**H-O-5**

# OBSERVATION OF AEROSOL EFFECTS IN THE UV- B SPECTRAL REGION

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## 1. Introduction

An understanding of the effect of atmospheric aerosols on biologically- and photochemically-active UV radiation reaching the surface is important for many ongoing climate, biophysical and air pollution studies. Measurements of UV radiation have been important because of their direct impact on human health. The United Nations Environment Programme [WHO, 1994] has estimated that over 2 million nonmelanoma skin cancers and 200,000 malignant melanomas occur globally each year. Further, the impact of increasing UV levels over many biological processes such as crop production, photosynthesis, aquatic ecosystems etc. is largely unknown [Diaz et al. 2007]. Aerosol is one of the major components modifying the UV radiation and hence studies on impact of aerosols on UV radiation are very important. It is shown that the increase of anthropogenic aerosols in nonurban areas of industrialized countries since the industrial revolution is supposed to have decreased the biologically active UV radiation by a range of 5 to 18% [Liu et al. 1991]. Such UV measurements are sparse over India and hence an attempt has been made to characterise the changes in UV –B radiation due to aerosols over Pune, an urban station in India.

The instruments used in this study are sun/sky radiometer (Prede, POM-01L) and an Ultraviolet Pyranometer (Yankee Environmental Systems Inc., UVB-1) are installed in the roof of Indian Institute of Tropical Meteorology, Pune [18° 32' N, 73° 51' E, 559 m AMSL]. The Prede sky radiometer is an automatic sun tracking instrument, which is capable of measuring direct solar and diffuse sky radiance at five spectral channels. The filters are centered at wavelengths 400, 500, 675, 870 and 1020 nm and a detailed description of calibration methodology and data reduction procedures of this instrument are presented in Nakajima et al. [1996]. Ultraviolet Pyranometer is used to measure down-welling UV-B radiative fluxes.

## 2. Methodology

Using the 1-minute averaged radiation data from the UVB Pyranometer, cloud screening has been performed to select about 25 clear sky days during the pre-monsoon season (April and May) of 2004. The sun/sky radiometer derived aerosol optical depth (AOD), single scattering albedo (SSA) and asymmetry parameter (g) at 400, 500, 675, 870 and 1020 nm were used as inputs in Santa Barbara Discrete ordinate radiative transfer model (SBDART) to simulate UV-B fluxes at hourly interval in the same spectral range as that of the UVB Pyranometer (280-320 nm) for the selected clear sky days. Observed and SBDART derived fluxes were found to be in good agreement with a mean bias of -0.07 $Wm^{-2}$ (Figure 1).

Aerosol radiative forcing has also been estimated through differential approach as similar to the method proposed by Conant (2000). A clear sky day with lowest AOD (AOD=0.236 at 400 nm) in the selected ensemble of days were chosen as a reference day and the corresponding day's UV-B flux is chosen as reference flux. In order to avoid the

zenith angle dependence in the obsevations, fluxes and AODs were normalized with respect to airmass. The difference between the average normalized net fluxes on other clear sky days with respect to the reference day is correlated with the change in AOD to estimate aerosol radiative forcing (ARF).

## 3. Results and Conclusion

The impact of UV radiation on human health has been primarily characterized through UV index, which is a non-dimensional unit defined as the CIE-weighted UV-irradiance ($Wm^{-2}$) multiplied by the factor 40 ($W^{-1}m^{2}$). The UV index has been estimated through the UV model namely FastRT [Engelsen and Kylling, 2005]. Angstrom Beta value derived from Sky radiometer observations, climatological ozone values over Pune and MODIS derived surface albedo were used as inputs in the FastRT model. The UV-B fluxes derived through FastRT were found to be in good agreement with observed fluxes with a mean bias of -0.09 $Wm^{-2.}$ The UV index derived over the station found to be varying between 10.1 to 12.9 on different experimental days during pre-monsoon is dangerous to sensitive skin. UV index values found to be having a negative correlation with increase in AOD (Figure 2). The aerosol radiative forcing in UV-B spectral region derived by differential method and obtained from SBDART yielded a surface forcing efficiency values of -1.17 and -1.08 $Wm^{-2}$, respectively at the surface. So this study reveals that in a way, increase in aerosol levels minimizes the dangerous UV impacts on biological activities and human health.

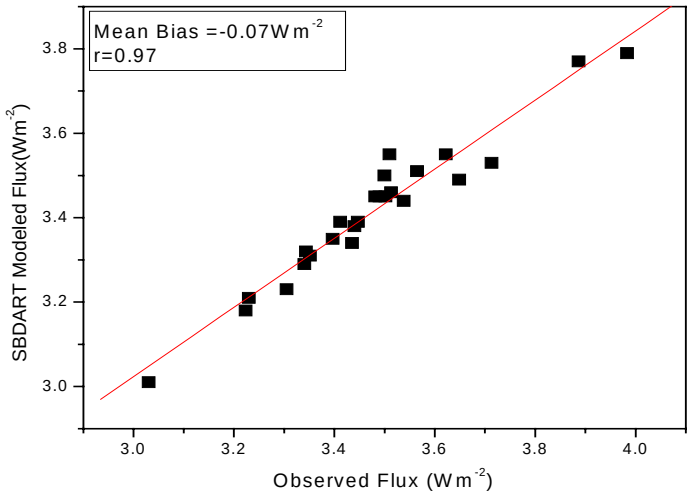


**Figure 1.** Comparison of observed and SBDART derived UV-B Fluxes

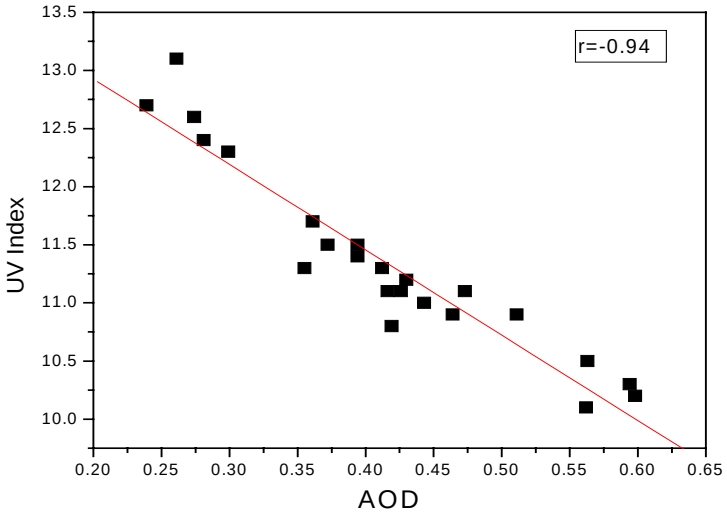


**Figure 2**. Variation of UV index with AOD

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