

## MEMORANDUM

SUBJECT: Recommendations on Use of Intermountain West Data Warehouse for Air Quality 2011b Model Platform

FROM: Intermountain West Data Warehouse – Western Air Quality Study Oversight Committee

TO: Intermountain West Data Warehouse Users

DATE: July 6, 2016

The Intermountain West Data Warehouse – Western Air Quality Study (IWDW-WAQS) produced an updated air quality model platform for year 2011 (hereafter referred to as “2011b”). The 2011b model platform and individual components, as described below, have been reviewed and approved by the [IWDW-WAQS Cooperating Agencies](#). The model products are released for use in regional air quality modeling studies by the cooperating agencies and for external users accepting the terms of the IWDW Data Use Agreement and authorized by the Cooperators.

The Western Air Quality Study’s 2011b modeling platform and individual components are described in the [2011b Modeling Platform Description](#) wiki and within detailed reports on the IWDW. Based on Model Performance Evaluation, the 2011b platform is suitable for regional studies of warm season ozone. Studies of: 1) cold season ozone formation; 2) particulate matter, visibility, and deposition, in general; and 3) decisions about which global model boundary conditions to apply should be undertaken only with knowledge and understanding of the limitations on model performance discussed in the 2011b platform documentation. The 2011b modeling platform improves specific model performance issues discovered in the 2011a platform. All 2011b modeling data and results are available through the IWDW-WAQS [Data Request page](#).

The 2011b model platform replaces the 2011a model platform, and it is recommended that the Cooperators use the products from the 2011b platform in their upcoming air quality studies until additional updates or improvements have been made available through the IWDW. Since the 2011a model platform, the 2011b model platform includes improvements to the emissions, boundary conditions, and model configuration. The Modeling Protocol, Model Performance Evaluation (MPE), and the Cooperators’ Comments provide additional details on this model platform. These documents are available through the IWDW.

The [IWDW-WAQS 2011b Modeling Platform O&G Emission Inventory memo](#) describes the second phase of 2011 Oil & Gas (O&G) inventory development, including: 1) refinements to the 2011a base year 2011 inventory to add hydraulic fracturing engine emissions and make use of additional inventory input data available from Tribal Minor New Source Review registrations in the Uinta Basin; and 2) refinements to 2011a future year 2020 Denver-Julesburg (D-J) emissions inventory based on 2017 emission inventory developed as part of the State Implementation Plan (SIP) for the 8-hour Ozone National Ambient Air Quality Standards. Changes from the 2011a to 2011b modeling platform O&G emissions were limited to the 2011 base year emission inventories and 2020 future year emissions for the D-J basin.

The Cooperators find that the 2011b model platform utilizes the most complete and representative inputs as summarized in the table below, for regional photochemical modeling studies across the Intermountain West. As noted in the IWDW Data Use Agreement, the model products provided through the IWDW should be carefully reviewed before using them in a study. The results from the MPE for the 2011b platform indicate model performance issues that users should be informed of when utilizing the model products and interpreting the model results. Some of the model performance issues identified by the Cooperators include:

- Negative model bias for ozone in May and June.
- Positive model bias for ozone in some areas of western Colorado in summer.
- Negative model bias for Volatile Organic Compounds (VOC) and ozone in winter in areas of intensive oil and gas production in Utah and Wyoming.
- The IWDW-WAQS evaluated two different global models (Mozart and GeosChem) for generating boundary conditions at the edges of the 36km North American modeling domain. The boundary conditions generated from each global model were found to produce different MPE results for Particulate Matter and ozone in the IWDW-WAQS study region. The results can be found at: <http://vibe.cira.colostate.edu/wiki/wiki/1043/bc-sensitivity-modeling-results>.

- The same model versions should be used in order to obtain similar model performance results. It has been found that more recent versions of WRFCAMx and CAMx produce significant differences in the model performance.
- Known and Corrected Emissions Errata – the 2011b emissions files for downloading are corrected for these errata:
  - Incorrect VOC speciation profile used for SCC 2310023509 (Survey-based Fugitives) in Weld County, CO.
  - Profile correction impacting surveyed (non-point/area) oil and gas (AROG) sources for a single SCC in Weld County only. The AROG sector accounts for about 86% of the anthropogenic VOC emissions in Weld County.
  - The South San Juan Coal Bed Methane (SSJCB) profile was used instead of the Denver-Julesburg Venting (DJVNT) profile. As the SSJCB profile represents a source that is predominantly methane (98.86%), it uses a large scaling factor to convert the inventory VOC to TOG.
  - Correcting the profile [reduces the 2025 Weld County AROG TOG by 89%](#), relative to the WAQS Base25a\_11b emissions. The TOG reduction is primarily a reduction in methane mass.
  - Correcting the profile [reduces the 2025 Weld County AROG VOC reactivity by 20%](#), relative to WAQS Base25a\_11b emissions.

The Cooperators recommend that users understand these limitations and consider the implications these uncertainties might affect application of the 2011b model platform as a whole and any of the platform’s individual input files. The Cooperators also note that the MPE Report for the 2011b platform focuses on analyses and conclusions that are based on statistical metrics that are averaged across multiple sites and multiple days. Evaluations of performance over long time periods and large areas may fail to distinguish specific episodes for which the model either performs especially well or especially poorly. These types of metrics may also cancel out biases and the results may not reflect the model performance on days that may be most relevant to the purpose of the air quality study (e.g., NAAQS ozone attainment demonstrations). Therefore, the Cooperators recommend that, in some cases, users of the model platform should evaluate how well the model performs for specific monitor sites and episodes most relevant to their study topic.

All 2011b modeling data and results are available through the IWDW by completing and submitting a [Data Request page](#) and accepting the terms of the Data Use Agreement. The 2011b platform consists of data and software for simulating year 2011 air quality over a modeling domain with a 4 km horizontal grid cell resolution focused on the states of Colorado, Utah, Wyoming, and northern New Mexico. The 4 km domain is nested in a 12 km grid cell domain covering the western half of the United States, and it in turn is nested in a 36 km grid cell North American domain.

Type	Option	Source	Description
Model Software	CAMx v6.10	ENVIRON	Chemistry-transport model configured with CB6r2 photochemistry
	CMAQ	US EPA	Chemistry-transport model configured with CB05 photochemistry
	WRF v3.5.1	NOAA	Regional climate model configured for simulating meteorology over the Inter-mountain West
	SMOKE v3.5.1	UNC-IE	Emissions processor for preparing emissions inventory and ancillary data for input to chemistry-transport models
Emissions Data	Emissions v2011b	WAQS	2011 emissions data prepared for CAMx and CMAQ with SMOKE
	Emissions v2025_11b	WAQS	2025 emissions data prepared for CAMx with SMOKE
Meteorological Data	Meteorology v2011a	WAQS	2011 meteorology data estimated with WRF and prepared for CAMx and CMAQ with WRFCAMx and MCIP
Initial and Boundary Conditions Data	MOZART ICBCs	NOAA/3SAQS	2011 Initial/Boundary Conditions from NOAA global GEOS5 MOZART simulations; prepared for CAMx with MZ2CAMx; fine and coarse mode dust and sea salt removed.
Other Input Data	Ozone Columns	NASA	Daily ozone column data processed for CAMx using the utility AHOMAPv4
	Chemistry Parameters	ENVIRON	CAMxv6.10 chemistry parameters files for CB6r2 and aerosol module C
	Landuse	ENVIRON	NALC data merged with Leaf Area Index data using ArcGIS macros, Perl, and Fortran
	Total UV columns	ENVIRON	Daily photolysis rates calculated using TUV v4.8
Other Output Data	CAMx Base11b	WAQS	Output data from a 2011 36/12/4-km domain CAMx simulation with MOZART boundary conditions
	CMAQ Base11b	WAQS	Output data from a 2011 36/12/4-km domain CMAQ simulation with MOZART boundary conditions
	CAMx Base25a_11	WAQS	Output data from a 2011-based 2025 36/12/4-km domain CAMx simulation with MOZART boundary conditions
	CMAQ Base25a_11	WAQS	Output data from a 2011-based 2025 36/12/4-km domain CMAQ simulation with MOZART boundary conditions