

Simulated clouds and precipitation over and around the Himalayas using the cloud resolving model

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Over the foothills of Himalayas, i.e., the lower area over Nepal and the northern India, nocturnal precipitation has been observed as well as the daytime convective precipitation. To simulate clouds and precipitation over and around the Himalayas and to understand its physical processes, we conducted a numerical experiment using the Weather Research and Forecasting model (WRF) with cloud-resolving resolution (horizontal 2-km mesh, vertical 50 layers). Initial and boundary conditions were provided from ERA5. The simulation period is from 01 June to 01 September, and the analysis period is from 01 July to 31 August. A series of multi-year simulations is underway. Here we report preliminary results for the 2010 case.

According to the merged-IR dataset, a daytime cumulus convection and a cloud formation during early morning were observed over the foothill of the Himalayas. The WRF with 2km horizontal resolution could simulate both of daytime cloud convections and the nocturnal cloud formation. The convective instability induced daytime precipitation, while an increase of precipitable water was a key factor for the nocturnal precipitation occurrence. A local-scale moisture convergence between southerly monsoon flow and northerly downslope wind over the Himalayas also enhanced nocturnal precipitation. The coarse resolution simulation (10km grid spacing) failed to simulate the daytime precipitation maximum. The seasonal mean precipitation over the southern slope of Himalayas was greater in the 10km experiment than the 2km experiment. The 2km experiment with lower resolution topography also simulated greater precipitation over the Himalayan slopes. This difference of orographic precipitation depended on the daytime precipitation simulation, while the difference of precipitation over the foothill of the Himalayas was large during early morning.