2010/RD/0142 Dynamically-Downscaled Climate Projections for the Eastern Seaboard $199,856

DYNAMICALLY DOWNSCALED CLIMATE PROJECTIONS

overview of the project

Global climate models resolve the landscape at coarse spatial scales of about 300 kilometres (ie grids on the map with 300km long sides). This limits the usefulness of the projections of temperature, rainfall and other variables at the local scales needed by environmental decision makers. The University of NSW (UNSW) has dynamically downscaled several Global Climate Models (GCM) to a scale of 10 kilometres across NSW and 2 kilometres in Sydney and the Blue Mountains. Thanks to this cutting edge research, researchers and decision makers now have access to more locally relevant climate change and bushfire risk projections.

how the project was carried out

Using a dynamical downscaling model called Weather Research and Forecasting (WRF), which draws on the latest very-high resolution modelling techniques, the grantees produced a series of simulations at 10 kilometres, each approximately 20 years long.

The model is based on the physical laws of motion of the atmosphere, coupled with the physics of radiation, energy and water. As well as projecting rainfall, temperature, soil moisture and wind, UNSW used the results to undertake much higher resolution simulations of 2 kilometre grid size over the Blue Mountains and Sydney metropolitan region. They made the data available online and entered it into a bush fire risk model to explore changes in the likelihood of high fire danger over the Blue Mountains and Sydney metropolitan region.

To ensure accuracy, the grantee compared forecasts and observations made between 1990-2010 with the simulation model over the same period to comprehensively assess the regional model's ability to simulate the climate on the Eastern Seaboard.

outcomes now and in the future

While the Regional Climate Model (RCM) projections usually agree with the Global Climate Model (GCM) projections, sometimes they differ significantly. By increasing model resolution, UNSW yielded more accurate simulation of climate in mountainous and coastal areas. This is leading edge science and has advanced our understanding of the limits of fine scale regional climate modelling. The response of the urban environment to changes in climate is not fully understood, however this work helps forecast the impact of climate change on urban landscapes.

While the grantee planned to make the data freely available, the Australian National Data Service (ANDS) approached them to assist in an additional $500,000 project that developed tools to help researchers more easily access and use the data for impacts research. The general public can also access information in a simpler form via the AdaptNSW website.

The very high resolution simulations over Sydney and the Blue Mountains are helping assess bushfire risk. Fire weather derived from the simulations is providing more detailed information to fire managers and the Rural Fire Service is now using data produced by this project to better estimate the Forest Fire Danger Index risk across entire landscapes throughout NSW.

The simulations are also helping to assess the impacts of urbanisation and projected land use changes, which under climate change conditions has profound impacts on minimum temperature. While the Sydney Basin is predicted to experience annual mean temperature increases of between 1.0°C and 1.75°C for daily maximum temperature and from 1.5°C to 2.25°C for daily minimum temperature, the grantees projected night time temperature extremes in new urban areas would be significantly warmer. This has important human health implications as higher minimum temperatures could exacerbate climate-change induced heat-stress on vulnerable populations.

benefits, challenges & lessons learned

Project outputs have been used by impacts researchers to forecast likely agricultural, hydrological, ecological and health impacts, and fed into the Towards a Resilient Sydney vulnerability assessment. The project also helped lay the groundwork for delivering the NSW and ACT Regional Climate Modelling (NARCliM) project.

"The investment from the Environmental Trust was like the first stone that begins to cascade down a mountainside," UNSW Professor Andrew Pitman said. "It … ended up as an avalanche of activity that remains ongoing".

Working with and effectively using climate data is challenging and complex. This project has provided the grantee and its collaborators with the opportunity to explore and apply this knowledge, and this understanding is expected to increase into the future.

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