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Evaluation of the parameterization for cloud top-down mixing in the boundary layer

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An enhanced turbulent mixing due to radiative cooling at cloud or fog top located in the planetary boundary layer (PBL) is parameterized by adopting the top-down diffusivity profile and the cloud top entrainment. The algorithm is first implemented to YSU PBL scheme to be evaluated for idealized cases and then applied for the regional and global real case simulations. Since the modified algorithm consider the mixing height as near surface cloud top, its enhanced mixing effect appears more distinctly especially for the stabilized nocturnal boundary layer. As a result, in the idealized radiation fog case study, it is found that near-surface air temperature decreases due to both radiative cooling at fog top and boundary layer mixing of the new algorithm. Also, the moisture is diffused more effectively to the above the boundary layer, which leads to the rapid dispersion of the fog in the modified algorithm. As a result, the new algorithm simulates the warm and dried near-surface and the cool and moistened boundary layer top in the following daytime. It is also found that the modified algorithm affects the cloud structure frequently occurring at the ocean boundary layer top in the regional and global simulation results.