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CIO observation by 4K cooled submm limb sounder ISS/JEM/SMILES

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The Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES) is one of the first instruments 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 O₃ with isotopes, HCl, ClO, HO₂, BrO, and HNO₃.

SMILES observed ClO several times higher sensitivity compared to previous satellite programs, Aura/MLS and Odin/SMR. Validation of SMILES ClO has been carried out with Aura/MLS data, and it agreed within error bars of Aura/MLS (since MLS has lower sensitivity and larger error bar). SMILES ClO in nighttime showed small bias and histogram showed gaussian shape, and it looks SMILES ClO value is reasonable at low altitude region down to 22 km altitude. Diurnal variation of ClO was obtained from 30-45 days dataset. ClO and ClO-OC1 equilibrium is observed within arctic polar vortex in January 2009.

Keywords: submm, ClO, stratosphere, ISS, Limb Observation