# RUN SPECIFICATION SHEET

WRAP 2014 Modeling Study

January 21, 2020

|  |  |
| --- | --- |
| Run Name: | **Task 1.8: Anthropogenic/Natural Source Apportionment** |
| Model: | CAM v7.0 |
| Domains: | 36US1 and 12WUS2 two-way nesting |
| Period: | 2014v2 annual period |
| Emissions: | Representative Baseline |
| Boundary Conditions: | WRAP 2014 GEOS-Chem stratified by international anthropogenic, U.S. anthropogenic and natural sources |
| Source Apportionment: | Particulate Matter (PSAT) and Ozone (APCA) |
| Purpose: | Obtain PM and ozone source contributions by anthropogenic, natural and fire emission source categories and by U.S. versus International sources. |

## Description

CAMx v7.0 will be run for a PSAT PM and APCA ozone source apportionment run using the WRAP Representative Baseline (2014-2018) emissions and the WAQS 36/12-km 36US1/12WUS2 modeling domains for the 2014 annual period.

### Source Apportionment Specifications

The CAMx Particulate Source Apportionment Technology (PSAT) tool would be used with the SO4 (3), NO3/NH4 (8) and Primary PM (14) families resulting in 25 reactive tracers used to track PM source apportionment for each Source Group. The Secondary Organic Aerosol (SOA) family of PSAT tracers (which requires 14 tracers for each Source Group) will not be used because it would increase the run time by ~50% and the standard model output SOA species can be used to operationally[[1]](#footnote-2) distinguish between anthropogenic (SOAA) and biogenic (SOAB) SOA. Although not needed for regional haze analysis, we will also invoke the Anthropogenic Precursor Culpability Assessment (APCA[[2]](#footnote-3)) version of the Ozone Source Apportionment Technology (OSAT) as it will only increase the number of reactive tracers and consequently run time by 20%.[[3]](#footnote-4)

Boundary Conditions: The Task 1.2 WRAP 2014 GEOS-Chem base case (BASE) and Task 1.7 2014 GEOS-Chem Natural (NAT, i.e., no anthropogenic emissions anywhere) and no international emissions (ZROW case) would be processed to generate hourly boundary conditions (BCs) for the CAMx 36-km 36US1 modeling domain (i.e., GCBC\_BASE, GCBC\_NAT and GCBC\_ZROW). These three GCBC CAMx input files would be processed to obtain three sets of BCs inputs whose contributions will be separately tracked in the CAMx Task 1.8 source apportionment simulation as Natural (BCNatural), International anthropogenic emissions (BCIntl) and U.S. anthropogenic emissions (BCUSA). The CAMx BC tool has to be provided with GEOS-Chem zero-out CAMx BCs (in UAM FORTRAN binary format) for each of the source categories to be tracked, which are defined as follows:

1. BCBase = GCBC\_Base
2. BCNatural = GCBC\_Base – GCBC\_NAT
3. BCIntl = GCBC\_ZROW
4. BCUSA = leftover

Source Groups: In addition to three source groups to accommodate the split of the BCs discussed above, plus one source group for Initial Concentrations (IC), PM and ozone contributions due to the following emissions based Source Groups will also be tracked:

* Natural Emissions (Biogenic, Sea Salt/DMS, LNOx and WBD)
* U.S. Wildfires (WF)
* U.S. Prescribed Burns (Rx)
* U.S. Agricultural Burning (Ag)
* Canada/Mexico Fires
* U.S. Anthropogenic Emissions (USAnthro)
  + USAnthro includes U.S. off-shore O&G and small CMV C1&C2 vessels
* Mexico Anthropogenic Emissions
* Canada Anthropogenic Emissions
* Off-Shore Commercial Marine Vessel (CMV) C3 Ocean Going Vessels (OGV) within 200 nautical miles of the coast (i.e., within the Emissions Control Area, ECA)
  + Emissions from CMV C3 OGV may be consisted as part of USAnthro
* Remainder off-shore anthropogenic emissions that includes CMV C3 OGV outside of the ECA and non-U.S. O&G

This results in 10 emissions, 3 BC and 1 IC Source Groups (14 total), or 350 additional reactive tracers.

Total U.S. anthropogenic emissions could be estimated with and without assuming CMV C3 OGV within the ECA boundaries are part of the U.S.

### Products from Source Apportionment Simulation

The Task 1.8 Ant/Nat RepBase 2014 36/12-km source apportionment simulation will provide several useful products for the WRAP 2014 Study:

* Estimates of International anthropogenic emissions contributions to PM concentrations and resultant visibility impairment that can used to adjust URP Glideslopes.
* Estimate of the contributions of RepBase U.S. anthropogenic emissions to visibility impairment as well as its compliment of contributions of sources other than U.S. anthropogenic emissions (Non-US Anthro) that can also be used to back-out U.S. Anthro Contributions in the 2002 Dynamic Evaluation case.
* Calculation of the CAMx RepBase modeled U.S. anthropogenic emissions most impaired days (USD) that can be used in alternative Relative Response Factors (RRFs) for projecting the observed 2014-2018 IMPROVE MID: (1) forward to 2028 for comparison to URP Glideslope; and (2) backward to 2002 for the Dynamic Evaluation.
  + Can also estimate the modeled USD for the 2002 Dynamic Evaluation base case so we can see how the modeled USD are changing over time (e.g., more sulfate dominated in 2002).
* Estimate of International anthropogenic emissions to ozone concentrations and ozone design values for use in Section 179B analysis.

1. In the operational definition of SOAA and SOAB we are assuming that all SOA from isoprene, terpene and sesquiterpene species are biogenic and SOA from aromatic species are anthropogenic even thought there are some anthropogenic isoprene emissions, but they are miniscule compared to the biogenic isoprene. [↑](#footnote-ref-2)
2. The APCA ozone source apportionment tool differs from OSAT in that ozone is only apportioned to biogenic emissions when it is due to biogenic VOC reacting with biogenic NOx. In the case when ozone is formed due to the interaction of biogenic VOC with anthropogenic NOx under VOC-limited conditions, a case where OSAT will assign the ozone formed to the biogenic VOC, APCA recognizes that biogenic VOC is not controllable so re-directs the ozone formed to the anthropogenic NOx emissions. [↑](#footnote-ref-3)
3. The APCA/OSAT ozone source apportionment requires 10 reactive tracers per Source Group, but 5 of those tracers are already being used in the PSAT NO3/NH4 family of tracers so the actual increase in number of tracers for invoking ozone source apportionment when already running PSAT is 5, or from 25 to 30 reactive tracers per source Group in this case. [↑](#footnote-ref-4)