Find It, Plot It, Grab It: Distributing Climate Data Via The Web

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Background

The Problem:

- Climate data exist in disparate locations and formats
- Difficult for researchers to locate and evaluate desired information
- Result: Duplicated effort, loss of collaborative opportunities

Goal: Implement a Web service that...

- Makes the process of locating, acquiring, and sharing climate data one which enables and encourages researchers' participation...
  - make it easy to find the information...
  - make it easy to evaluate the data before acquiring it...
  - and make it easy to retrieve **only** the desired data.
- Service should be easily extensible to all data holdings

Success and ease of implementation depends on:

- data storage decisions,
- data manipulation tools,
- and the CGI processes which integrate the HTTP server, stored data, and the data manipulation processes

Data Storage

- File naming conventions allow file name components to provide information for menu structure and contents

cid. mon.mean.nc
variable — statistic — netCDF identifier

- Store data in netCDF: Machine-independent *"Common Data Form"*
  - netCDF and its associated API provide convenient access to file metadata via C, Perl
  - netCDF format specified by conventions at:
    http://www.cdc.noaa.gov/cdc/conventions/cdc_netcdf_standard.shtml
  - netCDF file metadata example:

```
        float lat(lat) ;
                lat:long_name = "Latitude" ;
                lat:units = "degrees_north" ;
                lat:actual_range = 0.f, 0.f ;
        float lon(lon) ;
                lon:long_name = "Longitude" ;
                lon:units = "degrees_east" ;
                lon:actual_range = 180.f, 180.f ;
        double time(time) ;
                time:units = "days since 1-1-1 00:00:0.0" ;
                time:long_name = "Time" ;
                time:delta_t = "0000-01-00 00:00:00" ;
                time:avg_period = "0000-00-00 00:00:00" ;
                time:actual_range = 0., 334. ;
                time:prev_avg_period = "0000-00-00 00:00:00" ;
                time:bnds_range = 711855., 722785. ;
        float sst(time, lat, lon) ;
                sst:dataset = "COADS/5/at" ;"X";
                sst:best_significant_digit = 2s ;
                sst:var_desc = "Sea Surface Temperature/a" ;"S";
                sst:level_desc = "Surface/a" ;"N";
                sst:statistic = "Mean/a" ;"M";
                sst:parent_stat = "Long Term Mean/a" ;"C";
                sst:valid_range = 0.f, 40.f ;
                sst:actual_range = 26.42682f, 27.56459f ;
                sst:precision = 2s ;
                sst:units = "degC" ;
                sst:missing_value = -0.56025e+36f ;
                sst:long_name = "Sea Surface Temperature Monthly Long Term Mean at Surface" ;
                sst:add_offset = 0.f ;
                sst:scale_factor = 1.f ;
// global attributes:
                :platform = "Ship Observations" ;
                :title = "COADS/5" ;
                :history = "CRDhools Extract-Average Thu Mar 27 10:41:26 1997 from Input
                        file 1: /Datasets/coads/1/sst.bin.ac (ncl/a)",
```

Data Manipulation: GrADS

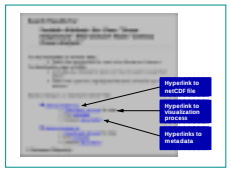
- Interactive desktop tool used worldwide in the analysis and display of earth science data
- Ported to a variety of platforms
- Supports a 4-D data model
- Freely available from:
  http://grads.iges.org/grads/head.html
- Batch mode provides straightforward integration with CGI processes
- Use X-windows virtual frame buffer rather than physical screen to capture output

Putting the Pieces Together in the Web Environment

Finding It

- Search interface guides user's keyword and value choices

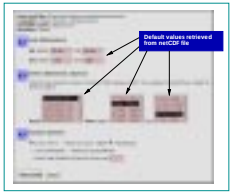
- Search is implemented with Harvest and customized summarizer software
- Search results provide hyperlinks to...
  - data visualization
  - detailed data set and file description
  - the actual data file (or a subset)

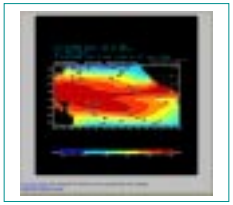


Putting the Pieces Together in the Web Environment, continued

Plotting It

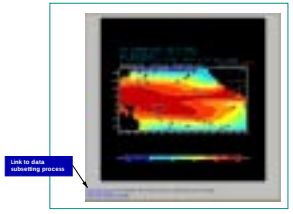
- Use netCDF metadata to build customized Web interface to GrADS toolkit
- Values extracted from the netCDF file provide contents of the menus and reasonable default values



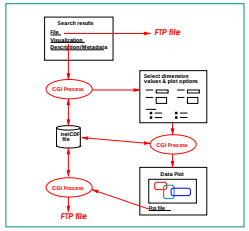


Grabbing It

- Follow hyperlink (on search results page) to netCDF file and execute FTP via browser FTP capability, or...
- Follow *FTP the data...* hyperlink. Resulting actions:
  - Execute data extraction process and create new netCDF file based on the parameters used to create data plot
  - Generate new web page which includes a hyperlink to the newly created file
  - User may then follow the hyperlink to this new netCDF file and FTP the file via browser FTP capability



Processing Summary



Extensibility

- Interface originally designed for two specific data sets
- Has since been extended to apply to all CDC data
- Web data interface may be applied to any netCDF data conforming to the COARDS metadata conventions
  - Managed data holdings
  - User-generated data

Conclusion

- Implementation is straightforward: Use standard HTML and CGI processes to generate interface
- Dynamic interaction with data ensures current information
- Interface easily extensible to all CDC data sets
- Web interface allows users to evaluate data and retrieve customized data subsets without depending on human interaction

References

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- The Grid Analysis and Display System. *http://grads.iges.org/grads/head.html*
- Unidata netCDF. *http://www.unidata.ucar.edu/packages/netcdf/*