WRF basics

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1. Introduction. What is WRF?
2. Why is it useful?
3. WRF workflow: WPS and WRF
4. Namelists and other configuration files
5. WRF online tutorial
What is WRF?

WRF = Weather Research and Forecasting model

- WRF is a Limited Area Model (LAM) developed by NCAR, NOAA/ESRL, NOAA/NCEP/EMC and others.

- Is a community model, with distributed development and centralized support. The code is freely available on internet.

- It has 2 dynamical cores:
  - Advanced Research WRF (ARW) → Research
  - Non-Hydrostatic Mesoscale Model (NMM) → Operational
Why is it useful?

WRF is able to downscale coarser models to high resolutions ~ 1 km with non-hydrostatic dynamics. Furthermore, it offers many advantages with respect to other LAM:

● It is open source. It is possible to look into the code and modify it. Experiments are reproducible.

● Flexibility: Large amount of different configurations (physics, dynamics, boundaries) adaptable for higher or coarser resolutions, long-term or short-term simulations.

● Online support, and excellent documentation:

   http://www.mmm.ucar.edu/wrf/users/
Applications

Parametrization research, case studies, short range forecast, data assimilation, air quality studies, renewal energy production forecast, and renewal energy potential evaluation, and of course Regional Climate

Most frequent experiments are sensitivity experiments. These experiments:

• Provide a better understanding of the physics and their shortcomings.

• Can be used to reduce model error and assess the uncertainty.
WRF workflow

• WRF Preprocessing System (WPS)
  - Tools to prepare the data that WRF is going to ingest (geogrid, ungrib, and metgrid). They process the driving model data as well as the static data.

• WRF model
  - Initialization program: real.exe
  - Numerical integration program: wrf.exe
WRF workflow

Taken from http://www.mmm.ucar.edu/wrf/users/tutorial/201207/WRF_Overview_Dudhia.pdf
WPS

WRF workflow

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WRF namelists:

Namelists are simple ASCII files which are used to define a large amount of parameters of WRF configuration.

WPS → namelist.wps

WRF → namelist.input

Other configuration files: GEOGRID.TBL, METGRID.TBL, Vtables, etc.
WRF-ARW online tutorial

• The best way to familiarize with Wrf workflow is to follow the online tutorial available in http://www.mmm.ucar.edu/wrf/OnLineTutorial/

• In this lecture, we are going to run the default case of the tutorial. Please go to

http://www.mmm.ucar.edu/wrf/OnLineTutorial/CASES/JAN00/index.html