

Satellite Observation of the Whole Atmosphere – Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES-2)

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The Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES) attached to the Japanese Experiment Module (JEM) on the International Space Station (ISS) demonstrated a 4 K mechanical cooler in the environment of outer space for high-sensitivity submillimeter limb-emission sounding of atmospheric observations. Based on the SMILES heritage, we propose a satellite mission to observe temperature and wind fields, and distributions of atmospheric trace gases from the middle atmosphere (stratosphere and mesosphere) to the upper atmosphere (thermosphere and ionosphere) for the period of five years. SMILES-2 observations will enable us to obtain global information with unprecedented accuracy on the whole atmosphere including upper mesosphere and lower thermosphere where observations have been significantly lacking. Using observation data from the middle atmosphere to the upper atmosphere as a whole, we will be able to grasp the 4-D dynamical structure of diurnal variations (atmospheric tides) which are one of the most essential characteristics in the earth's atmosphere. To understand climate change in the viewpoint of chemical processes affecting the ozone layer, we will be able to utilize high-sensitivity measurements of the atmospheric trace gases in a quantitative manner. In the upper atmosphere, a transition layer between the atmosphere and the outer space, we will be able to clarify a role of electromagnetic energy from the temperature and wind observations. These outcomes will greatly contribute to improve the reliability of chemistry climate models for future projection and the accuracy of prediction models for space weather.

Key words: middle atmosphere, upper atmosphere, satellite observation