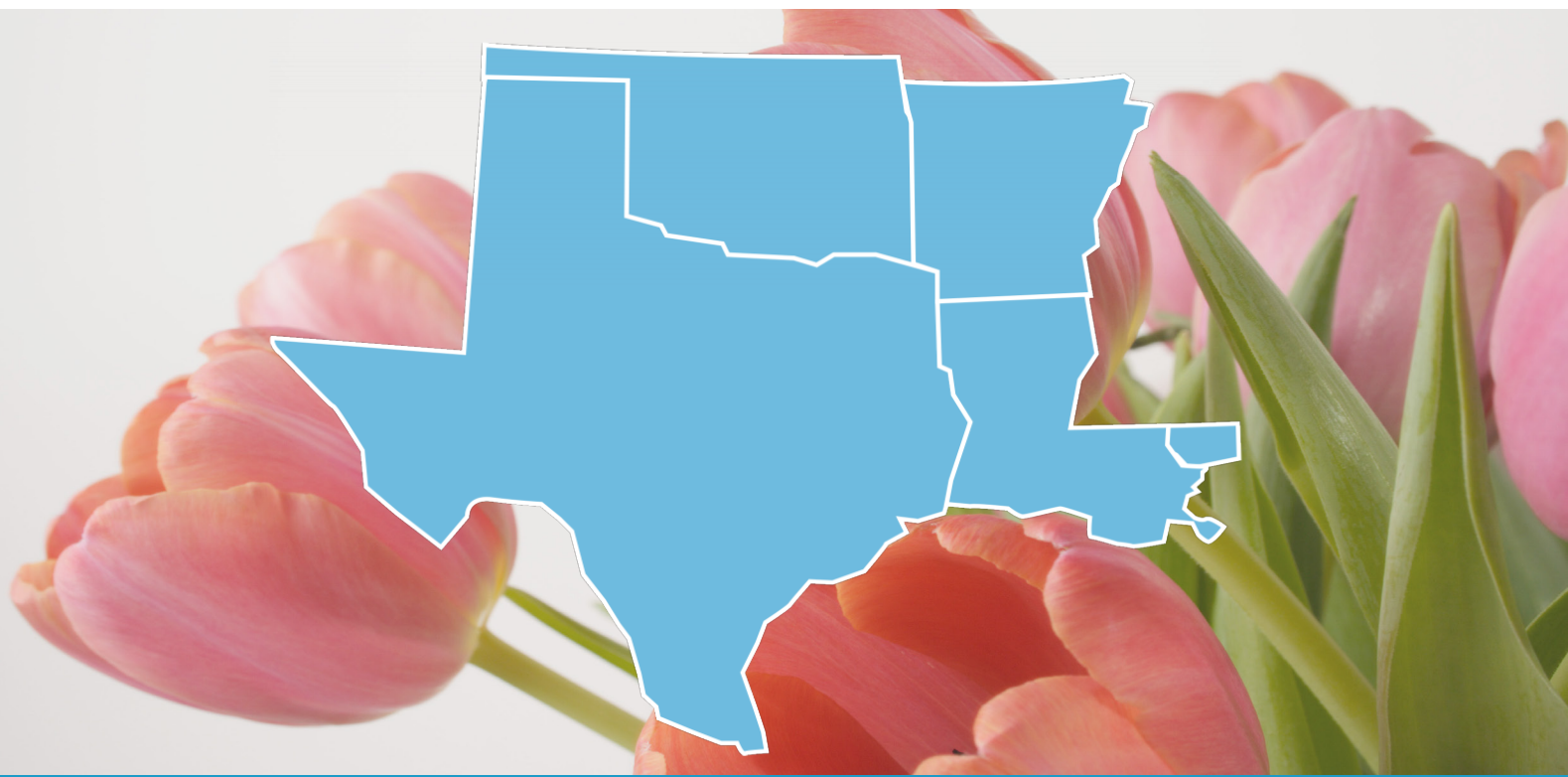




In This Issue:

- Page 2-5:** **A Look at Possible Changes in Tornado Locations**
- Page 6-7:** **Flood Hazards and perceptions — A comparative study of two cities in Alabama**
- Page 8:** **Disaster Recovery Reform Act of 2018 Transforms Field of Emergency Management**
- Page 10-11:** **Collaborating with Emergency Managers and Community Planners to Improve Awareness and Use of Climate Information**
- Page 12:** **The Biggest Baddest Gulf Coast Snow Event — Feb 1895**
- Page 13-14:** **ENSO Effects on the Gulf Coast**
- Page 15:** **About SCIPP Team: Mark Shafer**
- Page 16:** **From Our Partners**

A Look at Possible Changes in Tornado Locations

Harold Brooks, NOAA/NSSL Senior Research Scientist

Tornadoes are rare events at any particular location in the United States, but occur often enough overall to make them a significant threat to life and property and, as a result, require planning to prepare for their occurrence. Estimating the true distribution of tornado occurrence is surprisingly difficult, in large part because of our dependence on reports of their occurrence. Collection of reports has changed over time and from location to location because of changes in emphasis on their collection, public awareness, and changes in forecasting approaches. One of the big challenges is to get a large enough sample collected reasonably consistently to have confidence in the results. Over the years, there have been a lot of efforts to account for these changes. As an example, Krocak and Brooks (2018) developed a climatology of the occurrence of tornadoes rated at least (E)F1 on the Fujita or Enhanced Fujita damage scale at any location in the United States on an hourly basis throughout the year. To do this, they had to smooth the data in space and time and use many years of data to make the estimates. As a result, changes over the years in occurrence in small areas were difficult, if not impossible, to detect.

Another approach has been to use environmental proxies associated with tornadoes to estimate where tornadoes are likely to occur (Brooks et al. 2003). This approach has the advantage of relying on consistently collected observations and techniques that don't depend on the vagaries of reporting. The disadvantage is that it's not clear that the relationships between the proxies and tornadoes is the same everywhere or through time. Thus, a change in the implied

occurrence of tornadoes may not be reflected in the actual occurrence.

Nevertheless, despite the limitations, efforts to map tornadoes and to estimate their changes through time have gone on. So far, there's little evidence for a change in the average annual number of tornadoes or favorable environments computed over the entire United States. Variability in tornado occurrence has been seen, with fewer days having at least one EF1 or stronger tornado now than 40 years ago, but more days with many tornadoes taking place now, as well as more variability in the timing of the early part of the tornado season (Brooks et al. 2014). In addition, there have been hints of more tornadoes occurring in the mid-South region (Mississippi and surrounding area) in the last few decades, but because of their dependence on reports, the question of whether this increase has been a result of changes in actual tornadoes or reporting practices has been unanswered.

Gensini and Brooks (2018) have addressed this problem by considering both reports and environmental observations. In particular, they used the Significant Tornado Parameter (STP), a quantity that is used to forecast tornadoes on a daily basis and combines various factors in the environment that are associated with tornadoes. They showed that the STP, accumulated over a year, is strongly correlated with the number of tornadoes that occur during that year. Even more significantly, the correlation works well for monthly data except for August. As a result, we can have confidence that STP is a good predictor of tornado occurrence on a national scale. Gensini and Brooks then put the annual

STP and annual number of tornadoes on a grid and calculated trends from 1979-2017 at every grid point east of the Rocky Mountains in the United States (Fig. 1). Although there are small-scale details, the general pattern is that both the reports and the STP show decreases in the Central and Southern Plains, particularly in the Texas Panhandle and northwest Texas and increases over the Midwest and mid-South, in an area stretching from Illinois to Mississippi. The field of change of the STP is somewhat smoother than the reports, which is likely a reflection of the issues associated with reports.

The magnitude of the changes is important to consider, particularly with regards to the reports. Much of the central part of the United States experiences more than 1.5 tornadoes per year on the scale of the grid the analysis was done on (Fig. 2). The largest increases over time are approximately 0.75 tornadoes per decade. As a result, the changes are, at most, 5% of the average occurrence over a decade. Decreases are relatively smaller, with maximum values less than 0.5 per decade. At the extremely local level, such as an individual, the changes are probably of limited importance. At the peak level, it would be equivalent to the difference of 15 tornadoes in a decade in the general vicinity of someone compared to 16 in the following decade. It's not clear what different decisions would be made under those conditions. On larger scales, however, such as a regional or state planner, a 5% change in the number of disasters would have significant impacts on assessment of threats and preparation. In the regions of decreases, most of the places are in relatively high frequency of occurrence and the changes are small enough that there's still a significant threat. Taken over the forty year period of the analysis, places with 1.5 tornadoes per year and a change of 0.5 per

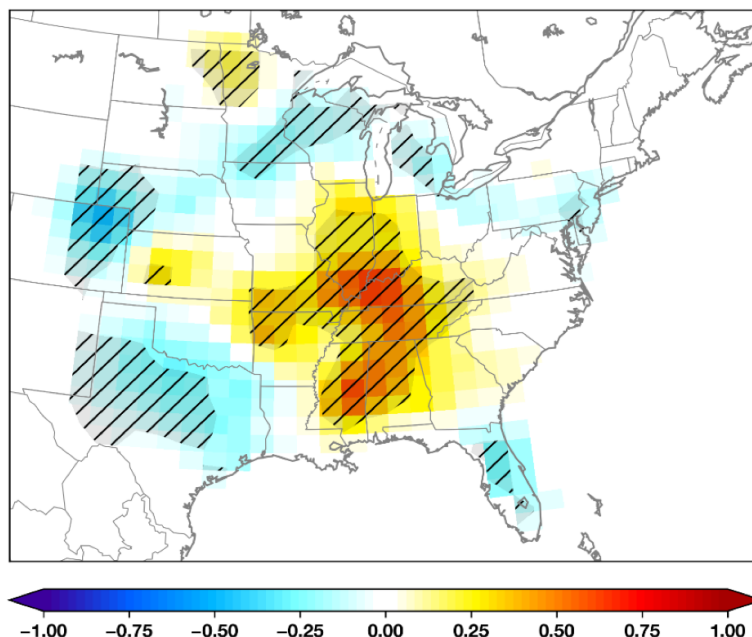


Figure 1: Change in annual F1 and stronger tornado reports per decade, 1979-2017. Hatching indicates statistical significance greater than 95% level. (Gensini and Brooks 2018)

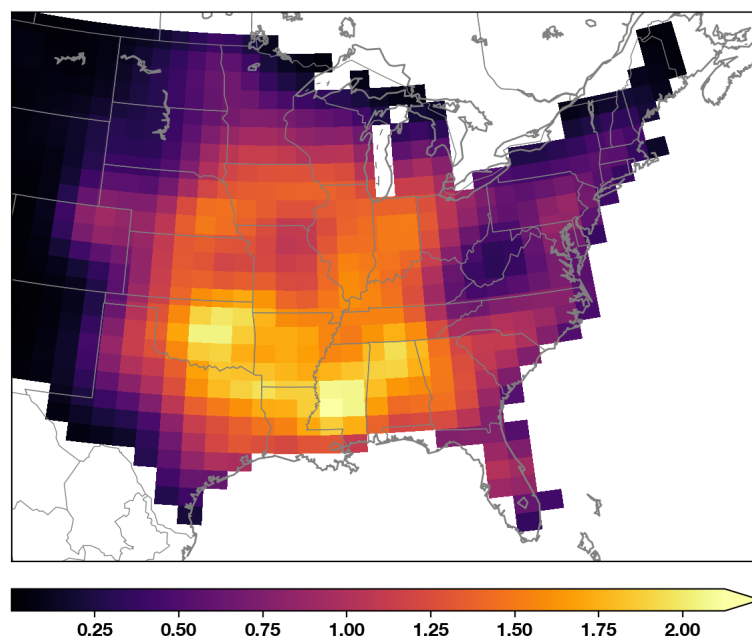


Figure 2: F1 and stronger tornadoes per year, 1950-2017.

decade implies that the estimate of occurrence at the beginning of the analysis would have been 16 per decade and, at the end, 14 per decade. Although that might change some large-scale planning, the hazard would still be large enough it couldn't be discounted. At the local level, individuals still need to prepare for the threat.

The implications for public safety are also interesting. A number of researchers have shown the higher death tolls associated with tornadoes in the mid-South and Southeast. A variety of factors have been discussed, including higher rural population densities, greater levels of poverty, mobile homes, forecast cover, and the frequency of nocturnal tornadoes. Increasing the number of tornadoes in that region would have the potential to increase the threat to life.

A big question is why this has happened. It's tempting to think it's another aspect of global climate change. The problem is that the chain connecting global temperature increases, particularly in the Arctic, through changes in the atmospheric structure and environments associated with tornadoes, to the actual occurrence of tornadoes, has several weak links. At this time, we cannot offer a complete physical explanation. However, an unrelated piece of research offers an intriguing possible connection. Last year, Seager et al. (2018a, b) published research related to the position of the "100th Meridian", a set of geographic features first noted in the 1800s by the early explorer John Wesley Powell, that nearly coincided with the longitude 100 W. Both natural vegetation and crops are different west and east of that line through the Central

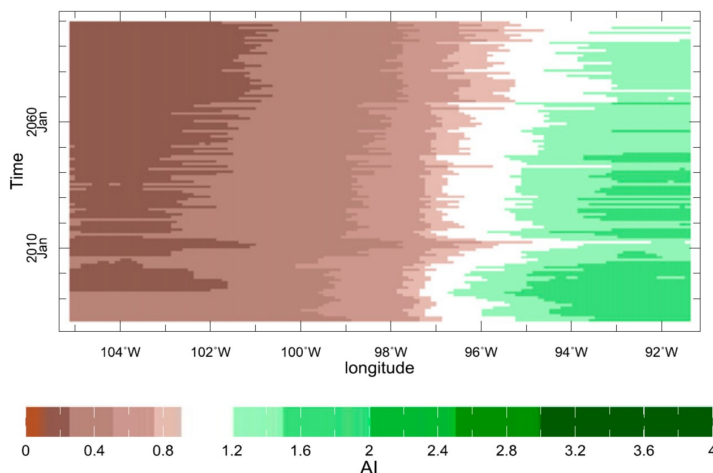


Figure 3: Climate model reconstruction and projection for east-west cross-section versus time of Aridity Index (AI) averaged over latitude across Southern Plains of US from 1980-2100. AI values greater (less) than 1 indicate moist (dry) areas. (Seager 2018b).

and Southern Plains and, in general, things are drier west of that line. In the Seager et al. works, they showed how this dividing line has been moving eastward slowly over last 30 years in a variety of measurements, and that it's projected to continue to move eastward in the future as the planet warms (Fig. 3). It's quite possible that the eastward movement of favorable tornado environments and reports are related to the same physical processes that have led to the movement of the 100th Meridian. Future work will try to combine these results for a better understanding of possible changes in weather hazards in the South Central United States.

References

Brooks, H. E., J. W. Lee, J. P. Craven, 2003: The spatial distribution of severe thunderstorm and tornado environments from global reanalysis data. *Atmospheric Research*, 67-68, 73–94.

Brooks, H. E., G. W. Carbin, P. T. Marsh, 2014: Increased variability of tornado occurrence in the United States. *Science*, 346, 349–352.

Gensini, V. A., H. E. Brooks, 2018: Spatial trends in United States tornado frequency. *npj Climate and Atmospheric Science*, 38, 1–5.

Krocak, M. J., H. E. Brooks, 2018: Climatological Estimates of Hourly Tornado Probability for the United States. *Weather and Forecasting*, 33, 59–69.

Seager, R., N. Lis, J. Feldman, M. Tang, A. P. Williams, J. Nakamura, H. Liu, N. Henderson, 2018a: Whither the 100th Meridian? The Once and Future Physical and Human Geography of America's Arid–Humid Divide. Part I: The Story So Far. *Earth Inteaactions*, 22 (5), 1-22.

Seager, R., J. Feldman, N. Lis, M. Tang, A. P. Williams, J. Nakamura, H. Liu, N. Henderson, 2018b: Whither the 100th Meridian? The Once and Future Physical and Human Geography of America's Arid–Humid Divide. Part II: The Meridian Moves East. *Earth Inteaactions*, 22 (5), 1-24.

Flood Hazards and perceptions – A comparative study of two cities in Alabama

Margret Boone, SCIPP Program Manager

Researchers from the University of Alabama, Louisiana State University, Princeton University and Auburn University at Montgomery published a new study analyzing the perceptions of flood hazards in relation to geographic location. The study, “Floods hazards and perceptions — A comparative study of two cities in Alabama,” appeared in the February 2019 Journal of Hydrology.

The two cities studied — Huntsville, AL and Mobile, AL — represent an inland location more susceptible to river flooding and heavy rainfall events and a coastal location that is susceptible to heavy rainfall, but also sea level rise and flooding associated with hurricanes and storm surge. The goal of the research was to understand whether people’s perception of their flood risk was consistent with the contributing factors (physical geography) of the flooding hazard.

The first part of this study was to understand the historical heavy precipitation events in both cities, and the storm surge history in Mobile. The Top 10 1-day, 2-day, 5-day and 10-day rainfall events were analyzed for each city. The storm surge history for Mobile shows there were several large storm surges that exceeded 2-meter height, and one that exceeded 4-meters in height. These storm surges had dramatic economic damage to the Mobile residents. Then, to better understand people’s perceptions of their flood risk, a survey was conducted in 2016 in both Huntsville and Mobile. Researchers received 550 responses, and asked questions such as “would you say

the precipitation in your local community has increased, decreased, or stayed the same?” For that particular question, 53% of respondents in Huntsville perceived increasing precipitation, whereas as 41% of respondents in Mobile perceived precipitation to be increasing.

Despite Mobile’s proximity to the coast and storm surge history, survey respondents indicated they were more likely to think both hurricane number and strength has decreased, than inland respondents in Huntsville. One conclusion is that residents of Mobile may have become complacent due to the absence of major impacts from landfalling hurricanes in recent years. Demographically, in Mobile, survey respondents with higher incomes appeared more sensitive to flooding and perceived an increasing trend in flooding events.

In conclusion, respondents in both cities were able to connect the natural hazard of flooding with their surrounding physical environment. Respondents were also influenced by their personal perceptions of precipitation. So if they perceived precipitation to be increasing, they then also perceived flooding events to be increasing.

If you are interested in reading this publication, the manuscript can be found online at the following link: <https://doi.org/10.1016/j.jhydrol.2018.11.070>

For more information about this research, contact Wanyun Shao, wshaol@ua.edu gov.

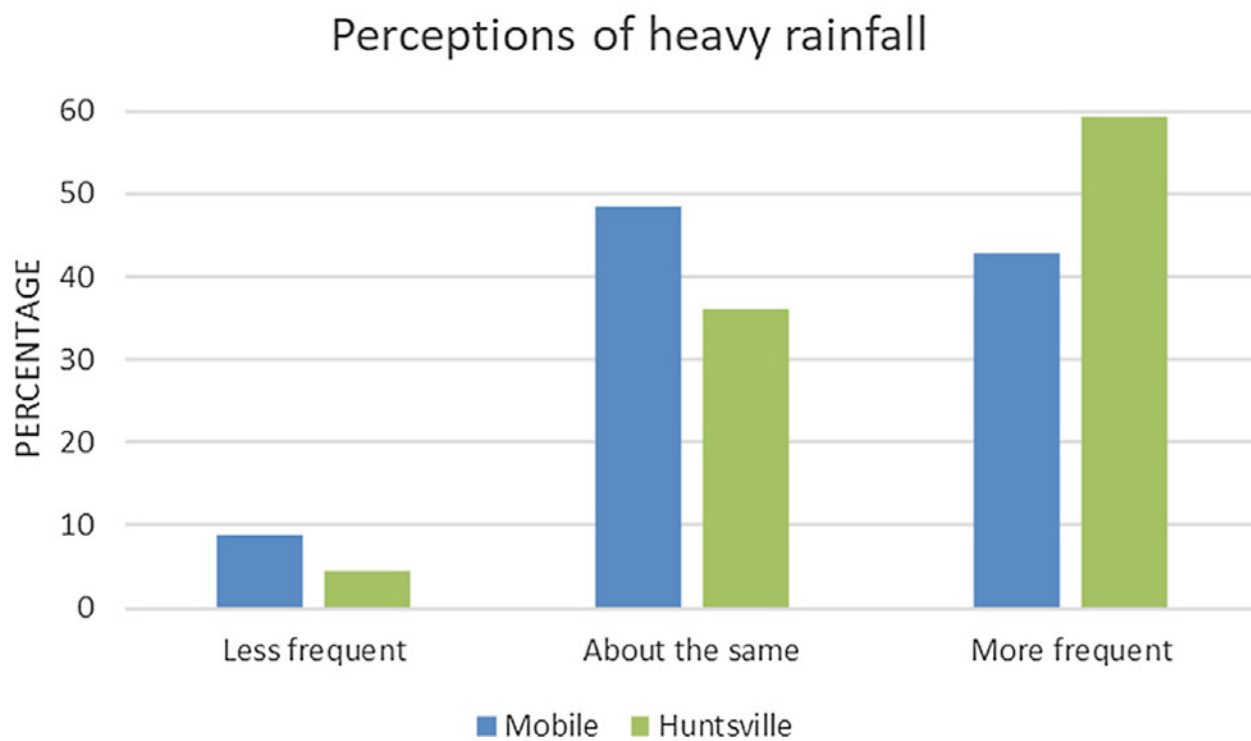
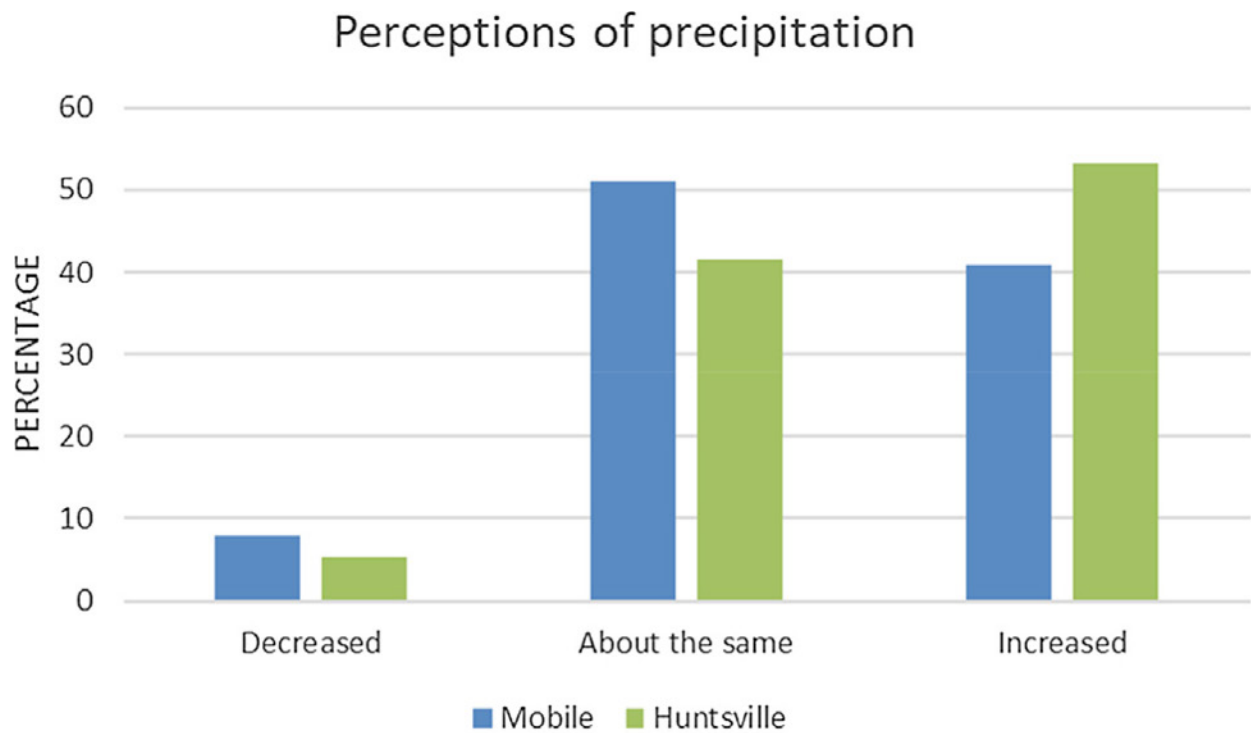


Figure: Comparison of perceptions of precipitation and heavy rainfall among residents in Mobile and Huntsville.

Disaster Recovery Reform Act of 2018 Transforms Field of Emergency Management

FEMA Email Bulletin

On Oct. 5, 2018, President Donald J. Trump signed the Disaster Recovery Reform Act of 2018 (DRRA) into law as part of the Federal Aviation Administration Reauthorization Act of 2018.

As the 2017 hurricane season and California wildfires demonstrated, impacts from a disaster can be devastating. With the economic disruption and the cost of disasters on the rise nationwide, FEMA worked closely with Congress over the past year as they considered, and ultimately passed, important reforms to federal disaster programs.

These reforms acknowledge the shared responsibility of disaster response and recovery, aim to reduce the complexity of FEMA and build the nation's capacity for the next catastrophic event.

Highlights from the DRRA include:

Greater investment in mitigation, before a disaster: Authorizing the National Public Infrastructure Pre-Disaster Hazard Mitigation Grant Program, funded through the Disaster Relief Fund as a six percent set aside from disaster expenses.

Reducing risk from future disasters after fire: Providing hazard mitigation grant funding in areas that received Fire Management Assistance Grants as a result of wildfire. Adding 14 new mitigation project types associated with wildfires and windstorms.

Increasing state capacity to manage disaster recovery: Allowing for higher rates of reimbursement to state, local, tribal and territorial partners for their administrative costs when implementing public assistance and hazard mitigation projects. Additionally, the legislation provides flexibility for states and tribes to administer their own post-disaster housing missions, while encouraging the development of disaster housing strategies.

Providing greater flexibility to survivors with disabilities: Increasing the amount of assistance available to individuals and households affected by disasters, including allowing accessibility repairs for people with disabilities, without counting those repairs against their maximum disaster assistance grant award.

Retaining skilled response and recovery personnel: Authorizing FEMA to appoint certain types of temporary employees who have been with the agency for three continuous years to full time positions in the same manner as federal employees with competitive status. This allows the agency to retain and promote talented, experienced emergency managers.

The [full text of the bill](http://www.congress.gov) can be found at www.congress.gov

Collaborating with Emergency Managers and Community Planners to Improve Awareness and Use of Climate Information

Rachel Riley, SCIPP Deputy Director

Two of the stakeholder groups with whom we have been interacting and collaborating over the past couple of years include emergency managers (EMs) and community planners in Oklahoma and Arkansas. At a national level there has been recognition that the two sectors have complimentary strengths and weaknesses and greater progress toward reducing hazards and disaster risk can be made by working together (American Planning Association 2010). For example, the American Planning Association (2010) report notes that EMs typically take the lead on addressing hazards in their communities and they view risk from an all-hazards perspective. However, EMs are unlikely to be trained in collaborative planning processes or facilitating public involvement, two facets that are needed to move forward with hazard mitigation and/or climate adaptation initiatives. Planners, on the other hand, are trained in those areas and have the ability to think comprehensively about a community, whereas many government officials manage particular and often isolated functions. Planners also think on longer timescales whereas many EMs are only trained to think on operational timescales.

Beginning in 2017, SCIPP took that framework, along with findings from our own work and engagement, and applied it to local levels. Workshops were hosted in Arkansas and Oklahoma with the purpose of facilitating collaborations between the emergency

management and planning sectors to increase awareness of hazard mitigation planning and disaster resilience initiatives across each state. The 2017 workshops spurred the idea to develop what has become the [Simple Planning Tool for Oklahoma Climate Hazards](#) (SPTOK) and [Simple Planning Tool for Arkansas Climate Hazards](#) (SPTAR). You can find the tools in the Data Tools tab of our website, www.southernclimate.org.

The SPTs help EMs and planners, along with officials who serve in similar capacities, identify locally-relevant climate information that can be used in plans such as hazard mitigation plans, land use plans, comprehensive plans, etc. The SPTs are a compilation of relatively easy-to-use online interactive tools, maps, and graphs that depict historical climatologies. The tool also provides state-of-the science summaries regarding what is known about how each hazard is being or is expected to be impacted by climate change in each state. The SPTs are primarily designed for planners and EMs who serve small- to medium-sized communities and have limited financial resources but they also may be of interest to those who serve larger areas. In fact, SCIPP is aware of several such examples. Version 1 of SPTOK was released April 30, 2018 and version 1 of SPTAR was released November 15, 2018. Version 1.5 of SPTOK and SPTAR was released January 30, 2019.

In conjunction with the development and release of the SPTs, SCIPP presented on the SPT and/or engaged with planners and EMs attendees about hazard mitigation at the following events in 2018:

- Arkansas Chapter of the American Planning Association Fall Meeting
- Central Oklahoma Emergency Management Association Workshop
- City of Tulsa Hazard Mitigation Plan Update Workshop
- Oklahoma Chapter of the American Planning Association Annual Conference
- Oklahoma City Community Foundation Central Oklahoma Resiliency Project Hazard Mitigation Focus Group
- Oklahoma Emergency Management Annual Conference
- Oklahoma State Hazard Mitigation Team Quarterly Meeting

SCIPP is currently developing a survey to formally evaluate the usefulness and impact of the SPTs. If you are the primary audience for the tool, look for an invitation in your email inbox in the coming weeks to participate in the survey. Additionally, secondary conversations that took place at some of the above events focused on hazard mitigation and/or climate adaptation actions that communities can take to address their hazard-related challenges. SCIPP plans to move those conversations forward in the near future and dig deeper into helping communities build resilience to weather and climate extremes.



SCIPP staff Leah Kos (left) and Rachel Riley (right) collaborated with Arkansas Chapter of the American Planning Association (AR APA) President Danielle Semsrott (middle) to host a workshop in collaboration with AR APA's Fall Conference in Siloam Springs, Arkansas in September 2018.



SCIPP staff Leah Kos (left) and Rachel Riley (right) collaborated with Oklahoma Chapter of the American Planning Association President Danielle Barker (middle) to present the Simple Planning Tool for Oklahoma Hazards at the chapter's annual conference in October 2018.

Historical Event

The Biggest Baddest Gulf Coast Snow Event – Feb 1895

Barry Keim, Louisiana State Climatologist

As winter winds down, and snow pummels the Midwest, I thought I would write about the biggest baddest snowstorm to ever hit, Texas, Louisiana, Mississippi, and really, the entire Gulf Coast. On February 14-15, 1895, there was the perfect set up of conditions for snow in the Southeast, with a storm forming in the Gulf of Mexico, while very cold air moved southward from Canada toward the Sun Belt. The clash of these two systems along the Gulf Coast united Gulf of Mexico moisture with frigid air from the north to produce snow.... and plenty of it, in this instance. Snow totals were impressive, including 4 inches in Corpus Christi, 15.4 inches in Galveston, 20 inches in Houston, 22 inches in Lake Charles, 24 inches in Rayne, LA (still the State Record), 12.5 inches in Baton Rouge, 8.2 inches in New Orleans, 16 inches in Shell Beach, 6.2

inches in Biloxi, 6 inches in Mobile, AL, and Tallahassee, FL even had 2 inches. At many of these locations, this is the record snow event. Furthermore, the total at Rayne — 24 inches — is the Louisiana State record, which has stood for over a century as THE snowstorm for Louisiana. What this storm demonstrates is that when all the ingredients come to together, we can have impressive snow events this far south. For better or worse, however, it doesn't happen often, and we may never see such an event in our lifetimes. BUT, you never know! There is a great summary of this storm, complete with a picture of Canal Street draped in snow at the following website; <http://earlychurchfathers.org/fullcircle/index.php?entry=entry091211-213857>. If you have any questions, feel free to contact me at keim@lsu.edu.

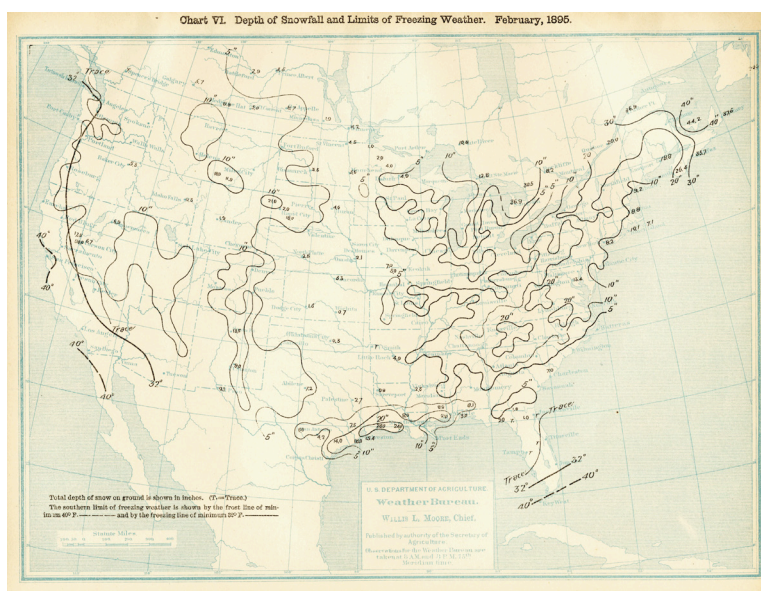


Figure 1: Snow across the United States for February 1895. Note that the snow totals along the Gulf Coast were the result of the February 14-15, 1895 event. Source: Monthly Weather Review, Volume 23, Issue 2, February 1895

ENSO Effects on the Gulf Coast

Vincent Brown, SCIPP Research Assistant/LSU Department of Geography

It is well understood that the El Niño/Southern Oscillation effects winter precipitation accumulation across the southeastern United States (Ropelewski and Halpert 1986; Henderson and Vega 1996) (Figure 1). This knowledge is useful, particularly for statistical forecasting and agricultural management (Hansen et al. 1998), but it does not provide information on precipitation characteristics. Currently, it is not clear how precipitation characteristics, such as the frequency, intensity, and duration of the events are influenced during different phases of ENSO. In fact, Legler et al. (1999) discussed how seasonal precipitation forecasts might be beneficial for agricultural applications only if details were provided regarding not only totals, but changes in a comprehensive

suite of precipitation characteristics. This research investigates how specific precipitation characteristics change across the Southeast United States during phases of ENSO.

To determine the effect of the El Niño/Southern Oscillation on winter (DJF) precipitation characteristics data, were acquired from 54 first-order weather stations across the Southeastern United States from 1950-2017. Time series of precipitation hours, accumulation, duration, intensity, and frequency of individual precipitation events were created from hourly data for each station. Using regression, the association between constructed time series and the Oceanic Niño Index (ONI) was investigated. Results showed 90% (80%) of the stations had

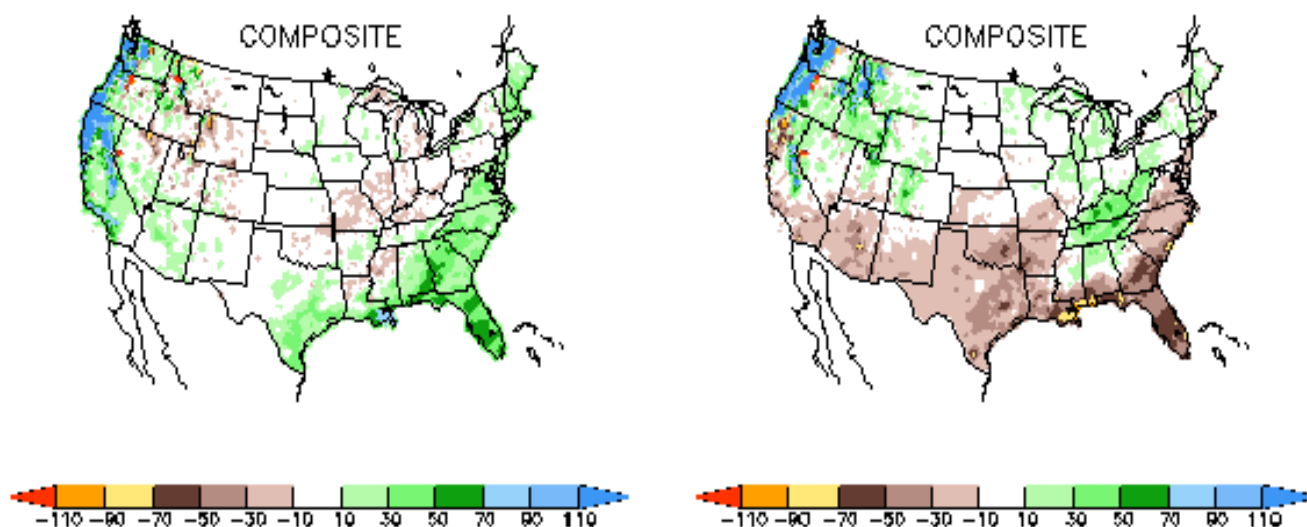


Figure 1. Average DJF precipitation (mm) departure during El Niño (left) and La Niña (right) from 1950-current, with departures compared to 1981-2010 mean values. Source: Climate Prediction Center. www.cpc.ncep.noaa.gov/products/precip/CWlink/ENSO/composites

a statistically significant positive association between precipitation hours (accumulation) and ONI. Climatologically, Gulf Coast stations experience approximately 100-150 hours with precipitation during winter. During El Niño (La Niña) winters, these coastal locations average between 120-180 (75-130) hours with precipitation, representing roughly a 20% increase (20% decrease) (Figure 2). Significant positive associations were also found between ONI and event duration (46 stations; 80%) and event frequency (30 stations; 55%). These changes are likely the result of a shift in storm tracks related to a displaced subtropical jet stream. Results further confirm that rainfall accumulation is not the only parameter of precipitation that changes during ENSO events.

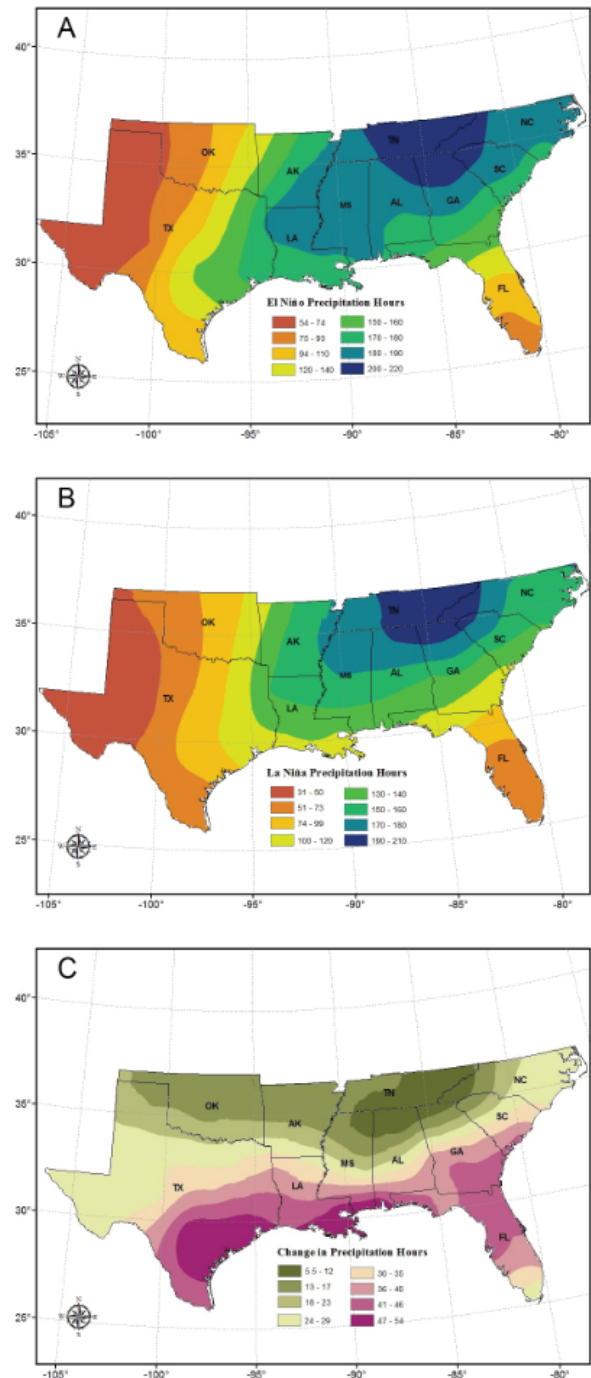


Figure 2. Average precipitation hours during the 24 El Niño (top) and 23 La Niña events (middle). The difference between El Niño and La Niña precipitation hours (bottom), calculated by subtracting La Niña event hours from El Niño event hours (El Niño – La Niña). All locations on average experienced more precipitation hours during El Niño events, with the biggest disparity along the Gulf Coast.

About SCIPP Team

Mark Shafer



Mark Shafer, SCIPP Director

Mark Shafer and Barry Keim founded SCIPP in 2008. Mark grew up in Chicago, Illinois, where he developed an interest in extreme weather. That interest drew him to study Meteorology at the University of Illinois and then brought him to Oklahoma in 1987 to study severe storms with the University of Oklahoma's meteorology program.

Following completion of his Masters degree from OU, he began work at the Oklahoma Climate Survey (OCS) as a staff climatologist, managing data archives and helping people find answers to questions about weather and climate from settling bar bets to planning for climate extremes. As the Climate Survey developed the Oklahoma Mesonet, he helped survey potential sites, developed the initial quality-assurance software, and developed products to share Mesonet information with the public.

While working at OCS, Mark began a Ph.D. program at OU, but not in Meteorology. Instead, he pursued Political Science, to better understand the connection between what scientists, like meteorologists, study, and its influence in policy and practice. He focused

on the emerging area of drought planning to look at the different roles scientists take, from providing advice to policy-makers to education and outreach, to advocacy.

This became the foundation for SCIPP, but applied more broadly to the use of climate information in preparing for extreme weather. Over the years, the SCIPP region has experienced almost every kind of extreme, including localized downpours, multi-year droughts, hurricanes, wildfires, and tornadoes. With the addition of resources from NOAA RISA, Mark is able to participate with the SCIPP team (who will be profiled in future editions of *The Monitor*) to provide place-based applications of climate and weather information to improve community preparedness to a range of natural hazards.

In addition to his work with SCIPP, Mark is also an Assistant Professor in OU's Department of Geography and Environmental Sustainability, where he teaches courses on the societal impacts of natural hazards and physical geography. He also is Associate State Climatologist, where he assists with tailoring weather and climate information to address specific needs of Oklahoma's decision-makers. His research interests focus upon natural hazards, particularly on communication between the scientific community and policy makers in planning for and managing response to extreme events and climate change.

Mark also has served as Chair of the American Meteorological Society's Board on Societal Impacts and program co-chair for the Symposium on Policy and Socio-Economic Research. He was a coordinating lead author for the Great Plains Chapter of the 2014 National Climate Assessment and served as an author on the 2018 Southern Great Plains chapter.

Southern Climate Monitor Team

Kyle Brehe, Regional Climatologist
Southern Regional Climate Center (LSU)

James Cuellar, Student Assistant SCIPP (OU)

Margret Boone, Program Manager SCIPP (OU)

From Our Partners

South Central CASC Climate 101 Training

The South Central Climate Adaptation Science Center (SC-CASC) held a Climate 101 training in November at the Southwestern Indian Polytechnic Institute as part of the National Tribal GIS conference's slate of pre-conference workshops. The training covered basic climate science, process of vulnerability assessment, as well as potential funding opportunities for those interested in pursuing climate adaptation. The training, originally intended for 20, ended up developing an extensive waitlist and receiving nearly 40 participants. To accommodate those on the waitlist, the CASC planned another training for December, which received another 18 participants.

If you have further questions about further projects and events related to SC-CASC, you can contact Christiaan Patterson at Christiaan.M.Patterson-1@ou.edu.

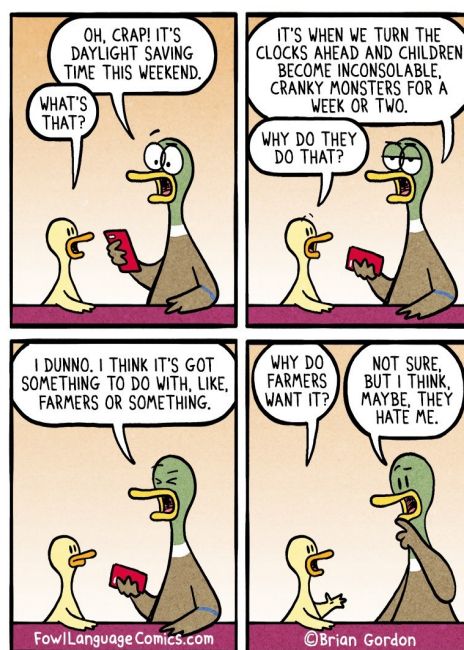
Contact Us

To provide feedback or suggestions to improve the content provided in the Monitor, please contact us at monitor@southernclimate.org. We look forward to hearing from you and tailoring the Monitor to better serve you. You can also find us online at www.srcc.lsu.edu & www.southernclimate.org.

For any questions pertaining to historical climate data across the states of Oklahoma, Texas, Arkansas, Louisiana, Mississippi, or Tennessee, please contact the Southern Regional Climate Center at **(225)578-5021**.

For questions or inquiries regarding research, experimental tool development, and engagement activities at the Southern Climate Impacts Planning Program, please contact us at **(405)325-7809** or **(225)578-8374**.

Monthly Comic Relief



Copyright © 2017 - Brian Gordon - The Reason
for Daylight Saving Time

