

Model simulations of heavy precipitation in Kashmir, India

Kar, S. C., and S. Tiwari
Natural Hazards, 81(1), 167-188

Abstract: Jammu and Kashmir in north India experienced one to the worst floods during first week of September 2014, due to unprecedented and intense rains. A cyclonic circulation moved northward and intensified between 4 and 7 September, as a result of which unprecedented very heavy rainfall occurred in the region. The main objectives of this study were to simulate this extreme rainfall event using high-resolution regional model and to document role of cloud microphysics on the simulations. A set of experiments have been carried out using Weather Research and Forecasting (WRF) model by configuring it with two nested domains with horizontal resolution of 18 and 6 km. The model was initialized with initial conditions of 00UTC of 2, 3 and 4 September 2014. For each initial condition, two set of numerical experiments were carried out with different cloud microphysics processes. While one set of run used WSM3 scheme, the other set used WSM6 scheme. It is found that the WRF model simulated a stronger cyclonic circulation when WSM scheme with graupels was used. The rainfall amount is also more in these experiments than those with WSM3 scheme. However, the cyclonic system is simulated to the east of the observed location in all the forecasts. The forecast skill is better with lesser lead time, i.e., the WRF model simulations were better when the model runs started from 4 September instead of earlier initial conditions. Examination of MODIS snow cover area suggests that a large mountainous area in catchment of Jhelum and its tributaries was covered with snow on 6 and 7 September 2014. This snow melted very fast, and by 8 September, most of the snow had melted. The WRF model also simulated good amount of snow in the mountains, but the location of maximum snow is to the east of observed location.

Keywords: Extreme event Precipitation Kashmir WRF model Simulations