

**LAND-ATMOSPHERE INTERACTIONS IN  
SOUTHWEST WESTERN AUSTRALIA**

by

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requirements for the degree of Doctor of Philosophy  
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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.

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## 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.

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