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AIR QUALITY MANAGEMENT AT THE RURAL/URBAN INTERFACE OF AN EXPANDING METROPOLIS

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ABSTRACT

Many Asian and Australasian cities are expanding so rapidly that, taken together with the ongoing changes in emission technology and potentially strong inter-annual climatic variability, it is often difficult to establish robust trends in air quality or to produce long-lived air quality management programmes. The outer suburbs ("peri-urban" areas) are often those that experience higher ozone levels due to traffic, industry and biogenic emissions, and sometimes bear the brunt of expectations for high residential amenity. Intensive animal production in response to population growth is often caught at the interface between semi-urban and rural areas. Major industries previously sited in forested rural areas near resource mines may unintentionally become influential in regional photochemistry. Decision makers rarely have the extensive monitoring or long history of validated airshed models on which to base considerations of air quality in holistic planning approaches.

This paper provides an initial overview of these issues and investigates the alternative avenues in which urban air quality may be analysed and managed in the sub-tropical city of Brisbane, Australia, that is the host to the 2007 IUAPPA conference. Techniques such as synoptic cluster analysis, "extent" of chemical reactions and prognostic modelling will be used to link emission information, climatic variability and observed ambient air quality to assess some of the causal factors of photochemistry in an urban airshed.

INTRODUCTION

Rapidly-expanding and relatively young cities are a striking feature of the fabric of many nations, especially in Asia, Australasia, Africa and South America. Some of these are included in the megacity category (population over 10 million) now receiving considerable attention (e.g. Molina and Molina, 2004, Schwela 2003). Sporadic or uneven growth of residential, transport and commercial facilities into an otherwise essentially rural region often occurs due to a variety of topographic, land-use, ecological and socio-political constraints. Compared to the relatively steady consolidation of the older European and North American cities with pre-existing urban areas or conurbations, the urban air phenomenology consists of a wider set of spatial and temporal scales and more interaction of city and regional air masses (Britter 2003). Heat island effects can be quite different in non-temperate areas and, especially for cities in developing countries, air pollution can reduce incoming solar radiation by as much as 20% (Fernando et al, 2001). Major research efforts such as SATURN (Moussiopoulas 2003) into the characteristics of urban air quality in Europe are more likely to characterise a quasi-stationary "equilibrium" situation where the major uncertainties are the details of traffic behaviour, the formation of secondary aerosols, the importance of upwind sources and the proper identification and control of pollution hot spots. The urban form and nature of the society existing within it are relatively fixed.

Our concerns here (and to be explored in the 2007 IUAPPA conference in Brisbane) are the cases of new urban form (sometimes included under the label of peri-urban) that occur as a