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Retrievals of SCIAMACHY limb BrO by Optimal Estimation with Comparison to OMI and GOME-2 column data during ARCTAS 2008

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The recent field campaign, Arctic Research of the Composition of the Troposphere from Aircraft and Satellites (ARCTAS), demonstrated large discrepancies between nadir satellite retrievals (OMI, GOME-2, and SCIAMACHY) of bromine monoxide (BrO) and collocated measurements taken from airborne chemical ionization mass spectrometers. To resolve this problem, it is crucial to determine the amount of stratospheric BrO contributing to these nadir columns. The channel 9 limb geometry radiance spectra from SCIAMACHY are convenient for answering this important question. Here, we present retrievals of BrO from the Envisat SCIAMACHY instrument in limb viewing geometry to target stratospheric BrO in the Arctic during the ARCTAS spring 2008 field campaign. Limb inversions were performed by optimal estimation, using the C. McLinden et al. limb geometry radiative transfer code to generate Jacobians. Measured radiances are averaged over the azimuth for each tangent height after applying the appropriate Envisat calibration tools to correct spectra. The instrument slit function and a wavelength shift parameter are calculated using a high-resolution synthetic solar spectrum derived from ground-based solar measurements. A non-linear least squares fitting routine is used then to determine all parameters describing the radiances (e.g., molecular absorptions) and also to approximate the measurement error for each tangent height. These spectral routines are adapted from the OMI operational retrieval algorithm and account for undersampling and 1st order Ring effect. In conjunction with this work, we compare our retrieved stratospheric BrO profiles with existing OMI and GOME-2 nadir BrO columns throughout April 2008 in the Arctic. Total stratospheric and tropospheric columns are calculated to help resolve the discrepancies between satellite and in-situ measurements during ARCTAS.