

Sensitivity Analysis for submm/THz limb sounder, SMILES-2 Proposal

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SMILES-2 is one of the satellite proposal to JAXA/ISAS small satellite program in January 2018, and it was not selected for this selection, but we are still working for the next selection. If it is selected for the next opportunity, 2024/25 launch can be expected. SMILES-2 satellite proposal is 600 km, 66 degree, 550 kg satellite carrying SMILES-2 (core instrument), *in-situ* instruments for ionosphere (Langmuir Probe and Ion Drift Analyzer) and GPS occultation (stratospheric temperature and ionosphere electron density) (Ochiai et al, 2017). SMILES-2 will be similar to ISS/JEM/SMILES, with adding 2-3 sub-mm bands using SIS mixer and THz band (1.8 THz for OH, HO₂, and O₃, and 2.0 THz for O atom) using HEB (Hot Electron Bolometer).

SMILES-2 program has four science objectives: (MO.1) To investigate the 4-D space-time structure of the diurnal variations (atmospheric tides) in view of dynamics, chemistry, and electromagnetic processes. (MO.2) To unveil the vertical propagation of planetary scale disturbances from the middle atmosphere (non-migrating tides and stratospheric sudden warming events) to the upper atmosphere. (MO.3) To understand atmospheric variations due to electromagnetic energy input from the magnetosphere (particle precipitation and magnetic storm). (MO.4) To provide benchmarks for whole atmosphere models and climate models with detailed description of the background thermal structure and distribution of minor species.

Previously, SMILES-2 was to have 3 sub-mm bands (LO=507 GHz, 566.5 GHz, and 638.075 GHz). After preliminary satellite design study, we should reduce sub-mm antenna size (80-100 cm down to 75 cm) and minimize the size of 4K cooled part. By choosing higher frequency band (LO=763.5 GHz), we concluded almost same (or better) sensitivity other than CO and BrO with (LO=638.075 GHz, and 763.5 GHz). Expected SMILES-2 data are: Horizontal wind (30-150 km), Temperature (15-150 km), O₃, all O₃ isotopes, O atom (80-150 km), H₂O (20-100 km), HO₂, OH, HCl, ClO, HOCl, BrO, N₂O, NO, NO₂, HNO₃, CH₃CN, HCN, and volcanic enhanced SO₂.

References

Ochiai. S., P. Baron, T. Nishibori, Y. Irimajiri, Y. Uzawa, T. Manabe, H. Maezawa, A. Mizuno, T. Nagahama, H. Sagawa, M. Suzuki, and M. Shiotani, 2017: *SOLA*, **13A**, 13–18.