Science AMA Series : Hi Reddit, we're Harold Brooks, Adam Clark, Kim Klockow and Patrick Marsh, NOAA scientists in Norman, Oklahoma. We're here to answer your questions on severe weather research and forecasting. Ask us anything!

NOAAgov [1] and r/Science AMAs[1]

[1]Affiliation not available

April 17, 2023

Abstract

Severe weather touches every state in the U.S. Tornadoes, severe thunderstorms, hail, strong winds and floods are real threats to our property and our lives. NOAA Hazardous Weather Testbed works to understand and predict severe weather to help everyone be prepared. We work in the National Weather Center in Norman, Oklahoma, which houses scientists from a variety of organizations, including NOAA's National Severe Storm Laboratory (NSSL) and Storm Prediction Center, as well as the University of Oklahoma Cooperative Institute for Mesoscale Meteorological Studies. Spring has arrived and with it come efforts to study and learn to better predict severe weather like tornadoes. Hazardous Weather Testbed and VORTEX-SE (Verification of the Origins of Rotation in Tornadoes EXperiment-Southeast), which are designed to learn more about storms, help improve our abilities and bring you better forecasts. We are ready to answer your questions today from 10 a.m. to 12 p.m. about all of it, so ask us anything!

the WINNOWER

REDDIT

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NOAAGOV R/SCIENCE

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Why does there seem to be a massive shift in Tornado Alley lately? Big hotbeds for tornadic activity seems to have moved from Texas and Oklahoma to the north and east. What has caused this, and are the big outbreaks cyclical?

Razzlefrazzy

Tornado Alley is an ambiguous concept that different people describe differently. If we look at long records back to the early-1920s, the region between the Rockies and the Appalachians is where most of the tornadoes in the US occur. Depending on what short period of time we look at during that long record, the absolute maximum moves around inside, typically between the Plains and the southeast. It's hard to identify any consistent trends. -Harold

Hi! I'm a weather enthusiast and current meteorology student. Thanks for doing this AMA!

1) I understand the current job market is highly competitive because new technologies are making human forecasting obsolete. In your experience, is this the case? If it is, what kind of weather forecasting/research related jobs will still be necessary in the near future?

2) Since I was a little girl, It's been my dream to work for NOAA, researching and forecasting severe weather in the US. I'd love to hear more about your average day. What's exciting? What sucks? What do you love most?

Thanks again for doing this AMA!

That_Cupcake

1) Since the 1970s, many of us at the Storm Prediction Center have heard the argument that humans will not be needed in the forecast process and yet we're still here! However, this does not mean our roles have not changed over the years as numerical weather guidance becomes more skillful at forecasting basic weather elements. Humans still play a vital role in forecasting and communicating high-impact weather events and will continue to do so for some time to come. I would encourage all aspiring meteorologists to spend time developing their communication skills as this will likely be a major component of meteorologists' responsibilities in the future.

2) At the Storm Prediction Center there is no such thing as an average day! We forecast thunderstorms somewhere in the contiguous United States more than 300 days per year on average and we spend most of the day focused on forecasting these thunderstorms and assessing their severe potential. Other days we spend a lot of time answering questions from media and private meteorologists about forecasts and past events, conducting research on severe storms, sharing our research with the larger weather community, and developing tools to help us with our predictions. Many days we do all of this! - Patrick

What does it take to tornado-proof a house?

sammyo

Simple answer: Money.

Slightly longer answer: Move to northern Alaska.

Serious answer: You can't make a house completely tornado proof from all tornadoes. However there are many things you can do to ensure your survivability from a tornado. Things such as ensuring that the walls of a house are bolted to the foundation and adding hurricane clips to secure the roof to the walls. However, a lot of these are things that have to be done during the construction of the house.

Regardless, the safest place to be in a tornado is in a reinforced shelter, especially one that has been rated as a shelter by Federal Emergency Management Agency (FEMA). -Patrick

Hey guys! OKC resident and OU grad here.

I've noticed that we've been pretty light on tornadoes and severe weather in general in OK for it being late April, but there seems to be a lot going on in more Eastern states. Are we in for an atypical storm system this year? As the climate warms, are we seeing Tornado Alley shift?

RuthlessNate56

In Oklahoma, peak tornado season is about mid-May. So, with it being late April we are still at the beginning of tornado season and it is difficult to predict how active it will be when all is said and done. Right now, we really can't say reliably whether it will be an atypical year for storms. Nationwide, there is little correlation between how active the beginning of the storm season is with how active the rest of the season ends up being. During the last few decades there have been some changes in tornadoes - namely, the beginning of the season in tornado alley is shifting a little bit earlier, but the location of tornado alley has not changed. - Adam

Hello! What developments do you forsee in the near future that will dramaticly change forcasting? Also have you ever had a close call with extreme weather? Thanks!

NomadicPot

An emerging area of research that could fundamentally change weather forecasting lies at the intersection of the physical and social sciences, an exciting new area for the field of meteorology as a whole. Cutting-edge ensemble weather prediction systems are currently under development that will help forecasters understand, especially in the timescale of the next few minutes to the next few hours, all the ways severe weather could potentially develop. These models will help forecasters move from a focus on providing deterministic information --- or yes/no forecasts --- to probabilistic information. Think about the watches and warnings you receive today from the National Weather Service: they're essentially yes/no forecasts, meant to convey "there is a threat of a tornado," with little description of exactly how likely that is. They force forecasters into one of two kinds of bins: they can talk about the broad environments that could produce a hazard (this is when they issue long-range outlooks and watches) or give warnings when hazards are imminent or ongoing. There's no room for shades of gray, or information between these time scales. From a communication perspective, new technologies could help us to tell a much richer story.

The new ensemble technologies could help bridge this gap, extending model guidance into a timescale that hasn't really existed before, and giving end-users - including emergency management officials - more time to prepare for and respond to imminent threats. The information can also help our end-users understand the many possible ways a given event can unfold, which helps them prepare for the scenarios they might face.

As promising as these technologies are, we need to to testing to assure that the technologies are useful and usable before they are deployed broadly. This is something we're doing at the National Severe Storms Laboratory. For example, FACETs-- Forecasting a Continuum of Environmental Threats: http://www.nssl.noaa.gov/projects/facets/. We want to assure that new technologies are accessible to everyone, and especially the most vulnerable populations - some of the people who are most likely to suffer serious consequences from weather hazards. We know, for example, that some people are not as numerate (or able to work with complex math) as others. So we need to test the ways we visualize and broadcast the information with a variety of audiences. We also know that our national communication infrastructure has been set up to communicate based on the deterministic information we've provided for decades; for example, TV stations post crawls on your screen and sirens are sounded when warnings are issued. If we offer probabilities of severe weather instead of simple yes/no forecasts, when would these systems begin to convey the threat? Because this information could pose new challenges and opportunities for these systems, we must develop these technologies hand-in-hand with key weather communicators. This work is happening today in the Hazardous Weather Testbed (http://hwt.nssl.noaa.gov/). We want to assure that these messages can get out, be understood, and be put to good use. -Kim

Good Morning! I lived in the OKC Metro for a decade, and in that time, I watched Moore get slammed 4 or 5 times by major tornadoes. Is there a reason for that, or has the city just been supremely unlucky?

sirtheguy

Mostly likely, they've been supremely unlucky. If we look at the 125 year record of tornadoes in the Oklahoma City area, you can't tell there's anything unusual about Moore in terms of occurrence. - Harold

Are there any severe weather events so high in the atmosphere above us and that they do not affect the people living below them?

syberburns

There are several things that occur higher in our atmosphere that do not directly affect us. For

example, lightning does not always originate in a cloud and strike the ground. Sometimes lightning will originate in the cloud and move toward space rather than the ground. These include blue jets and gigantic jets. Additionally, sometimes there will be an electrical discharge above thunderstorms. This electrical discharge is known as a sprite. -Patrick

Hey guys! Thanks for doing this. What's the most fun part of your job?

joeyferg

The most fun part of my job is helping weather forecasters understand the ways they help communities prepare for and respond to severe weather threats. Most meteorologists get into this field because they want to help people. That drive to serve is one thing I love about working in this field, and through my research with individuals and communities, I'm able to bring a lot of encouragement to the people who work so hard to keep our country safe. - Kim

Do you use machine learning to predict the weather? If so what data do you use to train your networks? Where do you get the data from? What networks / tools do you use?

pob_91

Yes. Currently, I am working with someone using machine learning to predict hail size. Their data comes from the different fields predicted by a numerical model combined with actual hail size data. I was also recently involved in a project that used machine learning approaches to automatically identify drylines in numerical models. Machine learning seems to be becoming very popular in meteorology, and in my opinion, if used correctly can be a very useful tool for helping severe weather prediction. - Adam

Are there career opportunities with meteorology that don't necessarily need a degree in meteorology? I went to weather camp at the University of Oklahoma and another at University of Pennsylvania, toured your facility countless times, and have been interested in weather since I was 8. However, I took an AP calculus class this year, and I completely failed out; math isn't my thing at all and math is such a big part of meteorology from what I've been told, so I'm struggling with finding another career for me that I loved as much as meteorology.

waaaffle

One way to contribute your meteorological knowledge is to serve as a community storm spotter affiliated with your local emergency management office. Many spotters become amateur radio operators and use that form of communication to relay critical storm information to emergency officials. No matter what career you end up pursuing you can still be a storm spotter and contribute to meteorology in that way. Other career paths include actually becoming an emergency manager. Also, you could work in communications for one of the NOAA agencies. -Adam

My son is seven years old and loves severe weather. I have struggled to find activities, programs, and resources to foster and maintain his interest in the field. What would you recommend for a youngster who is eager to learn more and for a parent who wants to help them grow? Thanks in advance!

drewcifer27

Your son sounds awesome! Many people I work with became interested in severe weather at a very young age and, because they were encouraged to pursue and learn about their passion, ended up becoming meteorologists. The best advice I could give you is to keep encouraging him, especially

when it comes to math and science. If your son ends up choosing meteorology as a career, a very strong background in math, science, physics, etc., will help him a lot! Feel free to use this tool to help encourage him http://www.nssl.noaa.gov/education/svrwx101/. -Adam

Hi. I'm from the Philippines, a country which has suffered through catastrophic typhoons in recent years.

I was just wondering whether having those successive freak typhoons every year is an experience unique to my country or is weird weather the new normal for everyone around the globe?

aliasbatman

The location of the Philippines in the northwest Pacific makes it an easy target for strong typhoons because it is surrounded by very warm ocean waters that extend to very deep water. Meteorologists call it a "warm pool." So, strong typhoons are unique to the Philippines in the sense that there are not many other countries that are such "easy targets." Although the successive strong typhoons seem freakish, it could be just bad luck and hopefully not a new normal! - Adam

Is there an accurate catalog of extreme weather throughout the past 50+ years? We hear about extreme weather due to climate change. If we have a pattern of more frequent and worse extreme weather trending, that would be great to see.

okverymuch

For severe thunderstorms and tornadoes, in the United States, there's Storm Data (https://www.ncdc.noaa.gov/stormevents/). It's not complete, because it depends on someone seeing the event and reporting it to the National Weather Service, but it's not terrible. Elsewhere, there's the European Severe Weather Database, which is getting better. Unfortunately, none of them are consistently collected over time and space. What we typically do is make relationships between events and the environmental conditions in which those events happen and look for changes, if any, in the environments. -Harold

Was there anything new learned from the record breaking El Reno tornado in 2013? I know it set a size record and at one point was alleged to have set a windspeed record as well, however that seems to have been rescinded.

As someone who grew up obsessed with weather and continues to be as an adult it was fascinating (and sad in regards to Samaras and others lost) to watch. Especially as someone who moved to Norman, Oklahoma a few years ago.

Alternatively, a great question for *others* I know it would be nice to have answered. Is there a benefit to SkyWarn storm spotter training to those that are enthusiasts, yet lack professional training. For instance, someone that has knowledge of studying the various products, scientific data, and has a grounded understanding of live radar?

UsagiMimi

In a general sense, I would say we learned just how dangerous and unpredictably the strongest tornadoes can be. For example, the El Reno tornado went from a small tornado with multiple vortices to a large "wedge" in a matter of minutes. Then, it made a sharp turn. In addition, there were smaller vortices rotating around the main tornado traveling at incredibly fast speeds. Many storm chasers on this day barely escaped because they were caught off guard by these rapid changes. An experimental Phased Array Radar operated by the National Severe Storms Laboratory was pointed at this El Reno

storm, which helped us learn a lot about this storm's behavior. On a personal note, I was part of a field program with Tim Samaras as a grad student at Iowa State that tried to get instruments in and near tornadoes, and work with a lot of folks who knew Tim and his group very well. So, it was a very sad day.

I don't know much about SkyWarn spotter training, but I would guess there is a benefit to anybody wanting to learn more. Check with your local National Weather Service Forecast Office or find more information here: http://skywarn.org/. -Adam

Greetings! Is there any science showing the influence of microclimates on tornado formation? I always wonder why they go to Moore, yet the El Reno F5 fizzled before even reaching the metro.

gary_debussy

As far as microclimates in Oklahoma, there is very little evidence for influence on tornado formation. Part of the reason is that there simply isn't much sharp change in elevation. The best example I can think of for microclimates affecting storm formation is the "Denver Convergence Vorticity Zone." This is a terrain-induced change in winds in Colorado scientists have studied a lot. It helps produce conditions favorable for tornadoes in a very localized region. -Adam

As a layperson, are there any good tools or methods to see the locations and directions of tornadoes in real time?

I have seen some weather stations that have that kind of information, and there is maybe one website that has a decent storm tracker tool, but it is hard to use.

I feel like a tool to show people whether or not they are directly in the path of danger would potentially be lifesaving. Are you aware of any tools like this?

whitevelcro

The best tools are to look for the tornado watches from the Storm Prediction Center and warnings from your local National Weather Service Forecast Office. Not only will they highlight current threats, they highlight anticipated threats. Uncertainty in storm growth and decay and movement make it really hard to extrapolate current locations of things to the future. -Harold

Hello! USAF weather technician and a heavy user of your products here.

What inspired you guys to get into meteorology and what were your paths leading up to working at the SPC work wise? Thanks for doing the AMA!

kenrain

Adam: I was always interested in weather as a kid. I'd climb on the roof of our house in Iowa and watch storms come through. I experienced lots of severe weather in Iowa. My most vivid memories were of the Flood of '93, during which Des Moines's water treatment plant was flooded and we went two weeks without running water. Also, many ice storms, blizzards, and severe weather fascinated me. In college at Iowa State University (ISU), it took a year for me to declare meteorology as my major, but when I took my first meteorology class I was hooked! An an undergrad, I didn't know whether I'd become a researcher, but was given the opportunity to do independent research in my senior year and knew that that was what I wanted to do. From ISU I did a post-doc at the National Severe Storms Laboratory and eventually became a full time federal scientist. I've always been interested in working with severe weather forecasters to find ways to improve the tools they use.

Patrick: The short answer is that my fastball only topped out at 85 mph in high school and I struggled to hit fastballs over 90 mph. The longer answer is that I've always been interested in weather. I remember growing up watching afternoon thunderstorms and being glued to the television anytime there was the potential for snow. In 1996 an F3 tornado struck my hometown during the late evening hours killing two people, both children. It was this tornado that caused me to focus on severe weather.

Kim: I grew up in the Chicago suburbs in the early 1990s, and we had a lot of very significant tornadoes, including one that followed my family as we raced home (the tornado destroyed a building we had been in earlier that day). Another tornado killed 29 people in a nearby suburb and, though it was an F5 tornado, was largely unwarned. I remember watching the news stories with a profound sadness, and I wanted to help make the situation better. That sadness grew into a passionate pursuit of public safety. I've known what I wanted to do since I was seven years old, and I couldn't be more grateful that I get to do it!

Harold: I stumbled into it. As an undergraduate, I was a physics major and really thought that the cutting edge was in areas I wasn't very good at. I went to a summer program at NASA's Goddard Institute for Space Studies/Columbia University and did early modelling of the last ice age. They invited me back for graduate school and I did climate work for my master's. For a lot reasons, I was looking around for something else for my PhD and ended up at Illinois to do computer modelling of thunderstorms. I had the chance to interact with Canadian forecasters about helicity (Google it!) as a forecast tool and fell into the forecast world. I think the fascination with anything that turns the world upside down or inside out is part of what makes tornadoes interesting. In terms of the intellectual challenge, every part of the study, forecasting, and response to tornadoes is decision-making under uncertainty with short time limits and where misclassification costs can be high.

Where I live in Texas, we had 4 tornadoes in San Antonio a few months ago. What kind of impact does climate chage have on weather patterns ? Can it actually cause an increase in bad weather?

Mirai182

Climate change could cause an increase in severe weather. Recent research suggests that, toward the end of the 21st century, severe weather frequency in the US will increase because of an increase in moisture near the surface. Also, this research suggests that the variability in severe weather frequency will increase. So, we will be more likely to experience years with little severe weather followed by years with a lot of severe weather. - Adam

Would predicting the forecast be harder on another planet if the gas isn't oxygen, especially if there are other elements that aren't on Earth that cause the weather to be the way it is on that planet?

Fred_72

Atmospheric scientists model weather on other planets, as well as earth. One of the big challenges on earth is the presence of three phases of water and the changes between those phases (water vapor becoming clouds, rain evaporating, snow becoming rain). On other planets, there's not significant amounts of water, and for the outer planets, there's no solid surface which complicates things. -Harold

Super jargony, but I was wondering what you think of the inhomogeneity of land surfaces and how the affect models output. For example, vertical circulations caused by differences in heat flux due to an inhomogeneous land-surface can be an initiation area for convection. Do models predict this accurately or is more work needed in this area?

Also, curious why the 2013 Moore tornado supercell produced and the Southern supercell didn't? Obviously, there were increased severe weather parameters for the Moore storm, but why? Is there

any research that you could show me because I haven't come up with anything.

Thanks

meteorchopin

Land surface and boundary layer processes are very difficult to model for many reasons. First, these processes have to be parameterized by models because they occur at scales below that of the model grid. Second, these processes are difficult to observe, so even evaluating whether the models are doing well is hard to do. So, more work is definitely needed!

If I remember correctly, the southern storm did produce a tornado, but it was not nearly as intense as the Moore tornado. Interestingly, many people on this day were more focused on the area further south of Moore because there seemed to be a better signal for tornado potential. The question of why some storms produce tornadoes and other don't (or only produce weak tornadoes) is still very much unknown and lots of the current tornado research is still trying to answer it. One current project is VORTEX-SE: VORTEX-Southeast: http://www.nssl.noaa.gov/projects/vortexse/

Sometimes, strong tornadoes seem to happen from very small scale and random processes (like interactions between multiple storms), so they are very difficult to predict. -Adam

How is it that that part of Oklahoma is such a hot bed for Tornados yet where the weather center is it just seems to be lucky enough to avoid it all? Quiet awesome really. Also, what really happened with that guy that crashed into the fence of the weather center? Awfully strange. Boomer Sooner!

emunety

Tornadoes are actually rare events anywhere. Lots of places, even in central Oklahoma, haven't been hit. The 1949 Cleveland County violent tornado missed the old National Severe Storms Lab/Storm Prediction Center/National Weather Service location by ~¼ mile and one of the May 10, 2010 violent tornadoes started just south of the National Weather Center. As far as the crash, the National Weather Center is a University of Oklahoma building and that's a University Police matter. - Harold

Pilot here. It seems like there are more hazardous weather days now than when I was learning to fly (convective weather, hail, gusty winds). Is there any truth to that trend? What effects do you think climate change will have on the aviation industry? Are there any interesting new aviation weather tools coming down the pipe?

DarkSideMoon

Interesting. The number of tornado days has actually gone down (with more tornadoes per event), but the severe weather database is not good enough to say whether wind and hail days has exhibited any trend. A paper was recently published that looked at how clear air turbulence will be affected by climate change. The authors found the frequency of clear air turbulence may increase in a warming climate. Regarding interesting new tools - NOAA is rapidly developing and improving its rapidly updating short-term prediction model known as the High Resolution Rapid Refresh (HRRR). This model predicts when and where storms will form and is becoming an increasingly important tool at NOAA's Aviation Weather Center. -Adam

How has climate change impacted recent weather and the severity of storms, or has there not been a noticeable change, aside from the overall consensus that the temperature is slowly rising world wide? Like, do you find yourselves forecasting strange events, or have things mostly been about the same?

sockgnomed

It's clear that global temperatures have increased and many aspects of temperature extremes have changed in their distribution. The physical relationship is fairly obvious. When we move away from temperature, the relationship is a little less direct. Precipitation extremes, both wet and dry, have increased in many parts of the world. For instance, the fraction of total annual precipitation that falls on the wettest days in the US has increased in the last half-century. There's evidence that the strength of the strongest tropical cyclones has increased. For severe thunderstorms and tornadoes, the relationship is not clear. In large part, this is because one of the basic ingredients (thermal energy) that is favorable for storms should increase as the planet warms, but another (the vertical wind shear that organizes storms) should decrease on average. How the balance works out isn't clear, particularly for tornadoes, which are extremely dependent on the shear. We've seen changes in the variability of occurrence of tornadoes, but don't have a complete set of physical links to tie that to global warming. You can learn more about our understanding of climate change and storms here http://nca2014.globalchange.gov/. - Harold

What kind of computer modeling is used when an event is in progress?

Do you get to use a supercomputer to shorten lead times and if so, what system are you using?

What changes to modeling need to be enacted to better predict when and where a tornado will form?

Explodo86

There are many ways to improve the models that help with tornado prediction. Here are some ways: (1) Improve the model resolution. This means being able to depict storms with greater detail. The resolution we can use is limited by the speed of the super computers available to us. So, as computer technology advances and more resources are devoted to computing, we'll be able to use higher resolution. (2) Improve the input to the models. The process of creating model input is called "data assimilation," and many scientists here at the National Severe Storms Laboratory and the University of Oklahoma Cooperative Institute for Mesoscale Meteorological Studies are working in this area. (3) Improve the model. Improving the model means better depicting the physical processes that lead to severe weather. -Adam

Are you storm chasers or do you work with them? Also, do storm chasers offer tours? Like a cop ride-along?

Also, why has hurricane season been so mellow the last few years? Is there a pattern or is just a statistical blip?

DeadGuy940

I do chase! I consider it an important part of my job. In my research, I frequently work with survivors of severe weather events and tornadoes, and it's valuable for me to understand what the environments around these storms are like and how they evolve. By chasing storms, I'm better able to understand the experiences and interpretations of forecasts that people report, and I can work with forecasters to develop improved communication practices. -Kim

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DeadGuy940

On your hurricane question: We do not do hurricane research at NSSL but our sister laboratory, the Atlantic Oceanographic and Meteorological Laboratory does. In fact, they participated in an AMA last year that you can find at https://www.reddit.com/r/science/comments/53ydgr/science_ama_series_hi_reddit_we_are_dr_frank/.

Interestingly, worldwide, the year 2016 was one of the most active hurricane seasons since the beginning of the satellite era (about 1970). In the US, we've had some below normal hurricane seasons recently, but what gets the most attention is about a 10 year drought in landfalling major hurricanes. Some recent papers have addressed the topic of a "drought" in landfalling major hurricanes for the US and basically conclude that it is a "statistical blip." -Adam

What did the movie Twister get wrong? What did it get right?

clorox2

Just like most of Hollywood productions, Twister was for entertainment. There's not a lot of the science that's accurate. What is accurate is the passion that scientists have for learning. I'm also told by people who have been through tornadoes that the noise and sense of chaos brought back memories. -Harold

Hello guys! Once i was with a friend and it was raining cats and dogs, and i said wouldn't it be nice if we could move the clouds somehow? (like with a giant fan or something) and he said no, that would be terrible and would definetly have catastrofic effects!! And i said well how do you know? the effects might disipate and not make much difference.... but he was sure of it... What do you guys think? can we tell beforehand? thanks in advance!

dr1672

One of the best tools researchers have to study these types of hypotheticals is models, since these are the types of things we can't do in the real world. So, you could build a model and insert the giant fan to see the impact! -Adam

[deleted]

[deleted]

The "event_type" header is used to describe the general category of the event itself. For example, all tornadoes will be categorized under the "TORNADO" event_type.

Also, there were 1,177 official tornadoes in the United States in 2015. -Patrick

Hey guys! You all do fantastic work. How is NOAA (and the SPC in particular) working to improve forecast communication with the public?

warrrr101

Patrick: Thanks! SPC regularly works with social scientists, emergency managers, and other meteorologists to ensure the most effective communication of severe storm risk. Some of our successes include standardizing our colors for risk categories, introducing numbers to accompany risk categories, and adding plain language summaries of our convective outlooks, mesoscale discussions and watches.

Kim: As Patrick has said, some operational units like SPC (also Weather Prediction Center, Climate

Prediction Center, National Hurricane Center, and several local forecast offices) are welcoming communication scholars and related social scientists right into their offices to work on specific communication issues (for examples, see this page: http://www.nws.noaa.gov/com/weatherreadynation/archives.html). Other efforts have been launched to provide tools and resources to these groups, including these recently published guidelines on risk communication and warning response: (http://www.performance.noaa.gov/wp-content/uploads/Risk-Communication-and-Behavior-Best-Practices-and-Research-Findings-July-2016.pdf). Especially without research-based training in these areas, physical scientists can find it difficult to know how they can improve their communication practices or connect with social scientists doing work that relates to their operations. We wrote this document to help foster these connections. We plan to expand this compendium to include deeper dives into modern topics like communicating uncertainty and using social media to communicate risk.

While we know some general best practices for communication, there is also a need for more social scientific research to improve fundamental knowledge about how people understand, perceive, and respond to risk. The Office of Weather and Air Quality has funded several projects that fall into this area (See: http://research.noaa.gov/LabsPrograms/OARPrograms/OfficeofWeatherAirQuality/GrantsandProjects.aspx).

Finally, improving communication means that we need to improve coordination among all of the entities involved in communicating weather risk, including broadcasters, emergency managers, private sector forecasters, and NWS forecasters. Especially in the social media era, there's growing recognition that developing consistency in messages and practices is difficult and requires coordination. Integrated Weather Teams (IWTs) have sprung up in many local areas to improve relationships among these groups. In addition, the Office of Weather and Air Quality, National Weather Service and Federal Highways Administration recently funded a National Academies study to identify ways that social scientific research can be better supported by and integrated within the Weather Enterprise in the future (https://www8.nationalacademies.org/cp/projectview.aspx?key=49794).

This isn't a science question, but I'm curious: do y'all get really excited when crazy storms are shaping up? Even if people are in danger, it's got to be a bit of a thrill to see textbook cases play out.

And do you ever argue about predictions? I'm trying to imagine a meteorologist fight. And after the system passes, are there any ha I was right moments?

Do meteorologists ever bet on the outcomes?

miparasito

I would be remiss if I said that a part of me doesn't get excited when the atmosphere comes together to produce severe storms. The reason for this is because I've spent my whole life studying the atmospheric processes that cause severe weather and when I see them playing out in the real world, it *is* exciting. This excitement should not be construed as excitement over the damage the storms may cause.

And, yes, we do have disagreements about the forecast here at the SPC. And it's a good thing! The worst possible thing that can happen in a forecast environment is everyone thinking the exact same thing as this is when you tend to miss something. SPC encourages every forecaster on a shift to make his or her own forecast and be willing to discuss it with the person tasked with writing up a discussion to reflect the collective forecast of the SPC. As with any group of experts, sometimes the disagreements can get animated, but this is because we are all passionate about what we do and want to produce the best forecast for the American people. After an event we don't really have "I told you so" moments because the atmosphere can be really humbling. We have a saying at the SPC that, "Every forecast is right and every forecast is wrong. It just depends on where you look!" -Patrick

Gooooooood morning from NWS Ruskin! In your opinions, what is the most important piece of technology we lack to better improve severe weather forecasts? What technologies are you developing now that you hope to see deployed in the coming years?

aexeron

The source code to the atmospheric model and a supercomputer big enough to run this model! In all seriousness, one of the biggest impediments is our inability to quickly and accurately assess all of the information that we have currently. NOAA's Storm Prediction Center is working on building better visualizations to help with some of the information that we use. As our tools become mature and we know they work we migrate these tools to our website to benefit everyone in the weather enterprise. You can find many of our visualization tools on our website here: http://www.spc.noaa.gov/exper/ - Patrick

I work next door, I see someone over there launching weather balloons. What data do you get from those? Any good stories where they end up, etc?

arcane_joke

We get temperature, relative humidity, and wind data with height from the balloons. We use this information to help start forecast models and for assessing the current state of the atmosphere. Once a balloon from one National Weather Service office landed at another National Weather Service office. My favorite story was when a balloon landed on Main Street of a small city and the instrument package was making noise. The local authorities didn't know what it was (despite the label on the package), so they called in the bomb squad and detonated it. The city will remain anonymous for its own protection. -Harold