Up and Running with WRFDA and WRFPLUS

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This document gets you up and running on Prospero with WRFDA and WRFPLUS version 3.9 using the data provided online for the tutorial.

This covers the tutorial WRFDA version 3.9. The 3DVar version does not require WRFPLUS where the 4DVar version does. I created separate directories for the 3DVar and 4DVar tutorials, but according to the manual, that isn't necessary.

Where this document is vague, the WRF user guide has a chapter on WRFDA that should help.

1 WRFDA 3DVar

1.1 Obtaining the Code and Tutorial Data

First, create a directory for the tutorial: `mkdir WRFDA_Tutorial`

```
cd WRFDA_Tutorial
```

Then create a directory for the test data and download it:

```
mkdir test_data

cd test_data

wget http://www2.mmm.ucar.edu/wrf/users/wrfda/download/V39/WRFDAV3.9-testdata.tar.gz

tar xvfz WRFDAV3.9-testdata.tar.gz
```

```
rm WRFDAV3.9-testdata.tar.gz
```

You should now have two namelist.input files and three directories: `be/`, `ob` and `rc`. Now go back to the `WRFDA_Tutorial` directory and get the code.

```
cd ../

wget http://www2.mmm.ucar.edu/wrf/src/WRFDA_V3.9.tar.gz

tar xfvz WRFDA_V3.9.tar.gz

rm WRFDA_V3.9.tar.gz
```

You should be left with a directory called `WRFDA`

1.2 Compiling

Before compiling, you need to make sure that your environment variables are set. These should be good to go on Prospero

```
echo $NETCDF

echo $HDF5

echo $LD_LIBRARY_PATH
```

If those are set, you should be ready to compile:

```
cd WRFDA/

./clean -a

./configure wrfda
```

Chose the Intel (dmpar) compiler option

```
./compile all_wrfvar >& compile.log&
```

If all goes well, you should have 43 executables in `var/build/` and a 44th in `var/obsproc/src/`.

```
ls -lh var/build/*.exe var/obsproc/src/obsproc.exe
```

The main executable is `da_wrfvar.exe`

1.3 Observation Preprocessor (OBSPROC)

OBSPROC prepares observations for data assimilation. For the tutorial, you shouldn't have to change any files. Copy the proper namelist and link the necessary observation file. Then you should be good to run.

```
cd var/obsproc/

cp namelist.obsproc.3dvar.wrfvar-tut namelist.obsproc

ln -sf ../../../test_data/ob/2008020512/obs.2008020512 .

./obsproc.exe >& obsproc.log&
```

1.4 Running WRFDA

To run WRFDA, you'll want to create a working directory in your `WRFDA/` directory and link everything you need into there. You also need to set the environment variables for the directory of your test data and working directory.

```
cd ../../
```

You should now be in the `WRFDA/` directory

```
export DAT_DIR='/data/ctrujillo/Tutorials/WRFDA_Tutorial/WRFDA/workdir'

mkdir workdir

cd workdir/

pwd

export WORK_DIR='/data/ctrujillo/Tutorials/WRFDA_Tutorial/WRFDA/workdir'
```

Now copy and link all the files you need

```
cp ../../test_data/namelist.input.3dvar namelist.input

ln -sf ../run/LANDUSE.TBL .

ln -sf ../../test_data/rc/2008020512/wrfinput_d01 ./fg
```

```
ln -sf ../../test_data/ob/2008020512/obs_gts_2008-02-05_12\:00\:00.3DVAR ./ob.ascii

ln -sf ../../test_data/be/be.dat .

ln -sf ../var/da/da_wrfvar.exe .
```

Now is when you would edit the namelist.input file

```
./da_wrfvar.exe >& wrfda.log&
```

2 WRFDA and WRFPLUS: 4DVar

2.1 Downloading the Code and Data

First, create a directory for the tutorial:

```
mkdir WRFPLUS_Tutorial

cd WRFPLUS_Tutorial
```

Then create a directory for the test data and download it:

```
mkdir test_data

cd test_data

wget http://www2.mmm.ucar.edu/wrf/users/wrfda/download/V39/WRFDAV3.9-testdata.tar.gz

tar xvfz WRFDAV3.9-testdata.tar.gz

rm WRFDAV3.9-testdata.tar.gz
```

You should now have two namelist.input files and three directories: `be/`, `ob` and `rc`. Now go back to the `WRFDA_Tutorial` directory and get the codes.

```
cd ..

wget http://www2.mmm.ucar.edu/wrf/src/WRFPLUS_V3.9.tar.gz

wget http://www2.mmm.ucar.edu/wrf/src/WRFDA_V3.9.tar.gz
```

```
tar xvfz WRFPLUS_V3.9.tar.gz

tar xfvz WRFDA_V3.9.tar.gz
```

You should be left with two directories: `WRFDA` and `WRFPLUSV3`

3 Compiling WRFPLUS and WRFDA for 4DVAR

You must compile WRFPLUS and set `WRFPLUS_DIR`before compiling WRFDA. You must also make sure to change the `-override-limits` flag to `-qoverride-limits` in `arch/configure_new.defaults`. This is not in the manual and your code will not compile on Prospero unless you do this.

```
cd WRFPLUSV3/

./clean -a
```

It's unnecessary to clean if you just downloaded the code, but I do it out of habit.

```
vim arch/configure_new.defaults
```

Change flag from `-override-limits` to `-qoverride-limits`. It should be for the `FCOPTIM` variable around line 316. Now you're ready to configure and compile.

```
./configure wrfplus

./compile wrf >& compile.log&
```

If all goes well, you should have a `wrf.exe` executable in the `main/` directory. Now you're ready to compile WRFDA

```
cd ../WRFDA

./clean -a

export WRFPLUS_DIR='/data/ctrujillo/Tutorials/WRFPLUS_Tutorial/WRFPLUSV3'

./configure 4dvar

./compile all_wrfvar >& compile.log&
```

If all goes well, you should have 43 executables in `var/build/` and a 44th in `var/obsproc/src/`.

```
ls -lh var/build/*.exe var/obsproc/src/obsproc.exe
```

The main executable is `da_wrfvar.exe`

3.1 Observatin Preprocessor (OBSPROC) for 4DVAR

OBSPROC prepares observations for data assimilation. For the tutorial, you shouldn't have to change any files. Copy the proper namelist and link the necessary observation file. Then you should be good to run.

```
cd var/obsproc/

cp namelist.obsproc.4dvar.wrfvar-tut namelist.obsproc
```

Now would be the time to change namelist options if you were going to.

```
ln -sf ../../../test_data/ob/2008020512/obs.2008020512 .

./obsproc.exe >& obsproc.out&
```

This should leave you with 7 observation files for hours 12 through 18.

3.2 Running WRFDA with WRFPLUS for 4DVAR

Similar to the 3DVAR case, you'll want to create a working directory in your `WRFDA/` directory and link everything you need in there. There is a lot to link with the 4DVAR case. You'll also need to set some environment variables.

```
cd ../../

mkdir workdir

cd workdir/

pwd

export WORK_DIR='/data/ctrujillo/Tutorials/WRFPLUS_Tutorial/WRFDA/workdir'

export DAT_DIR='/data/ctrujillo/Tutorials/WRFPLUS_Tutorial/WRFDA/workdir'

ln -sf ../var/da/da_wrfvar.exe .
```

```
ln -sf ../../test_data/ob/2008020512/ob01.ascii .

ln -sf ../../test_data/ob/2008020513/ob02.ascii .

ln -sf ../../test_data/ob/2008020514/ob03.ascii .

ln -sf ../../test_data/ob/2008020515/ob04.ascii .

ln -sf ../../test_data/ob/2008020516/ob05.ascii .

ln -sf ../../test_data/ob/2008020517/ob06.ascii .

ln -sf ../../test_data/ob/2008020518/ob07.ascii .

ln -sf ../../test_data/rc/2008020512/wrfinput_d01 .

ln -sf ../../test_data/rc/2008020512/wrfbdy_d01 .

ln -sf wrfinput_d01 fg

ln -sf ../../test_data/be/be.dat .

ln -sf ../run/LANDUSE.TBL .

ln -sf ../run/GENPARM.TBL .

ln -sf ../run/SOILPARM.TBL .

ln -sf ../run/VEGPARM.TBL .

ln -sf ../run/RRTM_DATA_DBL RRTM_DATA

cp ../../test_data/namelist.input.4dvar namelist.input
```

With all that linked and copied, you should be ready to execute.

```
./da_wrfvar.exe >& wrfda.log&
```

This will take a while so you may want to do this as a batch job with `mpirun`.