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EXTREME TEMPERATURE VARIABILITY IN THE SOUTHEASTERN UNITED STATES: TRENDS IN MISSISSIPPI STATE

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Abstract:
Over the past century, Mississippi has experienced significant increases in average temperatures, contributing to a variety of environmental and socioeconomic challenges. Changing precipitation patterns, including more frequent and severe droughts, threaten the state's agriculture and water resources. At the same time, increasingly intense storms and floods pose risks to infrastructure and human safety. This paper explores evolving climate patterns in Mississippi, focusing on increasing temperatures, changing precipitation patterns, and the increasing frequency of extreme weather events, and examines the broader implications of these extreme temperature trends for Mississippi's economy, health, and livelihoods. Trend analysis shows that Mississippi experiences year-round precipitation, hot summers, and relatively mild winters. The warm waters of the Gulf of Mexico serve as a major source of moisture and help moderate temperatures along the Mississippi coast, which impacts tourism and agricultural productivity. Over the past thirty years, the average annual precipitation in Mississippi has been 58.9 inches, with the northern region receiving about 50 inches and the coastal region nearly 65 inches. The state's average temperature is extremely high, with a record low of 53°F and a record high of 75.3°F. This paper offers valuable insights into how Mississippi can adapt to a warming climate while protecting its natural resources and communities. The analysis highlights the need for stronger climate adaptation strategies and policy interventions to mitigate these impacts, with a focus on sustainable land and water management practices. This paper provides valuable insights for policymakers, environmental scientists, and stakeholders seeking to address the state's climate challenges.

Keywords: Climate change, Mississippi, rising temperatures, precipitation patterns, extreme weather, environmental policy, adaptation strategies.

INTRODUCTION

The phenomenon of extreme temperature variability is increasingly recognized as one of the main consequences of climate change. Rapid and noticeable temperature variations over brief durations are the hallmarks of this variability, which has major ramifications for human health, ecological systems, and socioeconomic stability. Mississippi offers a fascinating case study for analyzing these dynamics in the Southeastern United States, an area already vulnerable to various harsh weather patterns. The difficulties caused by significant temperature variability are best shown by Mississippi, which has a distinct geographic location, diverse topography, and socioeconomic weaknesses. The climate of the Southeastern United States is shaped by subtropical systems, the Gulf of Mexico, and cyclical atmospheric phenomena like the El Niño-Southern Oscillation (ENSO). Historically, the region has been marked by substantial seasonal and interannual climate variability, with Mississippi frequently at the center of these changes. Anthropogenic climate change has increased the frequency and severity of temperature extremes (Diffenbaugh et al., 2005).

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Carter et al. (2018) intimated that the climate of Mississippi is primarily humid subtropical, with hot summers, mild winters, and heavy precipitation all year. Nonetheless, the state has seen a rise in extreme heat events, record-breaking cold spells, and sudden changes in temperature. Temperature fluctuations like these impair infrastructure, reduce agricultural output and worsen health inequalities, especially for vulnerable groups. Temperature extremes in the Southeastern United States have significantly increased during the previous century, according to recent studies. Wang et al. (2021) argue that high heat days were becoming more common in Mississippi, whereas extreme cold occurrences were becoming less frequent. These tendencies are consistent with more general regional and worldwide trends, where temperature distributions are skewed by climate change, leading to a rise in extreme highs and a decrease in severe lows (Rogelj et al., 2018).

Meehl et al. (2012) posit that the Southeastern United States has distinct aberrations despite these general patterns. The Southeast has seen a so-called "warming hole," an area with less noticeable warming or cooling trends in the 20th century than other US regions. However, Risser et al. (2017) contend that recent studies indicate that this pattern is abating, with Mississippi displaying increased variability and a noticeable increase in average temperatures. A variety of interconnected factors causes extreme temperature variability in Mississippi. Seasonal and interannual variations are influenced by natural climate cycles like ENSO. Trenberth (2011) intimated that La Niña years are linked to warmer, drier weather, whereas El Niño often offers milder, wet winters.

Kalnay and Cai (2003) emphasize that the region is now more vulnerable to severe temperature events due to anthropogenic reasons, especially greenhouse gas emissions. Urbanization and the heat island effect accompanying local temperature extremes are worsened, especially in places like Jackson. Temperature variations are exacerbated by changes in land use, such as deforestation and agricultural growth, which also affect surface albedo and evapotranspiration rates. Extreme temperature variability has wide-ranging and significant effects in Mississippi. One of Mississippi's main economic sectors, agriculture, is especially at risk. Temperature extremes can affect crops, including corn, soybeans, and cotton; heat stress at key growth phases lowers yields and quality (Lobell et al., 2011). Thornton et al. (2009) argue that livestock are also in greater danger since extended heat waves raise mortality rates and lower productivity.

Sarofim et al. (2016) opine that hot temperature variability has had an adverse effect on the public health system in the southeastern United States. Extreme heat events raise the risk of heat-related disorders, including heatstroke and exhaustion, especially in children, the elderly, and people with underlying medical issues. Even though they happen less frequently, cold extremes can cause problems such as hypothermia and elevated cardiovascular stress. Mississippi's socioeconomic inequalities also worsen these health effects since low-income areas frequently lack access to sufficient heating or cooling supplies.

Aivalioti (2015) argues that temperature fluctuations may stress energy and infrastructure systems. Extended heat waves increase demand for electricity, putting pressure on power systems and raising the risk of outages. On the other hand, severe cold weather can cause transportation system problems, frozen pipelines, and broken water mains. These difficulties highlight the necessity of robust infrastructure that can survive these kinds of shocks.

According to Stevens (2024), approximately 1,220 Americans die each year due to extreme heat. In 2004, there were 297 fewer heat-related deaths than the average over the previous 20 years. However, in 2018, heat-related fatalities reached 1,008. Alarmingly, this number increased to 1,600 in 2021, marking a 59% rise over the previous four years and a staggering 439% increase since 2004. As of April 2023, about 69.7 million Americans lived in counties with average temperatures higher than those in the 20th century (USA Facts, n.d.).

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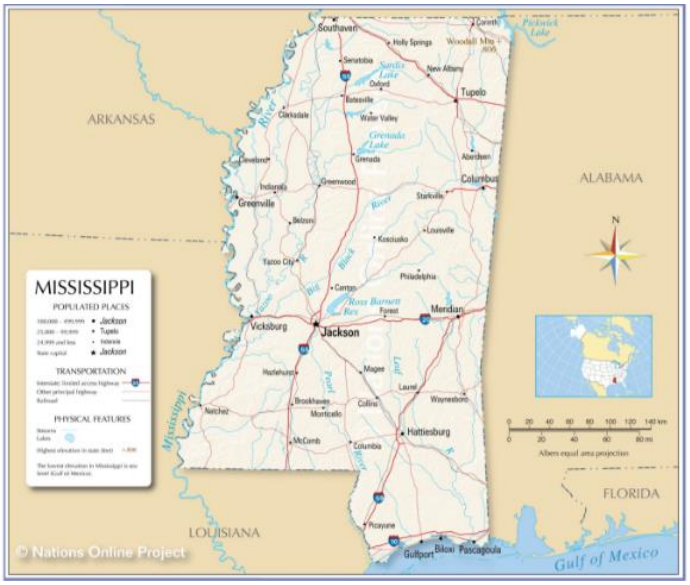
This paper meticulously examined relevant literature geared toward understanding the extreme temperature variability observed in Mississippi for the past three decades. Scientific discussions around climate change sometimes involve complex terminology and jargon that can be challenging for non-experts to comprehend. Therefore, the paper comprehensively analyzes Mississippi's extreme temperature trends using a simplified, valid, and reliable National Oceanic and Atmospheric Administration (NOAA) dataset. The emphasis of the trend analysis is on temperatures, although the data partially include precipitation trends. The paper seeks to enhance understanding of the local impacts of high temperatures in Mississippi trends.

METHODS

Data Collection. Mississippi's temperature variability must be quantified and understood using strong methodological frameworks and precision. Trend analysis benefits greatly from the long-term climatological records postulated in the National Oceanic and Atmospheric Administration (NOAA) and Mississippi State Climate dataset. This paper utilized a reliable dataset obtained from the National Oceanic and Atmospheric Administration (NOAA) and US Climate Data. It employed trend analysis, a statistical method, to identify patterns in the data over time, providing insights into how various variables changed during that period. The process involved collecting and organizing relevant information and using Python statistical tools to run and represent this data visually through graphs and charts. The approach is vital for strategic planning, risk assessment, and decision-making based on historical climate trends in Mississippi. The paper focused on the annual weather averages of sixteen cities in Mississippi from 1991 to 2020, as well as changes in the state's average temperature and precipitation levels. The unpredictability of the climate has significant implications for the residents and ecosystems of Mississippi.

Study Area. The paper is based on temperature trends recorded in various cities across Mississippi. The map of Mississippi illustrates the state's lakes, rivers, cities, and highways. It includes over forty-three significant cities and communities, such as Jackson, Biloxi, Hattiesburg, and Gulfport, as shown in Figure 1.



Source: The National Atlas of the United States of America

Figure 1. Map of Mississippi State

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Mississippi, often referred to as part of the Dixie region, is in the Southern United States and has a southern marine boundary with the Gulf of Mexico. It also shares borders with Alabama, Tennessee, Arkansas, and Louisiana. The Magnolia state is experiencing significant impacts from climate change throughout the major cities, which include Jackson, Gulfport, Hattiesburg, and Biloxi (Morris, 2014). These cities, with their diverse geographical and socioeconomic contexts, illustrate the diverse challenges and responses to climate change across the state. Over the past century, climatic patterns have shifted, with rising temperatures and altered precipitation rates becoming increasingly evident. The state has observed a gradual increase in average temperatures. Data from the National Oceanic and Atmospheric Administration (NOAA) reveal that the average temperature has increased by approximately 1.5°F over the past century. Precipitation patterns have also become more erratic, with heavier rainfall events and severe droughts (Andresen et al., 2012; NOAA, 2022).

As the state capital and largest city, Jackson is a central hub for Mississippi's political, economic, and cultural activities. Located in the state's central region, it is characterized by urban sprawl, a diverse population, and significant infrastructure. Gulfport, the second-largest city, lies on the Gulf Coast and is crucial to the state's maritime economy. It is known for its ports, tourism, and proximity to the Gulf of Mexico, which makes it particularly vulnerable to sea-level rise and hurricanes. Hattiesburg, situated in southern Mississippi, is an essential educational and economic center and home to the University of Southern Mississippi. It features a mix of urban and rural characteristics and is affected by both inland and coastal climate impacts. Biloxi, located on the Gulf Coast, is famous for its casinos, tourism, and military presence. Like Gulfport, it faces significant sea-level rise, hurricanes, and coastal erosion risks. Jackson has experienced noticeable temperature increases, especially during the summer months. Rising temperatures exacerbate heatwaves, leading to public health concerns such as heat exhaustion and heatstroke. In Mississippi, higher temperatures affect human health, increase the demand for cooling, strain water resources, and impact local ecosystems.

Hattiesburg faces similar temperature increases, disrupting agricultural activities, particularly cultivating heat-sensitive crops. Its coastal location somewhat moderates Biloxi's temperatures, but rising temperatures still pose significant risks, especially for vulnerable populations and the elderly (Schoof, 2013). Jackson has seen increased frequency and intensity of heavy rainfall events, leading to urban flooding, overwhelmed drainage systems, and water quality issues. Gulfport's precipitation patterns have become more erratic, with severe storms causing flooding and damaging infrastructure, homes, and businesses. Hattiesburg experiences heavy rains and droughts, impacting agriculture, water supply, and flood management systems. Biloxi faces similar challenges, with heavy rains leading to flash floods and hurricanes causing extensive damage. Though less frequent, drought can also affect water availability and local agriculture (C2ES, n.d.; Mississippi Gulf Region, n.d.).

The cities of Gulfport and Biloxi are the most affected by rising sea levels. In the Gulf of Mexico, increasing sea levels are causing coastal erosion, destroying wetlands, and raising the risk of flooding. These impacts threaten property, infrastructure, and local economies, heavily relying on tourism and fishing. In Jackson, heightened temperatures and changing precipitation patterns contribute to health risks, including heat-related illnesses, respiratory issues due to poor air quality, and vector-borne diseases. In Gulfport, climate change worsens public health issues by increasing the prevalence of mosquito-borne illnesses, heat-related health problems, and mental health stress from extreme weather events. Hattiesburg faces similar health challenges, with an added focus on agricultural impacts that affect food security and nutrition. Biloxi's health risks include those related

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to heat, flooding, and hurricanes, which can lead to injuries, displacement, and long-term health problems (Petkova et al., 2015).

Jackson's economy, which relies on both the public and private sectors, is vulnerable to the impacts of climate change. These changes could disrupt infrastructure and increase operating costs. Gulfport's economy is particularly at risk due to its dependence on the port and tourism, making it susceptible to climate-related events such as heatwaves, hurricanes, flooding, and rising sea levels.

Hattiesburg's economy, which encompasses agriculture, healthcare, and education, also faces threats from extreme weather. Such events can affect everything from crop yields to the safety of patients and students. Biloxi is economically sensitive to climate change effects, primarily because of its tourism industry and military presence. While the term climate is often discussed in relation to the future, average temperatures and the frequency and intensity of extreme weather events are changing. Mississippi has recently experienced unprecedented heatwaves, increased flooding and drought, and a rapid rise in sea levels. As global temperatures rise, the state will likely see more heatwaves, droughts, floods, rising sea levels, and stronger hurricanes (Seneviratne et al., 2021).

RESULT AND DISCUSSION

Temperature Trends. The Paris Climate Agreement, established in 2015, aims to limit global warming to well below 2°C above pre-industrial levels and to strive for a more ambitious target of 1.5°C. This agreement represents a global commitment to reduce greenhouse gas emissions and mitigate the impacts of climate change (Damoah et al., 2023). Nearly all nations have signed on, agreeing to set and regularly update voluntary targets for reducing emissions, transitioning to renewable energy, and promoting sustainable development. Achieving these goals is essential for minimizing climate-related consequences, including extreme weather events, rising sea levels, and biodiversity loss (En-Roads, 2024).

Mississippi is one of the few places in the world experiencing a net warming trend. Forecasts predict that this century will witness significant warming. Additionally, extreme precipitation events are expected to occur more frequently and intensely. Elevated temperatures may exacerbate existing drought conditions by accelerating soil moisture loss during dry periods. While Mississippi's average annual temperature has only increased by a slight 0.1°F since the early 20th century, recent years have been unusually warm, with the warmest five-year span occurring between 2016 and 2020.

In the 1920s, 1930s, and 1950s, Mississippi experienced above-average temperatures. However, in the 1960s and 1970s, there was a significant temperature drop of approximately 2°F. Since then, temperatures have increased by over 2°F. Since 1900, the contiguous United States has warmed by about 1.8°F, with only a slight cooldown occurring from the 1930s to the 1960s. Several factors may explain the differences in warming rates, including increased cloud cover and precipitation, heightened emissions of small particles from burning coal, natural processes related to forest regeneration, reduced heat flux from irrigation, and multidecadal variability in surface temperatures in the tropical Pacific and North Atlantic. The amount of greenhouse gases emitted into the atmosphere in the coming decades will influence future temperature rises. Rogelj et al. (2018) argue that, in the year 2100, global temperatures are expected to increase by an additional 3 to 12°C. Forecasts predict that the Southeast region of the United States will see temperature increases of 3 to 4 degrees by 2100, with interior states likely to experience 1 to 2 degrees of warming more than coastal areas. Figure 2 illustrates the predicted and observed temperature increases, along with Mississippi's hot and freezing days and the expected rise in emissions by 2100 (Raftery et al., 2017; Tollefson, 2020).

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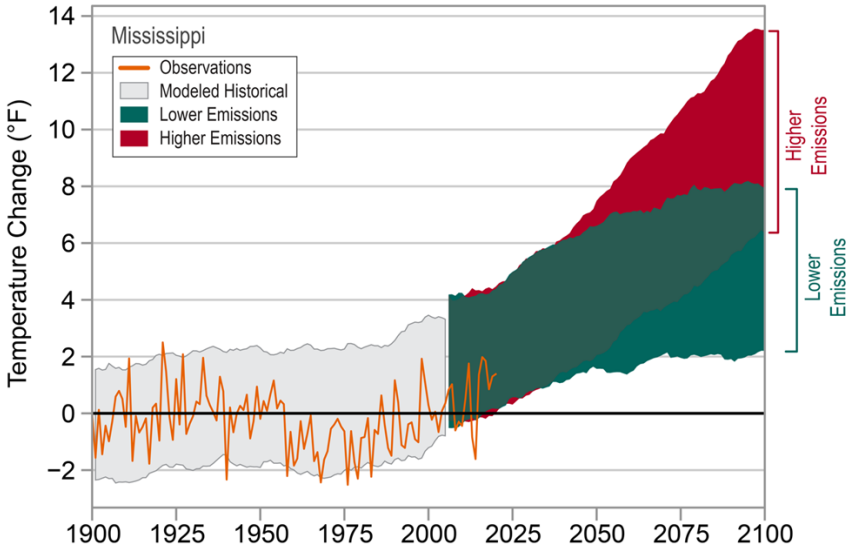

Source: CISESS and NOAA NCEI.

Figure 2. Observed and Projected Temperature Change in Mississippi State

The graph in Figure 2 compares the average temperature from 1901 to 1960 with the observed and anticipated changes in Mississippi's near-surface air temperature. According to the data, Mississippi's temperatures have increased by 0.1°F since the turn of the 20th century. The warmest five-year span that occurred consecutively was from 2016 to 2020. Expectations indicate that this century will see historically unprecedented warming, with less warming predicted for a future with fewer emissions and greater warming predicted for a future with higher emissions (Raftery et al., 2017; Tollefson, 2020).

3.2 Precipitation Patterns

The state's northern region receives less than 35 inches of rain annually, while the Mississippi coast receives over 65 inches. Rising temperatures have led to increased evaporation and heightened storm activity, contributing to a rise in rainfall along the coast in recent years. Conversely, droughts occur more frequently in the delta, central Mississippi, and northern areas. The year 2011 experienced the most significant drought in American history, with dry conditions and prolonged dry spells causing $810 billion in damages throughout the Southeast (University of Texas, n.d.). A similar drought in 2008 incurred costs of $8.7 billion for the United States, with 70% of the losses stemming from corn, cotton, and wheat; soybeans and grain sorghum followed. Tables 1 and 2, along with Figures 4 and 5, illustrate the trends in recorded average temperatures and precipitation for Mississippi State.

Table 1. Mississippi Statewide Temperature and Precipitation Averages (1991-2020)

Month	High (°F)	Low (°F)	Precipitation (in)
Jan	56.0	35.2	5.5
Feb	60.6	38.7	5.3
March	68.4	44.9	5.5
April	75.8	51.8	5.7
May	83.1	60.5	4.7
June	89.0	68.0	4.7
July	91.3	70.8	5.0
Aug	91.2	69.8	4.5

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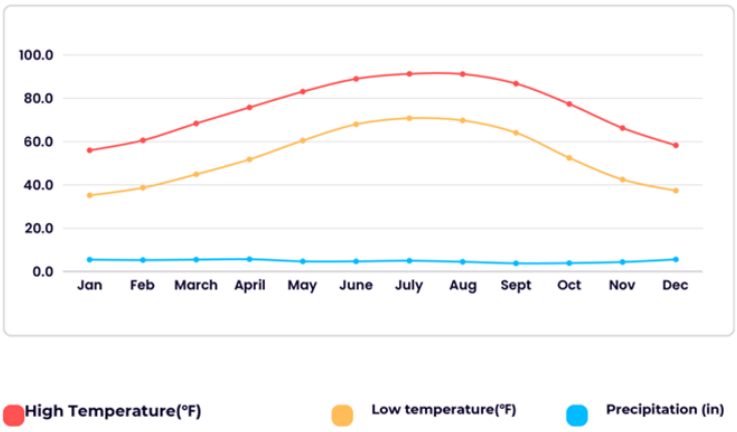
Sept	86.8	64.1	3.8
Oct	77.4	52.5	3.9
Nov	66.3	42.5	4.4
Dec	58.3	37.4	5.6
Entire Year	75.3	53.0	58.5

Source: NOAA: US Climate Data (2024)



Source: NOAA; US Climate Data

Figure 3. Mississippi Statewide Temperature and Precipitation Averages (1991-2020)

According to data from NOAA and US Climate Data (2024), Mississippi's weather over the past three decades has been marked by inconsistency and unpredictability. There has been an unprecedented rise in temperatures, with recorded highs during the summer months reaching 89°F in June, 91.3°F in July, 91.2°F in August, and 86.8°F in September. This has resulted in an annual average temperature of 75.3°F, as illustrated in Fig. 4. This figure shows a pattern of rising high and low temperatures along with precipitation levels. The winter months, December, January, and February, record the lowest average temperatures, measuring 37.4°F, 35.2°F, and 38.7°F, respectively. Compared to other states, Mississippi receives an average of 5.7 inches of precipitation per year, as detailed in Table 1 and Fig. 3. These visual aids highlight the trends more clearly. The increased precipitation has led to various weather-related events, including storms, tornado alerts, megafloods, flash floods, and hurricanes. This climate unpredictability has severely affected both the ecosystem and public health in the state of Mississippi.

Table 2. Mississippi Cities Yearly Weather Averages (1991-2020)

City	High °F	Low °F	Record High°F	Low °F
Aberdeen	73.7	51.2	114	-15
Biloxi	76.5	60.8	104	1
Greenville	74.4	53.9	110	-2
Gulfport	77.3	59.5	107	1
Hattiesburg	78.1	55.4	107	-1
Hernando	72.5	51.3	112	-12
Houston	72.9	49.9	109	-10

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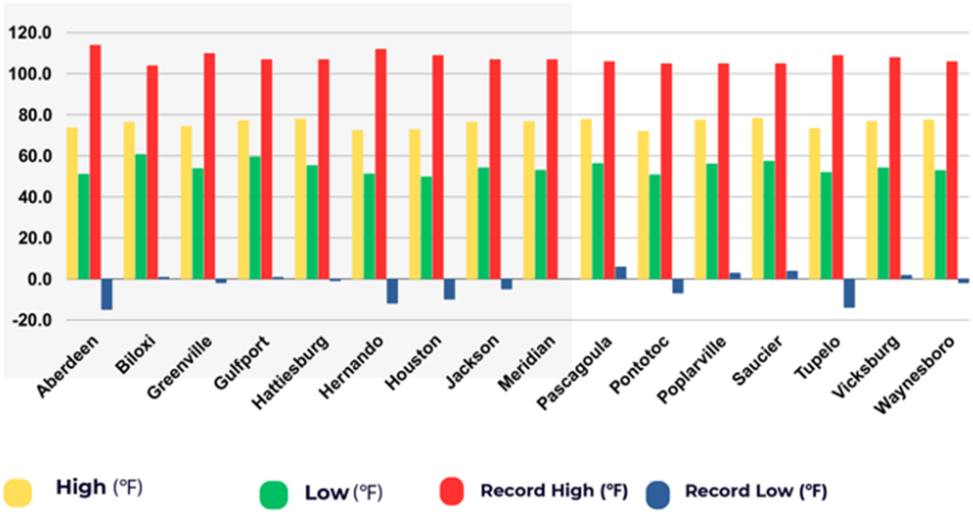
Jackson	76.6	54.3	107	-5
Meridian	76.8	53.1	107	0
Pascagoula	77.9	56.4	106	6
Pontotoc	72.1	50.9	105	-7
Poplarville	77.6	56.2	105	3
Saucier	78.4	57.5	105	4
Tupelo	73.5	52.1	109	-14
Vicksburg	76.9	54.3	108	2
Waynesboro	77.6	53.0	106	-2

Source: NOAA; US Climate Data



Source: NOAA; US Climate Data (2024)

Figure 4. Mississippi Cities Yearly Weather Averages (1991-2020)

The data trends indicate that Mississippi's temperature and precipitation variability have been inconsistent and unpredictable over the past 30 years. According to NOAA, the monthly average temperatures show unprecedented highs in June, July, August, and September, with recorded temperatures of 86.8°F, 89°F, 91.3°F, and 91.2°F, respectively. The overall annual monthly average temperature is 75.3°F. US Climate Data (2024) states that the state experiences year-round precipitation. The lowest monthly average temperatures occur in December, January, and February, with averages of 37.4°F, 35.2°F, and 38.7°F, respectively. Research indicates that this climate variability has impacted Mississippi's public health and ecosystem.

Temperature observations from 16 cities reveal record-high temperatures throughout these urban areas, with all 16 cities recording average highs exceeding 100°F. Among these cities, Aberdeen and Tupelo have been identified as the hottest and coldest locations, with summer temperatures reaching 109°F and 114°F and winter temperatures dropping to -14°F and -15°F, respectively. The inhabitants of Mississippi face extreme heat, alongside severe droughts and flooding due to climate change. Tornado damage in Aberdeen is significantly above both state and national averages. As temperatures continue to rise, cities across Mississippi experience increased storm surges. Warmer air holds more moisture, intensifying storms and resulting in violent thunderstorms and frequent lightning.

Data collected from 1991 to 2020 indicates a clear trend: heat waves in Mississippi are becoming hotter and more frequent. Researchers have determined that these changes are not due to

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natural fluctuations but rather to climate change. Even after sunset, residents of Mississippi experience little relief from the intense heat, as nighttime temperatures are now consistently higher.

In April 2023, 69.7 million Americans lived in counties where the average temperature exceeded levels recorded in the 20th century. Even in areas where high temperatures are common, Americans are experiencing longer heat waves this year. The Environmental Protection Agency has referred to these conditions as "heat domes" or "heat islands." For instance, Phoenix, Arizona, recorded an average daily high temperature of 114.7°F in July (EPA, n.d.).

The fewest heat-related deaths recorded in the US over the past 20 years was 297 in 2004. In 2018, 1,008 Americans lost their lives due to heat-related causes, and this number rose to 1,600 in 2021. This represents a 59% increase from just four years prior and an alarming 439% increase compared to 2004. However, these figures are still lower than the highest recorded temperature in Mississippi, which reached 115°F in Holly Springs on July 29, 1930. According to USA statistics (n.d.), Mississippi endured an extreme summer in 2023, with several towns setting new daily heat records. It appears that 2024 may bring even hotter conditions.

According to the National Weather Service Climate Prediction Center, the odds suggest a hotter-than-normal summer, with a 40% to 50% likelihood of elevated temperatures in June, July, and August. Mississippi's climate variability has led to record-high temperatures. For instance, Jackson recorded 106 degrees in August 2023, and temperatures have risen slightly since then. The historical record high reached 107 degrees in 2000. Heatwaves disproportionately impact impoverished communities and Black Americans. The counties most affected during these heatwaves are in northwest Mississippi, including the Mississippi Delta, among the country's poorest regions. Additionally, Mississippi has the highest concentration of African Americans in the United States (NOAA, 2022; US Climate Data, 2024).

Intensified hurricanes and storm surges, ongoing sea level rise and variations in rainfall suggest that Mississippi will likely experience more frequent periods of heavy precipitation interspersed with prolonged dry spells. Climate change raises the likelihood of powerful storms, heat waves, floods, droughts, and other extreme weather events. There has been a notable increase in droughts' frequency, duration, and intensity. After a drought, rainfall falls swiftly and heavily, leading to flash floods and damaging aging infrastructure. According to Damoah et al. (2024), we can expect an increase in the frequency of large wildfires fueled by rising temperatures, higher humidity, and more lightning strikes. Over the next century, global sea levels will rise between 1 to 6 feet. If the sea level rises by six feet, most of Gulfport, Biloxi, Ocean Springs, Pascagoula, and Bay St. Louis will be submerged (USGS, n.d.).

We can also anticipate longer growing seasons for plants, changes in the types of plants that can thrive in Mississippi, and more intense rainfall events that will lead to frequent flooding in agricultural areas. Changes in hardiness zones have already begun, and as winter freezes occur less often, these zones will continue to shift northward. Hardiness zones are used to categorize the types of plants that can grow in a specific area based on the local climate. As temperatures rise, more tropical plants that can endure milder winters will move northward, allowing exotic plants and insects to displace native species (USDA, n.d.; Lumpkin, 2020).

According to Ding et al. (2021), two main effects of global warming are a general decline in freezing episodes and frosts and a notable increase in hot days (over 95 degrees) yearly. Higher heat and less cooling are anticipated to lead to more heat-related mortality, more vector-borne illnesses, and a significant shift in plant species. Even though rising temperatures result from global warming, it is not easy to understand climate change. Mississippi has had a rise in temperature during the past 30 years, but not as gradually as the rest of the nation. Climate change has resulted in a trend for

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Mississippi that includes fewer days with freezing temperatures in the winter, hotter summer evenings, and less respite from protracted heat waves.

As the number of freezing days and yearly frosts dropped during the past ten years, mosquito-borne diseases such as malaria and dengue fever began to move Southeast. In certain areas of Mississippi, the number of freezing days has decreased by an average of 10–16 days annually since 1970. In the last 23 years, as heat waves have increased in frequency and intensity, the annual rate of heat-related illnesses and fatalities in the United States has tripled. Higher temperatures kill more people each year than all the combined effects of hurricanes, floods, tornadoes, blizzards, and lightning. A two-degree increase in global temperature has been the cause of all the environmental changes seen over the past 150 years. Figures 2 and 3 illustrate the projections of Raftery et al. (2017) and Tollefson (2020) that the US Southeast will see an additional 4–8 degrees of temperature increase by 2100.

CONCLUSION

Extreme heat is one of the deadliest and most costly climate disasters, with global economic losses exceeding $2 trillion. Major cities in Mississippi face unique challenges due to their geographical location and socioeconomic conditions. Addressing these issues requires a combination of legislative measures, community involvement, and technological advancements. Temperature fluctuations significantly impact the state's environment, economy, and public health. To mitigate these effects and protect Mississippi's future, it is crucial to implement effective adaptation and mitigation policies. Communities, businesses, and lawmakers' collaboration could adopt sustainable practices and enhance resilience against climate change's current and potential impacts. It involves supporting renewable energy sources, incorporating sustainable land use planning, and implementing comprehensive climate action plans with specific emission reduction targets. It also requires adherence to zoning regulations and building codes that enhance resilience to extreme weather and flooding.

Additionally, it is essential to raise public awareness about the hazards posed by climate change, encourage community involvement in resilience-building efforts, and provide funding for local projects, such as urban gardening, green infrastructure initiatives, and community preparedness campaigns. Promoting wind and solar energy use will help reduce reliance on fossil fuels.

Investing in technology that improves the resilience and efficiency of transportation, electricity, and water systems is crucial. As global warming intensifies, proactive measures to mitigate the impact of heat waves become increasingly important. In response to the rising extreme heat experienced by communities worldwide, this paper recommends using the Urban Heatwave Risk Index as a tool for equitable decision-making. By adapting to and addressing the effects of climate change, Mississippi can protect its communities, natural resources, and citizens' well-being.

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