NHM Tutorial
Part II. Install and Excute
Idealized Experiments

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2. Practical Exercise

2.0 Installation of the NHM

- We need the following hardware.
  - Unix-based machines and OS
  - Machine: super-computer or PC(s)
  - OS: Unix or Linux
- Fortran Compiler
  - The NHM is written in FORTRAN90.
  - vendor: Intel, g95, PGI, Fujitsu, NEC, HITACHI
- (for Parallel computer)
  - MPI is available for distributed memory machine or clusters
  - open-MP for shared memory is not supported
- (Visualization tool :GrADS and webpandah)

Step 0: Installation model

- Copy the "Nhm" on your machine.
- Configure for your machine
  - Configuration files are prepared for typical environment.
  - Type configuration command as follows.
    $> cd ${NHM}/Module/Mk
    $> configure –c config/pc/config.ifc8_lam
  - If you need, change configuration file for your environment. (e.g. name of compiler, location of libraries and so on...)

Step0: compile NHM and Tools

- compile a model (for single core processor)
  $> cd ${NHM}/Module/Mk
  - compile " idealized exp. tools"
    - $> make step1_1 (for idealized exp.)
    - $> make orgbell_n01 (for idealized exp.)
    - $> (make zsls (for visualization topographic files))
  - compile "realistic exp. tools"
    - $> sh COMPILE (for realistic exp.)
  - compile only model core (included in "COMPILE")
    - $> make fcst_nfx
  - (if you want to reset & remove loadmodules)
    - $> sh deconfigure
    - $> rm -r ${NHM}/Module/Bin

Step0: compile NHM and Tools

- compile some tools
  - $> cd ${NHM}/Tool/time_card
    - $> gmake
    - "time_card" is generated in this directory.
  - $> cd ${NHM}/Tool/nus2grads
    - $> sh configure
    - $> gmake
    - "nus2grads" is generated in this directory.
      - Using this tool, NuSDaS files can be converted to GrADS format with ".ctl" file easily

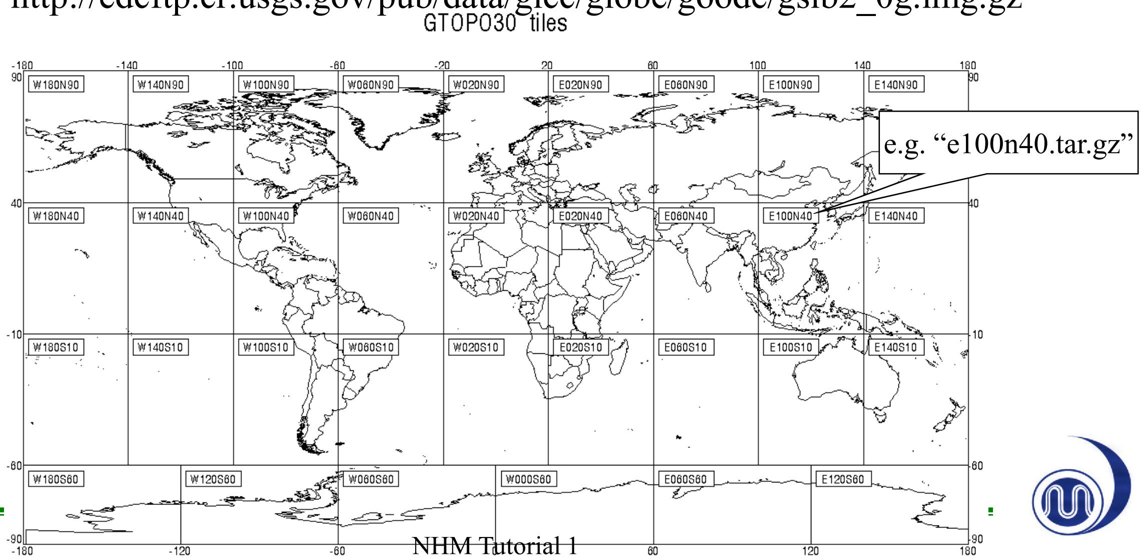
Prepare External files and software

- If you have "**nhm.const.tgz**" file, extract it on your disk and link extracted directory "Const" as "Nhm/Const". That's all, you don't need to read below.

- Unfortunately, if you don't have "**nhm.const.tgz**", please see below.
  - landuse data (not use in idealized exp., but for real exp. later)
    - download glcc (gusgs2_0ll.img.gz) (see next slide) and extract on disk (need 1GB disk space)
    - NHM expects that the location is "Nhm/Const/glcc/version2/gusgs2_0ll.img"
  - topography data (not use in idealized exp., but for real exp. later)
    - download GTOPO30 (see next slide) from USGS.
    - convert 10x10degree data for the NHM by "Nhm/Tools/gtopo_tools" (need over 10GB file space). If you have converted gtopo-files, skip below.
    - $> gcc -o gtopo_tool gtopo.c
      $> (e.g.) gtopo_tool E020N40.HDR E020N40.DEM gusgs2_0ll.img
      gtopo_1km_***.dat and land_sea_***.dat are made.
      $> "gtopo.sh" can convert easily all of the GTOPO30files.
    - Expected location is "Nhm/Const/GTOPO30/gtopo_1km~ & land_sea_1km ~"
- other constant files (BANDCNX, band.dat, band2004.dat, OZN_T42L68_clm.dat, GSM9603.VEG)
  - the NHM need some constant files for radiation and others at "Nhm/Const"
- Put or link these files under "Nhm/Const"

GTOPO30 and GLCC

- These data set is included in "**nhm.const.tgz**" file.
- GTOPO30 download from "http://edcftp.cr.usgs.gov/pub/data/gtopo30/global/"
- GLCC landuse (version2->global->filelisting->) data download from
  "http://edcftp.cr.usgs.gov/pub/data/glcc/globe/latlon/gusgs2_0ll.img.gz"
  "http://edcftp.cr.usgs.gov/pub/data/glcc/globe/goode/gsib2_0g.img.gz"



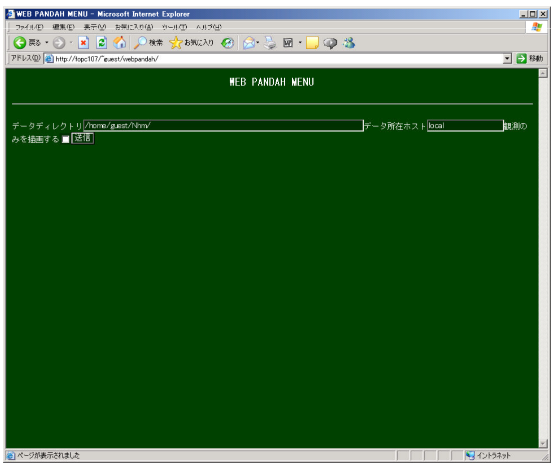
Install the "webpandah"

for visualization of NuSDaS format

- Nhm/Tools/pandah/Mk
  - $> configure -c config.ifort
  - $> make pandah
- Nhm/Tools/pandah/sh
  - $> configure -c config.ifort
- mkdir ${home}/public_html/
- Nhm/Tools/pandah/webpandah
  - $> sh install.sh -h
  - $> sh install.sh --map jma/JW_leaf --language en -obselm 0
  - (coast line files put at Nhm/Tools/pandah/Parm/map/)
- available "cgi" on your machine (please check "httpd.conf"(?))
  - (need ImageMagik, ghostview)
  - (if you use icc, you have to write "LD_LIBRARY_PATH" in configure of httpdaemon)

Usage of webpandah

- Enter the "data directory (${HOME}/Nhm/Data/***)" and "hostname (local)"
- Seek ***.nus file and select

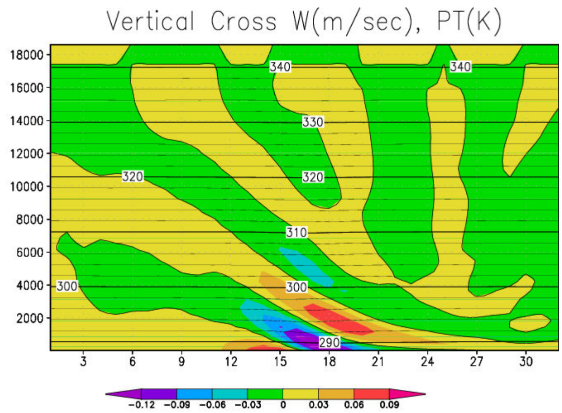


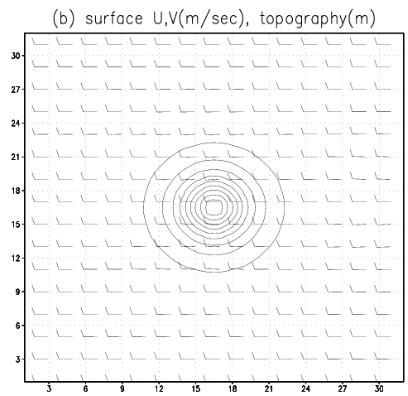
2. Practical Exercise
2.1. Idealized Experiments (1)

- Linear mountain wave experiment (Nhm/Ss/Lmwv)
  - Execute the NHM in very simple condition
    - Make 100-m height bell-shaped mountain.
    - Set uniform wind in vertical and horizontal and gradient PT in vertical for initial condition .
  - Make bell-shaped mountain (mountain height 0.1km) file.
    32 x 32 x 32 grid points in x-y-z with 2-km horizontal grid
    - $> sh make_bellorg_wave.sh
  - Run the NHM
    - $> sh fcst_mountainwave_nusdas[grads].sh
    - The results file (NuSDaS format or GrADS) appear as
      ${NHM}/Ss/Lmwv/work_wave/fcst_p.nus, fcst_mdl.nus, fcst_surf.nus
  - Successfully done, you can see dry mountain waves.

Visualization

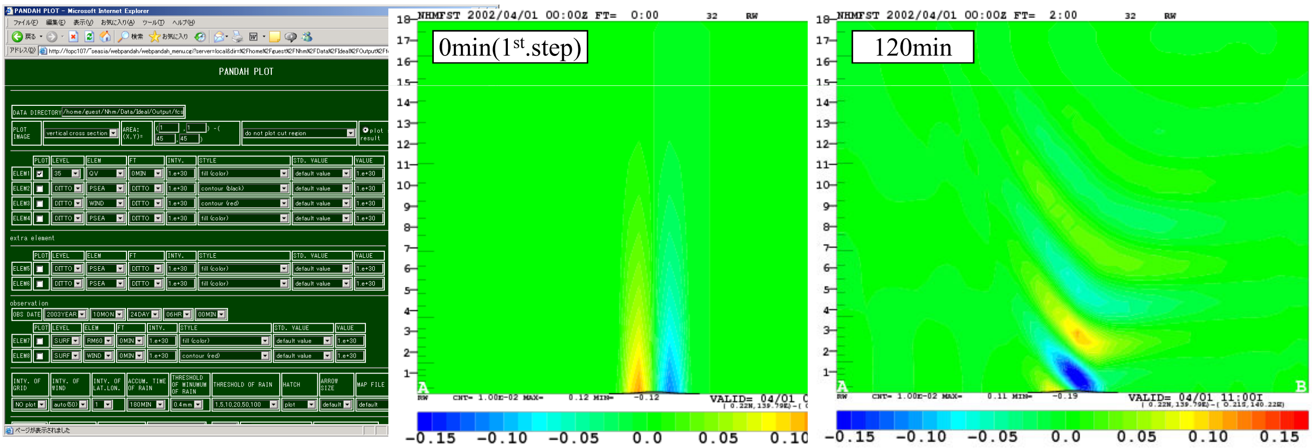
- Visualization by GrADS
  - $> grads
  - $> no
  - $> open zlev.ctl
  - $> set z 2 31
  - $> set y 16
  - $> set t 7
  - $> set gxout shaded
  - $> d w
  - $> d pt
  - You can simulate successfully
    (dry) mountain waves.





Visualize NuSDaS by webpandah

- Select “vertical plot”, Element (RW) and FT(0min, 120min)
- Change "FT"or others, to confirm the results.



Idealized Experiments (2)

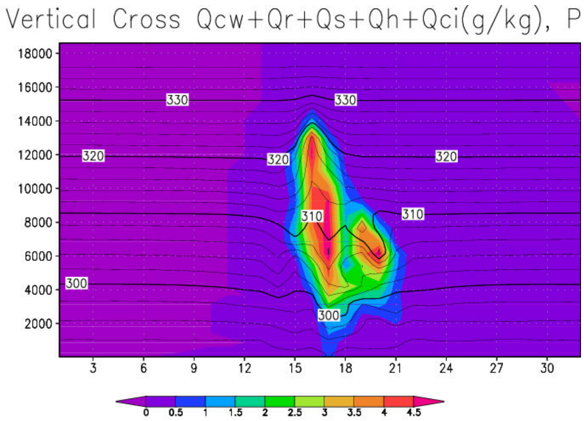
- Next, we run the rainfall events over isolated mountain. (mountain height 1km)
- Make simple mountain file for ideal test. 32 x 32 x 32 grid points of 2-km grid in horizontal
  - $> cd ${NHM}/Ss/Lmwv
  - $> sh make_bellorg_prec.sh
- Run the NHM
  - $> sh fcst_org_prec_grads.sh (wet simulation MSWSYS(18)=2 -> 0)
  - The results file (GrADS format) appear as ${NHM}/Ss/Lmwv/work_prec
  - (sh fcst_org_prec_nusdas.sh (NuSDaS output version))

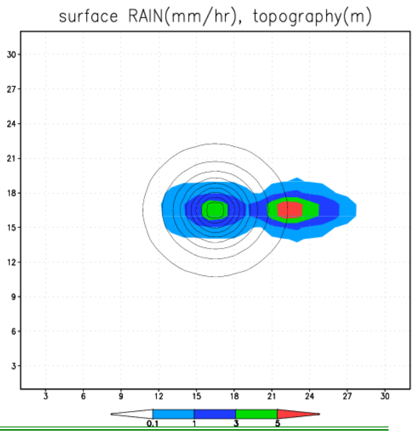
MSWSYS:Mode switches
(for wet process only)

- If you change these switches, you can conduct sensitive experiments easily.
- mswsys(18): cloud microphysics
  - 2: dry (<- **Idealize exp. 1**)
  - 1: warm rain
  - 0: ice phase included, qc, qr, qi, qs, qg, and Ni predicted (<- **Idealize exp. 2**)
  - -2: same as 0, but qc, qr, qi, qs, qg, Nc, Nr, Ni, Ns and Ng predicted
- mswsys(22): cumulus parametrization
  - 0: w/o cumulus parametrization
  - 1: cloud microphysics w/moist convective adjustment (MCA), condensation in MCA added to cloud water
  - 5: same as 1, but condensation in MCA added to rain and graupel
  - 11: same as 1, but w/Arakawa-Schubert scheme (AS)
  - 20: same as 1, but w/Kain-Fritsch scheme (KF) *
- Full description of these switches are described in "Nhm/Doc/En/namelist/fcst.sh_namelist.html"

Visualization

- Visualization by GrADS
  - $> grads
  - $> set gxout shaded
  - $> d qc+qci+qr+qs+qg
  - $> set gxout contour
  - $> d pt
  - show another variable
  - $> grads
  - $> open zlev.ctl
  - $> set t 19
  - $> set x 1 32
  - $> set y 1 32
  - $> set y 1
  - $> d smqr (draw accumulated rain)



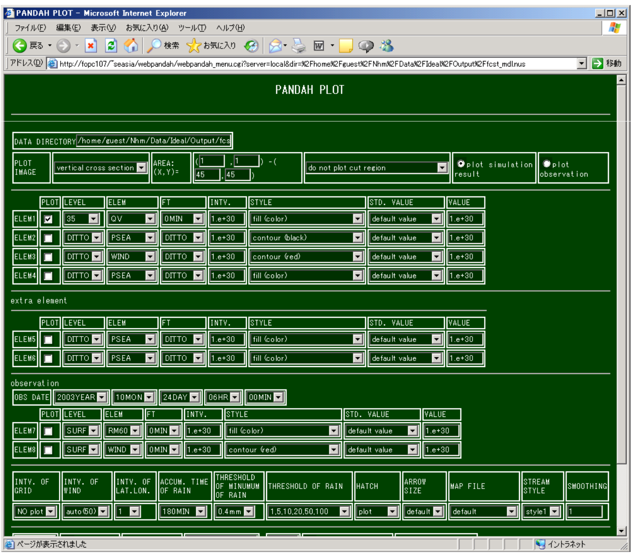


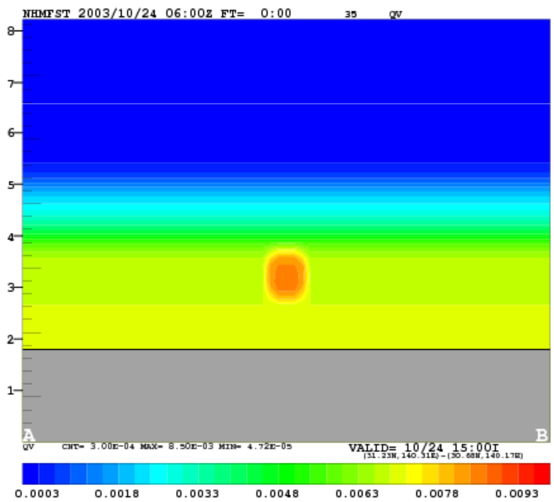
Idealized Experiments (3)

- Warm Bubble Experiment
  - before this experiment, need to install “webpandah” (see next slide)
  - $> cd ${NHM}/Ss/Ideal/SC
  - $> sh setup.sh (ifc -> ifort)
  - $> sh idealfcst.sh (np -16 -> -1)
    (In the default setting, 16-MPI are used.)
  - In the running, you can see proceedings in "tail -f "./${WORK}/log.fcst_nfx.${pid}""
  - The results files are output in NuSDaS format... at "${NHM}/Data/Ideal/SC"

Sample of webpandah

- Select “plot image”, Element (QV) and FT(0min)
- Change "FT", to confirm the results.





sample of "pandah.sh" in command line

- Documents are prepared in "Nhm/Doc/" and link "pandah"
- In Nhm/Tools/pandah/Sh, basically usage is shown as follows
  - sh pandah.sh –D "data directory (e.g. ${NHM}/Data/RF20km/ yyyymmdd hhmn/fcst_sfc.nus)" --time "yyyy mm dd hh mn" --map jma/JW_leaf.txt --element "element file" --area "area file"
  - "Element file" and "area files" can be output from "webpandah" That is easy way to create "element file" and "area file" and then you modify them as you like.
  - if you want to change localtime, you make "fort.80" that is filled e.g. "9 JST". (different from UTC and name of localtime)

Sample of "element file" and "area files"

```
! ------------------------------------------------------------------
! PANDAH element file
! ------------------------------------------------------------------
   1,        : maximum number of output sheets
   2,    1,   : number of chart : NCLM * NROW <= 24
  TOP,  CLM,   : order of plot : (TOP, BTM) -> (CLM, ROW)
  15,  15,  00,  00, : (LEFT, RIGHT, TOP, BOTTOM) margin(unit = mm)
! ---------------------------+--------------------------------------
'                            ': page title(upper of the sheet) (a30)
! ---------------------------+--------------------------------------
  -99, -99, -99, 1  : KTSTART, KTEND, KTCYCL, KT_UNIT
! KTSTART, KTEND, KTCYCLE : available if >= -50
! KT_UNIT = 60 : unit = hour, = 1 : unit = minute
! ------------------------------------------------------------------
!  type1,   type3,  nmap,    level,     sp,     color, area,
!      type2,  member,    kt,        elem,    contr,  file, date,
!
 _NHMMRLY,FCSV,STD1,,1,1800,SURF,RAIN,#,1.e+30,-204,0,10,0,h,1,301,1,301
 _NHMMRLY,FCSV,STD1,,1,1800,SURF,PSEA,#,1.e+30,1,0,10,0,h,1,301,1,301
!_NHMMRLY,FCSV,STD1,,1,1800,SURF,WIND,#,1.e+30,2,0,10,0,h,1,301,1,301

!########,####,####,####, 1, 12,######,######,#, 1.e+30, -1, 0,10, 0, h,   1, 100,   1, 100
end
! ------------------------------------------------------------------
0, -50, 8 : interval of grid, wind(unit = grid), weather mark
   1, 1,  : smoothing(except for RAIN, RAIN) (unit = grid)
   1,     : intervals of latitude lines and longitude lines
  30,        : grid range to investigate maximum and minimum values
   180,   1,   : rain accumulation time(except for WETH, WETH)
   4,        : rain cut off(unit = 0.1mm)
! ------------- rain contour(unit = 0.1mm, max number is 10)
10,50,100,200,500,1000,9999,-99,
! ------------------------------------------------------------------
   1,        : convert WIND unit(1 : m -> knot, -1 : knot -> m)
   1,        : convert T    unit(1 : K -> C,    -1 : C    -> K)
 -999,        : topography cut off(unit = m)
 'A','B', 4.0, 46, 5, 1 : caption of cross section etc.
```

```
&name_area
  i = 1, 301,
  j = 1, 301,
  im = 301,
  jm = 301,
npro = 'MER ',
dels = 5000,
slat = 5.00000,
slon = 105.00000,
  xi = 1,
  xj = 300,
xlat = -5.34663,
xlon = 94.63924,
&end
```