Modeling Domain and Grid Resolution

Utah Division of Air Quality

Photochemical Modeling Domains

The UDAQ CAMx 6.30 modeling framework consists of two spatial domains: a high-resolution 1.33 km domain nested inside of a coarser 4 km domain (see Figure 1, below). This configuration allows us to efficiently integrate regional effects with local impacts within the Salt Lake nonattainment area.

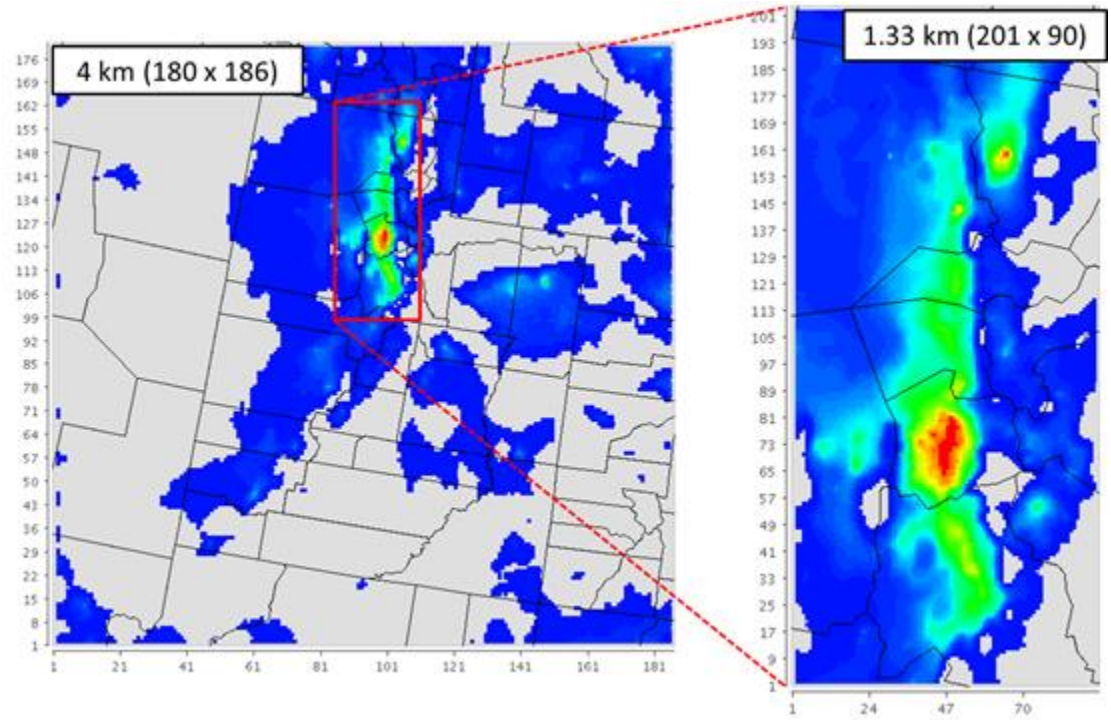

Figure 1: Two CAMx modeling domains in two-way nesting configuration.

Throughout this document, we will refer to the fine 1.33 km domain as the "modeling domain" when the coarse domain is not specified. We projected the grids using a Lambert Conformal Conic (LCC) projection. The LCC projection parameters listed in the following table:

LCC Parameter	4 km Domain	1.33 km Domain

Central Longitude	-97˚	-97˚
Central Latitude	40˚	40˚
Standard Parallel 1	33˚	33˚
Standard Parallel 2	45˚	45˚
Southwest Corner X-Origin	-1,644 km	-1,309.4 km
Southwest Corner Y-Origin	-312 km	78.579 km

Table 1: Lambert Conformal Conic (LCC) projection parameters for both CAMx modeling domains.

The UDAQ 4 km coarse domain covers the entire state of Utah, a significant portion of Eastern Nevada (including Las Vegas), as well as smaller portions of Idaho, Wyoming, Colorado, and Arizona. The number of rows and columns in our 4 km grid are 180 and 186, respectively. The coarse domain is shown below:

The fine 1.33 km domain covers Utah's the Salt Lake nonattainment area. The north-south extent of the fine domain runs from southern Franklin County, Idaho (North) to Utah County, Utah (South). The west-to-east extent covers the eastern portion of the Great Salt Lake (West) in the East and into the upper elevation areas of the Wasatch Front mountain range (East).

CAMx Model Options

Table 2, below, lists lists important CAMx parameters and the settings UDAQ used for the modeled attainment demonstration:

Parameter	Parameter Setting
Number of Grids	2
Grid size(s)	4 km/1.33 km
Vertical layers	41
Grid interaction	Two-way nesting
Boundary conditions	MOZART
Point Sources processing	Plume-in-grid model
Aerosol scheme	CF
Chemistry	cb6r2h
Chemistry solver	EBI
Advection scheme	PPM
Dry deposition	ZHANG03
Wet deposition	On

Table 2: Key CAMx parameters/settings used for SIP modeled attainment demonstration.

Chemistry Mechanisms

UDAQ used the Carbon Bond "CB6r2 with Halogen Chemistry" (CB6r2h) from Ramboll Environ for gas phase chemistry in their air quality modeling. For aerosol phase chemistry, the coarse/fine (CF) mechanism developed by Ramboll, was used in the modeled attainment demonstration. UDAQ tried a Volatility Basis Set (VBS) mechanism, but tests did not show a significant difference in model performance that justified the emissions processing required for using the VBS mechanism.

Initial and Boundary Conditions

UDAQ used MOZART-4 data[1] in conjunction with the mozart2camx v2.2 post-processor (Ramboll) to generate initial and boundary conditions (IC/BC) data for the 4 km CAMx modeling domain. The 4 km modeling domain will generate IC/BC data for the 1.33 km CAMx modeling domain in a two-way nesting configuration.

The air quality modeling includes only one day of spin-up time depending. The short spin-up time is justified because PM2.5 concentrations are near background levels at the beginning of the January 2011 wintertime episode. The WRF model performs best when not starting on an elevated PM2.5 day (personal communication with Dr. Erik Crosman, Univ. of Utah).

[1] http://www.acom.ucar.edu/wrf-chem/mozart.shtml