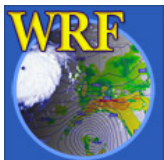


Considerations for Designing an Numerical Experiment

Wei Wang

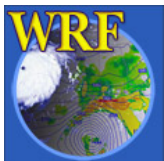
NCAR/NESL/MMM

July 2012

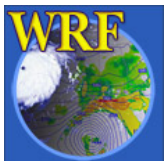
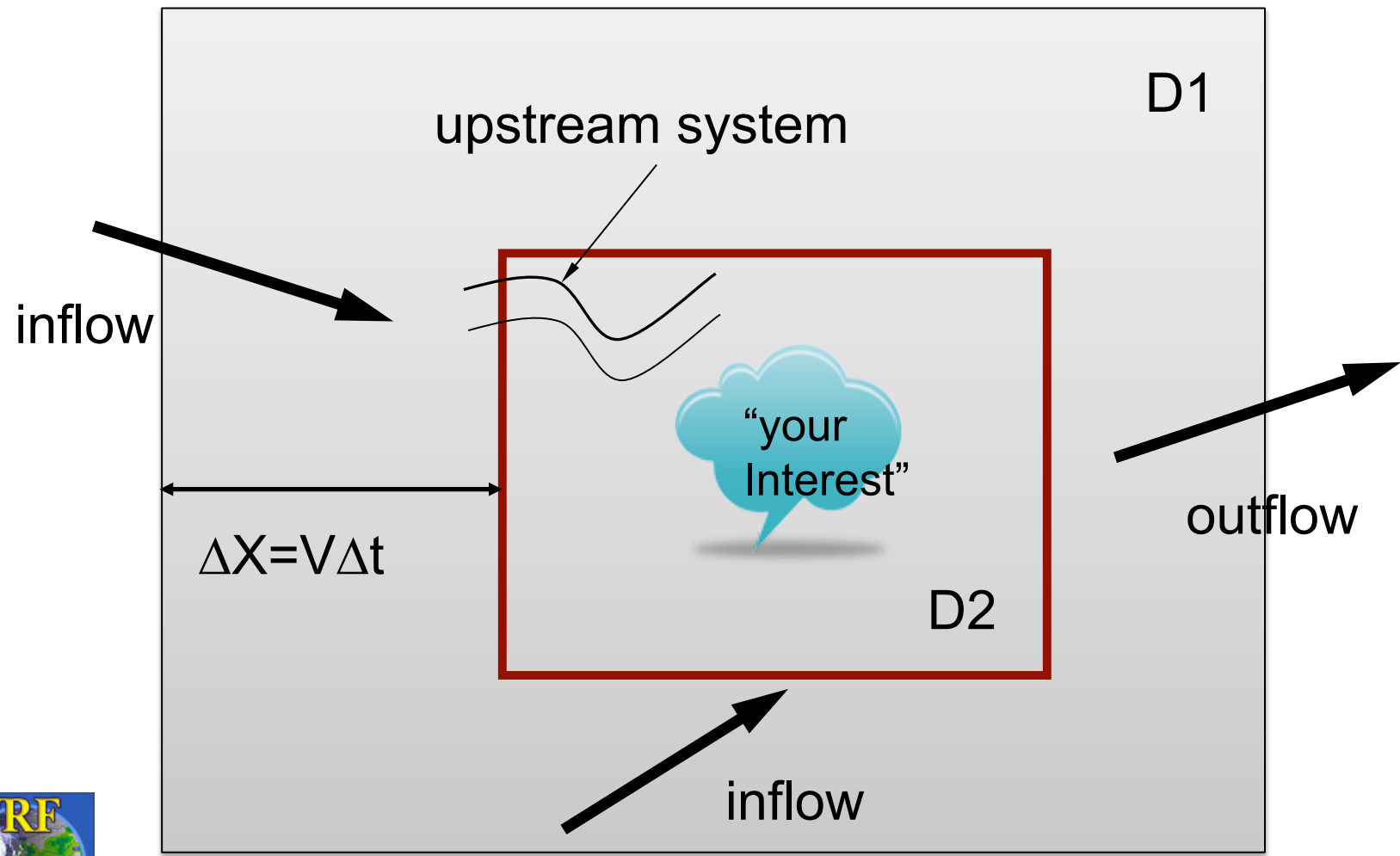


Domains

- How large do they need to be?
 - Depending on applications
 - Simulations for a few days: IC
 - Simulations for a few months, or years: BC
 - Domain sizes should not be too small: no less than 100x100
- Where to place my lateral boundaries?
 - Avoid steep topography
 - Away from my interest

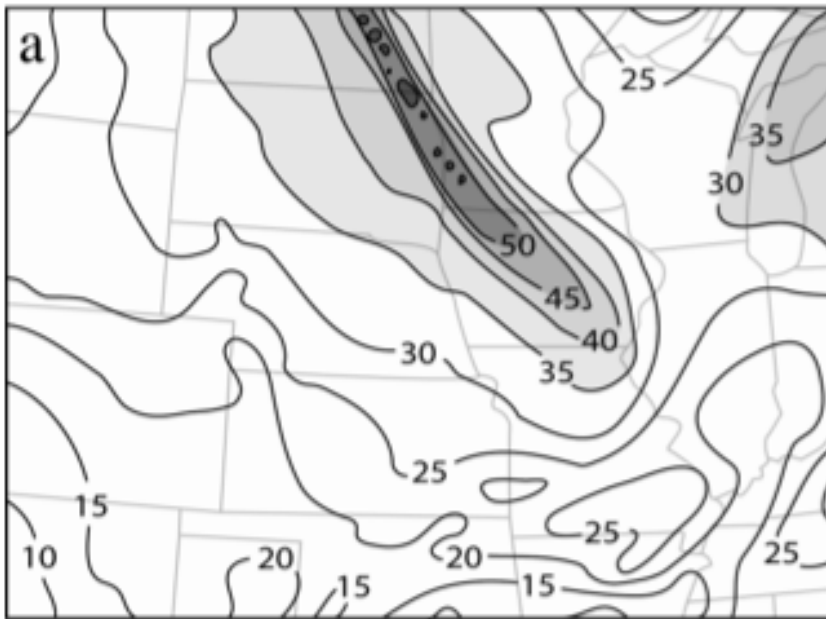


Note on Configuring Domains: Horizontal

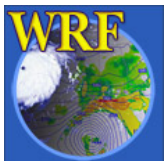
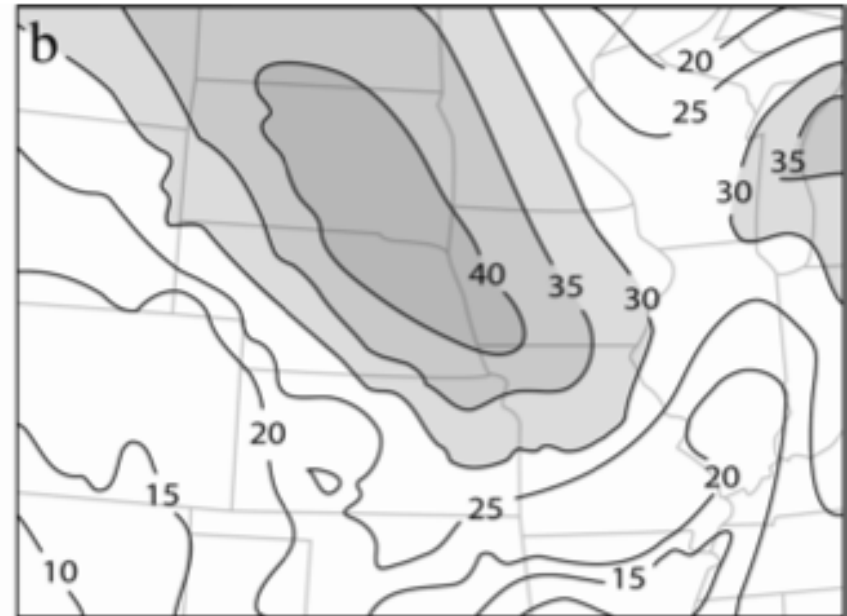


Note on Configuring Domains: Horizontal

Large regional domain



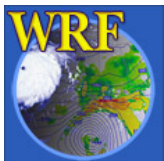
Smaller regional domain



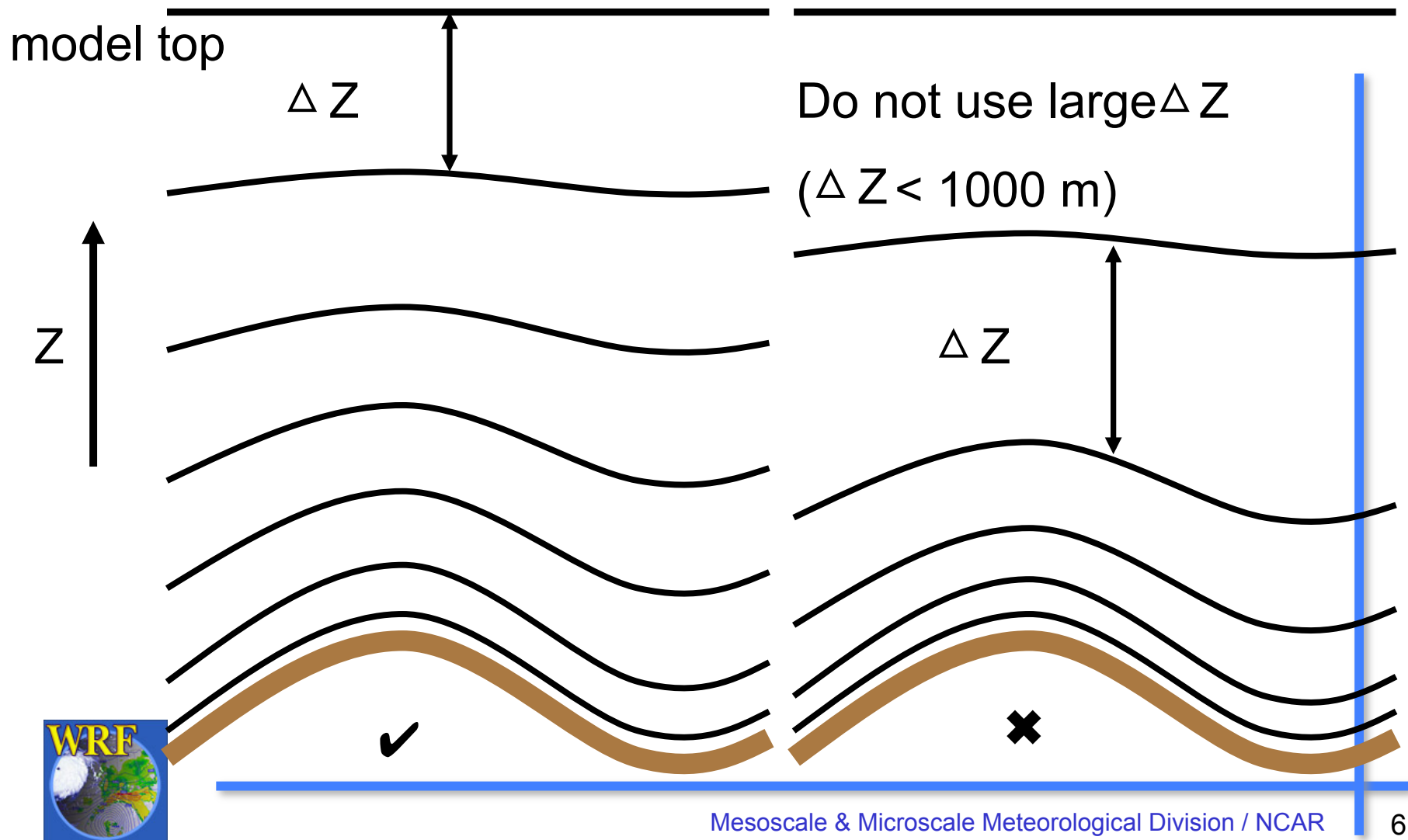
(From Warner, 2011)

Domains

- How many vertical levels should I use?
 - At least 30 or more levels
 - Vertical grid distance should not be larger than 1000 m:
 - Radiation, microphysics, less accurate lateral BDY
 - Related to horizontal grid size too: if finer horizontal grid size is used, consider adding a few more levels in the vertical

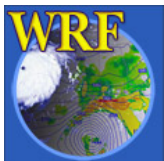


Note on Configuring Domains: Vertical



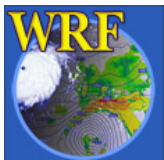
Nests:

- When should I use nests?
For example,
 - Input data resolution is too coarse
 - There isn't sufficient computing resources
- Nest domain sizes should not be too small;
- Nest boundary should be kept away from coarse domain boundary, and steep topography.



Input Data

- Check land data:
e.g. landuse: *does it represent my area well?*
- Know about the data: *how good are the data?*
 - Forecast data
 - Reanalysis data
 - Climate model data
- How frequent do I need to have boundary conditions?
 - More frequent is better

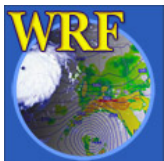


Model Options

- What do I start with?
 - What other people have success with?
 - References, papers
 - Simple options first:

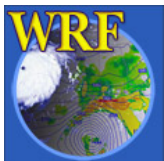
For example,

 - Graupel may not be important if $dx \gg 10$ km
 - mixed layer ocean model may not be needed if the modeled track isn't correct
 - Use analyses from weather centers before trying to create your own (via either *obsgrid* or DA) for both initial and lateral boundary conditions



Bottomline..

- Model results can be affected by many choices:
 - Domain configuration, both horizontal and vertical;
 - Input data;
 - Lateral boundary conditions.
- Model has limitations:
 - Physics: biases, may not handle certain process well, etc.



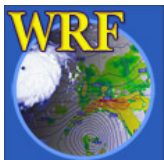
References:

Numerical Weather and Climate Prediction, 2011. By Thomas Warner, *Cambridge University Press*.

Warner, T., 2011. Quality assurance in atmospheric modeling. *Bull. Amer. Met. Soc. Dec. issue, p1601 – 1611.*

Stensrud, D., 2007. Parameterization Schemes: Keys to Understanding Numerical Weather Prediction Models. *Cambridge University Press*.

Haltiner G. and R. Williams, 1980. Numerical Prediction and Dynamic Meteorology. *Wiley*.



WRF USERS PAGE

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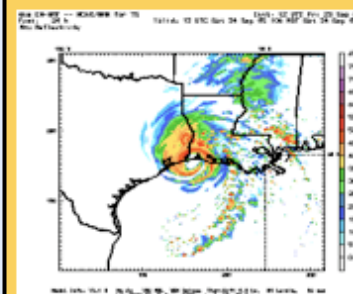
Welcome to the users home page for the Weather Research and Forecasting (WRF) modeling system. The WRF system is in the public domain and is freely available for community use. It is designed to be a flexible, state-of-the-art atmospheric simulation system that is portable and efficient on available parallel computing platforms. WRF is suitable for use in a broad range of applications across scales ranging from meters to thousands of kilometers, including:

- Idealized simulations (e.g. LES, convection, baroclinic waves)
- Regional and global applications
- Parameterization research
- Data assimilation research
- Forecast research
- Real-time NWP
- Hurricane research
- Coupled-model applications
- Teaching

The Mesoscale and Microscale Meteorology Division of NCAR is currently maintaining and supporting a subset of the overall WRF code (Version 3) that includes:

- WRF Software Framework (WSF)
- Advanced Research WRF (ARW) dynamic solver, including one-way, two-way nesting and moving nests, grid and observation nudging
- WRF Pre-Processing System (WPS)

WRF FORECAST



[WRF Real-time forecast](#) ([old site](#))

ANNOUNCEMENTS

[WRF Version 3.3 Release](#)
(4/6/2011)

'Known Problems' posts for [V3.3](#)
(posted 4/8/11)

12th WRF Users' Workshop: June
20 - 24, 2011. [Registration](#) is open..

New Users' tutorial, July 11 - 22.
[Registration](#) is open.

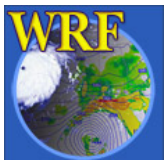
'Known Problems' posts for [V3.2](#)
and [V3.2.1](#) WRF (12/13/10)

[Program, extended abstracts, and
presentations](#) from the 11th WRF
Users' Workshop, June 21 - 25,
2010.

[planetWRF](#) released.

Miscellaneous Information for Users

- Become a registered user
- Visit Users' web pages
 - Check code updates, bug reports, updated documents, Version 3
 - Check upcoming events, like annual workshop
- Write to wrfhelp@ucar.edu for WRF related problems / feedback
- Participate in annual users' workshop (June)



Good Luck & Happy Computing!

THANKS FOR COMING TO THE TUTORIAL!

