

HWRF Real-Time FY2011 Parallel Experimental Forecasts Request for t-Jet Resources

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Planned HWRF Experimental Forecasts FY2011

○ HFIP Stream 1.5 Demo Configurations (EMC/HRD):

○ High-Resolution triple nested 27:9:3 HWRF

- 2011 Operational HWRF Physics (EMC)
- Alternate physics options for high-resolution (EMC/HRD/ESRL)
- Coupled to POM/HYCOM (EMC)
- Operational vortex Initialization and cycling at highest resolution (3 km) (EMC/HRD)
- Alternate vortex initialization procedure (EMC)
- GSI run on 3 km analysis domain and 27 km outer domain (EMC)
- High-resolution vortex tracker (EMC)
- Hourly output for 3-D and 2-D variables (EMC/HRD)
- High-Frequency (9-minute or higher) output for storm location, Vmax, Pmin and location of Vmax and Pmin from 3 km domain (EMC)
- Post-processed output includes high-resolution satellite imagery (EMC/HRD)

○ HFIP Stream 2.0 Demo Configurations from EMC:

- HWRF-HYCOM coupled system with 2011 operational HWRF physics and initialization and cycling (27:9:3)
- HWRF-POM-NOAH LSM coupled system with 2011 operational HWRF initialization and cycling (27:9:3)
- HWRF-Hybrid DA experiments (27:9 and/or 27:9:3) with emphasis on assimilating real-time TDR data
- HWRF with modified GFS Shallow Convection and PBL parameterization schemes (27:9 and/or 27:9:3)
- HWRF with modified radiation and microphysics experiments (27:9 and/or 27:9:3)

Selection of Stream 1.5 Configuration⊗▽
(Advance FY2012 Pre-implementation T&E)

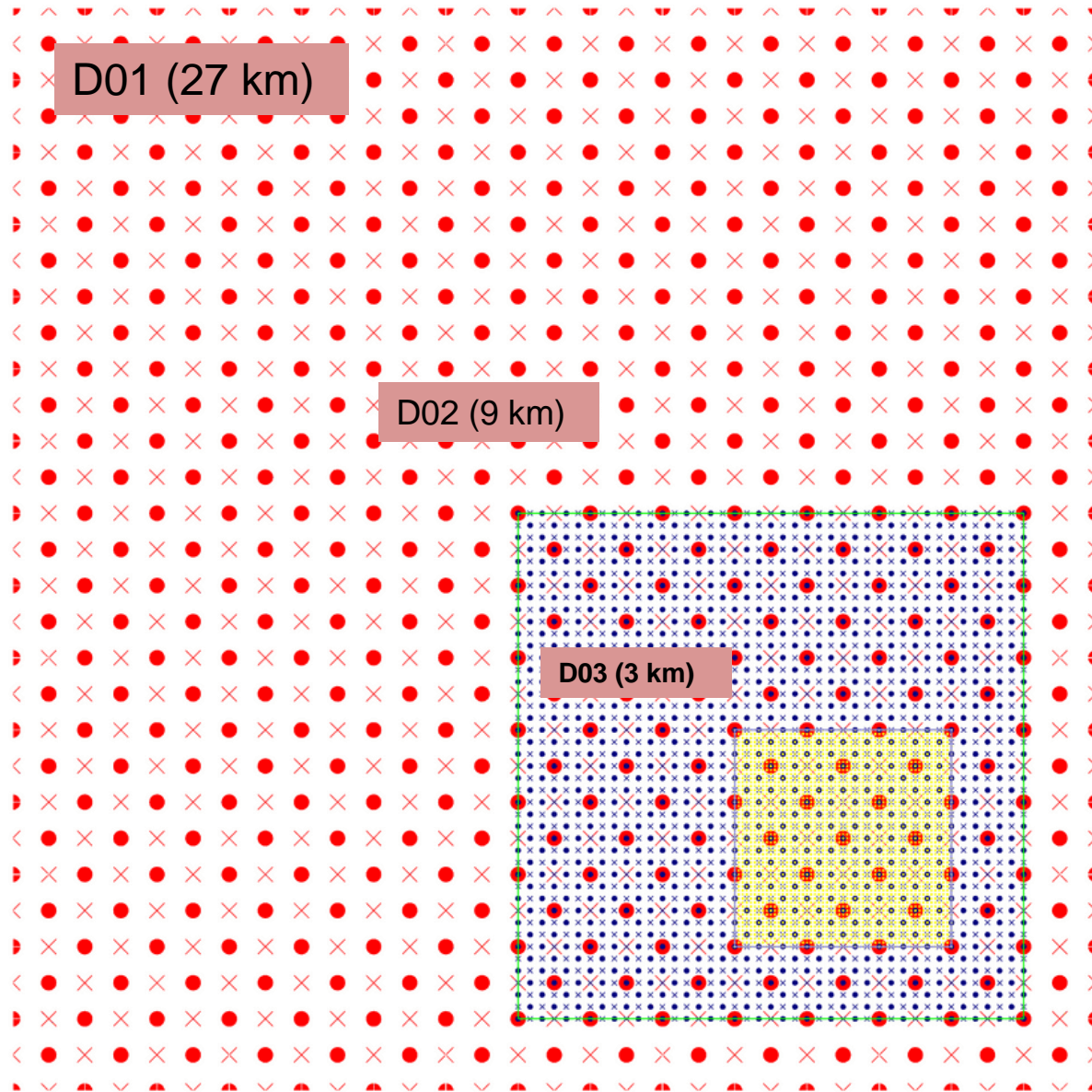
Experiment	Physics	Coupling	Initialization	Resources (No. of Cores/timing/Disk per forecast)
H3P1 HWRF 27:9:3	2011 Oper. Physics	POM	2011 Oper. Init w/ cycling	Init: 36 cores for 1 hr Fcst/post: 121 cores for 4 hrs Output: 25 cores for 20 min Runtime disk: 1 TB Archive: 15 GB Total: 172 cores per forecast
H3P2 HWRF 27:9:3	Modified 2011 Oper. Physics tuned for 3 km	POM	2011 Oper. Init w/ cycling	
H3P3 HWRF 27:9:3	Alternate high-resolution physics	POM	2011 Oper. Init w/ cycling	
H3P4 HWRF 27:9:3	2011 Oper. Physics	POM	New Vortex init w/cycling*	
H3H1 HWRF 27:9:3	2011 Oper. Physics tuned for HYCOM*	HYCOM*	2011 Oper. Init w/ cycling	

*Could be delayed due to technical issues

⊗All configurations are being tested for entire 2010 Atlantic season

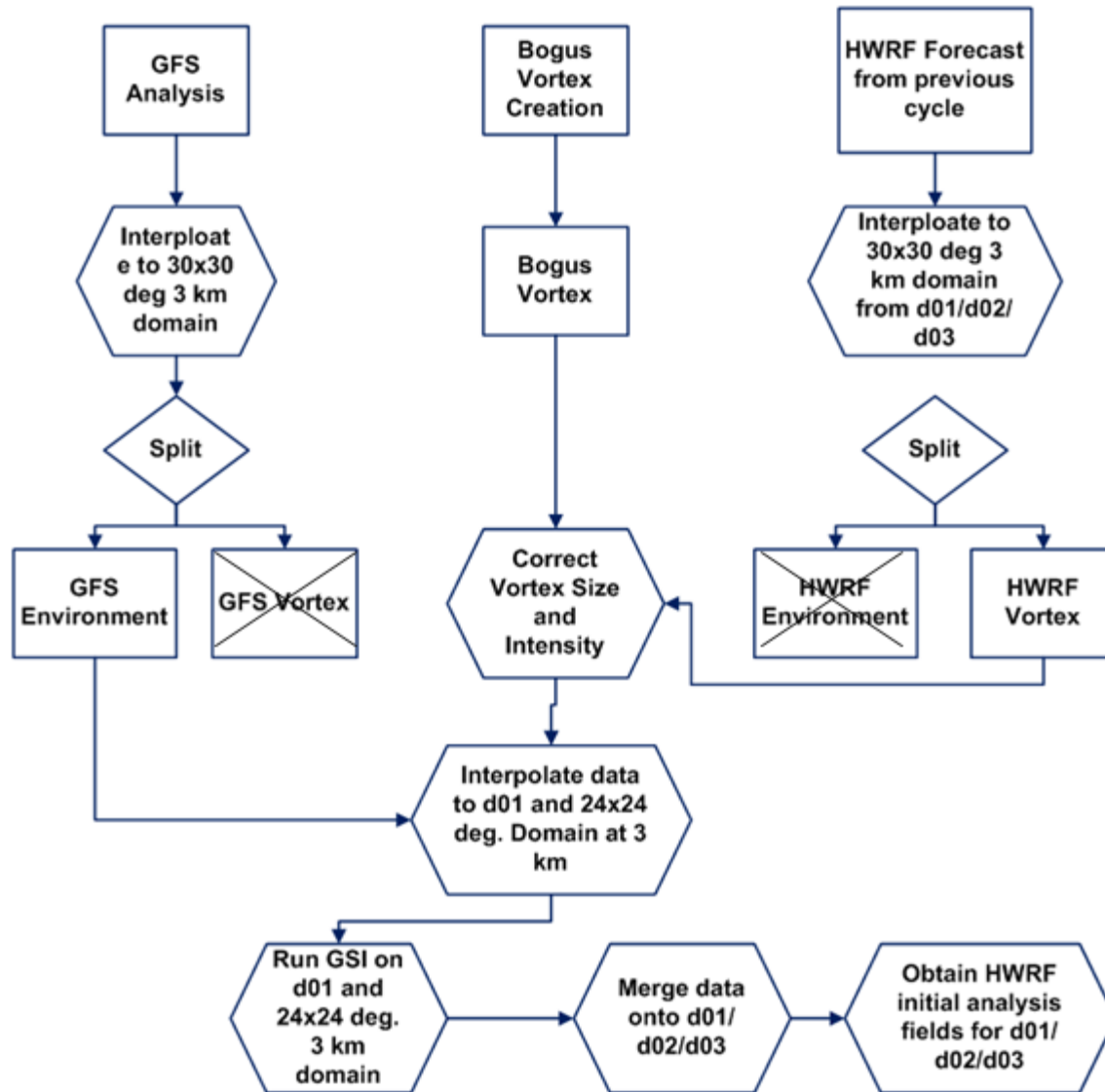
▽ Final configuration to be chosen by end of April, submit results for evaluation by May 20th.

Third Nest Configuration



Nest movement (HRD's Centroid based algorithm)

Initialization for Third Nest



Background

HWRF vortex initialization/relocation

Warm start: GFS environment + relocated and modified HWRF 6hr forecast vortex

cold start: GFS environment + bogus vortex

\mathbf{x}

(multiple time levels of background if FGAT)

... \mathbf{x}^{t-1} , \mathbf{x} , \mathbf{x}^{t+1} , ...

hybrid

short range ensemble
forecast \mathbf{x}_k^{en}

GSI (includes Hybrid DA Capability)

Data selection, quality control, data thinning

Iterative minimization

3DVAR cost function

$$2J(\mathbf{x}) = \mathbf{x}^T \mathbf{B}^{-1} \mathbf{x} + (\mathbf{H}\mathbf{x} - \mathbf{y})^T \mathbf{R}^{-1} (\mathbf{H}\mathbf{x} - \mathbf{y}) + J_c$$

climatological
isotropic \mathbf{B}_c

flow-dependent
anisotropic \mathbf{B}_a

hybrid
 $\mathbf{B} = (\beta_1^{-1} \mathbf{B}_c + \beta_2^{-1} \mathbf{P}^{en} \mathbf{O})$

ensemble covariance $\mathbf{P}^{en} = \sum \mathbf{x}_k^{en} (\mathbf{x}_k^{en})^T$

Analysis \mathbf{x}_a

Post Balance

126 hours forecast

(3, 6, 9 hr forecast)

Potential and future obs

NOAA and
USAF: flight
level data,
SFMR data
new dropsonde
cloud radiance
data

EnKF

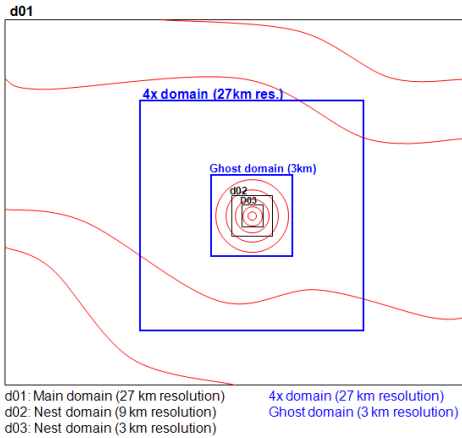
Update ensemble
members (\mathbf{x}_k^{en})

Ensemble forecast

Assimilated obs

rawinsonde, pibal,
class sounding,
profiler,
dropsonde,
AIRCFT, AIRCAR,
GPSIPW, surface
marine/land/splas
h-level/mesonet
satellite wind
satellite radiance
data: HIRS,
AMSU-A, AMSU-
B/MHS, AIRS,
GOES sounder
NOAA P3 TDR
Pseudo-MSLP

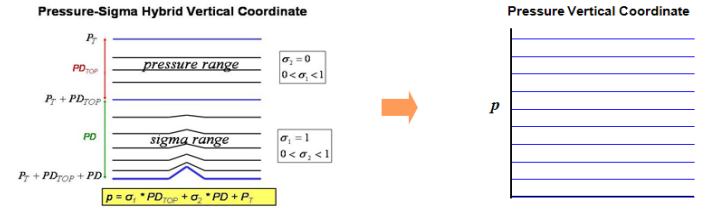
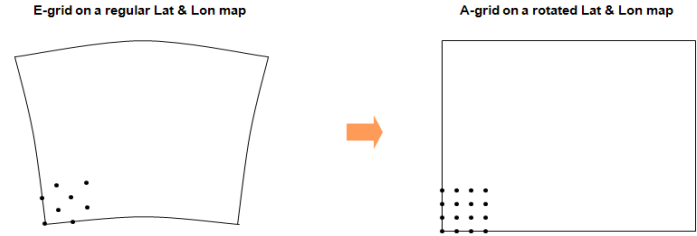
Alternate Configuration of Domains for Vortex Relocation & Initialization



Alternate Initialization Procedure

Based on gradient balance method

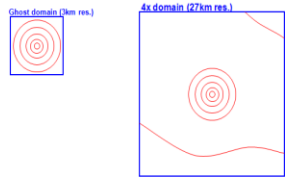
Pre-process of TC initialization



4x domain in current version	4x domain in new version	Ghost domain in current version	Ghost domain in new version
: 9km (0.06°) resolution	: 27km (0.18°) resolution	: 9km (0.06°) resolution	: 3km (0.02°) resolution
: 419 x 819 grids (E grid)	: 233 x 233 grids (A grid)	: 210 x 409 grids (E grid)	: 1201 x 1201 grids (A grid)
→ 838 x 819 grids (A grid)	→ 42° x 42° coverage	→ 420 x 409 grids (A grid)	→ 24° x 24° coverage
: 50° x 49° coverage		: 25.2° x 24.5° coverage	

1. Read HWRF 6h fcst

- Set the ghost domain (from d01,02,03) & 4x domain (from d01)

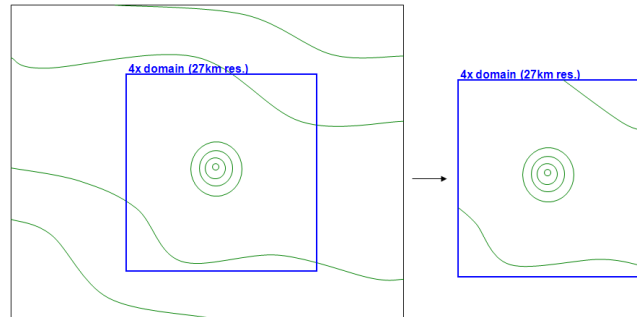


2. Size correction

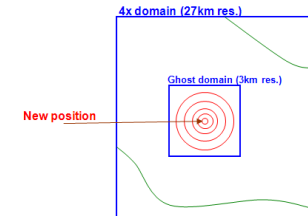


4. Read GFS analysis

- Set the 4x domain

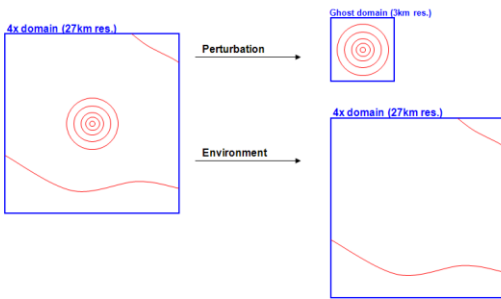


6. Merge the perturbation of HWRF into environment, Intensity correction, and humidity adjustment



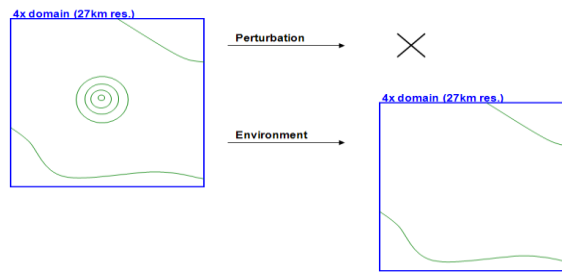
3. Filtering the HWRF 6h fcst

- Update 4x domain based on the ghost domain
- Filtering

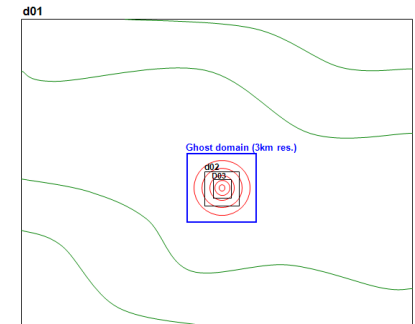


5. Filtering the GFS analysis

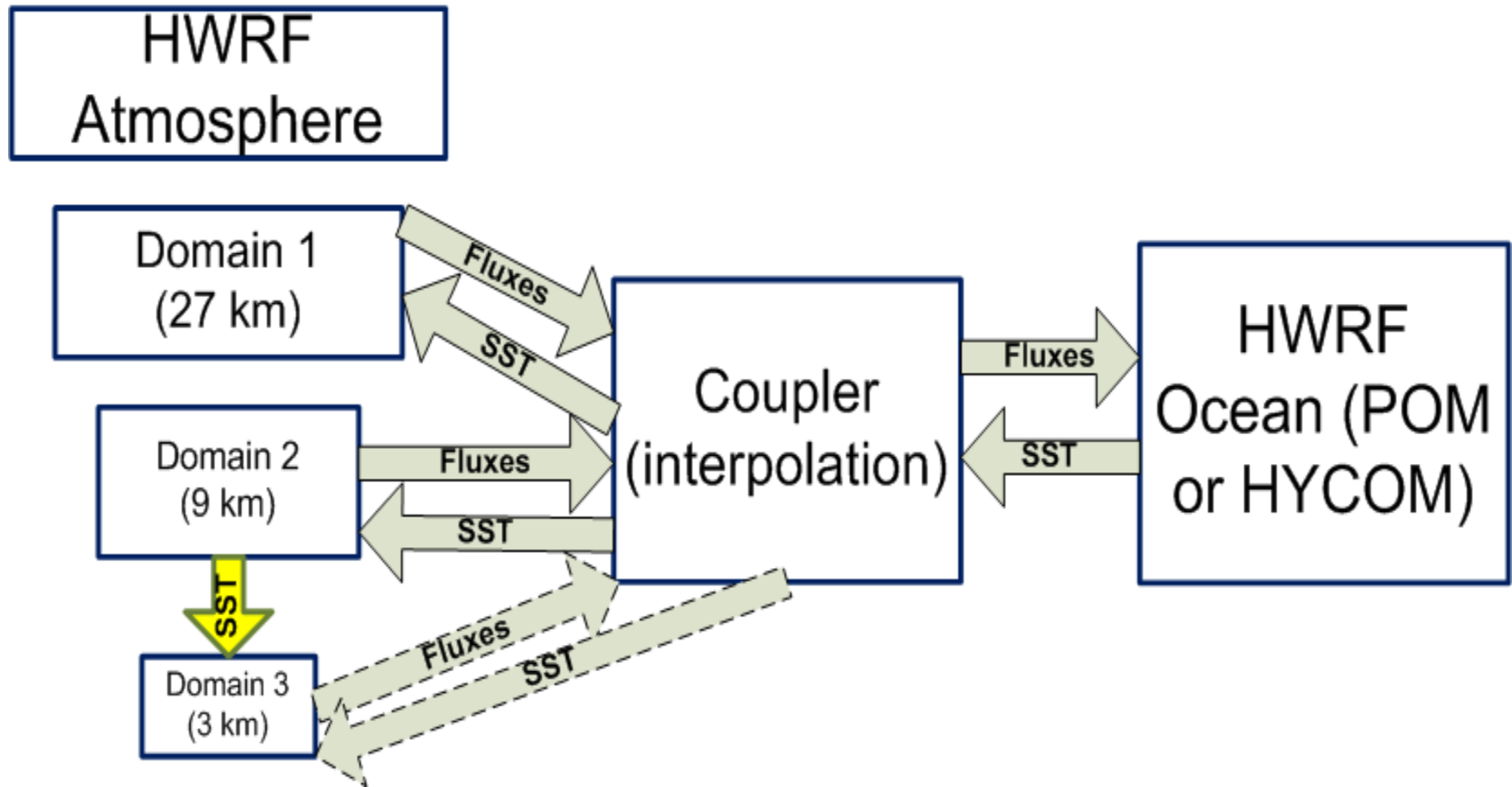
- Filtering



7. Set d01, d02 and d03 from the ghost domain



Coupler for Third Nest



Extension of 2-way interactive NCEP coupler
(dashed lines represent future development)

Planned FY2011 Real-Time Experiments on t-Jet

Experiment	Physics	Coupling	Init	Resources
Stream 1.5* HWRF 27:9:3	Choose from Table 1	POM	Chose from Table 1	172 cores per forecast for 4 hrs 15 GB archive space per forecast
Stream 2.0 HWRF-NOAH LSM	NOAH LSM and 2011 Oper. Physics	POM	2011 Oper. Init w/ cycling	To be run on CCS
Stream 2.0 HWRF-Hybrid DA ⁺	2011 Oper. Physics	POM	2011 Oper. Init w/ cycling	172 cores per forecast for 4 hrs 15 GB archive space per forecast
Stream 2.0 HWRF-HYCOM (Global)	2011 Oper. Physics	HYCOM	2011 Oper. Init w/ cycling	232 cores per forecast for 4 hrs 30 GB archive space per forecast
Stream 2.0 HWRF 27:9:3 HYCOM	Modified Oper. Phys.	HYCOM	2011 Oper. Init w/ cycling	Development in Progress To be run on CCS or Vapor
Stream 2.0 HWRF 27:9:3 with SC and PBL	GFS Shallow Convection and PBL	POM/ HYCOM	2011 Oper. Init w/ cycling	Development in Progress To be run on CCS or Vapor
Stream 2.0 HWRF	Radiation & Microphysics	POM/ HYCOM	2011 Oper. Init w/ cycling	Development in Progress To be run on CCS or Vapor
Stream 2.0 HWRF 27:9:3 w/new init	2011 Oper. Phys	POM/ HYCOM	New Init w/ cycling	172 cores per forecast for 4 hrs 15 GB archive space per forecast
			Total	748 cores per forecast cycle 75 GB archive space per forecast

+Tagged to real-time GFS Hybrid DA Ensemble Runs on CCS or tJet

EMC Proposal for t-Jet Resources during 2011 Hurricane Season

Experiment	Resources
Stream 1.5* HWRF 27:9:3 One configuration run by EMC and another by HRD	200 cores per forecast for 4 hrs 15 GB archive space per forecast
Stream 2.0 HWRF-Hybrid DA; HWRF-HYCOM and HWRF-New Init	600 cores per forecast for 4 hrs 75 GB archive space per forecast
Development Work	600 cores 24/7 Allows us to fix and run missing/failed cycles and multiple storms

Issues:

- Data transfer for GFS forecasts
- Product Generation, Dissemination and Graphics
- Tier I and Tier II products for TCMT evaluation
- Model Diagnostics