Remote sensing of clouds and aerosols from ground radiometers and imagers-An overview

Padmakumari B, Sneha Sunil
Indian Institute of Tropical Meteorology (IITM), Ministry of Earth Sciences, Pune – 411 008, India
padma@tropmet.res.in, sneha.sunil@tropmet.res,in

Clouds and aerosols widely distributed both horizontally as well as vertically, play a crucial role in the climate system by directly scattering and absorbing the incoming and outgoing radiation. The increasing aerosols/pollutants, contributed by both regional sources and long range transport, interact with clouds and alter cloud properties, which is an important phenomenon in modulating the precipitation mechanisms in space and time. The cloud and aerosol properties and their interactions are monitored using different measurement techniques from different platforms such as ground, air and space borne. Each platform has its own advantages and limitations. However, the combined data sets would provide a better understanding of vertical and spatial variability of aerosols and cloud properties. Compared to satellite and airborne measurements, ground-based in-situ and remote sensing techniques provide high temporal and diurnal variability of the evolution of any system passing over the region, but representing only a smaller domain. However, long-term measurements and trends are possible with ground-based observational networks.

Using the combination of ground-based radiometers such as Multi Filter Rotating Shadowband Radiometer (MFRSR) and Microwave Radiometer Profiler (MWRP), and sky imagers, cloud macro and microphysical properties such as cloud fraction (CF), cloud optical depth (COD), liquid water path (LWP) and cloud effective radii (CER) are retrieved using different radiative transfer techniques [1]. Aerosol optical depth (AOD) derived from MFRSR irradiance is highly correlated with AERONET AOD. The sky imagers are extensively used for continuous monitoring of real time sky conditions and CF retrievals. A simple methodology is also proposed to retrieve low cloud/fog at a high temporal resolution using surface irradiance, and real time Red-Blue Ratio (RBR) from the sky imager, and showed good comparison with INSAT-3D derived fog. High temporal and diurnal variability of simultaneous measurements of aerosols and clouds would help to understand the physical processes in clouds and fog due to aerosols. A close network of co-located many such remote sensing instruments could give a better representation.

1. Sneha Sunil and B. Padmakumari, “Optical and Radiative Characteristics of the Lower Part of Cirrus Clouds Over a Rain Shadow Region in South Peninsular India”. *Pure Appl. Geophys*., 2024. https://doi.org/10.1007/s00024-024-03466-4.