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Sensibility of rainfall simulation to model horizontal grid spacing: impact of complex terrain and shallow convection parameterization

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Highly accurate spatial and temporal distributions of rainfall are critical for hydrometeorological hazard research. The quantitative precipitation forecast (QPF) at high spatial resolution is important to predict flash floods in mountainous catchments. In this study, the non-hydrostatic numerical model (Meso-NH) is used to simulate tropical intense precipitation under different meteorological contexts (mesoscale convective system, storm, etc.), over the complex topography of La Réunion Island. Variety of model runs with different horizontal grid spacing (from 4 km to 500 m) and shallow convection parameterization are analyzed. The spatial distributions of rain simulated by models are then evaluated via comparisons with rain gauges and radar observations. The results suggest the necessity of using small grid spacing in the simulations (< 2 km) to capture the high intensity of rainfall localized on the windward slopes of mountains, while the coarse resolution model (4 km) underestimates significantly the precipitation in these areas. The shallow convection parameterization reduces the humidity in the boundary layer so that the intense precipitation produced by the simulation is more localized over the mountain peaks (above 2000 m). For some rain cases, the orographic feature at fine scale (500 m) plays an important role to simulate correctly the position and intensity of precipitations in mountainous areas.