Yong Han, J Laser Opt Photonics 2018, Volume 5
DOI: 10.4172/2469-410X-C7-041

10th International Conference and Exhibition on
LASERS, OPTICS & PHOTONICS
November 26-28, 2018 | Los Angeles, USA

The Asian dust and agricultural biomass burning aerosol from the ground-based Lidar and satellite measurements in China: Transport, optical properties and impacts on regional air quality

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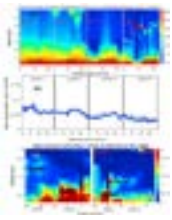
The optical properties, time-height distribution and impact on the local air quality from a heavy Asian dust transport episode are investigated with a synergistic ground-based, satellite sensors and model on May 2011 in Nanjing city (32.05°N, 118.78°E, 94m ASL), China. Two dust layers located in the planetary-boundary-layer (PBL, <2.5km) and free troposphere (3–6km) are observed by a Polarization Raman-Mie Lidar. Different transport paths originating from the Gobi deserts and Taklimakan deserts are demonstrated by the NOAA HYSPLIT, NAAPS models and NASA satellites (MODIS and CALIPSO) imageries. The dust aerosol layer shows the depolarization ratios at 0.1–0.2 and strong extinction coefficients attaining 1.0km-^{1} at 532nm and the Lidar ratios of dust are 47.3–55sr below 2.5km altitude. During this dust intrusion period, the aerosol optical depths (AOD) dramatically increase from 0.7 to 1.6 at 500nm whereas the Angstrom exponents decrease from 1.2 to 0.2 according to the Cimel-sunphotometer measurement. Meanwhile, both surface PM10 and PM2.5 concentrations show similar temporal variation and a significant increase with the peak value attaining 767μg/m^3 and 222μg/m^3 respectively. Regional influences of the transported dust are further illustrated by the AERONET-sunphotometer observations at Taihu and Xianghe sites (downwind and upwind from Nanjing), satellites MODIS, CALIPSO and model products in east China. In addition, we also discussed the agricultural biomass burning (ABB), which has been of particular concern due to its influence on air quality and atmospheric radiation, as it produces large amounts of gaseous and aerosol emissions. This study presents an integrated observation of a significant ABB episode in Nanjing, China during early June 2011, using combined ground-based and satellite sensors. The time-height distribution, optical properties, sources and transport of smoke, as well as its impacts on air quality are investigated. Lidar profiles indicate that the smoke aerosols are confined to the planetary-boundary-layer (PBL) and have a depolarization ratio of less than 0.08. The aerosol optical depth (AOD) increases from 0.6 to 3.0 at a wavelength of 500nm, while the Angstrom exponent varies from 1.0 to 1.6. The aerosol single scattering albedo becomes smaller (0.87-0.8) at 675-1020nm and shows a decreasing trend from the wavelength of 440nm to 1020nm, indicating more absorbing aerosols. The absorption Angstrom exponent (0.7) is smaller than 1.0, which may indicate the aged smoke particles mixed or coated with the urban aerosols. By combining MODIS fire, AOD, CO from AIRS and NO2 from OMI products, the ABB sources are identified in mid-eastern China. Surface PM10 and PM2.5 show a dramatic increase, reaching 800μg/m^3 and 485μg/m^3, respectively.`



Biography

Yong Han has completed his PhD (Major: Optics) in the year 2007 at the age of 32 years from the key lab of atmospheric optics, Anhui Institute of Optics and Fine Mechanics, Hefei Institute of Physical Science, Chinese Academy of Sciences. He has completed his post-doctoral (Major: Atmospheric Sciences) in the year 2010 at the age of 35 years from Key Laboratory of Middle Atmosphere and Global Environment Observation (LAGEO), the Institute of Atmospheric Physics, Chinese Academy of Sciences. Before 2017, he was an associate professor at the School of Atmospheric Science, Nanjing University. Now, he is a Professor of School of Atmospheric Sciences, Sun Yat-Sen University, an important scientific and talent training university. He teaches the undergraduate core course earth atmosphere integrated exploration and graduate courses radar and satellite. He has published more than 55 papers in reputed journals, two international invention patents, monographs of the editor in chief (the Principle and Method of Detection in Atmospheric Science) and has been serving as an member of the Atmospheric Exploration and Instrumentation Committee of China Meteorological Society, Youth Director of China Particle Society, Specialized Committee Member of Jiangsu Meteorological Society and Director of Jiangsu Particle Society, China, etc. His research interests are the study of Atmospheric Physics and Atmospheric Exploration, Atmospheric Remote Sensing and Atmospheric-ocean Optics, Atmospheric Composition and Observation Scientific Instruments.

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