

Mesospheric wind observation from Sub-millimeter limb sounding: Results from SMILES and simulation study for SMILES-2

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Wind observations in the middle atmosphere, i.e. stratosphere and mesosphere are sparse [1]. Observations have been obtained from ground-based active sensors (radar and lidar), and recently from passive infra-red and microwave spectrometers. Satellite observations were successfully conducted with instruments on-board the UARS and TIMED satellites but they mainly cover the mesosphere. Mesospheric winds have also been retrieved from AURA/MLS using the O₂ line at 118 GHz. It was the first demonstration that good quality winds can be provided by a microwave limb sounder. More recently winds were measured between 30 and 80 km (with a theoretical lower limit of 20 km), by the Superconducting Submillimeter Wave Limb Emission Sounder (SMILES) onboard the Japanese Experiment Module on the International Space Station. The advantage of SMILES was its low measurement noise, about 5 to 10 times lower than concurrent systems such as Odin/SMR and AURA/MLS [2]. Such noise level was obtained with the use of two 4-K cooled SIS mixers. However, the instrument was not designed for wind observations and suffered from serious limitations due to the choice of the spectrometers (type, bandwidth, resolution) and of the spectral lines. Sensitivity studies [3,4] have shown that with a careful selection of these parameters, the line of sight wind velocity can be retrieved between 40 — 90 km with a precision of 2 m/s and a vertical resolution of about 5 km, even without the use of a SIS mixer.

Wind has been selected as one of the products for the study of the successor of JEM/SMILES, namely SMILES-2, whose the main target is the study of the dynamics and chemistry in the mesosphere. In this presentation we summarize the results obtained from JEM/SMILES and discuss the SMILES-2 potential for wind measurements.

References:

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