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High resolution simulations of orographic flow over a complex terrain on the Southeast coast of Brazil

S. C. Chou (1), M.M. Zolino (2), J.L. Gomes (1), J.F. Bustamante (1), and P.P. Lima-e-Silva (3)

(1) INPE, Cachoeira Paulista, SP, Brazil (chou.sinchan@cptec.inpe.br), (2) CEMADEN, Cachoeira Paulista, SP, Brazil, (3) CNEN, Rio de Janeiro, RJ, Brazil

The Eta Model is used operationally by CPTEC to produce weather forecasts over South America since 1997. The model has gone through upgrades. 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 Eta Model was configured, 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 model domain includes the two Brazilians cities, Rio de Janeiro and Sao Paulo, urban areas, preserved tropical forest, pasture fields, and complex terrain and coastline. Mountains can rise up to about 700m. The region suffers frequent events of floods and landslides. The objective of this work is to evaluate high resolution simulations of wind and temperature in this complex area. Verification of model runs uses observations taken from the nuclear power plant. Accurate near-surface wind direction and magnitude are needed for the plant emergency plan and winds are highly sensitive to model spatial resolution and atmospheric stability. Verification of two cases during summer shows that model has clear diurnal cycle signal for wind in that region. The area is characterized by weak winds which makes the simulation more difficult. The simulated wind magnitude is about 1.5m/s, which is close to observations of about 2m/s; however, the observed change of wind direction of the sea breeze is fast whereas it is slow in the simulations. Nighttime katabatic flow is captured by the simulations. Comparison against Eta-5km runs show that the valley circulation is better described in the 2-km resolution run. Simulated temperatures follow closely the observed diurnal cycle. Experiments improving some surface conditions such as the surface temperature and land cover show simulation error reduction and improved diurnal cycle.