钠多普勒激光雷达回波光子数仿真及大气参数反演

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Simulation of echo-photon counts of a Sodium Doppler Lidar a atmospheric parameters

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摘要 钠多普勒激光雷达利用中层顶区域的钠原子作为示踪物,探测中层顶区域大气风场和温度剖面.本文主要分析钠多普勒激探测原理和大气参数反演算法.利用MSISE和HWM93等大气模型给出背景大气温度、密度及风场,并给定钠原子数密度剖面达方程出发,模拟计算了激光雷达的瑞利散射和钠共振荧光散射回波光子数.利用模拟的回波光子数剖面数据,反演得到大气温风速和钠原子数密度剖面,反演结果与模拟计算用的背景参数符合很好,验证了这一反演方法的正确性.分析了激光频率偏移变化对反演精度的影响.

关键词： 钠多普勒激光雷达　 回波光子数　 温度和风场反演

Abstract： The atmospheric winds and temperatures were retrieved with the received resonance fluore scattering photon echoes from Na atoms as a trace in the mesopause region. The lidar principle and the method of atmospheric parameters have been investigated. While the background temperature and dens atmosphere is given by atmospheric model MSISE and the background wind is given by HWM93 model, ar number density profile of the sodium layer is given with a Gaussian model, the lidar echo-photon counts simulated by using the lidar equations of Rayleigh scattering and sodium resonance fluorescence scatteri retrieved winds and temperatures agree well with the given winds and temperatures, which shows that t retrieval method is reliable. The effects of laser frequency bias and variations of the laser linewidth on th accuracy of retrieval results are analyzed and presented.

Keywords： Sodium Doppler Lidar　 Echo-photon count　 Temperature and wind retrieve

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