Are the impacts of climate change being overstated?

Peter Hayman

SARDI – Climate Applications Unit

GRDC
Grains Research & Development Corporation

Government of South Australia

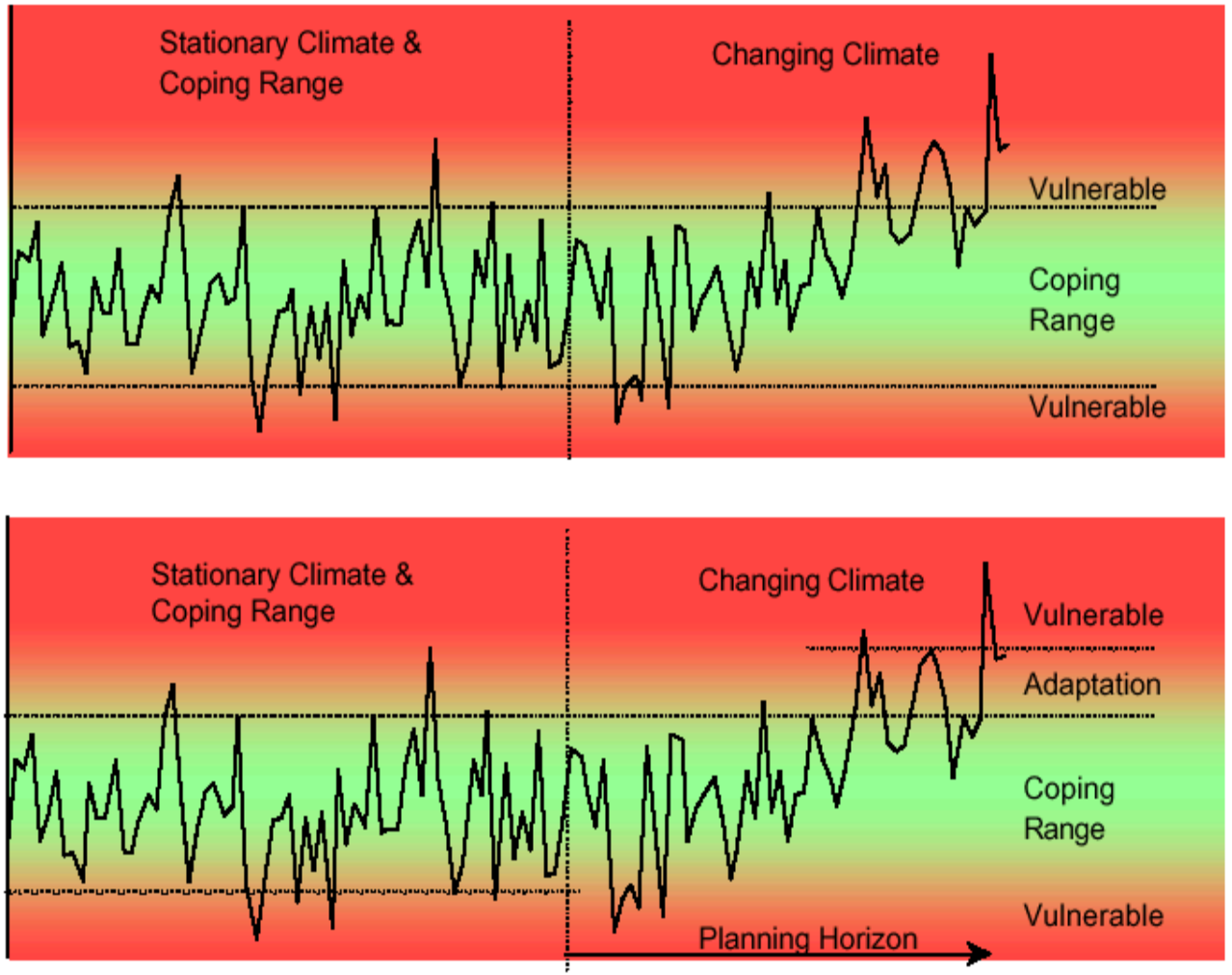


Figure 35: *Coping range showing the relationship between (a) climate change and threshold exceedance, and (b) how adaptation can establish a new critical threshold, reducing vulnerability to climate change.*

Recent seasons have shown ***vulnerability*** to climate

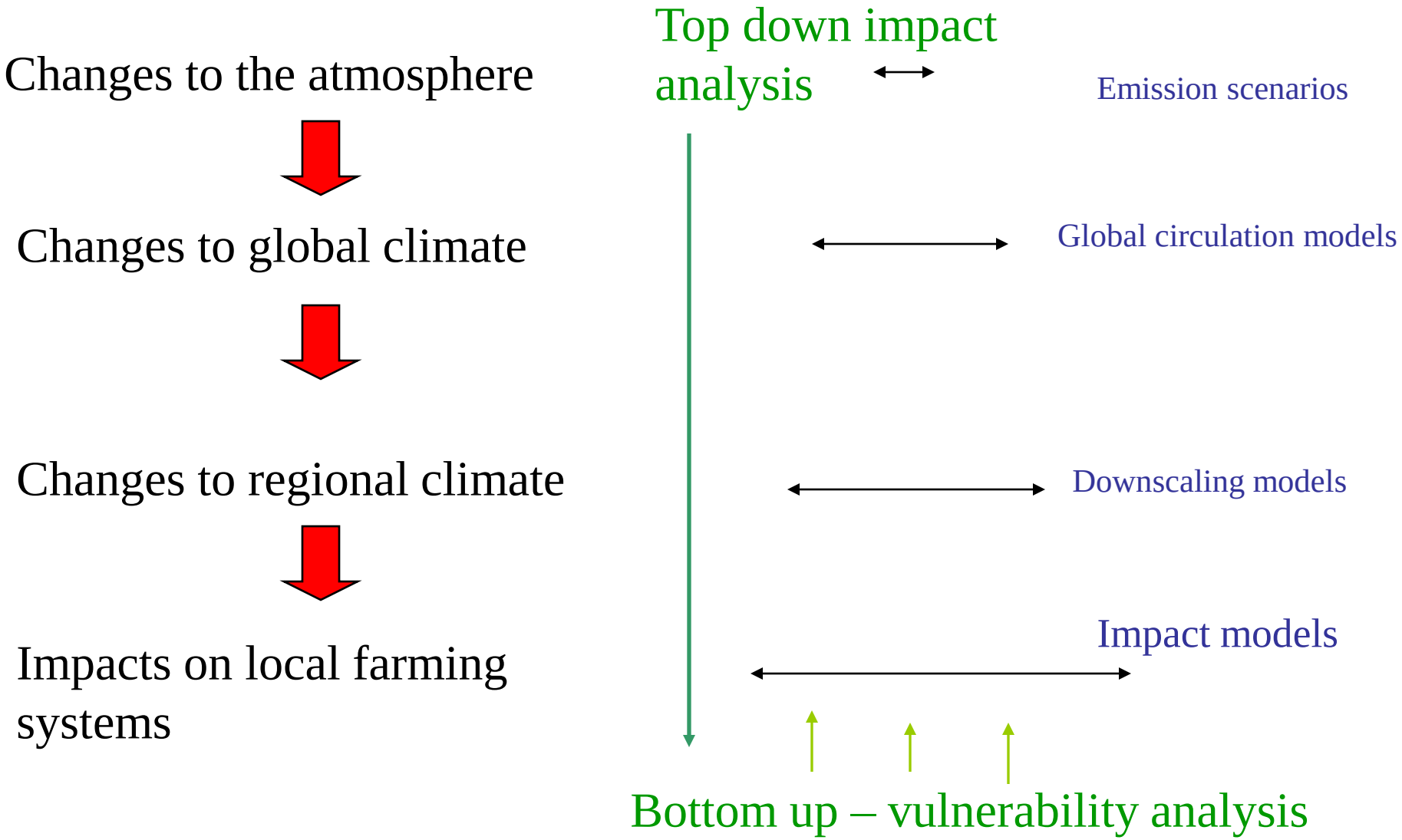
1. Stream flow in Murray Darling Basin and other catchments
2. Rainfall in recent seasons 02, 04, 06, 07
3. Very hot dry autumn in 2005
4. Heatwave in February impact on viticulture2004
5. Heatwave in March impact 2008

6. Changes in crop development (wheat and vines)
7. Changes in pests and diseases
8. Damaging frosts in 2002, 2004 and 2006.

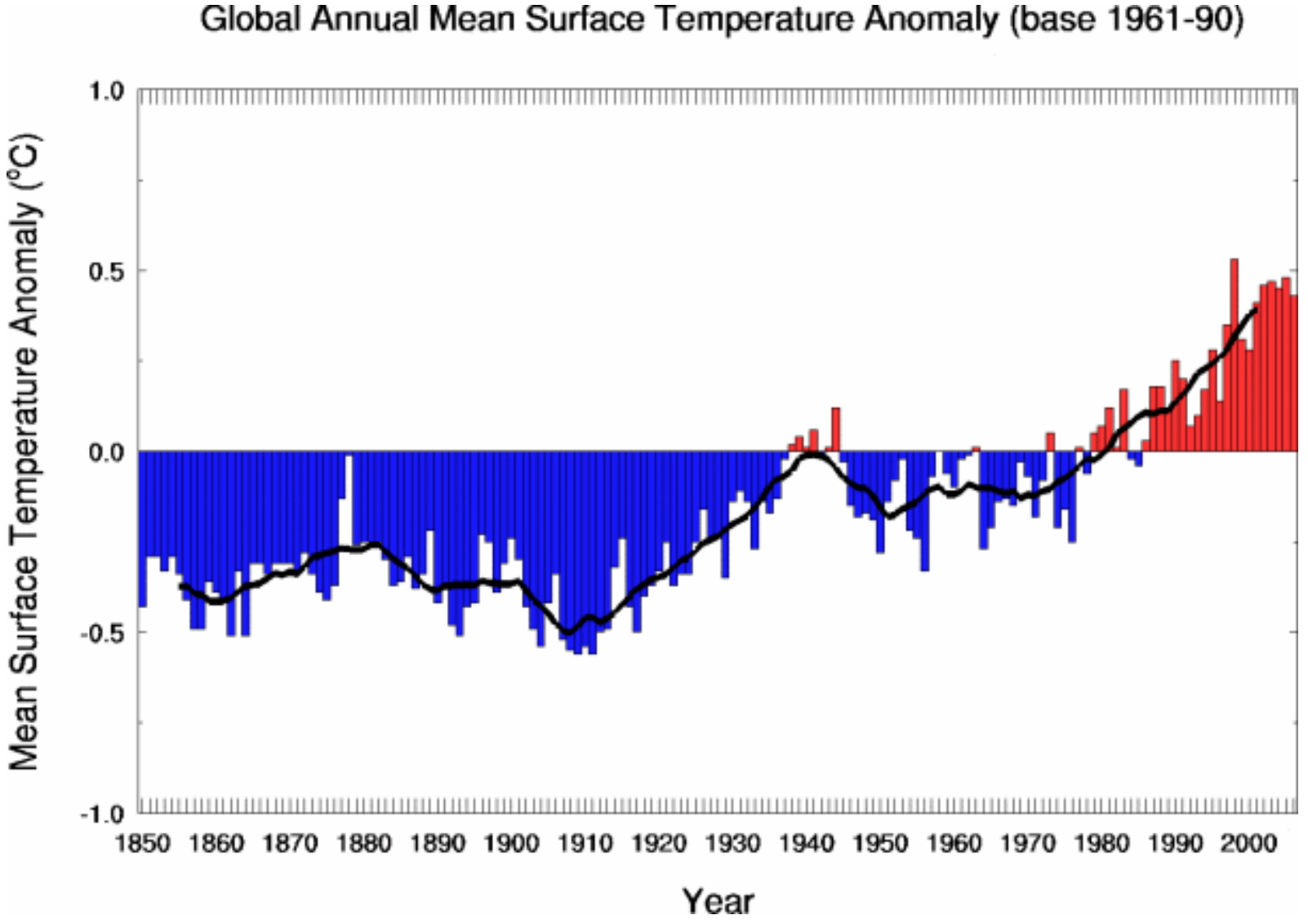
Evidence for ***vulnerability..***is it evidence for climate change

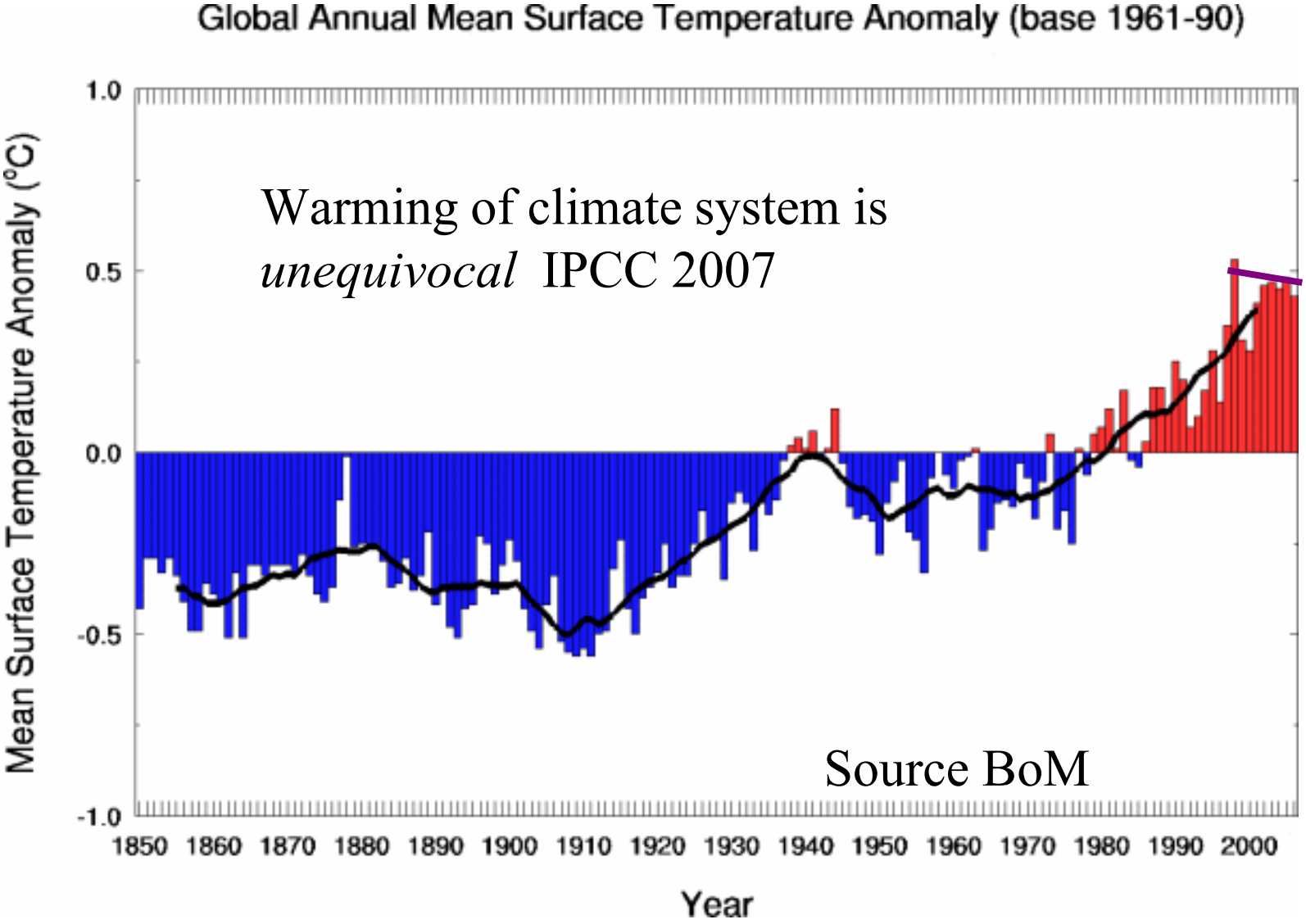
1. Stream flow in Murray Darling Basin and other catchments
2. Rainfall in recent seasons 02, 04, 06, 07
3. Very hot dry autumn in 2005
4. Heatwave in February impact on viticulture2004
5. Heatwave in March impact 2008

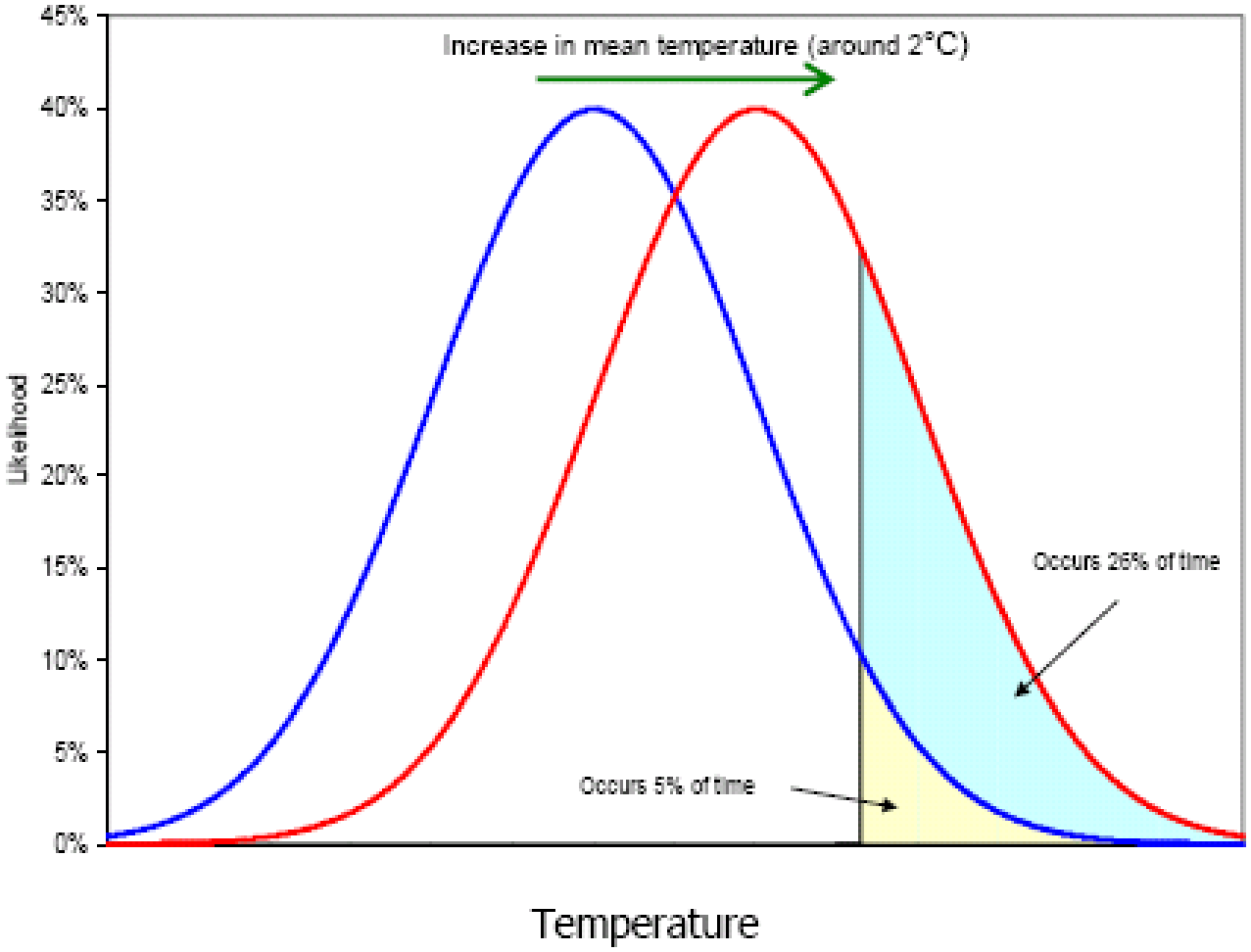
6. Changes in crop development (wheat and vines)
7. Changes in pests and diseases
8. Damaging frosts in 2002, 2004 and 2006.



Cascading uncertainty


Global Annual Mean Surface Temperature Anomaly (base 1961-90)
Mean Surface Temperature Anomaly (°C)
1.0
0.5
0.0
-0.5
-1.0
1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000
Year


Global Annual Mean Surface Temperature Anomaly (base 1961-90)
Mean Surface Temperature Anomaly (°C)
1.0
0.5
0.0
-0.5
-1.0
1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000
Year
Warming of climate system is
unequivocal IPCC 2007
Source BoM



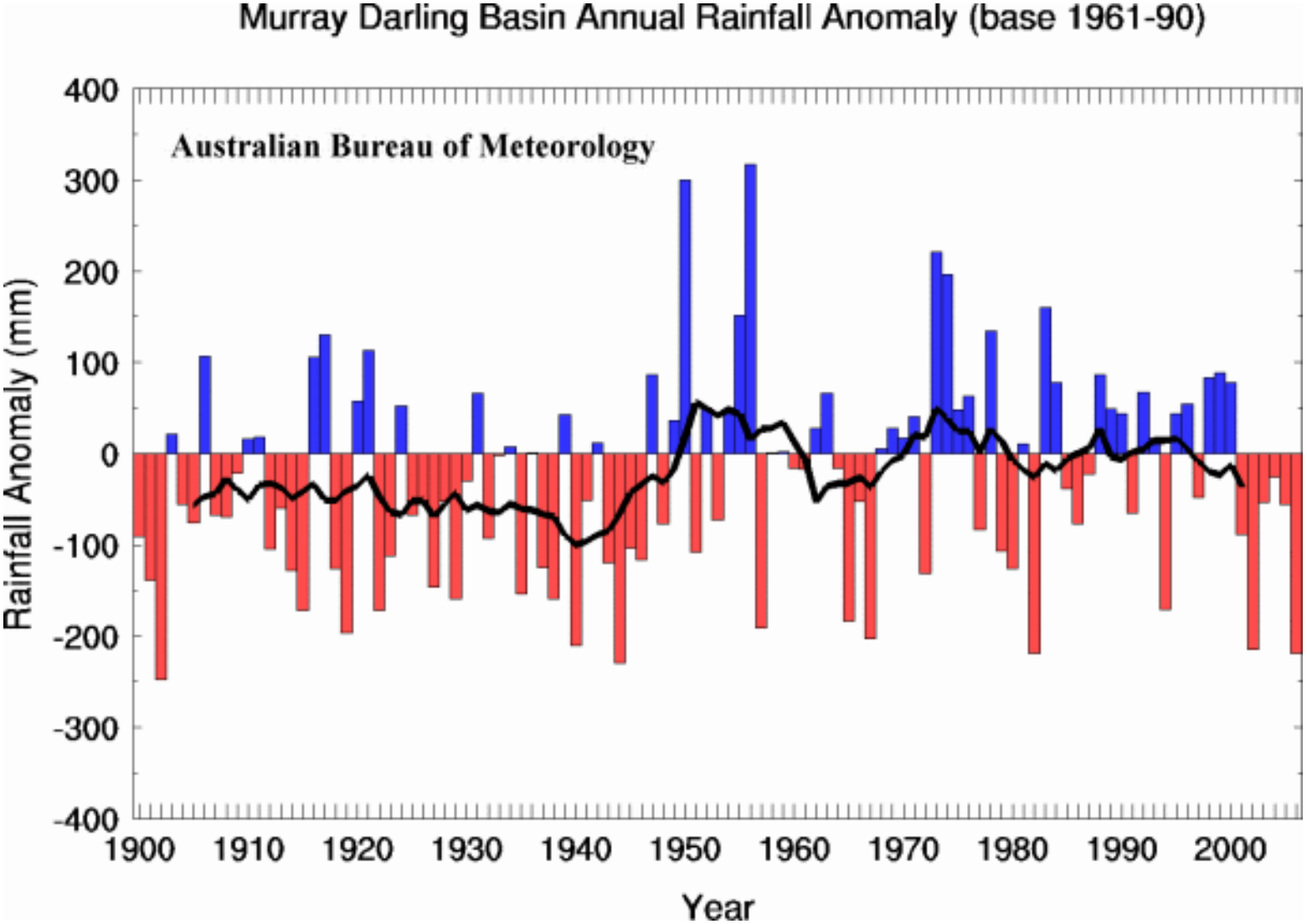
A one-in-200 year event (0.5%) is now a one-in-17 year event

A one-in-10,000 year event is now a one-in-280 year event

Detection and Attribution

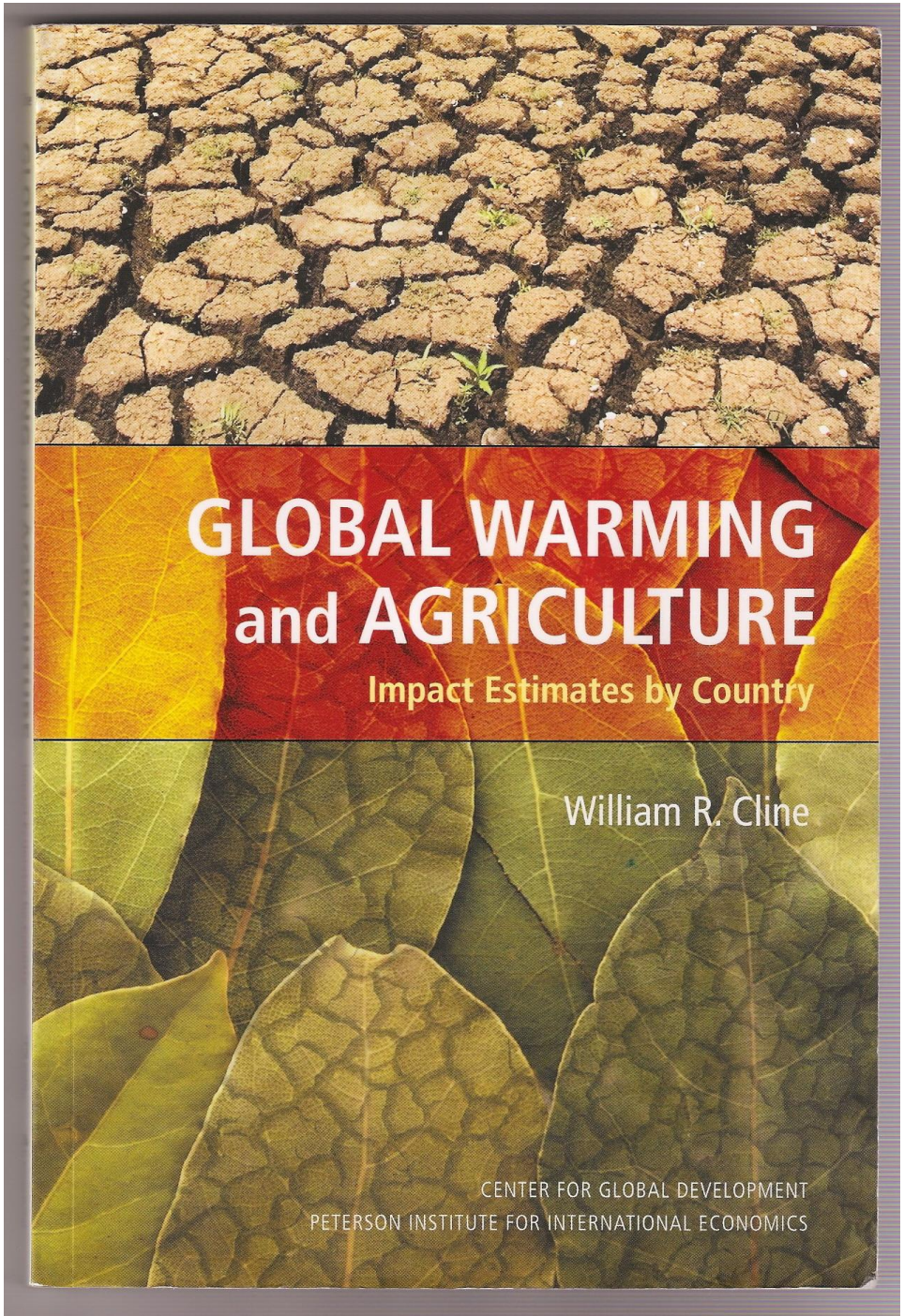
- Temperature changes are easier to detect and attribute than rainfall changes

- Extreme events are most dramatic but trends are strongest evidence


Murray Darling Basin Annual Rainfall Anomaly (base 1961-90)
Australian Bureau of Meteorology
Rainfall Anomaly (mm)
400
300
200
100
0
-100
-200
-300
-400
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Year

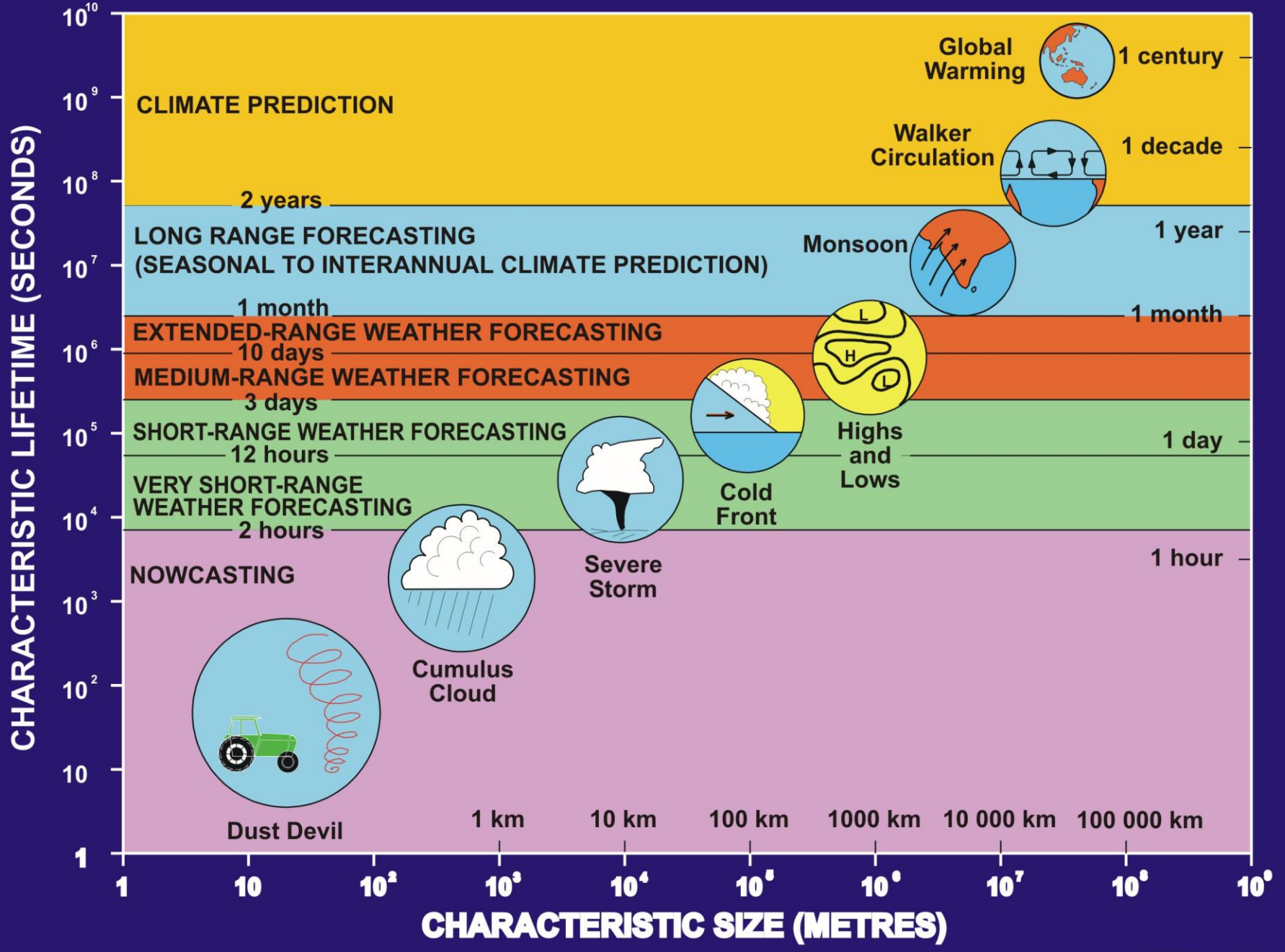
Drought or climate change

- Drought and warming (about 4% PET per degree warming)
- Drought or aridity (drought or drying)
- A more sensible question is what does the early stage of climate change mean for rainfall in southern grains region and wheat growth in the southern region.



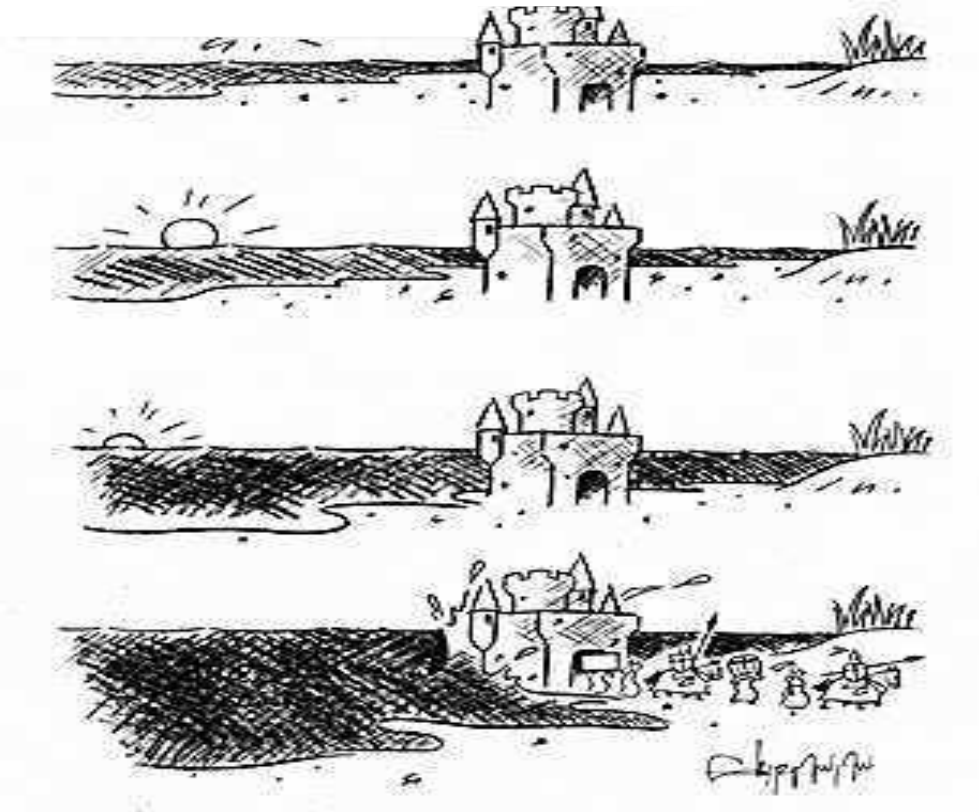
4 degrees by 2080

TIME AND SPACE SCALES OF ATMOSPHERIC PHENOMENA



Are we overstating the case ?

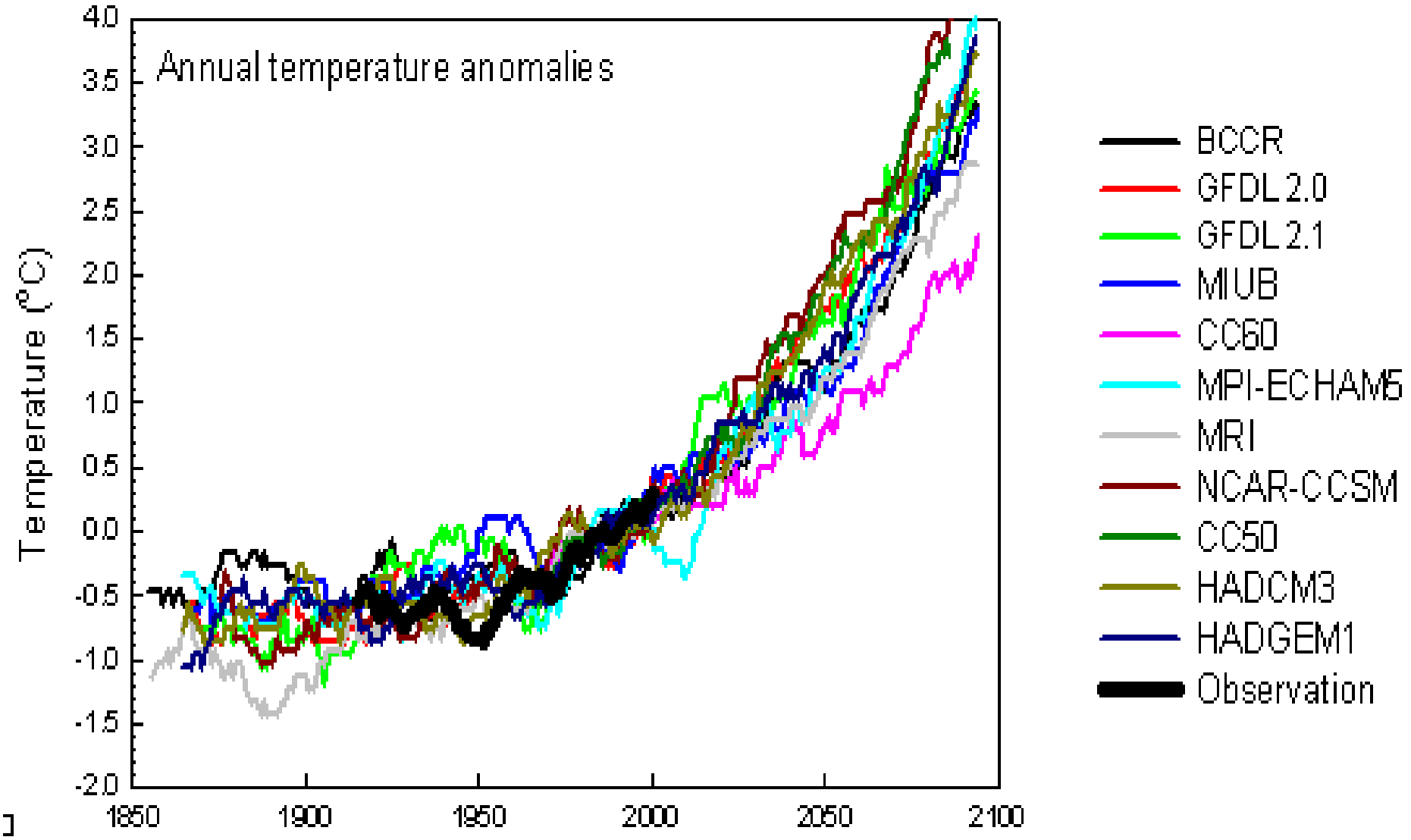
- Distinguish between media headlines and science
- In my experience the most credible scientists are the most worried



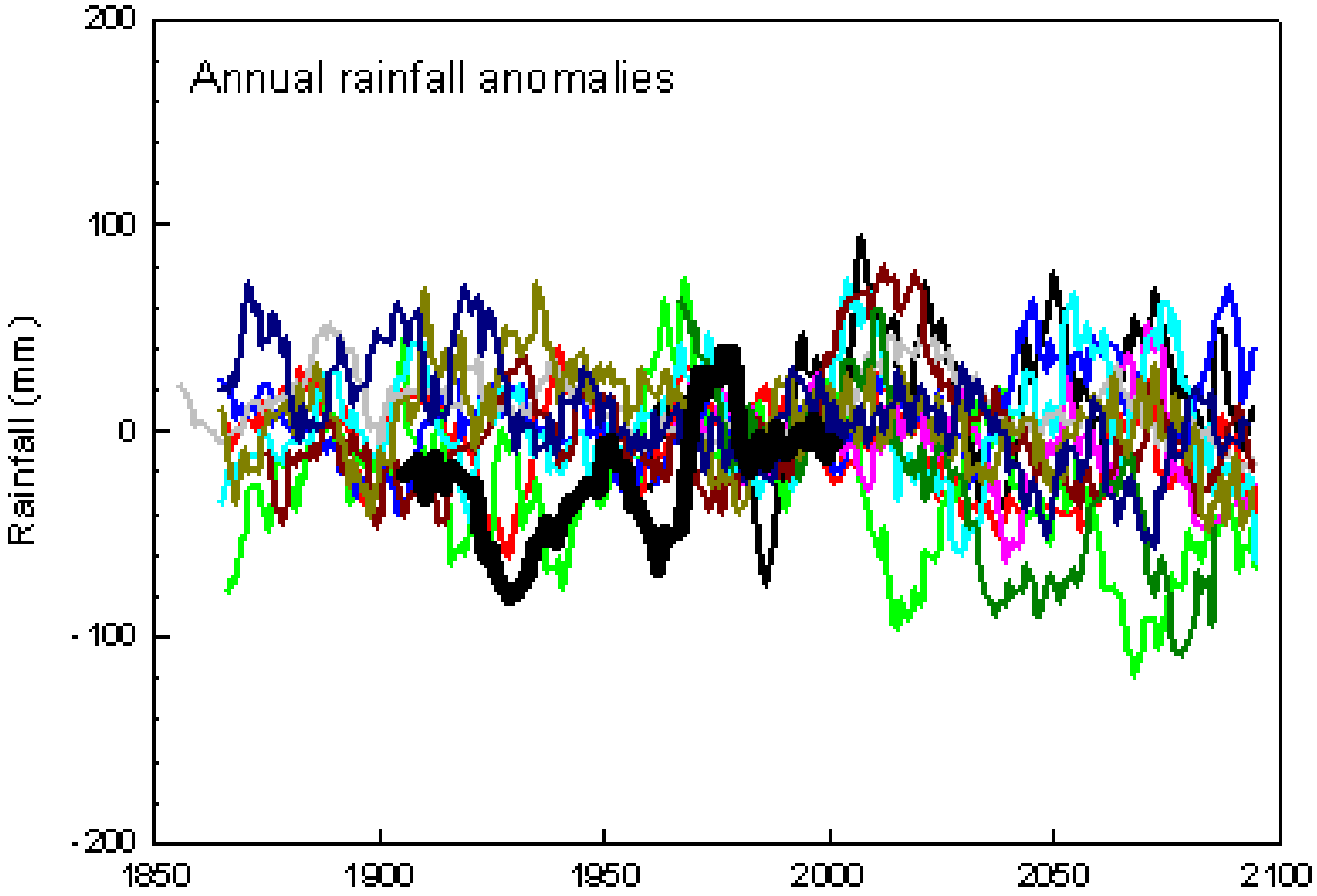
What destroyed the sand castle ?

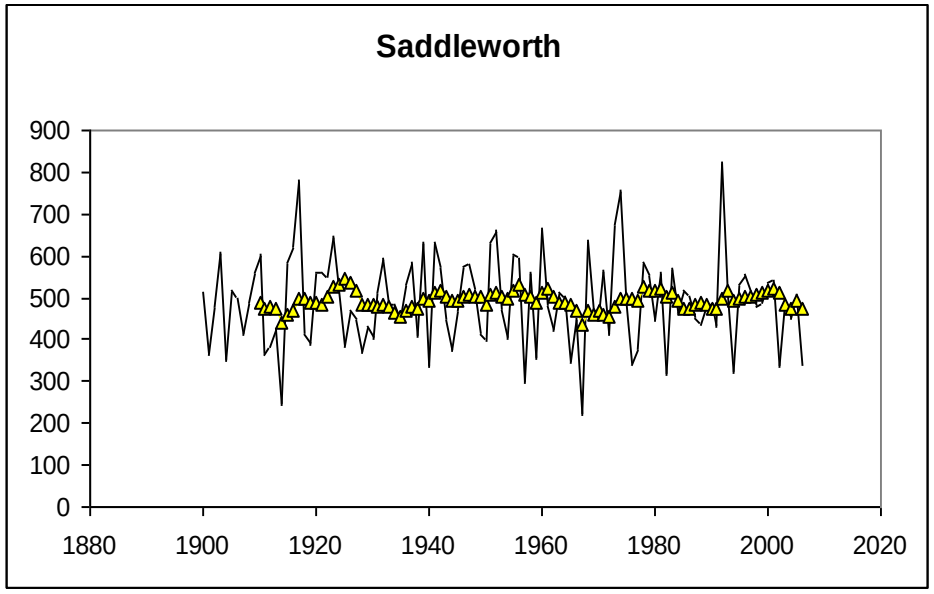
In a variable and changing climate it will always be hard to distinguish between extreme events (wave) and trends (tide)

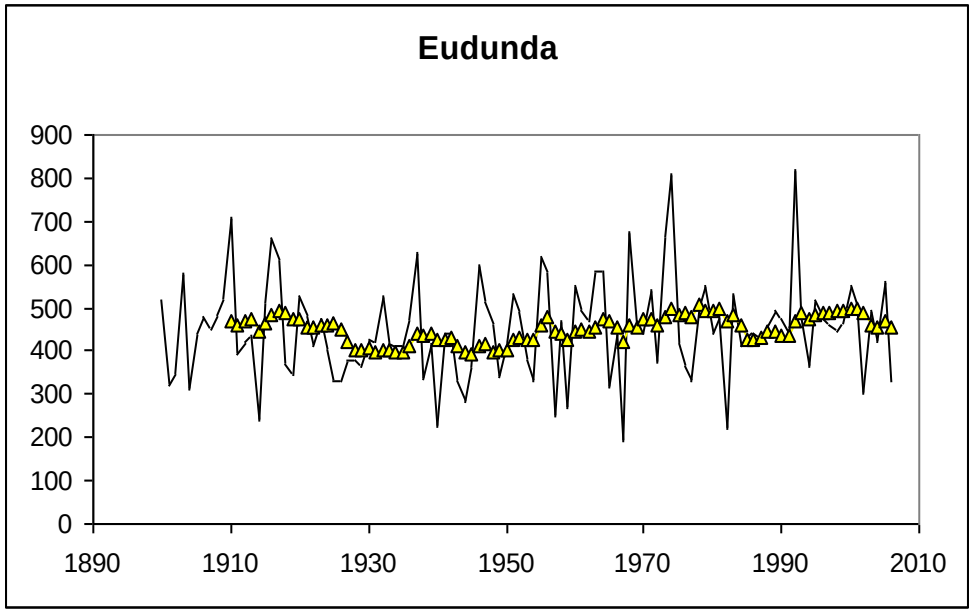
Temperature Projections

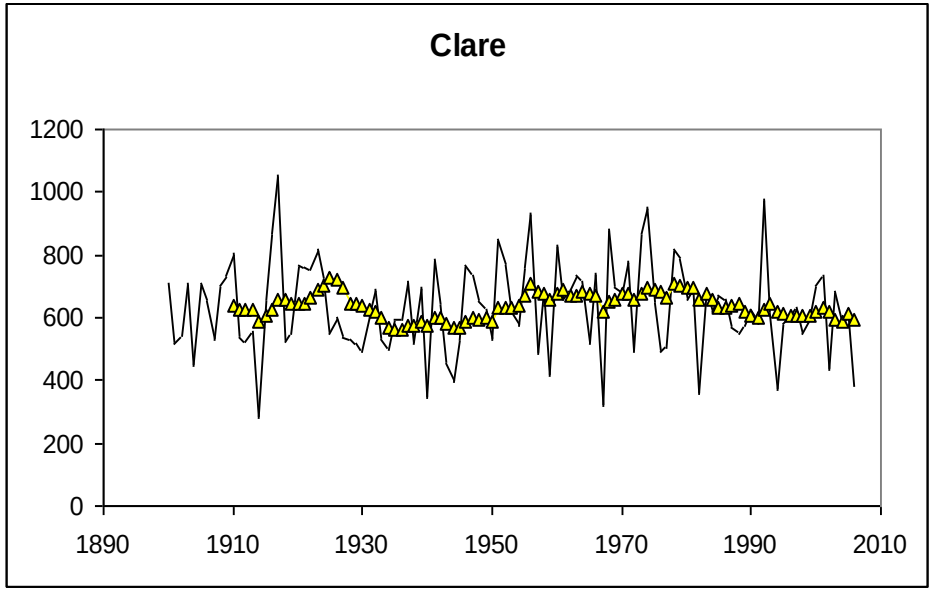


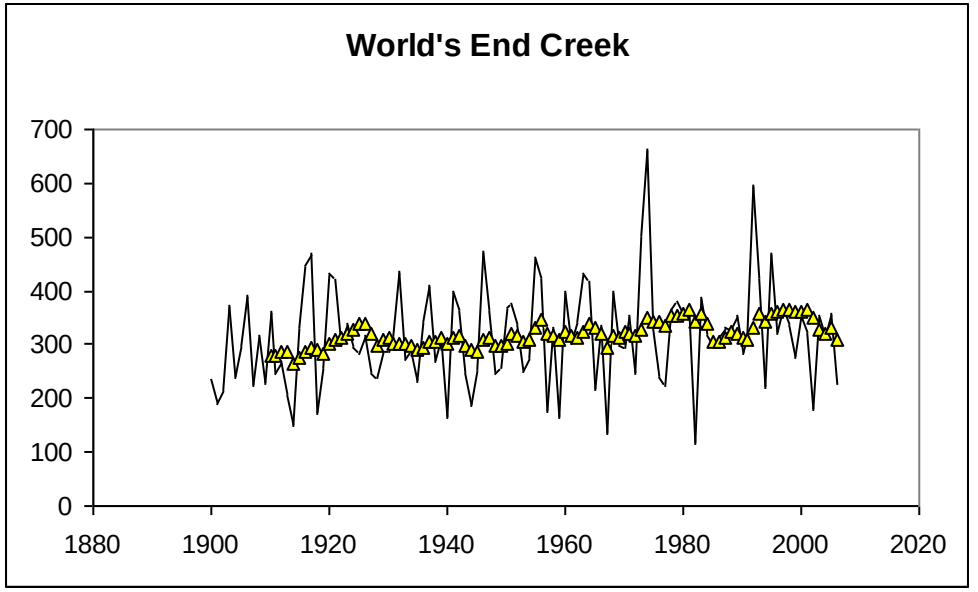
Rainfall Projections

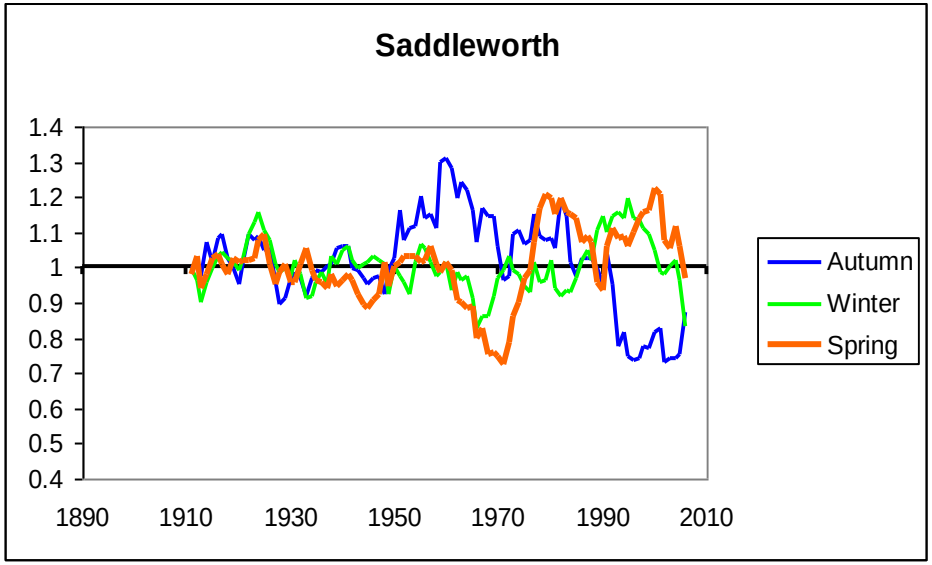


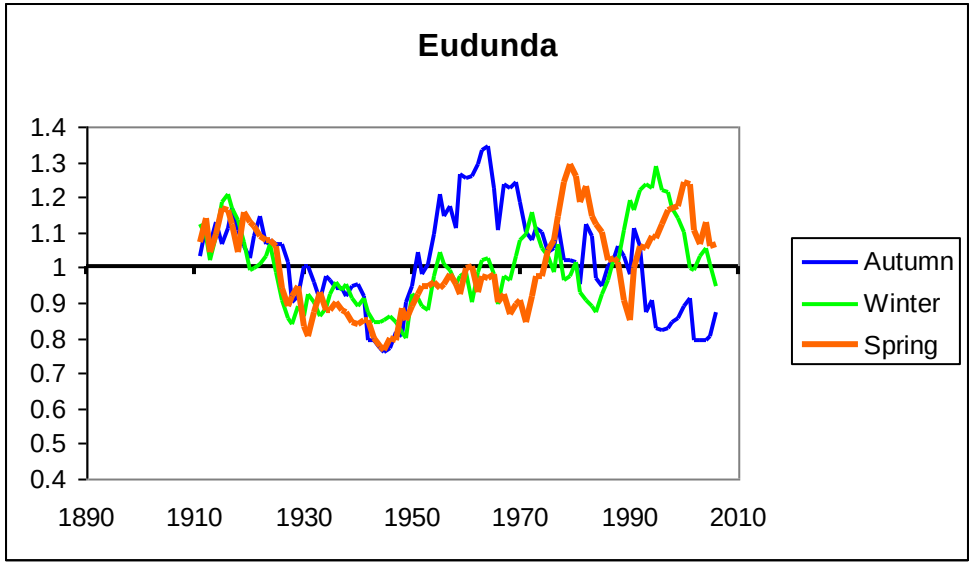

Saddleworth
900
800
700
600
500
400
300
200
100
0
1880
1900
1920
1940
1960
1980
2000
2020

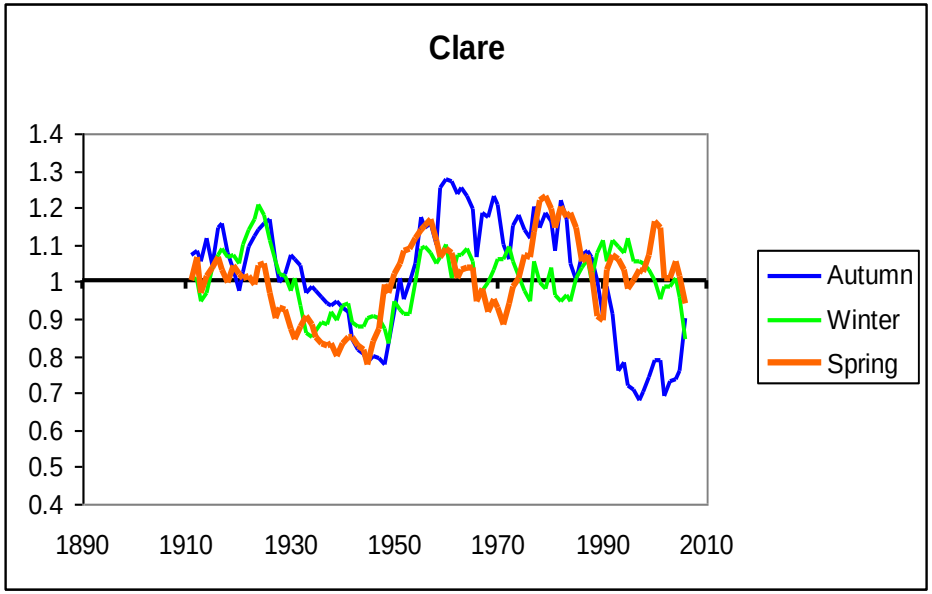

Eudunda
900
800
700
600
500
400
300
200
100
0
1890
1910
1930
1950
1970
1990
2010

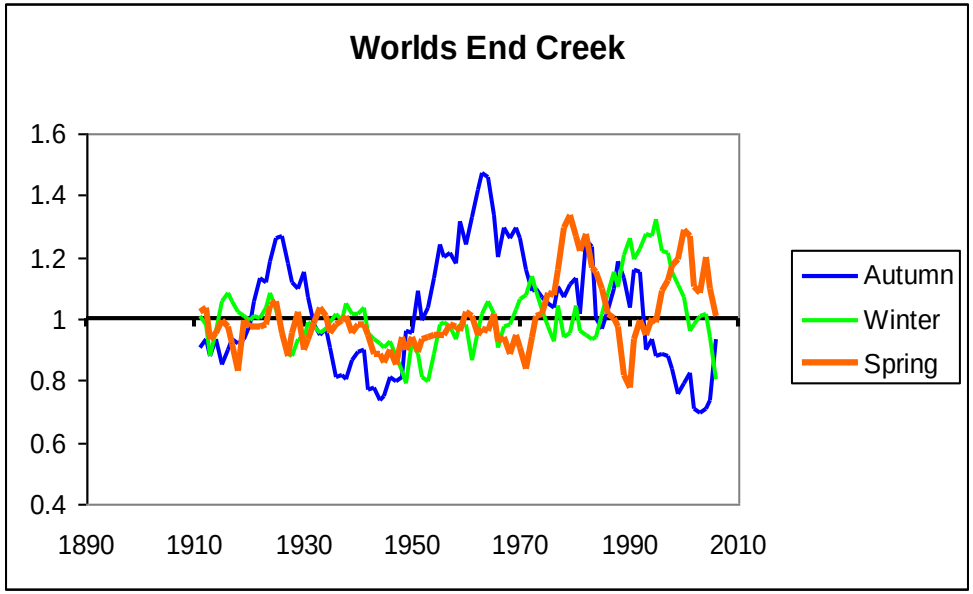

Clare
1200
1000
800
600
400
200
0
1890
1910
1930
1950
1970
1990
2010


World's End Creek
700
600
500
400
300
200
100
0
1880
1900
1920
1940
1960
1980
2000
2020

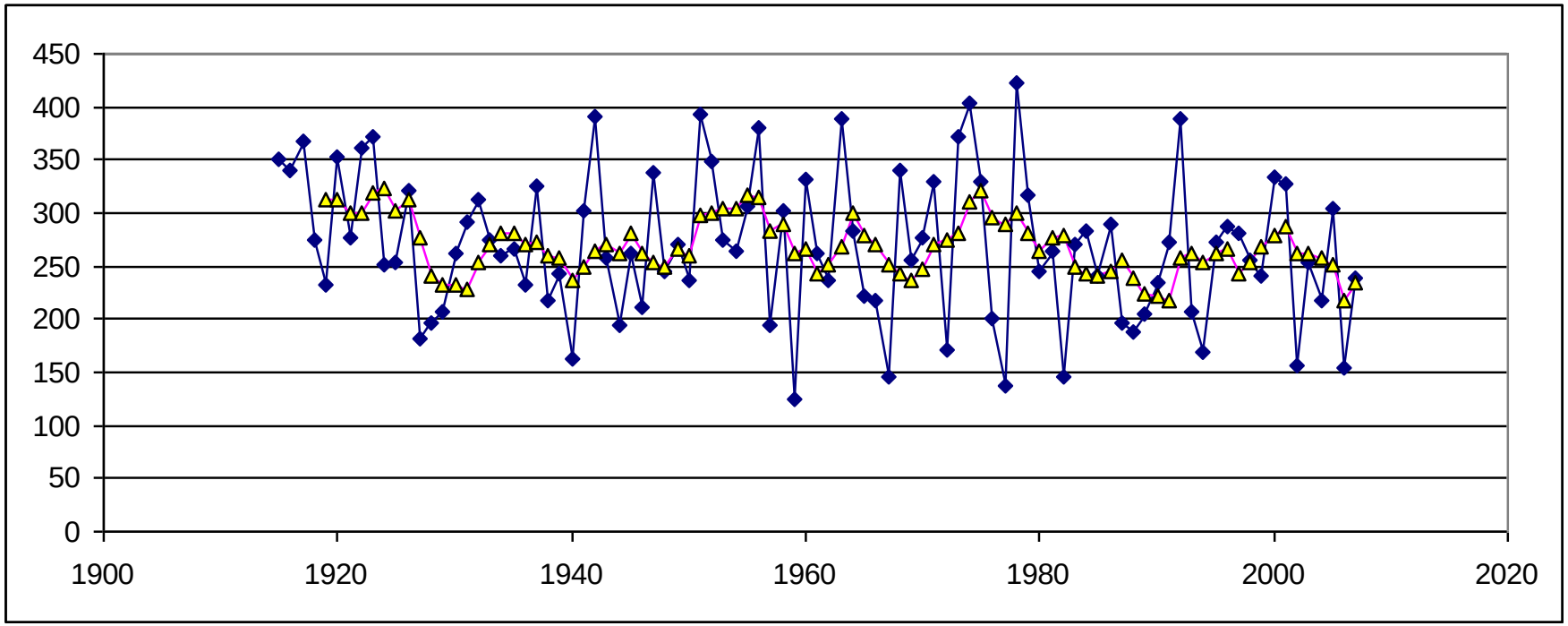

Saddleworth
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
1890
1910
1930
1950
1970
1990
2010
Autumn
Winter
Spring


Eudunda
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
1890
1910
1930
1950
1970
1990
2010
Autumn
Winter
Spring

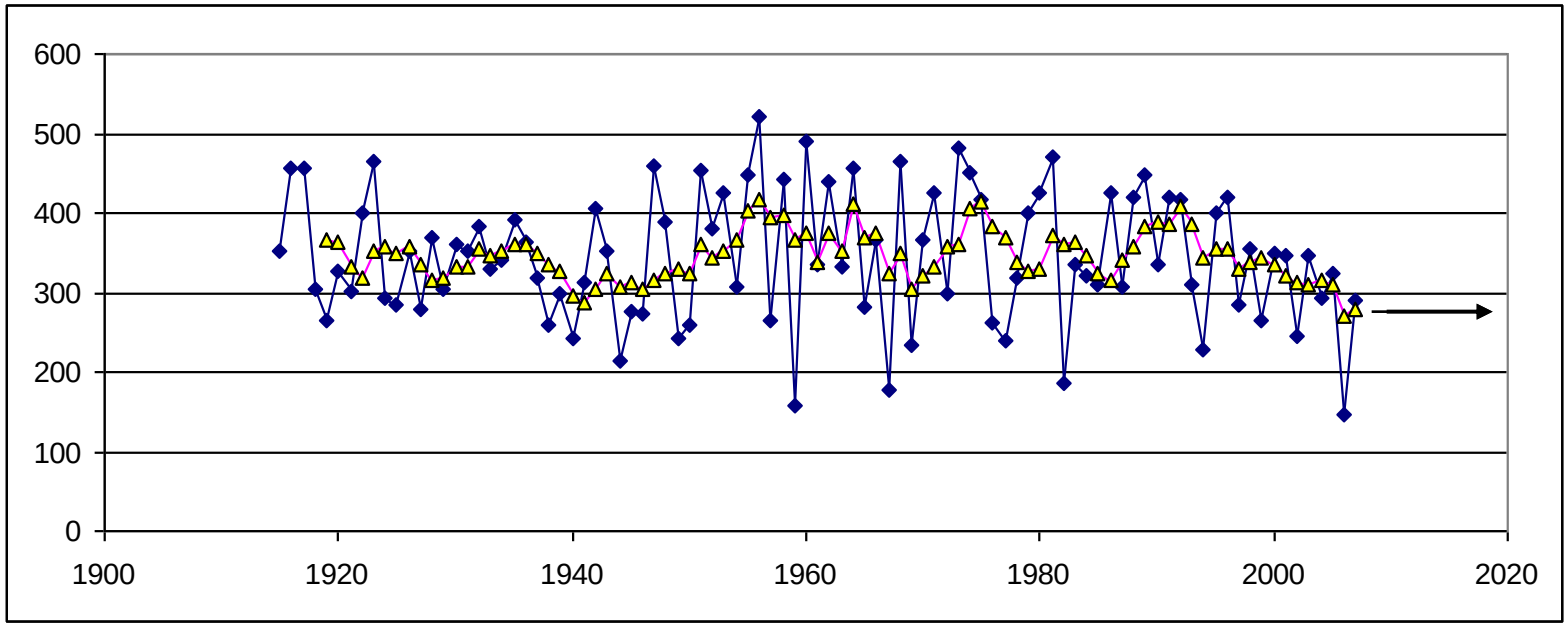

Clare
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
1890
1910
1930
1950
1970
1990
2010
Autumn
Winter
Spring


Worlds End Creek
1.6
1.4
1.2
1
0.8
0.6
0.4
1890
1910
1930
1950
1970
1990
2010
Autumn
Winter
Spring

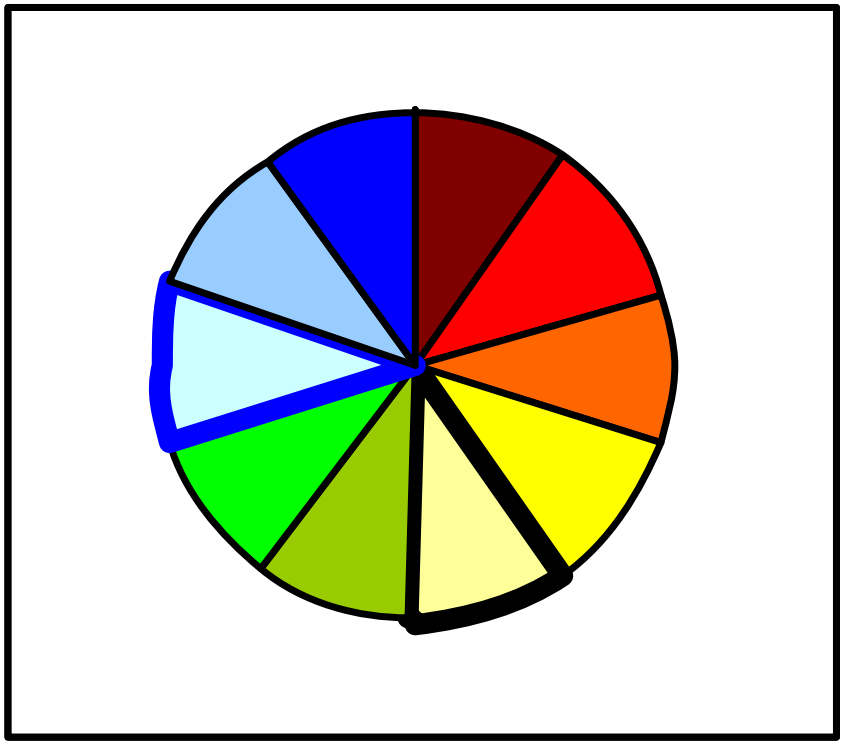
Balaklava Growing Season Rainfall



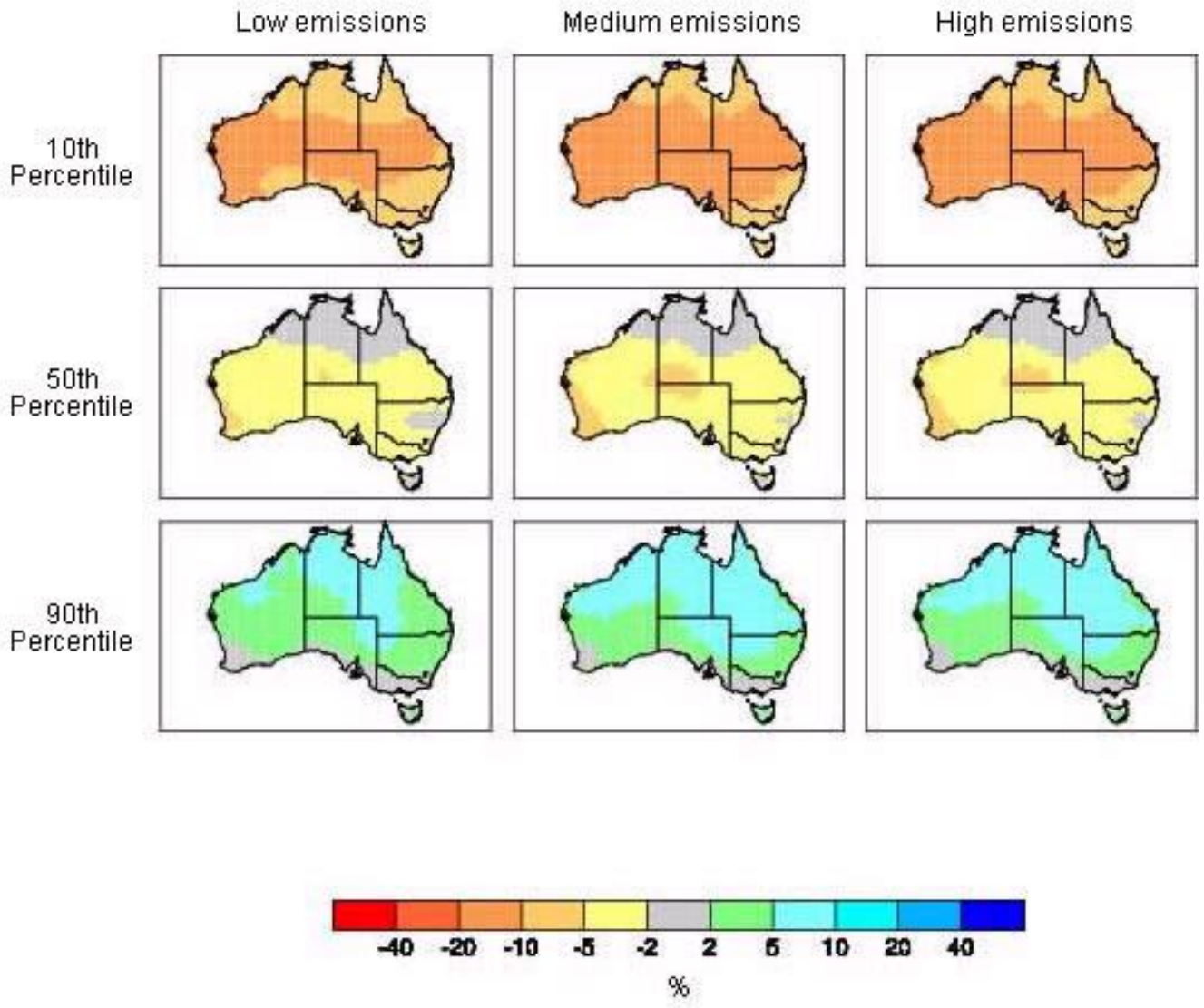
Keith GSR



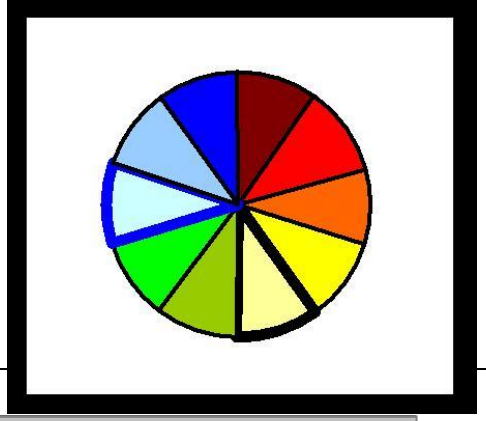
Deciles are the language of risk used by farmers and agronomists

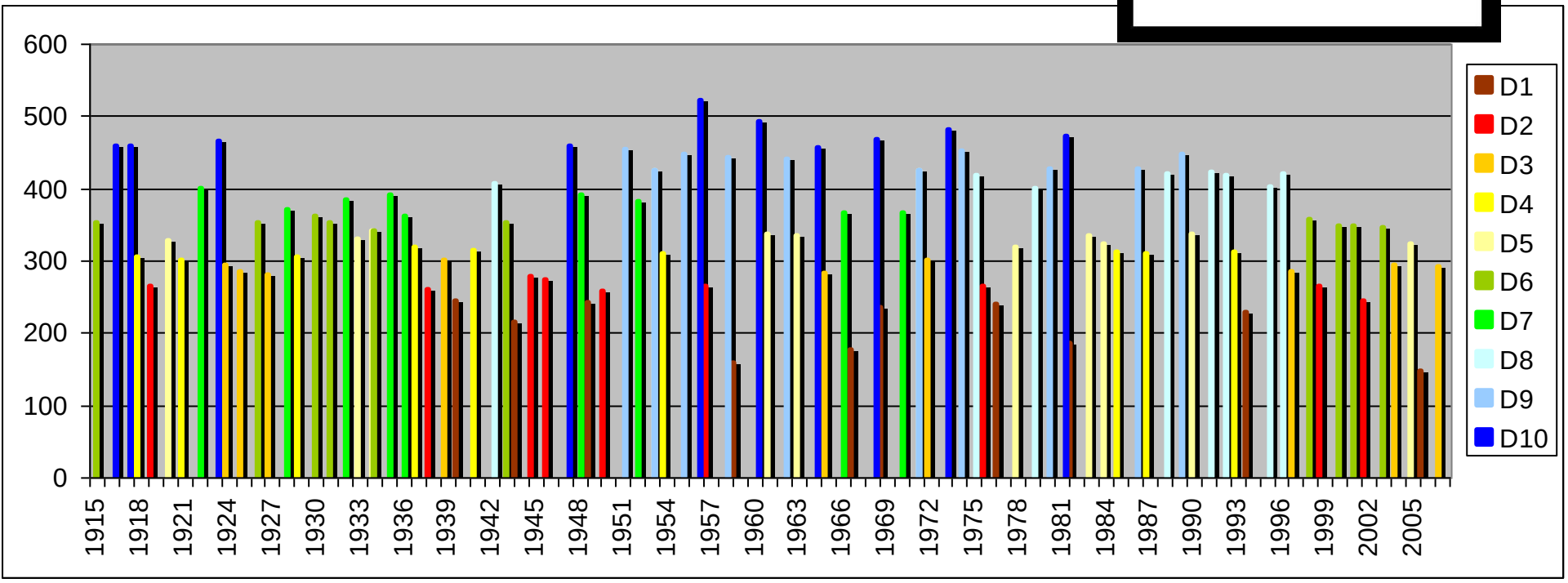


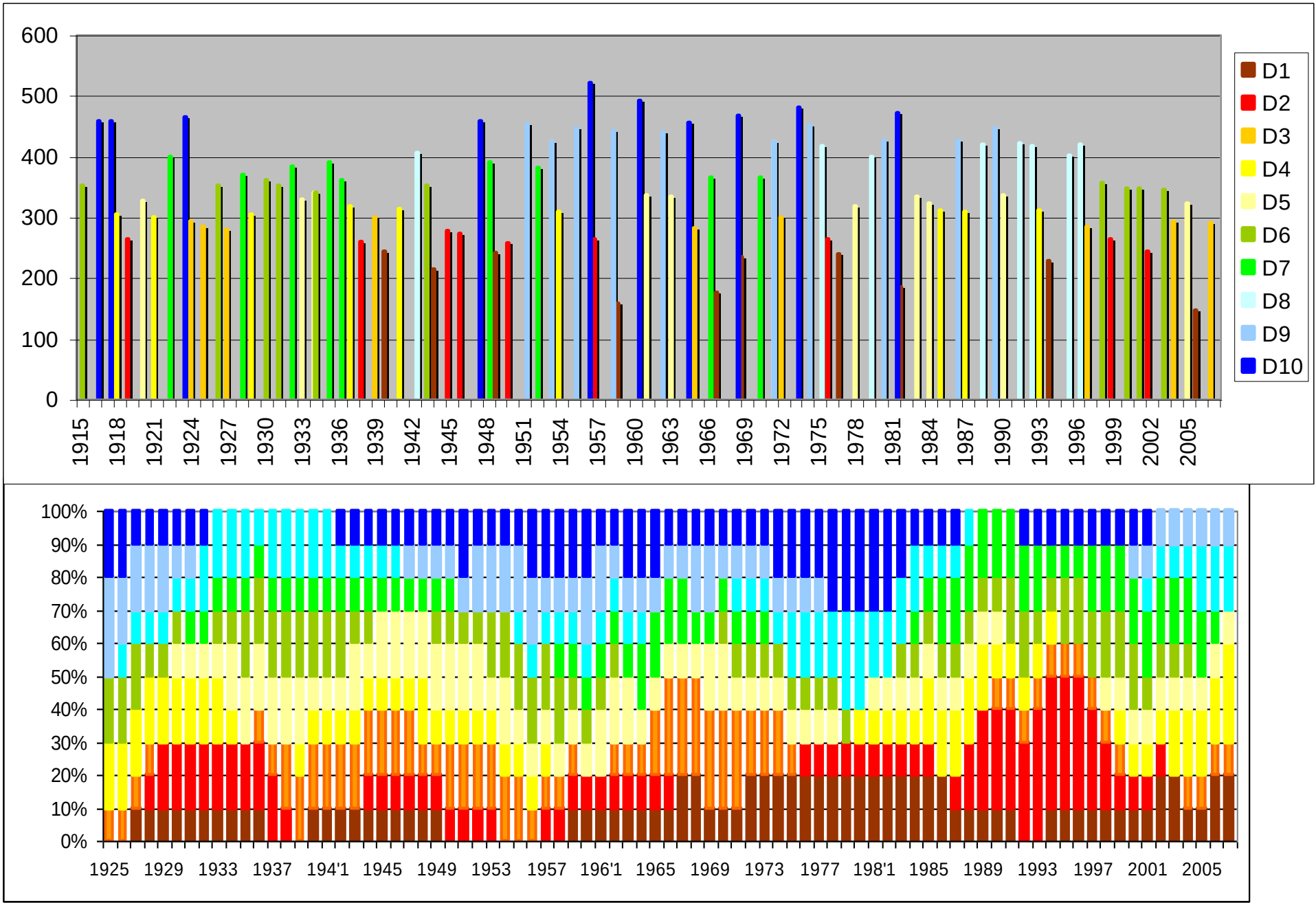
National Rainfall change 2030 Annual

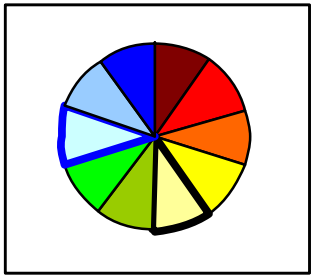


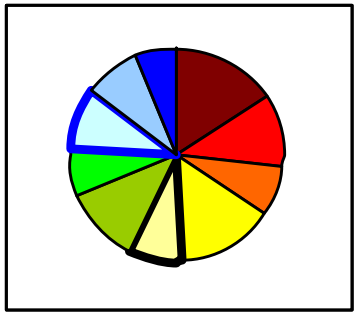
Keith GSR as deciles



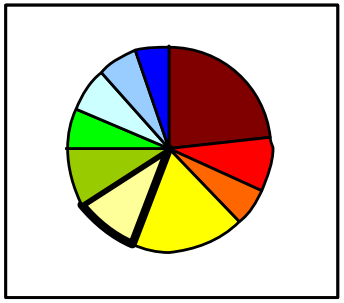



600
500
400
300
200
100
0
1915
1918
1921
1924
1927
1930
1933
1936
1939
1942
1945
1948
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1925
1929
1933
1937
194'1
1945
1949
1953
1957
196'1
1965
1969
1973
1977
198'1
1985
1989
1993
1997
2001
2005

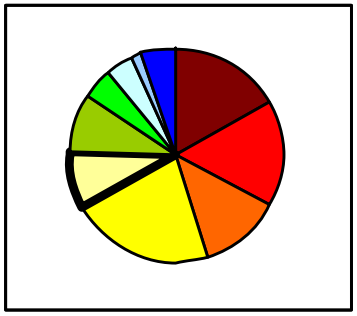




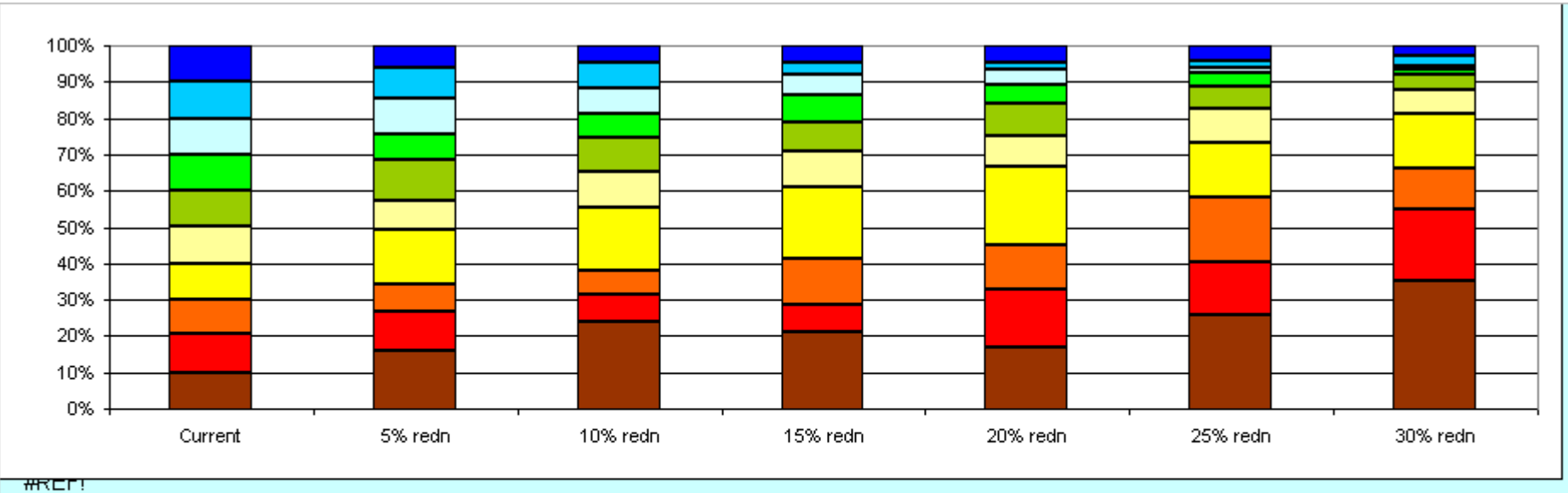
5% decline in rainfall



10% decline

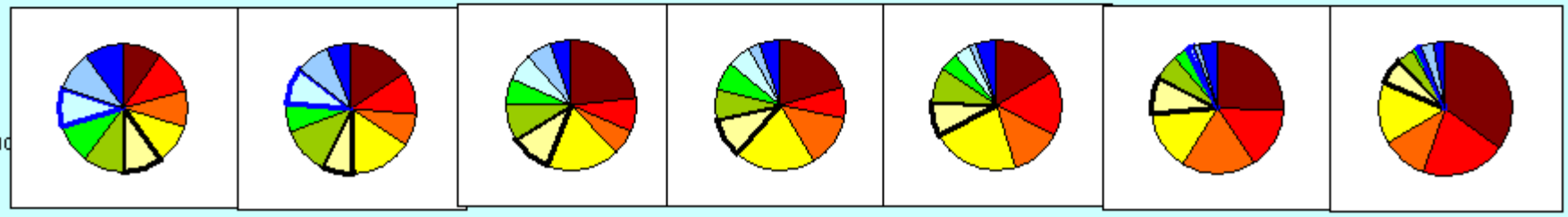


20% decline


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Current
5% redn
10% redn
15% redn
20% redn
25% redn
30% redn

#REF!

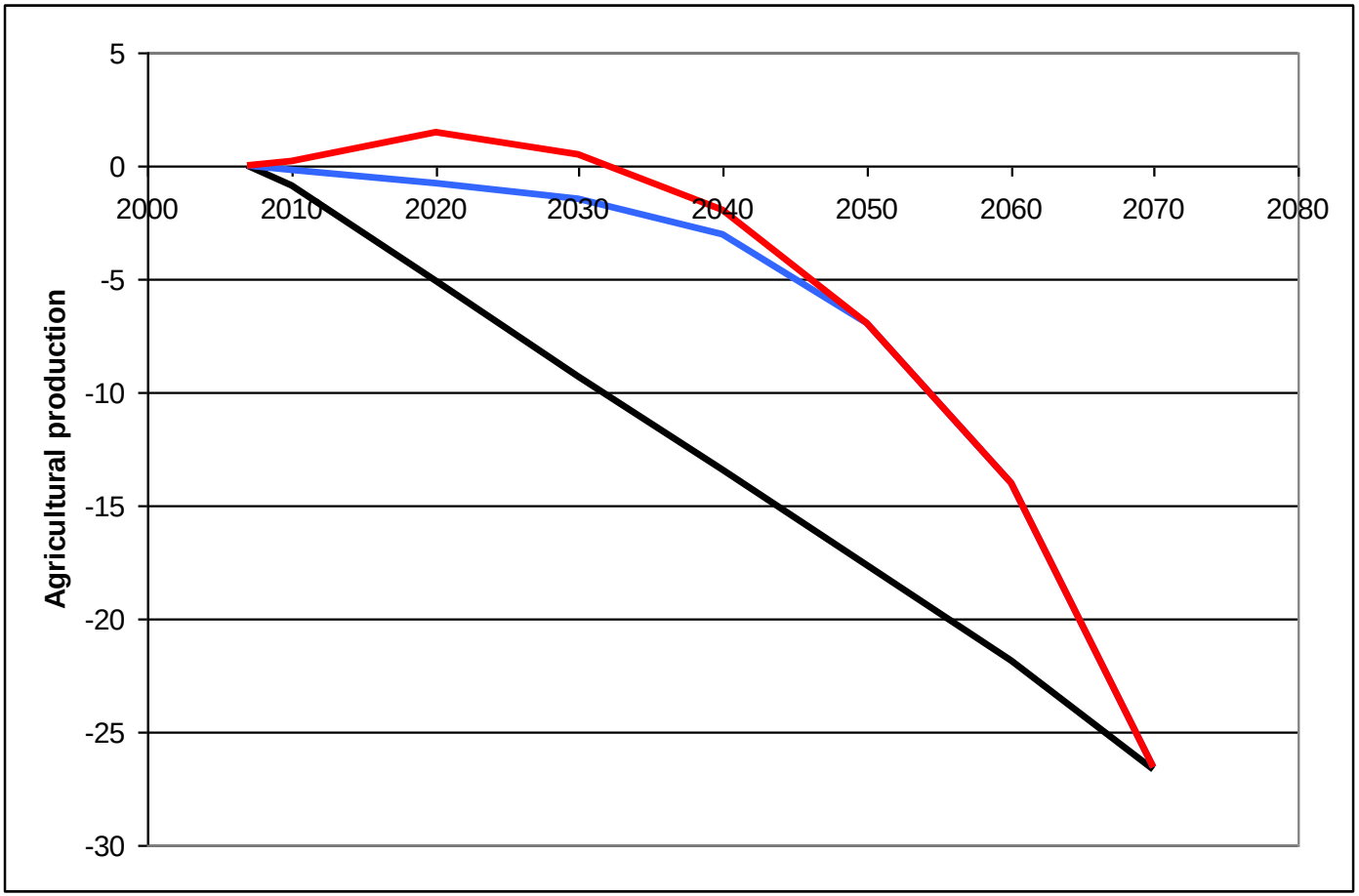
% reduc

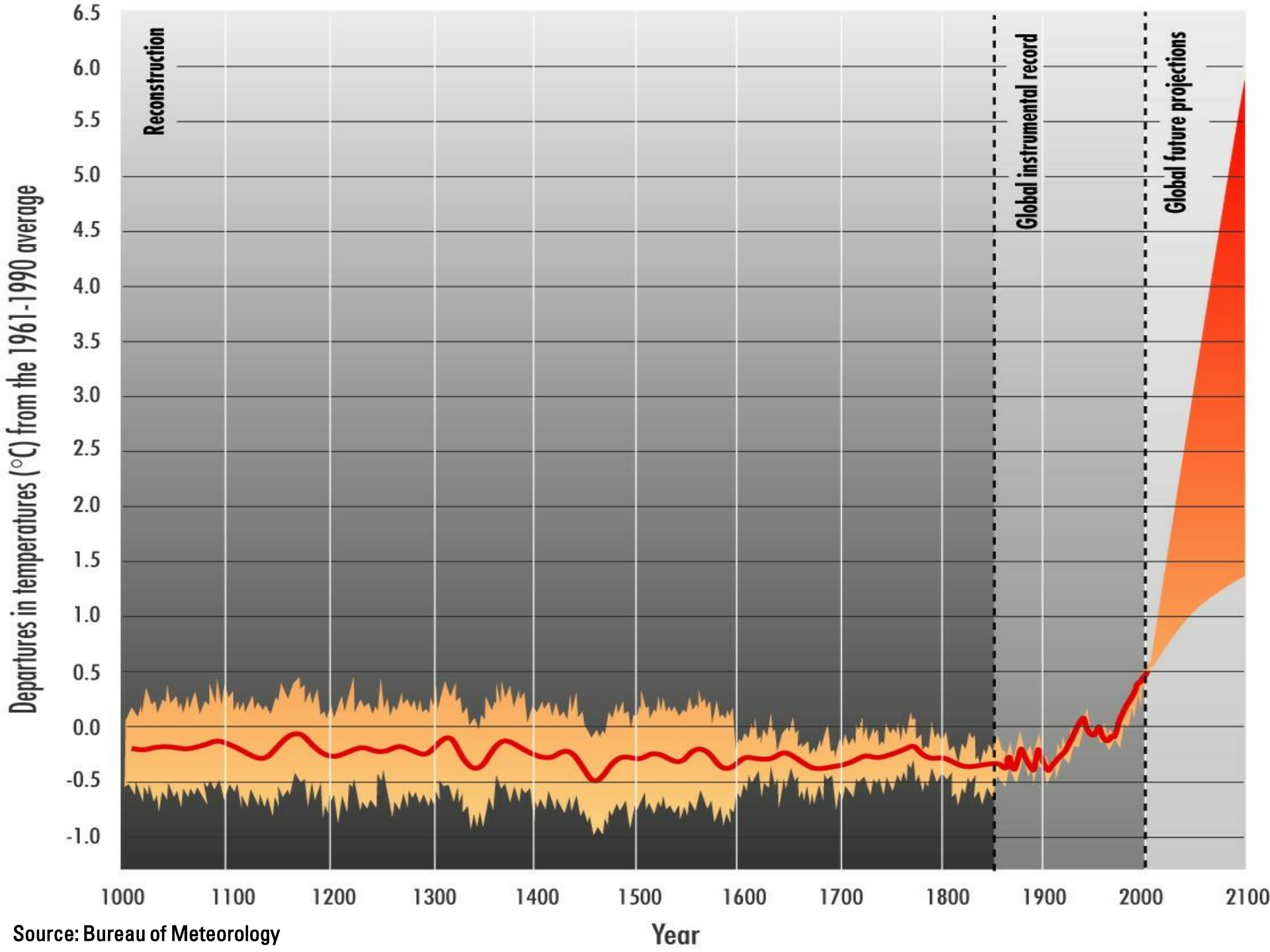


ABARE report

- Climate Change – Impacts on Australian Agriculture
- Australian production of wheat, beef, dairy and sugar production could decline by 9-10% by 2030 and 13-19% by 2050 relative to what would other wise be case.

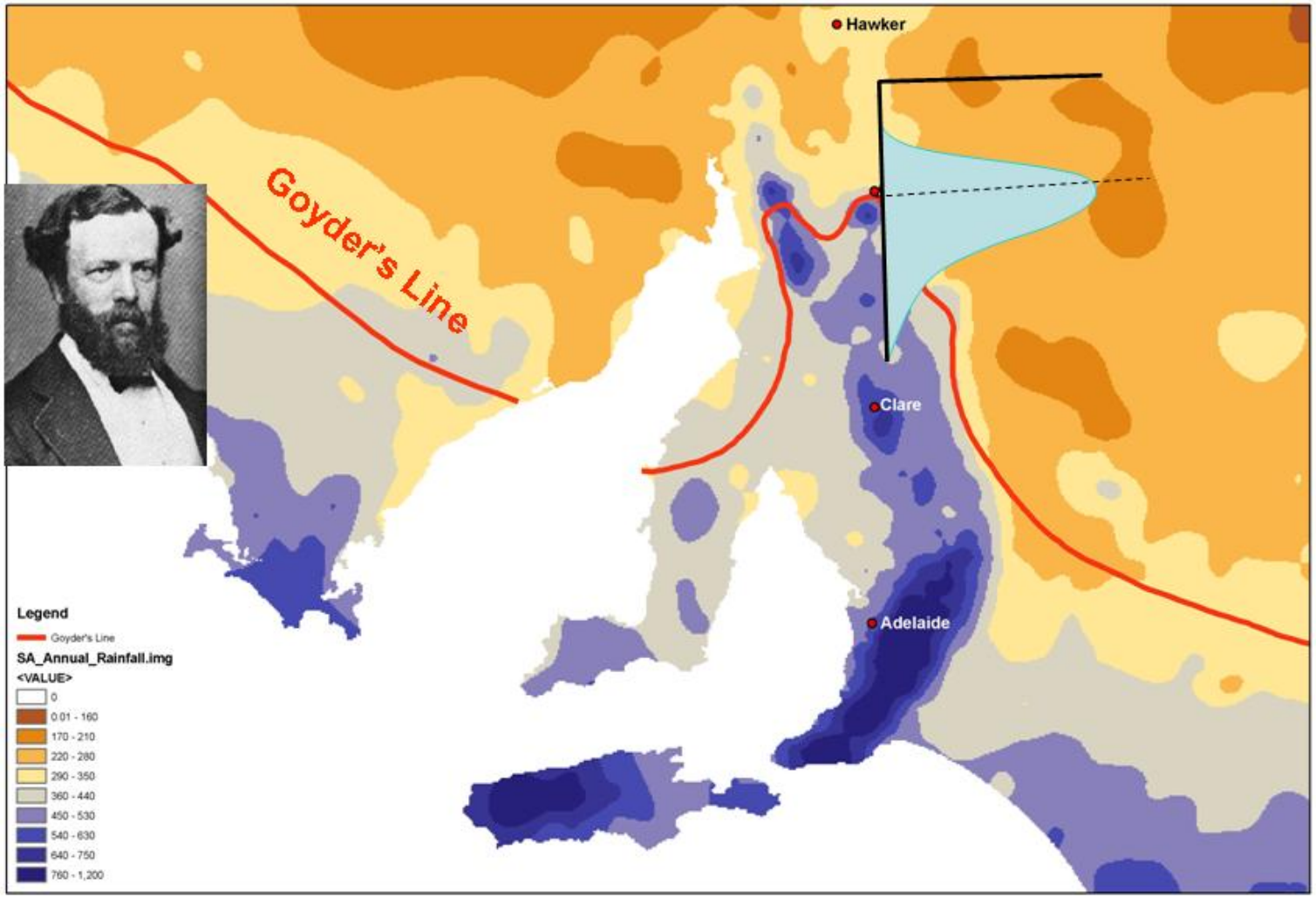
Different pathways to 2080



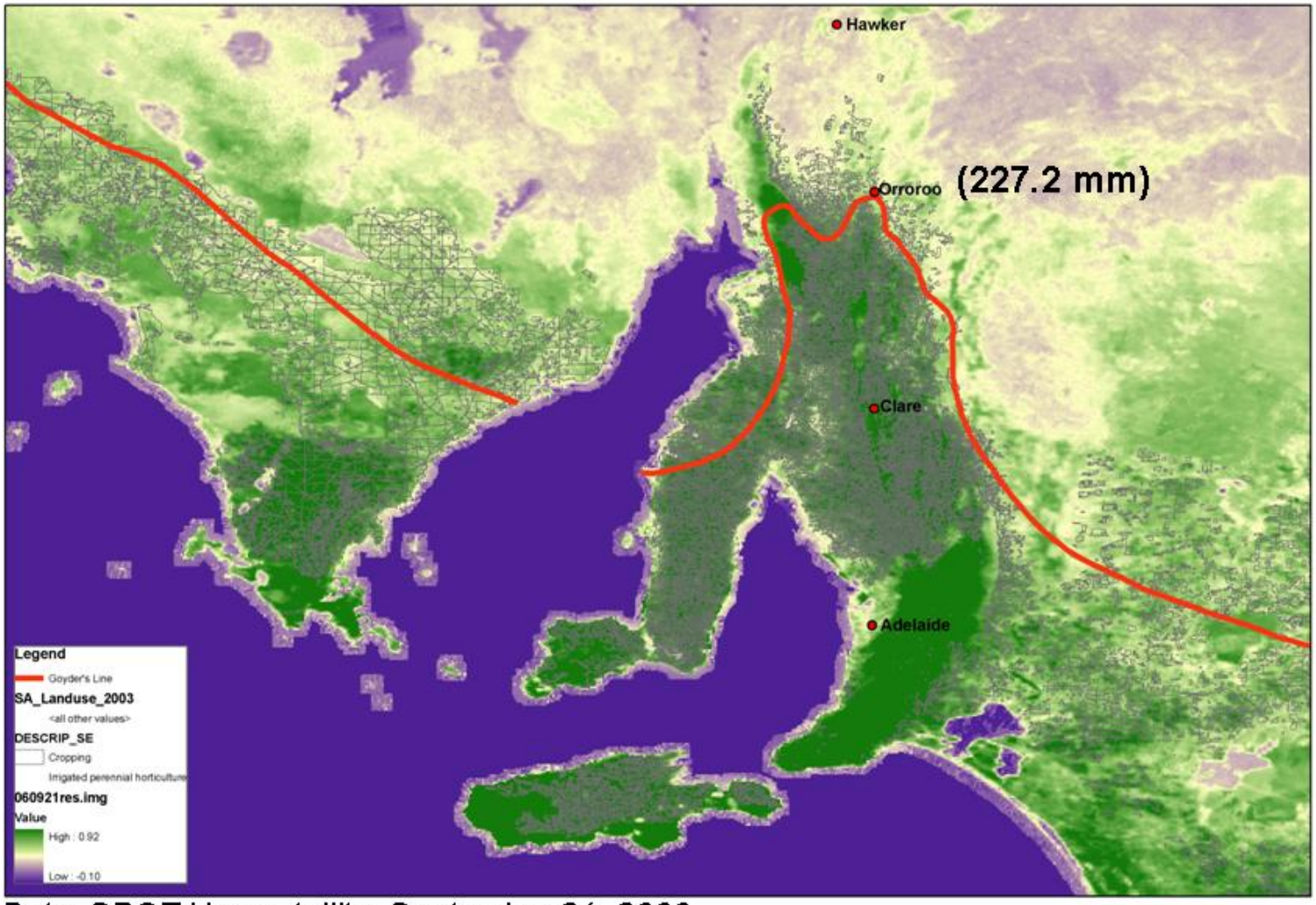


Source: Bureau of Meteorology

South Australia Annual Rainfall

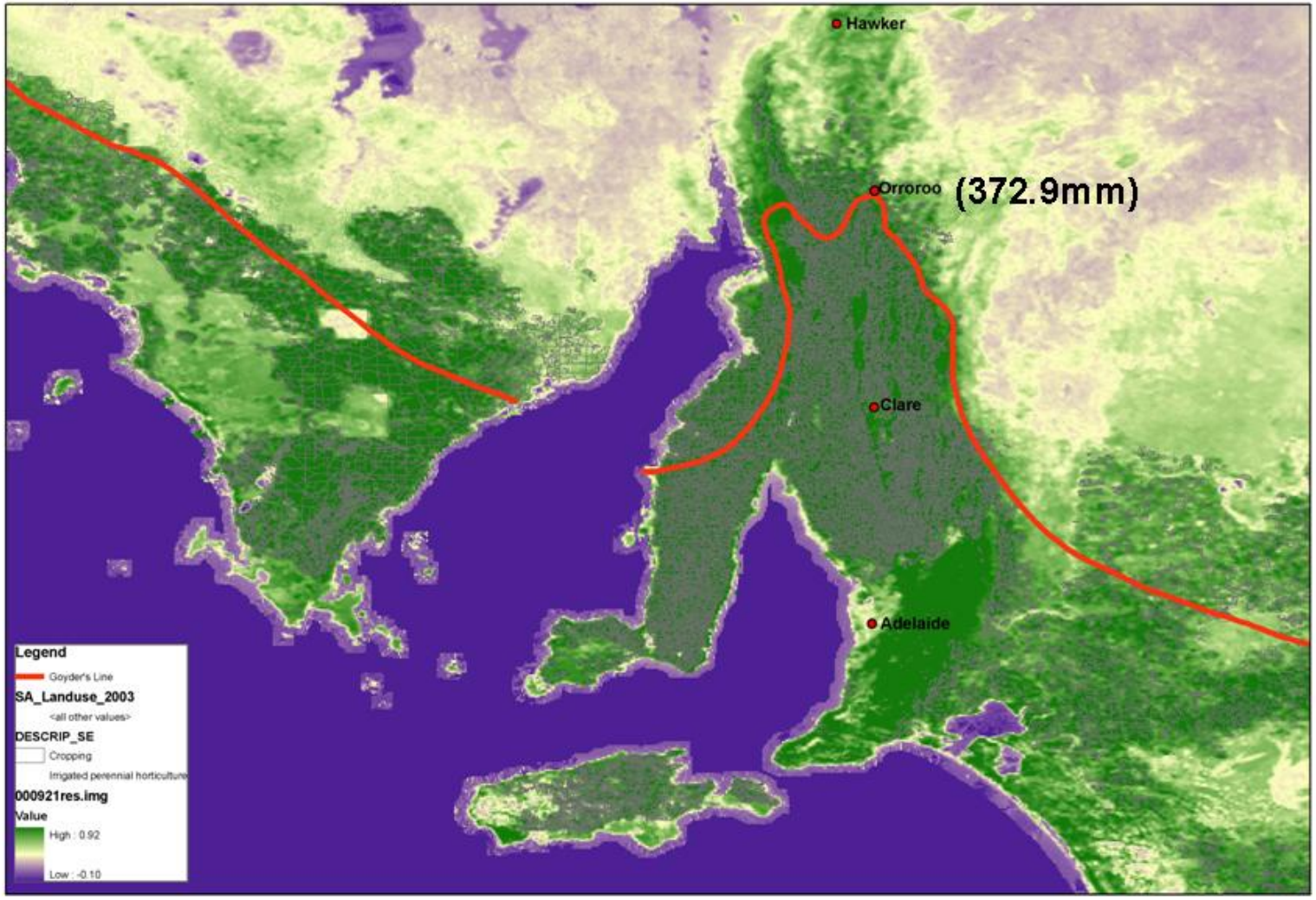


Goyder's Line from Space 2006



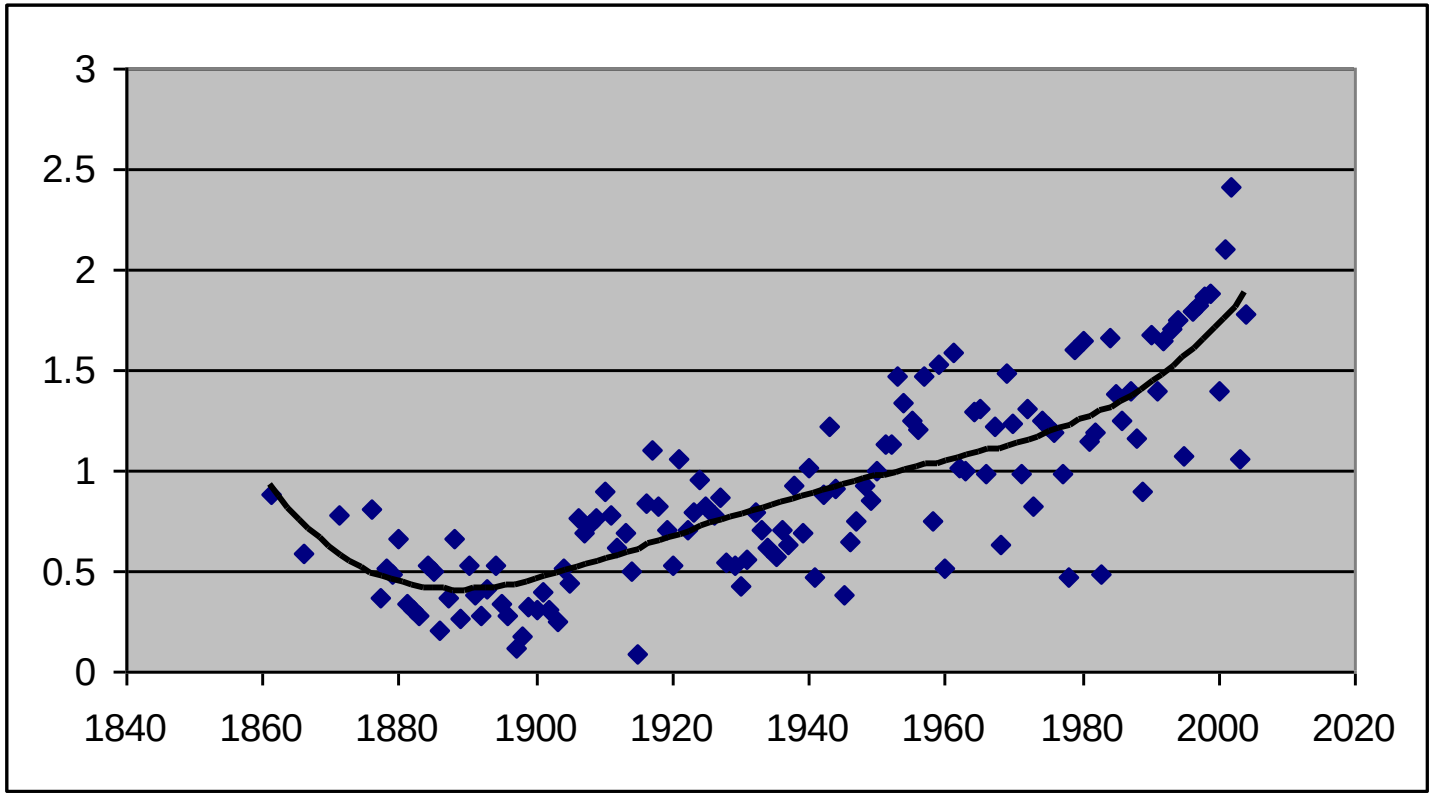
Data: SPOT Veg satellite, September 21, 2006

Goyder's Line from Space 2000



Data: SPOT Veg satellite, September 21, 2000

SA Wheat Yields



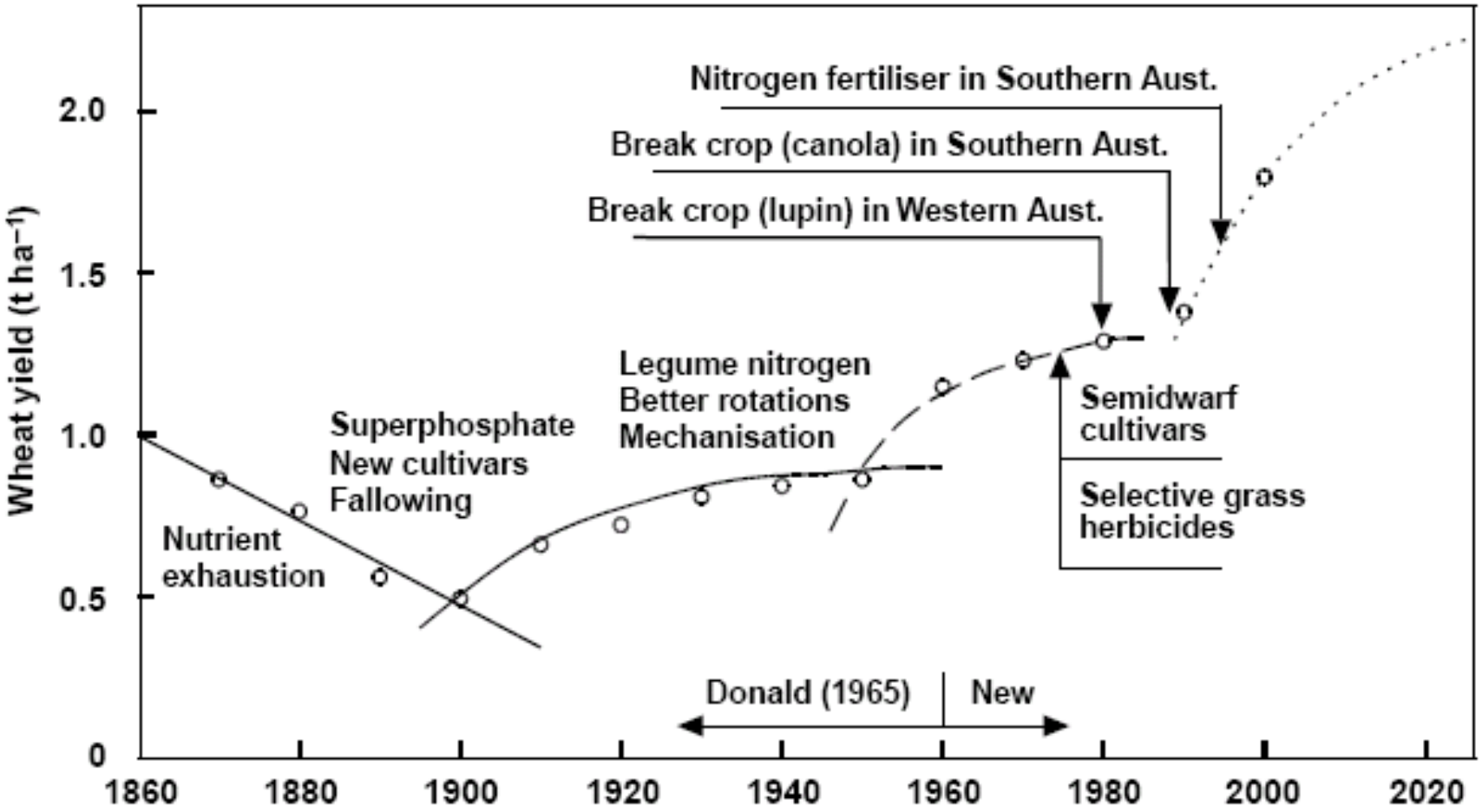


Fig. 1. Average decadal wheat yields in Australia since 1860, an extension by Angus (2001) of an earlier analysis by Donald (1965). Reproduced from the *Australian Journal of Experimental Agriculture* **41**, 277–288 (Angus JF, 2001) by permission of **CSIRO** PUBLISHING.

www.farmonline.com.au

Stock journal

SA's Premier Rural Weekly

28-page AgTrader classifieds liftout

Ph: 08 8372 5222 Classifieds: 08 8372 5252 Thursday, August 10, 2006 $3.00 including GST

INSIDE

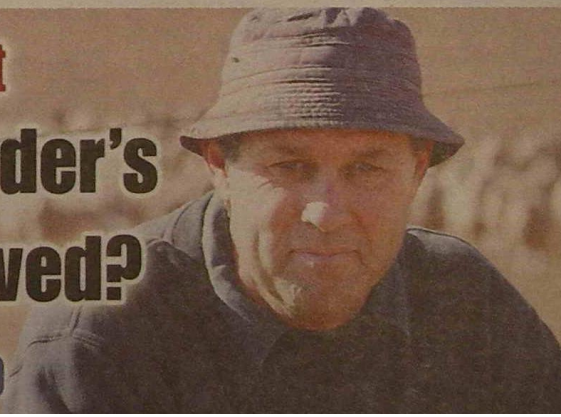
Bank SA People's choice Rural Business Awards

Stock journal rba BankSA

Nomination coupon p15

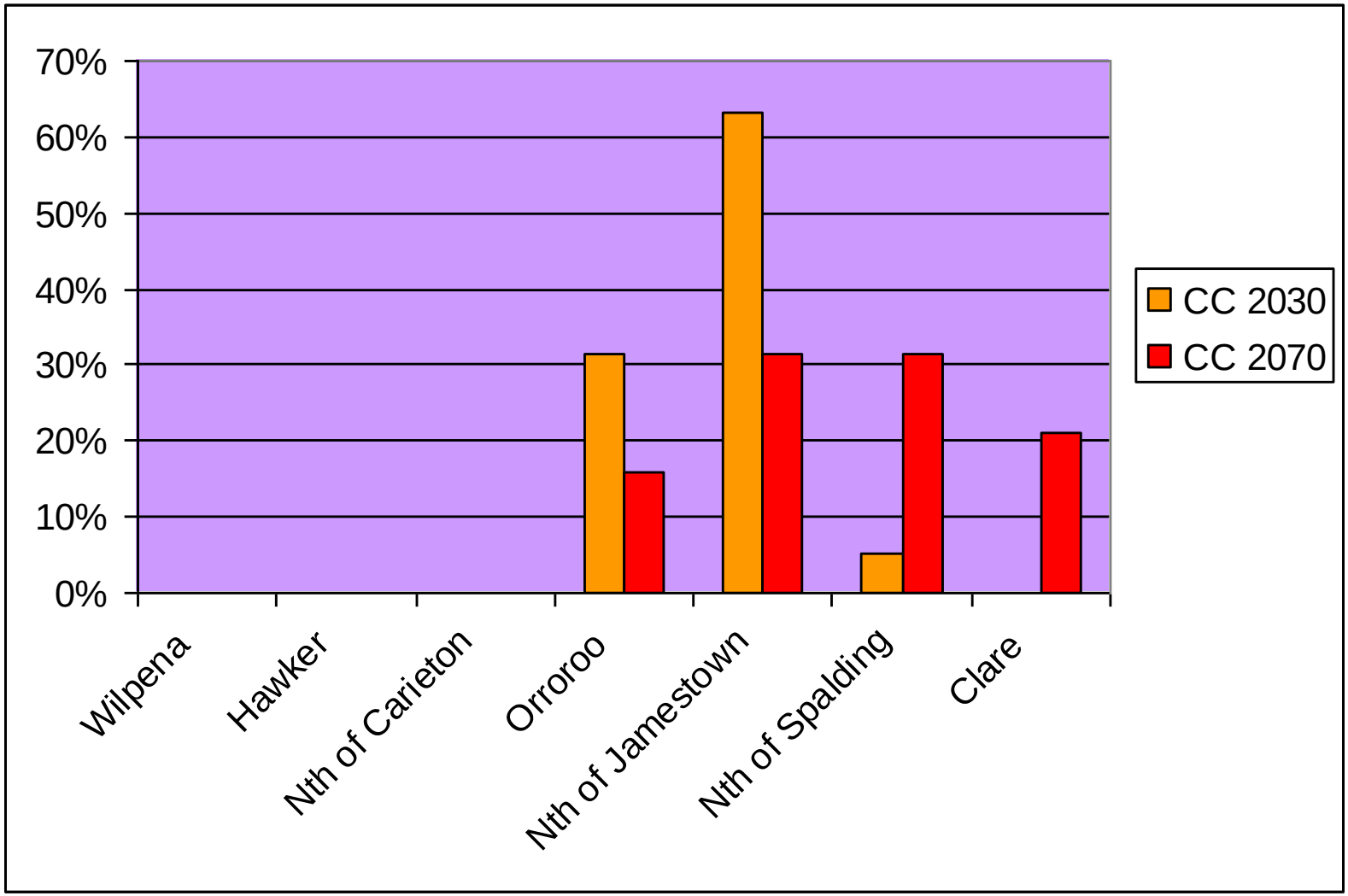
Special Report

Should Goyder's Line be moved?



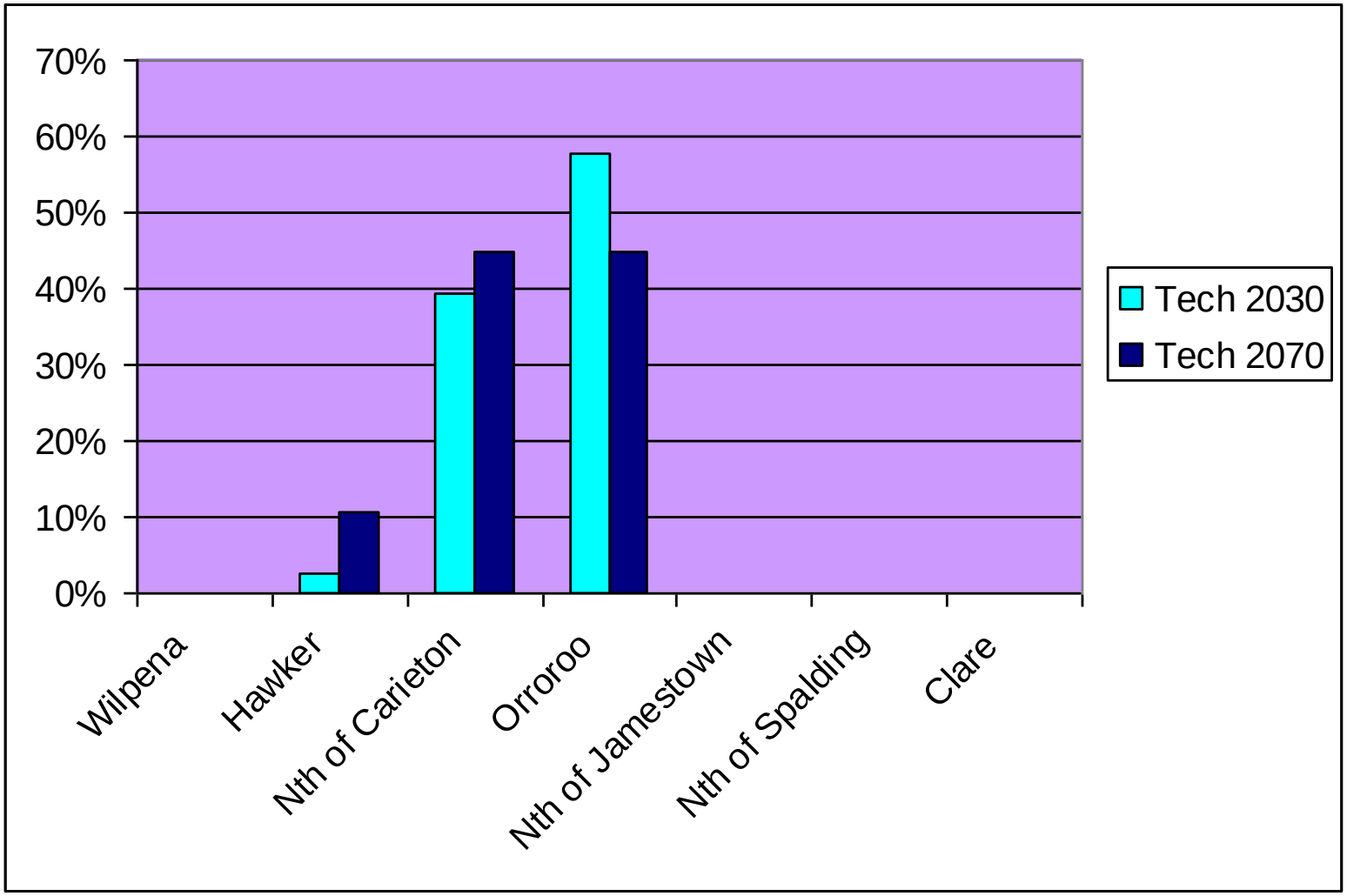
Full analysis p6-9

Climate change pull →



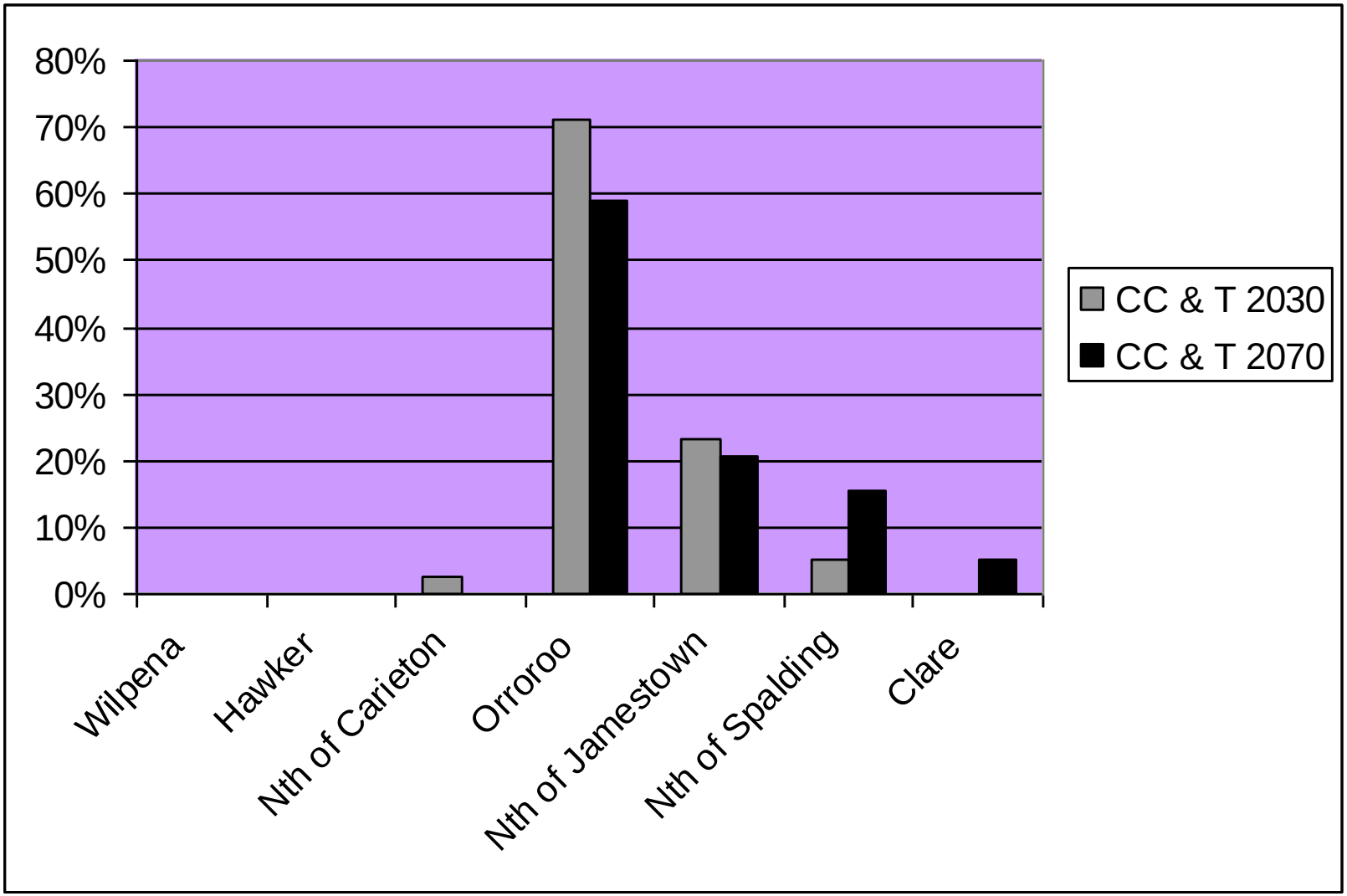
Upper North

Technology Push



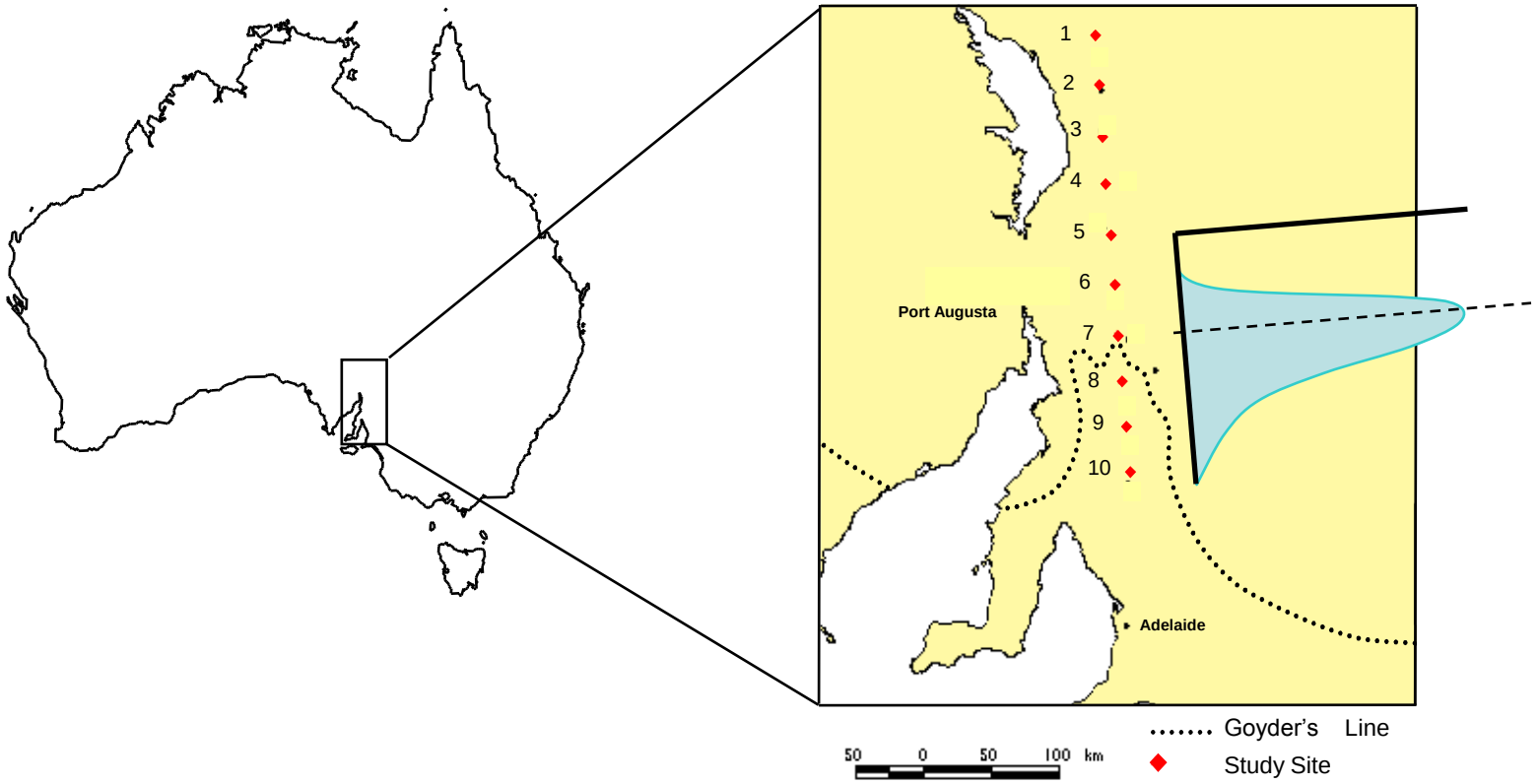
Upper North Survey

←Technology *and* Climate change →



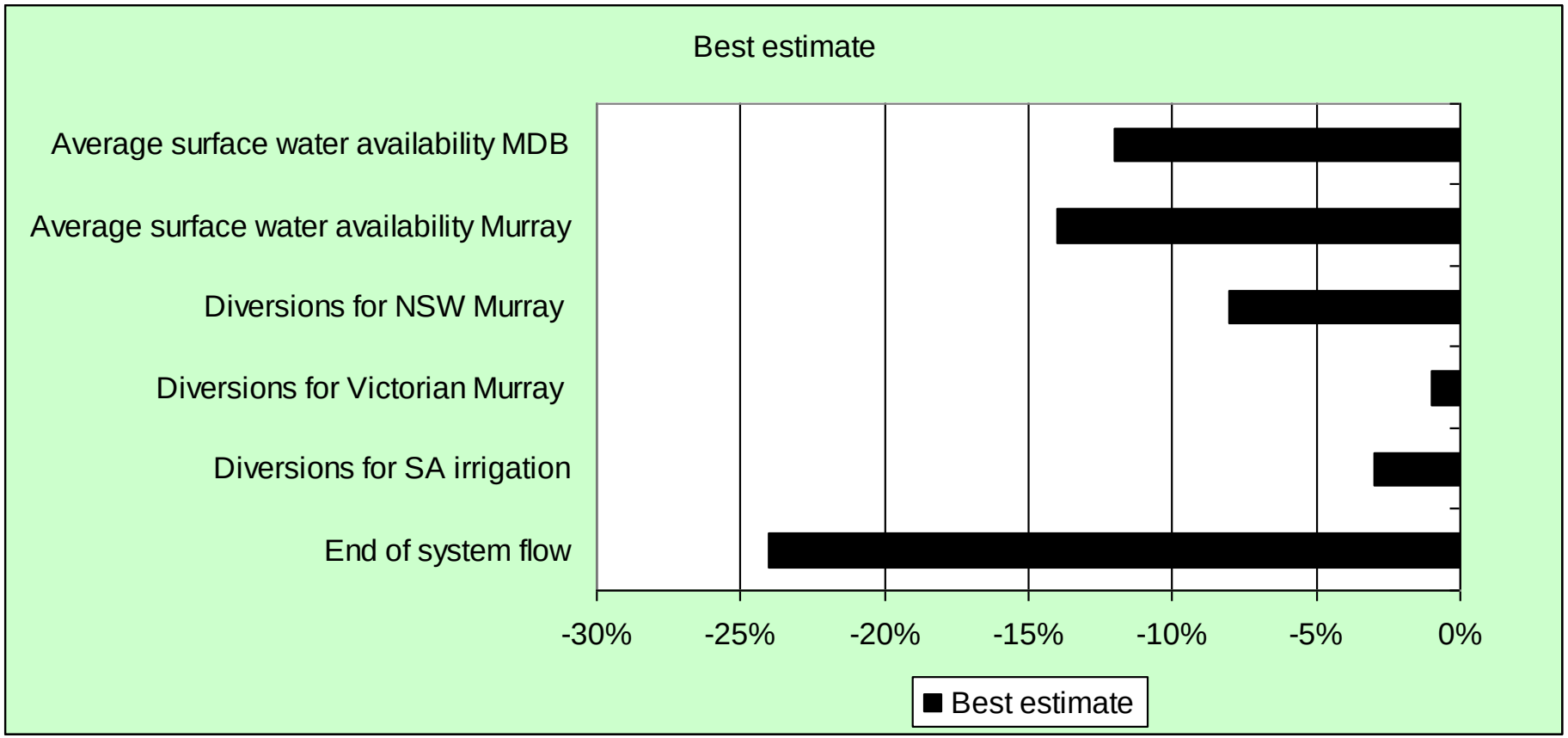
Upper North

‘Changes in the location of Goyder’s line’ 2070

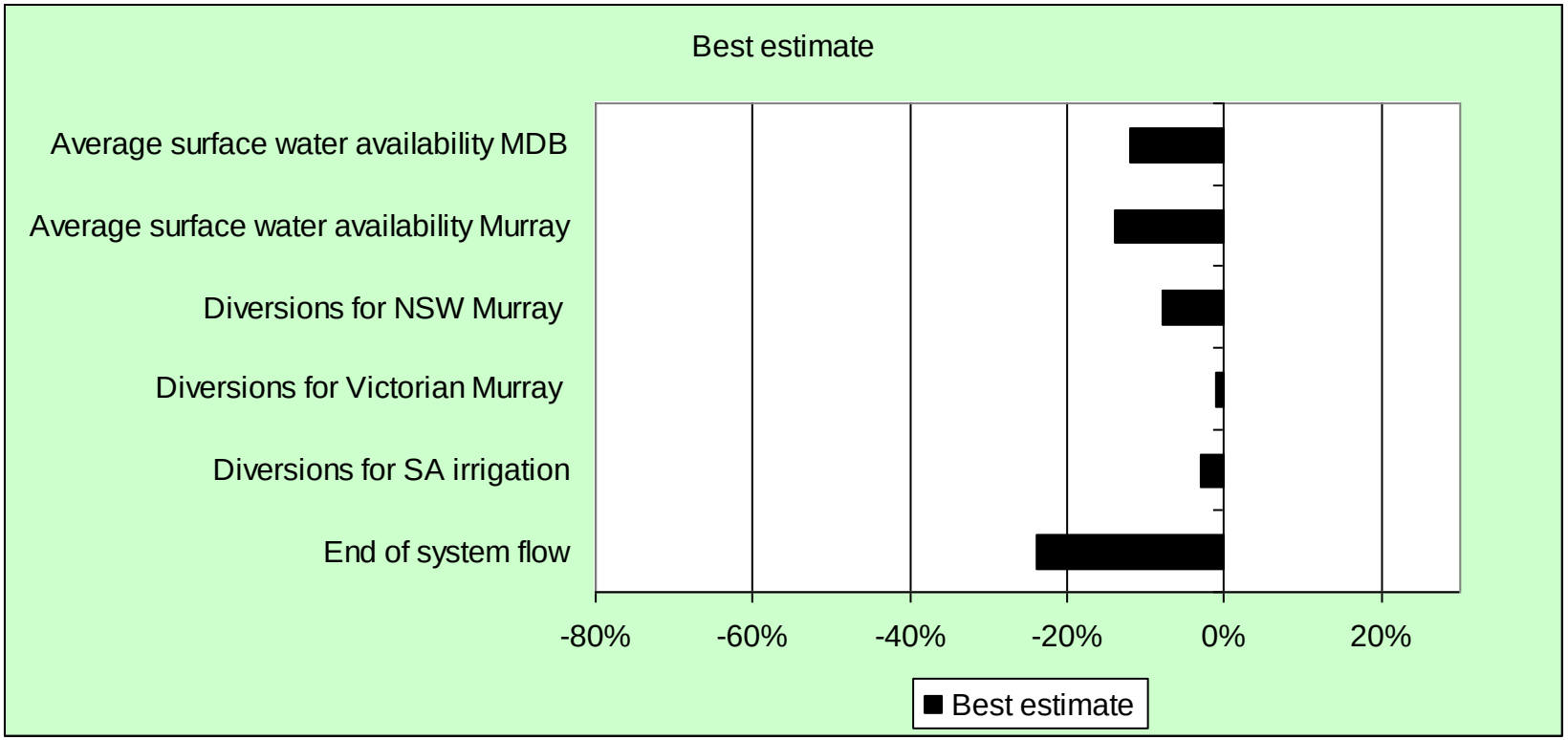


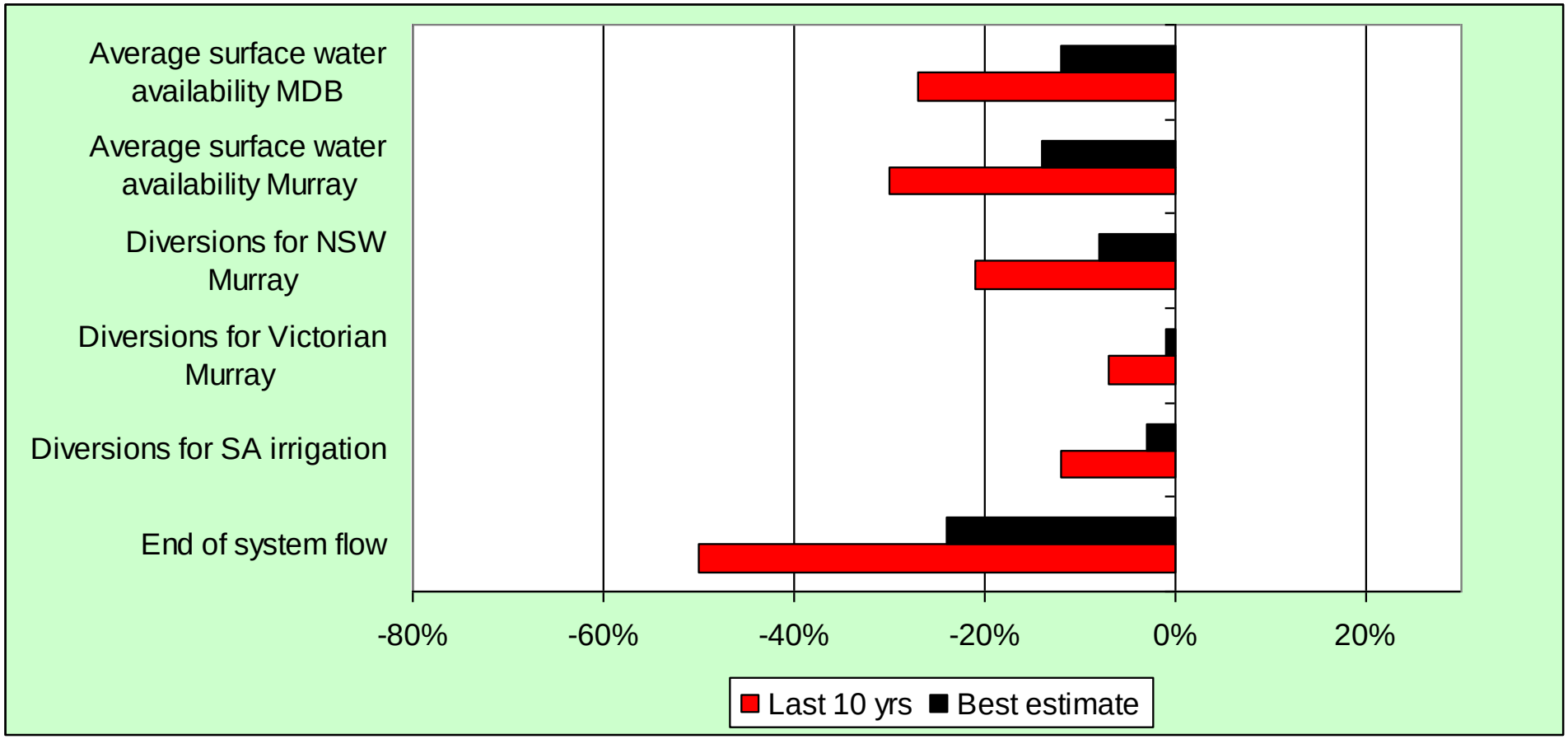
Howden and Hayman Greenhouse 2005

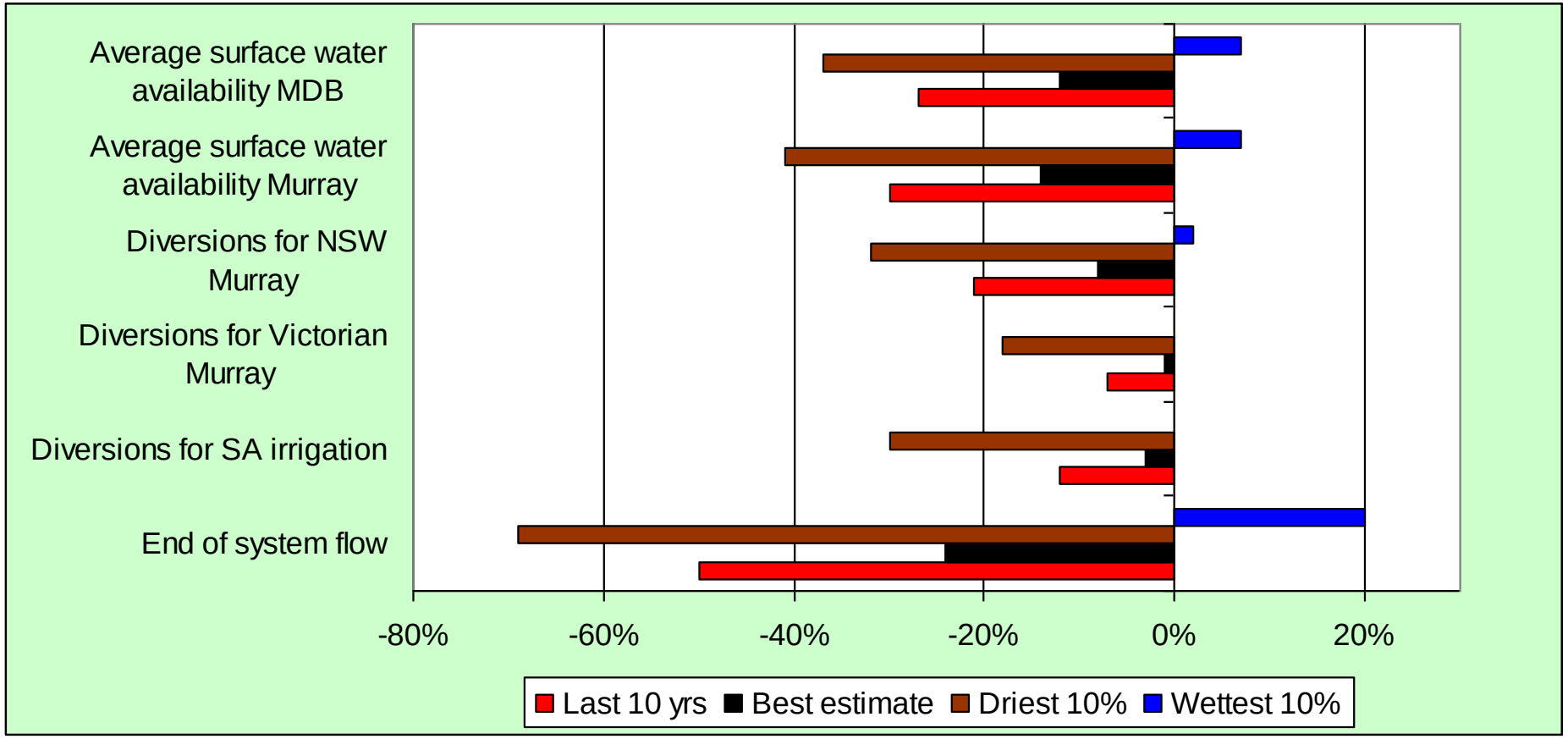
CSIRO Sustainable Yields



Median or Best estimate for 2030




Average surface water availability MDB
Average surface water availability Murray
Diversions for NSW Murray
Diversions for Victorian Murray
Diversions for SA irrigation
End of system flow
-80%
-60%
-40%
-20%
0%
20%
Last 10 yrs
Best estimate


Average surface water availability MDB
Average surface water availability Murray
Diversions for NSW Murray
Diversions for Victorian Murray
Diversions for SA irrigation
End of system flow
-80%
-60%
-40%
-20%
0%
20%
Last 10 yrs
Best estimate
Driest 10%
Wettest 10%

Are we overstating the case

- Vulnerability vs
- Virtuous corruption

- Yelling FIRE in a warming world.

- Truth is bad enough (Schneider)
- Risk management
- Looking forward
- Looking beyond Australia

SARDI

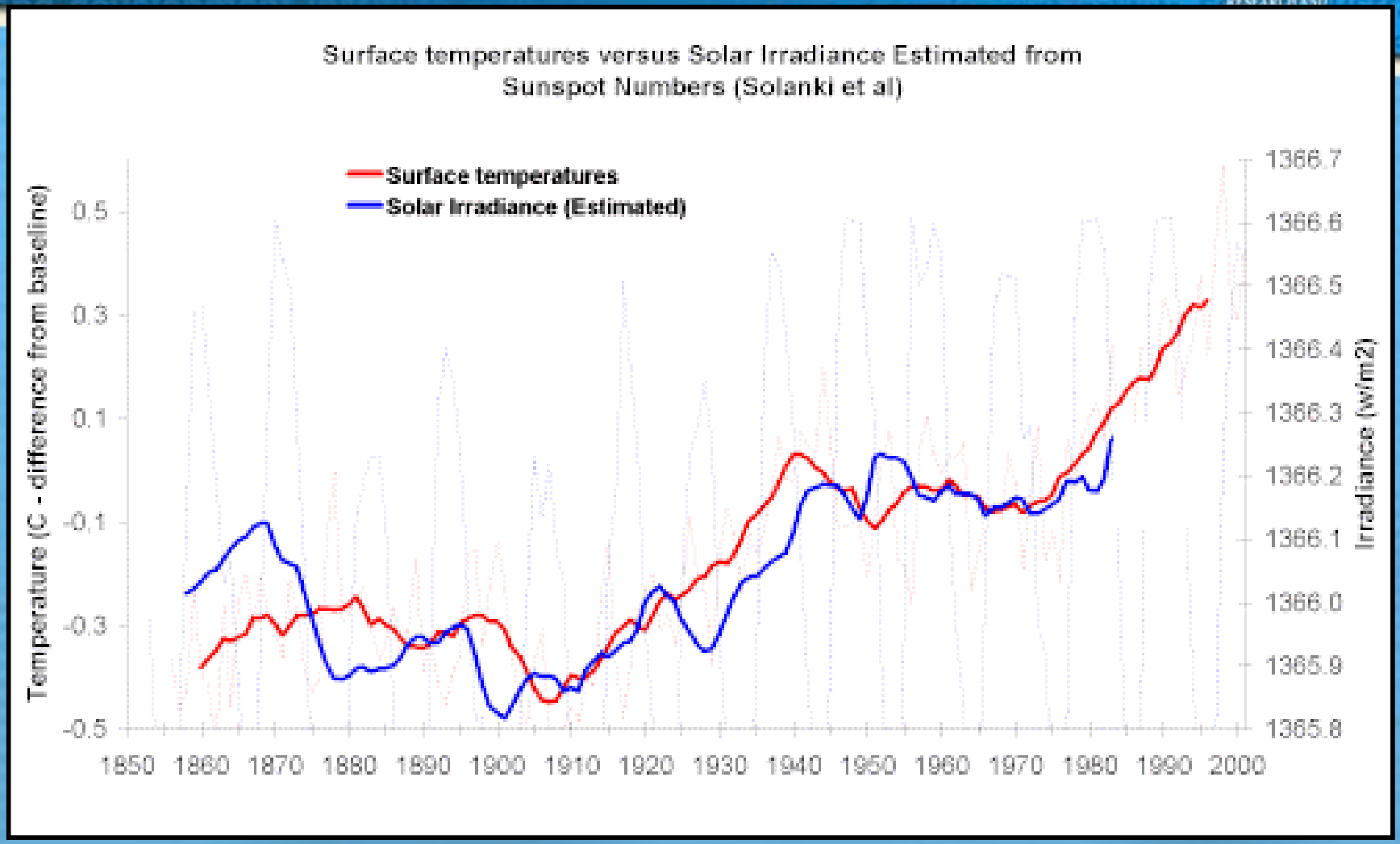
SARDI
RESEARCH AND DEVELOPMENT

Thankyou

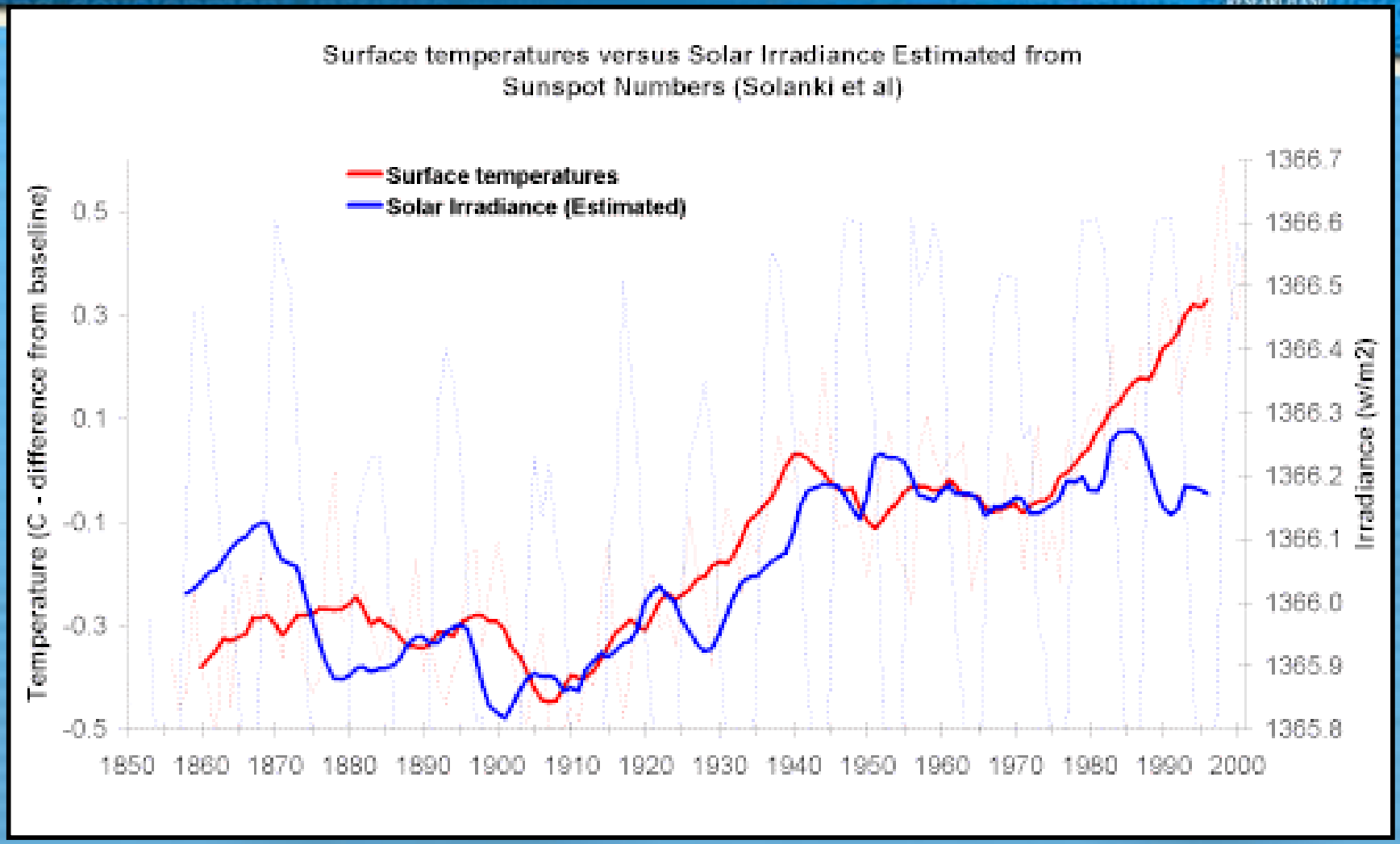
GRDC
Grains Research & Development Corporation

Australian Government
Australian Centre for International Agricultural Research

Government of South Australia

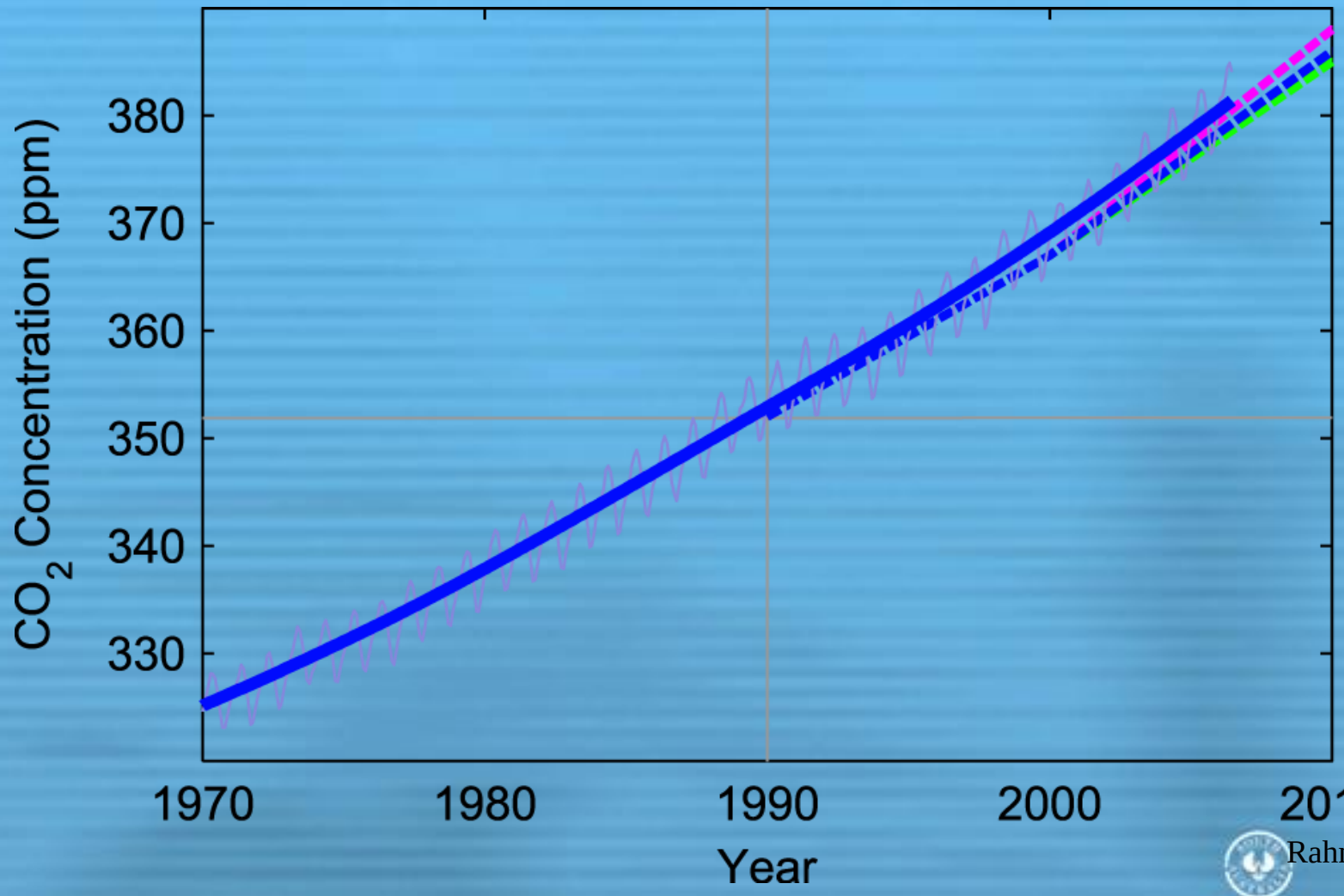


David Jones – National Climate Centre



David Jones – National Climate Centre

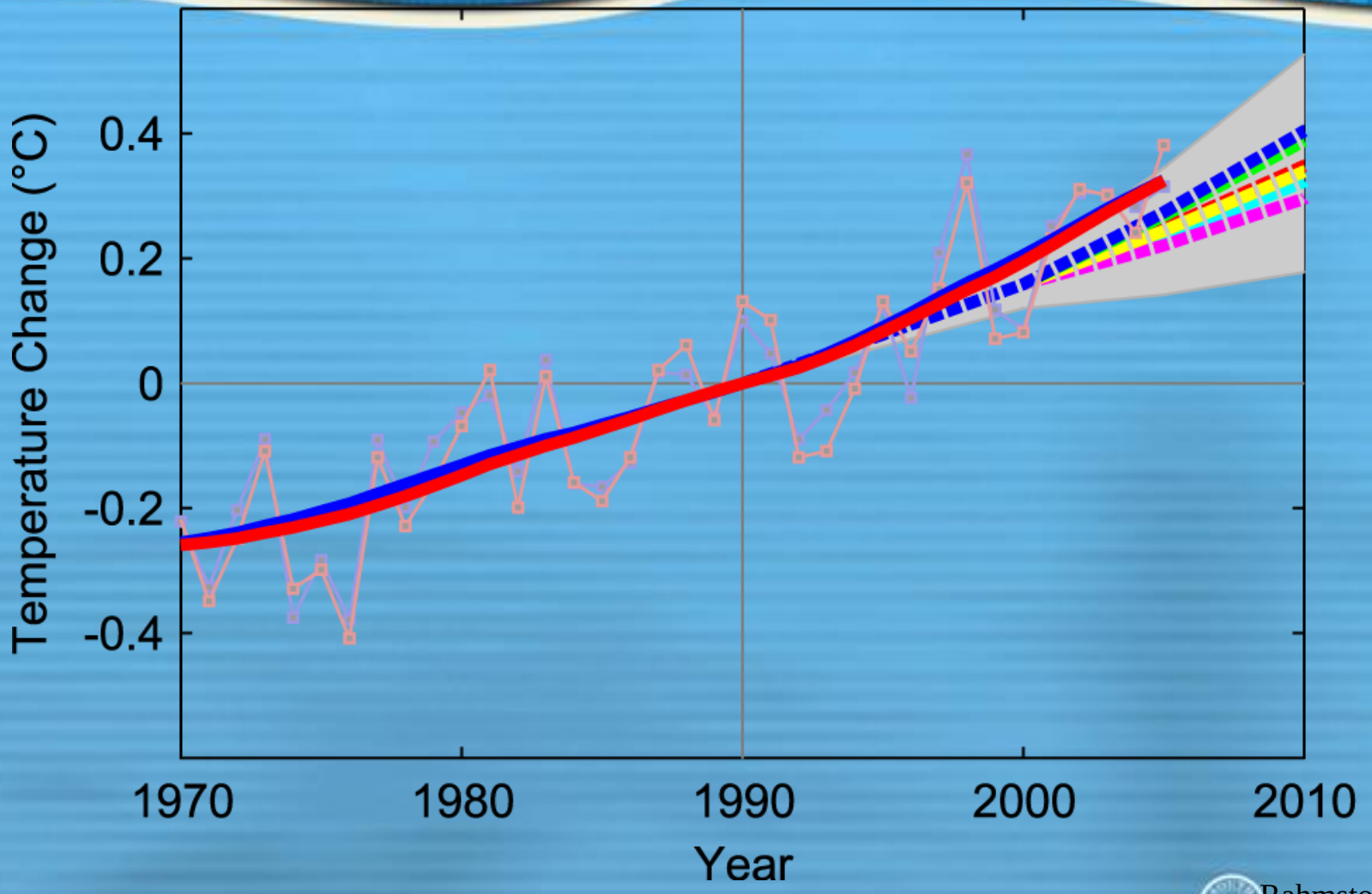
standing up to the test of time? Carbon Dioxide:



Rahmstorf et al.

- CO_2 projections match the observations.

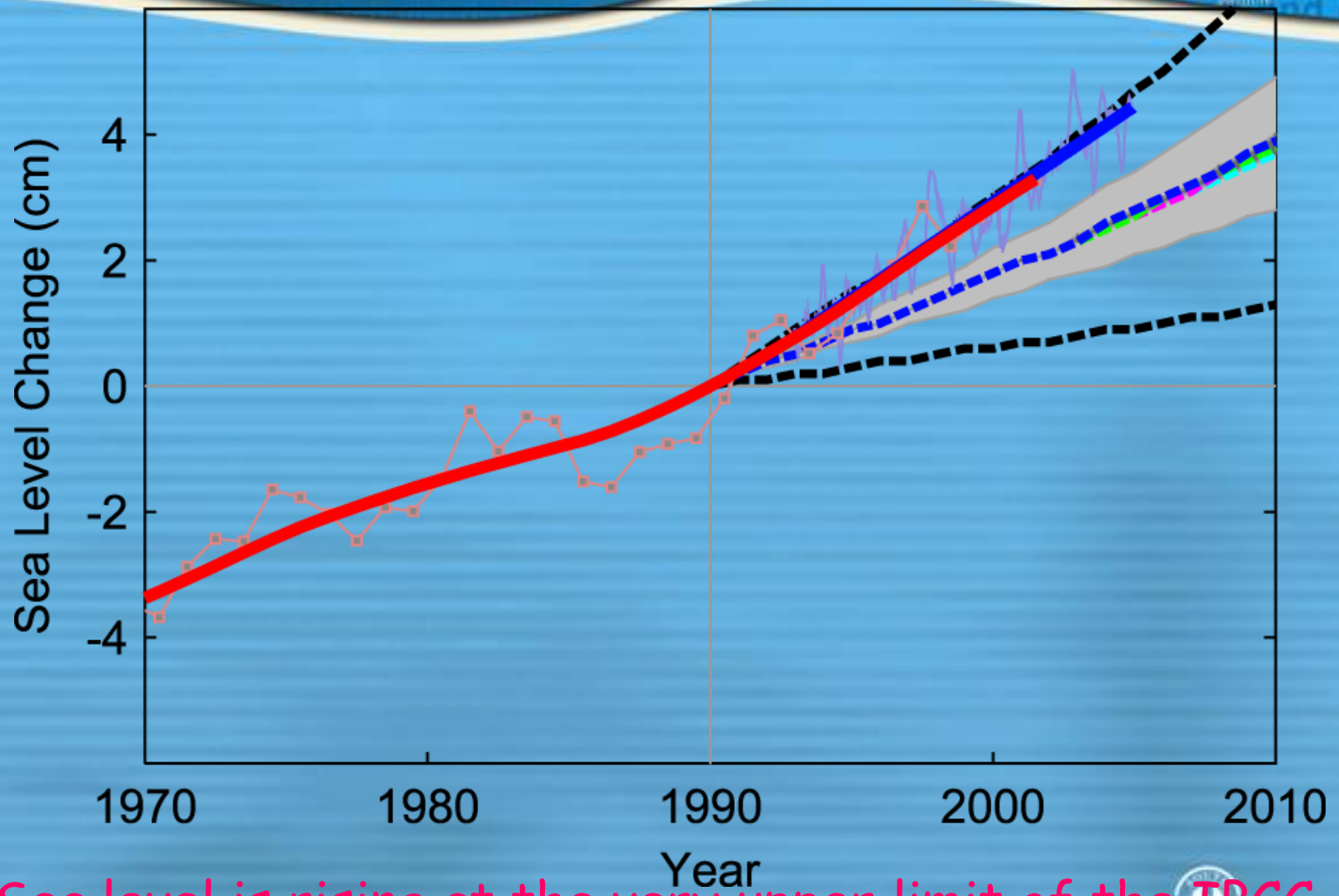
How well are the IPCC projections standing up to the test of time? Temperature:



Rahmstorf et al.

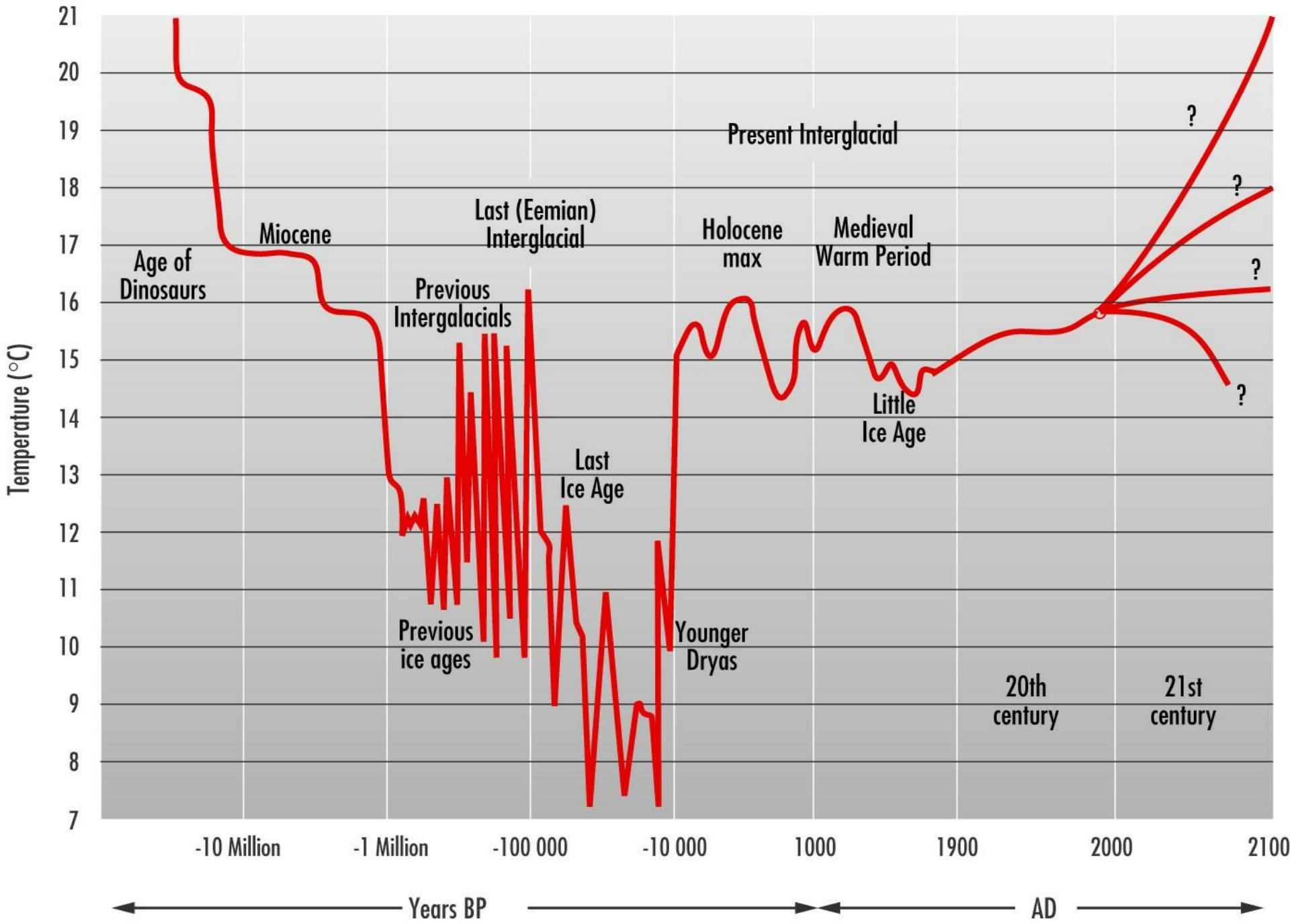
- Temperature rise near upper limit of the projections

How well are the IPCC projections standing up to the test of time? Sea Level Rise:



- Sea level is rising at the very upper limit of the IPCC (2001) projections (i.e. 88 cm rise by 2100)

Rahmstorf et al.



Source: Bureau of Meteorology