CALPUFF Modeling Course Outline – Pisa, Italy

March 30 – April 1, 2010

Tuesday, March 30 - Day 1 – Morning

1. **OVERVIEW (9:00 am - 1:00 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 (11:00 am – 11:15 am)

   - 1.4 Summary of data requirements
     - 1.4.1 Minimum data requirements
     - 1.4.2 Advanced data inputs
     - 1.4.3 World-wide MM5 dataset
   - 1.5 Computer requirements
   - 1.6 Typical applications and uses of the model
   - 1.7 Ongoing and future developments
     - 1.7.1 Technical advances
     - 1.7.2 Ease-of-use considerations
     - 1.7.3 Evaluation studies

LUNCH (1:00 - 2:00 pm)

Tuesday, March 30 - Day 1 – Afternoon

2. **HANDS-ON COMPUTER EXERCISES (2:00 pm - 5:30 pm)**
   - 2.1 Installation of the software and new GUIs
     - 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, AERMOD/ISC3 conversion program
   - 2.3 Test case simulations
     - 2.3.1 Sample model files and standard model test simulations
     - 2.3.2 No-Observations simulation (Sydney case study)

Wednesday, March 31 – Day 2 - Morning

3. TECHNICAL DESCRIPTION OF CALMET (9:00 am - 11:00 am)

3.1 Wind fields
- 3.1.1 Initial guess field
  - Interpolation
  - Vertical extrapolation
  - Bias parameters
  - Use of prognostic wind fields (MM5, RUC, Eta, RAMS datasets)
- 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
3.8 Precipitation and cloud data

BREAK (11:00 am – 11:15 am)

4. METEOROGICAL AND GEOPHYSICAL PROCESSORS (11:15 am – 1:00 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, PXTRACT)
4.5 Overwater data (BUOY program, SEA.DAT files)
4.6 Meteorological data display (PRTMET)
4.7 Prognostic processors (CALMM5, CALRUC, CALRAMS, CALETA)
4.8 Postprocessors: CALPOST, APPEND, CALSUM, POSTUTIL

LUNCH (1:00 – 2:00 pm)

Wednesday, March 31 – Day 2 – Afternoon

5. HANDS-ON COMPUTER EXERCISES (2:00 pm – 5:30 pm)
(Meteorological and Geophysical Processing)
- 5.1 Complex terrain near-field simulation (Pocatello, Idaho case study)
- 5.2 Advanced CALMET application (barriers)

Thursday, April 1 – Day 3 - Morning

6. TECHNICAL DESCRIPTION OF CALPUFF (9:00 am – 11:00 am)
- 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 Odor modeling
- 6.7 Chemical transformation
  - 6.7.1 MESOPUFF II chemistry
  - 6.7.2 RIVAD/ARM3 chemistry
  - 6.7.3 Chemistry files (CHEM.DAT, OZONE.DAT)
  - 6.7.4 NO_3 prediction refinement
- 6.8 Dry deposition
  - 6.8.1 VD.DAT
- 6.9 Wet removal
- 6.10 Complex terrain
  - 6.10.1 ISC-type of terrain adjustments
  - 6.10.2 CTDM-type of terrain adjustments
  - 6.10.3 Integrated terrain adjustment approach
  - 6.10.4 Terrain processors (OPTHILL, CTDMPLUS)
- 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 Memory management

BREAK (11:00 am – 11:15 am)

Thursday April 1 - Day 3 – Morning (continued)

7. POSTPROCESSORS (11:15 am – 1:00 pm):

- 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 Ammonia Limiting Method (ALM) options
- 7.5 CALTools
  - 7.5.1 CALANALYSIS
  - 7.5.2 AER2CAL
  - 7.5.3 Wind Rose Plotter
  - 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

LUNCH (1:00 – 2:00 pm)

Thursday, April 1 – Day 3 – Afternoon

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

(CALPUFF Dispersion Modeling and Postprocessing)

- 7.1 Gulf of Mexico coastal long range transport application
- 7.2 Accidental release (Texas coastal application) – sub-hourly time step application
- 7.3 Cooling tower visible plume (fogging) application
- 7.4 Coastal application in complex terrain (Koeberg, South Africa case study)