WRF Modeling System V2.0 Overview

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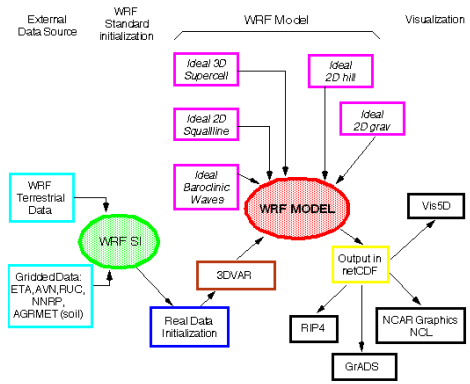
What is WRF?

- WRF: Weather Research and Forecasting
  - Advanced Research WRF core, or Eulerian mass core
- Its development is lead by NCAR/MMM and NOAA/FSL with partnership at NCEP, AFWA, FAA, NRL and collaborations with universities and other government agencies
- Current release: Version 2.0 (Advanced Research WRF Core, a.k.a. Eulerian mass)
  - Version 1.0 Dec 2000 (eh only)
  - Version 1.1 Nov 2001
  - Version 1.2 Apr 2002 (em release)
  - Version 1.3 Mar 2003

What can WRF be used for?

- Idealized simulations (e.g. convection, baroclinic waves, large eddy simulations)
- Parameterization research
- Data assimilation research
- Forecast research
- Real-time NWP
- Coupled-model application
- Teaching

WRF Modeling System Flow Chart (*for WRFV2*)



Modeling System Components

- WRF Standard Initialization (SI)
- WRF 3DVAR
- WRF Model (Eulerian mass)
  - Initialization programs for real and idealized data
  - Numerical integration program
- Graphics tools

WRF SI

Function

- Define simulation domain with user specification
- Produce terrain, landuse, soil data etc. on the simulation domain
- De-grib GRIB files for meteorological data
- Interpolate meteorological data to WRF model grid

WRF SI

Function (cont)

- Support WRF nesting
- Three map projections:
  - Lambert conformal
  - Polar stereographic
  - Mercator
- GUI for running the program

WRF 3DVAR

Function

- WRF V2.0 compatible
- Ingest observations into interpolated analysis from WRF SI
- May be used in cycling mode for updating WRF initial conditions
- Observation data studies

WRF 3DVAR

- Supported data types
  - Conventional surface and upper air, wind profiler
  - Remote sensing data: Cloud-track winds, ATOVS thickness, ground-based GPS TPW, SSM/I, SSM/T1, SSM/T2, SSM/I brightness temp, Quikscat ocean surface winds, radar radial velocity
- Two background error covariance models
  - NCEP model
  - UK / NCAR

WRF Model

Key features:

- Fully compressible, non-hydrostatic (with hydrostatic option)
- Mass-based terrain following coordinate

$$\eta = \frac{(\pi - \pi_t)}{\mu}, \qquad \mu = \pi_s - \pi_t$$

where π is hydrostatic pressure

- Arakawa C-staggering →

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WRF Model

Key features:

- Runge-Kutta time integration scheme
- Higher order advection scheme
- Scalar-conserving
- Complete Coriolis and curvature terms
- Two-way and one-way nesting

WRF Model

Key features:

- Choices of lateral boundary conditions suitable for real-data and idealized simulations
  - Specified
  - Periodic
  - Open
  - Symmetric
- Full physics options to represent atmospheric radiation, surface and boundary layer, and precipitation processes

Graphics Tools

- RIP4 (Read, Interpolate and Plot)
- NCAR Graphics Command Language (NCL)
- Conversion program for GrADS
- Conversion program for Vis5D

Software Requirement

- Fortran 90/95 compiler
- C compiler
- Perl
- netCDF library
- Public domain mpich for MPI

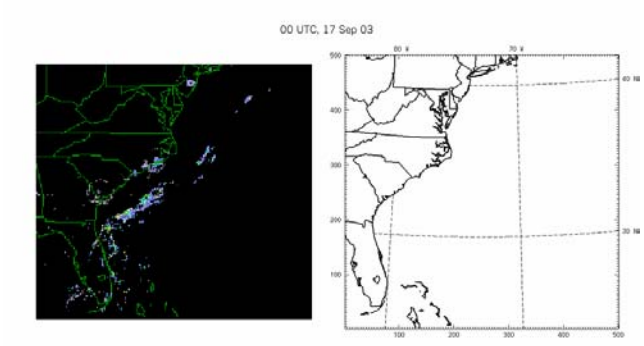
Portability

- Runs on Unix single, OpenMP and MPI platforms:
  - Alpha
  - IBM
  - Linux (PGI and Intel compiler)
  - SGI Origin and Altix
  - Sun

User Support

- Email: wrfhelp@ucar.edu
- User Web page:
  http://www.mmm.ucar.edu/wrf/users/
  - Latest update for the modeling system
  - WRF software download
  - Various documentation

Hurricane Isabel Simulation (4km)



Tutorial Schedule

- Lectures: Mon. and Tues.
- Practice for WRF: Wed.
- Practice for WRF 3DVAR: Thur.