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- Title and Author Search

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Atmos. Chem. Phys., 7, 621-627, 2007
www.atmos-chem-phys.net/7/621/2007/
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First-year sea-ice contact predicts bromine monoxide (BrO) levels at Barrow, Alaska better than potential frost flower contact

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Abstract. Reactive halogens are responsible for boundary-layer ozone depletion and mercury deposition in Polar Regions during springtime. To investigate the source of reactive halogens in the air arriving at Barrow, Alaska, we measured BrO, an indicator of reactive halogen chemistry, and correlated its abundance with airmass histories derived from meteorological back trajectories and remotely sensed sea ice properties. The BrO abundance is found to be positively correlated to first-year sea-ice contact (R^2=0.55), and essentially uncorrelated with potential frost flower (PFF) contact (R^2=0.04). Assuming that PFF accurately predicts frost flowers, these data indicate that snow and ice contaminated with sea salts on first-year sea ice is a more probable bromine source than are frost flowers, for airmasses impacting Barrow, Alaska. Climate-driven changes in Arctic sea ice are likely to alter frost flower and first year sea ice prevalence. An accurate understanding of how these sea ice changes would affect the halogen chemistry of the overlying atmosphere depends upon understanding the relative roles of frost flowers and saline snow and ice surfaces as reactive bromine sources.

Final Revised Paper (PDF, 413 KB) | Discussion Paper (ACPD)

Citation: Simpson, W. R., Carlson, D., Hönninger, G., Douglas, T. A., Sturm, M., Perovich, D., and Platt, U.: First-year sea-ice contact predicts bromine monoxide (BrO) levels at Barrow, Alaska better than potential frost flower contact, Atmos. Chem. Phys., 7, 621-627, 2007. Bibtex | EndNote | Reference Manager

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