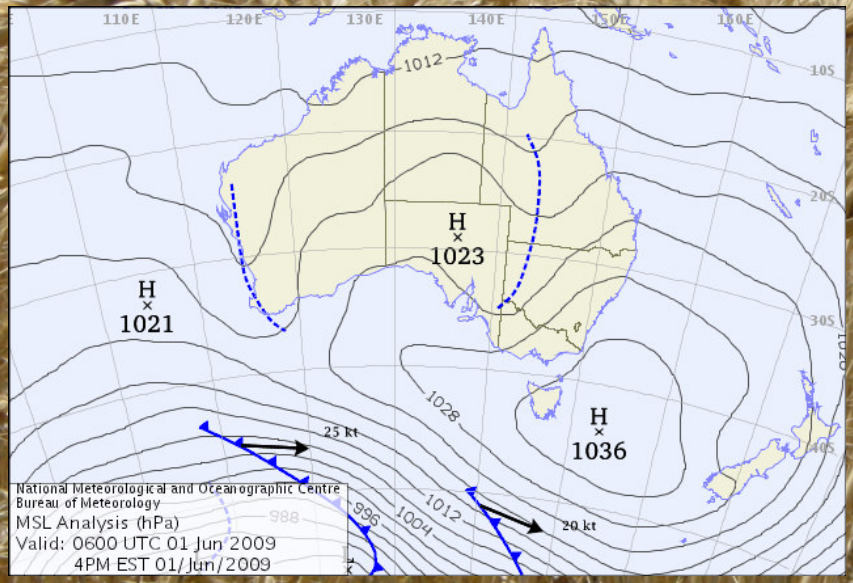
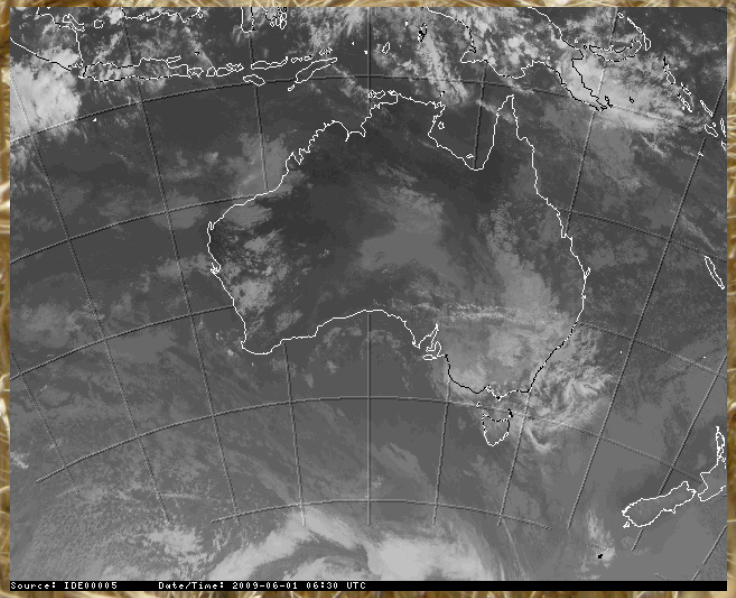
Climate Change Science
Local and Abroad Effects

Dale Grey

DPI Cobram





State Government Victoria
Department of Primary Industries

FUTURE FARMING
Productive, Competitive and Sustainable

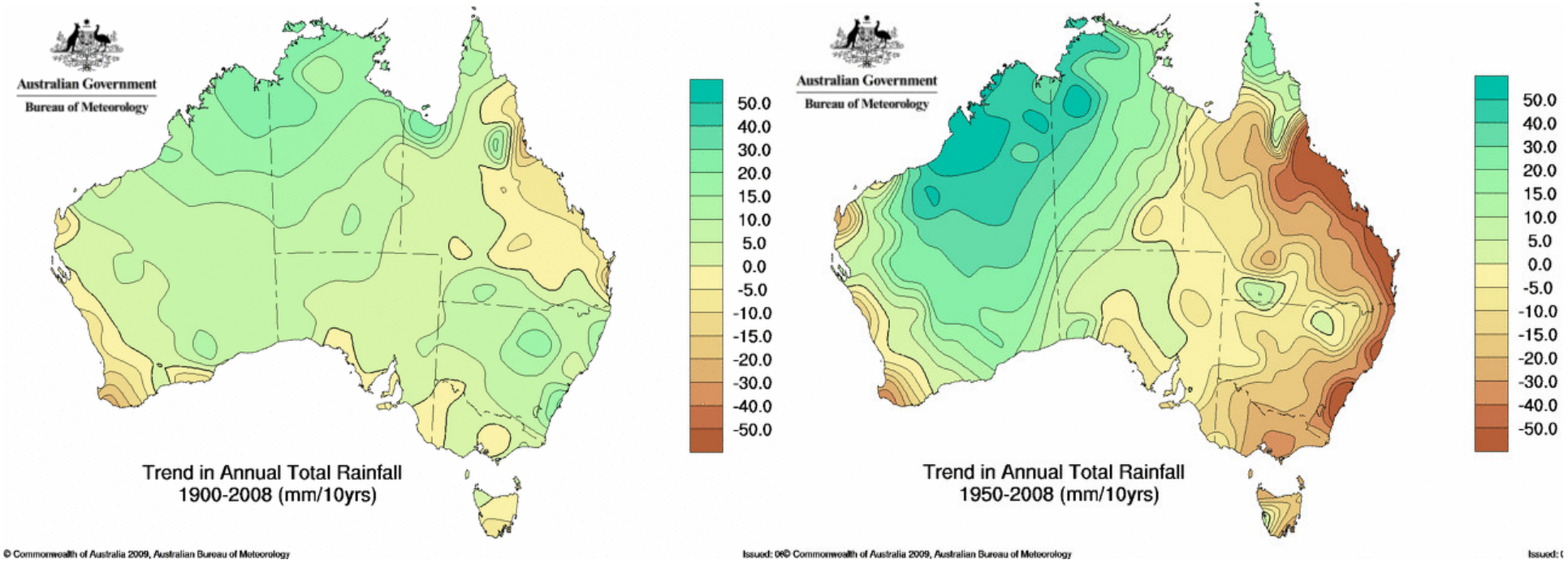
Some Climate Change Science-

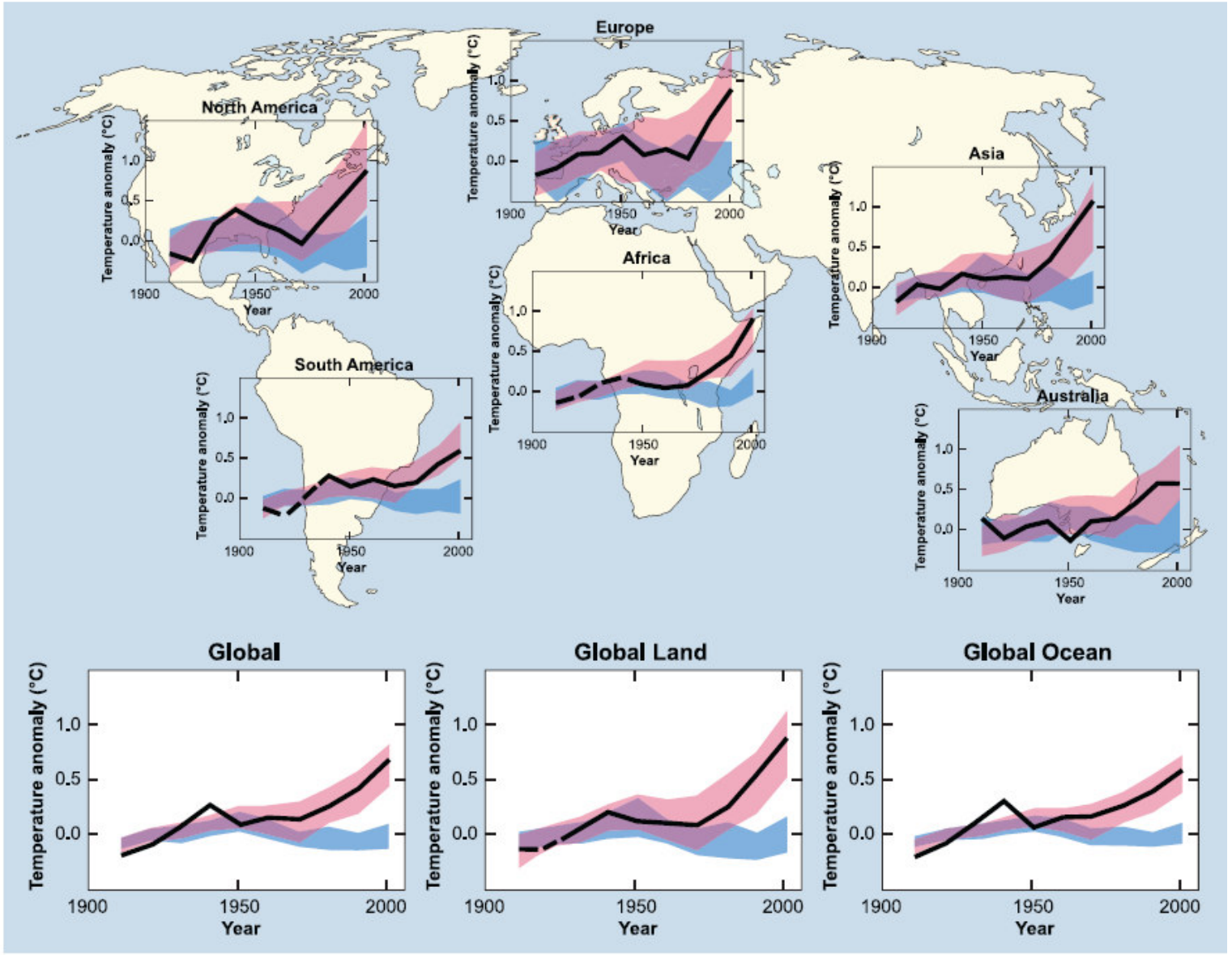
In 1896 a Swedish chemist predicted that a doubling of CO_2 would lead to a 4-6 degree rise in world temperature.

12 of the past 13 years are the warmest since 1880, based on 3 different datasets
The top 9 are 2005 1998 2002 2003 2007 2006 2004 2001 2008

The world incidence of severe weather, cold, hot, flood, wind, hail is constantly increasing, ask an insurance agent.

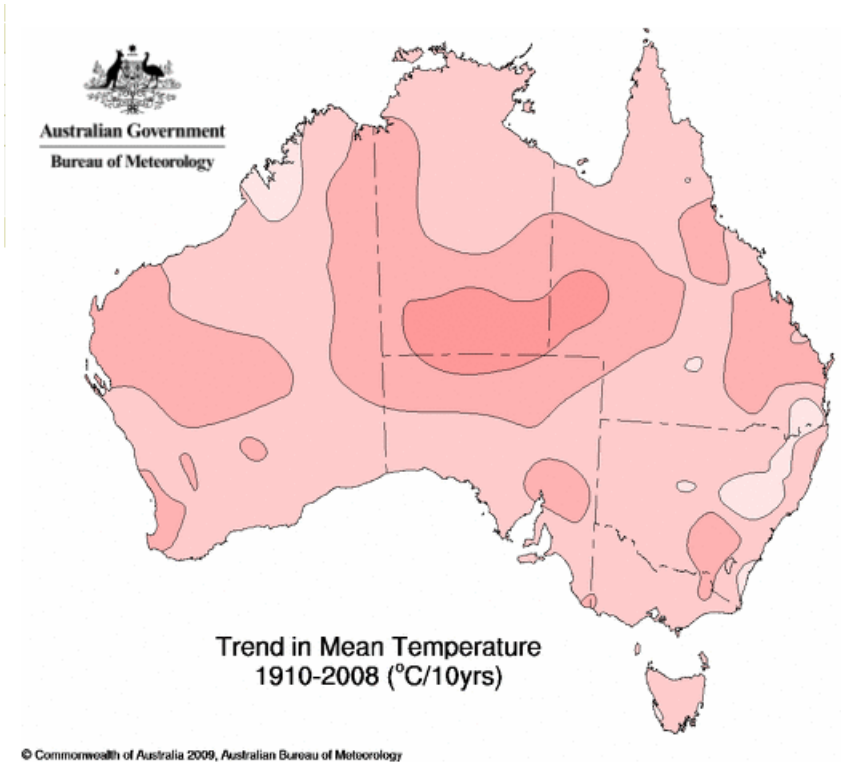
Since 1950, more rain in north-western Australia, less rain in southern and eastern Australia and SW WA
Since 1900 SW WA and Qld coast have dried, NW has wet up

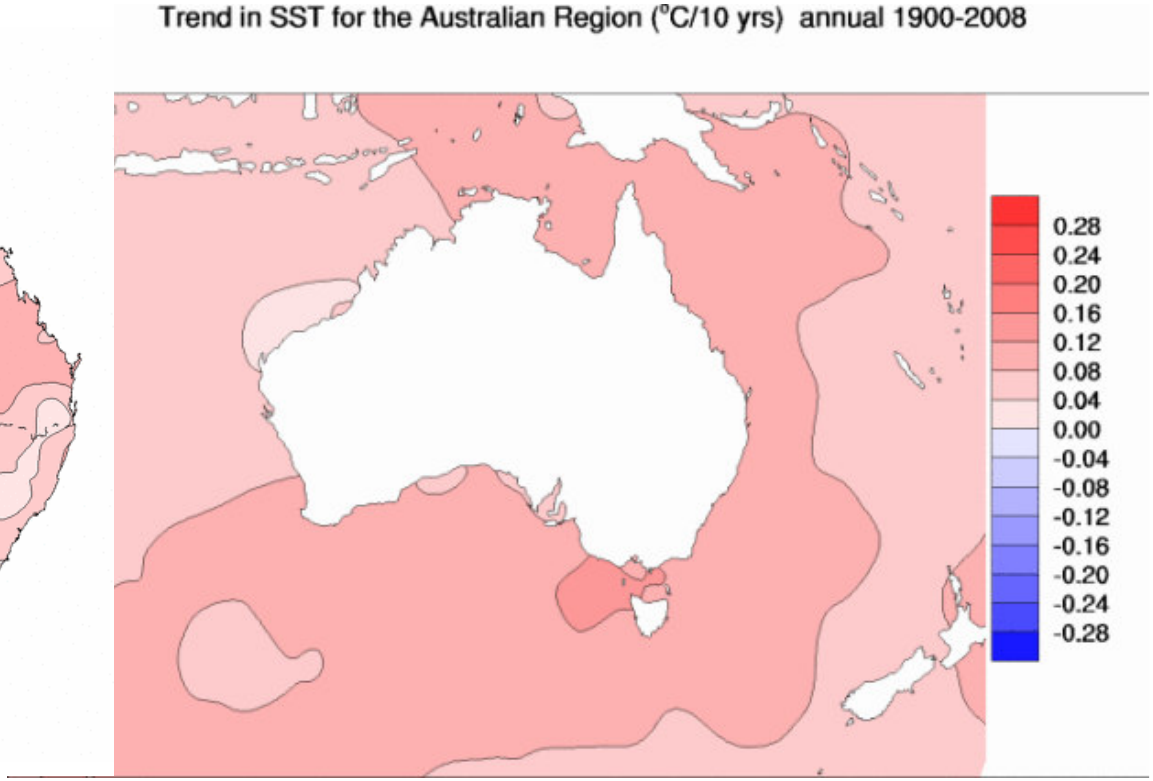


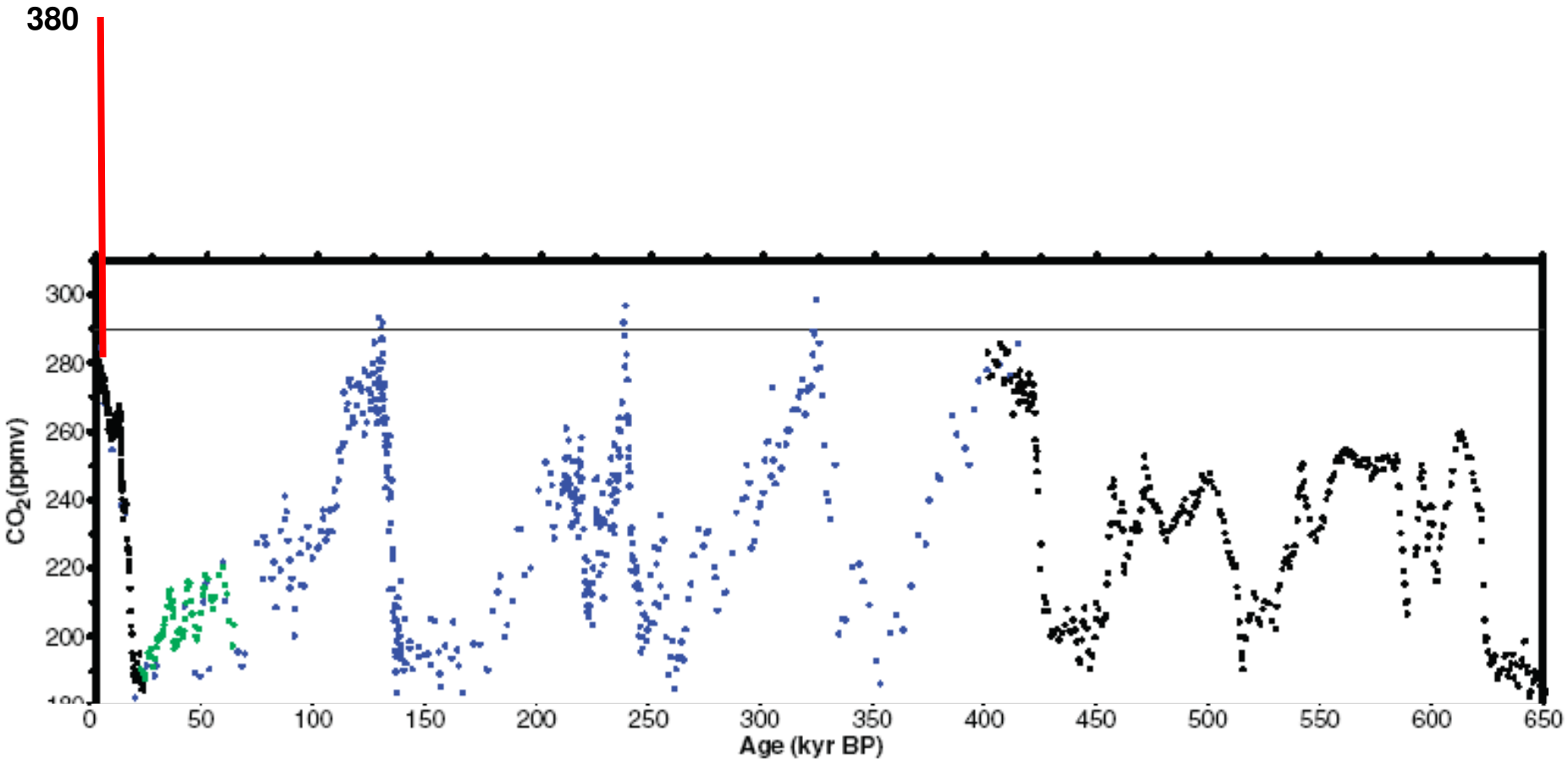


The Earth has warmed 0.7°C since 1900.

Since 1950, the Oceans off SE NSW and SW WA have warmed 1°C

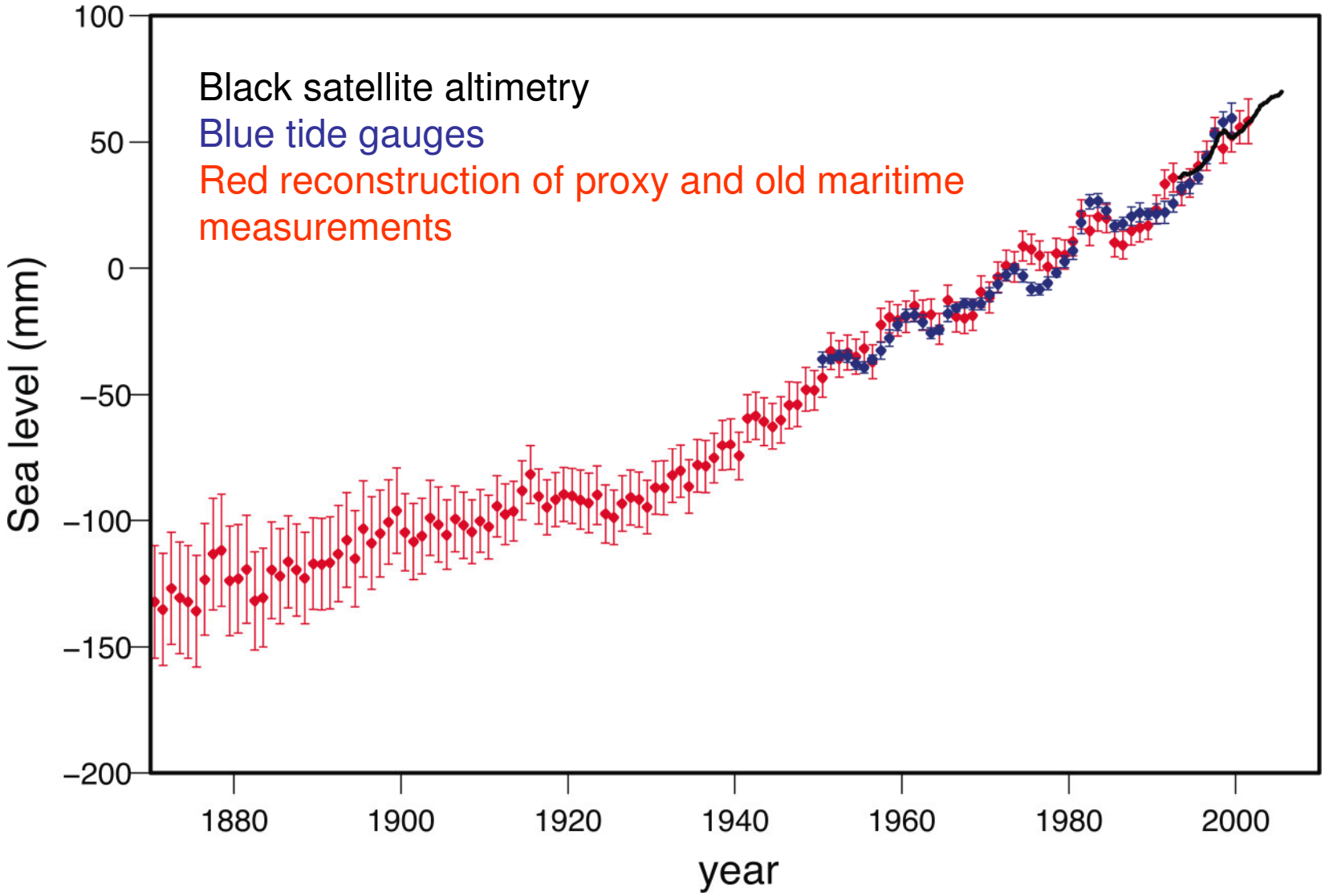






From analysis of air bubbles and impurities in the Vostok and Antarctic ice cores

$C0_2$ levels have fluctuated within 200-300 ppm for last 800,000 yrs. Currently we are 383 ppm.



In the last 50 years sea level has risen 7cm.

The oceans have acidified (the Sodastream® effect) by 0.1 pH unit, shells have got marginally thinner.

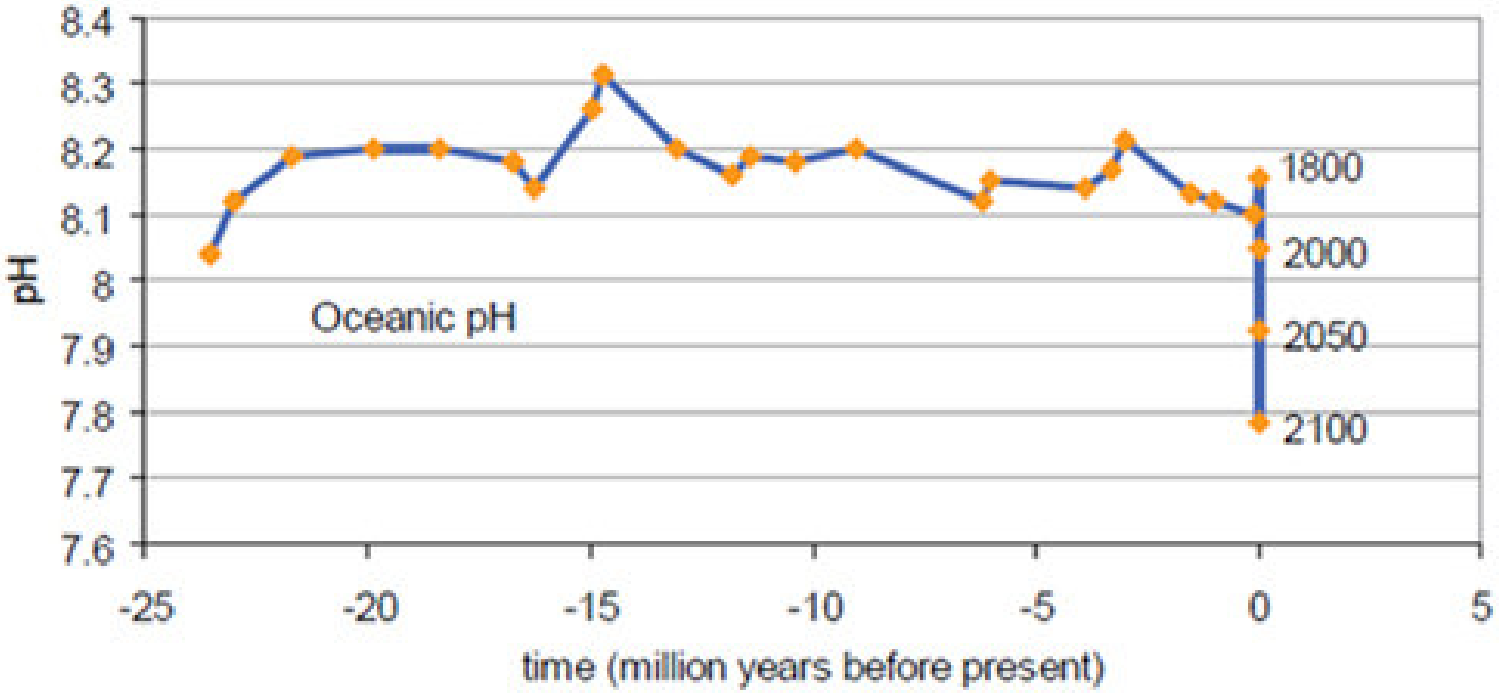
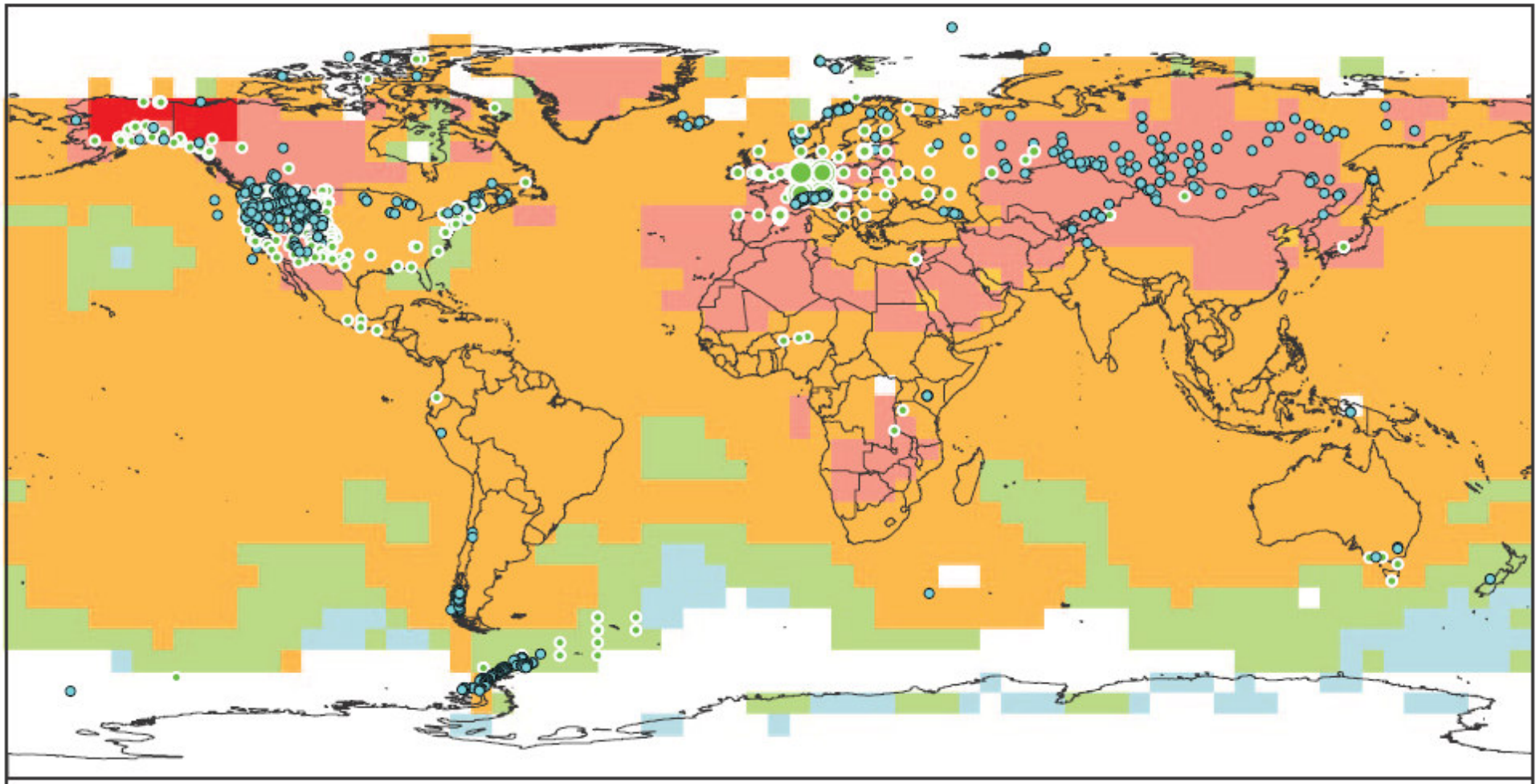


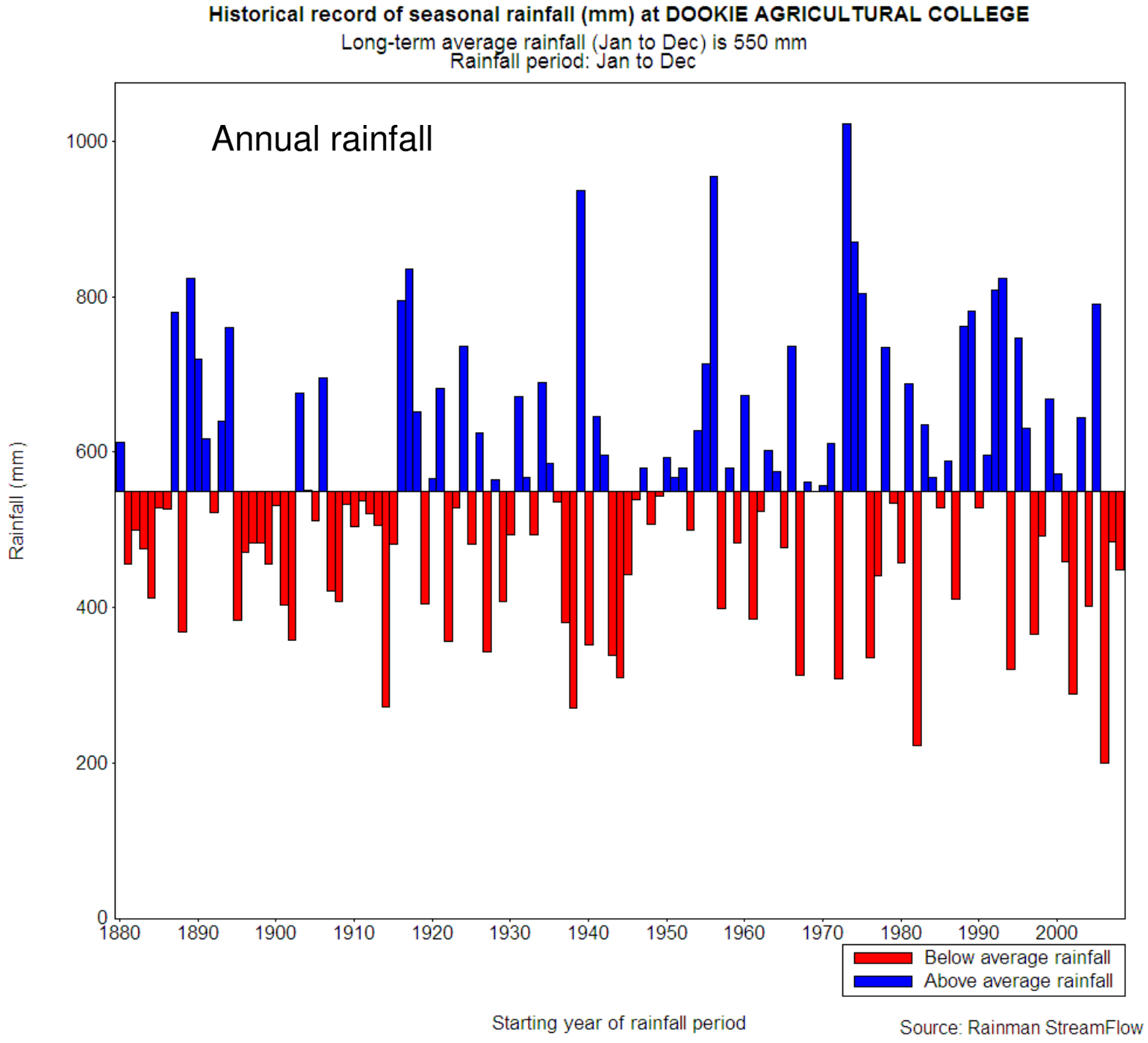
Figure 1. Past and contempory variability of marine pH. Future predictions are model derived values based on IPCC mean scenarios (from Turley *et al*, 2006. Cambridge University Press, 8, 65-70).

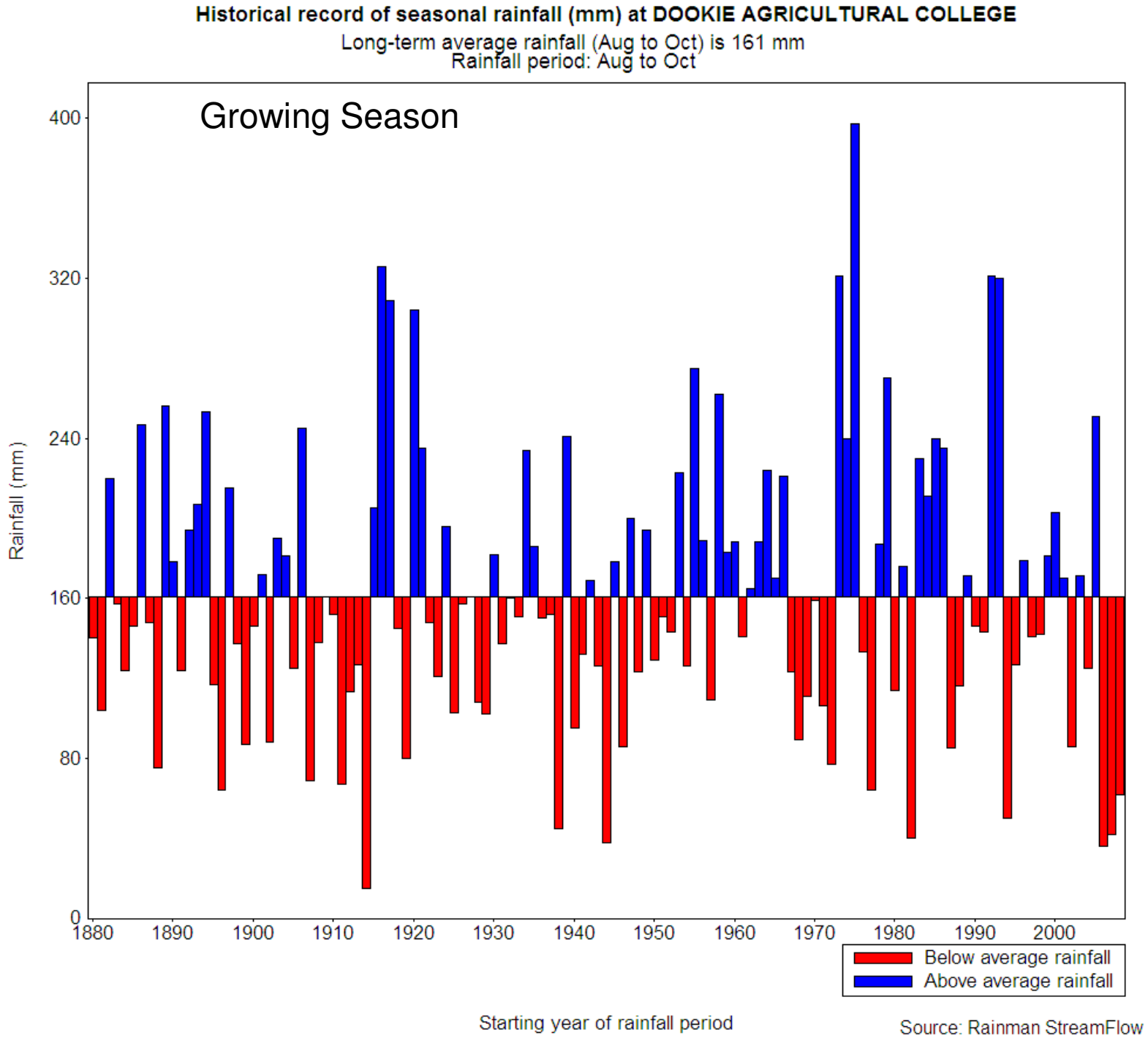
Changes in physical and biological systems and surface temperature 1970-2004

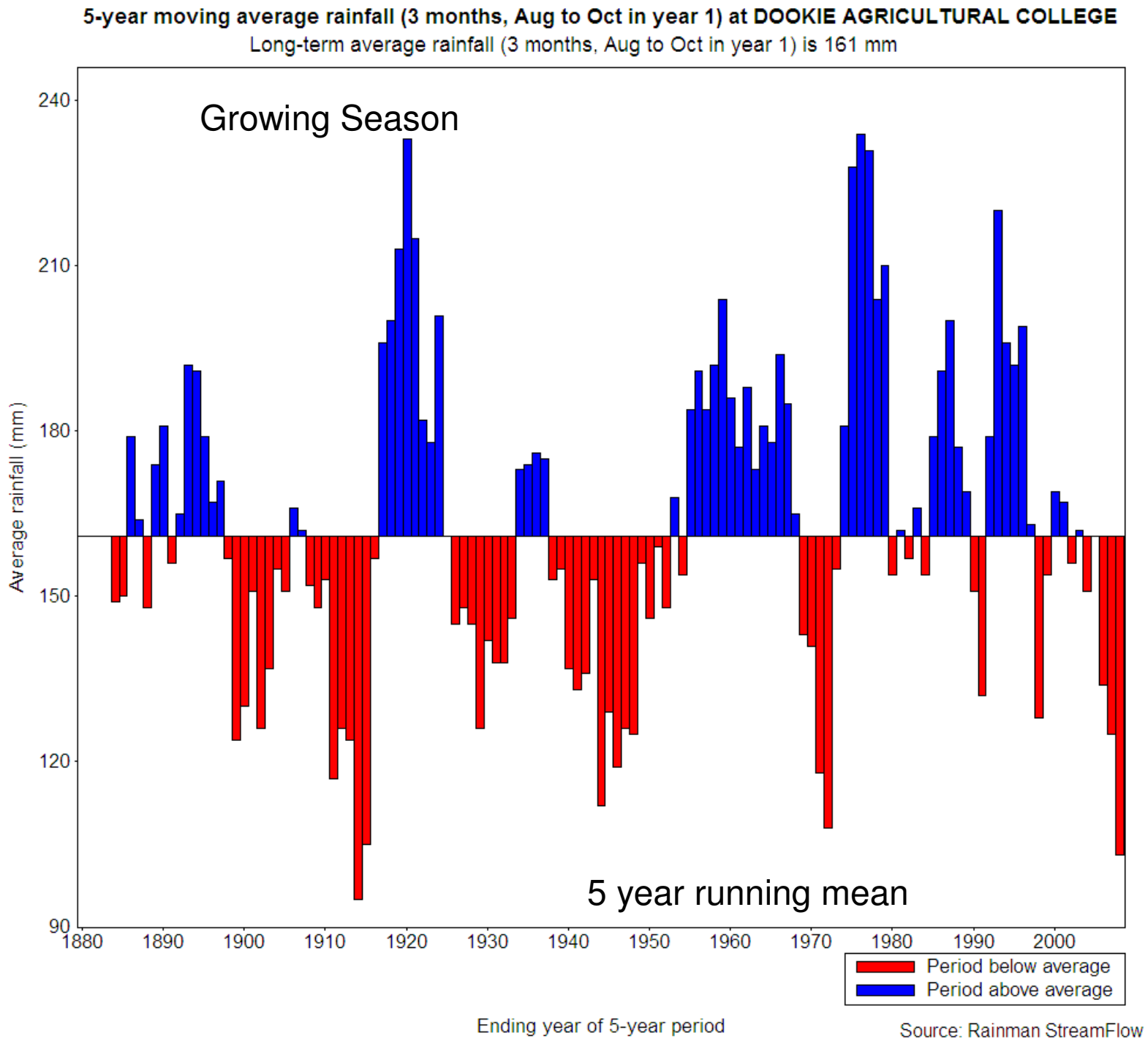


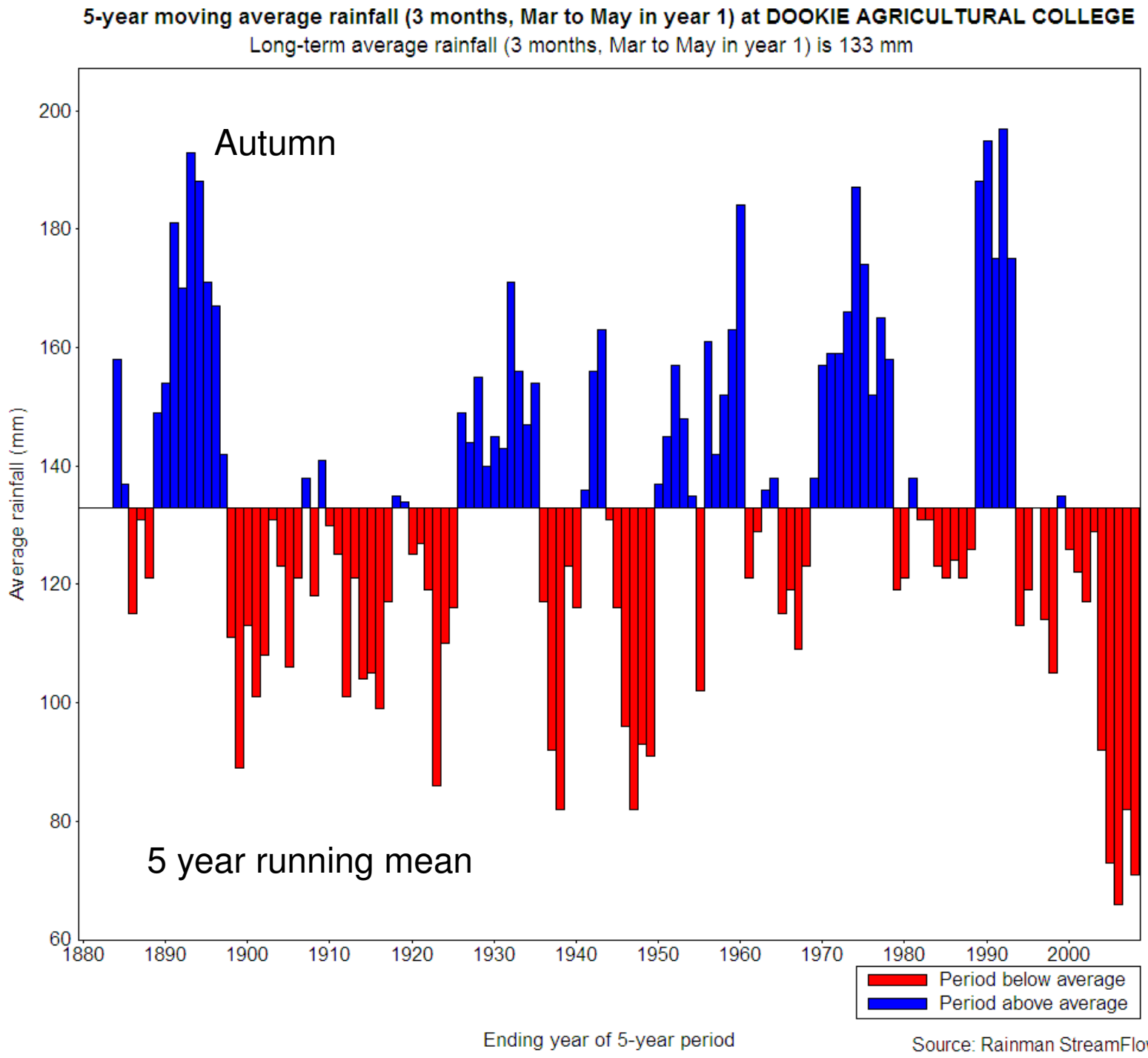
NAM		LA		EUR (28,115)		AFR		AS		ANZ		PR*		TER (28,586)		MFW**		GLO (28,671)	
355	455	53	5	119		5	2	106	8	6	0	120	24	764		1	85	765	
94%	92%	98%	100%	94%	89%	100%	100%	96%	100%	100%	–	91%	100%	94%	90%	100%	99%	94%	90%

In the Northern Hemisphere thousands of plants and animals have changed their behaviour and location in the last 30 years.

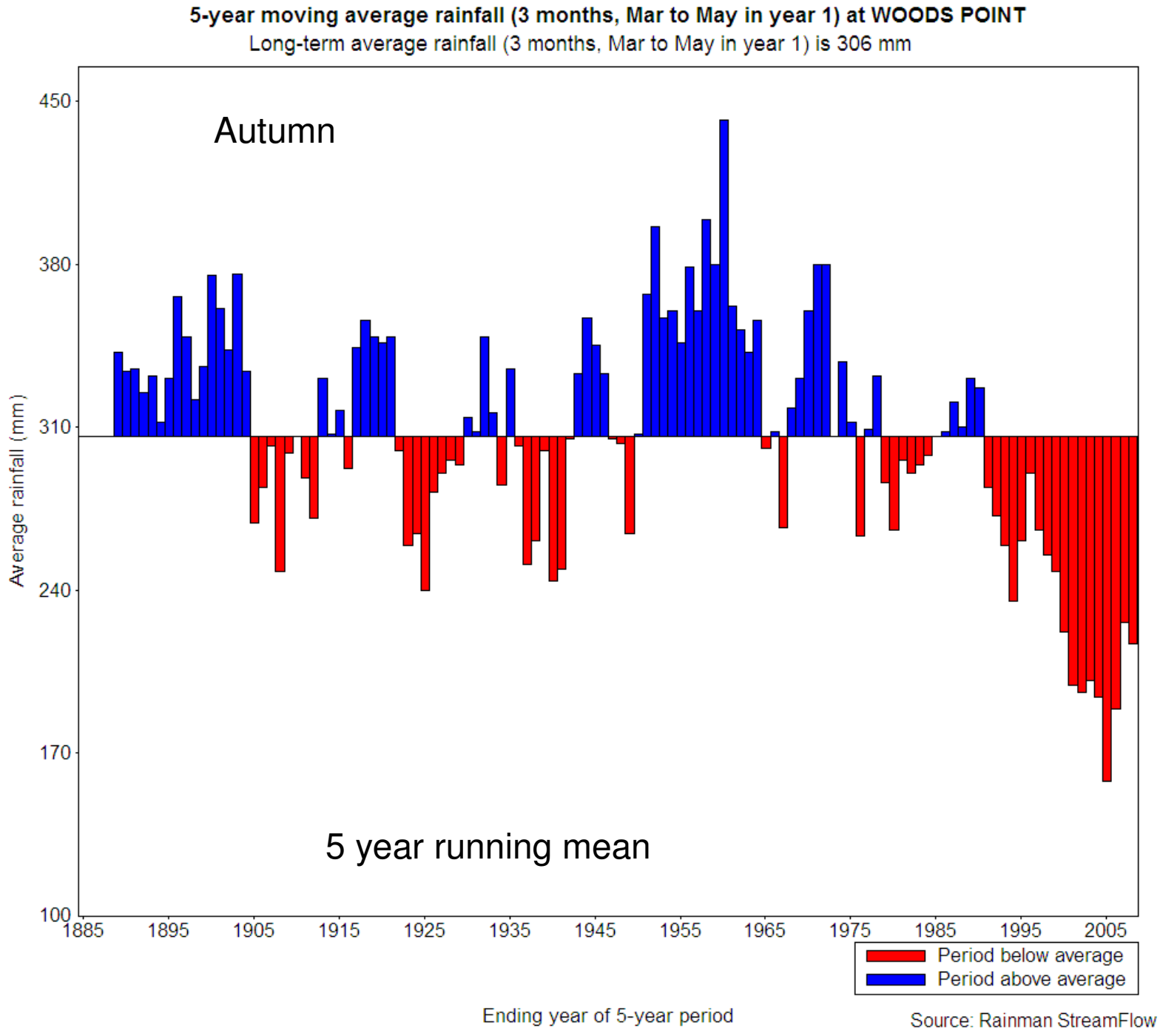

Historical record of seasonal rainfall (mm) at DOOKIE AGRICULTURAL COLLEGE
Long-term average rainfall (Jan to Dec) is 550 mm
Rainfall period: Jan to Dec
Annual rainfall
Rainfall (mm)
0
200
400
600
800
1000
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Below average rainfall
Above average rainfall
Starting year of rainfall period
Source: Rainman StreamFlow


Historical record of seasonal rainfall (mm) at DOOKIE AGRICULTURAL COLLEGE
Long-term average rainfall (Aug to Oct) is 161 mm
Rainfall period: Aug to Oct
Growing Season
Rainfall (mm)
400
320
240
160
80
0
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Below average rainfall
Above average rainfall
Starting year of rainfall period
Source: Rainman StreamFlow


5-year moving average rainfall (3 months, Aug to Oct in year 1) at DOOKIE AGRICULTURAL COLLEGE
Long-term average rainfall (3 months, Aug to Oct in year 1) is 161 mm
Growing Season
5 year running mean
Average rainfall (mm)
240
210
180
150
120
90
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Period below average
Period above average
Ending year of 5-year period
Source: Rainman StreamFlow

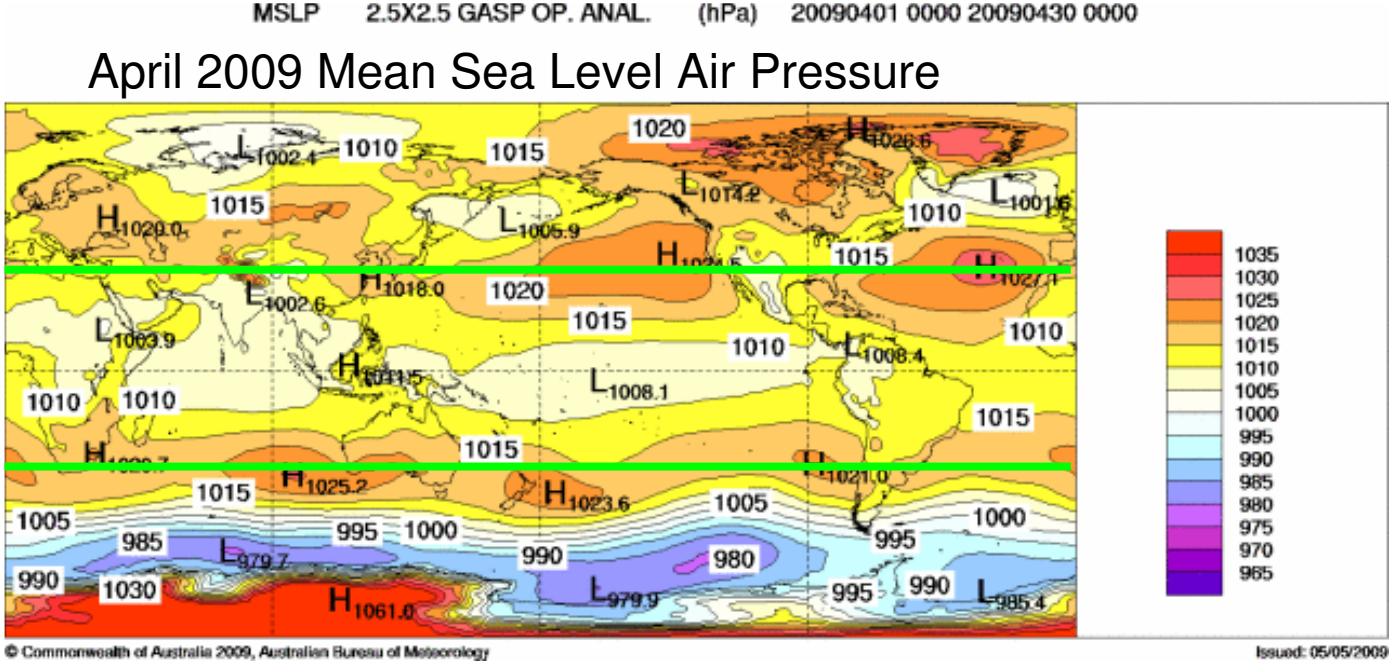


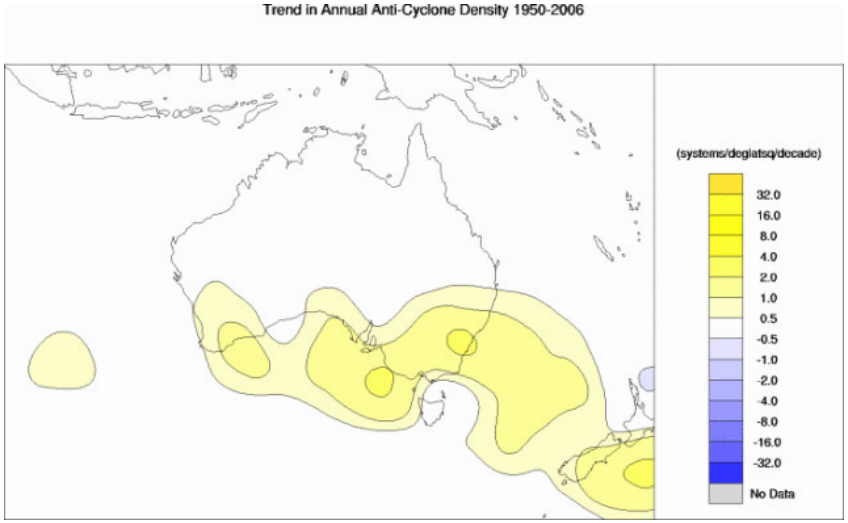
This is going on a bit too long and Unprecedented drying

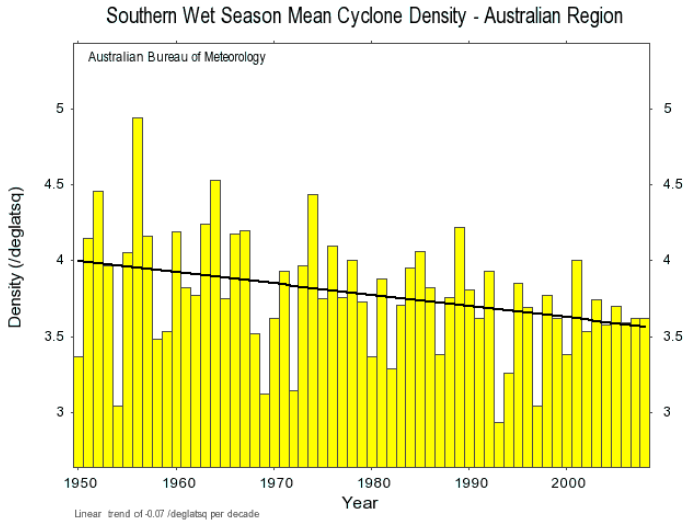

5-year moving average rainfall (3 months, Mar to May in year 1) at WOODS POINT
Long-term average rainfall (3 months, Mar to May in year 1) is 306 mm
Autumn
5 year running mean
Average rainfall (mm)
450
380
310
240
170
100
1885
1895
1905
1915
1925
1935
1945
1955
1965
1975
1985
1995
2005
Period below average
Period above average
Ending year of 5-year period
Source: Rainman StreamFlow

We know some things about the weird stuff going on here.

April 2009 Mean Sea Level Air Pressure

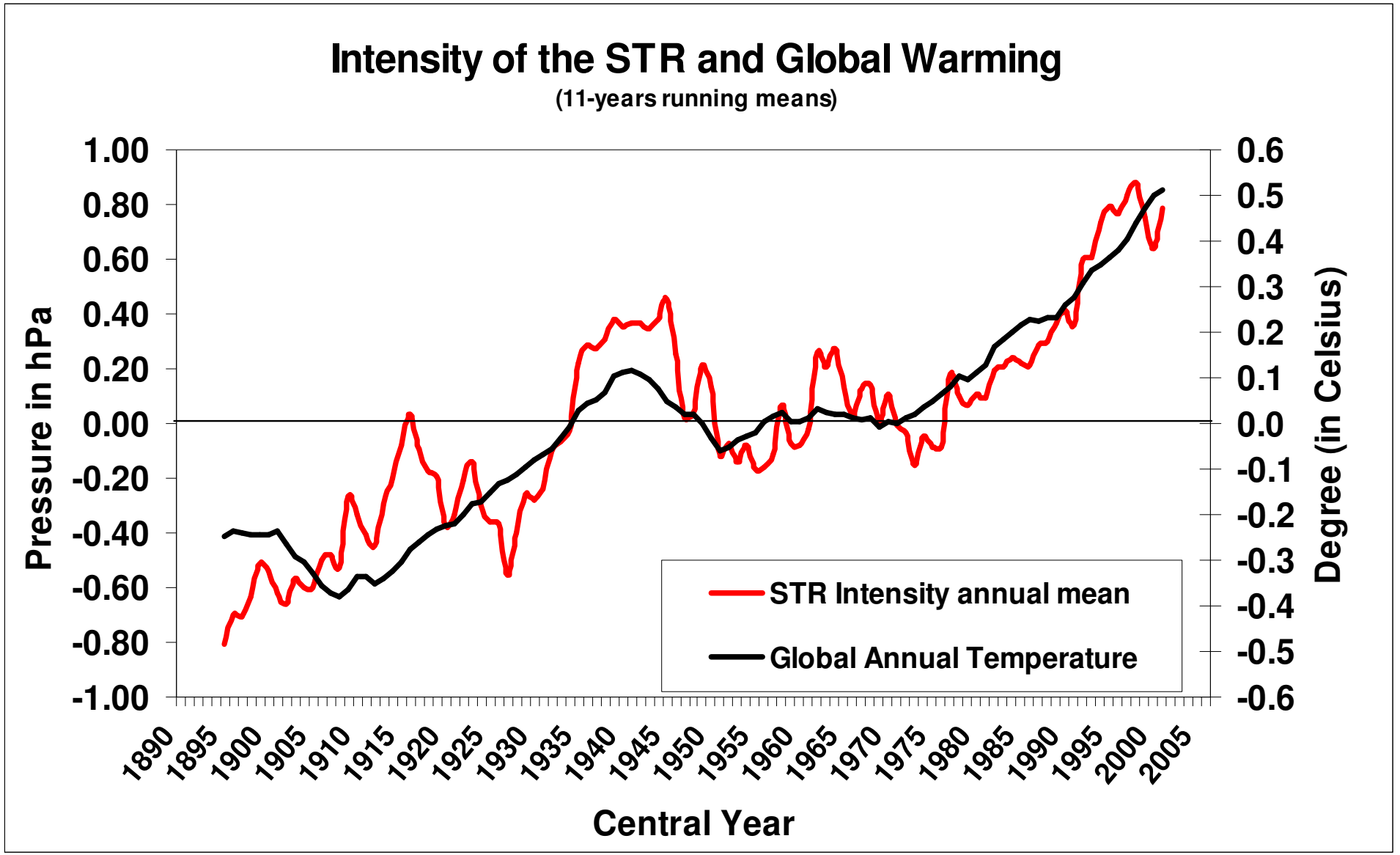






Strengthening trend of the subtropical ridge of high pressure

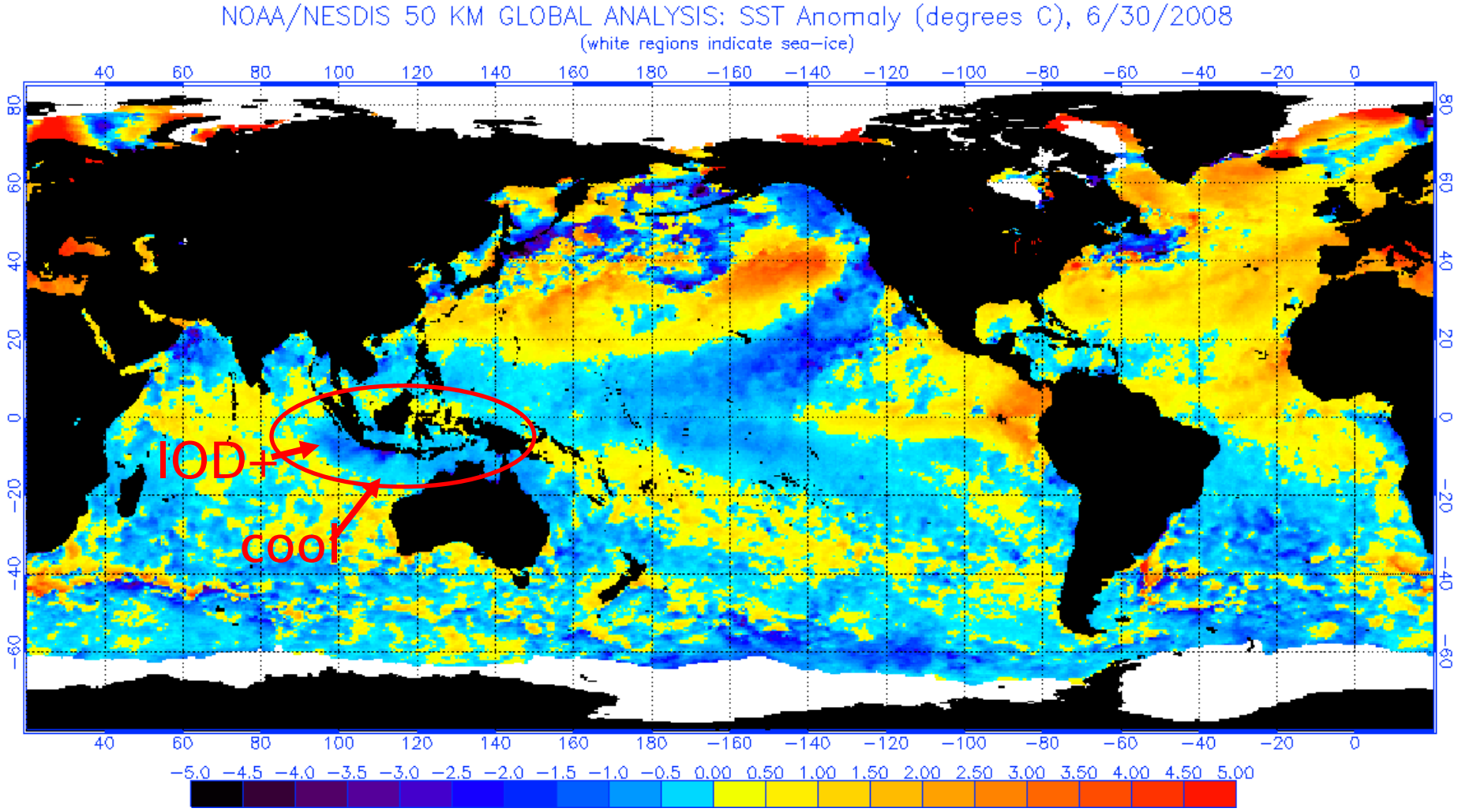
Most likely direct driver of drying in SE Australia and is consistent with greenhouse projections, but may have other causes.


Intensity of the STR and Global Warming
(11-years running means)
Pressure in hPa
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
Degree (in Celsius)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
1890
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Central Year
STR Intensity annual mean
Global Annual Temperature

Declining influence of tropical ocean temperatures north west of Australia recently (also happened in 1930's)

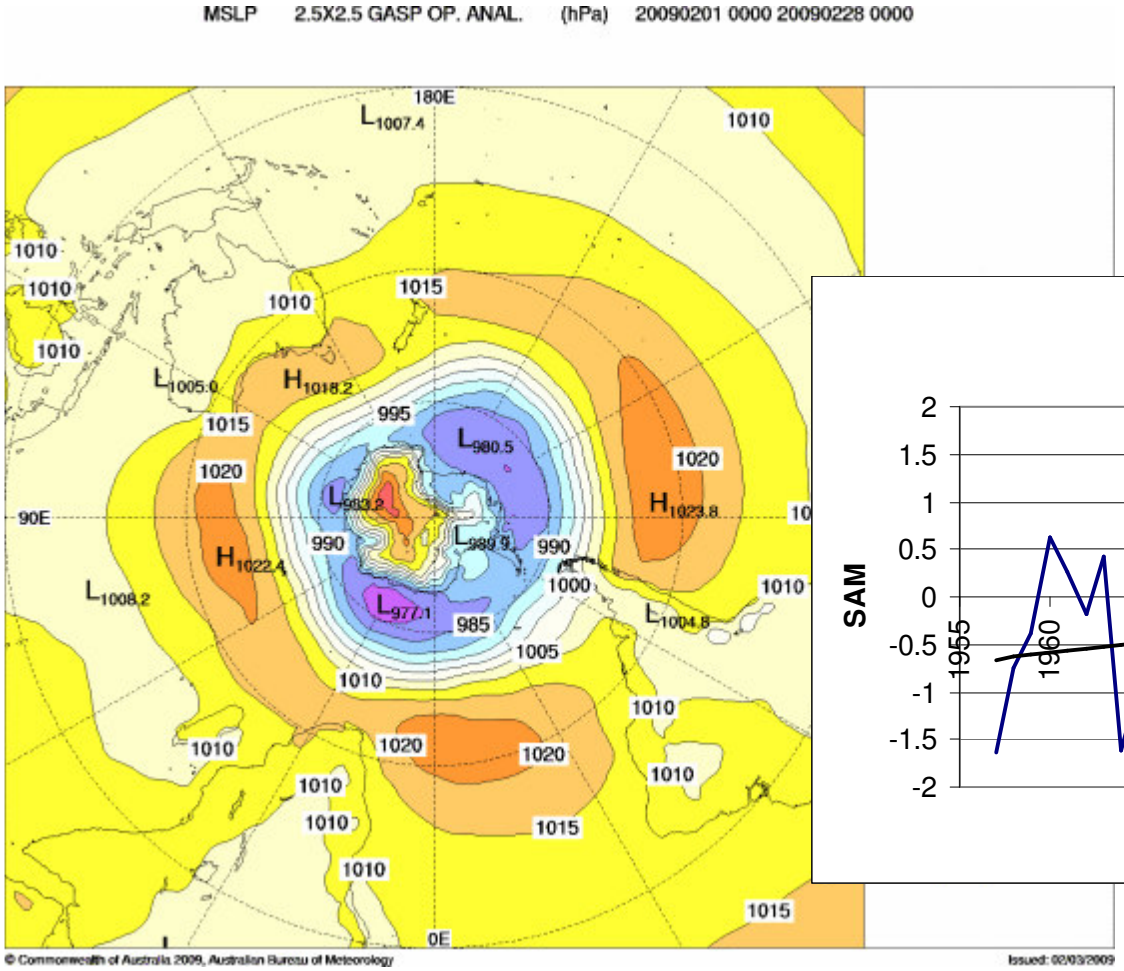
This decreased tropical connection has possibly reduced a major source of moisture for Victoria and less rainfall in cut-off low events. More Indian Ocean Dipole Positives

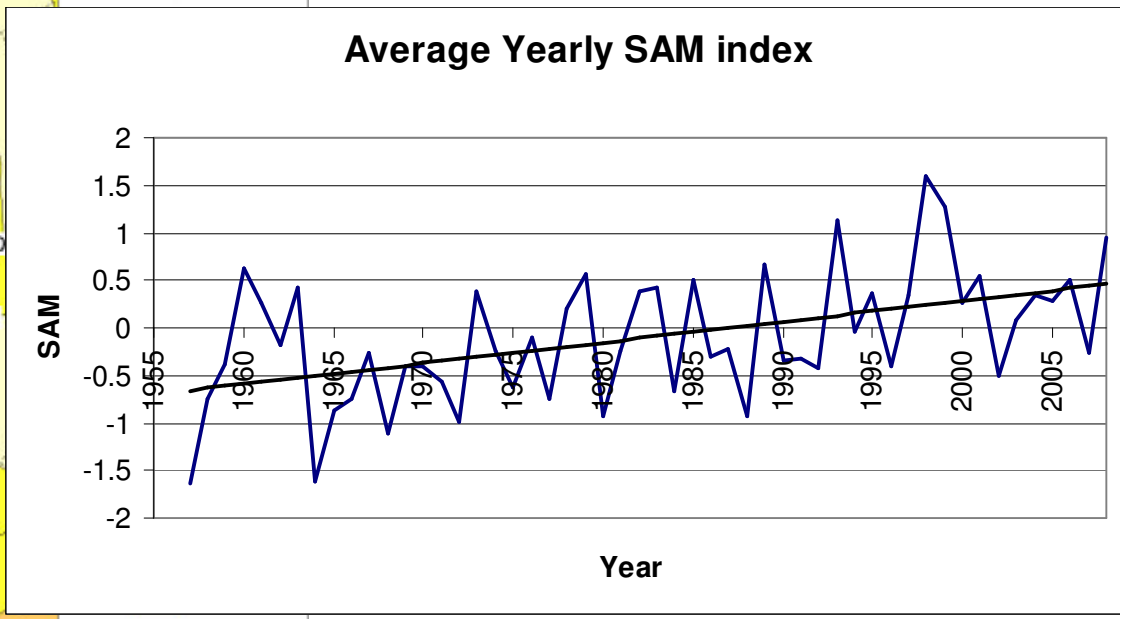
June 30th 2008



Trend in the Southern Annular Mode

The hemispheric southward retreat of the westerlies (also projected by climate models) may play a role in Victorian rainfall decline, particularly in the southwest.

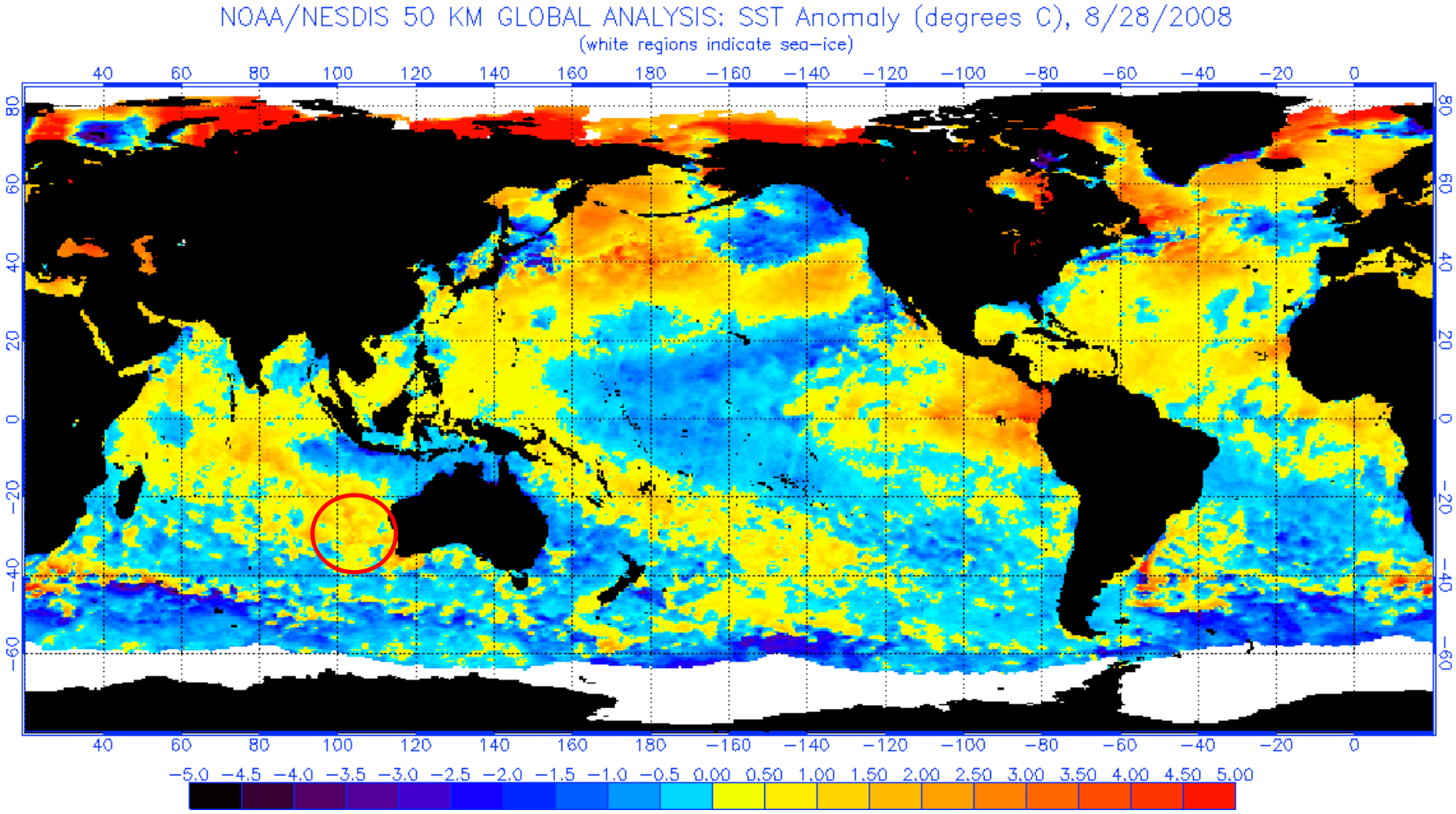




Warming in the southern Indian Ocean

This has reduced the sea surface temperature gradient between the sub-tropics and mid-latitudes, and is related to a weakening of low pressure systems over Victoria.

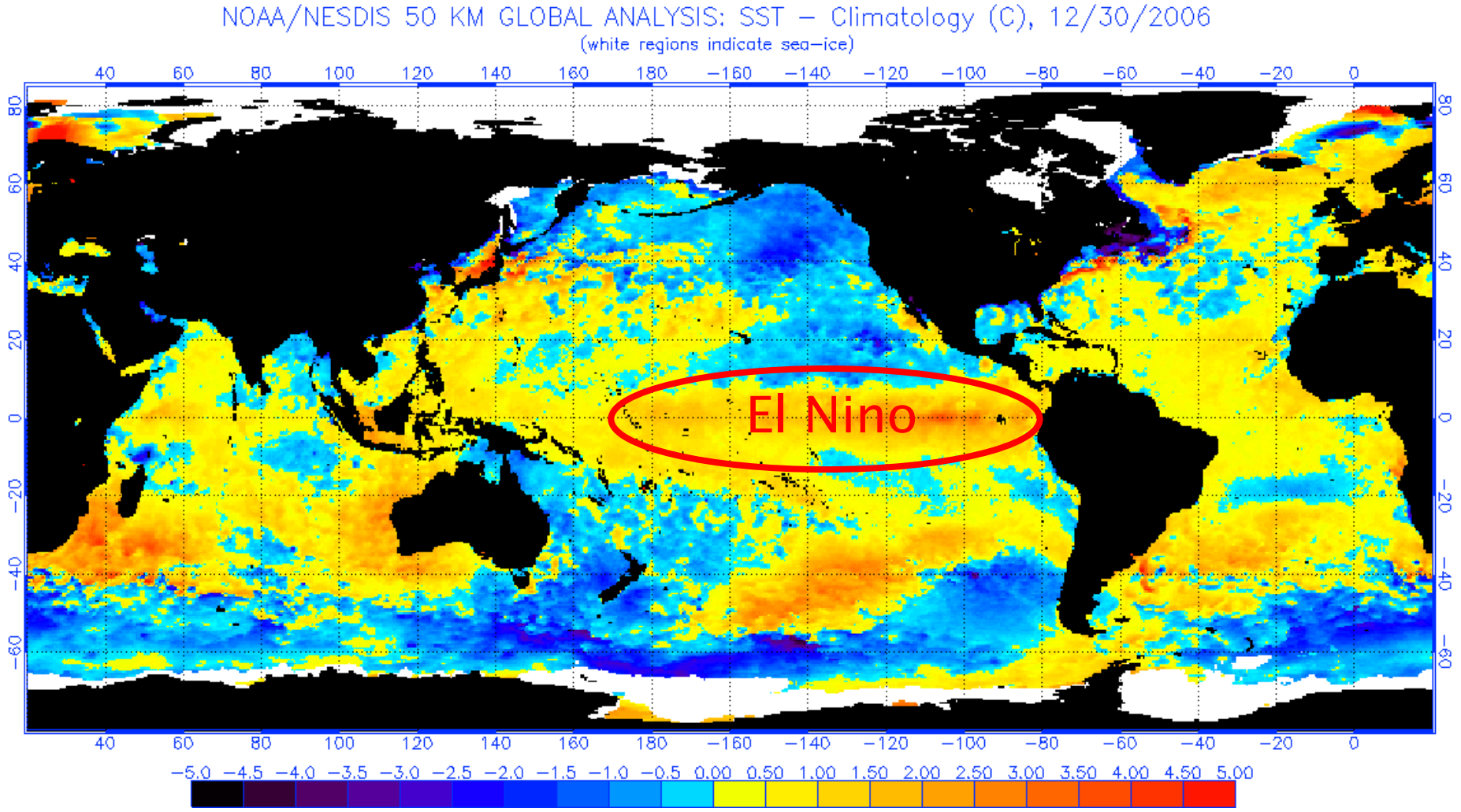
August 28th 2008



More El Niños since 1975, fewer transitions to La Niñas

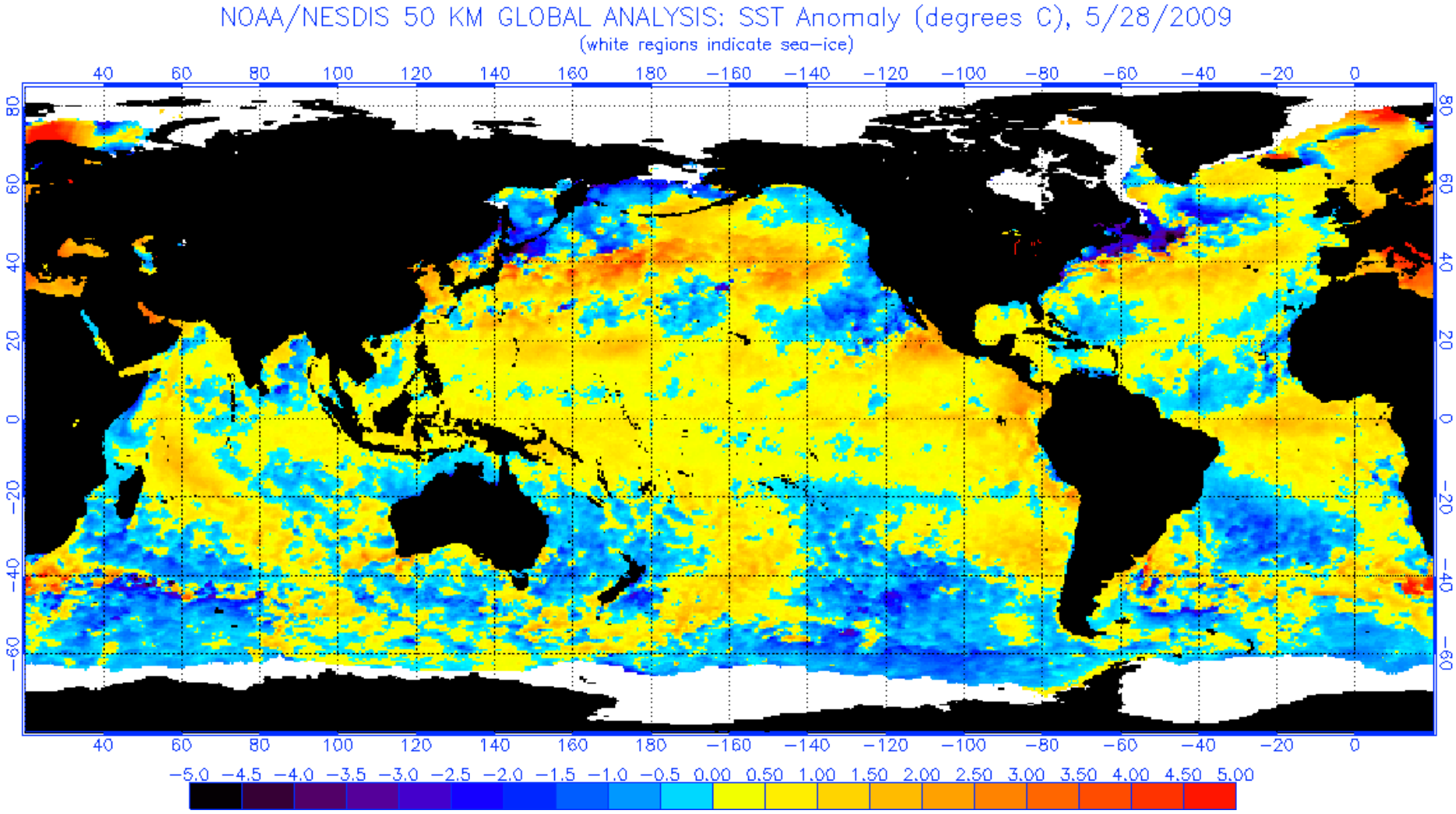
However ENSO link to Victorian rainfall has been weakening in recent years. ie La Niñas coming too late for us.

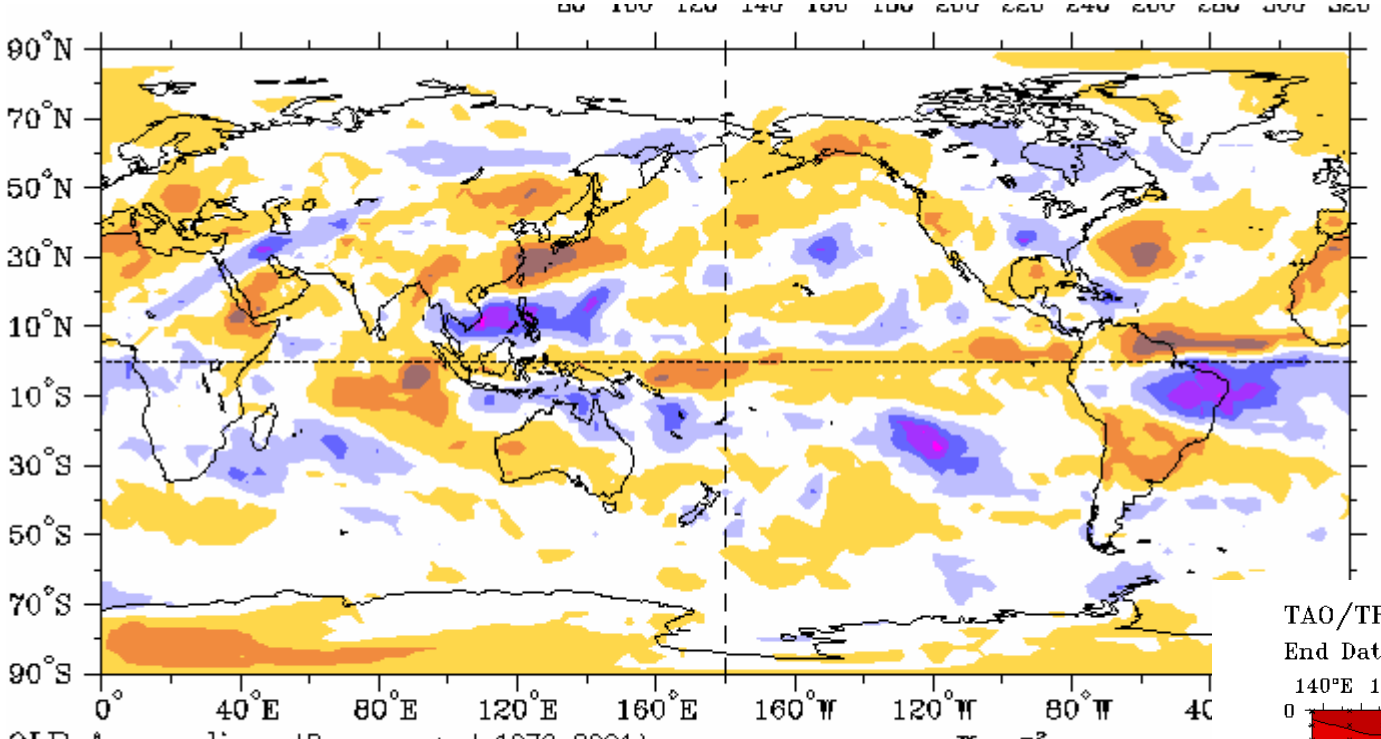
December 2006

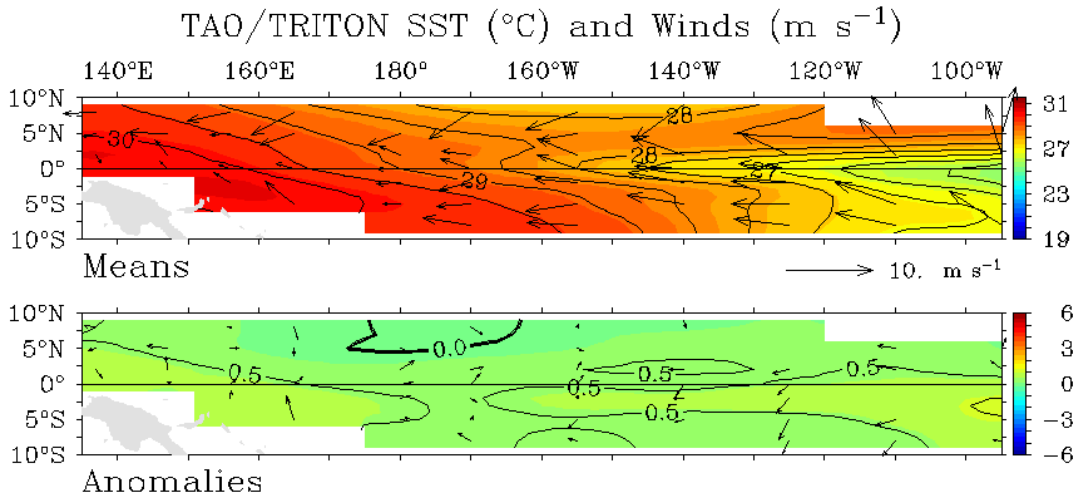


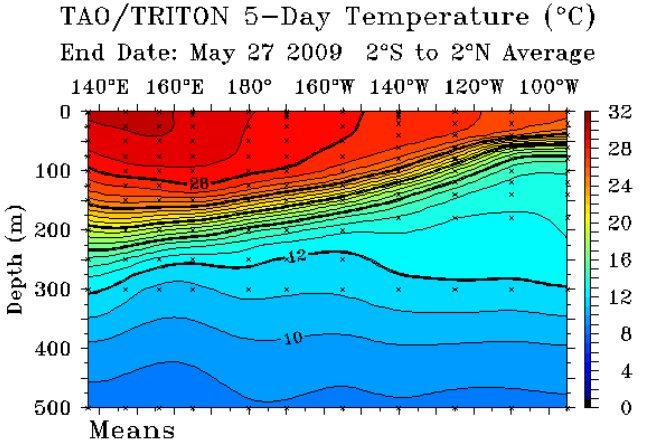

Thankyou

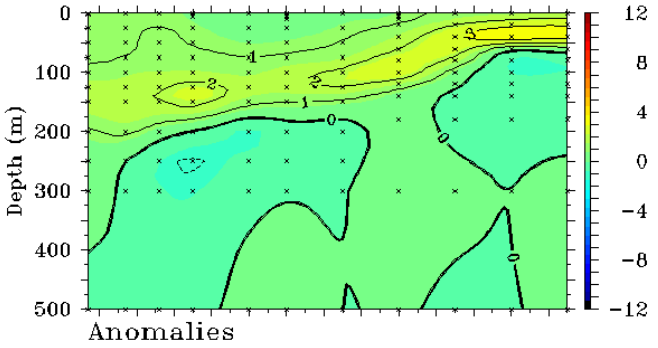
May 28th 2009











TAO Project Office/PMEL/NOAA

May 28 2009