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EMC Change Control Board (CCB) meeting for SREF.v7.0.0 (Q3FY15)

Jun Du, Geoff DiMego, Dusan Javic, Brad Ferrier, Bo Yang

March 23, 2015

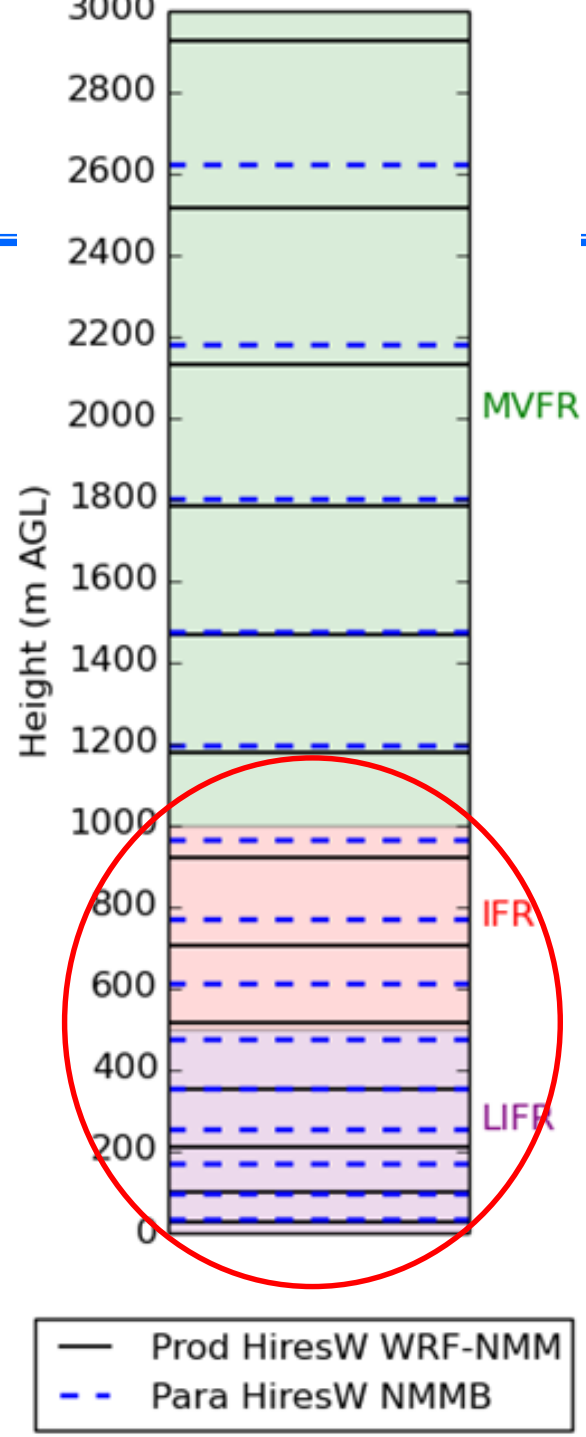
Science

Major Changes

1. 3 model core system becomes 2 model core system (NMMB, WRF_ARW, WRF_NMM)
2. Vertical resolution is increased from 35 to 40 layers (horizontal resolution remains the same of 16km)
3. Ensemble membership is increased from 21 to 26 members
4. IC diversity is enhanced: (a) mix use of multi analyses (NDAS, GFS and RAP) for each model core, and (b) blending of GEFS and SREF IC perturbations for all members
5. Physics diversity is enhanced: (a) more variety of physics schemes, and (b) stochastic flavor in physics parameters (GWD and soil moisture)
6. Others: name change from em to ARW; individual member ID in pgrb files etc.

Vertical level increase

- As for HiResWindow displayed here (35-40), adding vertical levels to SREF members will improve models' ability to distinguish ceiling heights at boundaries between critical flight categories



Physics schemes in 13 NMMB members

Physics 1: NAM1, NAM2, GFS

Micro/Physics 2: Fer_hires/Fer, GFS, WSM6, Thompson

Mod-Mem	IC	IC pert	LBCs	Physics 1			Physics 2		GWD	Land Surface		
				Conv	**PBL**	**Sfc layer**	**Microphys**	**LW, SW Rad**	**cleffamp**	**LSM**	**Initial**	**Soil pert?**
nmmb_ctl	**NDAS**	Blending (GEFS + SREF)	GFS	BMJ old shal	MYJ	MYJ	Fer_hires	RRTM	**cleffamp=1**	Noah	NAM	no
nmmb_n1			GEFS 2	SAS	GFS	MYJ	WSM6	GFDL	**cleffamp=0.5**	Noah	NAM	no
nmmb_p1			GEFS 1	BMJ new shal	MYJ	MYJ	~~GFS~~ Fer_hires	RRTM	**cleffamp=2**	Noah	NAM	no
nmmb_n2			GEFS 4	SAS	GFS	MYJ	~~Fer~~ Fer_hires	GFDL	**cleffamp=1**	Noah	NAM	Drier soil
nmmb_p2			GEFS 3	BMJ old shal	MYJ	MYJ	~~Thompson~~ WSM6	RRTM	**cleffamp=0.5**	Noah	NAM	Drier soil
nmmb_n3	**GFS**	Blending (GEFS + SREF)	GEFS 6	SAS	GFS	MYJ	Fer_hires	GFDL	**cleffamp=2**	Noah	NAM	Drier soil
nmmb_p3			GEFS 5	BMJ new shal	MYJ	MYJ	WSM6	RRTM	**cleffamp=1**	Noah	NAM	Drier soil
nmmb_n4			GEFS 8	SAS	GFS	MYJ	~~Thompson~~ WSM6	RRTM	**cleffamp=0.5**	Noah	NAM	no
nmmb_p4			GEFS 7	BMJ old shal	MYJ	MYJ	~~GFS~~ Fer_hires	GFDL	**cleffamp=2**	Noah	NAM	no
nmmb_n5	**RAP**	Blending (GEFS + SREF)	GEFS 10	SAS	GFS	MYJ	~~GFS~~ WSM6	RRTM	**cleffamp=1**	Noah	NAM	Drier soil
nmmb_p5			GEFS 9	BMJ new shal	MYJ	MYJ	~~Thompson~~ Fer_hires	RRTM	**cleffamp=0.5**	Noah	NAM	Drier soil
nmmb_n6			GEFS 12	SAS	GFS	MYJ	Fer_hires	GFDL	**cleffamp=2**	Noah	NAM	no
nmmb_p6			GEFS 11	BMJ old shal	MYJ	MYJ	WSM6	GFDL	**cleffamp=1**	Noah	NAM	no

Physics schemes in 13 ARW members

Physics 1: NCAR, NAM, RAP

Micro/Physics 2: WSM6, Fer, Thompson

Mod-Mem	IC	IC pert	LBCs	Physics 1			Physics 2				Land surface		
				Conv	**PBL**	**Sfc layer**	**Microphy**	**LW Rad**	**SW Rad**	**Stochastic**	**LSM**	**Initial**	**Soil pert?**
arw_ctl	RAP	Blending (GEFS + SREF)	GFS	KF	YSU	MM5	WSM6	RRTMG	RRTMG	no	Noah	NAM	no
arw_n1			GEFS 14	BMJ	MYJ	MYJ	Fer	GFDL	GFDL	no	Noah	NAM	Drier soil
arw_p1			GEFS 13	Grell	MYNN	MYNN	Thompson	Old RRTM	GSFC	no	~~RUC~~ Noah	NAM	no
arw_n2			GEFS 16	KF	YSU	MM5	Fer	GFDL	GFDL	no	~~RUC~~ Noah	NAM	Drier soil
arw_p2			GEFS 15	BMJ	MYJ	MYJ	Thompson	RRTMG	RRTMG	no	Noah	NAM	no
arw_n3	GFS	Blending (GEFS + SREF)	GEFS 18	Grell	MYNN	MYNN	WSM6	RRTMG	RRTMG	no	Noah	NAM	Drier soil
arw_p3			GEFS 17	KF	YSU	MM5	Thompson	Old RRTM	GSFC	no	Noah	NAM	no
arw_n4			GEFS 20	BMJ	MYJ	MYJ	WSM6	RRTMG	RRTMG	no	~~RUC~~ Noah	NAM	no
arw_p4			GEFS 19	KF	YSU	MM5	Fer	GFDL	GFDL	no	Noah	NAM	Drier soil
arw_n5	NDAS	Blending (GEFS + SREF)	GEFS 2	Grell	MYNN	MYNN	Fer	GFDL	GFDL	no	Noah	NAM	no
arw_p5			GEFS 1	KF	YSU	MM5	WSM6	RRTMG	RRTMG	no	~~RUC~~ Noah	NAM	Drier soil
arw_n6			GEFS 4	BMJ	MYJ	MYJ	Thompson	Old RRTM	GSFC	no	Noah	NAM	Drier soil
arw_p6			GEFS 3	Grell	MYNN	MYNN	Thompson	RRTMG	RRTMG	no	~~RUC~~ Noah	NAM	no

Intended improvements with three goals

- (1) Reduce surface temperature cold bias and moisture wet biase (as well as precipitation dry bias for NMMB and precipitation wet bias for ARW)

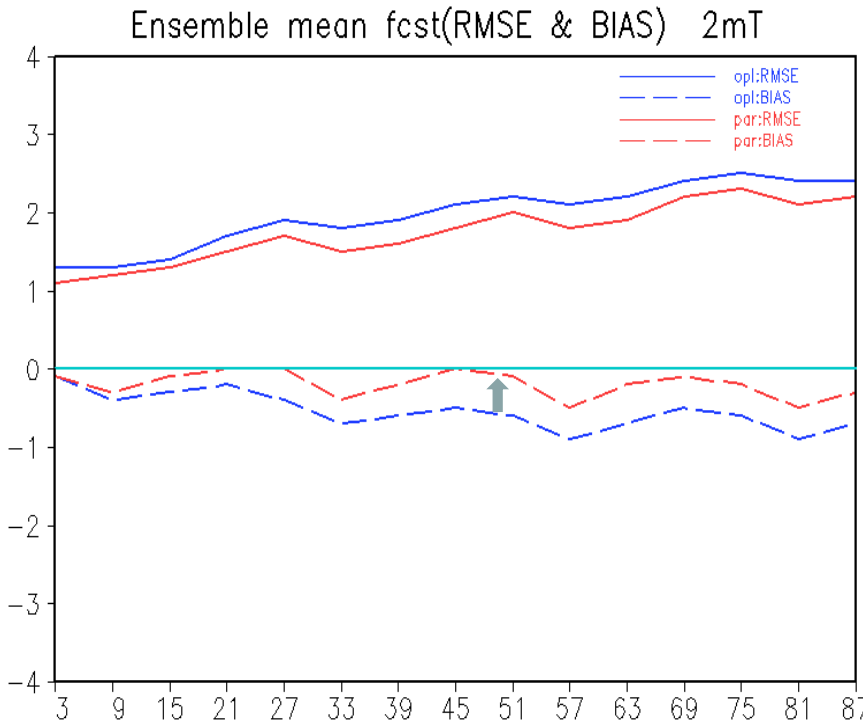
- (2) Increase spread especially ARW members

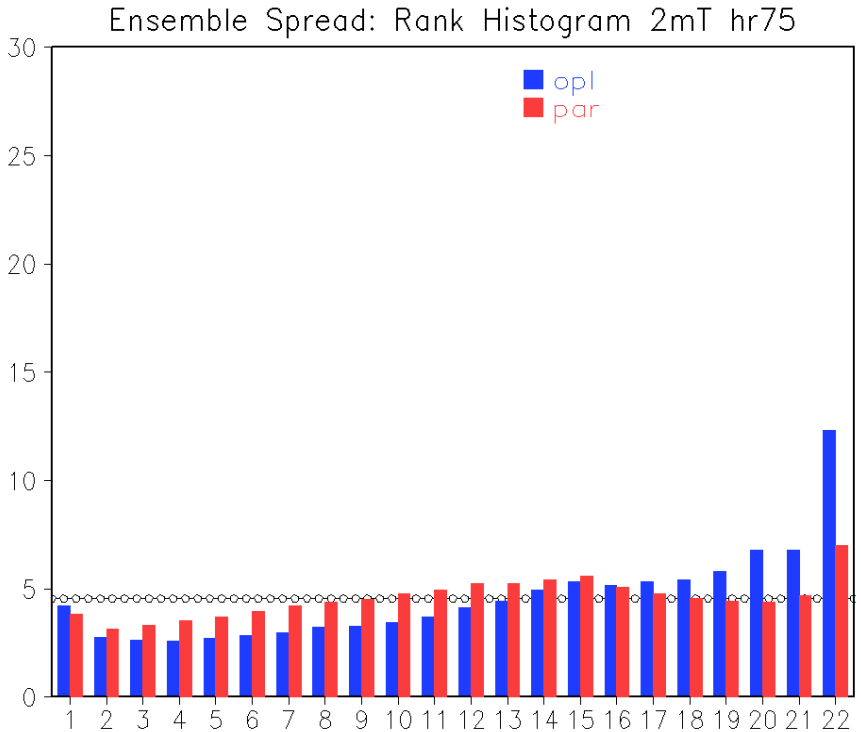
- (3) Improve overall probabilistic forecasts

Goal #1

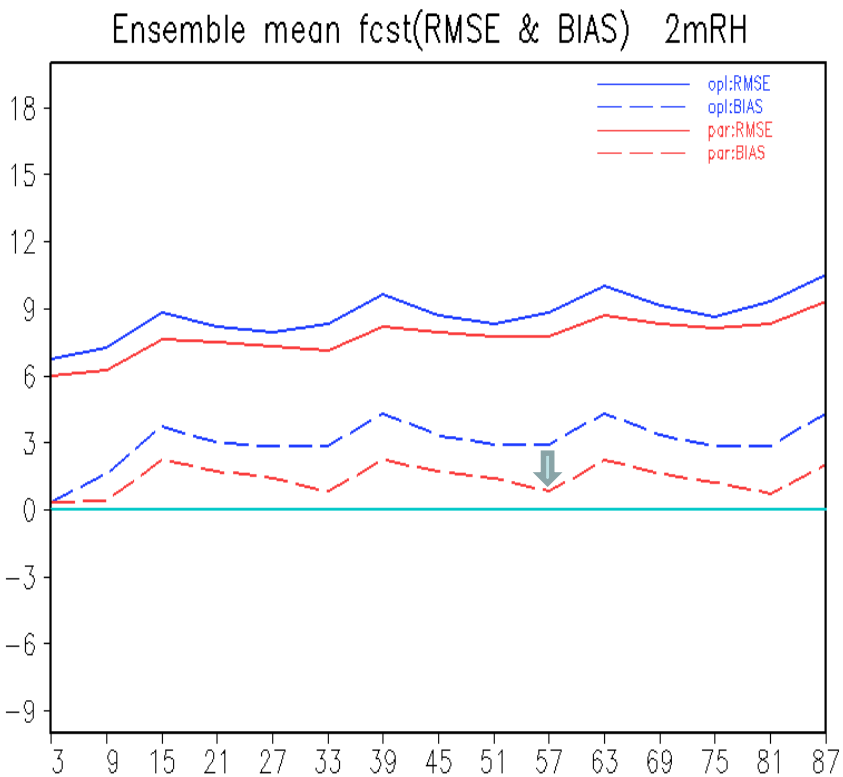
Reduce surface temperature cold bias and moisture wet bias (as well as precipitation dry bias for NMMB and precipitation wet bias for ARW members)

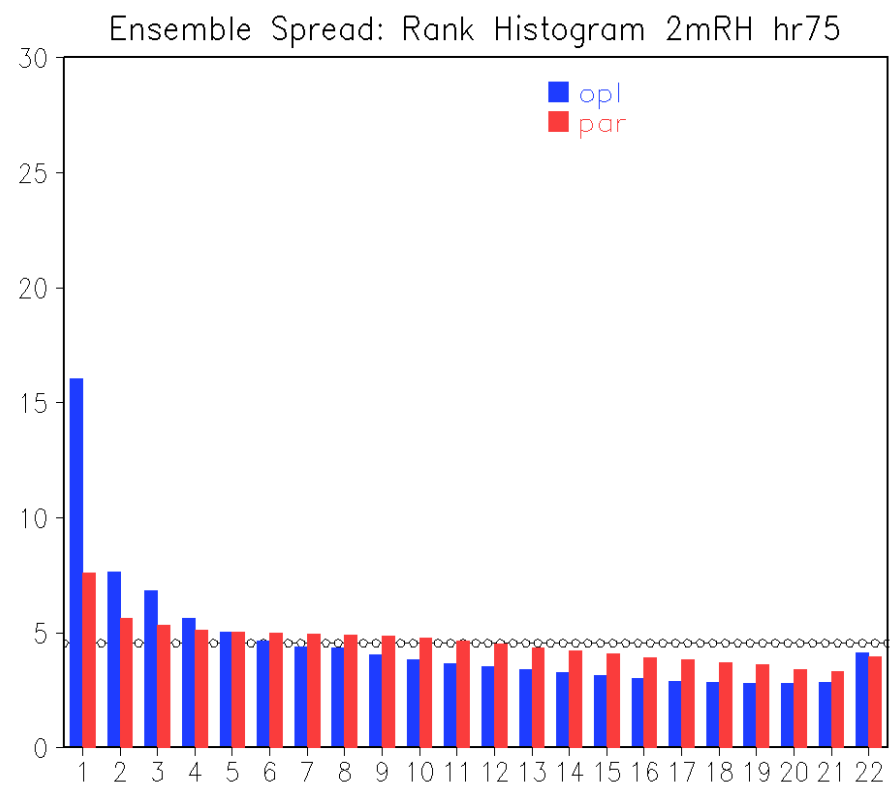
Much reduced cold bias in 2mT (Oct. 2014 – March 2015)



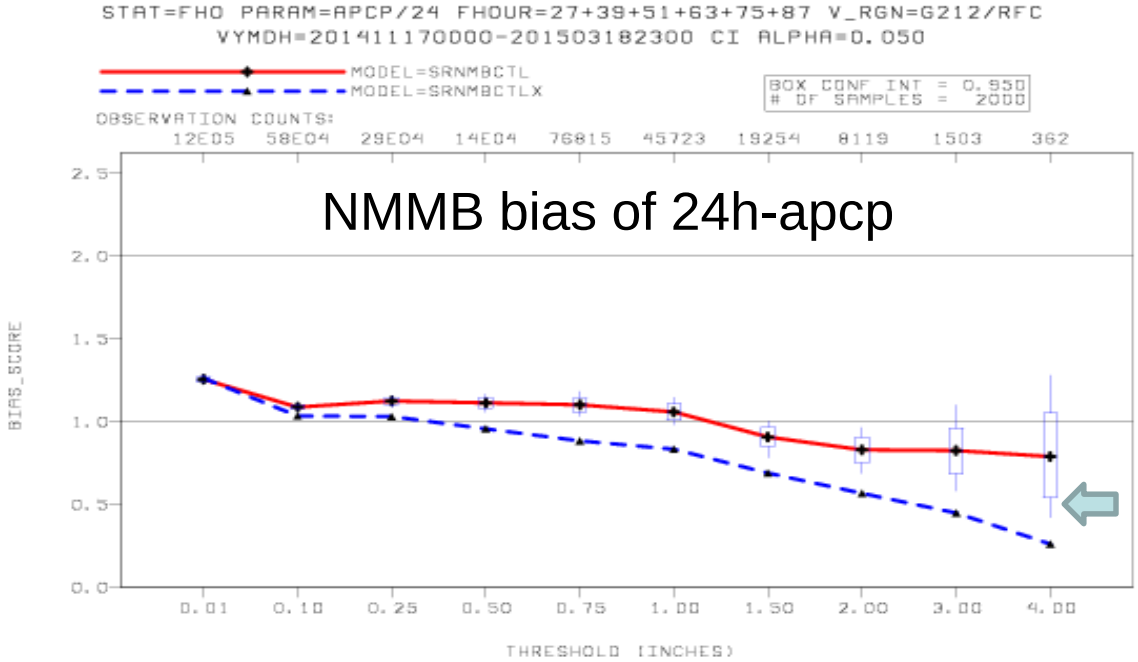


Much reduced wet bias in 2mRH (Oct. 2014 – March 2015)

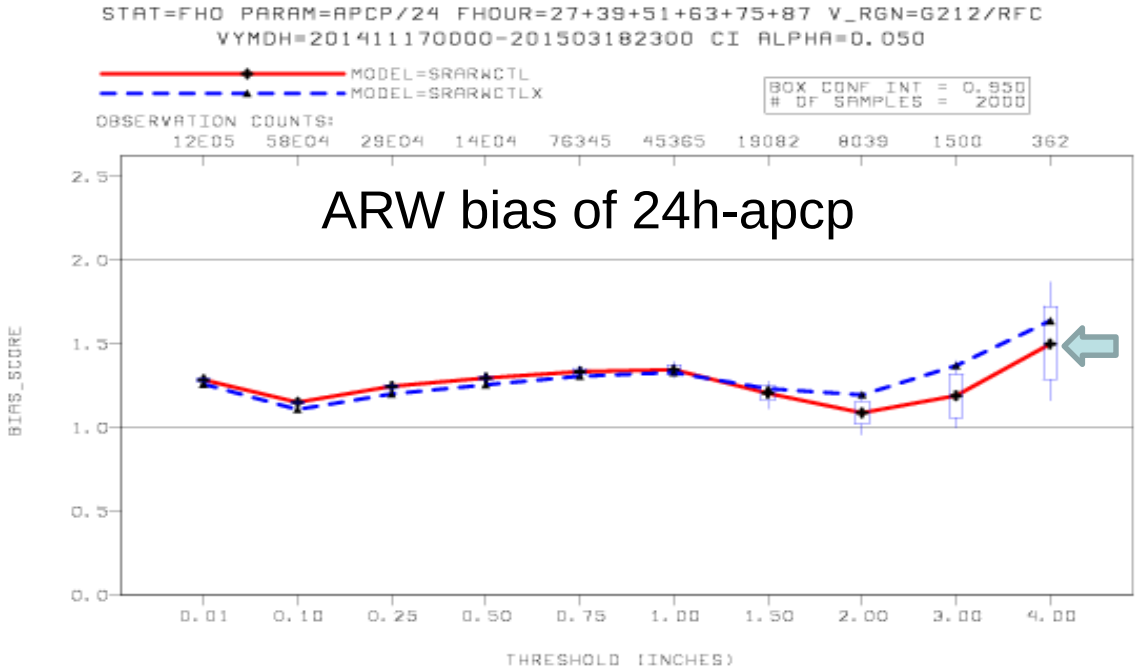




11/17/2014 – 03/18/2015



NMMB dry bias mostly reduced but still exists at heavy rain end

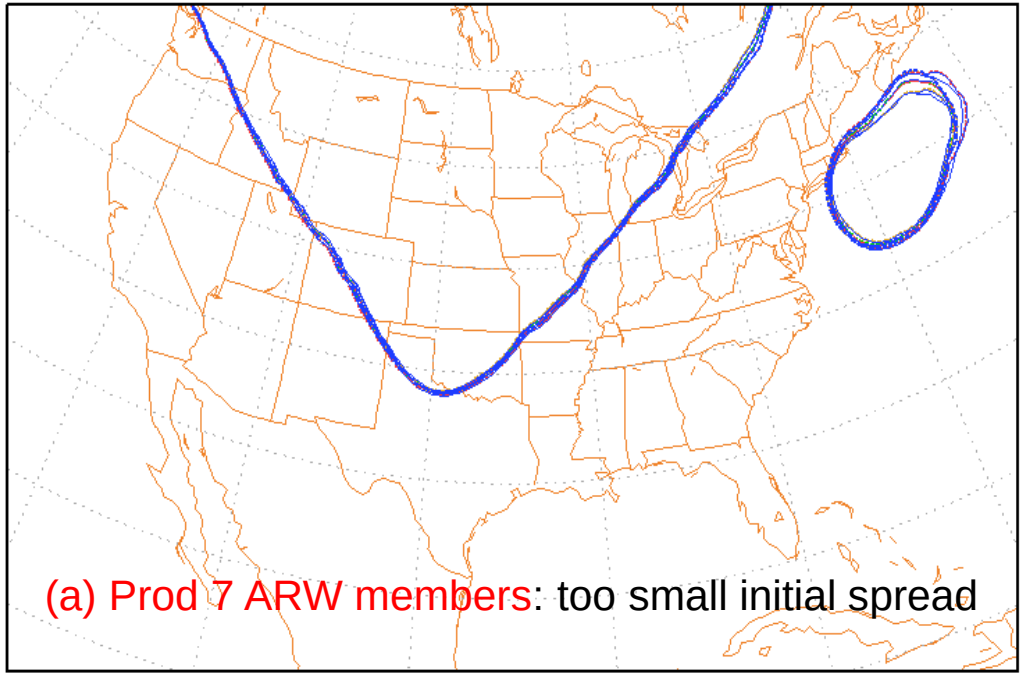


ARW wet bias slightly reduced but still prevails for all categories of rain

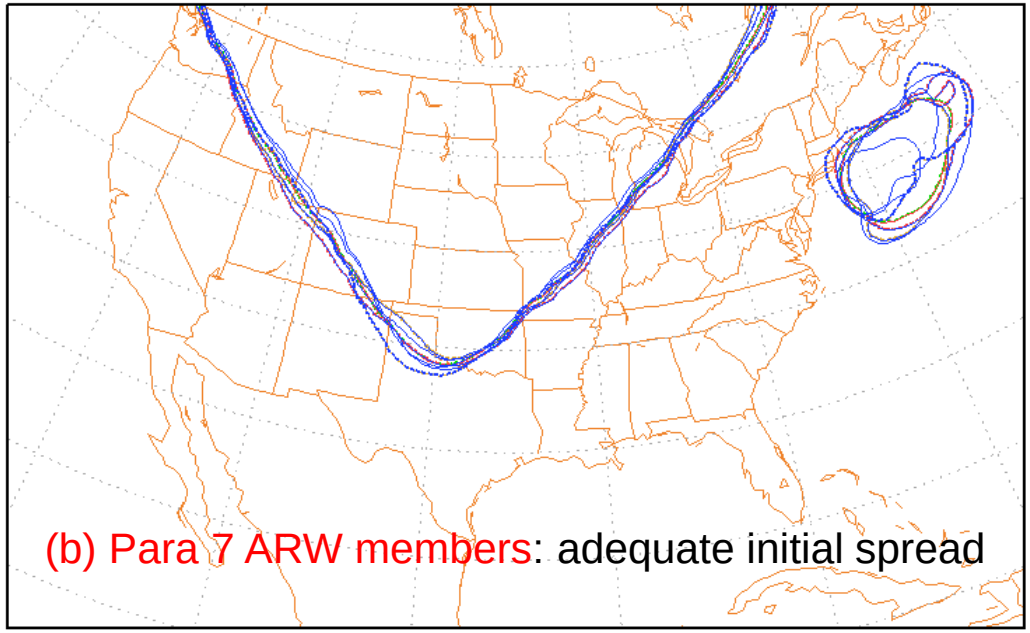
Goal #2

Increase spread especially ARW members

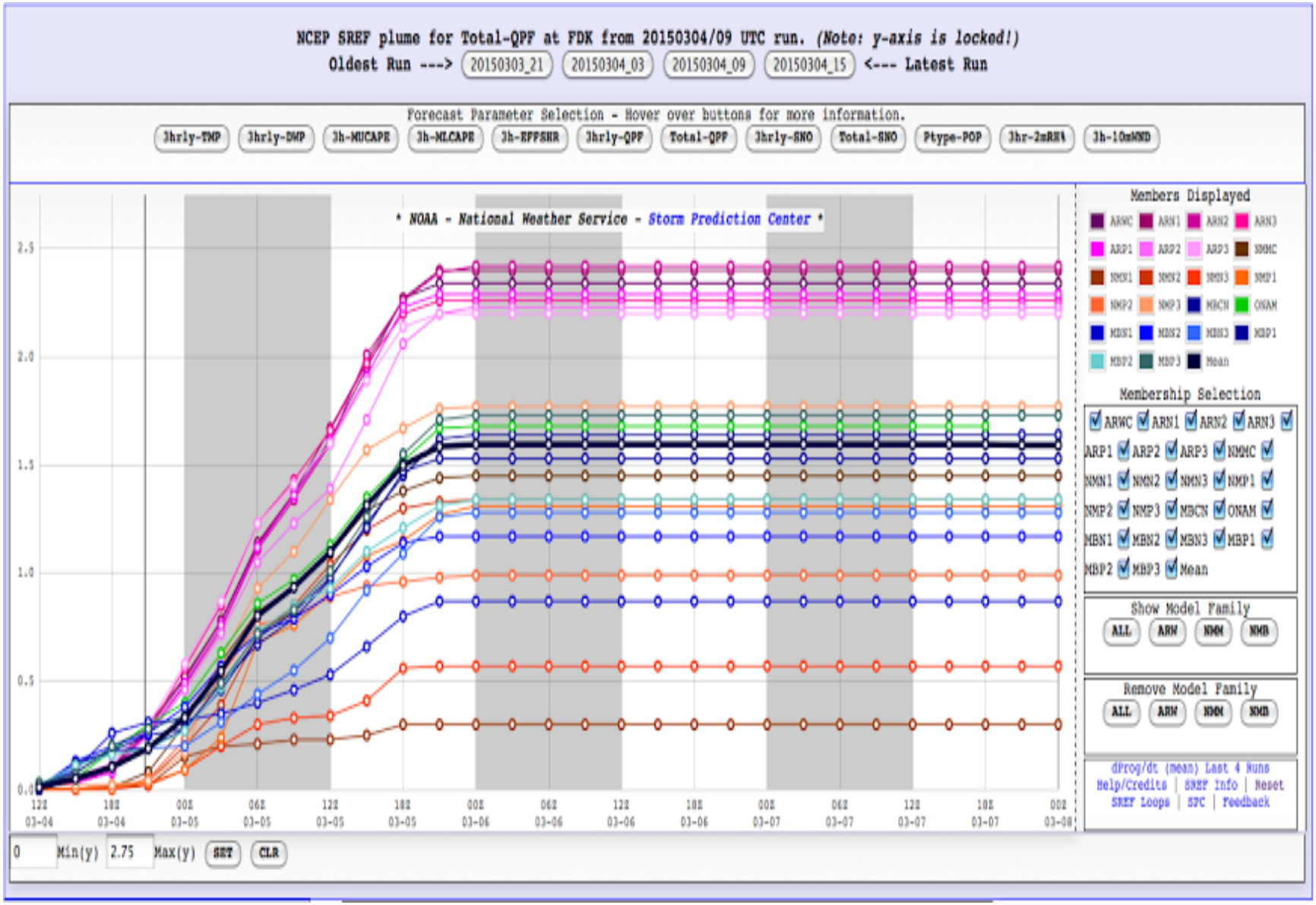
Example of increased IC perturbation size



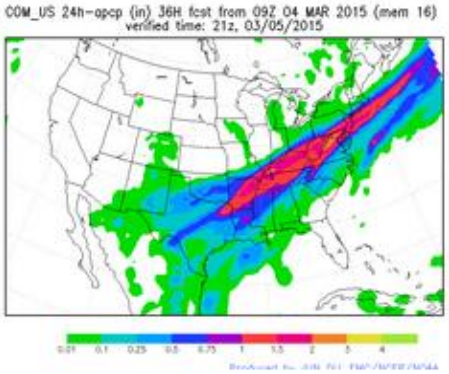
COM_US 500mb ht(m) 5760m Spgt 00H fcst from 21Z 02 OCT 2014
verified time: 21z, 10/02/2014

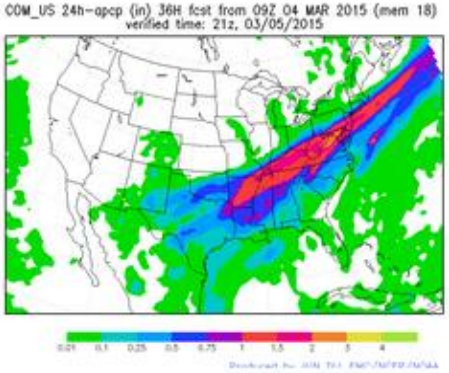


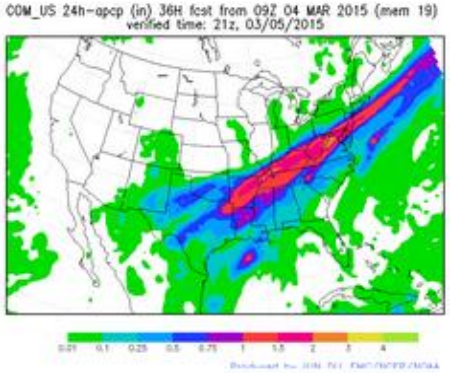
Forecaster's complain: all ARW members are grouped to be too wet: March 5, 2015 DC snow storm

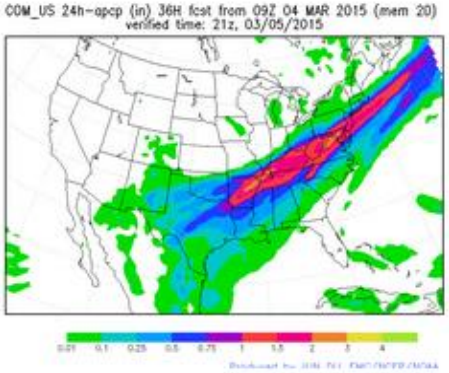


OPL SREF

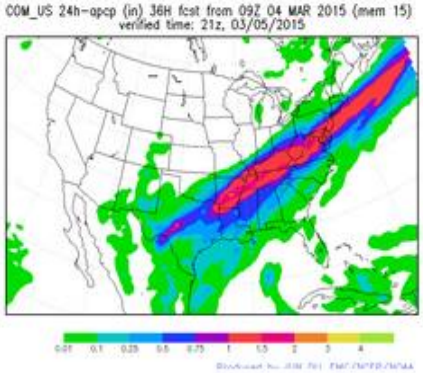


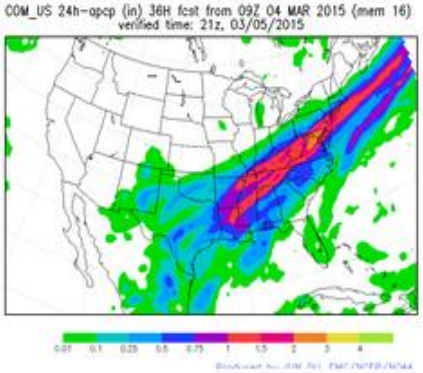


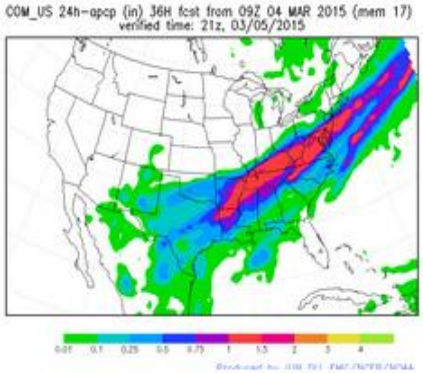


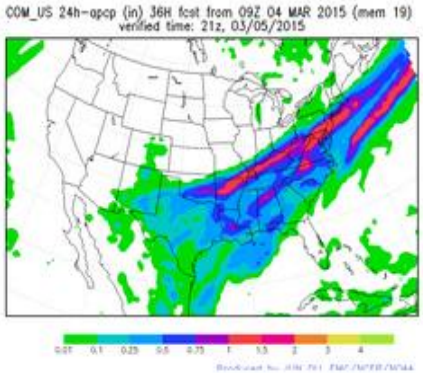


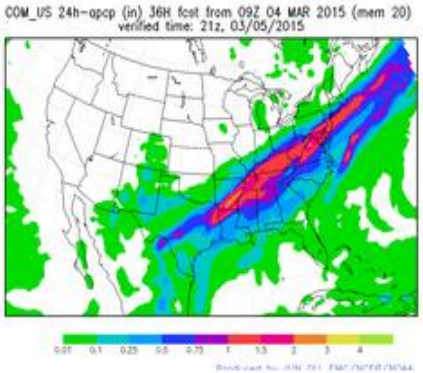
PARA SREF





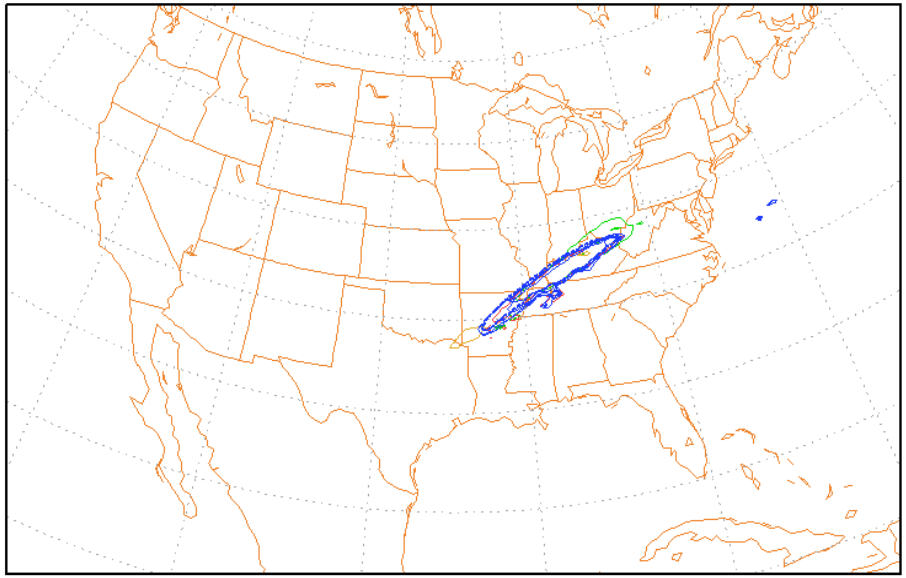






OPL SREF

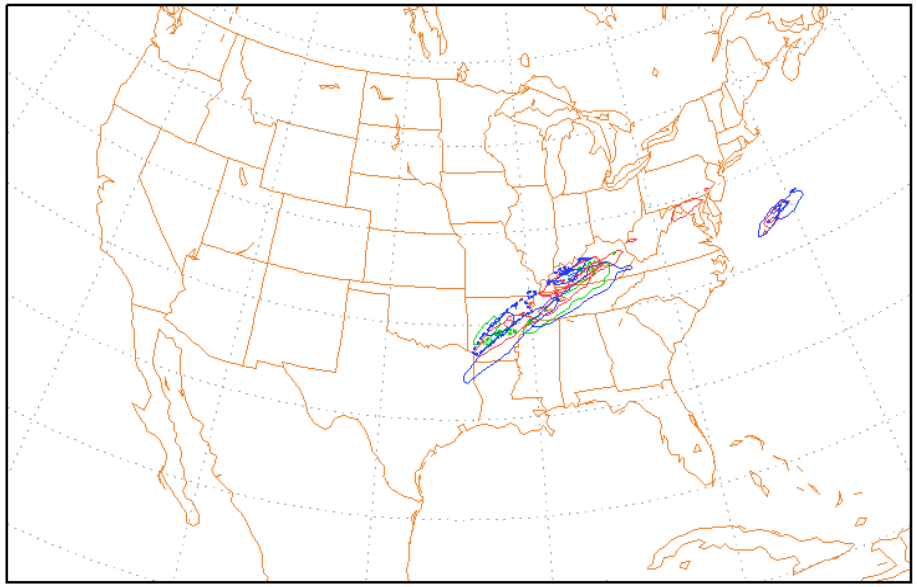
COM_US 24h-precip 2.0 in Spgt 27H fcst from 09Z 04 MAR 2015
verified time: 12z, 03/05/2015



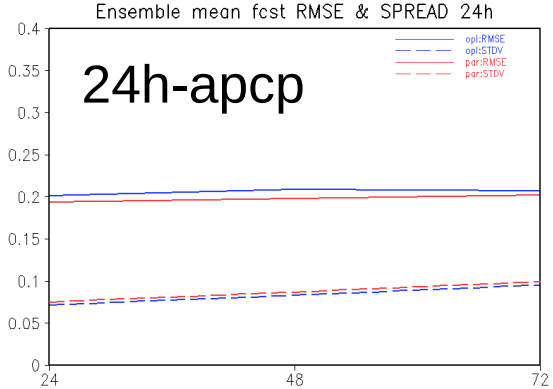
Produced by JUN DU, EMC/NCEP/NO

PARA SREF

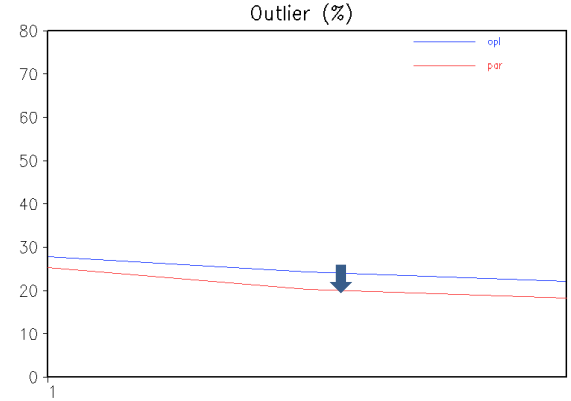
COM_US 24h-precip 2.0 in Spgt 27H fcst from 09Z 04 MAR 2015
verified time: 12z, 03/05/2015



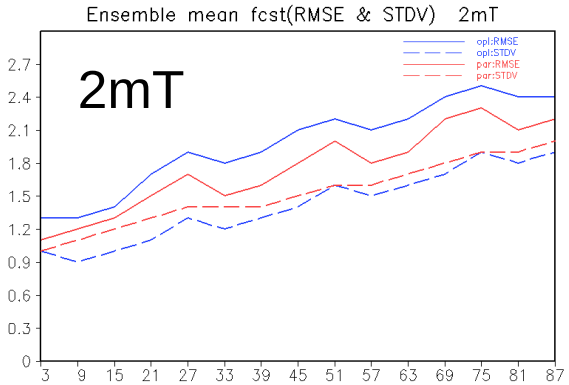
Produced by JUN DU, EMC/NCEP/NOAA

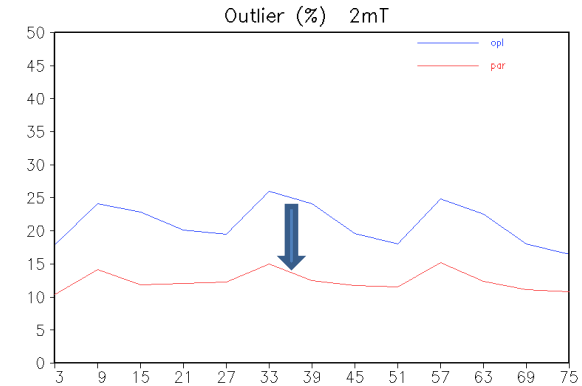


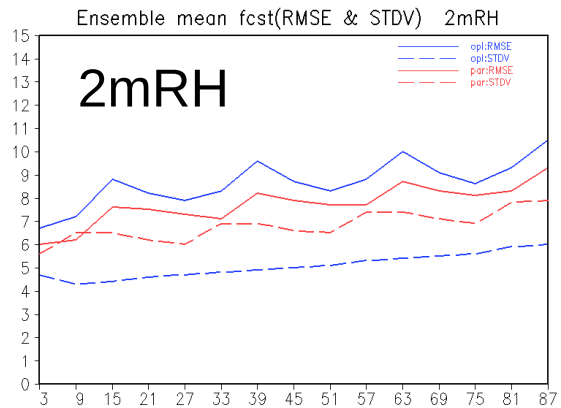
RMSE vs. spread



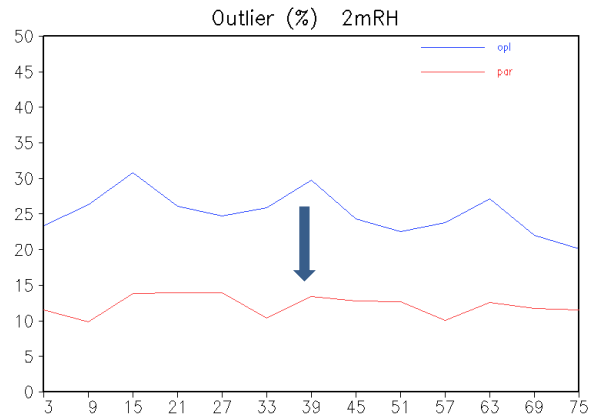
Spread becomes closer to ensemble mean forecast error, which leads to less outlier in forecasts in the para SREF







Outlier

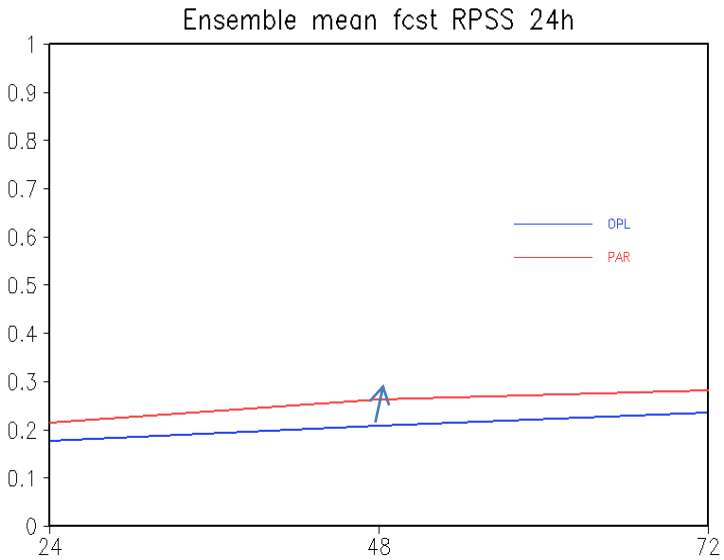


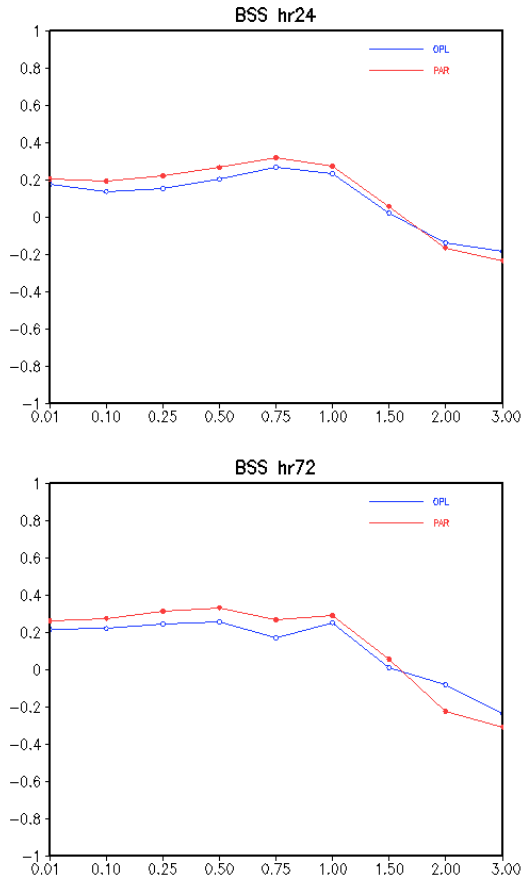
Goal #3

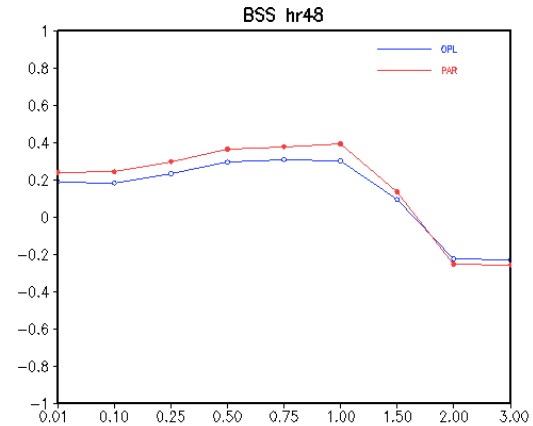
Improve probabilistic forecasts in overall

Probabilistic forecasts of 24h-apcp (Dec. 2014 – Mar. 2015)

RPSS

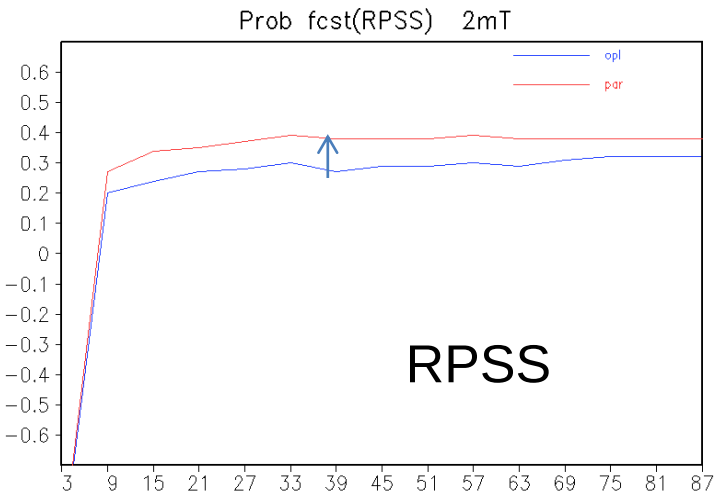


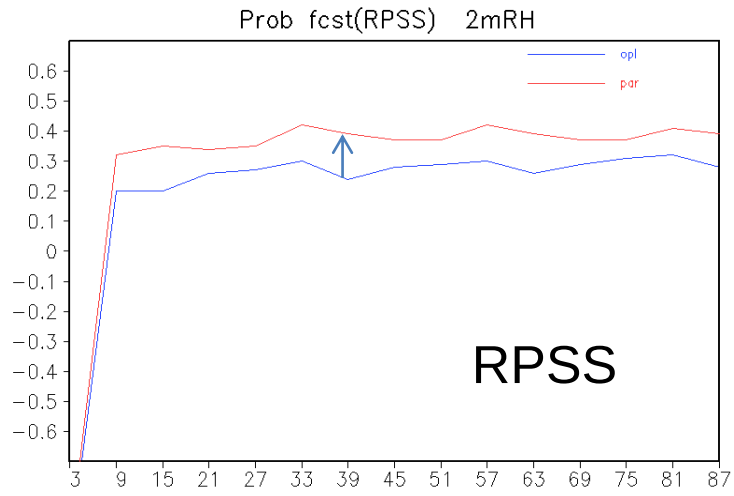


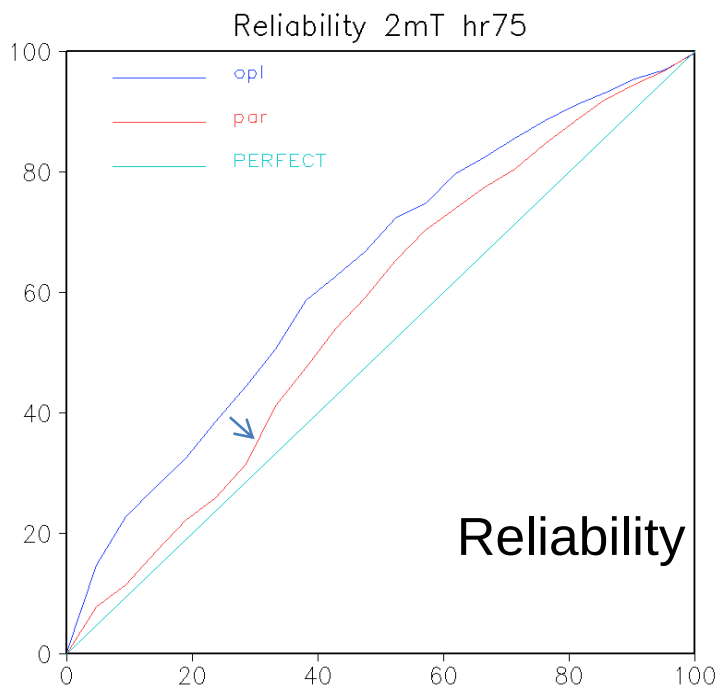


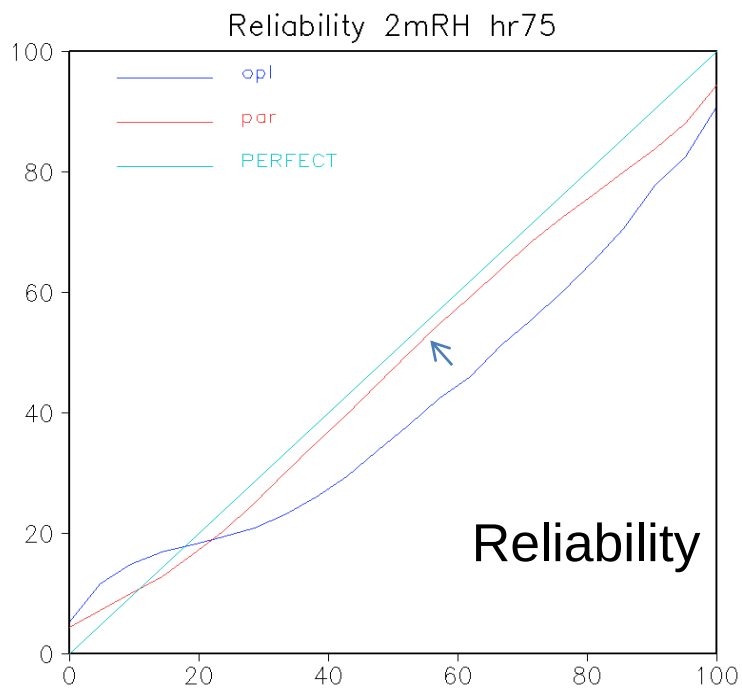
BSS

Probabilistic forecasts of 2mT and 2mRH (Oct. 2014 – Mar. 2015)

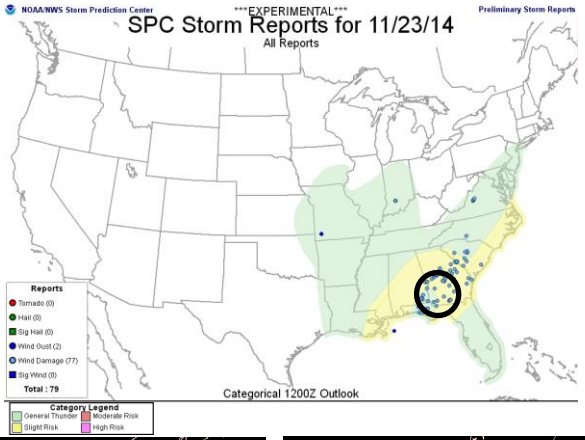


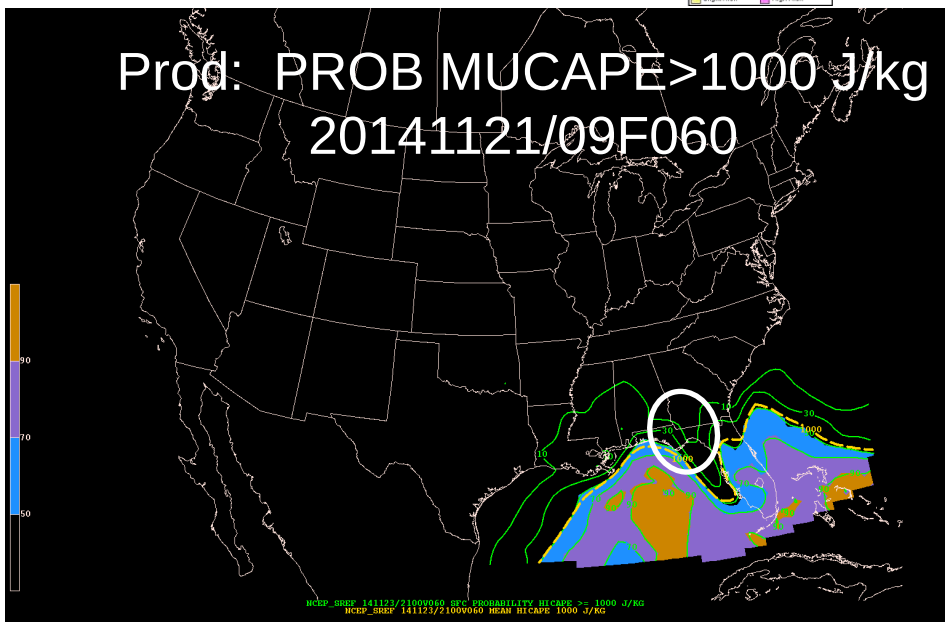


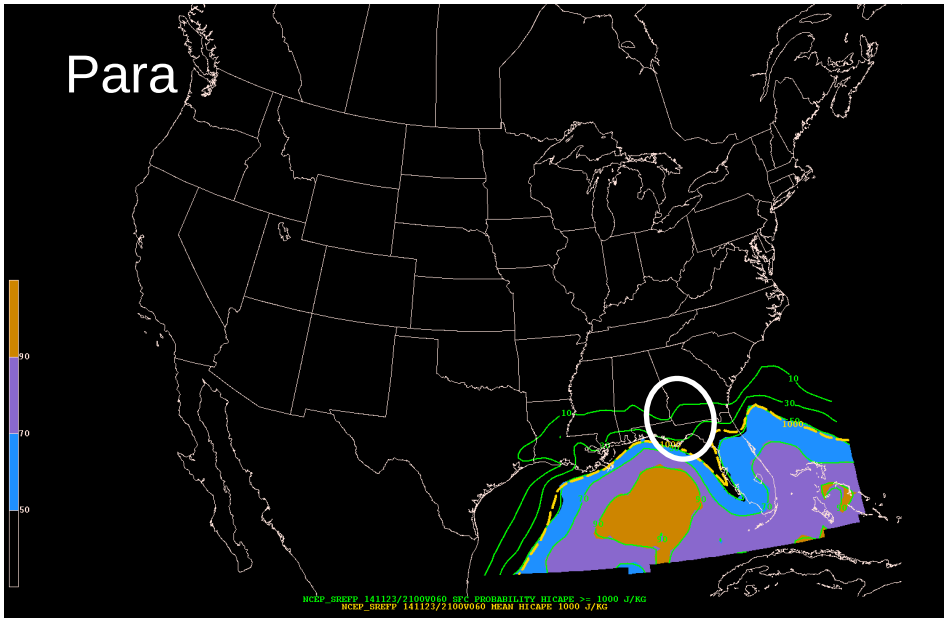




Nov. 23, 2014 severe storm outbreak in FL: SREF vs. SREFp (Israel Jirak, SPC)







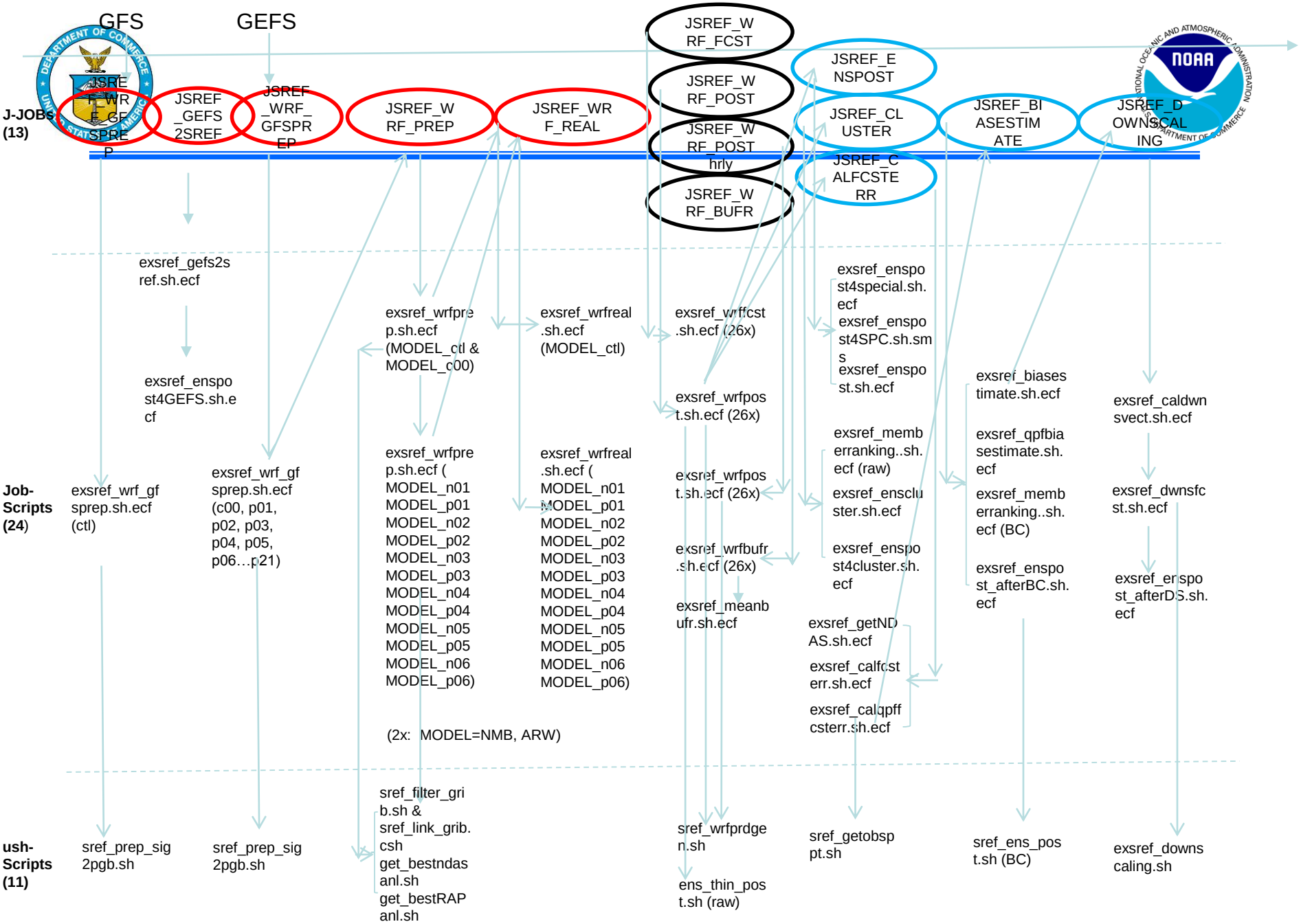
- Incorrect minimum in MUCAPE probability in operational SREF at 21Z on Sunday (Nov. 23, 2014) across SWRN GA into NERN Gulf

(1) Supported WPC Winter Weather Experiment with SREFp data (Jan. – Feb., 2015)

(2) Providing twice daily SREFp data to SPC for its product calibration since Oct. 2014

(3) Delivering retrospective runs for SPC (April 25 – May 31, 2014)

Implementation


GFS
GEFS
J-JOBS (13)
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JSREF_WRF_FCST
JSREF_WRF_POST
JSREF_WRF_POST_hrly
JSREF_WRF_BUFR
JSREF_ENSPOST
JSREF_CLUSTER
JSREF_CALFCSTERR
JSREF_BIASESTIMATE
JSREF_DOWNSCALING
exsref_gefs2sref.sh.ecf
exsref_enspost4GEFS.sh.ecf
exsref_wrfpre p.sh.ecf (MODEL_ctl & MODEL_c00)
exsref_wrfreal .sh.ecf (MODEL_ctl)
exsref_wrffcst .sh.ecf (26x)
exsref_enspo st4special.sh. ecf
exsref_enspo st4SPC.sh.sm s
exsref_enspo st.sh.ecf
exsref_wrfpos t.sh.ecf (26x)
exsref_biases timate.sh.ecf
exsref_caldwn svect.sh.ecf
Job-Scripts (24)
exsref_wrf_gf sprep.sh.ecf (ctl)
exsref_wrf_gf sprep.sh.ecf (c00, p01, p02, p03, p04, p05, p06…p21)
exsref_wrfpre p.sh.ecf (MODEL_n01 MODEL_p01 MODEL_n02 MODEL_p02 MODEL_n03 MODEL_p03 MODEL_n04 MODEL_p04 MODEL_n05 MODEL_p05 MODEL_n06 MODEL_p06)
exsref_wrfreal .sh.ecf (MODEL_n01 MODEL_p01 MODEL_n02 MODEL_p02 MODEL_n03 MODEL_p03 MODEL_n04 MODEL_p04 MODEL_n05 MODEL_p05 MODEL_n06 MODEL_p06)
exsref_wrfpos t.sh.ecf (26x)
exsref_wrfbufr .sh.ecf (26x)
exsref_meanb ufr.sh.ecf
exsref_memb erranking..sh. ecf (raw)
exsref_ensclu ster.sh.ecf
exsref_enspo st4cluster.sh. ecf
exsref_getND AS.sh.ecf
exsref_calfcst err.sh.ecf
exsref_calqpff csterr.sh.ecf
exsref_qpfbia sestimate.sh. ecf
exsref_memb erranking..sh. ecf (BC)
exsref_enspo st_afterBC.sh. ecf
exsref_dwnsfc st.sh.ecf
exsref_enspo st_afterDS.sh. ecf
(2x: MODEL=NMB, ARW)
ush-Scripts (11)
sref_prep_sig 2pgb.sh
sref_prep_sig 2pgb.sh
sref_filter_gri b.sh & sref_link_grib. csh get_bestndas anl.sh get_bestRAP anl.sh
sref_wrfprdge n.sh
ens_thin_pos t.sh (raw)
sref_getobsp pt.sh
sref_ens_pos t.sh (BC)
exsref_downs caling.sh

50% for model and 30% for the rest increase in computing power and 50% in disk space (model: within 60 min, Phase I)

Member	Task	Node	Member	Task	Node
nmb_ctl	112	7	arw_ctl	144	9
nmb_n1	112	7	arw_n1	144	9
nmb_n2	96	6	arw_n2	144	9
nmb_n3	96	6	arw_n3	176	11
nmb_n4	128	8	arw_n4	176	11
nmb_n5	128	8	arw_n5	144	9
nmb_n6	96	6	arw_n6	144	9
nmb_p1	112	7	arw_p1	176	11
nmb_p2	128	8	arw_p2	192	12
nmb_p3	128	8	arw_p3	144	9
nmb_p4	96	6	arw_p4	144	9
nmb_p5	112	7	arw_p5	144	9
nmb_p6	96	6	arw_p6	208	13
total				3520	220
current				2352	147
increase			~50%	1168	73

Dissemination of the new SREF data and products to forecasters and users

- **NCO web (MAG)**: To add AK domain (repeating the CONUS one), clusters (mean)

- **HPSS**: To archive 132 grid (16km)

Dependent Job Check List

- SREF downstream dependences
  1. VERF_PRECIP (Ying Lin, tested)
     - Scripts
     - Parameter files
  2. VERF_GRIDTOBS (Perry Shafran, tested)
     - Scripts
     - Parameter files
  3. TRACKER VERIFICATION (Guangping Lou, tested)
     - Scripts
  4. SPCSREF (Andy Dean, tested)
     - Source Codes
     - Scripts
     - Parameter files
  5. DGEX downscaling (smartinit) (Jeff McQeen)

     Need test new dataset

SREF v7.0.0 Major Upgrade Package

Project Status as of 03/23/15

G **Project Information and Highlights**

Lead: Geoff DiMego/Jun Du, EMC and Stephen Earle, NCO

Scope:

1. Eliminate WRF_NMM model (from 3 models to 2 models)
2. Increase membership from 21 to 26
3. Increase model vertical resolution from 35 to 40
4. Increase diversity in both initial conditions and physics schemes
5. Other minor changes such as name change

Expected Benefits:

1. Increase ensemble spread of surface variables;
2. Reduce surface cold and wet biases
3. Improve overall probabilistic forecast skill

G **Scheduling**

Milestone (NCEP)	Date	Status
EMC testing complete/ EMC CCB approval	03/23/2015	
Final RFC submitted to NCO	04/10/2015	
Technical Information Notice Issued	04/30/2015	
Initial Test Complete	04/15/2015	
CCB approve parallel data feed	04/30/2015	
IT testing begins	05/01/2015	
IT testing ends	05/07/2015	
Parallel testing begun in NCO	05/01/2015	
Real time evaluation ends	05/30/2015	
Management Briefing	06/10/2015	
Implementation	06/15/2015	

G **Issues/Risks**

Issues:

Risks:

Mitigation

G **Finances**

Associated Costs:

Funding Sources:

R	Management Attention Required	Y	Potential Management Attention Needed	G	On Target