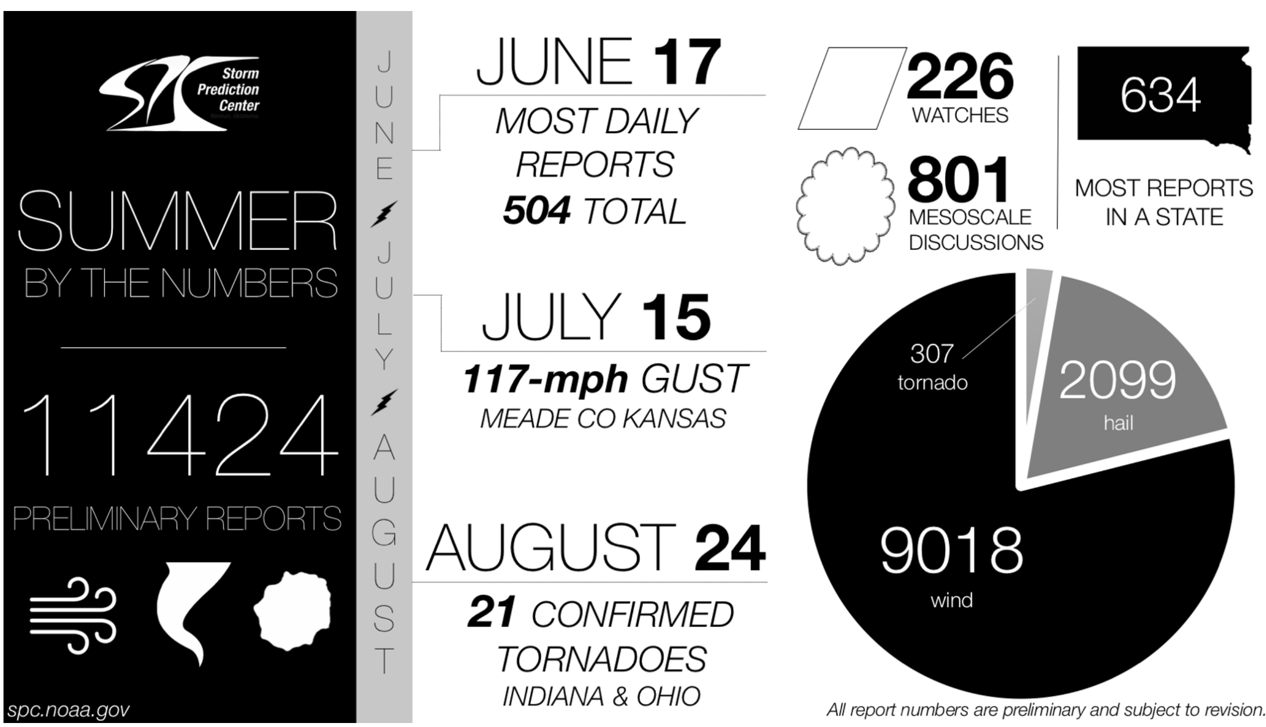
THE CONVECTIVE WATCHER

By The Numbers…

By Joey Picca, Dr. Ariel Cohen and Liz Leitman, Mesoscale Assistant/Fire Weather Forecasters

Summer 2016

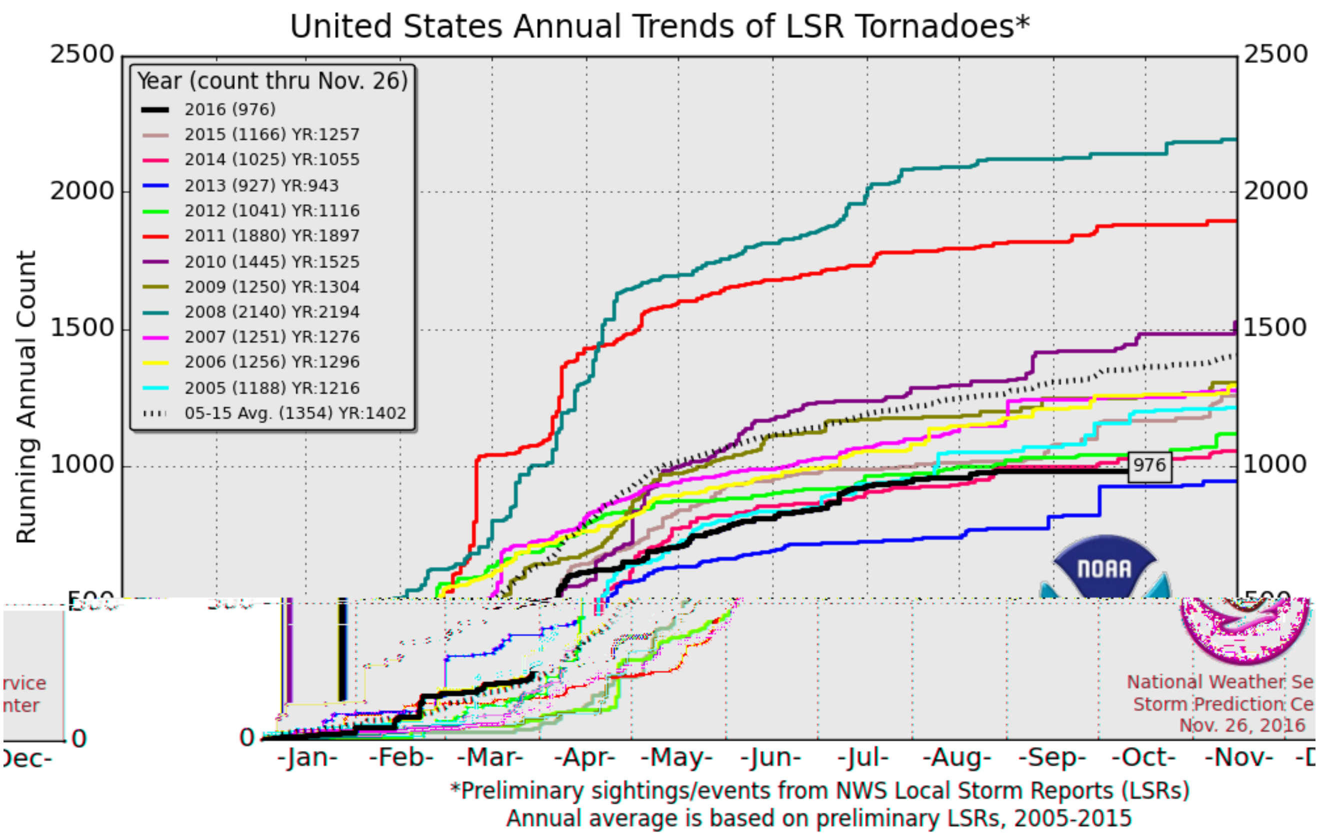
The infographic below shows severe weather stats for the months of June, July and August 2016. There were several notable events during this time, including the tornado event across Indiana and Ohio on August 24th



and the widespread damaging wind event of June 17th. Watches issued during the 2016 summer were below average, a trend similar to what we have seen so far for all of 2016 in both watch counts and the number of reported tornadoes.

2016 Preliminary Tornado Reports and Watch Issuance

As of November 26, 2016, 976 tornadoes have been reported. This number is far below the 2006-2015 average (from January 1 through November 26). In fact, 2013 is the only year in the last decade that has had fewer tornado reports.



In our Summer 2016 newsletter, we talked about the below average watch count for 2016 through early August. This trend has continued into fall and, through November 15th 2016, a total of 496 severe thunderstorm and tornado watches have been issued. To put this in perspective, from 1985 through 2015, there was only one year when fewer than 500 convective watches were issued, and that was the year 1985 when 477 watches were issued. Prior to 1985, there were several years during which fewer than 500 convective watches were issued.

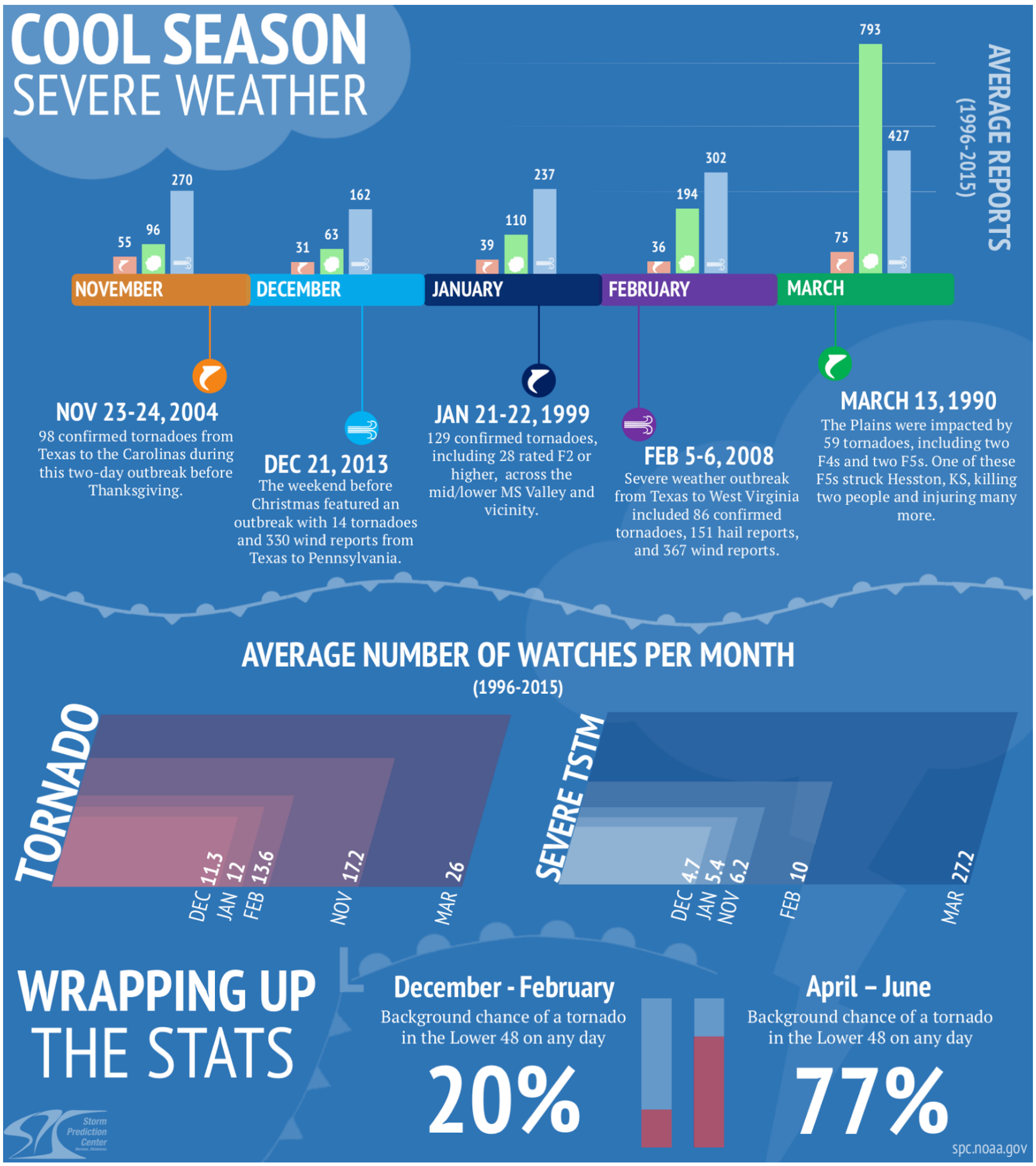
Did you know…

While severe thunderstorms and tornadoes are our specialties and most well-known forecast phenomena, the SPC also issues some winter weather forecasts. Keep reading to learn more about our winter-time operations!

Cool Season Severe Storms

By Joey Picca and Liz Leitman, Mesoscale Assistant/Fire Weather Forecasters and Andy Dean, Techniques Development Meteorologist

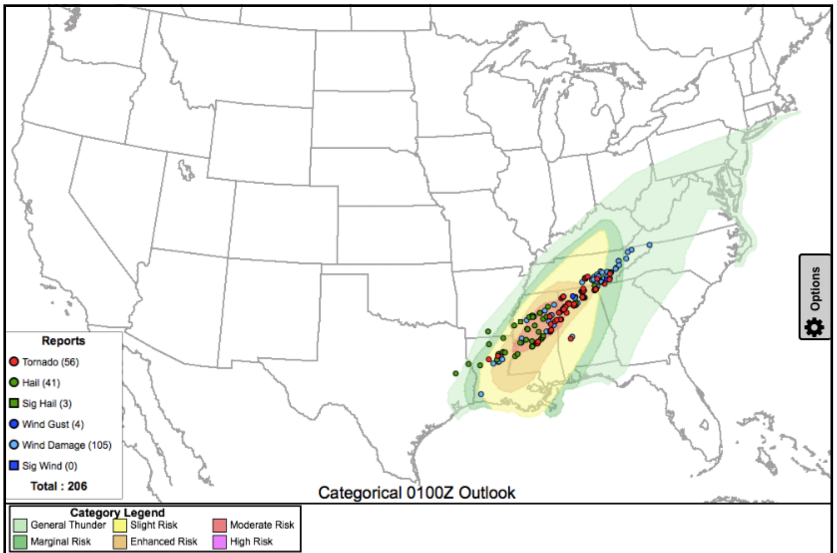
Climatologically, the frequency of severe convection declines during the late fall and continues to remain low through the winter months. We have defined the "cool season" as running from November through March. It should be noted that while severe convection overall is low during this time, strong and widespread severe weather episodes can and do happen. Let's take a closer look at cool season severe climatology and some notable events.

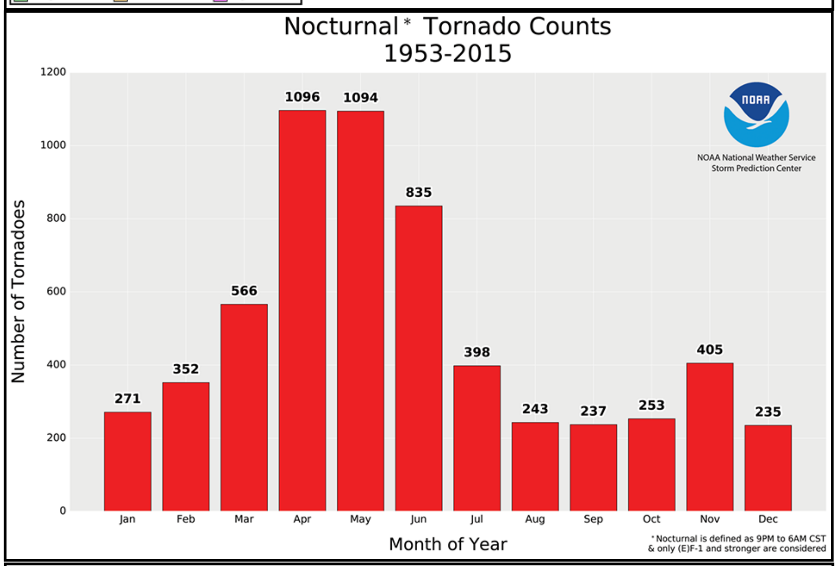


More recently, an example of a cool-season severe weather event was on November 29, 2016 across parts of the lower Mississippi and Tennessee Valley region. Pictured to the right are the preliminary storm reports. This particular event had a large number of nocturnal tornadoes. The accompanying graph indicates nocturnal tornado counts for each month of the year from 1953 to 2015. As you can see, November stands out among fall and winter months with regard to nighttime tornado totals. This may be due in part to strong upper level troughs tracking across the country during the transition from fall to winter, resulting in favorable parameters for severe thunderstorms.

Interested in learning more about cool-season severe thunderstorms? Several formal publications discussing this topic can be found on our website at: http://www.spc.noaa.gov/publications/

Stay tuned for our next newsletter when we'll do a review of the 2016-2017 cold season severe weather period to see how things stack up compared to climatological normals!





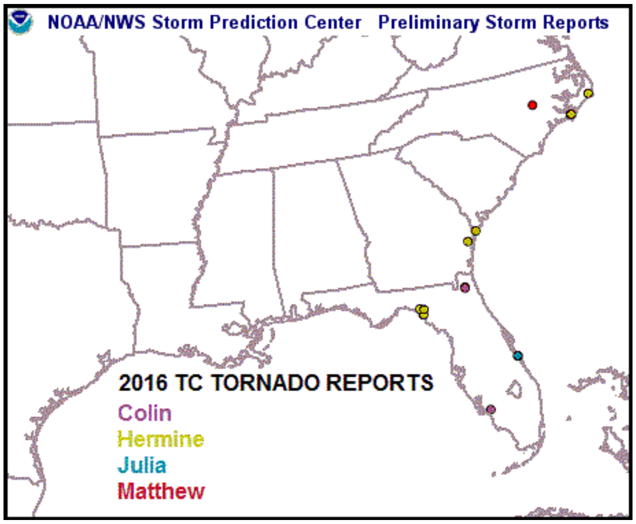
Top: Severe storm reports and convective outlook from November 29, 2016. Bottom: Bar chart showing the number of nighttime tornadoes each month of the year from 1953-2015.

2016 Tropical Cyclone Tornado Wrap-Up

By Roger Edwards, Lead Forecaster

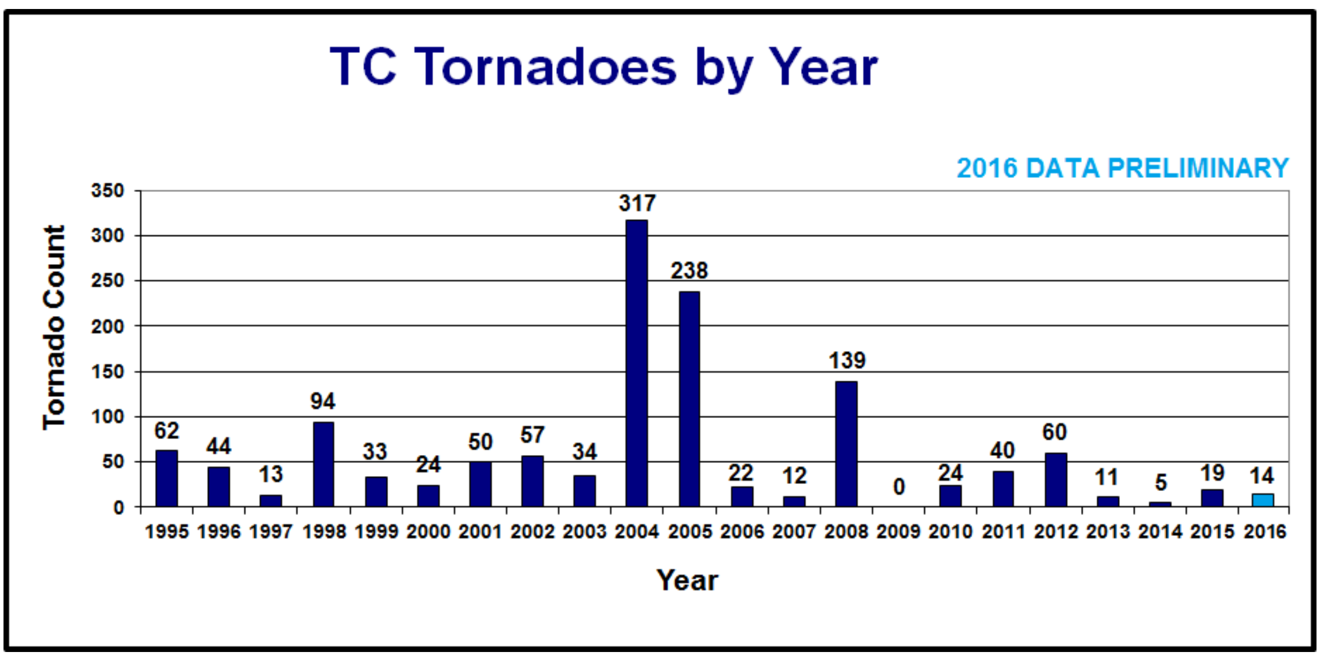
Tropical cyclones (TCs for short) include hurricanes, tropical storms, tropical depressions, and remnant lows, as classified by the National Hurricane Center (NHC). As described in detail in this formal scientific review, TCs often spawn tornadoes as they approach the U.S. Gulf and Atlantic Coasts, through their decay stages hundreds of miles inland. Hurricane Ivan (2004) is the known record-holder, with 118 tornadoes in a three-day span from the eastern Gulf Coast to southern Pennsylvania. Hurricane Beulah (1967) produced 115 documented tornadoes in central and southern Texas, and may have had more. TCs tend to have fewer than

25 tornadoes, but the counts can vary widely from one to the next. Most TC tornadoes are relatively small, brief and weak, with over 90% rated EF0 or EF1 on the Enhanced Fujita scale. Still, any tornado can be deadly, and several TC tornadoes have caused multiple fatalities and/or injuries.



Preliminary tornado reports associated with tropical cyclone in 2016. 14 total tropical cyclone tornadoes were reported in 2016.

In landfalling and inland TC situations, SPC issues outlooks, mesoscale discussions and watches for tornadoes, and coordinates closely with NHC on describing the tornado threat in their forecasts. We also maintain a listing of over a thousand TC tornadoes in the modern WSR-88D radar era, called "TCTOR", as a spinoff of our far larger nationwide tornado database. According to preliminary "rough log" data, just 14 TC tornadoes were recorded in 2016—all in Florida, southeastern Georgia and the Carolinas, as plotted on the map to the left. On this map scale, some of the tornado reports overlie each other. Again these are ***preliminary reports***, based entirely on local storm reports sent to us by NWS forecast offices. These totals almost certainly will change once duplicates are removed, and more tornado listings appear in the final Storm Data list that weren't included in the local storm reports. Regardless, even if the final 2016 counts double (unlikely), we still will have experienced a tropical cyclone tornado season well below the 1995–2015 annual average of 62. The chart below shows each year's TC tornado reports since 1995.



Not all landfalling tropical systems produce tornadoes. In 2016, Tropical Storm Bonnie and its preceding low-pressure area affected parts of the coastal Carolinas at the beginning of June, but failed to produce favorable tornado conditions. We evaluate the tornado risk as the atmosphere's ingredients dictate, and sometimes do not issue tornado watches for a tropical cyclone. Bonnie was one such tropical system that had no tornado reports or watches.

Let us now look at a system-by-system summary of this year's TC tornado activity that we have received. An early June TC, Colin, caused three tornado reports very near each other in Duval County, northern FL, while another tornado occurred in Lee County near the southwest Florida coast. Tornadic TCs took a break until early September when Hermine produced eight reports in two days, from the Florida coastal bend to the eastern Carolinas. This shouldn't be confused with the previous Hermine from 2010, when the Dallas area experienced several highly visible and well-documented tornadoes.

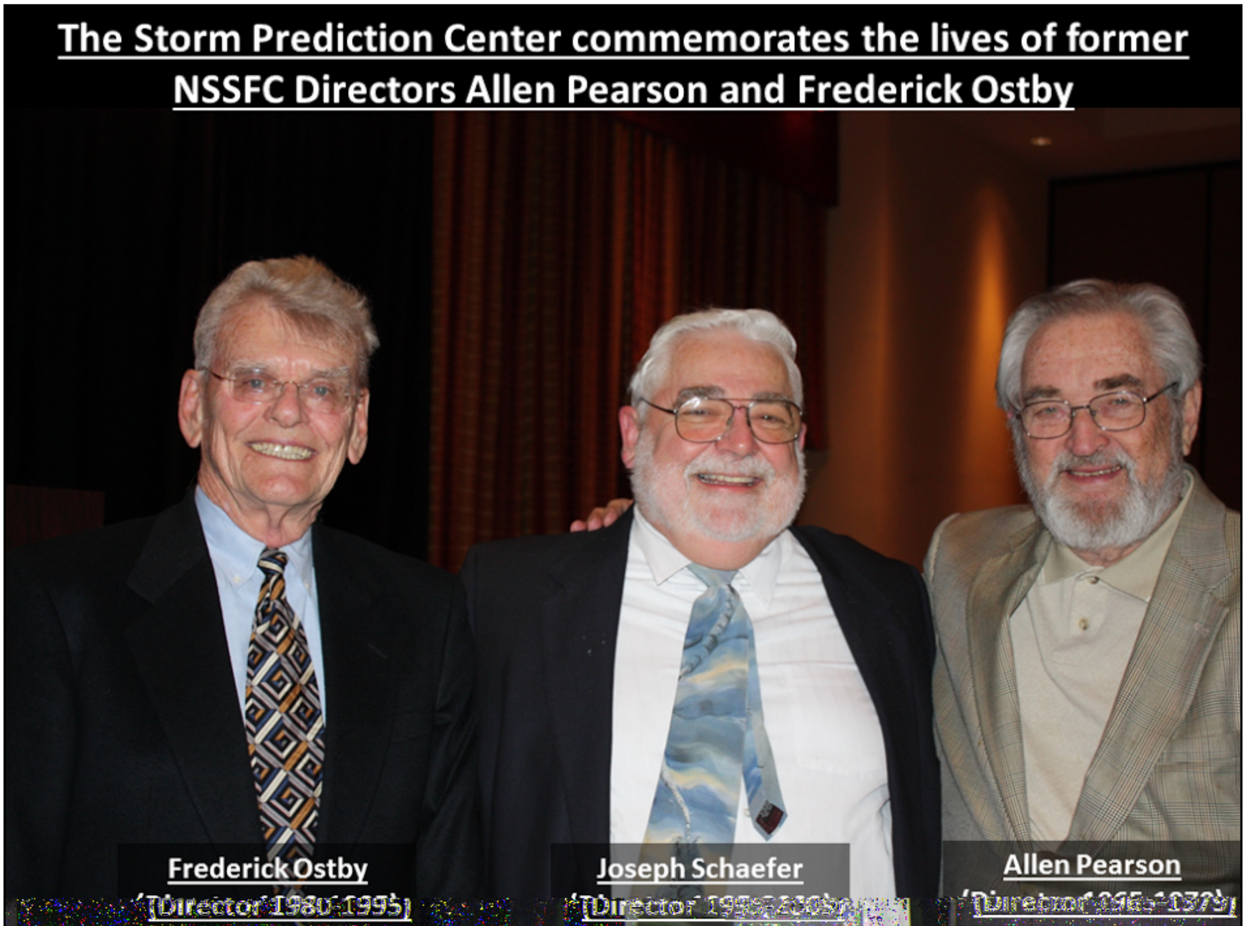
TC Julia, in mid September, yielded two tornado reports within a few minutes and miles of each other in Brevard County, near Florida's Space Coast. In early October, TC Matthew produced at least one tornado in North Carolina. Radar evidence indicates more tornadoes may have occurred with Hermine and Matthew that have yet to be listed. The TCTOR dataset will be updated late this winter or early spring 2017 with final tornado information, including damage ratings.

The Passing of Former Directors of the National Severe Storms Forecast Center (NSSFC)

By Roger Edwards, Lead Forecaster; Steven Weiss, Science Support Branch Chief; and Dr. Ariel Cohen, Mesoscale Assistant/Fire Weather Forecaster

The Storm Prediction Center is commemorating the lives of two former directors of the National Severe Storms Forecast Center (NSSFC), who passed away in recent months: Allen Pearson (August 11, 2016) and Frederick Ostby (October 27, 2016). The Severe Local Storms (SELS) unit of NSSFC became the SPC in 1995 as part of the reorganization of the National Meteorological Center into the National Centers for Environmental Prediction (NCEP). Pearson's and Ostby's combined 31 years of service as directors (from 1965 through 1995) spanned nearly half of the 64 years of SPC and SELS. Under their leadership SELS modernized and ultimately became SPC, during a time of profound evolution in the broader science of severe storms meteorology.

Pearson (director 1965–1979) emphasized the need for outreach and effective communication across the weather enterprise to enhance the value of severe weather forecasts to improve planning and preparedness. His leadership role in the 1965 Palm Sunday tornado outbreak's service assessment encouraged meteorologists to investigate why so many severe-weather casualties can occur, despite excellent forecasts. Pearson stressed the importance of conveying information about severe-storm threats more effectively, and helped to bring the National Weather Service into the media age with his regular appearances on national news shows during the primary severe weather season. He also contributed path elements to the Fujita-Pearson scale for documenting tornadoes. Furthermore, Pearson oversaw the creation of a Techniques Development Unit (now SPC Science Support Branch) in 1975, a critical step in the advancement of scientific forecasting, applied research, and computerized data processing and visualization. He also oversaw the creation of a national program in 1978 to issue new hourly aviation advisories (Convective SIGMETs) for hazardous thunderstorm activity designed to provide more timely information for commercial and private aviation interests. This occurred in response to a fatal Southern Airways crash in 1977 that was caused by



The picture shows Fred Ostby (left) and Allen Pearson (right) standing on either side of former SPC director Joseph Schaefer.

thunderstorms. He became director of the National Weather Service's Central Region in 1979 and retired in 1981.

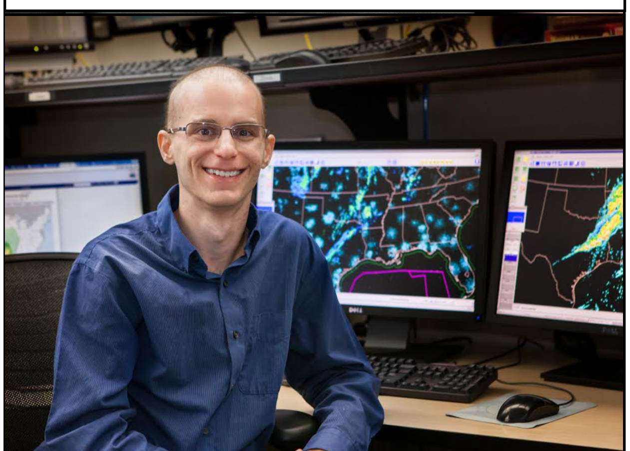
Ostby (director 1980–1995) played a key role in the operational implementation of the first modern interactive computer workstations in the NWS, when a specialized version of McIDAS developed at the University of Wisconsin for SELS, called the Centralized Storm Information System (CSIS), was installed in 1982. That year also saw the creation of the National Aviation Weather Advisory Unit (NAWAU), which centralized the forecasting of aviation weather hazards previously done at multiple regional locations. NAWAU later became the Aviation Weather Center as part of the establishment of NCEP in 1995. Ostby also led a noteworthy expansion of the SPC/SELS product suite. In particular, the first Day-2 Convective Outlook, Mesoscale Discussion and Particularly Dangerous Situation (PDS) Tornado Watch products each were issued during Ostby's leadership. He hired several current SPC forecasters who moved from Kansas City when the centers diverged in the mid 1990s.

We celebrate the lives of these two industrious and progressive leaders. For additional information about the history of SPC/SELS, please visit the following website: http://www.spc.noaa.gov/history/early.html. A timeline of SPC/SELS is available at the following website: http://www.spc.noaa.gov/history/timeline.html.

Two New Lead Forecasters at the Storm Prediction Center

By Dr. Ariel Cohen, Mesoscale Assistant/Fire Weather Forecaster

SPC Lead Forecaster Jared Guyer.



SPC Lead Forecaster Jeremy Grams.

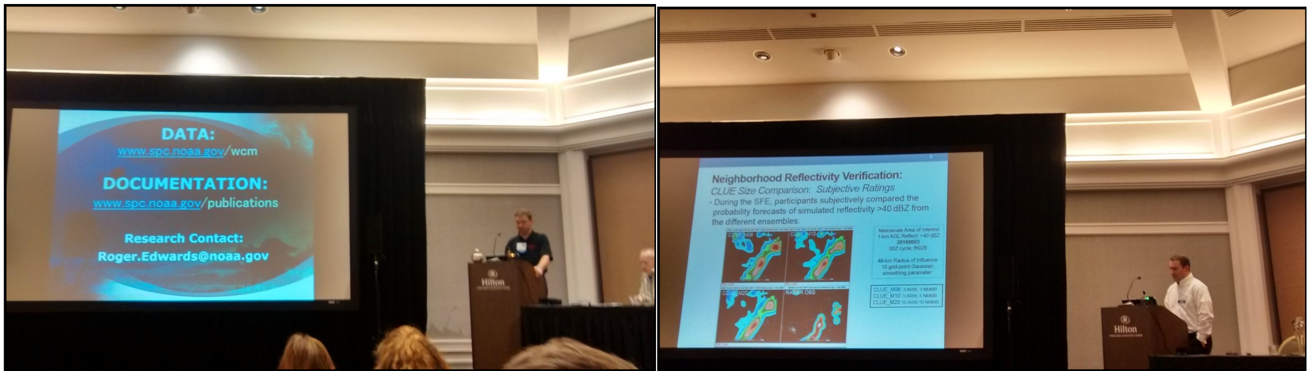
Following the departure of former Lead Forecasters Stephen Corfidi and Corey Mead from the SPC, Jeremy Grams and Jared Guyer have been selected as our newest Lead Forecasters. Jared and Jeremy were previously Mesoscale/Outlook Forecasters for many years. As Lead Forecasters, they are now responsible for leading the SPC forecasting team, issuing the nation's severe thunderstorm and tornado watches, overseeing product issuance, managing and guiding shift operations, and performing many other tasks critical for the success of the SPC. Both Jared and Jeremy have provided numerous contributions to research and development initiatives in severe-weather meteorology, and have combined decades of experience in forecasting severe, fire, and winter weather across the country from the SPC and from local National Weather Service Forecast Offices. We at the SPC extend tremendous congratulations to Jared and Jeremy on being selected as Lead Forecasters, and look forward to their leadership in carrying out the National Weather Service's mission supporting the protection of life and property. For more information about the SPC, and the functions of various positions within the SPC, please visit: http://www.spc.noaa.gov/misc/aboutus.html.

Interested in seeing SPC forecasters at work? Tours of the National Weather Center are possible! Public tours are held throughout the week, but must be scheduled in advance. For more information, visit http://www.ou.edu/content/nwc/visit/tours.html

SPC Staff Present Research at the American Meteorological Society's 28th Conference on Severe Local Storms

By Liz Leitman, Mesoscale Assistant/Fire Weather Forecaster

Several SPC meteorologists presented new research, including new forecast tools and techniques, at the American Meteorological Society's (AMS's) Conference on Severe Local Storms in November 2016. During this week-long conference, ten SPC meteorologists and affiliates presented work on a range of topics related

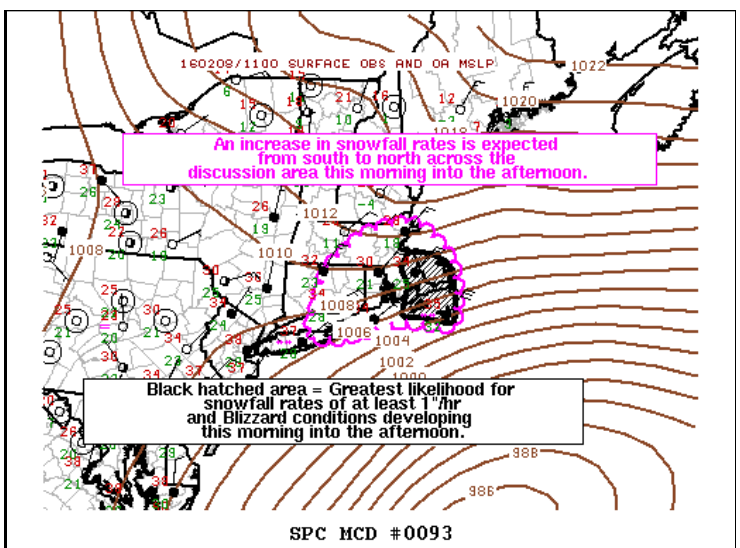


Left: SPC Lead Forecaster, Roger Edwards, presenting his research, titled Estimated Convective Winds: Reliability and Effects on Severe-Storms Climatology. Right: SPC Science Operations Officer, Dr. Israel Jirak, presenting his research, Comparison of the SPC Storm-Scale Ensemble of Opportunity to other Convection-Allowing Ensembles for Severe Weather Forecasting.

to severe storms forecasting. Some of these topics include high-resolution and ensemble model guidance, severe weather climatologies, probabilistic forecast guidance, forecast techniques and societal impacts. These meetings are especially important for sharing new ideas and techniques between operational meteorologists and those in academia and the private sector, with the ultimate goal being improved outlooks, communication, and watches and warnings. For more information and the full conference program, visit the AMS's 28th Conference on Severe Local Storms webpage.

SPC Winter Weather Mesoscale Discussions

By Aaron Gleason, Mesoscale Assistant/Fire Weather Forecaster



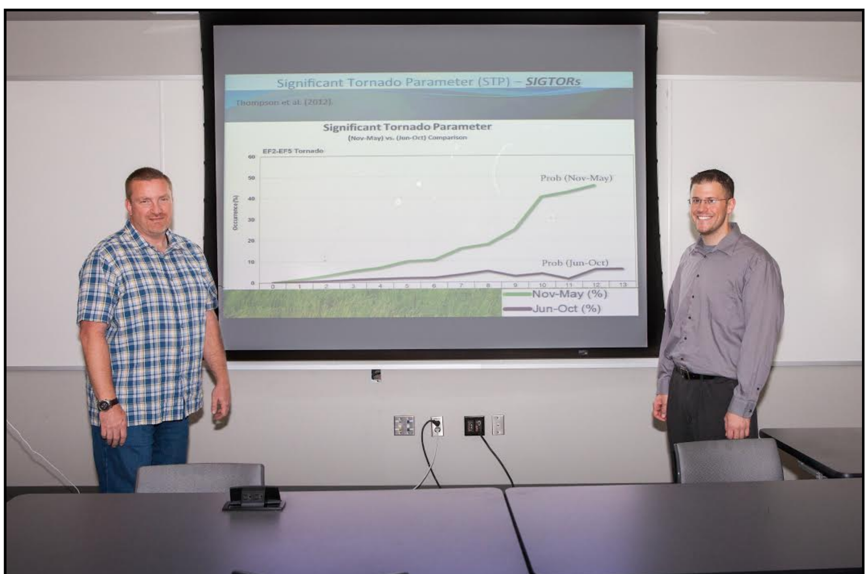
An example of an SPC winter weather Mesoscale Discussion. This particular discussion is addressing a heavy snow and blizzard condition threat.

Forecasting severe thunderstorms is one of the main responsibilities at SPC. However, SPC meteorologists also produce forecasts of winter weather. SPC issues event-driven Mesoscale Discussions (MDs) for short-term heavy snow, freezing rain, mixed winter precipitation, and blizzard events across the contiguous United States. These MDs incorporate a multitude of observational data, as well as near-term model information, into a graphic and technical text product that highlight the winter weather threat for typically the next 2-6 hours across a specific geographic area. The graphic to the left is a good example of a winter weather MD, showing the highest threat area expected to receive heavy snowfall and blizzard conditions within 6 hours, in this case across parts of New England.

But, exactly how do we define heavy snow and the other winter weather terms? Most of these definitions vary depending on who you ask, but at SPC we look for snowfall rates in excess of 1 inch per hour for at least two hours at elevations below 4000 feet above mean sea level, an in excess of 2 inch per hour for lake effect snow events. Heavy snow MDs may also be written when two inch per hour rates for at least two hours are expected between 4000 and 8000 feet above mean sea level. Freezing rain MDs are created when rates greater than 0.05 inch per 3 hours are anticipated. The National Weather Service has a set definition for blizzards: sustained winds of 35 mph or greater, accompanied by falling and/or blowing snow, which frequently reduces visibility to one quarter of a mile or less for 3 or more hours. For winter mixed precipitation MDs, a combination of heavy snow, sleet, and/or freezing rain that has a noticeable impact to a region is needed for issuance. A winter weather MD may also be written for any climatologically rare event as well, such as snow or ice along the Gulf Coast, for example. Notice that forecasts for total snow, sleet, or freezing rain accumulations have not been mentioned. Accumulation forecasts are provided by your local National Weather Service forecast office, with additional guidance from the Weather Prediction Center in College Park, MD. The focus of the winter weather MD is to provide a quick snapshot of potentially high-impact winter weather that will happen soon (typically within 6 hours), with supporting meteorological details in the text. We will often include details about convectively enhanced snowfall rates (possibly with thundersnow), since forecasting convection is one of our main tasks.

SPC Forecasters Develop and Document the Statistical Severe Convective Risk Assessment Model (SSCRAM)

By Dr. Ariel Cohen, Mesoscale Assistant/Fire Weather Forecaster



John Hart (left), SPC Lead forecaster, and Dr. Ariel Cohen (right), SPC Mesoscale Assistant and Fire Weather Forecaster, present the new forecast tool called SSCRAM.

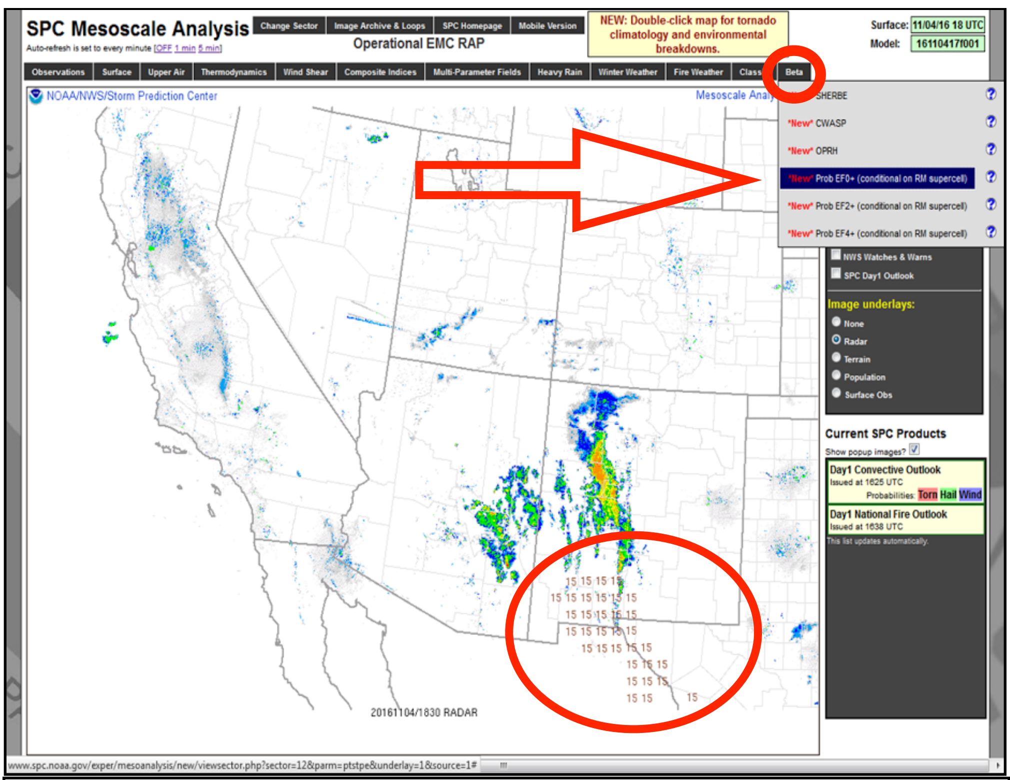
Storm Prediction Center Forecasters John Hart and Dr. Ariel Cohen are working together on a major project to improve the way forecasters perform short-term threat assessment of severe thunderstorm hazards. Their work involves the development and documentation of the “Statistical Severe Convective Risk Assessment Model”, also known as SSCRAM. SSCRAM produces severe thunderstorm wind, hail, and tornado probabilities for locations in the path of thunderstorms within a couple of hours, based on parameters describing the storm’s current environment. This system combines the meteorological environment, location, and time of year corresponding to millions of cases of past lightning strikes, and evaluates whether those lightning strikes are linked to severe weather reports in the short-term. Such a large database naturally serves as the basis for deriving relationships between various parameters and severe weather hazards, which directly feed into short-term severe weather threat assessment.

Hart, Cohen, and others on the SPC staff continue to evaluate SSCRAM's output in real-time to continue improving its design. Eventually, it is envisioned that SSCRAM will serve as the foundation for expressing probabilities for individual severe thunderstorm hazards. SSCRAM is expected to be able to directly improve the precision and accuracy of critical, impact-based decision support services relevant for severe thunderstorm forecasting to aid our facilitation of a Weather-Ready Nation.

Furthermore, Hart and Cohen have used SSCRAM to research various types of high-impact weather phenomena. For example, they used the SSCRAM system to highlight the challenge of significant tornado forecasting using meteorological parameters during the months of June-October compared to November-May. Hart and Cohen already have had their manuscripts on SSCRAM appear in the American Meteorological Society's *Weather and Forecasting* journal. Their manuscripts are entitled "The Statistical Severe Convective Risk Assessment Model" and "The Challenge of Forecasting Significant Tornadoes from June to October using Convective Parameters", and provide additional details on SSCRAM and its applications.

New Operational Forecast Tool

By Bryan Smith, Mesoscale/Outlook Forecaster



The new conditional probability of a tornado tool can be found on our Mesoscale Analysis webpage.

A new operational forecasting technique designed to assist forecasters with diagnosing the *conditional* probability for a tornado is now available for consideration in an operational workflow and decision-making scenario. This new data can be found within the ***Beta*** menubar located on the SPC mesoanalysis webpage, and is labeled **Prob EF0+, EF2+, or EF4+ (conditional on RM supercell)**. A ***Help*** file can be accessed by clicking the "?" located next to the label. The ***Help*** file contains a description of the data and the appropriate manner in which to consider the probabilities. These probabilities represent the *conditional* probability for an EF0+ (or EF2+, EF4+) tornado to occur given the presence of a right-moving supercell, based on the mesoscale environment. The relationship between the Significant Tornado Parameter (STP) and an empirically based dataset of right-moving supercells was developed over the past 5 years at the SPC. This work has been published as peer-reviewed journal articles that can be found on the SPC Publications webpage. This most recent work was presented at the American Meteorological Society's 28th Conference on Severe Local Storms in November 2016.

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