MODIS_yyyymmdd** – A name based on date.
 - Many different date/time representations – MODIS_20040110, MODIS_2004010, ...
 - Cumbersome for multiple passes per day; requires date and time: MODIS_200401102315
 - Subsequent request can overwrite the structure, if the data/time are the same.
 - Possibility of lots of structures – a 4x4 pixel region for 1000 days \Rightarrow 1000 structures in the user's workspace.
- **OPeNDAP_rrrr** – Some generic, non-descriptive name for the structure. (rrrr is the request number and is incremented for every read.)
 - Not user friendly.
- We are converting to the generic name representation plus a function to convert it to date/time
 - Provides for a user friendly response.
 - Avoids overwriting structures
 - Allows for different date/time naming conventions.
 - Puts the work in the function not in the GUIette.

The Structure Name Problem

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The Structure Name Problem

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Basic Idea

Demo

Remaining
Issues

Geospatial
Datasets

Options

- **MODIS_yyyymmdd** – A name based on date.
 - Many different date/time representations – MODIS_20040110, MODIS_2004010, ...
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The Structure of the Structure Problem

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Basic Idea

Demo

Remaining
Issues

Geospatial
Datasets

OPeNDAP_0001. { *temp* – [1024x2096x12x2000]
temp_error – [1024x2096x12x2000]
temp – [1024x2096x12x2000]
Longitude – [1024]
Latitude – [2096]
Depth – [12]
Time – [2000]
URL
Metadata

The Structure of the Structure Problem

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temp – [1024x2096x12x2000]
Longitude – [1024]
Latitude – [2096]
Depth – [12]
Time – [2000]
URL
Metadata

nnnn = 1 : 2400 *OPeNDAP_nnnn.* { *temp* – [1024x2096]
temp_error – [1024x2096]
temp – [1024x2096]
Longitude – [1024]
Latitude – [2096]
Depth – 3
Time – 127
URL
Metadata

The Structure of the Structure Problem (continued)

We are leaning toward 2D fields, although another option is native

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Datasets

- 1 Matlab GUIs
 - Basic Idea
 - Demo: Matlab 4km Pathfinder GUIette
 - Remaining Issues

- 2 Geospatial Datasets

Motivation

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Issues

Geospatial
Datasets

- UCSB, URI and OPeNDAP have been funded by NSF to explore data discovery and access in a distributed environment.
 - Alexander Digital Library discover + OPeNDAP data access
- As part of this project, we are looking at:
 - The organization of geospatial data, and
 - The metadata found with OPeNDAP accessible data sets.

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Spatial Structure of Data Sets

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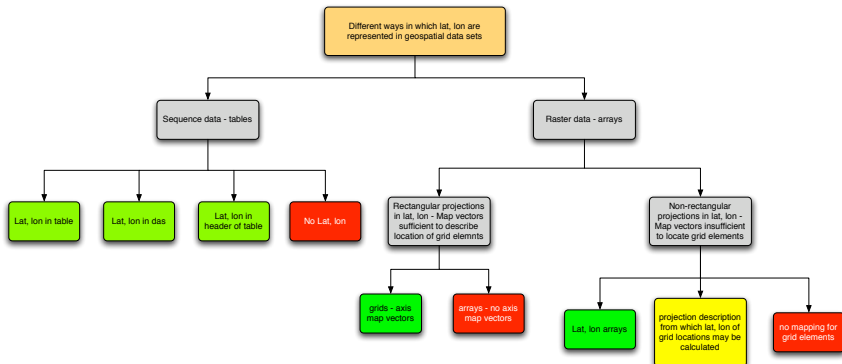
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Basic Idea

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Remaining
Issues

Geospatial
Datasets



- **Green** rectangles mean lat, lon are readily available (assuming that one can associate them with the variable names used).
- **Yellow** rectangles mean that lat, lon are accessible, but require work.
- **Red** rectangles mean that lat, lon information is not accessible. **Bad, bad, bad**

Temporal Structure of Data Sets

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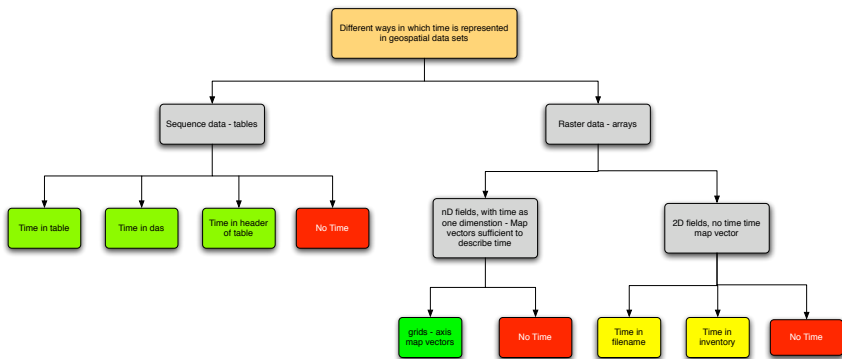
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Demo

Remaining
Issues

Geospatial
Datasets



- **Green** rectangles mean time is readily available (assuming that one can associate time with the variable name used).
- **Yellow** rectangles mean that time is accessible, but requires work.
- **Red** rectangles mean that time information is not accessible. *Bad, bad, bad*

Organizational Structure of Geospatial Data Sets

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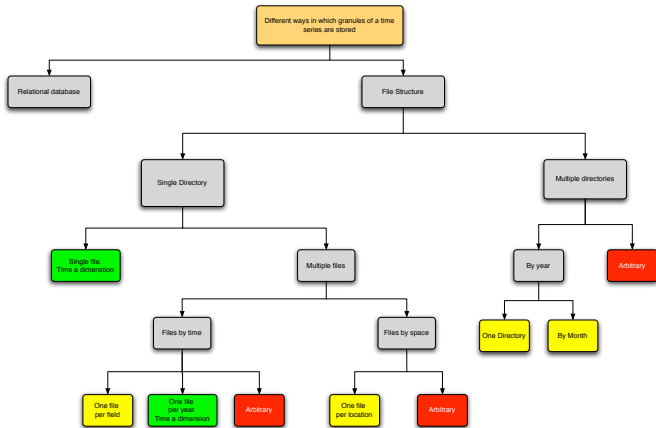
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Issues

Geospatial
Datasets



- Green rectangles mean the structure is **very** easy to parse.
- Yellow rectangles mean mean the structure is **pretty** simple to parse.
- Red rectangles mean that the structure is impossible to parse. **Bad, bad, bad**

Feedback

I'd appreciate any feedback on the structures (spatial, temporal or archive) that I have presented.

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Issues

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