Introduction to the CALPUFF Meteorological Interface Program (CalMIP)

Bret Anderson, EPA R7

Chris Emery, ENVIRON

Bart Brashers, ENVIRON

History

- Meteorological interface introduced at 8th Conference on Air Quality Modeling in September 2005.
- Prototype developed by EPA R7 and EPA/OAQPS in Spring 2008.
- ENVIRON developed CalMIP in Spring 2009.

Features at a Glance

- Converts either MM5 or WRF meteorological fields to CALPUFF ready format
- Applicability on either Linux/Unix or Windows platforms
- A simple text-based user interface “control” file;
- Two options to determine Pasquill-Gifford (PG) stability class
- Options to re-diagnose or pass through PBL depth
- An option to generate output on a sub-set of the meteorological modeling grid
- An optional mass-weighted vertical aggregation of multiple MM5 layers

Geophysical and Meteorological Fields Produced by CalMIP

Time-invariant fields

- 2-D surface roughness length, m (Z0)
- 2-D landuse code, dimensionless (ILANDU)
- 2-D topographic elevation, m (ELEV)
- 2-D leaf area index, dimensionless (XLAI)

Time-variant fields

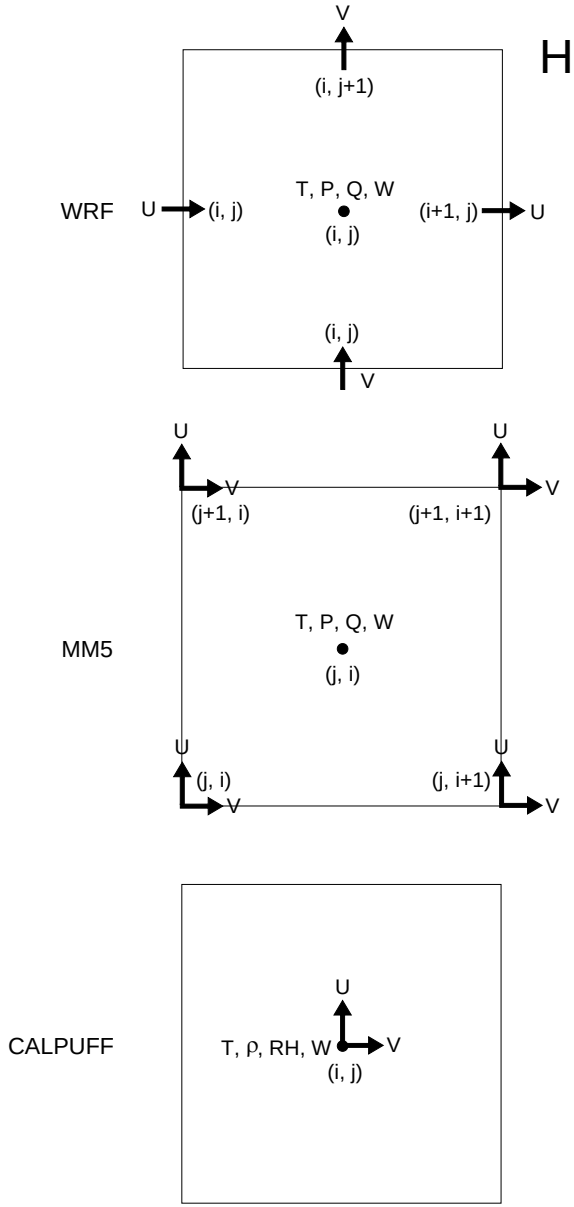
- 3-D U-component (west-east) scalar wind, m/s (U-LEV);
- 3-D V-component (south-north) scalar wind, m/s (V-LEV);
- 3-D W-component (vertical) scalar wind, m/s (WFACE);
- 3-D temperature, K (T-LEV);
- 2-D PG stability, dimensionless (IPGT);
- 2-D surface friction velocity scale, m/s (USTAR);
- 2-D PBL depth, m (ZI);
- 2-D Monin-Obukhov length, m (EL);
- 2-D convective velocity scale, m/s (WSTAR);
- 2-D rainfall rate, mm/hr (RMM);
- 2-D surface temperature, K (TEMPK);
- 2-D density, kg/m3 (RHO);
- 2-D surface solar flux, W/m2 (QSW);
- 2-D relative humidity, % (IRH);
- 2-D precipitation code, dimensionless (IPCODE).

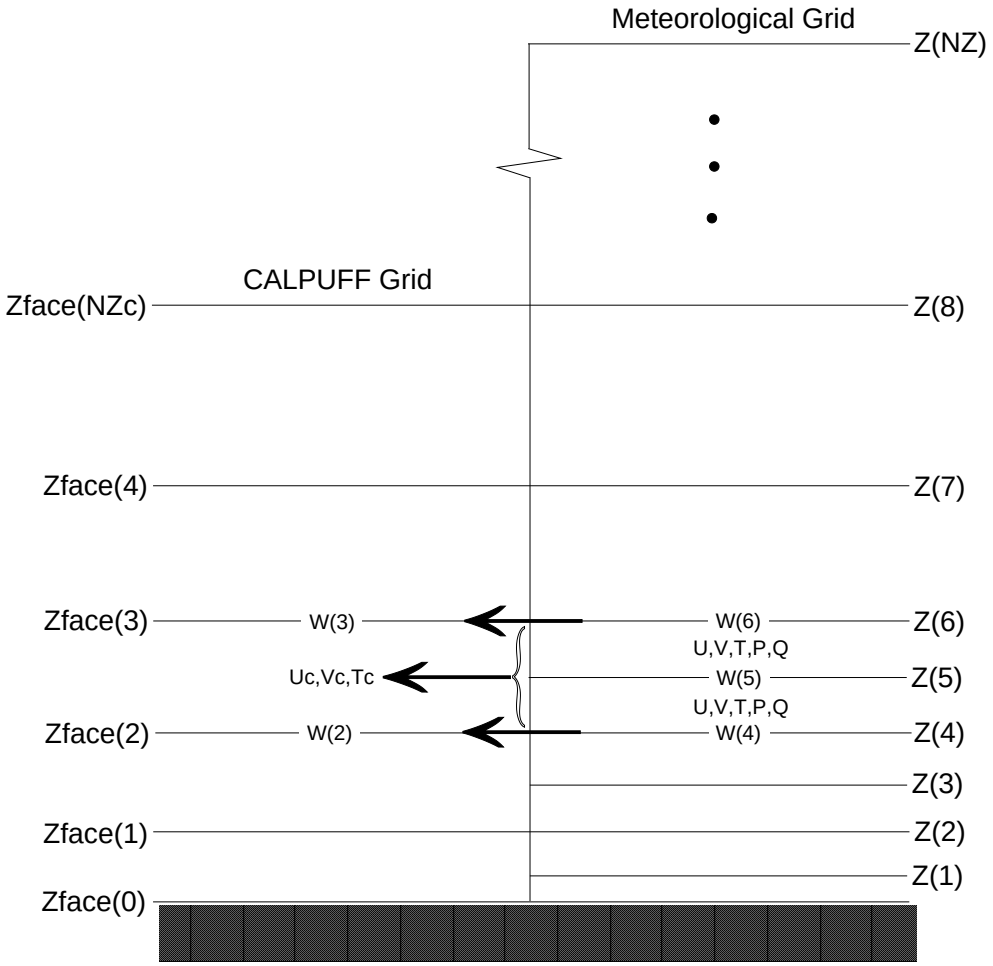
P-G Class Calculation Methods

- SRDT method
  - PG is based upon the wind speed, solar radiation, and the "Delta-T" (SRDT) method published in Supplement C to the Guideline on Air Quality Models (EPA, 1995).
  - Daytime stability is derived from the Turner method using 10-meter wind speed and solar radiation to estimate an insolation class. Nighttime stability is derived from the sign of the temperature difference between 10 meter and surface temperature.
  - The code was implemented directly from the Meteorological Processor for Regulatory Models (MPRM).
- Golder (1972) method
  - PG is based upon relationships among Monin-Obukhov lengths and surface roughness.
  - The code was implemented from the AERMOD LTOPG subroutine.

Model Grid Structures

Horizontal Grid Structure





Vertical Grid Structure

Example Input File

```
MM5 or WRF?             |MM5
Start extracting        |2006 05 29 00
Stop  extracting        |2006 05 29 23
Use Time Zone           |6
PBL Override (T/F)      |F
P-G Calc Method         |1
I-range to extract      |0,0
J-range to extract      |0,0
No. CALMET Layers       |21
Layer Mapping           |1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,19,21,23,25
Layer Heights File      |test_mm5.zface
Output File Name        |test_mm5.met
No. MM5 Files           |2
                        |/2006mm5_4km.run4/2006-05-28/MMOUT_DOMAIN4_01
                        |/2006mm5_4km.run4/2006-05-28/MMOUT_DOMAIN4_02
```

Schedule

- Operational testing to be conducted by FLM's during summer 2009
- Performance testing to be conducted by EPA R7/R10 during Summer 2009
- EPA R10, NPS, FWS, USFS sponsor Phase 2 – statistical analysis tools
- Release for use with guidance in autumn 2009

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