A new methodology to derived total ozone from AERONET photometric measurements

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At present, ground based and satellite measurements, e.g. WOUDC (World Ozone and Ultraviolet Data Center) network and TOMS (Total Ozone Mapping Spectroradiometer) or OMI (Ozone Monitoring Instrument) remote sensors, provide ozone global distribution. Nevertheless, to extend the platforms from where total ozone could be derived, as AERONET (Aerosol Robotic Network) and/or SKYNET networks, will allow better assessment of their levels and trend globally. For that, current study describes and evaluates a methodology for estimating the concentration of ozone column from direct solar radiation measurements, by means of evaluating of the optical depth in column.

The ozone inversion model developed take into account the algorithm proposed by Flittner *et al*. (1993). Total optical depth in column can be expressed as the contribution of Rayleigh scattering, the extinction of atmospheric aerosols and the absorption of atmospheric gases respectively. If it considers the wavelengths at which ozone is primarily responsible for gas absorption, the spectral optical depth of absorption can be expressed as a function of total concentration of ozone in column.

In order to analyze the viability and precision of the ozone inversion model, stations that provide both total optical depth and total ozone concentration in column measurements have been selected. These stations include Ispra, Bratt's Lake and Mauna Loa (MLO), all of which belong to AERONET network and WOUDC program. A complete site description can be found in García *et al*. (2008). The spectral total optical depths are provided as direct solar radiometric measurements taken from CIMEL photometer. These measurements are registered in channels 340, 380, 440, 500, 670, 870 and 1020 nm, which correspond to the first case. Other three configurations have been considered: adding two channels into the Chappuis band (600 y 750 nm, case 2), and employing measurements in the Huggins band 315 nm (case 3) and 310 nm (case 4). Although the CIMEL photometers do not currently include these channels, the considerable benefits of their possible inclusion to the viability of the ozone inversion model are also analyzed in this work.

Ozone concentration in column at these stations is based upon spectral measurements of direct UV-B irradiance obtained via Brewer spectro-radiometers (Kerr *et al.*, 1981). The uncertainty of the ozone concentration obtained via this instrument is estimated at around 1%. In order to validate the values obtained the daily averages of ozone in column registered at each station provided by the WOUDC network were considered. In the same way the ozone concentration values derived by AERONET were also averaged on a daily basis. As an example on figure 1 it is shown the direct comparison between both the WOUDC ozone measurements and those derived by the methodology developed for each station.

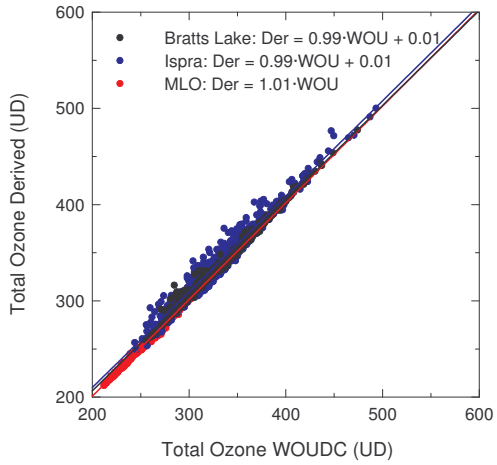

Figure 1. Total ozone concentration derived by case 4 contrasted with the measured concentration at the stations. Theoretical fit error of ±0.01 in all cases.

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Flittner, D.E., B.M. Herman, K.J. Thome, J.M. Simpson and J.A. Reagan (1993), *J. Atmos. Sci*., 50 (8), 1113-1121.

García, O.E., A.M. Díaz, F.J. Expósito, J.P. Díaz, O. Dubovik, P. Dubuisson, J.-C. Roger, T. F. Eck, A. Sinyuk, Y. Derimian, E.G. Dutton, J.S. Schafer, B.N. Holben and C.A. García (2008), *J. Gheophys. Res*., 113, D21207.

Kerr, J.B., C.T. McElroy and R.A. Olafson (1981), in *Proceedings of the Quadrennial International Ozone Symposium*, J. London, Natl. Cent. For Atmos. Res., Boulder (Colorado), 74-79.