MICHIGAN AIR QUALITY

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Abstract

This dataset contains the information needed to calculate the nationally consistent data and measures for air quality in the State of Michigan for use on the Michigan public portal.

This dataset contains the following metrics for ozone and particulate matter 2.5 ($PM_{2.5}$) concentrations in Michigan per year:

- Number of days with maximum 8-hour average ozone concentration over the National Ambient Air Quality Standard (NAAQS) based on air monitor data only
- Number of days with maximum 8-hour average ozone concentration over the National Ambient Air Quality Standard (NAAQS) based on air monitor data and modeled data
- Number of person-days with maximum 8-hour average ozone concentration over the NAAQS based on air monitor data only
- Number of person-days with maximum 8-hour average ozone concentration over the NAAQS based on air monitor data and modeled data.
- Percent of days with $PM_{2.5}$ levels over the National Ambient Air Quality Standard (NAAQS) based on air monitor data only
- Percent of days with $PM_{2.5}$ levels over the NAAQS based on air monitor data and modeled data
- Number of person-days with $PM_{2.5}$ over the NAAQS based on air monitor data only
- Number of person-days with $PM_{2.5}$ levels over the NAAQS based on air monitor data and modeled data
- Annual average ambient concentrations of $PM_{2.5}$ based on seasonal averages and daily measurement from air monitor data only
- Annual average ambient concentrations of $PM_{2.5}$ based on seasonal averages and daily measurement from air monitor data and modeled data.

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) is responsible for collecting information on air quality from air monitoring stations located across the state. There are 26 locations in the state where $PM_{2.5}$ is monitored. EGLE provides air quality data to the Environmental Protection Agency (EPA) which maintains these types of data from states across the country in its Air Quality System (AQS). The Centers for Disease Control and Prevention (CDC) and the EPA work together to use the AQS to create the dataset. This includes developing a system for estimating air quality in counties that do not have air monitors. Data for these counties are called “modeled data.”

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

These data are used to calculate measures of contaminants in the air for ground-level ozone and $PM_{2.5}$. The dataset is intended to provide public health professionals, researchers, Tracking grantees, and the general public with summary information on air quality for the State of Michigan for the two contaminants listed above.

Supplemental Information

To be able to tell if people are possibly exposed to a dangerous level of ozone or $PM_{2.5}$, air quality measurements are compared to a national standard or limit. This concentration is listed in the National Ambient Air Quality Standards (NAAQS). The NAAQS, which also set limits for five other air pollutants, were established by the EPA under authority of the 1970 Clean Air Act.

The dataset provides ozone (monitor-derived) concentration data that will be statistically 'fused' with modeled concentration data (from the Community Multi-scale Air Quality [CMAQ] model) via EPA's Hierarchical Bayesian statistical space-time model (HBM). The HBM concentration output minimizes the bias and error inherent in monitored and modeled data and can be used to correlate concentration levels to specific health outcomes via concentration-response (C-R) relationships.

Limitations of the data:

- The air monitoring stations indicate the quality of air at a specific location and these measurements – along with other stations located within a county in some cases – are used to make general statements about an entire county. However, air quality likely varies within a county.
- The measure of person-days is used to provide an indication that incorporates both the number of days that a certain pollution level exists and the number of people potentially exposed. Similar to the limitation noted above, this assumes that a certain pollution level exists throughout a county and exposes the entire county population equally, which may not be the case.
- These measures represent only comparisons to the NAAQS, but they provide no information on the severity of ozone and $PM_{2.5}$ exposure, that is, the maximum concentration reached on a given day.
- These measures cannot tell us if higher rates of certain diseases, such as asthma, in a county are due to that county having a relatively large number of days exceeding the NAAQS for ozone and $PM_{2.5}$. Diseases are usually caused by a number of factors.
- Most of the state's counties have no air monitors and thus rely on modeled data. Modeled data are based on certain assumptions and if those assumptions are inaccurate, the modeled data will produce inaccurate results. Therefore, counties with modeled data may have less reliable results than counties that have air quality data provided by monitors.

Keywords

Ozone; Ground-level ozone; particulate matter; $PM_{2.5}$; Environmental hazard; Environment; Air quality; Environmental Protection Agency: Air Quality System; AQS; NAAQS; NAAQS violations; National Ambient Air Quality Standards; Clean Air Act; Air Quality Monitoring; Air Quality Modeling

Bounding Coordinates[1]

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**)*:*** Publish Date

Frequency at which the data are updated: Annually

Data Status*:* Complete

Completeness Report

This dataset contains air quality records for the State of Michigan for the years 2001-most recent. These data are used to calculate summary measures of monitored and modeled air contaminants at the county level.

The air quality data are tested to ensure that they are 75% complete during an area's ozone season. If data for a county do not achieve the 75% completeness test, then no estimate is made for the county. For $PM_{2.5}$ the air quality data is tested to ensure that there are 11 samples per quarter and 4 quarters per year for each area's year. If data for a county do not achieve this completeness test, then no estimate is made for the county

Data Processing Description[2]

The measured concentration data obtained from AQS monitors are stored in the EPA's database along with other attributes, e.g., sample date, state, county, etc. An EPA computer

[1] From CDC Tracking Metadata Creation Tool

[2] OVERVIEW: Air Quality Data Handling for EPHT Air Indicators, 2008. CDC Tracking Air Team workgroup.

program is used to extract the concentration data and associated attributes from the database and incorporate it into an *.xml file.

First, the EPA extracts the air quality data from the AQS. The EPA then uses the following steps in developing the air data and measures for the CDC Tracking Program's air quality indicators:

- Step 1 – The $PM_{2.5}$ daily concentrations (micrograms per cubic meter [$\mu g/m^3$]) (parameter code '88101' and duration code '7'), daily maximum 8-hour average ozone concentrations (parts per million [ppm]) (parameter code '44201' and duration code 'W'), and supplemental data fields (e.g. latitude, longitude, elevation) for all the monitoring sites across the US were accessed from the EPA's DataMart[3]. The data were obtained only from monitors that have been designated as Federal Reference Methods or equivalent. The data include any flagged values associated with exceptional events (high winds, fires, construction, etc.) regardless of concurrence by the EPA Regional Office. The flags were specified in the dataset.
- Step 2 – For the ozone concentrations, only data from monitors that met the minimum data completeness criteria set forth in the national air quality standard (i.e. if valid 8-hour averages are available for at least 75% of possible hours in a day or the maximum 8-hour average is above the level of the standard) were retained. For $PM_{2.5}$, the daily concentration values for duration code 7, by definition, are always complete.
- Step 3 – For each monitoring site, the maximum concentration at the site for each monitored day was retained. The pollutant occurrence code (poc) which distinguishes multiple monitors at a single site was listed in the output dataset. [This set forms the data file of site level data.]
- Step 4 – For county level measures, the maximum concentration within the area for each monitored day was retained. [This set forms the data file of county data.]

Second, data handling/processing, using the data files from EPA and the "how to" guides developed by the air team, was performed by CDC and were based on several givens and a series of mathematical steps.

- Before calculating any measure, an initial test is required to determine the percent completeness for any given county. The completeness test is used to determine if enough data in a year are available to calculate a representative indicator for the area and year.
- For $PM_{2.5}$-based indicators, a complete (valid) quarterly average must have at least 11 observations (valid 24-hour values). A valid annual average must have valid quarterly averages for all four quarters. The daily $PM_{2.5}$ indicators for each county are based on

[3] The EPA DataMart contains post-processed air quality data from EPA's Air Quality System (AQS), which is a data warehouse of federal, state, and local air program air quality data. The DataMart calculates 8-hour maximum concentrations from hourly ozone concentration s according to standard procedure used by EPA. See http://www.epa.gov/ttn/airs/airsaqs/index.htm for more information on the AQS.

the maximum values for each day among monitors in that county without regard to the quarterly or annual completeness. The annual average is based on using the monitoring data (not the county data) and performing the completeness test for each $PM_{2.5}$ monitor.

- For ozone-based indicators, the completeness test is whether 75% of the monitoring days in an area are available for the area's ozone season[4]. To calculate the indicators for each county, the maximum values for each day among monitors in that county were selected if the area had complete data.

Notes for data handling for each indicator:

- ***Number of days with ground-level ozone over the NAAQS:*** The domain/time of interest (e.g., counties in MI) were queried, and the days greater than the user selected ozone benchmark were counted.
- ***Number of person-days with ozone over the NAAQS:*** For the person-days indicator, the same calculations as above were done, and the ozone days were multiplied by the county (or state) population from the United States Census.
- ***Percent of days with $PM_{2.5}$ levels over the NAAQS:*** For percent of days, the domain/time of interest were queried. The days greater than the user selected $PM_{2.5}$ benchmark were divided by the number of monitored days to calculate the percent.
- ***Person-days with $PM_{2.5}$ over the NAAQS, in counties with monitors:*** The percent of days (in decimal form) from the indicator *Percent of days with $PM_{2.5}$ levels over the NAAQS* was taken and multiplied by 365 days (to estimate annual days) and then by the appropriate area's population (i.e., county).
- ***Annual average for ambient concentrations of $PM_{2.5}$:*** The domain/time of interest was queried based on monitors with complete quarterly and annual data for the years of interest (using the monitor site data file). Next, the quarterly average for each calendar quarter was calculated and the annual average for each monitor with four valid quarters was computed by averaging the quarterly averages. The $PM_{2.5}$ annual average indicator for each county is the maximum annual average among monitors with complete (4 valid quarters) data in that county.

Access Constraints

There are no access constraints for data available through the Michigan Environmental Public Health Tracking data portal. For more information or access to additional Michigan-specific data, please visit the EGLE Air Quality Division website.

[4] The data for the ozone season start and end dates was provided by EPA. If an area perhaps does not have a start/end date for its ozone season, the ozone season for the state the county resides in is the default season (see http://www.epa.gov/oar/oaqps/greenbk/o3season.html).

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.

Security Handling Description

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

Confidentiality of all data is required by law and strictly maintained by the Health Department staff. Section 2631 of the Public Health Code regulates procedures protecting confidentiality and regulating disclosure of data and records.

Distribution Liability

The Michigan Public Health Tracking Network is maintained, managed, and operated by the Environmental Health Bureau (EHB) 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 via email or telephone (See Contact Information below).

Custom Order Process

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

For more information or access to unrestricted or public use Michigan-specific data, please visit the EGLE Air Quality Division website.

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