THE CENTER TO LIMB DARKENING EFFECT FOR UV/VIS SOLAR OCCULTATION BALLOON-BORNE MEASUREMENTS

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In recent years (1996-2000), we were probing the stratospheric composition for a variety of geophysical conditions in 8 LPMA/DOAS (Laboratoire de Physique Molculaire et Applications/Differential Optical Absorption Spectroscopy) balloon flights. The LPMA/DOAS payload is an azimuth angle controlled gondola equiped with a Sun tracker. The collected direct Sun light is fed into two UV/visible and a IR spectrometer for further spectroscopic analysis of absorption features for a wide range of atmospheric trace gases (O3, NO2, BrO, OClO, O4, IO, OIO, CH4, N2O, H2O, HNO3, ClONO2, ...).

Spectral retrieval exercises showed that a solar Center to Limb Darkening (CLD) correction had to be included in minimizing residual structures from solar Fraunhofer lines. This correction appeared to be necessary since the solar Fraunhofer line optical density values change across the solar disk, and the relative contributions of Sun light emitted from different parts of the solar disk were observed to change with increasing atmospheric air mass, the latter being due to changing atmospheric transmission with respect to Rayleigh and Mie scattering.

This paper discusses the importance of a suitable CLD correction for air- or spaceborne solar occultation UV/vis measurements involving atmospheric absorbers of extremely small optical densities (< 0.001), c.f. IO and OIO.