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High-resolution modelling of the potential impact of land-surface conditions on regional climate over the Southeast Asia monsoon region associated with the diurnal rainfall cycle

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This study examined the impact of changes in land-surface conditions on regional climate over Indochina using a high-resolution regional climate model. Anthropogenically-induced land-surface changes are ongoing in this part of tropical Southeast Asia. Because a previous study suggested that deforestation in this area affected September precipitation, we chose September as the study period. We performed a control simulation (CTL) driven by reanalysis data combined with current land use and predicted soil-moisture data. The CTL reproduced the spatial distribution of total precipitation well. In addition, it also simulated a distinct diurnal cycle of precipitation that was previously reported in observational studies. Two sensitivity experiments, assuming wetter and drier land-surface conditions over the Khorat Plateau (northeast Thailand) compared with the current land-surface condition, were conducted and examined the impact of land-surface changes on precipitation. The results indicated that drier land-surface conditions increased precipitation over the disturbed region. A pronounced increase in precipitation was found only during nighttime, which coincided with the peak in the climatological diurnal precipitation cycle. Climatologically, the diurnal peak in precipitation occurs from evening to early morning over the Khorat Plateau. Drier conditions intensified the diurnal variation of precipitable water associated with the thermally-induced local circulation responsible for a horizontal gradient of near-surface temperature. The effects of land-use and land-cover changes in the tropics are shown to be strongly related to the diurnal precipitation cycle.