Tutorial 3: Quick plots with ferret

Ferret:

Ferret is an interactive computer visualization and analysis environment designed to meet the needs of oceanographers and meteorologists analyzing large and complex gridded data sets. It runs on most Unix systems, and on Windows XP/NT/9x using X windows for display. It can transparently access extensive remote Internet data bases using OPeNDAP (formerly known as DODS); see http://www.unidata.ucar.edu/packages/dods/.

Ferret was developed by the Thermal Modeling and Analysis Project (TMAP) at PMEL in Seattle to analyze the outputs of its numerical ocean models and compare them with gridded, observational data. The model data sets are generally multi-gigabyte in size with mixed 3 and 4-dimensional variables defined on staggered grids. Ferret offers a Mathematica-like approach to analysis; new variables may be defined interactively as mathematical expressions involving data set variables. Calculations may be applied over arbitrarily shaped regions. Fully documented graphics are produced with a single command.

Many excellent software packages have been developed recently for scientific visualization. The features that make Ferret distinctive among these packages are Mathematica-like flexibility, geophysical formatting, "intelligent" connection to its data base, memory management for very large calculations, and symmetrical processing in 4 dimensions.

Ferret is widely used in the oceanographic community to analyze data and create publication quality graphics. We have compiled an (incomplete) list of publications where the authors felt that the contribution of Ferret was sufficient to warrant an acknowledgment. We appreciate your acknowledgment of Ferret in your publications. Here is a suggested acknowledgment that you may use.

Official website: http://ferret.wrc.noaa.gov/Ferret/

Online tutorial: http://ferret.pmel.noaa.gov/Ferret/documentation/ferret-tutorials

Online documentation: http://ferret.pmel.noaa.gov/Ferret/documentation

Online FAQ: http://ferret.pmel.noaa.gov/Ferret/faq

Using ferret on the geog servers

In your HOMEDIR open the file .bash_profile and add these lines (dave you already have it):

######################################

Ferret paths

######################################

export FER_DIR=/usr/local/ferret

export FER_DSETS=/usr/local/ferret

Default Ferret

export FER_EXTERNAL_FUNCTIONS=$FER_DIR/ext_func/libs

FER_GO='/usr/local/ferret/go /usr/local/ferret/examples/usr/local/ferret/contrib'

export FER_GO

FER_DATA='/usr/local/ferret/data /usr/local/ferret/go /usr/local/ferret/examples /usr/local/ferret/contrib'

export FER_DATA

export FER_DESCR=$FER_DSETS/descr

export FER_GRIDS=$FER_DSETS/grids

export TMAP=$FER_DIR/fmt

export PLOTFONTS=$FER_DIR/ppl/fonts

export SPECTRA=$FER_DIR/ppl   # for old ferret versions

export FER_PALETTE=$FER_DIR/ppl   # palette search list

######################################

#PATH variable

######################################

#PATH=$PATH:$HOME/bin:$HOME/ncl_ncarg-5.0.0/bin:$FER_DIR/bin

PATH=$PATH:$HOME/bin:/usr/local/bin:$FER_DIR/bin

To launch ferret type: ferret&

You will normally have a blue terminal in which you can type your ferret command

Ferret commands:

Read files: use "path/file.nc"

Example

yes? use "/home/caminade/Obs/NCEP/psl_1m_194801_200801_NCEP.nc"

if you type cancel data/all

this will delete all variables in memory (important if you get lost)

Print informations about a specific dataset:

yes? show data

yes? sh d (shortcut)

This will print:

currently SET data sets:

 1> /home/caminade/Obs/NCEP/psl_1m_194801_200801_NCEP.nc (default)

name	title	I	J	K	L
PSL	Sea Level Pressure	1:144	1:73	...	1:721

The name of the variable is PSL, **I** is the index of the longitude dimension, **J** the index for the latitude dimension, **L** the index for the time dimension. If you have a 4D file (like the zonal winds at all levels, the **K** dimension will be the vertical dimension).

The **D** dimension is the data degree level

If you open more than one file for example:

yes? use "/home/caminade/Obs/NCEP/psl_1m_194801_200801_NCEP.nc"

yes? use "/home/caminade/Obs/NCEP/tas_1m_194801_200801_NCEP.nc"

you will have to write PSL[d=1] first file to be opened

and TAS[d=2] second file to be opened

List informations about a specific dataset:

Command LIST

Example LIST PSL[d=1,i=1,j=1] will list the first grid point values for the whole time period

Starting to plot the basic commands:

Normally the general syntax is

shade/option1/option2/option3... VAR[d=?,l=?]

The variable you want to shade must be 2D (for a contour plot) and 1D for a time serie plot thus you need to specify a specific time step...

shade (shading contour plot)

contour (contour lines)

fill (filled contour plot)

vector (plot arrows)

plot (plot 1D time serie)

1) CONTOUR PLOTS (fill, shade and contour):

Example: shade PSL[d=1,l=1] will display the sea level pressure contour shading for Jan 1948

The informations about the file are then included in the plot.

Type: go land 7 to display the country boundaries

Several options are available (see the online documentation) here are the most useful:

fill/x=-40:80/y=-40:40/lev=(996,1028,2) PSL[d=1,l=8] (august 1948)

contour/over/ x=-40:80/y=-40:40/lev=(996,1028,2) PSL[d=1,l=8] (add the line contours as overlaid)

go land 7 (display the continent)

you can setup the domain by entering the lon range/ x=-40:80 and the lat range /y=-40:40

(this is also true for vertical sections).

The /lev command allows you to fix the contour ranges /over means you overlay the plot on the former one.

Note you can add /palette=selected_palette if you want to change the color palette

To see the available palette type *spawn "ls $FER_PALETTE"*

fill/x=-40:80/y=-40:40/lev=(996,1028,2)/palette=no_blue PSL[l=1,d=1]

Lots of things can then be done, just see the command references (shade for example):

http://ferret.pmel.noaa.gov/Ferret/documentation/users-guide/commands-reference/

2) 1D PLOT (plot):

Let say you want to plot the grid point lat=10N, lon=0 (somewhere in Africa)

Then type (after opening the two files see above):

plot TAS[d=2,x=0,y=10]

Lots of options are available for plot see

http://ferret.pmel.noaa.gov/Ferret/documentation/users-guide/commands-reference/PLOT

3) VECTOR PLOT (vector):

First clean everything by typing:

cancel data/all

cancel window/all

then use the zonal and meridional wind from NCEP by typing:

use "/home/caminade/Obs/NCEP/ua_1m_194801_200801_NCEP.nc"

use "/home/caminade/Obs/NCEP/va_1m_194801_200801_NCEP.nc"

type sh d

then you will see that the winds are 4D (i=lon, j=lat, k=lev,l=time)

set window 1

vector/x=-40:80/y=-40:40 UWND[k=16,l=8,d=1],VWND[k=16,l=8,d=2]

For vector you need 2 components vector U,V

Lots of options are available for vector see

http://ferret.pmel.noaa.gov/Ferret/documentation/users-guide/commands-reference/VECTOR

Defining variables and doing math processing:

Ferret is not a proper language but it allows to do few things (especially if you combine it with NCO)

Generally you can do operations on variables

Type again sh d

The zonal and meridional wind from NCEP should still be in memory:

  1> /home/caminade/Obs/NCEP/ua_1m_194801_200801_NCEP.nc

 name   title   I   J   K   L

 UWND   Monthly mean u wind   1:144   1:73   1:17   1:721

   2> /home/caminade/Obs/NCEP/va_1m_194801_200801_NCEP.nc (default)

 name   title   I   J   K   L

 VWND   Monthly mean v wind   1:144   1:73   1:17   1:721

In ferret you can use several transformations and functions to perform averages, summing, standard deviation, interpolation etc...

List of transformations:

http://ferret.pmel.noaa.gov/Ferret/documentation/users-guide/variables-xpressions/XPRESSIONS#_VPID_148

List of functions:

http://ferret.pmel.noaa.gov/Ferret/documentation/users-guide/variables-xpressions/XPRESSIONS#_VPID_91

For example you can perform the total average as a function of time and plot it directly:

vector/x=-40:80/y=-40:40 UWND[k=16,d=1,l=@ave],VWND[k=16 ,d=2,l=@ave]

go land 7

@ave means you are averaging all values in the l(time) dimension so roughly the annual mean for the whole time period.

Another example:

fill/lev=(-35,45,5)/palette=centered UWND[d=1,x=-16:20@ave,l=7:9@ave]

contour/over/lev=(-35,45,5) UWND[d=1,x=-16:20@ave,l=7:9@ave]

This provide the vertical section of the zonal wind averaged between 16W and 20E, and for the season JJA in 1948. You can see the westerly jets and the tropical easterly jet

Define new variable:

let TOTO=VWND[d=2,l=1:12@ave,x=@ave] (zonal mean and time mean for the first year, the first 12 months)

sh var (show variable) will diplay the informations about TOTO

then you can plot TOTO like:

fill/lev=(-2.5,2.5,0.5)/palette=light_centered TOTO

You should see the Hadley and Ferrel cells...

SAVE A PLOT:

frame/format=gif/file=toto.gif

will save the plot as gif (be carrefull screen capture so do not overlay your active window with another one)

you can then see the gif under linux by typing:

xl toto.gif &

SAVE A FILE:

file/format=cdf/file=toto.nc TOTO

will save the variable TOTO in a netcdf file in the current dir

you can then see it by typing ncdump –h toto.nc

IMPORTANT SCRIPTING is possible:

You can edit a text file and save the extension as .jnl

Open a file called test.jnl:

nedit test.jnl &

Edit the file like this (copy and paste):

cancel data/all

cancel window/all

use "/home/caminade/Obs/NCEP/ua_1m_194801_200801_NCEP.nc"

use "/home/caminade/Obs/NCEP/va_1m_194801_200801_NCEP.nc"

set window 1

vector/x=-40:80/y=-40:40 UWND[k=16,d=1,l=@ave],VWND[k=16 ,d=2,l=@ave]

go land 7

set window 2

fill/lev=(-2.5,2.5,0.5)/palette=light_centered VWND[d=2,l=1:12@ave,x=@ave]

contour/over/lev=(-2.5,2.5,0.5) VWND[d=2,l=1:12@ave,x=@ave]

Then save the file and in ferret type:

go "path_where_you_saved_the_file/test.jnl"

for example one copy of test.jnl is saved on my homedir:

go "/home/caminade/test.jnl"

Then each line is interpreted by ferret

This script will produce 2 plots and will save them as fig1.gif and fig2.gif

I guess you understand what it means....

EXAMPLES AVAILABLE AT:

http://ferret.pmel.noaa.gov/Ferret/documentation/ferret-tutorials

Copy the jnl files to enjoy several examples!!!!