2012 CAPS Spring Forecast Experiment Program Plan

May 15, 2012

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1. Overview of New Features for 2012 Season

Major changes from 2012:

- **WRF version 3.3.1** is used for 2012 season. (ARPS v5.3)
- **28** 4-km SSEF members initiated at 0000 UTC, running at NICS.
- 3 **COAMPS members**, including new 2-moment Milbrandt-Yau microphysics
- **New** CI and Lightning Threat algorithm (in ARW members)
- **Native reflectivity algorithm** from each microphysics scheme (contributed by Scott Dembek, Greg Thomson etc.)
- **Synthetic GOES (**GOES-13 **) IR** BTs (for GOES-R Proving Ground)
- Stochastic backscattering perturbations (**SKEB** - new in WRF v3.3)

2012 season uses the same model domain setting as in 2010 & 2011 seasons:

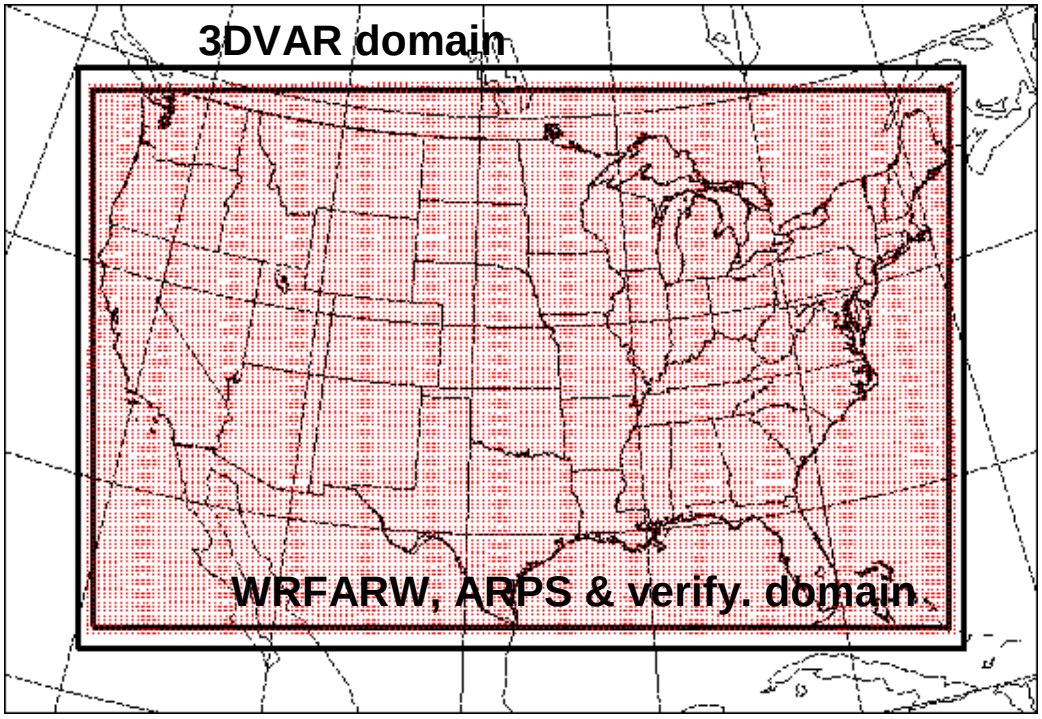

*Figure 1. Computational domains for the 2012 Season. The outer thick rectangular box represents the domain for performing 3DVAR (**Grid 1** – 1200×780). The red dot area represents the WRF-NMM domain (**Grid 2** – 790×999). The inner thick box is the domain for WRF-ARW, COAMPS, and ARPS and also for common verification (**Grid3** - 1160×720 at 4 km grid spacing).*

2. Program Duration

From **23 April 2012** through **8 June 2012**

The 2012 SPC/NSSL HWT Spring Experiment, a joint effort among NOAA Storm Prediction Center (SPC) and National Severe Storm Laboratory (NSSL) and the Center for Analysis and Prediction of Storms (CAPS) at University of Oklahoma, will officially **start on 7 May and end on 8 June**, with five days a week (Monday through Friday). CAPS 2012 Spring Program begins regular forecast production two weeks earlier on 23 April to identify possible issues and to provide training sample dates for QPF calibration, and remains five days a week (running forecasts on the night of Sunday through Thursday) with possible weekend runs upon SPC request according to weather circumstance.

Related program

CASA:

Starting April 1, 2012, to May 31, 2012

3. Multi-model Forecast System Configuration

Four NWP modeling systems, both WRF solvers, ARW and NMM, the Navy COAMPS model system, and the ARPS model system, are used in 2012 Spring Experiment. All forecasts use **51** vertical levels, though horizontal grids are different between ARW and NMM. WRF code (both cores) was modified by CAPS to allow initial hydrometeor fields generated from 3DVAR/ARPS Cloud analysis of WRS-88D radar reflectivity to pass into WRF initial condition, and (for ARW) to write out reflectivity field every 5 min. ARPS members have the same horizontal grid as WRF-ARW.

3.1 4-km grid storm-scale ensemble forecasts initialized at 00 UTC

SSEF forecasts are generated with both dynamical cores (solvers) of the Weather Research and Forecast (WRF) modeling system (**Version 3.3.1)**, the Advanced Research WRF (ARW) core and the operational NMM core, the Advanced Regional Prediction System (ARPS **v5.3**) developed by CAPS, University of Oklahoma, and the Navy COAMPS model**.** As in 2011 season, the 00Z NAM analyses available on the 12 km grid (218) are used for initialization of control and non-perturbed members and as first guess for initialization of perturbed members with the initial condition perturbations coming directly from the NCEP Short-Range Ensemble Forecast (SREF). WSR-88D data, along with available surface and upper air observations, are analyzed using ARPS 3DVAR/Cloud-analysis system, over the **Grid 1**. Forecast output at hourly intervals (higher time frequency output for a limited selection of 2D fields) are archived at the NICS mass storage (HPSS).

The *daily* ensemble forecast configuration includes the following, all of which are run on ***Kraken***, a Cray XT5 system with over 100,000 cores and one of NSF TeraGrid resources at NICS. CAPS SSEF forecasts use about 6,000 Kraken cores up to 6.5 overnight hours a day over the project period.

- ARW: 23-member ensemble at 4 km grid spacing over **Grid 3** initialized at 00 UTC. Model execution begins around 0130 UTC (8:30pm CDT) and finish in 6-8 hours, with results being processed as they become available. **Table 1** lists the configuration and physics options for each ARW member. All forecasts are 36 h, except stated specifically.
- NMM: A daily 36 h, 1-member NMM at about 4 km grid spacing over **Grid 2**, initialized at 00 UTC. **Table 2** lists the configuration and physics options for the NMM member.
- ARPS: 1-member ARPS forecasts at 4km grid spacing over **Grid 3**, initialized at 00 UTC. **Table 3** lists the configurations. Except the control member which has 36 h forecast, all other three are 18 h forecasts.
- COAMPS: 3-member COAMPS forecasts at 4-km grid spacing over **Grid 3**, initialized at 00 UTC. **Table 4** lists the configurations.

Table 1. Configurations for ARW members. NAMa and NAMf refer to 12 km NAM analysis and forecast, respectively. ARPSa refers to ARPS 3DVAR and cloud analysis.

Member	IC	BC	Radar data	Microphy	LSM	PBL
arw_cn	00Z ARPSa	00Z NAMf	yes	Thompson	Noah	MYJ
arw_c0 (18h)	00Z ARPSa	00Z NAMf	no	Thompson	Noah	MYJ
arw_m3	arw_cn + em-p1_pert	21Z SREF em-p1	yes	Morrison	RUC	YSU
arw_m4	arw_cn + nmm-n2_pert	21Z SREF nmm-n2	yes	Morrison	Noah	MYJ
arw_m5	arw_cn + em-n2_pert	21Z SREF em-n2	yes	Thompson	Noah	ACM2
arw_m6	arw_cn + rsm-n2_pert	21Z SREF rsm-n2	yes	M-Y	RUC	ACM2
arw_m7	arw_cn + nmm-p1_pert	21Z SREF nmm-p1	yes	WDM6	Noah	MYNN
arw_m8	arw_cn + rsm-p1_pert	21Z SREF rsm-p1	yes	WDM6	RUC	MYJ
arw_m9	arw_cn – etaKF-p1_pert	21Z SREF etaKF-p1	yes	M-Y	RUC	YSU
arw_m10	arw_cn + etaKF-n1_pert	21Z SREF etaKF-n1	yes	WDM6	Noah	QNSE
arw_m11	arw_cn – etaBMJ-p1_pert	21Z SREF etaBMJ-p1	yes	M-Y	Noah	MYNN
arw_m12	00Z ARPSa	00Z NAMf	yes	Thompson	Noah	MYNN
arw_m13	00Z ARPSa	00Z NAMf	yes	Thompson	Noah	ACM2

arw_m14	00Z ARPSa	00Z NAMf	yes	M-Y	Noah	MYJ
arw_m15	00Z ARPSa	00Z NAMf	yes	Morrison	Noah	MYJ
arw_m16	00Z ARPSa	00Z NAMf	yes	WDM6	Noah	MYJ
arw_m17	00Z ARPSa	00Z NAMf	yes	Thompson	Noah	QNSE
arw_m18	00Z ARPSa	00Z NAMf	yes	Thompson	Noah	YSU
arw_m19*	00Z ARPSa	00Z NAMf	yes	Thompson	Noah	MYJ
arw_m20*	arw_cn + em-p1_pert	21Z SREF em-p1	yes	Morrison	RUC	YSU
arw_m21*	arw_cn – rsm-n2_pert	21Z SREF rsm-n2	yes	M-Y	RUC	ACM2
arw_m22*	arw_cn + rsm-p1_pert	21Z SREF rsm-p1	yes	WDM6	RUC	MYJ
arw_m23*	arw_cn + etaKF-n1_pert	21Z SREF etaKF-n1	yes	WDM6	Noah	QNSE

Note 1: For all members: *ra_lw_physics*= RRTM; *ra_sw_physics*=Goddard; *cu_physics*=none
Note 2: Members with "*" are with SKEB option turned on.

Table 2. Configurations for each individual member with NMM core

member	IC	BC	Radar data	mp_phy	lw_phy	sw-phy	sf_phy
nmm_cn	00Z ARPSa	00Z NAMf	yes	Ferrier+	GFDL	GFDL	Noah

Note 1: For all members: *pbl_physics*=MYJ; *cu_physics*= NONE
Note 2: Ferrier+ refers to a subset of changes in the updated version now in NEMS/NMMB

Table 3. Configurations for each individual member with ARPS

member	IC	BC	Radar data	Microphy.	radiation	sf_phy
arps_cn	00Z ARPSa	00Z NAMf	yes	Lin	Chou/Suarez	Force-restore

* For all members: no cumulus parameterization

Table 4. Configurations for each individual member with COAMPS

member	IC	BC	Radar data	Microphy.	radiation	sf_phy

cmps_cn	00Z ARPSa	00Z NAMf	yes	Hobbs-Rutledge	-	-
cmps_c1	00Z ARPSa	00Z NAMf	yes	M-Y	-	-
cmps_c0 (18h)	00Z NAMa	00Z NAMf	no	Hobbs-Rutledge	-	-

* For all members: no cumulus parameterization

**** Members in red are contributing members for HWT (12 totals).**

3.2 4-km SSEF initialized at 12 UTC*

New in 2012 Spring Experiment, a second set of 15-member 4-km SSEF forecasts are produced locally on OSCER facility (*Boomer*), using the same configuration as 15 of SSEF members as initiated at 00 UTC. The forecast is initialized from 12 UTC and last 36 h. NAM 12 UTC analysis is used as the background and its forecasts are used to provide the LBCs.

These 16-members (see in Tables 1-3) are run at 12 UTC:
ARW: arw_cn, m3-m11, m12, m13, m17, m18
NMM: nmm_cn
ARPS: arps_cn

The same 12-member sub-ensemble are marked in red, as in 00 UTC.

**** This 12 UTC ensemble didn't run due to the new Boomer was not ready for the realtime SSEF.***

4. Logistics

- Up to 9000 NICS ***Kraken*** cores (750 nodes) are used for producing 00 UTC realtime 4-km ensemble forecasts.

- The ensemble forecasts are output every hour, and converted to ARPS grid in HDF4 format in high compression (on Grid 3). Hourly gridded output, in native WRF grids (ARPS grid for ARPS members, COAMPS format for COAMPS members), are archived at NICS HPSS mass storage for the 4 km ensemble runs. Data volume is close to 6 **TB** per day on ***Kraken*** luster system, while the HPSS archive data are roughly 60% the total size..

5. Forecast Product and Deliverables to HWT

5.1 Products available to HWT (NSSL/SPC, HPC) in GEMPAK

The NSSL/SPC required list of forecast fields for 2012 HWT Spring Experiment is listed in Table 5. Variables with field name underlined are hourly maximum. 56 total fields. The new fields GRAUP and HAIL are only available from certain microphysics schemes.

In order to keep realtime data flow into NSSL/SPC server low, the NSSL/SPC GEMPAK fields are over a sub-domain emphasizing the east part of the CONUS. Figure 3 is the desired sub-domain (860×690 grid points in horizontal). A complete set of extracted 2D fields (Table 7) over the full CONUS domain are archived by CAPS for post-analysis and external collaborations.

Two separate sets of variables are also packaged for NSSL/SPC: 1) composite reflectivity of every 15-min in the first 6 h of the forecasts with radar data analysis; 2) a 5-variable subset (P01M, VHEL, REFL1KM, VVELMAX, 15-min REFL1KM) in netcdf for radar data assimilation members.

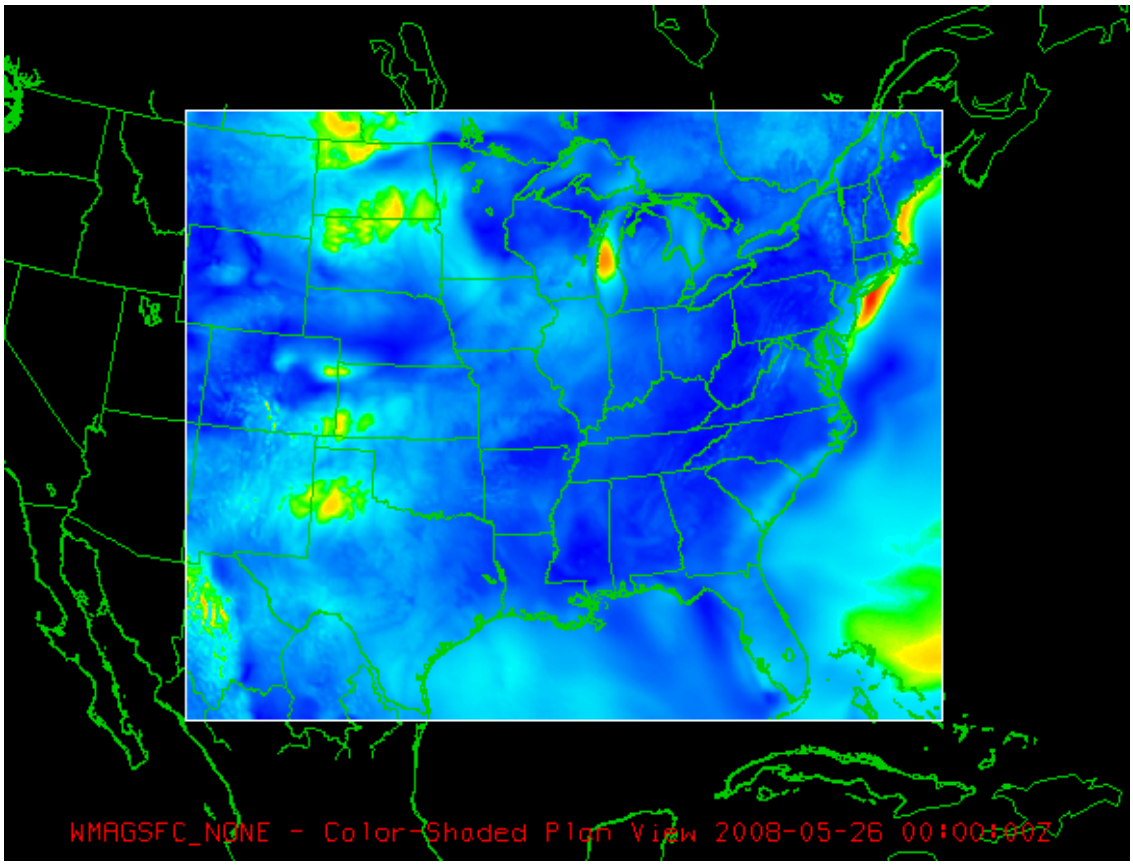

Figure 2. NSSL/SPC sub-domain for the GEMPAK dataset (850×690).

Table 5. 2D fields of each member for NSSL/SPC

Field	GEMPAK name	Unit	Type	Level
Surface pressure	PRES	hPa	Surface/single layer	0

Sea level pressure	PMSL	hPa	Surface/single layer	0
850-mb Z	HGHT	m	Surface/single layer	850
850-mb Temp	TMPC	C	Surface/single layer	850
850-mb mixing ratio	MIXR	g/kg	Surface/single layer	850
850-mb u-wind	UREL	m/s	Surface/single layer	850
850-mb v-wind	VREL	m/s	Surface/single layer	850
850-mb w-wind	VVEL	m/s	Surface/single layer	850
700-mb Z	HGHT	m	Surface/single layer	700
700-mb Temp	TMPC	C	Surface/single layer	700
700-mb mixing ratio	MIXR	g/kg	Surface/single layer	700
700-mb u-wind	UREL	m/s	Surface/single layer	700
700-mb v-wind	VREL	m/s	Surface/single layer	700
700-mb w-wind	VVEL	m/s	Surface/single layer	700
500-mb Z	HGHT	m	Surface/single layer	500
500-mb Temp	TMPC	C	Surface/single layer	500
500-mb mixing ratio	MIXR	g/kg	Surface/single layer	500
500-mb u-wind	UREL	m/s	Surface/single layer	500
500-mb v-wind	VREL	m/s	Surface/single layer	500
500-mb w-wind	VVEL	m/s	Surface/single layer	500
1-h precipitation	P01M	mm	Surface/single layer	0
Temperature at lowest model level	TMPF	F	Surface/single layer	0
Dew point at lowest model level	DWPF	F	Surface/single layer	0
10 m U	UREL	m/s	Surface/single layer	0

10 m V	VREL	m/s	Surface/single layer	0
Surface wind speed (10-m)	WMAGSFC	m/s	Surface/single layer	0
Wind speed (1-km)	WMAG1km	m/s	Surface/single layer	0
1 km AGL reflectivity	REFL1KM	dBZ	Surface/single layer	0
1 km AGL reflectivity	REFL1KM_HM	dBZ	Surface/single layer	0
*1 km AGL reflectivity - original	REFL1KM_ORG	dBZ	Surface/single layer	0
Composite reflectivity	REFLCMP	dBZ	Surface/single layer	0
*Composite reflectivity - original	REFLCMP_ORG	dBZ	Surface/single layer	0
Composite reflectivity	REFLCMP_HM	dBZ	Surface/single layer	0
Reflectivity at -10 C	REFLMTR	dBZ	Surface/single layer	0
CA count based on w, qr, qg	CA_WQQ	Time steps	Surface/single layer	0
CA count based on >35dBZ at -10°C	CA_REF	Time steps	Surface/single layer	0
Surface-based CAPE	CAPE	J/kg	Surface/single layer	0
Moist unstable CAPE	MUCAPE	J/kg	Surface/single layer	0
Surface-based CIN	CINS	J/kg	Surface/single layer	0
Moist unstable CIN	MUCINS	J/kg	Surface/single layer	0
Surface-based LCL	HLCL	m	Surface/single layer	0
0-1 km AGL SRH	SRH01	m^2/s^2	Surface/single layer	0
0-3 km AGL SRH	SRH03	m^2/s^2	Surface/single layer	0
Updraft helicity	VHEL	m^2/s^2	Surface/single layer	0
0-3 km Updraft helicity	VHEL3KM	m^2/s^2	Surface/single layer	0

Sfc-400 hPa max W	VVELMAX	m/s	Surface/single layer	0
0-1 km AGL wind shear	SHR01	1/s	Surface/single layer	0
0-6 km AGL wind shear	SHR06	1/s	Surface/single layer	0
Vertical-integrated Qg	COLQG	kg/ m^2	Surface/single layer	0
**Accumulated graupel	GRAUP	mm	Surface/single layer	0
***Accumulated hail	HAIL	mm	Surface/single layer	0
Accumulated hail (4-hr)	HAIL_4h	mm	Surface/single layer	0
Lightning Threat 3	LTG3_MAX	Flashes/km^2/5min	Surface/single layer	0
LFC Height	LFCH	m	Surface/single layer	0
PBL Height	PBLH	m	Surface/single layer	0
Vertical velocity at PBL top	WPBL	m/s	Surface/single layer	0
Simulated Satellite Ch. 10.67	SIMSAT1	??	Surface/single layer	0

Note 1: Simulated satellite BT: GOES-13 (GOES-13: 10.7um)
Note 2: Composite reflectivity – original: This variable would only be output from the microphysics members and is simply the composite reflectivity computed using the method from previous years. The purpose would be to gauge the impact/value of using the "correct" reflectivity calculation.
Note 3: Accumulated graupel is the graupel liquid equivalent surface accumulation and should be easily output as the variable "graupelnc" from the microphysics schemes Thompson, Morrison, Milbrandt-Yau, WSM6, and WDM6.
Note 4: Accumulated hail is analogous to accumulated graupel, but is only available from Milbrandt-Yau. The 4-h accumulated HAIL **for individual members** is not available for now.

Note 5: CA will also be output in text format. Basically, the time (at 5 minute intervals) and coordinates (i,j) of all grid-points that meet the CA criteria based on -10C reflectivity at any time step within 5 minute time windows will be output to a file.

5.2 Post-processed ensemble products in GEMPAK

A list of post-processed ensemble products are produced for NSSL/SPC for the 2012 HWT Spring Experiment (see Table 6). The 12 baseline ensemble members contribute to the products, they are:

arw_cn, arw_m3~m11	10-members
nmm_cn	1-members
arps_cn	1-member

The underlined variables refer to hourly (or 4-hr) maximum. Fields new for this year are shaded in blue. 96 total fields (there were 115 fields last year). This dataset is also available to DTC and HPC.

Table 6. Ensemble post-processed products for NSSL/SPC

Field	GEMPAK name	Unit	Type	Ens type
Sea level pressure	PMSL	hPa	Surface/single layer	Mean
850 hPa Z	HGHT850	m	Surface/single layer	Mean
500 hPa Z	HGHT500	m	Surface/single layer	Mean
250 hPa Z	HGHT250	m	Surface/single layer	Mean
850 hPa u-wind	UREL850	m/s	Surface/single layer	Mean
850 hPa v-wind	VREL850	m/s	Surface/single layer	Mean
250 hPa u-wind	UREL250	m/s	Surface/single layer	Mean
250 hPa v-wind	VREL250	m/s	Surface/single layer	Mean
500 hPa u-wind	UREL500	m/s	Surface/single layer	Mean
500 hPa v-wind	VREL500	m/s	Surface/single layer	Mean
500 hPa absolute vorticity	AVORT500	1/s	Surface/single layer	Mean
1-h precip	P01M_PM	mm	Surface/single layer	PM-mean
1-h precip	P01M_M	mm	Surface/single layer	Mean
1-h precip	P01M_MX	mm	Surface/single layer	Max
1-h precip $\geq$ 0.25 in	PR01MTH1_P	%	Surface/single layer	Prob
1-h precip $\geq$ 0.50 in	PR01MTH2_P	%	Surface/single layer	Prob
1-h precip $\geq$ 1.00 in	PR01MTH3_P	%	Surface/single layer	Prob
6-h precip	P06M_PM	mm	Surface/single layer	PM-mean
6-h precip	P06M_M	mm	Surface/single layer	Mean
6-h precip	P06M_MX	mm	Surface/single layer	Max
6-h precip $\geq$ 0.5-in	PR06MTH2_P	%	Surface/single layer	Prob
6-h precip $\geq$ 1.0-in	PR06MTH3_P	%	Surface/single layer	Prob

6-h precip ≥ 2.0-in	PR06MTH4_P	%	Surface/single layer	Prob
Lowest model level temp	TMPF	F	Surface/single layer	Mean
Lowest model level dew point	DWPF	F	Surface/single layer	Mean
precipitable water	PWAT	mm	Surface/single layer	Mean
10 m U	UREL	m/s	Surface/single layer	Mean
10 m V	VREL	m/s	Surface/single layer	Mean
1 km AGL reflectivity	REFL1KM	dBZ	Surface/single layer	PM-mean
1 km refl ≥ 40 dBZ	REFL1KMTH1_PN	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
4-hr max 1 km refl ≥ 40 dBZ	REFL1KM_4h_PN	dBZ	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Composite reflectivity	REFLCMP	dBZ	Surface/single layer	PM-mean
Comp refl ≥ 40 dBZ	REFLCMPTH1_PN	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Surface-based CAPE	CAPE	J/kg	Surface/single layer	Mean
sbCAPE ≥ 500	CAPE05	%	Surface/single layer	Prob
sbCAPE ≥ 1500	CAPE15	%	Surface/single layer	Prob
sbCAPE ≥ 3000	CAPE30	%	Surface/single layer	Prob
Surface-based CIN	CIN	J/kg	Surface/single layer	Mean
sbCIN < -100	CIN100	%	Surface/single layer	Prob
sbCIN < -50	CIN050	%	Surface/single layer	Prob
sbCIN < -25	CIN025	%	Surface/single layer	Prob
Surface-based LCL	HLCL	m	Surface/single layer	Mean
Max Updraft helicity	VHEL	m^2/s^2	Surface/single layer	Max
Updraft helicity ≥ 25 m^2/s^2	VHEL25	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Updraft helicity ≥ 50 m^2/s^2	VHEL50	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Updraft helicity ≥ 100 m^2/s^2	VHEL100	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Max Updraft helicity (4-hr)	VHEL_4h	m^2/s^2	Surface/single layer	Max
Updraft helicity (4-hr) ≥ 25 m^2/s^2	VHEL25_4h	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Updraft helicity (4-hr) ≥ 50 m^2/s^2	VHEL50_4h	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Updraft helicity(4-hr) ≥ 100 m^2/s^2	VHEL100_4h	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)

Max sfc-400 hPa W	VVELMAX	m/s	Surface/single layer	Max
Max sfc-400 hPa W ≥ 10 m/s	VVELMAX10	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Max sfc-400 hPa W ≥ 15 m/s	VVELMAX15	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Max 3-6 km W ≥ 20 m/s	VVELMAX20	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Max sfc-400 hPa W (4-hr)	VVELMAX_4h	m/s	Surface/single layer	Max
Max sfc-400 hPa W (4-hr) ≥ 10 m/s	VVELMAX10_4h	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Max sfc-400 hPa W (4-hr) ≥ 15 m/s	VVELMAX15_4h	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Max 3-6 km W (4-hr) ≥ 20 m/s	VVELMAX20_4h	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
0-3 km Updraft helicity	VHEL3KM	m^2/s^2	Surface/single layer	Max
0-3 km Updraft helicity (4-hr)	VHEL3KM_4h	m^2/s^2	Surface/single layer	Max
Accumulated graupel	GRAUP	mm	Surface/single layer	Max
Accumulated graupel (4-hr)	GRAUP_4h	mm	Surface/single layer	Max
0-1 km AGL wind shear	SHR01	1/s	Surface/single layer	Mean
0-1 km AGL wind shear ≥ 10 m/s	SHR01_10	%	Surface/single layer	Prob
0-1 km AGL wind shear ≥ 15 m/s	SHR01_15	%	Surface/single layer	Prob
0-1 km AGL wind shear ≥ 20 m/s	SHR01_20	%	Surface/single layer	Prob
0-6 km AGL wind shear	SHR06	1/s	Surface/single layer	Mean
0-6 km AGL wind shear ≥ 15 m/s	SHR06_15	%	Surface/single layer	Prob
0-6 km AGL wind shear ≥ 20 m/s	SHR06_20	%	Surface/single layer	Prob
0-6 km AGL wind shear ≥ 25 m/s	SHR06_25	%	Surface/single layer	Prob
Vertical-integrated Qg	COLQG	kg/ m^2	Surface/single layer	Max
Vertical-integrated Qg ≥ 20	COLQG20	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Vertical-integrated Qg ≥ 30	COLQG30	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Vertical-integrated Qg ≥ 40	COLQG40	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Vertical-integrated Qg (4-hr)	COLQG_4h	kg/ m^2	Surface/single layer	Max
Vertical-integrated Qg (4-hr) ≥ 20	COLQG20_4h	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Vertical-integrated Qg (4-hr) ≥ 30	COLQG30_4h	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)

Vertical-integrated Qg (4-hr) ≥ 40	COLQG40_4h	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Wind speed (1-km)	WMAG1km	m/s	Surface/single layer	Max
Wind speed (1-km) (4-h)	WMAG1km_4h	m/s	Surface/single layer	Max
Surface wind speed (10-m)	WMAGSFC	m/s	Surface/single layer	Max
Surface wind speed (10-m) ≥ 15 m/s	WMAGSFC15	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Surface wind speed (10-m) ≥ 20 m/s	WMAGSFC20	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Surface wind speed (10-m) ≥ 25 m/s	WMAGSFC25	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Surface wind speed (10-m) (4-hr)	WMAGSFC_4h	m/s	Surface/single layer	Max
Surface wind speed (10-m) (4-hr) ≥ 15 m/s	WMAGSFC15_4h	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Surface wind speed (10-m) (4-hr) ≥ 20 m/s	WMAGSFC20_4h	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Surface wind speed (10-m) (4-hr) ≥ 25 m/s	WMAGSFC25_4h	%	Surface/single layer	Prob-neighbor (ROI=40, sigma=10)
Significant Tornado Parameter ≥ 1	SIGTOR1	%	Surface/single layer	Prob
Significant Tornado Parameter ≥ 3	SIGTOR3	%	Surface/single layer	Prob
Significant Tornado Parameter ≥ 5	SIGTOR5	%	Surface/single layer	Prob
Supercell Comp. Parameter ≥ 1	SCP1	%	Surface/single layer	Prob
Supercell Comp. Parameter ≥ 3	SCP3	%	Surface/single layer	Prob
Supercell Comp. Parameter ≥ 9	SCP9	%	Surface/single layer	Prob
IR Brightness Temp. ≤ -32C	BTN32	%	Surface/single layer	Prob
IR Brightness Temp. ≤ -52C	BTN52	%	Surface/single layer	Prob

5.3 Products that will be extracted and archived as 2D HDF4 files

Table 7 lists the 2D fields that are produced and archived in HDF4 format over the full domain for each ensemble member as well as the 1km forecast.

Table 7. 2D fields archived for CAPS post-analysis

Field	Variable name	Variable ID	Unit	Type	Level
Surface pressure	PRES	sfpres	hPa	Surface/single layer	0
Sea level pressure	PMSL	mspres	hPa	Surface/single layer	0
1-h precipitation	P01M	accppt	mm	Surface/single layer	0

Precipitable water	PWAT	pwat__	mm	Surface/single layer	0
2 m temperature	TMPF	temp2m	F	Surface/single layer	0
2 m dew point	DWPF	dewp2m	F	Surface/single layer	0
2 m mixing ratio	MIXR	qv2m__	g/kg	Surface/single layer	0
1st level temperature	TMPF	tempk2	F	Surface/single layer	0
1st level dew point	DWPF	dewpk2	F	Surface/single layer	0
1st level mixing ratio	MIXR	qvk2__	g/kg	Surface/single layer	0
10 m U	UREL	u10m__	m/s	Surface/single layer	0
10 m V	VREL	v10m__	m/s	Surface/single layer	0
Surface wind speed (10-m)	WMAGSFC	wspmax	m/s	Surface/single layer	0
Wind speed (1-km)	WMAG1KM	wsp1km	m/s	Surface/single layer	0
Surface geo- height	HGHT	hgtsfc	m	Surface/single layer	0
1 km AGL reflectivity	REFL1KM	ref1km	dBZ	Surface/single layer	0
1 km AGL reflectivity	REFL1KM_HM	refmax	dBZ	Surface/single layer	0
4 km AGL reflectivity	REFL4KM	ref4km	dBZ	Surface/single layer	0
Composite reflectivity	REFLCMP	cmpref	dBZ	Surface/single layer	0
Composite reflectivity - original	REFLCMP_ORG	crefod	dBZ	Surface/single layer	0
1 km AGL reflectivity - original	REFL1KM_ORG	rf1kod	dBZ	Surface/single layer	0
Composite reflectivity	REFLCMP_HM	crefmx	dBZ	Surface/single layer	0
Reflectivity at -10C	REFLMTR	r10cmx	dBZ	Surface/single layer	0
Surface-based CAPE	CAPE	sbcape	J/kg	Surface/single layer	0
Moist unstable CAPE	MUCAPE	mucape	J/kg	Surface/single layer	0
Surface-based CIN	CINS	sbcins	J/kg	Surface/single layer	0
Moist unstable CIN	MUCINS	mucins	J/kg	Surface/single layer	0
Surface-based LCL	HLCL	sblcl_	m	Surface/single layer	0
0-1 km AGL SRH	SRH01	srh01_	m^2/s^2	Surface/single layer	0
0-3 km AGL SRH	SRH03	srh03_	m^2/s^2	Surface/single layer	0

Updraft helicity	VHEL	uh_max	m^2/s^2	Surface/single layer	0
0-3km Updraft helicity	VHEL3KM	uh03mx	m^2/s^2	Surface/single layer	0
Sfc-400hPa max W	VVELMAX	wupmax	m/s	Surface/single layer	0
Sfc-400hPa min W	VVELMIN	wdnmax	m/s	Surface/single layer	0
0-1 km AGL wind shear	SHR01	shr01_	1/s	Surface/single layer	0
0-6 km AGL wind shera	SHR06	shr06_	1/s	Surface/single layer	0
1-h accumulated graupel	GRAUP	grpl01	mm	Surface/single layer	0
1-h accumulated hail	HAIL	hail01	mm	Surface/single layer	0
Bunkers right-moving U	BKU	bku___	m/s	Surface/single layer	0
Bunkers right-moving V	BKV	bkv___	m/s	Surface/single layer	0
Echo top (>= 18 dBZ)	ECHOTOP	echotp	km	Surface/single layer	0
Vertical-integrated Qg	COLQG	cqgmax	kg/ m^2	Surface/single layer	0
100 m U	U100M	u100m_	m/s	Surface/single layer	0
100 m V	V100M	v100m_	m/s	Surface/single layer	0
Sfc downward radiation flux	RADDN	raddn_	W/ m^2	Surface/single layer	0
Qt above surface	QTSFC	qtsfc_	g/kg	Surface/single layer	0
500 hPa absolute vorticity	VORT500	vrt500	1/s	Surface/single layer	0
Lightning threat 3	LTG3_MAX	lg3max	Flashes/km^2/5 min	Surface/single layer	0
CA count based on w, qr, qg	NCA_WQQ	nca_wq	Time steps	Surface/single layer	0
CA count based on >35dBZ at -10°C	NCA_REF	ncaref	Time steps	Surface/single layer	0
LFC height	LFCH	lfch__	m	Surface/single layer	0
PBL height	PBLH	pblh__	m	Surface/single layer	0
W at PBL top	WPBL	wpbl__	m/s	Surface/single layer	0
Simulated satellite Ch 10.67 CRTM	SIMSAT1	btch01	K	Surface/single layer	0
Simulated satellite Ch 10.67 CIRA	SIMSAT1	crbt01	K	Surface/single layer	0
Geopotential height 850	HGHT	hgt850	m	pressure	850 hPa
Geopotential height 700	HGHT	hgt700	m	pressure	700 hPa

Geopotential height 600	HGHT	hgt600	m	pressure	600 hPa
Geopotential height 500	HGHT	hgt500	m	pressure	500 hPa
Geopotential height 250	HGHT	hgt250	m	pressure	250 hPa
850 hPa U	UREL	u850__	m/s	pressure	850 hPa
700 hPa U	UREL	u700__	m/s	pressure	700 hPa
600 hPa U	UREL	u600__	m/s	pressure	600 hPa
500 hPa U	UREL	u500__	m/s	pressure	500 hPa
250 hPa U	UREL	u250__	m/s	pressure	250 hPa
850 hPa V	VREL	v850__	m/s	pressure	850 hPa
700 hPa V	VREL	v700__	m/s	pressure	700 hPa
600 hPa V	VREL	v600__	m/s	pressure	600 hPa
500 hPa V	VREL	v500__	m/s	pressure	500 hPa
250 hPa V	VREL	v250__	m/s	pressure	250 hPa
850 hPa W	VVEL	w850__	m/s	pressure	850 hPa
700 hPa W	VVEL	w700__	m/s	pressure	700 hPa
600 hPa W	VVEL	w600__	m/s	pressure	600 hPa
500 hPa W	VVEL	w500__	m/s	pressure	500 hPa
250 hPa W	VVEL	w250__	m/s	pressure	250 hPa
850 hPa T	TMPC	tmp850	C	pressure	850 hPa
700 hPa T	TMPC	tmp700	C	pressure	700 hPa
600 hPa T	TMPC	tmp600	C	pressure	600 hPa
500 hPa T	TMPC	tmp500	C	pressure	500 hPa
250 hPa T	TMPC	tmp250	C	pressure	250 hPa
850 hPa mixing ratio	MIXR	sph850	g/kg	pressure	850 hPa
700 hPa mixing ratio	MIXR	sph700	g/kg	pressure	700 hPa
600 hPa mixing ratio	MIXR	sph600	g/kg	pressure	600 hPa
500 hPa mixing ratio	MIXR	sph500	g/kg	pressure	500 hPa
250 hPa mixing ratio	MIXR	sph250	g/kg	pressure	250 hPa

5.4 Name convention

SPC/NSSL file name	*CAPS web name*
ARW members:	
ssef_s4cn_arw_2012041500	SPC4-EF CN WRFARW Fcst
ssef_s4c0_arw_2012041500	SPC4-EF C0 WRFARW Fcst
ssef_s4m3_arw_2012041500	SPC4-EF M3 WRFARW Fcst
ssef_s4m4_arw_2012041500	SPC4-EF M4 WRFARW Fcst
ssef_s4m5_arw_2012041500	SPC4-EF M5 WRFARW Fcst
ssef_s4m6_arw_2012041500	SPC4-EF M6 WRFARW Fcst
ssef_s4m7_arw_2012041500	SPC4-EF M7 WRFARW Fcst
ssef_s4m8_arw_2012041500	SPC4-EF M8 WRFARW Fcst
ssef_s4m9_arw_2012041500	SPC4-EF M9 WRFARW Fcst
ssef_s4m10_arw_2012041500	SPC4-EF M10 WRFARW Fcst
ssef_s4m11_arw_2012041500	SPC4-EF M11 WRFARW Fcst
ssef_s4m12_arw_2012041500	SPC4-EF M12 WRFARW Fcst
ssef_s4m13_arw_2012041500	SPC4-EF M13 WRFARW Fcst
ssef_s4m14_arw_2012041500	SPC4-EF M14 WRFARW Fcst
ssef_s4m15_arw_2012041500	SPC4-EF M15 WRFARW Fcst
ssef_s4m16_arw_2012041500	SPC4-EF M16 WRFARW Fcst
ssef_s4m17_arw_2012041500	SPC4-EF M17 WRFARW Fcst
ssef_s4m18_arw_2012041500	SPC4-EF M18 WRFARW Fcst
ssef_s4m19_arw_2012041500	SPC4-EF M19 WRFARW Fcst
ssef_s4m20_arw_2012041500	SPC4-EF M20 WRFARW Fcst

ssef_s4m21_arw_2012041500 SPC4-EF M21 WRFARW Fcst

ssef_s4m22_arw_2012041500 SPC4-EF M22 WRFARW Fcst

ssef_s4m23_arw_2012041500 SPC4-EF M23 WRFARW Fcst

NMM members:

ssef_s4cn_nmm_2012041500 SPC4-EF CN WRFNMM Fcst

ARPS members:

ssef_arps_cn_2012041500 SPC4-EF CN ARPS Fcst

COAMPS members:

ssef_cmps_cn_2012041500 SPC4-EF CN COAMPS Fcst

ssef_cmps_c0_2012041500 SPC4-EF C0 COAMPS Fcst

ssef_cmps_c1_2012041500 SPC4-EF C1 COAMPS Fcst

Ensemble summary product:

ssef_s4ens_2010043000 (12-member)

6. Task List

Appendix

A.1 WRF-ARW timing

A.2 WRF-NMM timing

A.3 ARPS timing

A.4 COAMPS timing

A.5 List of SREF members (Old)

16 perturbed members:
sref_em_n1
sref_em_p1
sref_em_n2
sref_em_p2
sref_nmm_n1
sref_nmm_p1
sref_nmm_n2
sref_nmm_p2
sref_eta_n1 (etaKF)
sref_eta_p1 (etaKF)
sref_eta_n2 (etaBMJ)
sref_eta_p2 (etaBMJ)
sref_rsm_n1 (SAS – Ferrier MP)
sref_rsm_p1 (SAS – Ferrier MP)
sref_rsm_n2 (RAS – Zhao MP)
sref_rsm_p2 (RAS – Zhao MP)

5 control members:
sref_em_ctl (WRF-ARW)
sref_nmm_ctl (WRF-NMM)
sref_eta_ctl1
sref_eta_ctl2
sref_rsm_ctl1

A.6 List of SREF members (New – beginning April? 2012)
18 perturbed members:

sref_em_n1
sref_em_p1
sref_em_n2
sref_em_p2
sref_em_n3
sref_em_p3
sref_nmb_n1
sref_nmb_p1
sref_nmb_n2
sref_nmb_p2
sref_nmb_n3
sref_nmb_p3
sref_nmm_n1
sref_nmm_p1
sref_nmm_n2
sref_nmm_p2
sref_nmm_n3
sref_nmm_p3
sref_nmb_n2
sref_nmb_p2

3 control members:
sref_em_ctl (WRF-ARW)
sref_nmm_ctl (WRF-NMM)
sref_nmb_ctl (NMMB)