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A Look Back at this Past Winter

By Kevin Birk, General Forecaster

Wow, what a winter! The meteorological winter season, which we simply define as the 3 month period of December through February, ended up as the 3rd coldest on record in Chicago and Rockford, and also one of the snowiest ever. However, if you consider the four month period of December through March, Chicago experienced its coldest such period on record, dating back to 1872. Similarly, Rockford experienced its 2nd coldest December through March period.

The question that comes up naturally is why was it so persistently cold and snowy across the region this winter? The answer to this lies in the behavior of the upper-level jet stream pattern across North America. This year a large area of high pressure set up in the mid and upper levels of the atmosphere across western North America and Alaska. This acted as what Meteorologists refer to as an atmospheric block, which means it simply blocked the west to east jet stream pattern across the Pacific and western North America. This is a feature that has happened before, and it is important for meteorologists to recognize when such a setup is in place, or is about to develop, as it can have significant impacts on the day to day weather across the area for an extended period of time.

Typically, when an atmospheric blocking event develops, it forces the upper level jet stream pattern to buckle significantly southward downstream of the area of the atmospheric block, and due to the large scale nature this pattern it can lock in place for an extended period of time. This is exactly what happened this winter. In this case, the eastern half of country was on the downstream side of the blocking high. The blue line in figure 1 on the next page depicts the average jet stream pattern for most of this past winter across North America. Notice that while this block to the jet stream pattern across western North America produced very mild and dry conditions for much of the season, the same was not true for the eastern half the country. Instead, the highly buckled upper jet stream pattern resulted in most of our weather coming down out of the arctic regions of northern Canada and even Siberia. The presence of this jet stream pattern also drove a very active weather pattern, which led to countless winter storms and several feet of snowfall through the season.

A Look Back at this Past Winter (cont)

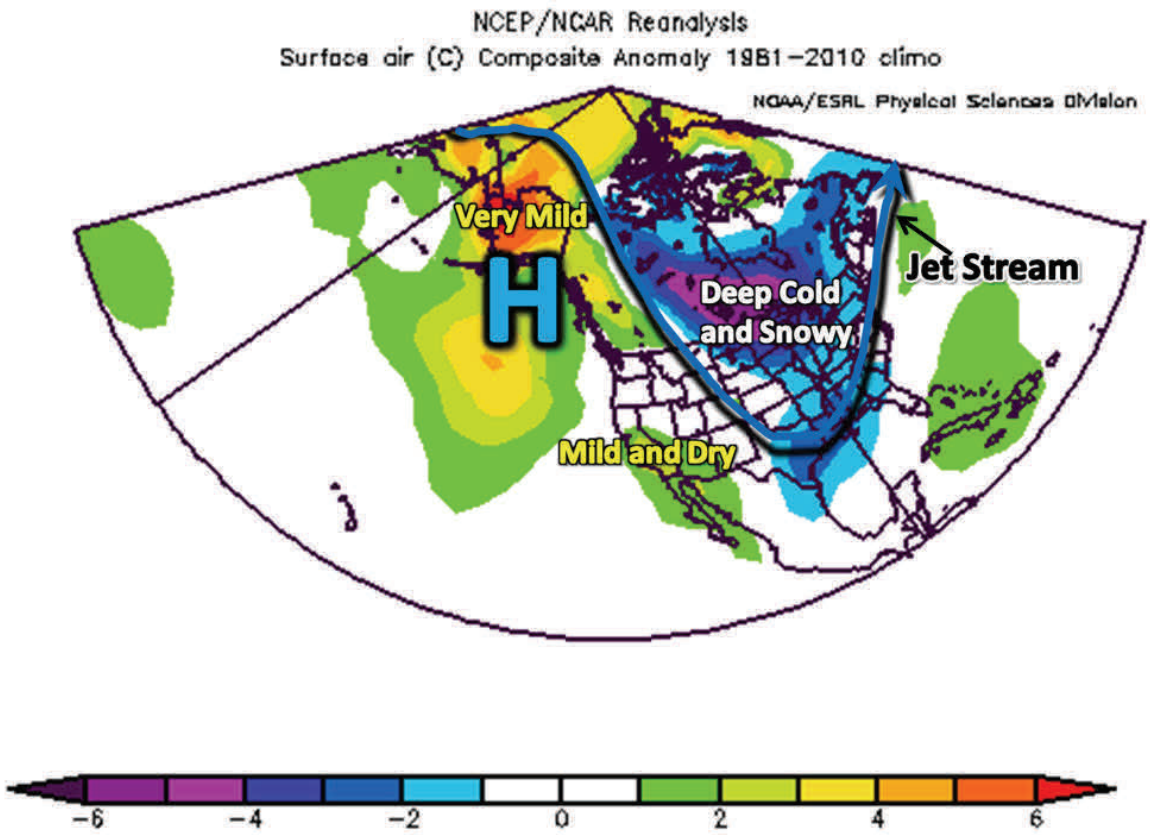


Figure 1. Upper-level jet stream pattern across North America.

It is not uncommon for atmospheric blocking events such as this to develop. However, what made this event different from many other blocking events was its strength and persistence. This general blocking weather pattern across the North Pacific and western North America has been in place since last autumn. In order to quantitatively compare this winters pattern across western North America and the eastern Pacific to those of past years, there is an index known as the Eastern Pacific Oscillation (EPO). This index is a measure of the upper wind flow over the Eastern Pacific and western North America. There are two phases: a positive and a negative. If the EPO is positive, there tends to be stronger zonal (west to east) flow across the eastern Pacific and Western North America. This pattern favors mild Pacific origin air masses across much of the country, with less frequent artic outbreaks. However, during the negative phase of the EPO, upper level ridging of high pressure sets up across Alaska and western North America, similar to what we experienced this past winter (see figure above). This favors more arctic and even polar outbreaks across the central and eastern CONUS. Data for this index dates back to 1948, and interestingly the average EPO index for the 4 month period December through March was -61.3, which is the 3rd lowest value on record. This is an indication that the persistence and strength of the blocking high pressure ridge across western North America is amongst the strongest on record, at least since 1948.

A Look Back at this Past Winter (cont)

The flow patterns across the Arctic and the North Atlantic also have a large influence on cold season weather patterns across the eastern CONUS. For example, the Arctic Oscillation (AO) and North Atlantic Oscillations (NAO), which are somewhat similar to the EPO, except they represent a measure of the atmospheric pressure across the arctic regions and the North Atlantic relative to atmospheric pressure across the mid latitudes of the Northern Hemisphere. These pressure patterns are important because they ultimately influence the strength and placement of the upper level jet stream pattern. In some of our past recent winters, these oscillations were the main drivers of cold winter weather experienced across the eastern CONUS. However, that was not the case this past winter. In fact, for the most part, these oscillations were in a phase more supportive for a warm pattern across the CONUS. Therefore, the record breaking cold pattern this past winter was driven largely by the strong and persistent atmospheric blocking pattern across the North Pacific.

Looking ahead to the late spring and summer

So, after this record breaking cold and snowy winter across northern Illinois and northwestern Illinois, many continue to eagerly look ahead to the late spring and summer. So this naturally brings up the question; what will the summer be like? Unfortunately, there are several phenomena that have low predictability, which can have profound influences on how the summer may end up. Therefore, forecaster uncertainty in the type of conditions that will be experienced a couple of months in advance tends to be much higher than a forecast for the next few days.

One of the phenomena that can affect the seasonal weather pattern across the country is the El Niño Southern Oscillation (ENSO). The ENSO is a naturally occurring oscillation that occurs across the equatorial Pacific. An oscillation is a motion that repeats itself over a period of time. For ENSO that period is between about 3 to 7 years. There are three phases that make up the ENSO. They are: El Niño, La Niña and Neutral. The defining characteristics of these three phases of ENSO are Sea Surface Temperature (SSTs) anomalies (departures from average) across the central and eastern equatorial Pacific. During El Niño conditions, warmer than average SSTs (at least +0.5° Celsius temperature anomalies) are found along the equator in the central and eastern Pacific region. Just the opposite occurs during La Niña events. However, during ENSO Neutral events SST's are near normal across the equatorial Pacific (between -0.5° and +0.5° Celsius temperature anomalies).

One of the things that have sparked interest of late is the increasing potential of a developing El Niño this summer into the fall. The Climate Prediction Center (CPC) states that all the model projections indicate warming of the tropical Pacific over the coming months. This is consistent with the transition to El Niño conditions. However, there is considerable uncertainty on the timing of this developing El Niño conditions. The CPC says there is about a 50% chance of El Niño conditions developing this summer into the fall. Typically ENSO events have their largest influence on the weather pattern during the cold season, with a weaker influence during the summer. In spite of this, however, local research has shown that during developing El Niño summers, there is a tendency to have below average temperatures and near to above average precipitation across northern Illinois and into northwest Indiana. So, the behavior and timing of this developing El Niño event will be of interest for us this summer.

A Look Back at this Past Winter (cont)

So what kind of weather pattern do El Niño events produce during the summer? Unfortunately, no single event produces the exact same conditions. However, by grouping past El Niño summers seasons together we can get an idea of a possible favorable large scale weather pattern across North America, which could shed some light on what may be possible this summer if we go into an El Niño. Figure 2 below shows a composite map of 15 past El Niño summers for the upper level wind anomalies (approximately 30,000 ft. above ground level). A couple of things stand out here. First, notice the area highlighted by the green arrows in the figure. This indicates that during these summers there tends to be an enhanced subtropical jet, which extends from the Pacific northeastward across the southwestern CONUS and into the mid -section of the country. This pattern would suggest the potential for more active weather with above average rain across central portions of the country. In addition, these summers show a tendency for an area of upper level high pressure near Alaska and an area of low pressure across eastern Canada. If a weather pattern similar to this were to set up and persist through the summer, it could lead to cooler than average temperatures across the area.

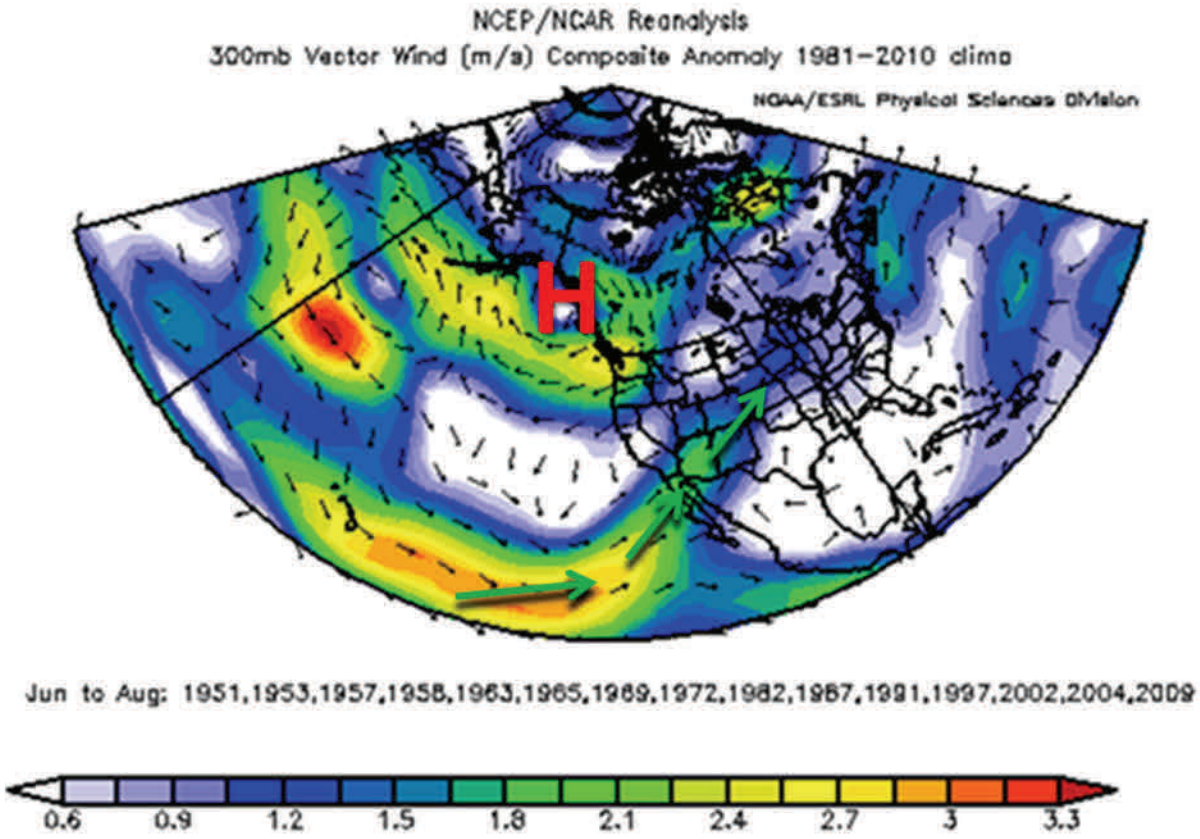


Figure 2. Composite Upper-level wind anomalies during developing El Niño summer seasons. The H indicates the presence of upper-level high pressure, and the green arrows highlight an enhanced sub-tropic jet stream.

A Look Back at this Past Winter (cont)

Figure 3 below displays the distribution of temperatures across northern Illinois during La Niña, ENSO Neutral and El Niño summers. Focusing just on El Niño summers, the figure for temperatures below tells us that 60% of the El Niño summers were cooler than normal, just over 13% were near normal and nearly 27% were warmer than normal (using the 1981-2010 period). The bold border around the below category indicates that there was a statistically significant (at 90% statistical significance) excess of below normal summers across northern Illinois during El Niño summers. Similarly, the bold box around the near normal category indicates a statistically significant lack of near average summers across northern Illinois. Therefore, there is a statistical tendency for summer seasons across northern Illinois to be cooler than average during El Niño events. Notice, however, that there were still a decent amount (26.7%) of summers that were warmer than average during El Niño events. This amount did not deviate significantly from the expected amount. So this tells us that although there is a significant tendency to be cooler than normal during these summer seasons, it is not a certainty.

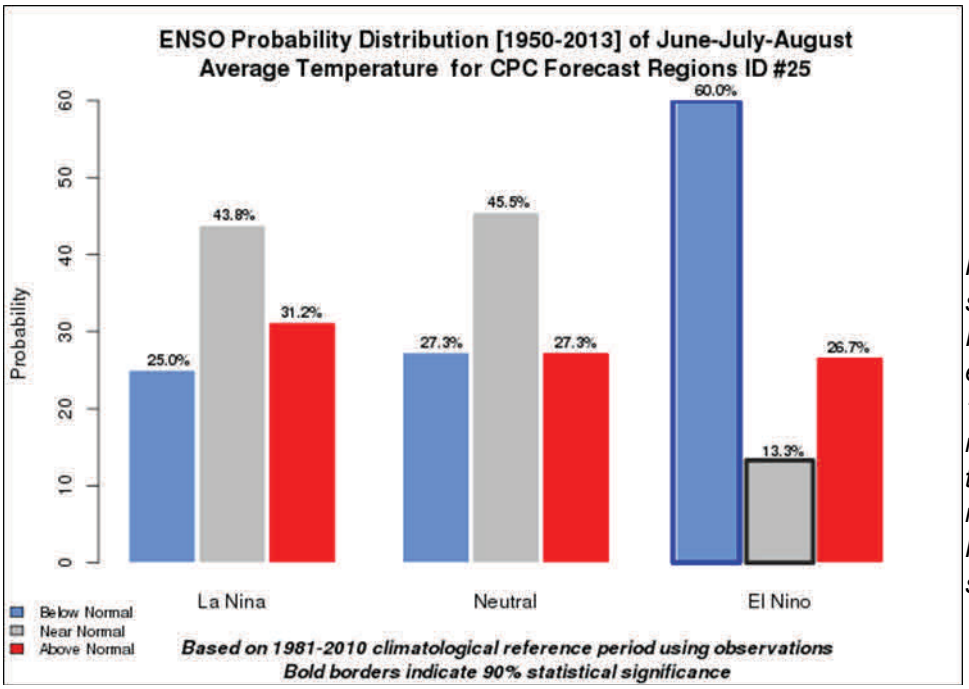


Figure 3. Distribution of summer season temperatures across northern Illinois (CPC region ID # 25) during each phase of ENSO relative to the 1981-2010 period. Blue (red) boxes represent below (above) normal temperatures, while the grey boxes represent near normal conditions. Highlighted boxes indicate a 90% statistical significance.

Figure 4 is the same as figure 3, except for summer season precipitation. Again, focusing just on El Niño summers, the figure for precipitation below tells us that nearly 27% of the El Niño summers were drier than normal, just over 53% were near normal and 20% were wetter than normal (using the 1980-2010 period). The bold border around the near normal category indicates a statistically significant excess of near average precipitation for summers across northern Illinois during El Niño events. Therefore, there is a statistical tendency for summer seasons across northern Illinois to have near average precipitation during El Niño events. Notice, however, that there were still a decent amount of summers that were drier and wetter than average during El Niño events. These amounts did not deviate significantly from the expected amount. So this tells us that although there is a significant tendency for near normal summer season precipitation during these summer seasons, it is also not a certainty.

A Look Back at this Past Winter (cont)

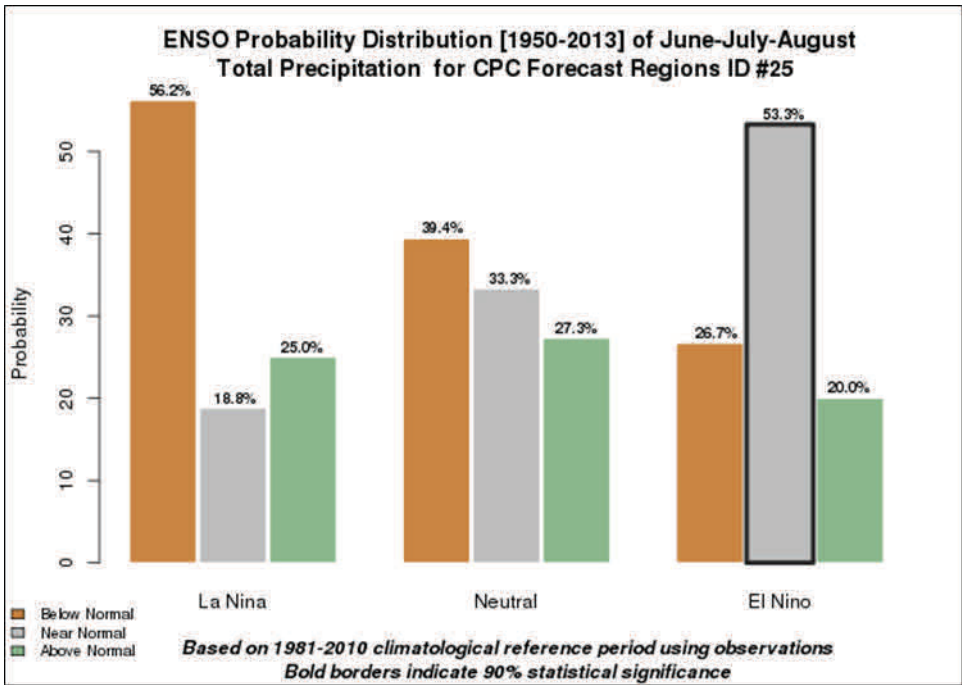


Figure 4. Same as figure 3, except for precipitation. Brown (green) boxes represent below (above) normal precipitation, while the grey boxes represent near normal conditions. Highlighted boxes indicate a 90% statistical significance.

Some of the most recent El Niño summer seasons were: 1997, 2002, 2004 and 2009. Of these four summers, three (1997, 2004, 2009) were cooler than average with near normal precipitation. The summer of 2009 was exceptionally cool, especially in July, which was the coolest on record in Rockford and 7th coolest in Chicago. This helped summer 2009 become the 3rd coolest summer on record in Rockford and 16th coolest in Chicago. In contrast, the 2002 summer season was warmer and wetter than average. An average summer season across northern Illinois and northwest Indiana typically entails maximum daily temperatures in the low to mid 80s and daily lows in the lower 60s during the months of June through August.

As for summer heat, there are typically about 13 to 17 days of 90 degree temperatures during the months of June through August. During the summers of 2009 and 2004, there were only 4 (3) 90 degree days in Chicago, respectively. In Rockford, there was only one day with a 90 degree temperature during the summer of 2004 and only 4 during the summer of 2009. So, if a cooler summer does pan out across the region, it appears this could possibly only result in a handful of 90 degree temperatures for the area, and make it less likely to see 100+ degree heat.

Conclusion

The potential for El Niño conditions in the tropical Pacific is high later this year. The main question is how quickly it will develop. If El Niño conditions set up in time for this summer, the results in this article suggest that the corresponding impacts on the large scale weather pattern across North America could stack the odds a bit in favor of a cooler than average summer season with near average precipitation. However, in spite of the strong statistical significance shown, it is again worth noting that not every event will produce the same conditions. There are many other less predictable variables that can dictate local and regional conditions during a season. Therefore, the information in the article is not meant to be a deterministic forecast suggesting that the summer will be cool with normal precipitation. Instead it is meant to show the potential for such conditions based off the behavior of the large scale pattern during other similar past El Niño conditions. The official forecast from CPC is currently forecasting equal chances of above, below and near average temperatures and precipitation for the area this summer. This “equal chances” forecast signifies the large uncertainty in what large scale pattern will set up across the area this summer.

America's PrepareAthon!

By Stephen Rodriguez, General Forecaster

Despite an increase in weather-related disasters, nearly 70 percent of Americans have not participated in a preparedness drill or exercise, aside from a fire drill, at their workplace, school, or home in the past two years (2012 FEMA National Survey). However, we have seen that communities are better prepared to withstand an emergency and recover more quickly when everyone is involved. In an effort to continue building resilience, the National Oceanic and Atmospheric Administration (NOAA) is partnering with the Federal Emergency Management Agency (FEMA) and other agencies on a national initiative known as America's PrepareAthon!, a community-based campaign to increase emergency preparedness at the grassroots level in support of Presidential Policy Directive (PPD-8), National Preparedness.

The first *America's PrepareAthon!* national day of action is **April 30, 2014**. It will focus on preparing organizations and individuals for tornadoes, hurricanes, flooding, and wild fires. *America's PrepareAthon!* events and activities will be held across the country twice a year to organize community days of action and encourage individuals to discuss, practice, and train for relevant hazards. The national days of action will be held in the spring and fall, and this year, the national days of action will be April 30, 2014 and September 30, 2014.

We are asking for your help and join NWS Chicago by getting involved and spreading the word about this national initiative. By getting involved, you can register to participate in *America's PrepareAthon!*.

Here's how to join:

- Register: Participate in *America's PrepareAthon!* at www.ready.gov/prepare and provide details about the activities you're planning.
- Be Smart: Download guides to learn how to prepare for a tornado, hurricane, flood or wildfire
- Take Part: Plan activities and host an event locally on April 30th
- Prepare: Practice a drill or have a discussion about preparedness
- Share: Promote your activities, events and best practices with national preparedness community members

Is NWS Chicago Registered?

Yes, and we are looking forward to participating this year with the public and our partners!

America's PrepareAthon! (cont)

NWS Chicago Actions

The main action item from NWS Chicago will occur on April 30th, 2014 (and then again in September), and will consist of having a Top News headline (www.weather.gov/chicago) detailing information about the four hazards listed above as well as sharing this information on our Facebook and Twitter pages. This information will stem from *America's PrepareAthon!* website, where information pertaining to each hazard reside.

Social Media

NWS Chicago is now following @PrepareAthon on Twitter and will ReTweet their Tweets this month (and then again in September). Although we will post our own information as well, primarily the week leading up to April 30th, and then again on that date.

NWS Chicago Twitter: @NWSChicago

NWS Chicago Facebook page: Search, National Weather Service Chicago

Questions

If you have any questions, please feel free to contact NWS Chicago at 815-834-1435.

Photo by Stephanie Kowalyk

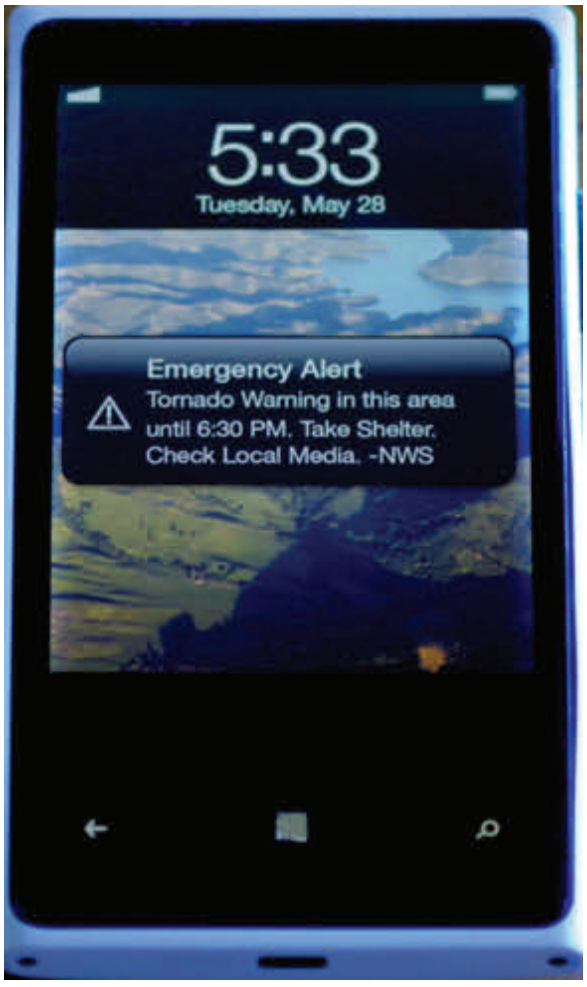
Summer Outdoor Event Season is Finally Here: Monitoring Hazardous Weather is a Group Effort

By Jamie Enderlen, General Forecaster

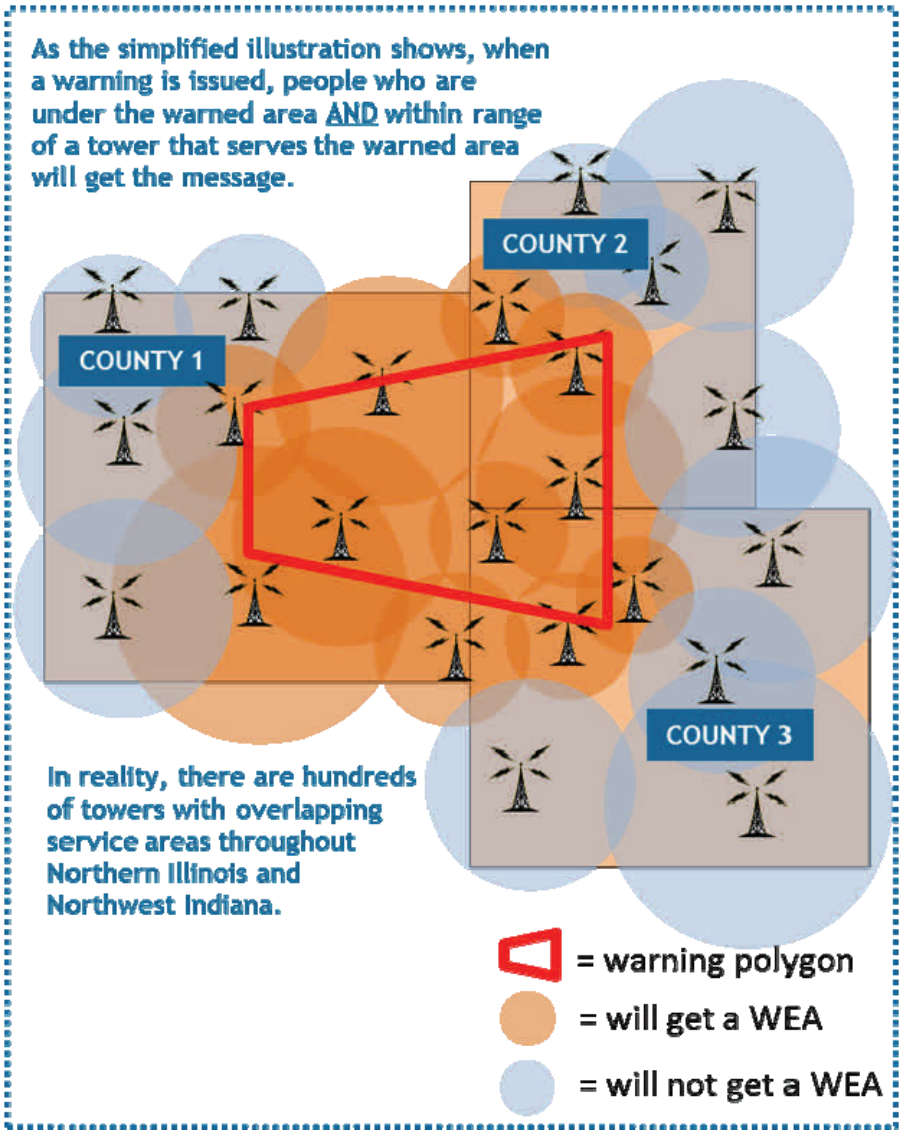
You've probably heard the NWS slogan "When thunder roars, go indoors" before. It's a reminder that there is no safe place outside during a thunderstorm. The concept is pretty straight forward for an individual who is at a park, golf course, baseball game, etc. He/she can simply head to his/her car or a sturdy building when the thunder begins and safely wait out the storm.

The concept becomes a bit more difficult, however, for organizers of large outdoor events who are responsible for the safety of hundreds to hundreds of thousands of people. From the Joliet Speedway, to the Taste of Chicago, to the Sweet Corn Festival, it's safe to assume there is at least one large outdoor gathering every weekend if not every day of the summer in northern Illinois and northwest Indiana. As such the NWS Chicago creates a database of large outdoor summer events thanks to our local emergency managers who provide the event information. The database allows us to plot that day's events on our forecast maps, which improves our situational awareness. The information is critical on severe weather days because we can see if the storms will impact any outdoor events and communicate this information with emergency managers and event leaders. They can then look at their weather plans and make the necessary decisions.

Just under three years ago, seven people were killed and dozens injured when damaging winds from a severe thunderstorm caused the rigging towers at a Sugarland concert to fall onto the crowd at the Indiana State Fair. No one wants to see an accident like this happen again, which is another reason why we create an event database every spring. However, it is your responsibility to remember to keep an eye on the weather prior to and while attending any outdoor event. New technology makes monitoring the weather easier than ever. You can bookmark your favorite weather website, download a weather app, or even carry a portable weather radio. Each of these options allows you to monitor the forecast, but it's equally important to make sure you have a way to receive watch and warning information. As a last resort, wireless emergency alerts (WEAs) are issued for tornado and flash flood warnings, but NOT severe thunderstorm warnings. When a tornado or flash flood warning is issued, all cell phones connected to cell phone towers under the warning receive a message indicating a tornado or flash flood warning was issued for the area (image on next page) and instruct the user to seek more information about the warning. The message is free, looks like a text (example right), but makes a unique sound when it arrives. All major cell phone providers offer WEAs, and you can go to http://www.ctia.org/wea to check if your phone is WEA-capable.



Summer Outdoor Event Season is Finally Here (cont)



If you are out and about when severe weather strikes, NWS Chicago includes extra location information in its warnings, both severe and tornado, to help people quickly identify if they are including in the warning or not. State parks, universities, well-known landmarks, interstate mile markers, and cities are included in our warnings. Finally, and most importantly, be sure you have a safe place to go when a storm approaches! After this winter, we certainly deserve an enjoyable summer, so go out, have fun, and stay safe!

Weather Preparedness: Do You Have a Plan?

By Jamie Enderlen, General Forecaster and Mike Bardou, Senior Forecaster

Every spring we are reminded to change the batteries in our smoke detectors, and to make sure we have a safety plan in case of a fire. It's also a good time to evaluate your hazardous weather plan. Are you, your family, your business, your school, etc. ready to react to thunderstorms, hail, damaging winds, flooding, and/or tornadoes? It's as simple as Plan, Practice, Monitor, Act.

You need to plan ahead, before hazardous weather is even in the forecast. When developing a plan, think about your circumstances. Where could you be when severe weather strikes? At home, soccer practice, work, school, commuting home? Each scenario has its own unique threats and conditions. For instance, if a storm hits while you are commuting home, what you do if you are stuck in traffic? Do your kids know what to do if they beat you home from school? The basic guideline is to go to the lowest floor of a sturdy building, then maximize the number of walls and minimize the number of windows between you and the outside. What if you are in a high rise? Get to an interior room with no windows. How about on the road with no easily accessible shelter? For a severe thunderstorm, pull over to the side of the road if possible and hold onto the steering wheel. If a tornado is approaching, lie in a ditch or lowest spot you can find. Avoid overpasses if a tornado is approaching! For information on creating a severe weather plan, go to http://www.ready.gov/make-a-plan, and for information on severe weather safety, go to http://www.nws.noaa.gov/com/weatherreadynation/severe.html#.U0EbkPldXTp.

Once you have a plan, practice it like a fire drill. Make sure every member of the family knows what to do as soon as a watch or warning is issued. If you have a plan, perform a dry run and see if you need to re-evaluate any aspects of it.

Monitoring the weather is another key aspect to any severe weather plan. Designate a weather watcher. This person monitors the weather throughout the day and notifies everyone if hazardous weather is expected or approaching. NWS Chicago updates its Hazardous Weather Outlook three times a day, which highlights the hazardous weather potential over the next seven days. On days when thunderstorms are expected, we include a breakdown of where and when we expect storms, what particular threats are expected, and a brief non-technical discussion providing background of the situation. You can find the Hazardous Weather Outlook via the drop down menu on our website as shown in the picture on the right.

Weather Preparedness: Do You Have a Plan? (cont)

If there is a threat of thunderstorms, monitor radar and remember “When Thunder Roars, Go Indoors.” Also be alert for watches and warnings. You can do this via most weather websites, television, radio, cell phone, or by having a NOAA Weather Radio. We highly recommend you have a NOAA Weather Radio because the radio will alert you when a watch or warning is issued for your county immediately after we issue it! The audio alert will also wake you up in the middle of the night when other means such as tornado sirens (which are really meant for people outside) will not, and remember that in this part of the country severe weather does occur overnight.

Lastly, be prepared to put your plan into action if hazardous weather is approaching or a warning is issued! Communicate that the plan is in action, and get to shelter as soon as possible. Our region can see weather go from benign to violent in a matter of minutes so make sure you can reach shelter quickly!

Planning ahead, practicing your plan, monitoring the weather, and knowing when to put your plan into action are simple yet critical steps in protecting you and your loved ones during severe weather.

Weather Puzzle

By Terrie Sheetz, Administrative Assistant

T V Q W P B K S P Q Q D J S V L G F L O O D I N G
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O Q I G H U H R E D N U H T W N I T V R A N V P R
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R M M X C O I D I U Q I R J N N E A U B U K K R L
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S D O O L F H S A L F W U Y C N O T Z E R T A J E
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C C A Q W S T W S R Q N E E Q D T J F I E O U N Q
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AMATEUR RADIO
BAROMETRIC PRESSURE
DEW POINT
DOWNDRAFT
FLASH FLOODS
FLOODING
FORECASTING
FUNNEL CLOUD
HAIL
HUMIDITY
HURRICANE
JET STREAM
LIGHTNING
SNOWSTORM
TEMPERATURE
THUNDER
TORNADO
UPDRAFT
WARNING
WATERSPOUT
WEATHER
WEATHER RADIO
WIND CHILL