Noah land-model simulations over a Tibetan plateau site

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Adjustments to the soil and vegetation parameterizations required to reproduce soil temperature states and surface fluxes using the Noah land-surface model are investigated using a 7-day period of in-situ measurements collected at a study site on the Tibetan Plateau. Analysis of the results from simulations obtained through application of the default parameterization has shown that (1) heat transfer through the soil column is not represented adequately, (2) partitioning between the sensible (*H*) and latent heat (*λE*) flux is biased. Amelioration of errors in these land surface processes is achieved through adjustments to soil and vegetation parameterizations.

By differentiating between soil thermal properties of a top- and subsoil, and including a thin top soil layer, uncertainties in the simulation of the soil heat transfer are reduced and Root Mean Square Differences (RMSDs) between the measured and simulated T_{skin}, T_{5cm} and T_{25cm} are obtained (1.25°C, 1.05°C and 0.68°C, respectively) using a 0.5-cm thick top soil layer. Adding a thin top soil layer has a stronger effect than differentiating between soil thermal properties of a top- and subsoil. A decrease in the vegetation parameters, minimum stomatal resistance ($R_{c,min}$) and optimum temperature for transpiration (T_{opt}), constrains the transpiration and reduces the RMSD for the *λE* from 33.2 [Wm^{-2}] obtained using the default Noah configuration, to 26.5 [Wm^{-2}] using the optimized parameterization. In addition, the improvement in the *λE* simulation also influences the *H* simulation and decreases the RMSD from 47.41 to 33.3 [Wm^{-2}], while the differences between the measured and simulated soil heat flux (G_0) do not change significantly.

Although the adjustments in the parameterization of the soil thermal properties and calibration of vegetation parameters improved Noah's ability in representing the soil temperature states and the surface energy balance components measured on the Tibetan Plateau, under conditions of high radiative forcings an underestimation is observed in measured T_{skin}. This underestimation results in an overestimation of the *H* and underestimation of G_0. The explanation for the discrepancy in the T_{skin} simulation is twofold. Firstly, the surface exchange coefficient for heat may not be properly parameterized. Secondly, the approximation, adopted for linearization of the surface energy balance used to calculate the T_{skin}, introduces some uncertainties when the difference between the measured T_{skin} and T_{air} is large, typical for midday conditions on the Tibetan Plateau.

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