MAE598 Fall 2012 HW7 - first draft

The difficulty level of this assignment is "**D**". You may turn in any answers you have to earn bonus points. Alternatively, you may expand this assignment into a full final report.

1. Background

We will use the NCAR-NOAA Weather Research and Forecast (WRF) model to do a short-term weather prediction for the southwest U.S. The precise date(s) and domain for the forecast will be released later. The WRF model is a nonhydrostatic, regional model driven by radiative forcing and time-varying lateral boundary conditions. It allows multiple layers of nesting. For simplicity, we will try the setup with either a 2-layer nesting or no nesting at all (just one fixed horizontal resolution). We plan to use 15 or 30 km as the horizontal resolution for the innermost model domain that covers several states in the western U.S. With this resolution, the focus is on the "synoptic scale" structures such as a winter storm. The forecast will be performed for a date/time in winter.

The detail of the model and the package of the codes, run scripts, and data for the initial and boundary conditions will be added to our common *student1* account shortly.

2. Key tasks

For the bonus homework only, you will execute a 72-hour forecast, plot the initial condition and the prediction at the end of the 72-hr period, and compare the forecast with the observation. The minimum set of variables to plot and validate are (i) precipitation, (ii) surface air temperature (the "2m temperature" in WRF output), and surface wind (u and v; the "10 m velocity" in WRF output). The "observation" for the surface (u,v,T) will be taken from a reanalysis dataset. Given that gridded precipitation datasets are mostly for monthly means, the "validation" for precipitation can be performed by just plotting the precipitation from WRF output and qualitatively comparing it with readily available daily weather maps from NOAA/NWS websites.

For the final report, you will do the plotting and validation for not only the 72-hr forecast but also the predictions for the intermediate times at 24 and 48 hrs. In addition, validations will be made against not only the gridded reanalysis but also local station data. The latter should be performed for at least two locations in Arizona, using the station data from AZMET as the local observation. In this case, the validation for precipitation should be more quantitative. The final report should also include a summary of the model architecture, i.e., a description of the basic governing equations, numerical methods, physical parameterization schemes, grid arrangement, and data assimilation procedure used in the model. You can obtain the information needed for this part from the NCAR Technical Report for WRF.