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Bromine Oxide in the Arctic Boundary Layer: Spatial Distribution at the Coast and "Out On The Ice"

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Bromine-catalyzed ozone and mercury depletion in the polar boundary layer is a widespread phenomenon and has been studied after polar sunrise at many locations in the Arctic and Antarctica. Satellite images of bromine oxide (BrO) clouds suggest that vast areas of the Arctic Ocean and the ice belt around Antarctica are subject to ozone depletion chemistry involving BrO radicals during polar spring. Salt on sea ice and the snowpack, possibly provided by fresh or wind-blown frost flowers, can release large amounts of reactive bromine into the gas phase through the bromine explosion mechanism. Most previous ground-based studies were performed at coastal sites and few measurements exist on the pack ice. For the first time in spring 2004, both BrO and surface ozone were measured using a fully automated instrument package deployed "Out On The Ice" (OOTI) of the Arctic Ocean north of Alert, Nunavut, Canada and at the Global Atmospheric Watch station Alert several kilometres inland. The data revealed significant differences between the OOTI and coastal data sets. The MAX-DOAS vertical profile information shows a generally stable boundary layer with enhanced BrO over the ocean while much more variability is seen inland. Ozone depletion is more persistent out on the ice than only a few kilometres inland at an altitude of 200m. Background ozone concentration over the ocean is only observed when wind and enhanced vertical mixing allow entrainment of free tropospheric air. During these periods of enhanced mixing, a distinct peak in BrO is observed, which can be explained by an increase of the BrO/Br ratio. The conditions at Alert with its distinct topography and solid ice pack are compared to measurements at Barrow, Alaska dur-

ing spring 2005, where elevation differences between ocean and land are minimal and where open leads form frequently when the ice breaks offshore.