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A laboratory study of ozone depletion over frost flowers

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Sudden loss of boundary layer ozone during springtime is now a recognized phenomenon of both polar regions. Air masses that are depleted in ozone are associated with passage over sea ice, and in particular, newly-forming sea ice. Frost flowers are often produced on the surface brine slush during the formation of fresh sea ice. They are highly saline and have a large surface area, and are potentially a significant source of halogens to the atmosphere.

We have conducted laboratory experiments designed to investigate the role of frost flowers in such observed ozone depletion. Frost flowers were formed from frozen salt solutions of varying composition. Zero air containing levels of ozone typical of polar springtime, was then passed over the frost flowers. A significant depletion of ozone was observed when the frost flowers were formed from sodium bromide solution. A lesser depletion was also observed in air passed over frost flowers grown from sodium chloride solution. In both cases, the ozone depletion increased when the processed air was illuminated with ultraviolet light. A rough estimate of the magnitude of the effect suggests that it may be sufficient to account for ozone depletion events observed during springtime in the polar boundary layer.