PAST, PRESENT AND FUTURE RAINFALL TRENDS IN QUEENSLAND

A dissertation submitted by

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Frontispiece: This thesis is dedicated to my two dogs Kelly (Australian terrier) and Snapper (Blue Heeler), who both passed away early in 2009 from untreatable cancer, both at the age of 15 years, soon after my initial PhD submission. Your friendship and loyalty will be forever remembered.

ABSTRACT

Queensland and much of eastern Australia have had significant rainfall declines since ~1951, causing economic hardship on rural and urban communities. However, no significant attempt has been made to identify and understand the physical causes of the rainfall declines over southeast Queensland (SE QLD) and whether they are likely to continue into the 21st century under higher levels of global warming.

In this research, climate observations, models and global climate data as well as palaeoclimate information are used to investigate past, present and future rainfall trends in SE QLD. Five global climate models (GCMs) from the Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC–AR4) show a significant decrease in rainfall will occur over the SE QLD region during the 21st century. Observations since ~1951 show the mean sea level pressure (MSLP) has been increasing over much of Queensland, indicating the subtropical ridge has been expanding. This study attributes the increase in the MSLP and some of the rainfall decline to changes in the subtropical ridge and the Southern Annular Mode (SAM). Projections show increases in the MSLP over the region are likely to continue during the 21st century associated with the positive polarity of SAM. Land cover changes over SE QLD were investigated using a regional climate model and show rainfall decreases with higher surface albedo values. Finally, a palaeoenvironmental record developed using lake sediments from Lake Broadwater in SE QLD, indicates a gradual rainfall decline has occurred during the last ~3.2 kyr B.P. Hence SE QLD has undergone a slow rainfall decline since the late Holocene and also since ~1951, with these conditions likely to continue and intensify during the 21st century.

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CERTIFICATION OF DISSERTATION

I certify that the ideas, experimental work, results, analyses, software and conclusions reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award, except where otherwise acknowledged.

_____ _____

Signature of Candidate Date

ENDORSEMENT

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Signature of Supervisor/s Date

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Signature of Associate Supervisor/s Date

PUBLICATIONS, CONFERENCES AND AWARDS FROM THIS RESEARCH

Journal Articles

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