

# Calibration of Kain-Fritsch Cumulus Scheme in Weather Research and Forecasting (WRF) Model using MVFSA and ASMO method over Western Luzon, Philippines

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## ABSTRACT

Weather forecast accuracy is improving in the recent years due to abundant observation data and state-of-the-art Numerical Weather Prediction (NWP) models. Furthermore, calibration of parameterization scheme in localized areas can improve overall forecast accuracy. Model development slows down because of the numerous simulations required for the calibration. Therefore, there is a need to utilize efficient methods for calibrating complex dynamical models. In this study, five parameters in Weather Research and Forecasting (WRF) Kain-Fritsch cumulus parameterization scheme were calibrated. Interpolated (Universal Kriging) daily precipitation of August 2017 were used for the calibration. Two optimization methods, Multiple Very Fast Simulated Annealing (MVFSA) and Adaptive Surrogate Modeling Based Optimization (ASMO), were implemented. The acquired optimized parameters were dependable since the two methods arrived almost the same value. These parameter sets were then evaluated over western Luzon, Philippines in July 2017 and CAR in January 2017. The overall optimized precipitation decreased on both locations. In addition, precipitation in western Luzon significantly improved, skill score decreased by 35%, when using the optimized parameter. In CAR, however, optimized values did not improved the precipitation accuracy. The results corresponded that the southwest (northeast) monsoon produced convective (non-convective) precipitation in western (eastern) side of the Philippines. In conclusion, ASMO was the best overall method regardless of its longer runtime. Calibration of model parameters using multiple different optimization method were essential to have more reliable result. Also, the optimized parameter can be transferred in areas with major convective precipitation.

Keywords: Automation, Cumulus parameterization scheme, Optimization method, Rainfall simulation