# 7. Lecture and exercise: Introduction to GrADS

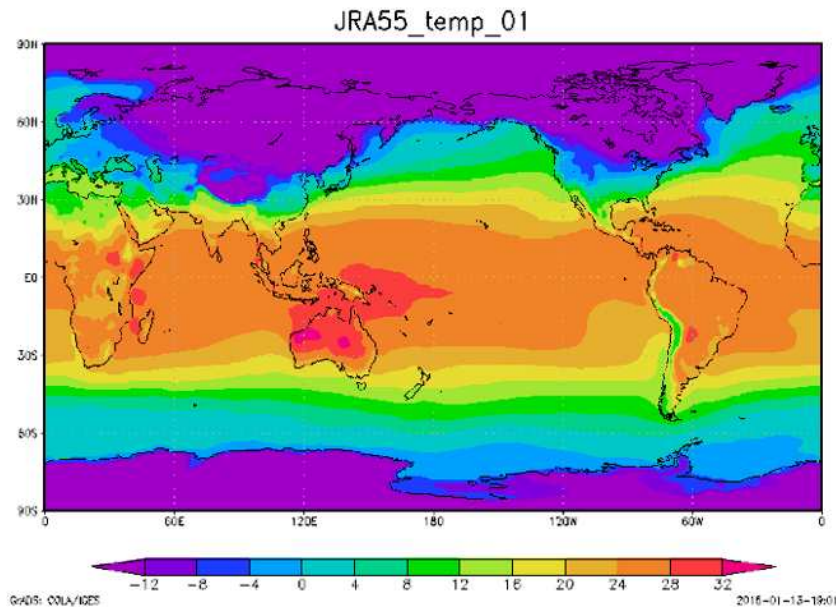Nobuyuki Kayaba

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Outline

# What's GrADS

draw image using JRA-55
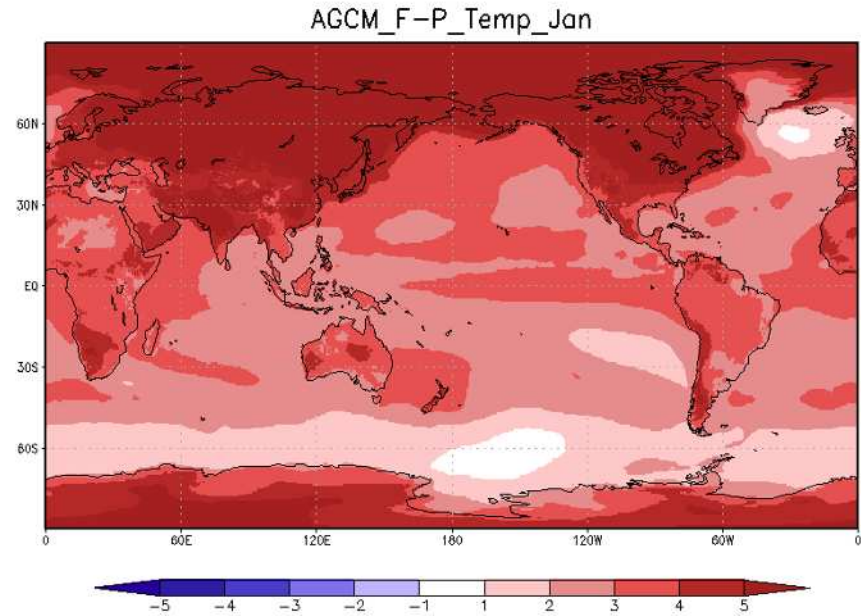draw image using  AGCM
draw image difference of two dataset

# Aim

## We can
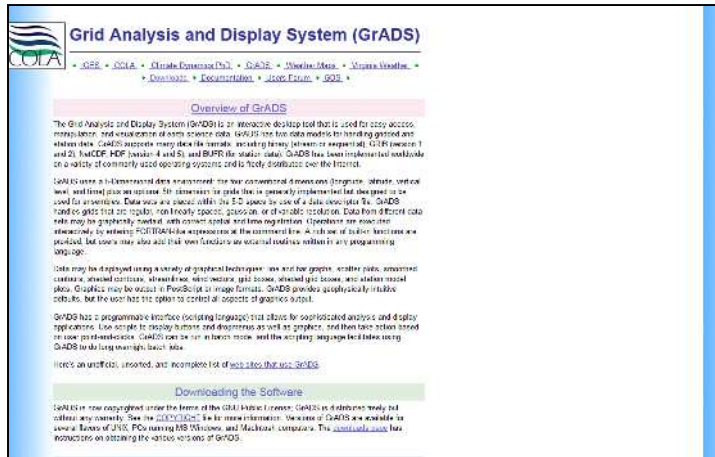draw the global map using JRA55 and AGCM
out put as a image file
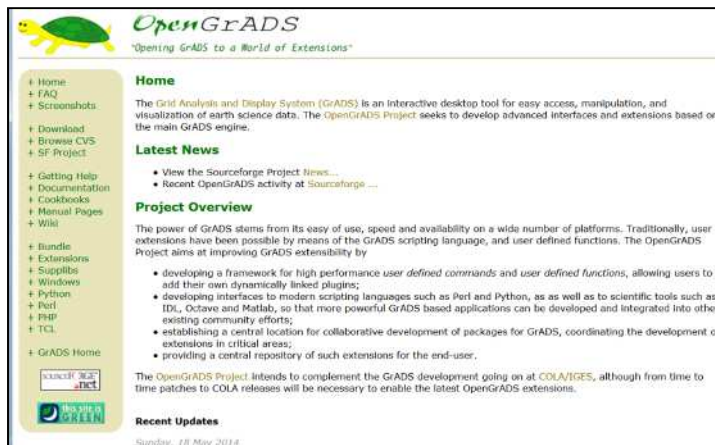


Climatology(1981-2010) at Jan
using JRA55



Climate change (21th-20th) at Jan
using AGCM

# What's GrADS

## Introduction


http://iges.org/grads/


http://opengrads.org/

The Grid Analysis and Display System (GrADS) is an interactive desktop tool that is used for easy access, and visualization of earth science data.

GrADS is implemented on all commonly available UNIX workstations and DOS based PCs, and freely distributed over the Internet.

GrADS provides an integrated environment for access,manipulation,and display of earth science data.
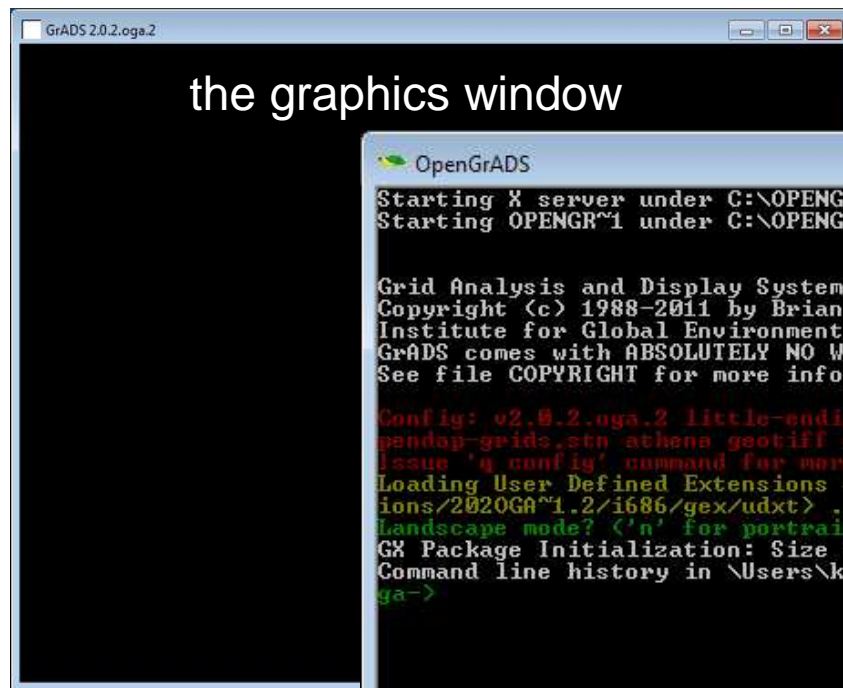
Windows users should install only one tool "OpenGrADS" .

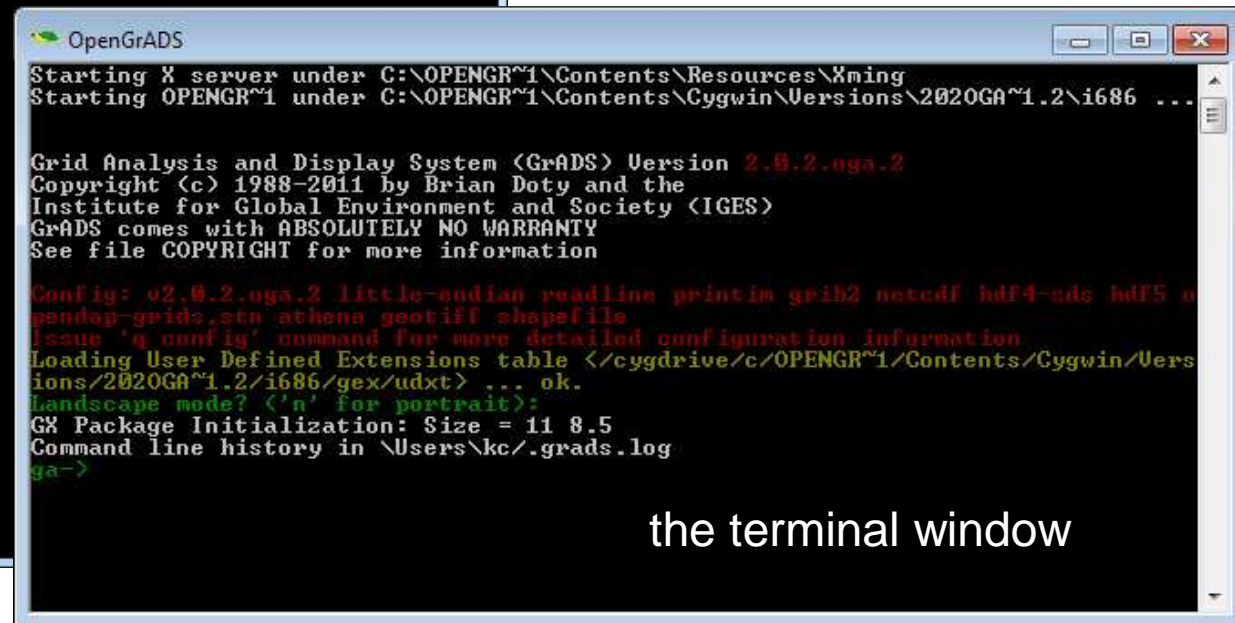The procedure for installing "OpenGrADS" is described website.

# What's GrADS

Click icon of "OpenGrADS" on your desktop.



OpenGrADS

Type "Enter" to "Landscape mode?", then Open two windows.



the graphics window

Landscape   11 x 8.5 inches
portrait   8.5 x 11 inches



```
OpenGrADS
Starting X server under C:\OPENGR~1\Contents\Resources\Xming
Starting OPENGR~1 under C:\OPENGR~1\Contents\Cygwin\Versions\2020GA~1.2\i686 ...

Grid Analysis and Display System (GrADS) Version 2.0.2.oga.2
Copyright (c) 1988-2011 by Brian Doty and the
Institute for Global Environment and Society (IGES)
GrADS comes with ABSOLUTELY NO WARRANTY
See file COPYRIGHT for more information

Config: v2.0.2.oga.2 little-endian readline printim grib2 netcdf hdf4-sds hdf5 o
pendap-grids.stn athena geotiff shapefile
Issue 'q config' command for more detailed configuration information
Loading User Defined Extensions table </cygdrive/c/OPENGR~1/Contents/Cygwin/Vers
ions/2020GA~1.2/i686/gex/udxt> ... ok.
Landscape mode? ('n' for portrait):
GX Package Initialization: Size = 11 8.5
Command line history in \Users\kc/.grads.log
ga->
```

the terminal window

# What's GrADS

## help

Gives a summary list of operations essential to do anything in GrADS.

```
ga-> help
```

```
For Complete Information See:  http://grads.iges.org/grads

Basic Commands:
 OPEN <descr>          opens a data file
 Query                 shows current status
 Clear                 clears graphics window
 SET <args>            sets options
 Display expr          displays a variable graphically
 QUIT                  exits the program
```

Exit the progrum

```
ga-> quit
```

# What's GrADS

## Basic Command

```
ga-> reinit

ga-> open   /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> query file 1

ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set   t  1

ga-> set  gxout shaded
ga-> set  clevs  -12  -8  -4  0  4  8  12  16  20  24  28  32
ga-> set  ccols  9  14  4  11  5  13  3  10  7  12  8  2  6

ga-> set grads off
ga-> display tas  -  273.15
ga-> cbarn
ga-> draw  title JRA55_Temp_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/1-1_jra_temp_01.png white

ga-> clear
```

## Work flow

initialize

open data

Set area and time

Setting
graphics type

Draw image

Clear  the display

# What's GrADS

## Out put image



draw title

display

cbarn

JRA55_Temp_Jan

GrADS: COLA/IGES                                    2015-01-21-15:59
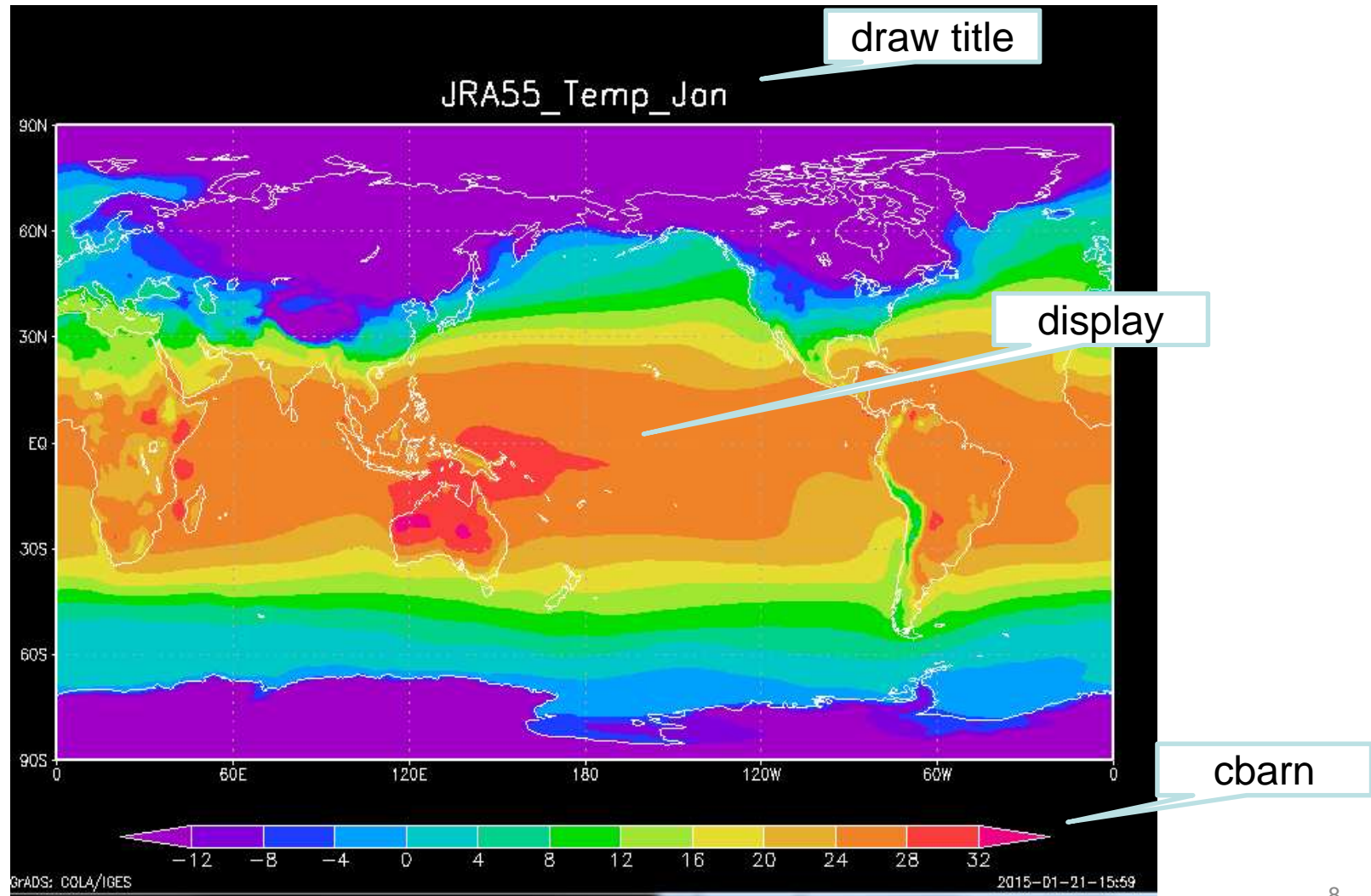
# What's GrADS

## Setting and realizing work space

1    !pwd            Show current directory.

```
ga-> !pwd                              positioning working directory
/cygdrive/c/OpenGrADS/Contents/Resources/SampleDatasets
```

To the external command, you need put a "!: exclamation mark" at the first.

2    cd *directory*      Change directory to "/cygdrive/c/TCC_2015/Doc/lecture/7/"

```
ga-> cd /cygdrive/c/TCC_2015/Doc/lecture/7/
```

3    !ls                    Show directorys and files in current directory.

```
ga-> !ls /cygdrive/c/TCC_2015/Data

AGCM    JRA55
```

Data sets

Shell command can be entered the GrADS command line, by proceeding the them with an exclamation point.

# What's GrADS

## Data set (ctl file and data file)

▸ Computer ▸ Local Disk (C:) ▸ TCC_2015 ▸ Data ▸ JRA55

**Data set**

**ctl file** (The meta data )

```
* standard
dset ^./data/tas.clim%m2.grd
options template little_endian
undef  -999.0000000
xdef      288  linear  0.0000000E+00   1.250000
ydef      145  linear  -90.00000       1.250000
zdef        1  levels 0
tdef 12 linear jan1981 1mo
vars 1
tas  0 99 2m Temperature(K)
endvars
```

the name of a GrADS data descriptor file,
also called a control file.

data

pr.clim.ctl
psl.clim.ctl
tas.clim.ctl
ua.clim.ctl
uas.clim.ctl
va.clim.ctl
vas.clim.ctl

pr.clim01.grd
pr.clim02.grd
pr.clim03.grd
pr.clim04.grd
pr.clim05.grd
pr.clim06.grd
pr.clim07.grd
pr.clim08.grd
pr.clim09.grd
pr.clim10.grd
pr.clim11.grd
pr.clim12.grd
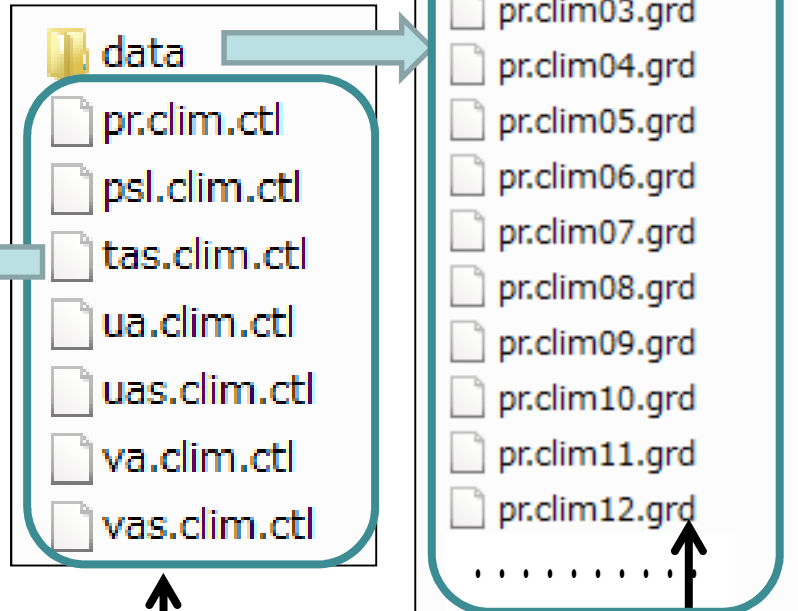
**ctl file**

**grid data file**

# What's GrADS

## Format of ctl file

ex

```
* standard
dset ^./data/tas.clim%m2.grd
options template little_endian
undef   -999.0000000
xdef      288  linear  0.0000000E+00    1.250000
ydef        145  linear  -90.00000        1.250000
zdef          1  levels 0
tdef 12 linear jan1981 1mo
vars 1
tas  0 99 2m Temperature(K)
endvars
```

Data dile

the X,Y dimension, or longitude,latitude

the Z dimension, or pressurre level.

the time dimension

Element information

We uses the four conventional dimensions
(longitude, latitude, vertical level, and time)

# Data description

| Control File Name | Description | Run | Duration |
|---|---|---|---|
| JRA55/pr.clim.ctl | JRA55 Precipitation (mm/day) | Climatology | 1981-2010 |
| JRA55/tas.clim.ctl | JRA55 2m Temperature (K) | Climatology | 1981-2010 |
| JRA55/psl.cim.ctl | JRA55 Sea Level Pressure (Pa) | Climatology | 1981-2010 |
| JRA55/ua.clim.ctl | JRA55 Eastward Wind (m/s) | Climatology | 1981-2010 |
| JRA55/va.clim.ctl | JRA55 Northward Wind (m/s) | Climatology | 1981-2010 |
| JRA55/uas.clim.ctl | JRA55 Eastward Near-Surface Wind (m/s) | Climatology | 1981-2010 |
| JRA55/vas.clim.ctl | JRA55 Northward Near-Surface Wind (m/s) | Climatology | 1981-2010 |
| AGCM/precipi-P.ctl | AGCM Precipitation (mm/day) | Present Simulation | 1979-2003 |
| AGCM/ta-P.ctl | AGCM 2m Temperature (K) | Present Simulation | 1979-2003 |
| AGCM/slp-P.ctl | AGCM Sea Level Pressure (Pa) | Present Simulation | 1979-2003 |
| AGCM/u-P.ctl | AGCM Eastward Wind (m/s) | Present Simulation | 1979-2003 |
| AGCM/v-P.ctl | AGCM Northward Wind (m/s) | Present Simulation | 1979-2003 |
| AGCM/ua-P.ctl | AGCM Eastward Near-Surface Wind (m/s) | Present Simulation | 1979-2003 |
| AGCM/va-P.ctl | AGCM Northward Near-Surface Wind (m/s) | Present Simulation | 1979-2003 |
| AGCM/precipi-F.ctl | AGCM Precipitation (mm/day) | Future Simulation | 2075-2099 |
| AGCM/ta-F.ctl | AGCM 2m Temperature (K) | Future Simulation | 2075-2099 |
| AGCM/slp-F.ctl | AGCM Sea Level Pressure (Pa) | Future Simulation | 2075-2099 |
| AGCM/u-F.ctl | AGCM Eastward Wind (m/s) | Future Simulation | 2075-2099 |
| AGCM/v-F.ctl | AGCM Northward Wind (m/s) | Future Simulation | 2075-2099 |
| AGCM/ua-F.ctl | AGCM Eastward Near-Surface Wind (m/s) | Future Simulation | 2075-2099 |
| AGCM/va-F.ctl | AGCM Northward Near-Surface Wind (m/s) | Future Simulation | 2075-2099 |

# 1

How to draw monthly mean climatology using JRA-55 reanalysis data.

1-1 Temperature
1-2 Precipitation
1-3 Sea level pressure
1-4 wind vector map

# 1-1

How to draw monthly mean climatology using JRA-55 reanalysis data.

Temperature map



JRA55_Temp_Jan
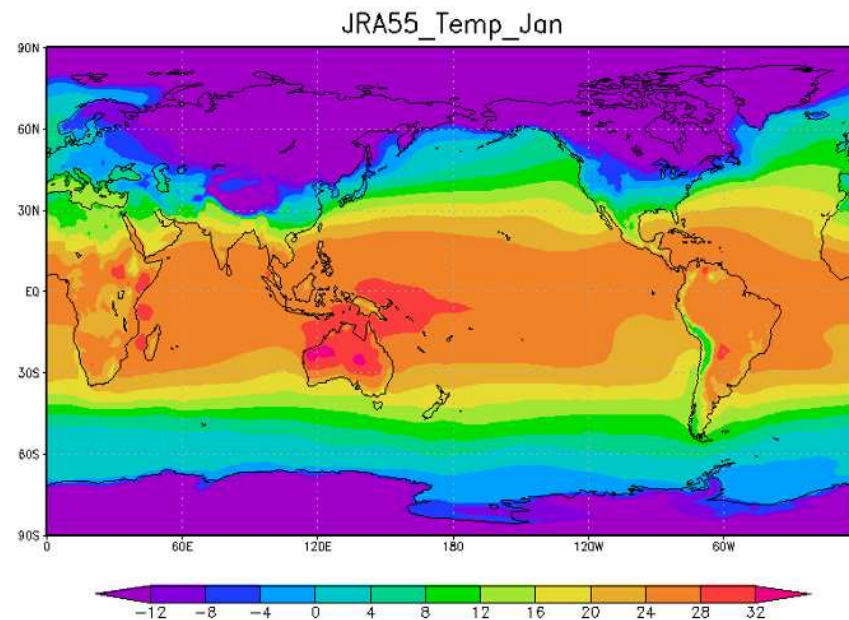
# Practice 1-1

**Command** : initialize

```
ga-> reinit                                              initialize

ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> query file 1

ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set   t  1

ga-> set  gxout shaded
ga-> set  clevs  -12 -8 -4 0 4 8 12 16 20 24 28 32
ga-> set  ccols  9 14 4 11 5 13 3 10 7 12 8 2 6

ga-> set grads off
ga-> display tas  -  273.15
ga-> cbarn
ga-> draw  title JRA55_Temp_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/1-1_jra_temp_01.png white

ga-> clear
```
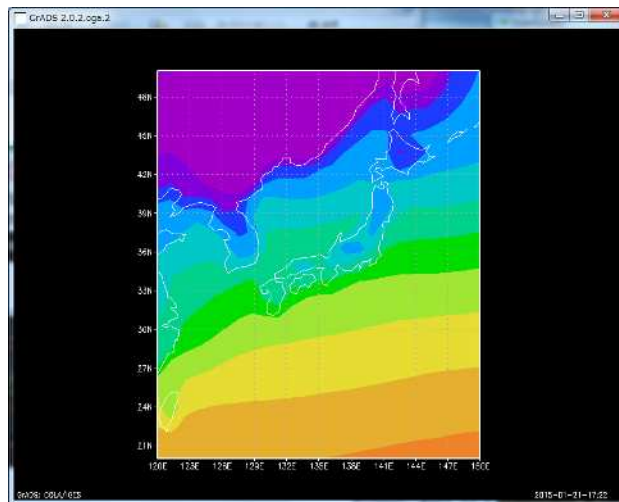
# Practice 1-1

**Initialize**

1-1    reinit        Initialize Grads to its initial state

```
ga-> reinit
```

```
No hardcopy metafile open
All files closed; all defined objects released;
All GrADS attributes have been reinitialized
```
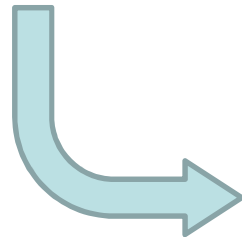
The reinit command returns GrADS to its initial state
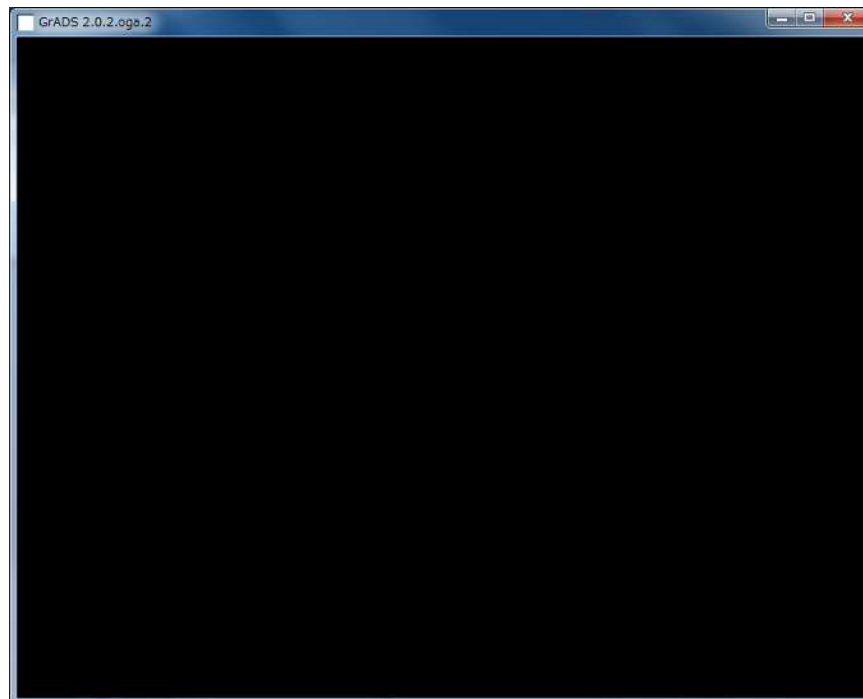
# Practice 1-1

**Command** : Open data

```
ga-> reinit

ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> query file 1                                    open data

ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set   t  1

ga-> set  gxout shaded
ga-> set  clevs  -12  -8  -4  0  4  8  12  16  20  24  28  32
ga-> set  ccols  9  14  4  11  5  13  3  10  7  12  8  2  6

ga-> set grads off
ga-> display tas  -  273.15
ga-> cbarn
ga-> draw  title JRA55_Temp_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/1-1_jra_temp_01.png white

ga-> clear
```

# Practice 1-1

## Open datafile(1)

2-1   open  *ctlfile*         Open the grads control file

```
ga-> open /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
```

```
Scanning description file:  JRA55/tas.clim.ctl
Data file JRA55/./data/tas.clim%m2.grd is open as file 1
LON set to 0 360
LAT set to -90 90
LEV set to 0 0
Time values set: 9999:1:1:0 9999:1:1:0
E set to 1 1
```

filename

2-2   query  *file*         Get information about the grads control file

```
ga-> query file 1
```

```
File 1 :
  Descriptor: JRA55/tas.clim.ctl
  Binary: JRA55/./data/tas.clim%m2.grd
  Type = Gridded
  Xsize = 288  Ysize = 145  Zsize = 1  Tsize = 12  Esize = 1
  Number of Variables = 1
    tas  0  99  2m Temperature(K)
```

element

You have to remember this element name

# Practice 1-1

## Open datafile(2)

2-3　open　*ctlfile*　　　Open the grads control file

```
ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/pr.clim.ctl
```

filename

```
Scanning description file:  JRA55/pr.clim.ctl
Data file JRA55/./data/pr.clim%m2.grd is open as file 2
```

2-4　query　*file*　　　Get information about the grads control file

```
ga-> query  file  2
```

```
File 2 :
  Descriptor: JRA55/pr.clim.ctl
  Binary: JRA55/./data/pr.clim%m2.grd
  Type = Gridded
  Xsize = 288  Ysize = 145  Zsize = 1  Tsize = 12  Esize = 1
  Number of Variables = 1
     pr  0  99  Precipitation(mm/day)
```

element

You have to remember this element

# Practice 1-1

**Command** :    Set area and time

```
ga-> reinit

ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> query file 1

ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set   t  1                          Set area and time

ga-> set  gxout shaded
ga-> set  clevs  -12 -8 -4 0 4 8 12 16 20 24 28 32
ga-> set  ccols  9 14 4 11 5 13 3 10 7 12 8 2 6

ga-> set grads off
ga-> display tas  -  273.15
ga-> cbarn
ga-> draw  title JRA55_Temp_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/1-1_jra_temp_01.png white

ga-> clear
```

# Practice 1-1

## Set area and time

3-1    set lon  *val1 val2*        Set longitude to vary from *val1 val2*

```
ga-> set  lon  0  360
```

```
LON set to 0 360
```

3-2    set lat  *val1 val2*        Set latitude to vary from *val1 val2*

```
ga-> set  lat  -90  90
```

```
LAT set to -90 90
```

3-3    set t *val*                        Set time at *val(month)*

```
ga-> set   t  1
```

```
Time values set: 1981:1:1:0 1981:1:1:0
```

. You will note that by default, GrADS will display a lat/lon plot at the first time and at the lowest level in the data set.

# Practice 1-1

**Command** :  Setting graphics type

```
ga-> reinit

ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> query file 1

ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set   t  1

ga-> set  gxout shaded        Setting graphics type
ga-> set  clevs  -12 -8 -4 0 4 8 12 16 20 24 28 32
ga-> set  ccols  9 14 4 11 5 13 3 10 7 12 8 2 6

ga-> set grads off
ga-> display tas  -  273.15
ga-> cbarn
ga-> draw  title JRA55_Temp_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/1-1_jra_temp_01.png white

ga-> clear
```

# Practice 1-1

**Set graphic types    graphics type**

4-1    set  gxout *graphics_type*      Set graphics output types
(*graphics_type*  shaded,contour, grfill  etc…)

```
ga-> set  gxout  {shaded/contour/grill}
```
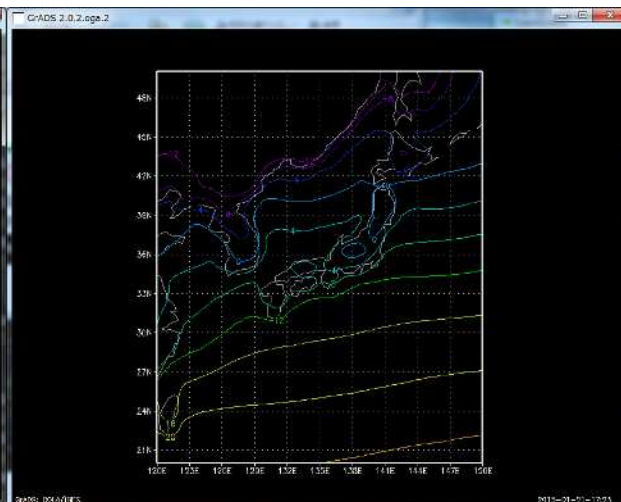
*shaded*                    *contour*                    *grfill*
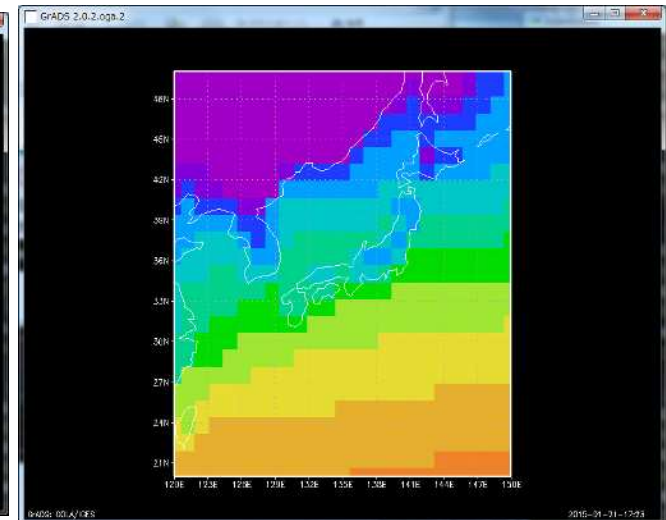


By default, you get a contour plot.  This default can be changed by the command

# Practice 1-1

**Set graphic types    colors    rainbow color**

4-2    set  clevs *vals*              Set contour levels

```
ga-> set  clevs  -12 -8 -4  0  4  8  12  16  20  24  28  32
```
```
Number of clevs = 12
```

4-3    set  ccols *vals*              Set color numbers

```
ga-> set  ccols  9  14  4  11  5  13  3  10  7  12  8  2  6
```
```
Number of ccols = 13
```

Color index   rainbow color

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 14 | 4 | 11 | 5 | 13 | 3 | 10 | 7 | 12 | 8 | 2 | 6 |

# Practice 1-1

**Set graphic type    projection**

4-5   Set  mproj *proj*    Sets current map projection

**ga->** set  mproj   {latlon/robinson/mollweide/orthogr/}

**latlon**
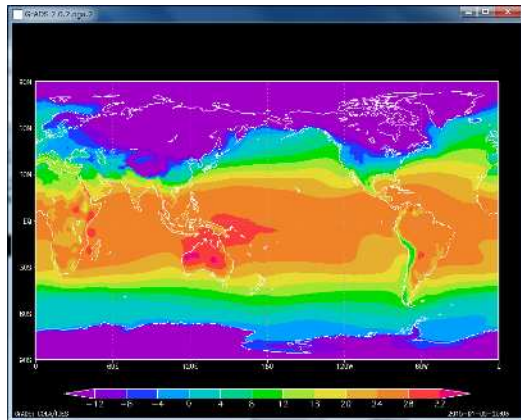


**robinson**
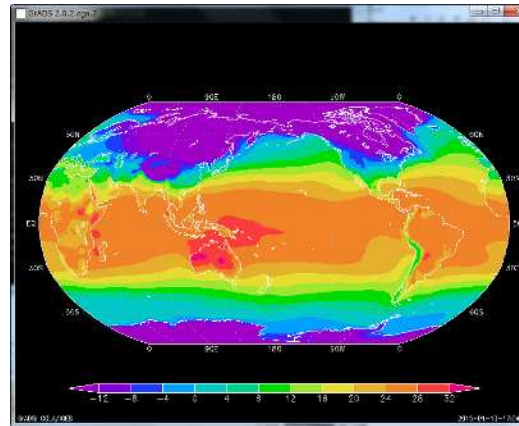


**mollweide**
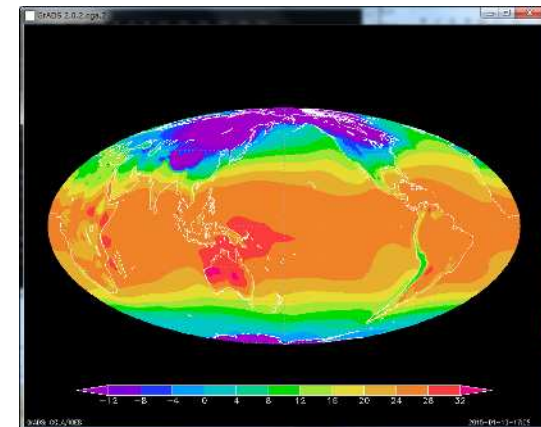
# Practice 1-1

**Set graphic type    resolution**

4-6    set mpdset *res*        Set map data resolution    (res *lowres,mres ,hires*)

```
ga-> set  mpdset {lowres/mres/hires /}
```

```
MPDSET file name = lowres
```
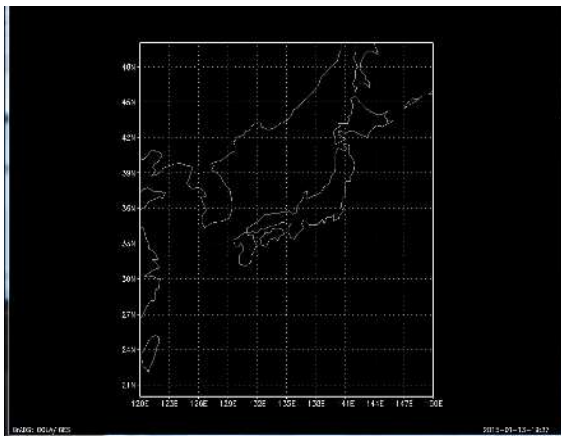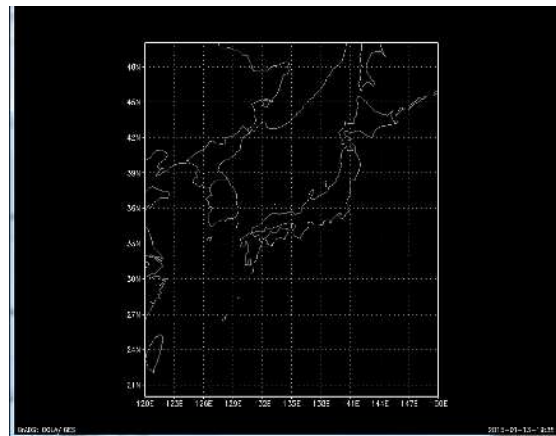
| *lowres* | *mres* | *hires* |
|---|---|---|
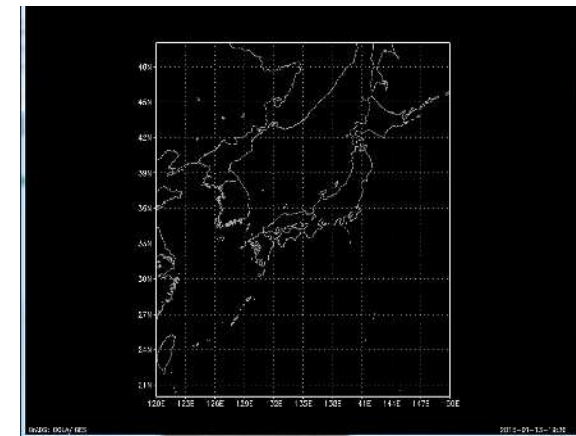
# Practice 1-1

**Command**    Draw image

```
ga-> reinit

ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> query file 1

ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set   t  1

ga-> set  gxout shaded
ga-> set  clevs  -12  -8  -4  0  4  8  12  16  20  24  28  32
ga-> set  ccols  9  14  4  11  5  13  3  10  7  12  8  2  6

ga-> set grads off                    Draw image
ga-> display tas  -  273.15
ga-> cbarn
ga-> draw  title JRA55_Temp_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/1-1_jra_temp_01.png white

ga-> clear
```

# Practice 1-1

## Draw image　display the graphic output window

5-1　Set grads on/off　turns on/off the display of the GrADS logo and the time label

```
ga-> set grads {on/off}
```

5-2　display *element*　Display data via the graphics output window

```
ga-> display tas.1-273.15
```
K → degC

we want to see the temperature in degree instead of Kelvin.

```
Contouring at clevs = -12 -8 -4 0 4 8 12 16 20 24 28 32
```

You can type just "d" instead "display"

5-3　cbarn　Draw a color bar next to shaded plots

```
ga-> cbarn
```

JRA55_Temp_Jan

5-4　draw title *String*　Creating titles

```
ga-> draw title JRA55_Temp_Jan
```
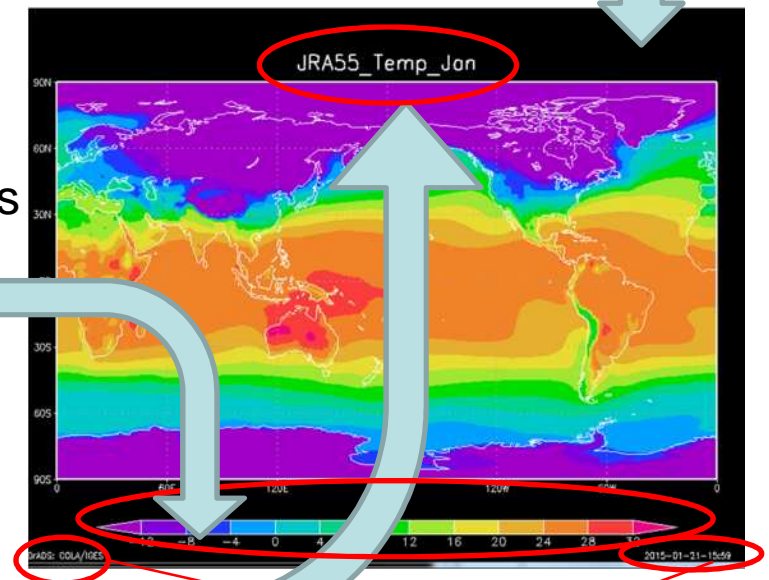
GrADS logo and the time label

# Practice 1-1

## Draw image　Output image files

21　printim *outfile colors*　　　Produce a image file

```
ga-> printim  /cygdrive/c/TCC_2015/Doc/lecture/7/images/jra_tas_01.png  white
```

Check saved image file from explorer

▸ Computer ▸ Local Disk (C:) ▸ TCC_2015 ▸ Doc ▸ lecture ▸ 7 ▸ images

We can produce a PNG, GIF, or JPG formatted image file ,which is the displayed on the screen.

background color is white
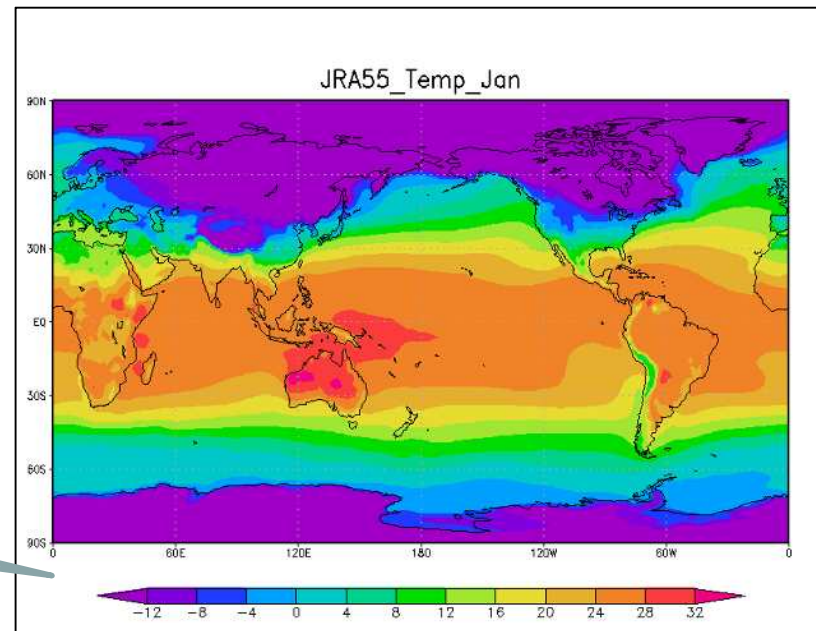
# Practice 1-1

**Command :**   Clear  the display

```
ga-> reinit

ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> query file 1

ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set   t  1

ga-> set  gxout shaded
ga-> set  clevs  -12  -8  -4  0  4  8  12  16  20  24  28  32
ga-> set  ccols  9  14  4  11  5  13  3  10  7  12  8  2  6

ga-> set grads off
ga-> display tas  -  273.15
ga-> cbarn
ga-> draw  title JRA55_Temp_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/1-1_jra_temp_01.png white
```

**ga-> clear**                              Clear   the display
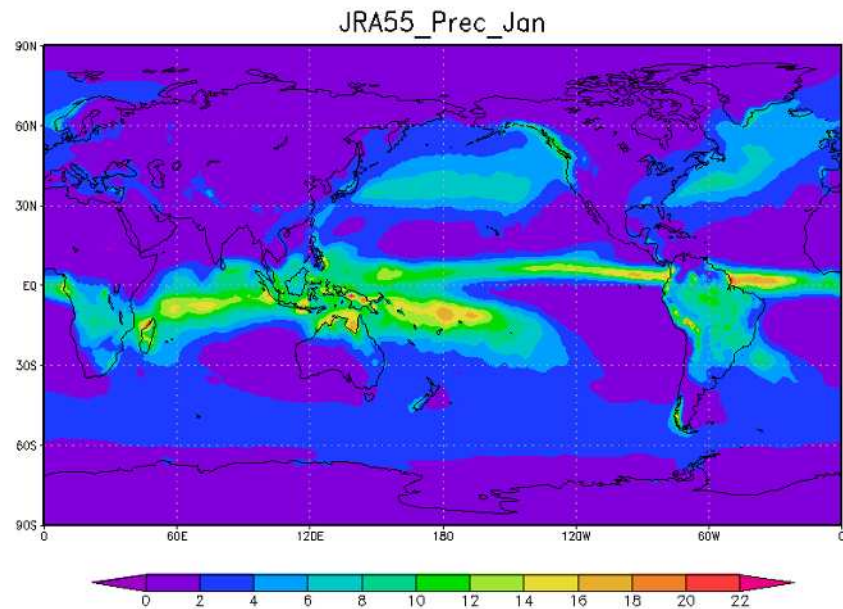
# Practice 1-1

## Clear the Display

6-1　　clear　　　　　　clear  the Display

**ga-> clear** 　(or  just c)

You can type just "c" instead "clear"

GrADS 2.0.2.oga.2
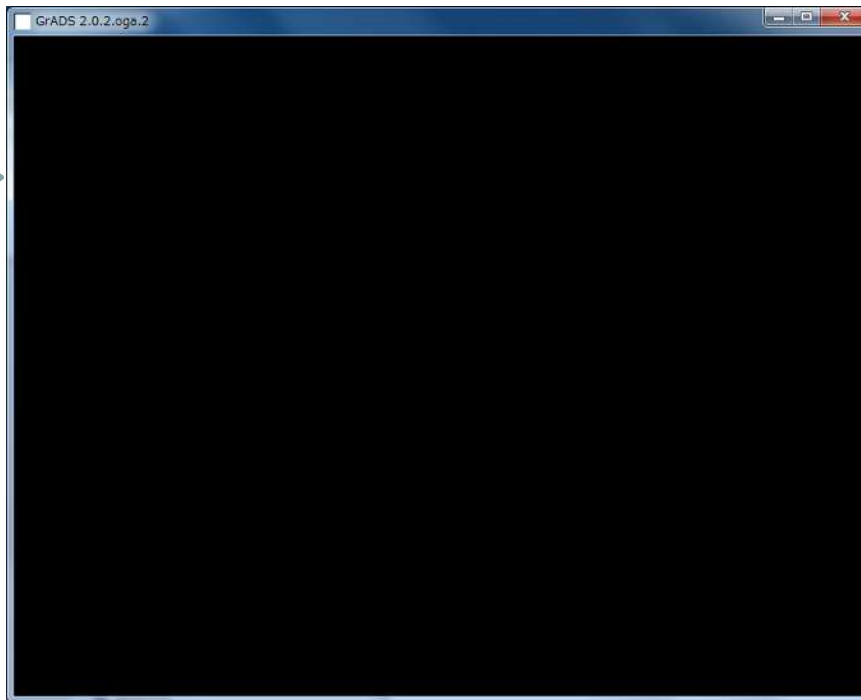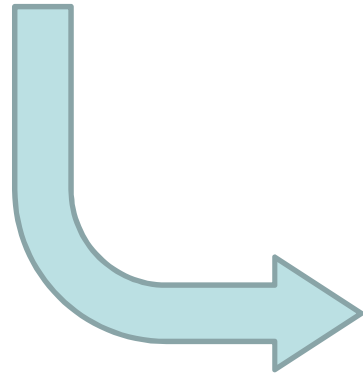
# Practice 1-1

**Command**

```
ga-> reinit
```
initialize

```
ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> query file 1
```
open data

```
ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set   t  1
```
Set area and time

```
ga-> set  gxout shaded
ga-> set  clevs  -12 -8 -4 0 4 8 12 16 20 24 28 32
ga-> set  ccols  9 14 4 11 5 13 3 10 7 12 8 2 6
```
Setting graphics type

```
ga-> set grads off
ga-> display tas  -  273.15
ga-> cbarn
ga-> draw  title JRA55_Temp_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/1-1_jra_temp_01.png white
```
Draw image

```
ga-> clear
```
Clear the display

# Practice 1-1　　　gsscript file

## Open the gsscript and run

▸ Computer ▸ Local Disk (C:) ▸ TCC_2015 ▸ Doc ▸ lecture ▸ 7 ▸ gsscript

```
1-1_jra_temp_01.gs
1-2_jra_prec_01.gs
1-3_jra_slp_01.gs
1-4_jra_wind850_01.gs
2-1_agcm_temp_f-p_01.gs
2-2_agcm_prec_f-p_01.gs
2-3_agcm_slp_f-p_01.gs
2-4_agcm_wind850_f-p_01.gs
3-1_agcm_f-jra55_temp_01.gs
3-2_agcm_f-jra55_prec_01.gs
3-3_agcm_f-jra55_slp_01.gs
3-4_agcm_f-jra55_wind850_01.gs
```

```
'reinit'                                              ;* initialize

'open /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl'   ;* open data file
'query file 1'                                         ;* query the data file

* Set area and time
'set lon 0 360'
'set lat -90 90'
'set t 1'

* Set Setting graphics type
'set gxout shaded'
'set clevs -12 -8 -4 0 4 8 12 16 20 24 28 32'
'set ccols 9 14 4 11 5 13 3 10 7 12 8 2 6'

* Draw image
'set grads off'
'display tas - 273.15'
'cbarn'
'draw title JRA55_Temp_Jan'
'printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/1-1_jra_temp_01.png white'
```

**ga-> run  gsscript/1-1_jra_temp_01.gs**

Check saved image file from explorer

▸ Computer ▸ Local Disk (C:) ▸ TCC_2015 ▸ Doc ▸ lecture ▸ 7 ▸ images ▸ 1-1_jra_temp_01.png

# Practice 1-1    How to edit and run gsscript file

1. Open the gsscript file with txt editor

▸ Computer ▸ Local Disk (C:) ▸ TCC_2015 ▸ Doc ▸ lecture ▸ 7 ▸ gsscript ▸ 1-1_jra_temp_01.gs

2. Editor the gsscript file

```
ga-> reinit

ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> query file 1
ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set   t   5

ga-> set  gxout shaded
ga-> set  clevs  -12  -8  -4  0  4  8  12  16  20  24  28  32
ga-> set  ccols  9  14  4  11  5  13  3  10  7  12  8  2  6

ga-> set grads off
ga-> display tas  -  273.15
ga-> cbarn
ga-> draw  title JRA55_Temp_May
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/1-1_jra_temp_05.png white
```

3. Save the gsscript file as "1-1_jra_temp_05.gs"

4. Run the gsscript file

```
ga-> run  gsscript/1-1_jra_temp_05.gs
```

5. Check saved image file from explorer

▸ Computer ▸ Local Disk (C:) ▸ TCC_2015 ▸ Doc ▸ lecture ▸ 7 ▸ images ▸ 1-1_jra_temp_05.png

# Practice 1-1 ex1

**Command    draw annual mean**



```
ga-> reinit

ga-> open /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> query file 1

ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set  t  1

ga-> set  gxout shaded

ga-> set clevs -12 -8 -4 0 4 8 12 16 20 24 28 32

ga-> set ccols 9 14 4 11 5 13 3 10 7 12 8 2 6

ga-> set grads off

ga-> display ave(tas  -  273.15,t=1,t=12)

ga-> cbarn

ga-> draw  title JRA55_Temp_annual

ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/1-1-ex1_jra_temp_annual.png white
```
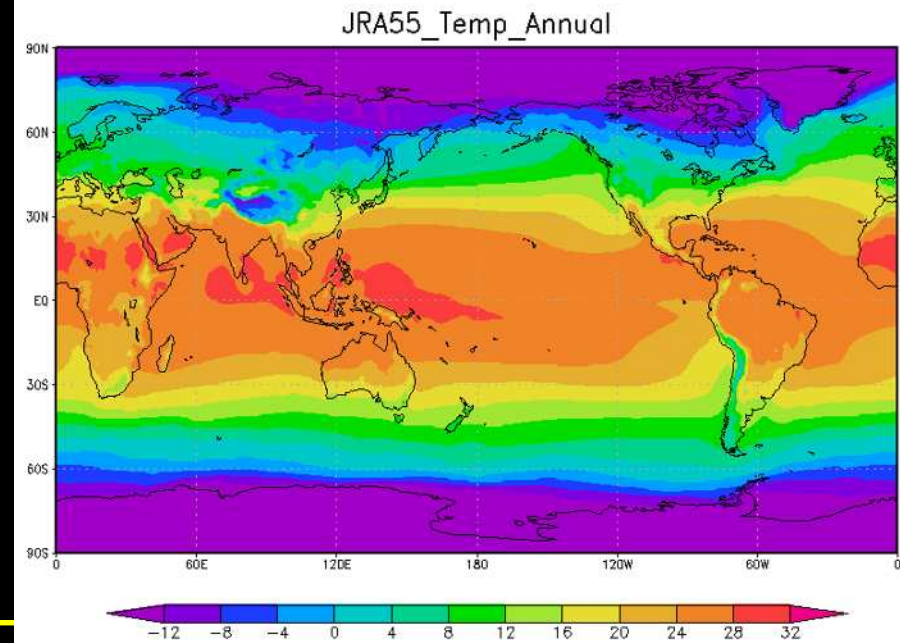
▸ Computer ▸ Local Disk (C:) ▸ TCC_2015 ▸ Doc ▸ lecture ▸ 7 ▸ gsscript ▸ 1-1-ex1_jra_temp_annual.gs

# Practice 1-1 ex2

**Command draw graph from Jan to Dec at 35N 135E**

```
ga-> reinit

ga-> open /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> query file 1
ga-> set  lon  135
ga-> set  lat  35
ga-> set   t  1  12
ga-> set  gxout shaded
ga-> set clevs -12 -8 -4 0 4 8 12 16 20 24 28 32
ga-> set ccols 9 14 4 11 5 13 3 10 7 12 8 2 6
ga-> set grads off
ga-> display tas  -  273.15
ga-> cbarn
ga-> draw  title JRA55_Temp_from Jan to Dec (35N,135N)
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/1-1-ex2_jra_temp_01-12.png white
```



JRA55_Temp_from Jan to Dec (35N,135E)
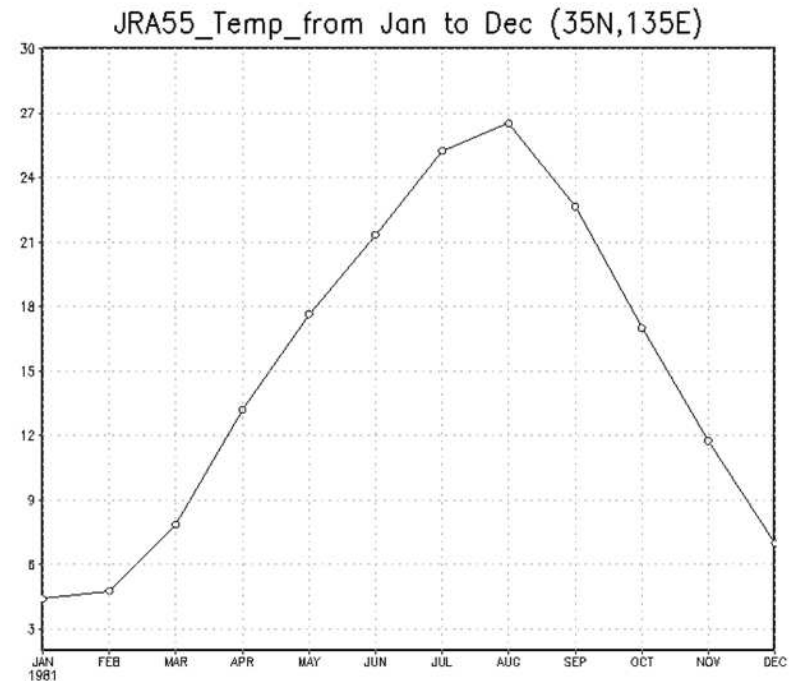
▸ Computer ▸ Local Disk (C:) ▸ TCC_2015 ▸ Doc ▸ lecture ▸ 7 ▸ gsscript ▸ 1-1-ex2_jra_temp_01-12.gs

# 1-2

How to draw monthly mean climatology using JRA-55 reanalysis data.

Precipitation map



JRA55_Prec_Jan

# Practice 1-2

```
ga-> reinit                                                          initialize

ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/ps.clim.ctl              open data
ga-> query file 1
ga-> query file 2

ga-> set  lon  0  360
ga-> set  lat  -90  90                                              Set area and time
ga-> set  t  1                              (default is 1)

ga-> set  gxout shaded                      (default is contour)
ga-> set  clevs  0 2 4 6 8 10 12 14 16 18 20 22                     Setting graphics type
ga-> set  ccols 9 14 4 11 5 13 3 10 7 12 8 2 6
ga-> set  mproj  latlon                     (default is latlon)
ga-> set  mpdset  lowres                    (default is lowres)

ga-> set  grads off                         (default is on
ga-> display pr.2
ga-> cbarn                    Two dimension expressions            Draw image
ga-> draw  title JRA55_Prec_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/jra_pr_01.png  white

ga-> clear                                                          Clear the display
```

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# 1-3

How to draw monthly mean climatology using JRA-55 reanalysis data.

Sea level Pressure map
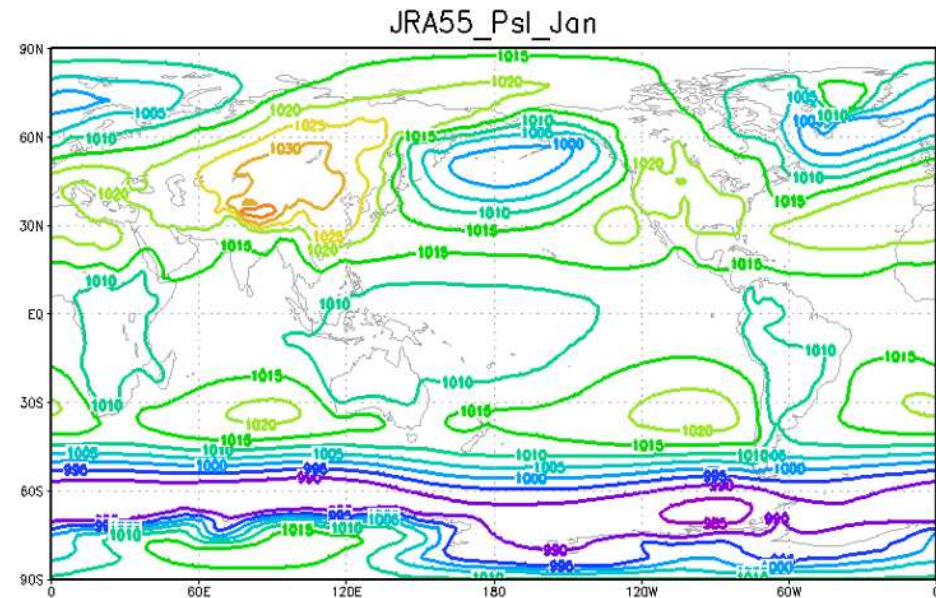


JRA55_Psl_Jan

# Practice 1-3

**Command**

```
ga-> reinit
```
initialize

```
ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/psl.clim.ctl


ga-> query file 1
```
open data

```
ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set  t  1                         (default is 1)
```
Set area and time

```
ga-> set  gxout contour               (default is contour)
ga-> set  clevs 985 990 995 1000 1005 1010 1015 1020 1025 1030 1035 1040
ga-> set  ccols 9 14 4 11 5 13 3 10 7 12 8 2 6
ga-> set  cthick 12
ga-> set  mproj  latlon               (default is latlon)
ga-> set  mpdset  lowres              (default is lowres)
```
**Setting graphics type**

```
ga-> set  grads off                   (default is on
ga-> display psl.1/100
```
Pa → hPa

Draw image

```
ga-> draw  title JRA55_Psl_Jan
ga-> printim  /cygdrive/c/TCC_2015/Doc/lecture/7jra_psl_01.png  white
```

```
ga-> clear
```
Clear the display

# Practice 1-3

**Set graphic types    graphics type**

4-1    set  gxout *graphics_type***{shaded/contour/grill}**

```
ga-> set  gxout  contour
```

4-2    set  clevs *vals*          Set contour levels

```
ga-> set  clevs  1 2 3 4 5 6 7 8 9 10 11 12
```

4-3    set  ccols *vals*          Set color numbers

```
ga-> set  ccols  9 14 4 11 5 13 3 10 7 12 8 2 6
```

4-4    set  cthick *vals*          Set the thickness  **{1    12}**

```
ga-> set  cthick  12
```

4-5    Set  mproj *proj*    Sets current map projection **{latlon/robinson/mollweide/orthogr/}**

```
ga-> set  mproj  latlon
```

4-6    set mpdset *res***{***lowres***/mres/hires /}**

```
ga-> set  mpdset  lowres
```

# 1-4

How to draw monthly mean
climatology using JRA-55
reanalysis data.
850hPa Wind Vector map
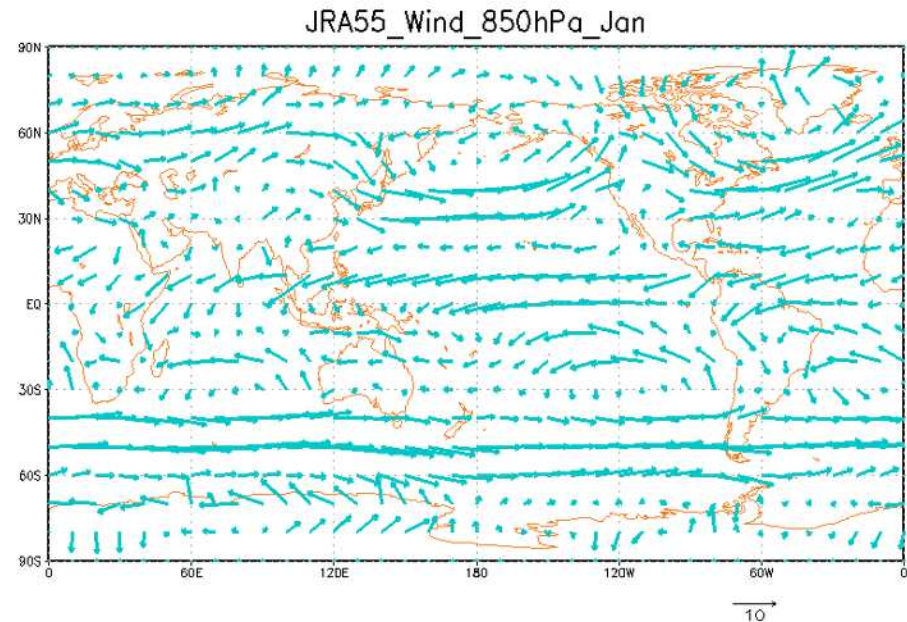


JRA55_Wind_850hPa_Jan

# Practice 1-4

```
ga-> reinit
```
initialize

```
ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/ua.clim.ctl
ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/va.clim.ctl
ga-> query file 1
ga-> query file 2
```
open data

```
ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set  lev 850
ga-> set  t  1                        (default is 1)
```
Set area and time

```
ga-> set  gxout vector
ga-> set  ccolor  5
ga-> set  cthick  12
ga-> set  mproj  latlon              (default is latlon)
ga-> set  mpdset  lowres             (default is lowres)
```
Setting graphics type

```
ga-> set  grads off                  (default is on
ga-> display skip(ua.1,4,4);va.2
ga-> draw  title JRA55_Wind_850hPa_Jan
ga-> set  arrlab  on
ga-> printim  /cygdrive/c/TCC_2015/Doc/lecture/7/jra_wind_850_01.png  white
```
**Draw image**

```
ga-> clear
```
Clear the display

# Practice 1-4

## Draw image　　display the graphic output window

5-1　Set grads off

```
ga-> set grads off
```

5-2　display *element*

```
ga-> display skip(ua.1,4,4);va.2
```

the first variable is treated as the U component, and the variable is treated as the V component. These two variable are provided to the display command by entering two expressions separated by a semicolon:

X,Y grid interval between the arrows

5-3　**set arrlab {on/off}:** Drawing the vector arrow label

```
ga-> set arrlab on
```

5-4　draw title *String*　Creating titles

```
ga-> draw title JRA55_　　_850hPa_Jan
```



JRA55_Wind_850hPa_Jan

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5-5　printim *outfile colors*　　Produce a image file
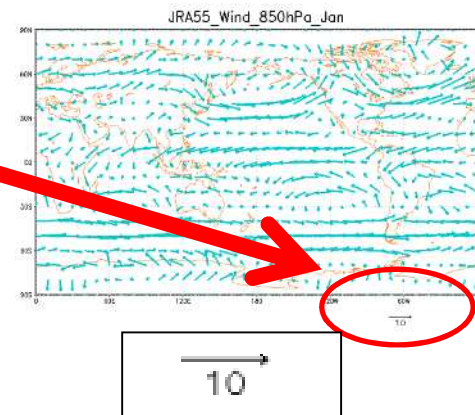
```
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/jra_Wind_850_01.png white
```

# 2

How to take the difference between the two data
by using AGCM Present and Future Simulation data

2-1 Temperature
2-2 Precipitation
2-3 Sea level pressure
2-4 wind vector map

# 2-1

How to take the difference
between the two data
by using AGCM
Present and Future
Simulation data

Temperature map



AGCM_F-P_Temp_Jan
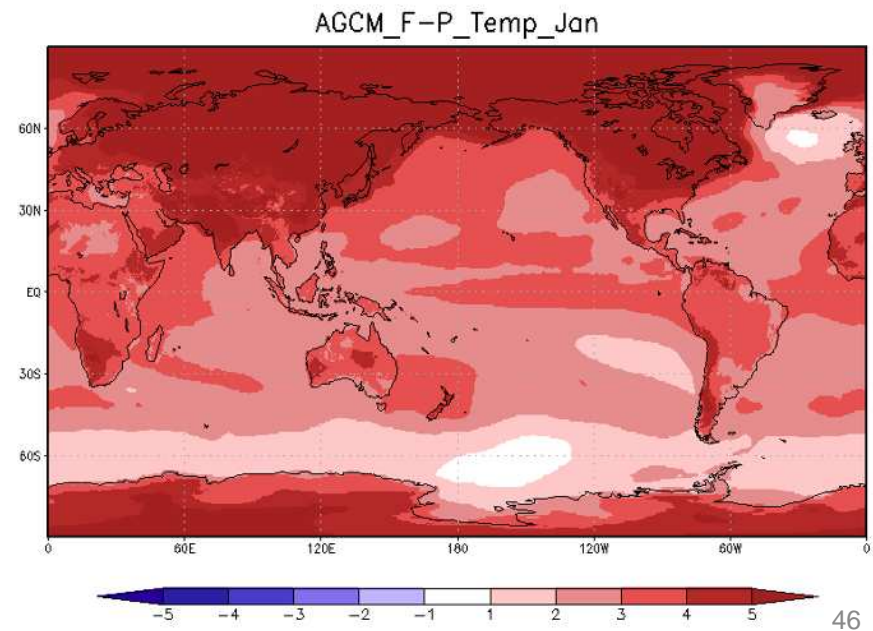
# Practice 2-1

**Command**

```
ga-> reinit

ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/ta-P.ctl
ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/ta-F.ctl
ga-> query file 1
ga-> query file 2

ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set  t  1

ga-> set  gxout shaded              (default is contour)
ga-> set  clevs  -5 -4 -3 -2 -1 1 2 3 4 5
ga-> define_colors
ga-> set  ccols 59  58  56 54  52  0  62 64  66  68  69
ga-> set  mproj  latlon              (default is latlon)
ga-> set  mpdset  lowres           (default is lowres)

ga-> set  grads off                (default is on
ga-> display ta.2(t=1)- ta.1(t=1)
ga-> cbarn
ga-> draw  title  AGCM_F-P_Temp_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/2-1_agcm_f-p_temp_01.png white

ga-> clear
```

**initialize**

**open data**

**Set area and time**

**Setting graphics type**

**Draw image**

**Clear the display**

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# Practice 2-1

**Set graphic types    colors**

4-1    set  gxout *graphics_type*

```
ga-> set  gxout  shaded
```

4-2    set  clevs *vals*          Set contour levels

```
ga-> set  clevs  -5  -4  -3  -2  -1  1  2  3  4  5
```

4-3   define_colors          Set colors

```
ga-> define_colors
```

4-4    set  ccols *vals*          Set color numbers

```
ga-> set  ccols  59  58  56 54  52  0  62 64  66  68  69
```

Color index

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 59 | 58 | 56 | 54 | 52 | 62 | 64 | 66 | 68 | 69 |

4-5    `ga-> set  mproj   latlon`

4-6.   `ga-> set  mpdset  lowres`

# Practice 2-1

**Draw image      display the graphic output window**

5-1   Set grads off

```
ga-> set  grads  off
```

5-2   display *element*

```
ga-> display ta.2(t=1)-ta.1(t=1)
```

(t=1) indicate "set time  1"      ta.1(file1:present climate)
subtracted from ta.2(file2:future climate)

5-3   cbarn

```
ga-> cbarn
```

5-4   draw title *String*

```
ga-> title AGCM_F-P_Temp_Jan
```

5-5   printim *outfile colors*

```
ga-> printim  /cygdrive/c/TCC_2015/Doc/lecture/7/agcm_f-p_temp_01.png  white
```

# 2-2

How to take the difference
between the two data
by using AGCM
Present and Future
Simulation data

Precipitation map



AGCM_F-P_Prec_Jan
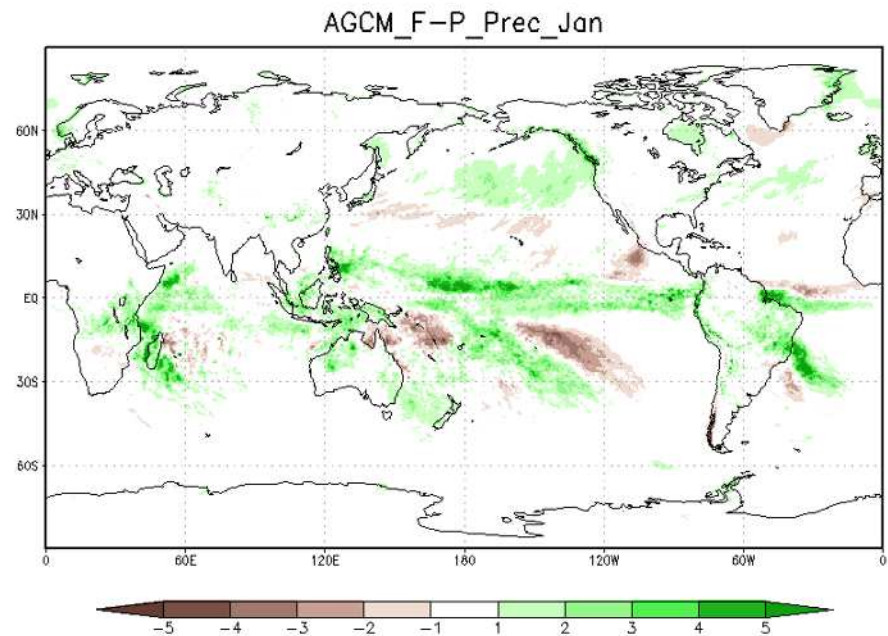
# Practice 2-2

**Command**

```
ga-> reinit

ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/precipi-P.ctl
ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/precipi-F.ctl
ga-> query file 1
ga-> query file 2

ga-> set  lon  0  360
ga-> set  lat  -90  90

ga-> set  gxout shaded              (default is contour)
ga-> set  clevs  -5 -4 -3 -2 -1 1 2 3 4 5
ga-> define_colors
ga-> set  ccols 79  78  76 74  72  0  32 34  36  38  39
ga-> set  mproj  latlon              (default is latlon)
ga-> set  mpdset  lowres            (default is lowres)

ga-> set  grads off                  (default is on
ga-> display precipi.2(t=1)- precipi.1(t=1)
ga-> cbarn
ga-> draw  title  AGCM_F-P_Prec_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/2-2_agcm_f-p_prec_01.png white

ga-> clear
```

initialize
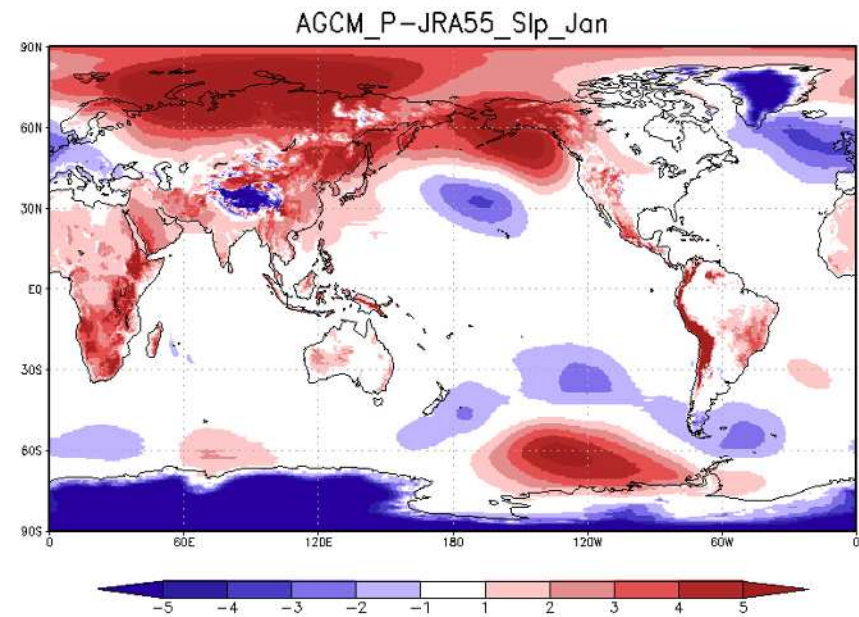
open data

Set area and time

**Setting graphics type**

Draw image

Clear the display

# Practice 2-2

**Set graphic types　colors**

4-1　set gxout *graphics_type*

```
ga-> set gxout shaded
```

4-2　set clevs *vals*　　　　Set contour levels

```
ga-> set clevs -5 -4 -3 -2 -1 1 2 3 4 5
```

4-3　define_colors　　　　Set colors

```
ga-> define_colors
```

4-4　set ccols *vals*　　　Set color numbers

```
ga-> set ccols 79 78 76 74 72 0 32 34 36 38 39
```

Color index

| 79 | 78 | 76 | 74 | 72 | 32 | 34 | 36 | 38 | 39 |
|----|----|----|----|----|----|----|----|----|----|

```
4-5  ga-> set mproj latlon
4-6. ga-> set mpdset lowres
```

# 2-3

How to take the difference
between the two data
by using AGCM
Present and Future
Simulation data

Sea level Pressure map



AGCM_F-P_Slp_Jan
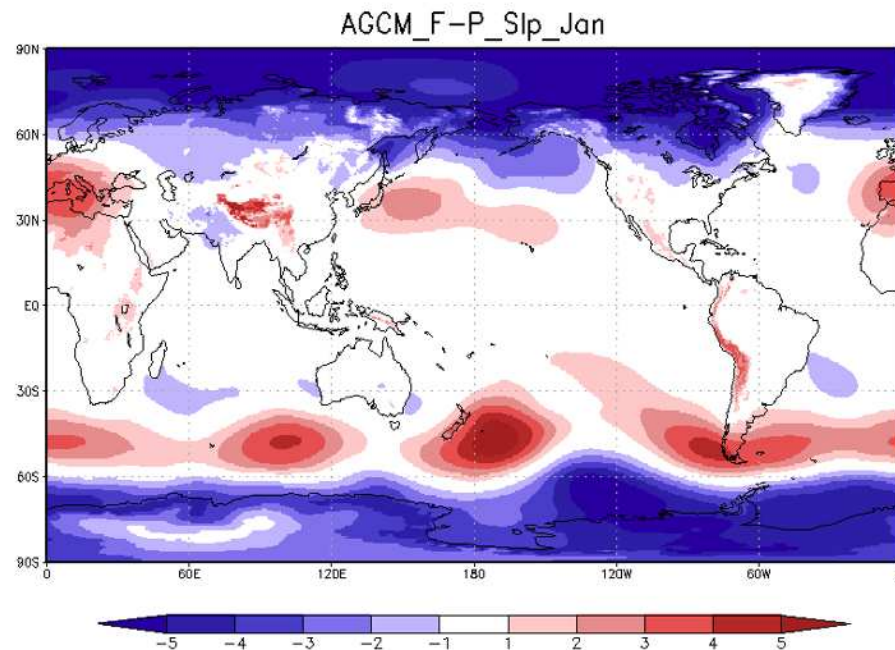
# Practice 2-3

**Command**

```
ga-> reinit                                              initialize

ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/slp-P.ctl
ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/slp-F.ctl      open data
ga-> query file 1
ga-> query file 2

ga-> set  lon  0  360
ga-> set  lat  -90  90                                   Set area and time

ga-> set  gxout shaded             (default is contour)
ga-> set  clevs  -5 -4 -3 -2 -1 1 2 3 4 5
ga-> define_colors
ga-> set  ccols 59  58  56 54  52  0  62 64  66  68  69  Setting graphics type
ga-> set  mproj  latlon            (default is latlon)
ga-> set  mpdset  lowres           (default is lowres)

ga-> set  grads off                (default is on
ga-> display slp.2(t=1)/100- slp.1(t=1)/100             Draw image
ga-> cbarn
ga-> draw  title  AGCM_F-P_Slp_Jan
ga-> printim  /cygdrive/c/TCC_2015/Doc/lecture/7/images/2-3_agcm_f-p_slp_01.png white

ga-> clear                                               Clear the display
```

# Practice 2-3

## Set graphic types  colors

4-1  set  gxout *graphics_type*

```
ga-> set  gxout  shaded
```

4-2  set  clevs *vals*          Set contour levels

```
ga-> set  clevs  -5  -4  -3  -2  -1  1  2  3  4  5
```

4-3  define_colors          Set colors

```
ga-> define_colors
```

4-4  set  ccols *vals*          Set color numbers

```
ga-> set  ccols  59  58  56 54  52  0  62 64  66  68  69
```

Color index

| 59 | 58 | 56 | 54 | 52 | 62 | 64 | 66 | 68 | 69 |
|----|----|----|----|----|----|----|----|----|----|

4-5  
4-6.
```
ga-> set  mproj   latlon
ga-> set  mpdset  lowres
```

# 2-4

How to take the difference
between the two data
by using AGCM
Present and Future
Simulation data

850hPa Wind Vector map



AGCM_F-P_Wind_850hPa_Jan

# Practice 2-4

**Command**

```
ga-> reinit                                              initialize

ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/u-P.ctl
ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/v-P.ctl        open data
ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/u-F.ctl
ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/v-F.ctl
ga-> query file 1
ga-> query file 2
ga-> query file 3
ga-> query file 4

ga-> set  lon  0  360                                    Set area and time
ga-> set  lat  -90  90
ga-> set  lev  850

ga-> set  ccolor  5                                      Setting graphics type
ga-> set  cthick  12
ga-> set  mproj  latlon          (default is latlon)
ga-> set  mpdset  lowres         (default is lowres)

ga-> set  grads off              (default is on          Draw image
ga-> display skip(u.3(t=1)-u.1(t=1),4,4);v.4(t=1)-v.2(t=1)))
ga-> draw  AGCM_F-P_Wind_850hPa_Jan
ga-> set  arrlab  on

ga-> printim  /cygdrive/c/TCC_2015/Doc/lecture/7/images/2-4_agcm_f-p_wind850_01.png white
ga-> clear                                               Clear the display
```

# Practice 2-4

**Set graphic types    colors**

4-1    set ccols *vals*

```
ga-> set  ccols  5
```

4-2    set  cthick *vals*                thikness of  vector (arrow)

```
ga-> set  clevs  12
```

4-3    `ga-> set  mproj   latlon`
4-4.    `ga-> set  mpdset  lowres`

# 3

How to take the difference  between the two data
by using JRA-55(55km) reanalysis data and AGCM(20km)
Simulation data.These data set have different resolution.

3-1 Temperature
3-2 Precipitation
3-3 Sea level pressure
3-4 wind vector map

# 3-1

How to take the difference
between the two data
by using JRA-55 reanalysis data
and AGCM Simulation data.

Temperature map



AGCM_P-JRA55_Temp_Jan

# Practice 3-1

**Command**

```
ga-> reinit                                                   initialize

ga-> open /cygdrive/c/TCC_2015/Data/JRA55/tas.clim.ctl
ga-> open /cygdrive/c/TCC_2015/Data/AGCM/ta-P.ctl             open data
ga-> query file 1
ga-> query file 2

ga-> set  lon  0  360
ga-> set  lat  -90  90                                        Set area and time

ga-> set  gxout shaded               (default is contour)
ga-> set  clevs  -5 -4 -3 -2 -1 0 1 2 3 4 5
ga-> define_colors
ga-> set  ccols 59  58  56 54  52  0  62 64  66  68  69       Setting graphics type
ga-> set  mproj  latlon                 (default is latlon)
ga-> set  mpdset  lowres            (default is lowres)

ga-> set  grads off                     (default is on
ga-> display ta.2(t=1)-lterp(tas.1(t=1),ta.2(t=1))           Draw image
ga-> cbarn
ga-> draw  title AGCM_P-JRA55_Temp_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/agcm-jra_temp_01.png  white

ga-> clear                                                   Clear the display
```

# Practice 3-1

**Draw image ⇒ display the graphic output window**

5-1    Set grads off

```
ga-> set  grads  off
```

5-2    display *element*

```
ga-> display ta.2(t=1)-lterp(tas.1(t=1),ta.2(t=1))
```

The lterp function performs interpolation between two grids.

5-3    cbarn

```
ga-> cbarn
```

5-4    draw title *String*

```
ga-> title AGCM_P-JRA55_Temp_Jan
```

5-5    printim *outfile colors*

```
ga-> printim  /cygdrive/c/TCC_2015/Doc/lecture/7/agcm-jra_temp_01.png  white
```

# 3-2

How to take the difference
between the two data
by using JRA-55 reanalysis data
and AGCM Simulation data

Precipitation map



AGCM_P-JRA55_Prec_Jan
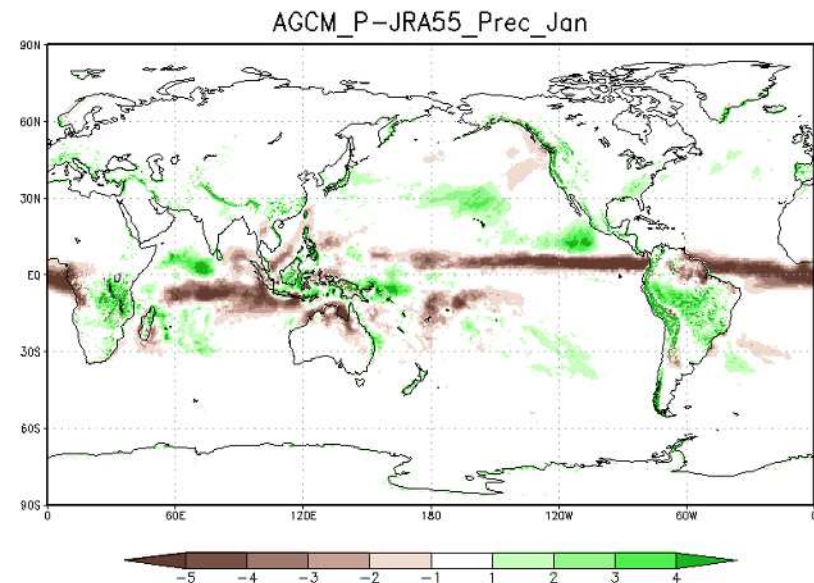
# Practice 3-2

**Command**

```
ga-> reinit
```
initialize

```
ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/pr.clim.ctl
ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/precipi-P.ctl
ga-> query file 1
ga-> query file 2
```
open data

```
ga-> set  lon  0  360
ga-> set  lat  -90  90
```
Set area and time

```
ga-> set  gxout shaded              (default is contour)
ga-> set  clevs  -5 -4 -3 -2 -1 0 1 2 3 4 5
ga-> define_colors
ga-> set  ccols 79 78 76 74 72 0 32 34 36 38 39
ga-> set  mproj  latlon              (default is latlon)
ga-> set  mpdset  lowres            (default is lowres)
```
Setting graphics type

```
ga-> set  grads off                 (default is on
ga-> display precipi.2(t=1)-lterp(pr.1(t=1),precipi.2(t=1))
ga-> cbarn
ga-> draw title AGCM_P-JRA55_Prec_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/3-2_agcm_p-jra_prec_01.png white
```
Draw image

```
ga-> clear
```
Clear the display

# 3-3

How to take the difference
between the two data
by using JRA-55 reanalysis data
and AGCM Simulation data

Sea level pressure map

AGCM_P-JRA55_Slp_Jan

# Practice 3-3

```
ga-> reinit                                                          initialize

ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/psl.clim.ctl
ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/slp-P.ctl                   open data
ga-> query file 1
ga-> query file 2

ga-> set  lon  0  360
ga-> set  lat  -90  90                                               Set area and time

ga-> set  gxout shaded                 (default is contour)
ga-> set  clevs  -5 -4 -3 -2 -1 0 1 2 3 4 5
ga-> define_colors
ga-> set  ccols 59  58  56 54  52  0  62 64  66  68  69              Setting graphics type
ga-> set  mproj  latlon                (default is latlon)
ga-> set  mpdset  lowres               (default is lowres)

ga-> set  grads off                    (default is on
ga-> display  slp.2(t=1)/100-lterp(psl.1(t=1)/100,slp.2(t=1)/100)    Draw image
ga-> cbarn
ga-> draw title AGCM_P-JRA55_Slp_Jan
ga-> printim  /cygdrive/c/TCC_2015/Doc/lecture/7/images/3-3_agcm_p-jra_slp_01.png white

ga-> clear                                                           Clear the display
```

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# 3-4

How to take the difference
between the two data
by using JRA-55 reanalysis data
and AGCM Simulation data

850hPa Wind Vector map

AGCM_P-JRA55_Wind_850hPa_Jan
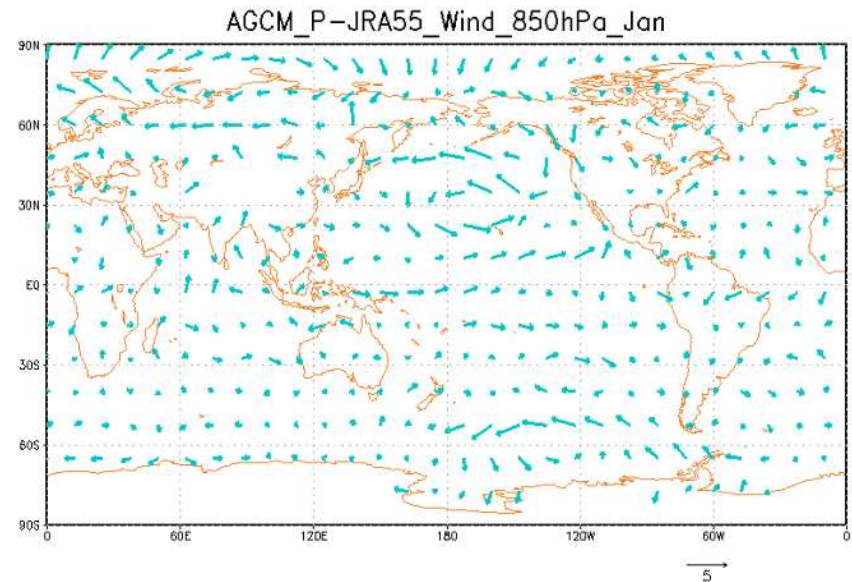
# Practice 3-4

```
ga-> reinit

ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/ua.clim.ctl
ga-> open  /cygdrive/c/TCC_2015/Data/JRA55/va.clim.ctl
ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/u-P.ctl
ga-> open  /cygdrive/c/TCC_2015/Data/AGCM/v-P.ctl
ga-> query file 1
ga-> query file 2
ga-> query file 3
ga-> query file 4

ga-> set  lon  0  360
ga-> set  lat  -90  90
ga-> set lev 850

ga-> set  ccolor 5              (default is contour)
ga-> set  cthick 12
ga-> set  mproj  latlon              (default is latlon)
ga-> set  mpdset  lowres          (default is lowres)

ga-> set  grads off                (default is on
ga-> display skip(u.3(t=1)-lterp(ua.1(t=1),u.3(t=1)),10,10);v.4(t=1)-lterp(va.2(t=1),v.4(t=1))
ga-> set  arrlab  on
ga-> draw  title AGCM_P-JRA55_Wind_850hPa_Jan
ga-> printim /cygdrive/c/TCC_2015/Doc/lecture/7/images/3-4_agcm_p-jra_wind850_01.png white
ga-> clear
```

**initialize**

**open data**

**Set area and time**

**Setting graphics type**

**Draw image**

**Clear the display**

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# Sample of Color number

## Set graphic colors

Reference number of colors

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 14 | 4 | 11 | 5 | 13 | 3 | 10 | 7 | 12 | 8 | 2 | 6 |

http://www.iges.org/grads/gadoc/gadocindex.html

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 69 | 68 | 66 | 64 | 62 | 0 | 52 | 54 | 56 | 58 | 59 |

# Sample of Color number

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 59 | 58 | 56 | 54 | 52 | 62 | 64 | 66 | 68 | 69 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 79 | 78 | 76 | 74 | 72 | 32 | 34 | 36 | 38 | 39 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 49 | 48 | 46 | 44 | 42 | 22 | 24 | 26 | 28 | 29 |

# MAP

# Thank you for your attention.
# Have a good seminar.