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The use of an optimization method to remove precipitation bias of the regional model BRAMS

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Regional model forecasts can contain significant systematic errors for forecasts of precipitation. Because these biases are so systematic, mathematical and statistical methods can be successfully used to correct for them. In this paper we consider an optimization problem applying the metaheuristic Firefly algorithm (FA) to remove systematic biases from simulation of precipitation of the Brazilian developments on the Regional Atmospheric Modeling System (BRAMS) over South America during January 2006. The method is addressed as a parameter estimation problem to weight the ensemble of convective parameterizations implemented in the BRAMS and solved as a inverse problem. The forward problem is addressed by the BRAMS, and the ensemble of convective parameterizations are expressed by several methodologies used to parameterize convection. The inverse problem is the optimization problem applying the FA to retrieving the weights of the ensemble members. The FA algorithm represents the patterns of short and rhythmic flashes emmited by fireflies in order to attract other individuals. The flashing light is formulated in such a way that it is associated with the objective function. The precipitation data estimated by the Tropical Rainfall Measuring Mission (TRMM) satellite was used to training process to calibrate the FA algorithm to reproduce the observed patterns. The quadratic difference between the model and the observed data was used as objective function to determine the best combination between the ensemble members to reproduce the TRMM. To remove the biases of the model, the set of weights computed using the algorithm is used to weight the model simulations to combine the precipitation simulations from different parameterization convection in order compute a retrieved precipitation that represents as closest as possible the TRMM precipitation and than remove the bias observed in the model simulations. The results have been reproduced best combinations between the weights, resulting in a retrieved field of precipitation closest to the observations.