Data Article

A geospatial environmental concentrations database of Oklahoma, United States

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\textbf{Abstract}

Environmental factors can affect human health throughout the lifespan. Reliable and accurate data are needed to understand and establish relationships between environmental factors and health outcomes. In this article, spatiotemporal data (across time and space) on environmental concentrations were compiled in a database for the State of Oklahoma, United States. Data were collected from local, state, and federal government agencies, and organized into a metadata document, which includes spatial extent (information on the area covered), attributes (i.e., variables such as chemical concentration), and temporal extent (time period) of the dataset, among others. Data have been cataloged for concentrations found in water ($n=53$ files), air ($n=15$ files), land ($n=7$ files), and industry ($n=3$ files). Data also included physical characteristics (i.e., data on location, geology, and features of waterways, watersheds, and lakes, among others, $n=31$ files) and administrative datasets (i.e., data on location and distribution of county boundaries and tribal statistical areas and reservations for federally recognized tribes in Oklahoma, $n=4$ files). The main result is a collection of a wide range of spatially-resolved concentration data. This spatiotemporal database will assist in future epidemiologic investigations and assessment of the geographic...
1. Data

Data have been cataloged for environmental concentrations found in water (n = 53 files), air (n = 15 files), land (n = 7 files), and industry (n = 3 files). Data also included physical characteristics (i.e., data on location, geology, and features of waterways, watersheds, and lakes, among others, n = 31 files) and administrative datasets (i.e., data on location and distribution of county boundaries and tribal statistical areas and reservations for federally recognized tribes in Oklahoma, n = 4 files). Table 1 demonstrates the breakdown of these data items by the data formats of a non-spatial table, point layer, line layer, polygon layer, and raster images. Additionally, Table 2 includes a summary and description of the metadata document that contains information on the data source, geometry type, attributes (i.e., variables, including concentrations), data processing, and temporal (time period) and spatial (area covered by the dataset) extents. The metadata table is provided as an Excel file (Microsoft Corporation, Redmond, Washington) in the supplementary material (Supplementary Table 1) and is available online as well [1].

2. Experimental design, materials, and methods

2.1. Data categorization, exploration, and identification

Based on a literature review, the main categories of data collected for the database include water, air, land, and industry. We additionally included data for physical characteristics and administrative datasets (described above). Data on physical characteristics and administrative datasets are included to provide a complete dataset, inclusive of common auxiliary data needed in typical epidemiological
research in Oklahoma. Additional information on the purpose of these datasets is available in column C of the supplementary material (Supplementary Table 1) and online reference [1]. We conducted permutations of web searches under each category with secondary terms such as concentration or pollutant and tertiary terms such as the US, national, or Oklahoma (Table 3). Accordingly, we used all combinations of these search terms (e.g., freshwater pollution Oklahoma) to find the most relevant data. For each category, we compiled data sources and their metadata as shown in Table 2, and acquired the data layers (known as shapefiles or feature classes) and tables under each category. We searched for data sources online and also contacted national, state, and local institutions, such as the Oklahoma Department of Environmental Quality to request and obtain relevant data.

### Table 1
Data items by theme and format in the database, Oklahoma, United States.

| Theme               | Table | Point | Line | Polygon | Raster | Total |
|---------------------|-------|-------|------|---------|--------|-------|
| Administrative      | 0     | 1     | 0    | 3       | 0      | 4     |
| Air                 | 0     | 7     | 1    | 7       | 0      | 15    |
| Industrial          | 0     | 3     | 0    | 0       | 0      | 3     |
| Land                | 0     | 3     | 0    | 4       | 0      | 7     |
| Physical Characteristics | 0   | 3     | 4    | 21      | 3      | 31    |
| Water               | 11    | 27    | 4    | 11      | 0      | 53    |
| Total               | 11    | 44    | 9    | 46      | 3      | 113   |

### Table 2
Attributes of the metadata document of the database, Oklahoma, United States.

| Column Name                                | Description                                                                 |
|--------------------------------------------|-----------------------------------------------------------------------------|
| A Theme/Feature Dataset                    | Information on dataset domain (water, air, land, industry, physical characteristics, administrative). |
| B Data Group Name                          | Group name for different sources of data.                                   |
| C Data Item Description                    | Purpose of including the data.                                             |
| D Original Data Item Name                  | Original file name from source.                                            |
| E Processed Table/Layer Name               | Revised table or layer name after importing into ArcMap.                   |
| F Geometry Type                            | Information on spatial representation, such as line, point, polygon, raster, and table. |
| G Attributes                               | Attribute information, such as chemical concentration, days active, etc.    |
| H Original Spatialization Status           | Information on whether the data were spatialized.                          |
| I Spatial Extent                           | Information on the area covered in the dataset for Oklahoma.               |
| J Temporal Extent                          | Information on the time period of the dataset.                             |
| K Variables                                | List of variables included in each dataset.                                |
| L Publication Date                         | Information on when the dataset were published.                            |
| M Processing Description                   | Information on how the data were spatialized.                              |
| N Notes                                     | Additional information on the dataset.                                     |
| O Source                                   | Information on the source of the dataset, such as the Environmental Protection Agency, etc. |
| P URL or Contact Point                     | URL or contact person for the dataset.                                     |

### Table 3
Search terms used for identifying data for the database, Oklahoma, United States.

| Category | Search Terms | Secondary Terms | Tertiary Terms |
|----------|--------------|-----------------|----------------|
| Water    | Freshwater   | Concentration   | USA            |
|          | Groundwater  |                 |                |
| Air      | Traffic      | Toxin           | National       |
|          | Exhaust      |                 | Oklahoma       |
| Land     | Pesticide    | Hazard          |                |
|          | Herbicide    |                 |                |
|          | Minerals     |                 |                |
|          | Mining       |                 |                |
| Industry | Chemicals    |                 |                |
|          | Waste        |                 |                |
Table 4
Select compounds and datasets with spatial, temporal, and variable information in the database.

| Compound/Dataset          | Spatial Extent         | Temporal Extent | Select Variables                                                                 |
|---------------------------|------------------------|-----------------|----------------------------------------------------------------------------------|
| Carbon monoxide           | State of Oklahoma      | 1980–2017       | Daily max 8-h CO concentration, units, daily AQI value, AQS parameter description, daily observation count, POC |
|                           | Nonattainment areas in entire US | 1990         | Pollutant, NAA status, class                                                      |
| Nitrogen dioxide          | State of Oklahoma      | 1980–2017       | Daily max 1-h NO₂ concentration, units, daily AQI value, AQS parameter description, daily observation count, POC |
|                           | Nonattainment areas in entire US | 1990         | Pollutant, class                                                                |
| Ozone                     | State of Oklahoma      | 1980–2017       | Daily 8-h ozone concentration, units, daily AQI value, AQS parameter description, daily observation count, POC |
|                           | Nonattainment areas in entire US | 2008         | Pollutant, NAA status, class                                                      |
| Lead                      | State of Oklahoma      | 1980–1997 and 2005–2017 | Daily mean Pb concentration, units, AQI value, AQS parameter description, daily observation count, POC |
|                           | Nonattainment areas in entire US | 2008         | Pollutant, NAA status, class                                                      |
| Particulate matter        | State of Oklahoma      | 1999–2017       | Daily mean PM₂.₅ concentration, units, daily AQI value, AQS parameter description, daily observation count, POC |
| (PM₂.₅)                   | Nonattainment areas in entire US | 2006         | Pollutant, NAA status, class                                                      |
| Particulate matter        | State of Oklahoma      | 1988–2017       | Daily mean PM₁₀ concentration, units, daily AQI value, AQS parameter description, daily observation count, POC |
| (PM₁₀)                    | Nonattainment areas in entire US | 1990         | Pollutant, class                                                                |
| Sulfur dioxide            | State of Oklahoma      | 1980–2017       | Daily max 1-h SO₂ concentration, units, daily AQI value, AQS parameter description, daily observation count, POC |
|                           | Nonattainment areas in entire US | 2010         | Pollutant, NAA status, class                                                      |
| EPA Toxic Release         | State of Oklahoma      | 1987–2016       | Chemical, CAS #/compound ID, classification, metal, metal category, carcinogen, unit of measure |
| Inventory                 |                        |                 |                                                                                   |
| EPA Water System Violation Report—Copper | State of Oklahoma | 07/01/1999–12/31/2016 | Contaminant name, sample measure (mg/L), sampling start date, sampling end date |
| EPA Water System Violation Report—Lead | State of Oklahoma | 07/01/1992–12/31/2016 | Contaminant name, sample measure (mg/L), sampling start date, sampling end date |
| OK DEQ Water Sampling—Nitrate | State of Oklahoma | 01/03/2011–12/15/2017 | Analyte, concentration, sample ID |
| OK DEQ Water Sampling—Arsenic | State of Oklahoma | 01/04/2017–09/18/2017 | Analyte, concentration, sample ID |
| OK DEQ Water Sampling—Methylmercury | State of Oklahoma | 10/2007–11/2016 | Lake name, species name, length (mm), Hg in fish (mg/kg), weight (g), length (in) |

Note: A detailed list of variables is provided in Supplementary Table 1 and online reference [1].
Abbreviations: AQI, air quality index; AQS, air quality system; CAS, Chemical Abstracts Service; CO, carbon monoxide; EPA, U.S. Environmental Protection Agency; Hg, Mercury; NAA, Nonattainment area status; NO₂, nitrogen dioxide; OK DEQ, Oklahoma Department of Environmental Quality; Pb, Lead; POC, parameter occurrence code.
2.2. Data compilation, processing, and development

Data for the environmental database originated from a variety of national, state, and local government departments and agencies. Natural units contained hydrology types, soil types, and other natural boundaries and administrative features contained within the county and tribal boundaries. Data available online were downloaded directly, and in some cases, we contacted necessary agencies and obtained the data that were not readily available online.

Most of the data from the government departments and agencies were in a spatial format (e.g., shapefiles) and imported to a geodatabase using ArcGIS for Desktop, version 10.5 (Environmental Systems Research Institute (ESRI), Redlands, California). When possible, extracted or provided data not available in this format (e.g., non-spatial text files) were spatialized using latitude and longitude information and transformed into feature classes. Non-spatial tables that could not be spatialized were still added to the geodatabase to achieve maximum completeness. All feature classes were projected to the same coordinate system, USA Contiguous Albers Equal Area Conic (USGS version). Several data files were saved and separated by year of data collection. After importing and creating a feature class, a new column was created with the year of data collection, if it were a multiyear dataset. Multiple feature classes containing the same type of data were then merged and sorted by date. The spatial data in our database includes data of point (e.g., wells), line (e.g., motorways and waterways), and polygon (e.g., agricultural and superfund zones) based layers. Once all the relevant layers/feature classes were imported to the database with their respective feature datasets, each feature class’s metadata was added manually if not already included previously. A list of select compounds and variables with spatial and temporal information is provided in Table 4, and a detailed list of variables in each dataset is available in column K of the supplementary material (Supplementary Table 1) and online reference [1]. Datasets from all domains include variables on compounds (such as type of sample, sample measure, and sample collection and date), geometry (such as shape), location (such as county and zip code), and coordinate system (such as latitude and longitude).

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104421.

Reference

[1] N. Dilekli, S.V. Gopalani, J.E. Campbell, A.E. Janitz. Oklahoma concentrations. https://docs.google.com/spreadsheets/d/1mAAd2xxRve7K94FMvTz-rtnWXCN4IBM7d4fL3CbzIE/edit?usp=sharing (accessed 22 July 2019).