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Cloud detection based on global and direct horizontal irradiances from UV and VIS multi-filter rotating shadow band radiometers

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The US Department of Agriculture (USDA) UV-B Monitoring and Research Program (UVMRP) is comprised of 40 stations over the North American region that provides solar measurements in the Ultraviolet (UV) and Visible (VIS) spectral range. With a suite of four solar radiation measuring instruments at each site, along with ancillary meteorological information obtained by secondary sensors, UVMRP has compiled one of the longest time series of solar UV and VIS records in United States. With today's technology, a variety of methods have been developed to detect the presence of clouds (e.g. geostationary meteorological satellites, lidar systems, human observations, total sky imagers); However, most of the systems have relatively low temporal resolution and are reliant on weather conditions or are observer dependent. On the other hand, clouds can be detected using a binary detection method from irradiance data which are normally available in high temporal rates, and thus can capture the variability of clouds. The aim of this study is to introduce and analyze the performance of cloud detection through measurements in the UV and VIS spectral channels from the Yankee Environmental System (YES) UV and VIS Multi-Filter Rotating Shadow band Radiometers (MFRSR). Both instruments are equipped with a sun-tracking band that enables the measurements of the global (GHI) and diffuse (DHI) horizontal irradiances. Then the direct normal irradiance (DNI) is calculated based on simple mathematical equations. All three components in 7 UV and 7 VIS channels are offered in the form of 3-minute averages, thus providing the desirable high temporal resolution of the radiation scene at each station. The benefits of the proposed cloud detection result from the fact that no model estimations are needed, while it can be also applied to the raw data of the sensor, providing a robust technique to identify the presence of clouds in high temporal analysis.

Biography

Melina Maria Zempila is a Research Scientist in the USDA UV-B Monitoring and Research Program hosted at Colorado State University. She received her PhD in Applied Physics from Aristotle University of Thessaloniki, Thessaloniki, Greece. As an atmospheric physicist, she has focused on the transfer of solar radiation in the atmosphere and the remote sensing of atmospheric parameters influencing the amount of solar radiation reaching the Earth's surface. She was instrumental in running the Greek UV Network and responsible for the operation of the Hellenic Network of Solar Radiation. Her focal point within the auspices of UVMRP is on measurements of solar radiation in the UV portion of the solar spectrum and its impacts, solar radiation transfer in the atmosphere and model simulations, and remote sensing of atmospheric parameters.

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