



NOAA Model Platforms: Regional CTMs

Ken Schere

NOAA/Atmospheric Sciences Modeling Division
Research Triangle Park, NC 27711

NOAA Chemical Modeling Workshop
October 10-11, 2007



RESEARCH & DEVELOPMENT

Building a scientific foundation for sound environmental decisions



Regional CTMs

- Community Multiscale Air Quality (CMAQ) Model
 - Principal developers
 - OAR/ARL/ASMD
 - R. Mathur, J. Pleim, K. Schere, et al.
 - Principal applications
 - Air quality forecast guidance (with NOAA/NWS)
 - Air quality assessments (with EPA, States)
 - Research studies: phys/chem processes; sensitivity/uncertainty
 - 3-D grid; mesoscale; “off-line” model
 - Urban to continental scale domains ($\Delta x \sim 1$ to 36km)
 - Variable vertical resolution ($\Delta z \sim 38$ m near sfc; 1500m near model top of 100mb)
 - Some hemispheric applications ($\Delta x \sim 108$ km)
 - “on-line” version in development



Regional CTMs (cont.)

- Principal outputs
 - Photochemical oxidants
 - Particulate matter
 - Visibility
 - Acid/Nutrient deposition
 - Air toxics
 - Mercury



Regional CTMs (cont.)

- WRF with Chemistry (WRF-Chem)
 - Principal developers
 - OAR/ESRL/GSD
 - G. Grell, S. Peckham, et al.
 - Principal applications
 - Air quality, dispersion
 - Weather and regional climate model forecasts
 - Field mission planning and data analysis
 - Process studies, incl. direct and indirect aerosol impacts
 - 3-D grid; mesoscale; “on-line” model
 - Hemispheric to cloud-scale domains (Δx as low as 200m; CONUS applications use $\Delta x=27$ km)
 - Variable vertical resolution ($\Delta z \sim 40$ m near sfc; 1500m near model top of ~ 20 km)
 - Two dynamic cores available: ARW, NMM
 - Global version in development
 - “off-line” version in development



Regional CTMs (cont.)

- Principal outputs
 - T, q, WS, WD, other meteorological state variables
 - Precip, clouds, PBL height, other derived variables
 - Photochemical oxidants
 - Particulate matter



Gases and Aerosols

CMAQ

WRF-Chem

Gas
Chem

CB4, CB05,
SAPRC99, RACM2
(in 2008)

RADM2, RACM,
RACM-MIM, CBM-Z

Aerosols

AE4 (modal model),
MADRID (sectional
model)

MADE/SORGAM
(modal model),
MOSAIC (sectional
model)



Required Data

CMAQ

WRF-Chem

Met

Met-drivers (off-line):
MM5, WRF/arw,
WRF/nmm, RAMS, GEM

Met-IC/BC: RUC, NAM,
GFS, ECMWF (IC); GSI,
WRF-3DVar (Data
assimilation); GFS, RUC,
WRF/nmm, ECMWF
(BC)

Chem/
Aerosols
IC/BC

Static climatological
profiles; Model-derived:
GEOS-Chem, GFS,
AM3-Chem (under
development)

NASA aircraft profiles;
Model-derived:
MOZART, RAQMS, Max-
Planck CTM, CHASER
(Japan)

Emissions

SMOKE processor; NEI
2001/2002; Mobile6.0;
BEIS3.13, CEMS, sea
salt; fires, dust (event-
driven)

NEI 1999; 4-km spatial
surrogates; BEIS3.11



More Information

- CMAQ
 - Byun and Schere, *Appl. Mech. Rev.*, 59, 51-77, 2006
 - www.cmaq-model.org
- WRF-Chem
 - Grell et al., *Atmos. Environ.*, 39, 6957-6975, 2005
 - www.wrf-model.org/WG11

