The Role of the Science and Operations Officer (SOO)

Dr. Ariel Cohen
Ariel.Cohen@noaa.gov

Summary

NWS Science/Operations Teacher

Summary

Leader for…

Integrating cutting-edge science/technology into local/regional/national operations:

To enhance NWS's ability to accomplish its vital mission --

******Life/property protection and enhancing economy******

WHY?

Summary

How?

A. *Publishing as many papers as possible and demanding that everyone follow your way of doing things*

A. *Developing professional relationships that encourage an embrace for learning, respect, and growth*

A. *Developing one's own deep expertise through research, science development, and teaching, and cultivating / leveraging the whole office's expertises*

A. *Both B and C*

Summary

Leader for…

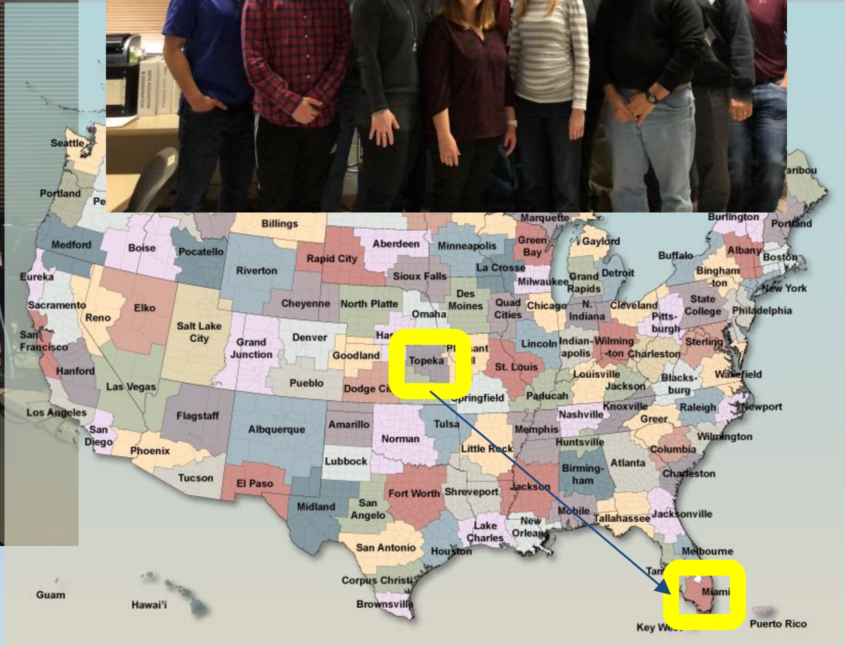
Integrating cutting-edge science/technology into local/regional/national operations:
To enhance NWS's ability to accomplish its vital mission --
****Life/property protection and enhancing economy****

⇒ Cultivating/leveraging individual/team expertise &
encouraging POSITIVE/HEALTHY operational culture and professional relationships

⇒ Developing and presenting research with entities internal and external to NWS
(e.g., universities, research labs, social sciences)

⇒ Working collaboratively with management team and staff to understand partner needs and how we can best tailor our products to meeting their needs

WFO Topeka -- Local Office Initiatives



Local Operations Focus: Servant Leadership

Serving in whatever role I can to help the team

(Picking up shifts, helping El Techs with the putting the office sign up, jumping in to answer questions, bringing in donuts during stressful times, …)

Local Operations Focus

Finding The Teaching Moments

Leading Local Training

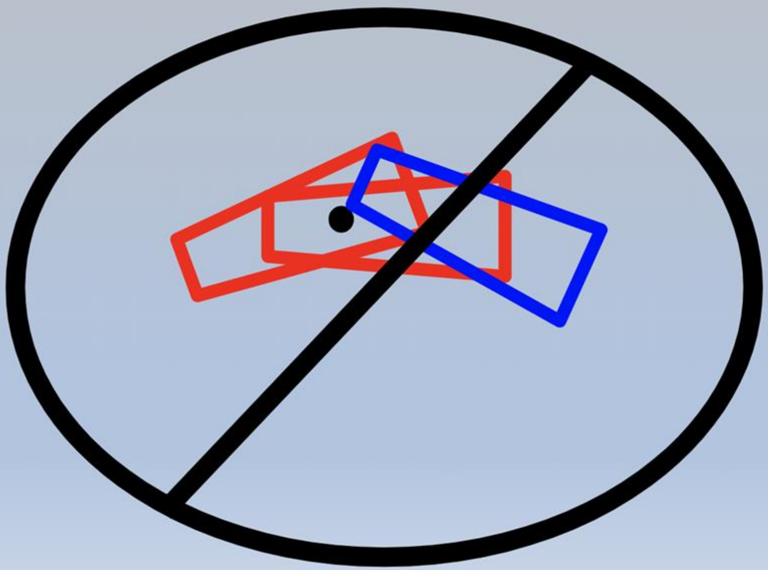
Weather Event Simulator (WES)

Displaced Real-Time Training / DRILLS -- Train Like We Fight

Warning Strategies

Some Polygon Goals (Weather-Ready Nation)

Don’t over-do polygon overlap



Some Polygon Goals (Weather-Ready Nation)

Considerations

Solution 2

Higher frequency of warnings -- mitigated by by longer durations

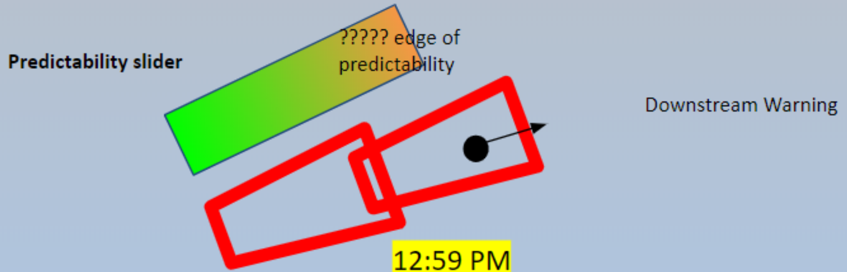
Risk for warnings to linger past severe risk -- mitigated by more frequent SVS cancellations

Upgrade to higher-end warning/emergency: CAPTURE STORM

Time to analyze!

Method: Track polygon at longest duration possible, finalize then change time to a shorter time *to ensure polygon endpoint is pulled behind trajectory endpoint.*

> *Should be bringing endpoint back anyway, since* ***default*** *buffers beyond trajectory endpoint forcing overlap if we're trying to get any downstream lead time*
>
> > *Storm will NEVER leave the* ***default*** *polygon in its duration, forcing multiple warnings for sustained severe risk*



12:59 PM

Storm actually sped up more than anticipated!

Cancel first warning long before 12:59PM!

Leading Local Operations Service Enhancements:

MESOANALYSIS -- Science to bridge the watch-warning gap: Enhance Impact-Based Decision Support Services (IDSS)!!!

Opportunity to provide vital, high-resolution information to partners/customers between outlook/watch and warning scales to support decision making!

Leading Local Operations Service Enhancements:

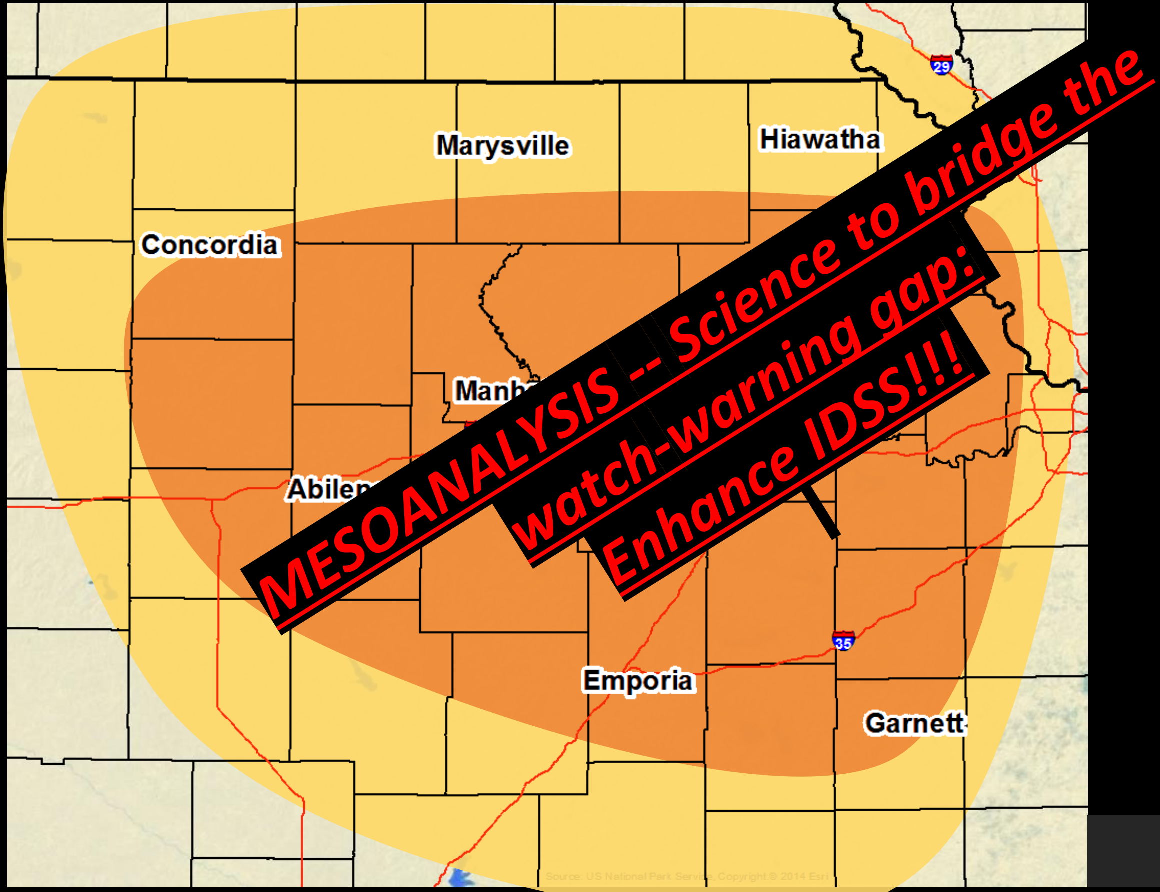
MESOANALYSIS -- Science to bridge the watch-warning gap: Enhance Impact-Based Decision Support Services (IDSS)!!!

How do we make this work?

A. *Demanding cultural change, expecting everyone to adapt to my way*
B. *Encouraging buy-in to new ideas by respecting a diverse variety of viewpoints, including others, and moving forward with give-and-take / compromise*
C. *Leveraging expertise across the WHOLE OFFICE as a team, and lead by example (demonstrate actions/ procedures I'd like others to consider following)*
D. *Both B and C*

Severe Thunderstorm Outlook

Valid 1:00 pm – 4:00 pm TODAY (July 19, 2018); Issued at 1630Z



Severe storm potential????

Very uncertain

Orange Shading

Greatest severe-storm potential with damaging winds, if storms can be sustained through the day

Yellow Shading

Some severe-storm potential, if storms can be sustained through the day

NATIONAL WEATHER SERVICE
WEATHER FORECAST OFFICE • TOPEKA, KS

Severe Thunderstorm Outlook

Valid 1:00 pm – 4:00 pm TODAY (July 19, 2018); Issued at 1745Z

What

Damaging winds to 60-80 MPH likely, potentially widespread

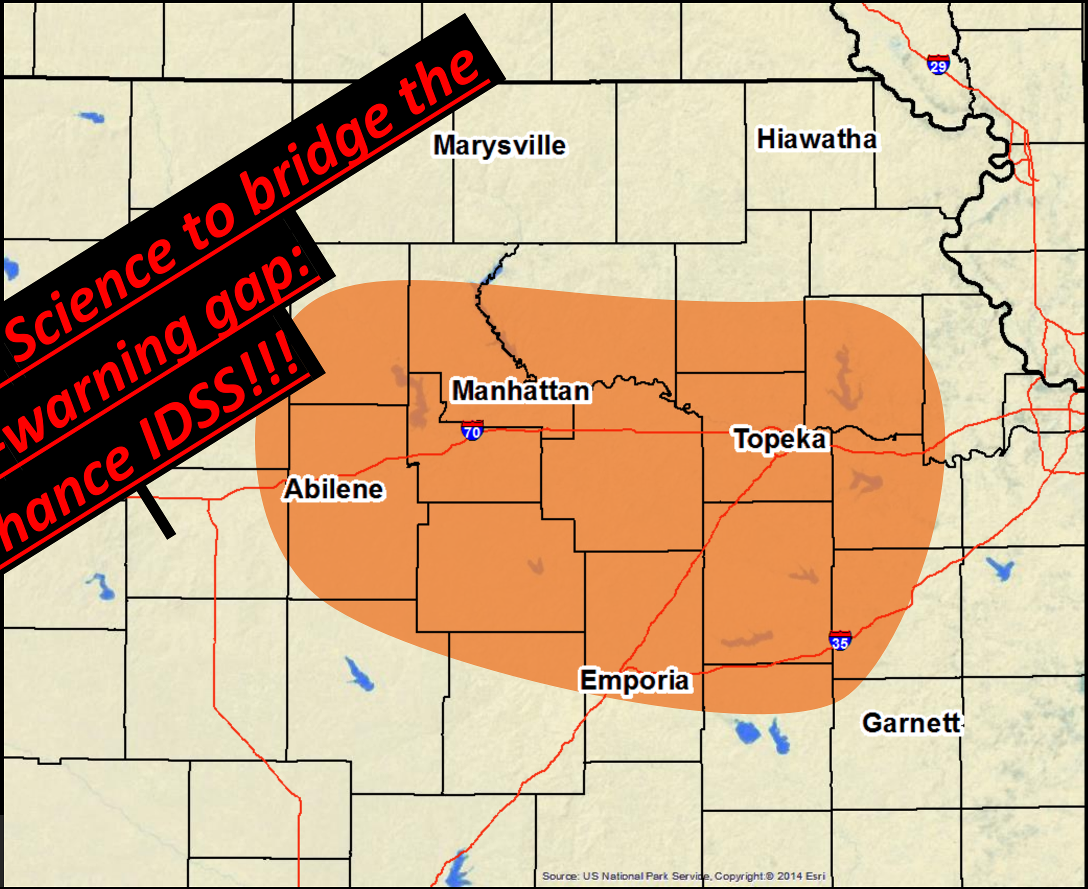
Where

Most-likely potential in or shaded area

Action

Move to a sturdy structure before storms arrive

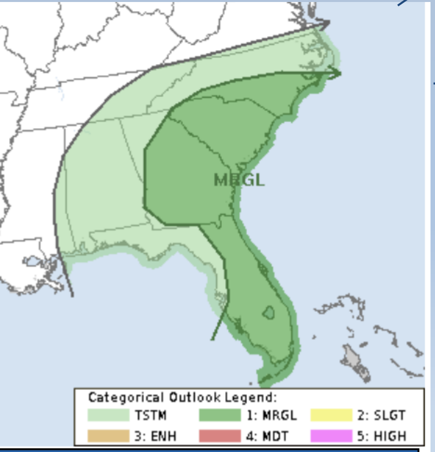
MESOANALYSIS -- Science to bridge the watch-warning gap: Enhance IDSS!!!



NATIONAL WEATHER SERVICE
WEATHER FORECAST OFFICE • TOPEKA, KS

WFO Miami

Heterogeneities in threats, various levels of certainty, impact, timing, etc.



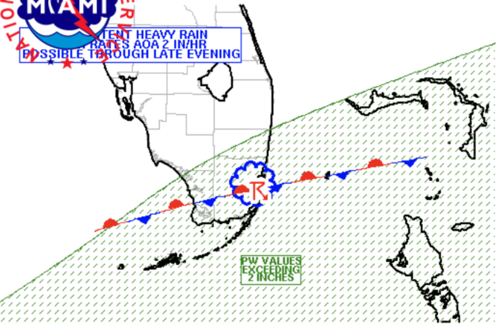
Local-scale, tactical threat assessment and messaging to enhance IDSS --

Leverages cutting-edge science tools, conceptual models, observational data, NWP datasets -- MESOANALYSIS

```
.MESOSCALE UPDATE...
A diffuse differential-heating zone extends west-east from northern
portions of Mainland Monroe County arching northeast through
northwest Miami-Dade County. This zone of baroclinicity is being
reinforced by persistent mid/high-level convective debris clouds
spreading downstream of regenerative convection approaching South
Florida from the adjacent Gulf waters. On the warm side of this
baroclinic zone, surface-layer heating resulting from insolation has
allowed temperatures to reach the upper 70s to lower 80s.
Correspondingly steepened low-level lapse rates have permitted
steepening low-level lapse rates, with boundary-layer cumulus fields
becoming increasingly agitated along horizontal convective rolls
extending northward across the far southern tip of the Florida
Peninsula toward the southern edge of thinner cirrus. Modest
southerly low-level winds of 5-10 kt will allow the baroclinic zone
to slowly advance northward during the next few hours -- south of
which moderate boundary-layer-based buoyancy will continue to exist.

Through 16Z, the aforementioned convection over the east Gulf will
continue to shift east, and will have the potential to experience a
slight uptick in intensity while interacting with inflow
characterized by 1000-2000 J/kg south of the baroclinic zone --
affecting areas from Mainland Monroe and eventually eastward to
western Miami-Dade Counties. With 35-45 kt of bulk shear in the
lower half of the convective depth, semi-organized convection may
evolve, multi-cell or transient/weak-supercell modes. However,
numerous cell interactions may tend to curtail the overall strong-
convective sustenance.

Thereafter, weak sea-breeze convergence in proximity to East Coast
Metro areas should phase with the diurnally deepening boundary layer
to support an uptick in eastern-CWA convection by early afternoon.
Areas south of a latitude through Fort Lauderdale should experience
the greatest potential for this activity where low-level lapse rates
become steepest. Similar convective modes are expected with eastern-
CWA convection, as previously identified. Such modes will have the
potential to support strong to locally damaging winds in association
with precipitation-loaded downdrafts and storm-scale vertical
circulations. Poor midlevel lapse rates and frequent cell
interactions may tend to limit the hail risk, though small hail
cannot be ruled out with any persistently rotating updraft. While a
brief tornado cannot be ruled out amid the appreciable low-level
MLCAPE environment and boundary-cell interactions, the 12Z Miami
RAOB indicates weak low-level flow/SRH which should mitigate the
overall tornado potential.
```

Mesoscale Discussion 2280

< Previous MD   Next MD >

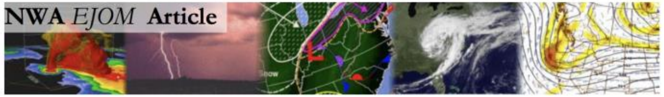


SPC MCD #2280

```
MESOSCALE DISCUSSION 2280
NWS STORM PREDICTION CENTER NORMAN OK
0755 PM CDT SUN OCT 30 2011

AREAS AFFECTED...THE MIAMI AREA

CONCERNING...HEAVY RAINFALL

VALID 310055Z - 310300Z

A 10-15-MILE-WIDE AREA OF HEAVY-RAIN-PRODUCING CONVECTION CENTERED
OVER BISCAYNE BAY NEAR PINECREST WILL LIKELY REMAIN QUASI-STATIONARY
DURING THE NEXT FEW HOURS. THIS WILL AFFECT PORTIONS OF THE MIAMI
AREA NEAR AND SOUTH OF CORAL GABLES TOWARD PERRINE AND CUTLER
RIDGE...WITH ADDITIONAL HEAVY RAIN POSSIBLY OCCURRING AFTER 0130Z
FARTHER NORTHEAST TOWARD MIAMI BEACH AND DOWNTOWN MIAMI.

SFC MESOANALYSIS AT 00Z DEPICTS THAT THE CONVECTION IS ANCHORED TO A
NEARLY STATIONARY FRONT ORIENTED WSW-ENE ACROSS THE SRN FL
PENINSULA. ELY INFLOW OF 20-25 KT WITHIN THE 925-850-MB LAYER PER
MIAMI 00Z RAOB WILL OPPOSE THE WLY COMPONENT OF FLOW DEEPER IN THE
CLOUD-BEARING LAYER TO LIMIT STORM MOTION. MEANWHILE...A
CONVECTIVELY INDUCED MCV WITHIN THE 3-6-KM-LAYER /PER KEY WEST
WSR-88D DATA/ WILL EXPERIENCE LITTLE STEERING FLOW PER VWP
DATA...THUS PROVIDING QUASI-STATIONARY FORCING FOR REGENERATIVE
CONVECTION. THESE FACTORS WILL YIELD LITTLE STORM MOTION...WITH
PERSISTENT HEAVY RAIN OVER MULTIPLE HOURS POSSIBLE. WITH THE 00Z
MIAMI RAOB INDICATING A 4.5-KM DEEP...SATURATED WARM-CLOUD
LAYER...COLLISION-COALESCENCE PROCESS WITHIN ABUNDANT DEEP-LAYER
MOISTURE /PW VALUE OF 2.23 INCHES/ WILL SUPPORT HEAVY RAINFALL RATES
OF 2-4 IN/HR. IF THE STORM IS ABLE TO DEEPEN AND EXPERIENCE STRONGER
SWLY FLOW WITHIN THE MID/UPPER LEVELS...IT WOULD GRADUALLY SHIFT
NEWD TOWARD DOWNTOWN MIAMI AND MIAMI BEACH...MAINLY AFTER 0130Z.
WHILE CONVECTION MAY OCCASIONALLY EXHIBIT A MID-LEVEL
CIRCULATION...WEAK LOW/MID-LEVEL LAPSE RATES AND WEAK LOW-LEVEL
SHEAR WILL GREATLY MITIGATE THE SVR POTENTIAL.

..COHEN.. 10/31/2011

ATTN...WFO...MFL...

LAT...LON   25428017 25458042 25608056 25778051 25868030 25788012
            25578008 25428017
```

To Accomplish This: Need Strong R2O <-> O2R Leadership!!!!!

Cohen, A. E., and P. Santos., 2012: South Florida flash flooding events. *Electronic J. Operational Meteor.*, **13** (11), 151–172.



South Florida Flash Flooding Events

ARIEL E. COHEN
NOAA/National Weather Service/National Centers for Environmental Prediction/Storm Prediction Center, Norman, Oklahoma

PABLO SANTOS
NOAA/National Weather Service, Miami, Florida

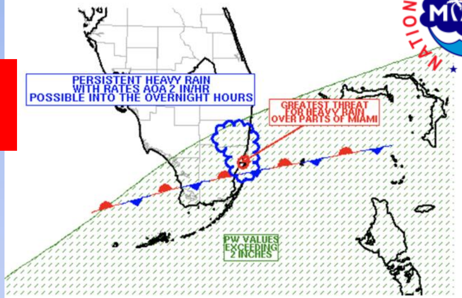
(Manuscript received 17 August 2012; in final form 13 December 2012)

ABSTRACT

During the period from around 2200 UTC 30 October through 0800 UTC 31 October 2011, supercell thunderstorm activity produced excessive rainfall over parts of the Miami, Florida area, particularly affecting locations along the northwest and north coast of Biscayne Bay toward south Miami Beach. This event was partly responsible for setting a monthly record rainfall total at Miami Beach. What was unique about the thunderstorm activity was its long duration and nearly stationary motion. It also exhibited high precipitation efficiency, with rainfall rates in excess of 101.6 mm (4 in.) per hour. In this paper, we identify ways in which this relatively rare event may have been anticipated based upon available upper-air data, identification of heavy rainfall ingredients involved, consideration of supercell motion, and the use of very high resolution atmospheric models. The background synoptic environment is also addressed, which featured a surface front near the storm, and an onshore component of the low-level flow. Weather Research and Forecasting (WRF) model simulations are used to illustrate the role that mesoscale convergence zones may have played in exacerbating the event. Finally, two other similar cases are considered for purposes of comparison. This paper ultimately seeks to aid in the short-term anticipation of potential flash floods in association with non-tropical, deep-moist convection in south Florida.

Mesoscale Discussion 2281

< Previous MD   Next MD >

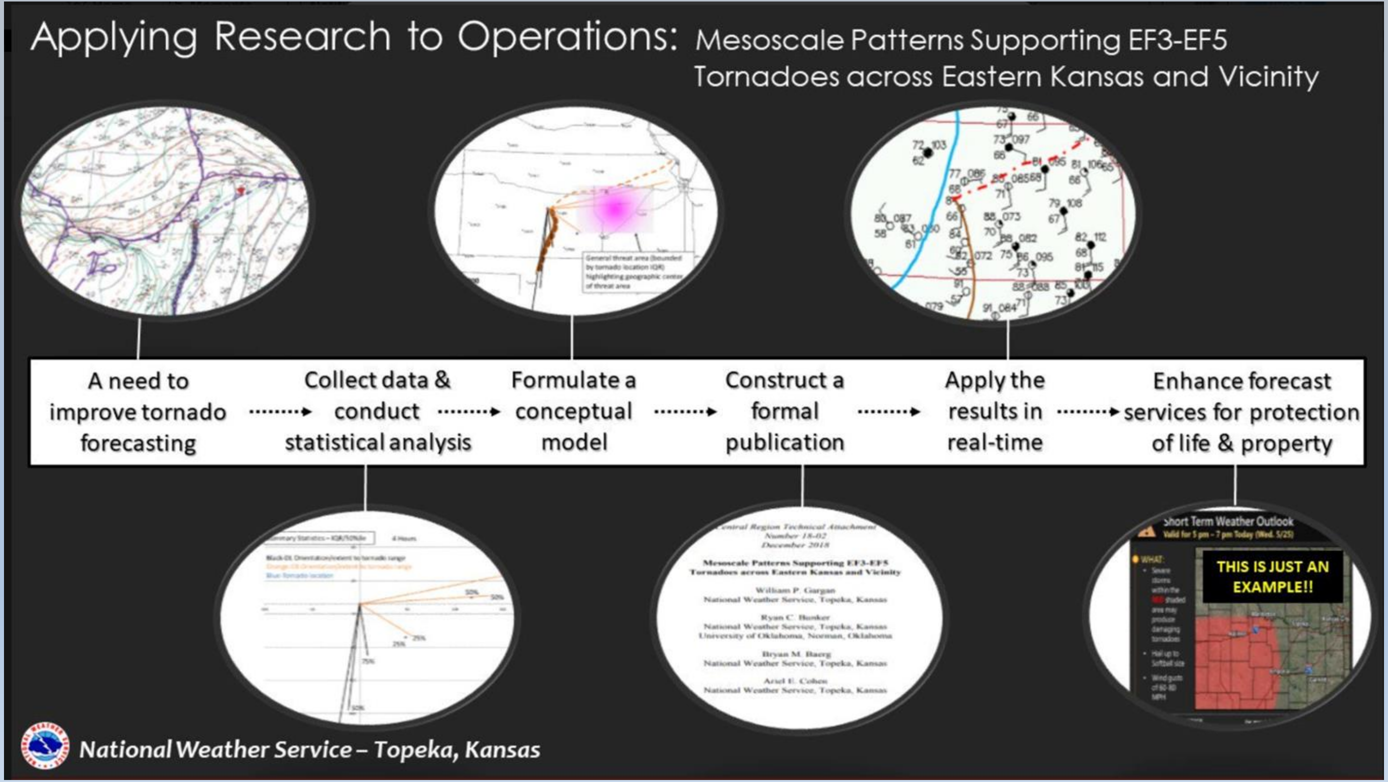


SPC MCD #2281

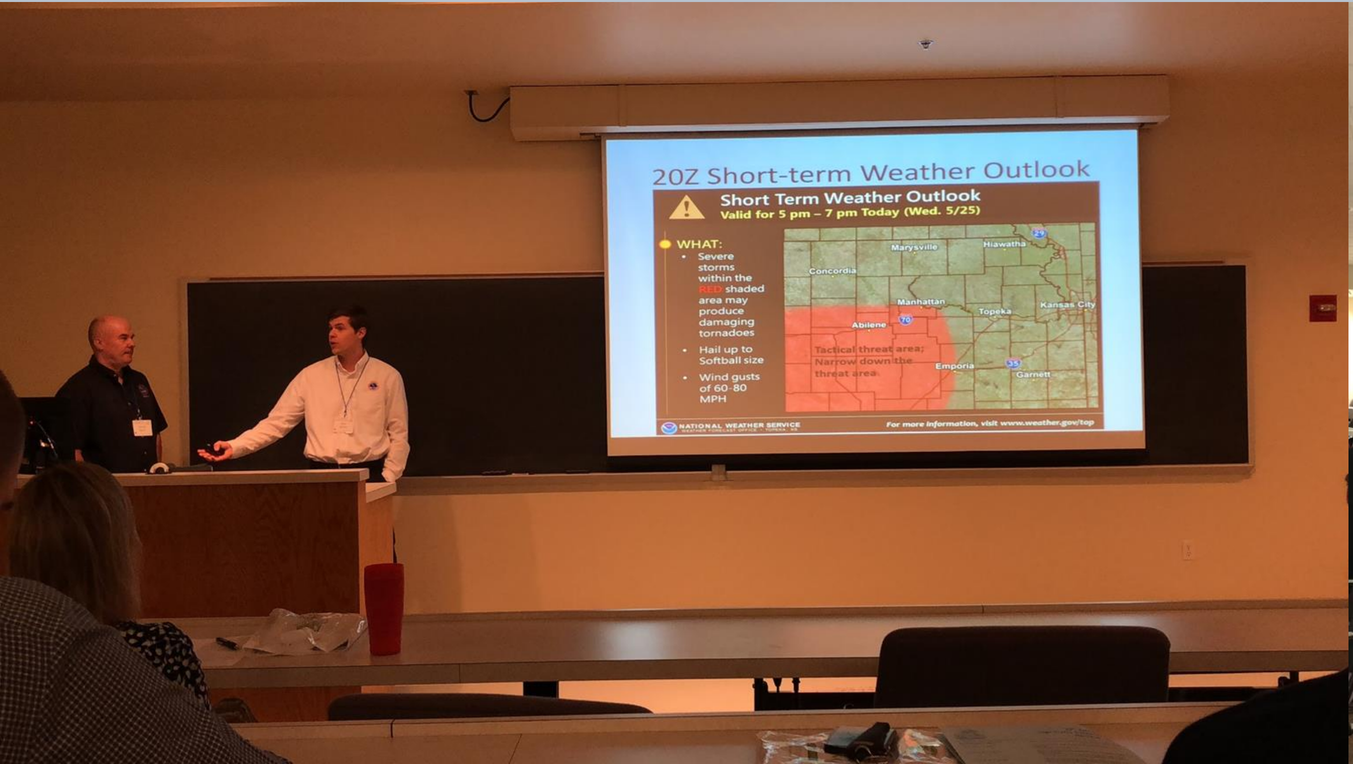
```
MESOSCALE DISCUSSION 2281
NWS STORM PREDICTION CENTER NORMAN OK
1135 PM CDT SUN OCT 30 2011

AREAS AFFECTED...PARTS OF THE SERN FL PENINSULA...INCLUDING THE
MIAMI AREA

CONCERNING...HEAVY RAINFALL

VALID 310435Z - 310630Z

RAINFALL RATES OF 2-4 IN/HR WILL BE POSSIBLE FROM CONVECTION OVER
PARTS OF THE SERN FL PENINSULA INTO THE OVERNIGHT HOURS. THE
GREATEST THREAT WILL OCCUR OVER PARTS OF THE MIAMI
AREA...PARTICULARLY FROM CORAL GABLES AND COCONUT GROVE TOWARD
DOWNTOWN MIAMI AND MIAMI BEACH...AS WELL AS KEY BISCAYNE.

TERMINAL DOPPLER RADAR FROM MIAMI INDICATES A VERY
PERSISTENT...10-15-MILE-WIDE AREA OF CONVECTION OVER BISCAYNE BAY
NEAR CORAL GABLES AND COCONUT GROVE. THE BULK OF THIS CONVECTION HAS
MOVED LITTLE DURING THE PAST SEVERAL HOURS...WITH ONLY A SLIGHT EWD
NUDGE AFTER HAVING DEVELOPED A BROAD MID-LEVEL STORM-SCALE
CIRCULATION /FURTHER SUSTAINING CONVECTION/. SFC MESOANALYSIS AT 04Z
INDICATES THAT THIS CONVECTION REMAINS ANCHORED TO A
QUASI-STATIONARY BAROCLINIC ZONE ORIENTED WSW-ENE ACROSS THE SRN FL
PENINSULA. PER MIAMI 00Z RAOB...ELY INFLOW OF 20-25 KT WITHIN THE
925-850-MB LAYER OPPOSING THE WLY COMPONENT OF FLOW DEEPER IN THE
CLOUD-BEARING LAYER IS CURRENTLY LIMITING STORM MOTION.
HOWEVER...NAM/RUC FORECAST SOUNDINGS SUGGEST THAT THE 925-850-MB
FLOW WILL GRADUALLY VEER TOWARD THE SE/S DURING THE NEXT SEVERAL
HOURS...ALLOWING THE CONVECTION TO CONTINUE TO SLOWLY TRANSLATE
TOWARD PARTS OF DOWNTOWN MIAMI...MIAMI BEACH...AND KEY BISCAYNE.
WITH THE 00Z MIAMI RAOB INDICATING A NEARLY 4.5-KM DEEP WARM-CLOUD
LAYER...COLLISION-COALESCENCE PROCESSES WITHIN ABUNDANT DEEP-LAYER
MOISTURE /PW VALUES AOA 2 INCHES PER GPS DATA/ WILL SUPPORT HEAVY
RAINFALL RATES OF 2-4 IN/HR. FARTHER NORTH INTO BROWARD
COUNTY...HEAVY RAINFALL WITH RATES TO 2 IN/HR WILL BE POSSIBLE WITH
CONVECTION NEAR WESTON AND FORT LAUDERDALE. HOWEVER...THE LACK OF
CONVECTIVE ORGANIZATION AND STRONGER MID-LEVEL FLOW YIELDING FASTER
STORM MOTIONS WILL LIMIT THE HEAVY RAIN THREAT. WHILE CONVECTION MAY
OCCASIONALLY EXHIBIT MID-LEVEL CIRCULATIONS...WEAK LOW/MID-LEVEL
LAPSE RATES AND WEAK LOW-LEVEL SHEAR WILL GREATLY MITIGATE THE SVR
POTENTIAL.

..COHEN.. 10/31/2011

ATTN...WFO...MFL...

LAT...LON   25518015 25598033 25898041 26018060 26228054 26258027
            26168006 25648003 25518015
```

Leading Local-Office Research-To-Operations (R2O)
Also Leverages Operations-To-Research (O2R)

Include WHOLE OFFICE STAFF for Science/Technology Integration!



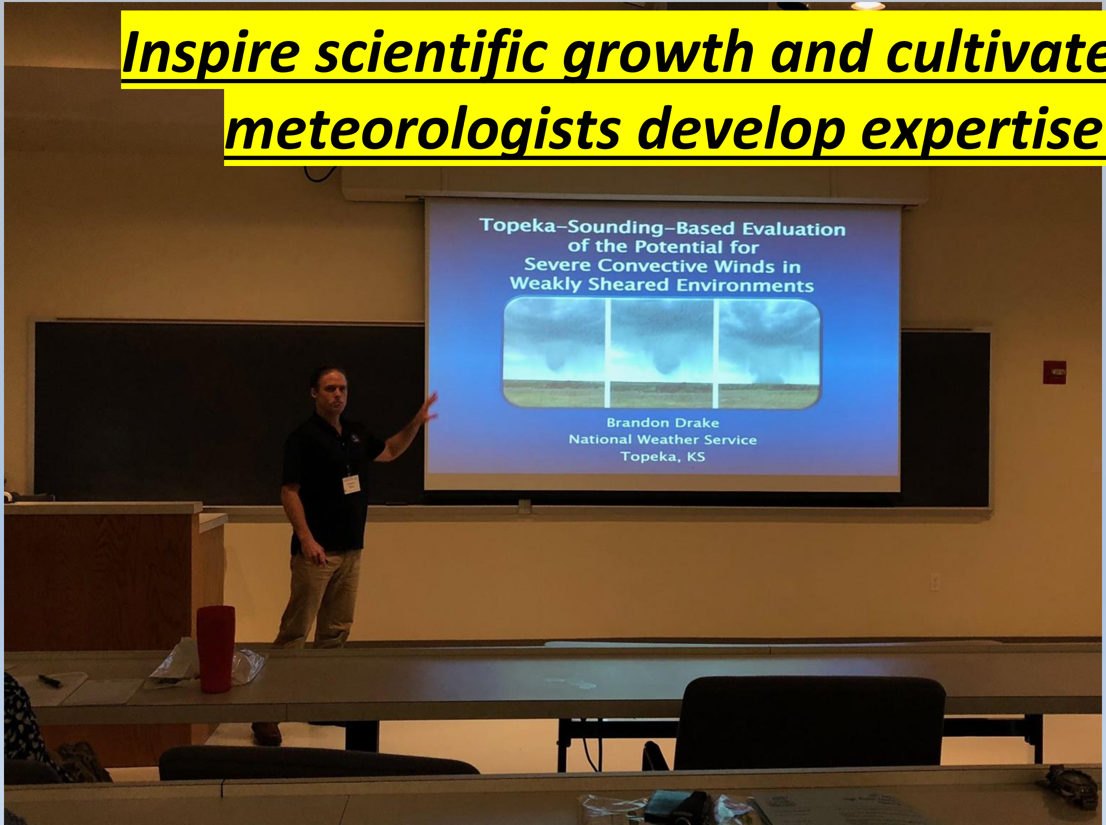
Leading Local-Office Research-To-Operations (R2O)
Also Leverages Operations-To-Research (O2R)
Include WHOLE OFFICE STAFF for Science/Technology Integration!

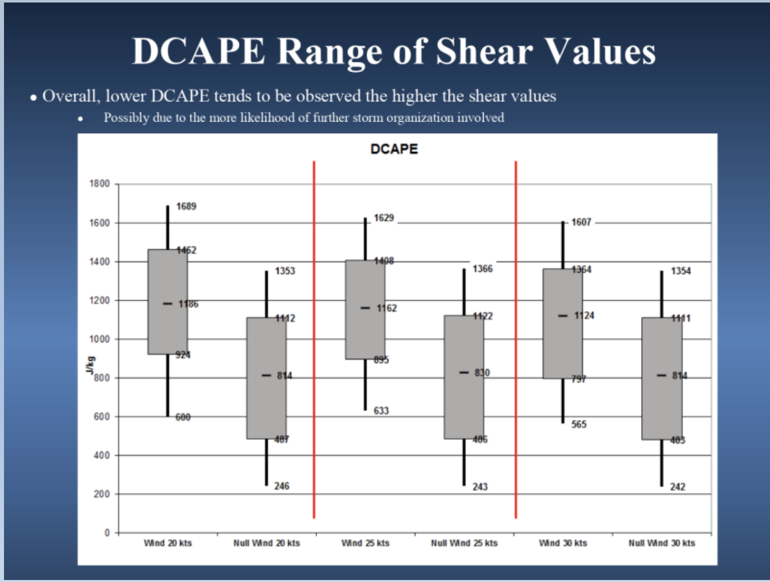


Leading Local-Office Research-To-Operations (R2O) Also Leverages Operations-To-Research (O2R)

Include WHOLE OFFICE STAFF for Science/Technology Integration!

Inspire scientific growth and cultivate an atmosphere where meteorologists develop expertise & build confidence





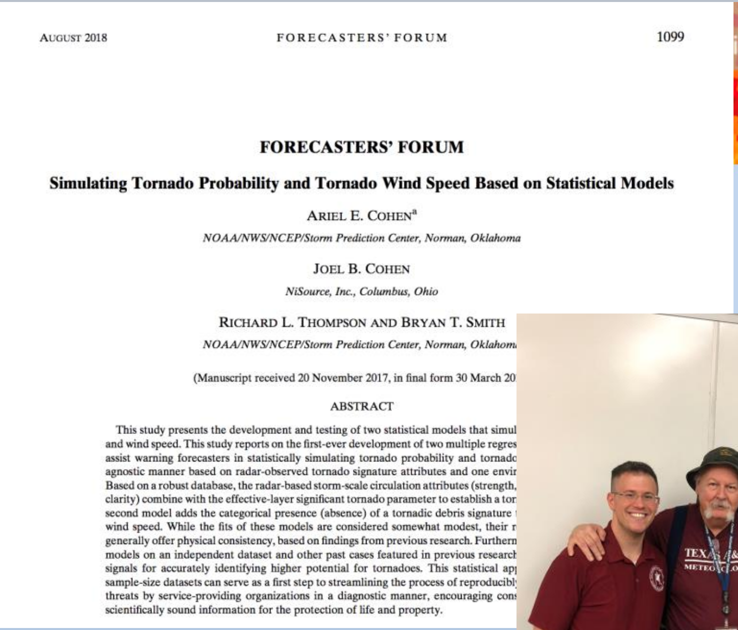
Leading Local-Office Research-To-Operations (R2O)
Also Leverages Operations-To-Research (O2R)

Include WHOLE OFFICE STAFF for Science/Technology Integration!

Inspire scientific growth and cultivate an atmosphere where meteorologists develop expertise & build confidence

Leading Local-Office Research-To-Operations (R2O) Also Leverages Operations-To-Research (O2R)

Include WHOLE OFFICE STAFF!


AUGUST 2018 FORECASTERS' FORUM 1099

FORECASTERS' FORUM

Simulating Tornado Probability and Tornado Wind Speed Based on Statistical Models

ARIEL E. COHEN[a]

NOAA/NWS/NCEP/Storm Prediction Center, Norman, Oklahoma

JOEL B. COHEN

NiSource, Inc., Columbus, Ohio

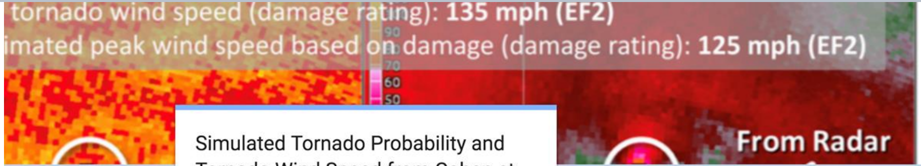
RICHARD L. THOMPSON AND BRYAN T. SMITH

NOAA/NWS/NCEP/Storm Prediction Center, Norman, Oklahom

(Manuscript received 20 November 2017, in final form 30 March 20

ABSTRACT

This study presents the development and testing of two statistical models that simul
and wind speed. This study reports on the first-ever development of two multiple regres
assist warning forecasters in statistically simulating tornado probability and tornado
agnostic manner based on radar-observed tornado signature attributes and one envir
Based on a robust database, the radar-based storm-scale circulation attributes (strength,
clarity) combine with the effective-layer significant tornado parameter to establish a tor
second model adds the categorical presence (absence) of a tornadic debris signature
wind speed. While the fits of these models are considered somewhat modest, their r
generally offer physical consistency, based on findings from previous research. Furthern
models on an independent dataset and other past cases featured in previous research
signals for accurately identifying higher potential for tornadoes. This statistical ap
sample-size datasets can serve as a first step to streamlining the process of reproducibl
threats by service-providing organizations in a diagnostic manner, encouraging cons
scientifically sound information for the protection of life and property.



Simulated Tornado Probability and Tornado Wind Speed from Cohen et al. (2018) Statistical Models

Enter in the following information to simulate tornado probabilities and wind speeds in a diagnostic manner, following Cohen et al. (2018): https://journals.ametsoc.org/doi/pdf/10.1175/WAF-D-17-0170.1.

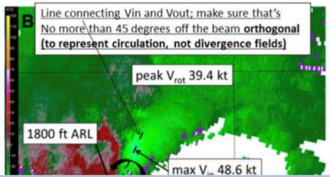
Collect data from the lowest radar tilt, if possible.

Make sure the maximum inbound velocity is within 5 n mi and 45 degrees of maximum outbound velocity (max in and max out aren't too far from each other and represent rotation and not divergence/convergence).

Examples follow, with subsequent entries needed to run the simulations. Corresponding results are found in the shared spreadsheet.

* Required

Make sure the maximum inbound velocity is within 5 n mi and 45 degrees of maximum outbound velocity (max in and max out aren't too far from each other and represent rotation and not divergence/convergence).



Select name *

Choose

Maximum inbound velocity (kt) *

If the couplet is comprised of only **outbound** velocities, set the lower-magnitude part of the couplet to a **negative** **inbound (here)**, and set the higher-magnitude part of the couplet as a **positive** **outbound (below)**. If the couplet is comprised of only **inbound** velocities, set the higher-magnitude part of the couplet to a **positive** **inbound (here)**, and set the lower-magnitude part of the couplet as a **negative** **outbound (below)**.

Your answer

Maximum outbound velocity (kt) *

Your answer

Height of circulation above radar level (ft) *

Your answer

Distance between maximum outbound and maximum inbound (n mi) *

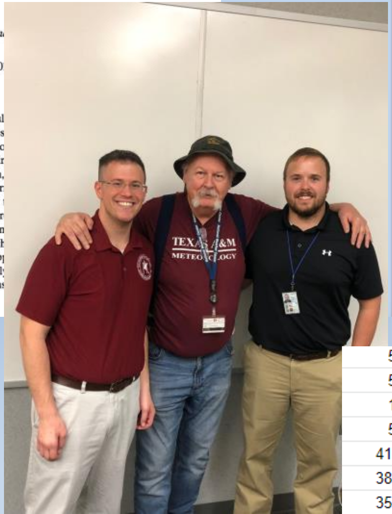
If couplet components are both outbounds or inbounds, use the distance between couple components.

Your answer

Representative significant tornado parameter (effective layer) *

Use SPC Mesoanalysis under Composite Parameters: https://www.spc.noaa.gov/exper/mesoanalysis/new/viewsector.php?sector=14#

Your answer



56	38	4600	1.5	3	1	0	50.88240837	95.5776
56	38	4600	1.5	3	1	0	50.88240837	95.5776
18	41	2030	2.5	3	0	0	7.946049037	83.75588
54	30	3200	2.4	3	0	0	15.5604954	91.8032
41.8	20.4	5800	3.9	2	1	0	7.369422178	85.4436
38.9	16.5	5300	2	2	0	0	9.49740432	83.1464
35.9	16.5	4300	3	2	0	0	4.647903773	81.6684

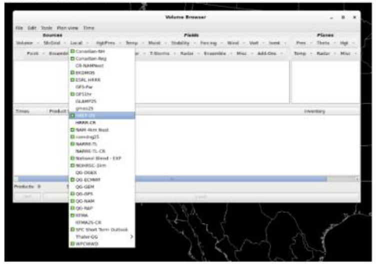
Leading Local-Office Research-To-Operations (R2O) Also Leverages Operations-To-Research (O2R)

Include WHOLE OFFICE STAFF!

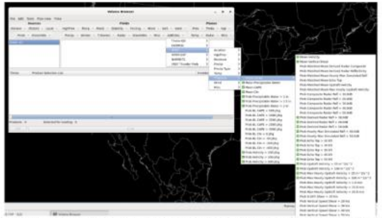
Newly installed severe weather datasets in CAVE:
HREF output and NSEA Digital Cursor Readout

High Resolution Ensemble Forecast (HREF) System

You can access HREF fields in CAVE by opening the Volume Browser, pulling down the Local menu under Sources, and then clicking on HREF-US:

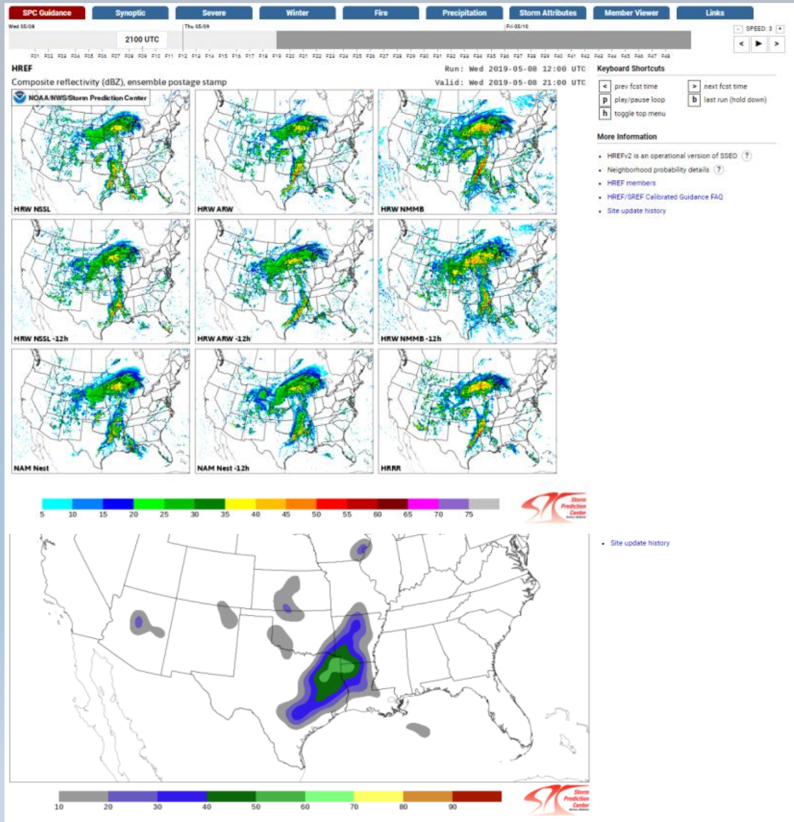


Then, pulling down the Add-Ons menu under Fields, click on HREF. From there, you can access numerous subcategories of HREF fields, from which you can look at various ensemble output: means, probability-matched means, exceedance probabilities, etc. But in particular, if you click on T-Storms, and then click on Storm Scale, you'll be able to see storm attribute ensemble fields. Below is a demo for how to pull that up:



Remember that if you go to SPC's HREF viewer page, you can see a lot of analogous information there: http://www.spc.noaa.gov/exper/href/#.

High-Resolution Ensemble Forecast (HREF) system



Leading Local-Office Research-To-Operations (R2O) Also Leverages Operations-To-Research (O2R)

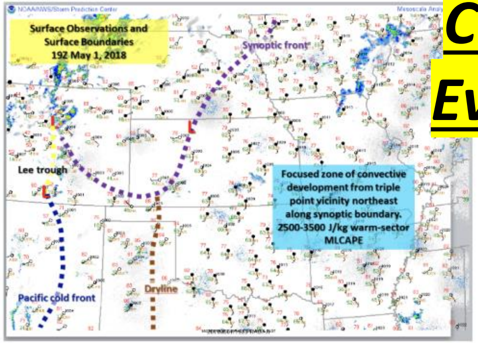
Include WHOLE OFFICE STAFF!

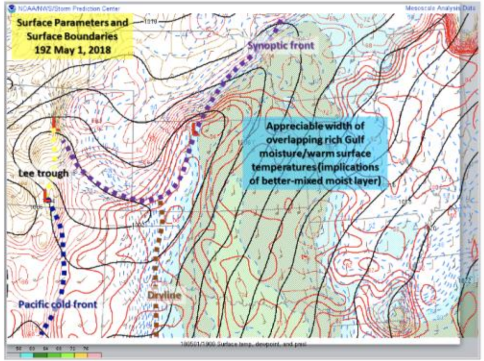
Collaborative Event Reviews

Event Review for May 1, 2018

Prepared by Bryan Baerg, Jenifer Prieto, Kris Sanders, and Kevin Skow

Initial Overview by Ariel Cohen



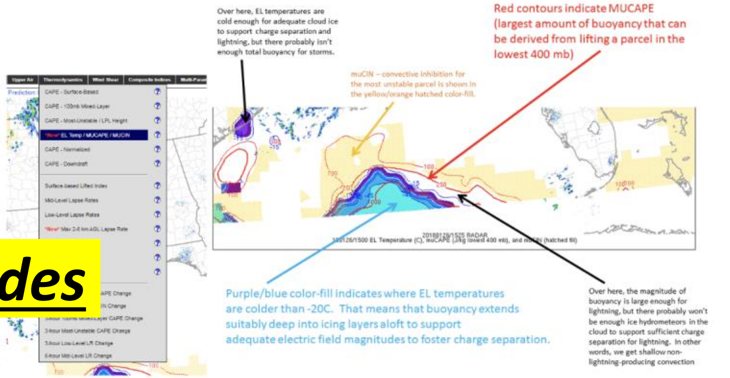


Reference Guides

Using Mesoanalysis to diagnose lightning potential

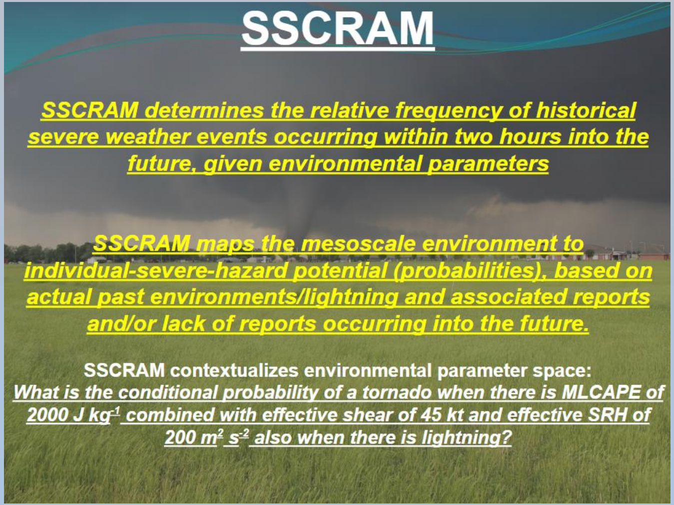
Ariel Cohen

There's an important field available on the SPC Mesoanalysis page that can be accessed under the Thermodynamics tab. This is the EL Temp / MUCAPE / MUCIN option. What this does is highlight areas where you have both sufficient buoyancy magnitude (MUCAPE) AND sufficient cloud ice (based on EL temperature) for lightning production. Instead of writing out all the details, I'm including a basic tutorial I put together below. This is intended to identify areas where the thermodynamic profile is sufficiently conducive to support lightning production. The basic premise is -- from the info option -- "Thunderstorms become more probable as MUCAPE increases to above 100 J kg^{-1} with EL temperatures of -20°C or colder." Since this is run in Mesoanalysis mode, this could be a useful component of the science supporting IDSS operations related to anticipating lightning. Please let me know if you have any questions. I used similar fields all the time when I prepared the General Thunderstorm portion of the Convective Outlooks. Remember, this does not overly vertical motion fields -- just addresses the thermo part of the equation.



Leading Local-Office Research-To-Operations (R2O) Also Leverages Operations-To-Research (O2R)

Include WHOLE OFFICE STAFF!



SSCRAM

The Statistical Severe Convective Risk Assessment Model

John A. Hart and Ariel E. Cohen

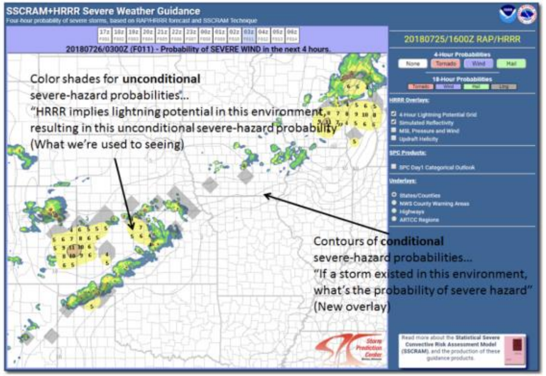
NOAA/NWS/NCEP/Storm Prediction Center, Norman, Oklahoma

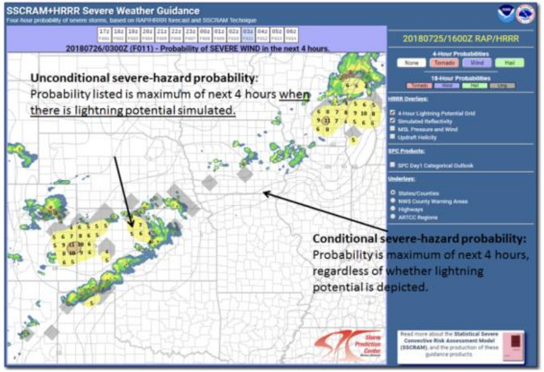
(Manuscript received 29 December 2015, in final form 9 August 2016)

ABSTRACT

This study introduces a system that objectively assesses severe thunderstorm nowcast probabilities based on hourly mesoscale data across the contiguous United States during the period from 2006 to 2014. Previous studies have evaluated the diagnostic utility of parameters in characterizing severe thunderstorm environments. In contrast, the present study merges cloud-to-ground lightning flash data with both severe thunderstorm report and Storm Prediction Center Mesoscale Analysis system data to create lightning-conditioned prognostic probabilities for numerous parameters, thus incorporating null-severe cases. The resulting dataset and corresponding probabilities are called the Statistical Severe Convective Risk Assessment Model (SSCRAM), which incorporates a sample size of over 3.8 million 40-km grid boxes. A subset of five parameters of SSCRAM is investigated in the present study. This system shows that severe storm probabilities do not vary strongly across the range of values for buoyancy parameters compared to vertical shear parameters. The significant tornado parameter [where "significant" refers to tornadoes producing (Fujita scale) F2/(enhanced Fujita scale) EF2 damage] exhibits considerable skill at identifying downstream tornado events, with higher conditional probabilities of occurrence at larger values, similar to effective storm-relative helicity, both findings being consistent with previous studies. Meanwhile, lifting condensation level heights are associated with conditional probabilities that vary little within an optimal range of values for tornado occurrence, yielding less skill in quantifying tornado potential using this parameter compared to effective storm-relative helicity. The systematic assessment of probabilities using convective environmental information could have applications in present-day operational forecasting duties and the upcoming warn-on-forecast initiatives.

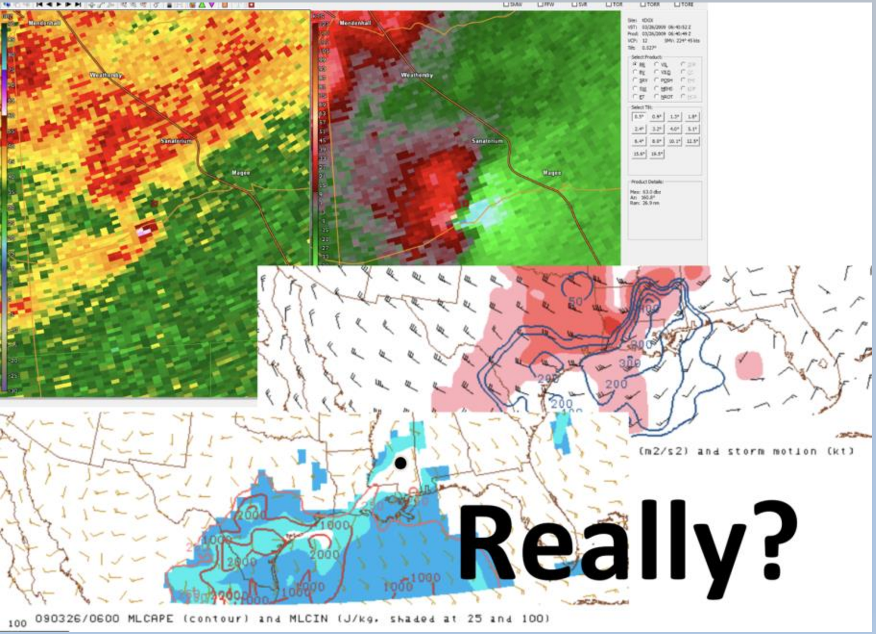
Eventually, the plan is for the overlay site to take precedence over the main SSCRAM site.





Leading Local-Office Research-To-Operations (R2O) Also Leverages Operations-To-Research (O2R)

Include WHOLE OFFICE STAFF!

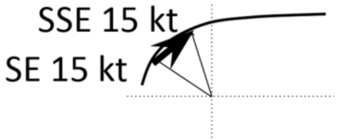


Understanding how to apply complex physical sciences / conceptual models to improving operations

*Recall, the hodograph is a curve that connects all wind velocities in the vertical profile at a point.

Plotted on the polar coordinate system

*Everything we need to know conceptually (sign) about each term in the p' equation comes right from the hodograph.

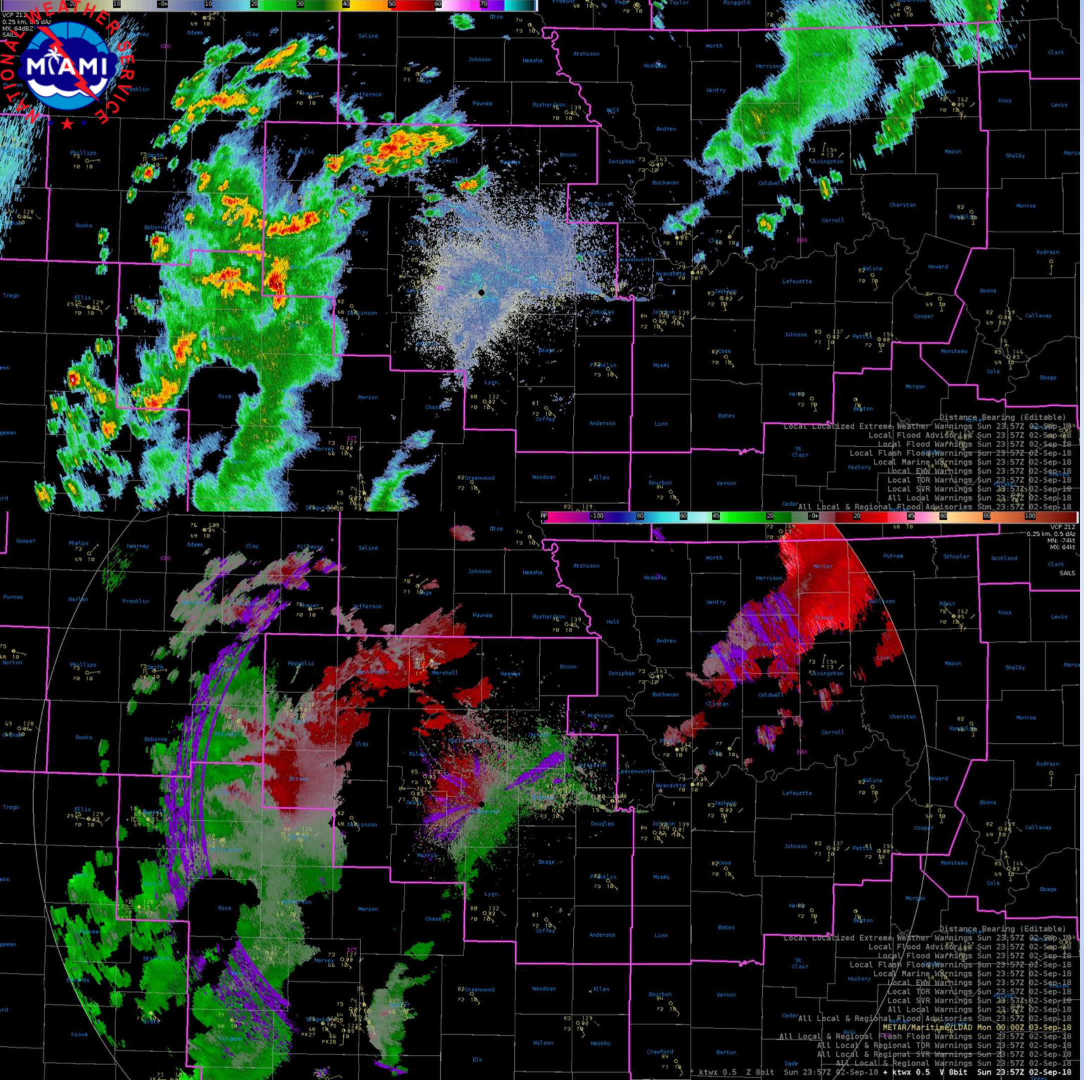


Resultant shear vector connects the two layer-binding levels, lying tangent to the hodograph!

*So, the bulk shear vector simply connects levels on the hodograph!

➔ As layer becomes infinitesimal, BOTTOM-TOP is merely is a hodograph tangent!

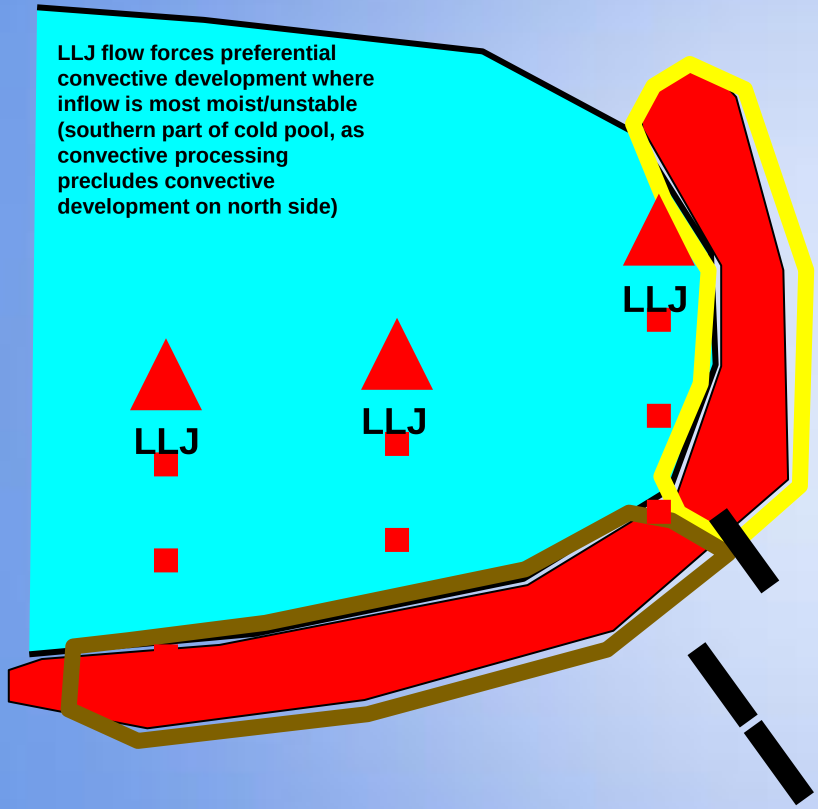
*So, the *hodograph* sketches out – is parallel to – the *vertical shear profile* $\frac{\partial u_h}{\partial z}$, and horizontal vorticity $\boldsymbol{\omega}_h = \hat{\boldsymbol{k}} \times \frac{\partial u_h}{\partial z}$ which is perpendicular and to the left of the hodograph sketch!



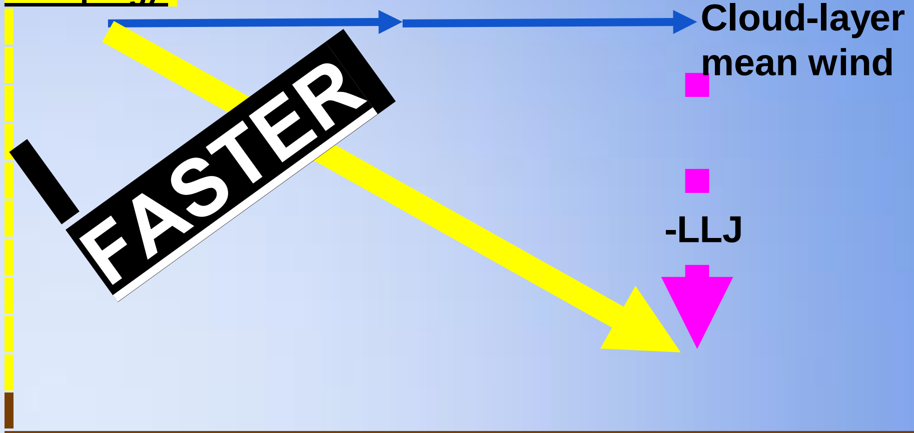
Discussion:

How do we best go about encouraging a culture of proactive messaging and warning, for complex/high-impact, low-confidence/isolated flash-flood events (reasonable worst-case scenario / 10-percent exceedance)?

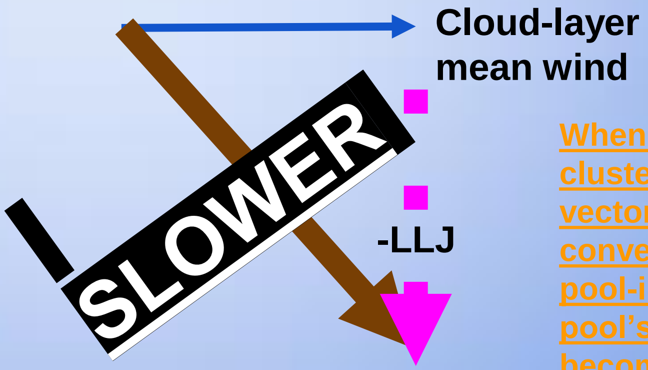
Corfidi Vectors: Convective motion explained by ADVECTION & PROPAGATION (from LLJ and cold-pool dynamics)



Driving, forward-propagating, progressive, downshear-propagating, downwind-propagating (include cold-pool scooping)!

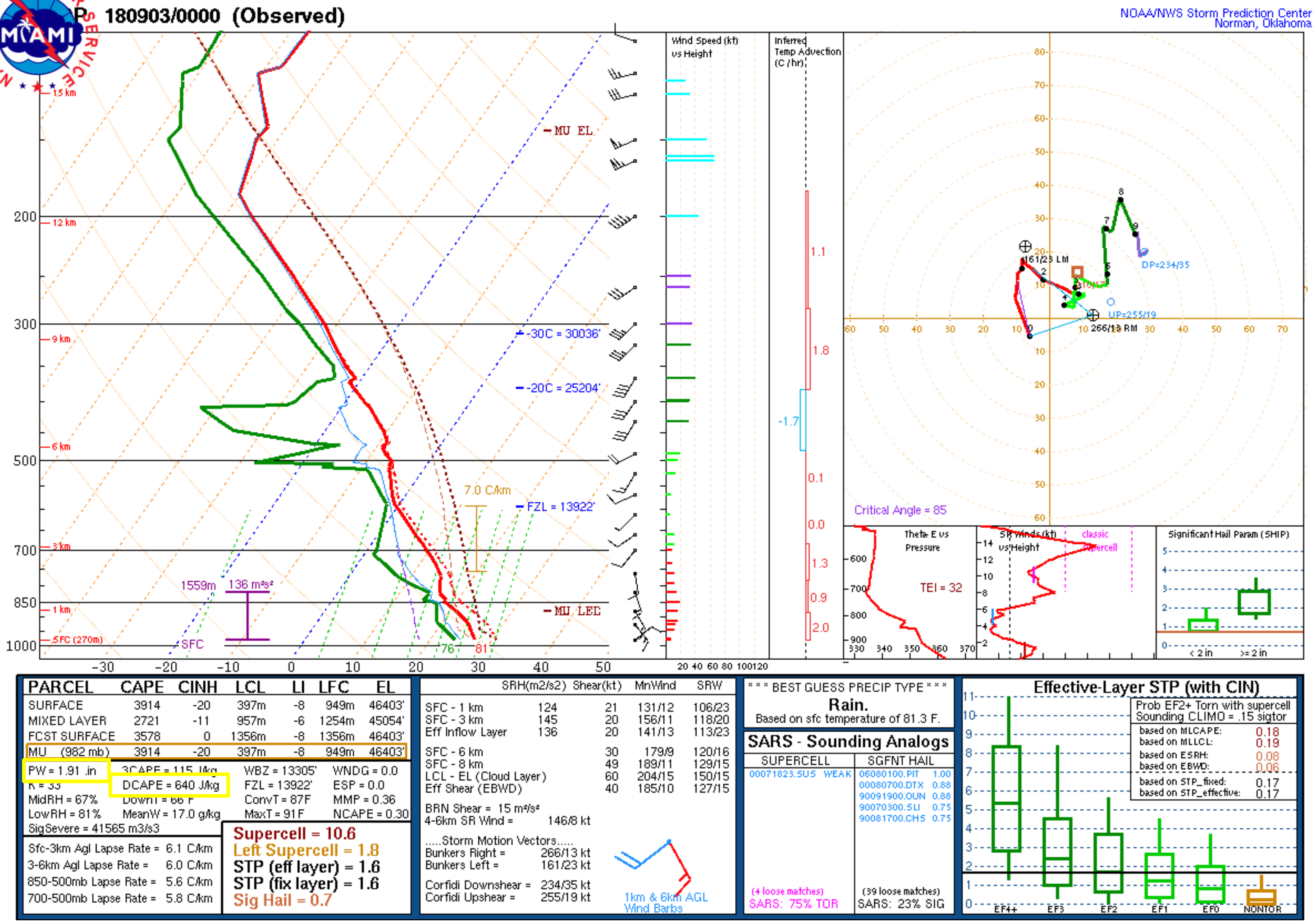


Trailing/training; backward-propagating, back-building, upshear propagating, upwind-propagating (slower moving and more sensitive to LLJ; no cold-pool inertia)



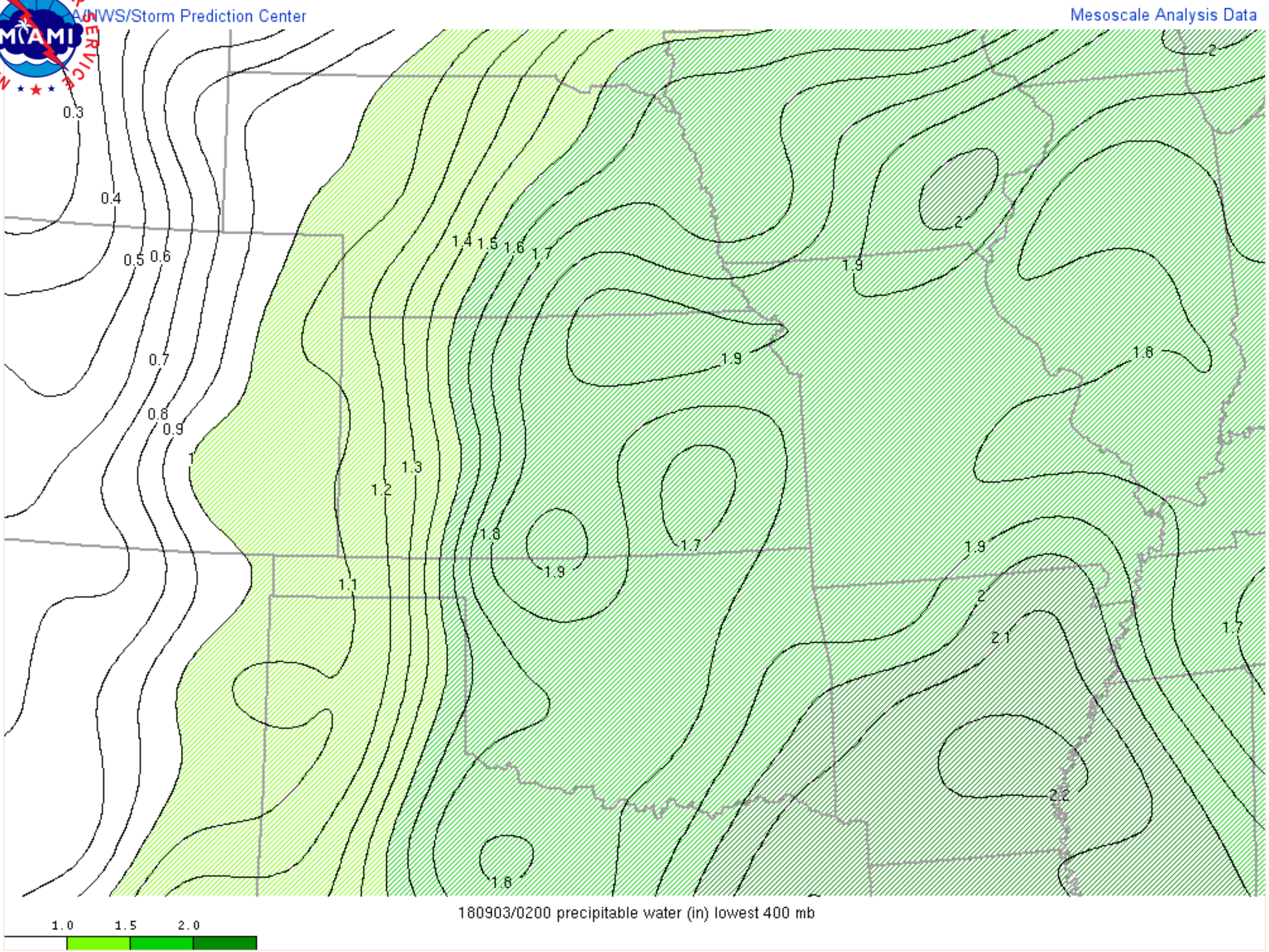
When we see a convective cluster start to follow these vectors, we know that the convection is becoming cold-pool-influenced as the cold pool's vertical circulation becomes established

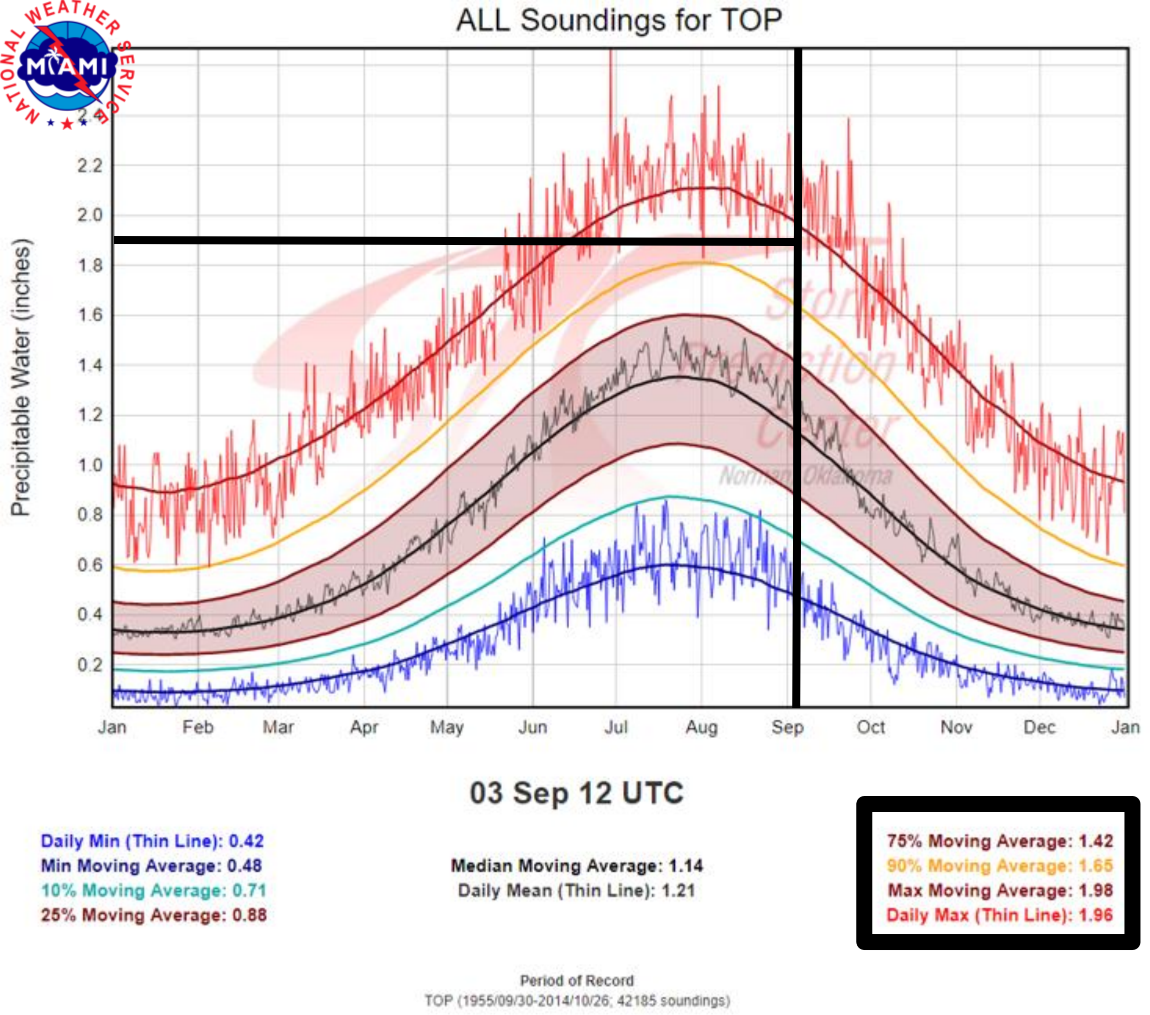
With backed low-level flow, we get enhanced warm advection over trailing isentrope gradient.



As described by C. F. Chappell and cited by Doswell et al. (1996): "the heaviest precipitation occurs where the rainfall rate is the highest for the longest time."

Rainfall Rate: large PW, low LCL, deep warm cloud (collision-coalescence), some convective instability (narrow MUCAPE profile), enhanced lowest-100-mb mean mixing ratio


A/NWS/Storm Prediction Center
Mesoscale Analysis Data
180903/0200 precipitable water (in) lowest 400 mb
1.0
1.5
2.0


ALL Soundings for TOP
Precipitable Water (inches)
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
03 Sep 12 UTC
Daily Min (Thin Line): 0.42
Min Moving Average: 0.48
10% Moving Average: 0.71
25% Moving Average: 0.88
Median Moving Average: 1.14
Daily Mean (Thin Line): 1.21
75% Moving Average: 1.42
90% Moving Average: 1.65
Max Moving Average: 1.98
Daily Max (Thin Line): 1.96
Period of Record
TOP (1955/09/30-2014/10/26; 42185 soundings)

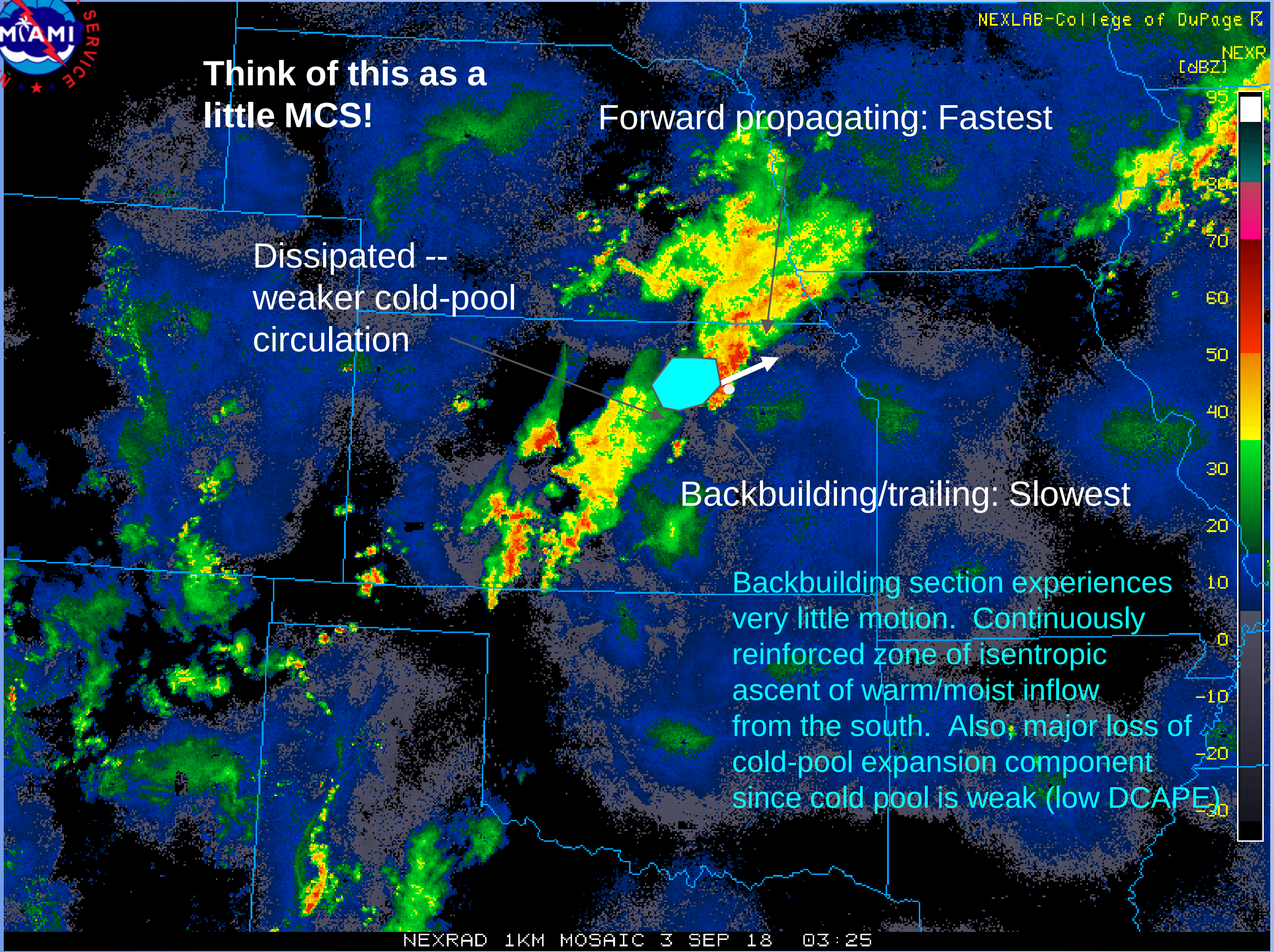
Think of this as a little MCS!

Forward propagating: Fastest

Dissipated -- weaker cold-pool circulation

Backbuilding/trailing: Slowest

Backbuilding section experiences very little motion. Continuously reinforced zone of isentropic ascent of warm/moist inflow from the south. Also, major loss of cold-pool expansion component since cold pool is weak (low DCAPE)



Repository of Reference Documents: SOO Site

SOO Corner Updated Mar 30, 2019, 9:35 AM

ariel.cohen@noaa.gov

Share

National Weather Service Topeka, KS

Search this site

Home | Administrative | Operations | DSS/Outreach | Situational Awareness | Training/Research | IT/Equipment | Radar Checklist | Discussion Forum | Backup

Navigation
- Home
- New Shift Log Entry
- Shift Checklist (Testing)
- Announcements
- TOP Office Schedule
- TOP SDM (View Only)
- Sitemap

Quick Links
- Blue Sky Initiative
- TOP COOP 2019
- Sign Out Board
- TOP Contacts List
- TOP Staff
- TOP Spotters
- TOP Web Bookmarks
- TOP River Flood List
- CRH Google Site
- CRH Event Reporting
- WebTA
- E2 Travel
- NWS Directives
- CR WRN Roadmap
- EMRS
- NOEES
- Leave Form
- NWSchat Live
- WxCoder
- Temp & Precip Sheet
- Commerce Learning Center
- CMS
- Hootsuite
- Facebook
- Twitter
- YouTube
- IRIS
- Station Digest
- RSM Messages
- Facilities Request
- ICT Google Site
- EAX Google Site

Home >

SOO Corner

Documents prepared by Dr. Ariel Cohen, unless otherwise noted

Meteorology Reference Materials

Convection Videos

SPC/University of Oklahoma Severe Thunderstorm Forecasting Video Lecture Series

Forecasting Organized Severe Storms video lecture series

Recorded December 2017 Science Meeting Presentation

Recorded January 2018 Science Meeting Presentation

Bill Bunting's (Chief, SPC Forecast Operations) talk on SPC operations

Convection Slides

General Theory and Applications

December 2017 Science Meeting Slides: Hodographs and perturbation pressure

January 2018 Science Meeting Slides: Convective mode and SHARPpy

February 2018 Science Meeting Slides: Storm Prediction Center...Behind the Scenes

Mesoscale Analysis / Hodograph / SSCRAM Slides from the Spring 2018 Severe Weather Seminar

Bill Bunting's (Chief, SPC Forecast Operations) presentation slides on SPC operations

Applications of GOES-16 data for convective-initiation assessment

Mesoscale Tools and Conceptual Models for Small-Scale Flash-Flood Detection

Wintertime Low-CAPE Severe Thunderstorms

Comparing severe-thunderstorm potential across Kansas in strong-forcing-for-ascent patterns

Wintertime Low-CAPE, High-Shear Severe-Thunderstorm Environments

Winter 2018-2019 Seminar: Cold-Season Severe Storms and ProbSnow

2018 High Plains Conference Slides

Meteorology Reference Materials

Convection Publications

Central Region Technical Attachment Number 18-02: Mesoscale Patterns Supporting EF3-EF5 Tornadoes across Eastern Kansas and Vicinity -- By Bill Gargan, Ryan Bunker, Bryan Baerg, and Ariel Cohen

Simulating Tornado Probability and Tornado Wind Speed Based on Statistical Models -- By Ariel Cohen, Joel Cohen, Richard Thompson, and Bryan Smith

Bridging Operational Meteorology and Academia through Experiential Education: The Storm Prediction Center in the University of Oklahoma Classroom -- By Ariel Cohen and Co-Authors

Evaluation of Multiple Planetary Boundary Layer Parameterization Schem... Season Severe Thunderstorm Environments -- By Ariel Cohen, Steven Ca... Brooks, and Israel Jirak

South Florida Flash Flooding Events -- By Ariel Cohen and Pablo Santos

Topics Other Than Convection Slides

Winter 2018-2019 Seminar: Dual-Pol & Top Down Review -- By Kevin Sk...

Tropical Meteorology and Marine Forecasting

Operational Blowing Snow Model Review -- By Chauncy Schultz

Blowing Snow Model Example -- provided by NWS Bismarck SOO Chaunc...

Myers-Briggs personality assessment presentation -- By Kim Runk

Post-Event Documents

October 6, 2017 Severe-thunderstorm event write-up (supercell and QL...

Some comments on migratory momentum-mixing microbursts / termin...

October 21, 2017 convective event: Some comments on the environmen...

Operational Links

Simulated Tornado Probability and Tornado Wind Speed from Cohen et al. (2018) Statistical Models -- INPUT FORM

Simulated Tornado Probability and Tornado Wind Speed from Cohen et al. (2018) Statistical Models -- OUTPUT SHEET

IMPORTANT LINKS FOR SEVERE-THUNDERSTORM THREAT ASSESSMENT

SPC High-Resolution Ensemble Forecast (HREF) System Viewer

SPC Mesoanalysis

SPC High-Resolution Rapid Refresh (HRRR) Model Browser

Wintertime Low-CAPE Severe Thunderstorms

Comparing severe-thunderstorm potential across Kansas in strong-forcing-for-ascent patterns

Wintertime Low-CAPE, High-Shear Severe-Thunderstorm Environments

Winter 2018-2019 Seminar: Cold-Season Severe Storms and ProbSnow

2018 High Plains Conference Slides

Mesoscale Patterns Supporting EF3-EF5 Tornadoes Across Eastern Kansas -- By Ryan Bunker, Bill Gargan, and Bryan Baerg

SSCRAM: The Statistical Severe Convective Risk Assessment Model -- An applications presentation by Ariel Cohen, John Hart, and Bryan Baerg

Topeka-Sounding-Based Evaluation of the Potential for Severe Convective Winds in Weakly Sheared Environments -- By Brandon Drake

2019 NWS Topeka Severe Weather Seminar Including Mesoanalysis Messaging

Folder with all contents
Convective warning polygon strategies

Convection Reference Guides

SPC Mesoscale Assistant Reference Guide

SSCRAM training resources -- Complete Set

Near Storm Environment Awareness (NSEA) Application

Severe weather datasets in CAVE: HREF output and NSEA Digital Cursor Readout

Using Mesoanalysis to diagnose lightning potential

Overview: A Simplified Approach to Forecasting the Probability of Thunderstorms in the ForecastBuilder Era -- By Chauncy Schultz and Ariel Cohen

Paper: A Simplified Approach to Forecasting the Probability of Thunderstorms in the ForecastBuilder Era -- By Chauncy Schultz, Patrick Ayd, and Ariel Cohen

Grid-Length Sensitivities in NWP-Simulated Convection

Post-Event Documents

October 6, 2017 Severe-thunderstorm event write-up (supercell and QLCS mesovortices)

Some comments on migratory momentum-mixing microbursts / terminology for damaging wind gusts

October 21, 2017 convective event: Some comments on the environmental paradox

Some comments on low-predictability tornado environments -- May 2, 2018 QLCS tornado case and LCL heights

Some comments on convective mode from May 14, 2018

Trends in SSCRAM data: May 19, 2018 Case Study

Some Comments on the May 29, 2018 Severe-Thunderstorm Environment

Event review on June 2018 MCSs producing severe/damaging winds in anafrontal-flow regimes

Event review for May 1, 2018 severe thunderstorms -- By Bryan Baerg, Jenifer Prieto, Kris Sanders, Kevin Skow, and Ariel Cohen

Event review for May 2, 2018 severe thunderstorms -- By Bryan Baerg, Jenifer Prieto, Kris Sanders, Kevin Skow, and Ariel Cohen

Event review for May 3, 2018 severe thunderstorms -- By Brandon Drake, Kevin Skow, and Ariel Cohen

June 30 and June 20 Event Review -- By Bryan Baerg

July 19, 2018 highly-conditional, low-predictability severe-convective-wind event -- By Ryan Bunker and Ariel Cohen

GOES-R Dust RGB Guide -- By Michael Bowlan
GOES-R Fire Temperature RGB Guide -- By Michael Bowlan
GOES-R Nighttime Microphysics RGB Guide -- By Michael Bowlan
GOES-R Simple Water Vapor RGB Guide -- By Michael Bowlan

GLM Flash Extent Density Guide -- By Chauncy Schultz

Short Module on GLM Basics and Applications -- By NASA SPoRT

GLM Flash Extent Density -- Applications for Airport Weather Warning -- Information can be extended to related IDSS -- By NASA SPoRT

Training Activities

SOO Development Course Convection Unit -- By Ariel Cohen and Dan Hawblitzel

Forecasting Organized Severe Storms Video Lecture Series Video Files

Summary Slides on Forecasting Organized Severe Storms Video Lecture Series

Forecasting Organized Severe Storms Video Lecture Series Assessment

Solutions to Forecasting Organized Severe Storms Video Lecture Series Assessment

SSCRAM Video Training Files

SSCRAM Training Assessment

Solutions to SSCRAM Training Assessment

Data for 2017-2018 WES Cases

Data for 2018-2019 WES Cases

Convective Outlook Workshop Exercise

Convective Outlook Workshop Train the Trainer Video

Mesoanalysis Messaging Activity

Developing Local Office Partnerships: NWS-Academia

Collage courtesy of
Bryan Baerg and Audra Hennecke
(WFO Topeka)

Developing *Local* Office Partnerships: NWS-Academia

IN BOX
INSIGHTS and INNOVATIONS

Bridging Operational Meteorology and Academia through Experiential Education

The Storm Prediction Center in the University of Oklahoma Classroom

Ariel E. Cohen, Richard L. Thompson, Steven M. Cavallo, Roger Edwards, Steven J. Weiss, John A. Hart, Israel L. Jirak, William F. Bunting, Jaret W. Rogers, Steven F. Piltz, Alan E. Gerard, Andrew D. Moore, Daniel J. Cornish, Alexander C. Boothe, and Joel B. Cohen

RESEARCH TO OPERATIONS AND THE NATIONAL WEATHER CENTER. The challenge of infusing research findings and theoretical principles into operational practice is no simple feat. The phrase "valley of death" (NRC 2001) has been linked to the repeated failure of meteorological research to become instilled within the practitioner's toolbox. It has been used to describe the gap between the academic and research communities in meteorology, and refers to cases where applied research fails to become implemented operationally (e.g., Hossain et al. 2014; Wolff et al. 2016). Alternatively, effective communication between research and operational communities is critical for creating scientifically relevant work, by which mutual missions are satisfied through collaboration. Strong relationships between research and operations entities can be considered a "bridge" to accomplish successful research-to-operations (R2O) initiatives, lessening the likelihood of research results falling into the valley of death.

As an integral member of the weather enterprise, academia not only lays the foundation for learning within the university classroom, but also plays a

Bulletin of the American Meteorological Society:

Cohen et al. (2018)

Outreach / Enhancing Partnerships: Science Sharing

Thomas Worthington High School

Media Interview:
Severe Weather Awareness

Leading Regional Research-To-Operations (R2O) Also Leverages Operations-To-Research (O2R)

Central Region Grid Methodology Advisory Team

Convection during the North American Monsoon across Central and Southern Arizona: Applications to Operational Meteorology

JARET W. ROGERS AND ARIEL E. COHEN

NOAA/NWS/NCEP/Storm Prediction Center, Norman, Oklahoma

LEE B. CARLAW

National Weather Service Forecast Office, Tucson, Arizona

(Manuscript received 5 August 2015, in final form 15 July 2016)

ABSTRACT

This comprehensive analysis of convective environments associated with thunderstorms affecting portions of central and southern Arizona during the North American monsoon focuses on both observed soundings and mesoanalysis parameters relative to lightning flash counts and severe-thunderstorm reports. Analysis of observed sounding data from Phoenix and Tucson, Arizona, highlights several moisture and instability parameters exhibiting moderate correlations with 24-h, domain-total lightning and severe thunderstorm counts, with accompanying plots of the precipitable water, surface-based lifted index, and 0–3-km layer mixing ratio highlighting the relationship to the domain-total lightning count. Statistical techniques, including stepwise, multiple linear regression and logistic regression, are applied to sounding and gridded mesoanalysis data to predict the domain-total lightning count and individual gridbox 3-h-long lightning probability, respectively. Applications of these forecast models to an independent dataset from 2013 suggest some utility in probabilistic lightning forecasts from the regression analyses. Implementation of this technique into an operational forecast setting to supplement short-term lightning forecast guidance is discussed and demonstrated. Severe-thunderstorm-report predictive models are found to be less skillful, which may partially be due to substantial population biases noted in storm reports over central and southern Arizona.

Paper: A Simplified Approach to Forecasting the Probability of Thunderstorms in the ForecastBuilder Era

Chauncy Schultz and Patrick Ayd
NOAA/NWS Bismarck, ND

Ariel Cohen
NOAA/NWS Topeka, KS

Discriminating between lightning-producing and non-electrified convection can provide a considerable challenge to operational forecasters, but the governing physical requirements for lightning production are well known, as summarized by Bright et al. (2005). Existing literature (e.g., Houze [1993] and MacGorman and Rust [1998]) suggests that both the presence of ice particles in the mixed-phase region of a convective cloud between -10 °C and -40 °C and an updraft strong enough to allow graupel to extend into the charge-reversal temperature zone from -15 °C to -20 °C are necessary for lightning occurrence. Bright et al. (2005) utilized these simplified physical requirements to develop the Cloud Physics Thunder Parameter (CPTP), which predicts lightning potential based on the equilibrium level temperature, Convective Available Potential Energy (CAPE) between the 0 °C to -20 °C levels, and a requirement for a lifting condensation level temperature to be warmer than -10 °C.

The Storm Prediction Center (SPC) produces calibrated thunderstorm probabilities from the Short Range Ensemble Forecast (SREF) using the CPTP and grid-scale precipitation from each member of the SREF (Bright et al. 2005). Bright et al. (2009) examined the performance of the SREF calibrated thunderstorm guidance, and while they found that it generally provides reliable and skillful guidance for the SPC forecast process, they also noted that the probabilities have a strong dependence on the SREF's grid-scale precipitation output. For example, in scenarios where the SREF overpredicts shallow convective precipitation, thunderstorm probabilities are biased high since the thermodynamic environment supports lightning even though the modeled precipitation represents something other than deep convection. The opposite is also true; where the SREF underpredicts precipitation, thunderstorm probabilities are accordingly biased low. Moreover, Bright et al. (2009) also cite coarse resolution of the guidance -- which was calibrated to 40 km grid boxes -- as a potential source of forecast biases. In contrast, Hughes (2001) presented a purely statistical approach to the lightning forecast problem with the development of Model Output Statistics (MOS) thunderstorm forecast equations. The primary predictors for the MOS forecast equations in Hughes (2001) were related to humidity, vertical velocity, moisture divergence, u- and v-wind components, and equivalent potential temperature

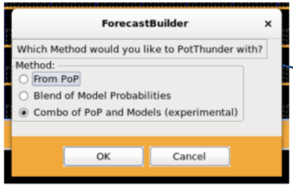
Leading Regional Research-To-Operations (R2O) Also Leverages Operations-To-Research (O2R)

Central Region Grid Methodology Advisory Team

Overview: A Simplified Approach to Forecasting the Probability of Thunderstorms in the ForecastBuilder Era

Prepared by Chauncy Schultz (NOAA/NWS Bismarck) with a few adjustments by Ariel

This new method for creating PotThunder grids should help alleviate some of the low bias we've seen with thunder from ForecastBuilder, especially in the long term. You'll notice a new PotThunder option available when you run ForecastBuilder through the non-precipitating weather types: "Combo of PoP and Models" (experimental)":



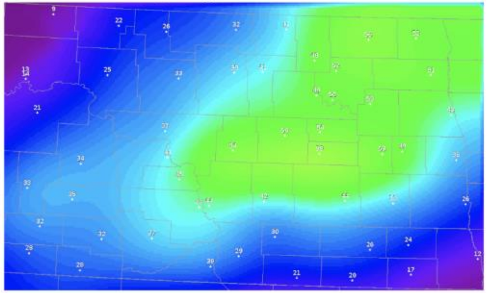
This option relies on a blend of lapse rates from all models and our official forecast dewpoints to determine PotThunder based on the table below:

		700-500 mb Lapse Rate (C/km) from a Multi-Model Consensus			
		> 8	7 to 8	6 to 7	< 6
Surface Dewpoint (F) from the Forecast Database	> 65	PotThunder = PoP	PotThunder = PoP	PotThunder = PoP	PotThunder = 15
	60 to 65	PotThunder = PoP	PotThunder = PoP	PotThunder = 15	PotThunder = 15
	55 to 60	PotThunder = PoP	PotThunder = PoP	PotThunder = 15	PotThunder = 15
	50 to 55	PotThunder = PoP	PotThunder = PoP	PotThunder = 15	PotThunder = 15
	45 to 50	PotThunder = 15	PotThunder = 15	PotThunder = 0	PotThunder = 0
	40 to 45	PotThunder = 15	PotThunder = 15	PotThunder = 0	PotThunder = 0
	< 40	PotThunder = 15	PotThunder = 15	PotThunder = 0	PotThunder = 0

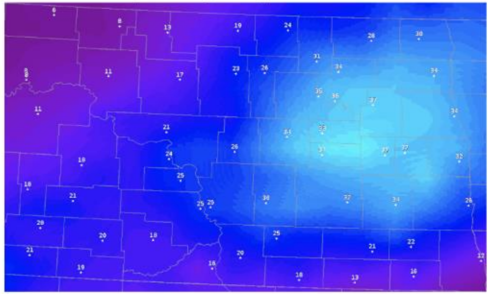
* If the SREF or gridded MOS value exceeds the table value, PotThunder will be set to the SREF or gridded MOS value.

You'll note that this "combo" still uses the old model-based/"Blend of Model Probabilities" (SREF and GMOS) method when and where those model probabilities exceed those from the table. This is admittedly a relatively simple approach, but since we don't get many fields from models in GFE that are correlated to lightning production, mid-level lapse rates and forecast dewpoints are solid choices. We have been working on this project with the GMAT, and if you want to know all of the details, click here.

Below is the PotThunder output for a past Tuesday evening from the new method, which is a period where we have forecast MLCAPE on the order of 3,000 J/kg:



Compare this with the old "Blend of Model Probabilities" method, and you'll notice a marked difference with much lower PotThunder values despite the strong instability:



This should greatly improve our first-guess thunder probabilities, especially in the long term, but that doesn't mean you cannot or should not still manually intervene to adjust them at times if you need to. You still may need to collaborate more on PotThunder while we are exploring the various options.

Leadership in National Team Initiatives:
Science / Technology Integration
To Enhance Services (IDSS) Promoting Weather-Ready Nation

MESOANALYSIS BOOTCAMP

These experiments evaluate capabilities to leverage observed meteorological data, science-based conceptual models, and cutting-edge numerical weather prediction datasets to enhance precise, targeted impact-based decision support services (IDSS) associated with high-impact convective weather events.

These immersive experiences are comprised of job-relevant exercises involving real weather events, instruction from subject matter experts, facilitated group discussions, and feedback from participating core partners.

This initiative represents a strong collaboration between the OPG, the Storm Prediction Center, Weather Forecast Offices across the NWS, the Office of the Chief Learning Officer, and the National Severe Storms Laboratory.

Ultimately, these experiments are expected to identify avenues for the NWS to enhance its services pertaining to high-impact convective weather using an understanding of the deep physical sciences.

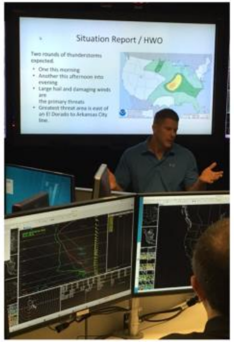
Front row from left to right: Brian Carcione (NWS Huntsville, AL), Kim Runk (NWS OPG), Katie Crandall Vigil (NWS OPG), Chauncy Schultz (NWS Bismarck, ND), and Corey Mead (NWS Omaha, NE)

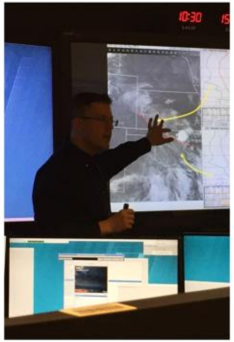
Back row from left to right: Matthew Foster (NWS OPG), Ariel Cohen (NWS Topeka, KS), Seth Binau (NWS Wilmington, OH), Daniel Hawblitzel (NWS Nashville, TN), and Chad Gravelle (NWS OPG)

Front Row: Bill Bunting, SPC; Ariel Cohen, TOP; Corey Mead, OAX; Chauncy Schultz, BIS

Second Row: Seth Binau, ILN; Chad Gravelle, OPG; Brian Carcione, HUN; Katie Vigil, OPG

Back Row: Matt Foster, OPG; Kim Runk, OPG; Jenni Laflin, EAX; Jim LaDue, WDTD; Dan Hawblitzel, OHX





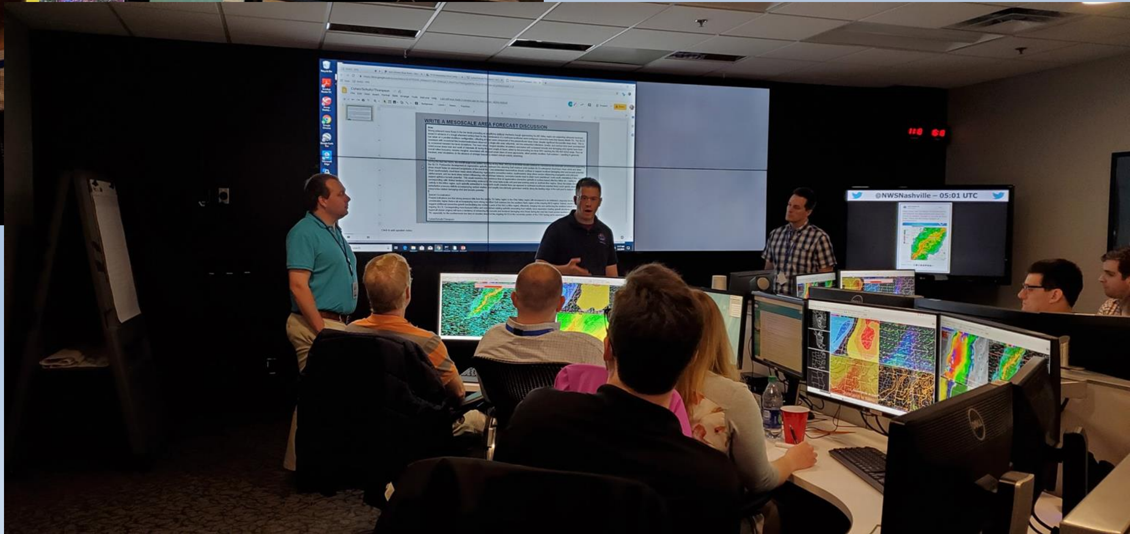
Front Row: Ariel Cohen (WFO Miami, FL); Chauncy Schultz (WFO Bismarck, ND); Brittany Peterson (WFO Grand Forks, ND); Brian Haines (WFO Raleigh, NC); Kristen Cassady (WFO Wilmington, OH); Chad Gravelle (Southern Region Headquarters)

Middle Row: Kim Runk (Operations Proving Ground); Nate McGinnis (WFO Jacksonville, FL); Timothy Humphrey (WFO Lake Charles, LA); Michael Evans (WFO Albany, NY); Matthew Foster (Operations Proving Ground)

Back Row: Andrew Loconto (WFO Blacksburg, VA); Jenni Pittman (WFO Kansas City/Pleasant Hill, MO); Jared Allen (WFO Cheyenne, WY); Alex Edwards (WFO Bismarck, ND); Eric Wise (WFO Springfield, MO); Rich Thompson (Storm Prediction Center)

Leadership in National Team Initiatives: Mesoanalysis Bootcamp

Leadership in National Team Initiatives: Mesoanalysis Bootcamp



Leadership in National Team Initiatives:

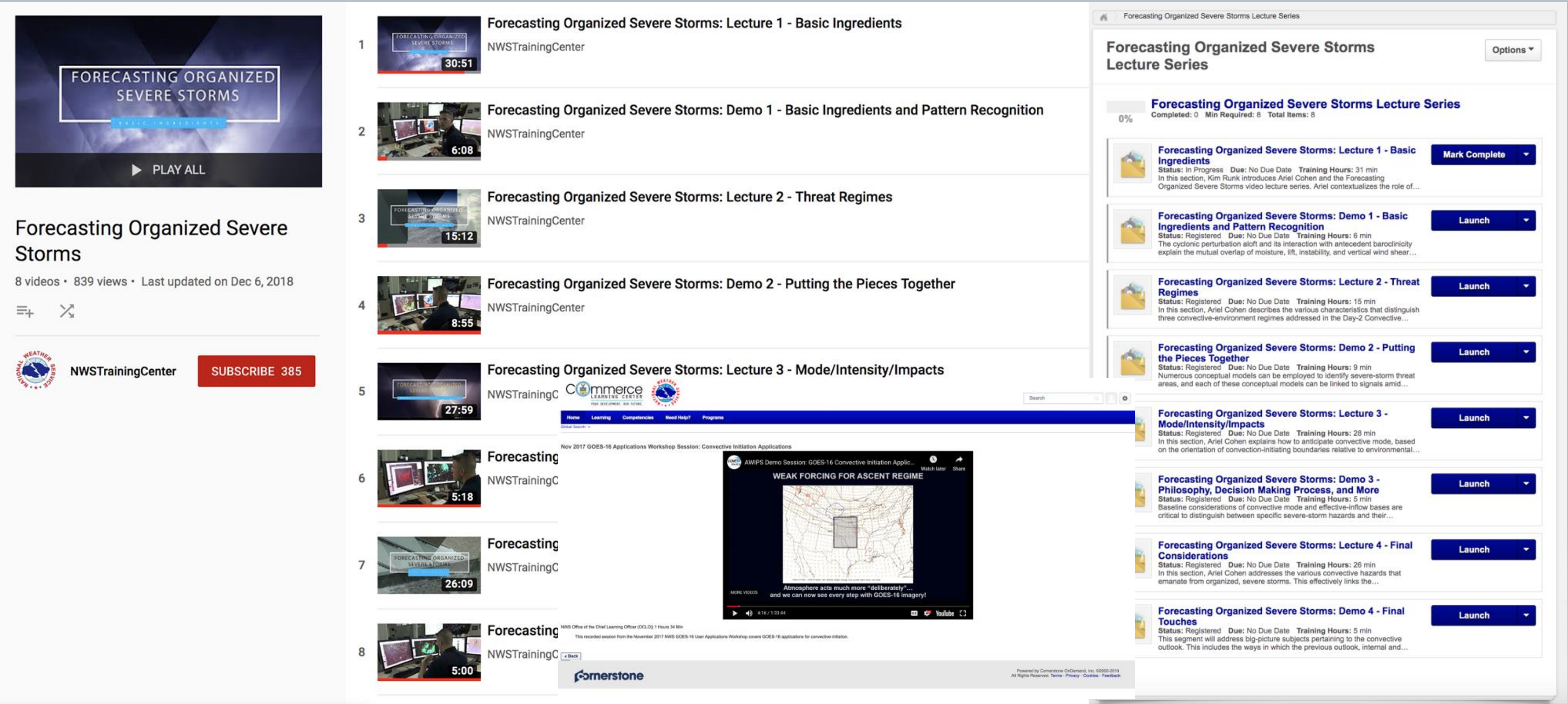
Mesoanalysis Bootcamp

Leadership in *National* Team Initiatives:

Mesoanalysis Bootcamp

Vital component: Feedback from partners, including Emergency Managers -- bringing people together

Development of National Training



NWS Representation at Conferences

Leadership in National Team Initiatives: SOO Development Course

Pictures courtesy of Kevin Scharfenberg (Forecast Decision Training Division)

The Role of the Science and Operations Officer (SOO)

Dr. Ariel Cohen
Ariel.Cohen@noaa.gov