Vertical coordinates
PRES – Pressure
TROP – Tropopause level
FRZL – Freezing level
CLDT – Cloud-top level
CLDL – Cloud-base level
HGHT – Height above the ground
HAGL – Height above the ground
ZAGL – Height above the ground
NONE – vertical coordinate meaningless (often refers to the surface)
PDLY – Pressure difference layer
MWSL – Maximum wind speed level

Some common scalar variables
PRES – Pressure
HGHT – Geopotential height (m)
HLCY – Storm-relative helicity
AVOR – Absolute vorticity
CORS – Coriolis parameter \( f = 2\Omega \sin \phi, \text{s}^{-1} \)
EMSL – Mean sea-level pressure calculated the way the Eta model did it
PWTR – Precipitable water
CAPE – Convective available potential energy
PMSL – Mean sea-level pressure
CINS – Convective inhibition
LFT4 – Lifted Index
LIFT – Lifted Index
P06M – Six-hour total accumulated precipitation (mm)
P06I – Six-hour total accumulated precipitation (in)
TMPC – Temperature (°C)
TMPF – Temperature (°F)
DWPK – Dewpoint (K) [DWPC and DWPF for Celsius and Fahrenheit]
TVRK – Virtual temperature (K) [TVRC and TVRF for Celsius and Fahrenheit]
TMWK – Wet-bulb temperature (K) [TMWC and TMWF for Celsius and Fahrenheit]
MIXR – Mixing Ratio (g/kg)
THTA – Potential temperature (K)
THTE – Equivalent potential temperature, i.e. \( \theta_e \) (K)
DRCT – Wind direction (degrees)
SPED – Wind speed (m/s)
UWND – Zonal (east-west) wind speed (m/s)
VWND – Meridional (north-south) wind speed (m/s)

Some common vector variables
WND – Total (i.e. actual) wind
GEO – Geostrophic wind
AGE – Ageostrophic wind
THRM – Thermal wind
Description of parameters in gdplot. Type "phelp parameter_name" while in gdplot for additional documentation about how to set these parameters.

**GDFILE**
- This is the directory and file you would like to make plots from. Set this in the form "$MODEL/nam/file_name" for this class.

**GDATTIM**
- This specifies the date and time for the plot. Since each file (that we'll be using) is for a unique date and time, we only need to specify the forecast hour here, in the form "f hh", where hh is the 2-digit forecast hour. So, for example, the 18 hour forecast is "f18" and the initialization is "f00".

**GLEVEL**
- This is the level at which we would like to plot our variables. In pressure coordinates (see next parameter), we would specify the level in mb (e.g., we would set it to "500" for 500 mb).

**GVCORD**
- This specifies the coordinate corresponding to the GLEVEL. If we want to plot on a constant pressure map, for example at 500 mb, we would set this to "pres". To plot surface variables, set this to "none". See the list of other vertical coordinates above.

**PANEL**
- This allows us to make multi-panel plots. We won't worry about doing this in this class. Just set this to "0" to make a full screen plot.

**SKIP**
- This allows us to skip plotting some data, particularly vectors. The NAM211 resolution is quite high and plotting a vector (e.g., the wind) at all points will result in a plot with way too many vectors/barbs. A typical value to set this to for plotting vectors on the NAM211 is "/2". There is a forward slash ("/") because we leave the first value blank, which refers to data thinning used to plot the contours, which we will not change. Setting this parameter to "/n" tells the program to skip n vectors for every one plotted in both the x and y directions. So, "/2" will skip 2 vectors and plot one, etc.

**SCALE**
- This scales the data plotted by a specified power of 10. Setting this to "n/m", for example, will multiply the scalar values by 10^n and the vector magnitudes by 10^m before plotting. This will be useful when plotting things like vorticity, which has values on the order of 10^{-5} s^{-1}. In that case, setting this to "5" will allow you to plot contours that are integers (e.g., 1, 2, 3) with units 10^{-5}s^{-1}, rather than numbers like 2 x 10^{-5} s^{-1}.

**GFUNC**
- This is one of the two most important parameters. It specifies the scalar quantity that you are actually plotting. This can be an already existing variable, such as "tmpf" (see list of common variables above), or a function of existing variables. **If you type a function here, it is important that the result is a scalar.**

**CTYPE**
- This is the type of contour we would like to use for plotting the scalar set in GFUNC. This can be "c" for contours that are lines or "f" for filled contours. We'll use both in this class.
CONTUR
- Allows us to smooth the data that is plotted for smoother contours. Set this to "n", where \( n \) is an integer, to have smoothing. The higher the number, the more the smoothing. Set this to "0" for no smoothing.

CINT
- Specifies the contour lines when \( \text{CTYPE} \) is set to "c". Set this in the form "\text{interval/min/max}" to have contour lines that start at \text{min}, end at \text{max}, and have the \text{interval} specified, where \text{min}, \text{max}, and \text{interval} are values of the scalar set in \text{GFUNC}, that are scaled by the value in \text{SCALE} (see above). You can also have irregularly spaced contours by specifying each individual contour in the form "\text{n1;n2;n3;n4}....". For example, if we want the contours for temperature (in °F) to start at 10 °F, end at 80 °F, and be drawn for every 10 °F, we would set this to "10/10/80" or "10;20;30;40;50;60;70;80". If the range of contours specified is larger than the range covered by the actual data, contours will only be drawn for the range that is covered in the data.

LINE
- This specifies the aesthetic properties of the contour lines when \( \text{CTYPE} \) is set to "c". We'll mainly care about the color, style (e.g., dashed vs. solid), and thickness of the lines in this class. Set this in the form "\text{color/style/thickness}/...", where \text{color} is the number of GEMPAK color listed at the end of this handout, \text{style} is another number referring to the line type (use "phelp line" to learn more about these), and \text{thickness} is an integer with larger numbers having greater thickness. The default thickness is 1, and 2 is usually large enough to differentiate from the default. You can get even more creative with this parameter- type "phelp line" to learn more.

FINT
- This is just like \text{CINT} except it is only used when \( \text{CTYPE} \) is set to "f", that is, this sets the contour values when you are plotting scalars with color fills instead of with lines. Set this the same way as you would \text{CINT}.

FLINE
- This tells which colors to use for color fills when \( \text{CTYPE} \) is set to "f". The parameter \text{FINT} essentially gives the boundaries between colors and this parameter specifies which colors to use in between these boundaries. Usually, you will set this in the form "\text{n1};\text{n2};\text{n3};\text{n4}....", where \text{n1} and so on are the numbers of the GEMPAK colors you want to use, in the order corresponding to the contours in \text{FINT}, from lowest to highest. There should be one more color than there are contours specified in \text{FINT}, otherwise GEMPAK will automatically repeat (or not use) all the colors you specify. Also, if \text{FINT} is set in the form "\text{interval/min/max}" and the data itself does not cover this entire range, color fills will only be drawn for the range of data that is covered and only the first colors specified in \text{FLINE} will be used for the color fills. To specify a unique color for each contour, set \text{FINT} in the form "\text{n1};\text{n2};\text{n3};\text{n4}....". For example, if I want to plot temperature contours at 40, 50, and 60 °F with blue fill for less than 40 °F, green for between 40 and 50 °F, yellow between 50 and 60 °F, and orange for above 60 °F, I would set \text{FINT} to "40;50;60" and \text{FLINE} to "4;3;5;10". Type "phelp fline" for more fancy options with this parameter.
HILO
- Allows you to specify information for plotting high and low symbols on a plot. Don't worry about this. Leave it blank.

HLSYM
- Controls the aesthetic qualities of the high and low symbols specified in HILO. Don't worry about this either. Leave it blank.

CLRBAR
- This specifies where and how to plot a color bar associated with color fills when CTYPE is set to "f". It is of the form "color/orientation/anchor/x;y/...". This is one of most annoying parameters to set and I won't expect you to mess around with it much. To have a nice horizontally oriented color bar on the bottom of a plot, just set CLRBAR to "1/h/cc/0.5;0.035/0.75;0.012/-1".

GVECT
- This is the second of the two most important parameters in gdplot. This is where you specify the vector that you actually want to plot. This can be a pre-existing variable like "wnd" (see list of variables) or a function of pre-existing variables. If you type a function here, the result must be a vector.

WIND
- This specifies the aesthetics of the vector you are plotting in GVECT. Specify this in the form "symbol/size/thickness/...". symbol refers to the type of vector (barbs or arrows), the units, and the color. Please type "phelp wind" to see how to set this. For example, to have wind barbs in m/s that are white, I would set symbol to "bm1". For green arrows for non-wind vectors, I would skip the units and set it to "a3". size is a real number that scales the vector size from the default, which is 1. So, to make the vectors a bit smaller, set this to something like "0.75". thickness is set like it is in the LINE parameter. Type "phelp wind" to see what else you can do with this parameter.

REFVEC
- This allows you to draw a reference vector on the map. It's as difficult to use as the CLRBAR parameter, so we won't worry about it in this class. Leave it blank.

TITLE
- This allows you to put a title on your maps, which will be important. Set this in the form "color/location/title". color is the color of the title, expressed as the GEMPAK color number. location is a positive integer indicating the number of lines from the top to display the title, or a negative integer indicating the number of lines from the bottom to display it. Setting this to "0" will draw it on the bottom line. title is, of course, the title you want to display. So, to draw the title "500 mb Height" two lines from the bottom in white, I would set this to "1/-2/500 mb Height". If you add "~" after the title name, it will display the date, time, and forecast hour of the data displayed.

TEXT
- This controls the aesthetic properties of any text on the plot, such as the title. It is of the form "size/...". We'll just set this to "1" for the default size and not worry about the rest.
CLEAR
- This tells gdplot whether or not to clear the map before running the program again (typing "r" in the GEMPAK prompt). Set this to "yes" to clear the map and have a new one displayed when you type "r". When, for example, you want to draw more than one vector or contour more than one scalar (or have different line styles for different contours), you would set this to "no", change the necessary parameters, then run the program again.

GAREA
- This specifies the geographical area that is displayed on the map. It can be set in the form "lat1;lon1;lat2;lon2" where (lat1, lon1) is the lower left corner of the map in latitude (negative for °S) and longitude (negative for °W) and (lat2, lon2) is the upper right corner. Set this to "20;-122;50;-58" for a domain covering the lower 48 states.

IJSKIP
This allows you to play with the internal grid. Don't worry about this. Leave it blank.

PROJ
- This specifies the projection of the map. We won't worry about the details of this in this class, and we'll keep it fixed at a Northern Hemisphere Lambert Conic Conformal projection. Just set this to "lcc/20;-97.5;55".

MAP
- This controls the aesthetic properties of the map background. Set this in the same way as you would the LINE parameter, only now you are specifying how you want the map to be plotted, rather than the contours.

MSCALE
- This allows you to draw a scale legend for the map. Don't worry about this. Leave it blank.

LATLON
- This allows you to draw latitude and longitude grid lines. Don't worry about this. Leave it blank.

DEVICE
- This tells gdplot what device to display your map on. Set this to "xw" to display it in a window. Set this in the form "ps\|filename.ps" to make postscript files for printing.

STNPLT
- This allows you to plot station markers. Don't worry about this. Leave it blank.

Additional parameters in gdcntr and gdwind that are not in gdplot:

SATFIL
- Allows you to put an image from a satellite on a plot. Leave it blank in this class.

RADFIL
- Allows you to put a radar image on a plot. Leave it blank in this class.

IMCBAR
- Controls the color bar for images, much like CLRBAR. Leave it blank in this class.

LUTFIL
- Used to enhance colors for images. Leave it blank in this class.