Biomass Burning at Cape Grim: Using Modeling to Explore a Possible Urban Influence on Plume Photochemistry and Composition

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Biomass Burning (BB) emissions were opportunistically measured at Cape Grim during the 2006 Precursors to Particles Campaign, when a fire burned through coastal vegetation on nearby Robbins Island. The plume was at times advected directly over the station (fresh plume) and at times was diluted and re-circulated over the ocean and mainland Australia (aged plume). When compared to the fresh plume, the aged plume contained enhanced Normalised Excess Mixing Ratios (NEMR) of ozone and Oxygenated Volatile Organic Compounds (OVOC) (see Figure 1), an increase in the ratio of cloud condensation nuclei to particles > 80nm (indicating enhanced particle hygroscopicity) and a particle growth event.

We used Chemical Transport Modeling to determine the relative contribution of both BB and urban mainland emissions to the observed changes in plume composition and to determine the age of the re-circulated plume. To achieve robust model data we undertook a modeling sensitivity study in which the key modeling uncertainties (fire emission factors, spatial uncertainty and meteorology) were systematically explored. Both primary and secondary species of BB origin were highly sensitive to the explored model uncertainties. Therefore, a synthesis of all model data from this sensitivity study will be used to determine the likely contributions from different sources.

This work demonstrates the value of model-observation synergy in resolving complex interactions between multiple sources and meteorology, and the importance of assessing model uncertainties to achieve robust model outcomes.

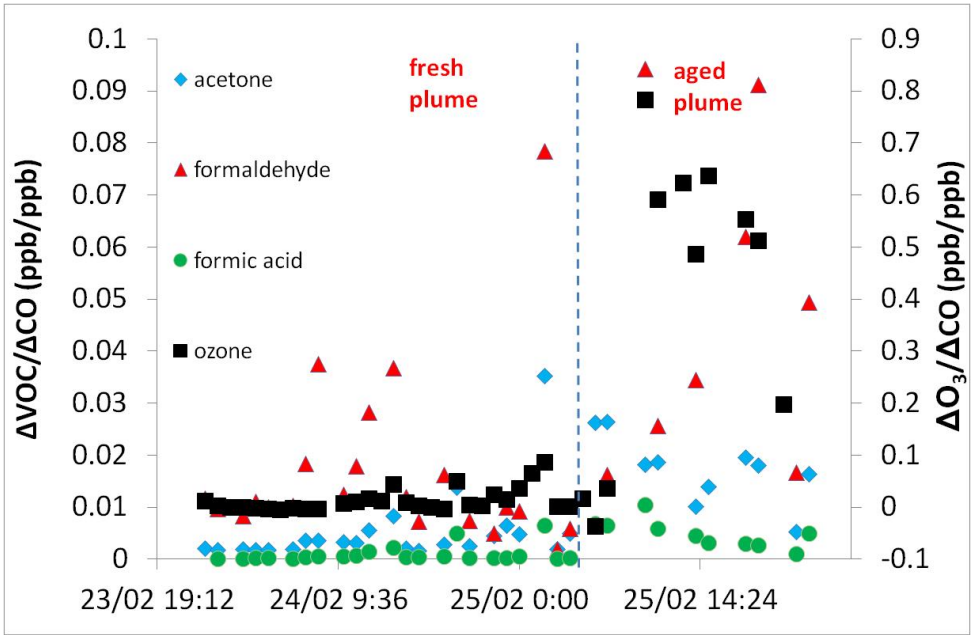

Figure 1. NEMR of oxygenated VOCs and ozone in the fresh plume, and in the aged re-circulated plume.