Installing WRF on Linux

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Research Report No. 2013-04-MW

July 2013

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1 Introduction

This research report shows how to install the Weather Research and Forecasting (WRF) model on a 64-bit Linux machine running Ubuntu 12.04 64-bit. These instructions will help the new user of WRF to select the proper compilers and required programs to successfully compile WRF. It is probable that the following procedure works fine even on a different Linux distribution and/or architecture, but it is not guaranteed.

2 Download the WRF model

This document will show how to download and install WRF version 3.3.1 (22 September 2011), the version that I am currently using for my research, with the Advanced Research WRF (ARW) dynamical solver. In the meanwhile, other versions have been released, but for the purpose of my research there was no need for an upgrade. WRF-ARW v. 3.3.1 can be downloaded from the webpage `http://www.mmm.ucar.edu/wrf/users/download/get_sources.html` (filename `WRFV3.3.1.TAR.gz`, about 28 MB). After downloading the file, copy it in a location in which you want to install WRF and extract it with the following command:

```
$ tar -xzf WRFV3.3.1.TAR.gz
```

This will extract WRF into the folder `WRFV3` (folder size: about 59 MB).

3 Required compilers and libraries

WRF-ARW will be compiled with gcc and gfortran. The version of these compilers that was found to be compatible with WRF 3.3.1 is v. 4.4.7, so be sure to have this version installed before proceeding. NetCDF libraries are also required, and it is suggested to use version 3.6.3 of these libraries. You can get gcc and gfortran through the software installer of your Linux distribution and the NetCDF libraries from the website `http://www.unidata.ucar.edu/downloads/netcdf/netcdf-3_6_3/index.jsp` (filename `netcdf-3.6.3.tar.gz`, 11.3 MB). The procedure for installing these programs is not included in this document.
In addition, you will need the C shell csh, the general purpose macro processor m4 and, optionally, the visual browser for NetCDF files ncview (install them through the software installer of your Linux distribution).

4 Set the environment variables

Navigate to the folder in which you extracted WRF (folder `WRFV3`) and then type the following commands:

```
$ export WRFIO_NCD_LARGE_FILE_SUPPORT=1
$ export LD_LIBRARY_PATH=<netcdf_folder>/lib
$ export NETCDF=<netcdf_folder>
$ export WRF_EM_CORE=1
```

```
$ export OBJECT_MODE=64
```

where <netcdf_folder> is the folder in which the NetCDF libraries were installed (in my case it is /usr/local).

5 Compiling

Without changing folder (at the previous step we were in WRFV3) launch the configuration script with the command:

```
$ ./configure
```

You will be prompted to select a supported platform. You can choose either

```
x86_64 Linux, gfortran compiler with gcc   (serial)
```

for single-processor simulations, or

```
x86_64 Linux, gfortran compiler with gcc   (smpar)
```

for multi-processor simulations (faster). The other two options (dmpar and dm+sm) were not tested.
You will be prompted again, this time for nesting. You can choose either 0=no nesting or 1=basic. The other nesting modes were not tested.
If everything went well you should see a message such as:

```
Settings listed above are written to configure.wrf.
If you wish to change settings, please edit that file.
If you wish to change the default options, edit the file:
     arch/configure_new.defaults


Testing for NetCDF, C and Fortran compiler

This installation NetCDF is 64-bit
C compiler is 64-bit
Fortran compiler is 64-bit
It will build in 64-bit
```

Now you can try to compile one of the test cases provided with WRF, for example em_hill2d_x if you selected the serial option or em_tropical_cyclone if you selected the smpar option:

```
$ ./compile em_hill2d_x >& compile.log
```

or

```
$ ./compile em_tropical_cyclone >& compile.log
```

This command may take quite a lot. In the meanwhile you can open a new terminal tab (CTRL+SHIFT+T) and start to check for errors (if any) inside the log file:

```
$ grep -i 'error:' compile.log
```

If the compiling was successful, the executables ideal.exe and wrf.exe are created in the subfolder ./run.

6 Execution

Navigate to the subfolder `./run` and type `ideal.exe` for the initialization. You should see a message such as:

```
wrf: SUCCESS COMPLETE IDEAL INIT
```

Finally launch the simulation with `wrf.exe`. If the simulation was successful, you should see a message such as:

```
wrf: SUCCESS COMPLETE WRF
```

7 Output file visualization

To check the outcome of the simulation, a first useful step is to read the header of the NetCDF output file, saving it into an ASCII file:

```
$ ncdump -h <filename> > <filename>.txt
```

where `<filename>` is for example `wrfout_d01_2007-09-01_00:00:00`. Reading the header is useful to know the correspondence of the variable names with the physical quantities, as well as their dimensions and units.
Once you have decided which variables you wish to visualize, open the file with ncview:

```
$ ncview <filename>
```

8 Known issues

Passing from a 32-bit operating system to a 64-bit operating system, it was necessary to modify a line of the file `./phys/module_cu_g3.F`. Inside this file search for the string

```
integer,  dimension (8) :: seed
```

and replace it with the string

```
integer,  dimension (12) :: seed
```

After this modification, go back to the main folder `WRFV3` and type:

```
$ ./clean -a
```

then follow again the instructions from Section 5.

9 Online resources

- WRF model users page: `http://www.mmm.ucar.edu/wrf/users/`
- WRF-ARW online tutorial: `http://www.mmm.ucar.edu/wrf/OnLineTutorial/index.htm`