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论文

微脉冲偏振激光雷达探测城市底层气溶胶

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摘要:

以单脉冲能量2μJ,重复频率1kHz的Nd:YAG固体激光器为光源研发了一台便携式人眼安全可三维扫描的微脉冲偏振激光雷达系统,可实现对城市底层气溶胶球形特性和分布情况的探测.为保证在西北地区等高密度气溶胶聚集的地域,实现近地表80~1000m范围内的精确探测,系统的光电检测采用模拟探测技术.利用该激光雷达系统首次对冬季西安局部地区1000m范围内大气气溶胶退偏比进行了俯仰扫描探测,并分析了天气过程和地面状况对退偏比的影响.实验结果表明,探测期间无明显沙尘事件发生,探测区域内气溶胶的退偏比在0.1左右,在无绿化带的交通干道交叉口等局部区域,受地面状况影响退偏比偏高,并获得了退偏比值与天气过程的初步关系,同时也验证了系统的可行性.研究成果可对城市底层气溶胶的产生、传输及扩散特性研究提供科学数据.

关键词: 气溶胶 退偏比 微脉冲偏振激光雷达

Detection of Bottom Aerosols in Urban Area using Micro-pulse Polarization Lidar

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Abstract:

A portable micro-pulse polarization lidar system with 3D scanner at eye-safety level is developed,in which Nd:YAG pulsed laser is employed as the exciting source with 2 μJ pulse energy and 1 kHz repetition rate, to detect the spherical characteristics and distribution of bottom aerosols in urban area. To ensure high accuracy detection near the earth's surface at the range from 80 m to 1000 m in the region of high-density aerosols such as northwest region, analog photoelectric detection technique is adopted. Continuous observations with scanning in zenith angle are carried out for the first time for depolarization ratio of atmospheric aerosols below 1 km in Xi'an in winter, the results of depolarization ratio scanning profiles are obtained and the effect of weather process and state of ground on depolarization ratio is analyzed. The experimental results show that, the depolarization ratio is around 0.1, where there were no sandstorms during the observations, and the depolarization ratio in certain regions is relative higher, which are occurred at the crossings of roads without greenbelts. The experimental results validate the feasibility of the system and will also provide scientific data for investigating the generation, transmission and diffusion characteristics of urban pollution particles.

Keywords: Aerosol Depolarization ratio Micro-pulse polarization lidar

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