Characterizing Carbonaceous Aerosols Transported to the Canadian Arctic: Attribution of Emission Sources/Regions of the Black Carbon at Alert

L. Huang[1], S. Sharma[1], W. Zhang[1], R. Leaitch[1], J. Brook[1], K. He[2], F. Duan[2] and F. Yang[2,3]

[1]Environment Canada, Toronto, Ontario M3H 5T4, Canada; 416-739-5821, E-mail: lin.huang@ec.gc.ca
[2]Tsinghua University, Beijing, China
[3]CIGIT, Chinese Academy of Science, Beijing, China

Black carbon (BC) is a major component of carbonaceous aerosols and formed by incomplete combustion of fossil fuels and biomass burning (including biofuels and open fires). It plays important roles in Earth's climate system through both direct and indirect effects. Identifying/attributing its emission sources and tracking source changes with time are important for understanding the impacts of BC on climate at the global and regional levels, as well as necessary for the strategies targeted to reduce its emissions. However, there are many challenges and uncertainties to carry out those tasks, particularly for BC aerosols transported to the Arctic region.

To address the concerns of BC in the Arctic, carbonaceous aerosol observations, including elemental carbon (EC), content as BC mass, C isotopes as a source tracer, and light absorption coefficient as BC's optical property, have been carried out at Alert, a World Meteorological Organization (WMO) Global Atmosphere Watch (GAW) station (82°27'N, 62°31'W) since the early 2000s. In this talk, nearly a decade of measurements will be presented, with a focus on the isotope results in EC (corresponding data from Beijing will also be shown for the purpose of comparison). Unique patterns of seasonal and inter-annual variations in $\delta^{13}C$ are characterized, inferring emission sources/regions and suggesting source changes over last 5-6 years. The relationships between BC mass and corresponding optical properties are also explored. In combination of C isotope results with BC mass and optical data, the possible emission sources/regions of BC contributed to the Canadian Arctic will be discussed and attributed.

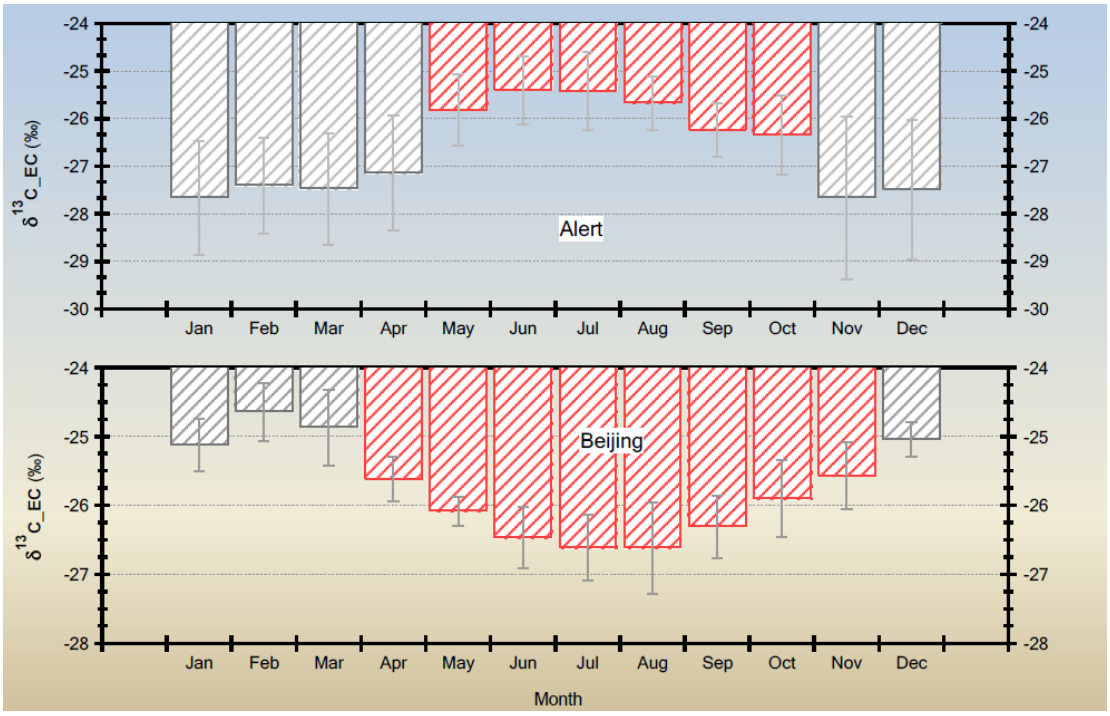

Figure 1. Mean seasonal patterns of $\delta^{13}C_{VPDBCO2}$ in EC at Alert (2002-2012) & Beijing (2006- 2010), suggesting that the dominant sources of BC transported to Alert are not from East Asia.