

Exploring the impacts of land surface characteristics and water availability on regional weather and climate extremes

Siyuan Tian, Mathew Lipson, Emma Howard, Chun-Hsu Su, Bureau of Meteorology

Land surface processes are crucial for atmospheric modelling as they significantly influence energy, water, and carbon exchanges between the Earth's surface and the atmosphere, impacting weather and climate predictions. Over the past decade, the Australian Water Resources Assessment Landscape (AWRA-L) model has underpinned the Bureau's operational landscape and water information services. However, AWRA-L operates independently of the operational Numerical Weather Prediction (NWP) systems, which use the Joint UK Land Environment Simulator (JULES) land surface model. JULES is also used in the Bureau's seasonal prediction, regional atmospheric reanalysis and regional climate modelling systems. One of the core aims of the Bureau's R&D 2020-2030 plan is to create a fully coupled Earth system modelling framework, one that seamlessly integrates information across the atmosphere, land, ocean, waves, sea-ice, and hydrology. Thus, the Bureau is now developing the JULES for the next generation of operational water information services. Adapting JULES to better represent Australia's hydrological and plant-physiological conditions requires substantial effort. This involves developing regional high-resolution ancillaries specific to Australian land surface and transient characteristics and enhancing model physics for soil hydrology, river routing, and vegetation phenology. Equally crucial is understanding how changes in land surface conditions, including surface water and soil moisture, impact Australian weather and climate. The development of an Australian regional coupled system that allows us to assess its impact on atmospheric modelling over weeks to months is incredibly valuable. This poster showcases our recent advancements in this area. We will present our latest research on how vegetation characteristics, including changes in land cover fraction and leaf area index (LAI), affect surface water and energy fluxes, as well as temperature, precipitation, and humidity. Ultimately, these efforts will enhance the accuracy of hydrological and weather predictions and reanalysis and climate projections, facilitating informed decision-making in water resource management.