NATIONAL WEATHER SERVICE

2023 SHAREHOLDERS REPORT

Indianapolis, Indiana

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A VERY ACTIVE YEAR IN REVIEW

by Ted Funk, Meteorologist-in-Charge

WELCOME

Our fourth annual National Weather Service (NWS) Indianapolis (IND) Shareholders Report summarizes some of our significant 2023 activities, weather events, and other information. It was another extremely busy year for our staff, and here we showcase some of these efforts as we continually strive to provide accurate and timely weather, water, and climate services for the protection of life and property. This past year, we finalized our operations area (Fig. 1) to optimize service efficiency and modernized our staff training and partner engagement conference room (Fig. 2).

WEATHER EVENTS

2023 was an eventful severe weather year across central Indiana. The most noteworthy event occurred on March 31 as the IND staff issued many accurate warnings during a major tornado outbreak which produced three EF-3 rated tornadoes based on exhaustive damage surveys. More severe thunderstorms hit on June 25, including two EF-2 tornadoes. In addition, an intense line of storms produced widespread wind damage over west-central Indiana on June 29. Issuing timely warnings is our bread and butter to facilitate hazardous weather awareness and safety for the people of central Indiana.

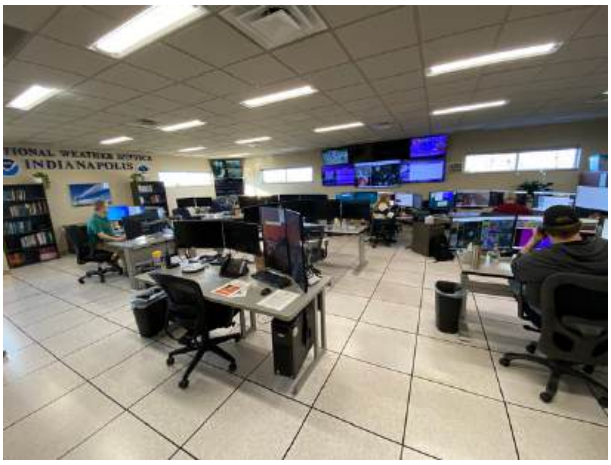


Fig. 1: NWS Indianapolis operations area

PARTNERSHIPS

Our staff worked diligently with our partners in Emergency Management, media, Indiana DHS, Indiana DOT, Indianapolis Motor Speedway (IMS), FEMA, and others. Some highlights comprised onsite weather support for several IMS events, including the Indy 500; virtual Fall and Spring Partner Workshops; participation in partner table top exercises; Pathfinders program interaction with INDOT; media scientific training workshops; requested weather and safety briefings for state and county fairs/festivals and sporting events; and training of around 1200 people via in-person and virtual spotter presentations.

INDIANA MESONET

Another significant endeavor was working with the State Climate Office, Indiana Geological and Water Survey, and other stakeholders to develop a vision and process to expand existing surface weather reporting stations into a spatially dense ("mesoscale") statewide network ("net") of weather observations, i.e., Indiana Mesonet. Such a network could enhance awareness, forecasts, warnings, and verification of many weather phenomena across the state. An initial informative meeting was held in July with heightened interest and a follow-up Board Meeting in November. This is an exciting project with much more work in 2024 and beyond.

Fig. 2: The NWS Indianapolis Training and Partner Engagement Conference Room

ACADEMIA

In late 2023, IND co-led a College

Road Show at four universities across Indiana to increase student awareness and job application skills in the meteorological field. We also hosted several college student volunteers at IND, conducted in-person map discussions at Purdue University (with expansion to Indiana University and Ball State in 2024), gave weather and safety talks at various K-12 schools, and participated in numerous school career fairs.

LOOKING AHEAD

In 2024, our extensive local "Roadmap" will continue to challenge ourselves and ensure another busy and productive year as we strive to continually provide indispensable weather information to our partners and public! As always, if you have questions or feedback, please contact us at nws.indianapolis@noaa.gov or call our office. Also, check our web and social media presence at weather.gov/ind, facebook.com/NWSIndianapolis, @NWSIndianapolis (#INWX), and youtube.com/NWSIndianapolis.

Please enjoy our 2023 Shareholders Report! Once again, I'm grateful to IND meteorologist Kacie Fuson who assembled another fantastic report!

Indianapolis Area 2023 Totals

	2023	Average
Total Precipitation	34.38"	43.63"
Highest Temperature	94° August 24	95°
Lowest Temperature	10° February 1	-5°

INTERNAL FUNCTIONAL EXERCISE FOR EARTHQUAKE RESPONSE

by Sam Lashley, Warning Coordination Meteorologist

On October 18, 2023, 15 NWS weather forecast offices (WFOs) across the Midwest (including WFO Indianapolis), the North Central River Forecast Center (NCRFC), and the NWS Central Region Operations Center (CR-ROC) participated in the first modern internal functional exercise for the NWS. The primary goal of this exercise was to test the ability of NWS offices to continue their mission of critical life saving services following a catastrophic 7.0 magnitude earthquake and aftershocks centered in the New Madrid Seismic Zone (NMSZ) and Wabash Valley Seismic Zone (WVSZ). This exercise was developed by a working group of operational field personnel to test local and regional response, backup capabilities, operational equipment and services, and mutual aid opportunities to meet the demand for NWS Impact-Based Decision Support Services (IDSS) during a regional disaster.

The NMSZ and WVSZ impacts eight states: Alabama, Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, and Tennessee. It has been well over 200 years since the last 7.5+

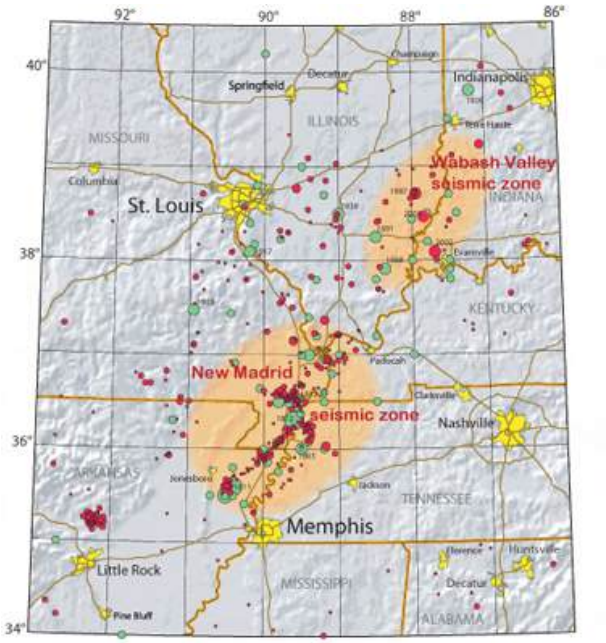


Fig. 3: This map shows earthquakes (circles) of the New Madrid and Wabash Valley seismic zones (orange patches). Red circles indicate earthquakes that occurred from 1974 to 2002 with magnitudes larger than 2.5 (University of Memphis). Green circles denote earthquakes that occurred prior to 1974 (USGS Professional Paper 1527). Larger earthquakes are represented by larger circles (USGS map).

earthquake. The USGS has projected that for an earthquake of magnitude 7.5 to 8.0, the probability of occurrence is approximately 7-10% over the next 50 years. For an earthquake of 6.0 to 7.0, the probability is 28-46% over the next 50 years. If a magnitude 7.7 occurred in the NMSZ, there could be $50-$80 billion dollars in direct losses alone, not including economic losses. A mass casualty event would also be likely as a result of this event with the potential for hundreds or thousands of injuries and many more left with uninhabitable homes. Indiana would likely experience widespread damage across the southwest third of the state with losses from an NMSZ event estimated to be around $1.5 billion.

The exercise was a success with over 500 injects for participants during a 4 hour exercise window. Numerous best practices and successes were identified, as were failures and areas for improvement. Ultimately, this functional exercise showed that the NWS could come together as an agency, utilizing unaffected offices and resources not within the NMSZ to support those offices with limited operating capacity due to communication outages, infrastructure problems, staffing shortages, and workload demand from core partners. The NWS will complete an After Action Review in the Spring of 2024 and will work toward improving any issues or limitations identified.

COOPERATIVE OBSERVER PROGRAM

by Earl Breon, Observations Program Leader & Alexander McGinnis, Meteorologist

Have you ever heard someone reference a weather-related normal or record for your area and wondered where that information comes from? Well, there are a few sources but one of the primary sources is the NWS Cooperative Observer (COOP) Program. But, what is that?

The COOP Program is a network of volunteer observers who take daily temperature, precipitation, and evaporation readings and relay that information to us. These observers are mostly citizen scientists who are farmers, gardeners, retirees, teachers, and other folks with a keen interest in weather. Some also work at city, county, and state institutions that have an aligned interest in public service and the role weather plays in it.

They take their readings daily during some of Indiana's biggest weather events and provide the historical record of their existence and impact on state and local communities. These data are then used by decision makers in the near term for disaster aid and recovery, energy management, construction project planning and more. In the long term, they are used to plan potential infrastructure needs, building codes, and seasonal needs planning by public works departments.

In Central Indiana we have approximately 55 stations throughout our area of responsibility that take these observations. Some highlights of their observations include temperature extremes ranging from 102°F at the Shoals 8S station on August 25 to 1°F at the Rockville station on February 1. Our Farmersburg TV-2 station reported 3.90 inches of rainfall on July 1 and our Young America Station recorded a 2-day snowfall total of 6.0 inches on January 25/26. Our greatest monthly precipitation total

recorded goes to our Vincennes 4E station which recorded 8.76 inches for the month of March. The NWS Cooperative Observer is a vital component of the Nation's weather safety and planning practices, and our Central Indiana Observers have a huge impact at the local level. So, join us in thanking them for all that they do to serve their fellow Hoosiers on a daily basis!

2023 saw many observers reach milestones, listed below:

40 Years
Shelley Edwards...Spencer

30 Years
Dan Reynolds...Farmersburg TV-2

25 Years
Gerald Lindsey...Franklin 1 W
Sally Brown...Franklin WWTP
Ken Blackwell...Carmel 3 E

15 Years
Alvin Hamilton...Young America
David Henderson...West Lafayette Sew Plant
Dennis Nowaskie...Vincennes 5 NE
J. William Porter...Elnora

SERVING THE LOCAL SPANISH SPEAKING COMMUNITY

by Cody Moore, Meteorologist

In 2023, IND worked to better serve those whose first language is Spanish. By developing relationships with local minority partners and adding new, innovative programs to our operations, we have made significant progress in breaking down barriers which had hindered many from accessing weather forecasts, warnings, and safety information.

The Spanish speaking community is Indiana's largest minority population with nearly 300,000 residents speaking the language. Our efforts to better serve this community began by posting graphics and convective warning information in Spanish on our social media pages. These initial steps were well received by the public, gaining the attention of the local Consulate of Mexico based here in Indianapolis. A relationship then quickly developed following a visit to the Consulate with Head Consul, Leticia Maki Teramoto Sakamoto, and Consul for Protection and Legal Affairs, Karla Munive Lima. We discussed various ways our agencies can partner together to spread weather forecasts and safety information in Spanish. This year, IND meteorologists Cody Moore and Greg Melo, in addition to Ball State University meteorology student Samantha Hernandez Lemus, created several recorded interviews in Spanish with the Consulate of Mexico, teaching the public about severe weather, extreme heat, and winter weather safety. Information was also provided on how to obtain NWS products and services in Spanish.

In addition to this partnership, IND greatly increased services in Spanish by working with surrounding WFOs and NWS Headquarters to create Spanish webpages and use innovative technology to translate products into other languages. NWS Indianapolis and NWS Louisville collaborated together to create a Spanish NWS webpage to

Fig. 4: Meteorologists at the Mexican Consulate

serve as a one stop shop for forecast, warning, and preparedness information in Spanish. While these new services greatly expanded the NWS's reach into other communities, the work didn't stop there. NWS Indianapolis meteorologist Cody Moore and NWS Louisville meteorologist Adrian Lopez joined the national NWS Automated Language Translation team led by Monica Bozeman at NWS Headquarters. This team has been working with a private AI company, Lilt, to use AI capabilities to help translate forecasts, watches, and warnings into other languages. Cody and Adrian are also bilingual members of this team who review the program's AI outputs, and fix any errors in order to teach the system the correct translations for all types of NWS products. NWS Indianapolis translated products can be found at the new NWS Translations webpage.

The NWS also strives to teach the public about weather safety and how anyone can help improve weather forecasts and warnings by submitting local storm reports. Meteorologist Cody Moore, Observation Program Leader Earl Breon, and summer intern Samantha Hernandez Lemus created an NWS Storm Spotter presentation with audio and slides completely in Spanish. This presentation provides an opportunity to thousands of individuals to learn about severe weather safety and observing in their first language. Reporting forms in Spanish for various types of inclement weather can be found on the NWS Indianapolis Spanish webpage under the "Reportes" tab.

As the NWS continues to strive to reach everybody, additional services in Spanish and other languages will become available in the future. In 2024, NWS Indianapolis hopes to increase partnerships with other local organizations and core partners to increase accessibility and awareness of NWS products in Spanish.

INTERACTING WITH LOCAL UNIVERSITIES

by Dave Beachler, Science Operations Officer

The weather enterprise spans several channels of employment opportunities from research to emergency management, media, and both state/federal government. One common thread is that the mission to ensure an accurate and efficient message is disseminated from the NWS to those partners and the public. In order to meet this benchmark, you have to build a partnership with not only those partners but also with prospective employees at local universities. The NWS in Indianapolis frequently engages with local students in nearby universities to pass on experiences and knowledge to the next generation of meteorologists.

Fig. 5: Students practice sending out warnings on the WES

A specific experience that NWS Indianapolis has been able to do is provide hands-on opportunities with our Weather Event Simulator (WES) that all forecasters utilize to remain proficient in issuing convective warnings. In April 2023, students within the Purdue University Meteorological Association (PUMA) spent the day at NWS Indianapolis learning about forecast operations and our warning decision making process. Each student was given an opportunity to sit with an experienced forecaster and understand the software and data we utilize to make warning decisions. Once an overview of the simulation and some basic training were provided to each student, they were given the opportunity to make warning decisions themselves on the simulator to

experience the many layers that exist to issue a convective warning.

Giving students this type of hands-on operational experience is priceless and helps to encourage our next generation of forecasters to consider employment within the National Weather Service or perhaps become developers that could enhance this warning process to become even more precise and valuable to the weather enterprise.

Fig. 6: Students practice sending out warnings on the WES

Indianapolis Records

Date	Record Type	New	Old	Year
March	Monthly Surface Pressure	28.91"	28.97"	1952
Mar. 3	Daily Precipitation	2.24"	2.01"	1953
2023	# of Days with Max Temp 32	7	10	1990
2020-2023	Min 4-Year Snowfall Total	51.1"	51.3"	1930-1933

ACTIVE SEVERE WEATHER SEASON FOR 2023

by Sam Lashley, Warning Coordination Meteorologist

After several years of below normal severe weather events, 2023 produced one of the more active and intense severe weather seasons since 2011 and 2012 across central Indiana. The IND County Warning Area (CWA) shown in Fig. 7 covers 39 counties for which IND is responsible for issuing forecasts, watches, warnings, and advisories. Severe weather statistics in this article have been computed for the IND CWA and include tornado, severe thunderstorm, and flash flood warnings.

Arguably the most memorable and intense severe weather event in 2023 was the March 31st tornadoes and severe thunderstorms. This storm system was responsible for 10 tornadoes in the IND CWA and a total of 23 tornadoes across the entire state. This ranked as the fifth largest tornado outbreak in Indiana history since official records began in 1950. Unfortunately this was also the first tornado with fatalities in Indiana in over 10 years, going back to the March 2, 2012 tornadoes that impacted southern Indiana, including the town of Henryville. There were three fatalities recorded in Sullivan, Indiana on March 31st due to a strong EF-3 rated tornado, and 2 other fatalities of campers at McCormick Creek State Park from another EF-3 tornado.

Fig. 7: NWS Indianapolis County Warning Area across central Indiana

NWS meteorologists recognized early in the day on March 31st that there was the potential for high end severe

weather, including large, long-lived tornadoes. For this reason, once reports of strong tornadoes were received from eastern Illinois, IND forecasters took a few unconventional steps for advanced notification to Sullivan County, which is on the western edge of the CWA along the Wabash River. While a tornado watch was already in effect and a tornado warning was issued 13 minutes before the first occurrence, meteorologists

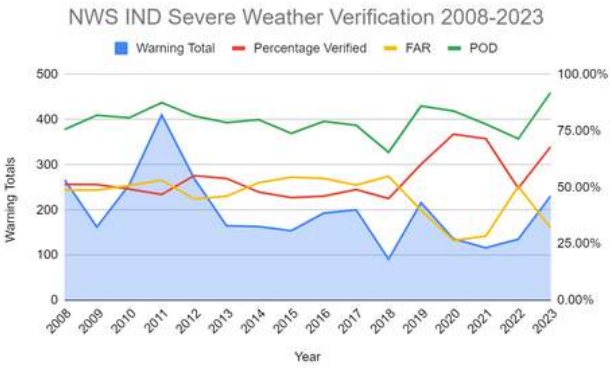


Fig. 8: Severe Weather Verification & skill score for NWS IND from 2008 to 2023

issued a Special Weather Statement (SPS) prior to the tornado warning to alert residents and safety officials that severe thunderstorms were occurring in Illinois and may impact Sullivan during the evening hours. A phone call was also made to the Sullivan County Emergency Manager to alert him as to what was occurring in Illinois and could potentially move into west central Indiana. NWS chat communication software was used to provide updates on storm evolution and movement to EMA, media, and amateur radio operators to assist in getting people to shelter. Shortly after the first tornado warning was issued at 10:08 pm, it was upgraded to a "considerable" tornado warning to provide heightened awareness with a confirmed tornado report included. While there unfortunately were 5 total fatalities with this tornado event, feedback from officials and citizens of Sullivan indicated that the advanced notification and actions of safety officials and local media were instrumental in getting many people to take safety actions which ultimately saved many lives.

Two other memorable severe weather events occurred at the end of June. Numerous severe thunderstorms developed across the western part of Indiana during the afternoon of June 25 and raced southeast. These storms produced several tornadoes, damaging winds, and very large hail up to 4 inches in diameter. One person was killed and one injured by an EF-2 rated tornado in Martin County. On June 29th, a Derecho (pronounced similar to "deh-REY-cho", a widespread, long-lived wind storm associated with bands of rapidly moving thunderstorms producing several gusts of 75 mph or

greater) rapidly moved east across central Illinois and Indiana. Widespread wind damage and power outages occurred with wind speeds between 70 and 80 mph recorded in many areas. There were no tornadoes with this event but extensive power outages did occur with power remaining out for days.

The entire state of Indiana experienced 54 tornadoes in 2023. This was the second most number of annual tornadoes since 1950, exceeded only by 72 which occurred in 2011. Indiana typically sees about 25 tornadoes on average each year.

For the year across central Indiana, an all inclusive total of 258 severe weather events (severe, tornado, flash flood combined) were recorded by NWS Indianapolis with 237 events either fully or partially warned and just 21 events having no warning. A total of 231 warnings were issued during the year. This resulted in a Probability of Detection (POD) equal to 92 percent, a False Alarm Ratio (FAR) of 32 percent, and a Critical Success Index (CSI) score of 0.64. Since 2010, NWS IND has averaged an annual POD of 80 percent, a FAR of 46 percent, and a CSI of 0.46 with about 195 warnings issued annually.

When we break the 2023 numbers down further and look just at tornado events, we find that NWS IND issued 34 tornado warnings, which is about 2 more than average. The POD this year was outstanding at 0.91. The FAR was 0.62 yielding a CSI of 0.37. These numbers are a significant improvement over the average POD of 0.54, FAR of 0.80 and CSI of 0.17.

It was an unusually dry year with a lack of flash flood events. Only 4 flash flood warnings were issued, well below the average of 29 warnings. This was justified with only 2 flash flood events recorded in central Indiana. This was well below the average of about 16 events each year. The POD was 1, FAR 0.50, and CSI was 0.50.

COMING THIS SPRING TO A WEB BROWSER NEAR YOU

THE NATIONAL WATER PREDICTION SERVICE

by Crystal Pettet, Hydrologist

The new National Water Prediction Service (NWPS) will replace the legacy Advanced Hydrologic Prediction Service (AHPS) in Spring 2024. When launched, NWPS will be the one-stop shop for critical NWS water resources information including river observations, forecasts, site data, and data services. A preview of this new web dissemination platform can be found at preview.water.noaa.gov, or preview.water.noaa.gov/wfo/IND for the local forecast office view for central Indiana. The NWPS has GIS layers that can be turned on or off as the user desires, making the display configurable for the end user, and is designed to be mobile friendly.

LOCAL MAP

The local map (Fig. 9) defaults to displaying river observation and forecast locations that are color-coded according to the flood status of their most recent stage or flow observation (inner circle), and/or according to the maximum stage or flow forecast through the entire forecast period (outer square). A big improvement from AHPS is that both the observation and the forecast can be displayed on the same map simultaneously.

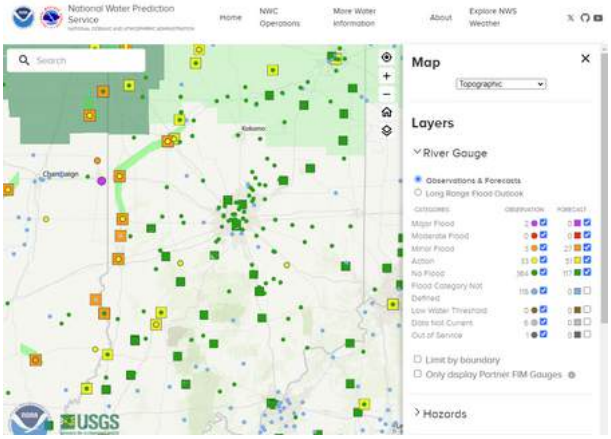


Fig. 9: Default home page for IND forecast area on NWPS

ACCUMULATED PRECIPITATION MAPS

Users may access accumulated

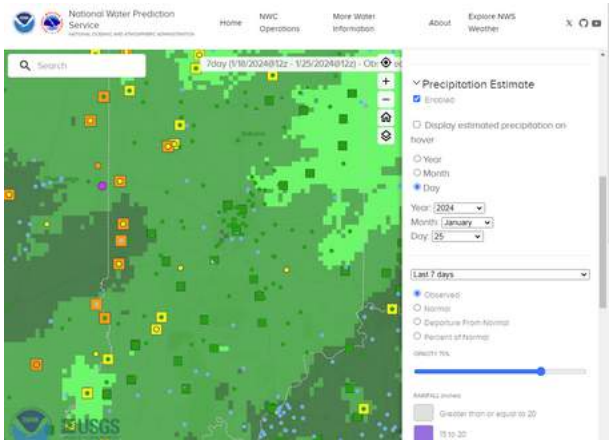


Fig. 10: Accumulated precipitation map on NWPS

Fig. 11: Hydrograph with past observations and official NWS forecast

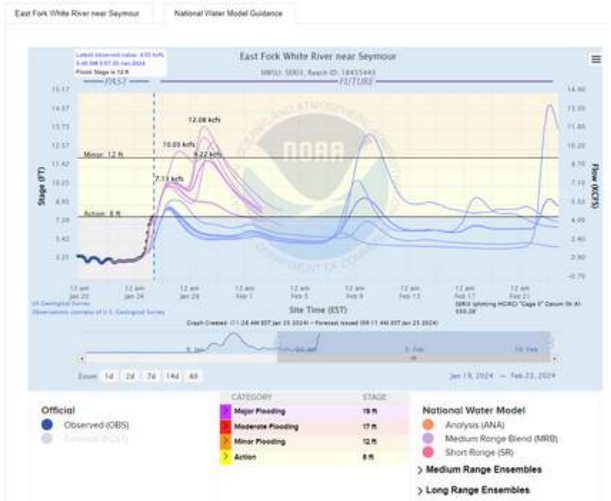


Fig. 12: Hydrograph with National Water Model Guidance

precipitation estimates (Fig. 10) over selectable periods of time from as little as one hour to as much as 365 days, as well as comparisons to normal for that timeframe. This will be available for not only central Indiana, but across the conterminous United States, Puerto Rico, and Alaska.

DYNAMIC HYDROGRAPHS

Dynamic hydrographs on NWPS depict the most recent river stage and/or flow observations. For many locations across the U.S., it shows a display of the official NWS forecast for the next several days along with complementary National Water Model guidance.

Hydrograph with the Official NWS Forecast: The hydrograph page with the official NWS forecast (Fig. 11) may include flood impact information, gauge information and photos, recent crests, probability information, a list of collaborative agencies, and other resources. While this content is very similar to that provided in AHPS, the hydrograph is more configurable with the ability to choose the timeframe as well as to scale to flood categories.

Hydrograph with National Water Model Guidance: Users may choose to toggle on and off the National Water

Model (NWM) streamflow guidance (Fig. 12) including the latest Analysis and Short-Range forecast, and Medium -Range and Long-Range ensemble forecasts. NWM guidance is available across 3.4 million river miles of the United States, which includes river and stream reaches without river gauges.

PROBABILISTIC FORECASTS

Weekly Chance of Exceeding Levels: This graphical product (Fig. 13) shows the probability of the maximum stage, flow, or volume exceeding a threshold value for 7-day increments over a 90-day period.

Chance of Exceeding Levels during Entire Period: This graphical product (Fig. 14) shows the probability of the river stage, flow, or volume going above threshold levels during the forecast period labeled above the graph (usually 30 or 90 days). It also includes the historical probability of exceeding these levels to reference how the current forecast probabilities compare to climatology.

Short-term Probabilistic Guidance: This graphical product (Fig. 15) depicts short-range river forecast uncertainty and conveys the range of possible river stages and flows at each forecast time-step. These forecast scenarios are shaded using different categories of forecast probability, ranging from most likely to least likely, and are derived from ensemble river forecasts produced by NWS River Forecast Centers (RFCs).

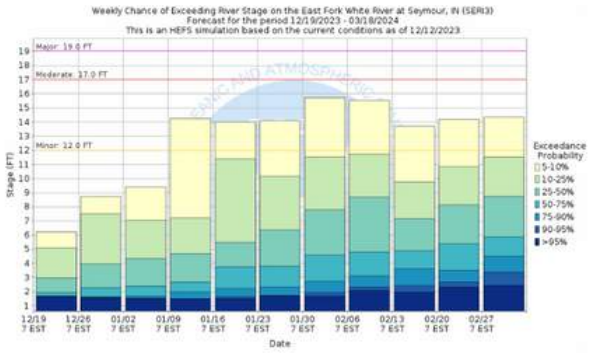


Fig. 13: Weekly chance of exceeding levels/stages

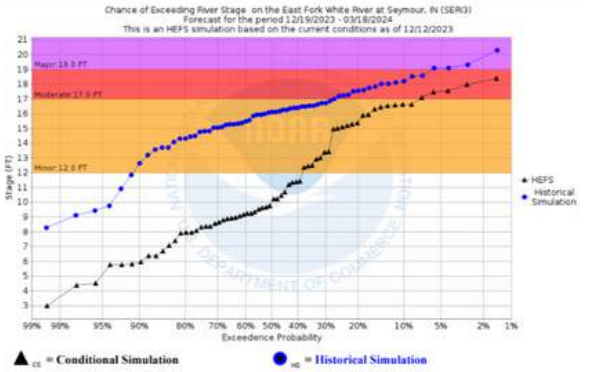


Fig. 14: Chance of exceeding levels during the entire period

FLOOD INUNDATION MAPS

Detailed flood inundation maps of extent and depth of water are available on gauge pages for select NWS forecast points where static flood inundation map libraries have been developed through partnerships. In central

Indiana, this includes the White River at 82nd Street near Nora (NORI3) and the Driftwood River at Hendricks Ford Bridge near Edinburgh (DREI3).

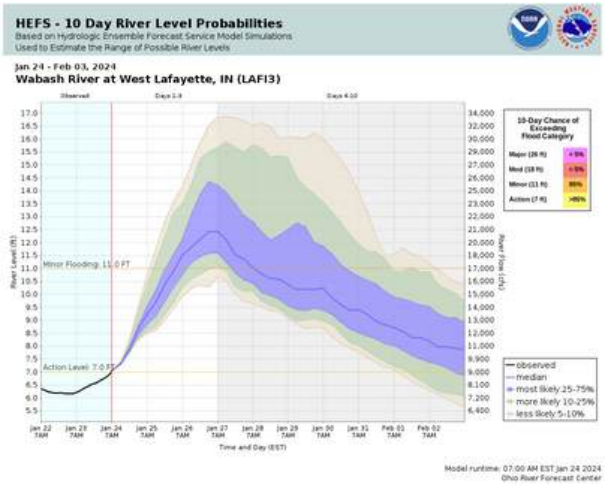


Fig. 15: Hydrologic Ensemble Forecast System (HEFS) 10 day probabilistic guidance

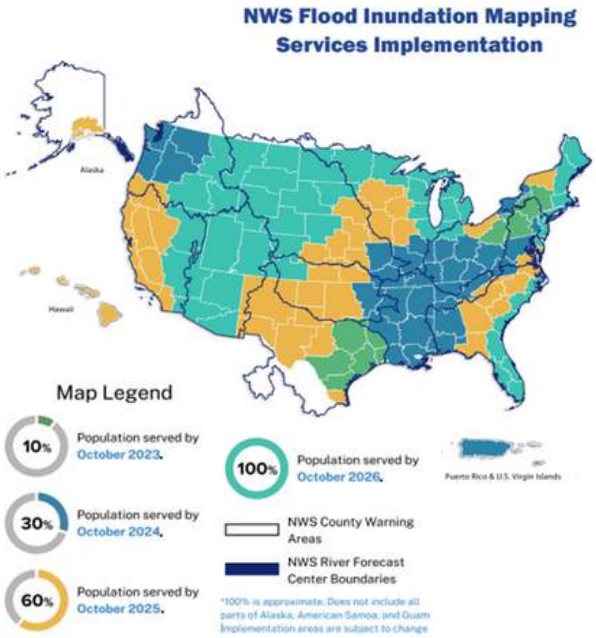


Fig. 16: Hydrologic Ensemble Forecast System (HEFS) 10 day probabilistic guidance

Within an area that encapsulates 10% of the United States population (Fig. 16), experimental forecast flood inundation extent maps are available downstream of RFC flood forecast locations and where NWM forecast guidance depicts anomalous high flow. An example for the West Fork San Jacinto River near Conroe, Texas can be seen in Figure 17. Visit www.weather.gov/owp/operations for more information on these NWS experimental flood inundation map services. This area will be expanded to include over 30% of the U.S. population this fall (also depicted in Fig. 16), and this expansion will include central Indiana. These experimental NWM Flood Inundation extent maps will be available on the NWPS. Look for more information on this from our office in Fall 2024 as these new experimental services become available in our area.

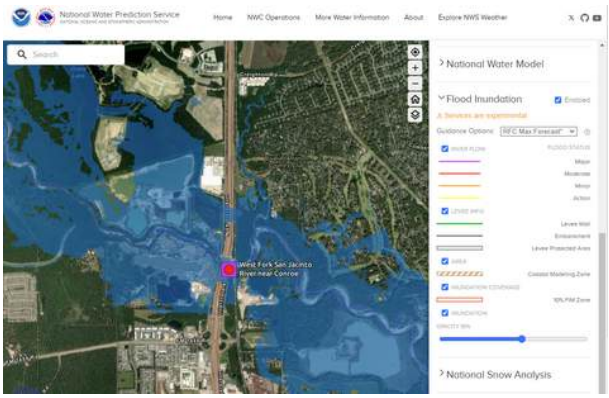


Fig. 17: RFC 5 day max forecast FIM for the West Fork San Jacinto River near Conroe, TX

FIRE WEATHER FORECASTING

By Michael Koch, Lead Meteorologist

Fire weather is one of the elements that NWS offices focus on. During 2023, IND sent out a total of 32 spot forecasts for prescribed burns, 2 for wildfires, and 2 for special events. The majority of the requests were received in March with 34. Through coordination with state fire weather officials, 1 Red Flag Warning was issued in April as well as severe fire weather related Special Weather Statements. The fall saw long lasting dry conditions that led to numerous days of elevated fire weather statements sent out along with many county burn bans across central Indiana. There were even large fires, one that covered 100 acres and another that covered 30 acres.

In addition to providing fire weather forecasts, IND provided information to local entities for bigger fire events such as creating HYSPLIT runs (projections of the direction and extent smoke would travel) for the Richmond Factory Fire in the middle of April. With this event there was an incoming weather front and wind shift ahead of it which led to a concern that smoke and particles from the fire could drift into the IND CWA.

The Fuel Specialist from Hoosier National Forest, Jeremy Kolaks, visited our office in July to learn about the fire forecast process and how IND disseminates the National Fire Danger Rating System forecast. From this meeting, a new forecast point was added for Sullivan, IN as well as additional instability indices which are helpful for fire planners working on prescribed burns.

INDIANA CLIMATE SERVICES

by Mike Ryan, Lead Meteorologist

NWS Indianapolis continues to be a leader for climate services within the NWS, guiding one of the few statewide teams dedicated to climate services in the country. The climate team was started in 2012 as a collaboration from all areas of the weather enterprise that serves the Hoosier state with climate needs. The team consists of over 30 members from the 6 NWS offices that cover Indiana, the Midwest Regional Climate Center and the state climatologist located at Purdue University, and other state and regional officials such as the Indiana Department of Homeland Security, the Indiana Department of Natural Resources, and Agricultural Extension Offices.

The Indiana Climate Services team maintained quarterly conference calls in 2023. Members of our team participated in a conference focusing on observation networks across the central U.S. during the late winter. In February, we participated in an NWS National Climate Services Workshop, including sharing presentations on the efforts of our state climate services team and ongoing climate services decision support to local partners over seasonal and sub-seasonal time periods. Throughout 2023, efforts were made to greatly increase our graphical climate products available via our website, including detailed daily, monthly, seasonal, and holiday records and data. In August, we assisted the State Climate Office in hosting a Climate Summit at the state fairgrounds during the 2023 Indiana State Fair. In addition to meeting in person with our core climate partners that cover the state, information booths were set up for fairgoers to visit.

The Drought Mitigation team, another statewide team, continued to interact regularly throughout 2023 with drier

than normal conditions impacting much of the state during the second half of the year. Calls are led by the Indiana State Climatologist Office and conducted monthly, and at times weekly when needed, to assess the evolution of drought conditions and their potential impacts across the state, and to develop specific guidance to share with the National Drought Mitigation Center. NWS Indianapolis is an important part of this team as well, with our Service Hydrologist and Climate Services team members providing specific information on precipitation trends and forecasts that are incorporated into the drought guidance developed each week. In an effort to improve drought services to partners, the National Weather Service introduced a more dynamic Drought Information Statement product that is issued when severe drought or worse conditions exist in our area.

Additional activities for 2024 include continued work on development of a statewide Severe Weather Climatology and studying extreme precipitation trends across the state. Our office will also assist the Midwest Regional Climate Center in planning for a state climate summit that will bring many of our climate service partners from around Indiana together this summer in Indianapolis.

DEVELOPING A HIGH RESOLUTION WEATHER DATA NETWORK

by Sam Lashley, Warning Coordination Meteorologist

High-impact weather events are on the increase across the United States, and Indiana has seen its share of tornadoes, derechos, flash flooding, extreme heat, and extreme cold events over the last 20 years. An increasing number of states are developing partnerships and investing money in high-resolution weather observation platforms, called mesonets, to help monitor and archive local weather conditions. A dense network of these instruments provide meteorologists with near-real time weather data that helps improve the accuracy and timeliness of forecasts, watches, and warnings. The data also aids local farmers and others in the agricultural industry with high-quality soil moisture, temperature, inversion, humidity, and wind data. Private businesses, public organizations, and the general public also have access to this high-quality weather information to be used as needed. The Oklahoma and Kentucky Mesonets are arguably the most well-known networks, but states such as Illinois, Ohio, Michigan, Maryland, New York, and now Indiana are working to expand and improve these networks for the benefit of their residents.

A mesonet is a dense network of automated weather and environmental instruments that record numerous atmospheric and ground variables such as temperature, moisture, winds, precipitation, solar radiation, inversions, and even ground water among many others. Indiana currently has two very small networks spread out across the state. Purdue has a mesonet (Fig. 18) focused on meteorological data and agricultural impacts, while Indiana University (Fig. 19) has a network focused on the hydrologic cycle, groundwater resources, and environmental impacts. While both networks currently are separate, there are many similarities between the two and there is an effort underway to possibly combine and expand them into one network dedicated to

Fig. 18: Information sheet on the Purdue University Mesonet

improved weather monitoring, forecasts, and cost savings to residents, agriculture, and other businesses across Indiana.

On November 28, 2023, the first meeting of the Indiana Mesonet Advisory Board (IMAB) took place at the MADE facility in Plainfield, IN. Attendees included representatives from the agricultural industry, state and federal government agencies, and university representatives. This kickoff meeting introduced everyone to the current networks covering Indiana and explored ways to move forward with expanding and improving Indiana's network for the benefit of residents and commerce. There was excitement and engagement from all of those in attendance and numerous ideas were exchanged. The biggest hurdles and issues to overcome that were identified initially included questions of funding, locations for new stations, how to tie both networks together, and what to call the new network to aid in advertising and gaining support for the benefits a mesonet would bring to the state.

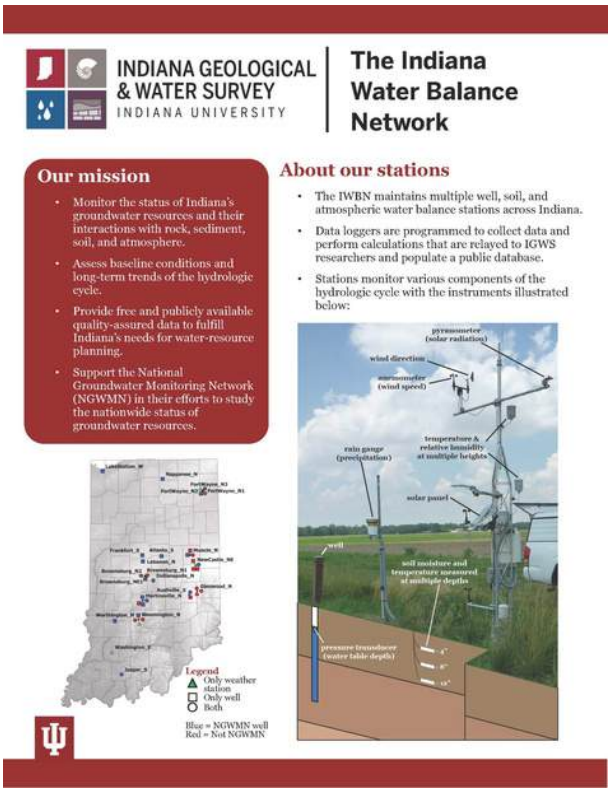
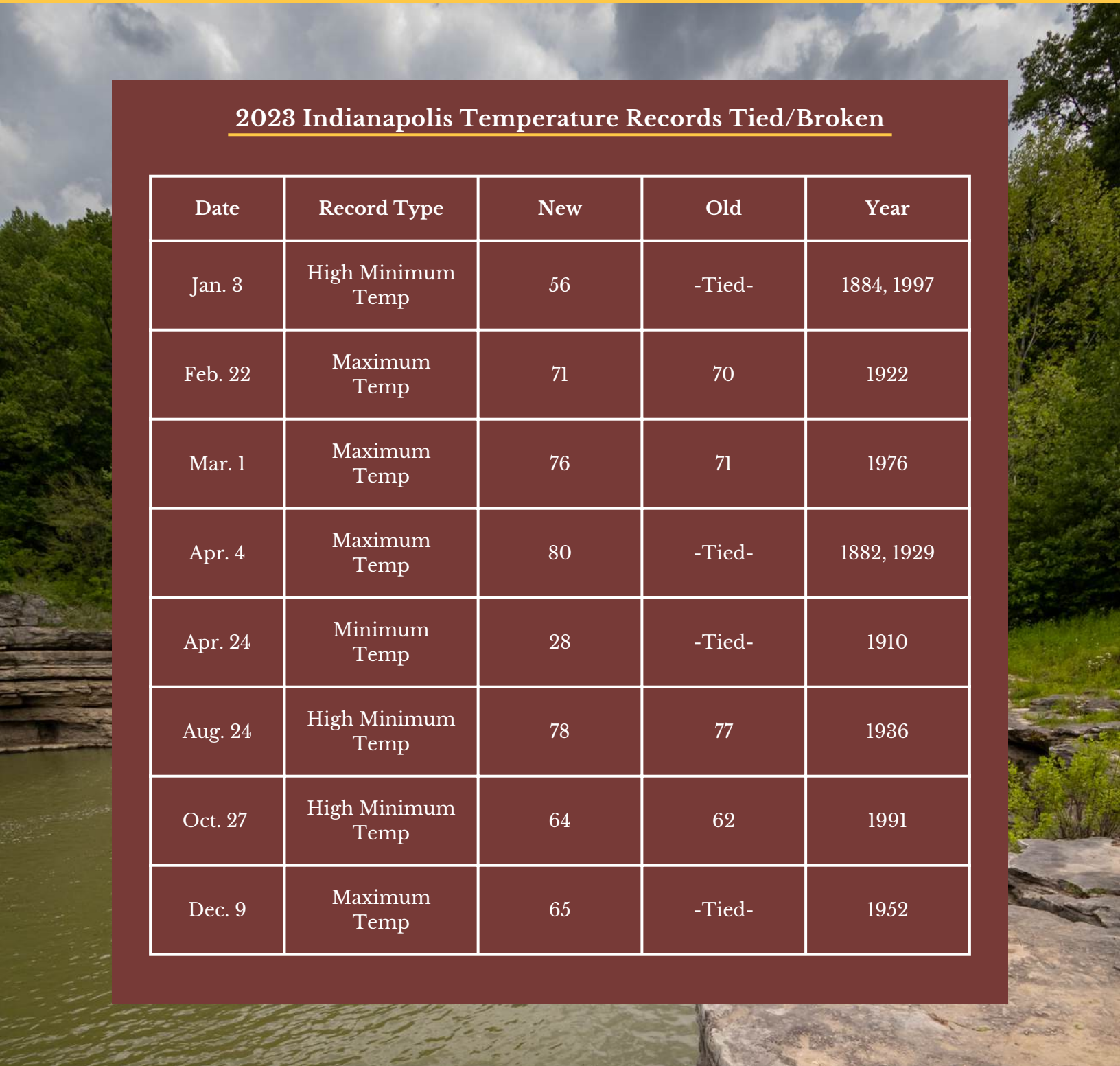


Fig. 19: Information sheet on the Indiana University Network

Future meetings of the IMAB are being planned and funding sources along with volunteers are being sought by this independent board. Anyone interested in helping can contact Dr. Beth Hall, Indiana State Climatologist (in-sco@purdue.edu) or Ginger Davis (gindavis@iu.edu) with the Indiana Water Balance Network.



2023 Indianapolis Temperature Records Tied/Broken

Date	Record Type	New	Old	Year
Jan. 3	High Minimum Temp	56	-Tied-	1884, 1997
Feb. 22	Maximum Temp	71	70	1922
Mar. 1	Maximum Temp	76	71	1976
Apr. 4	Maximum Temp	80	-Tied-	1882, 1929
Apr. 24	Minimum Temp	28	-Tied-	1910
Aug. 24	High Minimum Temp	78	77	1936
Oct. 27	High Minimum Temp	64	62	1991
Dec. 9	Maximum Temp	65	-Tied-	1952

INDIANA COLLEGE ROAD SHOW

by Ted Funk, Meteorologist-in-Charge

Today's meteorology students are tomorrow's future in the National Weather Service. In an effort to nurture their development, the Meteorologists-In-Charge (MICs) at IND and our neighboring offices participated in the College Road Show (CRS) of 2023 this past fall at 4 universities in Indiana that offer meteorology and atmospheric science programs. From November 13-15, the MICs visited Valparaiso, Purdue, and Ball State on consecutive days, and then Indiana University on December 5. There was excellent turnout as about 40 students attended at Valparaiso, 25 at Purdue, 16 at Ball State, and 14 at IU.

Fig. 20: Presentation given by NWS employees at Ball State University

Prior to the meetings, we met with faculty at each university to discuss meteorological, curriculum, and hiring topics of interest. During the sessions, students received one-on-one time with the MICs to review their resumes and offer comments. Students and faculty also listened to interactive presentations on developing effective resumes, the NWS interview process, ways to set yourself apart in the competitive job market, and

familiarization with NWS services (Fig. 20 and 21). Moreover, students who volunteered at an NWS office and are current or past students from the universities shared their NWS experiences with their peers. The CRS allowed us to provide students with valuable information on the NWS hiring process, their leadership development, and the importance of high character and interpersonal skills as they complete their academic careers and seek future employment.

Fig. 21: Presentation given by NWS employees at Valparaiso University

NWS STORMREADY PROGRAM

by Mike Ryan, Lead Meteorologist

The StormReady program is an important way to prepare for your community's increasing vulnerability to extreme weather and water events as a part of a Weather Ready Nation. Some 98 percent of all Presidentially declared disasters are weather related, leading to around 500 deaths per year and nearly $15 billion in damage. The StormReady program helps arm America's communities with the communication and safety skills needed to save lives and property-before, during, and after the event, and helps community leaders and emergency managers strengthen local safety programs through advanced planning, education, and awareness. No community is storm proof, but StormReady can help communities save lives.

StormReady uses a grassroots approach to help communities develop plans to handle all types of extreme weather, from tornadoes to winter storms. The program encourages communities to take a new, proactive approach to improving local hazardous weather operations by providing emergency managers with clear-cut guidelines on how to improve their hazardous weather operations. Applying is easy. To be officially StormReady, a community must:

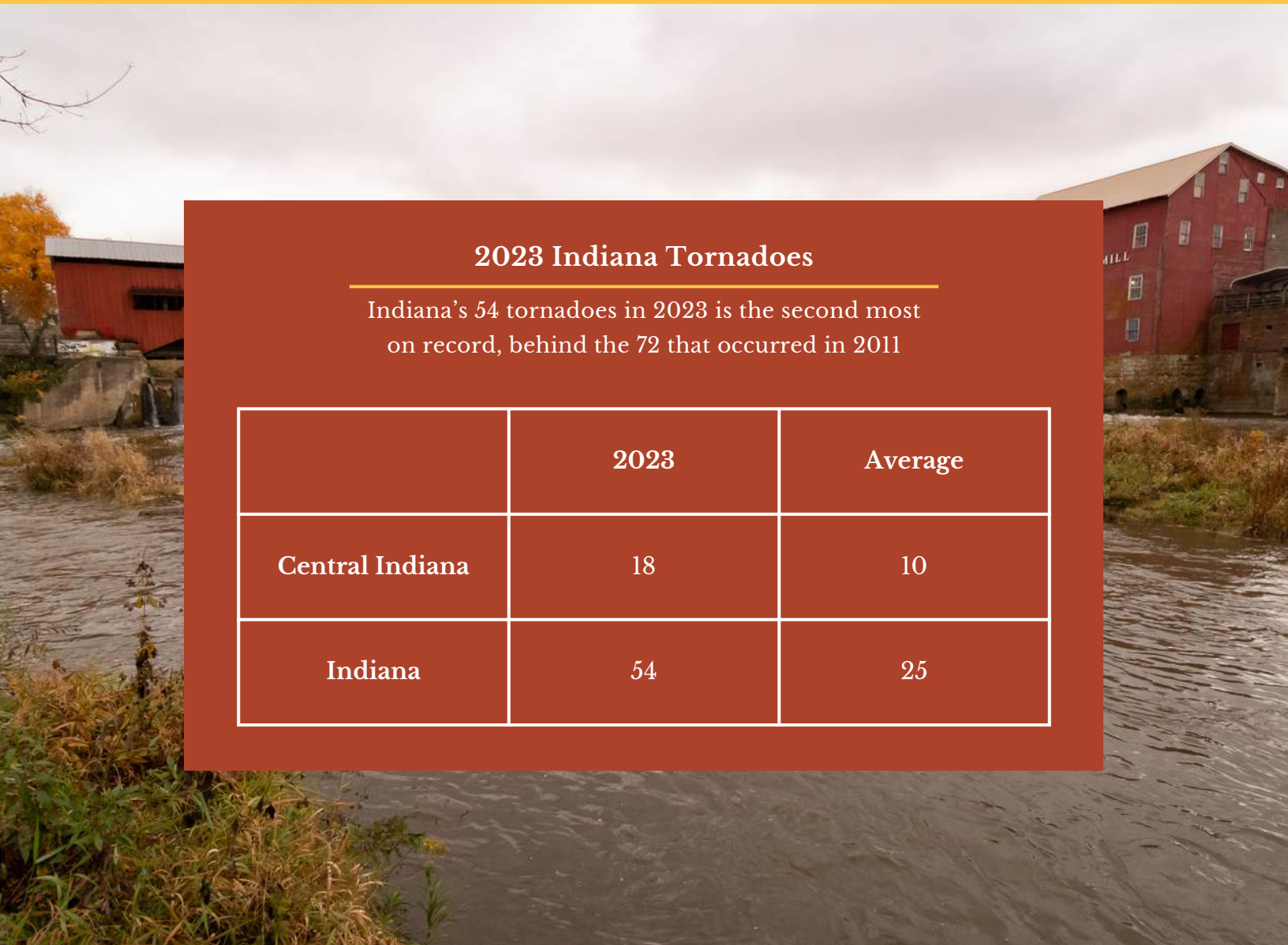
- Establish a 24-hour warning point and emergency operations center
- Have more than one way to receive severe weather warnings and forecasts and to alert the public
- Create a system that monitors weather conditions locally
- Promote the importance of public readiness through community seminars
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises

We have a robust StormReady network across central Indiana including:

- 20 of our 39 counties
- Major universities including Ball State, Indiana, and Purdue
- All of the Simon Malls

- Multiple major venues including the Indianapolis Motor Speedway, Indiana State Fair, Grand Park Sports Complex, and Gainbridge Fieldhouse
- Commercial partners including the Indianapolis International Airport and Eli Lilly and Company
- St. Vincent Hospitals Network

We are looking forward to further expansion of our local StormReady program in 2024 and will be adding new partners. For more information, please visit the NWS StormReady page. Contact Warning Coordination Meteorologist Sam Lashley or StormReady Program Leader Mike Ryan if you have additional questions or are interested in applying. Sites that can't meet the full StormReady criteria can show their support for weather safety by joining the StormReady Supporter program.



2023 Indiana Tornadoes

Indiana's 54 tornadoes in 2023 is the second most on record, behind the 72 that occurred in 2011

	2023	Average
Central Indiana	18	10
Indiana	54	25

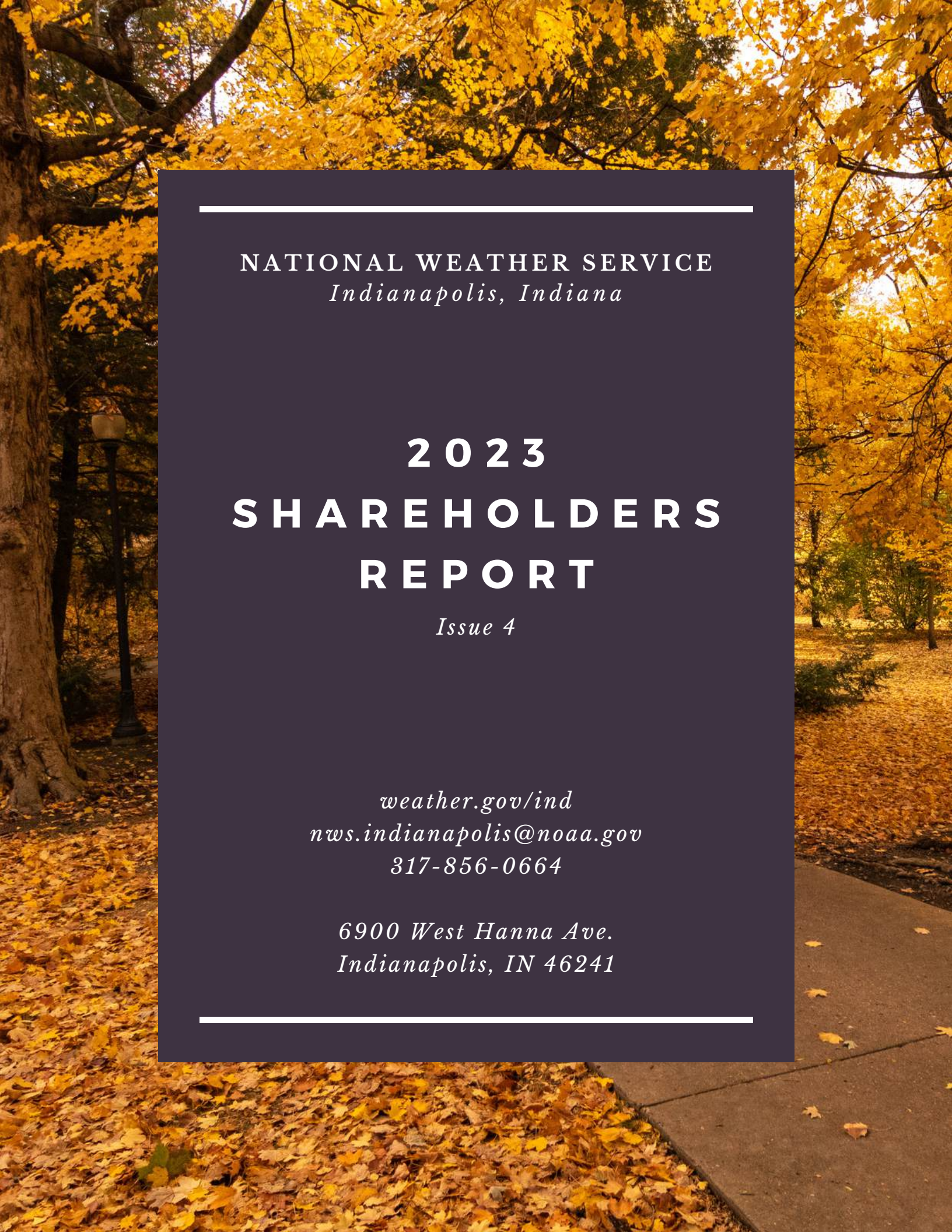
NEW 'ABOUT THE OFFICE' STORY MAP

by Aaron Updike, Meteorologist

Enhancing National Weather Service transparency is crucial for fostering public trust and providing valuable information. With this in mind, a few IND staff members created an ArcGIS Online StoryMap to provide a one-stop-shop for anyone looking to get to know more about our office and the services we provide. Stepping through this new webpage, you will see 5 different sections: Our Team, Our History, Our Operations, Our Technology, and Our Outreach.

Through the "Our Team" page, you can learn more about the levels of government that support the National Weather Service, while also gaining an understanding of our staff and structure locally at IND. Next, in "Our History", there is a timeline of important WFO Indianapolis events dating all the way back to 1870! "Our Operations" will be your go-to section for all of the various products and services we provide including Forecast Discussions, Event Summaries, and Hourly Forecasts. Looking to know more about our latest technology? Look through the "Our Equipment" page. Lastly, but most importantly, the "Our Outreach" page showcases our commitment to serving the public and provides direct access to businesses, schools, and communities who are looking for weather decision support and educational opportunities.

If this sounds of interest to you, check out our page at: storymaps.arcgis.com/collections/569094bec2a94f9386f1cfa9826da27c



NATIONAL WEATHER SERVICE

Indianapolis, Indiana

2023 SHAREHOLDERS REPORT

Issue 4

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