

Updates of JEM/SMILES L2Product v2.4: improvements of mesospheric O₃ and HCl profiles

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The SMILES (Superconducting Submillimeter-Wave Limb-Emission Sounder), an instrument for a joint mission of Japan Aerospace Exploration Agency and National Institute of Information and Communications Technology, had observed atmospheric submillimeter spectra from 2009/10/12 to 2010/4/21 from the International Space Station (ISS). The SMILES has 4K-cooled superconducting mixers and had performed the observation with high sensitivity and stability. Standard L2 products are O₃ and some molecules related O₃ chemistry, such as HCl, ClO, HNO₃, CH₃CN, HOCl, HO₂, BrO and O₃-isotopes (17OOO, O17OO, 18OOO) and v2.1 are released for non-limited users in spring, 2012. About O₃, the most sensitive SMILES product, validation study with comparing other satellite data and numerical modes is already advanced [Imai et al., 2012, submitted to JGR]. Additionally, ISS, attached SMILES, has a solar asynchronous orbit and SMILES data are used diurnal variation studies [e.g. Sakazaki et al., 2013, JGR].

Latest L2 Product v2.4 is scheduled to be released in spring, 2013. It is a one of the goals of updates after v2.1 to improve upper mesospheric profiles.

In v2.1, the recommended altitude range of O₃ for scientific use is 16 - 73 km since profiles vibrate in upper altitude range. It is because retrieval settings are not suitable. A priori profile of O₃ is monthly climatology based on AURA/MLS v2.2 for 2005-2007. However, a priori profile above 75 km is not suitable since it is outside of useful altitude range. In v2.4, retrieval altitude range is expanded up to 120 km, and a priori profile and error are adjusted. As a result, noise in the mesosphere is reduced, and SMILES profiles has sub-peak in upper mesosphere which is observed by other satellite like SABER [Smith et al., 2013, submitted to JGR].

In HCl case, retrieval altitude range was expanded up to 100 km like O₃. Additionally, about 2% of vibration near 50 km is suppressed. There are 2 factors. One is to revise AOS response function which is one of instrument functions by SMILES instrument team. Accuracy of signal extraction was improved by changing analysis method and vibration of HCl was reduced to 1%. The other is to update inversion algorithm. Although optimal estimation method was used, Tikhonov regularization method was also newly added. Thereby, HCl profiles become smooth.

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