Downscaling of GCM parameter outputs to RCM spatial scale using an artificial neural network

Robin Chadwick (1), Erika Coppola (2), and Filippo Giorgi (2)

(1) University of Reading, Department of Meteorology, United Kingdom (r.s.chadwick@rdg.ac.uk), (2) The Abdus Salaam International Center for Theoretical Physics, Trieste, Italy

An artificial neural network (ANN) approach was used to downscale temperature and rainfall fields from the ECHAM-5 global climate model to the spatial scale of the RegCM3 regional climate model over Europe. Inputs to the ANN include the GCM temperature/rainfall field, the GCM and RCM orography fields, and the distance between GCM and RCM gridpoints.

The ANN was trained with 20 years of RegCM3 and ECHAM-5 data, then ANN downscaled estimates were assessed against RegCM3 outputs for several different time periods within a 120 year model run. A comparison was also performed of the ANN method against a simple lapse-rate downscaling method for the ECHAM-5 temperature field. It was found that the ANN was able to accurately reproduce RegCM3 parameter fields for a validation time period near to the training time period, but not for time periods far from the training time period. For validation periods near to the training time-period, the ANN approach outperformed the lapse-rate method.

Work is ongoing into a 'timeslice' ANN training method, using data from three distinct 10 year slices within a RegCM3 model run for training, and results from this will be presented.