

Michigan Climate Change- Extreme Heat

Publication Date: 07/12/2024

Abstract

The Michigan Department of Health and Human Services (MDHHS), Michigan Environmental Public Health Tracking (MiTracking) Program obtained this dataset from the Centers for Disease Control and Prevention (CDC), from the raw, grid-level modeled NLDAS data using meteorological data from NASA. The MiTracking Program accesses CDC datasets through an Applied Programming Interface (API). This dataset includes the years 1979 to the most current year available. The dataset contains the information needed to calculate the nationally consistent data and measures for historical extreme heat in the state of Michigan for use on the MiTracking Data Portal.

This dataset contains the following annual Michigan extreme heat and historic temperature metrics:

- Number of extreme heat days with the following parameters:
 1. Heat index.
 2. Absolute threshold of 90°F.
- Number of extreme heat events with the following parameters:
 1. Heat index.
 2. Absolute threshold 90°F.
 3. Minimum duration of 2 consecutive days per event.

The measure is used to see how the number of extreme heat days and events are changing over time.

This dataset is updated every year.

All users are recommended to read and fully comprehend the metadata prior to data use. To access these data, please visit the [MiTracking Data Portal](#).

Purpose

MiTracking developed this dataset to provide public health professionals, researchers and the public with summary data and information to better understand spatial and temporal trends of extreme heat in Michigan. The average temperature of the Earth increased by 2 degrees Fahrenheit since the late 1800s, leading to changes in long-term climate patterns and altering the weather experienced day to day across the world.¹

These changes could affect human health in possibly serious ways. The World Health Organization (WHO) has called climate change, “The greatest threat to global health in the 21st

century.”² The public health and medical communities also recognize that addressing climate change is one of the greatest health improvement opportunities of this century.³

Along with the rest of the world, Michigan’s climate is changing. Overall, Michigan has gotten warmer and wetter since the mid-20th century. Since the 1950s, annual average temperature has increased by nearly 2.3 degrees Fahrenheit while annual average precipitation has increased by 14 percent in the Great Lakes region. The changes in the overall climate conditions are also leading to shifting seasonal patterns and more extreme and erratic heat and precipitation events. This includes more frequent extended periods of high heat and humidity and more precipitation occurring as heavy or extreme events. Current climate projections show those extreme weather patterns are projected to increase through the 21st century.⁴

Health effects such as heat cramps, heat exhaustion, heat syncope and heat stroke can happen during high ambient temperatures. Therefore, tracking temperature and relative-humidity data can help monitor these health effects associated with extreme heat. That is why the CDC Climate and Health Adaptation and Tracking programs have worked to provide climate and health data that will help public health officials and their partners respond.

Supplemental Information⁵

The CDC evaluates and processes raw, grid-level, modeled North American Land Data Assimilation System (NLDAS) data from National Aeronautics and Space Administration (NASA) to create county-level measures of extreme heat. National Weather Service Office weather stations provide reliable temperature and relative-humidity data; however, they are not always near population centers. The NLDAS contains modeled, quality controlled, spatially and temporally continuous meteorological data for Michigan and throughout the U.S.

Keywords

Heat; extreme heat; historical extreme heat; heat index; temperature; humidity; absolute threshold; climate change; climate; NLDAS; North American Land Data Assimilation System; environment

Bounding Coordinates

Geographically, all these data take place within the state of Michigan. This means that all cases fit within the latitude/longitude coordinates listed below.

- West Bounding Coordinate: -90.41813399999995.
- East Bounding Coordinate: -82.418394000000006.
- North Bounding Coordinate: 48.189534000000002.
- South Bounding Coordinate: 41.696088000000003.

Other Information on Data

- **Level of Geographic Detail:** County.
- **Currentness Reference (when data were last updated):** 5/31/2023.
- **Frequency at which the data are updated:** Annually.
- **Data Status:** Complete.

Completeness Report

The dataset contains historical extreme heat days and events for the state of Michigan for the years 1979 to the most current year available. The data are available at the county level only and include only the months May through September.

Data Processing Description⁵

Data Source: NLDAS data contain modeled, quality controlled, spatially and temporally continuous meteorological data for Michigan and throughout the United States. The dataset from which MiTracking data were obtained was created by the CDC.

Data Calculations:

1) CDC's dataset

- NLDAS data, available at the 1/8th-degree grid (approximately 14x14 km), consist of 103,936 grid cells that cover the U.S., excluding Alaska and Hawaii.
- CDC converts grid-level data to U.S. Census tract and county level estimates to determine population exposure to extreme heat and enable linkage to health datasets. A multi-stage geo-imputation approach is used to convert grid-level meteorological data.
 - **Step 1:** Each U.S. Census block centroid is assigned to a NLDAS grid cell based on a containment relationship, and block-level estimates of daily heat metrics are estimated from hourly grid-level data.
 - **Step 2:** Block-level population data are used as weights to calculate a population-weighted average of daily heat metrics by U.S. Census tracts. Average county-level estimates of daily heat metrics using tract population data as weights are derived from this census tract level data product.
 - **Step 3:** The 90th, 95th, 98th and 99th percentile values for daily heat metrics specific to each geography and summer months are calculated.
 - Extreme heat days are identified for each combination of the following parameters:
 1. Temperature or heat index.
 2. Absolute (i.e. 90°F, 95°F, 100°F, 105°F) or relative (i.e. 90th, 95th, 98th, and 99th percentile values) threshold.
 - Extreme heat events are identified using the following parameters:

1. Temperature or heat index.
2. Absolute (i.e. 90°F, 95°F, 100°F, 105°F) or relative (i.e., 90th, 95th, 98th and 99th percentile values) threshold.
3. Durations of consecutive days (i.e, 2 or more, 3 or more).

2) MiTracking dataset

- Data were uploaded into the MiTracking system using an Applied Programming Interface (API). Data were selected from the CDC dataset based on the following definitions:
 - Extreme heat days using the heat index with an absolute threshold of 90°F or above.
 - Extreme heat events using the heat index with an absolute threshold of 90°F or above for at least 2 consecutive days.
- Monthly average temperatures were calculated using the heat index in degrees Fahrenheit.
- Extreme heat days and events, and monthly average temperatures were included for the years 1979 to the most current year available.

Access Constraints

There are no access constraints for data available through the MiTracking Data Portal.

Use Constraints

All users are recommended to read and fully comprehend metadata prior to data use.

These data cannot be used for commercial purposes and shall not be used to engage in any method, act or practice to conduct the solicitation or advertisement of goods, services or real estate to Michigan consumers. Efforts have been made to assure the accuracy of the data. MDHHS specifically disclaims responsibility for any analyses, interpretations or conclusions made by those who access this information.

Limitations of the data:

- Modeled data overall perform relatively well but might differ from weather station-based observations. As a result, an area may be described as having higher or lower temperatures than what occurred.
- County-level estimates of temperature and heat index are calculated by processing modeled data at 1/8th-degree grid. This conversion of grid-level data to other geographies using population-weighted centroid approach might lead to potential misclassification of temperature and heat index for some areas.

Security Handling Description

If data are distributed, the use constraints specified in this metadata apply to all recipients of the data.

Distribution Liability

The MiTracking program is maintained, managed and operated by the Division of Environmental Health (DEH) within MDHHS. In preparation of these data, every effort has been made to offer the most current, correct, complete and clearly expressed information possible. Nevertheless, some errors in the data may exist. In particular, MDHHS disclaims any responsibility for source data, compilation and typographical errors and accuracy of the information that may be contained in these data.

These data do not represent the official legal version of source documents or data used to compile these data. MDHHS further reserves the right to make changes to these data at any time without notice.

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The sale or resale of the data, or any portions thereof, is prohibited unless with the express written permission from the Centers for Disease Control and Prevention’s National Environmental Public Health Tracking Program. All rights reserved. These data may not be used for commercial purposes without first obtaining written permission from MDHHS.

If errors or otherwise inappropriate information is brought to our attention, a reasonable effort will be made to fix or remove it. Such concerns should be addressed to the MiTracking Program.

Custom Order Process

For access to national and multi-state unrestricted or public use data, see [CDC Tracking](#).

For access to unrestricted or public use Michigan-specific data and information, contact the [Michigan Climate and Health Adaptation Program \(MICHAP\)](#).

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