
NHM Tutorial

Part. III. Realistic Simulations

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NHM Tutorial 1

Overall Index (Tutorial_0~3)

- 0. What is the NHM?
 - *NHM_Tutorial_0.ppt*
- 1. Brief usage of the NHM
 - *NHM_Tutorial_1.ppt*
- 2. Practical Exercise
 - *NHM_Tutorial_2.ppt*, ***NHM_Tutorial_3.ppt (this file)***
 - 2.0 Installation of the NHM
 - prepare the external files, compile the model and tools, and install the visualization tools
 - 2.1. Idealized Experiments
 - **2.2. Realistic Experiments**



NHM Tutorial 1



2. Practical Exercise

2.2. Realistic Experiments

- Realistic Weather Simulation Using Global analysis (or forecast) data and GTOPO30 as topography.
- We can use the following dataset.
 - **NCEP-GFS forecast** and analysis
 - JRA25 (JMA-25yr-reanalysis) & JCDAS (semi-realtime reanalysis)
 - JMA global model data supplied by the Japan Meteorological Business Support Center (JMBSC)



Available Global Dataset for the NHM

Data Set	Period	Resolution	File format
NCEP GFS Forecast	2007Apr ~ now (the last 6 months?)	1.0 x 1.0 degree global every 6hr, 180hr/3hr forecast	GRIB
NCEP GFS Analysis	2004Mar ~ last month	1.0 x 1.0 degree global every 6hr	GRIB
JRA25 (& JCDAS)	1979Jan ~ now	1.25 x 1.25 degree global every 6hr	GRIB
JMBSC (JMA GSM Forecast) (not including land-surface, sst and soil data)	2004Apr ~ 2007Nov20	1.25 x 1.25 degree global (thinned grid) every 6hr	GRIB
	2007Nov21 ~ now	0.5 x 0.5 degree global every 6hr	GRIB2

- Of course, NuSDaS formatted data from JMA are available. But they are not able to be downloaded freely.
(e.g. Meso-Analysis, Global-Analysis, Global-forecast in NuSDaS)





Nhm/Tools/grib2nus including Download and Convert tools

- (See “README” file)
- step 1. Configure
- (This tools need compiled pnusdas)
- `$> sh configure -c ../../Module/Mk/config/pc/config.[xxx]`

- step 2. make load-module for convertor
- `$> make`



Nhm/Tools/grib2nus including Download and Convert tools

- step 3. get data (JMBSC, NCEP1d_fct, NCEP1d_anl or JRA25)
 - Change date in the “**TIMECARD**” <- initial time
yyyy mm dd hh min
 - “**get_ncep1d_anl.sh**”, “**get_ncep1d_fct.sh**”, “**get_jra.sh**” and “**get_jmbsc.sh**” are prepared.
 - In default setting, these shells download the files for 48hr-forecast. As to your needs, you have to change the range of forecast for saving the download time. It is written in the head of each shell script.
 - `$> sh get_ncep1d_fct.sh` (or `get_ncep1d_anl.sh`, or `get_jra.sh ...`)
 - Download time depends on the Internet speed and forecast time.
 - save files at `Nhm/Data/ncep1d_fct(or jra, jmbsc)/${DATE:yyyymmddhhmm}`





Nhm/Tools/grib2nus including Download and Convert tools

- step 4. convert GRIB(or GRIB2) data to NuSDaS
 - “**jmbsc2nus.sh**”, “**jra2nus.sh**”, “**ncep1d2nus_anl.sh**” and “**ncep1d2nus_fct.sh**” are prepared.
 - `$> sh ncep1d2nus_fct.sh (or jra2nus.sh ...)`
 - Don't change **TIMECARD** when you are downloading the dataset.
 - And these shell scripts expect that the downloaded files are located at “Nhm/Data/ncep1d_fct(or jra, jmbsc)/\${DATE:yyyymmddhhmn}” which is the default value of the download tools.
 - NuSDaS files are output into the same directory at the downloading. (“fct_p.nus”, “fct_sfc.nus” are made.)



Nhm/Ss/RF20km

- (See “README” file)
- Edit "**TIMECARD**" same as downloaded DATE
- Edit "**parm.sh**" for your environments
- Select the appropriate "**pre.sh**" in "**all.sh**" for the downloaded data.
- And run the "**all.sh**". show the contents of all.sh
 - `$> sh setup.sh # set directories, etc`
 - `$> sh mkenst.sh # make orography file`
 - `$> sh mksfcnst.sh # make surface constant files like albedo, etc`
 - `$> sh pre_jmbsc.sh [pre_jra.sh, pre_ncep1d_anl.sh, pre_ncep1d_fct.sh] # make initial and boundary files`
 - `$> sh fcst.sh (attention! Check MPI process number) # start the forecast`
 - `$> sh end.sh # move result files`
- (And you can execute 1-way nesting-run in 5km (or more fine mesh) by using the results of RF20km)



Nhm/Ss/RF20km/parm.sh

- Edit parm.sh for your environments
 - # directory
 - **DIRNAME=RF20km** **#set experiment name**
 - **NHMDIR=/home/seasia/Nhm** **#set your \${NHM} directory**
 - MYDIR=\${NHMDIR}
 - BINDIR=\${MYDIR}/Module/Bin
 - **SHDIR=\${MYDIR}/Ss/\${DIRNAME}**
 - CSTDIR=\${MYDIR}/Const
 - PARMDIR=\${MYDIR}/Parm/\${DIRNAME}
 - TOPODIR=\${MYDIR}/Data/\${DIRNAME}
 - JGWKDIR=\${MYDIR}/Work/\${DIRNAME}
 - DATADIR=\${MYDIR}/Data/\${DIRNAME}
 - INPUTDIR=\${MYDIR}/Tools/grib2nus/data



Nhm/Ss/RF20km/parm.sh

- Edit parm.sh for your environments
 - # model parameters
 - **IDT=75** **# set dt about dx (in km) * 3~5 & can divide 600**
 - **FTEND=12** **# forecast hour**
 - **KTDEL=3** **# interval hour of boundary file**
"6" for JMBSC, JRA, NCEP_anl. "3" for NCEP_fct
 - # ---- parameter for domain
 - **NX=201** **# grid number in x-direction**
 - **NY=201** **# grid number in y-direction**
 - **NZ=40** **# grid number in z-direction**





Nhm/Ss/RF20km/parm.sh

- Edit parm.sh for your environments
 - **NPROJC='MER'** # map projection (in south-hemisphere, "MER" only)
 - "LMN" and "PSN" are available. Don't change "4 digit character".
 - **DX=20000.0000** # horizontal resolution in x-direction
 - **DY=20000.0000** # horizontal resolution in y-direction
 - **MDLTOP=23000.** # model top height in (m)
 - **SLAT=60.0000** # standard latitude for map projection (out of use in Lambert)
 - **SLON=140.0000** # standard longitude for map projection
 - **FLATC=36.0** # latitude at center of domain
 - **FLONC=140.0** # longitude at center of domain

 - **XI=-999.9999** # x-grid point of true Lat. and Lon. ("-999" means out of use)
 - **XJ=-999.9999** # y-grid point of true Lat. and Lon. ("-999" means out of use)
 - **XLAT=-999.9999** # true latitude at (XI,XJ) ("-999" means out of use)
 - **XLON=-999.9999** # true longitude at (XI,XJ) ("-999" means out of use)



Nhm/Ss/RF20km/parm.sh

- ### Usually DO NOT CHANGE BELOW ###
 - #parameter for boundary dumping area
 - **automatically** set 4% of domain size, respectively.
 - **#IWDTH=6** #domain of just using topography of outer model
 - **#IMERG=6** #domain of merging topography between outer model and inner model
 - **IDIFX=`expr \$IWDTH + \$IMERG`**

 - #start level of Rayleigh dumping : about $NZ * 0.8$
 - **automatically** set 80% of grid number in vertical.
 - **#KZDST=32**
- End edit parm.sh





Nhm/Ss/RF20km/

setup.sh, mkenst.sh, mksfcnst.sh, pre_[jbmsc].sh

- setup.sh
 - **automatically** make domain card and work directory from “parm.sh”.
 - **automatically** set NuSDaS_definition files from “parm.sh”.
- mkenst.sh
 - **automatically** make topographic data (mftopo) from GTOPO30
- mksfcnst.sh
 - **automatically** make land surface parameter file, if it is needed.
- pre_[jbmsc].sh
 - **automatically** make initial and boundary files.
 - output files; mfin(initial file), mfex(boundary file), ptgrd (surface parameter), mfhm(topographic data), [sst (for self-nesting)]



Nhm/Ss/RF20km/fcst.sh

- “fcst.sh” includes namelists for the setting of the NHM
 - link constant files
 - preparing the NuSDaS output
 - read the namelist for the NHM
 - If you want to change the namelists, over-write here.
 - The details of the namelist are describes in **“Doc/En/namelist/fcst.sh_namelist.html”**
 - execute the NHM (with MPI, check MPI-process!)
 - output the forecast





Nhm/Ss/RF20km/end.sh

- “end.sh”
 - Move output data to output directory.
 - ->DATADIR=\${MYDIR}/Data/\${DIRNAME}
 - If the same "DIRNAME" already exist, automatically change the name of pre-exist directory and then move new results.
 - Clean up work directories
- After the check of the whole shell scripts, Start forecast!



Start forecast!

- At the first time, execute each shell script in "all.sh" step by step.
 - \$> sh setup.sh
 - \$> sh mknst.sh
 - \$> sh mksfccnst.sh
 - \$> sh pre_jmbc.sh [or, pre_jra.sh, pre_ncep1d_anl.sh, pre_ncep1d_fct.sh]
 - \$> sh fcst.sh (attention! MPI process number)
running at "\${NHM}/Work/RF20km"
 - You can see progress in the command below.
tail -f \${NHM}/Work/RF20km/log.fcst_nfx.\${PID}
 - \$> sh end.sh
output at "\${NHM}/Data/RF20km"





Visualization by webpandah

- NuSDaS output files:
 - fcst_const.nus : surface constant file (height, sl, lat, lon...)
 - fcst_land.nus : skintemp, sst, landuse
 - **fcst_mdl.nus : model-plane forecast variables**
 - **fcst_p.nus : p-plane forecast (and diagnostic) variables**
 - **fcst_sfc.nus : surface forecast (and diagnostic) variables**
 - #for monitor
 - fcst_phy2m.nus : 2-D physical variables monitor
 - fcst_phy3m.nus : 3-D physical variables monitor

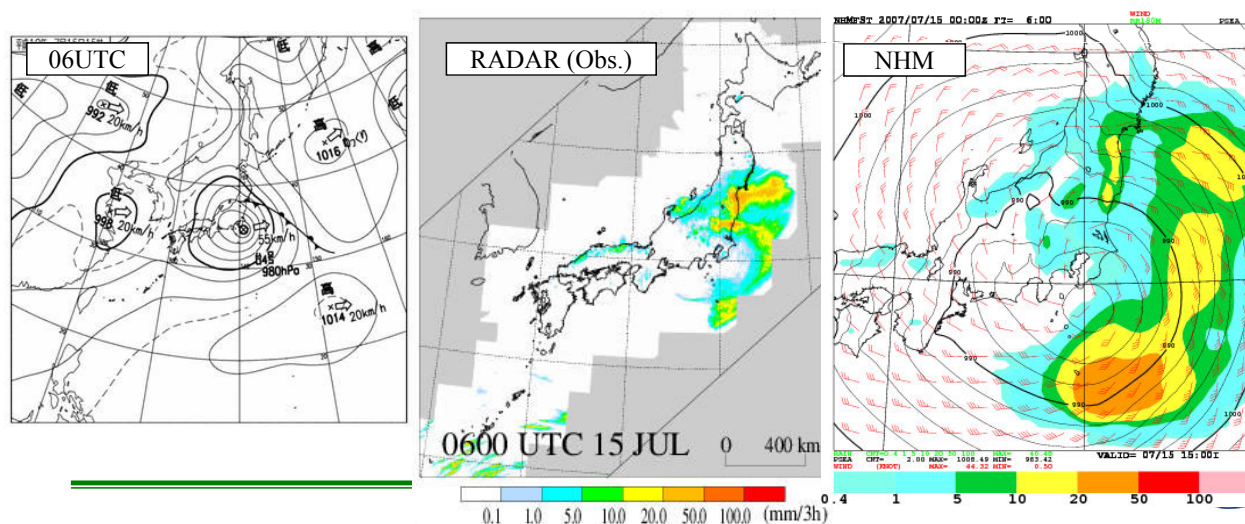


NHM Tutorial 1



Result of realistic experiment

- Initial time is 2007-Jul-15 00UTC. Typhoon "MAN-YI" hit Japan.
- For 6hr forecast around Japan (51x51x40 with 20km in horizontal) 10minutes need on this machine.
- So, I have already done this simulation.



Nhm/Ss/RFnest

(Using results of RF20km execute 1-way nesting-run in 5km)

- 1-way self-nesting shell script.
(NHM is available 1-way nesting only)
- Almost same as RF20km.
- (See “README” file)
- Edit "**TIMECARD**" same as target initial DATE
- Edit "**parm.sh**" for your environments
 - Change “**INPUTDIR**” for results of RF20km
 - set “**KTLAG**” and “**FTEND**”
 - and check another settings as in “RF20km/parm.sh”
- If you want to run once more, copy "**RFnest**" and rewrite "**TIMECARD**" and "**parm.sh**".



Single precision-run

- If you have a limitation of CPU-time for continuous run, you should use "single precision mode". (Default is double.)
- Using "single", you have to change source code in NHM and recompile NHM.
- Change Nhm/Module/Src/JMANHM/vardef.f90 as below.

module vardef

skip

! integer(4), parameter :: r_size = kind(0.0e0)

integer(4), parameter :: r_size=kind(0.0d0)

end module vardef



module vardef

skip

integer(4), parameter :: r_size = kind(0.0e0) < remove "!"

! integer(4), parameter :: r_size=kind(0.0d0) < add "!"

end module vardef

- But some fortran compilers make errors in single precision mode... sorry we can not solve this problem.

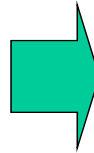


Restart-run

- If you have a limitation of CPU-time for continuous run, you should use "restart-run".
- Using "restart", you have to change some parameters in "fcst.sh".
- First of all, you have to prepare special fcst.sh for restart.

"all.sh" for normal-run

```
sh setup.sh
sh mkenst.sh
sh mksfcnst.sh
sh pre_[jra, ncep].sh
sh fcst.sh
sh end.sh
```



"all.sh" for restart-run

```
sh setup.sh
sh mkenst.sh
sh mksfcnst.sh
sh pre_[jra, ncep].sh
sh fcst_1.sh
sh fcst_[2, 3, 4, ...].sh
sh fcst_end.sh ...
sh end.sh
```

- Details are shown in the next slide.



fcst.sh for 1st-run (fcst_1.sh) (output restart files only)

"fcst.sh" for normal-run

```
&NAMPAR
ITST=1,ITEND=${ITEND},ITOU
T=5000,ITCHK=1,
.....
&NAMFIL
.....
IMT_RS_OUT=-1, output_ninfo =
0, ibase_fake=0,
.....
```



"fcst_1.sh" for (1st) restart-run

```
&NAMPAR
ITST=1,ITEND=${1st restart
end in timestep},ITOUT=5000,
ITCHK=1,
.....
&NAMFIL
.....
IMT_RS_OUT=1, output_ninfo
= 0, ibase_fake=0,
.....
```

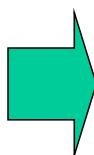
Then, restart-files are output in
\${work} directory in each mpi-
processes





fcst.sh for 2nd-run (fcst_[2, 3, 4, ...].sh) (input and output restart files)

```
"fcst.sh" for normal-run
&NAMPAR
ITST=1,ITEND=${ITEND},ITOU
T=5000, ITCHK=1,
.....
&NAMFIL
.....
IMT_RS_OUT=-1, output_ninfo =
0, ibase_fake=0,
.....
```

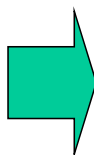


```
"fcst_2.sh" for (2nd) restart-run
&NAMPAR
ITST=${1st restart end in
timestep},ITEND=${2nd restart
end in timestep},ITOUT=5000,
ITCHK=1,
.....
&NAMFIL
.....
IMT_RS_OUT=1,
IMT_RS_IN=1, output_ninfo =
0, ibase_fake=0,
.....
```



fcst.sh for final-run (fcst_end.sh) (end of restart, input restart files only)

```
"fcst.sh" for normal-run
&NAMPAR
ITST=1,ITEND=${ITEND},ITOU
T=5000, ITCHK=1,
.....
&NAMFIL
.....
IMT_RS_OUT=-1, output_ninfo =
0, ibase_fake=0,
.....
```



```
"fcst_end.sh" for end of restart-
run
&NAMPAR
ITST=${previous restart end in
timestep},ITEND=${forecast
end in timestep},ITOUT=5000,
ITCHK=1,
.....
&NAMFIL
.....
IMT_RS_IN=1, output_ninfo =
0, ibase_fake=0,
.....
```





Note for restart-run

- **Don't change FTEND** in parm.sh from normal run. FTEND show the whole forecast hour in restart.
 - each forecast hour of fcst_[1,2,..].sh is set in **ITEND**.
- Initial and boundary files are same as normal (continuous) run. You have to prepare whole period for restart-run.
- Don't change MPI-process number in each restart run.
- Restart files are output in $\${work}$ directory and overwrite in each restart run by the same name for each MPI-process.



under-constructing now

- Execute NHM from "Meteorological Research Consortium" dataset (for collaborative research member with MRI/JMA only)
 - now available "RSMC125 **weekly ensemble forecast (50 members, 1.25degree resolution, 12hourly interval)**" **global forecast** data set
 - now available "GANAL (**20km resolution, 6hourly interval**)" for initial and boundary on **global analysis**.
 - constructing to use "**monthly ensemble forecast (50 members, 2.5degree resolution, 6hourly interval, once a week)**" **global forecast** data set
 - now available "MANAL (10km resolution, 3hourly interval)" for initial and "mfboundary" for boundary **around Japan only**.
- Preparing a convertor from NuSDaS to GRIB and GRIB2. ("NuSDaS to GrADS" is already available.)

