In this homework, you will be testing parameterization options in WRF. Since it is difficult to test parameterizations using real data cases, you will be using the Single Column Model idealized case to run WRF to modify the parameterizations. The single column model by default has a 4 km grid size and a 12 km top, has doubly periodic boundary conditions in x and y, and has the full suite of physics options available.

The model is compiled to simulate a dry stable boundary layer over land the CASES-99 field experiment. The experimental period was from October 1-31, 1999 near Leon, Kansas (50 km) east of Wichita, Kansas, and data from this experiment has been used for a number of model parameterization studies.

To compile the SCM model on ember.ncsa.illinois.edu, compile the em_scm_xy case. Select compile option 9. Linux x86_64 i486 i586 i686, ifort compiler with icc (serial), with no nesting. To run, make sure you do run_me_first.csh before running the model.

For this homework, the class will be testing the influence of surface parameterizations, surface layer parameterizations, radiation, and boundary layer parameterizations on your single column model simulations.

For each sounding, perform the following experiments:

Run the model with the following physics options:

Group 1: ra_lw_physics 1 (control), 3, 4
Group 2: ra_sw_physics 1 (control), 2, 4
Group 3: sf_sfclay_physics 1 (control), 2, 7
Group 4: sf_surface_physics 2 (control), 1, 3
Group 5: bl_pbl_physics 1 (control), 0, 5

Keep all of the namelist options the default values, except create output every 10 minutes instead of the default 60.

Plot time-height cross sections of temperature, relative humidity, u, v, w. (on mass points using UA, VA, WA in NCL). Also, plot time series of surface and top of atmosphere LW and SW radiation, surface heat fluxes of ground, sensible, and latent heat.

Describe using the figures you create how the changes in parameterization schemes influenced the results. Using the primary literature and WRF documentation, attempt to explain why these changes in the simulation happened.

Submit a written report summarizing to the class wiki. We will have 10 minute group presentations on Monday, November 29, when your written reports will be due.