Running ndown.exe for Three or More Domains

From WRF guide: "It is possible to use the ndown program to run for more than one nest, but the procedure is a bit cumbersome. Because of the way the code it written, it expects particular file names (specifically for d01 and d02), and therefore it is important to follow these steps precisely. Note: This example is for nesting down to a 3rd domain (3 domains total), and assumes that you already have wrfout_d01* files from a previous run."

Step 1: Run the geogrid.exe and metgrid.exe programs for 3 domains. You should have files met_em.d01.<date>, met_em.d02.<date>, and met_em.d03.<date>.

Step 2: Run real.exe for 3 domains.

- Copy the met_em* files into the directory in which you will be running real.exe.
- Edit the *namelist.input* file, changing 'max_dom = 3', and making sure columns 1, 2 and 3 are set-up for a 3 domain run, editing the correct start time and grid dimensions.
- Run **real.exe**. This will produce a wrfinput_d01, wrfinput_d02, a wrfinput_d03 file, and a wrfbdy_d01 file.
- Rename the wrfinput_d02 file to wrfndi_d02.

Step 2b: For WRF-Chem: Build emissions for all 3 domains before running ndown → now included in pre_step1.bash]

Step 2c: Create symbolic links to original coarse domain (d01) wrfout files

Step 3: Make the **domain 02** grid initial and boundary condition files, by running ndown.exe.

- Since V3.2, one **must add *io_form_auxinput2* = 2 in the &time_control section of *namelist.input* to run *ndown.exe* successfully**. (If one desires to refine the vertical resolution when running *ndown,* set *vert_refine_fact =integer* (new in V3.2). There are no other changes required in the namelist or in the procedure. Another way to refine vertical resolution is to use the utility program *v_interp* (see the chapter for 'Utilities and Tools' for details)).
- Change namelist variable *interval_seconds* to reflect the history output interval from the coarse domain model run.
- Do not change physics options until after running the ndown program.
- Run **ndown.exe**, which uses input from the coarse grid wrfout file(s), and the wrfndi_d02 file generated from Step 3 above. This will produce a wrfinput_d02 and wrfbdy_d02 file.
- Note that the program ndown may be run serially or in MPI, depending on the selected compile option. The ndown program must be built to support nesting, however. To run the program, type:
  ./ndown.exe
  or
  mpirun –np 4 ./ndown.exe

Step 3b: Rename all emissions files from d02 to d01

Step 4: Make the domain 02 WRF run.

- Rename wrfinput_d02 and wrfbdy_d02 to wrfinput_d01 and wrfbdy_d01, respectively.
- Rename (or move) the original wrfout_d01* files to something else (or another directory) so as to not overwrite them. [**delete symbolic links to original coarse domain wrfout files**]
- Edit namelist.input, moving all of the fine-grid domain data from column 2 to column 1 so that this run will be for the fine-grid domain only.
- Make sure that the time_step is set to comply with the fine-grid domain (typically 6*DX).
- If running with a restart file, copy restart file into run directory and change option in namelist to: restart = .true.
- It may be beneficial to save namelist.input to something else prior to this step in case you need to repeat this process in the future. Save the newly-edited namelist as namelist.input.
- You will now have new files named wrfout_d01* which will correspond to domain 02.

Step 4b: Create symbolic links to domain 2 wrfout files - So the domain 2 wrfout files needed to run ndown for domain 3, will actually be called: **wrfout_d01_**...]

[for namelist.wrf.prep.ndown.chem: I have set it up as d01 is d02 and d02 is d03, so time_step=60. Need to think about physics options → wait until after ndown to change cu_rad_feddback, cu_diag, cu_physics; also think about: mp_physics, cudt, radt]

Step 5: Make the **domain 03** grid initial and boundary condition files, by running ndown.exe.

- Rename the wrfinput_d03 file to wrfndi_d02 (this is the name the program expects)
- Make sure the namelist still has io_form_auxinput2 = 2 in the &time_control section.
- Change namelist variable interval_seconds to reflect the history output interval from the coarse domain model run.
- Do not change physics options until after running the ndown program.
- Run ndown.exe, which uses input from the d02 grid wrfout file(s), and the wrfndi_d02 file. This will produce a **wrfinput_d02** and **wrfbdy_d02** file (which will actually correspond to domain 03).

Step 5b: Rename all emissions files from d03 to d01 or CREATE EMISSIONS FILES IF USING HIGH RES INVENTORY****************

Step 6: Make the domain 03 WRF run.

- Rename wrfinput_d02 and wrfbdy_d02 to wrfinput_d01 and wrfbdy_d01, respectively.
- Rename (or move) the wrfout_d01* files to something else (or another directory) so as to not overwrite them (recall that these files correspond to **d02**). [**delete symbolic links to original domain 2 wrfout files**]
- Edit namelist.input, moving all of the fine-grid domain data from column 2 to column 1 so that this run will be for the fine-grid domain only.

- Make sure that the time_step is set to comply with the fine-grid domain (typically 6*DX).
- It may be beneficial to save namelist.input to something else prior to this step in case you need to repeat this process in the future. Save the newly-edited namelist as namelist.input.
- After running wrf.exe, you will have new wrfout_d01* files. These will correspond to domain 03. If you need to add any more nests, follow the same format, keeping the naming convention the same.