GrADS reference card version 1.7

(GrADS Version 1.7 beta 7)   compiled by *Karin Meier-Fleischer,* DKRZ (beratung@dkrz.de)

GrADS program executables

grads	link to one of the following executables
gradsnc	grads with netCDF enabled
gradshdf	grads with HDF enabled
gradsc	grads "classic", without netCDF/HDF/Athena GUI, etc.

Command line options

Program: grads [-lbpC] [-c 'command']	
-c 'command'	execute 'command' when starting GrADS
-b	run grads in batch mode. No graphics output window is opened.
-l	run grads in landscape mode. The orientation question is not asked.
-p	run grads in portrait mode. The orientation question is not asked.
-C	enable automatic setting of century for years < 100

General settings

help	gives a summary list of operations
set grads on | off	enable/disable display of the GrADS logo

set display <option <color>>	
	sets the mode of the display. options are:
grey|greyscale	sets the mode to greyscale.
color <black|white>	shading and contouring is done with rainbow colors. Default.

set frame <option>	
	control the frame on a plot. options are:
on	plots a rectangular frame around clipped region
off	plots no frame
circle	plots a rectangular frame for lat-lon projections, plots a circular frame for a polar plot at the outermost latitude. Whole hemisphere plots only.

set background ic	set background color to color or color index ic
display expression **d expression**	display data via the graphics output window; the simplest expression is a variable abbreviation
open filename	open descriptor file
sdfopen file.nc <template #timesteps>	
	opens a netCDF or HDF-SDS format file that conforms to the COARDS conventions. The optional arguments are for string a time-series of files together as one GrADS data object.
xdfopen file	opens a non-COARDS-conformant netCDF or HDF-SDS file via a data descriptor file similar to those used with the 'open' command.
close file#	close the last descriptor file opened.
set dfile number	change to descriptor file number for current file
define var=expr **var=expr**	create new variable, which then can be used in subsequent expressions
undefine var	free the resources used by the defined variable

modify varname <time type>	
	define variable, which is climatological. varname is the defined grid. Time types are:
seasonal	monthly or multi-monthly means
diurnal	over some time period less than a day

query <option> q <option>	query options are:
config	list GrADS configuration information
files	lists open files
file n	gives info on particular file
define	lists currently defined variables
dims	gives current dimension environment
gxinfo	gives graphics environment info
shades	gives colors and levels of shaded contours
pos	waits for mouse click, returns the position

time	gives info about time settings
fwrite	print name of fwrite ouput file
string s	gives the width of string s
defval v1 i j	gives the value of a defined variable v1 at point i,j
udft	list the user defined function table
lats	state of the GrADS-LATS interface
xy2w v1 v2	XY coords to world coords
xy2gr v1 v2	XY coords to grid coords
w2xy v1 v2	world coords to XY coords
w2gr v1 v2	world coords to grid coords
gr2w v1 v2	grid coords to world coords
gr2xy v1 v2	grid coords to XY coords
ll2xy lon lat	LON/LAT coords to XY coords
pp2xy ppx	page coords to XY coords
ppy	

set imprun script	automatically executes script before every display command
run file-name <params>	load and run a GrADS script (with parameters)
exec fname <arg0,..,arg9>	executes a sequence of GrADS commands from file fname. If a clear command is encountered, GrADS waits until enter is pressed before clearing and continuing with command processing

clear <option> c <option>	c <option> clear the display; option are:
events	flush event buffer
graphics	clear graphic, not widgets
hbuff	clear display buffer, when in double buffer mode

reset <option>	initializes GrADS to its initial state with following exceptions: 1) No files are closed. 2) No defined objects are released. 3) The 'set display' settings are not modified. Options are:

Default colors, line styles and marker types

Dimension environments

Graphics options

Page control

Graphic types

set grid on | off | <style> <color> | horizontal | vertical	
	draw grid lines using the specified options or not
set bargap val	sets the gap between bars in percent
set barbase value | bottom | top	bar rises from or falls from value
set baropts filled | outline	bar outlined or filled; default: filled
set dignum number	number of digits after the decimal place
set digsize size	size (in inches, or plotter units) of the numbers
set arrlab on|off	set arrow labeling on or off
set arrscl size <magnitude>	specifies arrow length scaling
set arrowhead size	specifies arrow head size
set fgvals v1 c1 <v2 c2>...	fgrid output type treats the grid values as rounded integers, and will shade a specified integer valued grid with the specified color.
set zlog on | off	sets log scaling of the Z dimension on or off
set strmden value	specifies the streamline density, where value is from 1 to 10. Default: 5
set stnopts <dig3> <nodig3>	plot the number in the slp location as a three digit number with only the last three digits of the whole number plotted
set mdlopts noblank | blank | dig3 | nodig3	
	plot the number of the model data as a three digit
set stid on | off	controls wether the station id is displayed next to the values or not
set wxcols c1 c2 c3 c4 c5 c6	set colors for weather symbols c1 - c6

Axis labeling/Annotation/labeling

set xaxis start end <incr>	specifies the axis is to be labeled
set yaxis start end <incr>	specifies the axis is to be labeled
set xlevs lab1 lab2 ...	specifies the label levels to plot for the X axis
set ylevs lab1 lab2 ...	specifies the label levels to plot for the Y axis
set xlint interval	specifies the label interval of the X axis
set ylint interval	specifies the label interval of the Y axis
set xyrev on	reverses the axes on a plot
set xflip on	flips the order of the horizontal axis
set yflip on	flips the order of the vertical axis
set xlab on | off | auto | string	controls and/or draws X axis label
set ylab on | off | auto | string	controls and/or draws Y axis label
set xlabs lab1 | lab2 |	abel the x axis with lab1, lab2, lab3, ...
set ylabs lab1 | lab2 |	label the y axis with lab1, lab2, lab3, ...
draw xlab string	draw x axis label
draw ylab string	draw y axis label
set xlopts col <thick <size>>	controls X axis
set ylopts col <thick <size>>	controls Y axis
set xlpos offset side	controls position of x axis labels. Where offset - in inches; side - b or t (bottom or top)
set ylpos offset side	controls position of y axis labels. Where offset - in inches; side - r or l (right or left)
set zlog on | off | swap | undefine	
	sets log scaling of the Z axis
set annot col <thick>	sets color and line thickness for the above 3 draw commands
set vrange vlo vhi	Set range for plotting 1-D or scatter plots; range of the variable values for y-axis scaling
set vrange2 vlo vhi	Set range for plotting 1-D or scatter plots; range of the variable values for x-axis scaling
set missconn on | off	lines will be connected across missing data
draw title string	draw title at top of graph

Map projections/drawing

set mproj proj	sets current map projection. Keywords are:
latlon	Lat/lon projection with aspect ratio maintained. Default.
scaled	latlon projection where aspect ratio is not maintained.The plot fills the plotting area.
nps	north polar stereographic
sps	south polar stereographic
robinson	Robinson projection
orthogr	Orthographic projection
mollweide	Mollweide projection
lambert	Lambert conformal conic projection

off	same as scaled, but no map is drawn and lables are not interpreted as lat/lon labels

set mpt type off | <<col> <style> <thick>>	
	command to control map background behavior. type is the map type; it can be a number from 0 to 255, or it can be an asterick (*) to indicate this command applies to all the type values. The color can be set to -1, which indicates to GrADS to use the set map settings for this map type, rather than the settings specified by the set mpt command.
set mpvals off | lmn lnmx ltmn ltmx	
	sets reference longitudes and latitudes for polar stereogr. plots
set mpdset lowres | mres | hires | nmap	
	mres and hires have state and country outlines. nmap covers only North America. Default:lowres.
set map auto | color <style <thick>>	
	draws the map background using the requested line attributes or auto mode
set mpdraw on | off	
	if off, does not draw the map background
set grid on | off <style <col>> | horizontal | vertical	
	draw or do not draw map lat/lon lines on polar plots using the specified color and linestyle
set poli on | off	selects whether you want political boundries drawn for the mres or hires map data sets. Default is on

Graphic primitives

draw line x1 y1 x2 y2	draws a line from x1, y1 to x2, y2 using current line drawing attributes
draw rec xlo ylo xhi yhi	draws an unfilled rectangle
draw recf xlo ylo xhi yhi	draws a filled rectangle
draw mark marktype x y size	
	draws a marker. Marker types (see Default colors and line styles).
draw polyf x1 y1 x2 y2 ... xn yn	
	draw a filled polyline, where xn=x1 and yn=y1
draw wxsym symbol x y size <color <thickness>>	
	Draws the specified wx symbol at the specified location

String primitives

set string col <justification> <thick> <rotation>	
	sets string drawing attributes. Justification: l - left; c - center; r - right; tl - top left; tc - center top; tr - right top; bl - bottom left; tc - center bottom; tr - right bott. Roation: 90 - counterclockwise, -90 - clockwise..
set strsiz width <height>	sets the string character size
draw string x y string	draws the character string at the x,y position
draw title string	draw a title 'string' on top of the graph

Color settings

set rgb num red green blue	defines new colors within GrADS, and assigns them to a new color number.color-number num must be a value between 16 and 99 (0 to 15 are predefined)

Font settings

set font number	change to font number [0-5]

Widgets

set button 1 bcol1 bcol2 bcol3 0 fcol1 fcol2 fcol3 thickness	
	set button colors. 1 - "on" state; 0 - "off" state
draw button number x y width height string	
	draws a button on position x,y with the attributes
redraw button number 0 | 1	
	redraws button number; 1 - "on"; 0 - "off"
set rband wn mode x1 y1 x2 y2	
	rubber banding. wn = widget #; mode = box or line x1, y1 = lowest point in x/y page units x2, y2 = highest point in x/y page units

draw dropmenu number x y width height text	
	display a dropmenu similar to 'draw button' command widget number (0 to 64); x and y are the center location for the 'base' of the dropmenu; width and height are the size of the 'base' of the dropmenu.

Double buffering

set dbuff on|off	sets double buffer mode on or off
swap	swaps buffers, when double buffer mode is on

Animation

set looping on|off	control animation; set animation on or off
set loopdim x|y|z|t	animate through x,y,z or t; default: t
set loopincr incr	set looping increment

Hardcopy output

enable print fname	enables the print command to the given file fname
print	copy the contents of current display into a file in a metacode format
disable print	close print output file
outxwd file	output the graphicw window to a file in the X windows dump format
wi file.format	output to a file with format (using ImageMagick), e.g. wi test.gif

Create/Write a grid file

set fwrite fname	output grid fname; if not set, fname=grads.fwrite
set gxout fwrite	enables grid file output
disable fwrite	close output grid file

Mathematical Functions

abs(expr)	absolute value of result of expr. Operates on gridded and station data
acos(expr)	applies the $\cos^{-1}$ function to the result of expr
asin(expr)	applies the $\sin^{-1}$ function to the result of expr
atan2(expr1,expr2)	applies the $\tan^{-1}$ function to the result of the two expr, using $\tan\theta = y/x$
cos(expr)	takes the cosine of the expr
exp(expr)	performs the ex operation, where expr is x. gridded and station data
gint(expr)	general integral, same as ave except do not devide by the total area
log(expr)	takes the natural logarithm of expr
log10(expr)	takes the logarithm base 10 of the expr
pow(expr1,expr2)	raises the values of expr1 to the power of expr2
sin(expr)	takes the sine of the provided expr (in radians)
sqrt(expr)	takes the square root of the result of the expr
tan(expr)	takes the trigonometric tangent of the expr

Averaging Functions

ave(expr,dexpr1,dexpr2<,tinc<,flags>>)	
	generalized averaging function. expr is averaged through the dimension range specified by dim1 and dim2
aave(expr,xdim1,xdim2,ydim1,ydim2)	
	does area average. xdim1 and xdim2 must be for lon or x, ydim1 and ydim2 must be for lat or y (e.g. aave(t,lon=0,lon=180,lat=0,lat=90))
mean(expr,dexpr1,dexpr2<,tinc<,flags>>)	
	same as ave, except that area weighting is disabled
amean(expr,xdim1,xdim2,ydim1,ydim2)	
	same as aave, except that area weighting is disabled
vint(psexpr,expr,top)	performs a mass-weighted vertical integral in mb pressure coordinates, where: exprexpression for quantity to be integrated psexpr expression yielding the surface pressure, in mb,which will be used to bound the integration on the bottom topconstant, giving the bounding top pressure, in mb. This cannot be provided as an expression

Grid Functions

const(expr,const<,flag>)	function allows you to set various parts of a grid to a constant
maskout(expr,mask)	whenever the mask values are less than zero, the values in expr are set to the missing data value
skip(expr,skipx,skipy)	sets alternating values of the expr to the missing data value.This function is used while displaying wind arrows or barbs to thin the number of arrows or barbs

Filtering Functions

smth9(expr)	performs a 9 point smoothing to the gridded result of expr

Finite Difference Functions

cdiff(expr,dim)	performs a centered difference operation on expr in the direction specified by dim

Meteorological Functions

tvrh2q(tvexpr,rhexpr)	given virtual temperature and relative humidity, tvrh2q returns specific humidity, q, in g/g
tvrh2t(tvexpr,rhexpr)	given virtual temperature and relative humidity, tvrh2t returns the temperature in degrees Kelvin

Special Purpose Functions

tloop(expr)	when time is varying dimension in the dimension environment, tloop function evaluates the expr at fixed times, then constructs the time series to obtain a final result that is the time varying

Vector Functions

hcurl(uexpr,vexpr)	calculates the vertical component of the curl (i.e.vorticity) at each grid pointusing finite differencing on the grids provided
hdivg(expr1,expr2)	calculates the horizontal divergence using the finite differencing
mag(uexpr,vexpr)	performs the calculation: sqrt(uexpr*uexpr+vexpr*vexpr)

Station Data Functions

gr2stn(grid_expr,stn_expr)	performs an interpolation from grid space back to station locations
oacres(grid_expr,stn_expr<,radii<first guess>>)	a Cressman objective analysis is performed on the station data to yield a gridded result representing the station data
stnave(expr,dexpr1,dexpr2<,-m cnt>)	takes an average of station data over time
stnmin(expr,dexpr1,dexpr2<,-m cnt>)	examines a time series of station data and returns the minimum value encountered for each station
stnmax(expr,dexpr1,dexpr2<,-m cnt>)	examines a time series of station data and returns the maximum value encountered for each station

Variables

complete specification for a variable name
abbrev.file#(dimexpr,dimexpr,...)
abbrev is the abbreviation for the variable as specified in the data descriptor file file# is the file number that contains this variable. The default initially is 1. dimexpr is a dimension expression that locally modifies the current dimension environment.

Create PostScript files

Program: gxps [-c] [-r] [-d] [-i mfile] [-o ofile]

converts the GrADS meta file into a PostScript file. Command line options:

```
-c        color on a white background   (=old gxpscw)
-r        color on a black background   (=old gxpsc)
-d        add ctrl-d to the end of the file, useful if printing on HP 1200C/PS printer
-i  mfile   where mfile is the name of the input GrADS meta file
-o ofile    where ofile is the name of the output PostScript file
```

Program: gxeps [-1][-2][-a	-l][-c][-r][-d][-L][-n][-s][-v] [-i mfile] [-o ofile]

converts the GrADS meta file into a PostScript file. Command line options:

```
-1         PostScript Level 1 output
-2         PostScript Level 2 output
-a         DIN A4 paper size
-c         color on a white background
-d         add ctrl-d to the end of the file, useful if printing on HP 1200C/PS printer
-l         US letter paper size
-L         ask for a label to be printed on the plot
-n         ask for a note to include in postscript file header
-r         color on a black background
-s         add a file & time stamp
-v         verbose
-i  mfile  where mfile is the name of the input GrADS meta file
-o  ofile  where ofile is the name of the output PostScript file
```

Create GIF files

Program: gxgif [-i mfile] [-o ofile]

converts the GrADS meta file into a GIF file. Command line options:

```
-i  mfile    where mfile is the name of the input GrADS meta file
-o ofile     where ofile is the name of the output GIF file
```