AERONET Version 2 Direct Sun Algorithm

Ancillary Data Set Corrections	Data Product	Spatial Resolution	Temporal Resolution	Source
NO_2 *[Reference 1]*	Total column concentration [molec/cm^2]	Global: 0.25 x 0.25 degrees resolution	Monthly climatology (2003-2005)	ESA SCanning Imaging Absorption SpectroMeter for Atmospheric CHartographY (SCIAMACHY)
O_3 *[Reference 2]*	Total column concentration [Dobson Units]	Global: 1 x 1.25 degrees resolution	Monthly climatology (1978-2004)	NASA Total Ozone Mapping Spectrometer (TOMS): Earth Probe and Nimbus
Pressure *[Reference 3]*	Station pressure [hPa] derived from standard pressure level heights [m] and sea-level pressure by using quadratic fit in logarithmic space	Global 2.5 x 2.5 degrees resolution Six pressure level heights: sea-level, 1000, 925, 850, 700 600 hPa	Use 6-hourly when available and default to monthly climatology (1993-2004)	NCEP/NCAR Reanalysis

Corrections	Explanation	Implication
O_3 Absorption *[Reference 4]*	Integration of ozone spectroscopy and fitted to filter function for each wavelengths to obtain ozone absorption coefficients.	Improved ozone wavelength-dependent absorption correction
NO_2 Absorption *[Reference 5]*	Integration of NO_2 spectroscopy and fitted to filter function for each wavelength to obtain NO_2 absorption coefficients.	Improved NO_2 wavelength-dependent absorption correction
CO_2 *[Reference 6]*	Constant value of 0.0089 at standard atmospheric pressure and temperature; adjusted by P/P_o.	Affects extended wavelength instruments (e.g., channel 1640nm)
CH_4 *[Reference 7]*	Constant value of 0.0036 at standard atmospheric pressure and temperature; adjusted by P/P_o.	Affects extended wavelength instruments (e.g., channel 1640nm)
Filter Functions *[Reference 8]*	Filter functions have been updated for instruments after 1997.	Improved data quality.
Rayleigh Optical Air Mass Formula *[Reference 9]*	Updated Kasten 1965 to Kasten and Young 1989.	Very small differences in air mass calculations at high solar zenith angles.
Ozone Optical Air Mass Formula *[Reference 10]*	Updated to Komhyr et. al. 1989.	The ozone layer is no longer fixed at 22km. The ozone layer height is adjusted by latitude to provide a more accurate representation of the ozone height layer.
Water Vapor Optical Air Mass [Reference 11]	Implement Kasten 1965.	Account for the water vapor optical air mass.
Water Vapor A and B Coefficients Recalculated *[Reference 12]*	Water vapor transmission (T_w) was modeled as $T_w = \exp[-A(mw)^B]$ using the radiative transfer code from Alexei Lyapustin. Constants A and B are unique to the particular filter and w is the vertical column water vapor content.	Improved water vapor calculations by up to 20%.
Rayleigh *[Reference 13]*	Rayleigh equation suggested by Bodhaine et. al. (1999)	<0.001-0.007 change in the τ_R depending on latitude and elevation.
H_2O *[Reference 14]*	Absorption optical depth computed for channels 1020 and 1640nm using instantaneous water vapor calculation (derived from the channel 940nm).	Affects channels 1020 and 1640nm.
Earth-Sun Distance *[Reference 15]*	The effective V_o is calculated using the earth-sun distance correction.	Improved calculation of the effective V_o for each wavelength.

References

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