Geophysical Research Abstracts
Vol. 15, EGU2013-1935, 2013
EGU General Assembly 2013

Boreal fire emissions in transported pollution plumes measured at the GEOSummit Station, Greenland

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Source contributions of O_3 precursors e.g. NO_x (NO_x = NO + NO_2) to the Arctic are strongly governed by anthropogenic and boreal fire emissions and their transport pathways. Uncertainties remain in the magnitude and the impact of photochemical O_3 production from boreal fire plume air masses in the Arctic. Results from previous studies have varied, with both O_3 production and O_3 destruction observed in transported boreal biomass burning plumes.

Here, measurements of total reactive nitrogen oxides (NO_y), peroxyacetyl nitrate (PAN), NO_x, O_3 and non-methane hydrocarbons (NMHC) and FLEXPART simulations over a 2-year period from 2008 to 2010 are used to identify polluted air masses transported to the GEOSummit station (72.6N, 38.5W, 3200 m.a.s.l.) and assess the impact of boreal fire emissions on O_3 levels in the Arctic lower free troposphere. During the measurement period a number of events were observed when O_3 increased above background levels, coinciding with elevated levels of nitrogen oxides. FLEXPART carbon monoxide (CO) tracer simulations indicate that these events occur when polluted air masses arrive at the measurement site. Our results indicate that O_3 is transported to the GEOSummit Station within biomass burning plumes. The high PAN and NO_y levels during these events suggest that further O_3 production may occur during transport downwind.