MICHIGAN CLIMATE CHANGE - EXTREME HEAT & HISTORIC TEMPERATURE

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Abstract

The Michigan Public Health Tracking Program (MiTracking) has created a dataset that 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 metrics on extreme heat and historic temperature in Michigan per year:

- Number of extreme heat days with the following parameters (1) heat index and (2) absolute threshold of 90°F;
- Number of extreme heat events with the following parameters (1) heat index, (2) absolute threshold of 90°F, and (3) minimum duration of 2 consecutive days per event.
- Monthly average temperatures using heat index in degrees Fahrenheit.

This dataset is updated annually.

Purpose

MiTracking developed this dataset to provide public health professionals, researchers, and the general public summary data and information to better understand spatial and temporal trends of extreme heat in Michigan.

The average temperature of the Earth increased by 1.8 degrees Fahrenheit from 1901 to 2016 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 has called climate change, "The greatest threat to global health in the 21st century".[2] However, 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 also changing. Overall Michigan has gotten warmer and wetter since the mid-20th century. Annual average temperature has increased by three degrees Fahrenheit while annual average precipitation has increased by 4.5 percent. 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 Centers for Disease Control and Prevention's (CDC) Climate and Health Adaptation and Environmental Public Health Tracking programs have worked to provide climate and health data that will help public health officials and their partners respond.

Supplemental Information[5]

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 United States.

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 State of Michigan. This means that all cases fit within the latitude/longitude coordinates listed below.

West Bounding Coordinate: -90.418133999999995

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**)***:* 2/5/19

Frequency at which the data are updated: Annually

Data Status*:* Complete

Completeness Report

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

Data Processing Description[5]

Data Source: The North American Land Data Assimilation System (NLDAS) data contains 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 Centers for Disease Control and Prevention (CDC), from the raw, grid-level, modeled North American Land Data Assimilation System (NLDAS) data using meteorological data from the National Aeronautics and Space Administration (NASA). Note: National Weather Service Office weather stations provide reliable temperature and relative-humidity data; however, they are not always near population centers, thus the need for modeled data.

Data Calculations:

1) CDC's dataset

- North American Land Data Assimilation System (NLDAS) data, available at the 1/8th-degree grid (approximately, 14x14 km), consist of 103,936 grid cells that cover the United Sates, 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, and (2) absolute (e.g. 90°F, 95°F, 100°F, 105°F) or relative (e.g. 90th, 95th, 98th, and 99th percentile values) threshold. Extreme

heat events are identified using the following parameters (1) temperature or heat index, (2) absolute (e.g. 90°F, 95°F, 100°F, 105°F) or relative (e.g., 90th, 95th, 98th, and 99th percentile values) threshold, and (3) durations of consecutive days (e.g. 2 or more, 3 or more).

2) MiTracking dataset

- 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 – the most current year available.

The data only include the months May through September.

Access Constraints

There are no access constraints for data available through the Michigan Environmental Public Health Tracking program public portal.

Use Constraints

It is recommended that all users 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 Michigan Public Health Tracking Network 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.

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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 Michigan Tracking Program.

Custom Order Process

For access to national and multi-state unrestricted or public use data, please see: http://ephtracking.cdc.gov

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

Contact Information

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