

ModSIG WORKSHOP SYDNEY 7th November 2008

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A speciality ModSIG workshop was held in Sydney on the 7th November 2008 which was well attended by 42 people. It followed the 3-day introductory and 1-day advanced CALPUFF training courses. The workshop was aimed at progressing key items identified in the 2006 and 2007 ModSIG workshops, with a focus on the accuracy of model predictions of ground level concentrations under low wind speed conditions.

A review of action items from the previous workshops showed that progress has been made on previous issues identified including:

- Development of a program to convert the 3-dimensional TAPM output to input for CALMET. Joe Scire (TRC atmospheric Studies Group) reported that a beta version of this converter is now available.
- Availability of good quality, fine resolution geophysical data bases for the Australian and New Zealand region of: terrain, land use, Bowen ratios and soil moisture. This issue is considered to be partially resolved by TAPM v4 which incorporates a predictive soil moisture module negating the need for soil moisture data.
- Provision of convenient summary tables of the CALMET and CALPUFF input parameters. Joe Scire advised this was currently being implemented into the models such that a summary output of one or two pages can be created.
- Provision of MM5 (the PSU/NCAR mesoscale model) databases for Australia and New Zealand. A limitation of the current CALMET system is that cloud cover estimates are required throughout the day which is lacking in many parts of Australia and New Zealand. Estimates for clouds and other meteorological variables will be available from the data initially available at a 12km resolution for the year 2006.

Key issues Workshopped

Fourteen presentations were made at the workshop (see CASANZ ModSIG web page under <http://www.casanz.org.au/>) with the primary outcomes being:

- **Low Wind Speed Meteorology and Dispersion**

There were six presentations on this topic. They included talks by Ashok Luhar on an improved stable similarity scaling regime and evaluation of schemes to estimate stable fluxes and by Jenny Barclay on the potential improvements using CALPUFF with sub-hourly time steps. Following discussion, agreement was reached that:

 - Future modelling methods will likely utilise sub-hourly data such as per CALPUFF. As such, to provide the best predictions, good quality sub hourly data is required. To this end, ModSIG reiterates that the following data should be provided at sites where low wind speed modelling is likely to be undertaken (see following Table 1).
- **CASA Guidelines for Conducting Plume Rise Assessment**

There was unanimous agreement that the present guideline is an overkill in effort for many sources, especially for low volume emissions. It was agreed that ModSIG should make a submission to CASA requesting a simplification of the procedure and to seek clarification on the derivation of the vertical velocity criteria of 4.3 m/s.
- **NPI Fugitive Dust Emission Workbook**

Following a presentation on issues with the current NPI workbook it was agreed that CASANZ should write a submission to NPI to highlight our concerns. The principal areas of concern are:

 - The NPI needs to be aware that modellers are major users of the NPI manuals for estimating emissions for fugitive dust modelling studies and that the issues described below were having significant impacts on environmental assessments;

- That past updates of the workbook contained many mistakes and appeared not to have been peer reviewed. As such, in any future updates it was recommended that the peer review process should be given a higher priority and level of funding;
- There was poor referencing and transparency in many of the manuals. In particular all emission factors need to be referenced and supporting reports made publicly available; and
- There were a number of sources for which the emission factors/equations were considered uncertain and in need of improvement. It is suggested that the NPI should implement a program where one such factor/equation is funded for improvement per year. Of highest importance was to improve/verify the equation for dust emissions from material handling which was considered to greatly understate true emissions.

Practical advice on collecting and analysing wind data for air quality modelling

Table 1- Recommendations for Meteorological Monitoring for Air Quality Modelling

Parameter	Recommendation	Reference or Rationale
Averaging Time	Preferably store data as 5 minute averages. To be constructed using no less than 30 readings as per AS 2923 or preferably no less than 60 readings as per USEPA	Provides input for modelling low wind speed conditions where sub hourly data is preferred. Data as 5-minute averages allows easy computation of both 10-minute and 15-minute averages, the latter often being used in noise assessments. Some systems store 6-minute averages, which gives 10 readings per hour, but this does not allow for easy conversion to 10 or 15-minute averages.
Thresholds for anemometers	Wind Speed < 0.5 m/s and Wind Direction < 0.3 m/s Sonic anemometers have effective thresholds down to 0.1 m/s or less.	AS 2923 Class 1 type – Sensitive Accurate Sensors
Averaging method for Wind Speed	Store both scalar and vector wind speed averages. AS2923 and USEPA give methods, which are straightforward.	Storing both averages provides more information for understanding light wind conditions. Steady-state Gaussian dispersion models recommend using the scalar average. The vector average is appropriate for determining the movement of the centre of the plume. In light, variable winds, the vector wind speed average can be much smaller than the scalar average.
Averaging method for Wind Direction	Use vector averaging. AS2923 and USEPA give methods. Note that function ATAN2, available in most programming languages, automatically puts the angle in the correct quadrant, but check the order of arguments in the function – Excel is unusual. Vector average is sometimes calculated assuming unit wind speed.	Do not use scalar averaging as it is incorrect if wind moves through 0°/360°.
Standard deviation in wind direction	Care needed because of discontinuity at 0°/360°. Don't use Eq, 12 in AS2329, instead refer to references 9 and 10 cited therein, or method of Mitsuta described in USEPA. Use sufficient data points; AS2329 says at least 180, USEPA specifies at least 360 data points.	Often used in dispersion models as an estimate of atmospheric turbulence.

Suggested other Requirements		
Sigma U and Sigma T	Some sonic anemometers provide output of standard deviation of wind components and temperature. Record these if available.	Sigma T provides a measure of atmospheric stability. Sigma U quantifies turbulence
Differential Temperature between nominally 10 and 2m	As per the US EPA, screens should be motor aspirated, not naturally ventilated. Required accuracy $\pm 0.1^{\circ}\text{C}$ and resolution $\pm 0.02^{\circ}\text{C}$. Nominally sensors mounted at heights of 2 and 10 m, but more specifically to be between 20 z_0 to 100 z_0 where z_0 is the roughness length	Not usually available but provides useful information on atmospheric stability. Requires inter-comparison between thermometers to remove bias.

References

AS 2923-1987 Ambient Air – Guide for Measurement of Horizontal Wind for Air Quality Applications

US EPA protocols, Meteorological Monitoring Guidance For Regulatory Modelling Applications, EPA-454/R-99-005 (February 2000),

<http://www.epa.gov/scram001/guidance/met/mmgrma.pdf>