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Exploiting UV lambertian equivalent reflectivity data to infer changes in cloudiness and sea-ice in southern middle and high latitudes

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Lambertian equivalent reflectivity (LER) ultraviolet (UV) data are routinely retrieved from many satellite-based instruments. Besides their original primarily function related to the retrieval of the ozone data, they also demonstrated to be useful as a cloudiness proxy comparable with data recorded from ground-based instruments, as well as for tracking ice/snow changes at high latitudes. LER time series spanning more than three decades can be retrieved from TOMS/OMI instruments although concerns related to the EP TOMS scan mirror degradation exist. Therefore, recently additional multi-satellite-based LER datasets have been created from SBUV instruments in the frame of the NASA MEaSUREs Program (Herman et al. 2013). In this presentation we report some recent applications of both datasets over southern middle and high latitudes focusing on cloudiness, surface UV and sea-ice.

LER data have been analyzed over eight locations spanning from about 18° (north of Chile) to 62° S (Antarctic peninsula) covering years 1978–2011. Generally the distribution of the reflectivity of both TOMS datasets is similar. On the other hand, OMI LER data differ from TOMS ones in almost all locations. Daily CMF values from ground-based global solar irradiance measurements have been compared with OMI LER-based CMF data. The northernmost and southernmost locations characterized by prevalent clear sky and winter snow conditions, respectively, showed the worse agreement while the other stations showed a better correlation. For one location clear sky ground UV index values for have been estimated for years 1979–2011 by means of an empirical reconstruction model based on data recorded by a multichannel radiometer. Then, we exploit satellite LER data for computing actual surface UV by correcting clear sky UV with LER-based CMF data.

Besides we also evaluated the cloud cover and the sea ice influence on the reflectivity in the Southern Ocean by comparing the MEaSUREs LER dataset with satellite observations of cloud cover and sea ice concentration for October to March from 1979 to 2012. In agreement with a previous study, despite the high cloud fraction for most of this period, the influence of sea ice was found to be stronger than that of cloud cover and was the main driver of the LER variability. Overall, an enhancement of the sea ice concentration from 0% to 100% results in an LER increase of 39 reflectivity units (RU) (approximately 74%). This value is larger than the corresponding sea ice-induced reflectivity increase computed for the observed and modeled shortwave albedos at the top of the atmosphere. The LER data distributions for different regions and months show a marked seasonal-dependent double peak in reflectivity. Statistically significant trends in the reflectivity of the grid cells characterized by a sea ice concentration greater than 30% were found. On the other hand, the trend in the reflectivity of the ice-free pixels for the entire Southern Ocean was generally positive.