

ADVANCED MODELLING TOOLS FOR AIR QUALITY MANAGEMENT – GLADSTONE 10 YEARS ON

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Summary

Major air quality field and modelling studies were carried out for the Gladstone region in the early 1990's to assist in land use planning for prospective major industrial developments. Recent air quality monitoring and modelling studies have focussed on ratifying a suitable scheme for estimating short-term concentrations of conservative pollutants in the region. A review of the air quality measurements in the light of historical monitoring since 1980 confirms the importance of seabreeze and convective conditions for significant pollution events from major emission sources and allows some definition of complex terrain influences. A coupled TAPM – CALPUFF scheme has been produced for event evaluation and production of air quality statistics. These advances have been encapsulated in a graphical user interface for regional air quality management, suitable for non-specialist use. This tool allows rapid evaluation of cumulative air quality impacts and industry planning, and is open to a wide range of future applications such as source-specific air quality models, complaint evaluation and resource scheduling.

Keywords: Regional air quality management, Gladstone air-shed, TAPM, CALPUFF, event evaluation.

1. Introduction

1.1. Air quality modelling of industrial regions

Industrial regions in Australia such as Gladstone, Hunter Valley, Latrobe Valley, Kalgoorlie and Kwinana contain a substantial mix of industries, tourism, agricultural facilities and major residential developments. Air quality management is required at various planning and operational stages of the industries:

- Feasibility and planning studies usually involve optimisation of industry location, fuel type, emission control and stack characteristics.
- Regional planning includes establishing constraints due to cumulative impacts from all pollution sources, strategic transport studies incentives for control of commercial and residential emissions (e.g. woodheaters), and the selection of monitoring sites for compliance testing and tracking regional air quality.
- Operational issues such as scheduling of intermittent releases due to process changes and the control of meteorologically-dependent emissions (e.g. fugitive dust and odour).
- Community interactions involving complaint analysis, health risk assessment, impact evaluation and education.

- Professional interactions such as model validation, generation of suitable datasets and promulgation of suitable design standards.

Ratified modelling tools together with a strong historical database can achieve many of the above tasks. A variety of modelling schemes may be required at either the regional, sub-regional or local air-shed scales. Table 1 gives a first-order evaluation of current readily-available dispersion schemes to treat the various types of industries encountered in the above industrial regions.

Whilst none of the schemes can treat all source types, the TAPM/CALPUFF schemes are attractive at the sub-regional scale, albeit at greater expense of computational complexity and personnel training. At the local air-shed level, it can be reasonably agreed that a variety of models is required to suit the range of source types and locations.

Other important considerations are the ability to treat regional photochemistry, bushfire influences, odour impacts, emission variability and computational requirements.

This paper presents an air-shed management approach and development of a management tool sponsored by the Queensland Government for use in the Gladstone region. The tool incorporates knowledge from previous studies and recently-available advanced modelling techniques in a user-friendly framework. This method can be transposed to other regions and has scope