



Summer monsoon convection in the Himalayan region: Terrain and land cover effects[†]

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During the Asian summer monsoon, convection occurs frequently near the Himalayan foothills. However, the nature of the convective systems varies dramatically from the western to eastern foothills. The analysis of high-resolution numerical simulations and available observations from two case-studies and of the monsoon climatology indicates that this variation is a result of region-specific orographically modified flows and land surface flux feedbacks.

Convective systems containing intense convective echo occur in the western region as moist Arabian Sea low-level air traverses desert land, where surface flux of sensible heat enhances buoyancy. As the flow approaches the Himalayan foothills, the soil may provide an additional source of moisture if it was moistened by a previous precipitation event. Low-level and elevated layers of dry, warm, continental flow apparently cap the low-level moist flow, inhibiting the release of instability upstream of the foothills. The convection is released over the small foothills as the potentially unstable flow is orographically lifted to saturation.

Convective systems containing broad stratiform echo occur in the eastern Himalayas in association with Bay of Bengal depressions, as strong low-level flow transports maritime moisture into the region. As the flow progresses over the Bangladesh wetlands, additional moisture is extracted from the diurnally heated surface. Convection is triggered as conditionally unstable flow is lifted upstream of and over the foothills. The convective cells evolve into mesoscale convective systems (MCSs) with convective and stratiform areas. The MCSs are advected farther into the Himalayan eastern indentation, where orographic lifting enhances the stratiform precipitation. Copyright © 2010 Royal Meteorological Society

Key Words: Asian monsoon; surface heat flux gradients; precipitating systems; convective systems; mesoscale simulation; orography

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1. Introduction

During the South Asian monsoon (June–September), convection occurs frequently in locations where moisture

flows into the subcontinent from the Arabian Sea and Bay of Bengal. Houze *et al.* (2007) (hereafter H07) and Romatschke *et al.* (2010) have shown that the location of occurrence of the most extreme convection is closely related to the unique