# How to set up and run WRF for one-way and two-way nesting

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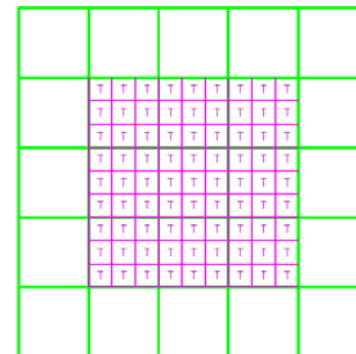
1-way *vs.* 2-way Nesting

- wrf integrates 1 domain at a time
- CG forces FG through lateral boundaries
- No FG to CG feedback
- ndown run between CG wrf and FG wrf

- wrf integrates 2 domains at a time
- CG forces FG at every FG timestep
- FG to CG feedback at every CG timestep
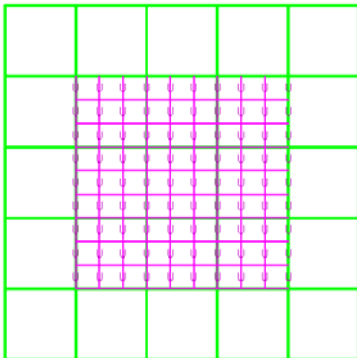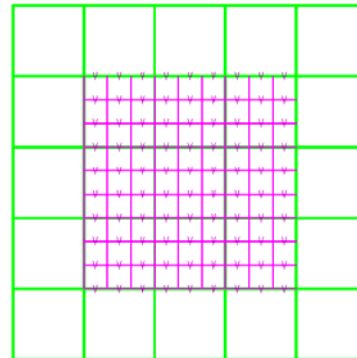- ndown not required

Arakawa-C Staggering
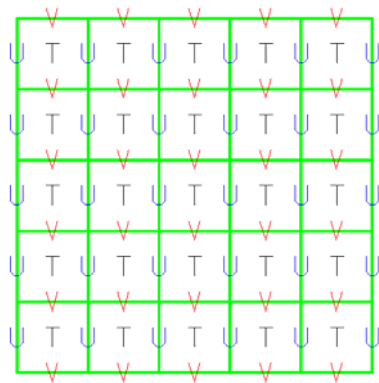
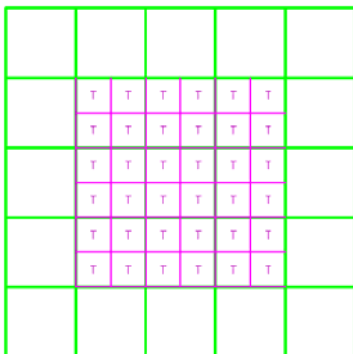

Arakawa-C Staggering – Mass Points 3::1 Ratio

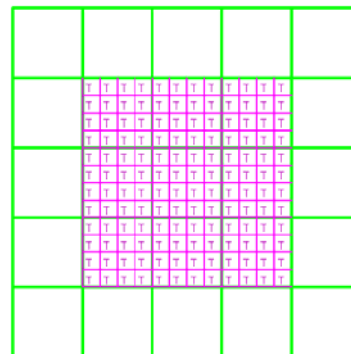Arakawa-C Staggering – U Velocity Points 3::1 Ratio

Arakawa-C Staggering – V Velocity Points 3::1 Ratio
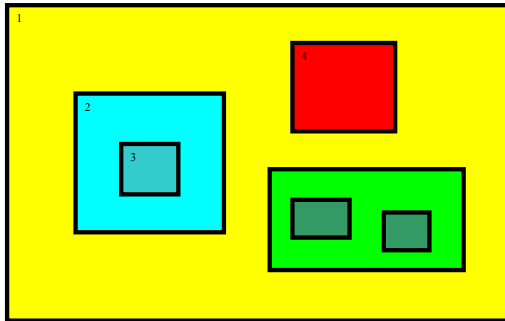
Arakawa-C Staggering – Mass Points 2::1 Ratio

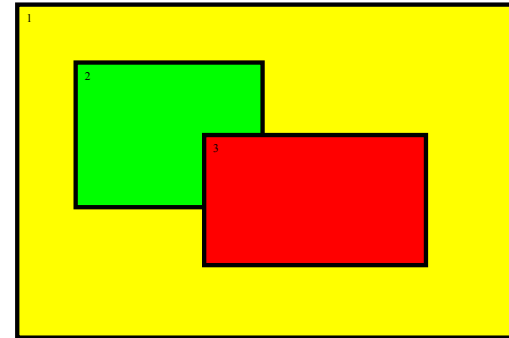Arakawa-C Staggering – Mass Points 4::1 Ratio

This is OK

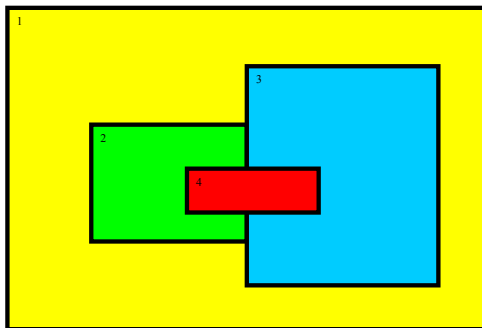Telescoped to any depth
Any number of siblings

Not OK

Domains may not have overlapping points in the CG

Not OK either

Domains have 1 and only 1 parent

Run-Time Changes for Nesting

```
start_year                  = 2000, 2000, 2000,
start_month                 = 01,   01,   01,
start_day                   = 24,   24,   24,
start_hour                  = 12,   12,   12,
start_minute                = 00,   00,   00,
start_second                = 00,   00,   00,
end_year                    = 2000, 2000, 2000,
end_month                   = 01,   01,   01,
end_day                     = 25,   25,   25,
end_hour                    = 12,   12,   12,
end_minute                  = 00,   00,   00,
end_second                  = 00,   00,   00,
interval_seconds            = 21600
```

Run-Time Changes for Nesting

```
max_dom                      = 2,
s_we                         = 1,      1,     1,
e_we                         = 74,    112 ,   94,
s_sn                         = 1,      1,     1,
e_sn                         = 61,     97 ,    91,
s_vert                       = 1,      1,     1,
e_vert                       = 28,    28,    28,
dx                           = 30000, 10000 ,  3333,
dy                           = 30000, 10000 ,  3333,
```
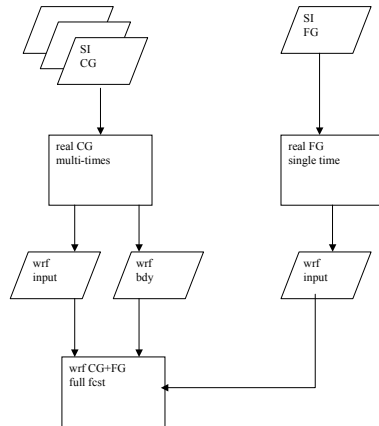
Run-Time Changes for Nesting

```
grid_id                      = 1,     2,     3,
level                        = 1,     2,     3,
parent_id                    = 0,     1,     2,
i_parent_start               = 0,     31,    30,
j_parent_start               = 0,     17,    30,
parent_grid_ratio            = 1,     3 ,     3,
parent_time_step_ratio       = 1,     3 ,     3,
feedback                     = 1,
smooth_option                = 0
```

2-Way Nest with 2 Inputs

2-Way Nest with 2 Inputs
real.exe

- There is file renaming required, so it is easier to start with the fine grid during the processing
- Probably should start the coarse and fine grids at the same time

2-Way Nest with 2 Inputs
real.exe

- Run single time period of fine grid SI output into real
- The namelist.input first column needs to have the fine grid dimensions
- The dx/dy values should be consistent with the fine grid
- The start and end date/times should reflect the single time for the fine grid

2-Way Nest with 2 Inputs
real.exe

- Link the SI output file for the fine grid into the domain, it needs to be "d01" for real to recognize it as input, run real, rename the output to "d02"
- `ln -s \`
  `$MOAD_DATAROOT/siprd/wrf*d02* \`
  `wrf_real_d01_2000_09_24-12:00:00`
- `./real.exe`
- `mv wrfinput_d01 wrfinput_d02`

2-Way Nest with 2 Inputs
real.exe

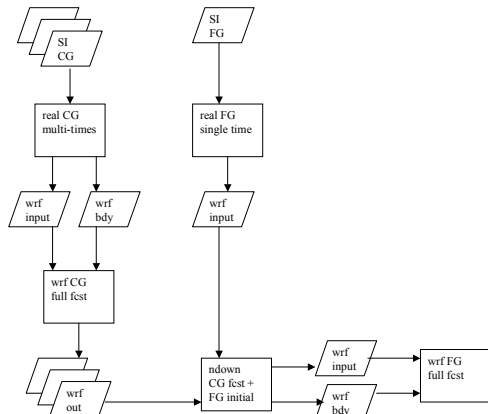- Run test case

2-Way Nest with 1 Input
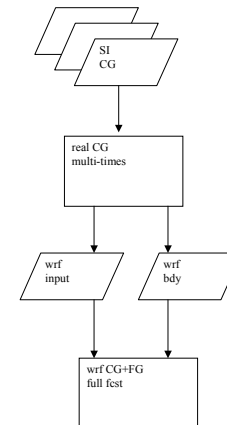
2-Way Nest with 1 Input
real.exe

- When running a 2-way nest with only a single input domain, the fine grid is entirely generated by the coarse grid
- No separate fine grid pre-processing is required
- The real.exe program is run identically to a single domain run (as if the coarse grid was running alone)

2-Way Nest with 1 Input
real.exe

- Run test case

1-Way Nest with 2 Inputs

1-Way Nest with 2 Inputs

- Similar to 2-way nesting with 2 input files
- Test script in ./WRFV2/test/em_real

1-Way Nest with 2 Inputs

- Run test case