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High-resolution forecasts over complex topography of Southeast Brazil

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In Southeast of Brazil, two major mountain chains run almost parallel to the coastline, the Serra do Mar and the Serra da Mantiqueira, and form the Paraiba do Sul river basin. This region of complex topography and the proximity to the coast favors the occurrence of flash floods. Most known Brazilian natural disaster in January 12, 2011 killed over a thousand people in the mountains of Rio de Janeiro State. The event was related to the northwesterly moist and warm flow combined with orographic enhancement of the heavy rainfall. Due to the small scale of the water basins, a numerical weather forecasting system based on a high-resolution 5-member ensemble at 5-km resolution and a convection permitting 1-km resolution mesoscale Eta model was set up. The 5-member ensemble was based on different representations of cumulus parametrization and cloud microphysics schemes. Although the simulations did not capture the about 300 mm/day precipitation of the event, the model using Kain-Fritsch scheme reached heavier rates. The 1-km resolution model setup produced widespread heavy precipitation. Mountains have steeper slopes at higher resolution and, consequently, vertical motions become stronger and air saturates more easily. Tests to reduce the conversion from cloud liquid water to precipitation were applied to reduce the widespread precipitation. Vertical mixing of moisture and temperature were enhanced in order to decrease local saturation. Evaluation for additional flash flood cases are shown.