WRF installation procedure and running process

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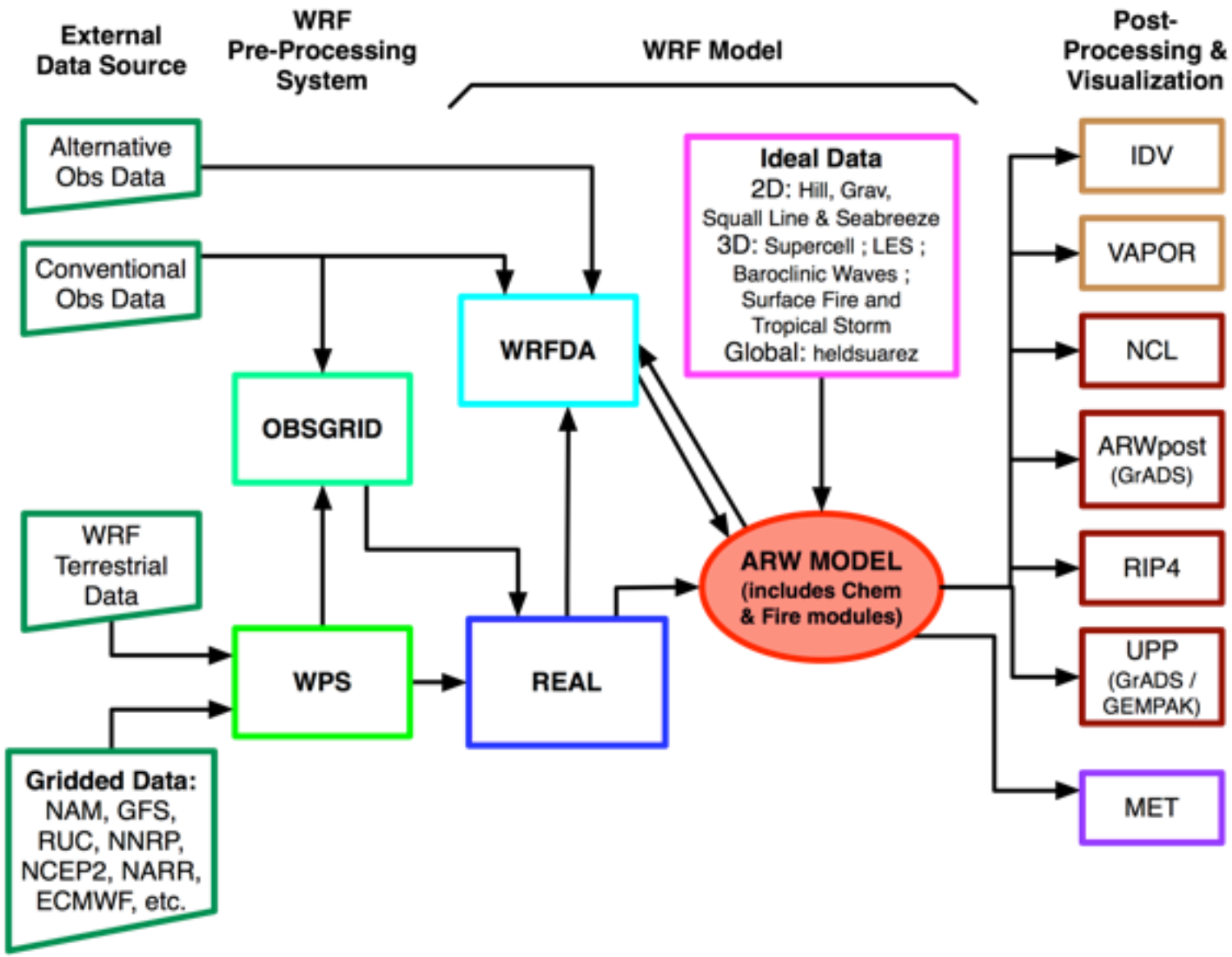
WRF Modeling System Flow Chart



Wu et al. (2015)

Contents

- Day 1
  - WRF installation procedure and running process for standalone computer
  - WRF installation procedure and running process for HPC
    - Installation procedure (step-by-step)
    - Linker procedure (The assumption is that the WRF model has been installed previously)
- Day 2 Case Study

WRF installation procedure and running process for standalone computer

- Virtual Machine
- Personal Computer
- Laptop

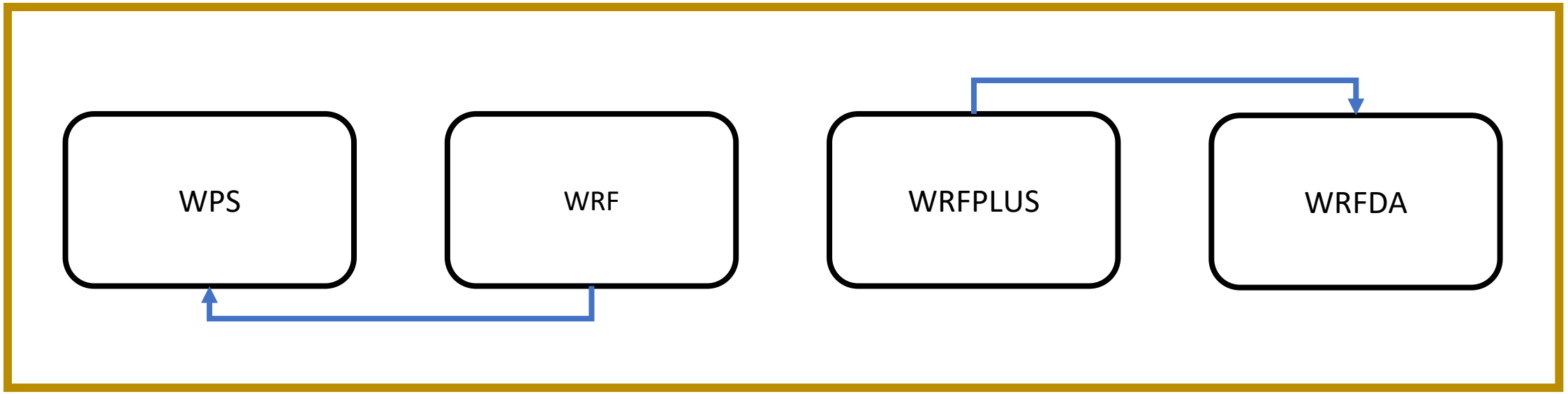
WRF installation procedure and running process for standalone computer

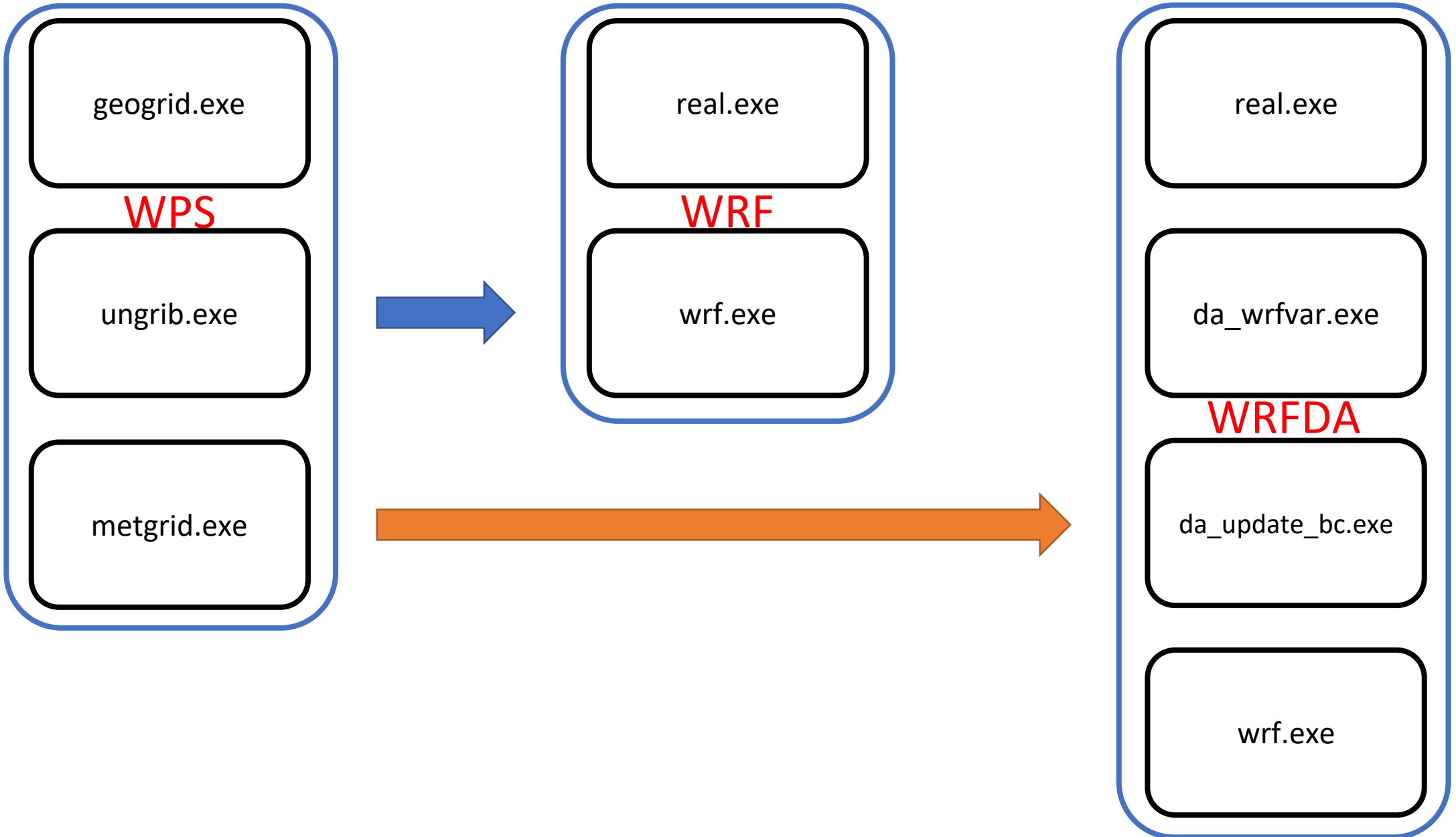
- For step by step installation and running process: https://github.com/denyanto/nwo_nwp_training/README.md

WRF installation procedure and running process for HPC

- High Performance Computing (HPC)
- PC Cluster
- Server

Libraries




geogrid.exe
WPS
ungrib.exe
metgrid.exe
real.exe
WRF
wrf.exe
real.exe
da_wrfvar.exe
WRFDA
da_update_bc.exe
wrf.exe

Download Libraries

- https://download.open-mpi.org/release/open-mpi/v4.1/openmpi-4.1.4.tar.gz (openmpi)
- https://support.hdfgroup.org/ftp/HDF5/releases/hdf5-1.12/hdf5-1.12.0/src/hdf5-1.12.0.tar.gz (hdf5)
- https://zlib.net/fossils/zlib-1.2.8.tar.gz (zlib)
- ftp://ftp.unidata.ucar.edu/pub/netcdf/netcdf-c-4.7.4.tar.gz (netcdf-c)
- ftp://ftp.unidata.ucar.edu/pub/netcdf/netcdf-fortran-4.5.3.tar.gz (netcdf-fortran)
- https://www.ece.uvic.ca/~frodo/jasper/software/jasper-1.900.1.zip (jasper)
- https://sourceforge.net/projects/libpng/files/libpng16/1.6.37/libpng-1.6.37.tar.gz (libpng)
- https://support.hdfgroup.org/ftp/lib-external/szip/2.1.1/src/szip-2.1.1.tar.gz (szip)

Download WRF

- https://github.com/wrf-model/WRF/releases/download/v4.4/v4.4.tar.gz (WRF)
- https://github.com/wrf-model/WPS/archive/refs/tags/v4.4.tar.gz (WPS)
- https://www2.mmm.ucar.edu/wrf/src/ARWpost_V3.tar.gz (ARWPost)

- pwd ~ please make sure you are on the “/home/{your-home-name}”
- mkdir NWP_{your_name}
- cd NWP_{your_name}
  - mkdir raw lib
  - cd raw
  - download all of the files (link of the previous slide)
- cd ../lib
  - mkdir openmpi-4.1.4 zlib-1.2.11 szip-2.1.1 hdf5-1.12.0 netcdf-4.7.4 jasper-1.900.1 libpng-1.6.37

OpenMPI

- cd ../raw
- tar -zxvf openmpi-4.1.4.tar.gz
- cd openmpi-4.1.4
- ./configure --prefix=/home/{your-home-name}/NWP_{your_name}/lib/openmpi-4.1.4
- make
- make check
- make install
- cd ..

Zlib

- tar –zxvf zlib-1.2.11.tar.gz
- cd zlib-1.2.11
- ./configure --prefix=/home/{your-home-name}/NWP_{your_name}/lib/zlib-1.2.11
- make
- make install
- cd ..

Szip

- tar –zxvf szip-2.1.1.tar.gz
- cd szip-2.1.1
- ./configure --prefix=/home/{your-home-name}/NWP_{your_name}/lib/szip-2.1.1
- make
- make install
- cd ..

Hdf5

- tar –zxvf hdf5-1.12.0.tar.gz
- cd hdf5-1.12.0
- ./configure --prefix=/home/{your-home-name}/NWP_{your_name}/lib/hdf5-1.12.0 \
  --with-zlib=/home/{your-home-name}/NWP_{your_name}/lib/zlib-1.2.11 \
  --with-szip=/home/{your-home-name}/NWP_{your_name}/lib/szip-2.1.1 \
  --enable-fortran
- make
- make install
- cd ..

Netcdf-c

- tar -zxvf netcdf-c-4.7.4.tar.gz
- cd netcdf-c-4.7.4
- ./configure --prefix =/home/{your-home-name}/NWP_{your_name}/lib/netcdf-4.7.4 \
  --enable-netcdf-4 \
  LDFLAGS="-L/home/{your-home-name}/NWP_{your_name}/lib/hdf5-1.12.0/lib" \
  CPPFLAGS="-I/home/{your-home-name}/NWP_{your_name}/lib/hdf5-1.12.0/include" \
  CC=gcc
- make
- make install
- cd ..

Netcdf-fortran

- export LD_LIBRARY_PATH=/home/{your-home-name}/NWP_{your_name}/lib/netcdf-4.7.4/lib
- tar –zxvf netcdf-fortran-4.5.3.tar.gz
- cd netcdf-fortran-4.5.3
- ./configure --prefix=/home/{your-home-name}/NWP_{your_name}/lib/netcdf-4.7.4 \
  --enable-netcdf-4 LDFLAGS="-L/home/{your-home-name}/NWP_{your_name}/lib/netcdf-4.7.4/lib" \
  CPPFLAGS="-I/home/{your-home-name}/NWP_{your_name}/lib/netcdf-4.7.4/include" FC=gfortran \
  F77=gfortran
- make
- make install
- cd ..

Jasper

- unzip jasper-1.900.1.zip
- cd jasper-1.900.1
- ./configure --prefix=/home/{your-home-name}/NWP_{your_name}/lib/jasper-1.900.1 \
  --enable-shared
- make
- make install
- cd ..

Libpng

- tar –zxvf libpng-1.6.37.tar.gz
- cd libpng-1.6.37
- ./configure --prefix=/home/{your-home-name}/NWP_{your_name}/lib/libpng-1.6.37 --with-zlib-prefix=/home/{your-home-name}/lib/zlib-1.2.11
- make
- make install

WRF

- export NETCDF =/home/{your-home-name}/NWP_{your_name}/lib/netcdf-4.7.4
- export NETCDF4=1
- export HDF5=/home/{your-home-name}/NWP_{your_name}/lib/hdf5-1.12.0
- export jasper=/home/{your-home-name}/NWP_{your_name}/lib/jasper-1.900.1
- export JASPERLIB =/home/{your-home-name}/NWP_{your_name}/lib/jasper-1.900.1/lib
- export JASPERINC =/home/{your-home-name}/NWP_{your_name}/lib/jasper-1.900.1/include
- export WRFIO_NCD_LARGE_FILE_SUPPORT=1

- cd /home/{your-home-name}/NWP_{your_name}/raw-mod
- tar –zxvf wrf.v4.4.tar.gz
- mv wrf.v4.4 WRF
- cd WRF
- ./configure
- ./compile em_real >& compile.log &
- cd /home/{your-home-name}/NWP_{your_name}/raw-mod
- mv WRF /home/{your-home-name}/NWP_{your_name}

WPS

- export JASPERLIB=/home/{your-home-name}/NWP_{your_name}/lib/jasper-1.900.1/lib
- export JASPERINC=/home/{your-home-name}/NWP_{your_name}/lib/jasper-1.900.1/include
- export WRF_DIR=../WRF
- export NETCDF=/home/{your-home-name}/NWP_{your_name}/lib/netcdf-4.7.4
- cd /home/{your-home-name}/NWP_{your_name}/raw-mod
- tar –zxvf wps.v4.4.tar.gz
- mv wps.v4.4 WPS
- cd WPS
- ./configure
- ./compile >& compile.log &
- cd /home/{your-home-name}/NWP_{your_name}/raw-mod
- mv WPS /home/{your-home-name}/NWP_{your_name}

ARWPost

- cd /home/{your-home-name}/NWP_{your_name}/raw-mod
- tar –zxvf ARWpost_V3.tar.gz
- mv ARWpost_V3 ARWpost
- cd ARWpost
- ./configure
- ./compile
- cd /home/{your-home-name}/NWP_{your_name}/raw-mod
- mv ARWpost /home/{your-home-name}/NWP_{your_name}

WRFPLUS

- cd /home/{your-home-name}/NWP_{your_name}/raw-mod
- tar –zxvf wrf.v4.4.tar.gz
- mv wrf.v4.4 WRFPLUS
- cd WRFPLUS
- export NETCDF=/home/{your-home-name}/lib/netcdf-4.7.4
- ./configure wrfplus
- ./compile wrfplus
- cd /home/{your-home-name}/NWP_{your_name}/raw-mod
- mv WRFPLUS /home/{your-home-name}/NWP_{your_name}

WRFDA

- cd /home/{your-home-name}/NWP_{your_name}/raw-mod
- tar –zxvf wrf.v4.4.tar.gz
- mv wrf.v4.4 WRFDA
- cd WRFDA
- export WRFPLUS_DIR=/home/{your-home-name}/WRFPLUS
- export NETCDF=/home/{your-home-name}/lib/netcdf-4.7.4
- export NETCDF4=1
- export HDF5=/home/{your-home-name}/lib/hdf5-1.12.0
- export WRFIO_NCD_LARGE_FILE_SUPPORT=1
- ./configure 4dvar
- ./compile –j 10 all_wrfvar
- cd /home/{your-home-name}/NWP_{your_name}/raw-mod
- mv WRFDA /home/{your-home-name}/NWP_{your_name}

- vi .bashrc
- export PATH={all-your-bindir}:$PATH
- export LD_LIBRARY_PATH={all-your-libdir}:$LD_LIBRARY_PATH

WRF installation procedure and running process for HPC

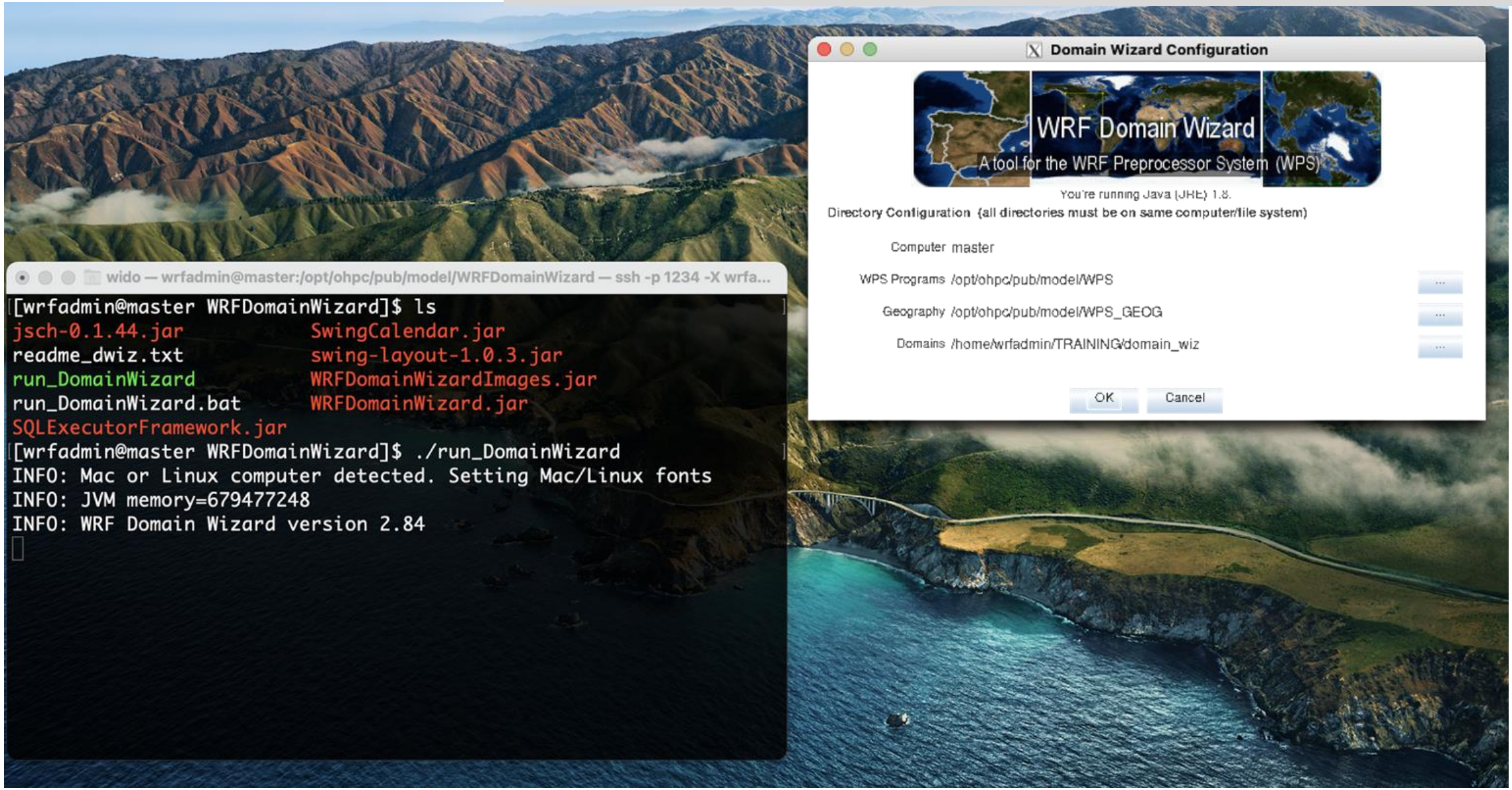
- For step by step installation and running process: https://github.com/denyanto/nwo_nwp_training/README-HPC.md
-

WRF installation procedure and running process for HPC

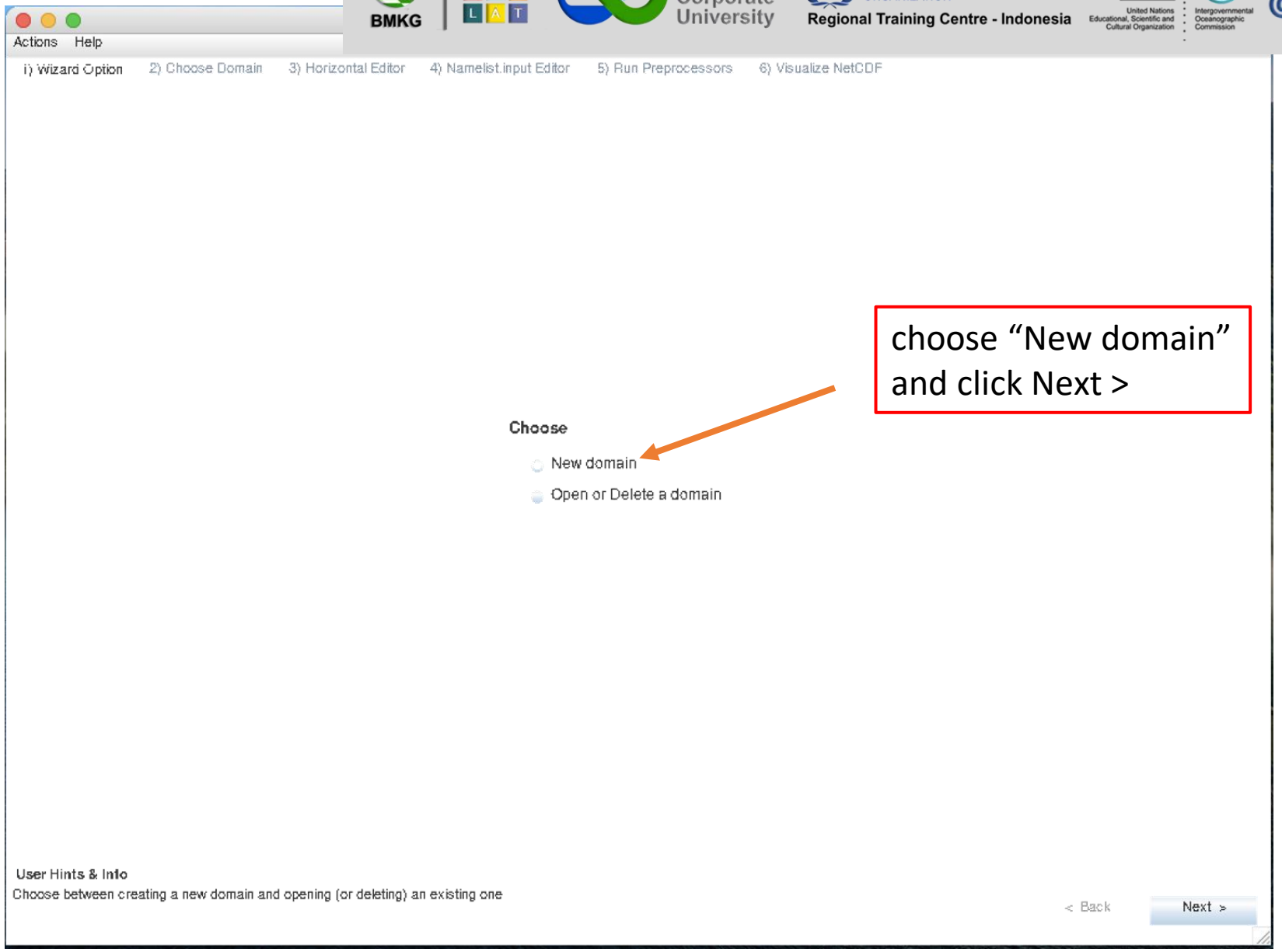
- WRFDomainWizard
- For creating domain and running easily

Geogrid

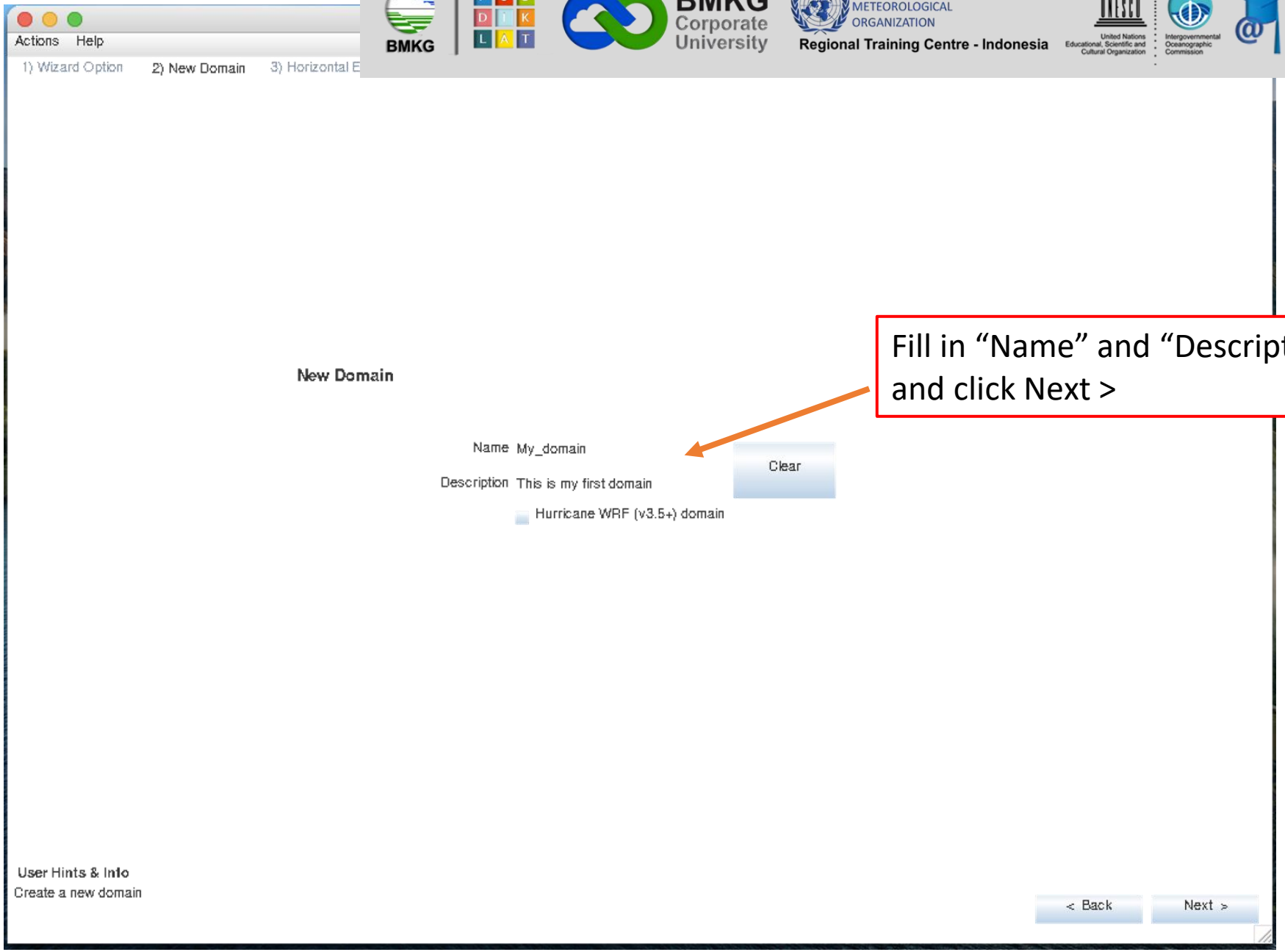
- cd /opt/ohpc/pub/model/WRFDomainWizard/
- ./run_DomainWizard


wido — wrfadmin@master:/opt/ohpc/pub/model/WRFDomainWizard — ssh -p 1234 -X wrfa...
[wrfadmin@master WRFDomainWizard]$ ls
jsch-0.1.44.jar SwingCalendar.jar
readme_dwiz.txt swing-layout-1.0.3.jar
run_DomainWizard WRFDomainWizardImages.jar
run_DomainWizard.bat WRFDomainWizard.jar
SQLExecutorFramework.jar
[wrfadmin@master WRFDomainWizard]$ ./run_DomainWizard
INFO: Mac or Linux computer detected. Setting Mac/Linux fonts
INFO: JVM memory=679477248
INFO: WRF Domain Wizard version 2.84
Domain Wizard Configuration
WRF Domain Wizard
A tool for the WRF Preprocessor System (WPS)
You're running Java (JRE) 1.8.
Directory Configuration (all directories must be on same computer/file system)
Computer master
WPS Programs /opt/ohpc/pub/model/WPS
Geography /opt/ohpc/pub/model/WPS_GEOG
Domains /home/wrfadmin/TRAINING/domain_wiz
OK
Cancel

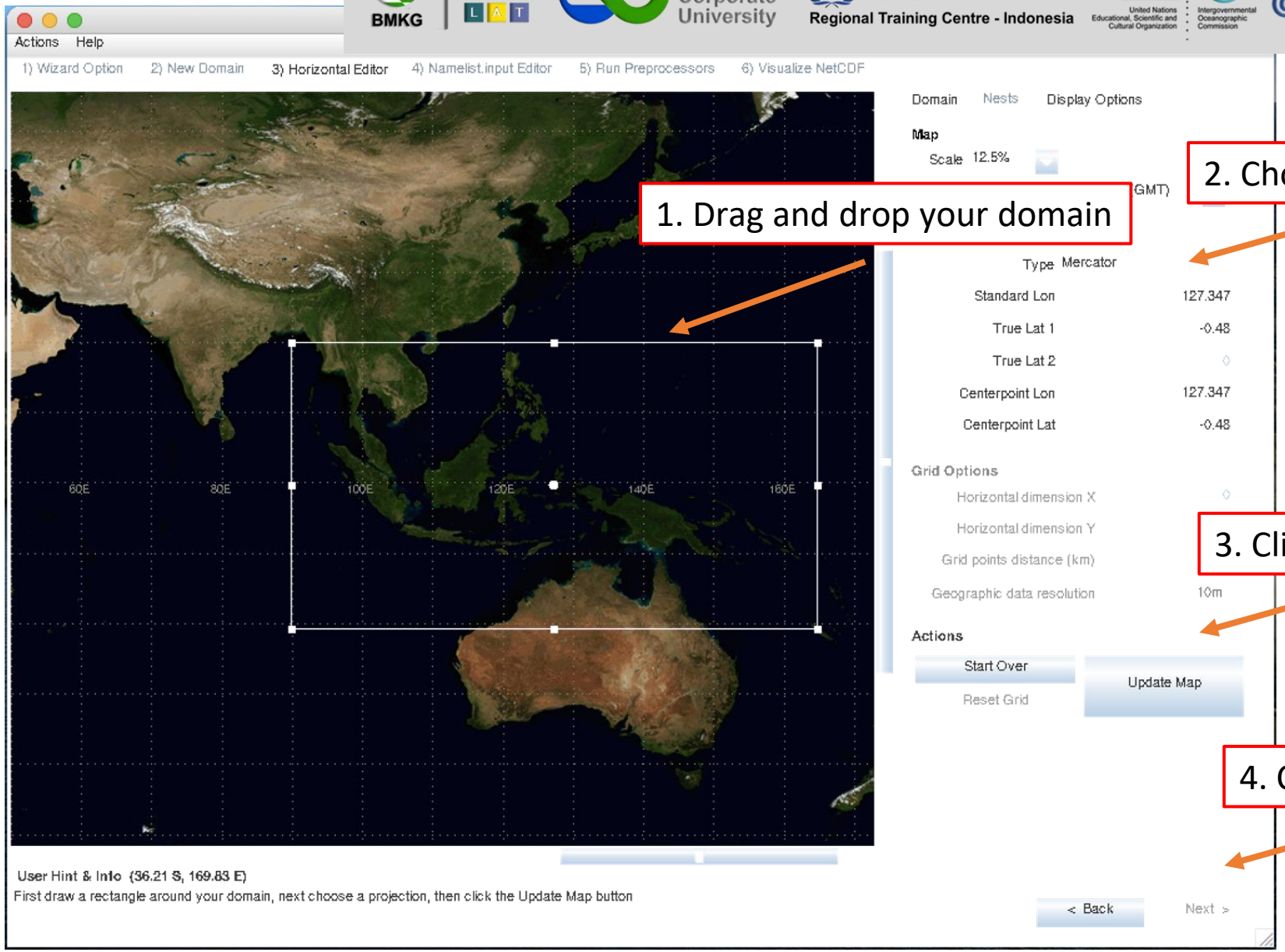
- WPS dir = /opt/ohpc/pub/model/WPS
- Geography dir = /opt/ohpc/pub/model/WPS_GEOG
- Domains dir = /home/{your-home-name}/NWP_{your_name}



choose “New domain” and click Next >



Fill in “Name” and “Description” column and click Next >

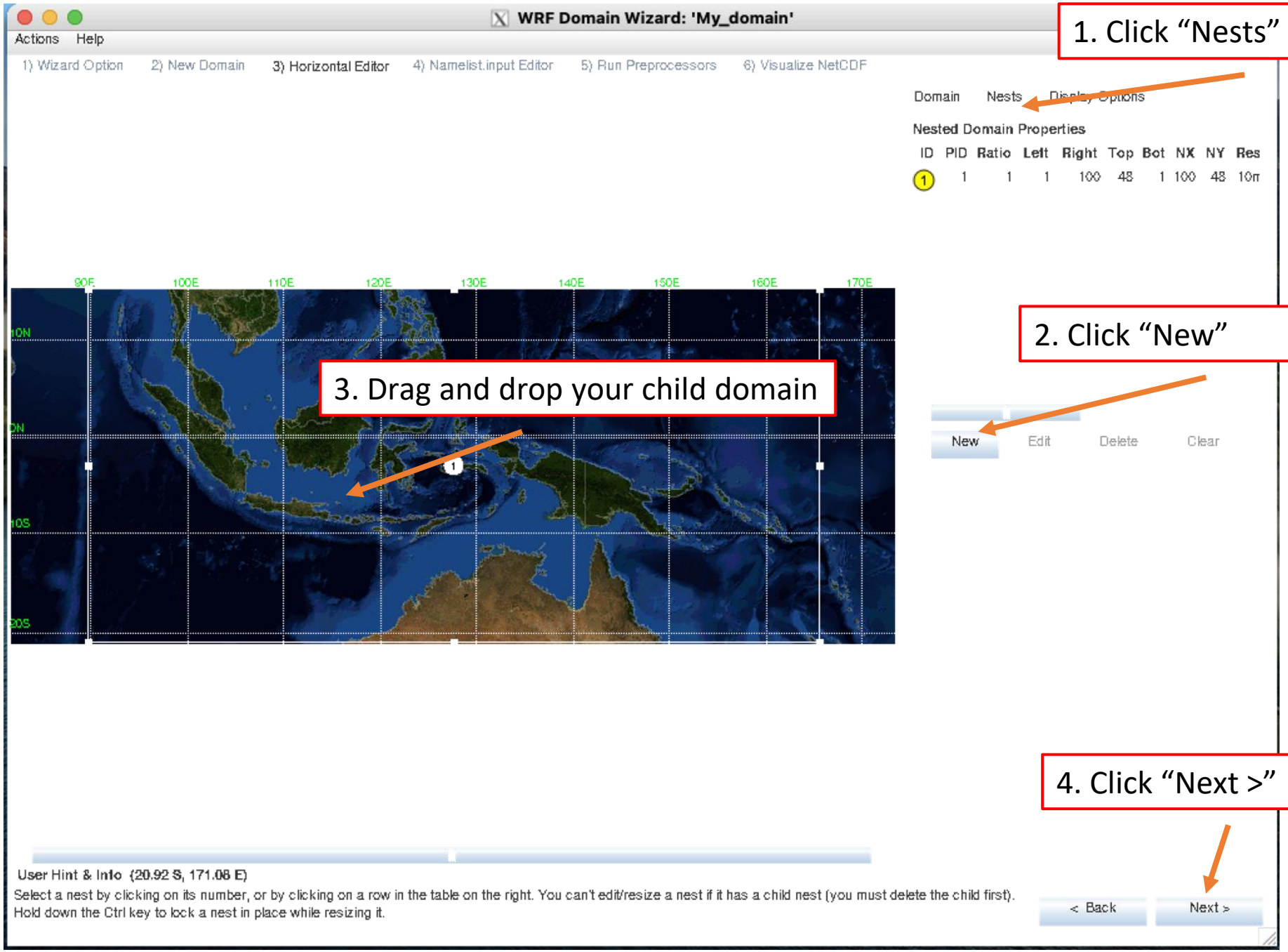


1. Drag and drop your domain

2. Choose projection

3. Click ”update map”

4. Click “Next”



1. Click “Nests”

2. Click “New”

3. Drag and drop your child domain

4. Click “Next >”

Actions Help

1) Wizard Option 2) New Domain 3) Horizontal Edi

Add or Edit ETA Levels | Reset For This Domain | Validate | Help | /home/wrladmin/TRAINING/my_domain/my_domain/namelist.input

GUI Editor Text Editor

Number of Domains (max_dom): 2

Parameter	Master Domain	Nest 1
&time_control		
run_days	0	
run_hours	12	
run_minutes	0	
run_seconds	0	
start_year	2000	2000
start_month	01	01
start_day	24	24
start_hour	12	12
start_minute	00	00
start_second	00	00
end_year	2000	2000
end_month	01	01
end_day	25	25
end_hour	12	12
end_minute	00	00
end_second	00	00

WRF NAMELIST.INPUT FILE DESCRIPTION

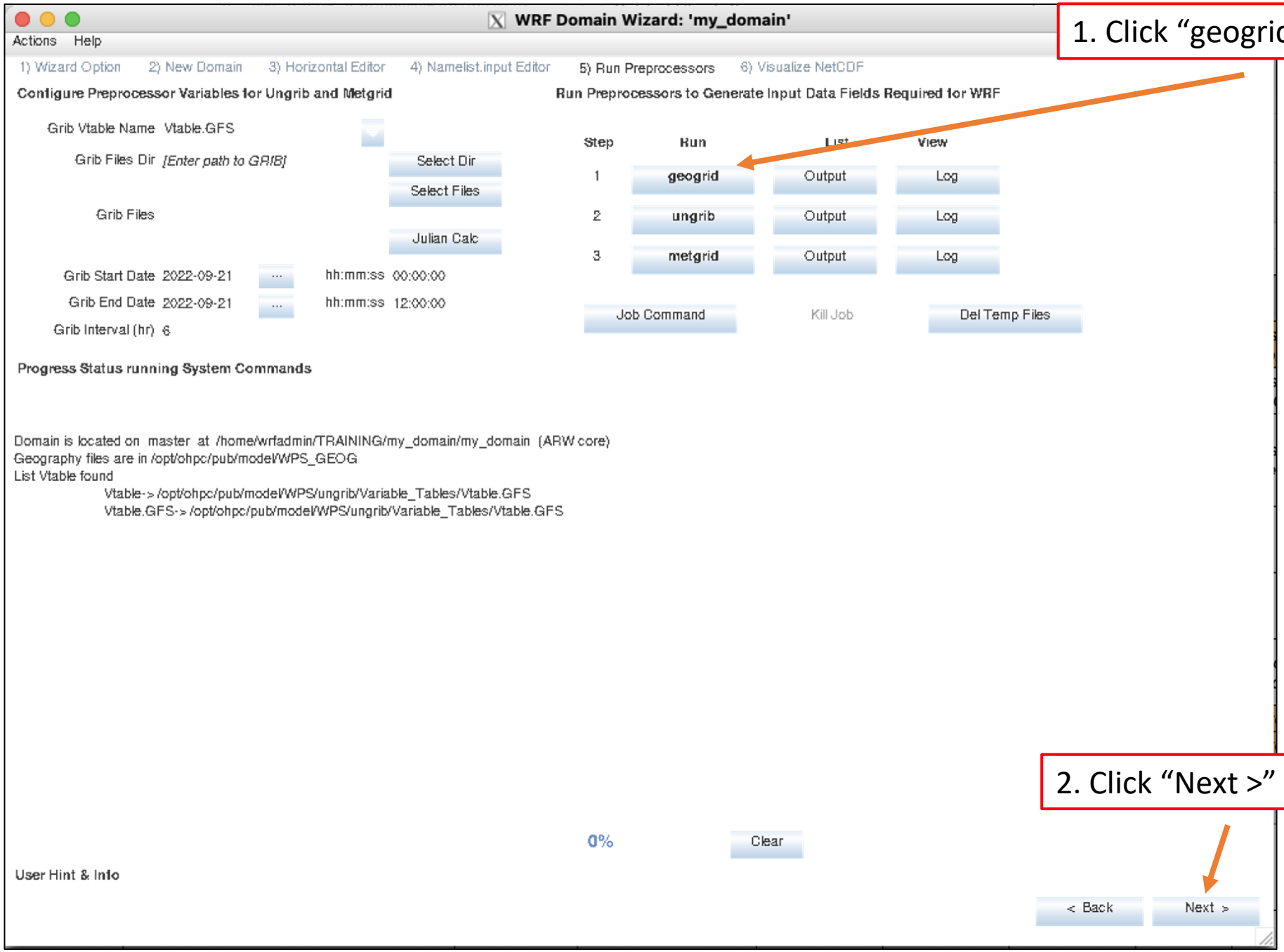
The namelist.input file is used for both the real.exe and wrf.exe executables. Within the file, multiple columns are used for multiple domains (nests) and the "max_dom" parameter determines the number of domains (and nests) to use. So, for example, if you define 3 columns for parameter in the namelist but set *max_dom* = 2, the last column will be ignored. Note that not all parameters have multiple columns.

User Hint & Info

Edit this domain's namelist.input file. The following parameters have been defaulted for this domain: max_dom, s_we, e_we, s_sn, e_sn, dx, dy, i_parent_start, j_parent_start, time_step. Right click in the window to Copy, Paste, or Find.

< Back | Next >

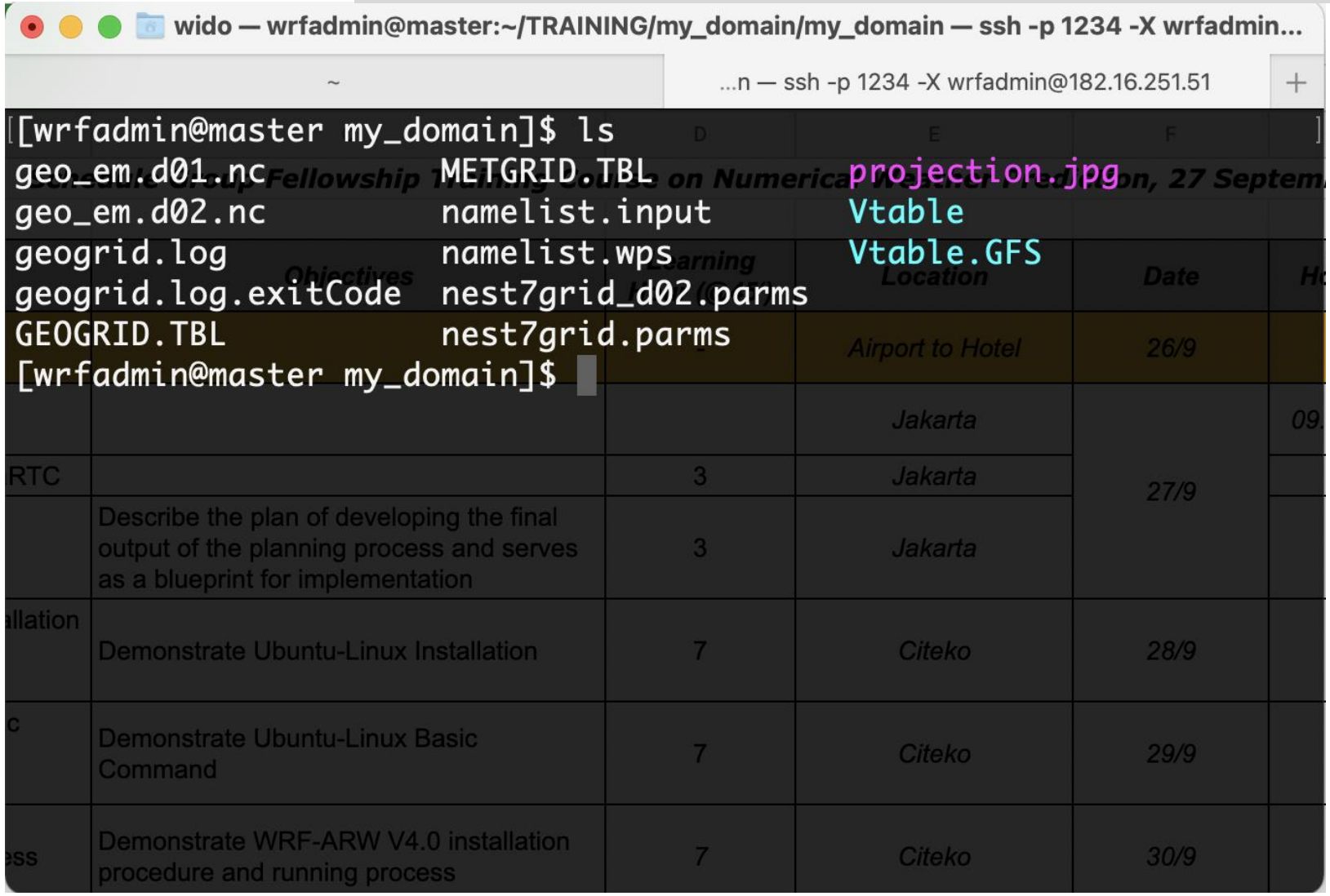
Click “Next >”



1. Click “geogrid”

2. Click “Next >”


Actions Help
1) Wizard Option 2) New Domain 3) Horizontal Ed
Important: after clicking 'View in Panoply' button, you must 'Quit' Panoplybefore viewing another netCDF file.
NetCDF Files in /home/wrfadmin/TRAINING/my_domain/my_domain
geo_em.d01.nc
geo_em.d02.nc
View in Panoply (and Google Earth)
User Hint & Info
Choose a netCDF file and click 'View in Panoply' button. When the Datasets Browser window pops up, simply double-click on a field of interest (e.g. GREENFRAC) to view your map. Then, select File menu, 'Export to KMZ' to export to a Google Earth .kmz file.
< Back
Exit
Click “Exit”



			Airport to Hotel	26/9	
			Jakarta	27/9	09.
RTC		3	Jakarta		
	Describe the plan of developing the final output of the planning process and serves as a blueprint for implementation	3	Jakarta		
llation	Demonstrate Ubuntu-Linux Installation	7	Citeko	28/9	
c	Demonstrate Ubuntu-Linux Basic Command	7	Citeko	29/9	
ess	Demonstrate WRF-ARW V4.0 installation procedure and running process	7	Citeko	30/9	

Ungrib

- cd /home/{your-home-name}/NWP_{your_name}
- mkdir ungrib
- cd ungrib
- ln –sf {your-WPS-dir}/ungrib/Variable_Tables/Vtable.GFS ./Vtable
- cp {your-WPS-dir}/link_grib.csh .
- ln –sf {your-WPS-dir}/ungrib.exe .
- ./link_grib.csh /opt/ohpc/pub/SHARED/wido-wrf1_data/gfs.0p25.2021040* .
- cp /home/{your-home-name}/NWP_{your_name}/my_domain/namelist.wps .
- “edit namelist.wps”

wido — wrfad

```
&share
 wrf_core = 'ARW',
 max_dom = 1,
 start_date = '2021-04-03_00:00:00', '2022-09-21_00:00:00',
 end_date   = '2021-04-03_09:00:00', '2022-09-21_12:00:00',
 interval_seconds = 10800,
 io_form_geogrid = 2,
 opt_output_from_geogrid_path = '/home/wrfadmin/TRAINING/my_domain/
my_domain/',
 debug_level = 0,
/

&geogrid
 parent_id         = 1,1,
 parent_grid_ratio = 1,3,
 i_parent_start    = 1,16,
 j_parent_start    = 1,9,
 e_we          = 100,88,
"namelist.wps" 81L, 1950C
```

- ./ungrib.exe

Metgrid

- cd /home/{your-home-name}/NWP_{your_name}
- mkdir metgrid
- cd metgrid
- ln –sf ../ungrib/FILE* .
- cp /home/{your-home-name}/NWP_{your_name}/ungrib/namelist.wps .
- ln –sf {your-WPS-dir}/metgrid/METGRID.TBL .
- ln –sf {your-WPS-dir}/metgrid.exe .
- mpirun –np 5 ./metgrid.exe

Real

- cd /home/{your-home-name}/NWP_{your_name}
- mkdir real
- cd real
- ln –sf ../metgrid/met_em* .
- ln –sf {your-WRF-dir}/run/real.exe .
- cp {your-WRF-dir}/run/namelist.input .
- edit “namelist.input”
- ./real.exe or mpirun –np 3 real.exe

Wrf

- cd /home/{your-home-name}/NWP_{your_name}
- mkdir wrf
- cd wrf
- ln –sf {your-WRF-dir}/run/wrf.exe .
- cp ../wrf/namelist.input .
- cp ../real/wrfbdy_d01 .
- cp ../real/wrfinput_d01 .
- ln –sf {your-WRF-dir}/run/CAMtr_volume_mixing_ratio .
- ln –sf {your-WRF-dir}/run/LANDUSE.TBL .
- ln –sf {your-WRF-dir}/run/ozone_plev.formatted .
- ln –sf {your-WRF-dir}/run/ozone_lat.formatted .
- ln –sf {your-WRF-dir}/run/ozone.formatted .

- ln –sf {your-WRF-dir}/run/RRTMG_LW_DATA .
- ln –sf {your-WRF-dir}/run/RRTMG_SW_DATA .
- ln –sf {your-WRF-dir}/run/VEGPARM.TBL .
- ln –sf {your-WRF-dir}/run/SOILPARM.TBL .
- ln –sf {your-WRF-dir}/run/GENPARM.TBL .
- edit “job_example.sh
- sbatch job_example.sh

ARWpost

- cd /home/{your-home-name}/NWP_{your_name}
- mkdir arwpost
- cd arwpost
- cp {your-ARWpost-dir}/namelist.ARWpost .
- ln -sf {your-ARWpost-dir}/ARWpost.exe .
- ln –sf ../wrf/wrfout* .
- edit “namelist.ARWpost”

Case Study

- Please make a WRF simulation of the next 6 hours using 0.25 degree GFS data, in your respective area. Give the model output per hour. You can use a virtual machine or HPC to run it.