

# Group Tutorial 5: WRF

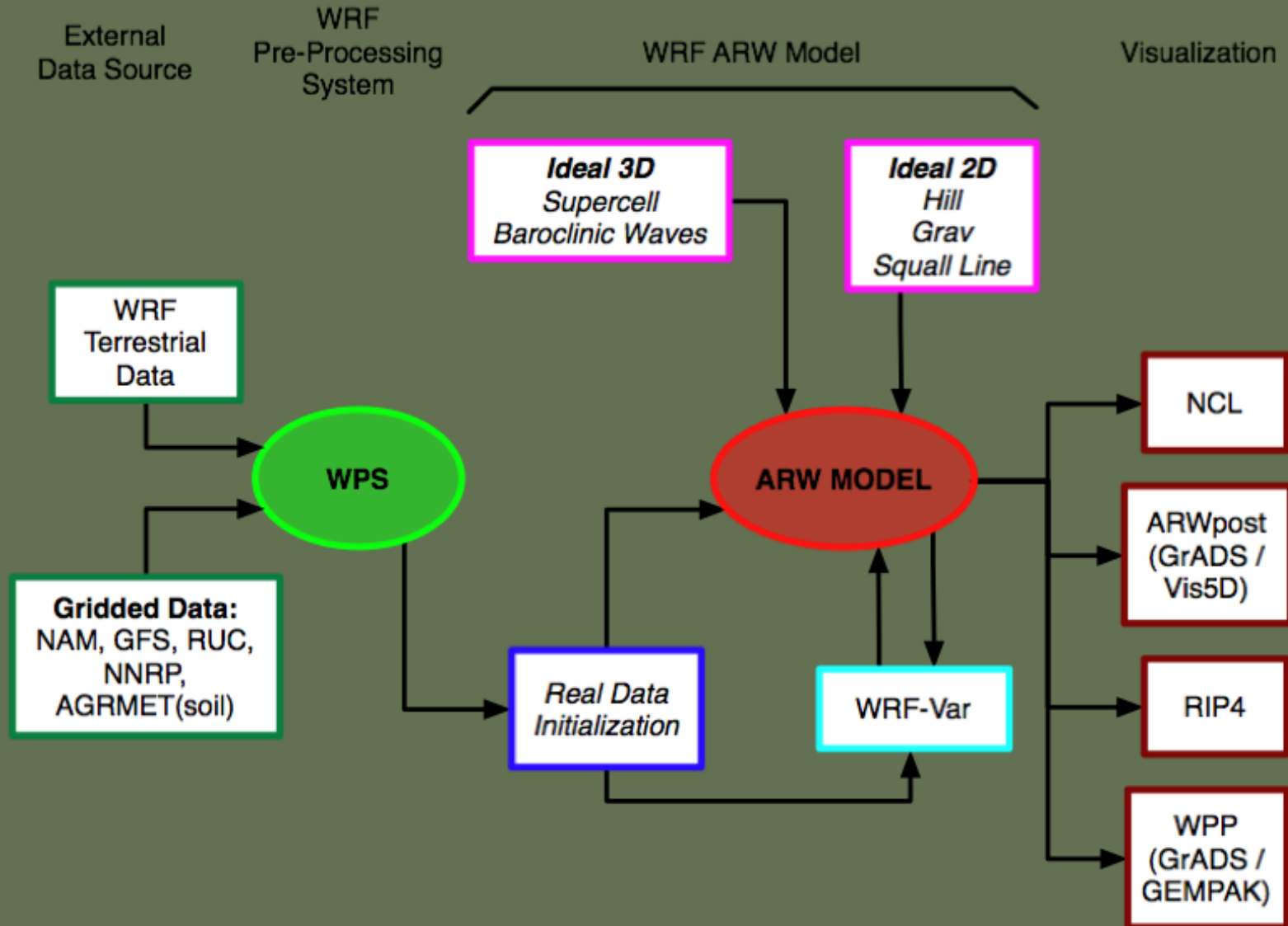
December 2<sup>nd</sup>, 2013

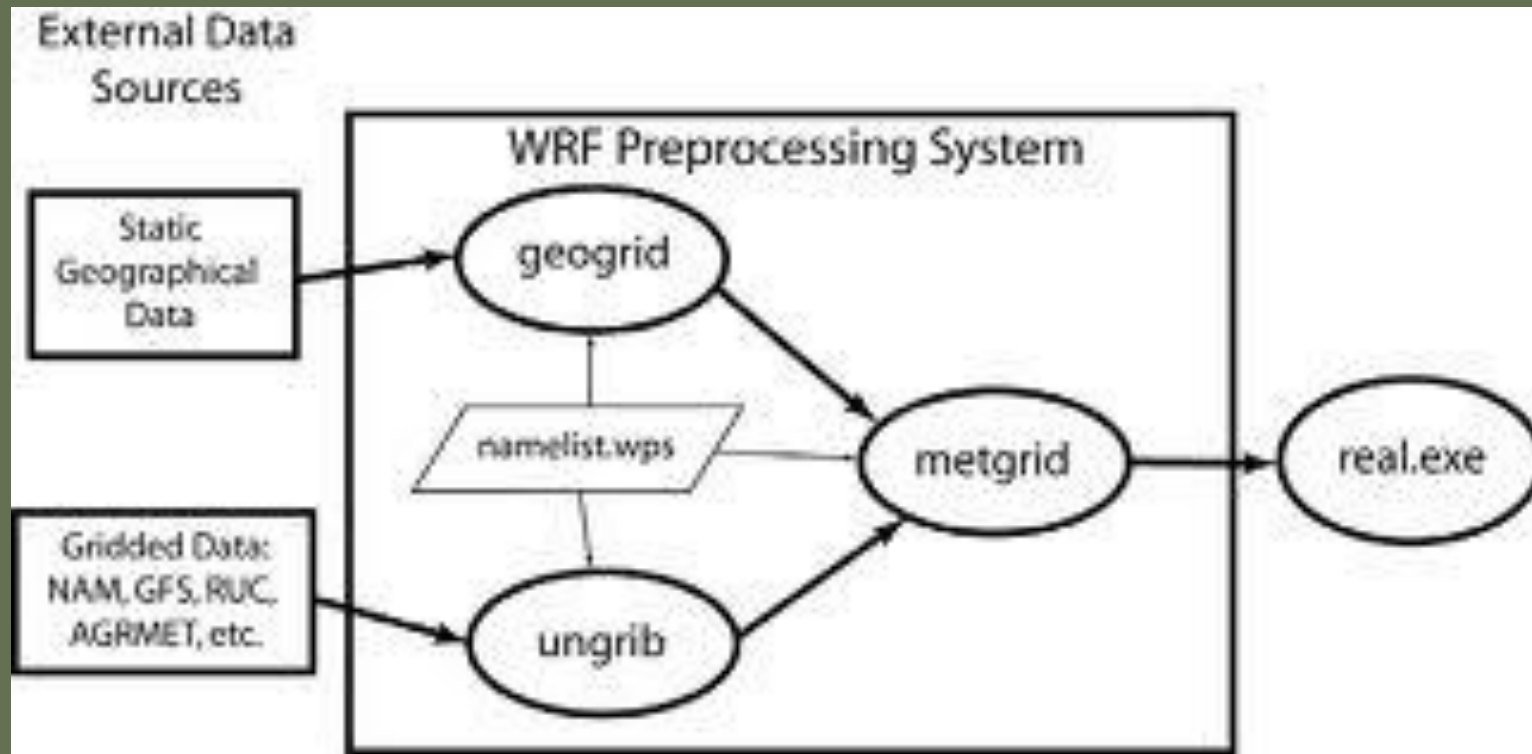
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# What is WRF?

- ▶ Weather Research and Forecasting Model
- ▶ Fully compressible non-hydrostatic equations with hydrostatic option
- ▶ Complete coriolis and curvature terms
- ▶ Vertical grid-spacing can vary with height
- ▶ Arakawa C-grid staggering
- ▶ Runge-Kutta 2nd- and 3rd-order timestep options
- ▶ 2nd to 6th order advection options (horizontal and vertical)
- ▶ Adaptive time stepping
- ▶ MUCH, MUCH more

# WRF ARW Modeling System Flow Chart (for WRFV2)





# Physics of the Model

- ▶ Microphysics
- ▶ Cumulus and Shallow Convection Parameterization
- ▶ Planetary Boundary Layer
- ▶ Surface/Land-Surface Layer
- ▶ Longwave/Shortwave Radiation
- ▶ Ocean Schemes
- ▶ Sub-grid Turbulence

# Example: Microphysical Schemes

Kessler

WRF Single Moment (WSM) 3, 5 and 6 class

Lin et al.

Eta Ferrier

Thompson

Goddard 6 class

Morrison 2-moment

WRF Double Moment (WDM) 5 and 6 class

Thompson scheme from old version

Milbrandt-Yau double moment

Stony-Brook University Lin scheme

NSSL 2-moment (v3.4) / 1-moment (v3.5)

CAM 5.1 2-moment (v3.5)

-This isn't All!

# Example: Boundary Layer Schemes

Yonsei University (S. Korea) with improved stable BL

Mellor-Yamada-Janjic

Asymmetric Convective Model (ACM2)

Quasi-normal scale elimination/Eddy diffusivity/ mass flux (QNSE-EDMF) (v3.4)

Level 2.5 and 3 Mellor-Yamada Nakanishi Niino (MYNN) PBL

Bougeault-Lacarrere PBL

University of Washington TKE PBL

Total energy - mass flux (TEMF) scheme

Grenier-Bretherton-McCaa TKE PBL (v3.5)

MRF

-Thousands and thousands of possible scheme combinations!

# Additional Information?

- ▶ Everything you have ever wanted to know about WRF can be found here!

<http://www.mmm.ucar.edu/wrf/users/>