

On the reaction $\text{ClO} + \text{HO}_2 \rightarrow \text{HOCl} + \text{O}_2$ based upon SMILES observation

MANAGO, Naohiro^{1*}, SUZUKI, Makoto¹, SANO, Takuki¹, MITSUDA, Chihiro², IMAI, Koji³, TAKAHASHI, Kenshi⁴, SH-IOTANI, Masato⁴

¹ISAS/JAXA, ²Fujitsu FIP Corp., ³TOME R&D Inc., ⁴RISH/Kyoto Univ.

SMILES (Superconducting Submillimeter-Wave Limb Emission Sounder) is an instrument to measure global distribution of minor species in the middle atmosphere by limb observation. It was attached to the Japanese Experiment Module (JEM) on the International Space Station (ISS) and obtained a half year's worth of data between mid October, 2009 and mid April, 2010. SMILES has an advantage in low system noise realized by cooling the receiver to 4 degrees kelvin with a mechanical cooler, and it enables to measure distribution of trace gases such as O₃, HCl, ClO, HO₂ and HOCl with high sensitivity.

It is a well-known fact that inorganic chlorine play an important role in the stratospheric chemistry. However, it is not fully understood quantitatively due to the limited precision of parameters such as the abundance of HCl, total abundance of inorganic chlorine, the ratio between HCl and other inorganic chlorine, the ratio between ClO and HOCl, and so on.

In this research, we estimated the reaction rate of $\text{ClO} + \text{HO}_2 \rightarrow \text{HOCl} + \text{O}_2$ with steady-state approximation. By using SMILES L2 ver.2.1 for the HOCl concentration and MODTRAN5 to calculate the photodissociation rate of HOCl, we obtained reaction rates similar to the JPL 2006 value at the altitude range of 30 - 40 km.

Keywords: stratosphere, inorganic chlorine