**Seasonal & Annual Variations in Aerosol Elemental Carbon (EC) Observations Over Canada: Constraints on Changes of Fossil Fuel Emissions**

L. Huang, W. Zhang, S. Sharma, J. Brook, Y.S. Lee, R. Leaitch and D. Ernst

Atmospheric Science Technology Directorate/ STB, Environment Canada, 4905 Dufferin Street, Toronto, Ontario M3H 5T4, Canada; 416-739-5821, E-mail: lin.huang@ec.gc.ca

Although lots of attention has recently been paid to Black Carbon (BC), there are still large gaps in the knowledge of quantifying their emission sources and estimating their impacts on regional/global climate, particularly when compared to corresponding effects from $CO_2$ and other Greenhouse Gases (GHGs). An observation network of aerosol carbon has been strategically set up and co-located with $CO_2$ and other GHG measurements across Canada since 2006. These sites represent different geographic locations with various source influences, including Toronto (a typical urban site), Egbert (a rural site), Fraserdale (a boreal East site, in northern Ontario), ETL (a boreal West site in Saskatchewan), and Alert (an Arctic baseline site). Due to the short atmospheric life-time of EC, the changes in source emission may be inferred from the changes in atmospheric EC concentration. Weekly integrated quartz filter samples collected at these sites over the period of 2006 to 2010 were analyzed for EC concentration. The weekly values were averaged into two seasonal means of summer-fall (May-Oct) and winter-spring (Nov- Apr) for the entire data set. The results show that: 1) EC concentrations during warm seasons are higher than those in cold seasons at all sites except for Alert (where the opposite pattern is found), which are consistent with source influencing patterns; 2) All the EC concentrations during warm seasons at Toronto, Egbert, Fraserdale as well as those during cold seasons at Alert show a decrease trend from 2007 through 2009 and a slight increase in 2010, which are consistent with the changes of the fossil fuel emission inventories (CDIAC: http://cdiac.ornl.gov/trends/emis/meth_reg.html) in North America & Europe during the same period; 3) Large variations in EC concentration at the ETL site during the warm seasons in 2006, 2008 and 2010 indicates that the impact of biomass burning emissions can not be underestimated at the site. The relationship between EC concentration and excess $CO_2$ (i.e. the difference between the observation and the marine boundary layer value) at Fraserdale site will be also investigated to explore a potential approach for mutual constraints on fossil fuel emitted EC and $CO_2$.

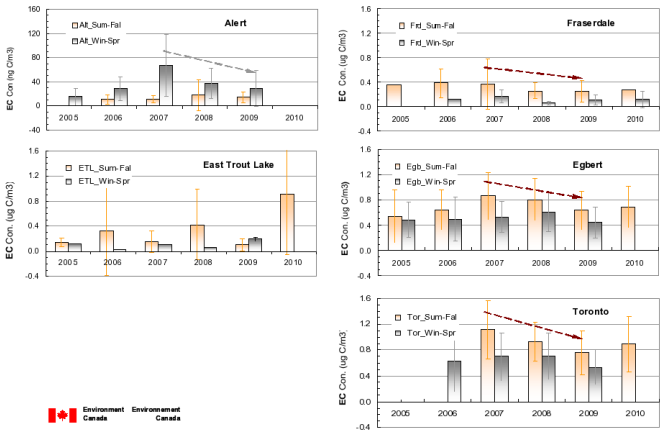


**Figure 1.** Seasonal variations of EC at five sites over Canada. Orange bars: warm seasonal means; gray bars: cold seasonal means. EC concentrations during warm seasons are mainly influenced by the polluted air masses from the south whereas during cold season major impacts on EC are from the clean air masses from the north at all sites except for Alert (where an opposite pattern is found). EC concentrations during warm seasons at Toronto, Egbert, Fraserdale and those during cold season at Alert show a decrease trend from 2007 through 2009 and a slight increase in 2010, which are consistent with the changes in fossil fuel emission inventory. (CDIAC: http://cdiac.ornl.gov/trends/emis/meth_reg.html).