

CHAPTER ONE

INTRODUCTION

SUNSET, OUTBACK AUSTRALIA, ISTOCK

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CHAPTER 1 INTRODUCTION

This Technical Report provides an up to date description and assessment of observed climate change in Australia and its causes, and details likely future changes over the 21st century. It provides information for assessing exposure, risks and opportunities that may flow from regional climate change due to global warming.

A range of products have been designed with the end users in mind. There has been extensive stakeholder consultation in order to assess information and data needs and the desired approaches to obtaining these. Hence, this Report is part of a suite of products that includes datasets, regional information, and guidance for users. The Climate Change in Australia website (www.climatechangeinaustralia.gov.au) provides ready access to the wealth of available material.

This Report underpins extensive climate change projections for Australia provided as part of a larger package of products developed with funding from the Commonwealth Government's Regional Natural Resource Management Planning for Climate Change Fund. This fund was established to support regional Natural Resource Management (NRM) organisations to update their plans to account for likely climate change impacts and to maximise the environmental benefits of carbon farming projects. Thus, this Report has a focus on science relevant to planning how best to manage the impact of climate change on Australia's natural resources, and on regional areas more generally.

The scientific context for new climate change projections includes the relevant conclusions of the latest Intergovernmental Panel on Climate Change (IPCC) report, recent climate trends in Australia and their causes, climate model results and regional projection methods. It presents projections for a range of simulated climate variables (*e.g.* temperature, rainfall, wind) and derived variables (*e.g.* indices of climatic extremes, fire weather, soil moisture), and concludes with guidance on a range of issues that arise when using climate projection information.

This Report links strongly to findings of the IPCC *Fifth Assessment Report*, but it provides the detail for Australia that cannot be provided by the IPCC's global perspective. This Report also draws upon relevant research from CSIRO, the Australian Bureau of Meteorology and Australian Universities, including the Australian Climate Change Science Programme. This Programme was undertaken by CSIRO and the Bureau of Meteorology in association with the Department of the Environment.

CSIRO has taken a major role in providing information about regional climate change for Australia over the past two decades. Information products were released in 1992, 1996, 2001 (CSIRO, 1992; 1996; 2001) and jointly with the Bureau of Meteorology in 2007 (CSIRO and BOM, 2007).

The new projections differ from those released in 2007 in a number of important ways:

- They are based on the latest global climate model archive (known as the Coupled Model Intercomparison Project phase 5 (CMIP5)). This contains simulations from more than 40 global climate models, representing the state of the art in climate modelling.
- The role of high resolution downscaling is enhanced.
- Levels of confidence are developed and attached to all key projection statements.
- In addition to providing 10th to 90th percentile ranges of change for most variables, the needs of risk assessment are better supported through the provision of application-ready data sets.

The functionality of the projections for decision-makers and planners has also been improved:

- The *Australian Climate Futures* tool has been developed (and made available online) to further support impact assessments. This tool helps in the development of future climate scenarios appropriate to applications and in the selection of climate model results to populate those scenarios. The tool also provides much improved capacity for users to set previous regional projection products in the context of the latest science.
- The capacity and functionality of the Climate Change in Australia website has been greatly enhanced to support users in understanding what information they need, what is available and how they can obtain it.

The structure of this Technical Report is as follows: Chapter 2 addresses the context of the projections and describes user needs, Chapter 3 covers global climate change science, Chapter 4 surveys observed Australian climate variability and climate changes and their possible causes, and Chapter 5 examines how well CMIP5 models simulate the Australian climate. Chapter 6 presents projection methods that are used in Chapter 7 to describe projected future climate change for a range of atmospheric and terrestrial variables, emission scenarios, and time periods to the end of the century. Chapter 8 provides observed trends and projections for a range of marine variables. Chapter 9 explains how climate projection information can be used in impact assessments. Finally, Chapter 10 explores future directions for climate change

projections research and communication. Appendix A compares findings from CMIP3 models with those from the latest CMIP5 assessments.

Climate change information is presented on a regional basis. The regionalisation is based on eight 'clusters' of NRM regions. The separate Cluster Reports each contain a description of the relevant biophysical and climatological features in each cluster. Readers primarily interested in regional climate change projections and less interested in the technical details surrounding their production should consult the Cluster Reports and Brochures.

Electronic copies of this Report, the Cluster Reports, and other related publications, are available at the Climate Change in Australia website (www.climatechangeinaustralia.gov.au). Further information on the projection products prepared for this project is given in Box 1.1.

The climate change projections described here contribute to the work of nine allied teams undertaking impacts and adaptation research projects. There is a team for each of the eight clusters, and one team focussed nationally. The above website contains information on each of these projects.

BOX 1.1: CLIMATE CHANGE IN AUSTRALIA – PRODUCTS

This Report is part of a suite of Climate Change in Australia (CCIA) products prepared as part of the Australian Government's Regional Natural Resource Management Planning for Climate Change Fund. These products provide information on climate change projections and their application.

CLUSTER BROCHURES

Purpose: key regional messages for everyone

A set of brochures that summarise key climate change projections for each of the eight clusters. The brochures are a useful tool for community engagement.

CLUSTER REPORTS

Purpose: regional detail for planners and decision-makers

The Cluster Reports are to assist regional decision-makers in understanding the important messages deduced from climate change projection modelling. The Cluster Reports present a range of emissions scenarios across multiple variables and years. They also include relevant sub-cluster level information in cases where distinct messages are evident in the projections.

TECHNICAL REPORT

Purpose: technical information for researchers and decision-makers

A comprehensive report outlining the key climate change projection messages for Australia across a range of variables. The report underpins all information found in other products. It contains an extensive set of figures

and descriptions on recent Australian climate trends, global climate change science, climate model evaluation processes, modelling methodologies and downscaling approaches. The report includes a chapter describing how to use climate change data in risk assessment and adaptation planning.

WEB PORTAL

URL: www.climatechangeinaustralia.gov.au

Purpose: one stop shop for products, data and learning

The CCIA website is for Australians to find comprehensive information about the future climate. This includes some information on the impacts of climate change that communities, including the natural resource management sector, can use as a basis for future adaptation planning. Users can interactively explore a range of variables and their changes to the end of the 21st century. A 'Climate Campus' educational section is also available. This explains the science of climate change and how climate change projections are created.

Information about climate observations can be found on the Bureau of Meteorology website (www.bom.gov.au/climate). Observations of past climate are used as a baseline for climate projections, and also in evaluating model performance.

