

Validation of stratospheric and mesospheric HCl (L2r product) measured by SMILES

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SMILES (Superconducting Submillimeter-Wave Limb-Emission Sounder) was attached to the ISS (Inter-national Space Station) / JEM (Japanese Experiment Module) to focus on molecules related to ozone destruction which includes hydrogen chloride (HCl). The period of observation covers October 2009 to April 2010. SMILES observes two HCl isotopes, H³⁵Cl and H³⁷Cl, in different SMILES frequency bands. The observation frequency of SMILES includes three bands around 625 and 649 GHz (called Band A, Band B and Band C). H³⁷Cl and H³⁵Cl are observed in the Band A (624.32-625.62 GHz) and B (625.12-626.32 GHz) of the AOS (Acousto-Optic Spectrometer), respectively. The altitude distributions of the volume mixing ratio of HCl (called Level-2 product) are derived from the measured spectra separately for H³⁷Cl and H³⁵Cl.

HCl is estimated to comprise 95% of total stratospheric chlorine (Cl) and it is a reservoir molecule in the chlorine chemistry relating to the ozone depletion in the stratosphere. We can predict the future distribution of ozone as the results of researching the global distribution of halogen molecules including HCl.

Several instruments including Aura/MLS (Microwave Limb Sounder) and ACE/FTS (Fourier Transform Spectrometer) have observed the global distribution of HCl before SMILES observation. But these measurement results show a difference of 0.2 ppbv at about 53 km [S.A. Montzka et al 2011]. This research shows the comparison and validation between SMILES HCl (Level-2 Research product version 2.1.5) profiles and Aura/MLS and ACE/FTS. The L2r HCl profiles retrieved from the band A agreed with those from Aura/MLS at the altitudes from 25 km to 50 km, but the difference of the HCl profiles between L2r and Aura/MLS becomes larger at the altitude higher than 50 km. We confirmed the same tendency for the comparison between the L2r HCl profiles retrieved from the band B and Aura/MLS.

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