LAND-ATMOSPHERE INTERACTIONS IN SOUTHWEST WESTERN AUSTRALIA

by

Jatin Kala

A thesis submitted in fulfillment of the
requirements for the degree of Doctor of Philosophy
in the School of Environmental Science
Murdoch University

July 2011

I declare that this thesis is my own account of my research, unless otherwise stated. It contains as its main content work which has not previously been submitted for a degree at any tertiary institution.

Jatin Kala

ABSTRACT

The Southwest of Western Australia (SWWA) is a region of extensive land cover change with an estimated 13 million hectares of native vegetation cleared since European settlement. Whilst previous studies have suggested meteorological and climatological implications of this change in land use, no studies have explicitly focussed on the detailed mechanisms behind the impacts of land-cover change on individual meteorological phenomena. This thesis seeks to identify the physical mechanisms inducing changes within the atmosphere by using the Regional Atmospheric Modeling System (RAMS V6.0) to simulate the impact of land use change on meteorological phenomena at different scales and evaluate these model results against high resolution atmospheric soundings, station observations, and gridded rainfall analyses where appropriate. Sensitivity tests show that land-cover change results in an increase in low-level atmospheric moisture advection associated with the southern sea-breeze due to a reduction in surface roughness. It also results in a decrease in convective precipitation associated with cold-fronts and convective clouds associated with the surface heat trough, due to an increase in wind speed, and a decrease in turbulent kinetic energy and vertically integrated moisture convergence within the PBL. Large-eddy simulations further highlight the role of land-cover change and soil moisture, as well as the contributions of surface versus entrainment fluxes on the growth of the PBL and development of convective clouds. These results are discussed within the broader

context of the meteorology of the region.

ACKNOWLEDGEMENTS

This thesis would not have been completed without the on-going support and feed-back provided by my principal supervisor, Prof. Tom Lyons. Working with Tom over several years has greatly improved my written and analytical skills, and greatly enhanced my knowledge of atmospheric science generally. I am very grateful for his patience, good sense of humor, and friendliness. I would also like to acknowledge the support of my parents and two siblings for their continual support throughout my university studies.

The radiosonde observations used in this thesis were acquired using the National Center for Atmospheric Research Mobile Global Positioning Advanced Upper-Air Sounding System with support from the National Science Foundation (Grant ATM 0523583) and the Australian Research Council's Discovery funding scheme (Project DP0664515). The station data and gridded rainfall analyses were provided by the Commonwealth of Australia Bureau of Meteorology. Prof. Tom Lyons, Dr. Debbie Abbs from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Division of Marine and Atmospheric Research (CMAR), and Drs. Yuling Wu and Udaysankar S. Nair from the University of Alabama in Huntsville provided much support in overcoming the various technical difficulties in running the regional atmospheric model used in this study. All numerical simulations were supported by iVEC (http:www.ivec.org) through the use of advanced computing resources provided by the Australian Resources

Research Center Facility located at Technology Park, Perth. The Australian Soil Water Availability Project soil moisture data were provided by Dr. Peter Briggs and Dr. Michael Raupach from the CSIRO CMAR. The Australian Research Network for Earth Systems Science (ARCNESS) provided travel and accommodation funding to attend the ARCNESS Winter School held at the University of New South Wales in September 2009, and the Australian Meteorological and Oceanographic Society Conference held at the Australian National University, Canberra, in January 2010. The administrative staff at Murdoch University provided much support throughout my PhD. All of this assistance is gratefully acknowledged.

Completing this thesis would not have been as much fun without the cordiality and friendliness of my fellow lab buddies, Dr. Rory Donnnelly, Brad Evans, Michael Dreher, and Dr. Niels Brouwers, as well as the Pot-Luck crew for countless Monday night pot-luck dinners and four o'clock meetings.

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