

# **Practical Exercises in GrADS with the NCEP GEFS week-2 forecasts**

First International Training Workshop  
WMO RCC-Washington

**NOAA's CPC International Desks**

Washington, USA, 30 September – 4 October 2019

# Download the directory *gefs\_forecasts.zip*

1. Download the directory *gefs\_forecasts.zip* from the NOAA's CPC ftp server

```
wget --no-check-certificate
```

```
https://ftp.cpc.ncep.noaa.gov/International/usrcc/training/2019/day3/  
gefs_forecasts.zip
```

2. List files/directories

```
ls
```

3. Unzip the directory *gefs\_forecasts*

```
unzip gefs_forecasts.zip -d gefs_forecasts
```

4. List files/directories

```
ls
```

5. Go to the directory *gefs\_forecasts*

```
cd gefs_forecasts
```

6. List files/directories

```
ls
```

→ You should see 4 directories

*grads\_files*

*precipitation*

*temperature*

*wind*

# Precipitation

7. Go to the directory *precipitation*

```
cd precipitation
```

8. List files/directories

```
ls
```

→ You should see 1 file

```
NCEP_GIFS_week2_precipitation_forecast.sh
```

9. Change the file permission to make it readable, writable and executable

```
chmod 777 NCEP_GIFS_week2_precipitation_forecast.sh
```

10. List files/directories

```
ls
```

# Precipitation

**11.** Create a directory *data* and a directory *figures*

```
mkdir data figures
```

**12.** List files/directories

```
ls
```

→ You should see your 2 new directories and 1 file

```
data    figures  NCEP_GEF5_week2_precipitation_forecast.sh
```

**13.** Open the shell script *NCEP\_GEF5\_week2\_precipitation\_forecast.sh*

**Linux:** `gedit NCEP_GEF5_week2_precipitation_forecast.sh &`

**Cygwin:** `npp NCEP_GEF5_week2_precipitation_forecast.sh &`

# Precipitation

## Define and display precipitation and precipitation anomaly

- **Line 123** – Define a variable *precip* as the 7-day accumulated precipitation forecast  
'define precip = total'
- **Line 126** – Define a variable *anomaly* as the precipitation anomaly forecast  
'define anomaly = total - clim'
- **Line 165** – Display the total precipitation *precip*  
'd precip'
- **Line 206** – Display the precipitation anomaly *anomaly*  
'd anomaly'

Save and run the shell script *NCEP\_GEFS\_week2\_precipitation\_forecast.sh*

```
./NCEP_GEFS_week2_precipitation_forecast.sh
```

Hit `enter` to see the next plot

# Precipitation

Set your preferences and change the date of initial conditions

- **Lines 10, 11, 13 and 14** – Change the coordinates to target your domain of interest
- **Line 18** – Change the date of initial conditions *icdate* for the date of today  
**icdate=02Oct2019**
- **Lines 27 to 72** – Change the plotting attributes according to your preferences

**Only for Central American countries, Guyana and Suriname (if needed)**

- **Lines 171 and 212** – Call the function *basemap* placed in the directory *grads\_files* to add an ocean mask

**'../grads\_files/basemap O 0 1 M'**

- **Line 238** – Change the display mode if needed

For landscape mode:

**grads -lc gefs\_week2\_precipitation.gs**

For portrait mode:

**grads -pc gefs\_week2\_precipitation.gs**

# Precipitation

Save forecast maps as .png

- **Lines 183 and 184** – Save the forecast map of total precipitation as .png  
`'printim gefs_week2_precip_total.png'`  
`!'convert -bordercolor white -border 10 gefs_week2_precip_total.png gefs_week2_precip_total.png'`
- **Lines 224 and 225** – Save the forecast map of precipitation anomaly as .png  
`'printim gefs_week2_precip_anom.png'`  
`!'convert -bordercolor white -border 10 gefs_week2_precip_anom.png gefs_week2_precip_anom.png'`
- **Line 237** – Move the forecast maps to the directory *figures*  
`mv *.png ./figures`

Check your forecast maps in the directory *figures*

## 2m air temperature

1. Go to the directory *temperature*

```
cd temperature
```

2. List files/directories

```
ls
```

→ You should see 1 file

```
NCEP_GIFS_week2_temperature_forecast.sh
```

3. Change the file permission to make it readable, writable and executable

```
chmod 777 NCEP_GIFS_week2_temperature_forecast.sh
```

4. List files/directories

```
ls
```



## 2m air temperature

5. Create a directory *data* and a directory *figures*

```
mkdir data figures
```

6. List files/directories

```
ls
```

→ You should see your 2 new directories and 1 file

```
data    figures NCEP_GEF5_week2_temperature_forecast.sh
```

7. Open the shell script *NCEP\_GEF5\_week2\_temperature\_forecast.sh*

**Linux:** `gedit NCEP_GEF5_week2_temperature_forecast.sh &`

**Cygwin:** `npp NCEP_GEF5_week2_temperature_forecast.sh &`

## 2m air temperature

### Define and display temperature and temperature anomaly

- **Line 123** – Define a variable *tmean* as the 7-day mean temperature forecast  
`'define tmean = total'`
- **Line 126** – Define a variable *anomaly* as the mean temperature anomaly forecast  
`'define anomaly = total - clim'`
- **Line 165** – Display the mean temperature *tmean*  
`'d tmean'`
- **Line 206** – Display the temperature anomaly *anomaly*  
`'d anomaly'`

Save and run the shell script *NCEP\_GIFS\_week2\_temperature\_forecast.sh*

```
./NCEP_GIFS_week2_temperature_forecast.sh
```

# 2m air temperature

## Display variable with shaded areas

- **Line 144** – Set the temperature fields as shaded areas

```
'set gxout shaded'
```

- **Line 146** – Call the function *define\_colors* placed in the directory *grads\_files*

```
'../grads_files/define_colors'
```

- **Lines 161 and 162** – Set the levels and colors for temperature (*tmean*)

```
'set clevs 20 24 25 26 27 28 29 30'
```

```
'set ccols 0 21 22 23 24 25 26 27 28'
```

- **Lines 202 and 203** – Set the levels and colors for temperature anomaly (*anomaly*)

```
'set clevs -3.0 -2.0 -1.5 -1.0 -0.5 0.5 1.0 1.5 2.0 3.0'
```

```
'set ccols 49 47 45 43 41 0 21 23 25 27 29'
```

- **Lines 168 and 209** – Call the function *cbarmerc2* placed in the directory *grads\_files* to add the color bar for temperature (*tmean*) and temperature anomaly (*anomaly*) forecasts

```
'../grads_files/cbarmerc2'
```

## 2m air temperature

Set your preferences and change the date of initial conditions

- **Lines 10, 11, 13 and 14** – Change the coordinates to target your domain of interest
- **Line 18** – Change the date of initial conditions *icdate* for the date of today  
**icdate=02Oct2019**
- **Lines 27 to 62** – Change the plotting attributes according to your preferences

**Only for Central American countries, Guyana and Suriname (if needed)**

- **Lines 171 and 212** – Call the function *basemap* placed in the directory *grads\_files* to add an ocean mask

**'../grads\_files/basemap O 0 1 M'**

- **Line 238** – Change the display mode if needed

For landscape mode:

**grads -lc gefs\_week2\_temperature.gs**

For portrait mode:

**grads -pc gefs\_week2\_temperature.gs**

## 2m air temperature

### Check the forecast maps

- Save and run the shell script *NCEP\_GEF5\_week2\_temperature\_forecast.sh*  
`./NCEP_GEF5_week2_temperature_forecast.sh`
- Check your forecast maps in the directory *figures*

# Wind forecast

1. Go to the directory *wind*

```
cd wind
```

2. List files/directories

```
ls
```

→ You should see 1 file

***NCEP\_GEF5\_week2\_wind\_forecast.sh***

3. Change the file permission to make it readable, writable and executable

```
chmod 777 NCEP_GEF5_week2_wind_forecast.sh
```

4. List files/directories

```
ls
```

# Wind forecast

5. Create a directory *data* and a directory *figures*

```
mkdir data figures
```

6. List files/directories

```
ls
```

→ You should see your 2 new directories and 1 file

```
data    figures  NCEP_GEF5_week2_wind_forecast.sh
```

7. Open the shell script *NCEP\_GEF5\_week2\_wind\_forecast.sh*

**Linux:** `gedit NCEP_GEF5_week2_wind_forecast.sh &`

**Cygwin:** `npp NCEP_GEF5_week2_wind_forecast.sh &`

# Wind

## Define wind components

- **Lines 131 and 132** – Define variables *u850anom* and *v850anom* as the 7-day wind anomaly forecast at 850mb

```
'define u850anom = u850mb'
```

```
'define v850anom = v850mb'
```

- **Lines 135 and 136** – Same for 700mb

```
'define u700anom = u700mb'
```

```
'define v700anom = v700mb'
```

- **Lines 139 and 140** – Same for 500mb

```
'define u500anom = u500mb'
```

```
'define v500anom = v500mb'
```

- **Lines 143 and 144** – Same for 200mb

```
'define u200anom = u200mb'
```

```
'define v200anom = v200mb'
```



# Wind

## Define wind divergence

- **Line 150** – Define variable *div850anom* as the 7-day wind divergence anomaly forecast at 850mb

```
'define div850anom = hdivg(u850anom,v850anom)*1e05'
```

- **Line 153** – Same for 700mb

```
'define div700anom = hdivg(u700anom,v700anom)*1e05'
```

- **Line 156** – Same for 500mb

```
'define div500anom = hdivg(u500anom,v500anom)*1e05'
```

- **Line 159** – Same for 200mb

```
'define div200anom = hdivg(u200anom,v200anom)*1e05'
```

# Wind

## Display wind components and wind divergence anomalies

- **Line 198** – Display the wind divergence anomaly forecast *div850anom* at 850mb  
'd div850anom'
- **Line 201** – Display the wind anomaly forecast at 850mb on the same plot  
'd u850anom ; v850anom'
- Save and run the shell script *NCEP\_GEF5\_week2\_wind\_forecast.sh*  
`./NCEP_GEF5_week2_wind_forecast.sh`
- **Line 201** – Adjust the number of wind vectors if needed  
'd skip(u850anom,2,2);v850anom'

# Wind

## Display wind divergence anomaly with shaded areas

- **Line 177** – Set the wind divergence fields as shaded areas

```
'set gxout shaded'
```

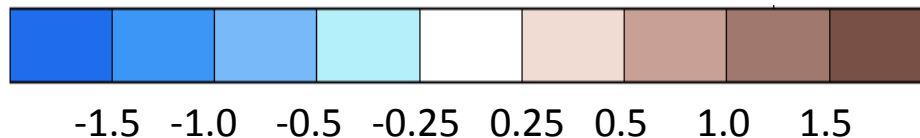
- **Line 179** – Call the function *define\_colors* placed in the directory *grads\_files*

```
'../grads_files/define_colors'
```

- **Lines 194 and 195** – Set the levels and colors for wind divergence anomaly (*div850anom*)

```
'set clevs -1.5 -1.0 -0.5 -0.25 0.25 0.5 1.0 1.5 '
```

```
'set ccols 48 46 44 42 0 72 74 76 78 '
```



At low atmospheric levels  
**blue: convergence**  
**brown: divergence**



light blue to dark blue: 41 ... 49

white: 0

light brown to dark brown: 71 ... 79

- **Line 204** – Call the function *cbarmerc2* placed in the directory *grads\_files* to add the color bar

```
'../grads_files/cbarmerc2'
```

- Save and run the shell script *NCEP\_GEFS\_week2\_wind\_forecast.sh*

```
./NCEP_GEFS_week2_wind_forecast.sh
```

# Wind

## Set your preferences and change the date of initial conditions

- **Lines 10, 11, 13 and 14** – Change the coordinates to target your domain of interest
- **Line 18** – Change the date of initial conditions *icdate* to the date of today  
**icdate=02Oct2019**

- **Lines 27 to 62** – Change the plotting attributes according to your preferences

- **Line 240** – Change the display mode if needed

For landscape mode:

```
grads -lc gefs_week2_wind.gs
```

For portrait mode:

```
grads -pc gefs_week2_wind.gs
```

- Save and run the shell script *NCEP\_GEFs\_week2\_wind\_forecast.sh*  

```
./NCEP_GEFs_week2_wind_forecast.sh
```

# Wind

## Same procedure for wind anomaly at different levels

- Copy **lines 182 to 220** and modify them to produce wind divergence anomaly and wind anomaly forecast maps at 700mb, 500mb and 200mb



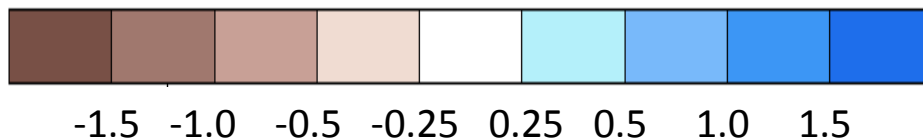
**Do not forget to change the levels (variables, titles of figures, rename figures, etc.)**

- For wind divergence anomaly at 200mb, inverse levels and colors!

```
'set clevs -1.5 -1.0 -0.5 -0.25 0.25 0.5 1.0 1.5 '
```

```
'set ccols 78 76 74 72 0 42 44 46 48 '
```

At high atmospheric levels  
**brown: convergence**  
**blue: divergence**



light blue to dark blue: 41 ... 49

white: 0

light brown to dark brown: 71 ... 79

- Save and run the shell script ***NCEP\_GEFS\_week2\_wind\_forecast.sh***  
`./NCEP_GEFS_week2_wind_forecast.sh`