



UNIVERSITY OF THE PHILIPPINES

Master of Science in Meteorology

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Calibration of Kain-Fritsch Cumulus Scheme in Weather Research and Forecasting (WRF) Model using Multiple Very Fast Simulated Annealing (MVFSA) and Adaptive Surrogate Modelling Based Optimization (ASMO) Method over Western Luzon, Philippines

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Calibration of parameterization scheme in localized areas is one of the methods that can improve numerical forecast accuracy. Model development, however, slows down due to the numerous simulations required for the calibration. Therefore, an efficient method for calibrating complex dynamical models is important. In this study, five parameters in Weather Research and Forecasting (WRF) Kain-Fritsch cumulus scheme were calibrated using the interpolated (Universal Kriging) daily precipitation of August 2017 over western Luzon, Philippines. Two optimization methods, Multiple Very Fast Simulated Annealing (MVFSA) and Adaptive Surrogate Modeling Based Optimization (ASMO), were implemented. Using both methods, higher coefficient of downdraft (P_d) and longer consumption time of the convective available potential energy (P_c) were found to be more optimal than default, leading to more evaporation and reduction of intensity of convection. Applying and evaluating these optimized parameters over western Luzon for July 2017 and over Caraga region for January 2017 resulted to overall decreased precipitation bias over both locations. In addition, precipitation in western Luzon significantly improved, wherein the skill score increased by 35% when using the optimized parameter. In Caraga, however, optimized values did not improve the precipitation accuracy. Improvement of model accuracy in three variables (temperature, wind speed and rainfall) from the optimized parameters varied in every location but only rainfall had significant effect to the model. In conclusion, ASMO was the better overall method despite of its longer runtime. Also, the optimized parameter increases the accuracy of simulated precipitation in WL with a negligible effect in Caraga.