



Measurements of optical thickness by star radiometry on large fields of view carried out with a digital camera

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Measurements of the nighttime atmospheric optical thickness, along directions where stars of adequate magnitude could be detected, are being carried out with a computer controlled commercial digital camera. In a single exposure with an integration time of 20 s, a camera lens of f number 1.4 and focal length 50 mm, as many as 30 stars of magnitude between 2 and 6 may be simultaneously acquired in a FOV of approximately $27^\circ \times 19^\circ$. The camera is supported by a computer controlled alt-azimuthal mount: thus, a series of shots may be obtained in quick sequence on adjacent sky spaces to cover a larger fields of view: the whole zenithal arc may be acquired in 5 minutes. The optical thickness can be obtained in two different ways: as an average, based on a Langley plot of the normalized intensities of the stars available on a relatively large zenithal arc, in this case no calibration is necessary since the optical thickness is the angular coefficient of the best fit line. If a preliminary calibration is possible, a point-by-point measure of the sky optical thickness can be obtained, resulting in a map of the aerosol distribution.

The analysis of the photographic images uses a mapping procedure to connect image co-ordinates to celestial co-ordinates; these are used to identify the stars in the Tycho catalogue, obtain magnitude and light stability, and are useful to determine the horizon heights. The camera operates on the RGB color modality: the signal acquired in the G channel (green, $500 \div 600$ nm) overlaps with the wavelength range of the Johnson V filter utilized by the catalogue. It should be pointed out that the second harmonic of a

NdYAG laser, frequently utilized as a source in LIDAR systems, is at $\lambda=532$ nm. The measurements of optical thickness and extinction carried out with the camera are in some way complementary with the backscatter measurements carried out by LIDAR, where extinction may sometime be difficult to obtain.