Eye on the Sky

National Weather Service
Louisville, Kentucky

Spring 2001
Volume 2, Issue 1

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A Newsletter for Emergency Managers, Core Storm Spotters, Media, and Public Officials in our County Warning Area.

Bits from the Boss

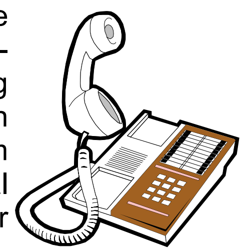
by Mike Matthews, Meteorologist-In-Charge

This edition of our "*Eye on the Sky*" newsletter celebrates our one year anniversary. Our ongoing goal is continued improvement to make this publication informative and educational in order to better serve you. As a result, with this issue we are expanding our mailing list to include county judge executives in our county warning area. Welcome!

In the last edition, we asked you to evaluate this service and provide feedback. Many of you provided invaluable responses with positive and supportive comments. Your feedback will be considered closely as we commit to further publications in the future. Graphical results of some of your answers to our feedback form can be found inside this newsletter. You also can view this publication in electronic format on our Web site at **www.crh.noaa.gov/lmk/newsletter**.

I would like to emphasize that this newsletter is not copyrighted and can be used as an informational and educational tool for schools, media, state agencies, civic organizations, and an array of other groups. Please distribute it as you see fit and pass along the Web address to a friend or colleague who might find the publication useful.

This issue focuses on our historically active and potentially hazardous spring weather months of April through June, which bring the increased threat of severe thunderstorms, tornadoes, damaging winds, hail, and flooding. When damaging weather occurs, storm reports from you and the general public are invaluable to us. Your timely reports called in to the nearest law enforcement agency or our office are critical to public safety. We need your trained eyes to assist us. We also encourage your use of our customer friendly electronic storm report form at **www.crh.noaa.gov/lmk/storm_report.htm**.



In closing, I thank you for your support of this service, your cooperation with us, and your dedication to public safety.

Automated Warnings on NWR

by Steve Marien, Forecaster

The NOAA Weather Radio (NWR) program at NWS Louisville has undergone many exciting changes over the last few years. One major milestone occurred in June 1999 when the Console Replacement System (CRS) became operational to automate routine forecast and weather summary products using a computer-synthesized voice. This spring, we plan to automate all of our watch, warning, and advisory products using the automated CRS system.

(Continued on Page 4)

Inside this Issue:

Severe Weather Operations at NWS Louisville . . . Behind the Scenes

by Tony Sturey, Lead Forecaster

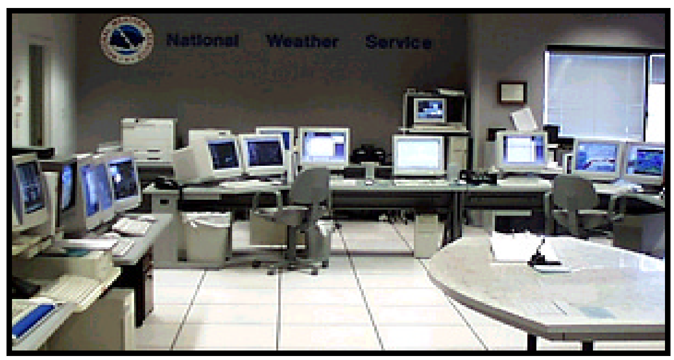
We are rapidly approaching the 2001 severe weather season in central Kentucky and south-central Indiana. NWS Louisville staff members do not take the responsibility of issuing accurate, timely warnings lightly or for granted. After all, the protection of life and property from hazardous weather is one of our core missions. As a result, our staff is ready throughout the year for any severe weather that may occur, with particular focus and training in late winter and spring. This may be transparent to citizens in our county warning area (CWA), but make no mistake about it, we are ready when severe weather threatens. The following information highlights some of our internal office operations before and during a severe weather event.

Practice, practice, practice! Each month all forecasters are required to issue practice severe weather watches, warnings, and statements. Proficiency is the key. These drills are simple but effective, and reinforce the mechanics of issuing products quickly and efficiently during actual events.

Severe weather training seminars are conducted periodically with the staff. Convective storm structure and evolution are reviewed, including an evaluation of past events in the Ohio Valley and discussion of the latest convective research. TV meteorologists from Louisville, Lexington, and Bowling Green also participate in an annual severe weather seminar to ensure their continued understanding of storm structure, as they play an integral part in the severe weather process. In addition, written and oral examinations must be completed by NWS Louisville forecasters to sharpen their ability to diagnose severe weather signatures on our WSR-88D Doppler radar. Forecasters also enhance their meteorological skills by participating in teletraining sessions with other NWS offices, completing internal and Web-based training modules, and by attending periodic severe weather workshops across the country.

When an outbreak of severe weather is expected in NWS Louisville's CWA, the lead forecaster lays the ground work for what may lie ahead. For example, the lead forecaster is responsible for ensuring proper staffing levels, designating job tasks, requesting amateur radio operator support, coordinating with the Storm Predication Center and surrounding forecast offices, issuing forecast products, and requesting, as needed, special upper-air sounding releases and rapid-scan satellite pictures.

This pre-storm preparation is "bread and butter" in that it "sets the table" for the staff to work efficiently and coherently during hazardous weather. Various job positions and duties must be carried out during a major event. These include 1) an internal storm coordinator who logs and disseminates warning, statement, and damage information among the staff, 2) primary and secondary radar analysts and warning meteorologists, 3) synoptic forecaster who issues severe weather watches and updates forecast products, 4) mesoscale forecaster who issues severe weather statements, short-term forecasts, and aviation products, 5) another forecaster who issues statements and local storm reports, 6) hydrometeorological technician who monitors and/or disseminates products on NOAA Weather Radio and assesses river and stream levels during heavy rainfall, 7) a floater person to help out as needed, including soliciting real time damage information through phone calls with county officials, spotters, and the media, and 8) an electronic technician to ensure our equipment performs flawlessly.



Part of the NWS Louisville operations area where forecasts and warnings are prepared.

In a large severe weather event, we normally have about 8 people present, assigned specific duties to accomplish all essential tasks. Unfortunately, severe weather does not always follow a "textbook" type recipe! As a result, our staff must be flexible in performing assigned duties, react quickly to extra workload, and remain available to work odd hours.

If major damage, injuries, or fatalities occur in our CWA, individuals are deployed to conduct detailed damage surveys. Upon their completion, a public statement is issued to the media and public.

We hope this snapshot of our core duties during severe weather gives you a better understanding of the fundamental responsibilities we face. So, when severe weather threatens this spring or anytime during the year, we'll put our "game plan" into action and be ready for whatever happens.

The April 3, 1974 Tornado Super Outbreak in Kentucky and Southern Indiana

by Don Kirkpatrick, Severe Weather Meteorologist

The largest known outbreak of tornadoes within a 24-hour period devastated parts of the Tennessee and Ohio Valleys including central Kentucky and southern Indiana on April 3, 1974. One of the most violent tornadoes, an F5 on the Fujita damage scale, leveled Brandenburg (Meade County), Kentucky claiming 31 lives and injuring 270. Other destructive tornadoes occurred near Madison and Depauw in Indiana, and near Louisville, Bardstown, Frankfort, Campbellsville, and Richmond, Kentucky.

Severe storm forecasters have long known that the superposition of certain atmospheric parameters can induce tornadic thunderstorms. These parameters include:

> Strong vertical wind shear (change in wind direction and/or speed with height)
> A buoyant (unstable) air mass
> Abundant moisture in the lower atmosphere (below 10,000 feet)
> Mass (wind) convergence near the surface
> Mass (wind) divergence aloft at jet stream level (25,000-40,000 feet)
> A "trigger" or lifting mechanism (e.g., a warm front, cold front, or low-level boundary).

On April 3, strong low pressure at the surface and aloft moved from Kansas to Michigan. An associated warm front advanced northward across the Ohio Valley during the morning resulting in the influx of very moist and unstable air over Kentucky and southern Indiana. Sustained southerly winds at the surface increased to 20-30 knots after the warm front passed, while jet stream winds aloft tripled in strength to near 120 knots from the southwest. As a potent cold front approached and acted as a trigger within the highly sheared and extremely unstable air mass, severe thunderstorms ignited rapidly leading to the memorable super tornado outbreak.

Events of the Super Outbreak:

> At the peak of the outbreak, 15 tornadoes were on the ground at the same time from middle Tennessee into central Kentucky and eastern Indiana.
> The Brandenburg tornado, which virtually destroyed the town, caused a significant fall and ensuing rise of the water level as the tornado crossed the Ohio River.
> A curtain rod was driven to a depth of two inches into a tree in Brandenburg.
> The tornado near Depauw, Indiana deposited a car in the basement of a two story frame house.
> The tornado near Frankfort left a damage path about 5 miles wide near Stamping Ground in Scott County, Kentucky.
> Two tornadoes in middle Tennessee moved over the same house, first taking off the roof, then the remainder of the house.
> An earthquake measuring 4.5 on the Richter Scale in southern Illinois was felt over Kentucky and Indiana and as far away as Arkansas. Minor damage occurred across parts of Illinois and Indiana.

The violent tornadoes of April 3, 1974 likely will be unrivaled in number and strength for years to come. Much has changed regarding tornado safety since that catastrophic day. These changes will be explored in more detail in the next edition of "*Eye on the Sky*."

Eye on the Sky is a quarterly newsletter published by NWS Louisville for the benefit of Emergency Managers, core storm spotters, TV media outlets, and certain public officials within our county warning area. Comments and suggestions are welcome.

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Did You Know?

Nearly 2 million hours of training were provided to the nationwide National Weather Service work force from 1990 through 1999.

Automated Warnings on NWR *(continued)*

In preparation for this change, we have adjusted the computer-generated pronunciation of many communities across central Kentucky and south-central Indiana to the best of our ability. However, if you feel additional improvements are possible, please contact us with the correct phonetic pronunciation of your community.

Automated severe weather warnings on NOAA Weather Radio will speed vital information to the public.

The automation of severe weather watches, warnings, and advisories will have several advantages. First and foremost, the speed at which vital weather information is disseminated will increase. As soon as we issue one of these products, the text and any necessary alert tones will be transferred to the appropriate transmitter within seconds. This will make NOAA Weather Radio the most timely and effective manner in which to receive watches, warnings, and advisories. Second, product automation will allow staff members to focus on other important duties, including composing and transmitting warnings and statements, collecting storm data reports, and answering phone calls. This streamlining of duties will create a more efficient office team during significant weather events, which in turn means improved service to our listeners.

Spotter Training Classes in March 2001

by Norm Reitmeyer, Warning Coordination Meteorologist

During late winter and spring, NWS Louisville, under the direction of Norm Reitmeyer, conducts many spotter training and preparedness classes. We invite you to attend a class near you. Below is a list of the dates and locations of classes currently scheduled for March 2001. For more specific information, updates, or to set up a training class for your area, please contact Norm at 502-969-8842. Our Web site also lists spotter sessions at **www.crh.noaa.gov/lmk/spotter_reference/spotter.htm**.

Day/Date	City/County
Thu, March 1	Jamestown, Russell County, KY
	Frankfort, Franklin County, KY
Fri, March 2	Danville, Boyle County, KY
Sat, March 3	Franklin, Simpson County, KY
Mon, March 5	Lexington, Fayette County, KY
Tue, March 6	Milton, Trimble County, KY
	Shelbyville, Shelby County, KY
Wed, March 7	Jasper, Dubois County, IN
Thu, March 8	Georgetown, Scott County, KY
	Shelbyville, Shelby County, KY
Mon, March 12	Cynthiana, Harrison County, KY
Tue, March 13	Campbellsville, Taylor County, KY
	Lawrenceburg, Anderson County, KY
Wed, March 14	Harrodsburg, Mercer County, KY
Thu, March 15	Liberty, Casey County, KY
	Winchester, Clark County, KY
Mon, March 19	Elizabethtown, Hardin County, KY
	Columbia, Adair County, KY
Tue, March 20	Albany, Clinton County, KY
	Munfordville, Hart County, KY
Thu, March 22	Pleasureville, Henry County, KY

Severe Weather Terminology

by Ted Funk, Science Officer

Severe Weather Watch: Atmospheric conditions are favorable for severe weather in and close to the watch area. Watches are issued by the Storm Prediction Center in Norman, OK for severe thunderstorms and tornadoes for relatively large geographic areas, such as portions of or multiple states.

Severe Weather Warning: Severe weather is imminent or occurring. Warnings are issued by local NWS offices for severe thunderstorms and tornadoes for relatively small geographic areas, such as single or small groups of adjacent counties.

Flash Flood Watch/Warning: Issued by local NWS offices when conditions are favorable for flash flooding (watch) or flash flooding is imminent (warning).

Downburst: A severe downdraft and outrush of damaging wind on or near the ground. A downburst that is less (greater) than 2.5 miles in diameter is called a microburst (macroburst).

Mesocyclone: A cyclonically-rotating updraft within a severe thunderstorm.

Shelf cloud: Long, wedge-shaped cloud that marks the leading edge of a thunderstorm's downdraft or outflow along the gust front (outflow boundary). Strong winds are possible along the boundary.

Wall Cloud: An isolated lowering of a rain-free cloud base near the updraft/downdraft interface, indicating the strongest inflow into a supercell storm. A tornado may descend from a rotating wall cloud.

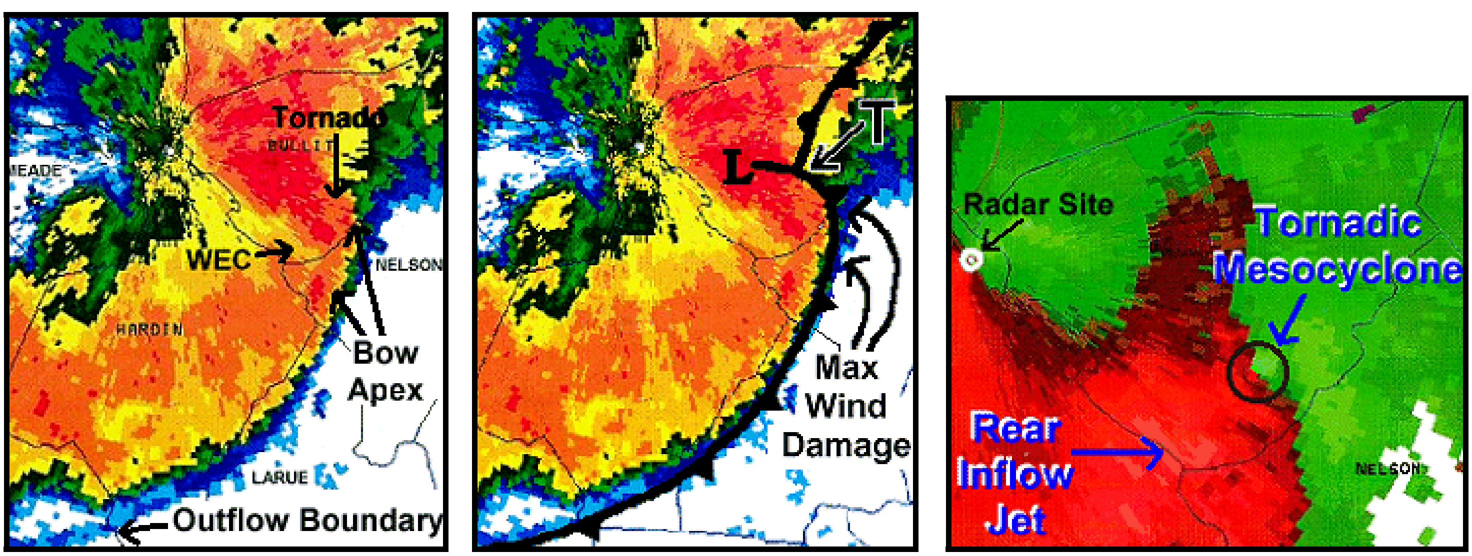
The Science Corner

by Ted Funk, Science Officer

Editor's Note: *Welcome to the first installment of "*The Science Corner*," a new column in "*Eye on the Sky*." In each newsletter, "*The Science Corner*" will feature a technically-oriented article on various meteorological subjects, pertinent for the season. Comments and suggestions for topics to be covered are welcome! Thank you.*

Structure and Evolution of Squall Lines and Bow Echoes

Severe thunderstorms produce damaging winds in excess of 50 kts, hail 3/4 inch in diameter or larger, and/or tornadoes. Tornadoes can be one of the most destructive forces on earth, especially those large tornadoes that make the headlines in the spring across the central United States. Such tornadoes typically are from vicious "supercell" thunderstorms. In the Ohio Valley, we experience supercells periodically, but our most common severe weather is produced by squall lines and bow echoes, i.e., arched (bowed) lines of storms. Strong bow echoes can produce widespread straight-line wind damage of such force that the damage can be mistaken for a tornado. Indeed, bow echoes also can produce tornadoes, but they usually are shorter-lived, smaller, and less potent than supercell tornadoes. Nevertheless, bow echo tornadoes do produce damage, but typically it is the straight-line winds along the bowing line of storms that produce the vast majority of observed damage. These types of storms demand rapid severe signature detection and evaluation on WSR-88D Doppler radar by highly trained forecasters, who must issue warnings quickly. Below is a set of radar images and an accompanying discussion for a damaging bow echo in Kentucky. Bow echo characteristics as observed on our Doppler radar are then summarized on page 7.

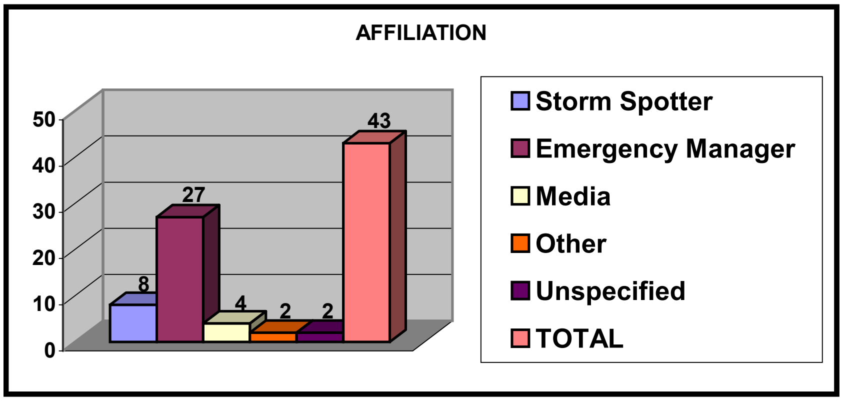


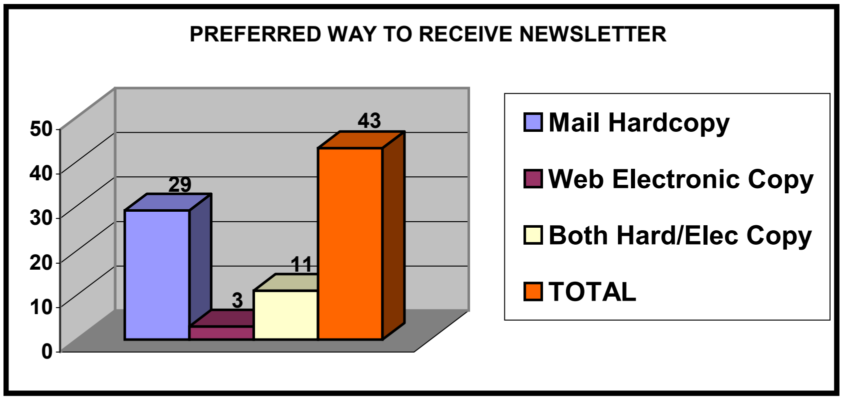
Low-level WSR-88D reflectivity (left/middle) and storm-relative velocity map (SRM; right) images show a bow echo that produced straight-line winds up to 100 mph and widespread damage across north-central Kentucky in May 1995. The damage was greatest along the bow apex (left), where the rear inflow jet (bright red; right) was coincident with a weak echo channel (WEC; left). A tornado also was occurring just north of the apex (left) where SRM data showed a strong, tight cyclonic circulation (mesocyclone; right). Organized bow echoes typically exhibit a convective-scale low and frontal structure (middle), analogous to a synoptic-scale system. The low is near the inflection point in the bow, with a cold (gust) front along the leading reflectivity gradient, and a stationary/warm frontal structure extending to the northeast of the low. Maximum wind damage occurs along the bulging cold front with the tornado ("T") near the frontal triple point. An outflow boundary is visible on the southwest part of the line (left).

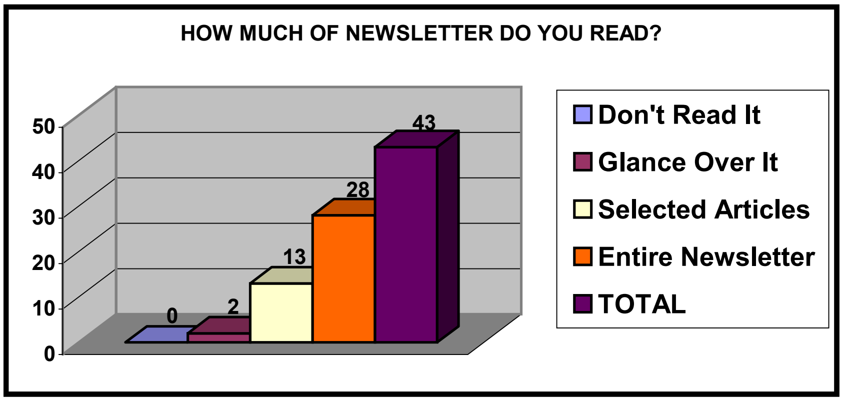
(Continued on Page 7)

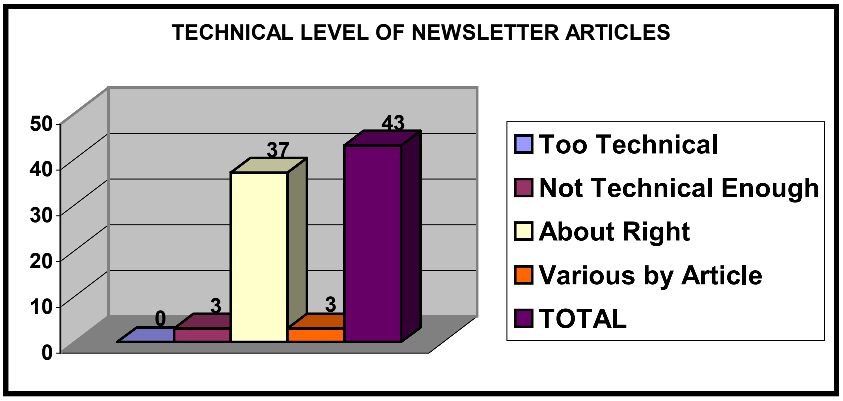
Eye on the Sky Newsletter: Selected Feedback Form Results

by Ted Funk, Science Officer









Thank you to those of you who completed and returned our newsletter feedback form included in the previous issue of "*Eye on the Sky*." We received 43 responses out of a possible 105 (41 percent). Your answers were very helpful to us in assessing the utility of our newsletter and ways we can improve this publication. At left are your answers in graphical format to four of the questions asked.

We received feedback from 27 county emergency managers, 8 spotters, 4 TV stations, and 2 NWS offices. Two others did not specify their affiliation.

Twenty-nine (29) people preferred receiving the newsletter in the mail, while 11 desired both a mailed hardcopy and an electronic copy. Our newsletter is posted as a PDF (Portable Document Format) file on our Web site at **www.crh.noaa.gov/lmk/newsletter**. Three people preferred a Web-based copy only.

Sixty-five (65) percent (28 out of 43) read the entire newsletter, while another 30 percent read selected articles. This is encouraging as most of you read some or all of the articles we provide.

Finally, 37 out of 43 people answered that the technical detail of the newsletter was about right, while 3 desired additional technicality. As a result, overall we will continue the basic form of the newsletter, but begin a new "Science Corner" section where a more technically-oriented article will be offered as appropriate.

A number of you also offered helpful comments that we will consider closely in future issues of our newsletter.

Thank you again for your responses. We greatly value your support and interest, and hope you will continue to provide us feedback on our service in the future, either by mail, e-mail, letter, or phone.

Did You Know?

The NWS receives over 1 million observations each day to develop forecasts and warnings for the American people.

Structure and Evolution of Squall Lines and Bow Echoes *(continued)*

REFLECTIVITY CHARACTERISTICS:

> During a bow echo's incipient stage, a strong downburst may descend within or on the rear flank of a convective storm, resulting in an initial bulging echo pattern.

> Bow echoes exhibit a bulging/bowing of the reflectivity gradient forward/downwind from the rest of the squall line. Usually, a strong low-level reflectivity gradient is present on the leading edge of intense convection indicating strong convergence and a vertical updraft.

> Weak echo channels (WECs) frequently are noted behind the leading intense convection, which usually are co-located with local enhancements in the rear inflow jet (RIJ).

> Within a mature squall line, there may be several bowing echo segments embedded.

> Bow echoes often produce significant damaging surface winds (assuming a well-mixed boundary layer) near the apex of the bow (i.e., along the RIJ), and possible tornadoes just north of the apex.

> The leading convective line stays intense if the outflow boundary (gust front) remains on the leading edge of the convective line. An outflow boundary propagating ahead of the line may initiate new cells downwind but eventually will diminish the intensity of the main line.

> There may or may not be a relatively large trailing precipitation area behind the leading convective line depending on the amount of storm-relative elevated front-to-rear flow.

REAR INFLOW JET (RIJ) CHARACTERISTICS:

> Local enhancements in the RIJ tend to develop along and behind axes of bowing line segments, especially those associated with significant trailing precipitation. Convective downdrafts can intensify wind flow and damage associated with RIJs along the leading bow apex.

> If the ambient vertical wind shear is strong, bow echoes tend to be long-lived as the RIJ remains elevated behind the leading line, then rapidly descends near the gust front causing significant surface wind damage.

> If the ambient shear is weak, the RIJ tends to descend and spread out along and behind the leading line, usually resulting in less intense/shorter-lived wind damage than for stronger sheared convective systems.

> Mature squall lines often contain two storm-relative airflow streams, i.e., rear-to-front associated with the RIJ and an elevated front-to-rear stream. This stream originates ahead of the squall line, rises rapidly within the leading line, then ascends rearward much more gently behind the line resulting in trailing precipitation.

MESOCYCLONE CHARACTERISTICS:

> Cyclonic circulation (mesocyclone) and subsequent tornado formation within squall lines usually occur in association with bowing line segments given sufficient lift, instability, and wind shear.

> For leading line (bow echo) tornadoes, the mesocyclone typically develops as an area of enhanced cyclonic convergence in the lower portions of the storm along/just north of the bow apex, then rapidly intensifies and deepens in altitude, partly due to rapid vertical air stretching in the updraft.

> Tornado occurrence is most likely during the mesocyclone intensifying and deepening stage, when tight shears and strongest rotational velocities exist. The tornado may be wrapped within precipitation, making it more difficult to spot on the ground.

> High precipitation (HP) supercell structure can develop within organized bow echoes. In these cases, mesocyclones and tornadoes are located within a weak echo region on the front forward flank of the storm.

> Vortex evolution along an organized, long-lived bow echo can be cyclic, i.e., the initial circulation develops and intensifies, propagates along the bow, and eventually weakens. However, new circulations can develop quickly along the bow apex just to the south and/or east of the initial vortex and undergo the same life cycle. This can result in a series of transient tornadoes.

> Bow echo tornadoes frequently develop quickly, are relatively short-lived, and cause F0-F2 damage.

> Tornado damage often is embedded within and/or on the northern fringe of maximum straight-line wind damage associated with the bow apex and rear inflow jet. While tornado damage within bow echoes can be significant, the large majority of damage from bow echoes is from straight-line winds.

Spring Hazardous Weather Safety Rules

FLASH FLOOD

> When a flash flood warning is issued or flash flooding is imminent, act quickly. Get out of areas subject to flooding, including dips, low spots, canyons, river beds, and valleys. Move to higher ground if necessary.

> Avoid already flooded and high velocity flow areas. Do not attempt to cross a flowing stream on foot where the water is above your knees.

> Do not drive across flooded roads; the road bed may not be intact under the water. If your vehicle stalls in water, abandon it. Rapidly rising water may engulf the vehicle and its occupants and sweep them away.

> Be especially cautious at night when it is harder to recognize flood dangers.

> Do not camp or park your vehicle along streams and washes, especially during threatening conditions.

THUNDERSTORM AND LIGHTNING

> Go inside a home, large building, or hard top automobile with the windows up.

> Do not use electrical appliances or the telephone except for emergencies.

> Do not stand underneath isolated tall trees, telephone poles, towers, or power lines. Avoid projecting above the surrounding landscape; for example, do not stand on a hilltop.

> In the woods, seek shelter in a low area under a thick growth of small trees. In open areas, go to a low place such as a ravine or valley.

> Get away from open water, tractors, metal farm equipment, motorcycles, bicycles, and golf carts.

> If you are outside away from shelter and feel your hair stand on end or skin tingle, lightning may be about to strike nearby. Do not lie flat on the ground. Instead, squat low to the ground on the balls of your feet and place your hands over your ears and your head between your knees.

TORNADO

> Avoid windows, doors, and outside walls. Protect your head. Be aware of flying debris.

> In homes and small buildings, go to the basement or small, interior room on the lowest level such as a closet, bathroom, or interior hallway. Get underneath something sturdy. In high-rise buildings, go to an interior small room or hallway.

> In schools, nursing homes, hospitals, factories, and shopping centers, go to pre-designated shelter areas. Interior hallways on the lowest floor usually are the safest.

> Leave mobile homes or vehicles, and go to a substantial shelter. If there is no shelter nearby, lie flat in the nearest ditch or ravine with your hands shielding your head. Be alert for possible rapidly rising waters.

We are always looking for new, dynamic, reliable weather spotters to assist us in our warning and verification programs. If you or someone you know is interested, please contact us at 502-969-8842 for more information.

Climatological Calendar: A Season of Change

by Mike Callahan, Service Hydrologist
Ted Funk, Science Officer

November 2000 to February 2001 will go down as a season of change across central Kentucky and south-central Indiana. We experienced many types of weather, from very cold to unseasonably warm air, and from severe thunderstorms to snow.

An outbreak of severe weather occurred on November 9. While thunderstorms are not common in November, they certainly can occur. In this event, a rapidly moving squall line produced widespread wind damage across 51 counties in our county warning area, including many downed trees and power lines, and barn and roof damage. In addition, 5 brief tornadoes were verified along the line, producing F0-F1 damage. Fortunately, the remainder of November was relatively quiet. Louisville, Lexington, and Bowling Green recorded monthly temperatures about 2-3 degrees below normal, with monthly rainfall 0.5-1.5 inches shy of normal.

December was harshly cold as arctic air dominated the Ohio Valley. The average temperature was 10-12 degrees below normal, making it the coldest December on record in Louisville, and the second coldest in Lexington and Bowling Green. With temperatures this cold, much of the precipitation which fell in December was frozen. Louisville received about 14 inches of snow, Lexington about 6 inches, and Bowling Green 2 inches.

For the year 2000, the drought was still quite evident in parts of south-central Kentucky, as Bowling Green's annual precipitation total ended up over a foot below normal. Its two year total (1999-2000) was a whopping 30 inches behind. In contrast, Lexington's yearly precipitation was only just over 2 inches below normal for 2000, while Louisville ended up over 5 inches above normal for the year.

The new year started on a tranquil note. The arctic air abated allowing temperatures to rebound to around normal in January 2001. Of course, after December's deep freeze, it seemed warmer than normal. Precipitation ended up 1-2 inches below normal, with the driest sections again in south-central Kentucky. Over 4 inches of snow fell in Louisville and Lexington, while Bowling Green picked up 2 inches in January.

February was a month of change as well, as temperatures roller coasted. High temperatures were in the 30s and 40s the first week of the month, but rose to unseasonably warm levels around 70 on the 8th and 9th. However, a cold front plummeted temperatures back to the 30s on the 10th and 11th, only to rise back to 60 around Valentine's Day accompanied by rainfall around 2 inches. Then, it was back to the 30s for highs soon thereafter, but the cold weather again was short lived as temperatures rebounded quickly to the 50s. The up and down temperatures continued through late February.

Two charts appear below. The first summarizes observed climate data for this past November, December, and January. The second gives climatological normal values for March through June.

Location	*Month*	*Average Temp*	*Departure from Normal*	*Total Precipitation*	*Departure from Normal*	*Highest Temp (Date)*	*Lowest Temp (Date)*
Louisville	November	44.0	-3.1	3.24	-0.46	81 (2nd)	16 (22nd)
	December	25.1	-11.6	4.59	+0.95	57 (11th)	2 (23rd/25th)
	January	32.4	+0.7	1.51	-1.35	59 (29th)	5 (3rd)
Lexington	November	43.5	-2.5	2.00	-1.39	79 (2nd)	15 (22nd)
	December	25.1	-10.8	3.96	-0.02	55 (16th)	1 (22nd)
	January	31.1	+0.3	1.35	-1.51	58 (29th/30th)	5 (3rd/21st)
Bowling Green	November	45.4	-2.1	3.49	-0.94	83 (1st)	17 (22nd)
	December	27.5	-10.3	2.50	-1.90	58 (11th)	4 (22nd/23rd)
	January	32.0	0.0	1.78	-2.04	63 (29th)	3 (3rd)

	Normal High/Low Temperatures				*Normal Monthly Precipitation*			
Location	*March 1*	*April 1*	*May 1*	*June 1*	*March*	*April*	*May*	*June*
Louisville	50/31	62/41	72/50	80/59	4.66"	4.23"	4.62"	3.46"
Lexington	49/30	61/40	70/49	79/58	4.40"	3.88"	4.47"	3.66"
Bowling Green	52/32	64/41	73/50	82/59	5.10"	4.32"	4.94"	4.17"

Astronomical Calendar

Moon Phases

Month	New Moon	First Quarter	Full Moon	Last Quarter
March	March 25	March 3	March 9	March 16
April	April 23	April 1 and 30	April 8	April 15
May	May 23	May 29	May 7	May 15

Sunrise/Sunset

Louisville			Lexington			Bowling Green		
Date	***Sunrise***	***Sunset***	***Date***	***Sunrise***	***Sunset***	***Date***	***Sunrise***	***Sunset***
March 1	7:15 am est	6:37 pm est	March 1	7:10 am est	6:32 pm est	March 1	6:17 am cst	5:41 pm cst
April 1	7:28 am edt	8:07 pm edt	April 1	7:23 am edt	8:02 pm edt	April 1	6:32 am cdt	7:07 pm cdt
May 1	6:47 am edt	8:35 pm edt	May 1	6:42 am edt	8:30 pm edt	May 1	5:52 am cdt	7:35 pm cdt
June 1	6:22 am edt	9:01 pm edt	June 1	6:17 am edt	8:56 pm edt	June 1	5:28 am cdt	8:00 pm cdt

Note: Times are given in est (Eastern Standard Time), edt (Eastern Daylight Time), cst (Central Standard Time), and cdt (Central Daylight Time) as appropriate.

Spring Equinox (Start of Spring): **March 20 at 8:31 AM EST (7:31 AM CST)**
Start of Daylight Savings Time: **Sunday, April 1, 2001 at 2:00 am (turn clocks ahead one hour)**

NWS Mission: ***"The National Weather Service provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters, and ocean areas for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community."***