[EE] Evening Poster | P (Space and Planetary Sciences) | P-EM Solar-Terrestrial Sciences, Space Electromagnetism & Space Environment

[P-EM10]Coupling Processes in the Atmosphere-Ionosphere System

convener:Huixin Liu(Earth and Planetary Science Division, Kyushu University SERC, Kyushu University), Loren Chang(Institute of Space Science, National Central University), Yuichi Otsuka(名古屋大学宇宙地球環境研究所)

Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

Vertical coupling mechanisms throughout the whole atmosphere are critical to understanding the near Earth space environment, as well as its sensitivity to the solar, geomagnetic, and atmospheric drivers. This international session focuses on physical/chemical processes occurring in the mesosphere, thermosphere, and ionosphere (MTI) from both the poles to the equatorial region. Both quiet and disturbed states in response to lower atmospheric forcing or solar forcing are important for understanding the MTI system and its coupling to other regions. We invite presentations of observations and observational concepts with ground-based and/or space-borne instruments, theoretical studies, numerical simulations, and development of data analysis systems for various kinds of temporal and spatial variations in MTI system.

[PEM10-P09]SMILES-2 mission, conceptual design for applying to ISAS M-class mission

*Satoshi Ochiai[1], Philippe Baron[1], Yoshihisa Irimajiri[1], Yoshinori Uzawa[1], Toshiyuki Nishibori[2], Makoto Suzuki[2], Hiroyuki Maezawa[3], Takeshi Manabe[3], Akinori Saito[4], Masato Shiotani[4] (1.National Institute of Information and Communications Technology, 2.Japan Aerospace Exploration Agency, 3.Osaka Prefecture University, 4.Kyoto University)

Keywords:satellite observation, middle atmosphere, limb observation, wind observation, atomic oxygen, submillimeter-wave

We propose a satellite mission of submillimeter-wave limb sounder to observe temperature, wind, and atmospheric composition in the stratosphere, mesosphere, and lower thermosphere. The proposed mission, SMILES-2, will have many unique features in atmospheric observation. SMILES-2 will observe temperature profile with a precision of 0.2 K and a vertical resolution of 3 km in an altitude range between 15 and 50 km and with relaxed precision and vertical resolution better than 20 K and 5 km, respectively, in an altitude below 150 km. The horizontal wind will be also observed with a precision and vertical resolution of 3 m/s and 3 km in an altitude range between 40 and 90 km and with 10 m/s and 5 km below 150 km. Temperature and wind in such wide altitude range has never been observed by any satellite mission. Those vertical profiles are measured at gloablly distributed about 800 places in a day. The latitude range of measurement position is between 50S and 81N or 81S and 50N depending on which side the direction of the sun is on with respect to the orbit plane. As successful observation by JEM/SMILES, which is a predecessor mission and was operated for a half year in 2009/2010 on the International Space Station, SMILES-2 will observe a variety of atmospheric compositions with better precision than the other existing microwave limb sounders. In our proposal the bandwidth of the SMILES-2 receiving bands is wider than that of JEM/SMILES so that SMILES-2 can observe larger number of different molecules in the atmosphere including NO, NO_2, and N2O, which were not observed by JEM/SMILES. The significant unique feature of SMILES-2 observation is the capability of diurnal variation measurement due to its non-sun-synchronous orbit Diurnal variation of the profiles can be composed from 1.5-3 month measurements which covers 24-hour local time.
SMILES-2 is equipped with superconducting receivers at bands of 638 GHz, 763 GHz, and 2 THz.

Comparing to the JEM/SMILES receiver, higher frequency and wider bandwidth are used for SMILES-2. The band of 638 GHz is used with JEM/SMILES but will be wider bandwidth of 8 GHz for SMILES-2 than that of JEM/SMILES, that is 2 GHz. The receiver at 2 THz for observation of atomic oxygen and OH uses a newly developed hot-electron bolometer (HEB) mixer. A cryocooler system to cool the superconducting devices to about 4 K will be a similar configuration with that of JEM/SMILES, but an improved system, that is having a longer life time which has been demonstrated with a ground test experiment. A concern of using cryocooled superconducting receivers on SMILES-2 is limitation of available power of small size (M-class) satellite. With the SMILES-2 orbit, that is 550 km altitude and 66 degree inclination, the ratio of time length of sun shade to the orbit period reaches 37 %. This large sun shade ratio increases the power demand during the sun shinning period because large current is required to charge batteries. The available power for the SMILES-2 mission instrument can be estimated to be less than 323 W on the assumption that a realistic electic power system of the small size satellite bus is used. We are seeking a feasible system design that consists of a cryocooler system consuming a power of 282 W and other mission instruments consuming 41 W. SMILES-2 is one of the space science mission concept submitted to the opportunity for JAXA/ISAS M-class missions which is planned to launch in 2024 and 2026.