4K冷却サブミリ帯リムサウンダーISS/JEM/SMILESによる成層圏中間圏のフリーラジカルClO, BrO, HO2の観測

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Observation of stratospheric/mesospheric free radicals, ClO, BrO, and HO2 by using 4K cooled submm limb sounder ISS/JEM/SMILES

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Atmospheric chemistry in the stratosphere and mesosphere is controlled by the photochemical chain reactions where the trace species such as ClO, BrO, and HO2 etc play major role. Observation of these species has been difficult since they are trace amount. Previously, there has been no satellite instrument which can measure BrO or HO2 in a single scan. The Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES) is one of the firstt instrument to use 4K mechanical cooler in space. It was successfully launched and attached to the Japanese Experiment Module (JEM) on the International Space Station (ISS) on September 25, 2009. It has been making atmospheric observations since October 12, 2009 with the 4-K cooled superconducting mixers for submillimeter limb-emission sounding in the frequency bands of 624.32-626.32 GHz and 649.12-650.32 GHz. Unfortunately, SMILES observations have been suspended since April 21, 2010 due to the failure of a critical component. On the basis of the observed spectra, the data processing has been retrieving vertical profiles for the atmospheric minor constituents and trace free radicals in the middle atmosphere, such as O_3 with isotopes, HCl, ClO, HO_2, BrO, and HNO_3. Results from SMILES have demonstrated its high potential to observe atmospheric minor constituents in the middle atmosphere.

Figure. Examples of the retrieved profile for (a) BrO and (b) HO2. Left: Red marks and horizontal bars indicate retrieved values and one standard deviations in red, and those for the a priori in blue. Right: S = Total error, Sn = Smoothing error, Sm = Measurement error.