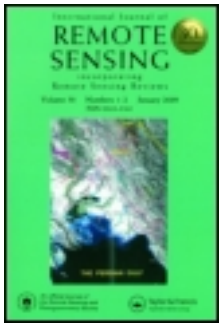

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Satellite-derived UV irradiance for a region with complex morphology and meteorology: comparison against ground measurements in Santiago de Chile

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Satellite-derived UV irradiance for a region with complex morphology and meteorology: comparison against ground measurements in Santiago de Chile

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Ground-based measurements of ultraviolet (UV) irradiance, carried out by a four-channel UV radiometer in Santiago de Chile from October 2004 to December 2011, have been used to estimate daily values of the UV index (UVI). These ground-based data have been compared with UVI estimates retrieved from the Ozone Measurement Instrument (OMI) on board the Aura spacecraft. Since the widely used OMI-gridded UVI data may not be suitable for the complex local morphology and meteorology, a careful screening of overpass OMI data was applied.

Nevertheless, we found that OMI-derived UVI data overestimate ground-based values; depending on cloud-cover conditions, the mean bias (MB) and the root mean square error (RMSE) range from 34.53% to 30.29% and from 35.22% to 43.50%, respectively, with the lowest MB (and the highest RMSE) values occurring under overcast conditions. Moreover, the difference between satellite-derived and ground-based UVI data exhibits a limited seasonality with somewhat larger differences in the fall season. The detected overestimation seems to be linked with the boundary layer aerosol absorption that is not accounted for by the OMI algorithm. Indeed, we found that the difference in UVI increases with the aerosol concentration (which in Santiago shows seasonal variations). Ceilometer profiles of backscatter intensities, directly related to aerosol concentrations, and PM10 concentrations correlate with UVI differences (correlation coefficient r of approximately 0.6 and 0.4, respectively) under cloud-free conditions for time scales ranging from months to years.

Additional comparisons were performed between UVI estimates retrieved from our ground-based measurements in Santiago and from the Tropospheric Emission Monitoring Internet Service (TEMIS) Scanning Imaging Absorption Spectrometer for Atmospheric Cartography (SCIAMACHY). Under cloudless conditions, also TEMIS-derived data overestimate ground-based UVI estimations (by about 31%) and exhibit a small seasonality.

1. Introduction

The most important consequence of the worldwide depletion of stratospheric ozone is the increase of ultraviolet (UV) radiation reaching the ground, mainly in the UV-B (280–315 nm) and UV-A (315–400 nm) (CIE 1987) regions of the solar spectrum. Although there is a strong evidence that UV-B irradiance increased over the period of ozone depletion

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