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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characterization of the size-segregated water-soluble inorganic ions at eight Canadian rural sites" *by* L. Zhang et al.

Anonymous Referee #1

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General Comments: The authors describe and interpret measurements of water soluble inorganic ions in airborne particulate matter collected during campaigns over a total period of five years at eight Canadian rural sites with different exposure to local sources. The samples are size-fractionated using a MOUDI impactor and much of the discussion focuses upon the particle size distributions. The work appears to have been carefully conceived and is conceptually sound. However, as a new contribution to the scientific literature, the work does not offer much in the way of new insights that were not already available. None of the results is in any obvious way counter-intuitive and the justification of the work appears to be a general introduction to knowledge rather than any kind of innovation or pushing back of the frontiers. Some aspects of the data may be of utility locally, such as the particle size distributions which will be of value for

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estimating deposition processes.

Specific Comments: (1) For those samples which exhibit an ion equivalence between ammonium and sulfate and nitrate, one would expect an equivalence also of cations and anions if the data are of high quality. It would be appropriate for the authors to calculate and report such a check through the cation-anion balance.

(2) It is essential that the authors clarify what they mean by the term mass mean diameter. They use the abbreviation MMD which is usually used to refer to a mass median diameter. Similarly, the geometric standard deviation would normally be associated with a geometric mean diameter which for a log normal size distribution would be the same as the mass median diameter. For clarification they may refer to the textbook of Hinds (Aerosol Technology, 2nd Edition, Wiley, 1999). Throughout the text they frequently refer to MMD for fine and coarse fractions and again it is not entirely clear what they are referring to. Of most interest to the reader is likely to be the modal diameters, which for a single log normal distribution would correspond to the median. It also needs to be clarified that presumably they are referring to aerodynamic diameters as measured by the MOUDI.

(3) Much of the data is discussed in terms of warm season and cold season data. Given that each campaign was only of the order of 2-4 weeks, some consideration needs to be given as to whether the data were representative of an entire season given the relatively short sampling duration. Since multiple samples were collected in each campaign, it will be possible to test for statistically significant differences between campaigns in different seasons.

(4) In the penultimate paragraph in the section on sulfate, reference is made to removal rates through dry deposition processes. Have the authors considered the influences of wet deposition and how this might vary between the seasons? Another important issue is how relative humidity varies between the seasons and whether this influences particle size and behaviour.

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(5) In section 3.2, third paragraph referring to nitrate – it is stated that as expected from reaction kinetics, coarse particle nitrate dominate in the warm seasons ..... The loss of fine particle nitrate in the warm seasons is a function of thermodynamics rather than reaction kinetics.

(6) Section 3.5 – there is no acknowledgement of sea salt as a source of potassium and magnesium. If the seawater ratios are applied to the sodium data, does sea salt appear to be a significant contributor? What is the explanation for the biomodality of magnesium and calcium? What would the potassium levels lead us to consider as the likely contribution of biomass burning to aerosol loadings?

(7) Section 3.6 – it is hard to believe that a ground-level source at 12 kilometre distance at its closest could provide sufficient road salt to influence chloride and sodium concentrations. This explanation should be discounted unless the authors can use a dispersion model to calculate a source strength which can be shown to be plausible. Local concentrations adjacent to the road must surely be astronomic?

(8) The paper is generally well written and easy to read. The title well reflects the content and the abstract gives a good summary of the data. The number and quality of references is generally appropriate.

Technical Corrections: None was found.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 13801, 2008.