6.198 Seasonal and geographical patterns of chlorine species in Northern Europe.

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Abstract:

Chlorine can have significant impacts on several aspects of atmospheric chemistry, from the formation of tropospheric ozone to the oxidation of methane and non-methane hydrocarbons, and the cycling of nitrogen and sulphur. An accurate assessment of the role played by chlorine in the chemical processes of the lower atmosphere is complicated by an incomplete understanding of its sources, sinks and distribution.
We present a set of observations of inorganic chlorine (Cl_2, $ClNO_2$, particulate chloride) and supporting data (N_2O_5, O_3, NO_x, VOC,
photolysis rates and meteorological parameters). This dataset provides insight into the geographical and seasonal variability of chlorine in Northern Europe. The measurements were taken between 2014 and 2016 at different locations in Britain: an urban site 200 km from the sea (Leicester), a coastal site in the south-west, experiencing clean air from the Atlantic Ocean (Penlee Point, Cornwall) and a coastal site in the east experiencing clean air from the North Sea or polluted air from inland (Weybourne, Norfolk).
$ClNO_2$ was almost always present at night with peak concentrations of the order of hundreds parts-per-trillion; Cl_2 was observed only
occasionally, with concentrations of a few tens of parts-per-trillion. Distinct seasonal patterns were observed for $ClNO_2$ with springtime maxima and summertime minima. The implications of the ubiquitous presence of these forms of inorganic chlorine for the

production of ozone and other pollutants in Northern Europe are investigated and discussed with the help of the NAME atmospheric dispersion model and of the GEOS-Chem 3-D chemical transport model.