## Project 1: Getting familiar with FORTRAN

(1/17/23, due 1/24/23)

**FORTRAN Program Instructions A. Introduction**

A sample program, *S23_P1_cm1_terrain.f90*, is designed to help you familiarize yourself with compile, link, and run FORTRAN programs and plot its results using GrADS. You can download *S23_P1_cm1_terrain.f90* from the MesoLab website (http://mesolab.ncat.edu => NWP => Project 1 => *S23_P1_cm1_terrain.f90)*. The GrADS program will also be used for plotting results after running *advec1.f* in Project 1.

You should get yourself familiar with *S23_P1_cm1_terrain.f90* before working on Project 1.

Program *S23_P1_cm1_terrain.f90* is a sample FORTRAN program which essentially computes the discretized values, $f(x_i,y_j)$, to approximate the continuous values of the real-valued function $f(x,y)$, of the independent variables, $x$ and $y$, over a computational grid whose spatial interval is specified to be $\Delta x$ and $\Delta y$. This particular function will allow you to get familiar with certain graphics software, which can plot one-dimensional curves and contour two-dimensional fields. You will see both types of figures throughout the course, and so you will need to get an early start in understanding the basics of simple plotting routines.

To compile and link the FORTRAN program *S23_P1_cm1_terrain.f90,* at the prompt type:

```
% cd (Need to get to the directory where the .f90 scripts are located)

% gfortran -o sample.exe S23_P1_cm1_terrain.f90
```

This command will invoke the FORTRAN compiler on your local system and create the executable file *sample.exe* in your directory. To run the program, at the prompt type:

```
% ./sample.exe
```

The program will create two output files of form *perts.ctl* and *perts.dat*. These will be used with the software plotting packages.

**B. GrADS and *sample.exe* output**

The file *perts.dat* contains output in a GrADS-readable format. When *sample.exe* was run, an additional file *perts.ctl* was created. This GrADS control file is needed for plotting output in GrADS. To view the output of *sample.exe* interactively using GrADS, first type the following:

```
% grads -l
```

Or `grads`

This opens the GrADS software from your Linux terminal. Enter y or 'l' for landscape or n for portrait mode.

**[N.B.**, If you have never used GrADS before, I would complete the GrADS tutorial linked below. This takes about 30 minutes to complete, http://cola.gmu.edu/grads/gadoc/tutorial.html. This will help you get a basic understanding of GrADS and how to output plots for Project 1 as well as future projects.**]**

A new window should appear, and the prompt `ga->` should appear in the terminal window. Make sure that no terminal window obscures this new window when running GrADS. Next, open a GrADS control file and display the contained field.

For the 2-D field, enter:

```
ga-> open perts.ctl
ga-> d height
ga-> close 1
```

To save the image as a PNG file,

```
ga-> printim (name of the image, e.g., terrain.png)
```

Type 'quit' when finished viewing GrADS plots.

You may also want to practice making a gif or movie of the animation of your images by using the command:

```
% convert -delay 100 *.png (file name, e.g., terrain.gif)
```

## Other Useful Information and Online Documentation

Students should also become familiar with basic UNIX or Linux commands, editors, along with GrADS package. You may find the following online documentation useful.

*(a) Commonly Used UNIX Commands*
https://faculty.tru.ca/nmora/Frequently%20used%20UNIX%20commands.pdf
*(c) How to Use the vi Editor:*
https://www.washington.edu/computing/unix/vi.html
*(d) How to Use 'xedit'*
http://manpages.ubuntu.com/manpages/trusty/man1/xedit.1.html
*(e) GrADS Plotting Software*
http://cola.gmu.edu/grads/