

Using the LEAD Portal for Customized Weather Forecasts on the TeraGrid

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Relocatable On-Demand Forecasts Future Vision

- Numerical Weather Prediction (NWP) forecasts should *adapt* to the weather and user needs
- Detailed NWP forecasts run in region of concern:
 - Storm Prediction Center: before issuing a severe thunderstorm or tornado watch
 - Local Weather Forecaster: anticipating local event
 - Community Emergency Manager: fire or disaster need
- Data mining of large-scale forecasts could identify areas of expected risk or higher uncertainty where additional forecasts would be most useful.
 - Higher resolution
 - Using more recent data
 - Using customized physics packages



LEAD

- Linked Environments for Atmospheric Discovery
- NSF Large Information Technology Research Project
- Goals
 - **Democratization** of high performance computing
 - Provide seamless integration of data access, analysis, and numerical weather forecasting models
 - Ease data exploration and mining
 - Support research and education
- Collaboration among Computer Scientists and Meteorologists
- 9 Research Partners
 - Univ of Oklahoma, Univ of Indiana, Univ of Illinois, Millersville Univ., Howard Univ., Univ of North Carolina, Univ of Alabama, Univ. of Michigan, UNIDATA Program



WRF and TeraGrid





- Open source community Numerical Weather Prediction model.
- Competition a workstation.
 Even Even Set up on a supercomputer.
- Further of the sum, to link to real-time or archived data.
- TeraGrid

- Tera Contraction TeraGrid
- NSF-sponsored supercomputing centers
- Large facilities to handle BIG projects.

LEAD: Lets make it EASY to run WRF on TeraGrid!



LEAD Portal

www.leadproject.org



S WELCOME TO THE LEAD PORTAL

Linked Environments for Atmospheric Discovery (LEAD) makes meteorological data, forecast models, and analysis and visualization tools available to anyone who wants to interactively explore the weather as it evolves. The LEAD Portal brings together all the necessary resources at one convenient access point ... read more



👂 LEAD NEWS





LEAD Workflow

	WORLOW			
My Workflows (0)	Sample Workflows (6)			
Public: ADAS Initialized WRF Forecast				
Description				
WRF Forecasting using OU ADAS 10km Analysis Data for Initial Conditions and NCEP NAM Core) Version 2.2. WRF ouput can be visualized with Unidata IDV.	1 40Km for setting Lateral Boundary interpolated by ARPS Preprocessing Versions			
AssimilatedADASData				
Config ADAS_Analysis_V5_2_8_	Pub_Interpolater			
Terrain_V5_2_8_Pub_Preprocessor	WRF_Forecast_V2_2_F			
	ARPS2WRF_V5_2_8_Pub_Interpolater			
CrossCuttingConfigurations Config				

- Build experiment (Xbaya Workflow Builder/Monitor)
- Orchestrate components (BPEL Based with WSDL files)
- Pre-built workflows allow fast submit



ADAS & WRF NWP Workflow

- Accept interactive user input
- Build terrain
- Build land surface features
- Find and access LEAD-10km gridded weather analysis including radar data
- Interpolate initial conditions
- Interpolate boundary conditions
- Build job script
- Obtain TeraGrid authorization token
- Transfer files to TeraGrid Supercomputing Center 2007: Tungsten at NCSA 2008: BigRed at Indiana University, NCSA as back-up
- Submit job to queue
- Transfer result files back using GLOBUS GRID-FTP
- Display and annotate files in user workspace
- Copy output files to OU for post-processing
- Optionally catalog results for sharing results, data mining.



Interactive Location Selection

Region Type Selection

- Regional 1000Km X 1000Km X 51 Domain with 20 Km Grid Spacing
- Regional 1000Km X 1000Km X 51 Domain with 5 Km Grid Spacing
- CONUS (5520Km X 3520Km X 51) Domain with 20 Km Grid Spacing

Forecast Start Time	
Dates and times in Greenwich Mean	Time (GMT)
Now (in other words, run a forecas Please specify:	st using the most recent data available)
Start Date: 2008/01/16	Current Time: 2008/01/16 06:16Z
Start Hour: OZ 💌	
orecast Duration: 6 hours	

Using your mouse, drag and drop the center of the model domain grid to position it as desired on the map



Storm Prediction Center

- NOAA/SPC produces
 - Severe Thunderstorm and Tornado Watches
 - Mesoscale weather discussions
 - 1-8 day outlooks for severe and hazardous weather

DUTLOOK

 Located in the National Weather Center at the Univ. of Oklahoma





Linked Environments for Atmospheric Discovery

SPC Convective Watches

SPC Spring Program in the Hazardous Weather Testbed

- Testing and calibration of new forecasting methods in a simulated operational setting
- Collaboration among
 - NOAA units
 - Universities
 - Private sector



 Testbed located between the NOAA Storm Prediction Center and Norman National Weather Service Forecast Office



2007 SPC Spring Experiment LEAD On-Demand WRF

- High resolution forecast location of forecast based on morning data and severe weather outlook
- Weather Research and Forecasting (WRF) model
- ~1000x1000 km domain
- Start WRF using
 - Interpolation from operational NWP model (NAM) and/or
 - Interpolation from 10-km ADAS analysis
- Submit using LEAD web portal, selecting
 - Initial time
 - Domain center



2007-2008 Spring Experiments





Interactive Forecast Runs

Domain Centers



Spring 2007

Spring 2008



Results - Technology

- Workflow service for *submitting* runs flawless and efficient
- Robustness of end-to-end system was A Tale of Two Seasons
 - 2007: Difficulties with robustness
 - 2008: Largely successful

April 28-June 3 2008 62 Forecasts Submitted 87% of end-to-end workflows successful





idsnews.com

Flooding around Bloomington

Don't Fool With Mother Nature !!



Pete Stuttgen • IDS An IU bus plows through about three-foot deep water at the intersection of Indiana Avenue and 6th Stree flood Wednesday afternoon.

June 4-6th, 2008 Flooding at IU caused power and hardware problems bringing down Big Red and data capacitor

5 of 6 workflows lost in this period

Flash Flooding at IU on June 4th



Results – Sample Case 7-June-2007

- WRF ARW 1-km grid spacing
- 1000 x 1000 km domain
- Domain centered in SW Wisconsin
- Submitted two on-demand WRF runs
 - 1. Initialized with 3h forecast 12 UTC NAM
 - 2. Initialized with 15 UTC ADAS analysis



20 UTC 7-June-2007



00 UTC 8-June-2007



From 2008: Forecasting Storm Initiation in Oklahoma

Forecast, 01-02 May 2008

Additional Cases http://www.caps.ou.edu/wx/spc/



Computed Cloud





Results – NWP Forecasts

Subjective Scoring Scheme

Reflectivity

Parameter/Points	4	3	2	1	0
	Excellent	Very	Good	Fair	Poor
		Good			
Initiation Timing (hr)	< 1	1-2	2-3	3-4	>4

Location (k Speed Error Preliminary Results

nked Envi.

Direction E 14 forecast cases evaluated to date

(max dBZ)
Mode Accu
(% matchinMean Score Sum: 14.1 (2.8 avg element)AdditioMean LEAD ADAS: 14.8 (2.3 avg element)AdditioMean LEAD NAM: 13.0 (2.0 avg element)Highest scores; direction of movementLowest scores: location of initiation



Future Plans

- Science
 - Complete subjective scoring of results for 2007 & 2008
 - Use 1-km NOAA Quantitative Precipitation gridded radar data (QP2) to objectively score forecasts
- Technology
 - Continue to work on improving robustness and repeatable turnaround time
 - Improve graphics for additional thunderstorm-specific diagnostic variables
 - Resume work with SPRUCE for urgent computing



LEAD on the Web

LEAD site www.leadproject.org

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