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耗散大气中的声波射线追踪

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Ray tracing of acoustic wave in the lossy atmosphere

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摘要 基于分层大气中声波的局地色散关系方程,建立一种计入真实大气衰减效应的有耗大气声波射线追踪模型.在色散方程的虚部中导出声波在运动大气中的耗散系数和竖直方向上的增长因子,并利用真实大气中的衰减理论对所得到的耗散系数进行修正.利用Hamilton方程组解出大气声波在考虑耗散效应下的射线微分方程组.该有耗射线追踪模型的数值模拟结果表明,声波的耗散效应对声波的传播路径存在一定影响,在近场情况下,这种影响可以忽略,但是对于声波的远场传播,则影响较大.

关键词: 声波 耗散大气 射线追踪 局地色散关系 衰减

Abstract: An acoustic ray tracing model considering the real atmospheric acoustic attenuation is developed in this paper based on the local acoustic dispersion relation in the stratified atmosphere. The acoustic attenuation coefficient and growth factor in the moving atmosphere are calculated from the imaginary part of the dispersion relation, and the acoustic attenuation coefficient is corrected by the theory of attenuation in real atmosphere. The ray equations in the lossy atmosphere are then obtained through Hamilton equations. The numerical results of this ray tracing model indicate that the atmospheric absorption could have a considerable influence on the acoustic trajectory. This influence, though maybe obscure for near field propagation, cannot be neglected under the circumstance of far field propagation.

Keywords: Acoustic waves Dissipative atmosphere Ray tracing Local dispersion relation Attenuation

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