

CALPUFF Modeling Course Outline
Boulder, Colorado
March 14 - 16, 2011

Monday March 14 - Day 1 – Morning

1. OVERVIEW (8:30 am - 12:30 pm)

- 1.0 Introduction
- 1.1 Background
 - 1.1.1 Puff vs. Plume models
 - 1.1.2 Comparison with other models
 - 1.1.3 Regulatory status
 - 1.1.4 Near-field applications
- 1.2 CALPUFF modeling system overview
- 1.3 Major features of the CALPUFF modeling system
 - 1.3.1 Geophysical & meteorological preprocessors
 - 1.3.2 Meteorological modeling
 - 1.3.3 Dispersion modeling
 - 1.3.4 Postprocessing & display

BREAK (10:30 am - 10:45 am)

- 1.4 Summary of data requirements
 - 1.4.1 Minimum data requirements
 - 1.4.2 Advanced data inputs
- 1.5 Computer requirements
- 1.6 Typical applications and uses of the model
- 1.7 New developments and ongoing research
 - 1.7.1 New technical advances in CALPUFF v6.4
 - ISORROPIA (v2.1) chemistry, new gas phase module, secondary organic aerosol (SOA) module, aqueous phase chemistry options
 - CALPUFF nested grid features
 - Treatment of daily snow cover
 - 1.7.2 Graphical User Interface (GUI) developments
 - CALTools
 - CALANALYSIS (source contributions, significant contribution analysis)
 - CALPUFF Plot (Google Earth-based contour and source plots)
 - Time series plotting tool
 - New postprocessing features for 1-hour USA SO₂ and NO₂ standards
 - 1.7.3 Evaluation studies

LUNCH (12:30 - 1:30 pm)

CALPUFF Modeling Course Outline
Boulder, Colorado
March 14 - 16, 2011

Monday March 14 - Day 1 – Afternoon

2. HANDS-ON COMPUTER EXERCISES (1:30 pm - 5:00 pm)

- 2.1 Installation of the software and new CALPRO Plus GUI
 - 2.1.1 On-line datasets and links
- 2.2 Overview of Graphical User Interfaces (GUIs)
 - 2.2.1 Menu commands
 - 2.2.2 Online Help system
 - 2.2.3 Utilities, ISC3/AERMOD conversion program
- 2.3 Test case simulations
 - 2.3.1 Sample model files and standard model test simulations
 - 2.3.2 No-Observations simulations (Sydney case study)

Tuesday March 15 - Day 2 – Morning

3. TECHNICAL DESCRIPTION OF CALMET (8:30 am - 10:30 am)

- 3.1 Wind fields
 - 3.1.1 Initial guess field
 - Interpolation
 - Vertical extrapolation
 - Bias parameters
 - Use of prognostic wind fields (WRF, MM5, RUC, NAM-WRF, RAMS data)
 - 3.1.2 Diagnostic wind module (Step 1 adjustments)
 - Initial guess field
 - Kinematic effects
 - Terrain blocking
 - Slope flows
 - 3.1.3 Objective analysis (Step 2 adjustments)
 - Interpolation
 - Vertical extrapolation
 - Influence parameters
 - Smoothing
 - O'Brien adjustment
 - Divergence minimization
- 3.2 Boundary layer modules
 - 3.2.1 Overland boundary layer formulation
 - 3.2.2 Overwater boundary layer formulation
- 3.3 Surface friction velocity
- 3.4 Monin-Obukhov length
- 3.5 Convective velocity scale
- 3.6 Mixing height
- 3.7 Stability class

CALPUFF Modeling Course Outline
Boulder, Colorado
March 14 - 16, 2011

3.8 Gridded Precipitation and snow data

BREAK (10:30 am – 10:45 am)

Tuesday March 15 - Day 2 – Morning (continued)

- 4. METEOROLOGICAL AND GEOPHYSICAL PROCESSORS (10:45 am – 12:00 pm)**
 - 4.1 Terrain and land use processors and data bases (TERREL, CTGPROC, MAKEGEO)
 - 4.2 Upper air processors (READ62)
 - 4.3 Surface meteorological processors (SMERGE)
 - 4.4 Precipitation processors (PMERGE, PEXTRACT)
 - 4.5 Overwater data (BUOY program, SEA.DAT files)
 - 4.6 Meteorological data display (PRTMET)
 - 4.7 Prognostic processors (CALMM5, CALRUC, CALRAMS, CALETA, CALWRF, CALTAPM)

LUNCH (12:00 – 1:00 pm)

Tuesday March 15 - Day 2 – Afternoon

- 5. HANDS-ON COMPUTER EXERCISES (1:00 pm – 5:00 pm)**
(Meteorological and Geophysical Processing)
 - 5.1 Complex terrain near-field simulation (Pocatello, Idaho case study)
 - 5.2 Advanced CALMET application (barriers)

Wednesday March 16 - Day 3 – Morning

- 6. TECHNICAL DESCRIPTION OF CALPUFF (8:30 am – 12:00 noon)**
 - 6.1 Solution of puff equations – puffs vs. slugs
 - 6.2 Dispersion coefficients
 - 6.3 Building downwash
 - 6.4 Plume rise
 - 6.5 Overwater and coastal dispersion
 - 6.6 Chemical transformation
 - 6.6.1 MESOPUFF II chemistry
 - 6.6.2 RIVAD/ARM3 chemistry
 - 6.6.3 Chemistry input files (CHEM.DAT, OZONE.DAT)

CALPUFF Modeling Course Outline
Boulder, Colorado
March 14 - 16, 2011

- 6.6.4 New chemistry modules in CALPUFF v6.4
 - Updated RIVAD gas phase chemistry of SO₂, NO_x-HNO₃
 - Gas-particle equilibrium for SO₄, NO₃ (ISORROPIA v2.1)
 - Aqueous phase chemistry (RADM cloud module in CMAQ (SCICHEM))
 - Secondary Organic Aerosol (SOA) module (based on Caltech SOA routines in CMAQ-MADRID)
- 6.7 Dry deposition
 - 6.7.1 VD.DAT
- 6.8 Wet removal
- 6.9 Complex terrain
 - 6.9.1 ISC-type of terrain adjustments
 - 6.9.2 CTDM-type of terrain adjustments
 - 6.9.3 Integrated terrain adjustment approach
 - 6.9.4 Terrain processors (OPHILL, CTDMPLUS)
- 6.10 Visibility
 - 6.10.1 New FLAG (2010) methodology (Method 8)
 - 6.10.2 Alternative techniques
- 6.11 Emissions data – arbitrarily varying files (points, areas, volumes and lines)
- 6.12 CALPUFF meteorological data options
 - 6.12.1 CALMET meteorological data (CALMET.DAT) file
 - 6.12.2 AERMOD/AERMET meteorological data option
 - 6.12.3 ISC meteorological data (ISCMET.DAT) file
 - 6.12.4 CTDM meteorological data (SURFACE.DAT, PROFILE.DAT) files
 - 6.12.5 Other options (site-specific turbulence data – PROFILE.DAT)
- 6.13 Odor modeling
- 6.14 Memory management

BREAK (10:45 am – 11:00 am)

7. POSTPROCESSORS:

- 7.1 CALPOST
 - 7.1.1 Method 8 Visibility including automatic access of Class I data
- 7.2 APPEND
- 7.3 CALSUM
- 7.4 POSTUTIL
 - 7.4.1 ALM options
- 7.5 CALTools
 - 7.5.1 CALANALYSIS
 - 7.5.2 AER2CAL
 - 7.5.3 Wind Rose Plotter

CALPUFF Modeling Course Outline
Boulder, Colorado
March 14 - 16, 2011

- 7.5.4 Time Series Plotter
- 7.5.5 Back Trajectory Generator
- 7.5.6 Quantitative Meteorological Evaluation Package
- 7.5.7 Pollution Rose Plotter
- 7.5.8 Key Variable Extractor
- 7.5.9 Quantile-Quantile (Q-Q) Plotter

Wednesday March 16 - Day 3 – Afternoon

LUNCH (12:00 – 1:00 pm)

8. HANDS-ON COMPUTER EXERCISES (1:00 pm - 5:00 pm)

(CALPUFF Dispersion Modeling and Postprocessing)

- 8.1 Gulf of Mexico coastal long range transport and visibility application
 - 8.1.1 Visibility methods including new FLAG (2010) methodology
- 8.2 Accidental release (Texas coastal application) – subhourly met and emissions data
- 8.3 Cooling tower visible plume (fogging) application
- 8.4 Coastal application in complex terrain (Koeberg, South Africa case study)