Day – 4
Generation of NetCDF files

Data visualization of Marine Met Data

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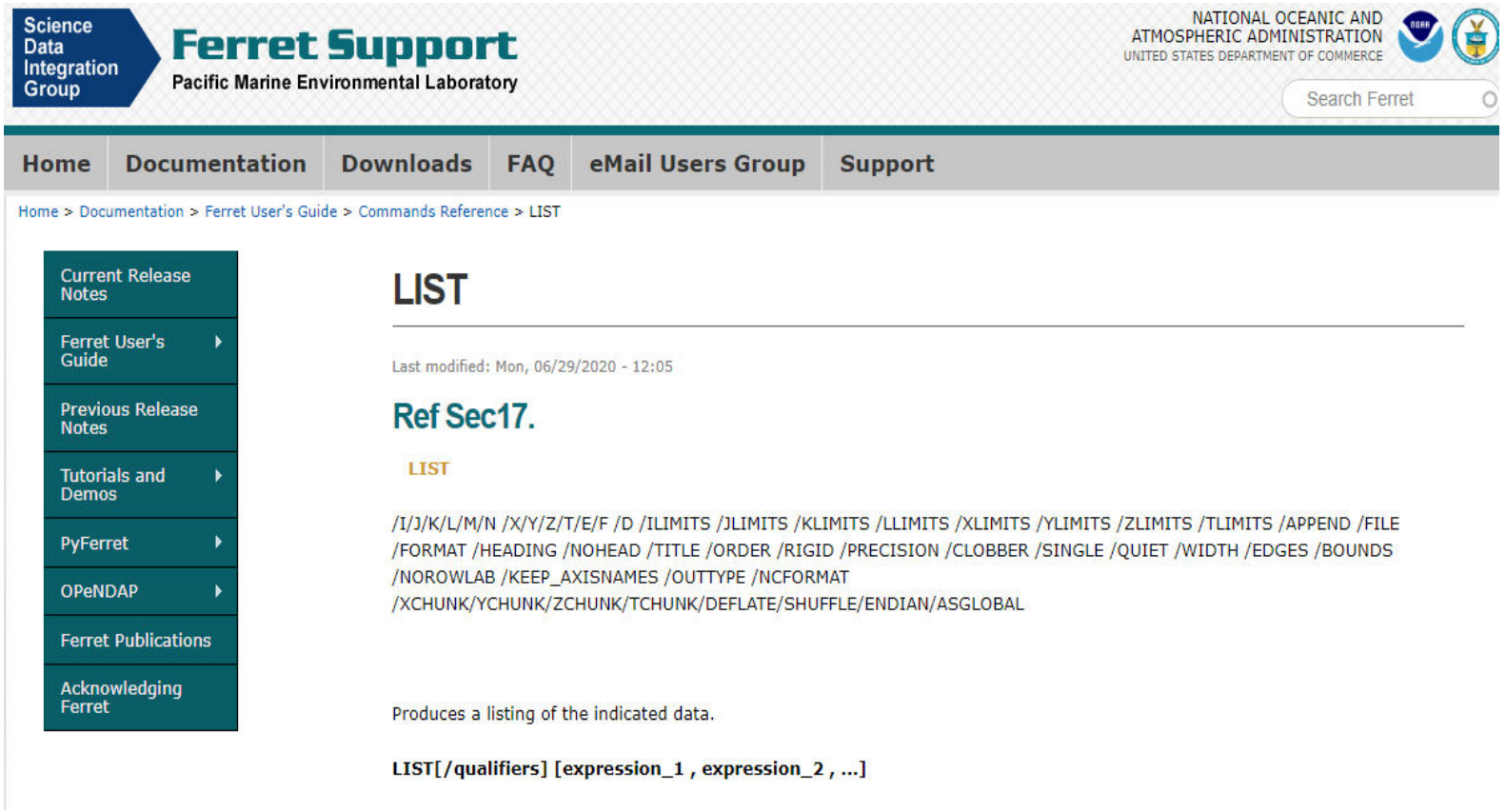
Topics to be covered

- Listing and saving files.
- How to generate NetCDF files.
  - Using FERRET s/w
  - Using ctl files, ncdump and ncgen.
- Some examples in our domain.
  - 1D data of SST and Wind Speed
  - 2D data from coads_climatology
  - 3D data from levitus climatology
- How to use ncdump and ncgen.

Listing and saving files

- To extract data from NetCDF files the command used is ‘list’.



Most common things with ‘list’

- List/format=
  - Format=stream is used for listing binary output.
- List/precision=
- List/file=
- List/clobber/file=
- List/order=xy (or yx)
- List/quiet

List/format=

```
yes? sh da
    currently SET data sets:
   1> /usr/local/ferret/fer_dsets/data/coads_climatology.cdf  (default)
 name     title                    I         J         K         L         M         N
 SST      SEA SURFACE TEMPERATURE  1:180     1:90      ...       1:12      ...       ...
 yes? list/format=(F9.3) sst[x=65,y=15]
            VARIABLE : SEA SURFACE TEMPERATURE (Deg C)
            FILENAME : coads_climatology.cdf
            FILEPATH : /usr/local/ferret/fer_dsets/data/
            BAD FLAG : -1.E+34
            SUBSET   : 12 points (TIME)
            LONGITUDE: 65E
            TIME     : 01-JAN 00:45 to 31-DEC 06:34
            LATITUDE : 15N
   25.745
   26.204
   27.184
   28.557
   29.647
   29.184
   27.694
   26.665
   26.964
   28.015
   27.742
   27.186
```

List/file=

LIST/**FILE** [=file_name]

Names a file to receive the listed data. If /FILE is specified with no name then the default name is used from the SET LIST/FILE command.

Example:

```
yes? LIST/FILE=my_file.dat sst[D=coads_climatology]
```

See SET LIST/FILE=AUTO for further information on automatic filename generation.

List/clobber/file=

LIST/**CLOBBER**

Used with LIST/FILE. Indicates that any existing file with the name used is to be deleted, before writing. If CLOBBER is not specified and the file exists, and error message is given.

Example:

```
yes? LIST/FILE=my_file.dat/CLOBBER sst[D=coads_climatology]
```

List/precision=

LIST/**PRECISION**=#

Controls the digit precision of LIST output

Using the qualifier /PRECISION=#digits the output precision of the LIST command may be easily controlled. This qualifier functions exactly as does the SET LIST/PRECISION= command but it applies only to the current command. Note that this controls only the output precision of the data. *(Previous to Ferret v6.8, note that in fact at most 7 digits were significant since Ferret calculations are performed in single precision.)*

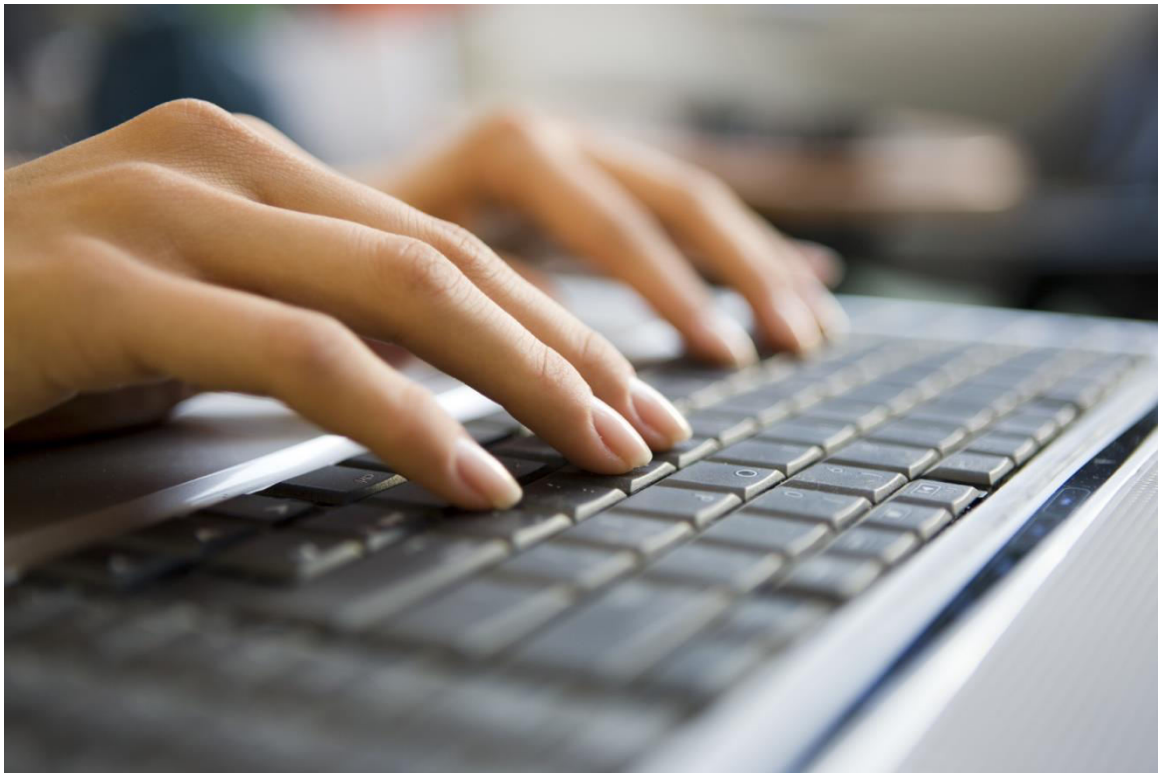
If the value specified for #digits is zero or negative Ferret will interpret this as the desired number of decimal places rather than the number of significant digits. (Ferret v7.5 and higher)

- **yes? list/precision=10 sst[x=65,y=15]**
- **VARIABLE : SEA SURFACE TEMPERATURE (Deg C)**
- **FILENAME : coads_climatology.cdf**
- **FILEPATH : /usr/local/ferret/fer_dsets/data/**
- **SUBSET : 12 points (TIME)**
- **LONGITUDE: 65E**
- **LATITUDE : 15N**
- **65E**
- **23**
- **16-JAN / 1: 25.74499893**
- **15-FEB / 2: 26.20407295**
- **17-MAR / 3: 27.18423080**
- **16-APR / 4: 28.55677414**
- **16-MAY / 5: 29.64679909**
- **16-JUN / 6: 29.18387032**
- **16-JUL / 7: 27.69437408**
- **16-AUG / 8: 26.66482735**
- **15-SEP / 9: 26.96374893**
- **16-OCT / 10: 28.01535606**
- **15-NOV / 11: 27.74214172**
- **16-DEC / 12: 27.18605995**

List missing values to our desired valued

- While listing filled/BAD/undefined values are shown as **********.
- To eliminate these, we can set the filled/BAD/undefined to any number we want as follows:
  - List/format=(F9.3) missing(sst[x=65,y=15],9999.000)
- This will replace all the undefined valued to 9999.000. This can be used while creating NetCDF files too.

Hands on ‘list’ commands



Generation of NetCDF files

- NetCDF files can be generated from ASCII or Binary files.
- One need to know the detailed information of
  - X (longitude range: X_{int} and X_{fin} and increment)
  - Y (latitude range: Y_{int} and Y_{fin} and increment)
  - Z (Depth range: Z_{int} and Z_{fin} and increment)
  - T (Time range: T_{int} and T_{fin} and increment)
- The fundamental rule is that these ranges are to be in monotonic increasing range.
  - If not in monotonic increasing range, FERRET will throw error while creating the NetCDF file.

To create NetCDF

- The axes are to be defined with initial and final ranges, increments, number of points, units etc.
- After axes are defined, grid need to be defined based on axes.
- The data in the file need to be mapped to the grid definition. If the count is not matching then FERRT will throw error.
- Titles, BAD or undefined (fill values) need to be specified properly.

Define the x-axis

- Yes ? define axis/x= X_{int} : X_{fin}:Δx /npoints=number/units=degrees_e (name)
- Eg:
  - define axis/x=65:65:1/npoints=1/units=degrees_e xaxis.
  - define axis/x=60:65:1/npoints=5/units=degrees_e xaxis
  - define axis/x=60:65:0.5/npoints=11/units=degrees_e xaxis

Define the y-axis

- Yes ? define axis/y= Y_{int} : Y_{fin}:Δy /npoints=number/units=degrees_n (name)
- Eg:
  - define axis/y=15:15:1/npoints=1/units=degrees_n yaxis.
  - define axis/x=10:15:1/npoints=5/units=degrees_n yaxis
  - define axis/x=10:15:0.5/npoints=11/units=degrees_n yaxis

Define the z-axis

- Yes ? define axis/z= Z_{int} : Z_{fin}:Δz /npoints=number/units=meters (name)
- Eg:
  - define axis/z=0:15:1/npoints=15/units=meters zaxis.
  - Z values can be discrete and need not be continuous, but they should be monotonically increasing.

Define the t-axis

- Yes ? define axis/t= T_{int} : T_{fin}:Δt /npoints=number/units=days (name)
- Eg:
  - define axis/t=1:5:1/npoints=5/units=days taxis.
  - define axis/t="15-jan-2020":"30-jan-2020":1/npoints=15/units=days taxis
  - define axis/t="15-jan":"15-jan":1/npoints=1/units=days taxis (generally for climatology)

Define grid

- Define grid/x=xname/y=yname/z=zname/t=tname/order=xyzt/var="par1,par2,…." filename grid_name
- Eg: define grid/x=xaxis/y=yaxis/z=zaxis/t=taxis/order=xyzt sample_grid

Example of 1D data

- **Let us pick data at central Arabian Sea (lon = 65, lat = 15) corresponding to SST from coads_climatology and create a NetCDF file.**

25.745
26.204
27.184
28.557
29.647
29.184
27.694
26.665
26.964
28.015
27.742
27.186

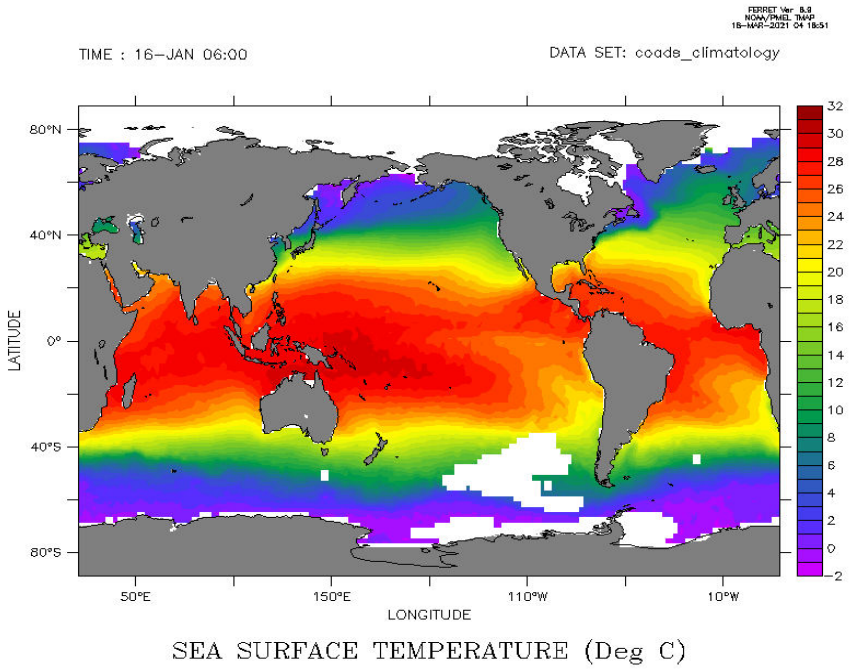
- **Here X and Y are fixed, since it is SST depth is also fixed to surface (or 3 meters say). Only time is varying from Jan – Dec. We need to build the jnl accordingly.**

Sample 1D data

- **yes? define axis/x=65:65:1/npoints=1/units=degrees_e xaxis**
- **yes? define axis/y=15:15:1/npoints=1/units=degrees_n yaxis**
- **yes? define axis/z=3:3:1/npoints=1/units=meters zaxis**
- **yes? define axis/t="01-Jan-2009":"31-Dec-2009":1/npoints=365/units=days taxis**
- **yes? define grid/x=xaxis/y=yaxis/z=zaxis/t=taxis onedgrid**
- **yes? file/var="sst"/grid=onedgrid TMI_SST.dat**
- **yes? save/file=MB_Data.nc sst**
- **LISTing to file MB_Data.nc**

Example of 2D data

- **Let us pick data corresponding to SST from coads_climatology for the month of Jan and create a NetCDF file.**



- **Here X and Y are varying from 30 – 120 and -30 - 30, since it is SST depth is fixed to surface. Time is also fixed to be January. We need to build the jnl accordingly.**

Saving sample 2D data

- Use list command to list the data to a file:
- Yes? Use coads_climatology
- Yes? Set region/x=30:120/y=-30:30
- Yes? List/format=(2F9.2,F9.3) x[gx=sst],y[gy=sst],missing(sst[l=1],9999.000)
- The output can be save in a file which can be used.

Creation of 2D NetCDF file

yes? define axis/x=30:120:0.25/npoints=361/units=degrees_e xaxis

yes? define axis/y=-30:30:0.25/npoints=241/units=degrees_n yaxis

yes? define axis/z=0:0:1/npoints=1/units=meters zaxis

yes? define axis/t="15-Jan-2010":"15-Jan-2010":1/npoints=1/units=days taxis

yes? define grid/x=xaxis/y=yaxis/z=zaxis/t=taxis twodgrid

yes? file/var="lon,lat,sst"/grid=twodgrid TMI_2Dsst.dat

yes? save/file=TwoD_Data.nc sst

LISTing to file Two_Data.nc