

A LES modeling study of impact of aerosol radiation effect on the evolution of the smoggy boundary layer

气溶胶辐射效应对灰霾边界层影响的大涡模拟研究

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Smoggy boundary layer is a new challenge to atmospheric boundary layer meteorology and atmospheric environment in our country. Aerosol radiation effect is the key to determine the structures of smoggy atmospheric boundary layer. A radiation model (Discrete Ordinates Radiative Transfer Program, DISORT) will be coupled with the NCAR's Large-Eddy Simulation (LES) model to study the impact of aerosol radiation effect on the turbulence structures of the boundary layer. Both field experiments and the online-coupled modeling system are integrated to investigate the interactions among haze, aerosol radiation, and boundary layer processes, and their impacts on turbulence, thermodynamics, and entrainment through numerical experiments. This study will provide scientific evidence for improvement of boundary layer parameterization schemes in weather, climate, and air quality models and provide a benchmark to assess regional aerosol radiation effect.

灰霾边界层是我国大气边界层气象学和大气环境学面临的共同问题。确定气溶胶辐射效应对灰霾大气边界层的影响是解决这一难题的关键。本项目拟在观测的基础上，将 NCAR 的大涡模式 (Large-Eddy Simulation, LES) 与气溶胶辐射传输模型 (Discrete Ordinates Radiative Transfer Program, DISORT) 相耦合，建立一个大气溶胶辐射动态耦合模式，用于研究重灰霾污染条件下大气边界层的动力和热力结构及其演变特征，阐明灰霾与边界层物理过程之间的相互反馈机制，评估灰霾的辐射效应对湍流结构、温度层结和夹卷过程等的影响，为改进天气、气候和空气质量数值预报模式中的边界层参数化方案及评估区域气溶胶辐射效应提供科学依据。