

# The Latin American Grid WRF Portal

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## Motivation

- Meteorological researchers suggest hurricane modeling improvements by incorporating ensemble forecasting and model coupling
- Ensemble/couple based forecast requires a scale out of computing resources achievable through Grid infrastructure
- Ensemble/couple model will generate an order of magnitude more data for researchers to manage and study

## Challenges

- Address various User Community Needs
  - Diverse Targeted audience (meteorologists, home owner, business owner, emergency response community) have different level of expectation and expertise for interpreting the output of a hurricane forecast.
- Can we achieve improvements in performance by scaling out using Grid computing middleware?
  - WRF designed for Cluster architecture not Grid
  - Globus challenges include steep learning curve, reliability and performance issues
  - Addressing communication latency over Grid nodes
- Realization of a cyber infrastructure that facilitates the investigation of model data and collaboration among researchers.

## Goals & Objectives

- LA Grid WRF Portal to provide a Comprehensive User Interface
  - Data Input Selection & Ingest
  - Model Parameter Settings
  - Automate WRF simulation runs to support ensembles
  - Output Management and Organization
  - Visualizations for Forecast Data
  - Optimize WRF Model runs (Grid enhanced version)
    - Parallelize pre & post aspects of WRF runs
    - Efficient Resource Allocation for WRF, visualization and GIS data sets
- Visualization (Meteorologists/ER Teams/Business Continuity Managers)
  - Interactive Visualizations
    - JPEGs, GIFs overlaid on Maps
    - Zoom In/Zoom out & Navigability
    - Runtime update of visualizations (Driven by Model Parameters)
  - Non-Interactive Visualizations
    - Static Granularity MPEGs for WRF runs

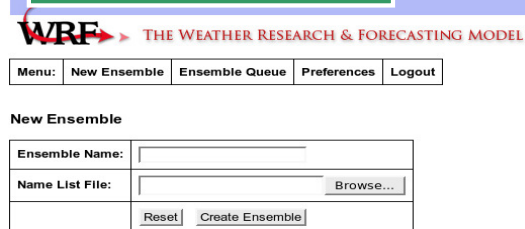
## WRF Background

- Computationally Expensive Process
- WRF Statistics
  - ~ 165,000 lines of code (40,000 lines generated at compile time)
  - Simple 75 x 75 grid @ 4 km resolution (~1.5 Hours on single node, ~ 30 mins on 8 nodes)
- Installation, Compilation and Run requires
  - NetCDF library, Script & Compiler Installation Configurations
  - Edit input file for input model parameters

## Project Road Map

- WRF Portal 0.5 - Meteorologists in prediction phase
  - Auto-configuration of single WRF simulations
  - Simple Visualization Output (2-D Track, Wind Intensity)
- WRF Portal 1.0 - Meteorologists/sophisticated end-users in prediction & impact phases
  - Ensemble Orchestration (scripting) & Simple Visualizations
  - Data Extraction based on geographical areas, time frame and parameter variation etc.
- WRF Portal 2.0 - End-users in impact & recovery phases (Static)
  - End-user driven Simulations based on expected views and requirements
  - Ensemble Orchestration & Integration of simulation and visualization via job flow management
  - Customized views targeted at each end-user community
- WRF Portal 3.0 - End-users in impact & recovery phases
  - Dynamic Environment
    - Resource Discovery
    - WRF Package Provisioning
    - New ensemble generation (work flow creation)
    - Support for new model addition (Behavioral Calibration)
  - Support for coupling with Ocean model

## WRF Portal Prototype



**WRF THE WEATHER RESEARCH & FORECASTING MODEL**

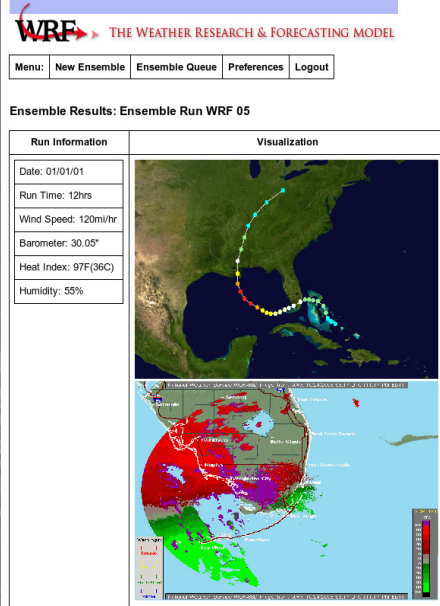
Menu: [New Ensemble](#) [Ensemble Queue](#) [Preferences](#) [Logout](#)

**New Ensemble**

Ensemble Name:

Name List File:  [Browse...](#)

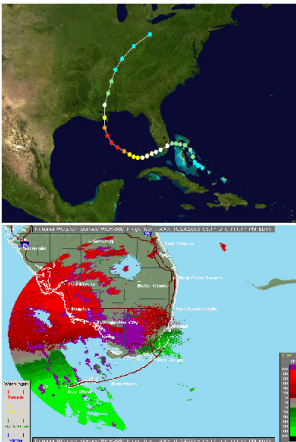
[Reset](#) [Create Ensemble](#)

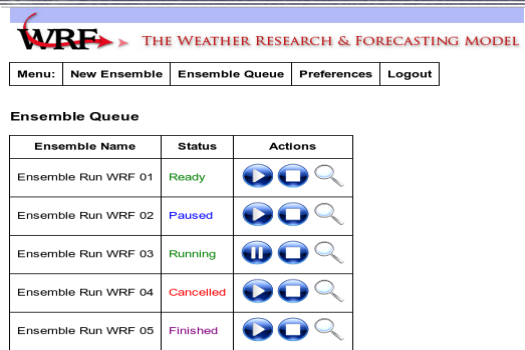


**WRF THE WEATHER RESEARCH & FORECASTING MODEL**

Menu: [New Ensemble](#) [Ensemble Queue](#) [Preferences](#) [Logout](#)

**Ensemble Results: Ensemble Run WRF 05**

Run Information	Visualization
Date: 01/01/01 Run Time: 12hrs Wind Speed: 120mi/hr Barometer: 30.05" Heat Index: 97F(36C) Humidity: 55%	



**WRF THE WEATHER RESEARCH & FORECASTING MODEL**

Menu: [New Ensemble](#) [Ensemble Queue](#) [Preferences](#) [Logout](#)

**Ensemble Queue**

Ensemble Name	Status	Actions
Ensemble Run WRF 01	Ready	<a href="#">Play</a> <a href="#">Stop</a> <a href="#">Refresh</a>
Ensemble Run WRF 02	Paused	<a href="#">Play</a> <a href="#">Stop</a> <a href="#">Refresh</a>
Ensemble Run WRF 03	Running	<a href="#">Play</a> <a href="#">Stop</a> <a href="#">Refresh</a>
Ensemble Run WRF 04	Cancelled	<a href="#">Play</a> <a href="#">Stop</a> <a href="#">Refresh</a>
Ensemble Run WRF 05	Finished	<a href="#">Play</a> <a href="#">Stop</a> <a href="#">Refresh</a>

## Portal Prototypical Architecture

