Geophysical Research Abstracts
Vol. 19, EGU2017-11904, 2017
EGU General Assembly 2017

The relative contributions of cloud and aerosol on the clearness index derived from global solar and UV radiation observations in Korea

Yun Gon Lee (1), Jaemin Kim (1), and Ja-Ho Koo (2)

(1) Department of Atmospheric Sciences, Chungnam National University, Daejeon, South Korea (yungonlee@gmail.com), (2) Department of Atmospheric Sciences, Yonsei University, Seoul, South Korea

Solar radiation in the ultraviolet, visible, and near-infrared ranges is the major source of energy for the climate and ecosystems on Earth. Global solar (GS) and Ultraviolet (UV) radiation refer to the total area (290-2800 nm) and some portion (200-400 nm) of solar energy reaching the Earth's surface, respectively. These values fluctuate dramatically over temporal and spatial scales due to varying atmospheric conditions above the surface. These variations can be attributed to the absorption and scattering of radiation by clouds, water vapor, aerosols, and other gases in the atmosphere, but are difficult to predict, primarily because of non-linear interactions in this complex system. To quantify the extinction of solar radiation in the atmosphere, the combined contributions of various atmospheric parameters that affect incoming solar radiation need to be examined. While these extinction processes are complex, the estimation of sky conditions using incident solar radiation at a given location has been proposed as a simple approach. The ratio of the solar radiation measured at the surface to the extraterrestrial solar radiation is defined as the clearness index (KT). The clearness index has been used as a general indicator of the combined effects of the various extinction processes, which determine the transmission of solar radiation through the atmosphere.

In this study, the relative contributions of cloud and aerosol on the respective clearness index were analyzed by using daily and hourly measurements of GS and erythemal UV radiation (EUV, the component of UV to redden the human skin over 280-320 nm) for the period of 2011-2015 in Korea. The ratio (EUV/G) between EUV and GS decreases as the cloud amount increases (i.e. the increase of atmospheric turbidity), whereas the ratio increases when the aerosol loading increases. Also, these results are evaluated by the individual contributions of cloud and aerosol on the respective solar radiations. This finding implies that the extinction processes (i.e. transmittance by absorption and scattering) can be different at the corresponding wavelength ranges and their levels may be related to the optical characteristics of cloud and aerosol.