Introduction

Utah Division of Air Quality

Collaborators

The Utah Division of Air Quality (UDAQ) performed air quality modeling for the Daily PM2.5 SIP. UDAQ developed emissions inventories for the following sectors: point, non-road mobile, on-road mobile, and stationary non-point. Meteorological modeling was carried by the University of Utah via financial support from UDAQ.

Dr. Erik Crosman (University of Utah) collaborated with UDAQ to choose the most appropriate meteorological episodes for modeling. Dr. Crosman and Chris Foster (University of Utah) used the Weather Research Forecasting[1] (WRF) model to prepare meteorological datasets for our use with the photochemical model. Gail Tonnesen (EPA - Region 8) was instrumental in providing valuable feedback and support for UDAQ's air quality modeling work. Dr. Randy Martin (Utah State University) provided ambient ammonia measurements that UDAQ used for quality assurance of modeling output.

UDAQ jointly developed on-road mobile source emission inventories with the appropriate metropolitan planning organizations (MPO's). The MPO's and the counties for which they are responsible for (in parenthesis) are: Wasatch Front Regional Council (Salt Lake, Weber, Davis, Box Elder, and Tooele), Mountainland Association of Governments (Utah) and Cache Valley Metropolitan Organization (Cache).

Air Quality Modeling

Utah DAQ used the Comprehensive Air Quality Model with Extensions (CAMx) version 6.30 for air quality modeling. CAMx v6.30 is a state-of-the-art air quality model that includes State of Utah funded enhancements for wintertime modeling. These enhancements include snow chemistry, topographical and surface albedo refinements. CAMx is an EPA approved model for use in SIP modeling.

Emissions Preparation

The emissions processing model used in conjunction with CAMx is the Sparse Matrix Operator Kernel Emissions Modeling System (SMOKE) version 3.6.5[2]. SMOKE prepares the annual emissions inventory for use in the air quality model. There are three aspects to the preparation of an annual emissions inventory for air quality modeling:

[1] https://www.mmm.ucar.edu/weather-research-and-forecasting-model
[2] https://www.cmascenter.org/smoke/

- Temporal: Convert emissions from annual to daily, weekly and hourly values.
- Spatial: Convert emissions from a county-wide average to gridded emissions.
- Speciation: Decompose PM2.5 and VOC emissions estimates into individual subspecies using the latest Carbon Bond 6 speciation profiles.

The 2014 National Emissions Inventory (NEI) version 2 inventory was used as a basis for creating projected inventories (2011, 2016, 2017, 2019, 2020). The process of breaking down emissions for the air quality model was done with sets of activity profiles and associated cross reference files. These are created for point or large industrial source emissions, smaller area sources, and mobile sources. Direct PM2.5 and PM2.5 precursor estimates were modified via temporal profiles to reflect wintertime conditions.

Activity profiles and their associated cross reference files files from the EPA's 2011v6[3] modeling platform were used. For stationary non-point and mobile sources, spatial surrogates from the EPA Clearinghouse for Inventories and Emissions Factors (CHIEF[4]) were used to distribute emissions in space across the modeling domain. Emissions from large industrial sources (i.e., point) were placed at the location of the source itself. Where reliable local information was available (e.g., population density, traffic demand modeling, residential heating), profiles and surrogates were modified or developed to reflect that information.

[3] https://www.epa.gov/air-emissions-modeling/2011-version-6-air-emissions-modeling-platforms
[4] https://www.epa.gov/chief