

HCl/Cl_y ratios of just before the breakup of the Antarctic vortex as observed by SMILES/MLS/ACE-FTS

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The International Space Station (ISS) / Japanese Exposure Module (JEM) borne instrument, the Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES), was successfully launched by the Japanese H-II Transfer Vehicle (HTV) on 11 September 2009 to measure chemical species in the stratosphere. We focus on inorganic chlorine species measured inside the Antarctic vortex in late spring when it is just before the breakup. At that time and location, the hydrogen chloride (HCl) is generally a main component of the total inorganic chlorine (Cl_y) in the lower stratosphere.

On 19-24 November 2009, SMILES measured southern latitudes up to 66 degrees. We will use the first public release of the dataset both for the operational and the research products. High HCl values up to 2.8 ppbv were observed near 460 K potential temperature levels (at altitude of 18 km). This characteristic agrees well with that observed in the past spring inside the Antarctic vortex. Comparisons with other satellite instruments, Microwave Limb Sounder (MLS) and Atmospheric Chemistry Experiment Fourier transform spectrometer (ACE-FTS), were also made at the same time and location. The results have shown the validity of the SMILES HCl data quantitatively. This also confirms the high HCl/Cl_y ratios inside the Antarctic vortex just before the breakup of the vortex. Then, such a feature in the recent past was examined using the MLS data between 2004 and 2011. It is found that this feature is rather regular in this late spring period in the Antarctic. Implication for this is to suggest that the future trend of Cl_y in the stratosphere can be deduced at this time and location by utilizing some aircraft or balloon measurements of HCl even below 20 km, as if no satellite measurement of HCl in the upper stratosphere in the future.

Keywords: stratosphere, antarctic, polar vortex, inorganic chlorine