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Relative importance of primary and secondary aerosol components in fresh and aged air masses: Results with Environment Canada's regional air quality model

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As urban plumes age chemically, it is hypothesized that the secondary aerosol fraction increases due to gas-to-particle conversion processes, aerosol-phase oligomerization reactions and in-cloud aerosol production mechanisms. The increase in the secondary aerosol fraction plays a critical role in altering the cloud-activating and optical properties of the aerosol distribution. This paper will outline recent improvements to Environment Canada's research-grade regional air quality model (AURAMS) to predict primary and secondary aerosol concentrations and application to the PRAIRIE 2005 field intensive. The PrAIRie2005 campaign took place in the summer of 2005 in the city of Edmonton, Alberta, Canada. The overarching goal of the measurement campaign was to determine the extent to which air pollution events in the city are the result of locally emissions versus long-range transport. A nested version of the AURAMS model has been constructed for evaluation against the measurement data. The nest model runs at a 3km horizontal resolution centered on the urban airshed. The high resolution and two minute time step allows for direct comparison to continuous ground and airborne measurements of gas and particle composition, and atmospheric structure (meteorology and particle layering via LIDAR). The simulations show that the Edmonton area largely creates its own air-pollution, but that regional transport will sometimes return aged pollutants originating in Edmonton back to the city, with

a transport timescale of several days. Case study periods will be highlighted to study the evolution of the modelled primary and secondary particle contributions representing fresh urban emissions, fresh petrochemical emission and an aged air mass which underwent cloud processing on regional scales and returned back over the Edmonton airshed. A factor analysis will be applied to the aircraft mass spectrometer organic aerosol measurements to deconvolve the data set into hydrocarbon-like and oxygenated (HOA and OOA) organic aerosol fractions. The measurement-derived HOA and OOA fractions will be compared to AURAMS's predictions for the primary and secondary organic aerosol fraction.