

## Evaluating Three Land Surface Models against GAME/Tibet Dataset for the Tibetan Plateau

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The Tibetan Plateau is a key region of land-atmosphere interactions. The accurate simulation of land surface processes for the Tibetan Plateau (TP) encounters some challenges. In this study, we use three land surface models (CoLM, SiB2 and Noah) to simulate the water and energy cycles at GAME/Tibet sites. Both the observations and simulations show that the Asia Monsoon imposes significant effects on land surface processes in the eastern Tibet Plateau, but little in the western part. The comparison between observations and simulations highlight at least two deficiencies among three models. First, the simulated land surface temperature is obviously underestimated, especially at noon, during the dry season when the surface-air temperature difference is especially large. Second, the simulated first layer soil moisture is dramatically underestimated in the eastern TP for both pre-monsoon and monsoon season. Those results may indicate that some components of the land surface parameterization scheme in three models are unsuitable for the TP. For instance, we found the thermal resistance calculated by models is apparently lower than observations, which lead to the underestimated land surface temperature and overestimated sensible heat flux. We also suggest that the underestimation of surface soil moisture is mainly due to insufficient consideration of the soil stratification. In the eastern TP, the top soil is mainly composed of dense roots and soil, which is characterized by high porosity and consequently high water-holding capacity. However, both SiB2 and Noah totally neglect the soil stratification, while CoLM needs refinements for a better description. A field campaign is now being designed to aim at a better description of the soil stratification in land surface models.

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