South Eastern Australian Climate initiative

Final report for **Project 2.2.1**

Hydrological sensitivity to climate

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Abstract

This project reviewed different methods for assessing hydrologic sensitivity to climate, from simple rule of thumb to complex hydrological modelling methods using downscaled rainfall. The review was written as a paper for the technical layperson and provides practical guidance to water resources managers and other practitioners for assessing climate change impact on water resources. The project also compiled hydroclimatological datasets, daily outputs from different GCMs and global warming scenarios, and developed daily rainfall-runoff modelling with SIMHYD at 5 km grids across south-eastern Australia, to assess the different methods for estimating climate change impact on runoff. This research will continue in Project 2.2.2.

Project Objectives

- Review alternative approaches for assessing hydrological sensitivity to climate.
- Apply and compare alternative approaches for estimating climate change impact on runoff, using data from south-eastern Australia.
- Provide guidance on appropriate methods for estimating climate change impact on runoff.

Project Summary and Results

Most climate change impact studies involve the use of a hydrological model where: (a) the model is calibrated against historical streamflow data; (b) the model is driven with rainfall and PET series for a future climate using the same optimised parameter values; and (c) the modelled streamflow for the future climate is compared against the historical streamflow to provide an estimate of the climate change impact on streamflow.

Models are generally tailored for specific studies and calibrated using local data. Many studies are concerned not only with climate change impact on catchment water yield, but also how changes in runoff characteristics affect water uses across river basins. After an appropriate model has been established for a climate change impact study, the next key consideration is how to obtain future climate data (of which rainfall is the most important) to drive the model.

This project reviewed different methods that have been used to assess hydrologic sensitivity to climate (modelling methods and nonparametric methods that are model independent), and to obtain future climate data to drive models (constant scaling method, daily scaling method, statistical and dynamical downscaled climate) to estimate impacts of climate change on catchment water yield and runoff characteristics. The review was written as a paper (also providing guidelines on the different methods that can be used to estimate climate change impact on runoff) that was presented at the Hydrology and Water Resources Symposium in Launceston in December 2006.

Chiew, F.H.S. (2006) An overview of methods for estimating climate change impact on runoff. Proceedings of the 30th Hydrology and Water Resources Symposium, Launceston, December 2006, Engineers Australia, CDROM (ISBN 0-8582579-0-4).

The different methods are currently being tested using hydroclimatological datasets (rainfall, PET and streamflow) in south-eastern Australia and projections of climate change from different GCMs and several global warming scenarios. To assess the different methods, this project has: compiled and analysed hydroclimatological datasets; developed hydrological modelling with the conceptual daily rainfall-runoff model SIMHYD at 5 km grids across south-eastern Australia; and collated and analysed daily data from different GCMs and several greenhouse gas emission scenarios and global climate sensitivities (from IPCC 4AR Assessment in PCMDI – Program for Climate Model Diagnosis and Intercomparison, http://www-pcmdi.llnl.gov/ipcc/about_ipcc.php). This research will be continued in Project 2.2.2 where the most appropriate method(s) will be used to develop projections of catchment water yield and key runoff characteristics across south-eastern Australia.

Significant Research Highlights

- Presented and published a paper that provides an overview of the different methods for assessing hydrologic sensitivity to climate, from simple rule of thumb to complex hydrological modelling methods using downscaled rainfall. This paper is written for the technical layperson and provides practical guidance to water resources managers and other practitioners for assessing climate change impact on water resources. This paper is reproduced in this report.
- Compiled hydroclimatological datasets, daily outputs from different GCMs and greenhouse gas emission scenarios, and developed daily rainfall-runoff modelling with SIMHYD at 5 km grids across south-eastern Australia, to assess the different methods for estimating climate change impact on runoff (this research will continue in Project 2.2.2).

Project Milestone Reporting Table

Milestone description[1] (brief) (up to 33% of project activity)	Performance indicators[2] (1- 3 dot points)	Completion date[3] xx/xx/xxxx	Budget[4] for Milestone ($)	Progress[5] (1- 3 dot points)	Recommended changes to workplan[6] (1- 3 dot points)
1. Review different methods for assessing hydrologic sensitivity to climate	Short draft internal document of different methods for assessing hydrologic sensitivity of climate	30/06/2006	30k	Completed	None

2. Test and further develop methods for assessing hydrologic sensitivity to climate	Report (or Paper or Guideline) for estimating impacts of climatic variability on hydrology and water resources	31/12/2006	45k	Paper providing overview and guideline completed. Methods developed, data analysed and rainfall-runoff modelling completed. Application of different methods continued in Project 2.2.2.	None