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Modelling the impact of spatial variability of precipitation on flood hazards in the Kathmandu Valley, Nepal

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In recent years, scientists have shown that the increasing trend in precipitation and flash floods during the monsoon season, combined with rapid land-use change, is leading to an increase in river discharge and flood inundation in the Kathmandu valley. The Kathmandu valley is a mid to low elevation mountain region (mean ~ 1250 m), surrounded by hills, particularly to the north, south and west, and has a population of over 3 million. In this study, statistical analysis of 30 to 50 years of historical rainfall and river discharge data indicate a strong spatial variability in daily rainfall over the catchment during the monsoon season. Hilly regions which surround the Kathmandu basin receive significantly more rainfall than the valley, and rainfall intensity can vary greatly between the northern and southern hills, in particular. Combining our statistical analysis with physical-based numerical modelling of a range of historical flood events we demonstrate that the spatial variability in rainfall can lead to large differences in flood inundation patterns across the valley. Traditional flood early warning systems in the Kathmandu valley do not consider the effect of spatial variability of rainfall on flooding in the basin, which can lead to over or under predictions of flood extent in certain regions for a given event. We demonstrate that flood extent is the centre of Kathmandu and to the west of the city will be significantly higher if heavy rainfall occurs in the northern region of the valley.