

Calpuff treatment of particle dispersion/deposition for crustal dust

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Calpuff Defaults

- When dry deposition of PM10 is modelled, the Calpuff species library by default describes the particle size distribution by:
 - a geometric mass mean particle diameter of 0.48 μm ;
 - a geometric standard deviation of 2 μm ;
 - defining 9 particle size intervals.
- For PM10 from crustal sources, this does not appear to be appropriate considering typical literature particle size distributions, eg:

USEPA emissions factor multipliers for dust emissions from material drop operations

Aerodynamic size (um)	USEPA emissions factor multiplier for batch material drop	
	TSP	PM10
<2.5	0.11	0.17
<5	0.20	0.47
<10	0.35	1.00
<15	0.48	
<30	0.74	
TSP	1.00	
Geo Mean =	12.7	3.6
Geo Std Dev =	3.0	2.2



Alternative approach

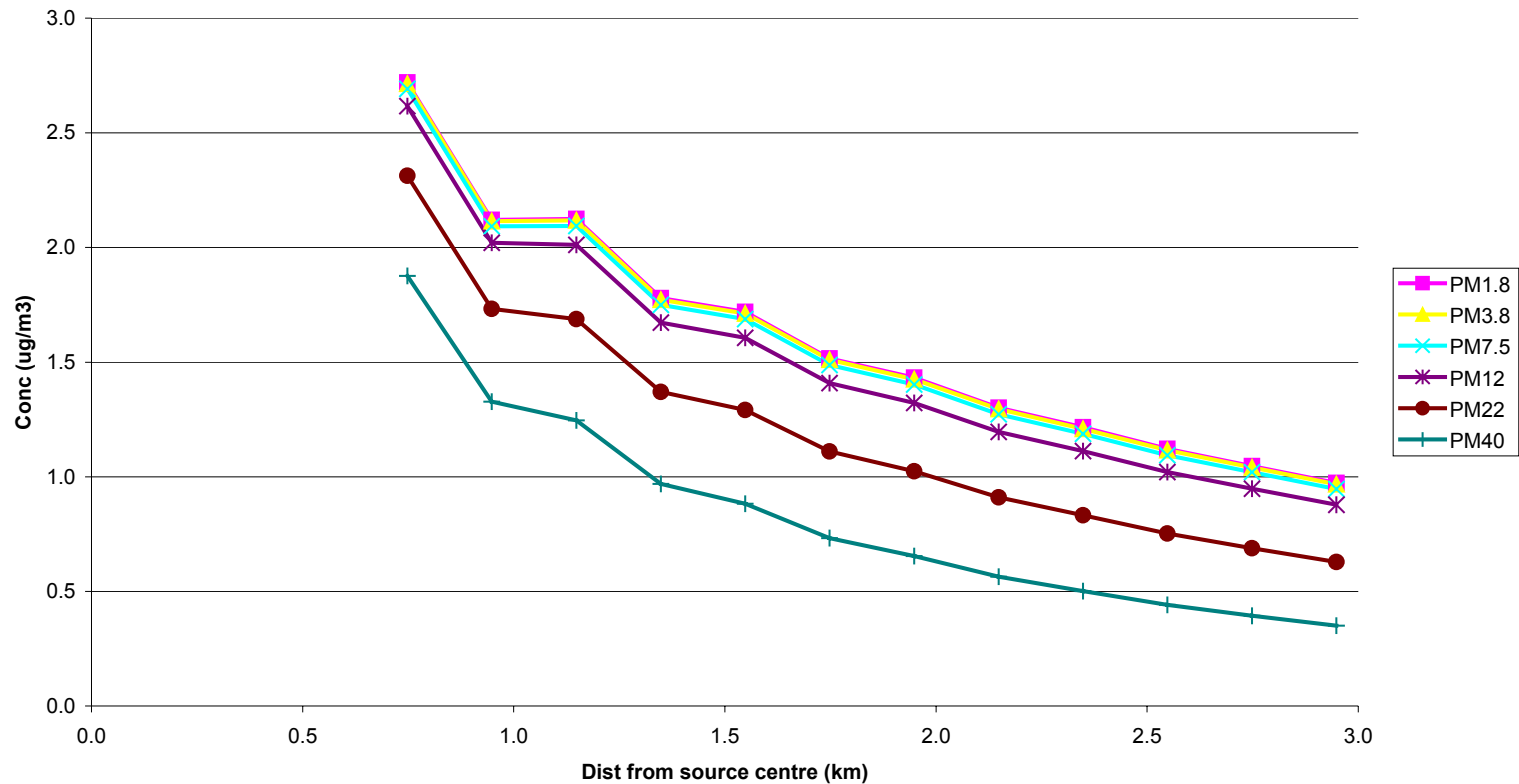
- It seems preferable to describe PM10 by simply defining a specific particle size distribution in the same way as Ausplume, ISC3 with:
 - a geometric standard deviation of 0 um;
 - specifying 1 particle size interval per size fraction.

Model set up

- A simple model run was set up as follows
 - Rectangular area source oriented 48° to wind direction.
 - Uniform emissions rates of 1×10^{-6} g/m²/s for each particulate fraction.
 - 3 m/s wind speed.
 - D class stability.
 - Roughness length = 0.05m.
- Some examples of predicted downwind concentration and dry deposition are shown following. These appear to show reasonable trends.

Downwind concentration for each particle size

Downwind concentration for each particle size for rectangular area source 48 deg to wind direction
($u=3\text{m/s}$, D , $z_0=0.05\text{m}$)



Downwind deposition rate for each particle size

Downwind deposition rate for each particle size for rectangular area source 48 deg to wind direction
($u=3\text{m/s}$, D , $z_0=0.05\text{m}$)

