Strategic Implementation Plan (SIP) for a Community-based Unified Forecast System (UFS)

CAM Working Group

Presented by

Curtis Alexander, NOAA/ESRL/GSD

Presented at Coordination Meeting

for UFS SIP

August 2, 2018; College Park, MD

CAM WG *Membership*

- *Curtis Alexander ESRL/GSD* **
- *Lucas Harris GFDL***
- *Jack Kain NCEP/EMC* **
- *Dave Stensrud Penn State* **

- Eric Rogers NCEP/EMC
- Geoff DiMego NCEP/EMC
- Lou Wicker NSSL
- Adam Clark NSSL
- SJ Lin GFDL
- Stan Benjamin ESRL/GSD

- Ming Xue OU/CAPS
- Xuguang Wang OU/SoM
- **Jaime Wolff NCAR/DTC (UFS CAM support)**
- Glen Romine NCAR/MMM
- Bill Putman NASA/GMAO
- Gary Lackmann NC State
- Vittorio Gensini NIU

***Co-Chair*

CAM WG
Project Milestone Accomplishments

- **SIP project accomplishments to date:**
  - RAPv4/HRRRv3 operationally implemented at NCEP on 12 July 2018 (GSD, EMC, NCO)
  - HREFv2.1 scheduled for late 2018 including new post-processed products (EMC, GSD)

  - Development of the stand-alone regional (SAR) FV3 code (EMC, GSD, NSSL, GFDL)
  - Creation of SAR-FV3 domains that mimic operational RAP (13-km)/HRRR (3-km) domains
  - Execution of SAR-FV3 24-84 hr forecasts at CAM scale using GFS ICs/LBCs (EMC, GSD)
  - Developing capability to initialize SAR-FV3 from additional external model sources (GSD)
  - Developed preliminary user-friendly workflow for end-to-end execution of SAR-FV3 (GSD)

  - Execution/eval of multi-physics FV3 CAM nests, HWT SFE 2018 (CAPS, NSSL, SPC)
  - Contribution of GSI-ensemble/variational radar reflectivity data assimilation (OU)
  - Execution/eval of single-core CAM ensembles in HWT SFE 2018 (GSD, NCAR, OU, CAPS)

  - Engaged DTC on UFS CAM support including participation in CAM WG (CAM WG)
  - Drafted holistic CAM verification metrics including prioritizations (CAM/V&V WGs)
  - Started development of pre-implementation CAM test plan for RRFS (CAM WG)
  - Revision of SIP CAM annex for FY19-21 (CAM WG)

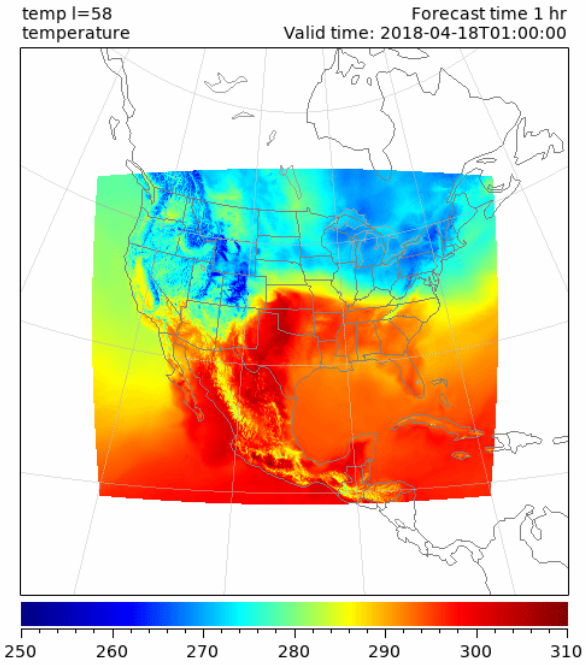
CAM WG
Project Milestone Accomplishments

Stand-Alone Regional FV3 CAM Development

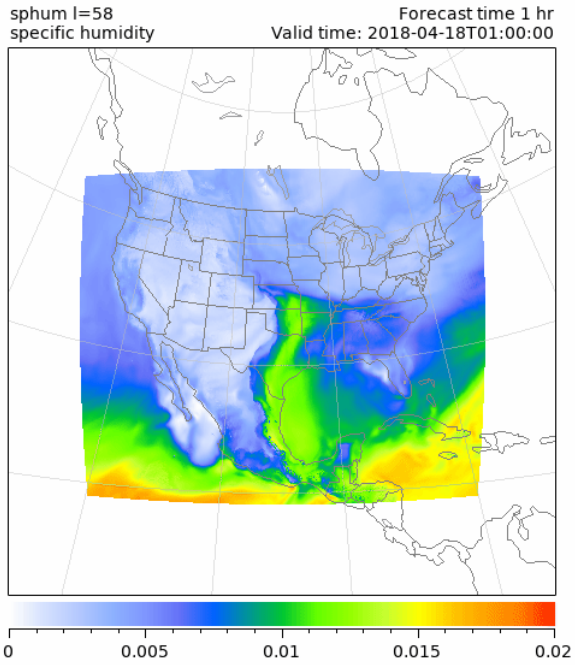
- Stand-alone regional FV3 test on NOAA Theia R&D HPC
- Nominal 3-km grid spacing
- 84-hr forecast
- 63 levels
- GFS initialization
- GFS physics
- Level 58 shown

Forecast/graphics from Tom Black NOAA/NCEP/EMC

Temperature



Specific Humidity



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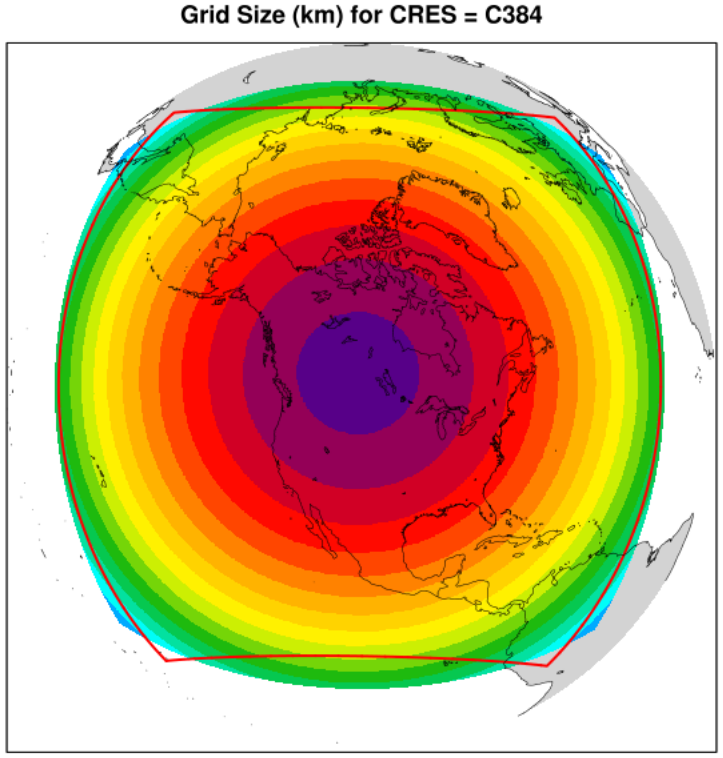
Project Milestone Accomplishments

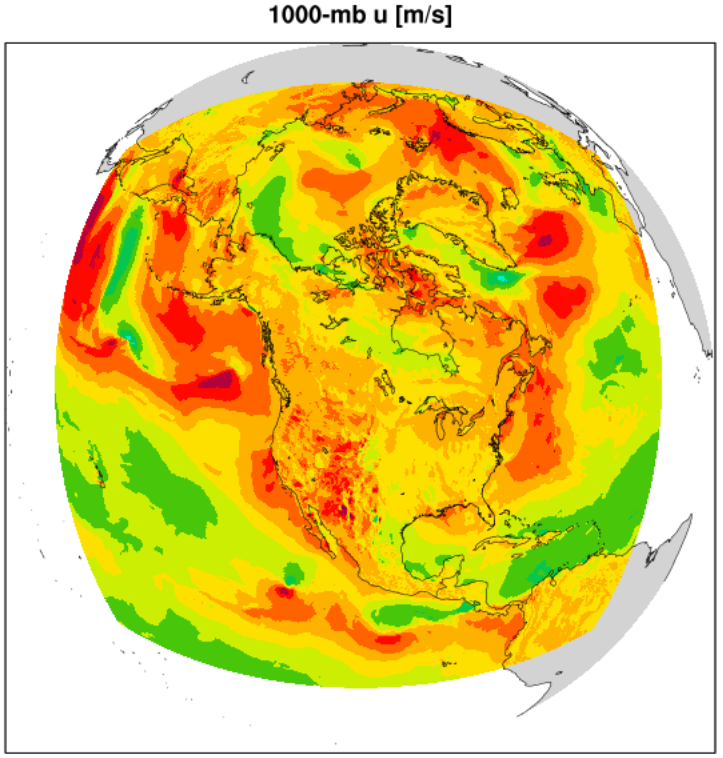
Stand-Alone Regional FV3 CAM Development

RAP Domain



Forecast/ graphics from Gerard Ketefian and Jeff Beck GSD

12-hr forecast plot of 1000 mb U-wind



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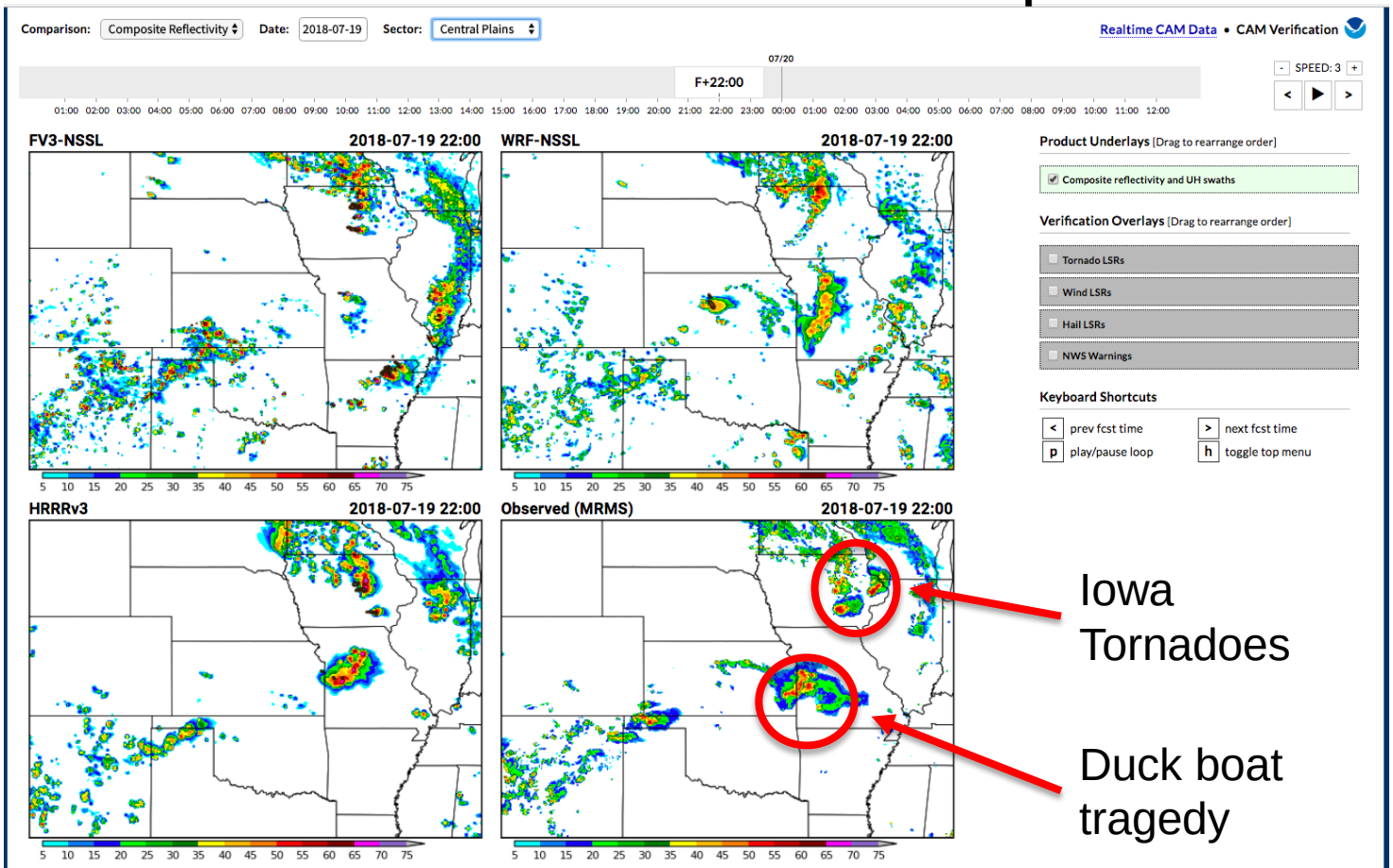
Project Milestone Accomplishments

Real-Time FV3 Comparisons



Can be viewed at https://hwt.nssl.noaa.gov/fv3/comparisons/

NSSL Homepage
Privacy Policy
Disclaimer

Data processed and plotted at NOAA NSSL
NSSL FV3 and WRF questions: adam.clark@noaa.gov
Website questions: brett.roberts@noaa.gov

FV3 shown with comparisons to HRRRv3 and NSSL-WRF and observations.

Iowa tornadoes and Table Rock Lake day.

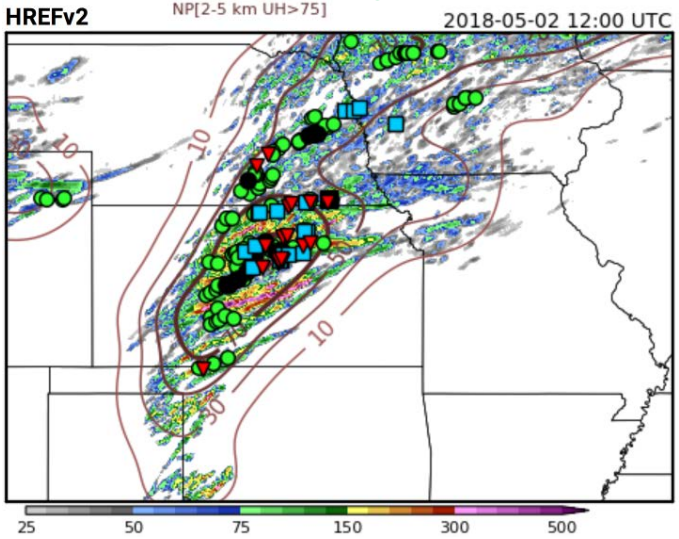
(webpage designed by Brett Roberts)

CAM WG
Project Milestone Accomplishments

Real-time CAM Ensemble Demos HWT SFE 2018
"May Day" Forecast

Forecasts from HREF, HRRRE, NCAR Ensemble, CAPS EnKF, and OU (MAP) were evaluated during Hazardous Weather Testbed "Spring Experiment"

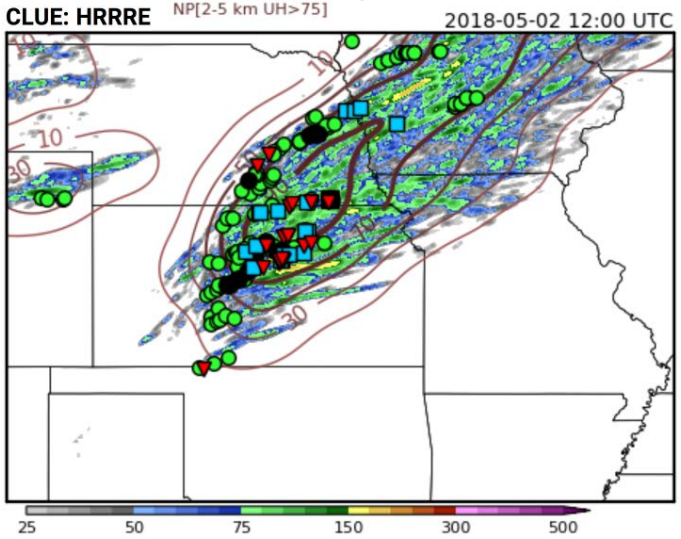
HREF: multi-model system



HREF (left)
HRRRE (right)
Updraft Helicity
0-24 h forecast
8 members

tornado, hail, and wind reports

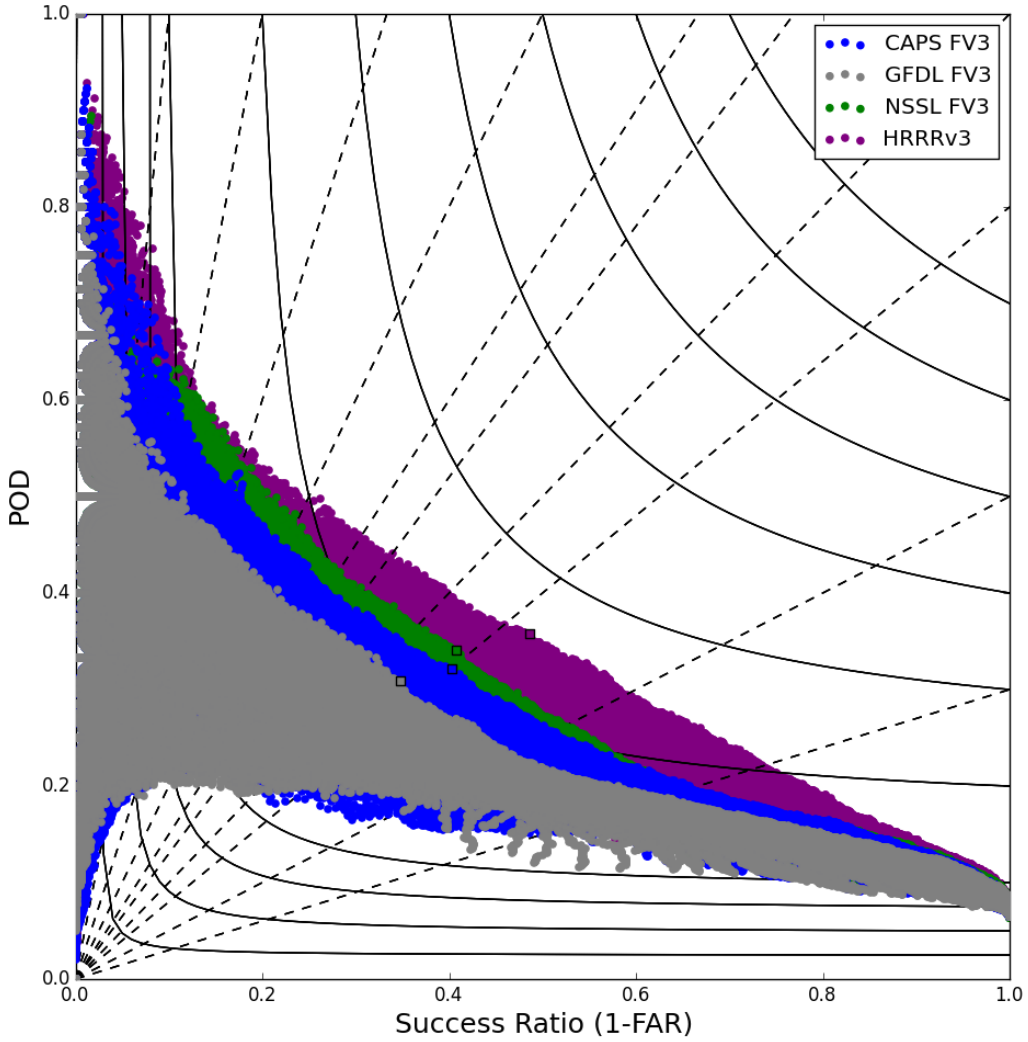
HRRRE: single-model system



graphics from Brett Roberts
Hazardous Weather Testbed

CAM WG
Project Milestone Accomplishments

NSSL FV3 Verification



Surrogate Severe performance diagram – every possible combination of forecast probability, UH percentile, and smoothing.

The closer to the top-right the better.

Performance Rank

1. HRRRv3
2. NSSL-FV3
3. CAPS-FV3
4. GFDL-FV3

(Created by Burkely Gallo)

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Project Milestone Accomplishments

HWT SFE CLUE FV3 Members

Members	Contributor	Microphysics	LSM	PBL	Cumulus (global)	Grid-spacing (global)	Grid-spacing (nest)
fv3-phys01	CAPS	Thompson	NOAH	MYNN-SA	Tiedtke	13-km	3.5-km
fv3-phys02	CAPS	Thompson	NOAH	MYNN	Tiedtke	13-km	3.5-km
fv3-phys03	CAPS	Thompson	NOAH	YSU-SA	Tiedtke	13-km	3.5-km
fv3-phys04	CAPS	Thompson	NOAH	YSU	Tiedtke	13-km	3.5-km
fv3-phys05	CAPS	Thompson	NOAH	EDMF	Tiedtke	13-km	3.5-km
fv3-phys06	CAPS	NSSL	NOAH	MYNN-SA	Tiedtke	13-km	3.5-km
fv3-phys07	CAPS	NSSL	NOAH	MYNN	Tiedtke	13-km	3.5-km
fv3-phys08	CAPS	NSSL	NOAH	YSU-SA	Tiedtke	13-km	3.5-km
fv3-phys09	CAPS	NSSL	NOAH	YSU	Tiedtke	13-km	3.5-km
fv3-phys10	CAPS	NSSL	NOAH	EDMF	Tiedtke	13-km	3.5-km
fv3-phys11	CAPS	Thompson	NOAH	MYNN-SA	SA-SAS	13-km	3.5-km
fv3-phys12	CAPS	GFDL	NOAH	EDMF	SA-SAS	13-km	3.5-km
nssl-fv3	NSSL	Thompson	NOAH	MYNN-SA	Tiedtke	25-km	3.3-km
gfdl-fv3	GFDL	GFDL	NOAH	YSU	Tiedtke	13-km	3.0-km

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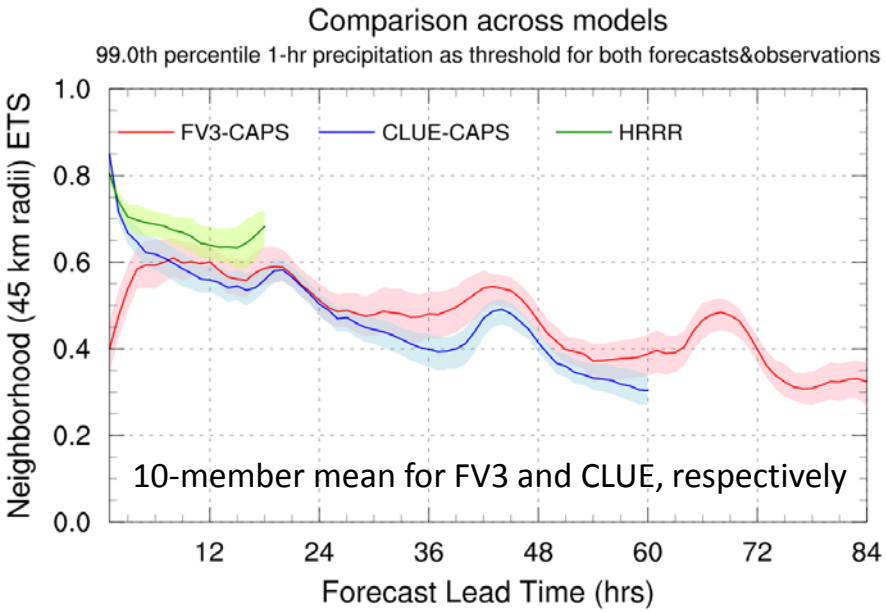
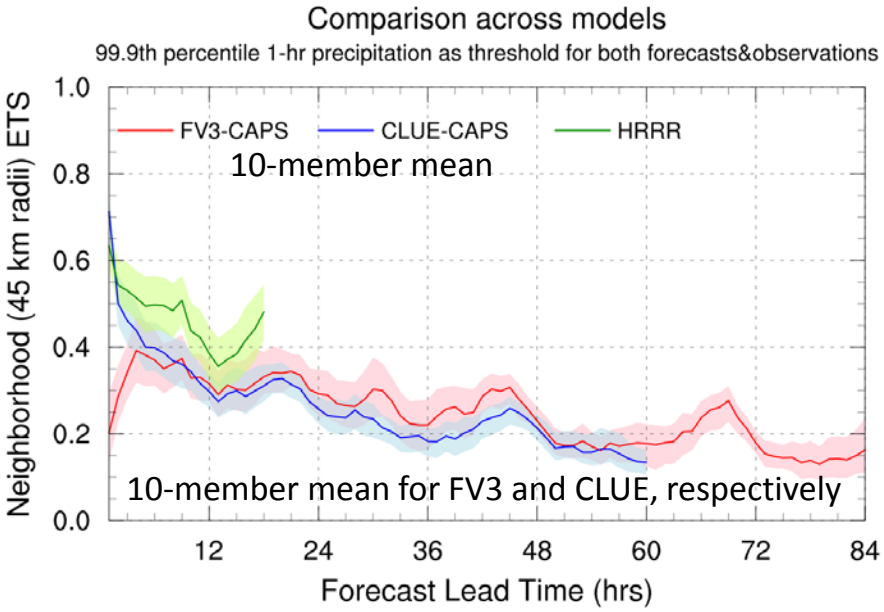
Project Milestone Accomplishments

HWT SFE CAM Precipitation Verification

99.9th percentile





(Chunxi Zhang, Ming Xue, Tim Supinie, Fanyou Kong, Nathan Snook, Kevin Thomas, Keith Brewster, Lucas Harris, Shian-Jiann Lin)

CAM WG Team Coordination and Dependencies

CAM Verification Metrics Development Coordinated with V&V (and other) WGs

Vertical and Temporal Attributes

Validation Source

Methodologies

Deterministic and Ensemble Stats

Fields to verify including maturity for current verification
(green = ready now)
(yellow = near future)
(red = long term)

Score Stratifications (scales, times, thresholds)

CAM/Verification WG Comments

Weather Element Categories (Environmental, Severe, Precip/Winter, Aviation, Air Quality/Energy)

CAM WG Team Coordination and Dependencies

SIP CAM annex changes for FY19-21

Consolidation to three primary projects:

- CAM deterministic transition to FV3
  - RAPv5/HRRRv4 transition to operations
  - SAR FV3 development
  - Transition RAP/HRRR/NAM/nest to SAR FV3
- CAM ensemble DA transition to FV3
  - Single-core CAM ensemble DA development
  - New observational data assimilated
  - Transition CAM ensemble DA to FV3
- CAM ensemble forecast transition to FV3
  - HREF development
  - Transition HRRRE/WoF to SAR FV3
  - RRFS formation and pre-implementation tests

CAM WG Team Coordination and Dependencies

SIP CAM annex changes for FY19-21

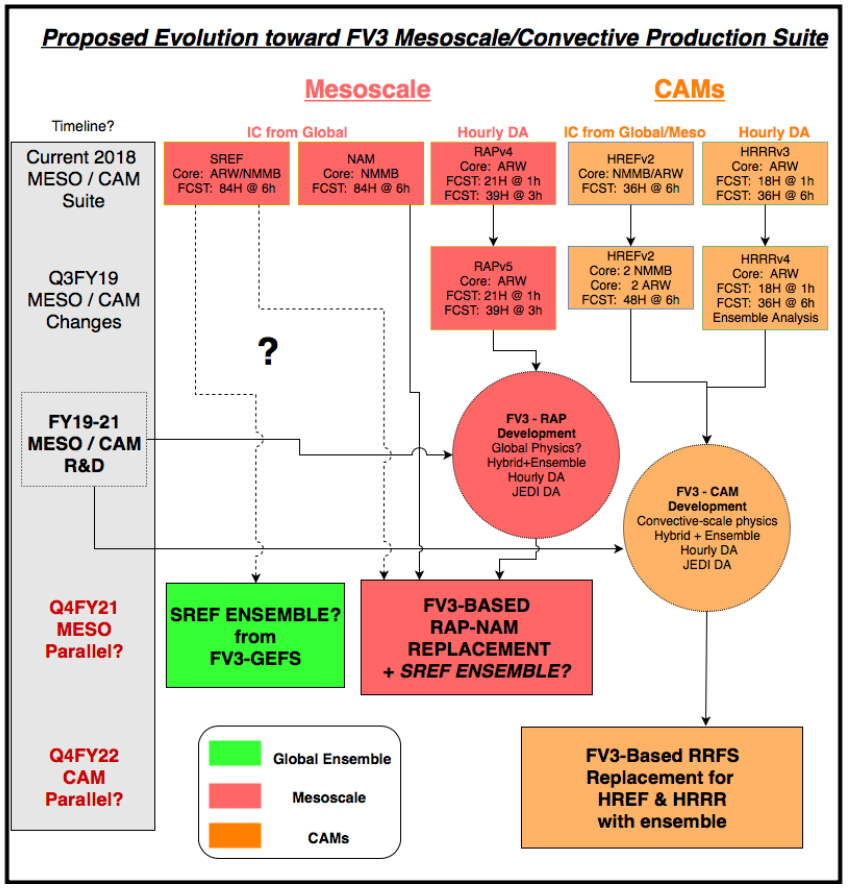
Building road map for regional/CAM component transition to FV3 and RRFS

Mesoscale deterministic and ensembles

- NAM/RAP consolidation
- SREF future with FV3-GEFS

CAM scale deterministic and ensembles

- NAMnest/HRRR consolidation
- HREF future with RRFS



CAM WG Team Coordination and Dependencies

SIP project issues:

- Level of granularity of vLab git branching between SAR FV3 developers (minor)
- Improving uniformity of grid size for SAR FV3 domains (minor)
- Assignment of MET post-processing to SAR FV3 workflows (minor)
- Documentation of SAR FV3 workflow (minor)

- Ramp-up DTC UFS CAM support (major but underway)

- Selection of operational baseline for RRFS implementation decisions (major)
  - Multiple existing operational CAMs (NAMnest, HRRR, HiResWindows)
  - Need more specificity and tighter scope in CAM test plan for implementation decision

- Future of NAM/RAP/SREF (major)
  - When can we transition to GFS/GEFS for CAM-scale initializations and other mesoscale environmental applications (i.e. SPC…)?
  - Need for global rapid-refresh capability (physics and DA) and implementation plan
  - Dependency on global SIP WG that doesn't exist (data assimilation/physics/ensemble WG proxies?)