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Tests of high-resolution simulations over a region of complex terrain in Southeast coast of Brazil

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The Eta Model is used operationally by INPE at the Centre for Weather Forecasts and Climate Studies (CPTEC) to produce weather forecasts over South America since 1997. The model has gone through upgrades along these years. In order to prepare the model for operational higher resolution forecasts, the model is configured and tested over a region of complex topography located near the coast of Southeast Brazil. The model domain includes the two Brazilians cities, Rio de Janeiro and Sao Paulo, urban areas, preserved tropical forest, pasture fields, and complex terrain where it can rise from sea level up to about 1000 m. Accurate near-surface wind direction and magnitude are needed for the power plant emergency plan. Besides, the region suffers from frequent events of floods and landslides, therefore accurate local forecasts are required for disaster warnings. The objective of this work is to carry out a series of numerical experiments to test and evaluate high resolution simulations in this complex area. Verification of model runs uses observations taken from the nuclear power plant and higher resolution reanalyses data. The runs were tested in a period when flow was predominately forced by local conditions and in a period forced by frontal passage. The Eta Model was configured initially with 2-km horizontal resolution and 50 layers. The Eta-2km is a second nesting, it is driven by Eta-15km, which in its turn is driven by Era-Interim reanalyses. The series of experiments consists of replacing surface layer stability function, adjusting cloud microphysics scheme parameters, further increasing vertical and horizontal resolutions. By replacing the stability function for the stable conditions substantially increased the katabatic winds and verified better against the tower wind data. Precipitation produced by the model was excessive in the region. Increasing vertical resolution to 60 layers caused a further increase in precipitation production. This excessive precipitation was reduced by adjusting some parameters in the cloud microphysics scheme. Precipitation overestimate still occurs and further tests are still necessary. The increase of horizontal resolution to 1 km required adjusting model diffusion parameters and refining divergence calculations. Available observations in the region for a thorough evaluation is a major constraint.