QOS2016-81-6, 2016
Quadrennial Ozone Symposium of the International Ozone Commission

Ultraviolet Radiation modeling from ground based and satellite measurements of Ozone over Réunion Island

K. Lamy (1), T. Portafaix (1), H. Bencherif (1,4), S. Godin-Beekmann (2), C. Brogniez (3), J.M. Metzger (5), A. Pazmino (2), and C. N. Long (6)

(1) Laboratoire de l'Atmosphère et Cyclones (LACy), UMR 8105 CNRS, Université de la Réunion, France, (4) School of Chemistry and Physics, University of KwaZulu Natal, Durban, South Africa, (2) Laboratoire Atmosphères, Milieux, Observations Spatiales, Service d'Aéronomie (LATMOS), CNRS, Institut Pierre Simon Laplace, Pierre et Marie Curie University, Paris, France, (3) Laboratoire d'Optique Atmosphérique (LOA), Univ. de Lille 1, Sciences et Technologies, Lille, France, (5) Observatoire des Sciences de l'Univers Réunion (OSU-R), UMS 3365 , Université de la Réunion, Saint Denis de la Réunion, France, (6) National Oceanographic and Atmospheric Administration, Earth System Research Laboratory, Boulder, Colorado, USA

Surface ultraviolet radiation is an increasing concern for human health. Its variability is well-known to depend on ozone levels but also on aerosols, clouds, and albedo. Reunion Island is located in the tropics, where ozone column is rather low. In addition, this island is mountainous and the marine atmosphere is often clean with low aerosol concentration. Thus, measurements shows much higher UV index compared to other site at the same latitude or at mid-latitude.[1]

In order to study ultraviolet radiation variability and its relationship to ozone, we need long-term data series to be able to detect trends. There are only a few ground-based measurements of surface irradiance in the Indian Ocean and for a limited time period, we want to reproduce these data from parameters governing surface uv radiation, and extend these series for longer period. To do so, we have developed a local parametrization using Tropospheric Ultraviolet and Visible Model (TUV[2]) and compared it to multiple years of ground based measurements of surface irradiance obtained from a BENTHAM DM300 spectroradiometer starting from early 2009 to present.

This spectroradiometer is composed of a two monochromators and has a wavelength range of 280-450 nm. In this study, we used action spectrum published by the International Commission on Illumination to calculate erythemal weighted and vitamin D weighted ultraviolet.

Only clear-sky ultraviolet radiations are modeled, therefore we need to sort-out clear sky measurements. We used observer's reports as a first approximation to detect cloudy conditions and from there fit our clear-sky points with a gaussian function in order to establish long-term clear-sky measurements. We also follow Long and Ackerman[3] methods to determine clear-sky conditions from solar irradiance.

Multiple model inputs have been tested and evaluated against observations. For ozone total column we used ground based measurements from SAOZ spectrometer and satellite measurements from OMI and SBUV instruments, ozone profile come from radio-soundings and DIAL lidar operated locally. Aerosol optical properties come from a local aerosol climatology established using a CIMEL photometer.

[1]Lee-Taylor, J., and S. Madronich, 2007: Climatology of UV-A, UV-B, and Erythemal Radiation at the Earth's Surface, 1979-2000 / J. Lee-Taylor, S. Madronich. NCAR Technical Note NCAR/TN-474+STR, doi:10.5065/D62J68SZ.

[2]Madronich, S., UV radiation in the natural and perturbed atmosphere, in Environmental Effects of UV (Ultraviolet) Radiation (M. Tevini, ed.), Lewis Publisher, Boca Raton, pp. 17-69, 1993.

[3]Long, C. N., T. P. Ackerman, K. L. Gaustad, and J. N. S. Cole (2006), Estimation of fractional sky cover from broadband shortwave radiometer measurements, J. Geophys. Res., 111, D11204, doi:10.1029/2005JD006475.