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Satellite data processing for optimization of snow albedo parameterization in Noah LSM

Seung Yeon Lee[1,3], Sujung Lim[1,3], Ebony Lee[1,3], and Seon Ki Park[1,2,3]
[1]Department of Climate and Energy System Engineering, Ewha Womans University, Seoul, Republic of Korea (sy02021004@gmail.com)
[2]Department of Environmental Science and Engineering, Ewha Womans University, Seoul, Republic of Korea
[3]Severe Storm Research Center, Seoul, Republic Of Korea

To improve the predictability of weather/climate models, a prediction system capable of simulating the land surface-atmosphere interaction is essential. In the land surface model (LSM), the parameter values are applied differently depending on the land cover type. Previous studies reported that the Noah LSM underestimated the snow-related variables such as snow albedo, snow depth, and snow cover, compared to actual observations. In this study, among various processes in Noah LSM, we optimize several parameters related to snow albedo, using the genetic algorithm (GA) and satellite (MODIS) data: the parameters to be optimized include 1) the threshold value of the amount of snow with full coverage, , 2) the distribution shape coefficient related to the maximum albedo of new snowfall, and 3) the maximum albedo coefficient. We propose the MODIS data processing method to extract representative snow albedo values, rather than the point (pixel) values, for different land cover types in a 10 km by 10 km area around a model gridpoint the representative values are used to calculate the fitness function in the GA optimization. The snow albedo simulation by Noah LSM has alleviated the underestimation problem with the optimized parameter values: it showed better results with the parameter values optimized using the representative values than those optimized using the point values. We expect to see further improvement in the weather/climate simluations using the coupled land surface-atmosphere model (e.g., WRF-Noah LSM) by implementing the optimized parameter values related to snow albedo.