



Low Levels of Nitryl Chloride in the Lower Fraser Valley of British Columbia

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It is well recognized that the Lower Fraser Valley (LFV) of British Columbia is prone to episodes of poor air quality and exceedances of ozone (O_3) and fine particulate matter standards. *Ainslie and Steyn* (2007) have investigated 20 years of O_3 air quality data in the LFV region and deduced the existence of a "mystery [O_3] precursor" which builds up prior to exceedance days. One potential candidate for such a precursor is nitryl chloride ($ClNO_2$), which is formed at night from uptake of dinitrogen pentoxide (N_2O_5) on chloride containing aerosol.

Here, we present a comprehensive measurement data set collected at a routine monitoring site near the Abbotsford International Airport, which is located approximately 35 km from the Pacific Ocean in the LFV, from July 20 to August 4, 2012. Measurements included the nitrogen oxides NO, NO_2 , the peroxy-carboxylic nitric anhydrides PAN and PPN, N_2O_5 and $ClNO_2$, NO_y , O_3 , photolysis frequencies, selected volatile organic compounds (VOCs), and submicron aerosol composition and size distributions. At night, O_3 was rapidly and often completely removed by titration (with nitric oxide of anthropogenic origin and with unsaturated biogenic hydrocarbons) and by dry deposition in a shallow nocturnal inversion surface layer. The low nocturnal O_3 mixing ratios and presence of strong sinks for NO_3 limited the extent of nocturnal nitrogen oxide chemistry at the measurement site. Consequently, mixing ratios of N_2O_5 and $ClNO_2$ were low (<30 and <100 parts-per-trillion by volume (pptv), respectively). Mixing ratios of $ClNO_2$ usually peaked 1 - 2 hours after sunrise following the break-up of the nocturnal surface layer, rationalized by more efficient formation of $ClNO_2$ in the residual layer aloft than at the surface. Radical production of Cl atoms (from photolysis of $ClNO_2$) was negligible compared to that of OH (from $O(^1D) + H_2O$) except for a short period after sunrise (05:30 - 07:00 local time). Conditions required leading to air quality standard exceedances did not develop during the study period, such that the impact of $ClNO_2$ on exceedance days in the LFV remains unclear.