Accessing climate data via OPeNDAP

Using IDL with remote data
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Outline

1. Data Access Protocol (DAP)
2. Accessing DAP served data from IDL
3. Convenient set of routines for other SDFs
4. GPULib update

Data Access Protocol (DAP)

1. open standard
2. simple HTTP-based protocol
3. remote access data via an URL
4. access individual variables as well as subsets
5. client libraries for most languages, including web browsers
6. multiple DAP server implementations

DAP data sources for climate data

1. 20th Century Reanalysis at NERSC
2. NASA DAACs
3. NOAA, UCAR, USGS, JPL, COLA, etc.

See more at:

`docs.opendap.org/index.php/Dataset_List`

20th Century Reanalysis

- 18 variables
- 180 x 91 lat/lon
- 56 ensemble members
- 1460 reading per year (every 6 hrs)
- 140 years, 1871 to 2010

Over 12 TB of finished product, plus raw data

DAP access in IDL

Options for using DAP from within IDL:

1. OPeNDAP IDL client (DLM)
2. IDL’s netCDF 4.0 bindings (sort of)
3. Remote Data Toolkit

netCDF bindings

- netCDF 4.0 able to access DAP, but...
- curl library problem on some platforms, works for:
    - Linux: IDL 8.0+
    - Mac: IDL 8.2+
    - Windows: not yet

netCDF bindings for a file

```
filename = 'ps_1871.nc'
file_id = ncdf_open(filename, /nowrite)
var_id = ncdf_varid(file_id, 'ps')
ncdf_varget, file_id, var_id, value, $
             count=[180, 91, 1, 1], $
             offset=[0, 0, 25, 700], $
             stride=lonarr(3) + 1
ncdf_close, file_id
```

netCDF bindings for a DAP URL

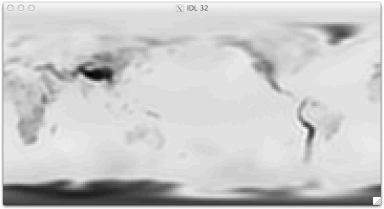
```
url = 'http://portal.nersc.gov/pydap/' $
        + '20C_Reanalysis_ensemble/' $
        + 'analysis/ps/ps_1871.nc'
file_id = ncdf_open(url, /nowrite)
var_id = ncdf_varid(file_id, 'ps')
ncdf_varget, file_id, var_id, value, $
             count=[180, 91, 1, 1], $
             offset=[0, 0, 25, 700], $
             stride=lonarr(3) + 1
ncdf_close, file_id
```

netCDF: TX_NC_GETDATA

```
url = 'http://portal.nersc.gov/pydap/' $
        + '20C_Reanalysis_ensemble/' $
        + 'analysis/ps/ps_1871.nc'
ps = tx_nc_getdata(url, 'ps[*, *, 25, 700]')
```

Special purpose routine

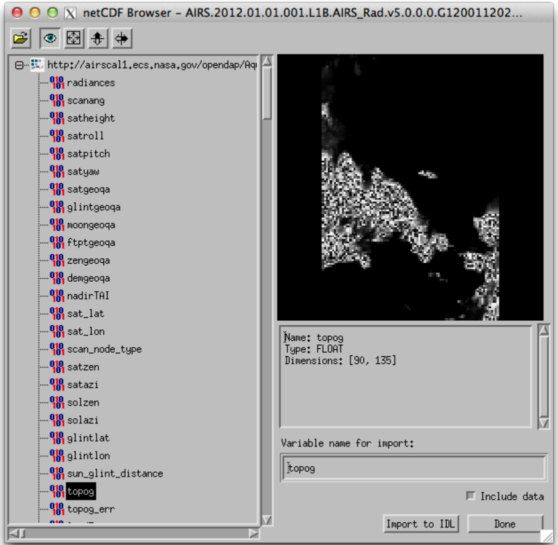
```
ps = mg_20c_getdata('ps', 1871, $
                    ensemble_member=25, $
                    time=700)
```



Attributes and TX_NC_DUMP

```
IDL> print, tx_nc_getdata(url, 'ps.standard_name')
surface_air_pressure
IDL> tx_nc_dump, url
+ FILE <http://portal.nersc.gov/pydap/20C_...>
  - VARIABLE fltarr(91) lat
    . ATTRIBUTE units = 'degrees_north'
    . ATTRIBUTE standard_name = 'latitude'
  - VARIABLE lonarr(56) ensemble_member
    . ATTRIBUTE long_name = 'ensemble member...'
...
```

TX_NC_BROWSER



```
Name: topog
Type: FLOAT
Dimensions: [90, 135]
```

topog

HDF5: TX_H5_GETDATA

```
f = filepath('hdf5_test.h5', $
             subdir=['examples', 'data'])
res = mg_h5_getdata(f, $
        '/arrays/3D int array[3, 5:*:2, 0:49:3]')
class = mg_h5_getdata(f, '/images/Eskimo.CLASS')
mg_h5_dump, f
```

HDF4: TX_HDF_GETDATA

```
filename = 'MOD021KM.A2010019.' $
             + '1235.005.2010259102219.hdf'
mg_hdf_dump, filename
sen_az = mg_hdf_getdata(filename, $
                        'SensorAzimuth')
```

Save files: TX_SAVE_GETDATA

```
IDL> cow_filename = file_which('cow10.sav')
IDL> mg_save_dump, cow_filename
Variables:                   4

Variables
---------
POLYLIST = lonarr(2321)
...
IDL> polylist = mg_save_getdata(cow_filename, $
                                'polylist')
```

GPULib 1.6 update

- curve fitting project for next two years (NASA SAGE III mission)
- release soon with:
    - CUDA update,
    - bug fixes,
    - 8-dimensional arrays,
    - optimized scalar/array operations,
    - added a few simple routines like `GPUCONJ`

Future features

1. MAGMA for GPU accelerated LAPACK routines
2. Levenberg–Marquardt curve fitting
3. ability to create kernels “on the fly” from strings

Conclusion

Questions!

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