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Seasonal variation of peroxyacetyl nitrate (PAN) in coastal Antarctica measured with a new instrument for the detection of sub-part per trillion mixing ratios of PAN

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Abstract. An automated gas chromatograph with sample pre-concentration for the measurement of peroxyacetyl nitrate (PAN) was constructed with a minimum detection limit below 1 pptv. This instrument was deployed at the British Antarctic Survey's Halley Research Station, Antarctica (75.6° S, 26.6° W) as part of the CHABLIS (Chemistry of the Antarctic Boundary Layer and the Interface with Snow) campaign. Hourly measurements were carried out between July 2004 and February 2005 with observed maximum and minimum mixing ratios of 52.3 and <0.6 pptv, respectively with a mean PAN mixing ratio for the measurement period of 9.2 pptv (standard deviation: 6.2 pptv). The changes in PAN mixing ratios typically occurred over periods of several days to a week and showed a strong similarity to the variation in alkenes. The mixing ratio of PAN at Halley has a possible seasonal cycle with a winter maximum and summer minimum, though the cycle is incomplete and the data are very variable. Calculations indicate that gross local PAN production is approximately 1 pptv d⁻¹ in spring and 0.6 pptv d⁻¹ in summer. Net loss of PAN transported to Halley in the summer is a small gas-phase source of NO_x and net production of PAN in the spring is a very small NO_x sink.

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