remote sensing

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Editorial

Editorial for Special Issue "High Resolution Active Optical Remote Sensing Observations of Aerosols, Clouds and Aerosol–Cloud Interactions and Their Implication to Climate"

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Abstract: This Special Issue contains twelve publications that, through different remote sensing techniques, investigate how the atmospheric aerosol layers and their radiative effects influence cloud formation, precipitation and air-quality. The investigations are carried out analyzing observations obtained from high-resolution optical devices deployed on different platforms as satellite and ground-based observational sites. In this editorial, the published contributions are taken in review to highlight their innovative contribution and research main findings.

Keywords: lidar; aerosols; remote sensing; precipitation; wind lidar; air-pollution; radiative effects

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New observations of atmospheric aerosols and clouds and, eventually, their mute interaction on sub-km, sub-diurnal scales, enabled by active optical remote sensing methodologies, are fundamental to assessing their role on climate and on Earth–Atmosphere radiative budget. The received submissions reflect the state-of-the-art of the active optical remote sensing instruments for determining the vertical and horizontal distribution of clouds and aerosols throughout the atmospheric column.

In [1], a new technology is developed to retrieve the vertically-resolved atmospheric precipitation intensity through a synergy between measurements from the National Aeronautics and Space Administration (NASA) micro-pulse Lidar network (MPLNET), an analytical model solution and ground-based disdrometer measurements. In [2], the aerosol optical depth (AOD) from Terra-Moderate Resolution Imaging Spectroradiometer (MODIS) High-quality flag Collections 6 and 6.1 (C6 and C6.1) retrievals were retrieved from dark-target (DT), deep-blue (DB) and merged DT and DB (DTB) level–2 AOD products for verification against Aerosol Robotic Network (AERONET) Version 3 Level 2.0 AOD data obtained from 2004–2014 for three sites located in the Beijing–Tianjin–Hebei (BTH) region. In [3], the authors, based on lidar and aircraft soundings, investigated the features of the convective boundary layer height and determined the thresholds of the environmental relative humidity (RH) corresponding to the observed convective boundary layer heights over Southeast China from October 2017 to September 2018. In [4], the spatial–temporal distribution of dust aerosols over East Asia was investigated using Cloud–Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) retrievals (01/2007–12/2011) from the perspective of the frequency of dust occurrence (FDO), dust top layer height (TH) and profiles of aerosol subtypes. The results put in evidence that a typical dust belt was generated from the dust source regions (the Taklimakan and Gobi Deserts), in the latitude range of 25–45° N and reaching eastern China, Japan and Korea and, eventually, the Pacific Ocean. In [5], an improved above low-level cloud–aerosol (ACA) identification and retrieval methodology was developed to provide a new global view of the ACA distribution by combining three-channel Cloud–Aerosol Lidar with Orthogonal Polarization (CALIOP) observations. The new method can reliably identify and retrieve both thin and dense ACA layers, providing consistent results between the day- and night-time retrieval of ACAs. Then, new four-year (2007 to 2010) global ACA datasets were built, and new seasonal mean views of global ACA occurrence, optical depth, and geometrical thickness were presented and analyzed. In [6], the authors carried out the retrieval of the aerosol properties through sunphotometer observation data from March 2012 to February 2014 in Kunming, China, speculating possible causes about seasonal variations. In [7], the authors presented a proof-of-concept algorithm to automatically detect precipitation from lidar measurements obtained from the National Aeronautics and Space Administration micro-pulse Lidar network (MPLNET). In [8], the authors, utilizing the satellite observations and reanalysis data, investigated the effects of Black Carbon on the climate over the Tibetan Plateau, finding that the emissions intensify the East Asian Summer monsoon. In [9], the authors employed the wind profiling observations from the fine-time-resolution radar wind profiler (RWP), together with hourly ground-level $PM_{2.5}$ measurements, to explore the wind features in the planetary boundary layer (PBL) and their association with aerosols in Beijing for the period from December 1, 2018, to February 28, 2019. In [10], the authors developed a prototype of a homemade portable no-blind zone lidar system designed to map the three-dimensional distribution of aerosols based on a dual-field-of-view receiver system. This innovative lidar prototype has a spatial resolution of 7.5 m and a time resolution of 30 s. In [11], the author developed a Three-Dimensional Real-time Atmospheric Monitoring System to measure and analyze the vertical profiles of horizontal wind speed and direction, vertical wind velocity as well as aerosol backscatter obtained from lidar measurements. The system was applied to Hong Kong, a highly dense city with complex topography, during each season and including hot-and-polluted episodes (HPEs) in 2019. In [12], the authors conducted Doppler lidar measurements in 2019 to reveal the characteristics of typical daytime turbulent mixing processes in the convective boundary layer over Hong Kong. The authors assessed the contribution of cloud-radiative cooling on turbulent mixing and determined the altitudinal dependence of the contribution of surface heating and vertical wind shear to turbulent mixing.

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