

Three-dimensional and Scale Dependency Parameterization for the Urban Boundary Layer

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Abstract: The process of urban boundary layer plays an important part on the evolution of local weather and Urban climate characteristics over the city, the fine grid can distinguish the physical process of the urban boundary layer better, and then improve the urban weather forecast. However, the kilometer grid is the model gray zone of the atmospheric boundary layer, so the traditional boundary layer parameterization scheme, which bases on the ensemble average(no scale dependency) and only considers vertical turbulence, is no longer available. This paper evaluates the BouLac scheme in high resolution simulation and obtain its gray zone using high resolution large eddy simulation as the ideal atmospheric boundary layer benchmark ,resolute shows that the BouLac scheme simulates too much resolved and incorrect part. The scale (grid) -aware is established in BouLac scheme through blending weight function of large eddy simulation diagnosis, and the horizontal turbulence mixing term is added to the original one-dimensional BouLac scheme, developing a parameterization scheme for the urban boundary layer which considers both scale-aware and horizontal turbulence mixing. The realistic weather in urban areas experiment is conducted using the new scheme, to further test and optimize the parameters of the new scheme, and provide theoretical foundation and technical support for improving the urban weather forecast, the urban climate research and urban planning climate assessment.

Keywords: urban boundary layer, boundary layer parameterization scheme, gray zone; large eddy simulation