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Datasets from remote sensing of aerosols and clouds at Chiba University

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Aerosols and clouds play an essential role in the Earth's atmosphere by affecting the radiative balance, climate, and weather patterns. The continuous observation of these scatterers in the atmosphere can provide valuable information on their optical properties, scattering mechanisms, and characterization due to particle-atmosphere interaction. Combining data from different instruments can further enhance our understanding of these phenomena. At Chiba University, various continuously-operated instruments have been gathering data since 2011, including a nephelometer, aethalometer, lidar, visibility meter, and particle counters, providing valuable information on temporal variation and the effect of atmospheric conditions on aerosol optical properties near the ground [1-2]. A horizontal lidar system, in particular, has been continuously operated since 2021 at Chiba University as a pre-deployment activity to monitor radioactive dust in Fukushima.

In addition to ground-based observations, aerosols and nighttime clouds in the upper atmosphere can also be observed using lidar (slant and vertical) and camera systems. Chiba University has been collecting nighttime sky images since May 2017 using a camera system for nighttime cloud studies. The same camera systems have also been installed in Taiwan, Toyama College, Kyoto University's Research Institute for Sustainable Humanosphere, and the University of Guam for similar research objectives. By comparing nighttime cloud cover and pyrgeometer data, the relationship between net longwave radiation and nighttime cloud cover can be quantified.

Furthermore, Chiba University is an AERONET, SKYNET, and NIES lidar site. The dataset obtained over the years can be used to calibrate and validate datasets from different satellites, such as Himawari, MODIS, and AIRS. For example, a comparison of cloud cover from the ground-based camera and satellite data has shown that cloud cover underestimation from satellite data can be quantified for low-level clouds [3-4]. These findings demonstrate the importance of ground-based observations and their synergy with satellite data to understand atmospheric aerosols and clouds better.

Overall, datasets from continuous observations of aerosols and clouds at Chiba University provide an opportunity to apply the GRASP algorithm to yield more information about clouds and aerosols and the quantification of how they regulate radiation in the atmosphere.

Keywords: camera, ground-based instruments, aerosols, clouds, lidar

References

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