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Estimation of PBL scheme parameters using the micro-genetic algorithm for heavy rainfall events

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Planetary Boundary Layer (PBL) in the Unified Model (UM) parameterization scheme is a K-profile model that assumes diffusion coefficient profile and includes non-local mixing. And it considers the effect of cloud formation in PBL related to convection scheme. PBL types are classified into seven types based on complex criteria such as stability and capping cloud. The seven types are stable, stratocumulus over a stable surface layer, well mixed, decoupled stratocumulus not over cumulus, decoupled stratocumulus over cumulus, cumulus-capped, and shear-dominated unstable layer. The predictability of atmospheric phenomena differs with respect to the seven types of PBL. In this study, we estimate the parameters of PBL physics process using the micro-genetic algorithm (micro-GA) to investigate the effects of optimized parameters in PBL physics process.
Micro-GA is a kind of optimization technique. It is based on the evolution process and the survival of the fittest. It represents the solution to a given problem in a genetic form and searches for an optimal solution by evolving.
The estimated parameters are related to neutral mixing length, entrainment rate, and cloud-top diffusion. An interface between UM and micro-GA was applied to precipitation cases in Korea. One of the cases is heavy rainfall occurred on July 16, 2017 at Cheongju located at middle part of Korea. When the estimated parameters are compared to the default parameters, the mixing length increased, the entrainment rate decreased, and the cloud-top diffusion increased. And it is confirmed that the stable PBL converted into well-mixed PBL in southern part of Gyeonggi where the moisture fluxes are strong. As a result, the precipitation field was similar to the observation. And the predictability of simulated precipitation was improved in terms of intensity and time series. Through subsequent further study we will investigate not only precipitation forecasting but also other atmospheric phenomenon due to PBL changes.