

**SRDC Research Project
Final Report
CSE009 Appendices**

APPENDIX 1: BACKGROUND ON SEASONAL CLIMATE FORECASTING – PART 2.....2

APPENDIX 1: BACKGROUND ON SEASONAL CLIMATE FORECASTING**Part 2**

Yvette Everingham

Appendix A: PowerPoint slide for Plane Creek Cell Groups – Presented by Sarah Jones-Trifelly



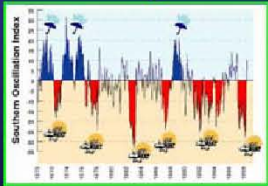
Seasonal Climate Forecasting

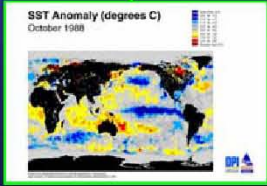
*Helping Industry Make Better Decisions
More Often !*

???

- Climate forecasting tells about the chance of rain over the next
 - a) day or two
 - b) week
 - c) months
 - d) years

Climate Forecasting Tools of Trade






Climate Forecasting Tools of Trade


- Southern Oscillation Index (SOI)
 - what is the SOI?
 - SOI phases
 - how do we use SOI phases to forecast rainfall?
- Sea Surface Temperatures (SSTs)
 - El Nino
 - La Nina



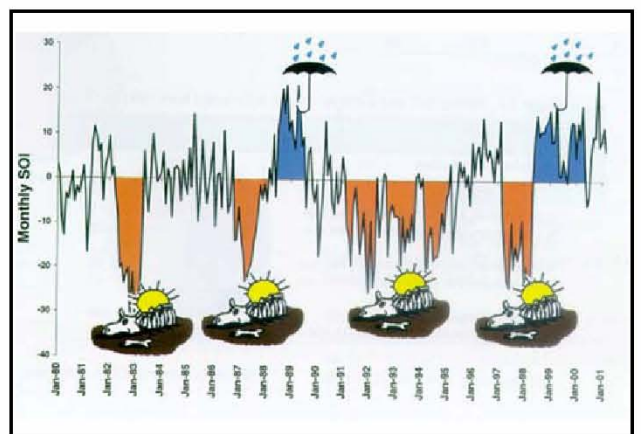
SOI: Zero

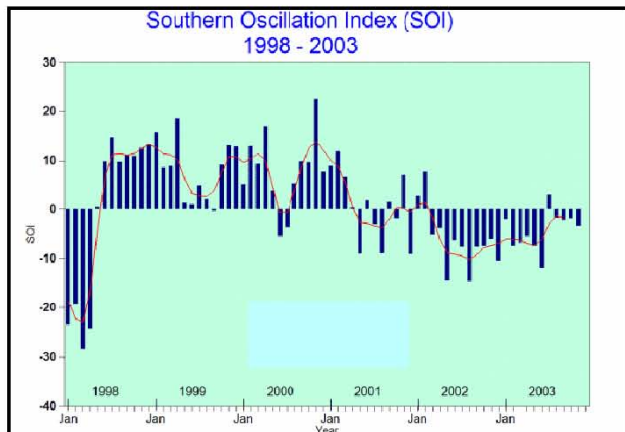


SOI: Negative



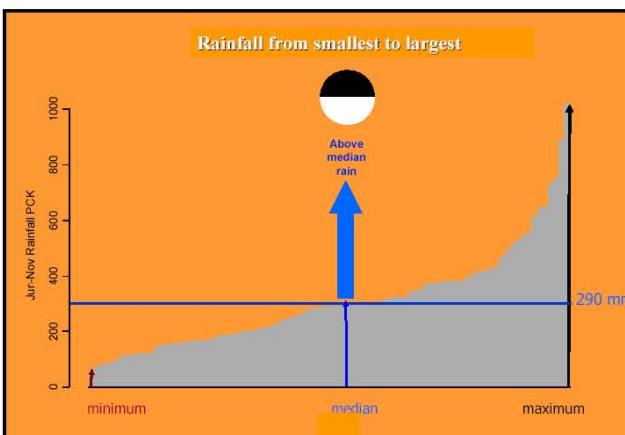
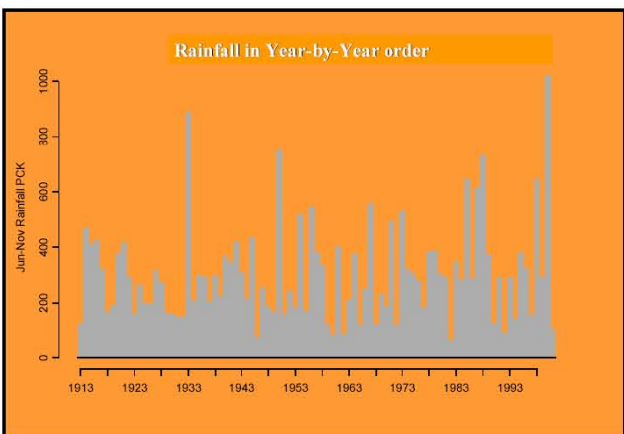
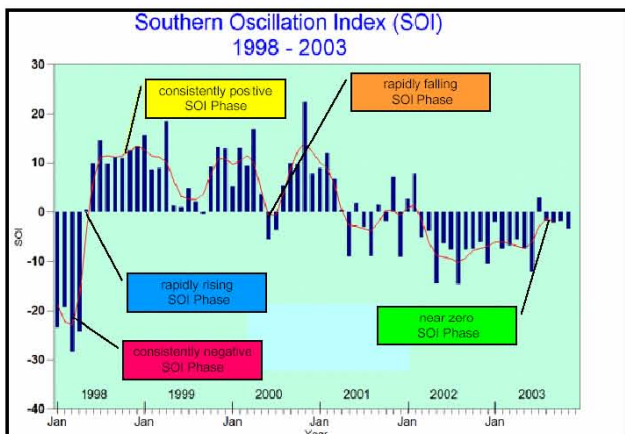
SOI: Positive





■ **SOI Phases**

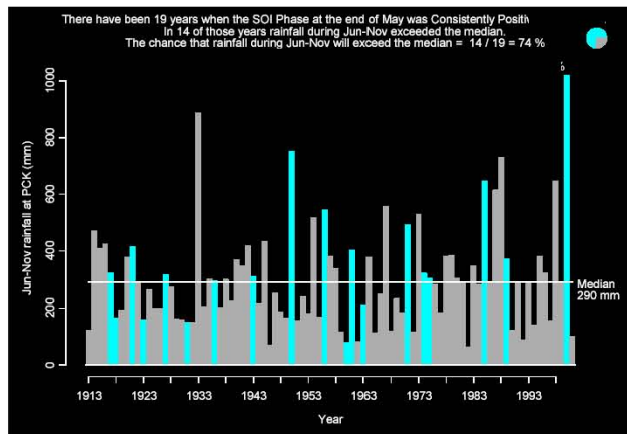
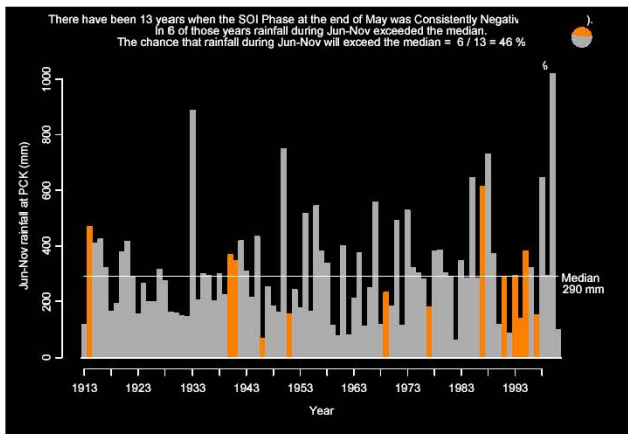
- Consistently negative
- Consistently positive
- Rapidly falling
- Rapidly rising
- Near zero



Understanding Probabilities

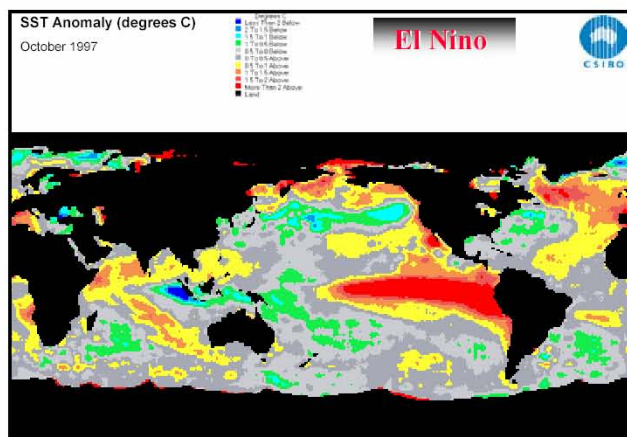
PROBABILITY	WHAT CHANCE?
100%	"dead cert"
85	bloody good
65	good
50	evens
35	poor
15	lousy
0%	Buckley's

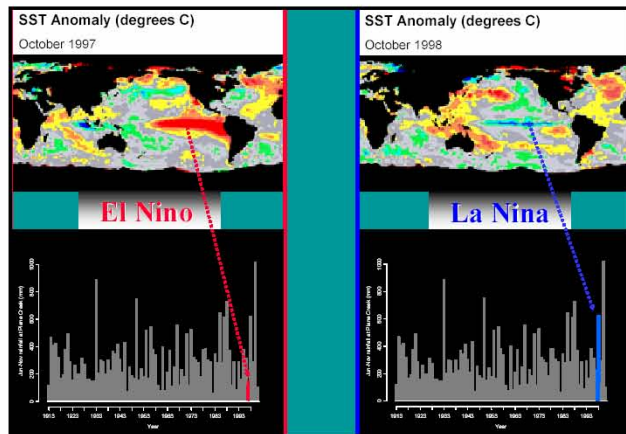
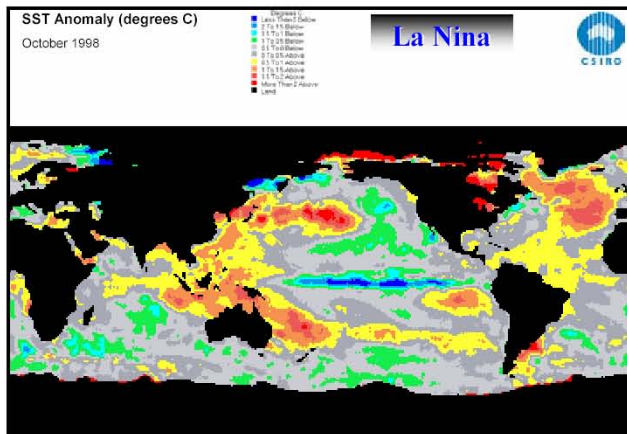
Queensland Centre for Climate Applications 1998
CCT 28.98



Climate Forecasting Tools of Trade

- Southern Oscillation Index (SOI)
 - what is the SOI?
 - SOI phases
 - how do we use SOI phases to forecast rainfall?
- Sea Surface Temperatures (SSTs)
 - El Nino
 - La Nina





Appendix B: NSW PowerPoint prepared for NSW extension staff to present at local meetings.



Seasonal Climate Forecasting

Helping industry make better decisions more often!

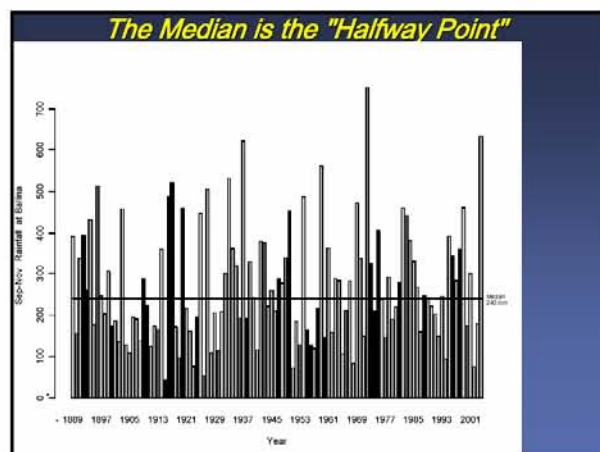
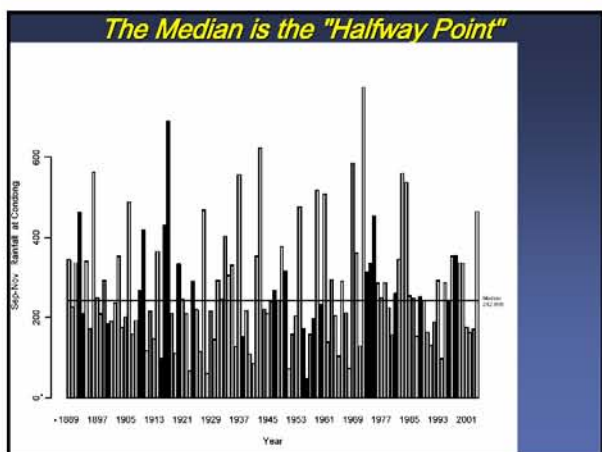
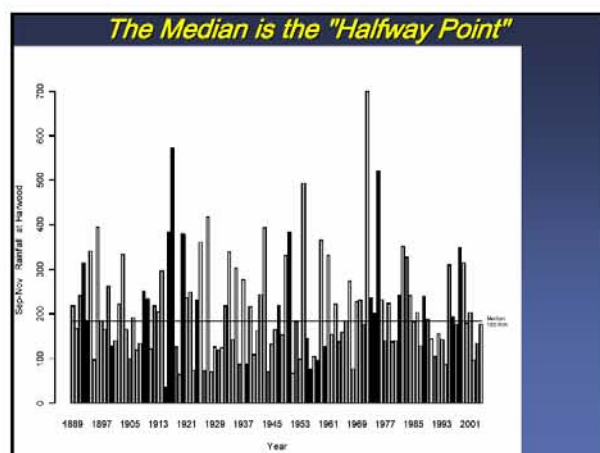
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Climate forecasting tells about the chance of rain over the next:

- a) day or two
- b) week
- c) months

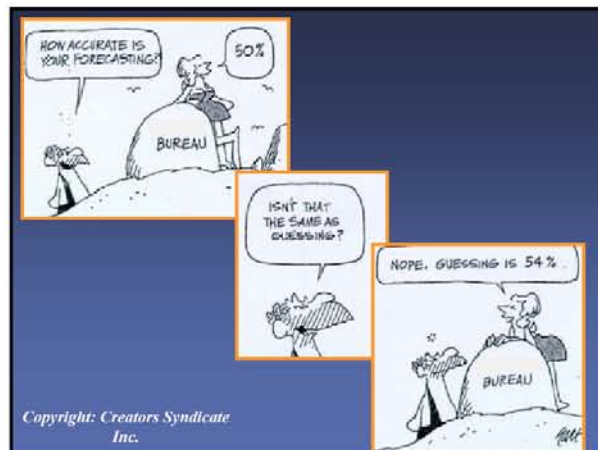
Climate Forecasting Jargon

- Median rainfall
- Chance
- SST/El Niño/La Niña
- SOI
- Autumn predictability barrier



Climate Forecasting Jargon

- Median rainfall
- **Chance**
- SST/El Niño/La Niña
- SOI
- Autumn predictability barrier



Median rainfall: how do the odd's stack up?

Bigger chance
>65ish %

Normal chance
close to 50%

Smaller chance
<35ish %

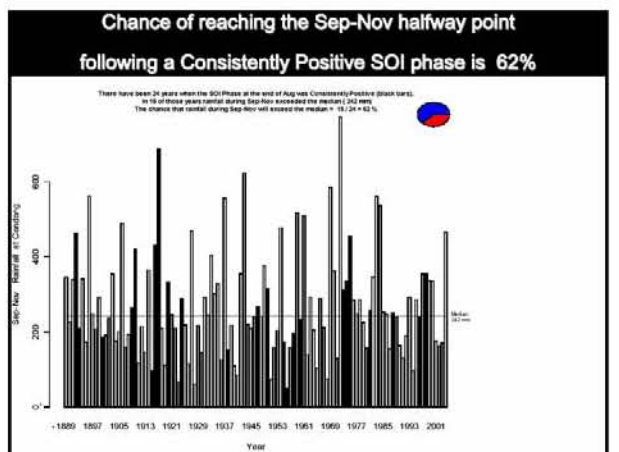
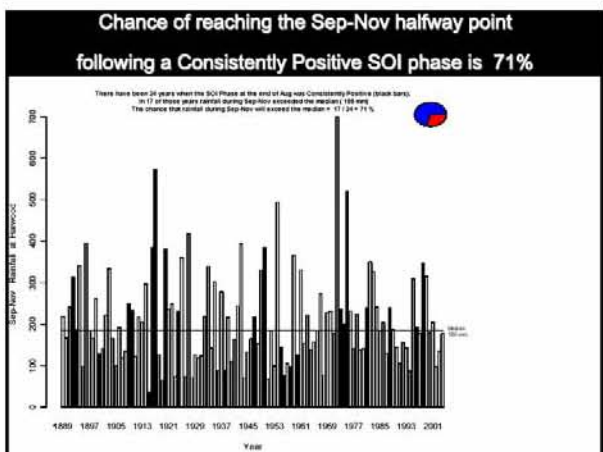
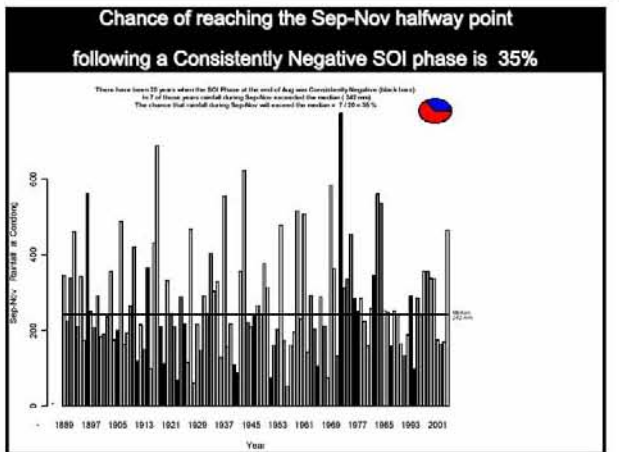
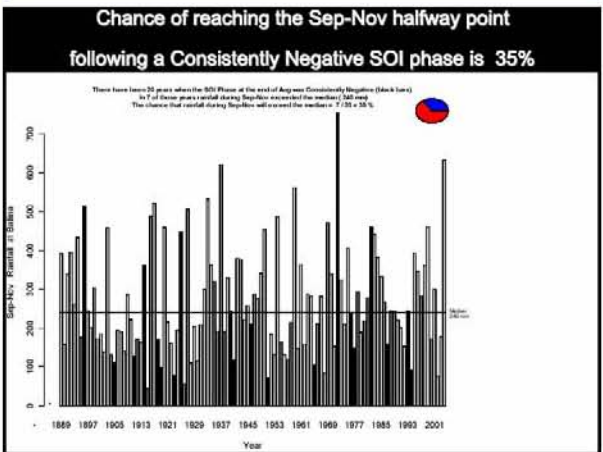
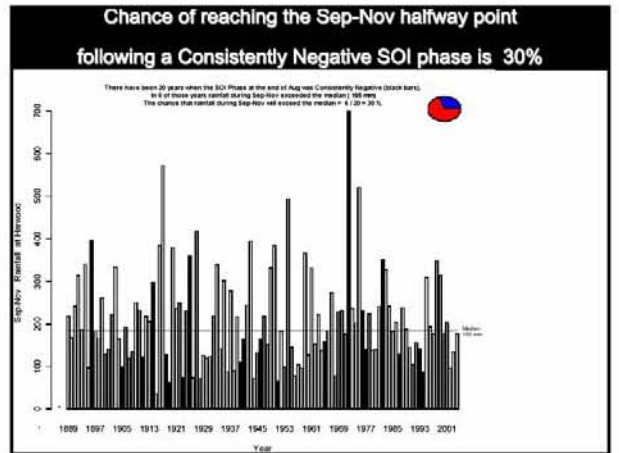
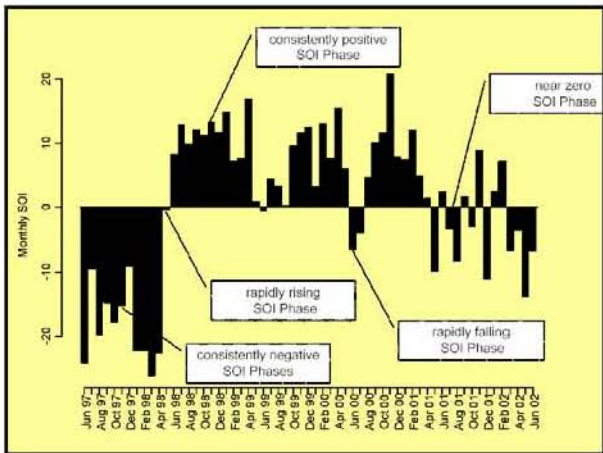
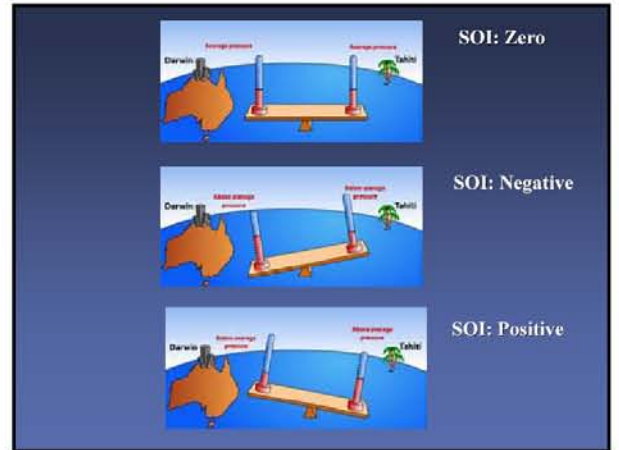
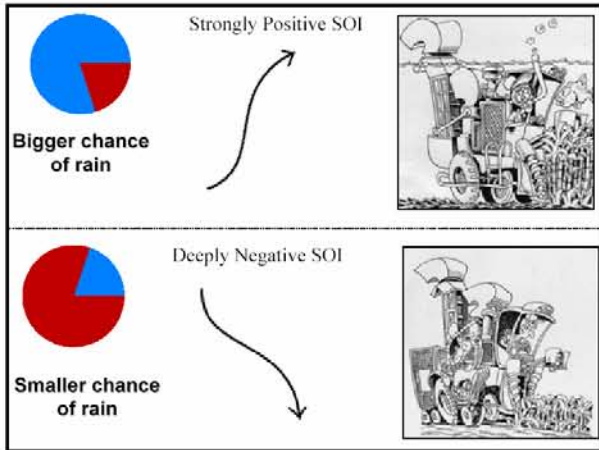
Climate Forecasting Jargon

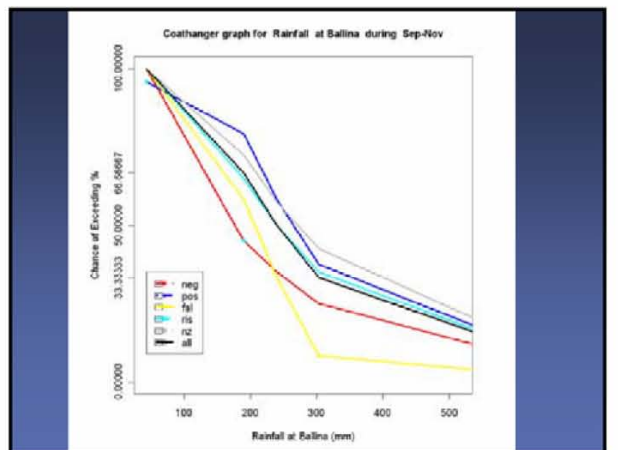
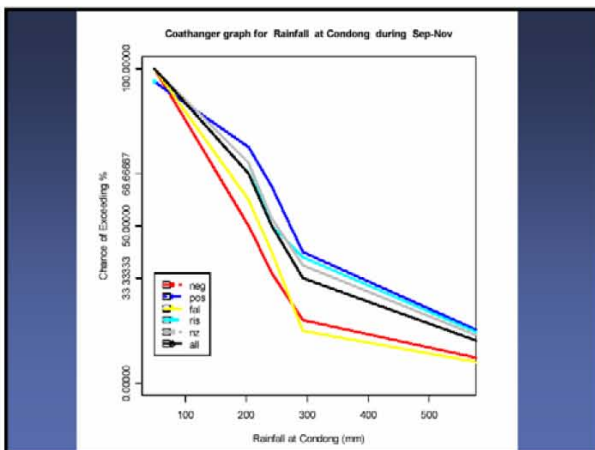
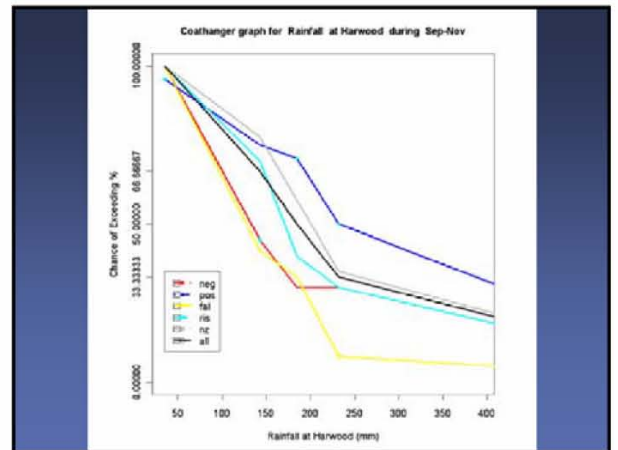
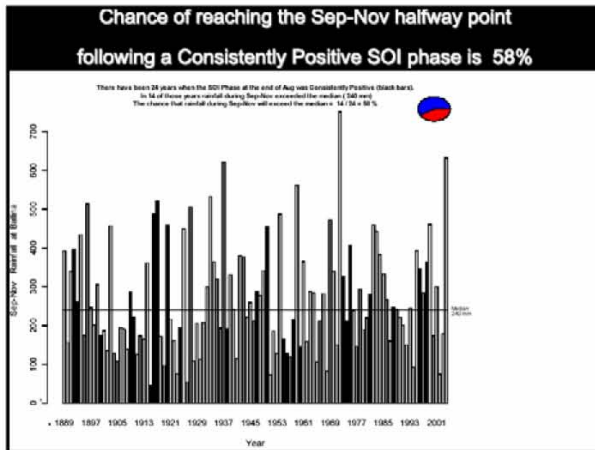
- Median rainfall
- Chance
- **SST/El Niño/La Niña**
- SOI

 Bigger chance of rain	<p>La Nina</p>	
 Smaller chance of rain	<p>El Nino</p>	

Climate Forecasting Jargon

- Median rainfall
- Chance
- SST/El Niño/La Niña
- **SOI**
- Autumn predictability barrier





- ### Autumn Predictability Barrier
- Climate forecasting methods lose accuracy during Autumn
 - Climate signals (eg SST, SOI) can quickly change in Autumn
 - Need to update regularly during Autumn, the signal emerging at the end of Autumn can often last until the following Autumn
 - The climate year runs closer to the financial year than the calendar year

Grower's Action – Darren Reinaudo 22 April 2002

- Climate in transitional stage so I keep a watchful eye on the climate updates
- I take special interest in the sea surface temperatures (SST) particularly in the Nino 3 region.
- There is currently some indications of warming in the Nino 3 region which hints at a possible El Niño pattern developing
- Replant would be kept to a minimum
- Harvest drier areas earlier, even if CCS maybe effected.
- We don't run the farm based solely on climate forecasts, it's just another tool to consider when making decisions.

Grower's Action – Jeff Cantamessa

Sugarcane growers lead field in climate data

By RACHEL BOWMAN

With the storm which is seen that predicted during the summer, we've got a plan. We've been expecting a high probability of rain and planting high risk crops in a furrow instead of a traditional furrow.

Climate forecasting information was used during the 2000 planting season. Forecasters predicted a high probability of rain. Unconventionally planted 50h on a ridge instead of a traditional furrow.

Cantamessa was able to establish a crop on that country for the first time in three years. Saved \$80000 by not having to replant.

In the 2001 planting season the climate forecast said there was a probability it would be dry.

Planted into a furrow to conserve soil moisture.

Grower's Action – Geoff Morley

Sugarcane growers lead field in climate data

By RACHEL BOWMAN

The forecast for June-July was a 20% chance of reaching median rainfall. Odds favoured not reaching the half-way point.

We decided to plant.

A week after we planted it rained for 21 days in June.

"We were victims of the 20% chance"

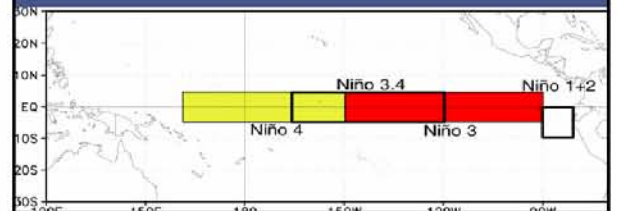
Aim confident it can also work in our favour.

Frequently Asked Questions

- How accurate are your forecasts?
- The amount of rain I get on my farm, differs from my neighbour...
- What about climate change...

How to interpret Seasonal Climate Forecasts

- Is the central-equatorial Pacific (eg Niño 3.4 region) warmer or cooler than average?
 - warmer: can point to El Niño type conditions
 - cooler: can point to La Niña type conditions



How to interpret Seasonal Climate Forecasts

- What is the value/phase of the SOI?
 - Deeply negative SOI values tend to coincide with El Niño type years
 - Strongly positive SOI values tend to coincide with La Niña type years

How to interpret Seasonal Climate Forecasts

- What is the chance of rain?
 - is the chance bigger or smaller than normal

Appendix C: Tully Media Kit

1: Introduction to Climate Forecasts

Climate forecasts – what are they about?

Unlike weather forecasts which tell us about the chance of rain over the next day or two, climate forecasts tell us the chance of rain in the future. For example, climate forecasts can indicate if the coming harvest is likely to be wetter or drier than normal, or if winter rain is likely to be above or below average.

Why consider climate forecasts?

Many decisions made by farmers, harvesters and millers are impacted by climate. Insight into if the coming months are likely to be drier (or wetter) than normal can help sugar industry members better plan for the future. For example, if the forecast was to indicate a wetter end of harvest, harvesting operations earlier in the season could be carried out with greater urgency.

What is the limitation of climate forecasts?

It is essential to remember that when we interpret climate forecast information, we are dealing with the element of chance. No climate forecast system is perfect but we can still use forecast information to help the chances work in our favour.

How are climate forecasts issued?

Climate forecasts can be presented as the chance of exceeding median rainfall over a 3 monthly period. For example, the median amount of rainfall for Tully Sugar Mill for September-November, is 333 mm. We calculate this by arranging the total September to November rainfall records from lowest to highest, the year standing in the middle is called the median, and in this case the median is 333 mm. Therefore, the normal chance of reaching median rainfall (333 mm) is 50%. As a matter of interest, in 1998 climate forecasts showed an 80% chance of reaching median rainfall for this period. The 80% chance was much higher than normal. That year eventuated to be quite a wet year to say the least.

What do we use to generate climate forecasts?

A number of different tools are used around the world to produce climate forecasts. For the Tully sugar growing region, we find that the Southern Oscillation Index (SOI) and Sea Surface Temperatures (SST) provide a good basis for climate forecasting. Future articles will explain in greater detail how climate forecasts are produced.

2: The Southern Oscillation Index (SOI)

The SOI can be used to forecast the chance of rainfall. The Southern Oscillation Index (SOI) measures the “see-sawing” effect in air pressure between Tahiti and Darwin. When the air pressure at Tahiti is above average, and the air pressure at Darwin is below average, as depicted in Figure 1, the SOI will be positive. When the SOI is positive the tradewinds are strengthened. When the air pressure for both Tahiti and Darwin is close to average, the SOI will be close to zero and the “see-saw” will be balanced. When the air pressure at Tahiti is below average and the air pressure at Darwin is higher than average the SOI will be negative and the “see-saw” will be slanted in the opposite direction from Figure 1. When the SOI is negative the tradewinds are weakened. The SOI usually ranges between – 30 and +30. Figure 2 takes a snapshot of the SOI during the years 1998 to 2003. Notice the positive SOI values for the wetter years 1998, 1999 and 2000. Conversely, notice how the negative SOI values have coincided with drier years like 2001 and 2002.

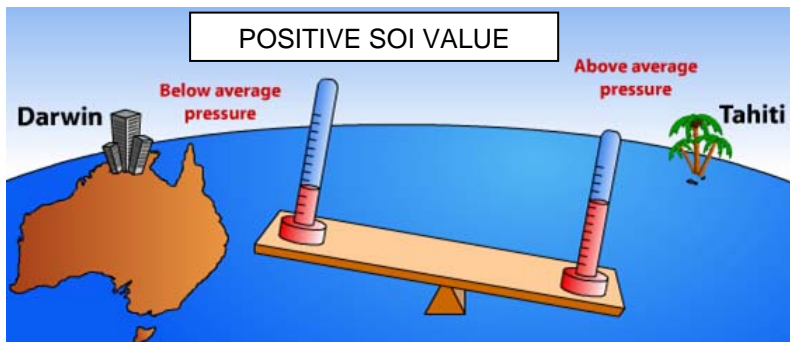


Figure 1: When the air pressure at Tahiti is above average, and the air pressure at Darwin is below average, the SOI will have a positive value.

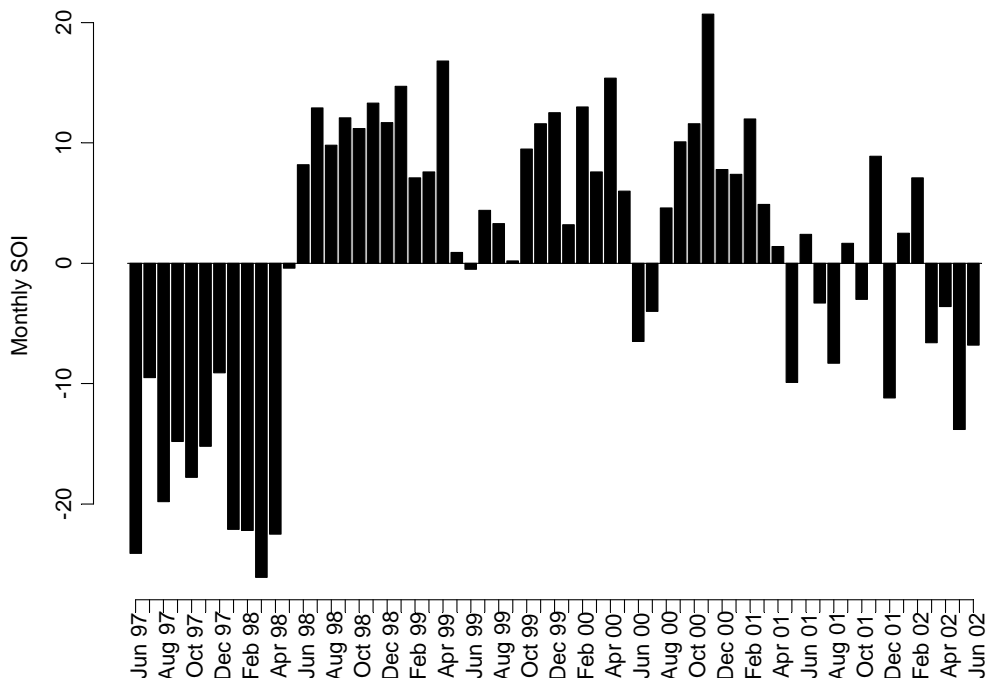


Figure 2: Monthly SOI values from June 1997 to June 2002.

What are SOI phases?

By comparing the average SOI for any month with the average SOI for the preceding month, it is possible to assign an SOI phase to every month. There are 5 SOI phases:

1. Consistently negative: the SOI maintains a very negative value from one month to the next.
2. Consistently positive: the SOI maintains a high positive value from one month to the next.
3. Rapidly falling: the SOI from one month to the next month decreases sharply
4. Rapidly rising: the SOI from one month to the next month increases sharply
5. Near zero: the SOI stays relatively close to zero over successive months.

Figure 3 shows examples of each of the phases. To find out the current SOI phase, please visit <http://www.longpaddock.qld.gov.au/SeasonalClimateOutlook/SouthernOscillationIndex/SOIGraph/index.html>

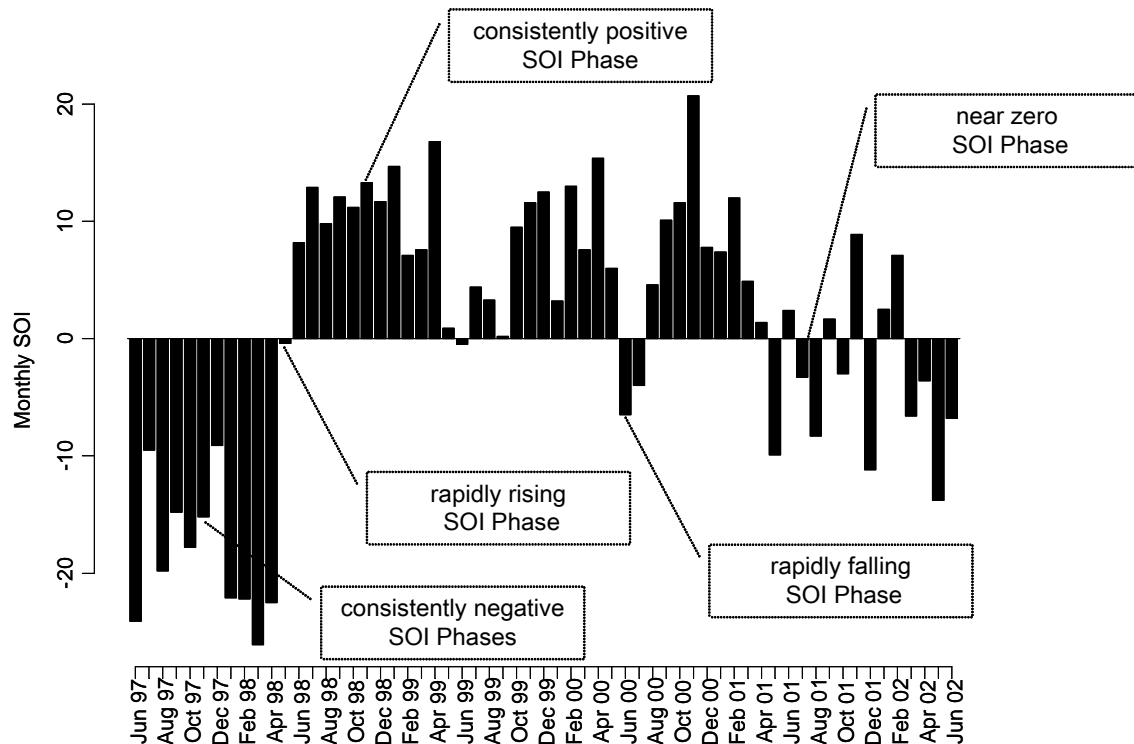


Figure 3: SOI phases. Consistently negative SOI phases were predominant during the later half and first part of 1998. Following a rapidly rising SOI phase in May 1998, a pattern of consistently positive SOI phases emerged. A rapidly falling SOI phase was experienced during June 2000 and there have been several near zero SOI phases, like that in July 2001.

3: Using the SOI Phases to Forecast Rainfall

Although there are some exceptions to the rule especially around Autumn, negative SOI values favour drier periods and positive SOI values favour wetter periods. Whilst a rough rule like this is helpful, we can actually work out the chance of rain more accurately. To do this we use the SOI phases. Recall, there are five SOI phases:

1. Consistently negative: the SOI maintains a low negative value from one month to the next.
2. Consistently positive: the SOI maintains a high positive value from one month to the next.
3. Rapidly falling: the SOI from one month to the next month decreases sharply
4. Rapidly rising: the SOI from one month to the next month increases sharply
5. Near zero: the SOI stays relatively close to zero over successive months.

Every month since rainfall records commenced at Tully sugar mill (1926) can be classified as one of these phases. The black bars in Figure 1 highlight the years when the July SOI phase was consistently negative. There were 11 years in total:

1940 1941 1946 1972 1977 1982 1987 1992 1993 1994 1997

Of these 11 years, only two years exceeded the median amount of rainfall for August-October (approx. 300 mm). These years were 1982 and 1993. Therefore, the chance of reaching median rainfall during August-October following a consistently negative July SOI phase is 18% (i.e. 2 divided by 11 multiplied by 100). We know the normal chance of reaching median rainfall is 50%. So, the 18% chance indicates the probability of reaching median rainfall is much less than normal. Figure 2 shows that the chance of reaching median rainfall for August-October following a consistently positive July SOI phase is 71% (i.e. 12 of the black bars exceed the median out of a total of 17 black bars, therefore 12 divided by 17 multiplied by 100 = 71%) - much higher than normal.

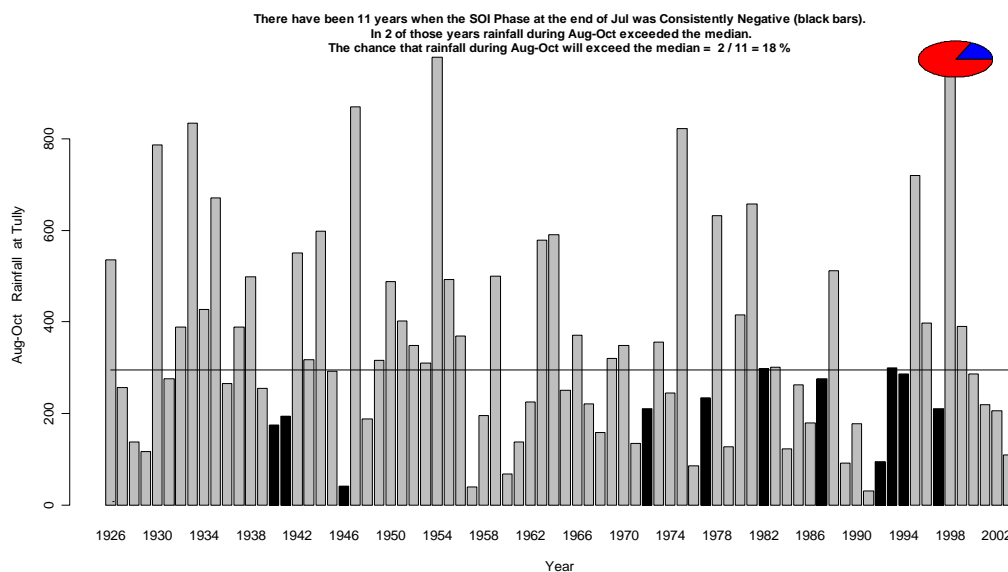


Figure 1: A demonstration of how total rainfall in August-October varies across years. Shaded in black are years when the July SOI phase was consistently negative. The 18% shading in the wheel chart reflects the lower than normal chance of reaching median rainfall (approximately 300mm) following a consistently negative July SOI phase.

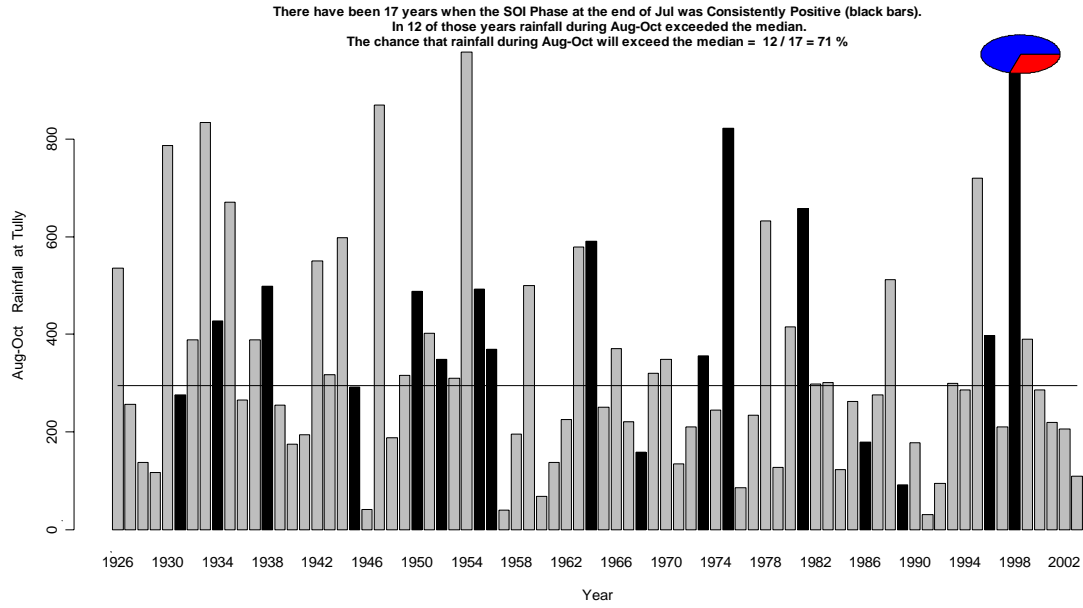


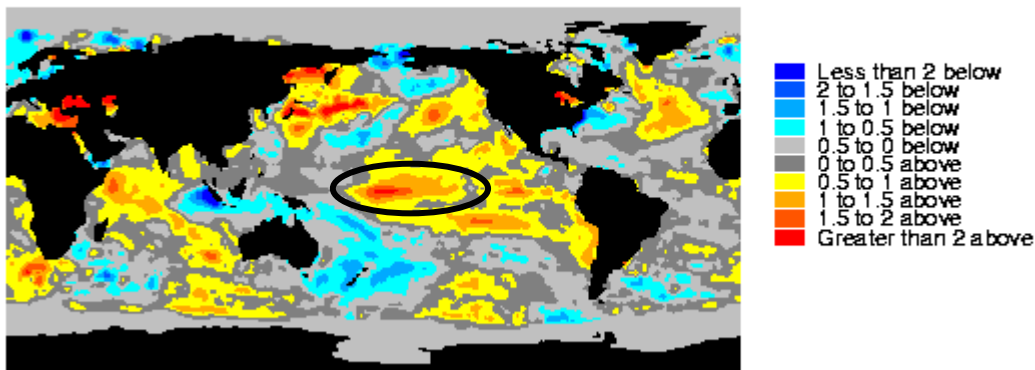
Figure 2: A demonstration of how total rainfall in August-October varies across years and between years with a consistently positive July SOI phase. The 71% shading in the wheel chart reflects the higher than normal chance of reaching median rainfall (approximately 300mm).

4: El Niño versus La Niña

Many canegrowers will have heard of the words 'El Niño' and 'La Niña', but what do these words really mean? In a nutshell, these words basically describe how hot or how cool sea surface temperatures (SSTs) are in a patch of the Pacific Ocean. This patch lies around the equator near the centre of the Pacific Ocean. This patch is circled in Figures 1 and 2. The patch circled in Figure 1 shows that SSTs in October 1994 were one to two degrees warmer than normal for this time of year. Since sea temperatures are warmer than normal in the circled patch, Figure 1 shows an El Niño SST pattern. Conversely, because sea temperatures are cooler than normal in the central equatorial Pacific, Figure 2 shows a La Niña SST pattern. In classical years, El Niño SST patterns will be complemented by deeply negative SOI values and La Niña years will coincide with strongly positive SOI values. Please visit

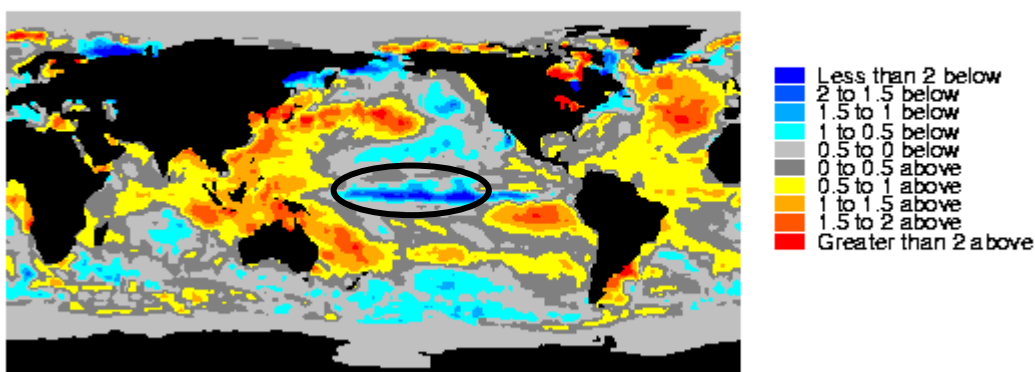
<http://www.longpaddock.qld.gov.au/SeasonalClimateOutlook/index.html> for a collection of SST maps.

Variation of Sea-surface Temperature from Average October 1994



www.LongPaddock.qld.gov.au

Variation of Sea-surface Temperature from Average October 1998



www.LongPaddock.qld.gov.au

5: How is rainfall impacted by El Niño and La Niña years?

Recall from the previous article that warmer sea surface temperatures in the central equatorial Pacific Ocean correspond to an El Niño pattern. Conversely cooler than normal waters in this region resemble a La Niña pattern. Negative SOI patterns are linked to El Niño years and positive SOI patterns are linked to La Niña years. It is interesting to compare how rainfall during the harvest season varies between El Niño and La Niña years. Figure 1 shows how rainfall during June to November has been distributed since 1970. The black bars represent El Niño years and the white bars correspond to La Niña years. Some years are neither El Niño nor La Niña. These “*El Normal*” years correspond to the grey bars! From historical rainfall records that commenced in 1926, we know that the long term median is 840 mm. We calculate this by arranging the rainfall records from lowest to highest, the year standing in the middle is called the median, and in this case the median is 840 mm. This is represented by the horizontal black line. There are a number of key learnings in Figure 1:

- Above median rainfall is more likely in La Niña years.
- Below median rainfall is more likely in El Niño years.
- But this is not always the case. There have been some El Niño years which have produced above median rainfall e.g. 1987. Similarly there have been some La Niña years like 1970, 1971 and 1974 which resulted in below median rainfall.
- There are a lot of years which are neither an El Niño nor a La Niña. The SOI phase climate forecasting system is especially useful in these years to give an indication of the chance of rainfall.

It is important to note that most El Niño and La Niña years run from Autumn in one year, to Autumn in the next year. For example what we are calling the 1997 El Niño in Figure 1 actually ran from Autumn 1997 to Autumn 1998. It was during Autumn 1998 that the 1998 La Niña pattern emerged.

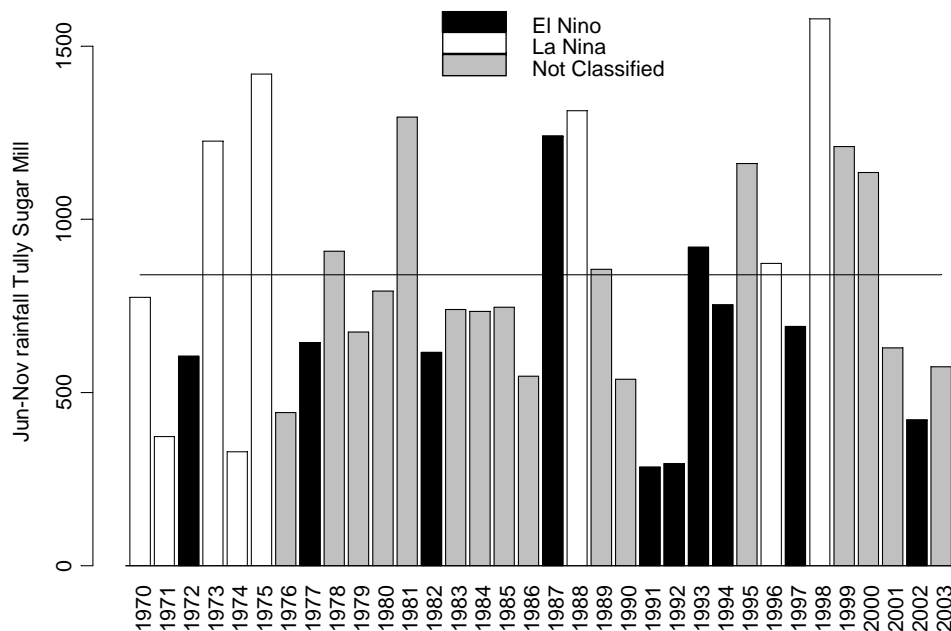


Figure 1: Harvest rainfall between the years 1973 and 2003.

Appendix D: General awareness raising article by Erich Hammer.

THE SOI AND YOU

By Erich Hammer

Have you ever wondered how the SOI (Southern Oscillation Index) affects you on your farm? Do you understand probabilities with regard to rainfall?

The SOI is basically the difference in barometric pressure at Tahiti and Darwin.

The best way to explain probabilities is by using the words of Dave McRae from his report in "The Long Paddock" (www.longpaddock.qld.gov.au) web site and I quote: -

"Understanding Probabilities Dave McRae 30/10/06

Given Australia's love of gambling be it on the dogs, ponies, sport or lotto it is interesting that many people are not comfortable with or do not understand probability based climate and weather forecasts. Although that may be the reason that we love gambling - we don't understand what probabilities or the chance of something occurring actually means.

When using a climate forecast you should remember that the probability or percent chance of something occurring is just that - a probability. For example if there is a 70% chance of recording more than 100 mm there is also a 30% chance of recording less than 100 mm i.e. 70-30; 30-70. It does not mean that you will get 70% more than 100 mm or 100 mm plus another 70%.

For example based on historical rainfall figures and a consistently negative SOI phase Clermont currently has a 30% chance of getting its long term October to December median rainfall of 170 mm. Therefore Clermont has a 70% chance of NOT getting its October to December median rainfall of 170 mm.

Another way of looking at this is that 3 times out of 10 historically with the current SOI phase Clermont has recorded above 170 mm during October to December. Therefore 7 times out of 10 historically Clermont has recorded below 170 mm during October to December.

When looking at the seasonal outlook for your area it may make it easier to think of rainfall probabilities in these terms. Probabilities above 80% equal a high chance, probabilities above 60% equal an above average chance, probabilities below 40%

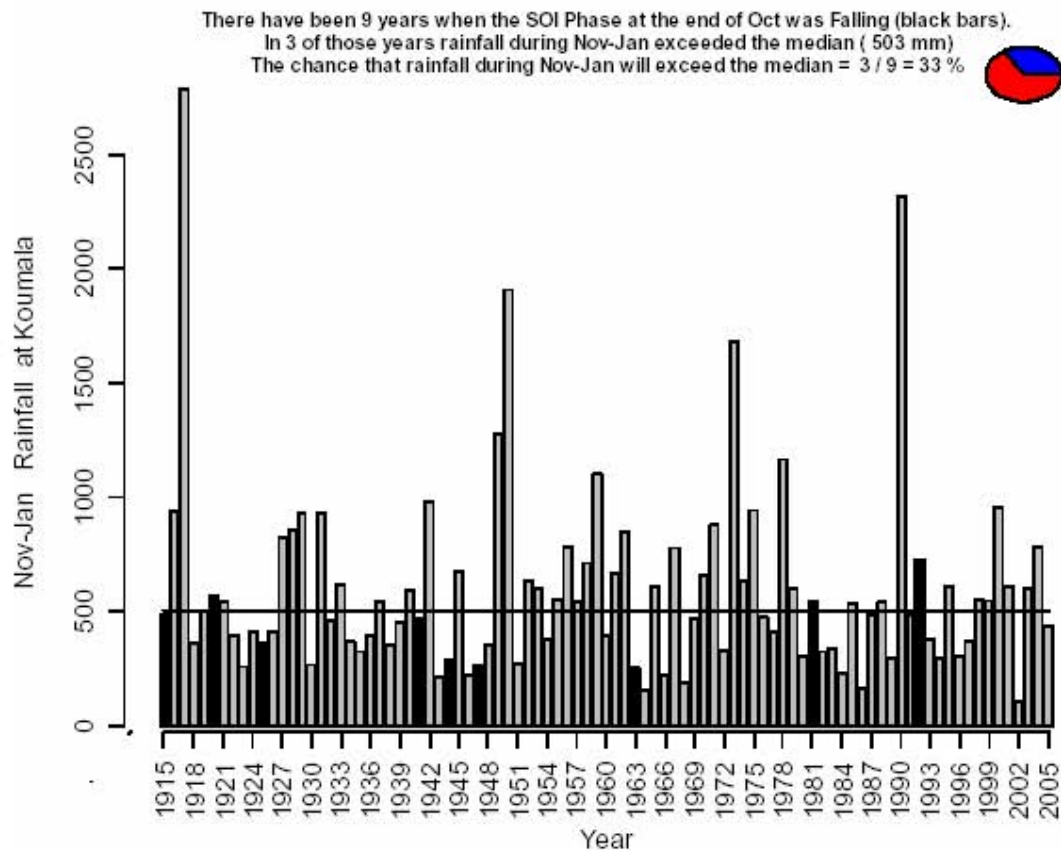
equal a below average chance and probabilities below 20% equal a very low chance of that occurring.”

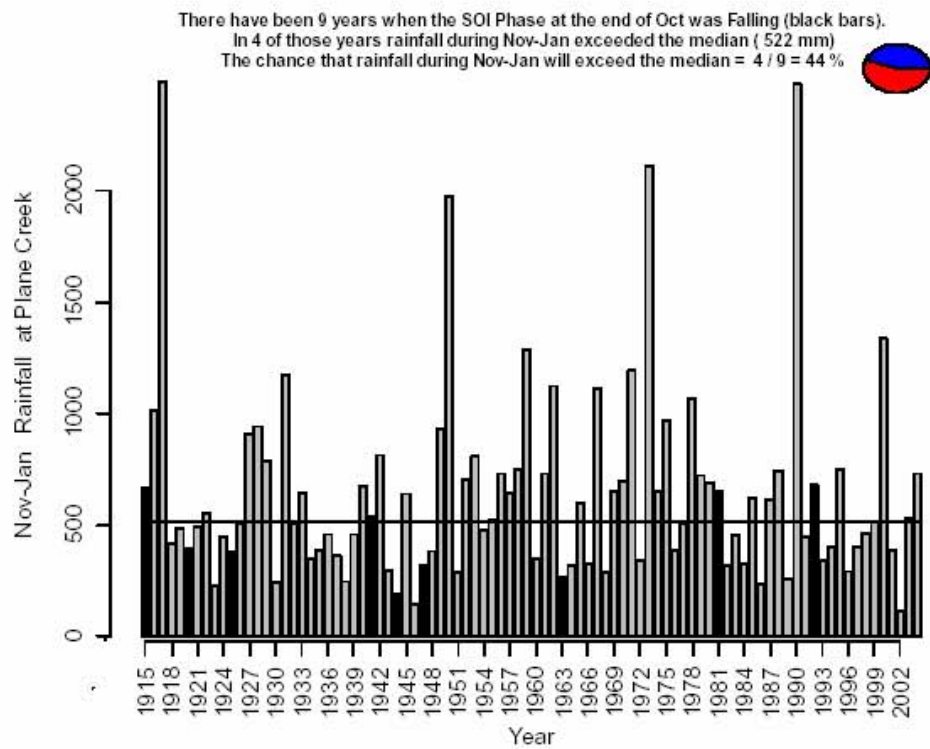
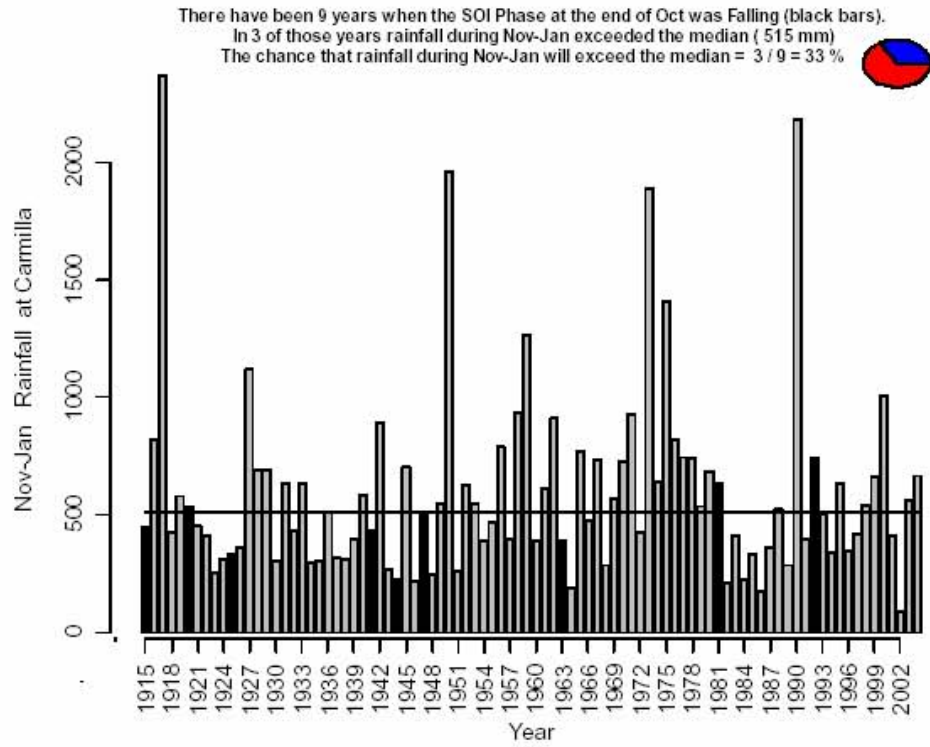
There are five phases of the SOI - 1. Consistently negative, 2. Consistently positive, 3. Rapidly falling, 4. Rapidly rising and 5. Consistently near zero.

How does this help me you may ask?

Yvette Everingham (JCU) and her team have developed a computer program called “North Qld Rain Forecaster” which is a tool that takes the historic rainfall figures for the three Plane Creek Mill areas (Plane Creek, Koumala and Carmila) and computes the rainfall probabilities given any of the five monthly SOI phases. The program was made with a lot of input from local farmers. The result is a graph showing rainfall probabilities for each area for the next three months. The horizontal line shows the median rainfall amount for this period. The chance of reaching median rainfall for Koumala, Carmila and Plane Creek is 33%, 33% and 44% respectively.

See below forecasts for Nov. - Jan.: -





If you would like these forecasts e-mailed to you on a monthly basis contact Erich Hammer at sonny10@bigpond.com and I will include you on our e-mail distribution list.