MICHIGAN CLIMATE CHANGE - EXTREME PRECIPITATION

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Abstract

The dataset contains the information needed to calculate the nationally consistent data and measure for historical extreme precipitation in the State of Michigan for use on the Michigan Environmental Public Health Tracking (MiTracking) data portal.

This dataset contains the following metric on extreme precipitation in Michigan per year:

- Number of extreme precipitation days with an absolute threshold of 1 inch

The measure is used to see how the number of days of extreme precipitation is changing over time. This dataset is updated annually.

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 general public data and information to better understand spatial and temporal trends of extreme precipitation 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]

According to the International Panel on Climate Change (IPCC), annual precipitation has increased in certain parts of the US over the past century, which could result in increases in

the frequency, duration, and intensity of extreme weather events such as floods and storms.[5] Extreme weather events can directly impact human health through injuries, drowning, hypothermia, infectious diseases, and ongoing mental health,[6] as well as indirectly impact infrastructure and economic vulnerability, water resources (i.e. pollution and scarcity), and agricultural loss.[5] Both extreme precipitation and total precipitation have contributed to increases in severe flooding events in certain regions. Some health hazards such as injuries and drownings occur immediately after or during the flooding event, while other health impacts appear once the storm has passed. Increases in waterborne disease outbreaks have been reported following a heavy rainfall along with other variables affecting these associations.[7]

Buildings that experience water intrusion can develop mold contamination, which can lead to indoor air quality problems. Those living in damp indoor environments might experience an increased prevalence of asthma and upper respiratory tract symptoms.[7] Individuals living in urban areas with higher amounts of impermeable surfaces are more prone to the effects of floods and storms. Elderly populations are also vulnerable to extreme weather events due to limited mobility and adaptive capacity.[6] Therefore, tracking precipitation will help monitor health outcomes associated with extreme precipitation, as well as provide information needed to increase preparedness and awareness among communities and stakeholders about extreme precipitation.[8]

Supplemental Information[8]

The Centers for Disease Control and Prevention (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 precipitation. The NLDAS contains modeled, quality controlled, spatially and temporally continuous meteorological data for Michigan and throughout the United States.

Keywords

Precipitation; extreme precipitation; historical extreme precipitation; inches; rain; 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**):** 2/5/2019

Frequency at which the data are updated: Annually

Data Status*:* Complete

Completeness Report

The dataset contains the number of historical extreme precipitation days for the State of Michigan for the years 1979-the most current year available.

Data Processing Description[8]

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: Precipitation data from the NLDAS do include both rainfall and the liquid-equivalent of snowfall, but each is modeled separately. For more details, visit the NLDAS project website.

Data Calculations:

1) CDC's dataset

- North American Land Data Assimilation System (NLDAS) data, available at the 1/8th-degree grid (approximately 14km x 14km), consist of 103,936 grid cells that cover the United States, excluding Alaska and Hawaii.
- CDC converts grid-level data to U.S. Census tract and county level estimates to determine population exposure to extreme precipitation 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 estimate block-level estimates of daily total precipitation metrics from hourly grid-level data.
    - **Step 2**: Block-level population data are used as weights to calculate a population-weighted average of daily total precipitation metrics by U.S.

Census tracts. Average county-level estimates of daily total precipitation metrics using tract population as weights are derived from this Census tract level data product.

- **Step 3**: The 90th, 95th, 98th, and 99th percentile values of daily total precipitation metrics specific to each geography for all available years of data are calculated. Extreme precipitation days are identified using the following parameters (1) absolute (e.g., 0.01 inches, 1 inch, 2 inches, and 3 inches) or relative (e.g., 90th, 95th, 98th, and 99th percentile values) threshold.

2) MiTracking dataset

- Data were selected from the CDC dataset based on the following definitions:
  - Extreme precipitation days using an **absolute threshold of 1 inch**.

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:

- NLDAS modeled meteorological data estimates precipitation relatively well but might not accurately represent true precipitation levels across counties.
- County-level estimates for population exposure to extreme precipitation 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 precipitation for some areas.
- The total precipitation information from NLDAS includes the liquid equivalent of snow; however, given the procedures / datasets to estimate hourly precipitation there could be some accuracy issues in estimating snowfall.

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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Use of the data with other data shall not terminate, void, or otherwise contradict this statement of liability.

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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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