

Irrigation impacts in SE Australia

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Motivation

LSMs originally developed for modeling natural system

**Many studies have shown irrigation impacts local climate
(Puma and Cook, 2010; Qian et al., 2013)**

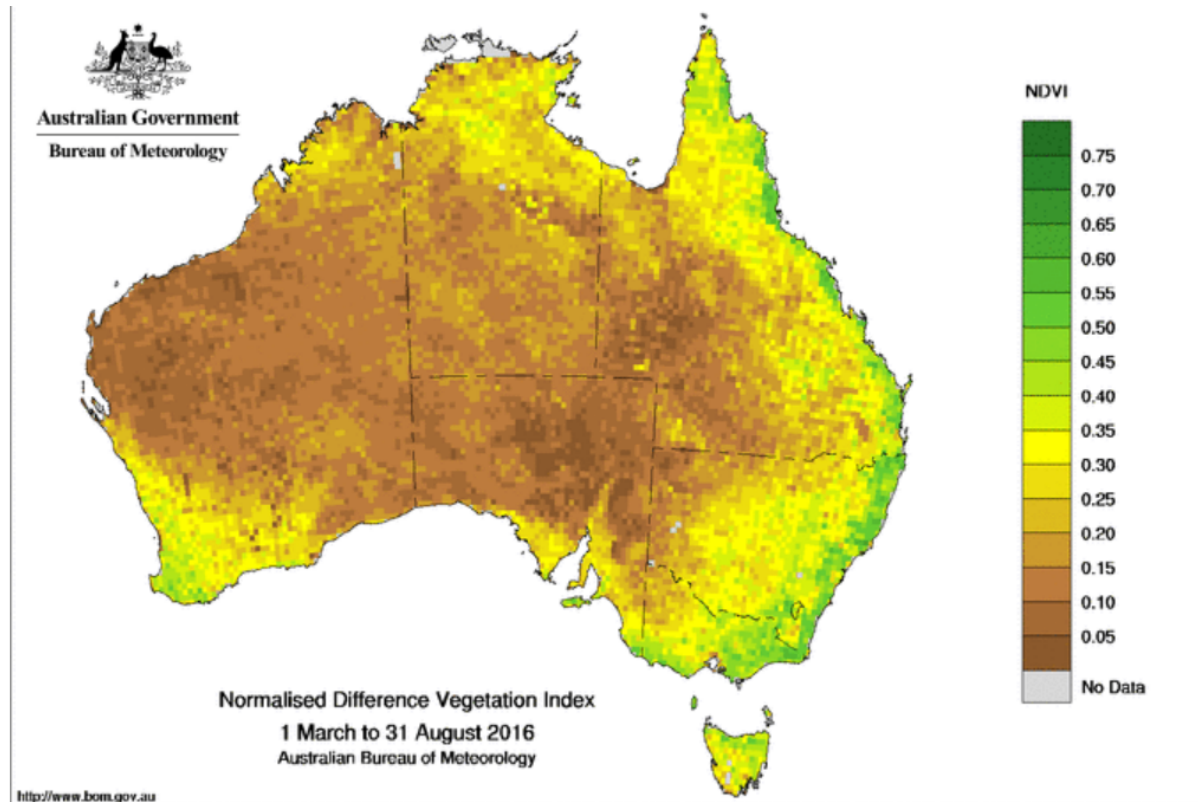
**Studies also document impact of climate change on irrigation
(Doll 2002)**

It is a two way street between irrigation and climate

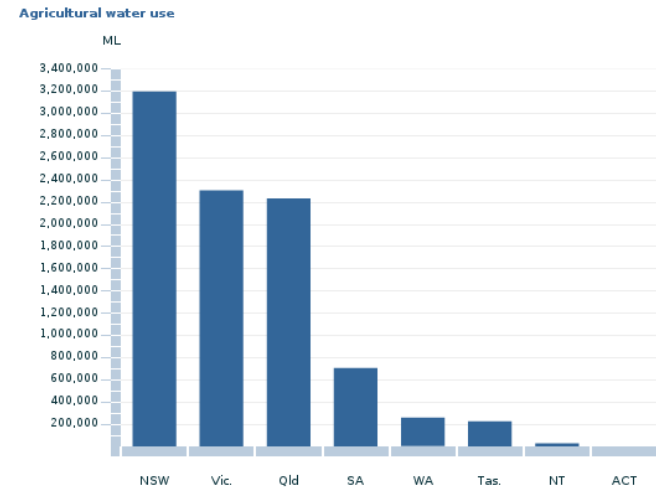
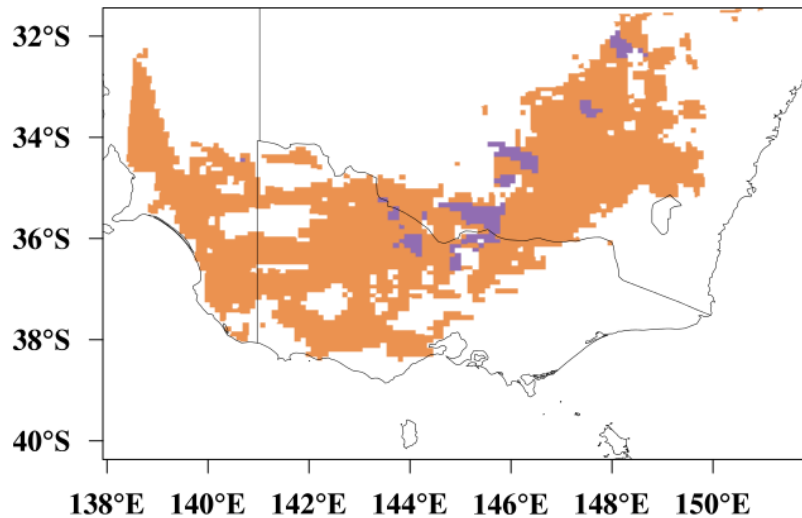
Goals:

**Develop an irrigation module for use in Australia first, then globally
Examine how irrigation alters climate in SE Australia
Determine if studies in SE Australia need to be coupled**

Crops and Irrigated Areas in SE Australia



Crops and Irrigated Areas in SE Australia



2014-15

Select a different graph

Irrigation, State and Territory (b)

Save Chart Image

Australian Bureau of Statistics

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National Land Use Mapping Project of the National Land
and Water Resources Audit
<http://data.gov.au/dataset/3c934692-b670-4608-8f74-ee36583f74c1>

CABLE in LIS-WRF

CABLE is the land surface component of the Australian Community Climate System Simulator (ACCESS)

Typical LSM in that it simulates storage and fluxes of heat, energy, and carbon to/from the atmosphere

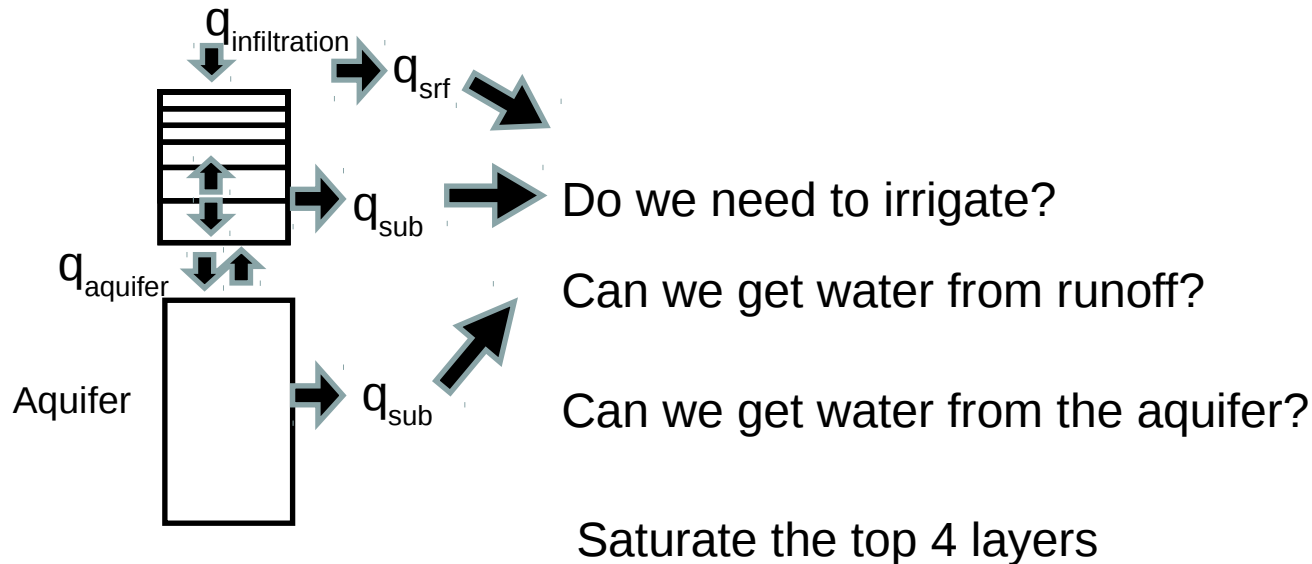
Recently added to the Land Information System (LIS v6) framework to run offline and coupled to WRF

Experiments:

Run offline for 1970-2015

Run Coupled 3X from 2005-2015 with and without irrigation

Irrigation Module GW equipped CABLE



When is irrigation initiated?

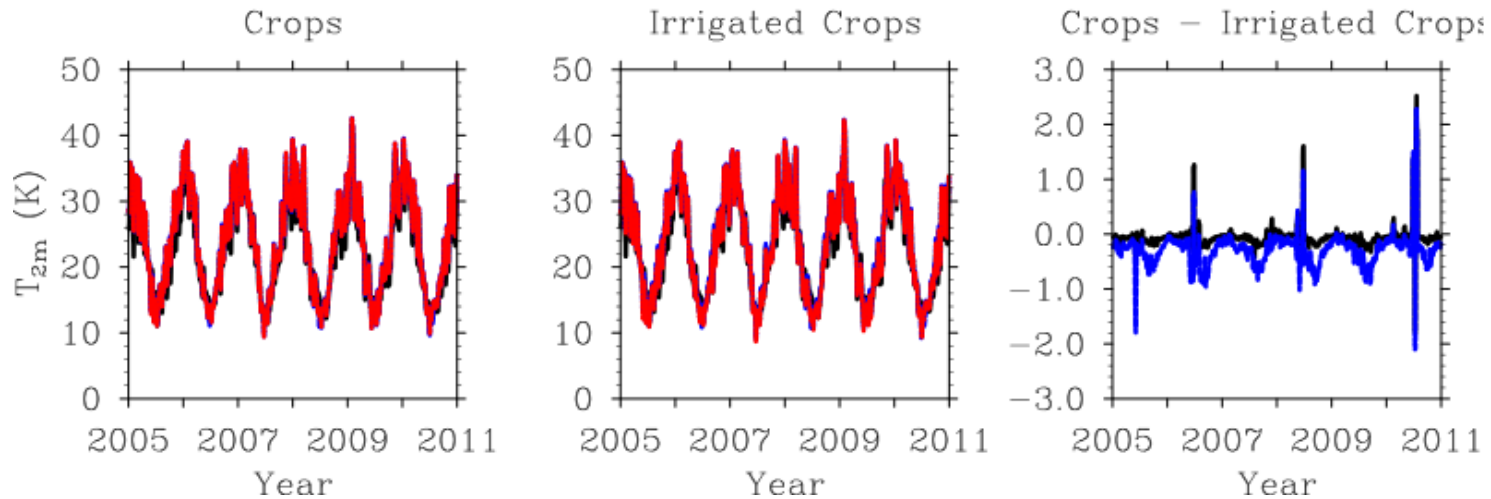
Follow Australian government guidelines

Start of growing season

When soil moisture is below 50% in all layers with roots

T_{2m}

Irrigated and non-irrigated crops

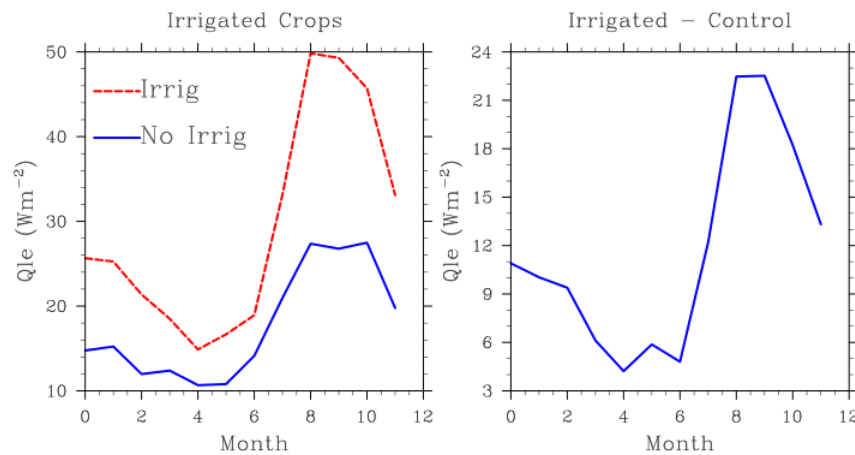
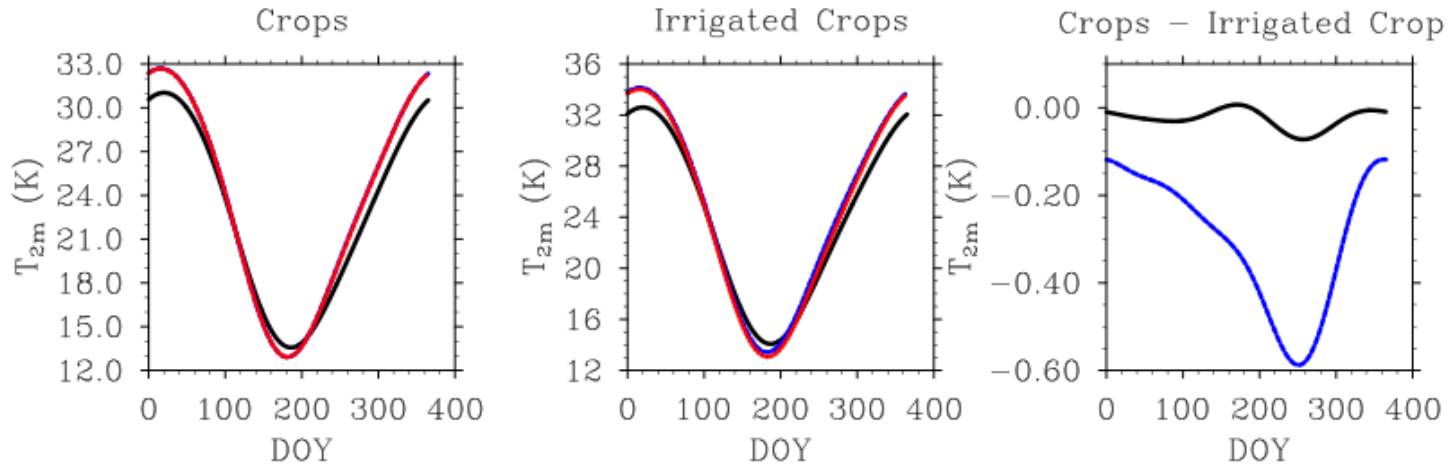


Without irrigation no difference in temperature between crops
Irrigated crops ~0.5-1K cooler than surrounding croplands

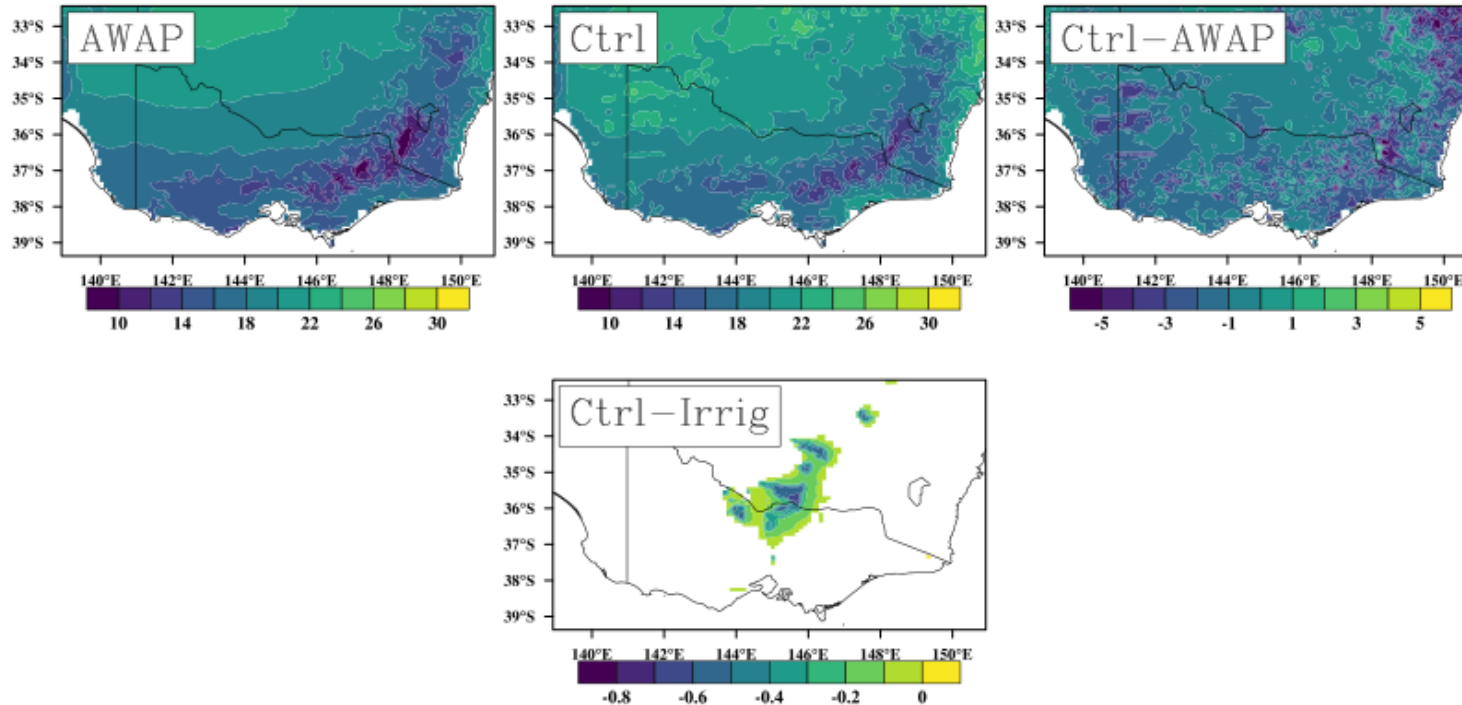


T_{max}

Irrigated and non-irrigated crops

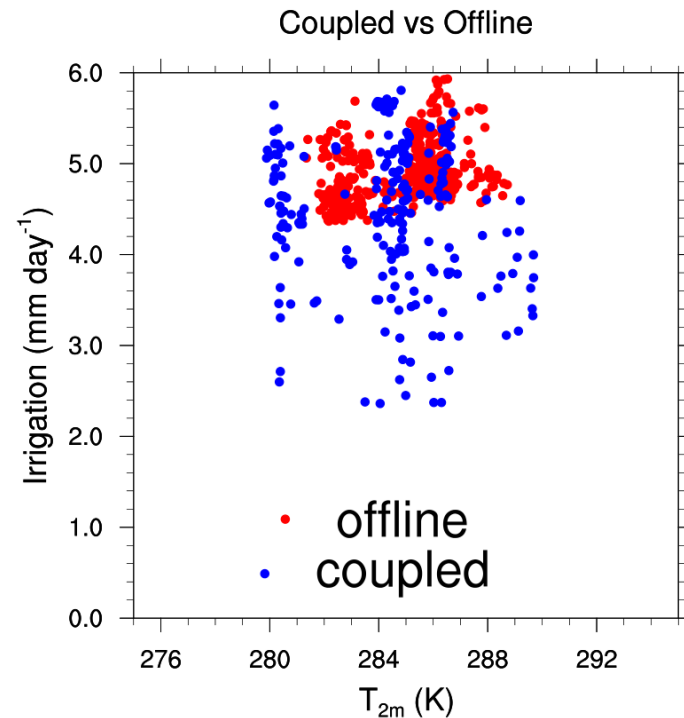
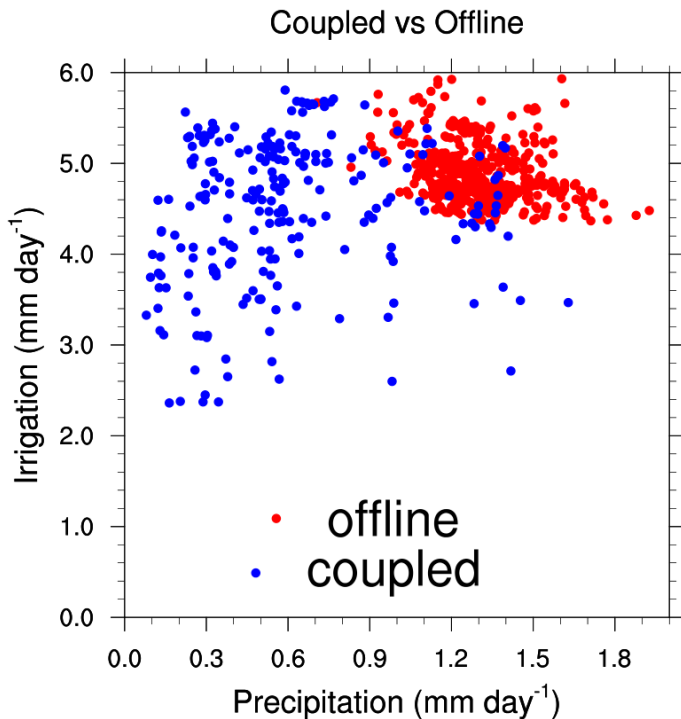


T_{max} Winter Crop Season



Irrigation reduces T_{max} by ~ 0.5 K
Only statistically significant over the irrigated areas
Minimal Impact on summer time temperatures

Do we need coupled simulations to predict irrigation amounts?



Offline: Always around 5 (mm day^{-1})
Coupled: Much more variable

Coupled	Offline	Obs
2.60E+12	4.50E+12	5.70E+12

Summary

**Crop irrigation module developed for CABLE
Follows irrigation guidelines**

**T_{\max} reduced by 0.5-1K during growing season
Impacts are local and limited in time**

**Offline irrigated amounts nearly always 5 mm day^{-1}
Coupled irrigated amounts vary greatly**

Future work

Do the offline and coupled runs differ as much with the exact same forcing?

Thank You!