EMS Annual Meeting Abstracts
Vol. 7, EMS2010-52, 2010
10th EMS / 8th ECAC

Using bias-adjustment to improve the use of high-resolution climate model output

S. Corney (1), G. Holz (1), J. Bennett (1,2), M. Grose (1), C.J. White (1), S. Gaynor (1), N.L. Bindoff (1,3)

(1) Antarctic Climate and Ecosystems Co-operative Research Centre, University of Tasmania, Hobart, Tasmania, Australia, (2) Hydro Tasmania Consulting, Cambridge, Tasmania, Australia, (3) Centre for Australian Climate and Weather Research, CSIRO Marine and Atmospheric Research, Hobart, Tasmania, Australia

Climate change is a global phenomenon whose impacts will be most keenly felt at a local level. General Circulation Models (GCMs) provide the best estimates for assessing potential changes to our climate on a global. However GCMs do not provide much direction for decision-makers (like local governments, state governments or industries) in deciding on appropriate adaptive responses to the local effects of climate change. Such decision makers often require output from conceptual models, such as biophysical or hydrological models, or knowledge of changes to specific operational information or the likelihood of extreme events; GCMs are largely not suitable for this purpose.

Biophysical and hydrological models require inputs such as rainfall, minimum and maximum temperature, evaporation and solar radiation, often in daily timesteps. Future climate input for these models are commonly created by perturbing historical datasets with climate anomalies based on output from climate models. This approach means that the shape of the probability distribution function (pdf) in observed data is maintained in the future data. This technique ignores the likelihood that climate change will result in changes to the synoptic drivers of climate variables which in turn result in changes to the pdfs of these variables.

An alternative approach is to use high-resolution regional climate models to dynamically downscale GCM projections. These regional climate models produce output that is at appropriate spatial and temporal resolution so that it can be used as input into conceptual models. Unfortunately all climate models contain biases and parameterisations that render their output unsuitable for direct use into conceptual models. Conceptual models are calibrated against observations, and so a bias in a climate model needs only to be relatively small to have a significant effect on output metrics that are calibrated against observed datasets.

In the Climate Futures for Tasmania project, climate variables were bias-adjusted against Australian Water Availability Project data over the period 1961-2007. Daily rainfall, minimum and maximum temperature, evaporation and solar radiation were adjusted using differences in one percentile bins for six models and four seasons for each 0.1° grid cell. The adjustments (1961-2007) were then applied to the climate model variables over the period 1961-2100. This technique assumes the 1961-2007 adjustments are maintained into the future.

The technique aims to preserve the statistical characteristics of the original model output (the pdf) without changing the trends and variability (the climate change signature) of the data. Bias-adjusted model output can then be input directly into conceptual models. We present the bias-adjustment method and example results where bias-adjusted climate model output has been used as input into biophysical and hydrological models that have been calibrated against an observational record.