

Observation of ClO at the lower stratosphere by JEM/SMILES

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In the chemistry of stratospheric, it is well known that the inorganic chlorine species such as ClO, HCl, HOCl, ClONO₂ and Cl-atom play major role. However, precision and/or accuracy of satellite observations for the inorganic chlorine species have been not sufficient for quantitative discussions of inorganic chlorine chemistry. In this paper, we report observed results of ClO in the lower stratosphere by using SMILES.

ISS/JEM/SMILES realized low-noise observation at the 650 GHz frequency region by using 4K-cooled superconducting SIS mixer. As a result, ClO was observed with high precision much better than previous observations (Aura/MLS and Odin/SMR).

Aura/MLS have been measuring ClO with a 0.1 ppbv precision at 25-50km altitude. Theoretical ClO precision of SMILES has been reported to be about 0.01 pptv at 30 km. This value can be verified from bin-width of histogram of nighttime ClO, since the ClO value during nighttime should be zero below 35km at the background atmosphere. We obtained actual bin-width, or ClO random error, to be 0.015 pptv, which is slightly larger than the theoretical value. It has been estimated that the additional random error might come from IFOV pointing error, temperature retrieval error, or baseline fitting error.

In tropical region (N10-S10), difference between day and night profiles was 79 pptv at 25 km. This result agreed quite well with reproductive calculated value (nearby 80 pptv) by using Chemical Transport Model (SD-WACCM). On the other hand, in middle latitude (N30-50) during Mar. 13-25, 2010, SMILES value were 71 pptv at 22km, and 35 pptv at 19 km. These value were significantly larger than reported as 10 pptv by airplane and balloon observation in 1986. SMILES mid-latitude value is about 3-7 times higher than the past observation, however, agrees with reproductive calculated value like as tropical region. These discrepancy in the mid-latitude between SMILES and past observation can be explained partly by the historical increase of total Clx from 2.4 pptv in 1968 to the present value, >3.0 ppbv.

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