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The SPC Storm-Scale Ensemble of Opportunity (SSEO):
Overview and Results from the 2012 Hazardous Weather Testbed Spring Experiment

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Introduction

- The Storm Prediction Center (SPC) has developed a 7-member experimental storm-scale ensemble of opportunity (**SSEO**).
- The **SSEO**:
  - consists of deterministic storm-scale models already available operationally to SPC.
  - provides a practical alternative to a formal storm-scale ensemble, given limited computing resources in NOAA.
  - contains hourly maximum storm-attribute fields, such as simulated reflectivity, updraft helicity, updraft speed, and 10-m wind speed.
- The **SSEO** has been utilized in SPC operations for the past year.
- The performance of the **SSEO** during the 2012 Spring Forecasting Experiment (SFE2012) was compared to other high-res ensembles:
  - OU CAPS storm-scale ensemble forecast system (SSEF)
  - Air Force Weather Agency (AFWA) 4-km ensemble.

SSEO Membership

- The 00Z **SSEO** is a multi-model, multi-physics ensemble comprised of 7 members with initial condition diversity from 2 time-lagged members:

	Grid Spacing	Vert Levels	Time Step	Fcst Length	PBL	Micro
NSSL WRF-ARW	4 km	36	24 s	36 h	MYJ	WSM6
EMC HRW WRF-ARW	5.15 km	35	30 s	48 h	YSU	WSM3
EMC HRW WRF-ARW* *12-hr time lag	5.15 km	35	30 s	48 h	YSU	WSM3
EMC HRW WRF-NMM	4 km	35	7.5 s	48 h	MYJ	Ferrier
EMC HRW WRF-NMM* *12-hr time lag	4 km	35	7.5 s	48 h	MYJ	Ferrier
EMC CONUS WRF-NMM	4 km	35	7.5 s	36 h	MYJ	Ferrier
EMC CONUS NAM NEST# #NEMS NMM-B	4 km	60	8.89 s	60 h	MYJ	Ferrier

SSEO Hourly Maximum Fields

Description of Fields:

- ***Simulated Reflectivity –*** calculated at 1-km AGL or as composite
- ***Updraft Helicity (UH) –*** representation of rotating updrafts in simulated storms
- ***Updraft Speed –*** maximum upward motion in the lower-to-mid troposphere
- ***10-Wind Speed –*** examined to identify convective gusts

Processing Techniques:

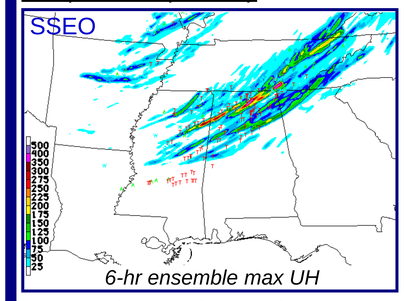
- ***Temporal Max –*** extract the max value over longer period, e.g., 24 hours
- ***Neighborhood Max –*** search within 40 km (~25 mi) radius to assign max value

Display Methods:

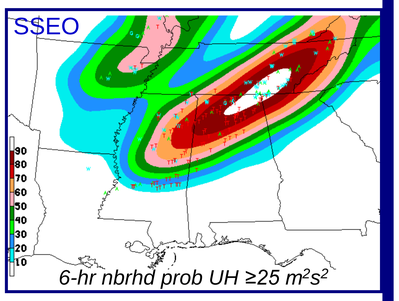
- ***Spaghetti –*** display members at a given threshold with different colors
- ***Ensemble Maximum –*** the maximum value for the ensemble at each grid point
- ***Neighborhood Probabilities –*** the ensemble probability of exceeding a given threshold for the neighborhood max field with a 2-D Gaussian smoother (40 km) applied

Examples

27 April 2011 (18-00Z)

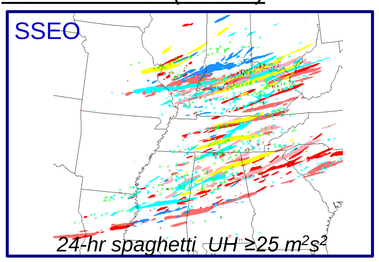


6-hr ensemble max UH

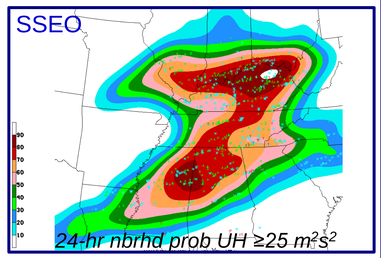


6-hr nbrhd prob UH ≥25 m^2s^2

02 March 2012 (12-12Z)

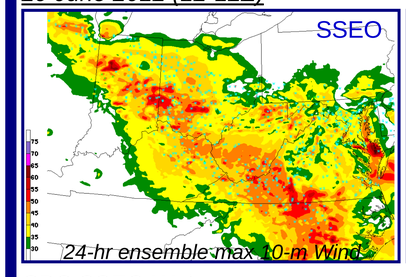


24-hr spaghetti UH ≥25 m^2s^2

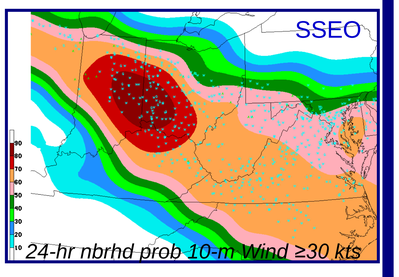


24-hr nbrhd prob UH ≥25 m^2s^2

29 June 2012 (12-12Z)



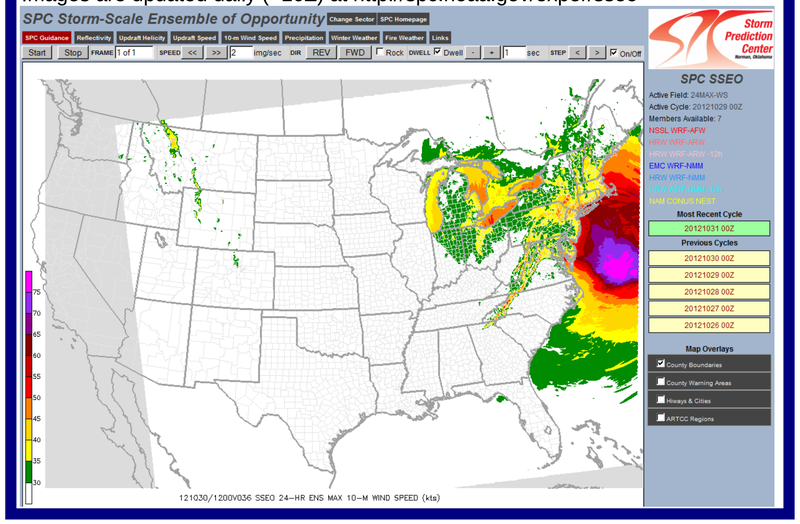
24-hr ensemble max 10-m Wind



24-hr nbrhd prob 10-m Wind ≥30 kts

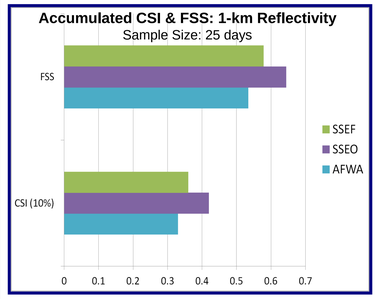
SPC SSEO Webpage

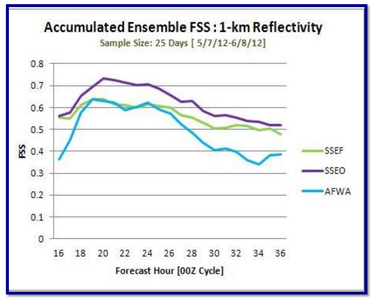
Images are updated daily (~10Z) at http://spc.noaa.gov/exper/sseo



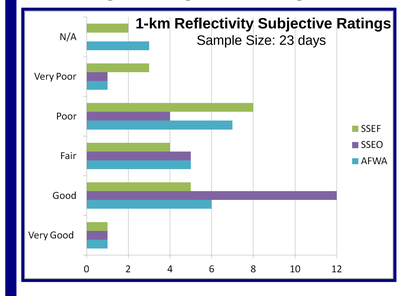
SFE2012 Results

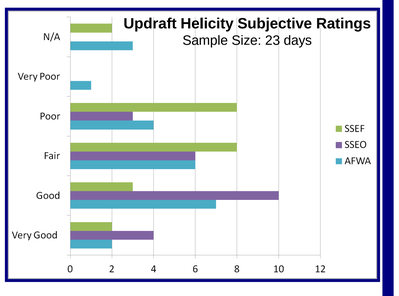
- The **SSEO** was compared to two other storm-scale ensembles during the 2012 HWT Spring Forecasting Experiment (SFE2012) from May 7 – June 8:
  - *SSEF* – 12-member multi-model, multi-physics, multi-initial conditions using SREF perturbations for IC/LBCs
  - *AFWA* – 10-member single-model (WRF-ARW), multi-physics, multi-initial conditions using global model forecasts for IC/LBCs
- Objective verification (i.e., CSI at 10% and FSS) was performed for neighborhood probabilities of 1-km AGL simulated reflectivity ≥40 dBZ with the SSEO having the highest objective verification scores accumulated over the 5-week period of the SFE2012.





- Subjective verification was performed by the SFE2012 participants in rating the usefulness of neighborhood probability forecasts of 1-km AGL simulated reflectivity and updraft helicity with the SSEO most commonly receiving the highest ratings.





Summary

- The SPC SSEO is a practical approach in generating storm-scale ensemble data and is currently available to SPC forecasters.
- Hourly maximum storm-attribute fields (e.g., UH) are processed in various ways to derive maximum usefulness from the data.
- The SSEO has performed reasonably well in highlighting the threat areas in many of the historic severe weather events over the previous two years.
- Subjective and objective evaluations from SFE2012 indicate the SSEO often performed as well as or better than more formal storm-scale ensembles in forecasting the occurrence of convective and severe weather.

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