Convection permitting regional climate modelling for short time scale precipitation extremes

J.P. Evans and D. Argueso

Climate Change Research Centre and ARC Centre of Excellence for Climate System Science, University of New South Wales, Sydney, Australia
Email: jason.evans@unsw.edu.au

Abstract: Previous work has found that errors in sub-daily precipitation are associated with deficiencies in the cumulus convection parameterization. This suggests studies of short time scale precipitation extremes are best performed using model resolutions that are high enough to remove the need for a convective parameterization (<4km). However, modelling at these resolutions is very computationally expensive particularly given that the domain must be large enough for small scale dynamic structures to develop and that simulations must be long enough to characterize extremes (decades).

Presented here are the results obtained when modelling the climate of the greater Sydney region using the Weather Research and Forecasting (WRF) model at 2km resolution for the period 1990-2009. The model is able to reproduce the 95th percentile of hourly precipitation totals well but tends to overestimate rarer events. This overestimate is much smaller at the daily (and longer) time scale. Examining Intensity-Frequency-Duration curves created by fitting a Generalized Extreme Value distribution to the annual maximum series reveals a similar overestimation of rare events (less than 1 in 2 years) but also demonstrates significant sensitivity to single data points in the time series and hence the uncertainty associated with these rare events.

Using this regional climate model allows investigation of possible future changes in these sub-daily extreme precipitation events. Given the large uncertainty in both the observations and model simulations however, it is very difficult to obtain statistically significant future changes. Nevertheless, estimates of changes in extreme precipitation events spanning a range of accumulation periods (from 1 hour to 1 day) and event frequency (from 1 in 2 years, to 1 in 100 years) have been calculated and are presented here.