The WRF Developmental Testbed Center (DTC)

Bob Gall

A facility where the NWP research and operational communities interact to **accelerate** testing and evaluation of new models and techniques for research applications and operational implementation, without interfering with current operations

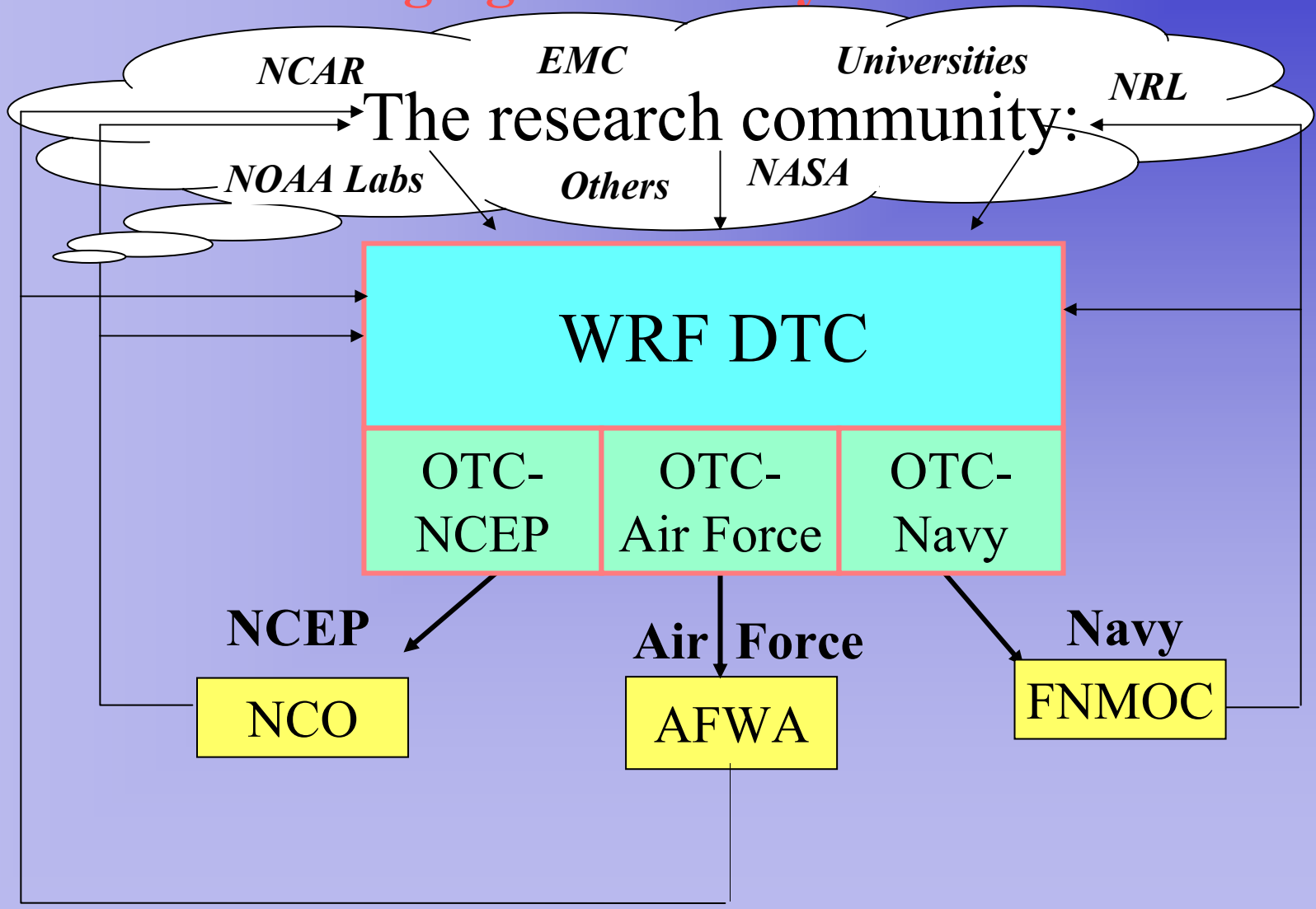
7 February 2005

Why Do We Need a DTC?

- Currently in the US the transfer of new NWP science and technology from research into operations is inefficient.
  - Primarily conducted at the operational centers and/or their associated research organizations
  - It does not take advantage of the considerable talent elsewhere in the research community
- Presently the research and operations NWP communities have insufficient opportunities to collaborate in an operations-like environment.
- There is nowhere that these communities can join to perform extensive rigorous model testing using a common model and operational data stream without disrupting operations.

The Flow of Science from Research to Operations in the WRF Era:

Bridging the "Valley of Death"



Goals

- Link Research and Operational Communities
- Speed transition of research results into operations
- Accelerate improvement in weather forecasts
- Develop and test promising new NWP techniques
- Provide an opportunity for NWP community to perform cycled or real-time tests of model and data assimilation systems

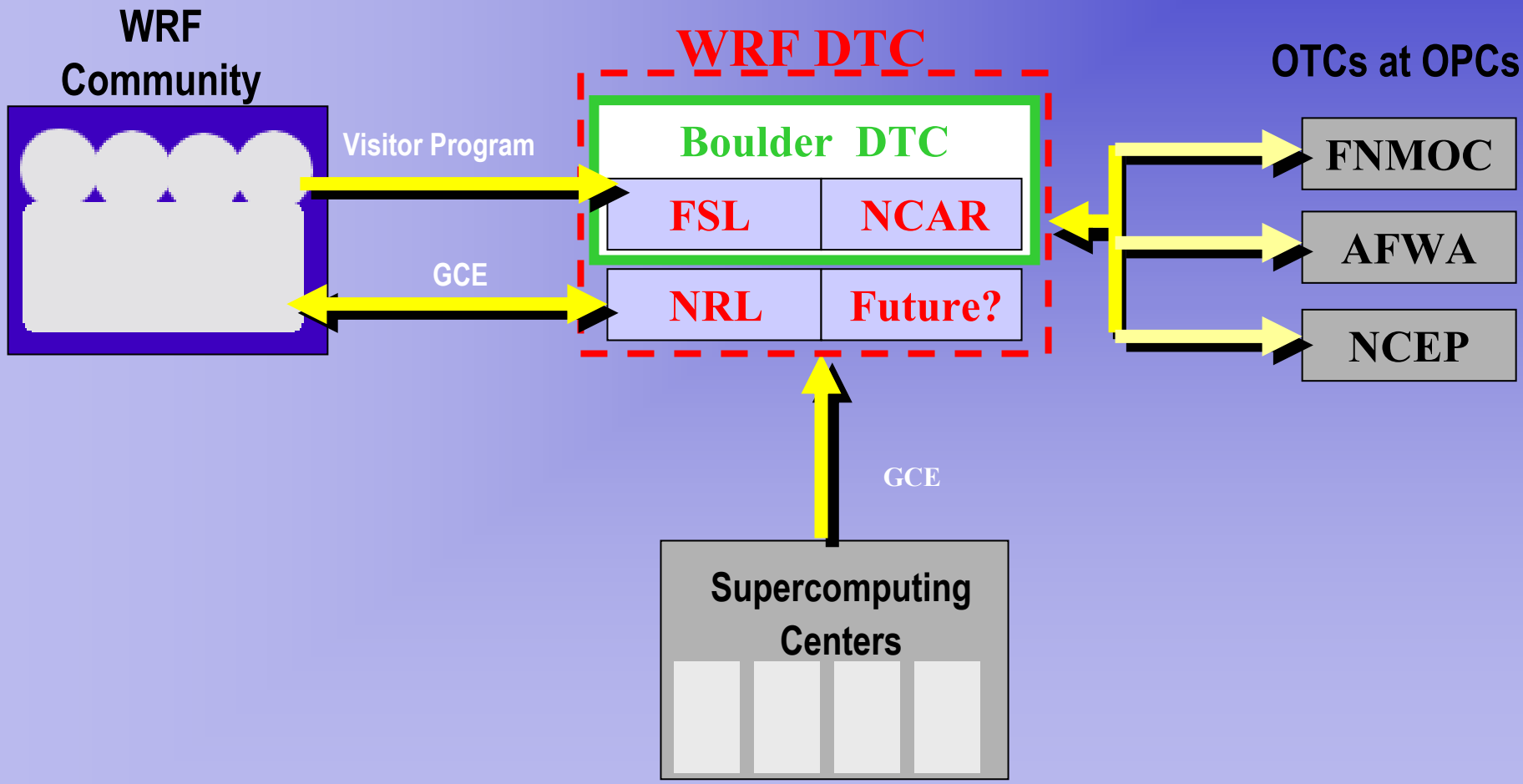
Basic Structure of the DTC

- The DTC will be a distributed facility with Components in:
  - Boulder (Boulder DTC)
  - NRL Monterey (NRL DTC)
  - Other?
- The Boulder DTC will have components:
  - NCAR (NCAR DTC)
  - FSL (FSL DTC)

Structure of a Distributed Component

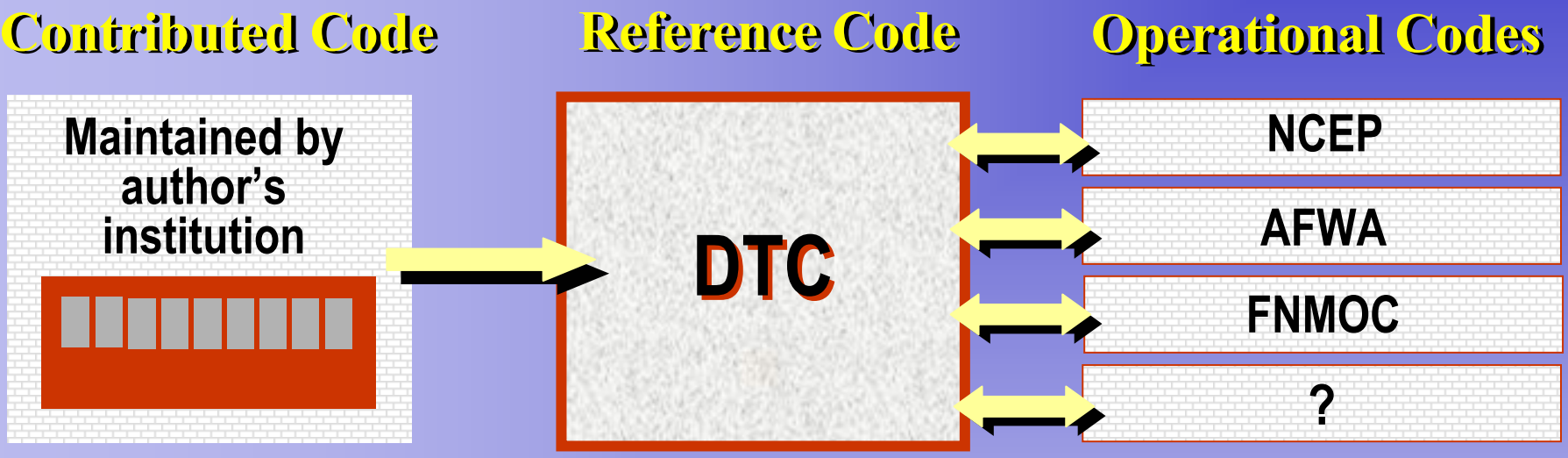
- Similar for all components. There will be
  - A director of the distributed component who will serve as a deputy director of the full DTC
  - A clearly defined staff who reports to that director (with a significant fraction of their time dedicated to the DTC)
  - A budget
- The deputy directors of the distributed components would form an executive committee that would guide DTC activities and coordinate among the various components
- One of the deputy directors will be the DTC Director
- Members of a component would make extended visits to other components

The DTC Architecture



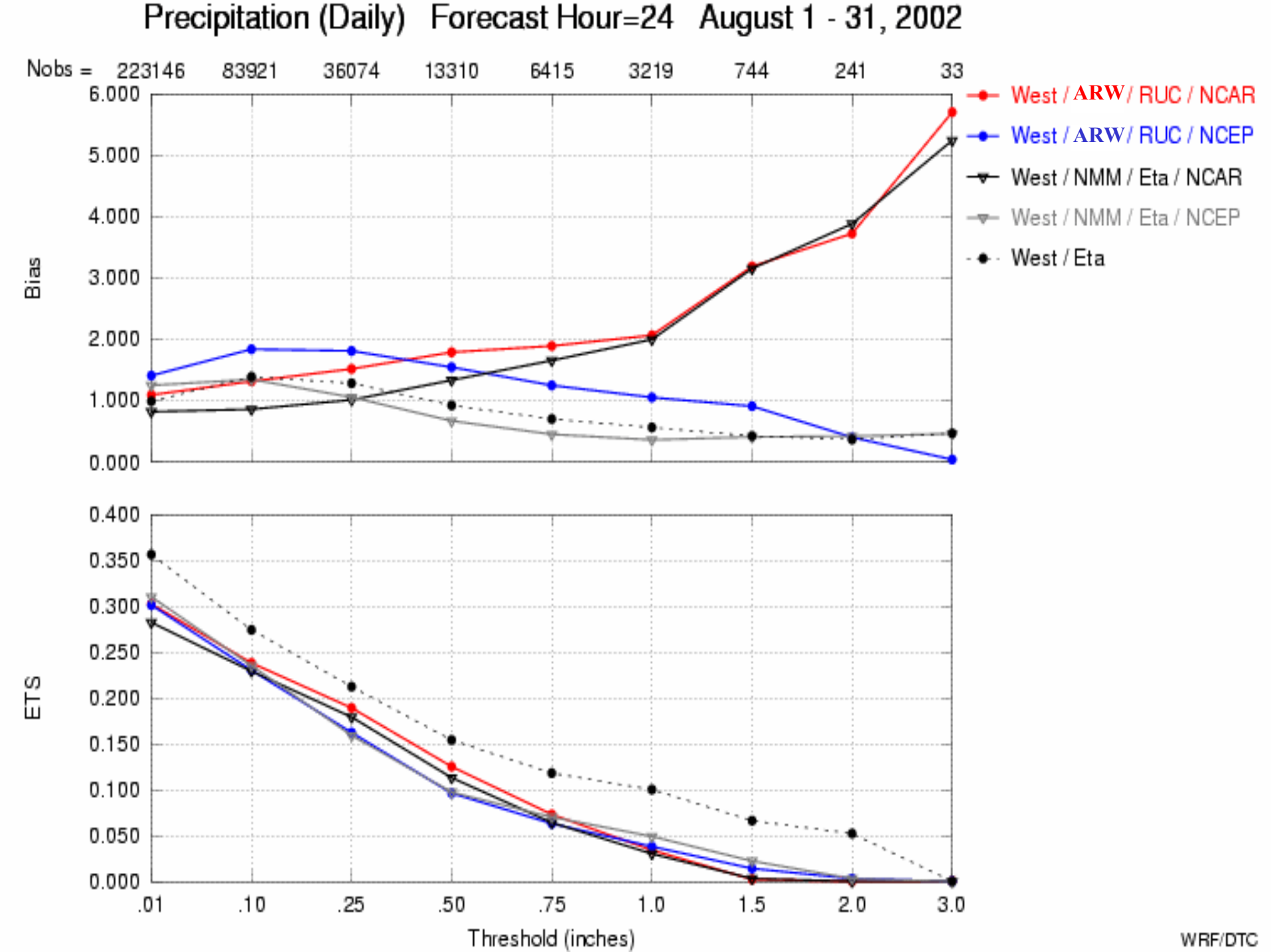
GCE—Grid Computing Environment

WRF Code Systems



Accomplishments FY03-04

- *Strong working relationship* between central DTC partners (FSL and NCAR), NCEP, and AFWA
- Completed the basic *WRF Reference Code* (including NCEP Nonhydrostatic Mesoscale Model (NMM) and NCAR Advanced research WRF (ARW) dynamic cores)
- *Ported* NCEP Post and Verification codes and the NMM code to FSL computer. These codes were also *transferred* to NCAR, NCEP, & AFWA computers
- *Tech transfer*: WRF ARW core implemented at NCEP for real-time predictions as part of Initial Operating Capability
- *Completed WRF Test Plan*
  - Critical for NCEP Initial Operating Capability by Oct04
  - Began evaluating results—presented at the WRF workshop in June and being written for publication presently


Precipitation (Daily) Forecast Hour=24 August 1 - 31, 2002
Nobs = 223146 83921 36074 13310 6415 3219 744 241 33
Bias
6.000
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West / ARW / RUC / NCAR
West / ARW / RUC / NCEP
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ETS
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1.0
1.5
2.0
3.0
Threshold (inches)
WRF/DTC

Accomplishments FY03-04

- Began providing WRF code to the community (EM core, NMM will be available in version 2.0, Fall?)
- Real-time cloud resolving (4-km) WRF experiment over Midwest (May-July)
- First ensemble WRF application developed (in support of predicting winter road conditions for NHWA)
- First use of WRF in an operational forecast environment with displays on AWIPS (at the Jacksonville WFO)
- Obtained needed support to initiate a visiting scientist program for the DTC in summer 2004

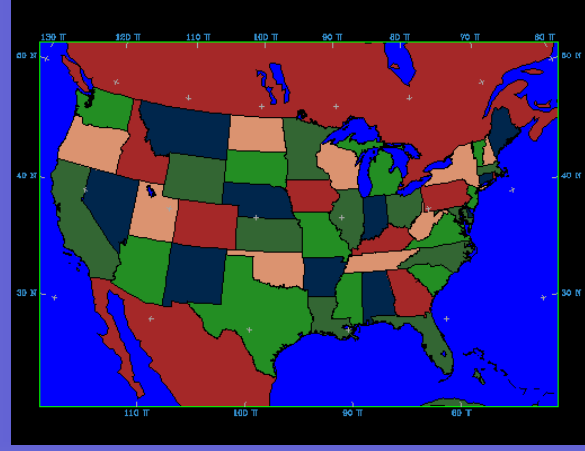
FY04 Visitor Program

- Bill Gallus and Isidora Jankov (Iowa State University)
  - Sensitivity of WRF warm season forecasts to changes in physics, dynamic core and grid resolution
  - Verification techniques
  - Fastest version of WRF that still allows convection resolving resolution (grid spacing, physics time-step, fastest physics)
- Dave Dempsey (San Francisco State University)
  - Investigate optimal model physics for WRF (cloud microphysics, precipitation, and boundary layer)
  - Develop and test additions to the WRF physics
- Ying Lin (NCEP)
  - Develop a “Relaxed Threat Score” and other verification techniques.

FY05 Annual Plan

- Determine configuration of WRF that can be run at cloud-resolving resolutions in the High Resolution Window (HRW)
- Optimal configuration of ensemble for the HRW
- Conduct the first Tutorial for the NMM core
- Conduct a Hi-Res WRF real-time winter forecast experiment over the CONUS

DTC Winter Forecast Experiment



- The WRF Developmental Testbed Center will conduct a high resolution NWP forecast experiment during the winter season
  - December 2004-March 2005
  - Horizontal resolution—5km
  - 38 vertical levels
  - Domain Size—CONUS
  - Emphasis on the Eastern US
  - Forecast period 48 hours

Computer resources

- It will be run on the FSL (NMM core) and NCAR (ARW core) computers

- Forecasts would be made available to NWS forecasters through AWIPS, FXNet and the WEB (http://DTCenter.org)
  - The research community will have assess through the WEB

FY05 Annual Plan

- Continue visitor program
  - An additional visitor this calendar year?
  - Announcement of opportunity
- Begin making NMM core available to the community
  - Offer has been made to add an associate scientist to the DTC. This will be his/her primary responsibility
- Convene the first Advisory Panel meeting
- Complete a DTC Terms of Reference

The Long Term Plan
Phased Implementation Strategy

- Phase 1

  (FY03-FY05) Implement a minimal Central DTC

  – Limited Staff at NCAR and FSL

  – Emphasis on a visitor program

  – Conduct tests similar to those currently underway
    - Will include a series of real-time experiments with forecaster participation (Hi Res large domain, corresponding ensemble)

  – Develop the distributed computing resource
    - GCE development?

  – Develop and implement the distributed DTC concept

The Long Term Plan
Phased Implementation Strategy

- Phase 2

  FY06-FY07 Fully Functional DTC
  - Gradual ramp-up to full staff
  - Entire WRF model maintained for and made available to the community
  - Transparent use of the distributed computing resources
  - Full and competitive visitor program
  - DTC fully responsive to the the WRF Research Applications and Operational Requirements Boards

- Phase 3

  FY08-FY09 Unified Modeling in the DTC
  - Ocean Modeling, Global modeling…

Current staffing in the Central DTC

- NCAR
  - Director (Gall .75 FTE)
  - Project Scientist (Nance, 1.0 FTE)
  - Associate Scientist (Meral Demirtas, will start in Oct)
  - Total (2.75 FTE)
- FSL
  - Deputy Director (Koch, .2 FTE)
  - Project Scientist Contractor (Bernadette, .5 FTE)
  - Software porting/development (Harrop, Hart, Tierney, 1.1 FTE)
  - Scientific Programmers (Loughe+Middlecoff, .7 FTE)
  - Total (2.5 FTE—1.75 contributed from FSL)

FY 05 Funding (Central DTC) Threshold

• NCAR		
– Salaries		$ 674,094
– Travel		$ 29,649
– Visitor Program		$ 70,220
– Advisory Panel		$ 15,605
– Total (burdened)		$ 789,567
• NCAR contribution	$ 257,500	
• Total needed from NOAA		$ 532, 067
• FSL		
– Salaries		$ 419,870
– Travel		$ 7,000
– Total (burdened)		$ 426,870
– Cosponsored 1.75 FTE	$ 375,000	
• Total needed from NOAA		$ 426,870
• Total Budget		$1, 590,937

Eventual Annual Budget needed for the Central DTC

• Visitor Program	$1.0 M
• 13 FTE technical staff (Including staff at FSL)	$2.9 M
• Other personnel 3 FTE (Admin, Director)	$0.7 M
• Enhancement to computing, networking and storage	$0.6 M
• Space	$0.2 M
• Travel and other	$0.1 M
• **Total**	**$5.5 M**

Sustained substantive support from NWS and OAR is needed, beginning in FY05, for the DTC to function.

END

USWPP Management Structure