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激光雷达专辑

基于Fernald和Klett方法确定气溶胶消光系数边界值

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摘要：

基于Fernald方法和Klett方法，推导出一个具有明确物理意义的确定气溶胶消光系数边界值的表达式，该式比目前用于确定边界值的Collis斜率法表达式增加了两项：空气分子消光系数项和后向散射项，这两项与Collis斜率法的值符号相反。空气分子消光系数项较小，但后向散射项为后向散射系数的倒数和导数的乘积，绝对值能达到Collis斜率法的75.2 %。分析表明，考虑了新增两项反演的大气气溶胶光学厚度（AOD）与实测更接近，所以增加这两项是合理的、必要的。不同标高反演2007年9月20日的AOD在0.20~0.25之间，变化范围较小；反演的AOD方差为0.003，相对较小。说明新方法对标高的依赖较小且较稳定。分析424个时次晴空资料的反演结果可知，反演比实测大7.4%，反演与实测的相关系数为93.2%，相对误差和绝对误差分别为10.9%和0.03，反演的AOD方差为0.02，AOD小于0.45（占到资料总数的91.7%）时，反演结果较好。

关键词： 大气遥感 激光雷达 消光系数 边界值 标定高度 光学厚度

A novel approach based on Fernald’s and Klett’s method to determine the atmospheric extinction coefficient boundary value

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Abstract:

Based on Fernald’s and Klett’s method, a new expression of the atmospheric extinction coefficient boundary value is presented. This expression is a formula that has two more terms than Collis’ method. The absolute value of the two terms may account for 78.2% of the term in Collis’ method and have opposite sign. Taking the two terms into consideration, aerosol optical depth（AOD) derived by lidar is closer to the observed one by sun-photometer. With the change of reference height，the derived AOD ranging from 0.20~0.25 and the variance is about 0.003，showing that this approach is independent from reference height and relatively stable. 424 clear sky data is selected in the inversion. AOD derived by lidar is 7.4 % bigger than the observed one. The correlation coefficient is 0.932, the relative error is 10.9 %, the absolute error is 0.03 and the variance is 0.02. The approach has a better performance when AOD is less than 0.45.

Keywords: remote sensing lidar extinction coefficient boundary value reference height aerosol optical depth

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