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Technical Note: Time-dependent limb-darkening calibration for solar occultation instruments

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Abstract. Solar occultation has proven to be a reliable technique for the measurement of atmospheric constituents in the stratosphere. NASA's Stratospheric Aerosol and Gas Experiments (SAGE, SAGE II, and SAGE III) together have provided over 25 years of quality solar occultation data, a data record which has been an important resource for the scientific exploration of atmospheric composition and climate change. Herein, we describe an improvement to the processing of SAGE data that corrects for a previously uncorrected short-term time-dependence in the calibration function. The variability relates to the apparent rotation of the scanning track with respect to the face of the sun due to the motion of the satellite. Correcting for this effect results in a decrease in the measurement noise in the Level 1 line-of-sight optical depth measurements of approximately 40% in the middle and upper stratospheric SAGE II and III observations where it has been applied. The technique is potentially useful for any scanning solar occultation instrument and suggests further improvement for future occultation measurements if a full disk imaging system can be included.

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