Enhanced probability of mesoscale convective system initiations due to of land surface heterogeneity

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This study investigated the relationship between land surface heterogeneity and Mesoscale Convective System (MCS) initiations. We analyzed geostationary satellite data over East Asia during June–August from 1996 through 2018 by applying the objective detection and tracking tool. The detected MCSs over land exhibited clear diurnal variation with the lowest existence frequency at 10:00 and highest initiation frequency during 12:00–17:00 local time. To quantify land surface heterogeneity, the spatial standard deviation of equivalent Black-Body Temperature (TBB) within a cloud-free 0.35° × 0.35° box (σLSTBB: Land Surface TBB) was computed for 10:00 each day. A comparison of the σLSTBB and MCS databases revealed that the probability of MCS initiations increased with increasing σLSTBB in East Mongolia while the probability was not sensitive to σLSTBB in East China. This indicates that MCSs tend to form over heterogeneous land surface conditions in the semiarid region. We found that the impact of land surface heterogeneity on MCS initiations was highest over flat terrain in East Mongolia, where topographically-induced circulation that triggers the MCS is very weak. These results suggest that the impact of land surface heterogeneity on MCS initiations during the warm season varies with climate zones and terrain complexities in East Asia, with strongest impact in semiarid and flat regions.