



# Will we keep growing food in a hotter and water-constrained Adelaide?

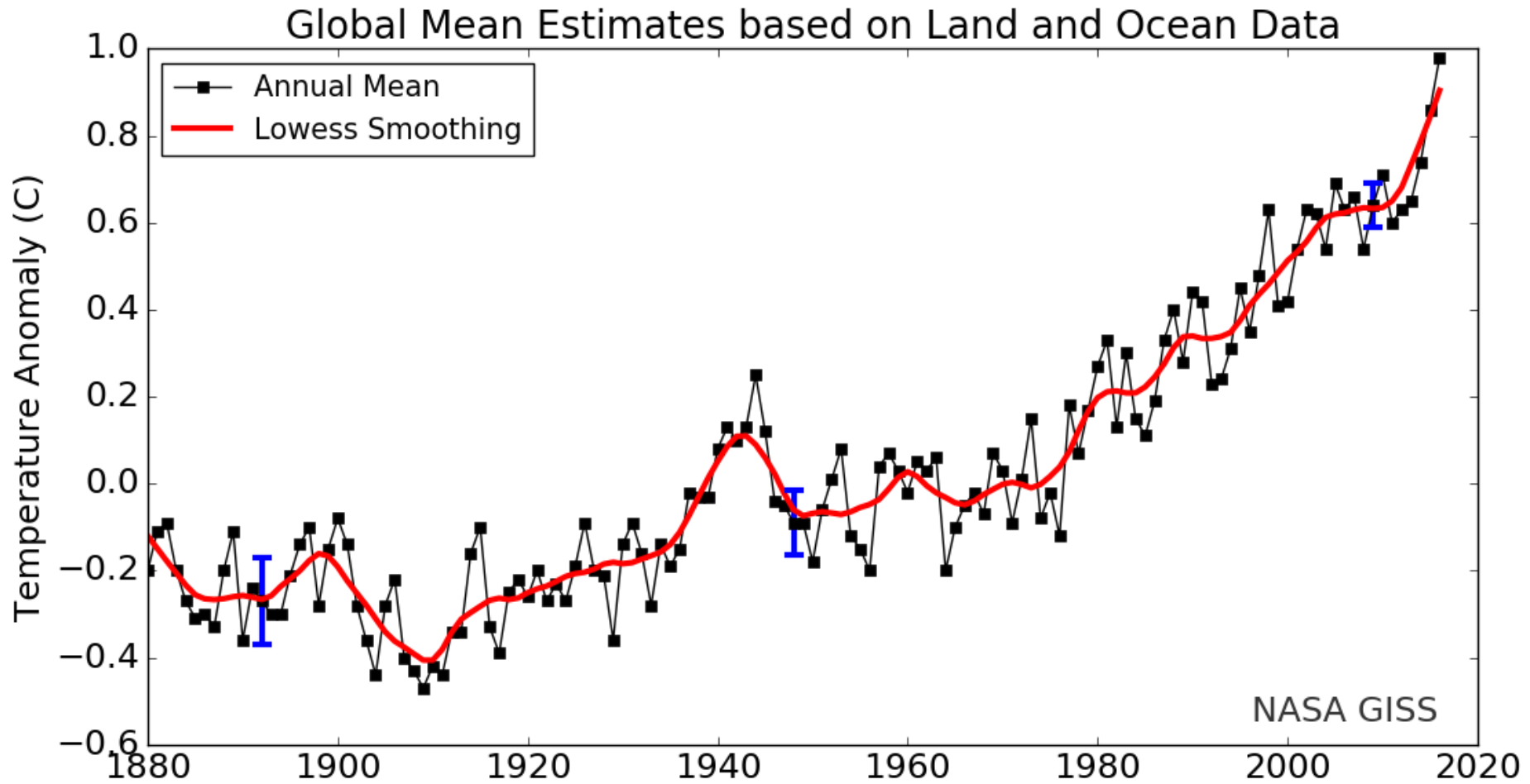
Mark Howden, Steve Crimp and many others

ANU Climate Change Institute

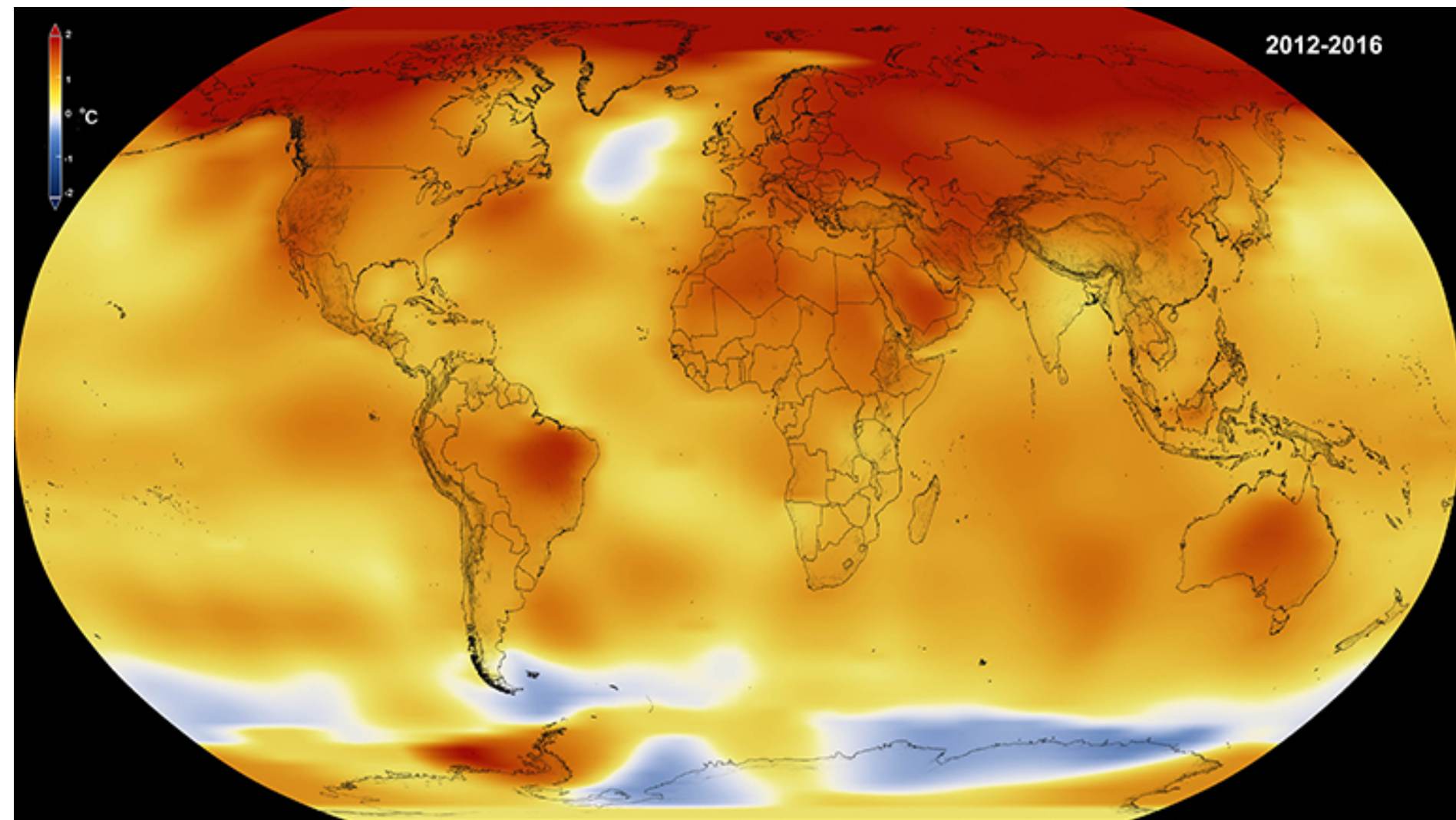
Vice Chair, IPCC Working Group II



# Global temperatures keep rising



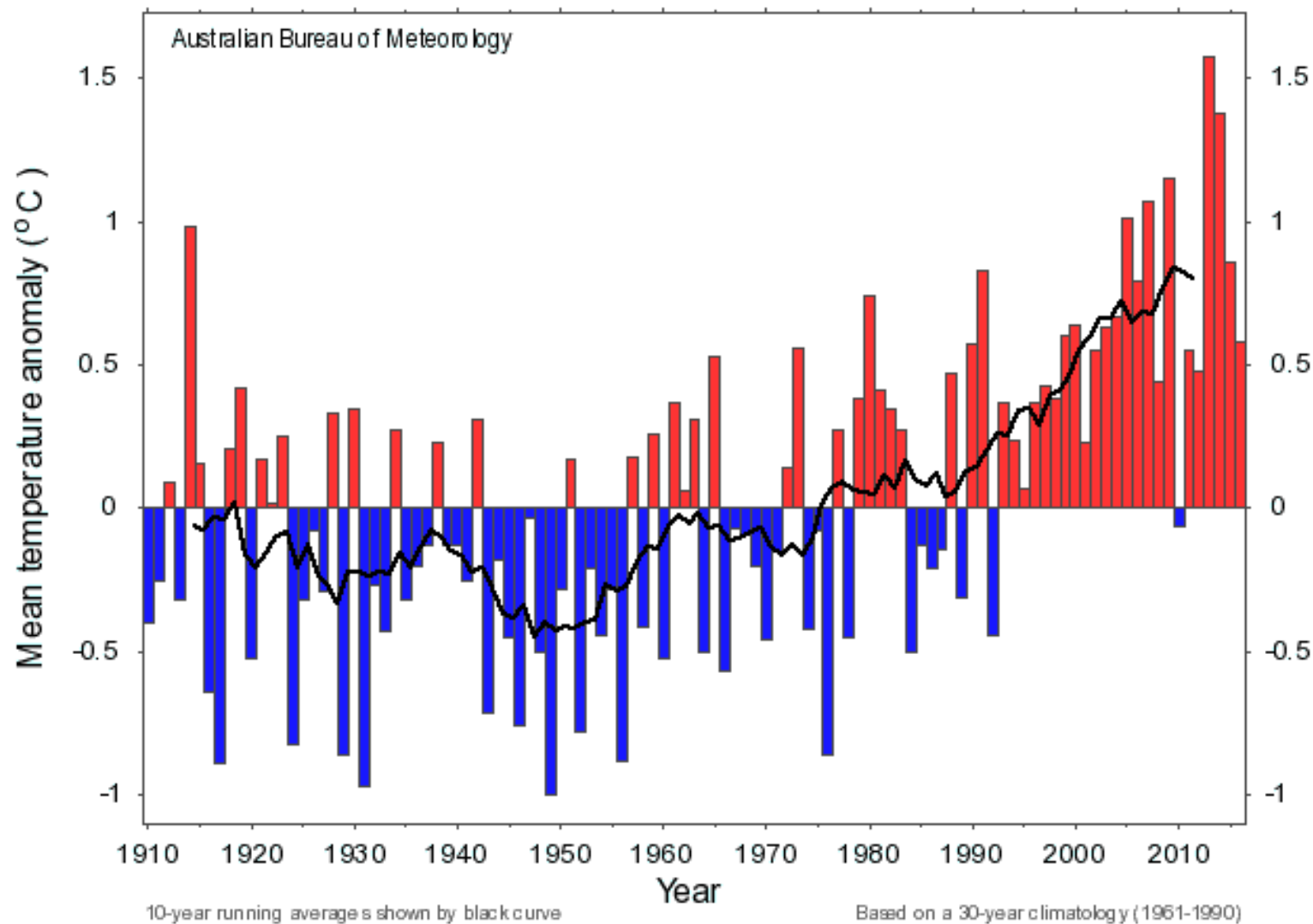
# Warming almost everywhere





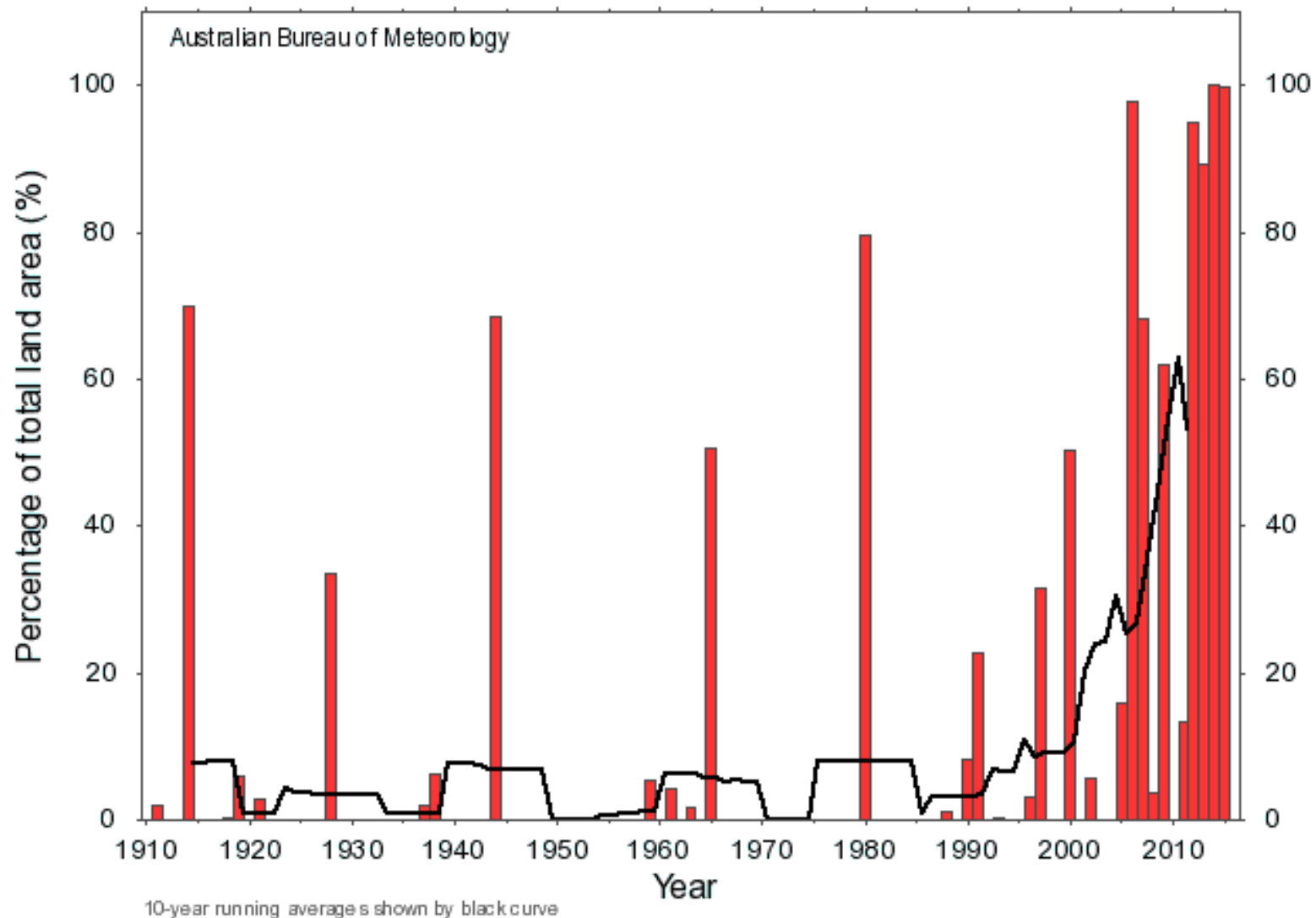
# Temperatures increasing for SA

Annual mean temperature anomaly - South Australia (1910-2016)



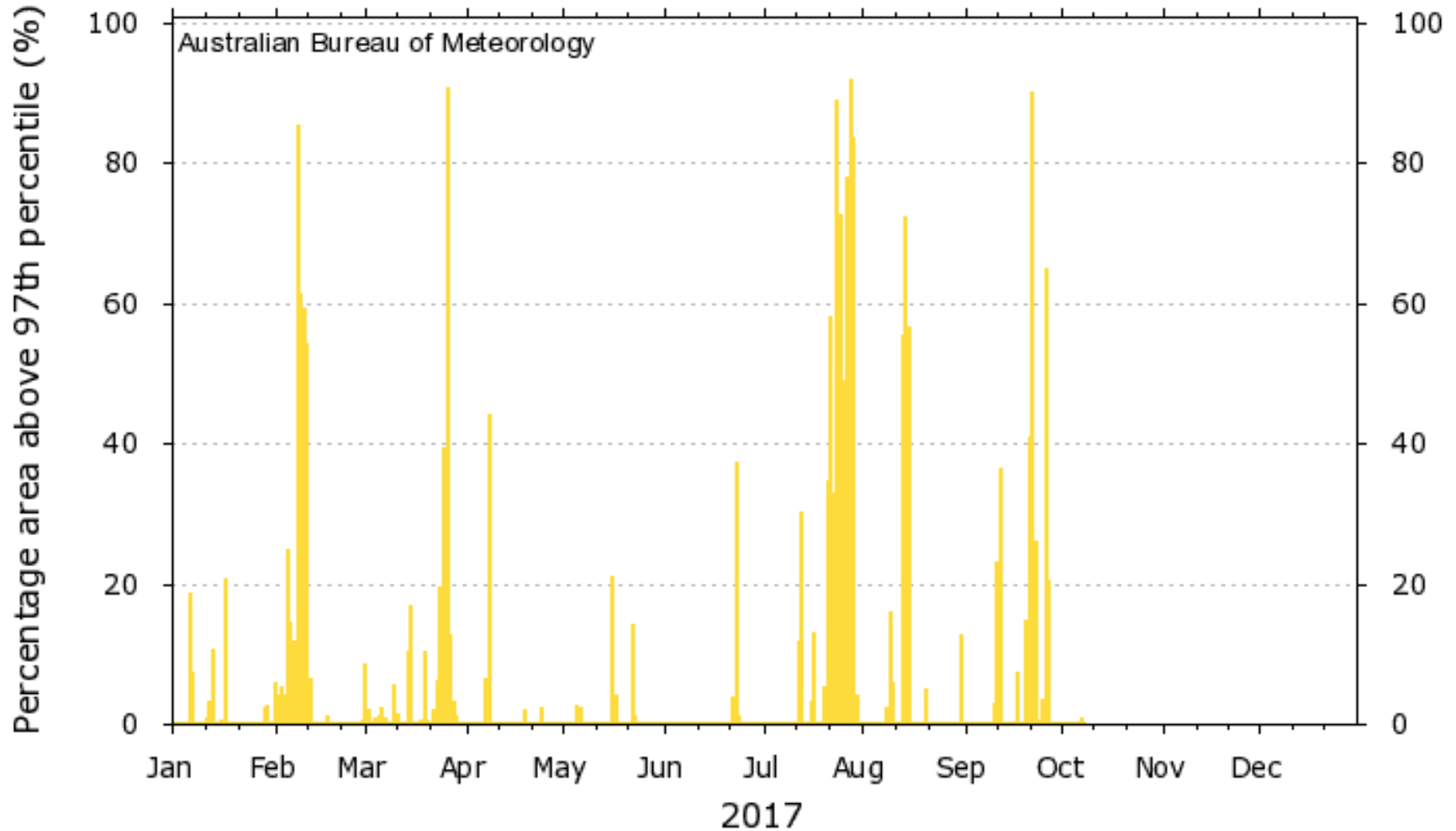
# Extremes: everywhere, all the time

Spring percentage area in decile 10 - South Australia (1910-2016)



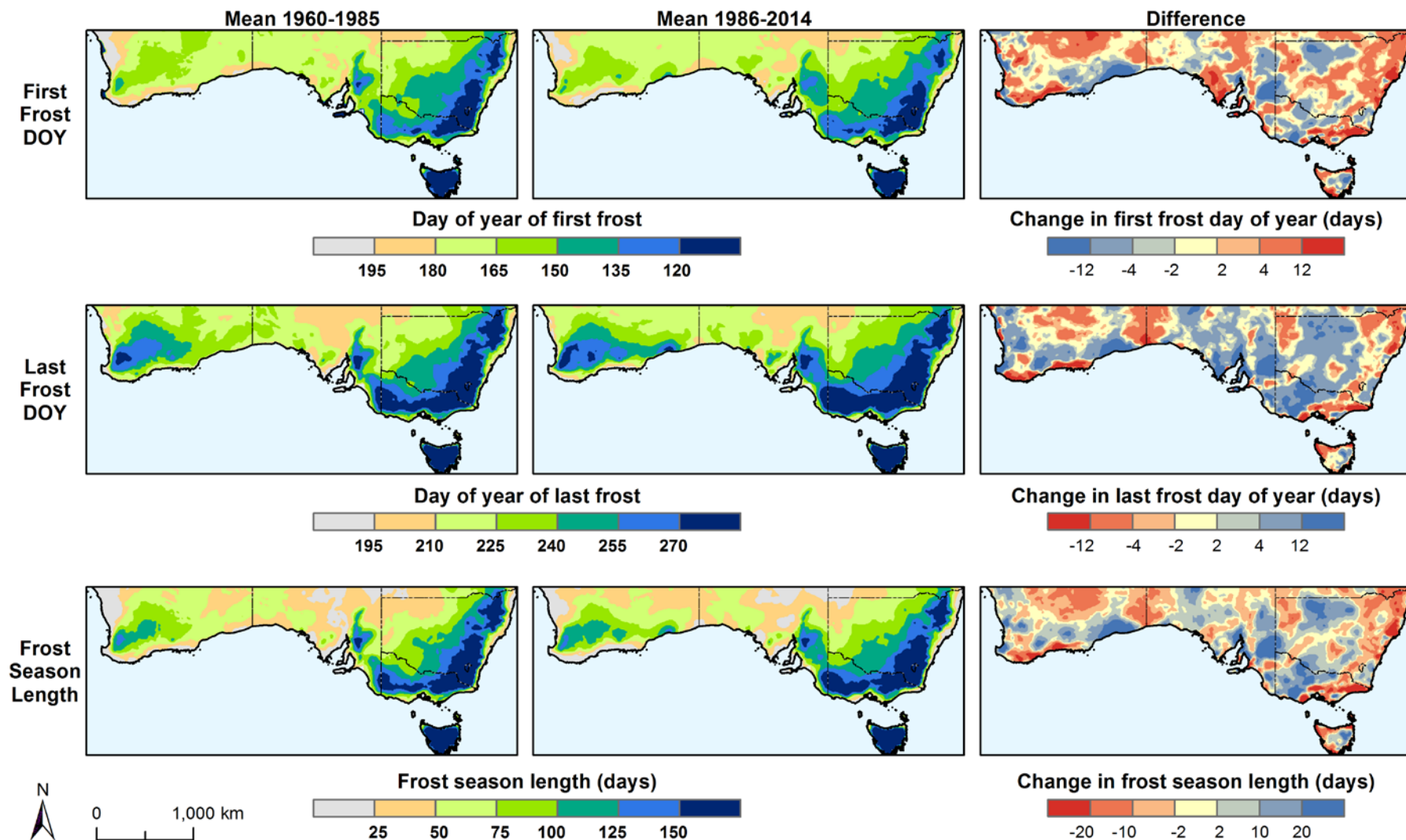
# Extremes: this year too

Daily Extreme Maximum Temperature in South Australia



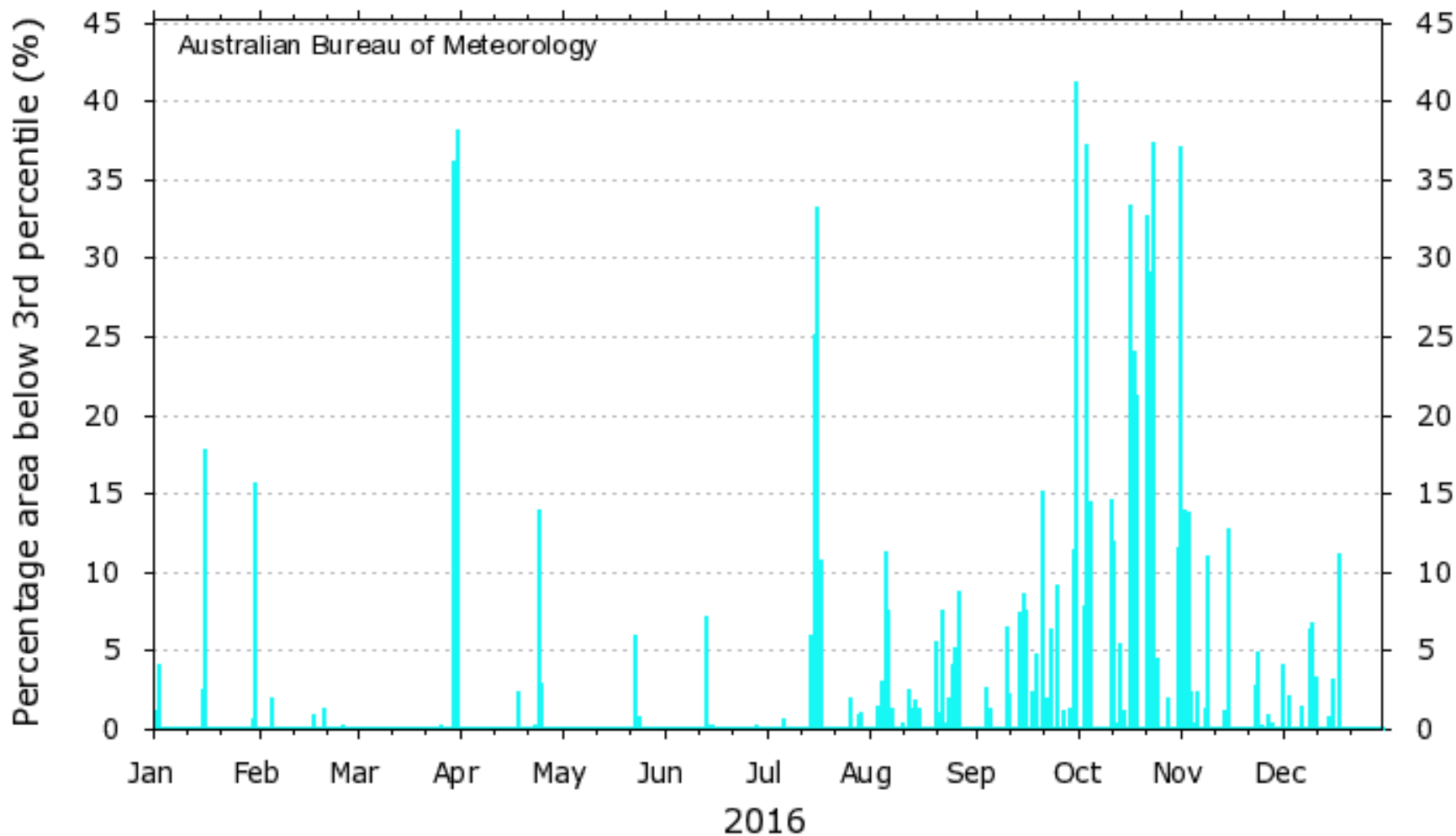
# Frost risk increasing too

## Frost season start, finish and length



# Cold extremes: last year too

Daily Extreme Minimum Temperature in South Australia

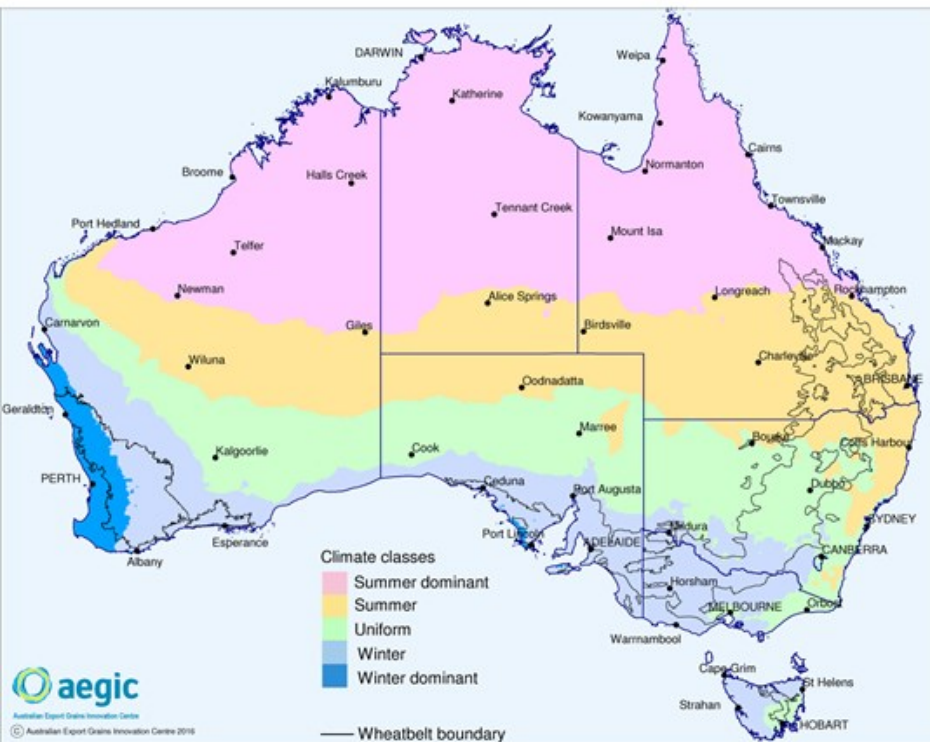




# Rainfall zones 'moving south'

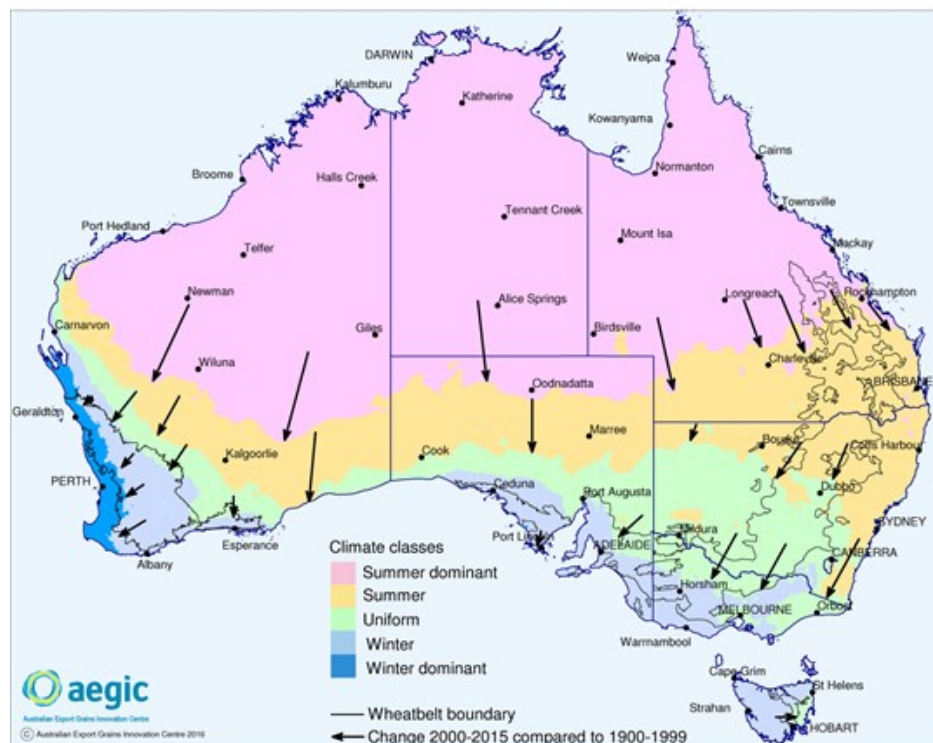
**Australia Seasonal Rainfall Zones**

Based on rainfall data 1900-1999



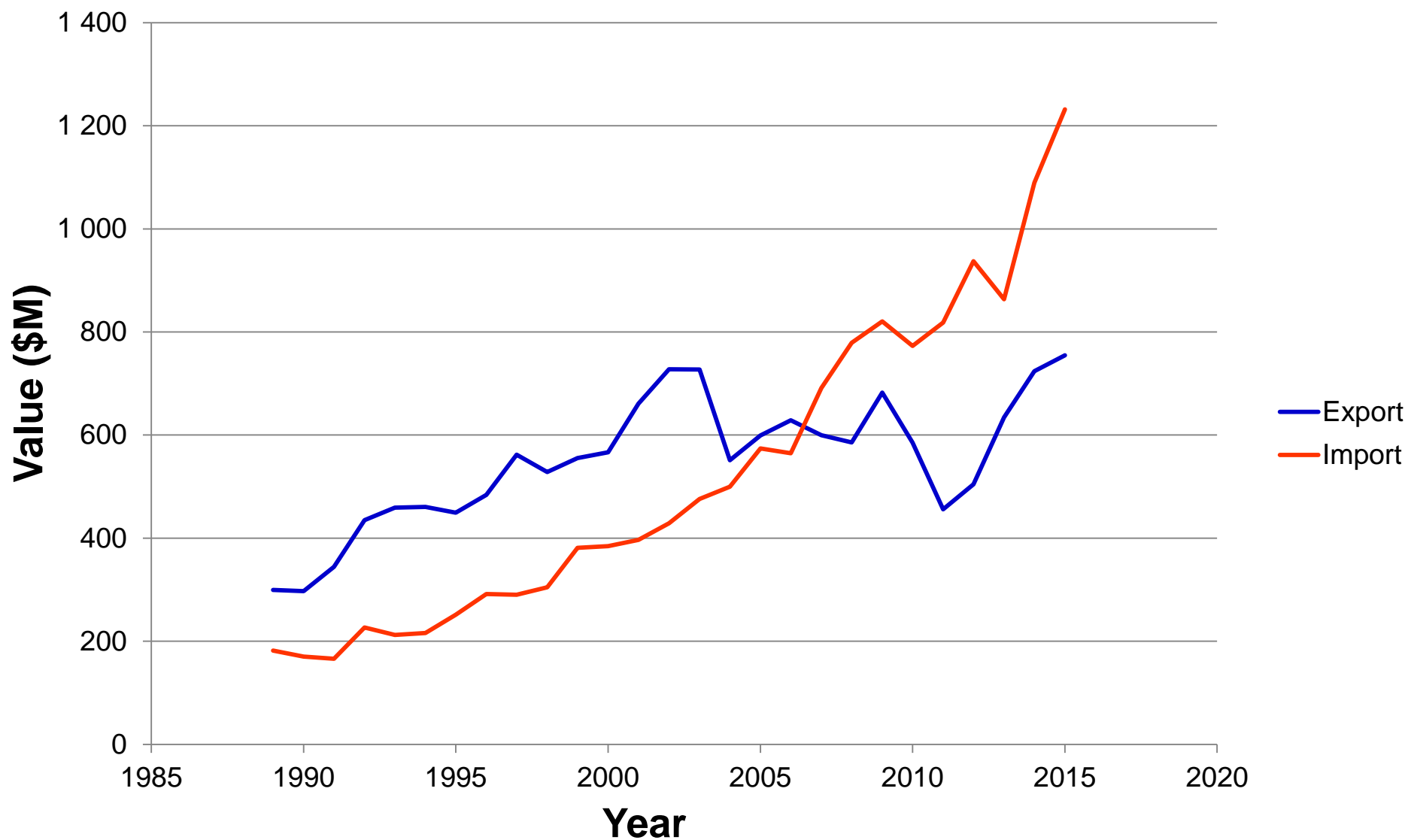
**Australia Seasonal Rainfall Zones**

Based on rainfall data 2000-2015



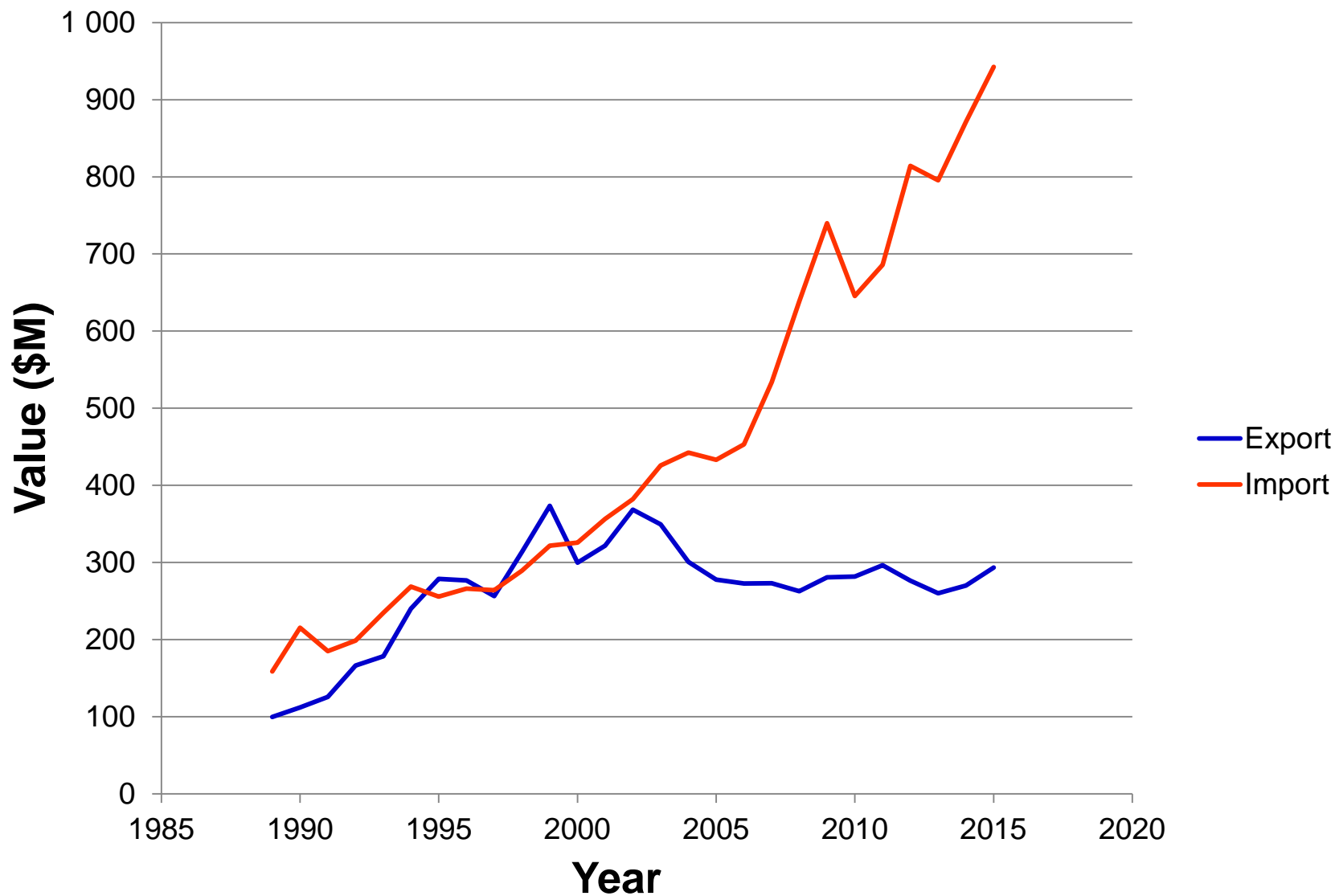
- Rainfall declining in the south
- Increasing in the north

# Fruit: exports vs imports





# Vegetables: exports vs imports



‘Past performance is not a reliable indicator of future performance’

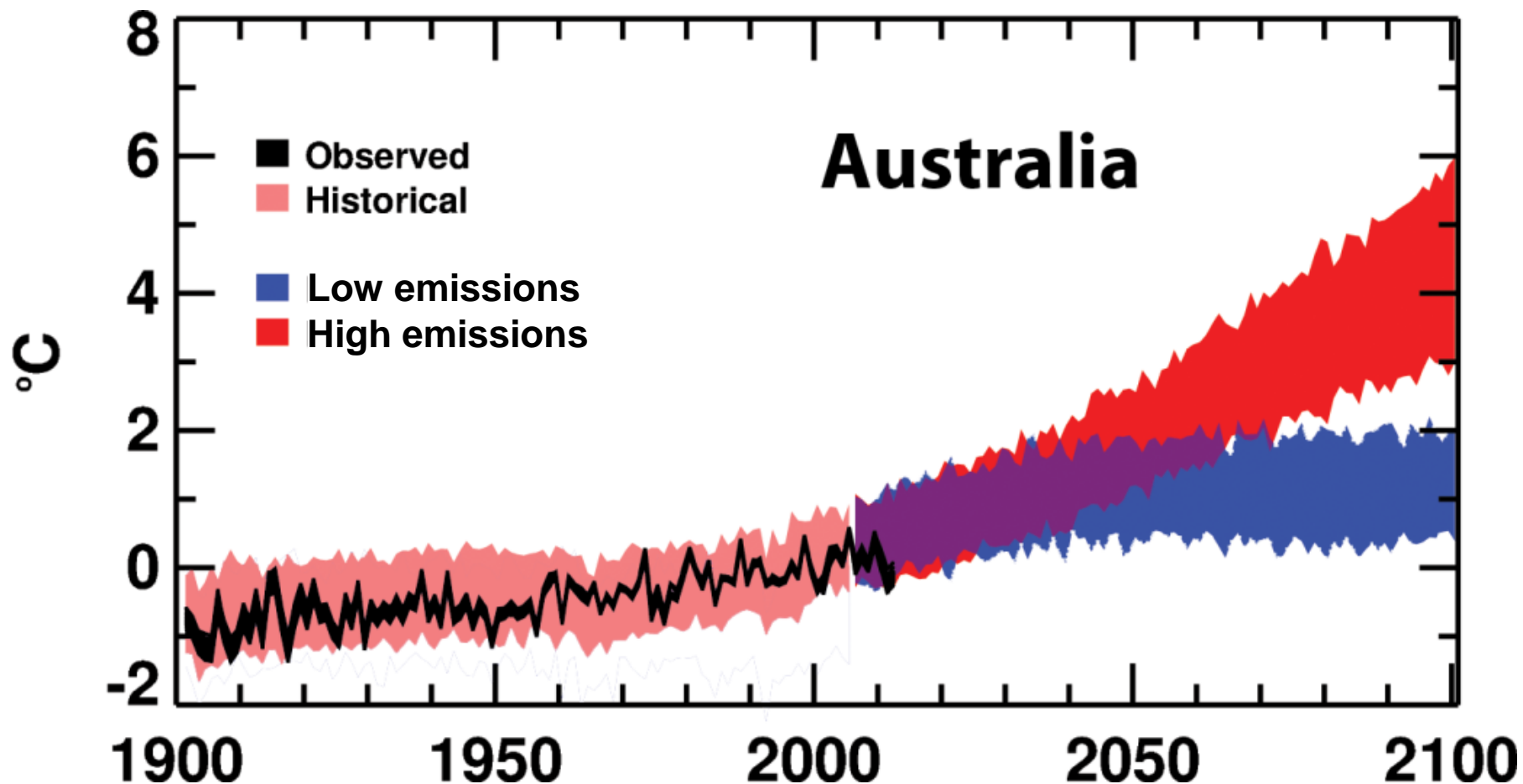
— *Aust Securities & Investment Commission*

‘The past climate is no longer a reliable indicator of the future climate’

— *message from scientific community*



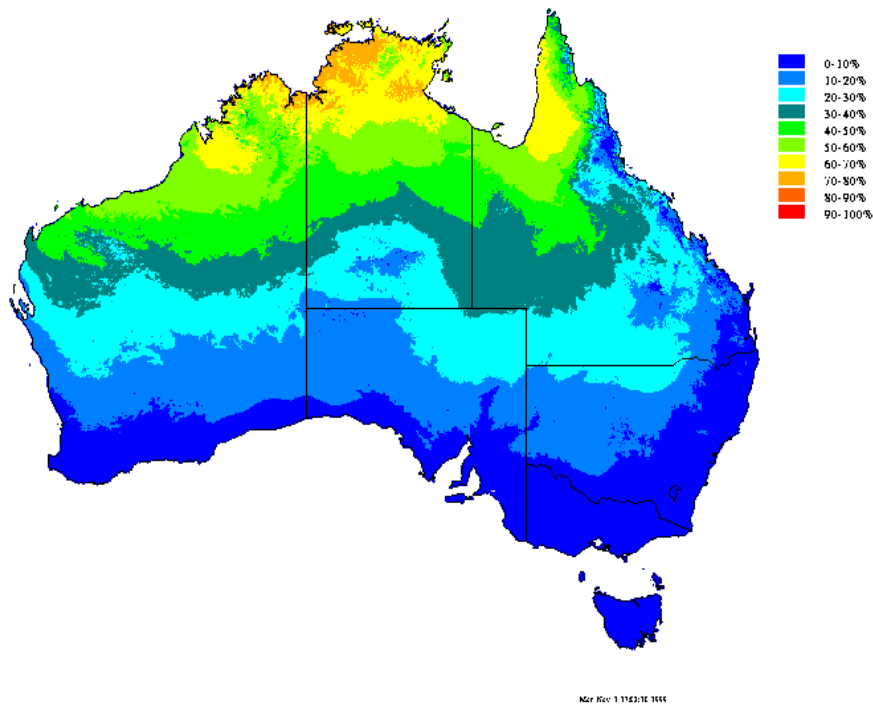
# Emission and temperature scenarios



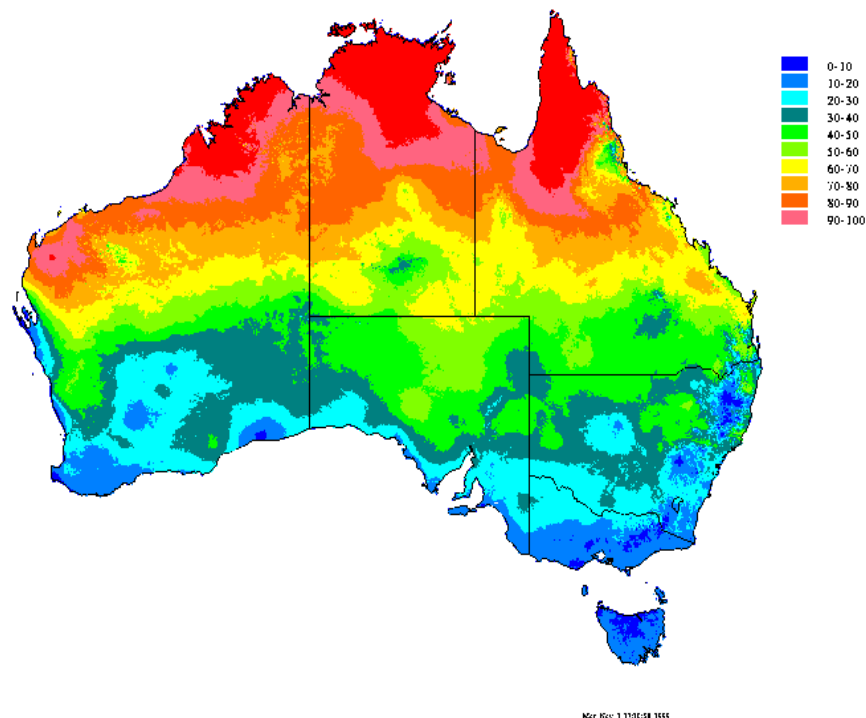


# Heat stress frequency

## Current heat stress

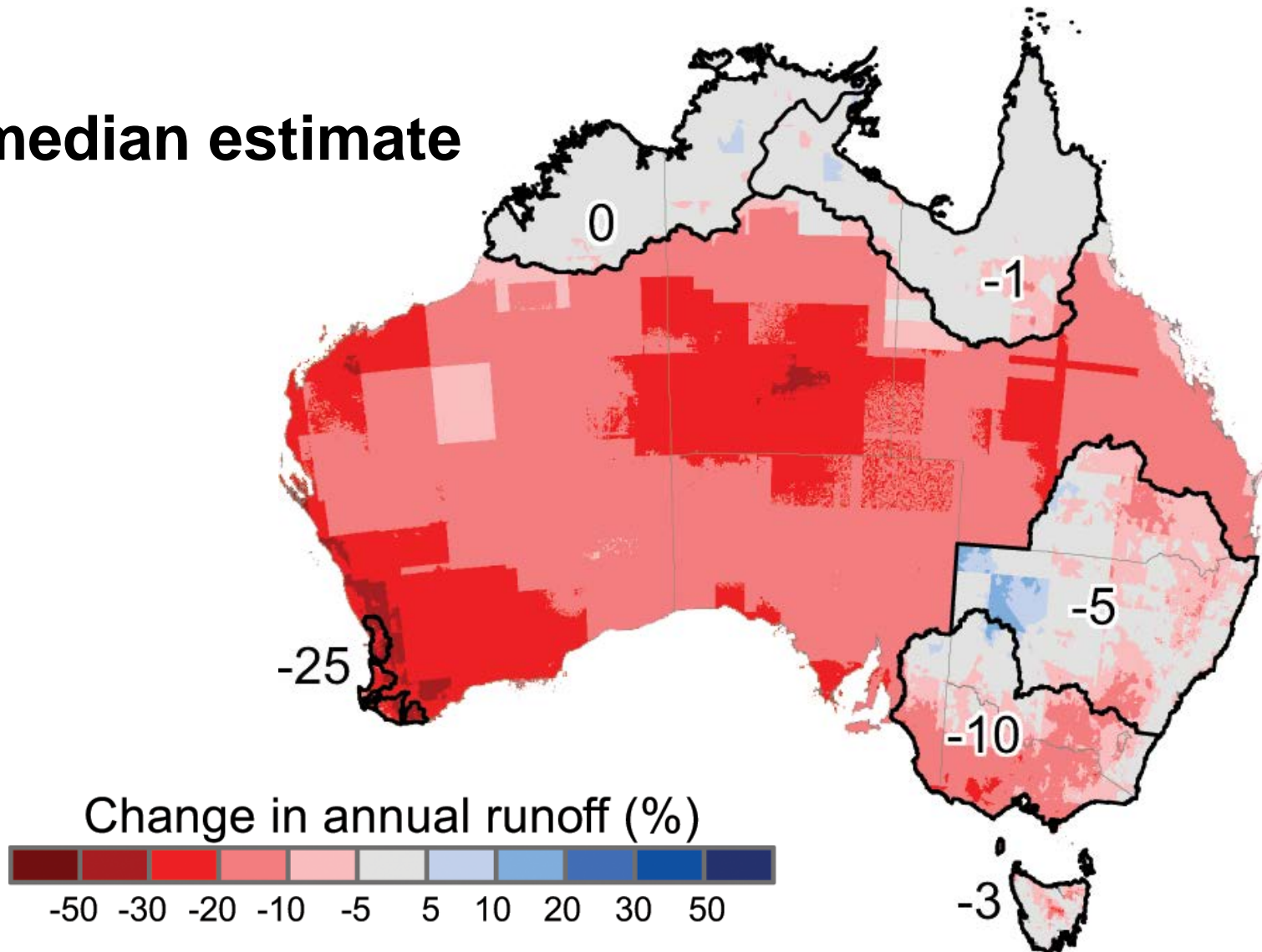


## Heat stress 2.7°C warmer

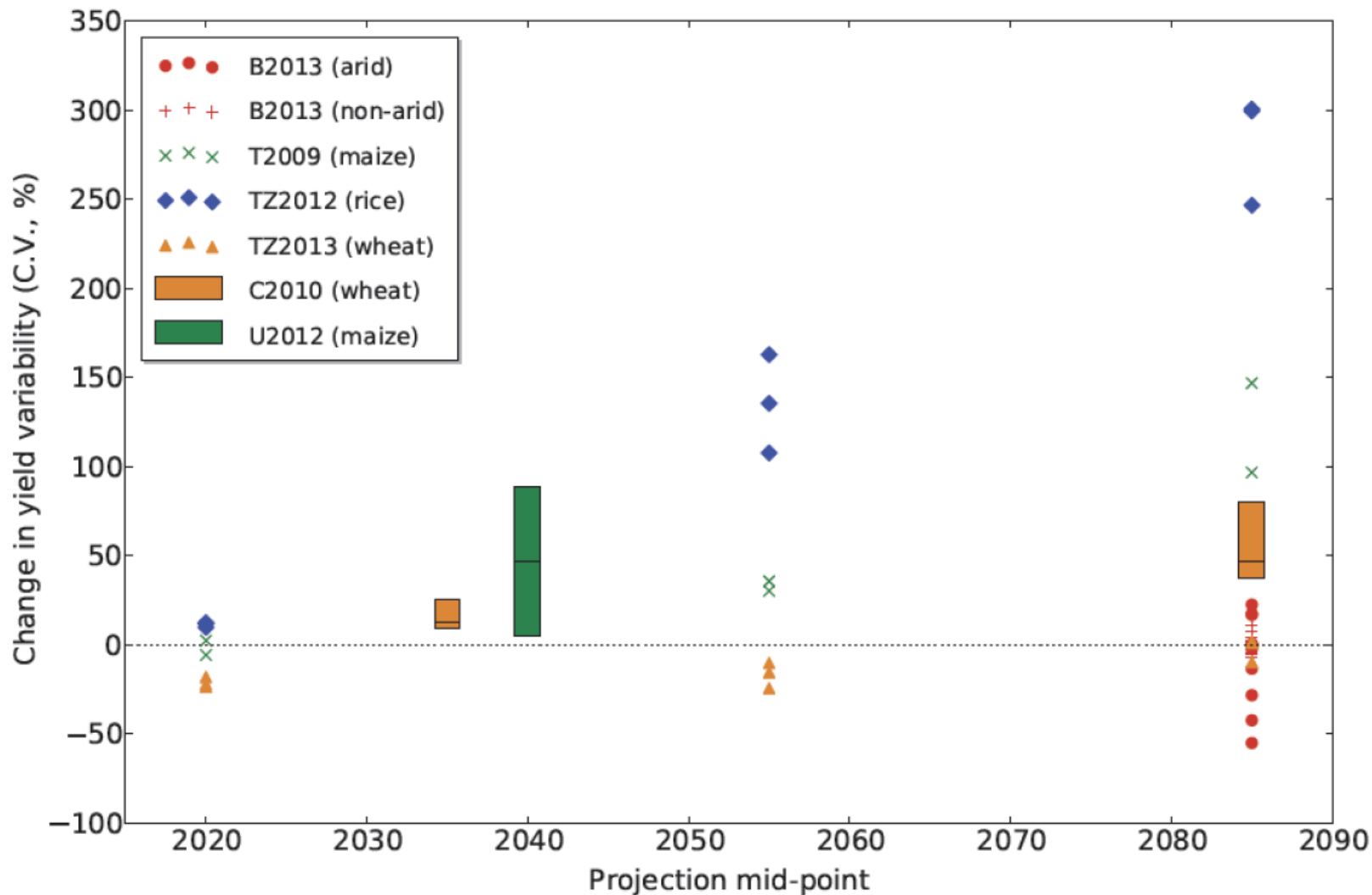


# Run-off change per °C warming

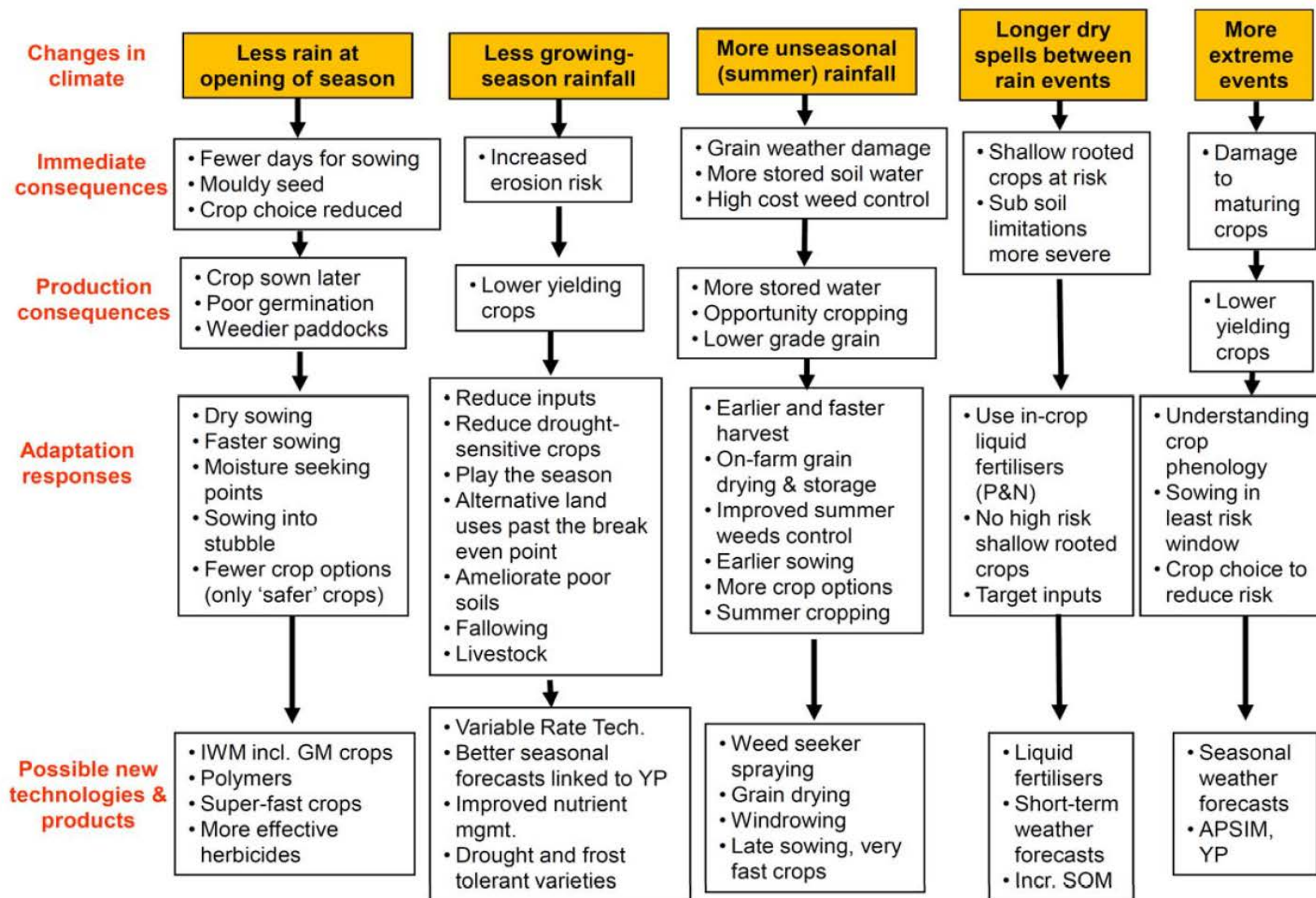
median estimate



# Yield variability likely to increase



# Climate change adaptations from farmers



- Change species or varieties
  - Silverbeet vs English spinach
  - Californian vs European hops
  - low chill fruit trees vs traditional varieties
  - long-season or short-season
  - lower water use or more drought-tolerant
  - new options: snake beans, kangkong or yams
- Change planting times
  - tomatoes and Melbourne Cup day
  - multiple crops
  - autumn crops



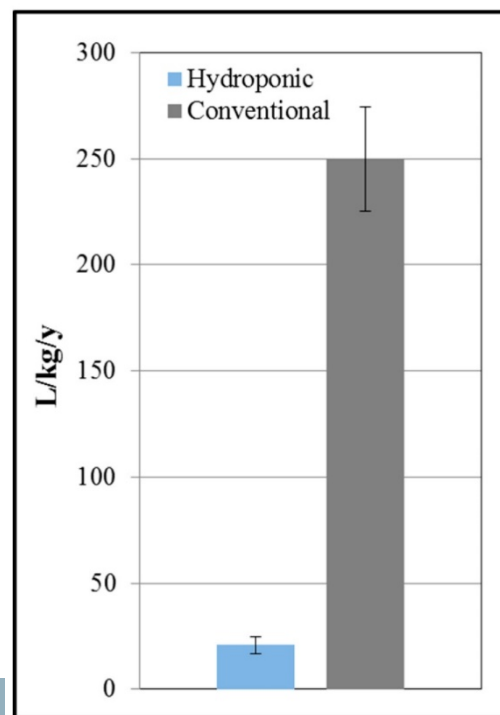
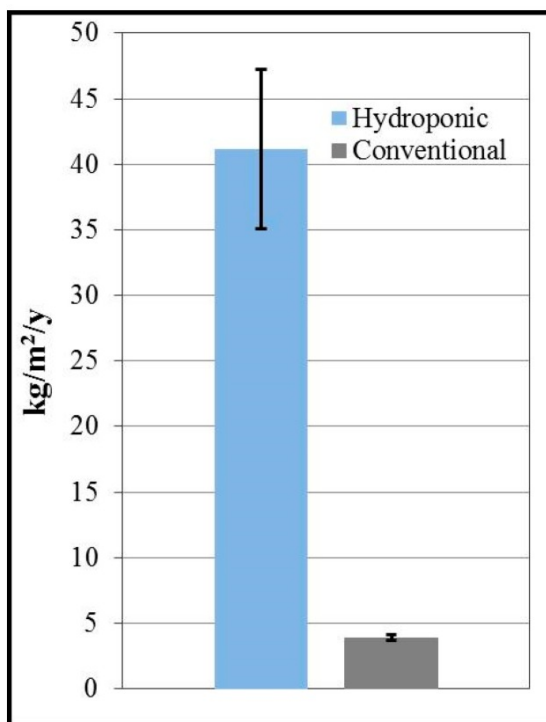
- Change in-crop management
  - watering (including monitoring)
  - mulch, shade and frost cover
  - fertilisation
  - weeds, pests, diseases
  - enhance soil carbon
- Change growing systems
  - hydroponics
  - aquaponics
- Change harvest and post-harvest treatment

# Hydroponics



# Hydroponics: yields, water and energy

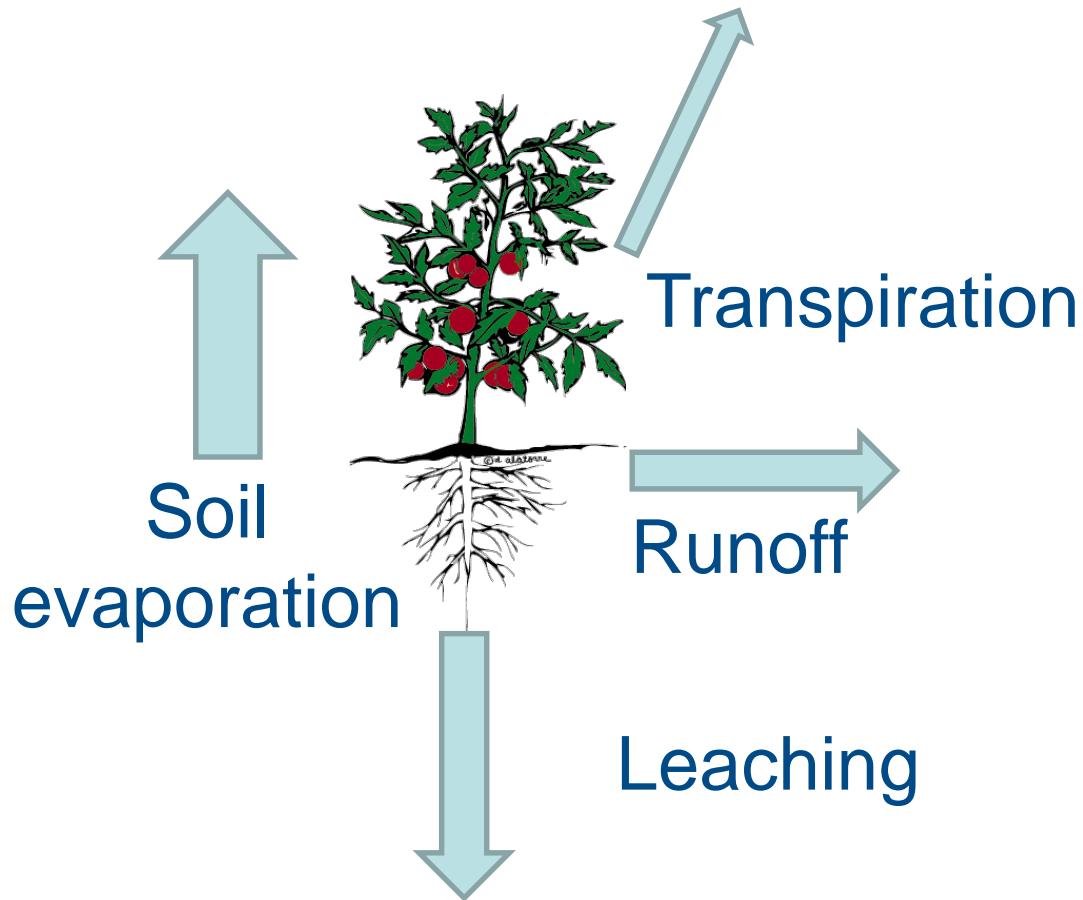
- Lettuce in semi-arid USA
- Hydroponics yields ( $\text{kg}/\text{m}^2$ ) about 10 times higher
- Water use only about 8%
- But higher energy use (mostly heating and cooling)
- More efficient nutrient use too (usually 1/3<sup>rd</sup> less used)



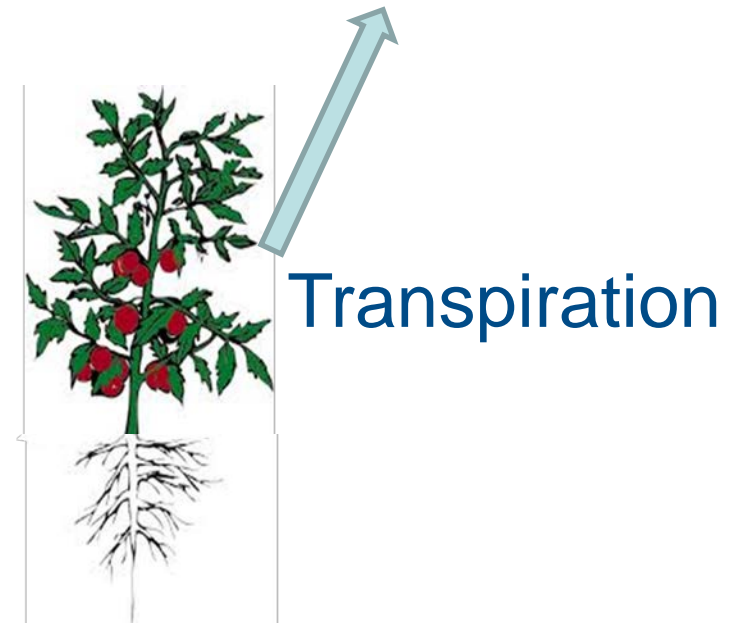


# Water balance and efficiency

## Soil-based

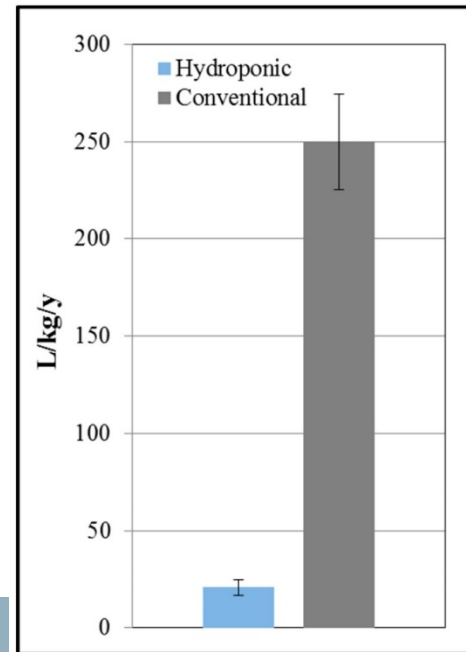
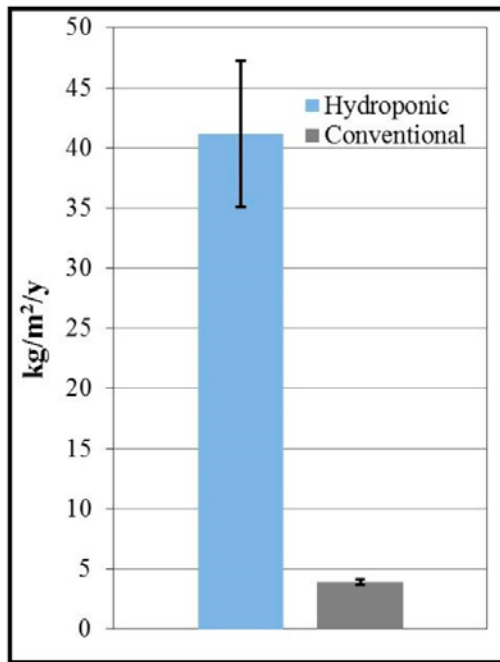


## Hydroponics



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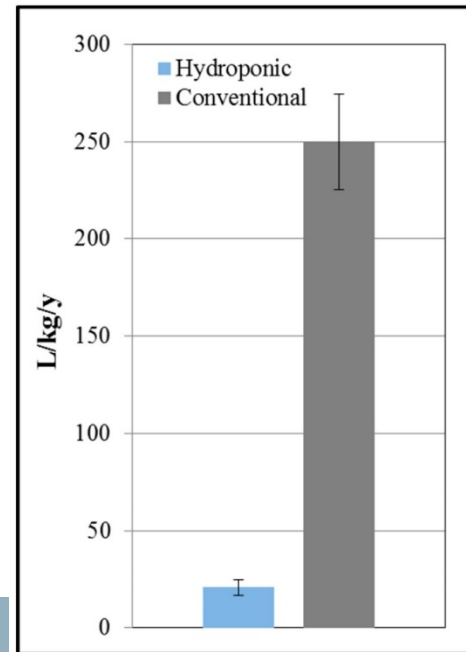
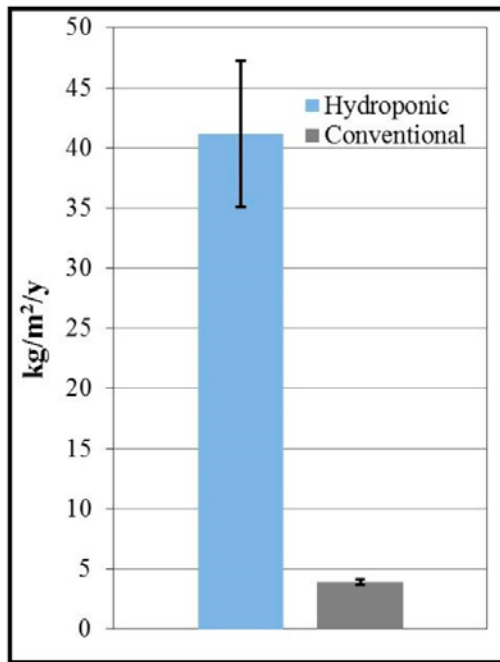


# Sundrop: powered by the sun



# Yields, water, energy, nutrient efficiency

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- Change in-crop management
  - watering
  - mulch
  - fertilisation
  - weeds, pests, diseases
- Change growing systems
  - hydroponics
  - aquaponics
- Change harvest and post-harvest treatment
- Learn and get inspiration from each other

# Summary

- Our climate is changing, more change seems likely
- Urban agriculture in Adelaide is already being affected, with more impacts in store
- A range of practical options are available that could help urban agriculture adapt
  - some are minor changes to existing practices, others more systemic
  - often multiple benefits
  - all require some level of water security but some likely much less demanding than others
- Urban ag will increasingly be part of providing nutritious food with a low environmental footprint





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National  
University

*Thankyou*



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