A New Approach for Parameter Optimization of Land Surface Model

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Land surface model (LSM) is an important tool in land-atmosphere interaction studies. Current LSMs have been successful in simulation of the land surface state and mass/energy exchange between land surface and atmosphere. Unfortunately, there are still defects in simulation of some variables, such as soil moisture. In terms of the limits of model"s simulation, determination of values for the land surface parameters takes the substantial role. Therefore, parameter optimization comes out to be a useful method to gain the proper value. In this paper, we introduced a new parameter optimization method by investigating the expansion of Conditional Nonlinear Optimal Perturbation (CNOP) in parameters optimization of LSM by using the long-term enhanced filed observations at Tongyu station in Jilin province of China, a Reference Site of the international Coordinated Energy and Water Cycle Observations Project (CEOP) in the semi-arid regions, which has been suffering from desertification, salinization and degradation since late 1960s, combined with a sophisticated land surface model (Common Land Model, CoLM). In this study, three key land surface parameters, namely, soil color, soil sand/clay proportion and leaf area index are parameters to be optimized. Two experiments are designed in our work: the first one is single parameter optimization while the second one is triple parameters optimization. Notable improvements in simulating sensible heat flux (SH), latent heat flux (LH), soil temperature (TS) and moisture (MS) at shallow layers are found by using optimized parameters. In addition, the latter experiment shows a better performance than the former. All results above illustrate that CNOP method can be expanded in parameters optimization of Land Surface Model. And what is more, due to its other advantages, such as the clear mathematical meaning, the simple design structure, and the fast computing speed, it exhibits a great potential for its further application in parameters optimization of Land Surface Model.

Key words: Land Surface Model, Parameters optimization, Conditional nonlinear optimal perturbation