GEMPAK Ensemble Functions
Syntax and Usage

Scott Jacobs
Keith Brill
11 July 2006

Agenda

- Overview
- File specification
- Functions
  - Syntax
  - Usage
- Examples

Overview

- Ensemble meeting held May 2004
  - From this meeting a number of requirements were generated for new diagnostic functions in GEMPAK
    - Mean, Spread and Median
    - Lowest and Highest value
    - Range between Lowest and Highest values
    - Univariate exceedance probabilities for selectable threshold
    - Multivariate exceedance probabilities for selectable threshold
    - Forecast value associated with selected univariate percentile

Overview

- Example basics
  - All restore files presented work with GDPLOT2
  - Help can be found by typing “help gparm” at the GDPLOT2 program prompt
  - Graphics can be output in a number of formats
    - GIF, PostScript, VG files for NMAP usage
  - The following entries for the Ensemble models in “datatype.tbl” are assumed
    - GEFS $MODEL/gefs gep*_YYYYMMDDHHfFFF
    - SREF $MODEL/sref sref_YYYYMMDDHH_*

File Specification

- The models used in the diagnostic function are listed in GDFILE
- Ensemble members are enclosed in braces and separated by commas
  - GDFILE = { gefs }
  - GDFILE = { sref, nam }
  - GDFILE = { nam, gfs, cmc, ukmet }

File Specification

- Individual ensemble members may be selected by giving the model name and member name separated by a colon
  - GDFILE = { gefs:01, gefs:10 }
  - GDFILE = { sref:eta_n1, sref:nmm_p1 }

File Specification

- Ensemble members may also have user specified weights
  - Valid values are 0 – 100
  - GDFILE = { gefs, 40%sref }
  - GDFILE = { sref, 50%nam }
  - GDFILE = { 20%gefs:01, 50%gefs:10, gefs:11 }
  - GDFILE = { 25%nam, gfs, 10%cmc, 15%ukmet }
- Other file attributes such as cycle time are valid for ensemble members

Function Specification

- There are several ensemble functions
  - Function name of the form ENS_XXXX
- Arguments of these functions can be
  - Individual parameters (pmsl, hght, etc.)
  - Constants
  - Other diagnostic functions (div(wnd), adv(tmpc,wnd), etc.)
- Arguments cannot be another ensemble function

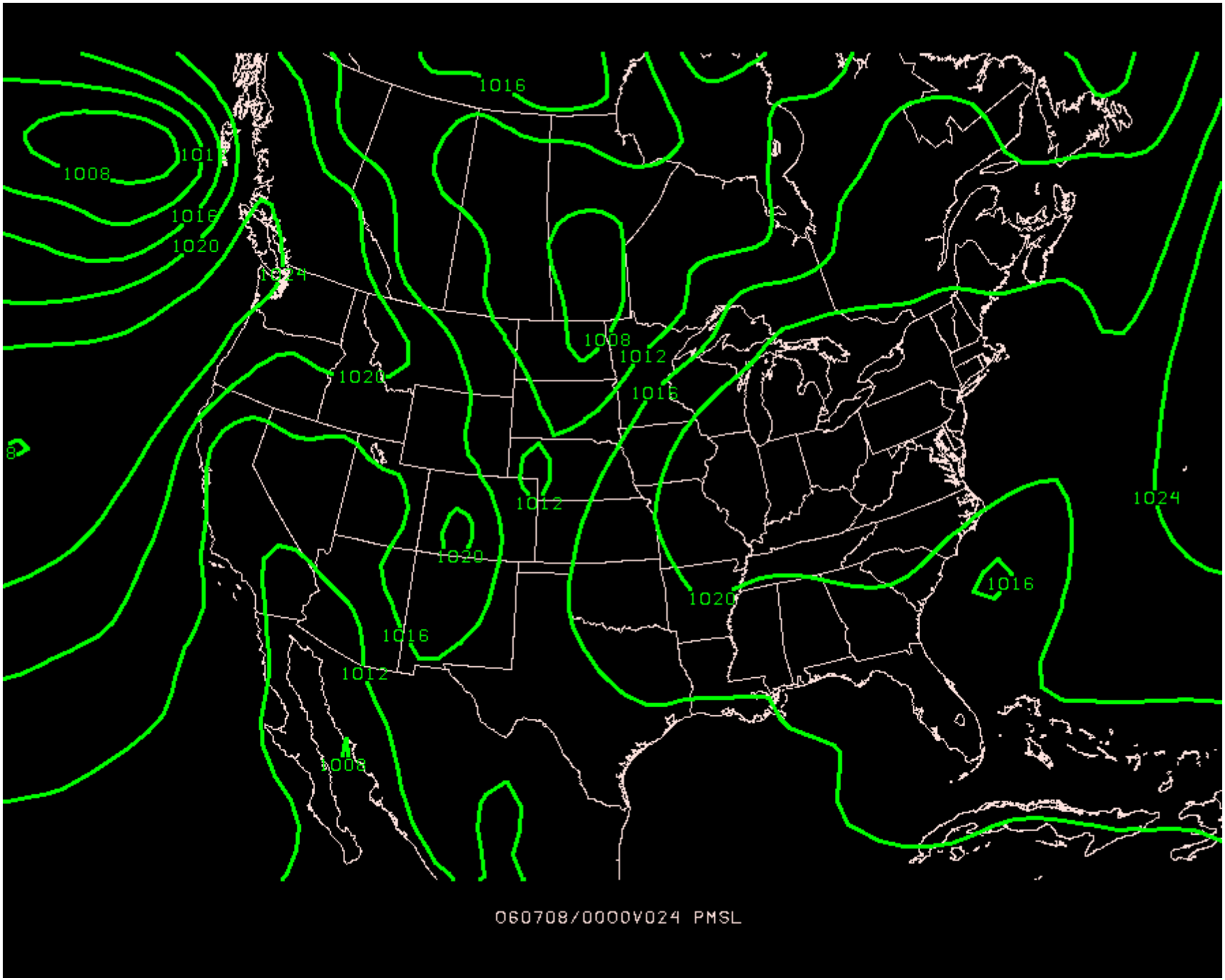
Functions

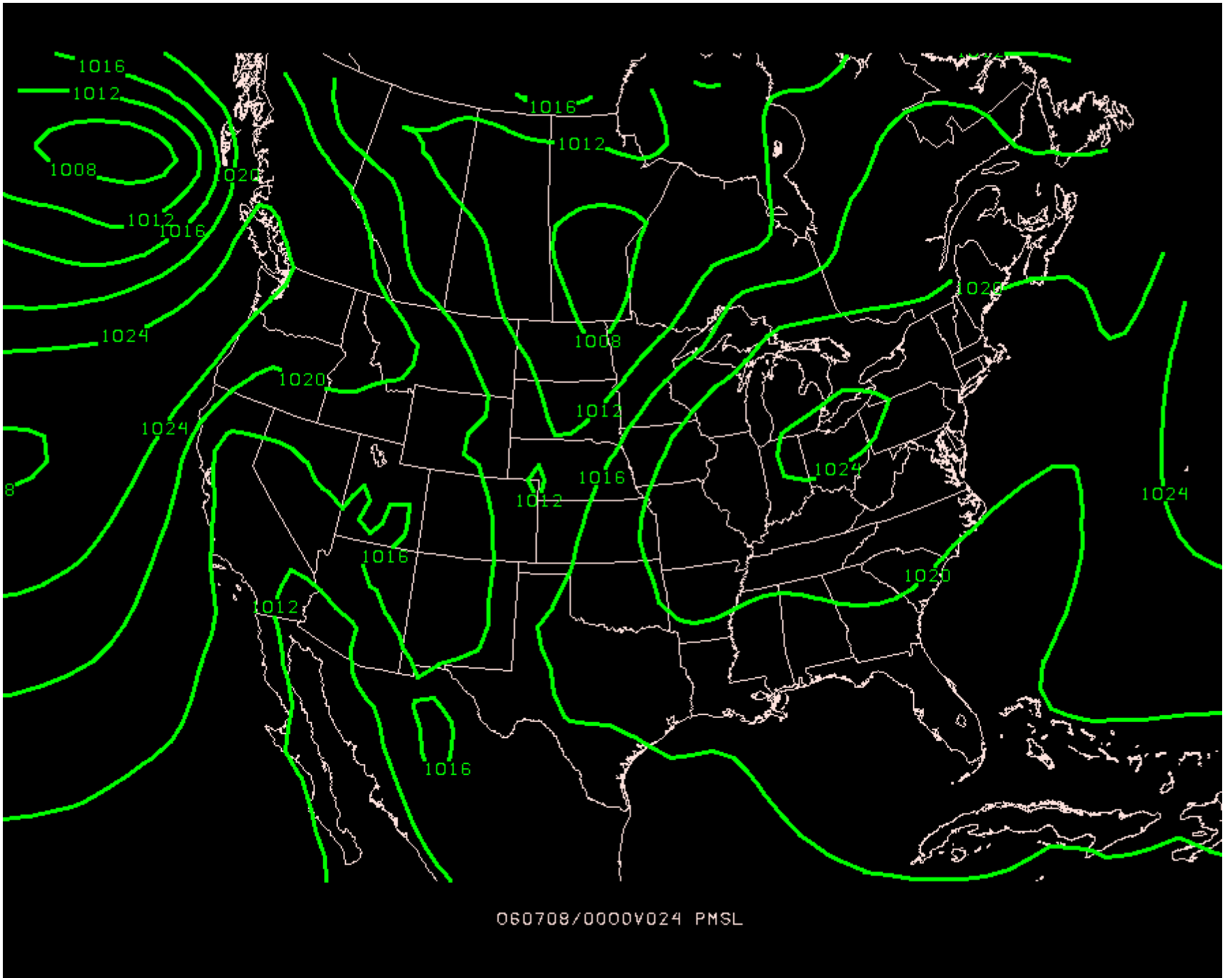
- Scalar Mean
  - Average over all members
  - ENS_SAVG (input_arg)
  - Example 1

```
GDFILE  = {gefs:01|00,gefs:02|00,gefs:03|06,gefc:00|00,gefc:00|06}
GDATTIM = f24
GLEVEL  = 0
GVCORD  = none
GDPFUN  = ens_savg(pmsl)
```

  - Example 2

```
GDFILE  = {gefs:01|00,gefs:02|00,gefs:03|06,gefc:00|00,gefc:00|06,50%sref|09}
GDATTIM = f24
GLEVEL  = 0
GVCORD  = none
GDPFUN  = ens_savg(pmsl)
```

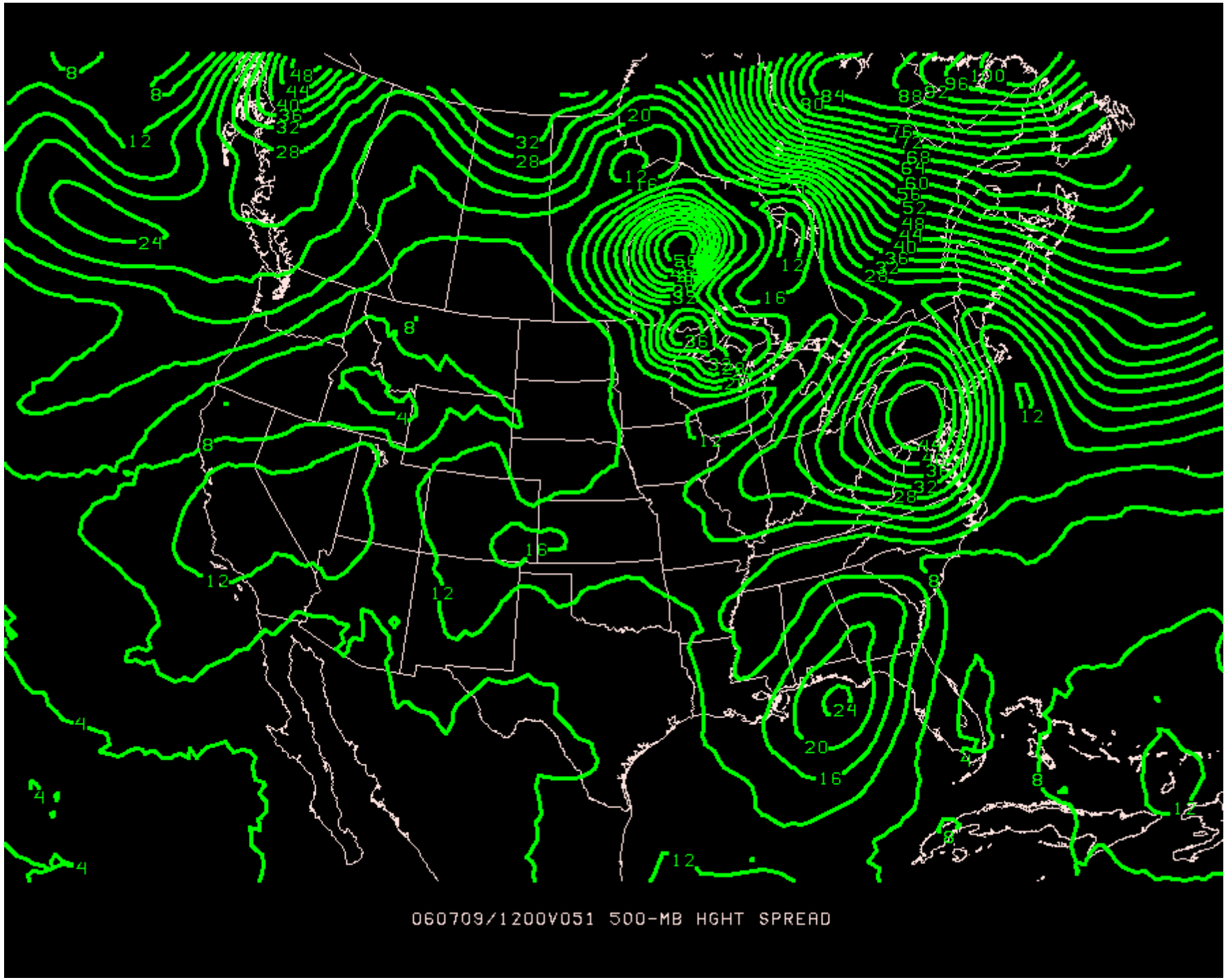

1016
1008
1016
1020
1008
1012
1020
1016
1012
1024
1020
1016
1020
1016
1012
1008
060708/0000V024 PMSL


1016
1012
1008
1012
1016
1024
1020
1024
8
1016
1012
1016
1012
1016
1008
1012
1016
1020
1024
1020
1024
060708/0000V024 PMSL

Functions

- Scalar Spread
  - Sample standard deviation
    - SQRT([SUM(Xi**2) - (SUM(Xi)**2) / N] / (N-1)
  - ENS_SSPRD (input_arg)
  - Example

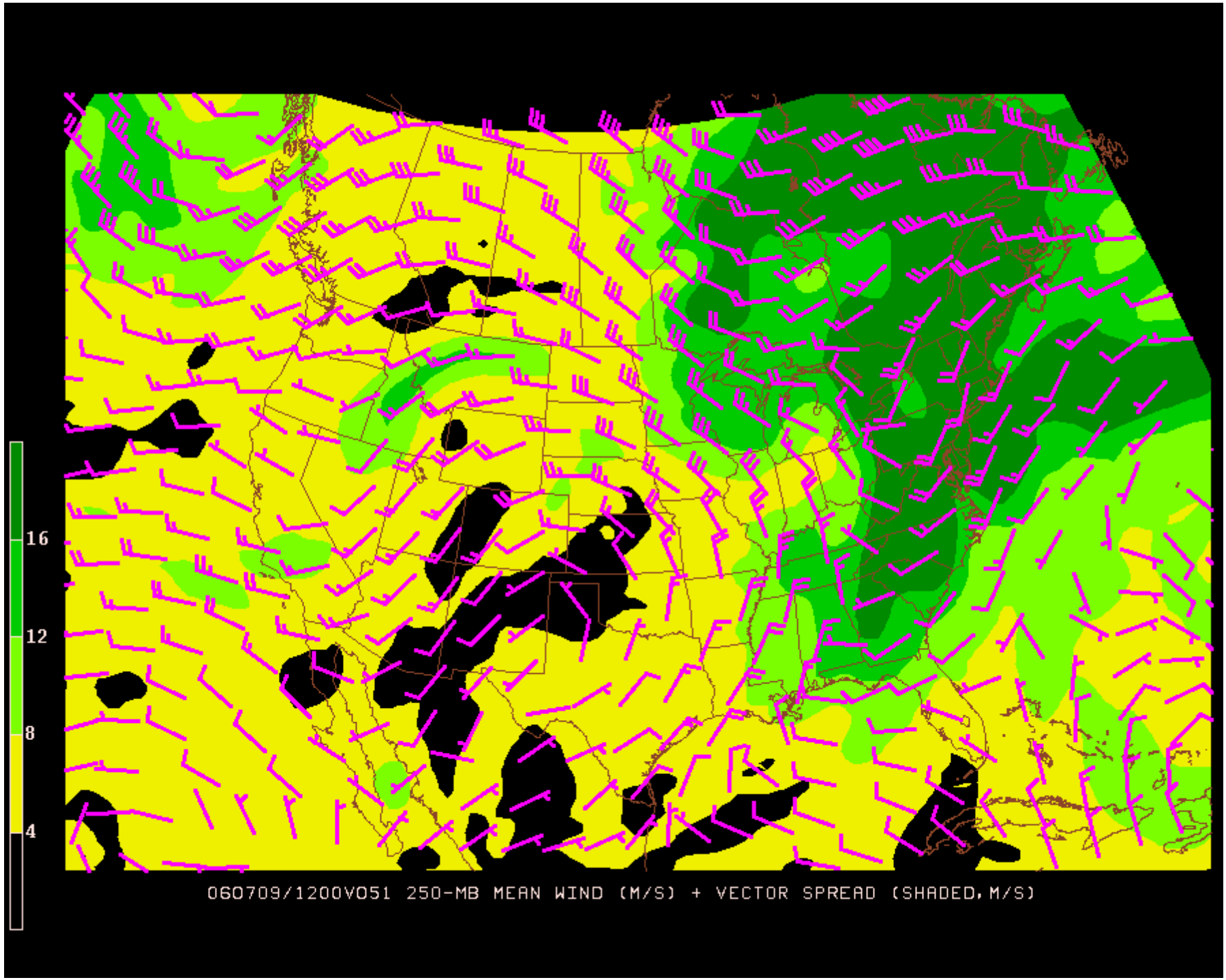
```
GDFILE  = {sref:em_ctl,sref:em_n1,sref:em_p1,sref:rsm_n1}
GDATTIM = f51
GLEVEL  = 0
GVCORD  = none
GDPFUN  = ens_ssprd(hght@500%pres)
```


060709/1200V051 500-MB HGHT SPREAD

Functions

- Vector Mean and Spread
  - Average over all members
  - ENS_VAVG (input_arg)
  - Spread computed using each component
    - SQRT(SUM(varianceU+varianceV)) / (N-1)
  - ENS_VSPRD (input_arg)
  - Example

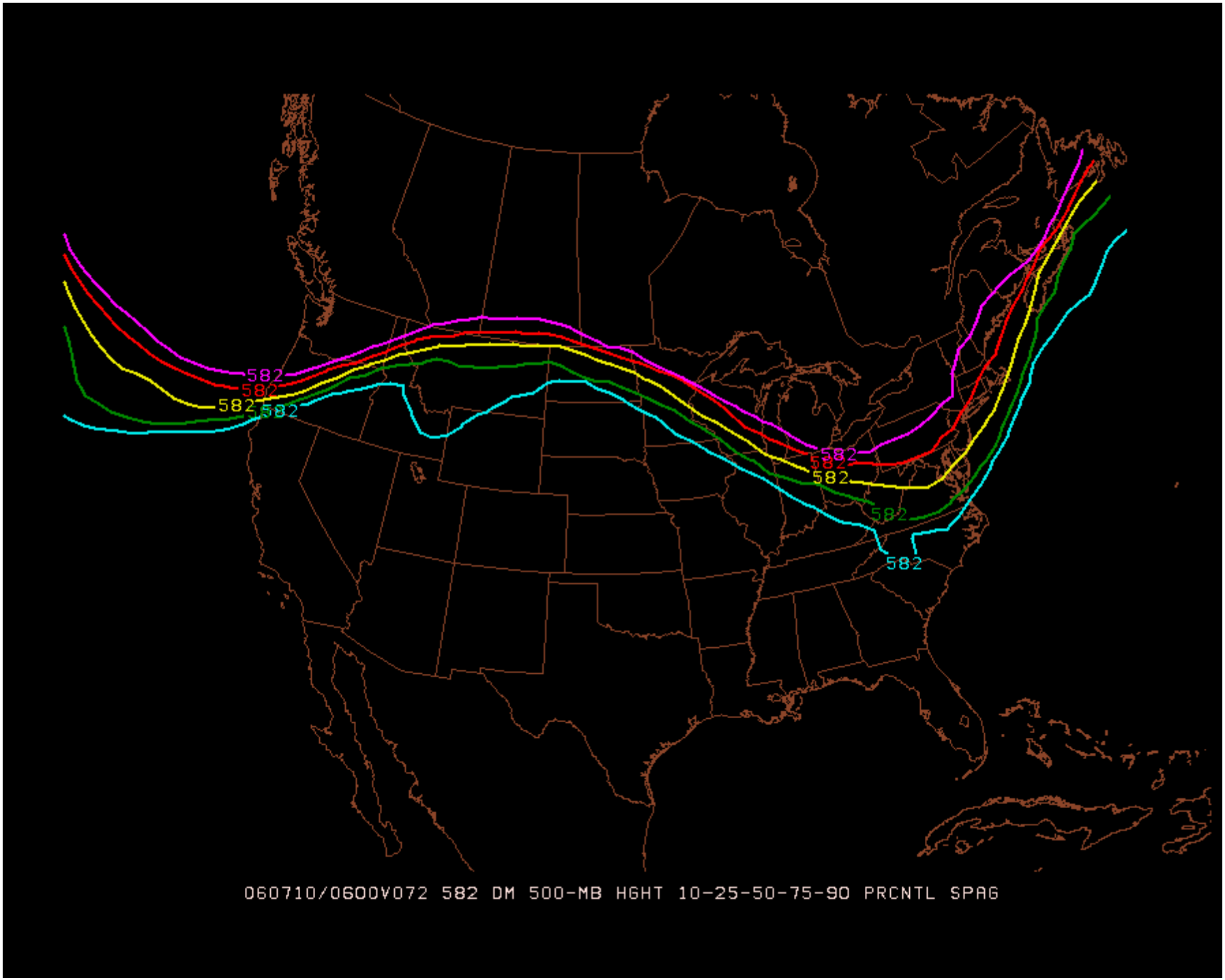
```
GDFILE  = {sref:em_ctl,sref:em_n1,sref:em_p1,sref:rsm_n1,sref:rsm_p1}
GDATTIM = f51
GLEVEL  = 0
GVCORD  = none
GDPFUN  = ens_vsprd(wnd@250%pres)!ens_vavg(wnd@250%pres)
```


16
12
8
4
060709/1200V051 250-MB MEAN WIND (M/S) + VECTOR SPREAD (SHADED, M/S)

Functions

- Percentile (including Median - 50%)
  - At each grid point, determine the value of arg1 such that it exceeds that found in (arg2)% of the members
  - ENS_PRCNTL (input_arg1 & input_arg2)
  - Input_arg2 is the percentile or a function/grid representing a percentile
  - Example

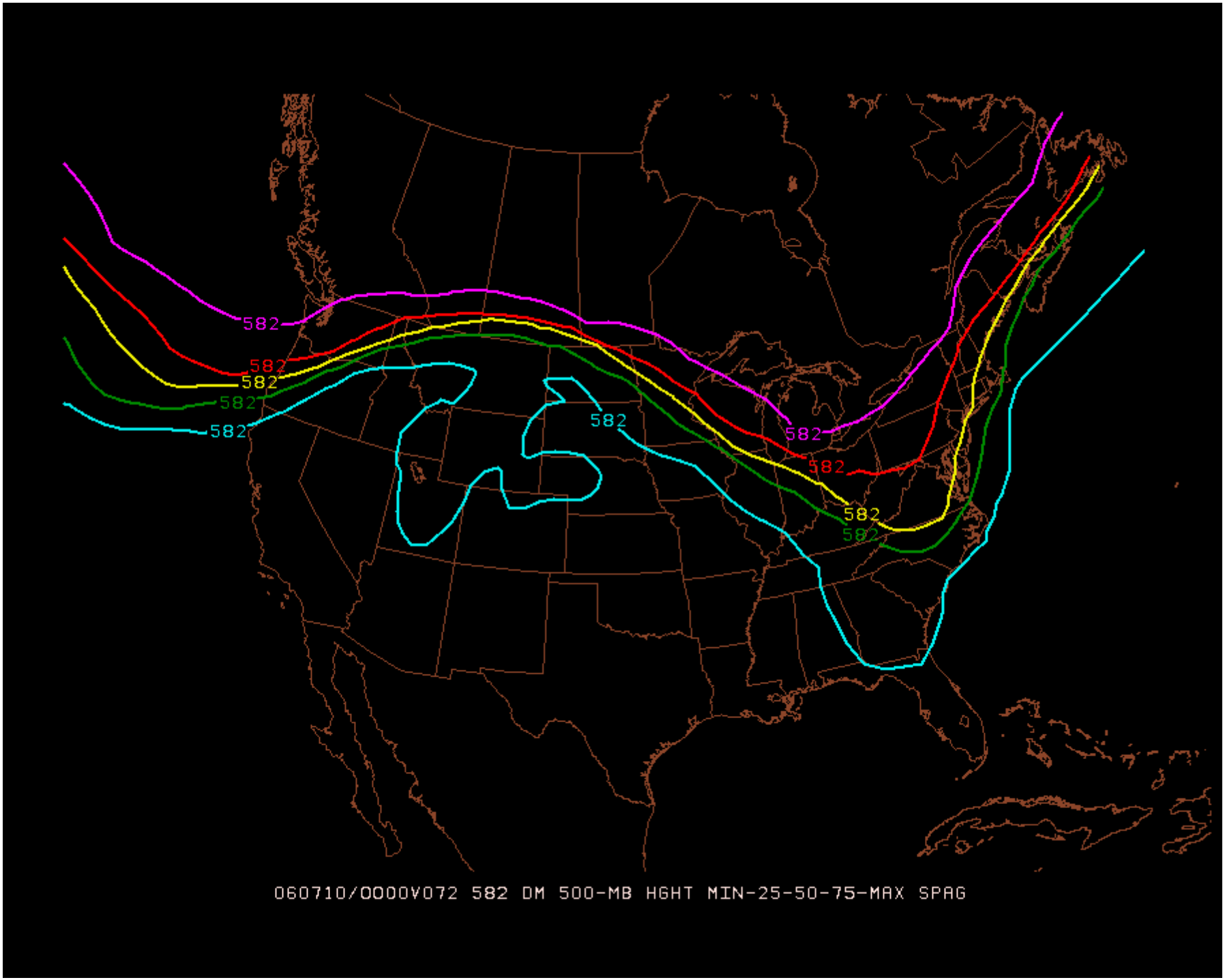
```
GDFILE  = {30%gefs|06,sref}
GDATTIM = f72
GLEVEL  = 500
GVCORD  = pres
GDPFUN  = ens_prcntl(hght&10)!ens_prcntl(hght&25)!ens_prcntl(hght&50)!
          ens_prcntl(hght&75)!ens_prcntl(hght&90)
CINT    = 582/582/582
```


582
582
582
582
582
582
582
582
582
060710/0600V072 582 DM 500-MB HGHT 10-25-50-75-90 PRCNTL SPAG

Functions

- Lowest and Highest Values
  - Max or Min value after checking all members
  - ENS_SMIN (input_arg)
  - ENS_SMAX (input_arg)
  - Example

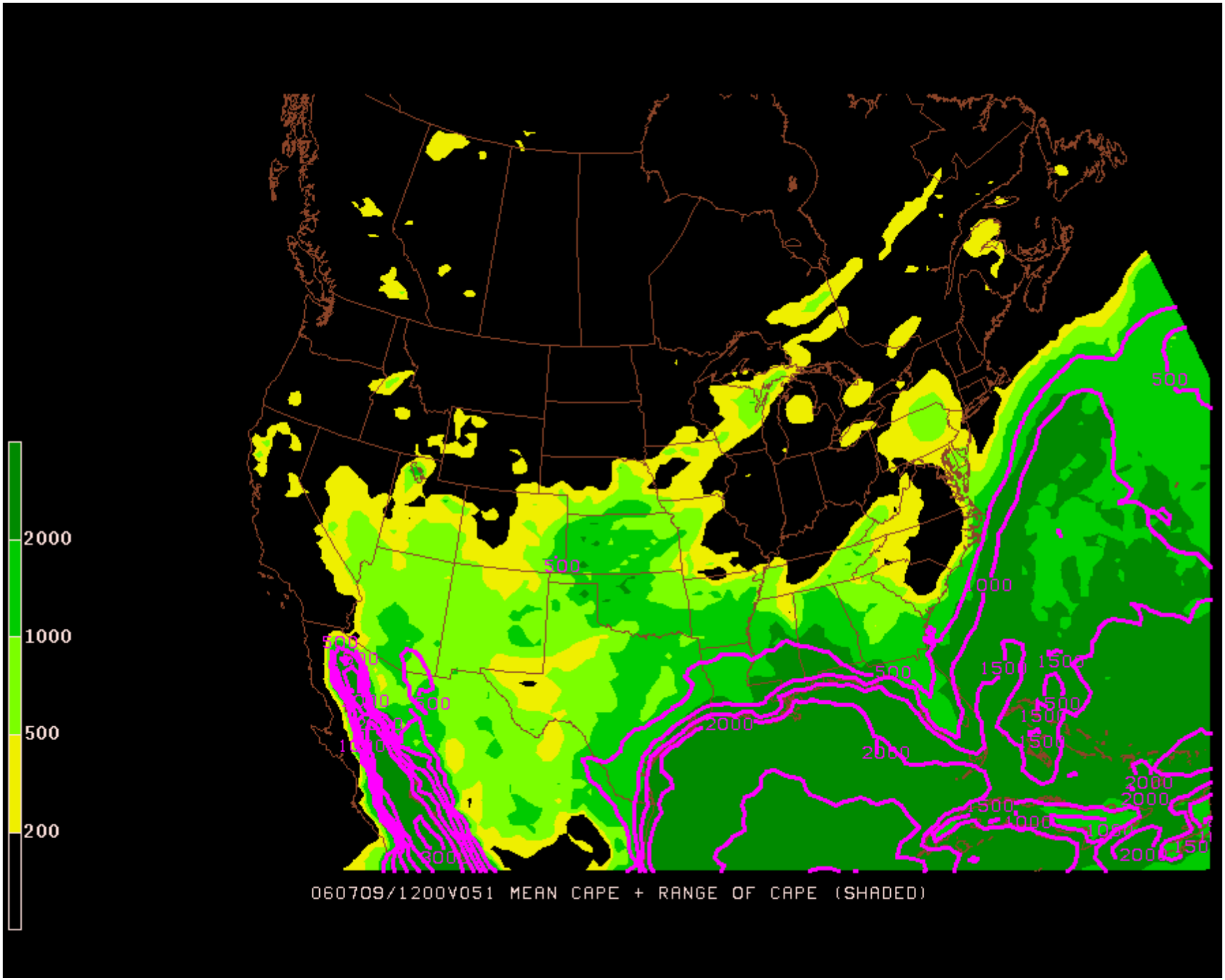
```
GDFILE  = {gefs|00,sref}
GDATTIM = f72
GLEVEL  = 500
GVCORD  = pres
GDPFUN  = ens_smin(hght)!ens_prcntl(hght&25)!ens_prcntl(hght&50)!
          ens_prcntl(hght&75)!ens_smax(hght)
CINT    = 582/582/582
```


582
582
582
582
582
582
582
582
582
582
060710/0000V072 582 DM 500-MB HGHT MIN-25-50-75-MAX SPAG

Functions

- Range of Values
  - Difference between the Max and Min values
  - ENS_SRNG (input_arg)
  - Example

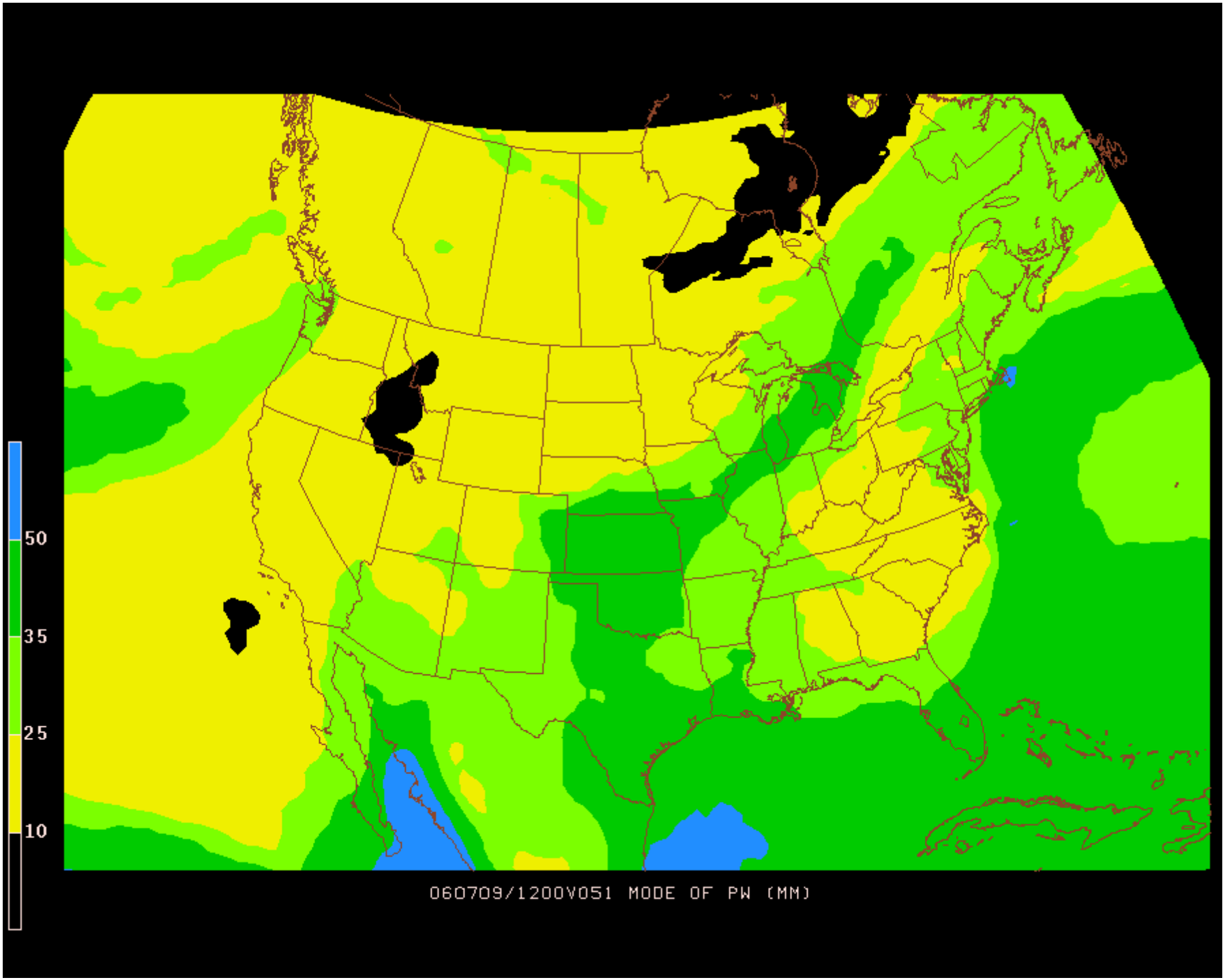
```
GDFILE  = {sref}
GDATTIM = f51
GLEVEL  = 0
GVCORD  = none
GDPFUN  = ens_srng(cape)!ens_savg(cape)
```


2000
1000
500
200
060709/1200V051 MEAN CAPE + RANGE OF CAPE (SHADED)

Functions

- Mode
  - ***Estimate*** of most frequent value
  - Multiple modes result in the mode closest to the mean
  - ENS_MODE (input_arg)
  - Example

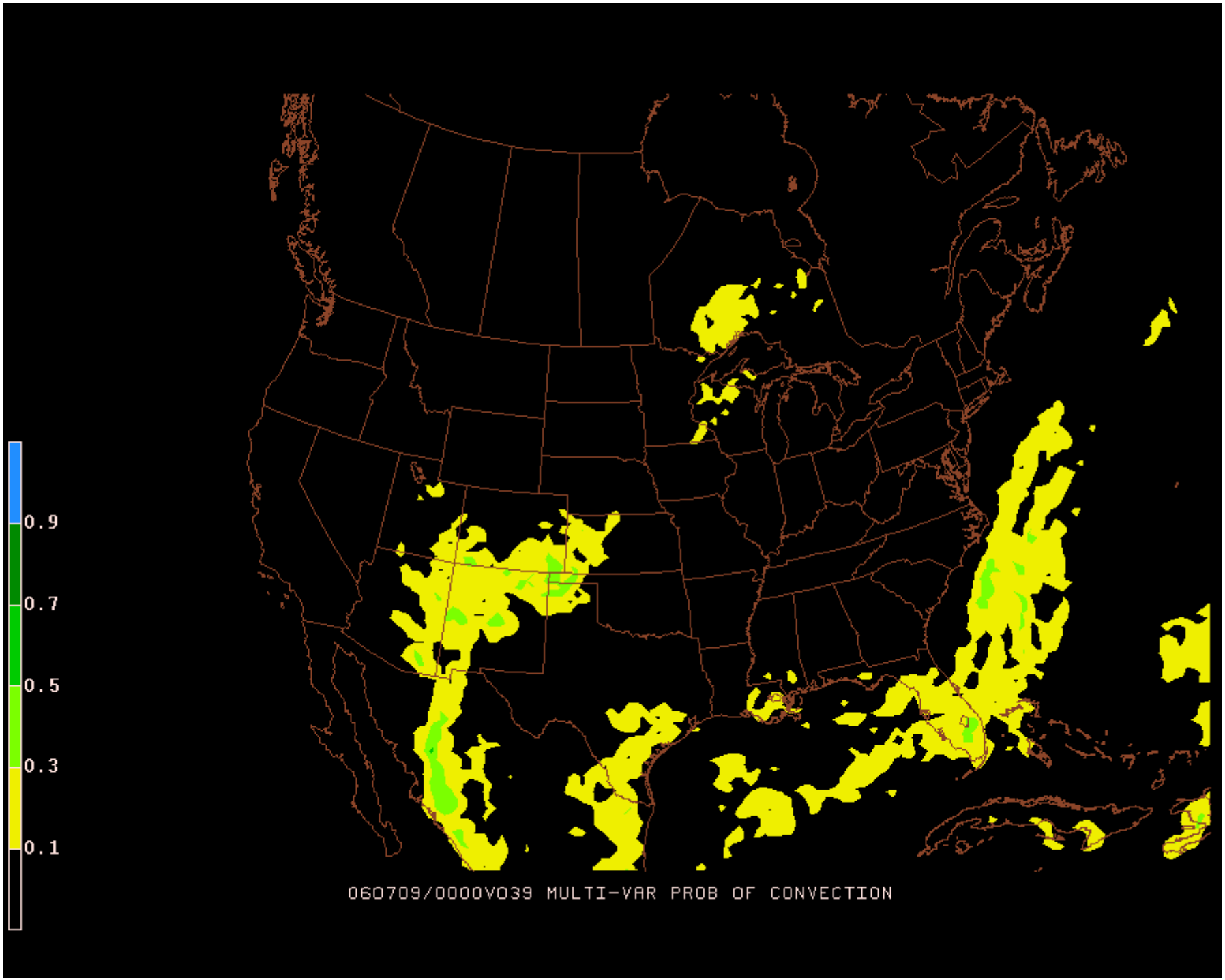
```
GDFILE  = {sref,gefs}
GDATTIM = f51
GLEVEL  = 0
GVCORD  = none
GDPFUN  = ens_mode(pwtr)
```


50
35
25
10
060709/1200V051 MODE OF PW (MM)

Functions

- Multivariate Probability
  - The probability of the occurrence of a multivariate expression across all members
  - Combinations of logical functions (AND, OR, EOR)
    - Combinations of comparison functions (LT, GT, etc.)
  - ENS_PROB (input_arg)
  - Example

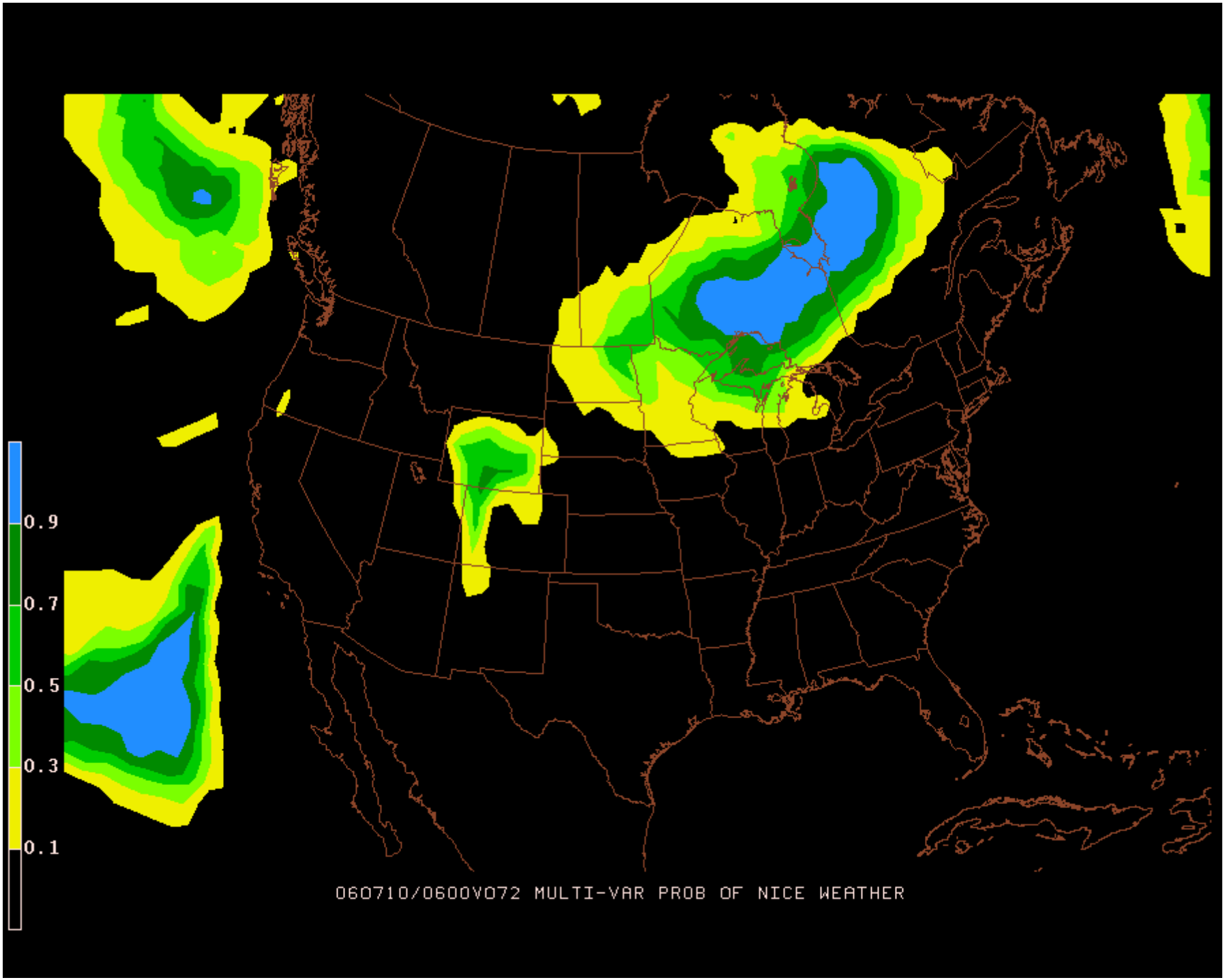
```
GDFILE  = {sref,gfs,nam}
GDATTIM = f39
GLEVEL  = 0
GVCORD  = none
GDPFUN  = ens_prob(and(gt(adv(avor@500%pres,wnd@500%pres),0),
          gt(pwtr,6),
          gt(p03m,1),
          gt(cape,500)))
```


0.9
0.7
0.5
0.3
0.1
060709/0000V039 MULTI-VAR PROB OF CONVECTION

Functions

- Multivariate Probability (Nice weather)
  - ENS_PROB (input_arg)
  - Example

```
GDFILE  = {gefs}
GDATTIM = f72
GLEVEL  = 0
GVCORD  = none
GDPFUN  = ens_prob(and(lt(cape@180:0%pdly,300),
          lt(relh@700%pres,50),
          gt(pmsl,1013),
          lt(p06m,1),
          lt(pwtr,18)))
```


0.9
0.7
0.5
0.3
0.1
060710/0600V072 MULTI-VAR PROB OF NICE WEATHER

Questions and Summary

- Any questions??????
- Read the help files when in doubt
- Experiment
- Don't forget the braces in the model names
- The datatype.tbl and the file system must be in sync