

Table 1. Input data used for operating the CMAQ-based DSS.

<b>Data Set</b>	<b>Type of Information</b>	<b>Source</b>	<b>Usage</b>
Regional climate model output	Simulation results from a regional climate model (RCM) used as a driver for CMAQ modeling; processed through meteorology-chemistry interface processor (MCIP)	RCM modeling team; PNNL, UIUC, NCEP, EPA, and universities	Regional climate characterization, driver data for air quality simulations, and emissions processing
Land use, land cover, subsoil category, and topography data; topography for meteorological modeling	Describes land surface conditions and vegetation distribution for surface exchange processes	Various sources from USGS, NASA, NCEP EPA, states, etc.	Usually the data are associated with RCM's land surface module; need to be consistent with vegetation information, such as BELD3 if possible
Biogenic emissions land use database version 3 (BELD3)	Land use and biomass data and vegetation/tree species fractions	EPA	Processing of biogenic emissions; used to provide activity data for county-based emission estimates; now also used for land surface modeling in RCM
Air emissions inventories: national emissions inventories (NEI) and state/special	Amount and type of pollutants into the atmosphere. Includes: - Chemical or physical identity of pollutants - Geographic area covered - Institutional entities	EPA, regional program organizations (RPO), states and local government, and foreign governments	Preparation of model-ready emission inputs; perform speciation for the chemical mechanism used; used to evaluate "top-down" emissions (i.e.,

inventories; often called as “bottom-up” inventories	<ul style="list-style-type: none"> <li>- Time period over which the emissions are estimated</li> <li>- Types of activities that cause emissions</li> </ul>		from inversion of satellite observations though air chemistry models)
Chemical species initial and boundary conditions	Clean species concentration profiles initial input and boundary conditions used for CMAQ simulations; originally from observations from clean background locations	EPA (fixed profiles), GEOS-Chem (Harvard & Univ. Houston), MOZART (NCAR); dynamic concentrations with diurnal variations (daily, monthly or seasonal)	CMAQ simulations; fixed profiles are used for outer domains where no significant emissions sources are located
AQS/AIRNow	Near real-time (AIRNow) and archived datasets (AQS) for ozone, PM, and some toxics species	Joint partnership between EPA and state and local air quality agencies	Measurement data used for model evaluations; report and communicate national air quality

Table 2. An illustrative example of the potential uses of the models and upstream and downstream tools for a CMAQ-based Climate Change Impact Decision Support System.

Component	Functions	Model Name: Owner	Users
Global climate models (GCM)	Performs climate change simulations over the globe for different SRES climate scenarios. Typical resolution for a long-term (50 year) simulation is at 4° x 5° latitude and longitude	Community Climate Model (CCM): NCAR Goddard Institute for Space Studies (GISS) GCM: NASA CM2: Geophysical Fluid Dynamics Laboratory (GFDL) of NOAA	Climate research institutes, universities, and government institutions
Global chemistry transport models (GCTM)	Computes global scale chemical states in the atmosphere; uses same resolution as GCM	GEOS-Chem: NASA, Harvard University MOZART: NCAR (ESSL/Atmospheric Chemistry Division)	Global chemistry research organizations, universities, and government institutions
Regional climate models (RCM)	Simulates regional scale climate and meteorological conditions downscaling the GCM output; for US application ~36 km resolution used	MM5-based: NCAR, PNNL, UIUC, and others; the weather research and forecasting (WRF) model - advanced research WRF (WRF-ARW) core based: NCAR, UIUC Eta-based: NCEP (before June, 2006) The WRF- nonhydrostatic mesoscale model (WRF-NMM) core based: NCEP (after June,	Regional climate research groups, universities, and government institutions

		2006)	
Regional air quality models (AQM)	Performs air quality simulations at regional and urban scales at the same resolution as the RCM	Community multiscale air quality (CMAQ): EPA Comprehensive air quality model with extensions (CAMx): Environment WRF-Chem: NOAA/NCAR STEM-II: University of Iowa	Regional, state, and local air quality organizations; universities; private industries; and consulting companies
Downstream tools for decision support	Performs additional computations to help decision support, such as sensitivity and source apportionment studies, exposure studies	CMAQ/DDM: GIT CMAQ/4Dvar: CalTech/VT/UH Stochastic human exposure and dose simulation (SHEDS): EPA Total risk integrated methodology (TRIM): EPA	Universities and consulting companies
Upstream tools for representing climate change impacts on input data	Performs additional computations to generate model inputs that affect simulations	Land surface models SLEUTH: USGS, UC Santa Barbara (captures urban patterns) CLM (community land model): NCAR (used for RCM and biogenic emission estimates after growth)	Universities and consulting companies