Discovery and Use of Operational Ocean Data Products and Services
06 – 10 March, 2017

Introduction to FERRET

An Analysis Tool for Gridded and Non-Gridded Data

Courtesy: http://www.ferret.noaa.gov/Ferret/

FERRET

An Analysis Tool for Gridded and Non-Gridded Data

- 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

Gridded data sets

- multi-dimensional model outputs
- gridded data products (e.g., climatologies)
- singly dimensioned arrays such as time series and profiles
- scattered n-tuples (optionally, grid-able using Ferret's objective analysis procedures)

Ability of Ferret

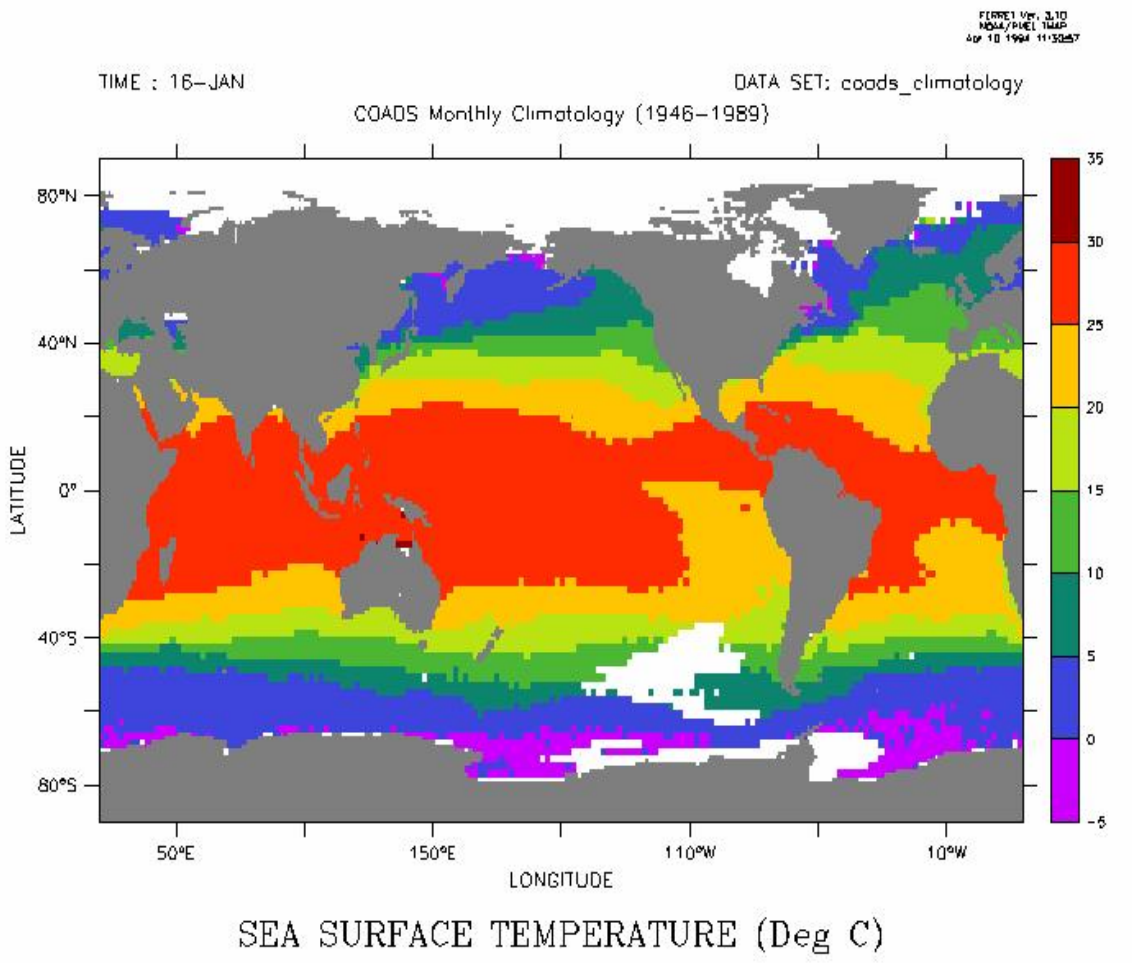
- To define new variables interactively as mathematical expressions involving data set variables and abstract coordinates
  - Density = $\int \rho Cd\ T\ dt$ (ρCd T[z=@din])
  - Anomaly = SST – SST[l=@ave]
  - MLD = temp[z=@loc:0]
- Calculations can be applied over arbitrarily shaped regions.
- external functions written in FORTRAN, C, or C++ can be merged seamlessly into Ferret at runtime.

Data sets Ferret can handle

- FERRET can handle ASCII and Binary data sets. But mainly deals with NetCDF files
- Data can be gridded data or non gridded data.
- Gridded data means data on regular interval with equal spacing in x and y.
  - Eg: A two dimensional SST data on Indian Ocean region can be from 30E – 120E and 30S – 30 N with spacing $\Delta x = 1$ and $\Delta y = 1$.

- Sample gridded data looks like this:

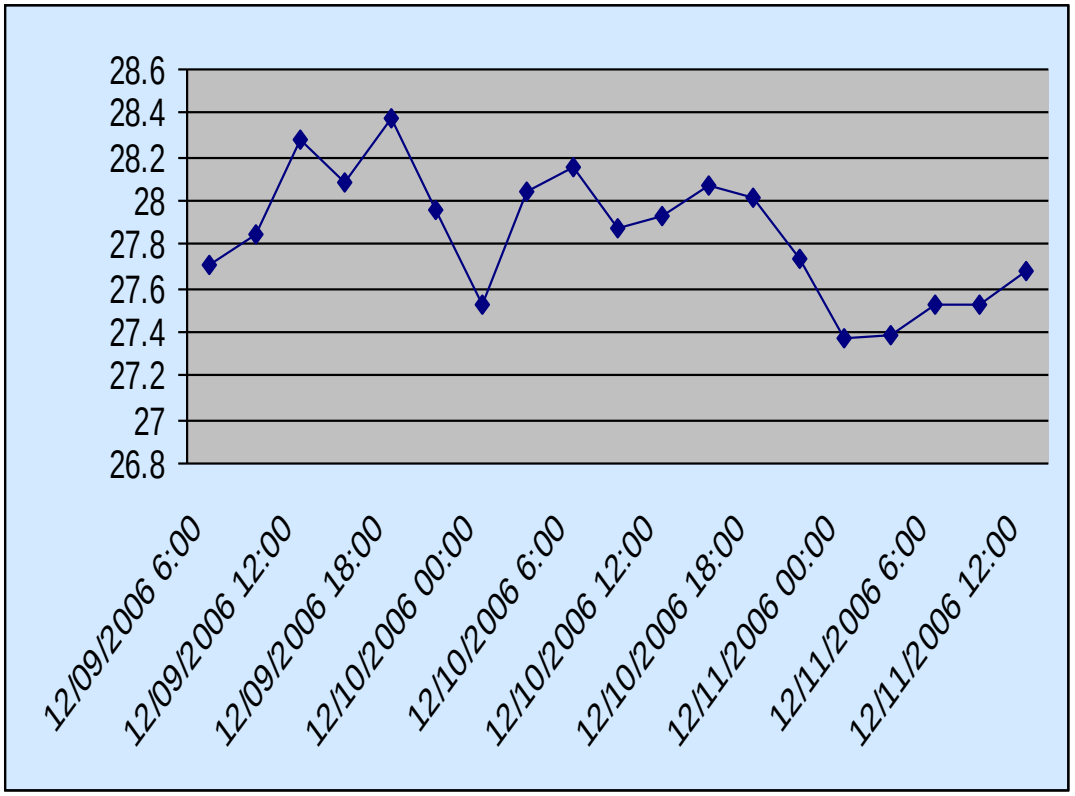
Lon	Lat	SST
30.0	-30.0	19.37
31.0	-30.0	19.32
32.0	-30.0	19.29
---	---	----
---	---	----
30.0	-29.0	19.37
31.0	-29.0	19.32
32.0	-29.0	19.29
---	---	----
---	---	----
---	---	----
---	---	----
30.0	30.0	9999
31.0	30.0	9999
32.0	30.0	9999



- Further Ferret handles 1D, 2D, 3D and 4D dimension data sets
  - Eg: 1D data – SST observation from Buoy
    - (Lon, Lat, Depth fixed Time varying)
  - Eg: 2D data – SST for Arabian Sea (40 – 80E and 0 – 30N)
    - (Lon and Lat varying, Depth and Time fixed)
  - Eg: 3D data – Temperature for Arabian Sea (40 – 80E and 0 – 30N and Z: 0 – 1000 depth) for the month of January
    - (Lon, Lat and Depth varying, Time fixed)
  - Eg: 4D data – Temperature for Arabian Sea (40 – 80E and 0 – 30N and Z: 0 – 1000 depth) for the months January – December
    - (Lon, Lat and Depth, Time all varying)

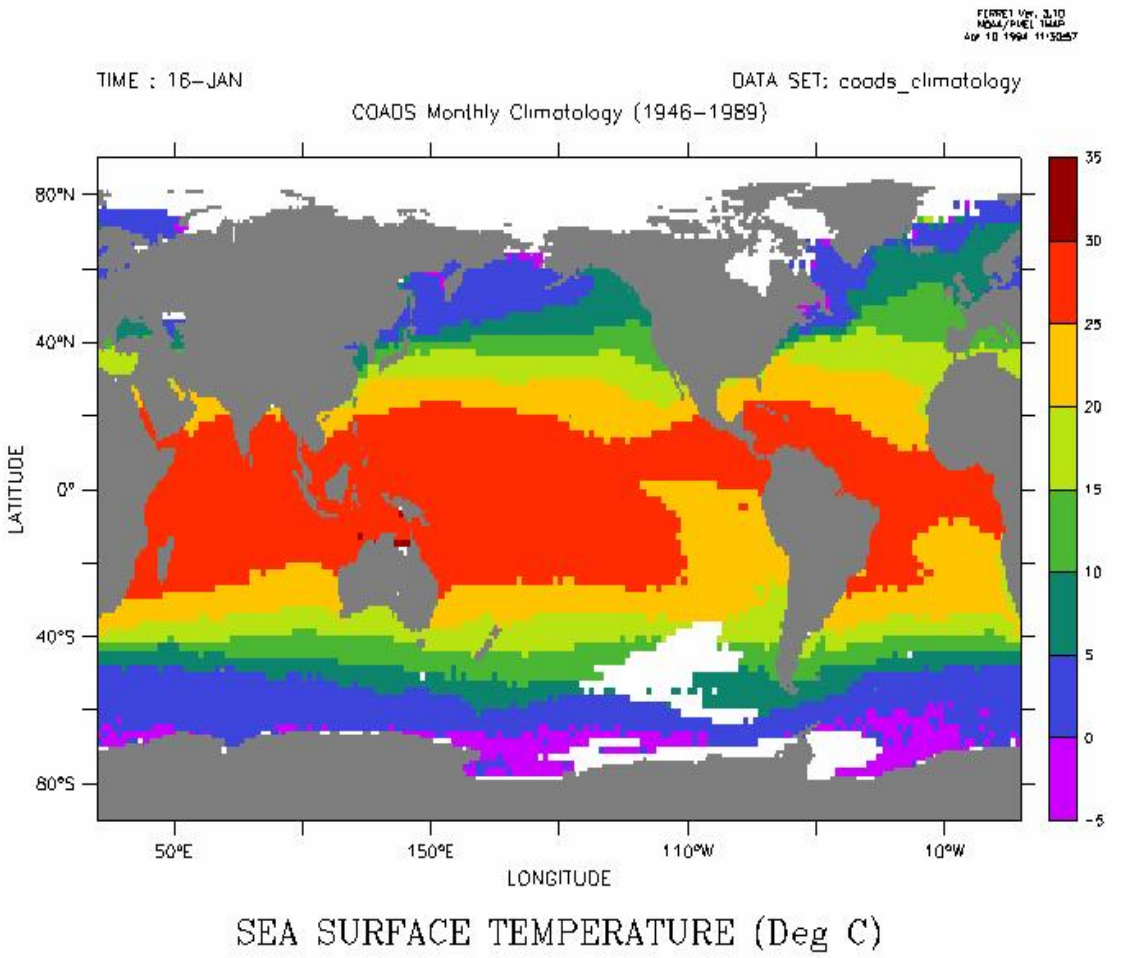
1D data sample

DS01	12/09/2006 6:00	27.71
DS01	12/09/2006 9:00	27.85
DS01	12/09/2006 12:00	28.28
DS01	12/09/2006 15:00	28.09
DS01	12/09/2006 18:00	28.38
DS01	12/09/2006 21:00	27.96
DS01	12/10/2006 00:00	27.52
DS01	12/10/2006 3:00	28.04
DS01	12/10/2006 6:00	28.16
DS01	12/10/2006 9:00	27.88
DS01	12/10/2006 12:00	27.93
DS01	12/10/2006 15:00	28.07
DS01	12/10/2006 18:00	28.01
DS01	12/10/2006 21:00	27.73
DS01	12/11/2006 00:00	27.37
DS01	12/11/2006 3:00	27.38
DS01	12/11/2006 6:00	27.52
DS01	12/11/2006 9:00	27.52
DS01	12/11/2006 12:00	27.68

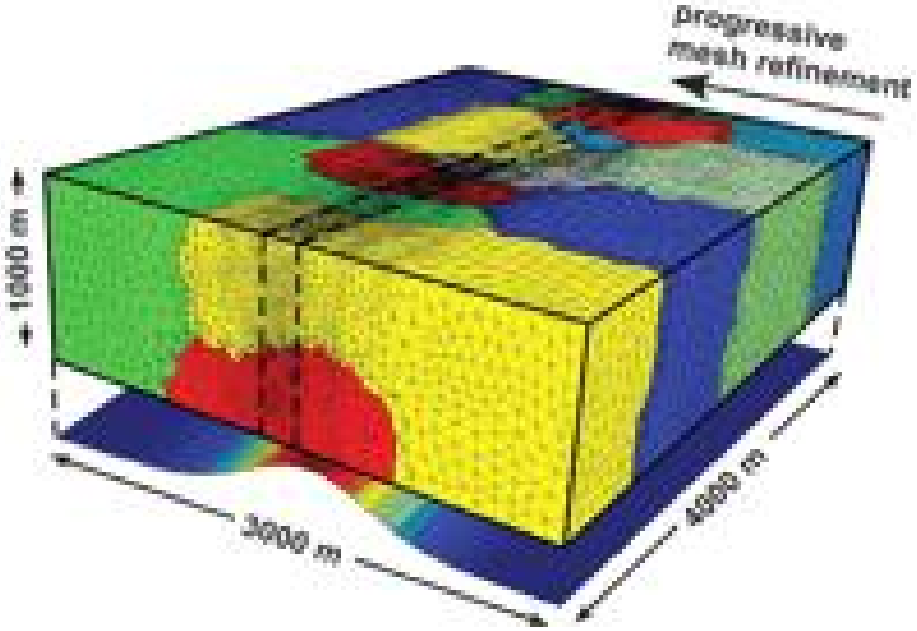


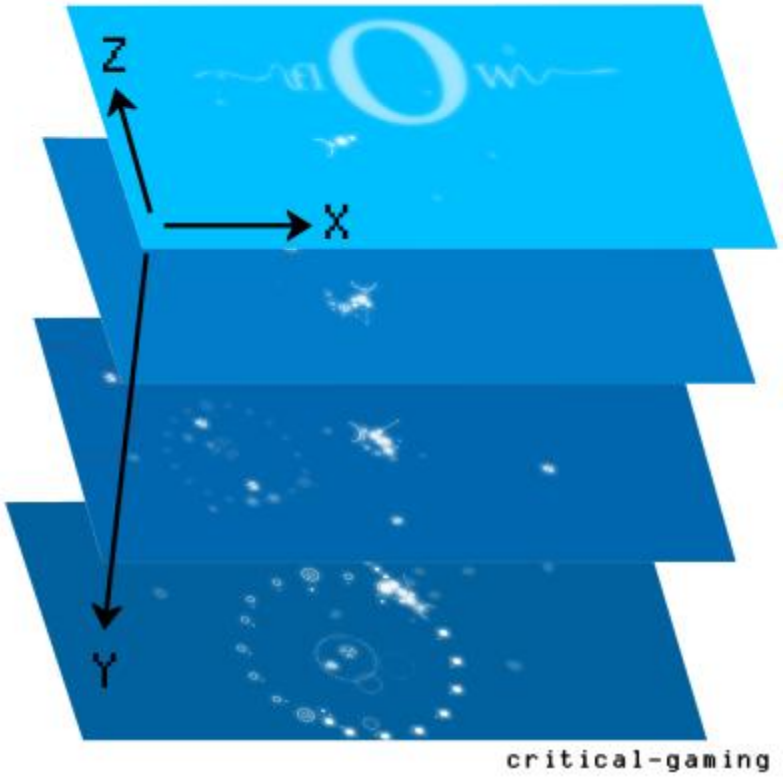
2D sample data

Lon	Lat	SST
30.0	-30.0	19.37
31.0	-30.0	19.32
32.0	-30.0	19.29
---	---	----
---	---	----
30.0	-29.0	19.37
31.0	-29.0	19.32
32.0	-29.0	19.29
---	---	----
---	---	----
---	---	----
---	---	----
30.0	30.0	9999
31.0	30.0	9999
32.0	30.0	9999



3D sample data

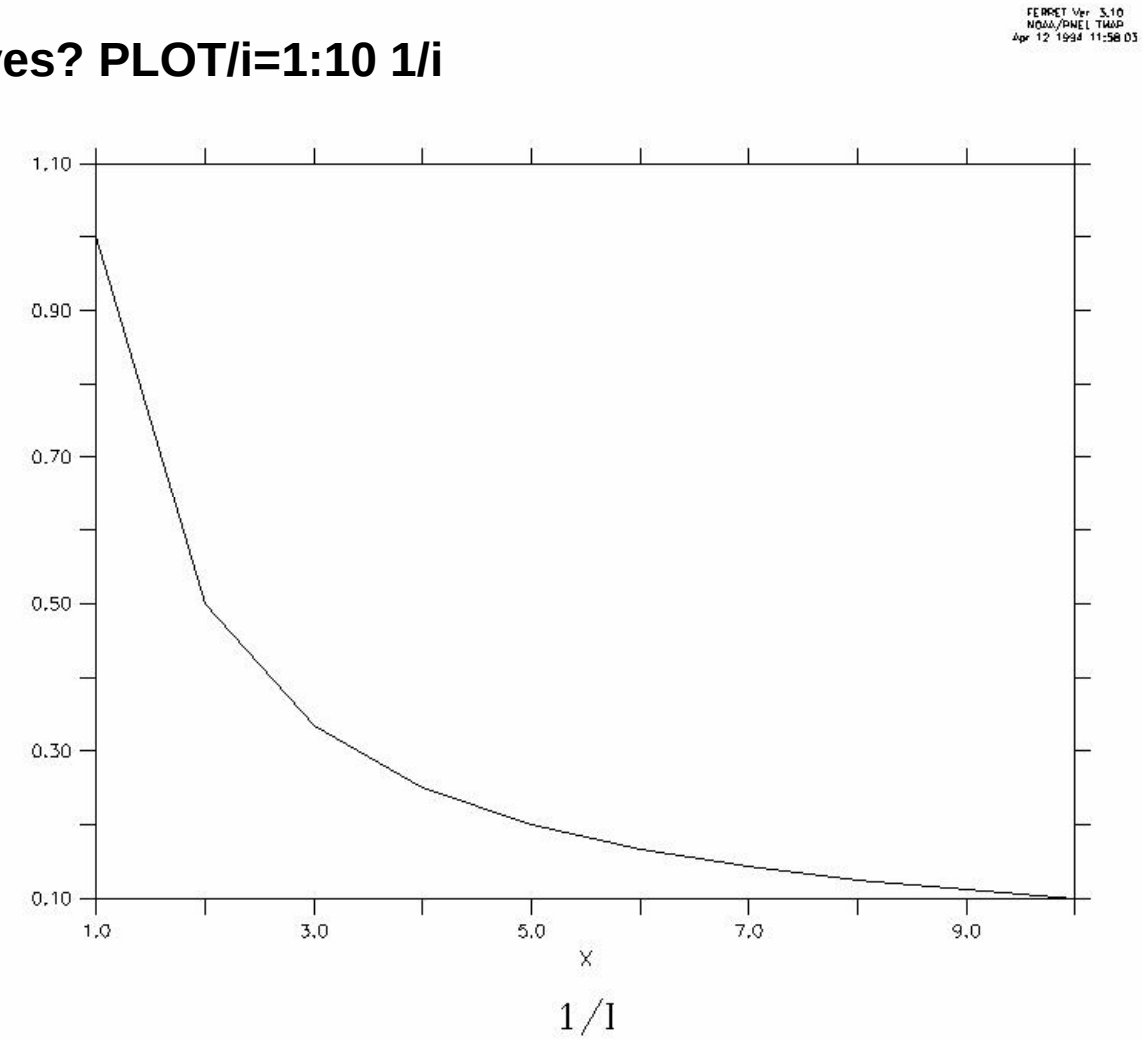




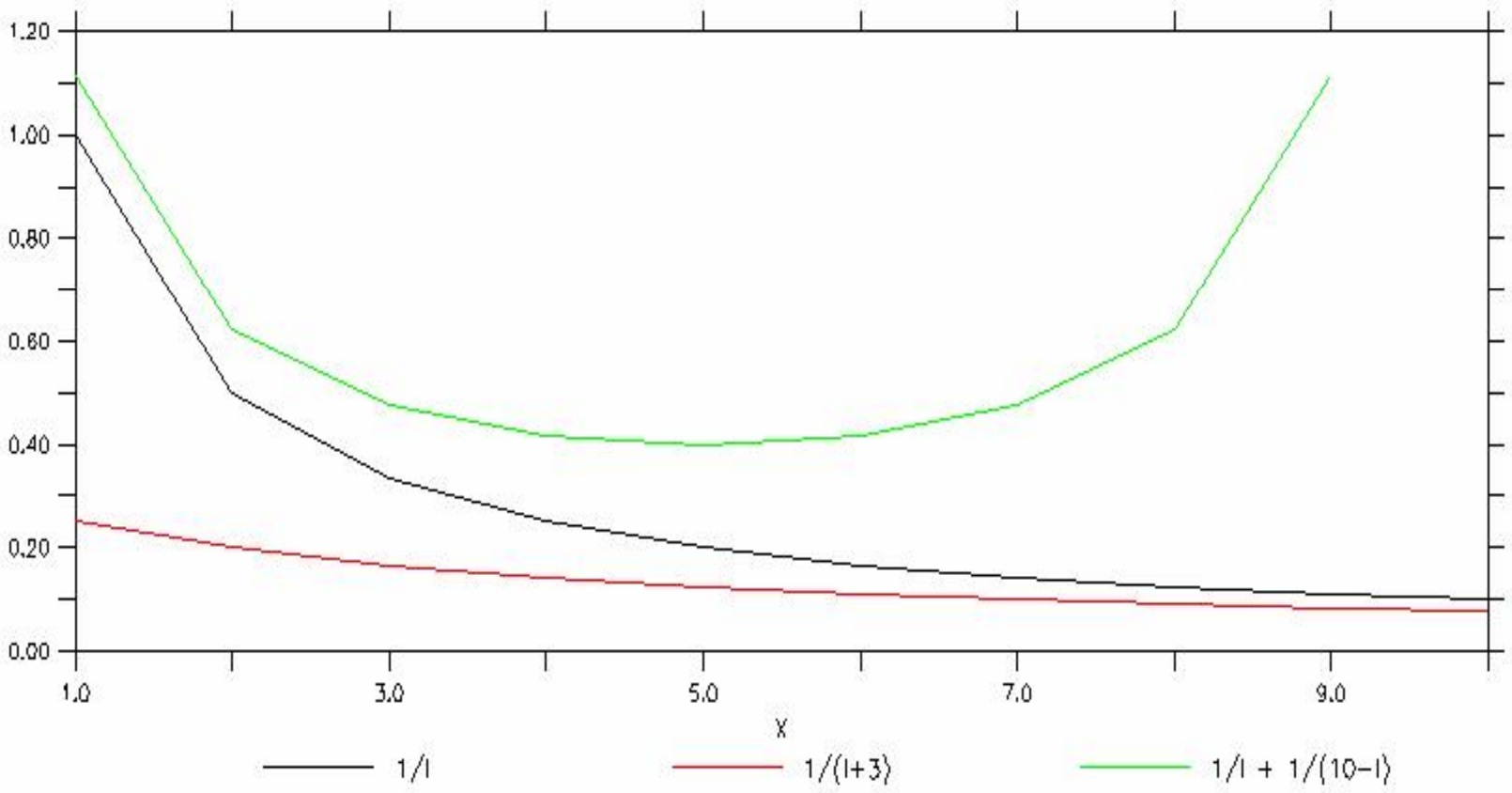
Getting Started

- Quick way know about Ferret is run the tutorial provided with the s/w
  - For this first type ferret at the prompt and enter return key. This will will result in
    - % ferret
      yes?
  - Then give go tutorial at the prompt
    - yes? GO tutorial
  - There are multitude of plots possible with in Ferret

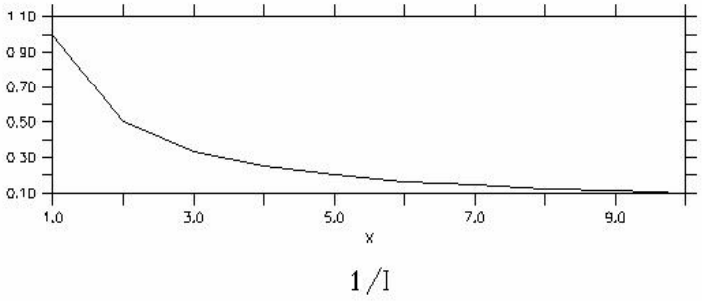
yes? PLOT/i=1:10 1/i

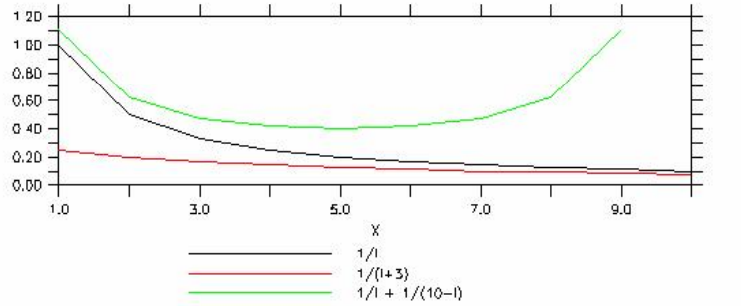


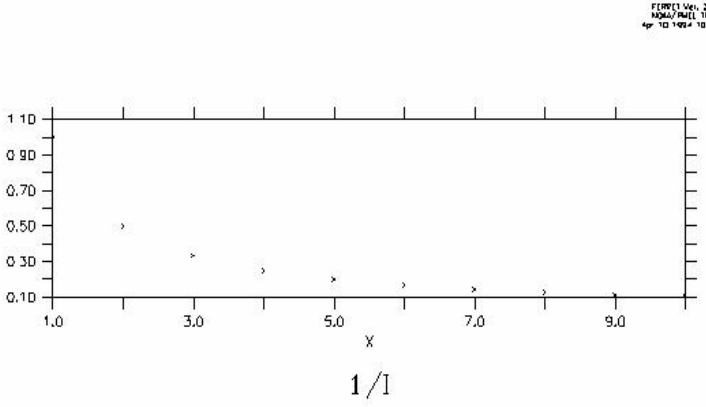
yes? PLOT/i=1:10 1/i, 1/(i+3), 1/i + 1/(10-i)

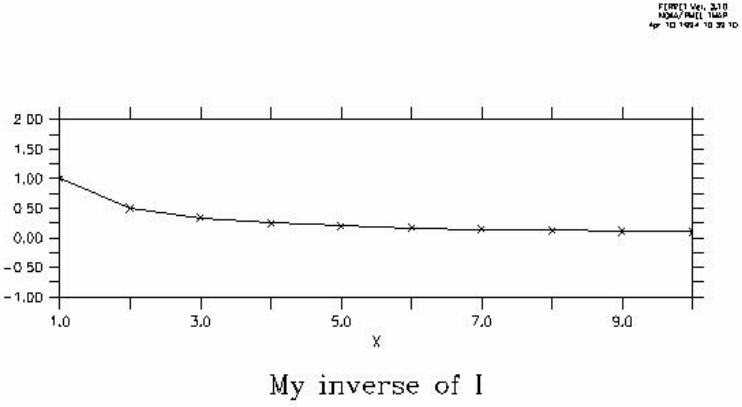


yes? SET WINDOW/SIZE=.9 ! (bigger 'cause there will be 4 plots)
yes? SET VIEWPORT UL yes? PLOT/i=1:10 1/i yes? SET VIEWPORT LL
yes? PLOT/i=1:10/SYMBOLS 1/i yes? SET VIEWPORT LR
yes? PLOT/i=1:10/SYMBOLS=2/LINE/VLIMITS=-1:2:0.25 iinverse
yes? SET VIEWPORT UR yes? PLOT/i=1:10 1/i, 1/(i+3), 1/i + 1/(10-i)

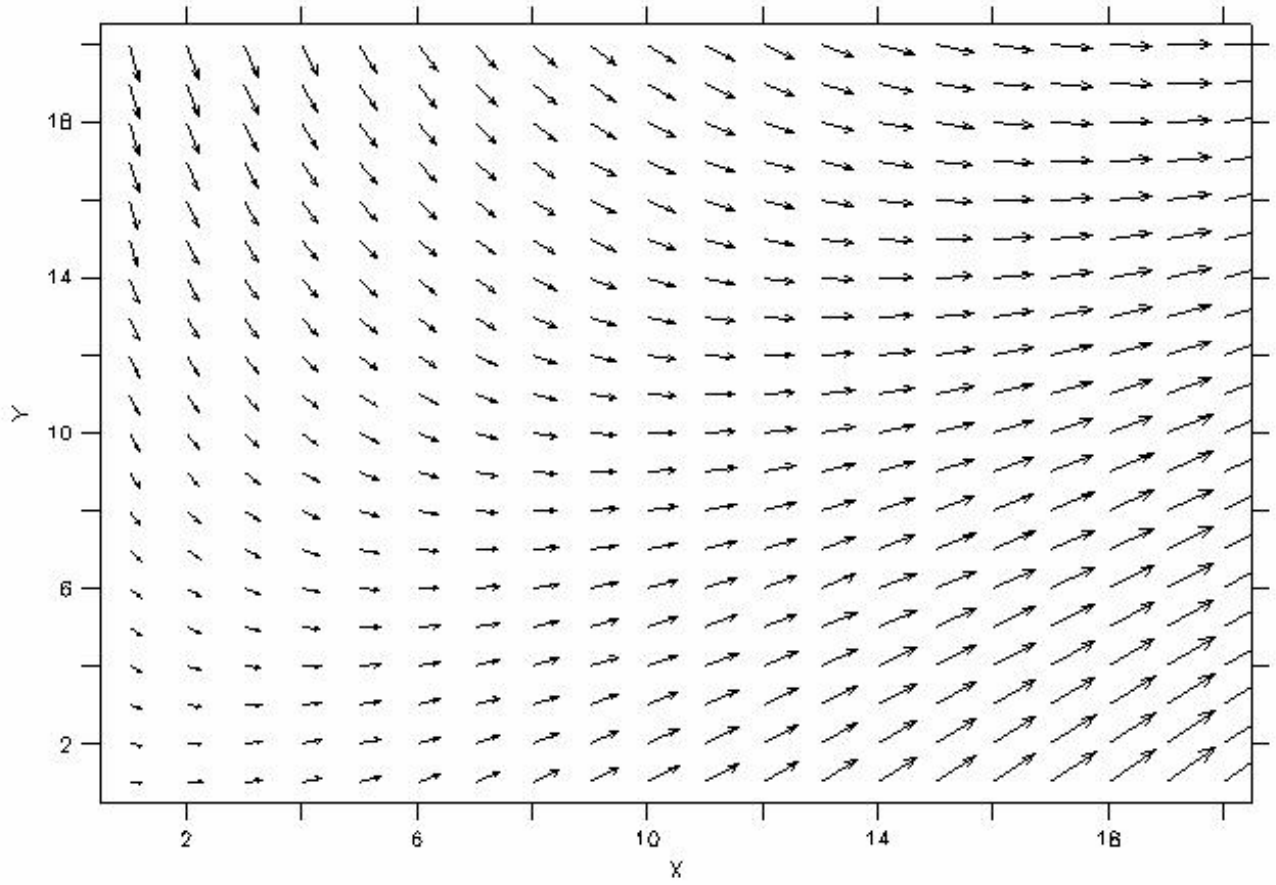




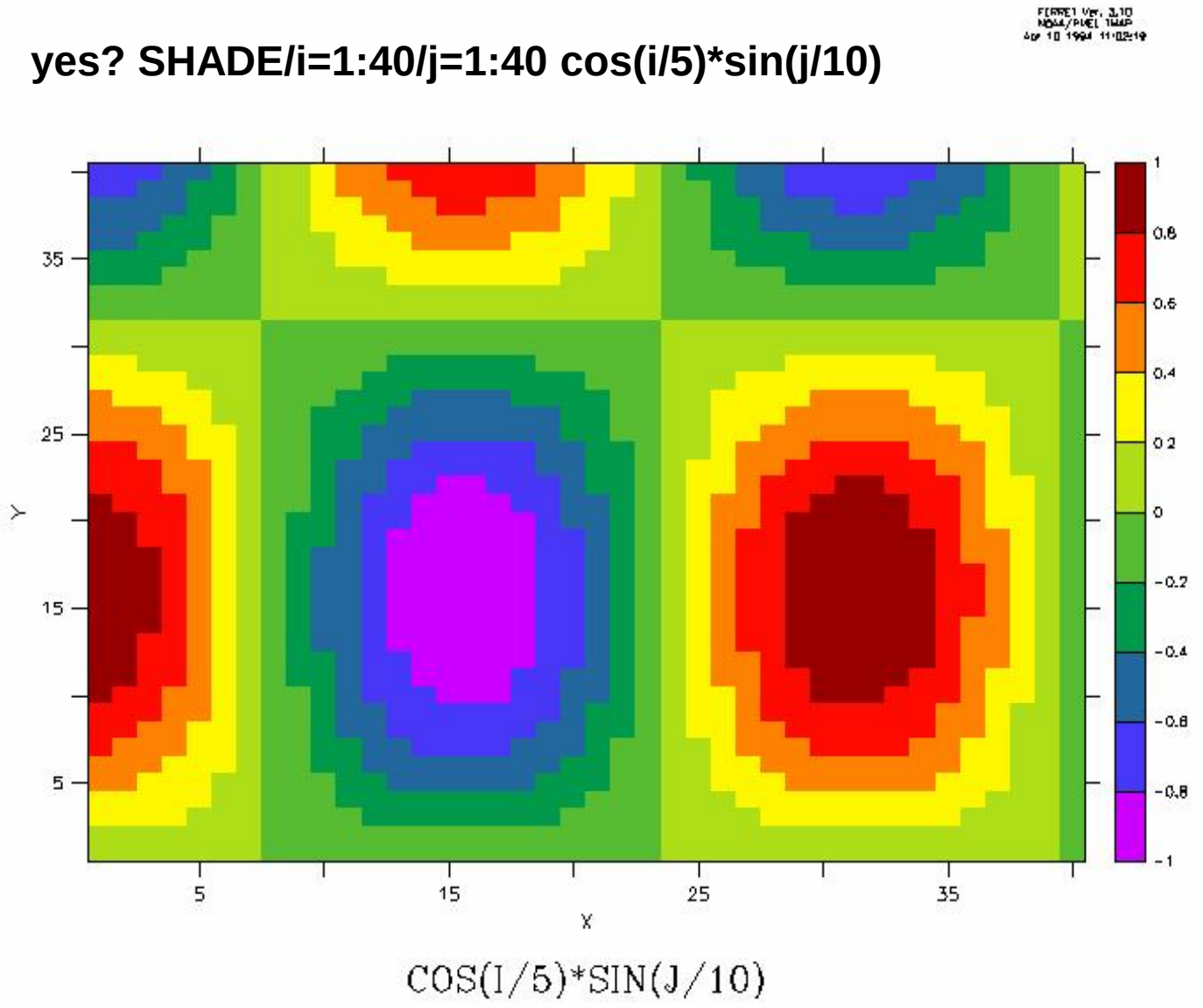




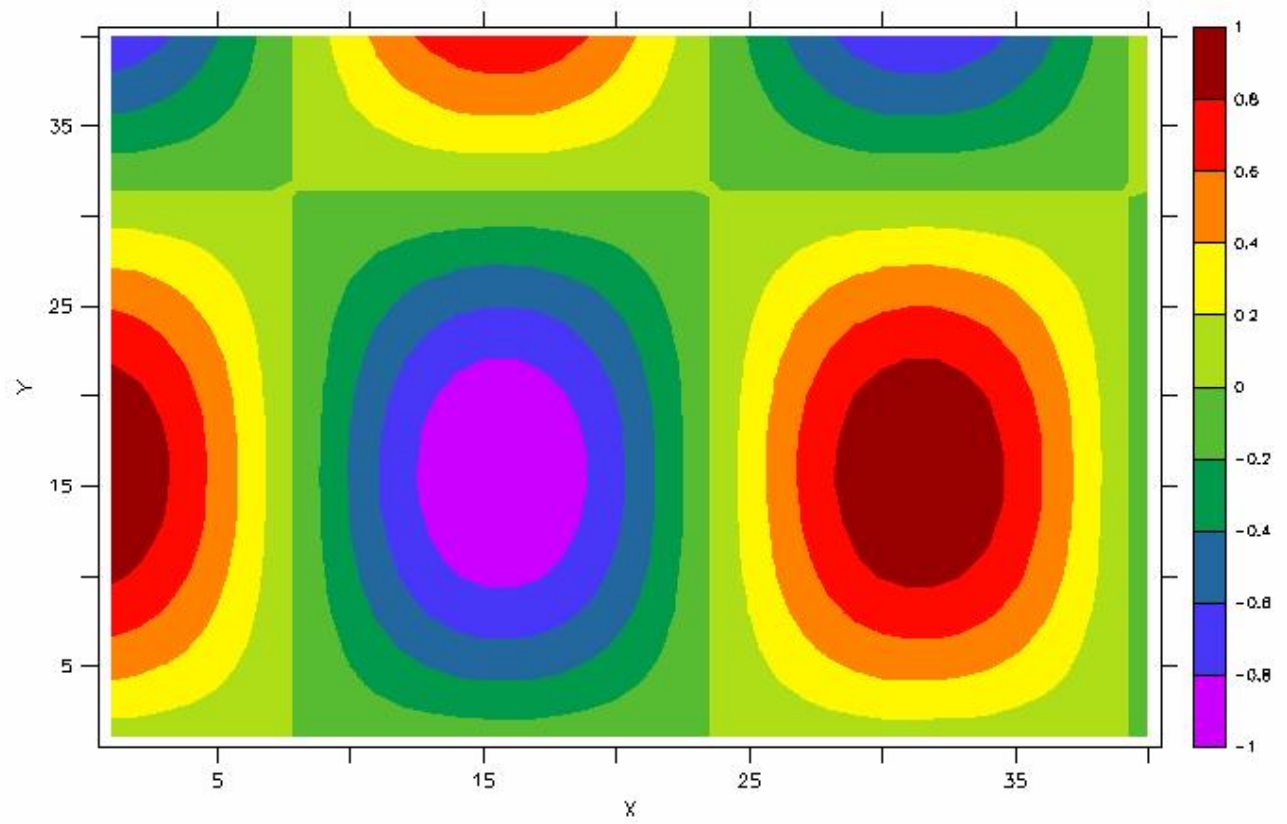
VECTOR/i=1:20/j=1:20 i+cos(j/5)+5,i-j



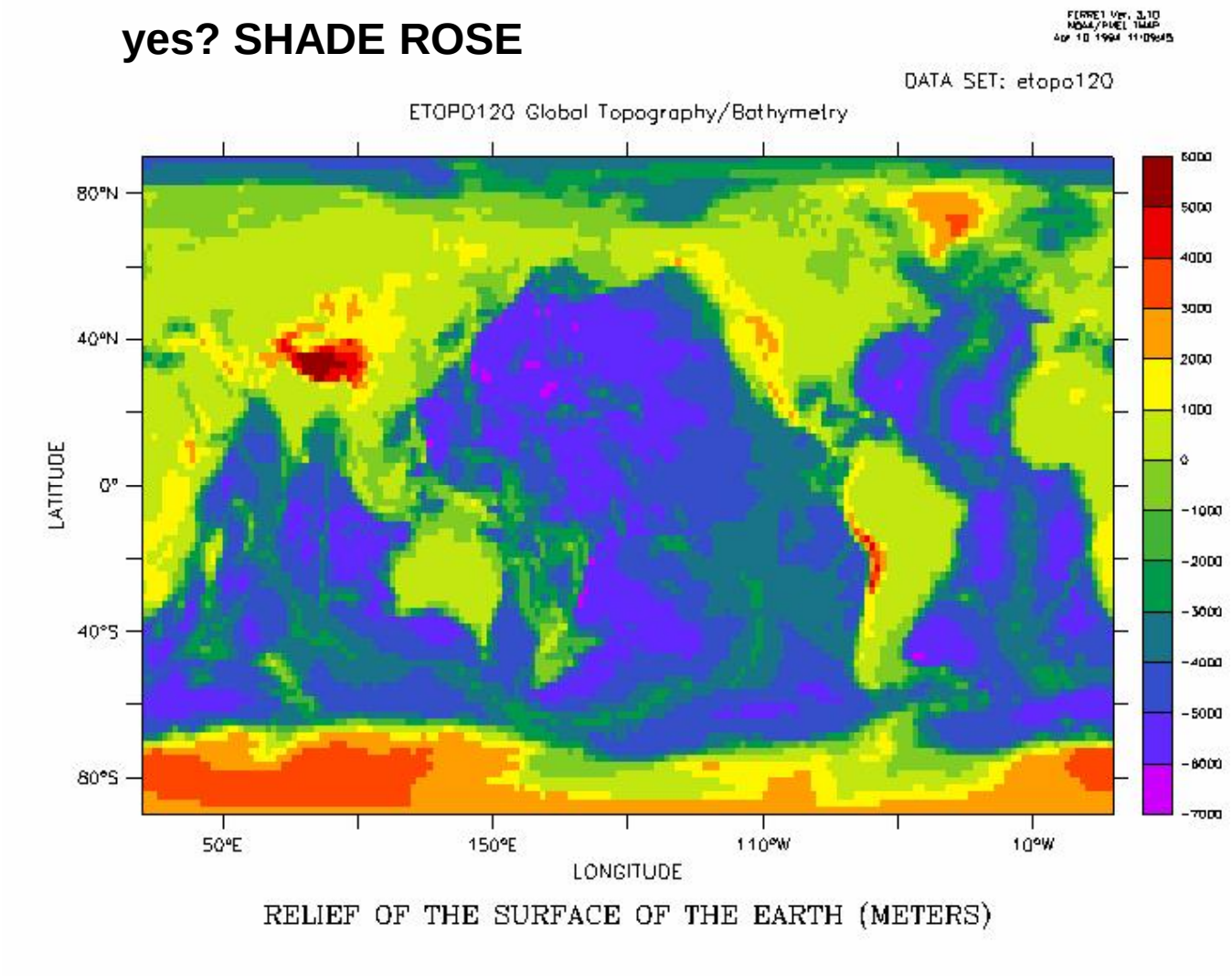
yes? SHADE/i=1:40/j=1:40 cos(i/5)*sin(j/10)



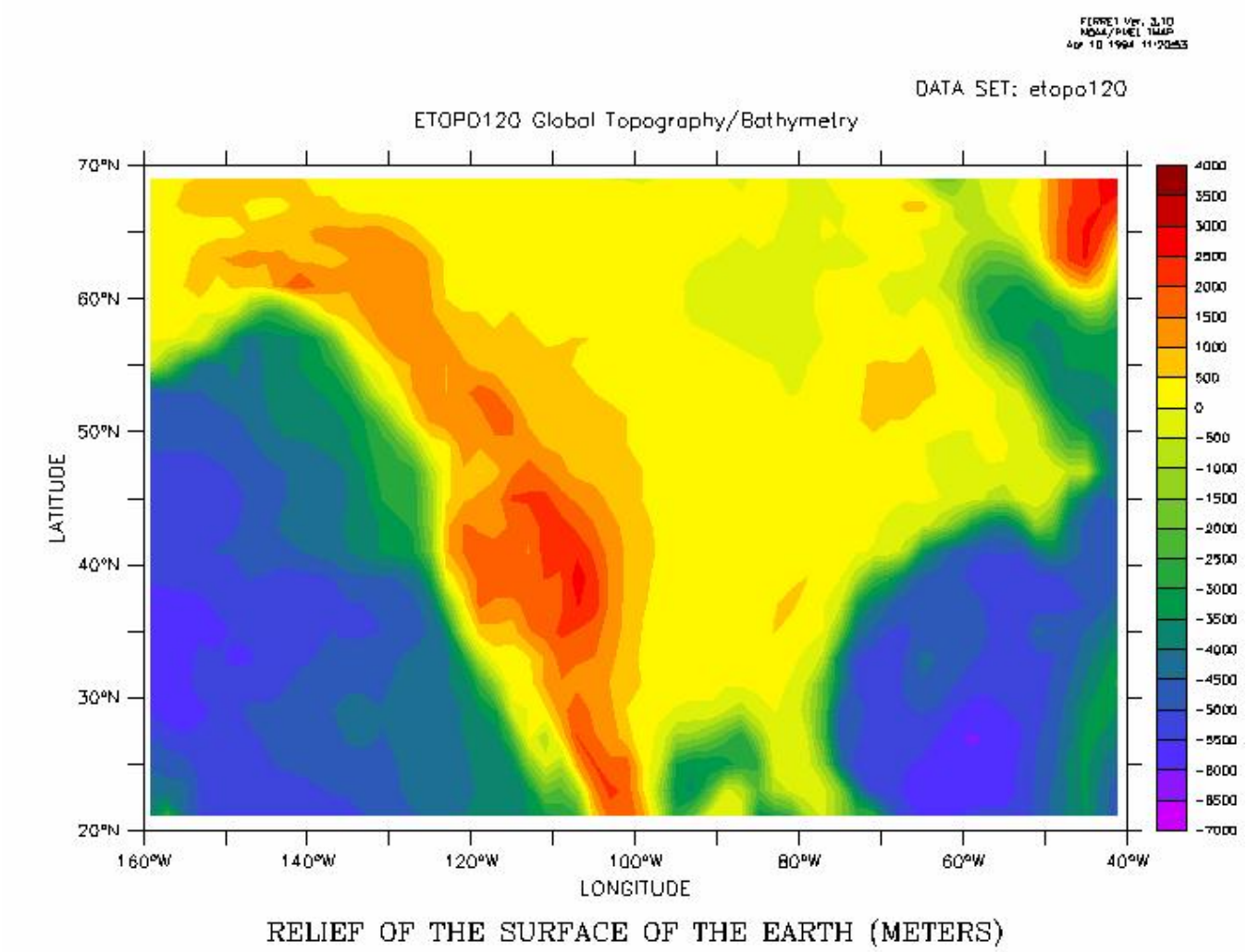
yes? FILL/i=1:40/j=1:40 cos(i/5)*sin(j/10)



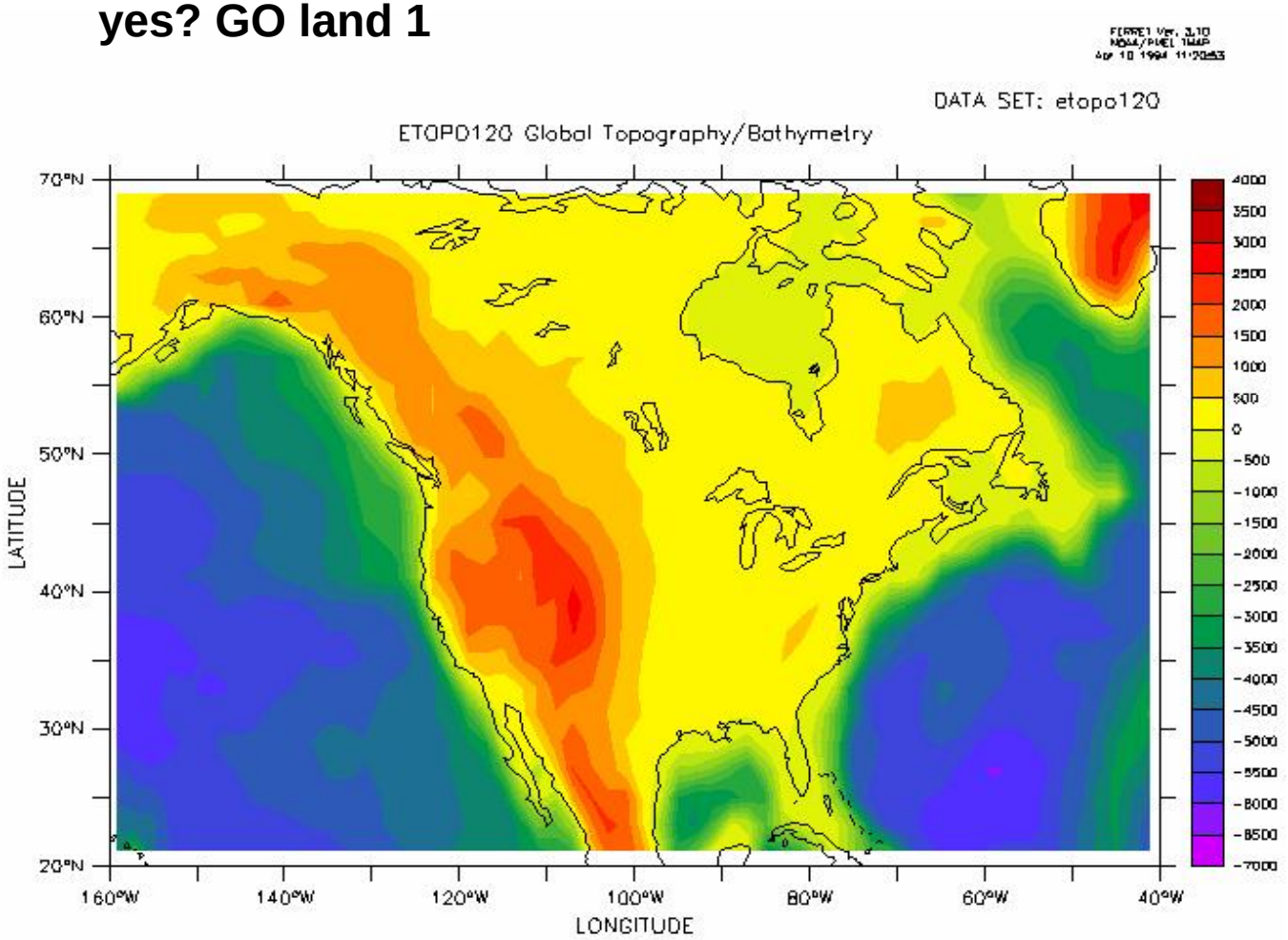
yes? SHADE ROSE



yes? FILL/X=160W:40W/Y=20N:70N/level=(-7000,4000,500) ROSE

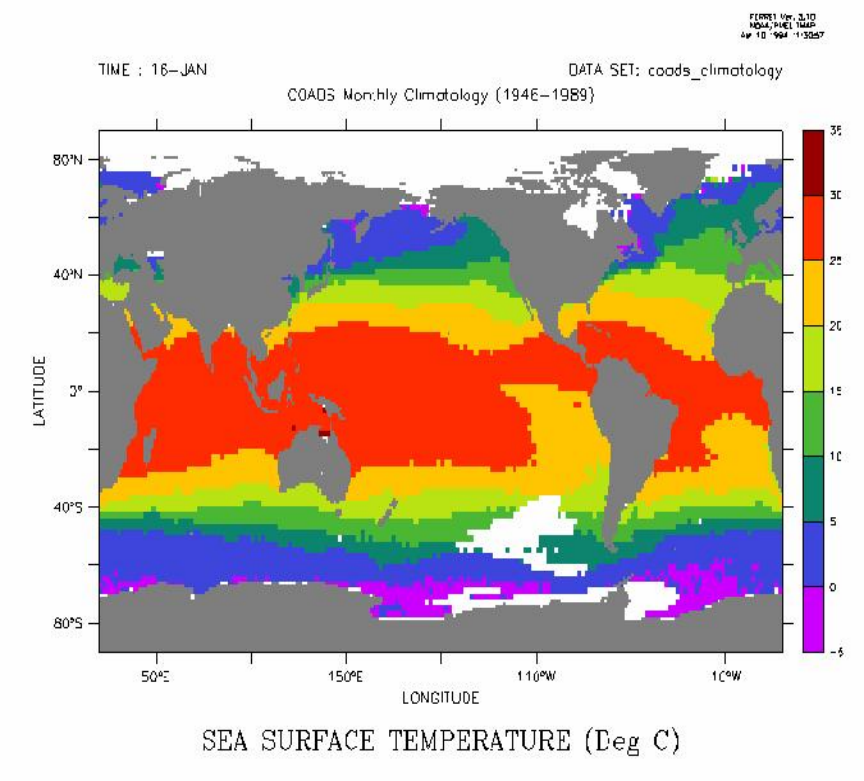


yes? GO land 1

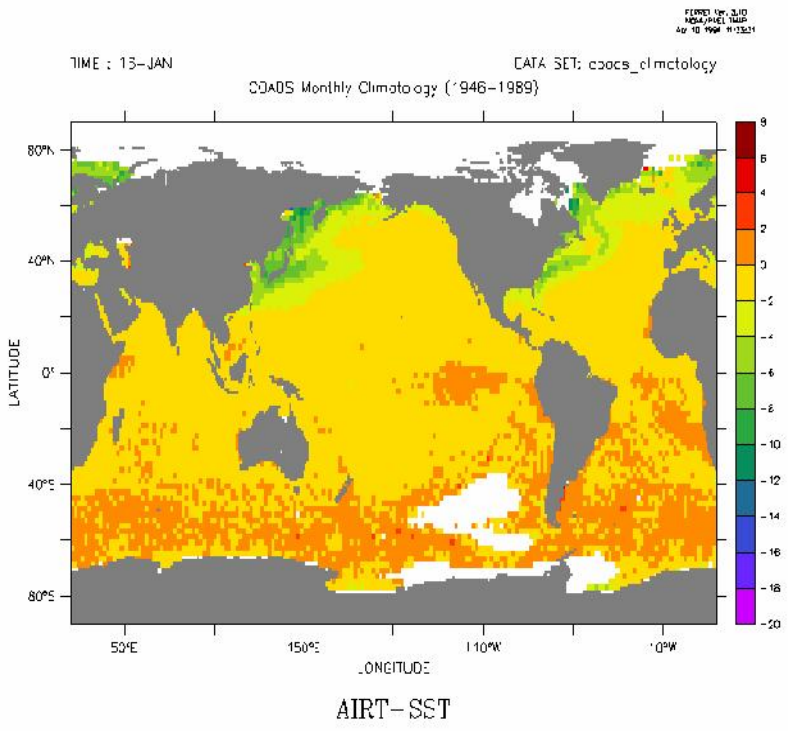


RELIEF OF THE SURFACE OF THE EARTH (METERS)

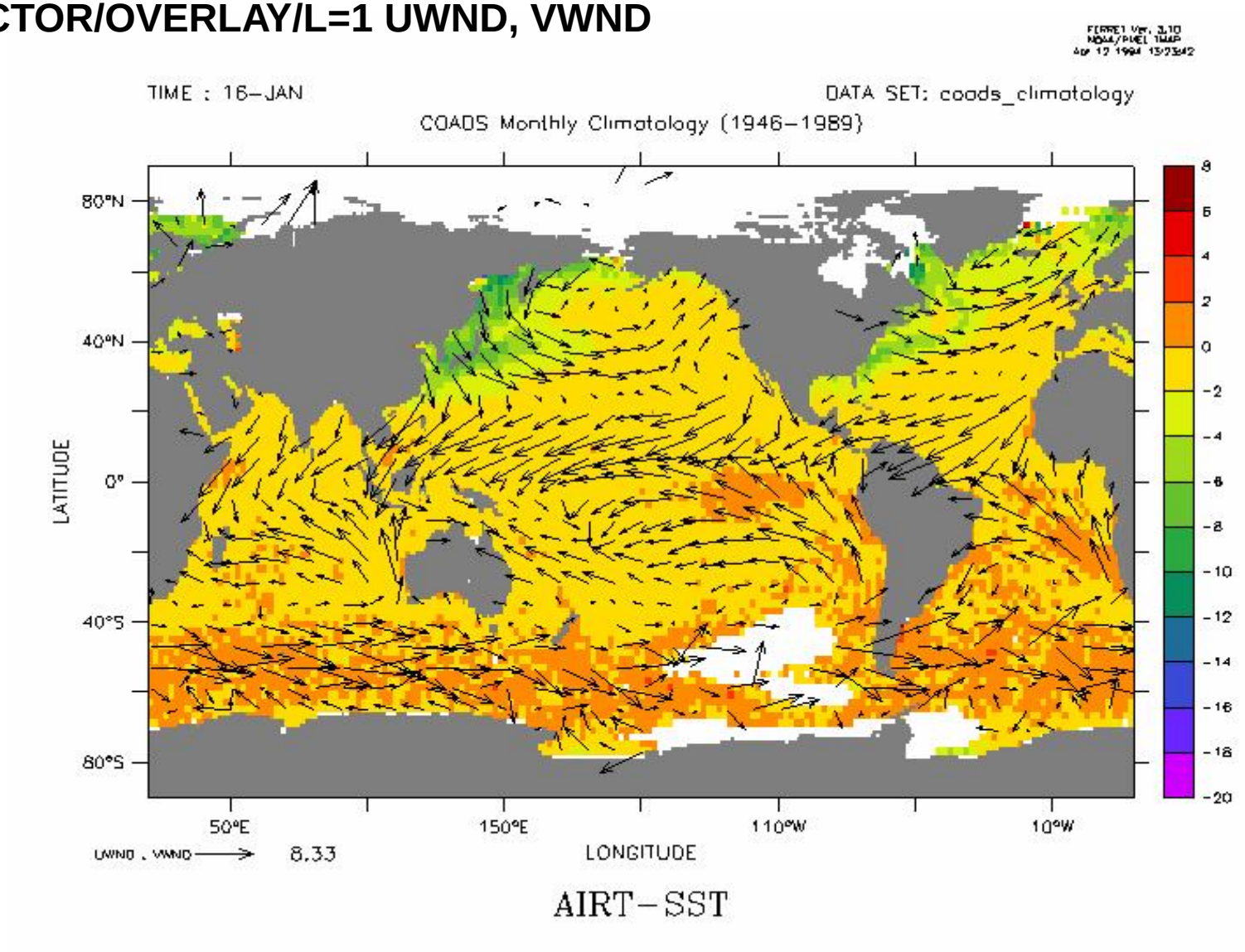
yes? SHADE/L=1 SST
yes? GO fland



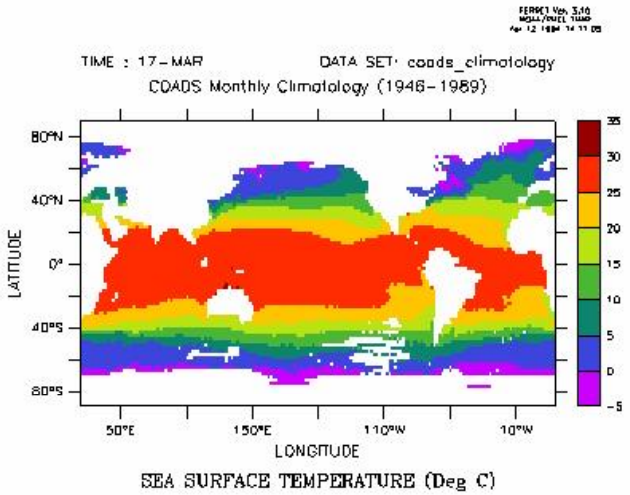
yes? SHADE/L=1 AIRT-SST
yes? GO fland

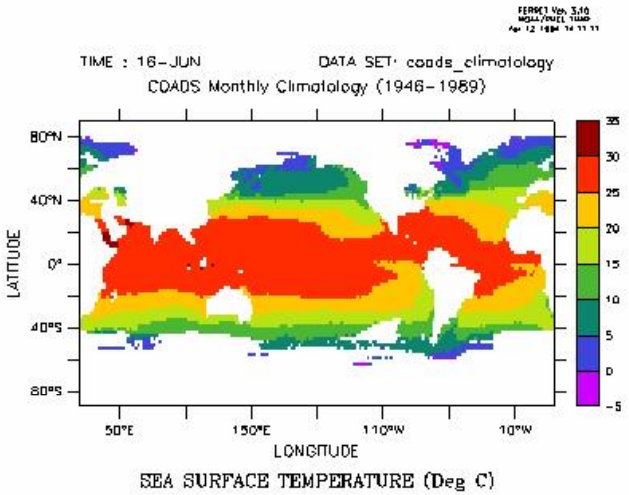


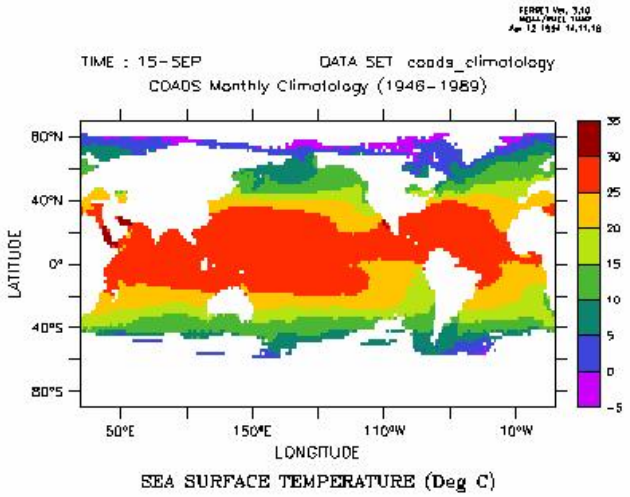
VECTOR/OVERLAY/L=1 UWND, VWND

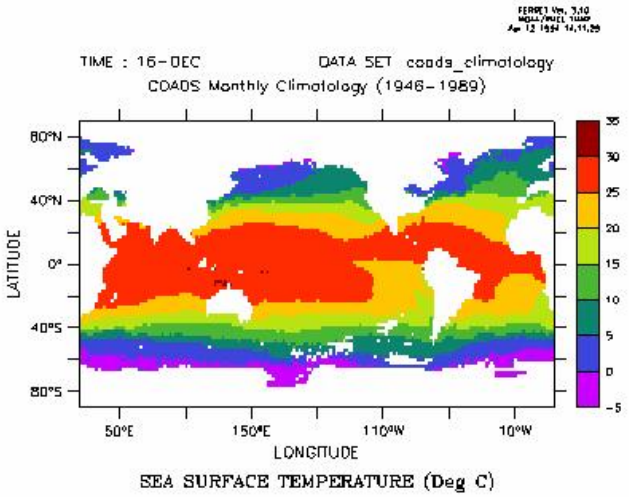


yes? SET WINDOW/SIZE=0.7
yes? SET VIEW Ul
yes? SHADE/L=3 sst
yes? SET VIEW UR
yes? SHADE/L=6 sst
yes? SET VIEW LL
yes? SHADE/L=9 sst
yes? SET VIEW LR
yes? SHADE/L=12 sst

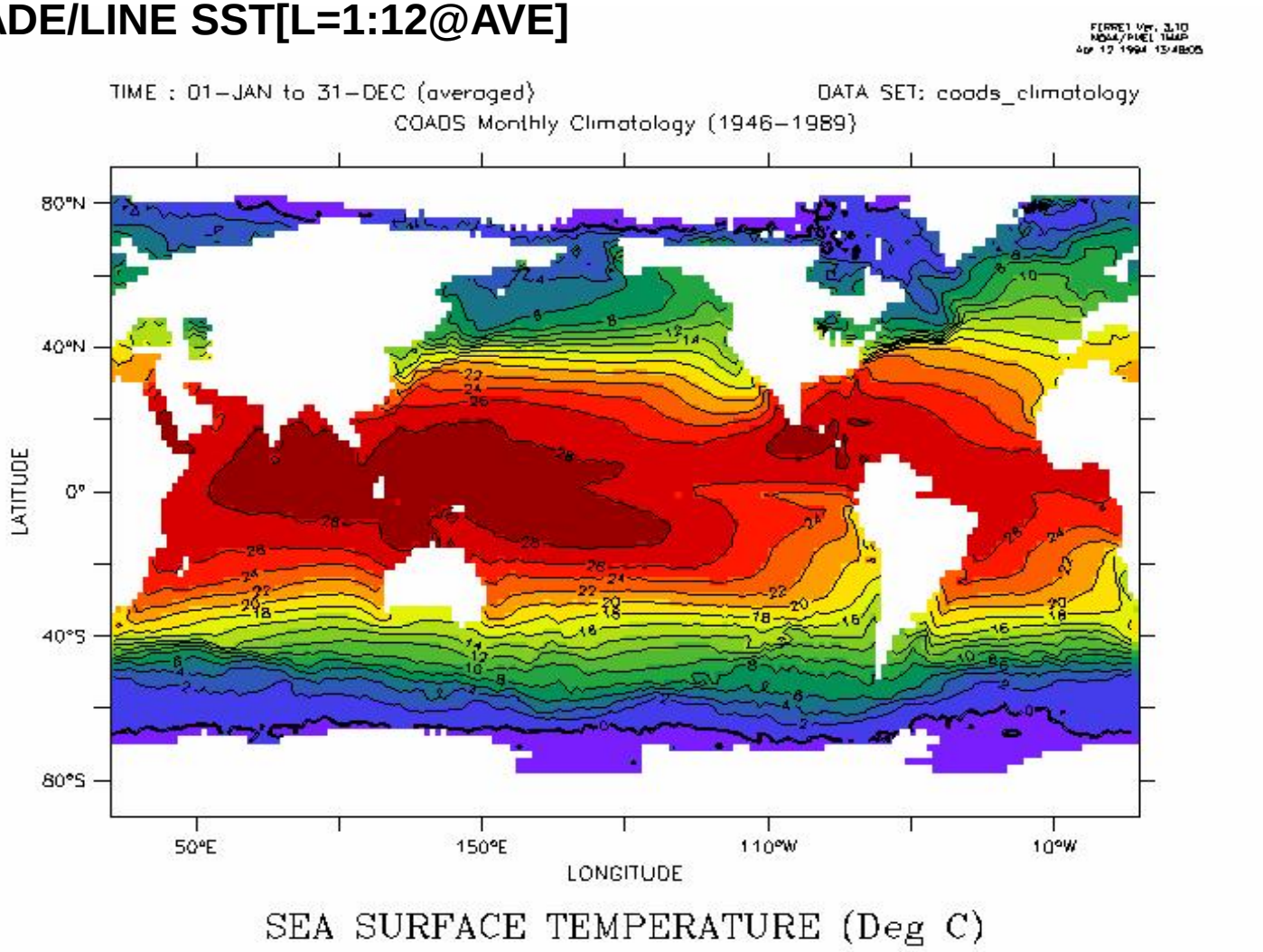




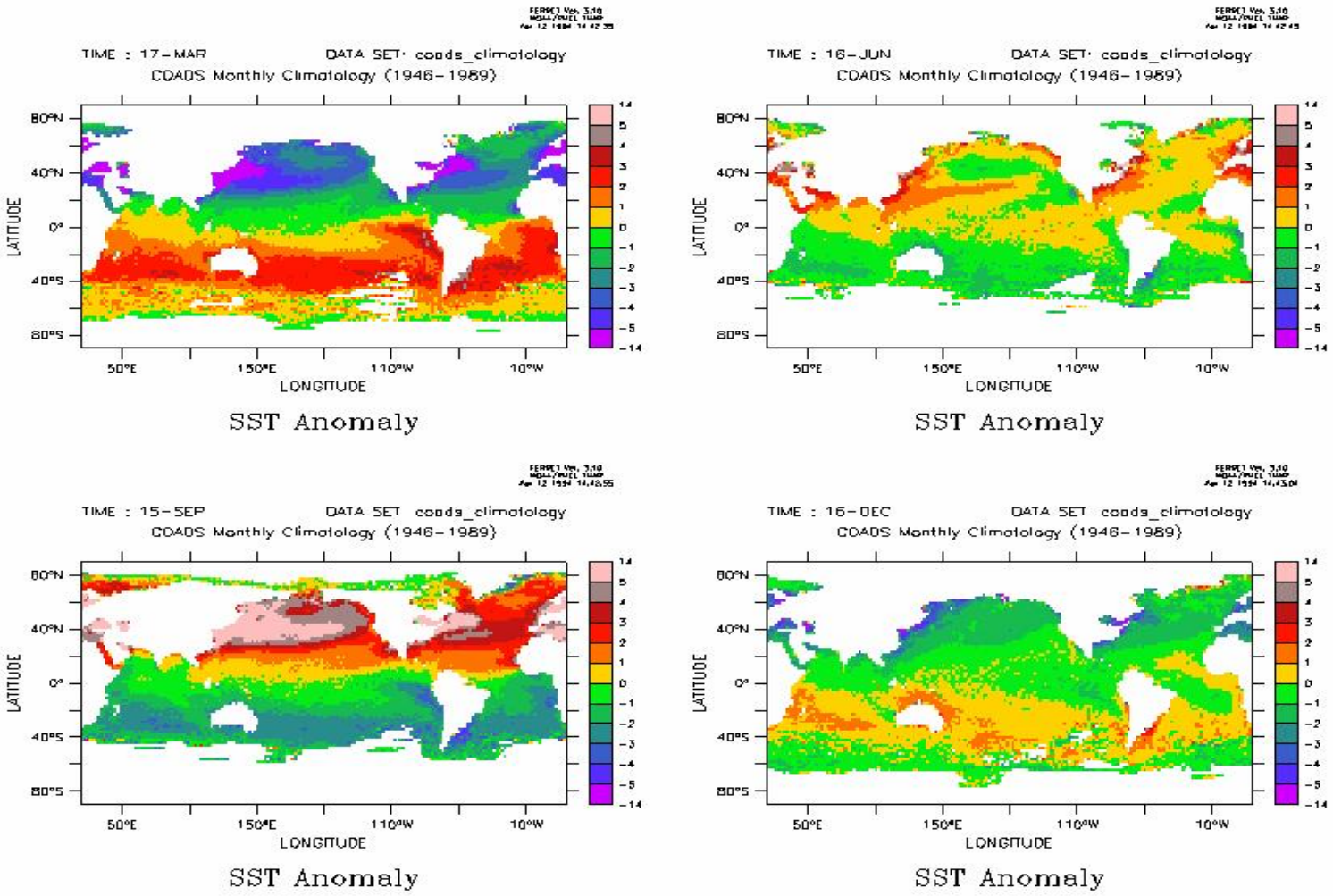




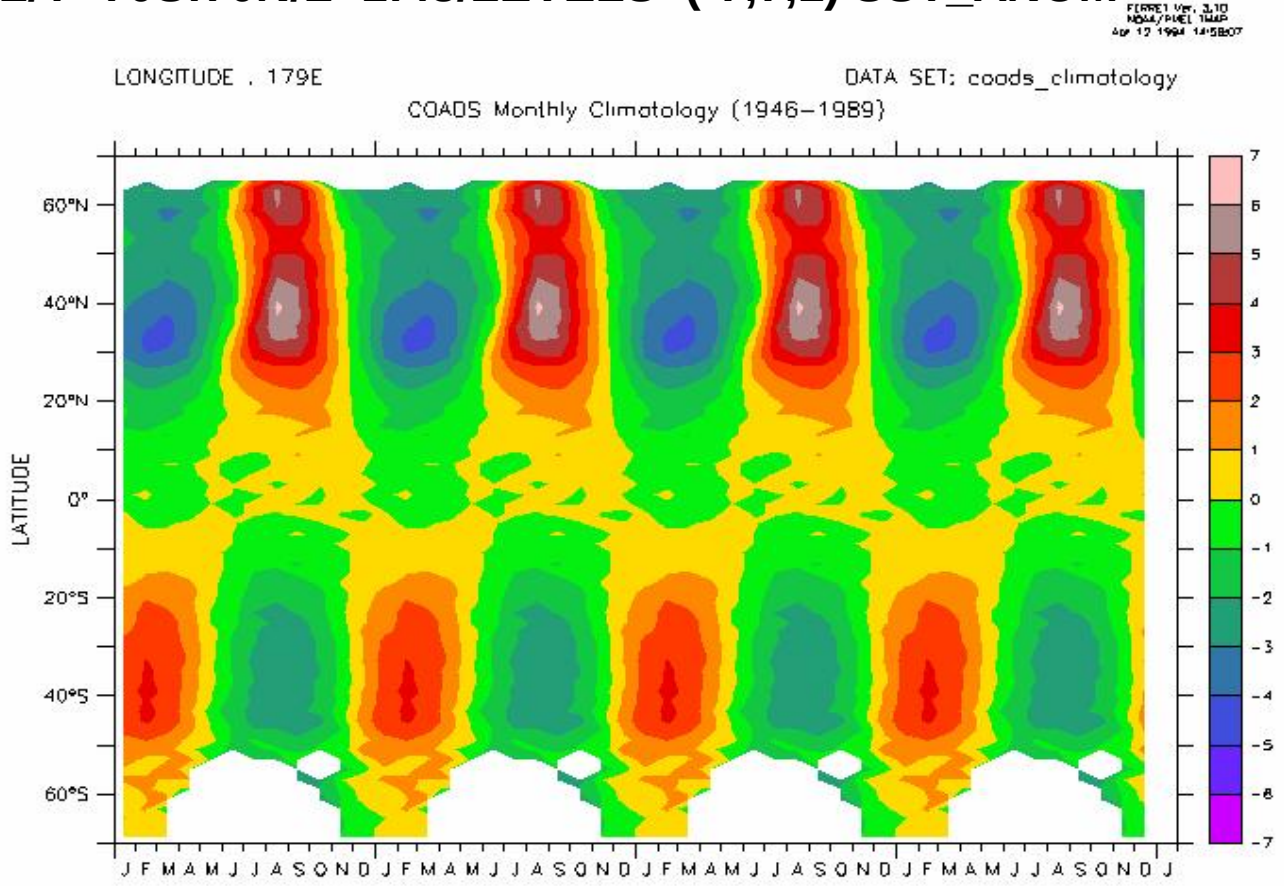
yes? CANCEL VIEWPORTS
yes? SHADE/LINE SST[L=1:12@AVE]



yes? SET WINDOW/SIZE=.7
yes? LET SST_AVE = SST[L=1:12@AVE]
yes? LET/TITLE="SST Anomaly" SST_ANOM = SST - SST_AVE
yes? SET VIEW UL yes? SHADE/L=3/LEVELS=(-14)(-5,5,1)(14) sst_anom
yes? SET VIEW UR yes? SHADE/L=6/LEVELS=(-14)(-5,5,1)(14) sst_anom
yes? SET VIEW LL yes? SHADE/L=9/LEVELS=(-14)(-5,5,1)(14) sst_anom
yes? SET VIEW LR yes? SHADE/L=12/LEVELS=(-14)(-5,5,1)(14) sst_anom



yes? CANCEL VIEWPORTS
yes? SET WINDOW/SIZE=.5
yes? SET REGION/X=180
yes? FILL/Y=70S:70N/L=1:48/LEVELS=(-7,7,1) SST_ANOM



SST Anomaly

In this class You've been shown a number of FERRET's capabilities:

- Line, contour, vector and shaded plots
- Multiple viewports, and windows
- Color controls
- Abstract mathematical functions, data from data sets, and new variables defined from old ones
- Transformations and plots along various axes

And there's much more to explore …..