

An Overview of CAPS Storm-Scale Ensemble Forecast for the 2015 NOAA HWT Spring Forecast Experiment

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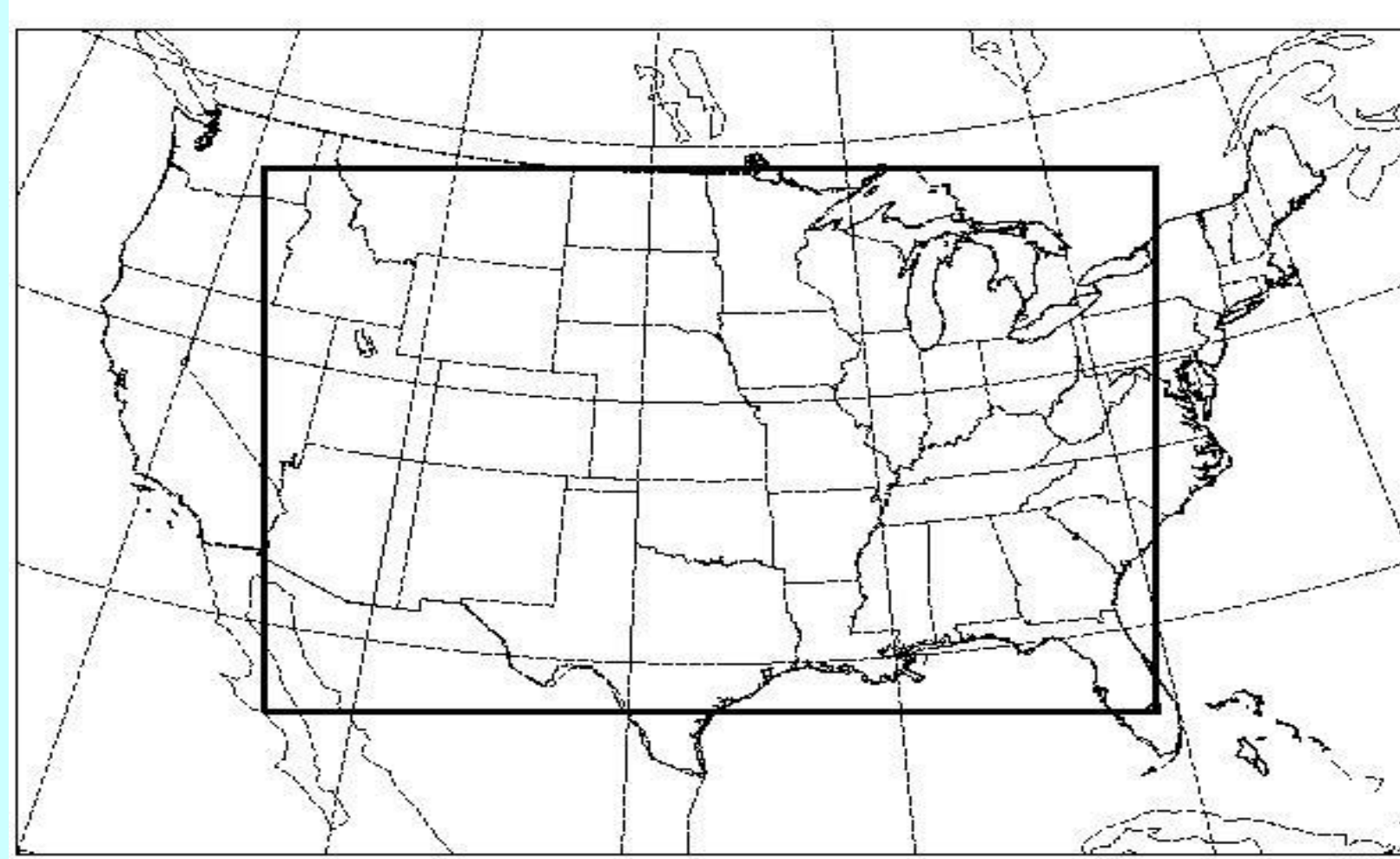
In support of the NOAA Hazardous Weather Testbed (HWT) 2015 Spring Forecast Experiment, the Center for Analysis and Prediction of Storms (CAPS) produced WRF-ARW storm-scale ensemble forecasts (SSEF) in realtime from 20 April through 5 June 2015 over the entire CONUS domain at 3-km grid spacing.

There are two suites of SSEF runs in 2015: The ordinary SSEF with 20-member consisting of multi-physics, IC and LBC perturbation, and initialized from a onetime 3DVAR analysis at 0000 UTC; and a EnKF-based SSEF that includes a one hour EnKF cycling DA at 15 min interval from 2300 UTC to 0000 UTC following a 5-h 40-member ensemble forecast initiated from 1800 UTC, over the same CONUS domain as the ordinary SSEF.

The NSSL Multi-Radar/Multi-Sensor (MRMS) QPE (Zhang et al. 2011) data were used as verification dataset for the SSEF QPF.

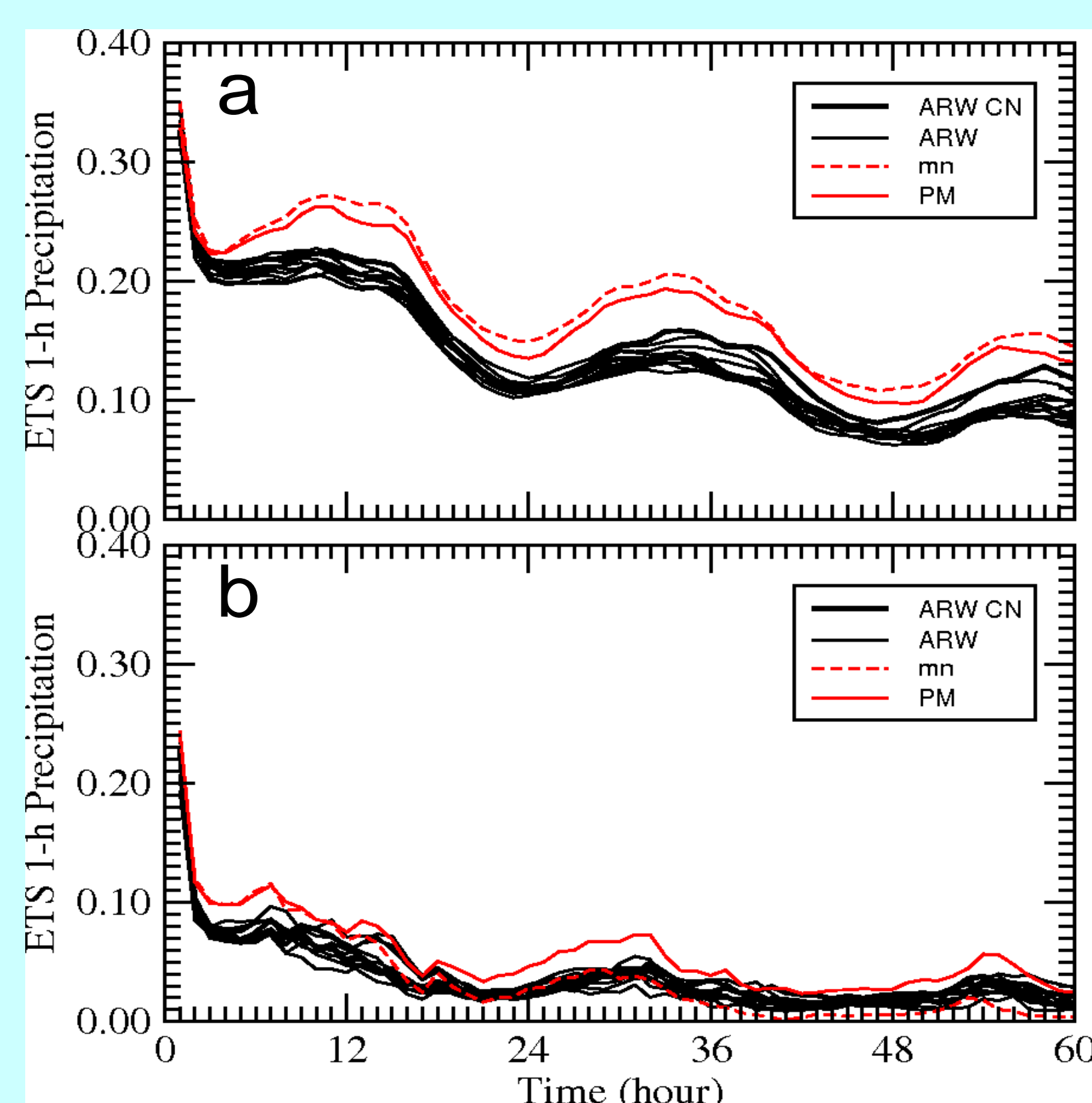
This work is primarily funded by the NOAA CSTAR program, leveraged by other grants

CONUS domain (1680x1152, at 3-km)



Forecast domain for the 2015 HWT Spring Experiment (thick inner box is the verification sub-domain).

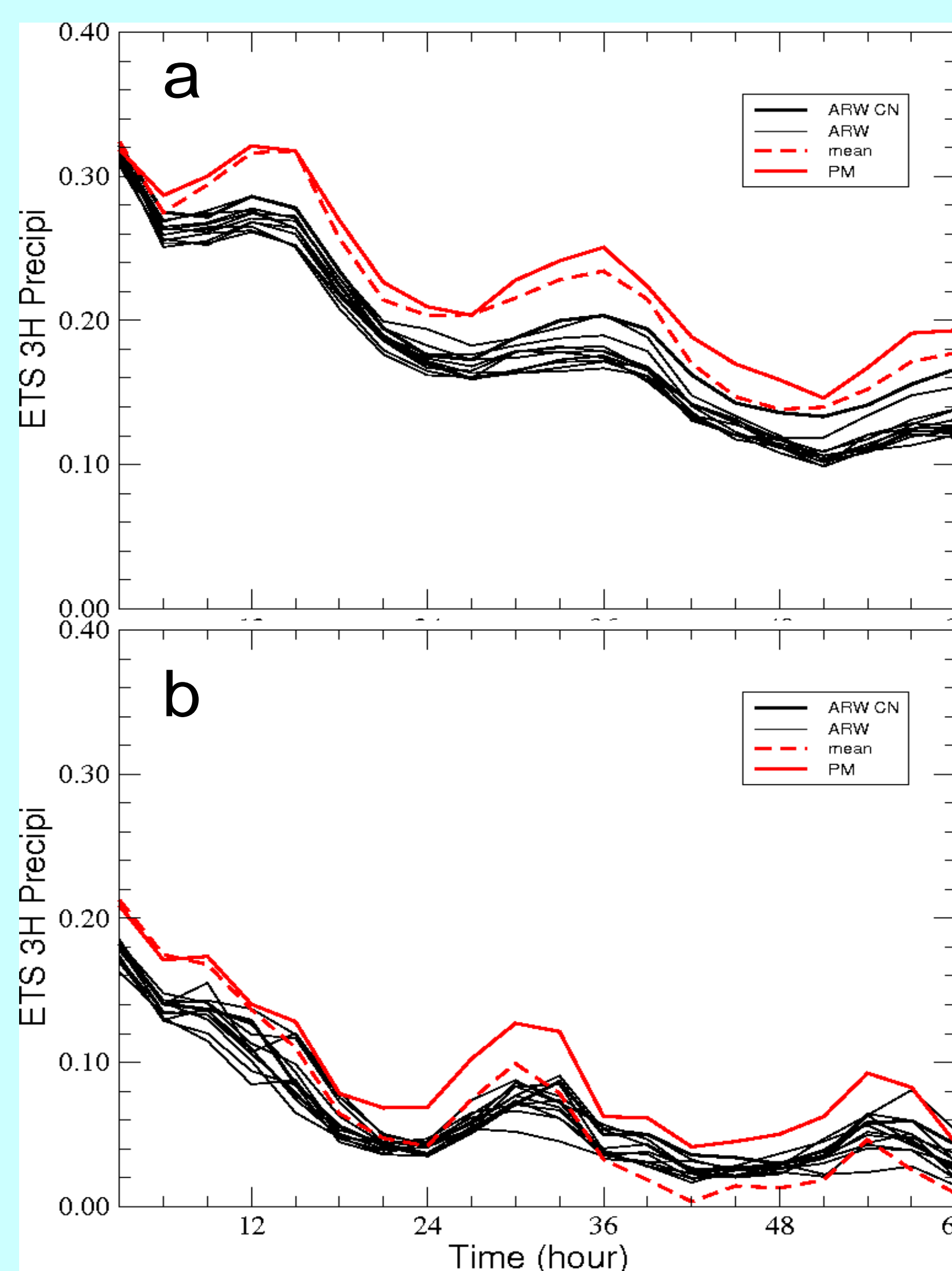
ETS of 1-hourly QPF



(a) ≥ 0.01 inch (b) ≥ 0.25 inch, averaged over all 2015 3DVAR SSEF forecasts initiated at 0000 UTC.

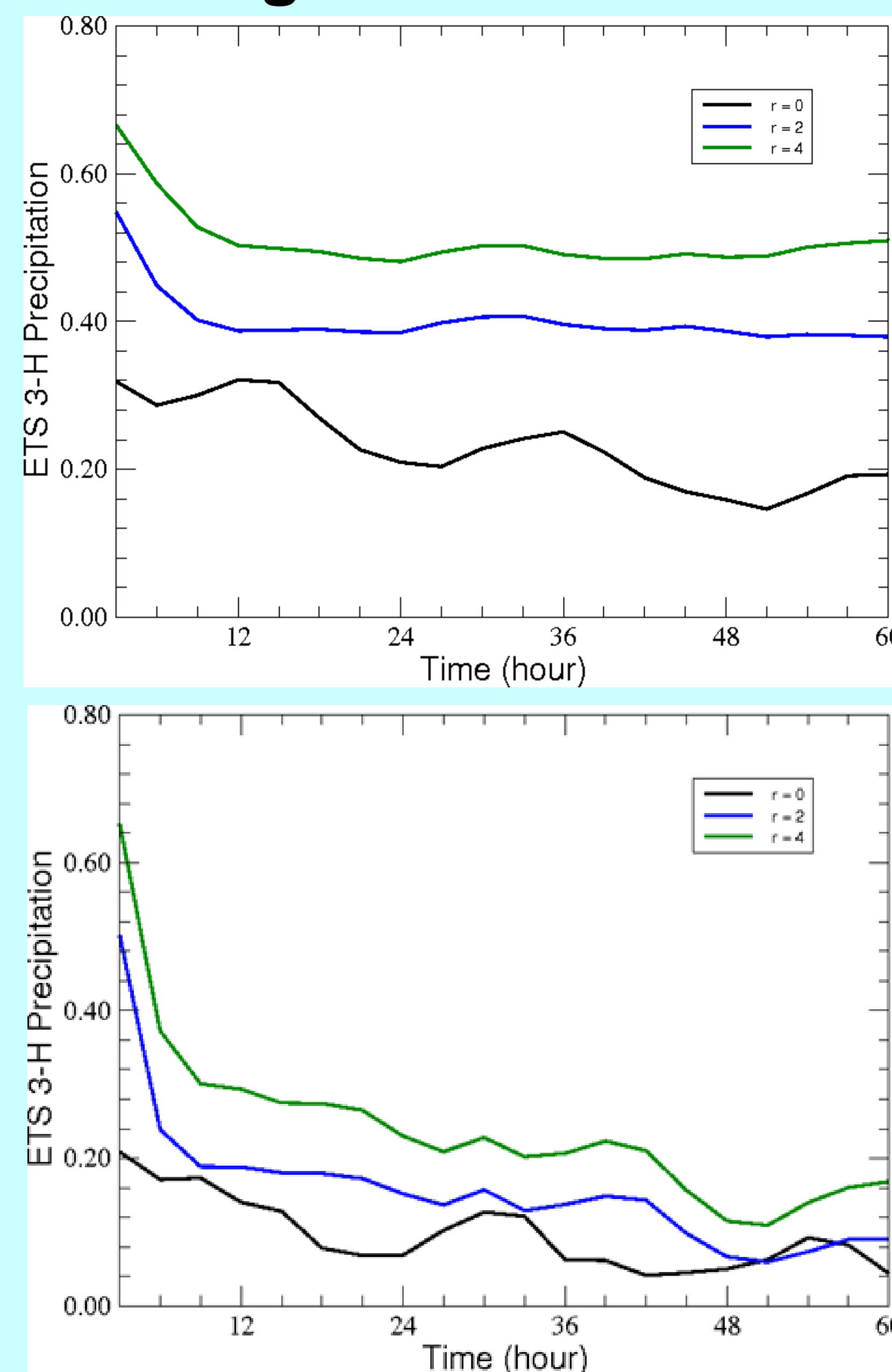
2015 CAPS SSEF Highlight

- 3-km horizontal grid spacing (1680x1152)
- WRF version 3.6.1 (coupled with ARPS v5.3.6)
- A 3DVAR-based SSEF with 20 ARW members, initiated with 3DVAR analysis at 0000 UTC, with 60-h forecast, running on Stampede at TACC
- EnKF-based ensemble forecast: with 40-member storm-scale ensemble background, a one hour EnKF cycling at 15 min interval, and a 11-member ensemble forecast starting at 0000 UTC. Running on Darter at NICS
- Visualization demonstration (VAPOR based)



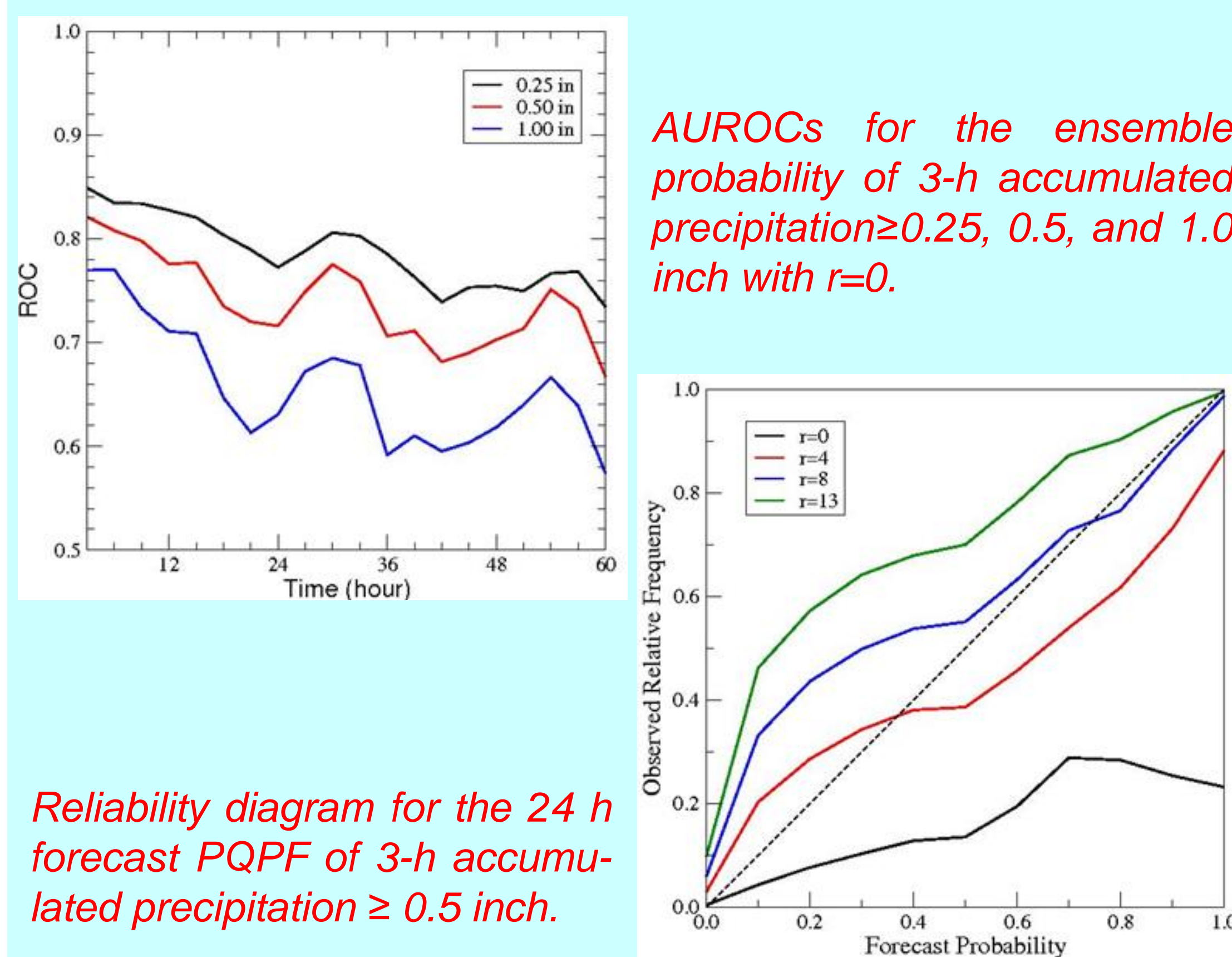
ETS of 3-h accumulated precipitation ≥ 0.01 inch (top) and 0.5 inch (bottom) averaged over all 2015 3DVAR SSEF forecasts initiated at 0000 UTC.

ETS in Neighborhood context



ETS of the probability matched mean 3-h accumulated precipitation ≥ 0.01 inch (top) and 0.5 inch (bottom), averaged over all 2015 3DVAR SSEF forecasts initiated at 0000 UTC. R is the neighborhood scale in grid points.

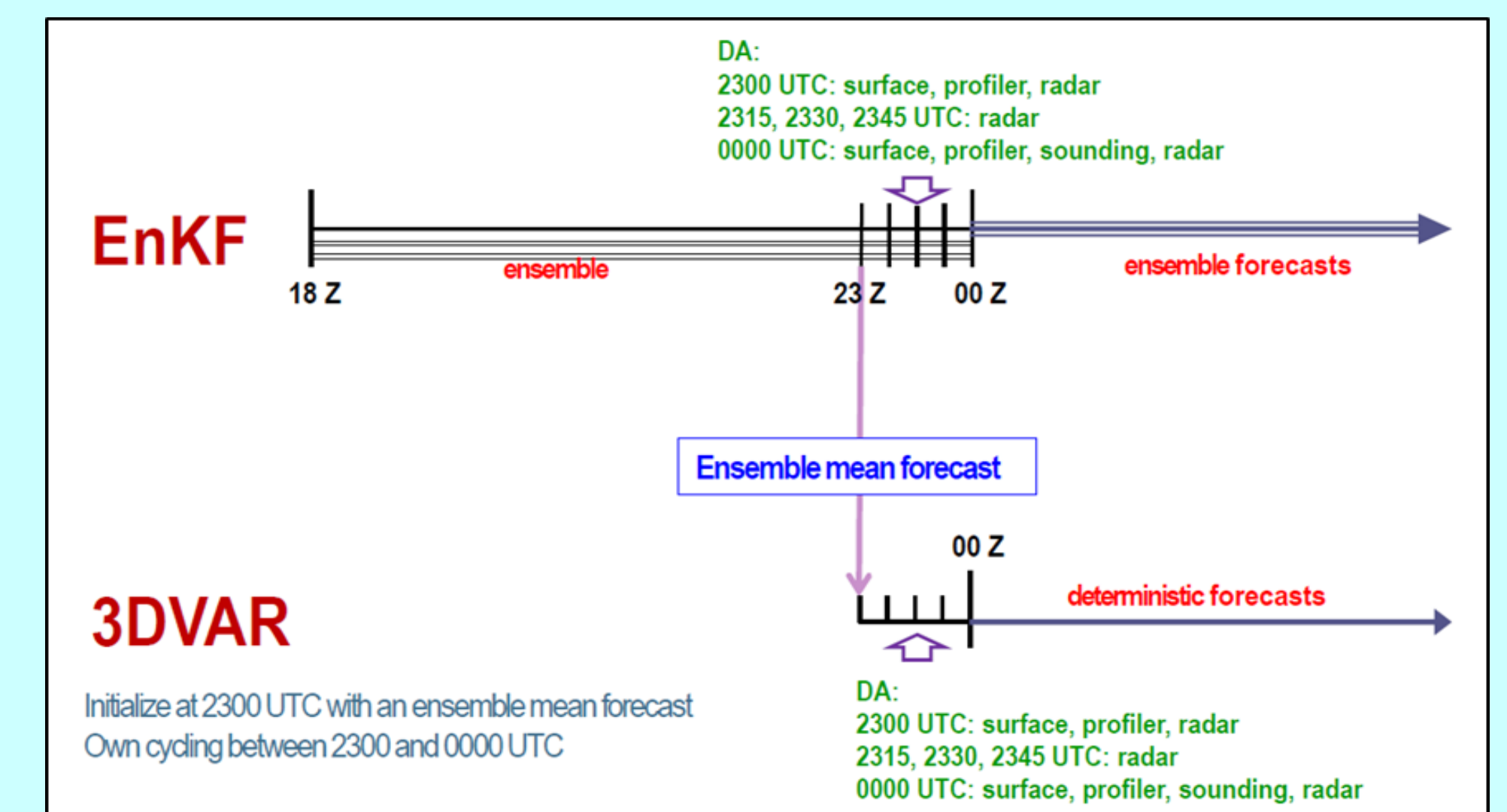
PQPF Verification



Reliability diagram for the 24 h forecast PQPF of 3-h accumulated precipitation ≥ 0.5 inch.

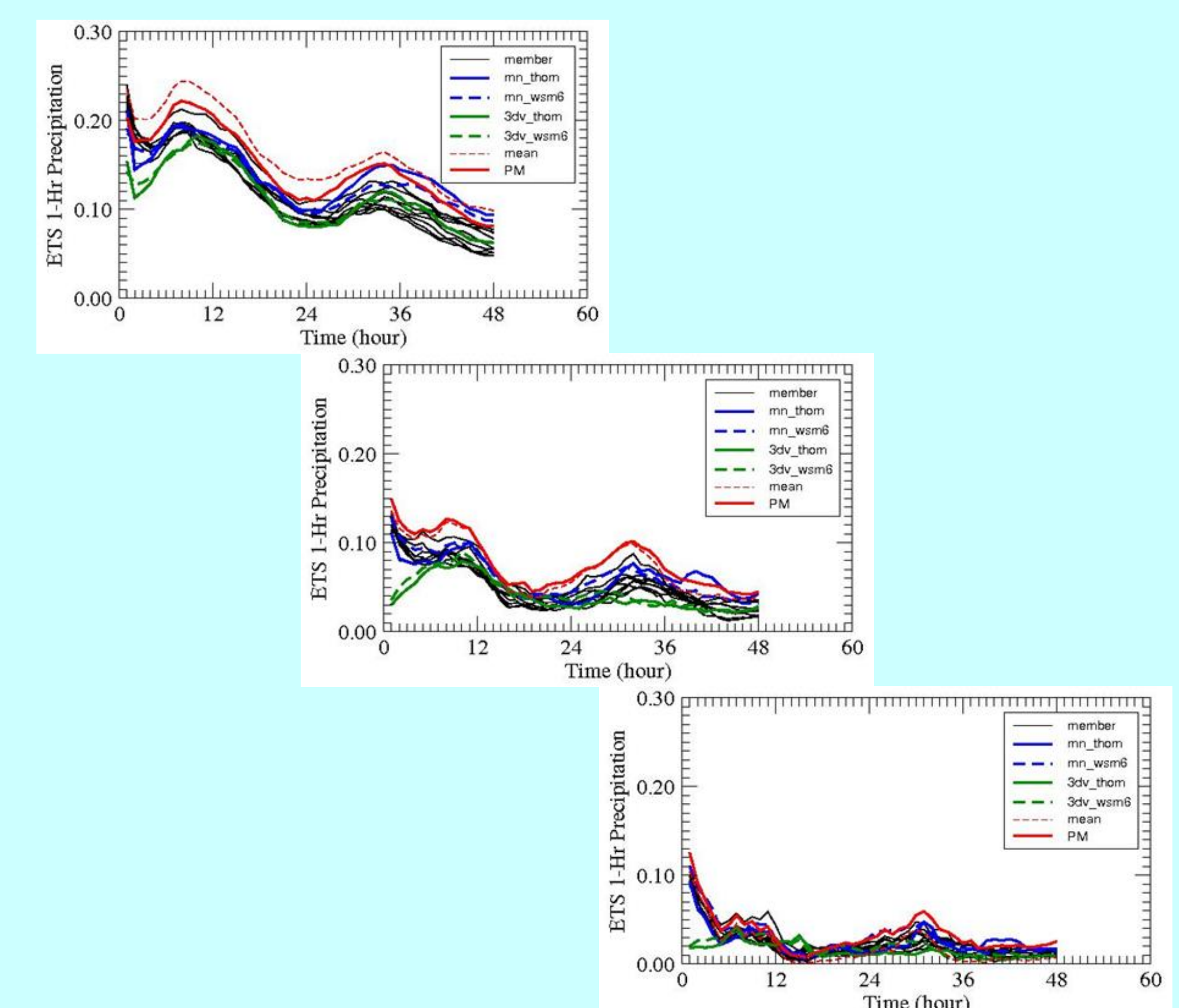
AUROC for the ensemble probability of 3-h accumulated precipitation $\geq 0.25, 0.5,$ and 1.0 inch with $r=0$.

Flow diagram for the realtime cycled EnKF and 3DVAR storm-scale forecasts



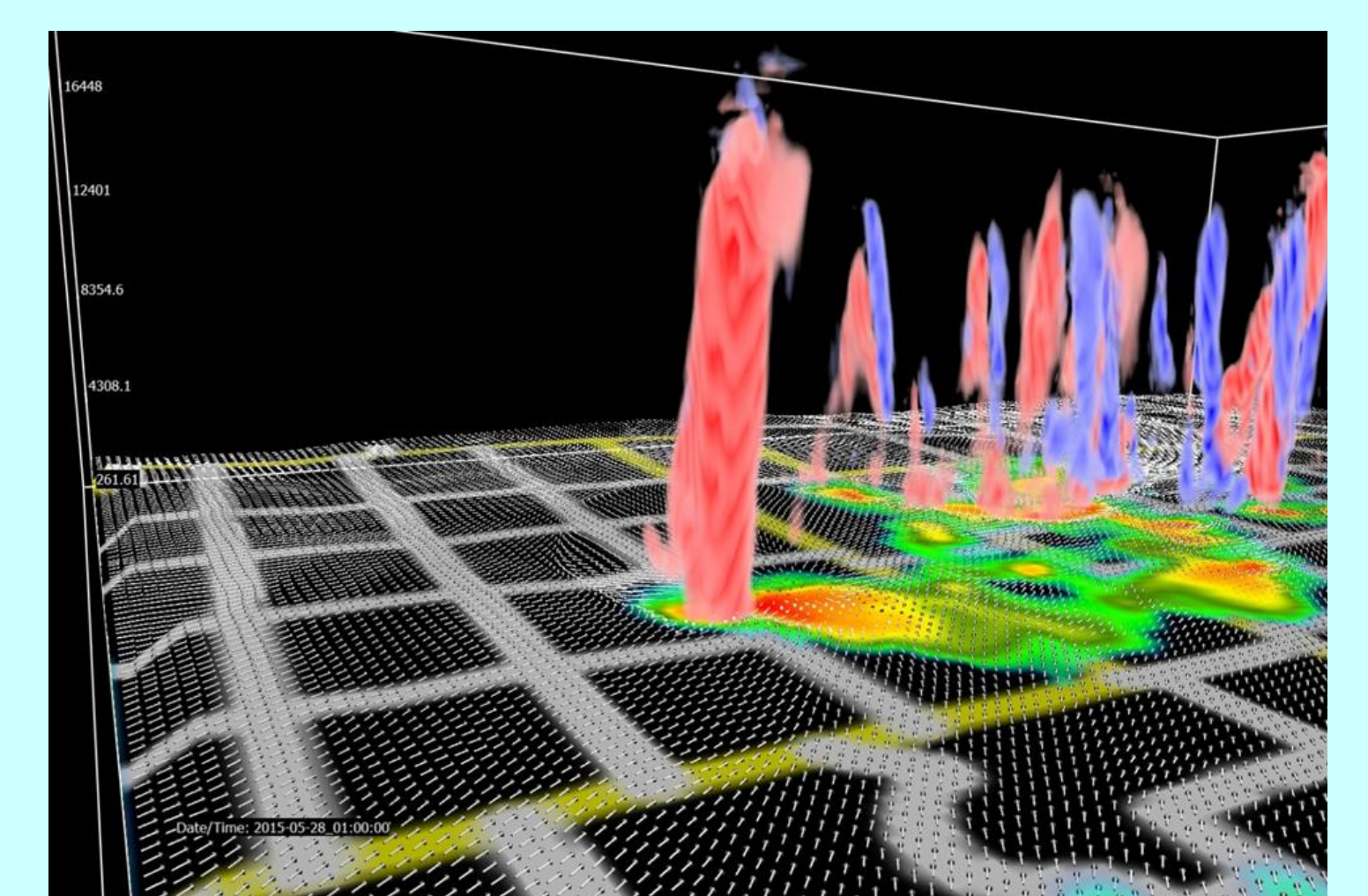
The EnKF DA are performed from 2300 UTC to 0000 UTC at 15 minute intervals. A 3DVAR DA is carried out on the ensemble mean forecast at 2300 UTC followed by its own DA cycles to facilitate direct comparison with the EnKF forecasts.

EnKF-based Ensemble

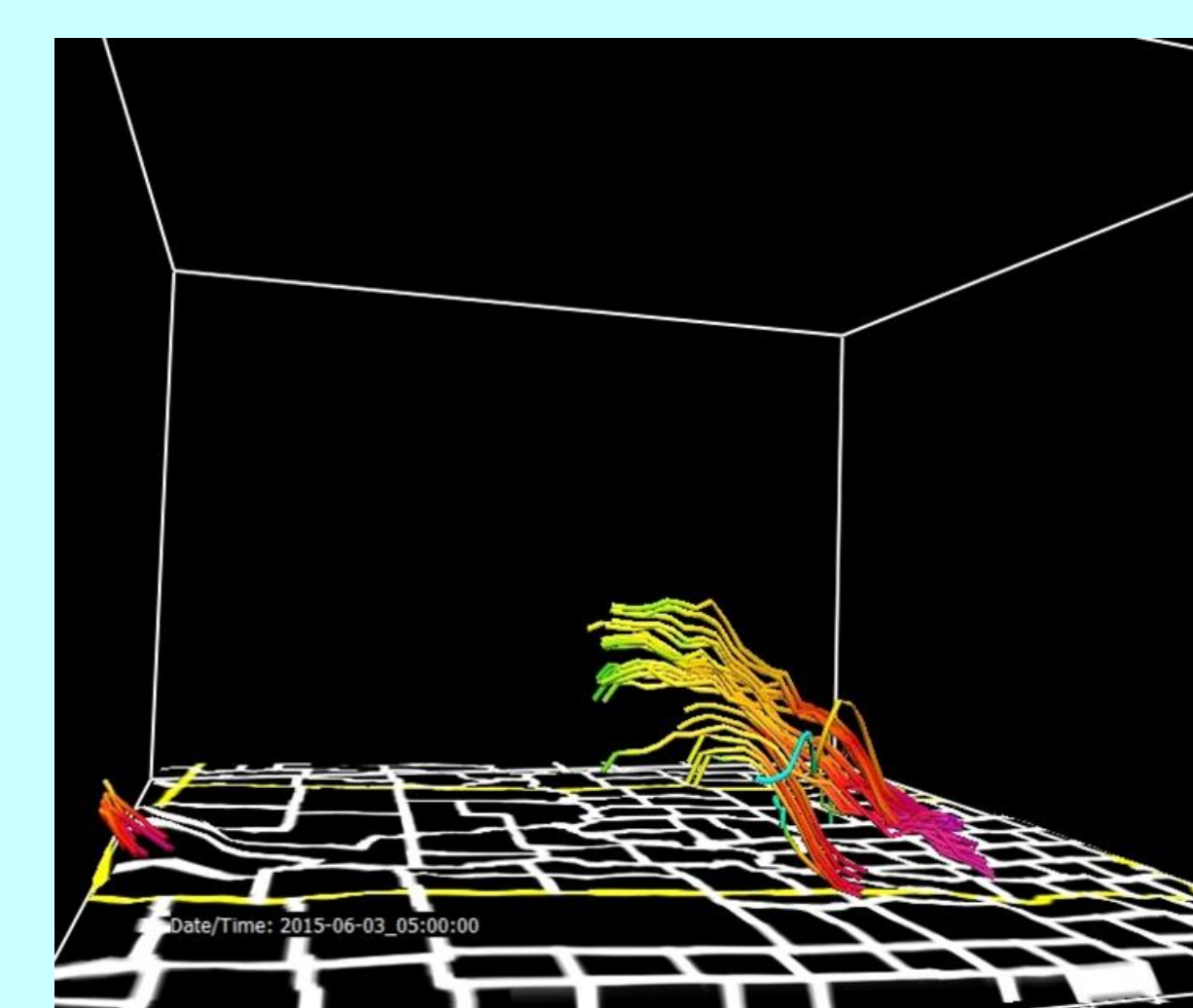


ETS of 1-h accumulated precipitation (top) ≥ 0.01 , (middle) ≥ 0.10 , (bottom) ≥ 0.25 inch, from the EnKF-based 0000 UTC ensemble members, mean, PM, and four deterministic forecasts.

Visualization Demonstration



Example of VAPOR visualization of CAPS Control Run (WRF-ARW with 3DVAR-Cloud Analysis radar initialization) shown at the HWT weather briefing depicting near-surface wind (vectors), near-surface model reflectivity (2D shading), and updraft helicity (3D shading, red hues positive and blue hues negative), county boundaries (white) and state boundaries (yellow). For a 25-hour forecast valid 0100 UTC 28-May-2015. Domain shown is centered in the northeast Texas Panhandle, with view point looking northwest. An EF2 tornado was observed in northern Hemphill Co., near the most dominant UH column depicted, in neighboring Roberts Co.



Trajectories (wind speed color shaded) for parcels in forecasted storms in South Dakota the evening of 02-June-2015 with strong near-surface winds.