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# The measurement of middle and upper atmospheric wind, temperature, density and geomagnetic field with Superconducting Submillimeter-Wave Limb-Emission Sounder-2 (SMILES-2)

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Superconducting Submillimeter-Wave Limb-Emission Sounder-2 (SMILES-2) is a satellite designed for providing an unprecedented description of the atmosphere between 20 and 160 km with its diurnal changes. The mission will be proposed for the 2nd time to the M-class scientific satellite mission call for proposals by the Institute of Space and Astronautical Science (ISAS) and Japan Aerospace Exploration Agency (JAXA).

The instrument is composed of three radiometers cooled to 3-K operating in spectral bands near 700 GHz and 2 THz. It will measure the limb thermal emission with two antennas pointing at perpendicular directions to each other. Both antennas will probe the same air mass with about 7 mn delay. SMILES-2 could measure the temperature and the horizontal wind vector from 20 and 30 km, respectively, up to 160 km (precision better than 10 K and 10 $\mathrm{m\,s^{-1}}$), as well as the abundances of more than 20 chemical species. The wind retrieval precision is estimated to be better than 3 $\mathrm{m\,s^{-1}}$ with a vertical resolution of 2.5 km between 40–70 km, a range where winds have never been measured from satellite. Atmospheric density could be measured between 20–90 km with a precision better than 3%. In this study we will present the measurement performances assessed with simulations taking into account the instrumental modifications for the future proposal. We will present the simulation method and focus on the performances for the most relevant parameters such as wind, temperature, density. We will show that using the signals from both antenna, the 3-d magnetic field vector could be retrieved with a precision between 50–300 nT between 70 km to 110 km from the Zeeman effect on the selected molecular oxygen line (773 GHz).