# SMILES observations of mesospheric ozone during the solar eclipse

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To monitor the global distribution of ozone ($O_3$) and related trace gases, the Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES) was developed and deployed on the Japanese Experiment Module (JEM) of the International Space Station (ISS) [*Kikuchi et al.*, 2010]. The unprecedented high sensitivity measurements made using the 4-K cooled submillimeter limb sounder provided new insights into the physics and chemistry of the middle atmosphere such as the diurnal variation in stratospheric $O_3$ [*Imai et al*., 2013; *Sakazaki et al.*, 2013; *Parrish et al*., 2014] and successfully observed vertical distributions of $O_3$ concentration in the middle atmosphere during the annular solar eclipse that occurred on 15 January 2010. In the mesosphere, where the photochemical lifetime of $O_3$ is relatively short (ca. 100 s), altitude-dependent changes in $O_3$ concentration under reduced solar radiation and their temporal variations were clearly observed as a function of the eclipse obscuration. This study reports the vertical distributions of mesospheric $O_3$ during a solar eclipse event, and analyzes theoretically the eclipse-induced changes. We show that simple analytical expressions for $O_3$ concentration, which assume that $O_3$ and O are in a photochemically steady state, can be used to describe the $O_3$ concentration under reduced solar radiation. The SMILES data obtained during the eclipse provide a unique opportunity to test our current understanding of mesospheric $O_3$ photochemistry.

Key words: SMILES, ozone, mesosphere, eclipse

**References**

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