NAMELIST.INPUT

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8th August, 2006

Outline

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- **An example from the test case *namelist.input* file**

Why do we need namelist?

The ***namelist.input*** file helps users to design their model run.

- Before running ***real_nmm.exe*** and ***wrf.exe***, edit ***namelist.input*** file for runtime options.
- The most up-to-dated namelist.input instructions are given in the WRF-NMM User's Guide (Chapter 5)

&time_control

- **time_control:**
  (It will be explained in detail during ***"Initialization with Real Data" presentation by Matthew Pyle.)***

- **io_form_history/restart/input/boundary:** IO format options
  1. binary
  2. netCDF (recommended option)
  4. PHDF5
  5. Grib-1

- **debug_level:**
  0. for standard runs, no debugging.
  1. netcdf error messages about missing fields.
  50,100,200,300 values give increasing prints.
  Large values trace the job's progress through physics and time steps.

&domains

- **time_step, time_step_fract_num, time_step_fract_den,max_dom, s_we, e_we,s_sn, e_sn, s_vert, e_vert, dx, dy:**
  As in "Initialization with Real Data" presentation by Matthew Pyle.
- **grid_id (max_dom):** Domain identifier
  (For WRF-NMM, currently set to 1, since nesting not currently available.)
- **tile_sz_x (max_dom):** Number of points in tile in x direction.
- **tile_sz_y (max_dom):** Number of points in tile in y direction.
- **numtiles (max_dom):** Number of tiles per patch
  (alternative to tile_sz_x and tile_sz_y).
- **nproc_x (max_dom):** Number of processors in x–direction for decomposition.
- **nproc_y (max_dom):** Number of processors in y-direction for decomposition:
  * If nproc_y = -1: code will do automatic decomposition.
  * If nproc_y > 1 for nproc_x and nproc_y: will be used for decomposition.

&physics: Physics options

- ***mp_physics***: microphysics

The Ferrier scheme is currently the only microphysics scheme that works with WRF-NMM. Changes will be made in future releases to accommodate the other microphysics options.

0. No microphysics
1. Kessler scheme
2. Lin et al. scheme
3. WRF Single-Moment (WSM) 3-class simple ice scheme
4. WRF Single-Moment (WSM) 5-class scheme
5. ***Ferrier scheme***
   (Well tested for WRF-NMM, used operationally at NCEP)
6. WSM 6-class graupel scheme
8. Thompson et al. scheme

98. NCEP 3-class simple ice scheme (to be removed)
99. NCEP 5-class scheme (to be removed)

Microphysics related flags

- ***nphs***: *This flag is only for WRF-NMM core.* Number of fundamental time steps between calls to turbulence and microphysics. Defined as: ***nphs=x/dt***, where ***dt*** is the time step (s), and ***x*** is typically in the range of 160s to 180s. (Traditionally it has been an even number, which may be a consequence of portions of horizontal advection only being called every other time step.)

Radiation related flags

- ***ra_lw_physics***: longwave radiation
  1. RRTM scheme: (Preliminary testing for WRF-NMM)

99. GFDL scheme (Schwarzkopf and Fels)
(Well-tested for WRF-NMM, used operationally at NCEP)

- ***ra_sw_physics***: shortwave radiation

1. Dudhia Scheme
2. Goddard Shortwave scheme

99. GFDL Scheme (Lacis and Hansen).
(Well-tested for WRF-NMM, used operationally at NCEP)

- ***radt***: Minutes between calls to the Dudhia and Goddard (GSFC) shortwave radiation schemes. Recommend 1 min per km of dx (e.g. 10 minutes for 10 km)

- ***nrads:*** *This flag is only for the WRF-NMM core.* Number of fundamental time steps between calls to GFDL shortwave radiation scheme. NCEP's operational setting: “nrads” on the order of “3600/dt”. For more detailed results, use “1800/dt”.

- ***nradl:*** *This flag is only for the WRF-NMM core.* Number of fundamental time steps between calls to GFDL longwave radiation scheme. Note that ***nradl*** must be set equal to ***nrads***.

- ***co2tf:*** *This flag is only for the WRF-NMM core.* Controls CO2 input used by the GFDL radiation scheme.

  0: Read CO2 functions data from pre-generated file

  1: Generate CO2 functions data internally

- ***sf_sfclay_physics:*** surface layer

  0. No surface-layer scheme
  1. Monin-Obukhov Similarity scheme
  2. Janjic Similarity Scheme
  (Well tested for WRF-NMM, used operationally at NCEP)
  3. NCEP Global Forecasting System (GFS) scheme:
  (Tested by NCEP for the WRF-NMM.)

- ***sf_surface_physics:*** land surface

  1. Thermal Diffusion scheme
  2. NOAH Land-Surface Model
  3. RUC Land-Surface Model
  99. NMM Land Surface Scheme
  (Well tested for WRF-NMM, used operationally at NCEP)

- ***num_soil_layers:*** number of soil layers in land surface model

4. For NMM Land Surface Model
(Well-tested for WRF-NMM, used operationally at NCEP)

5. Thermal diffusion scheme
6. RUC Land Surface Model

- ***bl_pbl_physics:*** planetary boundary layer

1. Yonsei University scheme (YSU)
   (Preliminary testing for WRF-NMM)

2. Mellor-Yamada-Janjic Scheme
(Well-tested for WRF-NMM, used operationally at NCEP)

3. NCEP Global Forecast System scheme
   (Tested by NCEP for WRF-NMM)
99. MRF scheme

Flags related with cloud parameterization

- ***cu_physics***: cumulus parameterization

  0. No cumulus parameterization. (Tested for WRF-NMM)
  1. Kain-Fritsch scheme: (Preliminary testing for the NMM)
  2. Betts-Miller-Janjic scheme
  (Well tested for WRF-NMM, used operationally at NCEP)
  3. Grell-Devenyi ensemble scheme
  4. Simplified Arakawa-Schubert scheme
  (Well tested for WRF-NMM by NCEP)

- ***ncnvc:*** *This flag is only for WRF-NMM core.* Number of fundamental time steps between calls to convection.
  Note that "ncnvc" should be set equal to "nphs".

- ***isfflx:*** heat and moisture fluxes from the surface for the Monin-Obukhov scheme (sf_sfclay_physics=1)

  0. No flux from the surface
  1. With fluxes from the surface

- ***ifsnow:*** snow-cover effects for Thermal Diffusion scheme (sf_surface_physics=1)

  0. No snow-cover effect
  1. With snow-cover effect

- ***icloud:*** cloud effect to the optical depth in the Dudhia shortwave and RRTM longwave radiation schemes

  0. No cloud effect
  1. With cloud effect

- ***mp_zero_out:*** For non-zero mp_physics options, to keep water vapor positive, and to set the other moisture fields smaller than a threshold value to zero.

  0. No action is taken, no adjustment to any moist field. (Conservation maintained.) ***For WRF-NMM, mp_zero_out MUST BE set to 0.***

  1. All moist arrays, except for Qv, are set to zero if they fall below a critical value. (No conservation)

  2. Qv<0 are set to zero, and all other moist arrays that fall below the critical value defined in the flag "mp_zero_out_thresh" are set to zero. (No conservation.)

- ***mp_zero_out_thresh:*** Critical value for moisture variable threshold, below which moist arrays (except for Qv) are set to zero (unit: kg/kg). Default value is "1.e-8".

&dynamics: Dynamics options

dyn_opt: 4. WRF-NMM dynamics

&bc_control: Boundary control

spec_bdy_width: Total number of rows for specified boundary value nudging. ***It must be set to 1 for WRF-NMM.***

& namelist_quilt: Specifies asynchronized I/O for MPI applications.

nio_tasks_per_group: Default value is 0, means no quilting; value > 0 quilting I/O

nio_groups: Default is 1, do NOT change.

A summary of physics options that are well-tested for WRF-NMM

Microphysics ***(mp_physics)***	***Ferrier scheme (5)***
Longwave Radiation ***(ra_lw_physics)***	***GFDL scheme (99)***
Shortwave Radiation ***(ra_sw_physics)***	***GFDL scheme (99)***
Surface Layer (sf_sfclay_physics)	***Janjic Similarity scheme (2)***
Land Surface (sf_surface_physics)	***NMM Land Surface scheme (99)***
Planetary Boundary Layer ***(bl_pbl_physics)***	***Mellor-Yamada-Janjic scheme (2)***
Cumulus Parameterization ***(cu_physics)***	***Betts-Miller-Janjic scheme (2)***

WRF-ARW SPECIFIC NAMELIST FLAGS

- bldt, cudt
- rk_ord, diff_opt, km_opt, damp_opt, zdamp, dampcoef, khdif, kvdif, mix_cr_len, smdiv, emdiv, epssm, time_step_sound
- spec_zone, relax_zone, specified, periodic_x, symmetric_xs, symmetric_x, open_xs, open_xe, periodic_y, symmetric_ys, symmetric_ye, open_ys, open_ye, nested

AN EXAMPLE FROM TEST CASE NAMELIST.INPUT

- **&time_control** : Specifies the length of the model forecast.

```
run_days                = 1,
run_hours               = 0,
run_minutes             = 0,
run_seconds             = 0,
start_year              = 2005,
start_month             = 01,
start_day               = 23,
start_hour              = 00,
start_minute            = 00,
start_second            = 00,
end_year                =2005,
end_month               = 01,
end_day                 = 24,
end_hour                = 00,
end_minute              = 00,
end_second              = 00,
```

```
interval_seconds        = 10800,
history_interval        = 60,
frames_per_outfile      = 1,
restart                 = .false.,
io_form_history         = 2 (for netCDF)
io_form_restart         = 2 (for netCDF)
io_form_input           = 2 (for netCDF)
io_form_boundary        = 2 (for netCDF)
debug_level             = 1 (Shows only netCDF errors)
```

- **& domains** : Specifies the model domain.

time_step	= 33,	(Must be integer!)
time_step_fract_num	= 1,	(Number for fractional time step)
time_step_fract_den	= 3,	(Denominator for fractional time step)
max_dom	= 1,	(No nesting)
s_we	= 1,	Always set to 1
e_we	= 56,	*Domain dimension in x direction: xdim+1*
s_sn	= 1,	Always set to 1
e_sn	= 92,	*Domain dimension in y direction: ydim+1*
s_vert	= 1,	Always set to 1
e_vert	= 38,	End index in z (vertical) direction (staggered dimension). Note: This parameter refers to full levels including surface and top.
dx	= .097500,	*Always in degrees*
dy	= .090600,	*Always in degrees*
grid_id	= 1,	
tile_sz_x	= 0,	
tile_sz_y	= 0,	
numtiles	= 1,	

- **& physics:** Specifies physics options.

mp_physics	= 5,	Ferrier
ra_lw_physics	= 99,	GFDL longwave radiation scheme (Fels-Schwarzkopf)
ra_sw_physics	= 99,	GFDL shortwave radiation scheme (Lacis-Hansen)
radt	= 60,	
nrads	= 108,	Note that nrads=nradl
nradl	= 108,	
co2tf	= 1,	
sf_sfclay_physics	= 2,	Janjic scheme
sf_surface_physics	= 99,	NMM Land Surface Model
bl_pbl_physics	= 2,	Mellor-Yamada-Janjic
bldt	= 3,	
nphs	= 6,	
cu_physics	= 2,	Betts-Miller-Janjic scheme
cudt	= 3,	
ncnvc	= 6,	Note that ncnvc=nphs
isfflx	= 0,	
ifsnow	= 0,	
icloud	= 0,	
num_soil_layers	= 4,	NMM Land Surface Model
mp_zero_out	= 0,	

- **& dynamics:** Specifies dynamics options.

dyn_opt	= 4,	WRF-NMM dynamics
rk_ord	= 3,	*This flag is only for WRF-ARW core*
diff_opt	= 0,	*This flag is only for WRF-ARW core*
km_opt	= 1,	*This flag is only for WRF-ARW core*
damp_opt	= 1,	*This flag is only for WRF-ARW core*
zdamp	= 5000.,	*This flag is only for WRF-ARW core*
dampcoef	= 0.01,	*This flag is only for WRF-ARW core*
khdif	= 0,	*This flag is only for WRF-ARW core*
kvdif	= 0,	*This flag is only for WRF-ARW core*
mix_cr_len	= 200.,	*This flag is only for WRF-ARW core*
smdiv	= 0.1,	*This flag is only for WRF-ARW core*
emdiv	= 0.01,	*This flag is only for WRF-ARW core*
epssm	= 0.1,	*This flag is only for WRF-ARW core*
time_step_sound	= 4,	*This flag is only for WRF-ARW core*

- **& bdy_control:** Boundary condition control.

spec_bdy_width	= 1,	*Total number of rows for specified boundary value nudging.* ALWAYS SET TO 1 for NMM
spec_zone	= 1,	*This flag is only for WRF-ARW core*
relax_zone	= 4,	*This flag is only for WRF-ARW core*
specified	= .true.,	*This flag is only for WRF-ARW core*
periodic_x	= .false.,	*This flag is only for WRF-ARW core*
symmetric_xs	= .false.,	*This flag is only for WRF-ARW core*
symmetric_xe	= .false.,	*This flag is only for WRF-ARW core*
open_xs	= .false.,	*This flag is only for WRF-ARW core*
open_xe	= .false.,	*This flag is only for WRF-ARW core*
periodic_y	= .false.,	*This flag is only for WRF-ARW core*
symmetric_ys	= .false.,	*This flag is only for WRF-ARW core*
symmetric_ye	= .false.,	*This flag is only for WRF-ARW core*
open_ys	= .false.,	*This flag is only for WRF-ARW core*
open_ye	= .false.,	*This flag is only for WRF-ARW core*
nested	= .false.,	*This flag is only for WRF-ARW core*

- **& namelist_quilt:** Specifies asynchronized I/O for MPI applications.

nio_tasks_per_group	= 0,	Default value is 0, means no quilting; value > 0 quilting I/O
nio_groups	= 1,	Default is 1, do NOT change.

Acknowledgements: *Thanks to earlier presentations of NCAR/MMM Division (Wei Wang), for providing excellent starting point for this talk.*

I would like to also thank Tom Black, Zavisa Janjic, Brad Ferrier (NOAA/NCEP) and Jimy Dudhia (NCAR/MMM) for helping me to understand "namelist parameters"!