

A Decision Support System for drought monitoring and early warning in South-West Pacific

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Seasonal Climate Outlooks for Pacific Island Countries

Queensland the Smart State

www.bom.gov.au/climate/pi-cpp

scopic version 1


Decision support software providing seasonal climate outlooks for climate-sensitive industries in the Pacific Island Countries.

“...helping communities in the Cook Islands, Fiji, Kiribati, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.”

SCOPIC (Seasonal Climate Outlooks for Pacific Island Countries) has been developed as part of the AusAID-funded project “Enhanced Application of Climate Predictions in Pacific Island Countries”. The aim of this project is to enable Pacific Island National Meteorological Services to provide timely seasonal prediction services to people in climate sensitive industries. The project is implemented in the Cook Islands, Fiji, Kiribati, Niue, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.

Exploration


Highly graphical time-series and statistical analyses allow exploration of agri-climatic variables such as sea surface temperatures, Southern Oscillation indices, and rainfall. Analyses include scatter-plots and monthly/yearly summary statistics.



Time-series browsing and exploration.

Prediction

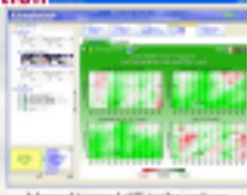
SCOPIC uses in-built discriminant-analysis algorithms to generate seasonal outlooks in above or below median formats. Results are presented graphically in the form of “chocolate wheels”, as well as in tabular and report formats.



Spatially weighted forecasts.

Evaluation


Temporal and spatial evaluation of forecasting skill is available through advanced skill-score and “hindcast” analyses. Skill can be assessed for different periods of the year and forecast lead-times. Individual “hindcast” results can be reviewed on a year-by-year basis.



Advanced temporal skill scoring analysis.

Reporting

Generate “rich-text” reports using pre-configured XSLT templates, customisable for each country. The reports provide a descriptive summary of the outlooks, and update automatically with program changes. The reports can then be edited, saved and printed.




Customisable rich-text reports (XSLT templates).



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“A collaborative project between the Queensland Climate Change Centre of Excellence and the Australian Bureau of Meteorology”



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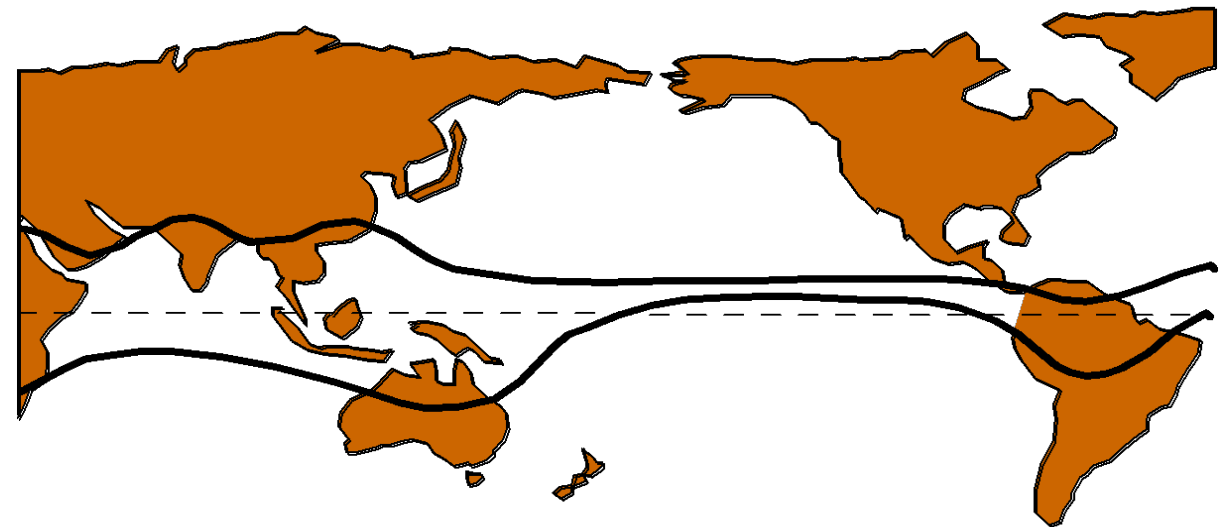
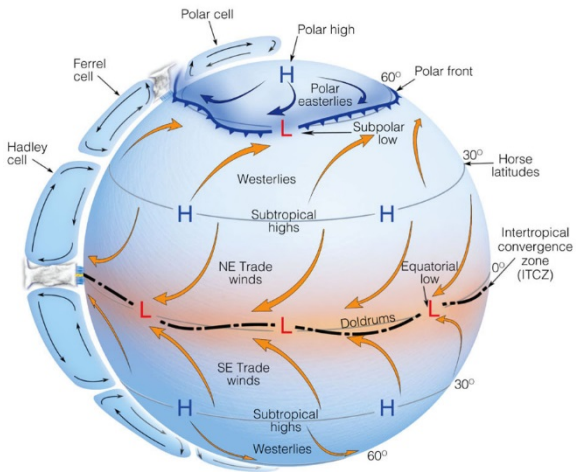


Australian Government
AusAID
Bureau of Meteorology

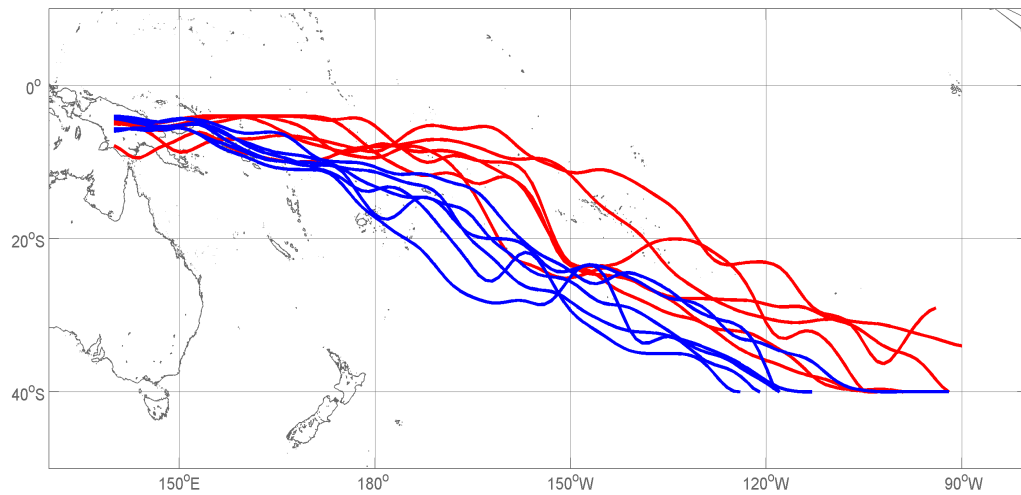


Queensland Government
Climate Change Centre of Excellence
Department of Natural Resources and Water

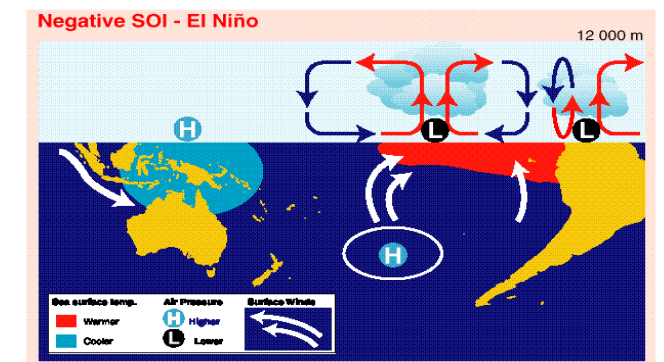
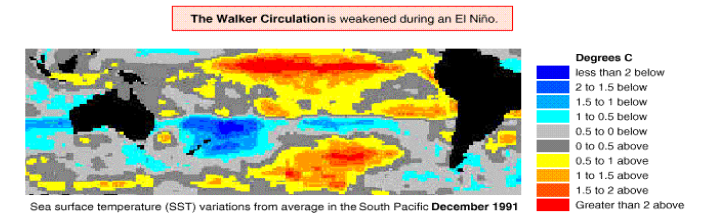
Drivers of climate in the Pacific



Average positions of the ITCZ during July and January



The Walker Circulation during an El Niño

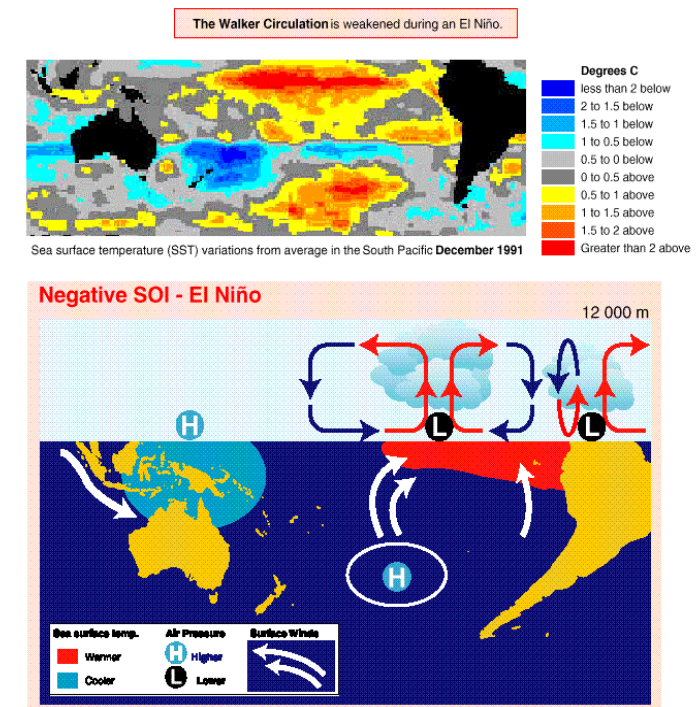


- **Madden-Julian Oscillation (MJO)**
- **El Niño Southern Oscillation (ENSO)**
- **Inter-decadal Pacific Oscillation (IPO)**
- **Inter-tropical Convergence Zone (ITCZ)**
- **South Pacific Convergence Zone (SPCZ)**

Drivers of climate in Pacific

- **Madden-Julian Oscillation (MJO)**
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The Walker Circulation during an El Niño



Predictive systems analyzed

SOI Values (from 1876)

SOI Values (from 1949)

SSTa 1

SSTa 9

SSTa 1 & 2

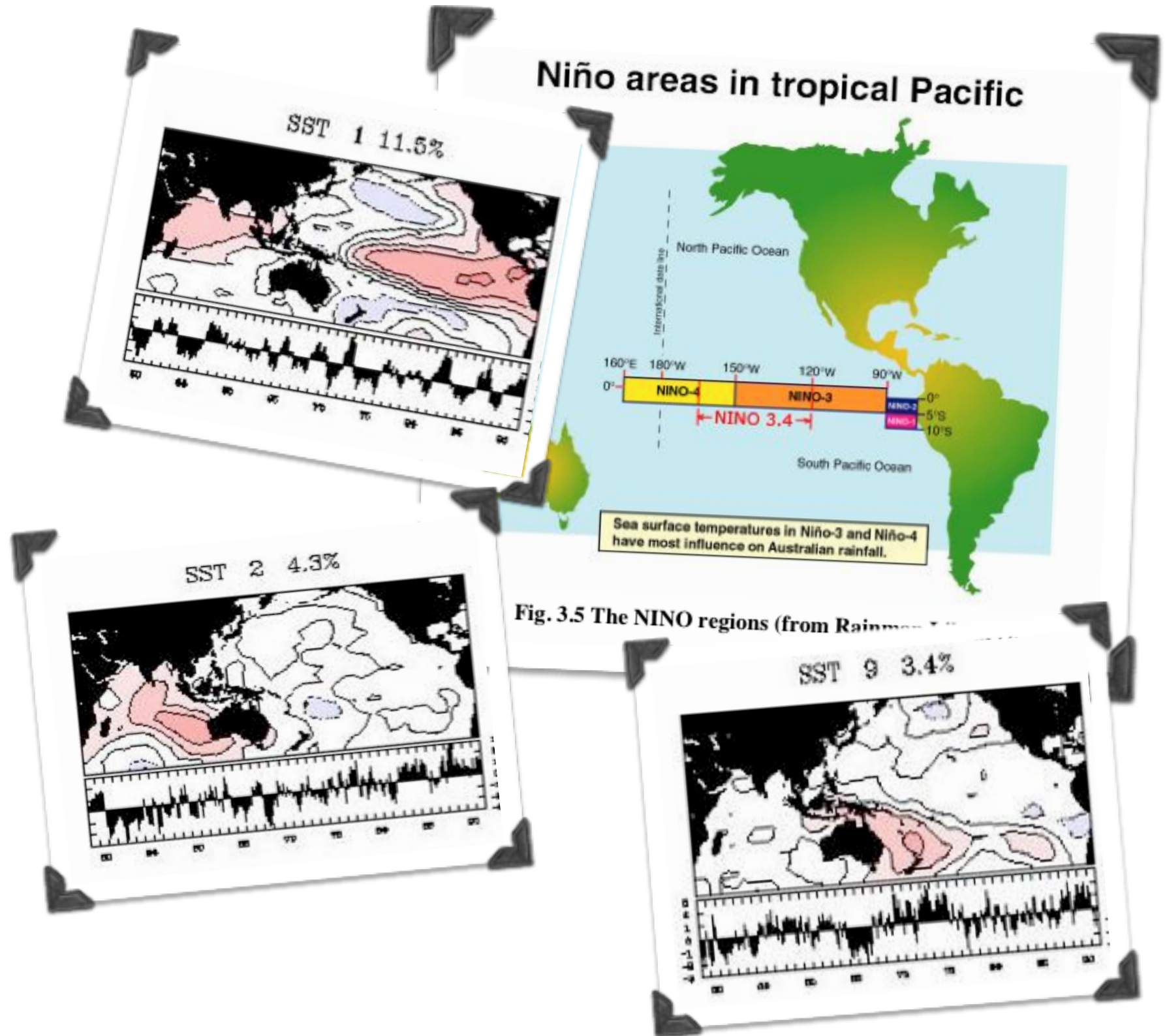
SSTa 1 & 9

Niño 1.2

Niño 3

Niño 3.4

Niño 4

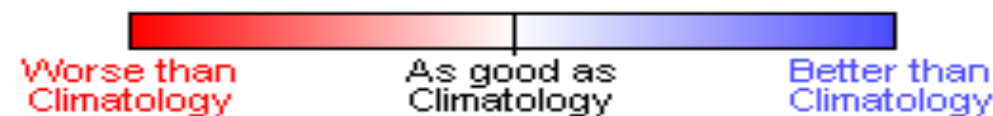
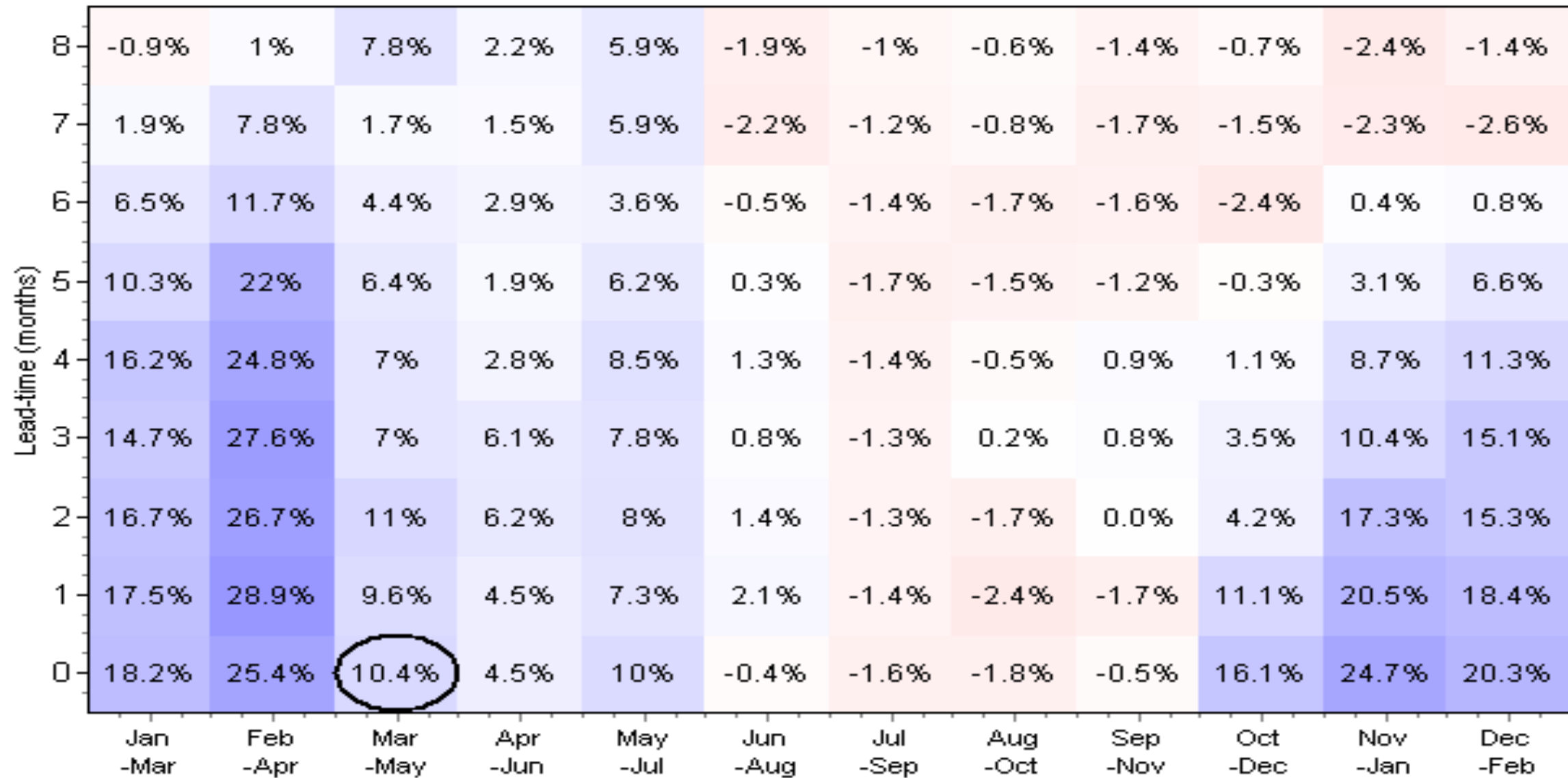


Rainfall Prediction Skill

Cross-validated Tercile LEPS Scores
3mth avg SOI Values

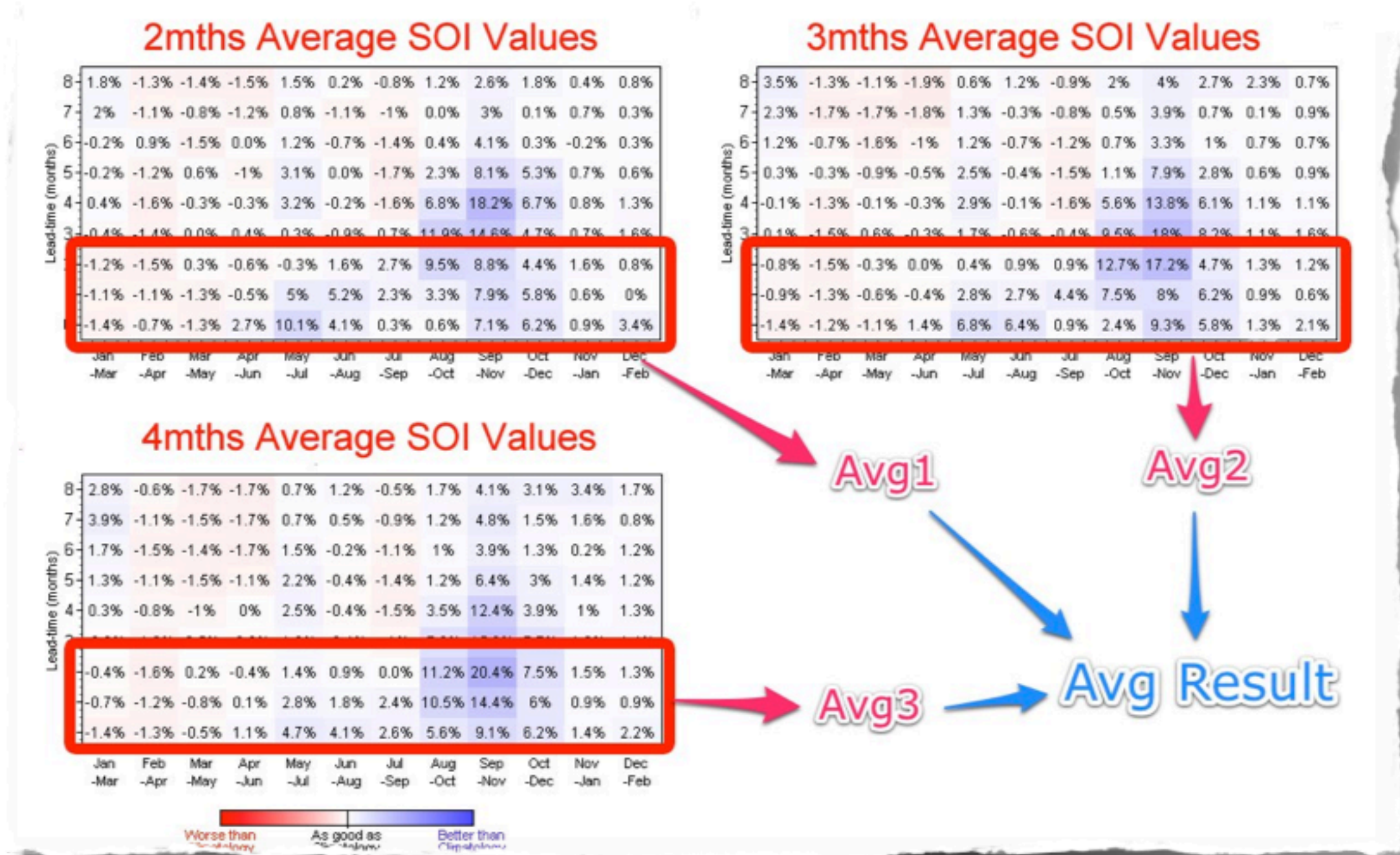


Honiara (51-55 Years)



Average LEPS score as a measure of overall skill

108 results averaged to a single result



Station results are also averaged for each country.

Summary of Results

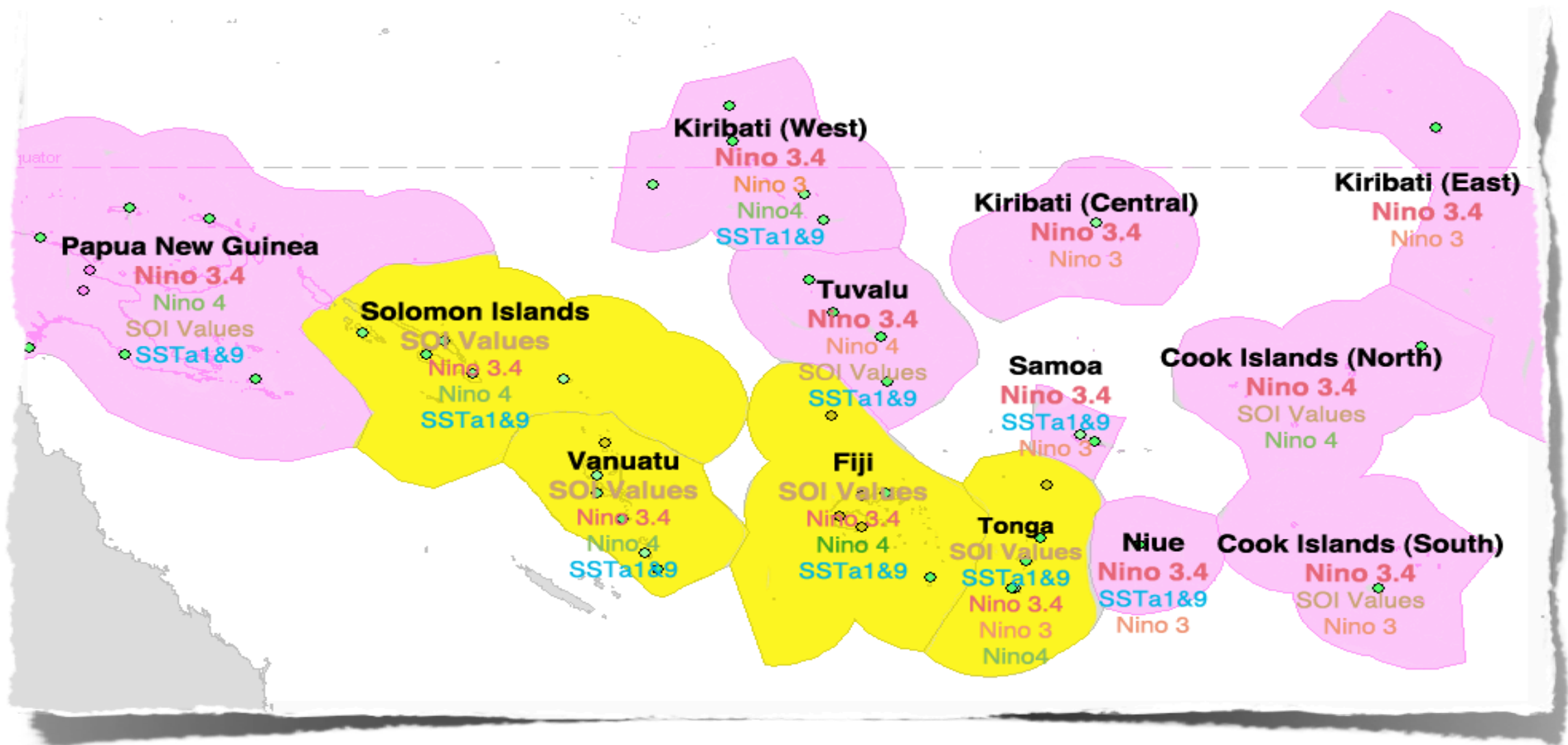
Percentage of tests (n=108) which have skill above chance (p=0.05)

	SOI	SOI(1949)	SSTa1	SSTa9	SSTa1&9	SSTa1&2	Nino1.2	Nino3	Nino3.4	Nino4
Papua New Guinea	38.3%	35.5%	35.5%	11.0%	36.9%	31.7%	28.5%	38.7%	42.0%	41.2%
Cook Islands (North)	100.0%	99.1%	93.5%	30.6%	92.6%	92.6%	78.7%	89.8%	98.1%	89.8%
Cook Islands (South)	75.0%	49.1%	25.9%	8.3%	19.4%	13.9%	38.0%	60.2%	57.4%	38.0%
Fiji	67.4%	65.3%	51.5%	30.9%	55.1%	44.9%	37.8%	57.6%	59.7%	62.7%
Kiribati (West)	85.4%	80.6%	85.0%	17.2%	86.3%	90.9%	82.2%	88.1%	86.1%	89.1%
Kiribati (Central)	75.9%	75.0%	66.7%	6.5%	65.7%	71.3%	85.2%	85.2%	73.1%	63.9%
Kiribati (East)	56.5%	65.7%	61.1%	9.3%	67.6%	68.5%	66.7%	81.5%	75.9%	63.9%
Niue	41.7%	45.4%	41.7%	28.7%	49.1%	24.1%	59.3%	62.0%	50.9%	44.4%
Samoa	47.7%	25.5%	33.3%	17.1%	31.9%	26.4%	47.7%	51.4%	38.9%	24.1%
Solomon Islands	48.3%	49.3%	31.9%	21.1%	35.9%	29.6%	28.1%	41.1%	44.8%	46.3%
Tonga	58.7%	61.3%	43.1%	31.7%	46.9%	35.9%	48.0%	60.6%	56.1%	47.0%
Tuvalu	73.6%	75.0%	64.6%	20.4%	66.0%	63.2%	50.2%	64.8%	71.8%	76.4%
Vanuatu	72.4%	72.2%	43.7%	29.8%	52.3%	39.5%	32.4%	57.4%	66.2%	67.1%

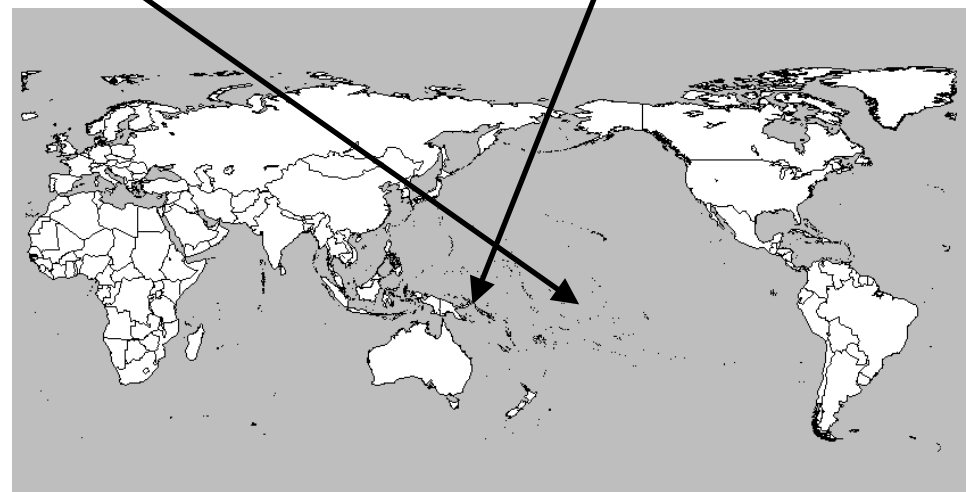
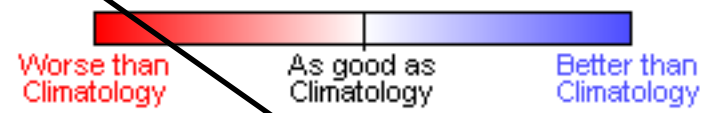
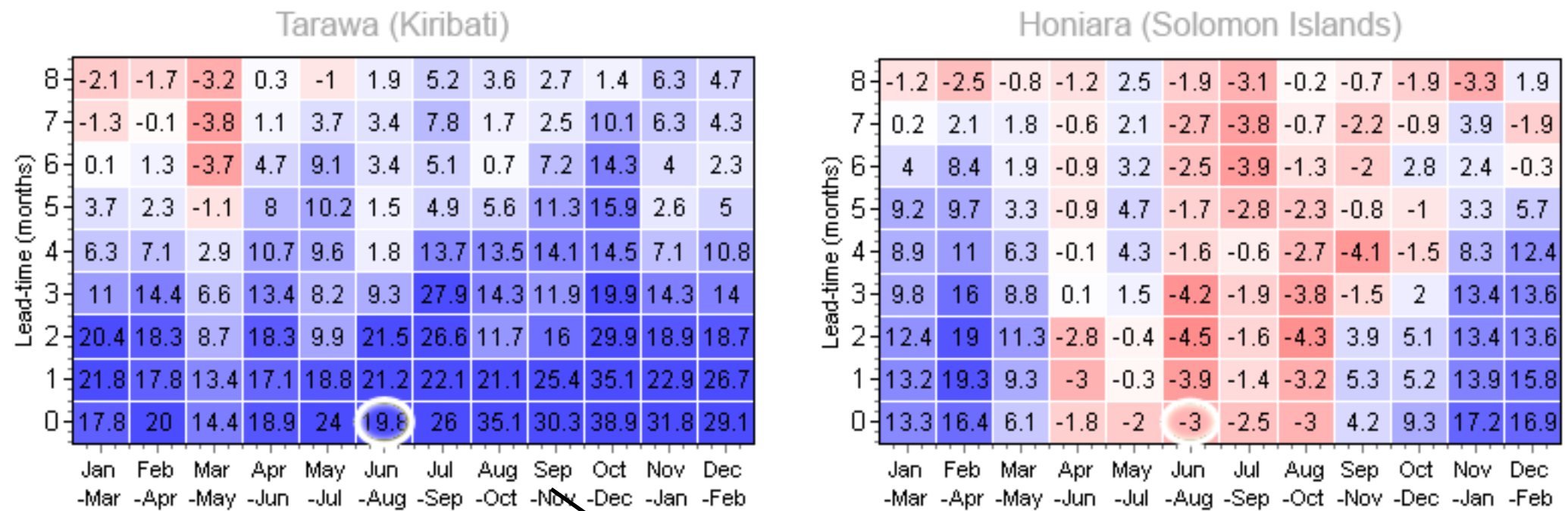
Average LEPS Score (n=108)

	SOI	SOI(1949)	SSTa1	SSTa9	SSTa1&9	SSTa1&2	Nino1.2	Nino3	Nino3.4	Nino4
Papua New Guinea	5.4	6.2	4.9	0.7	6.3	5.3	3.0	5.4	7.0	6.6
Cook Islands (North)	19.9	19.6	14.6	2.2	16.9	15.1	11.5	16.2	19.5	20.6
Cook Islands (South)	4.1	3.8	2.5	-0.2	2.7	2.0	3.2	5.0	4.8	3.3
Fiji	8.5	9.3	5.7	2.4	8.4	5.4	3.7	6.6	8.9	9.2
Kiribati (West)	16.8	19.3	18.6	1.7	21.3	20.7	14.0	23.0	25.7	24.1
Kiribati (Central)	14.9	15.2	14.0	0.1	15.7	14.4	16.3	20.9	18.9	14.7
Kiribati (East)	8.8	13.1	12.3	1.6	14.0	13.0	10.4	17.4	18.7	14.7
Niue	4.2	4.2	3.3	2.6	5.6	3.9	5.0	6.1	5.3	3.4
Samoa	3.5	3.0	3.4	1.6	4.6	2.9	4.4	5.0	4.4	2.8
Solomon Islands	8.3	8.3	4.1	2.7	6.6	3.8	3.2	5.6	6.8	7.2
Tonga	9.4	9.7	5.4	3.7	8.9	5.5	5.2	8.0	9.0	8.1
Tuvalu	11.6	13.2	10.6	1.2	12.8	11.7	5.9	10.7	14.2	14.4
Vanuatu	10.6	10.6	5.6	3.5	9.8	6.4	3.2	6.7	9.3	10.0

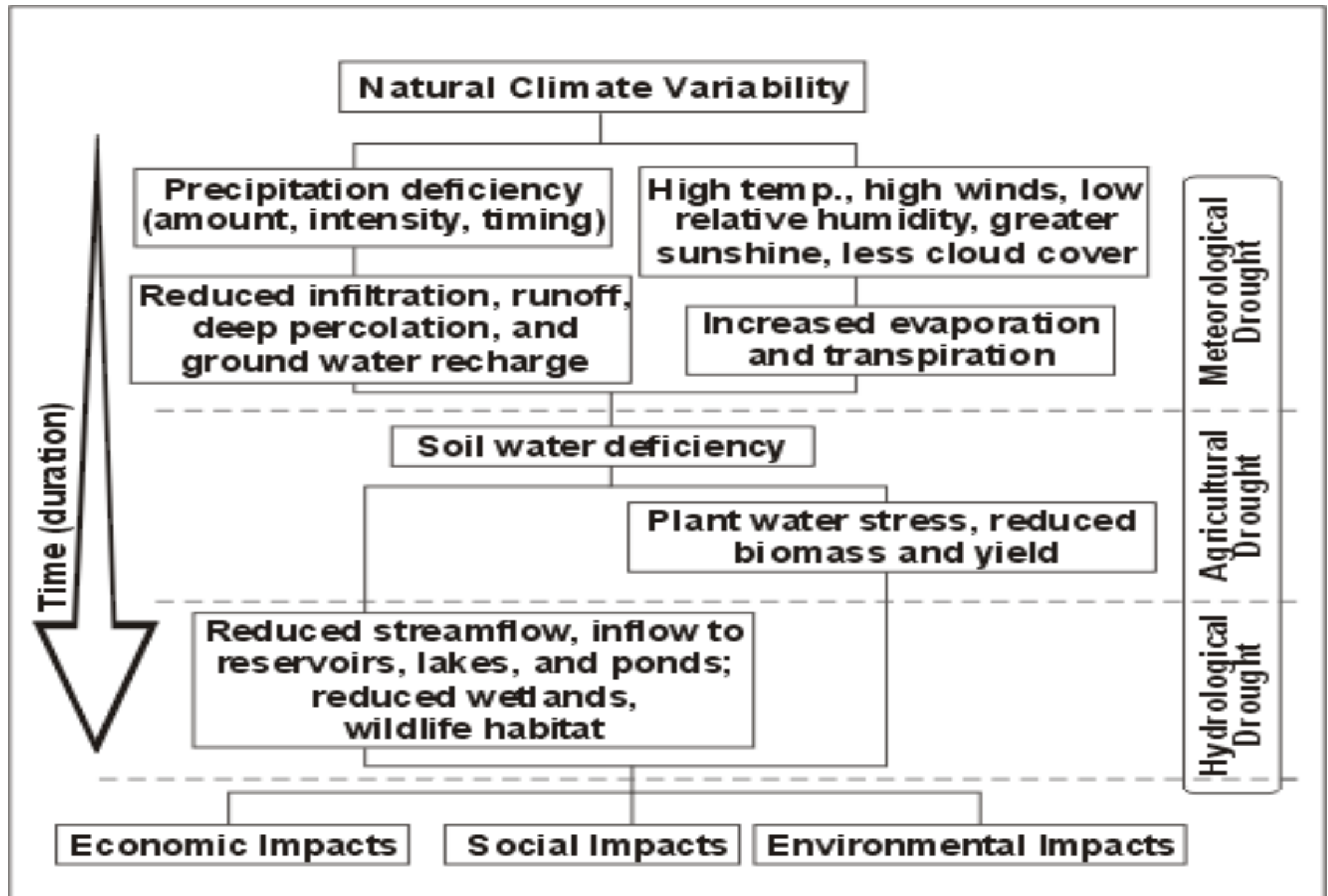
Application for rainfall prediction in the Pacific Islands



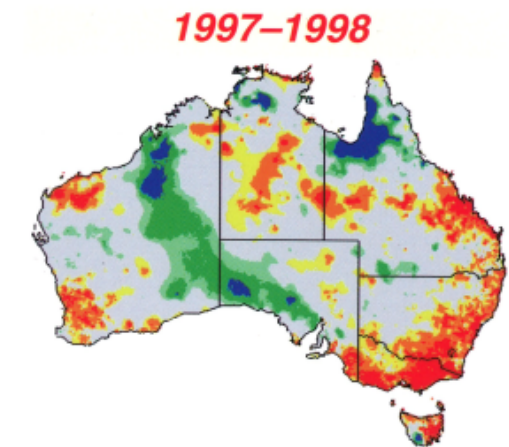
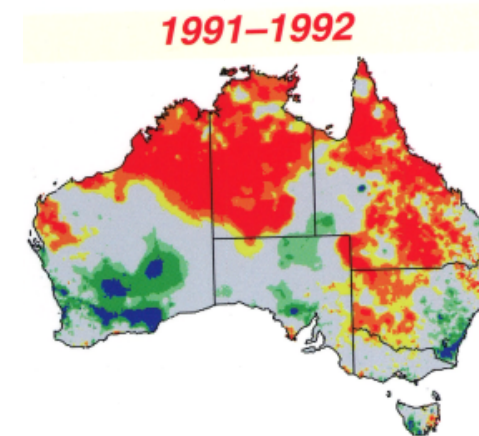
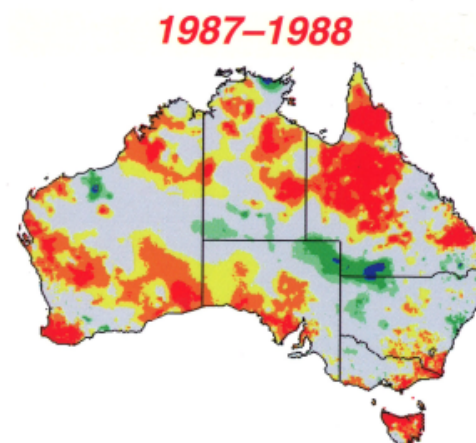
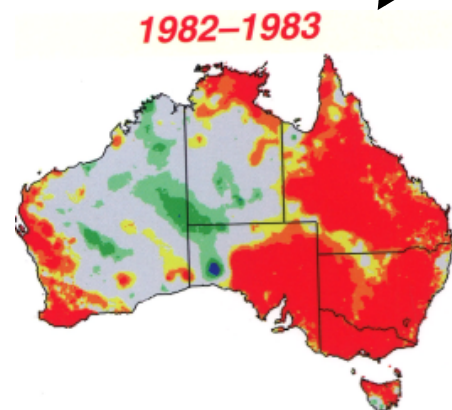
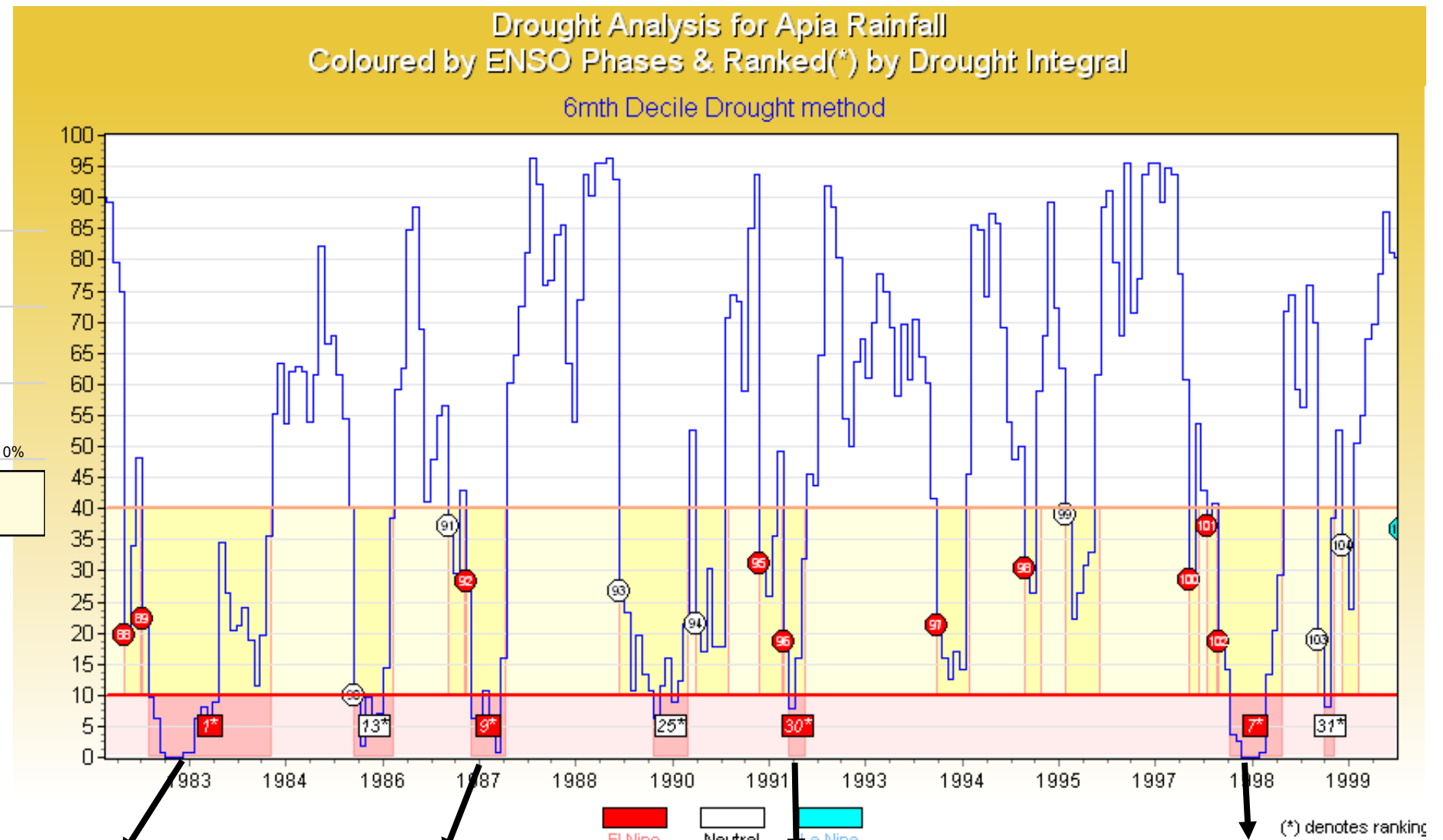
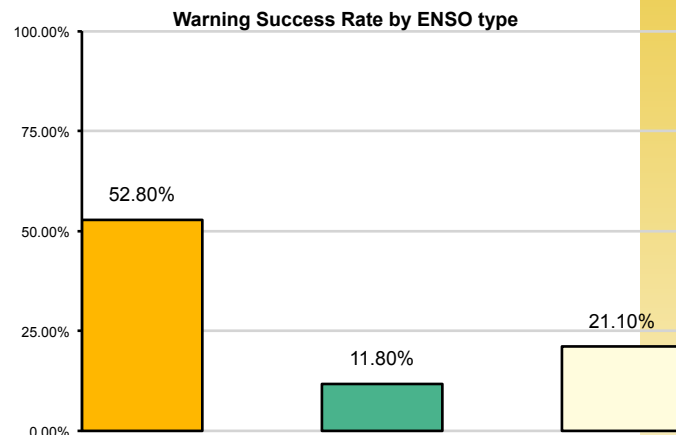
Prediction Skill vary by region, time of year and lead-time



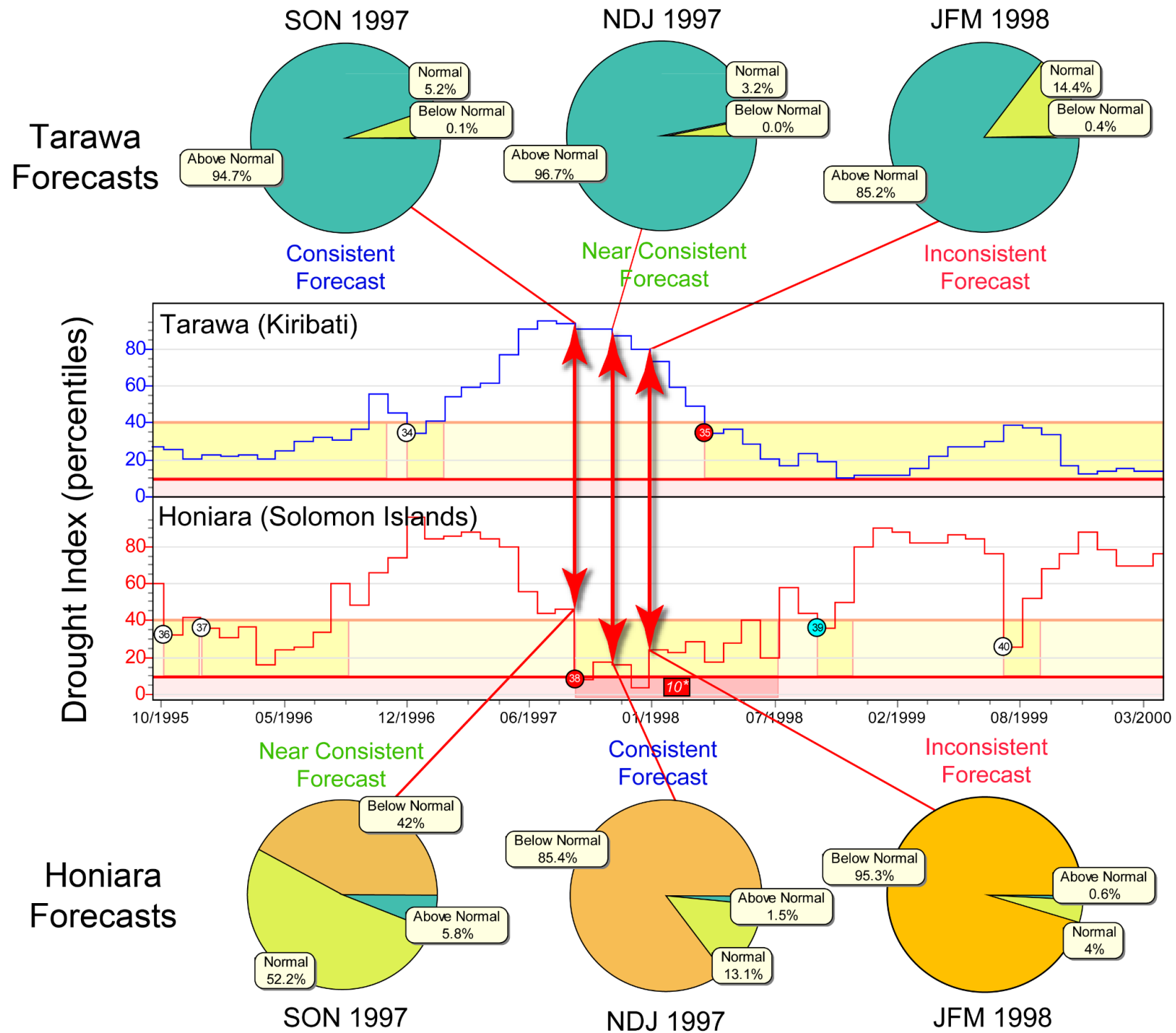
Sequences of drought impacts



Application for drought Monitoring and Forecasting

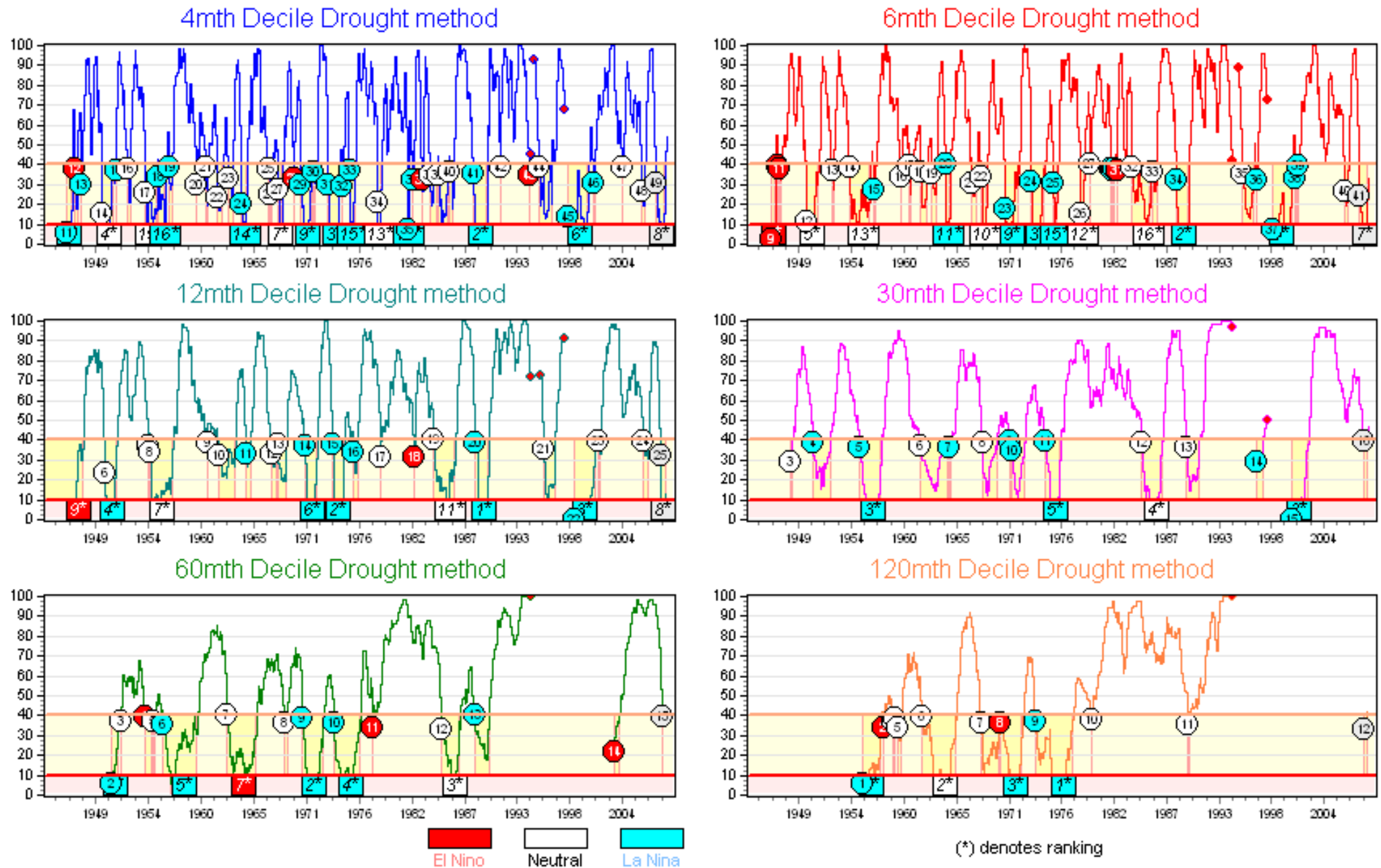


1997-1998 El Niño
1998-1999 La Niña



Time series of historical droughts Tarawa- Kiribati

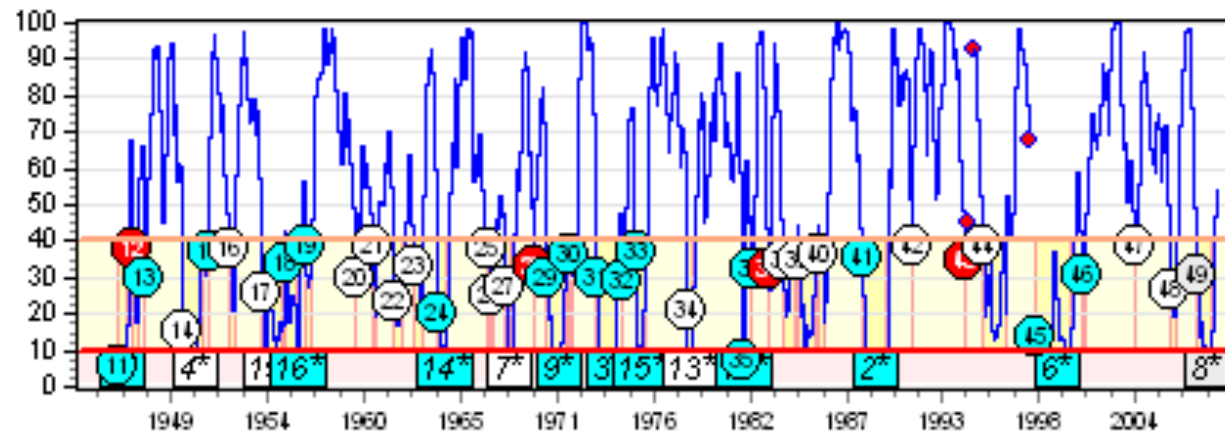
Drought Analysis for Tarawa
Coloured by ENSO Phases & Ranked(*) by Drought Integral



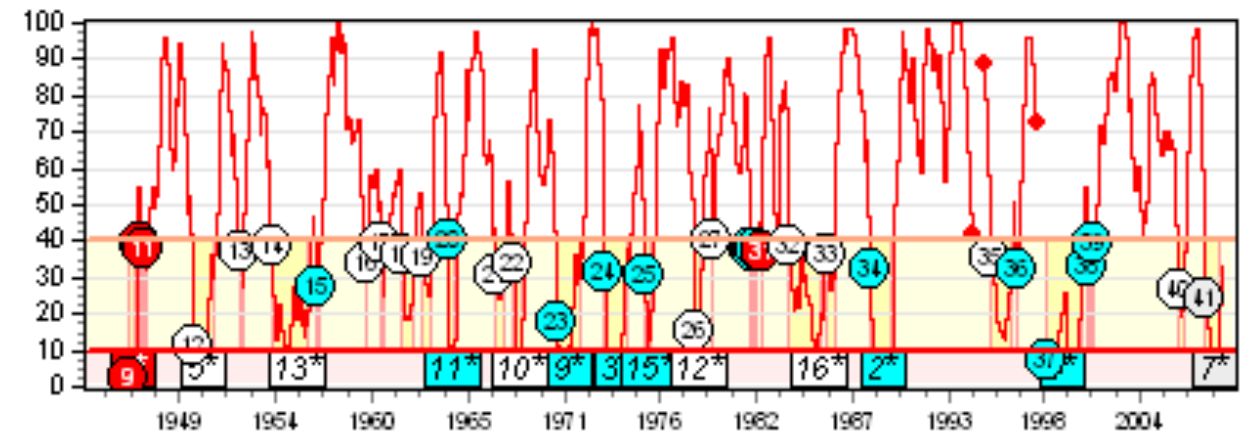
Drought Analysis for Tarawa

Coloured by ENSO Phases & Ranked(*) by Drought Integral

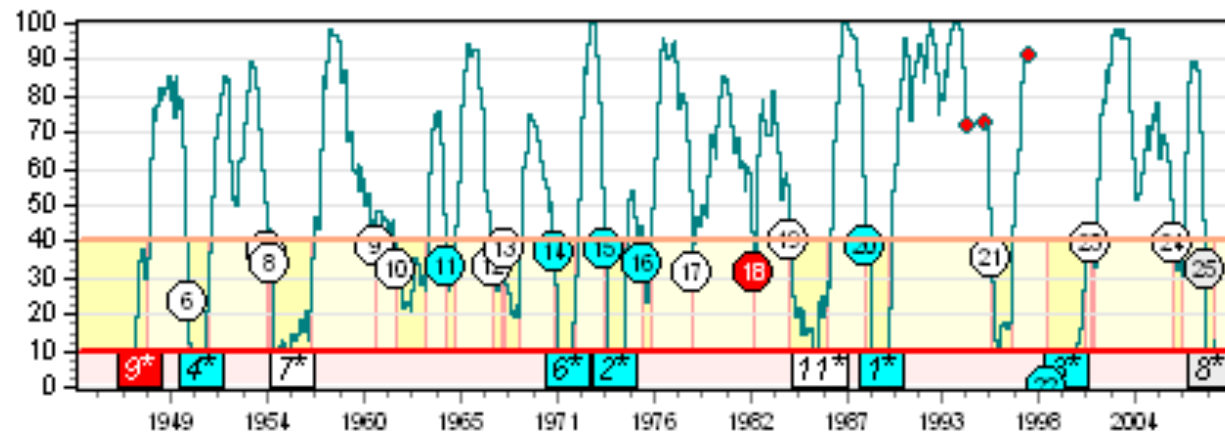
4mth Decile Drought method



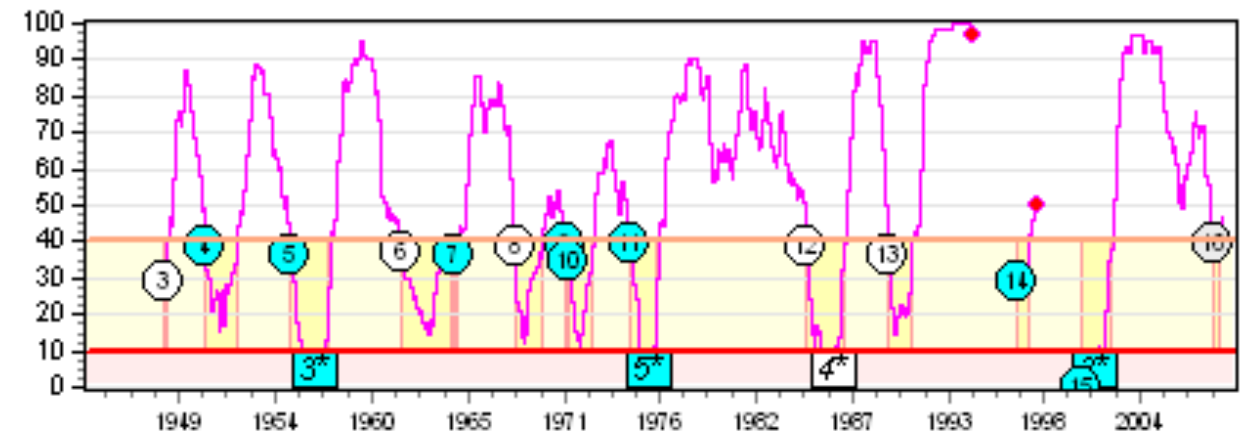
6mth Decile Drought method



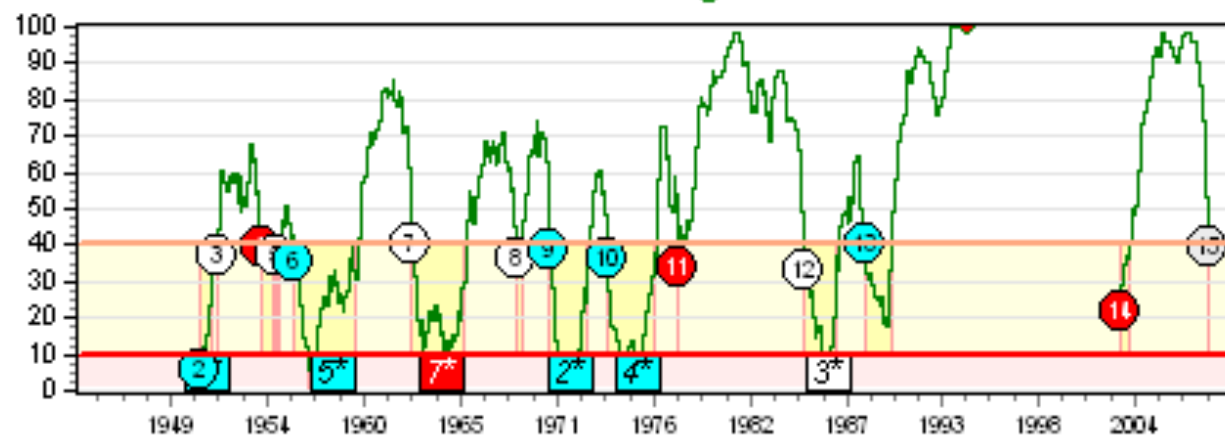
12mth Decile Drought method



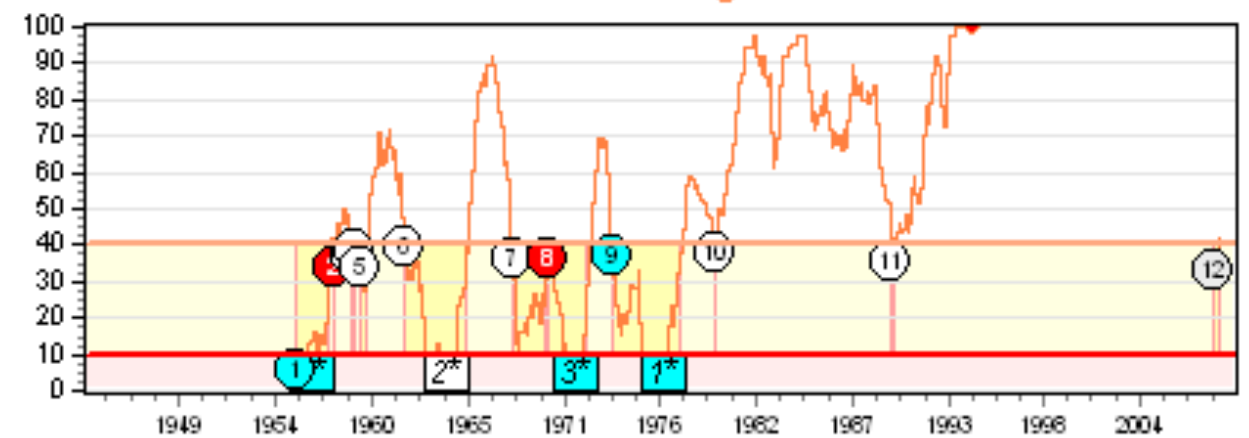
30mth Decile Drought method



60mth Decile Drought method



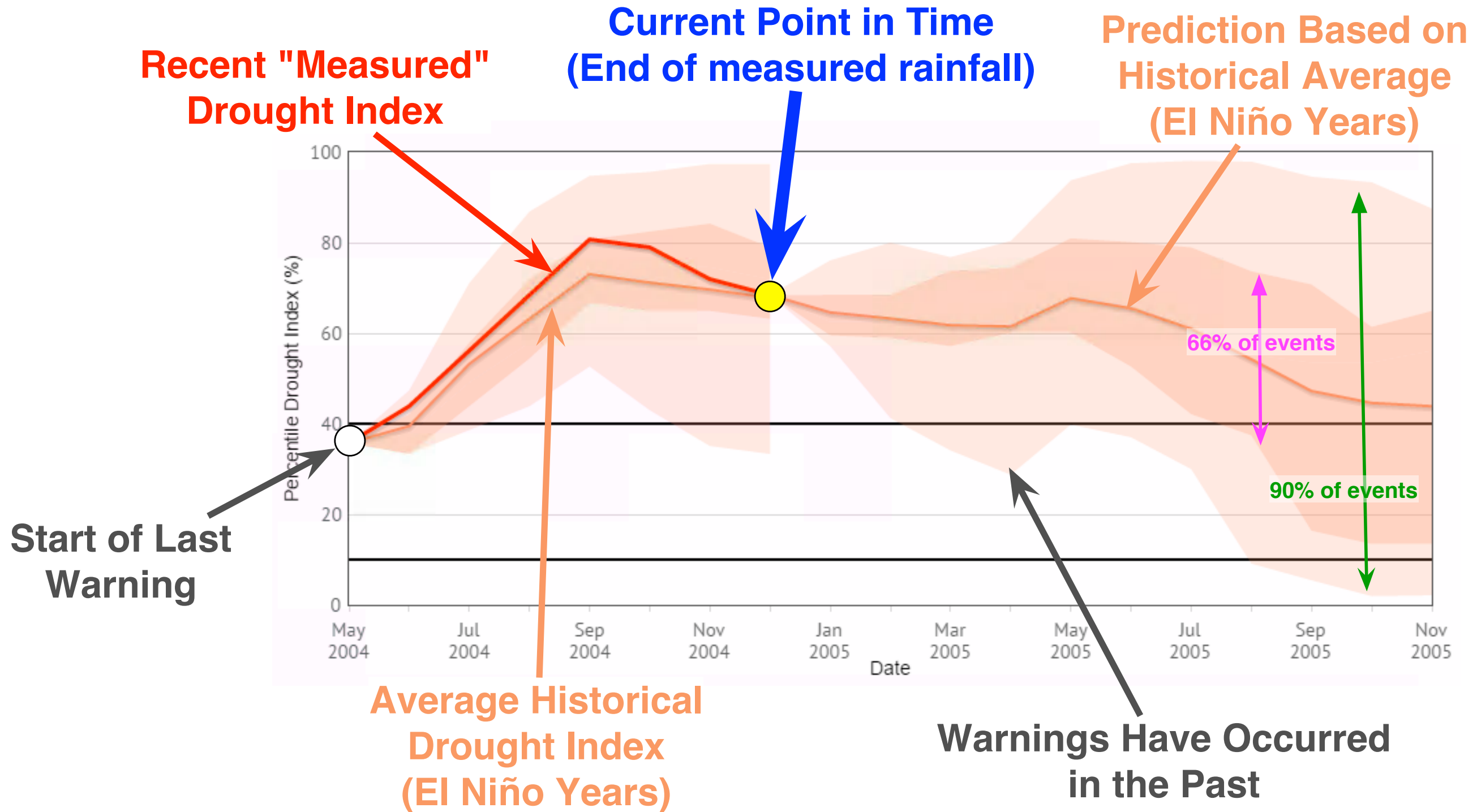
120mth Decile Drought method



■ El Niño Neutral ■ La Niña

(*) denotes ranking

Drought monitoring and prediction- Current & Future Plumes

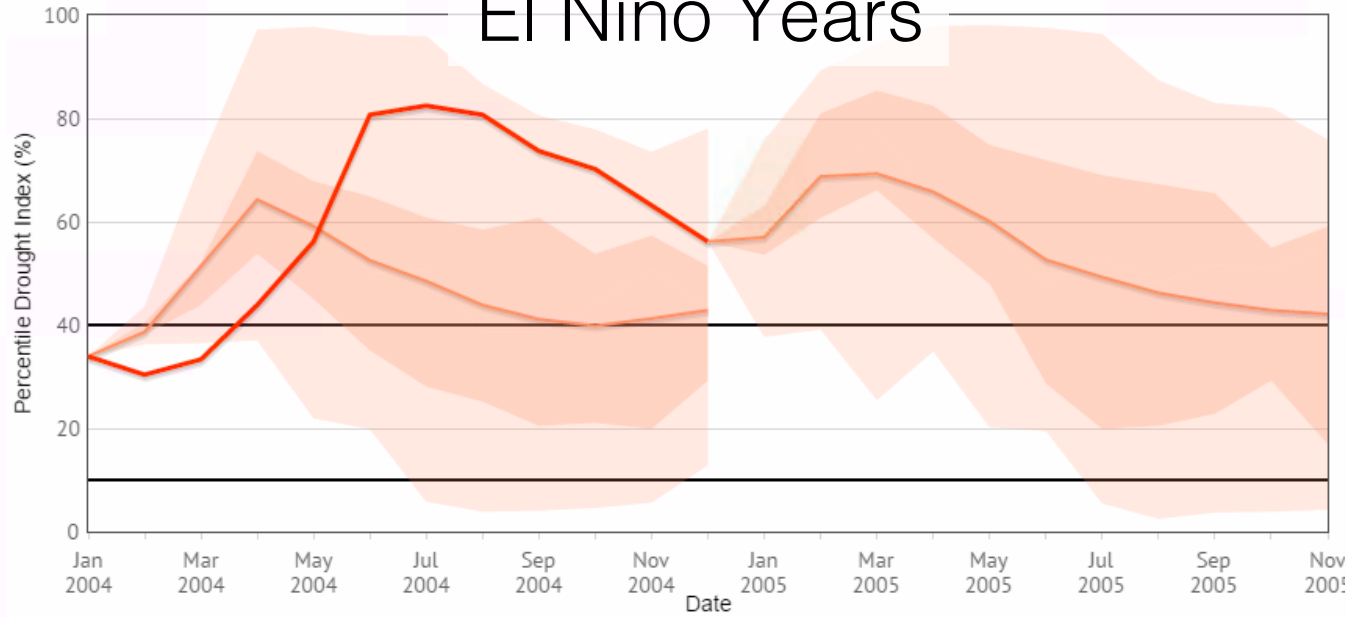


Three month drought analysis (Kiribati)

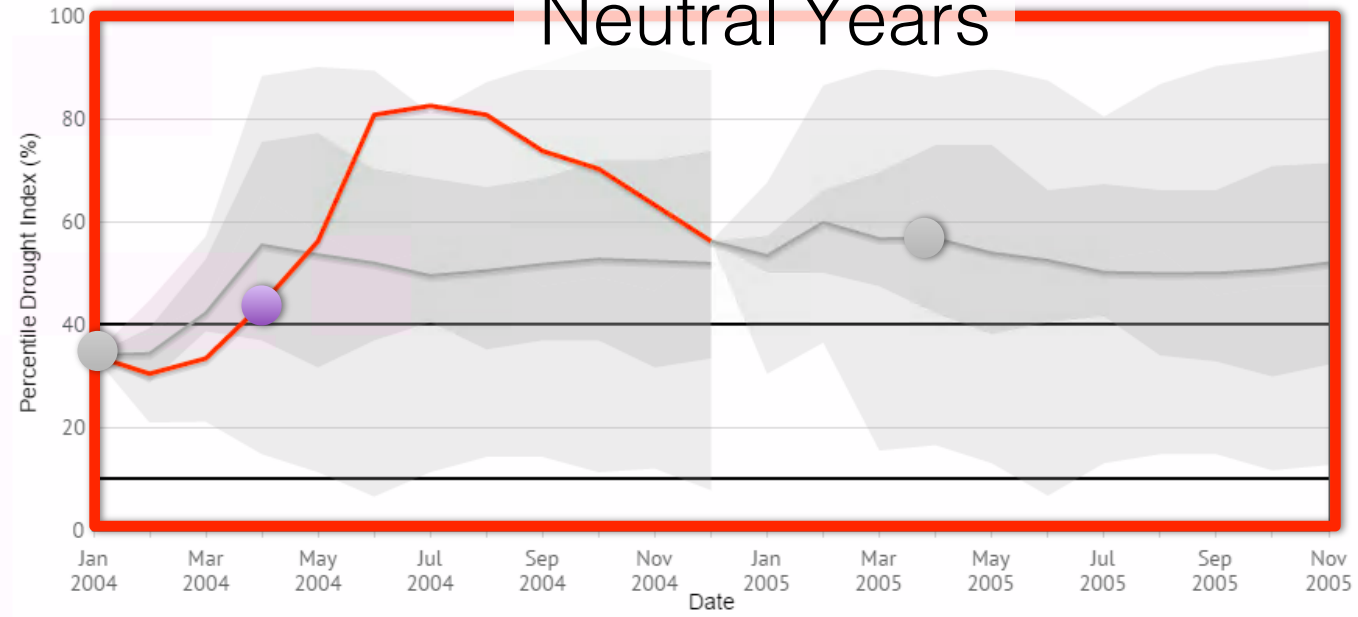
ENSO Legend

- 2003-2004: Neutral
- 2004-2005: El Niño
- 2005-2006: Neutral

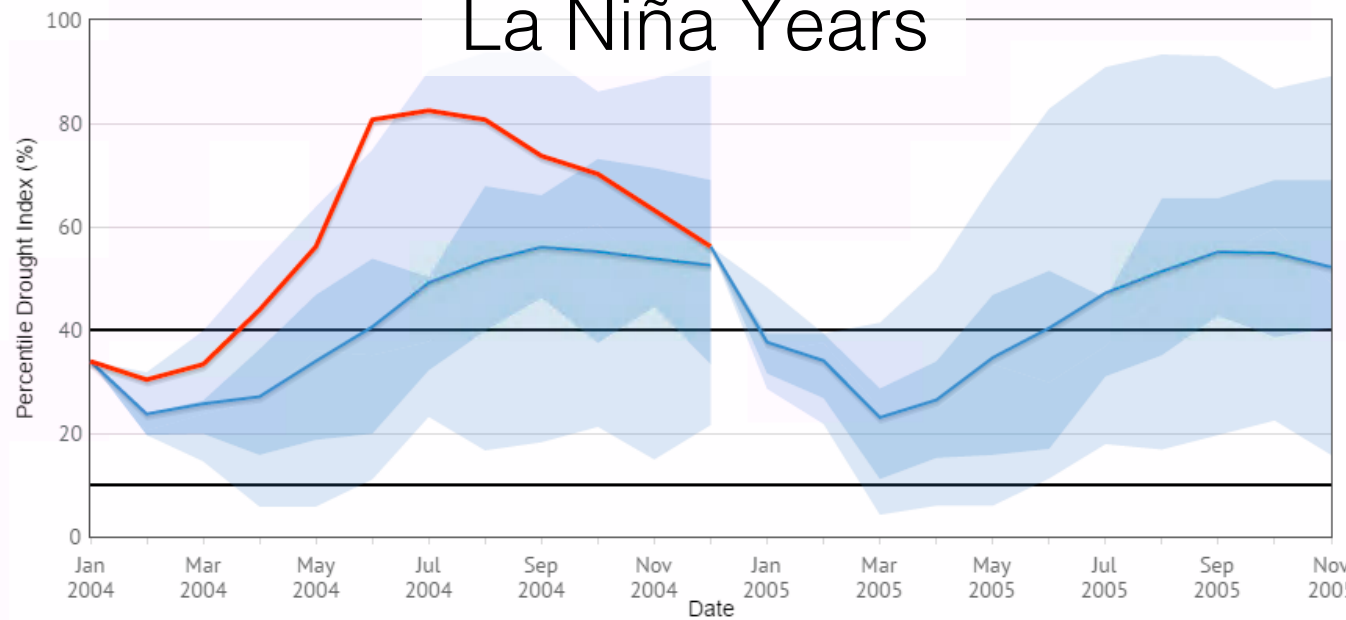
El Niño Years



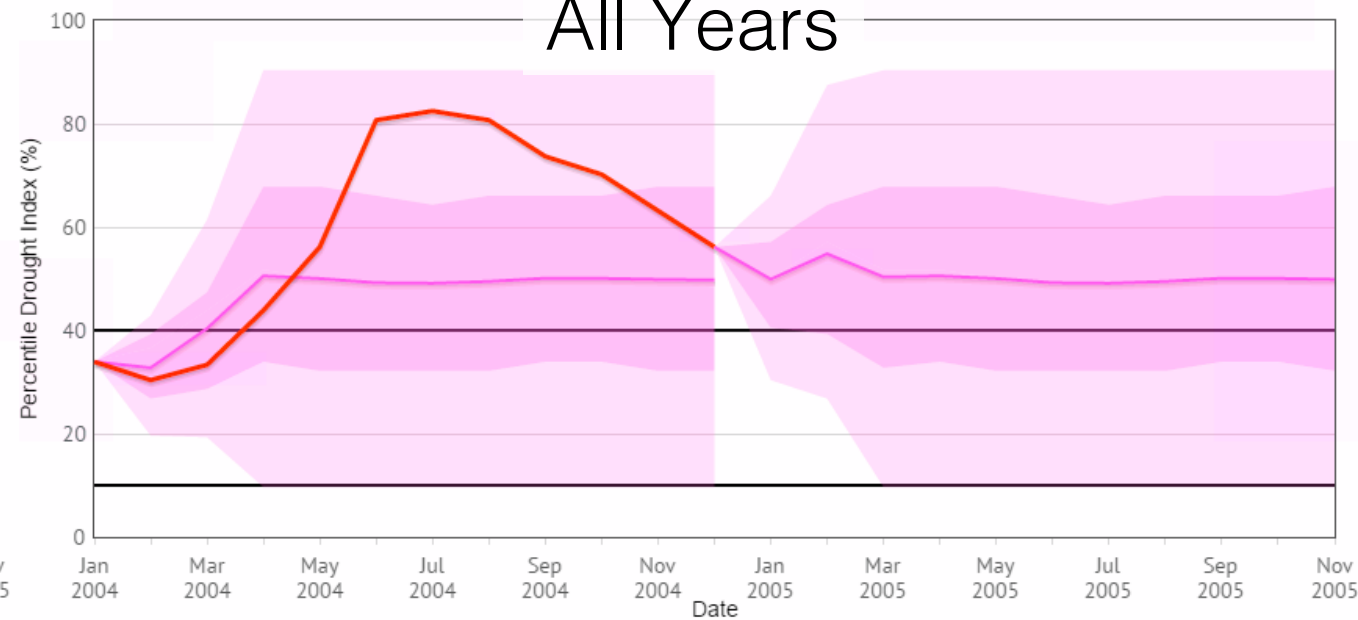
Neutral Years



La Niña Years



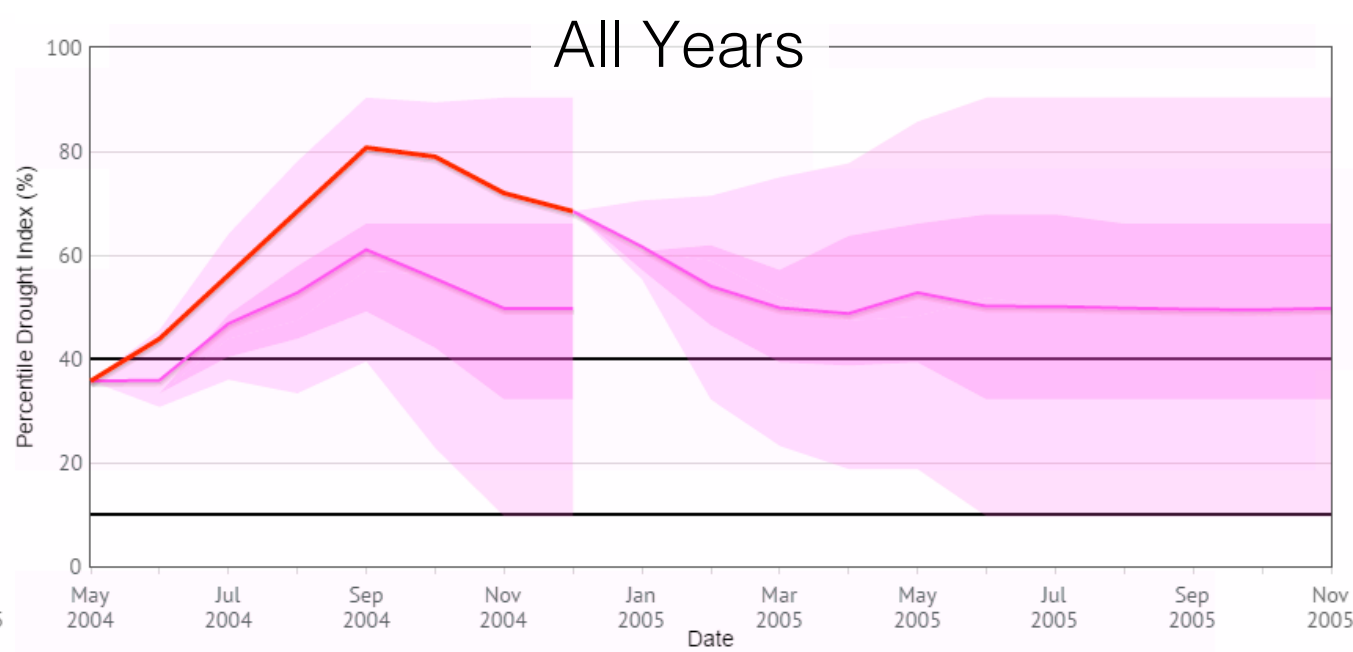
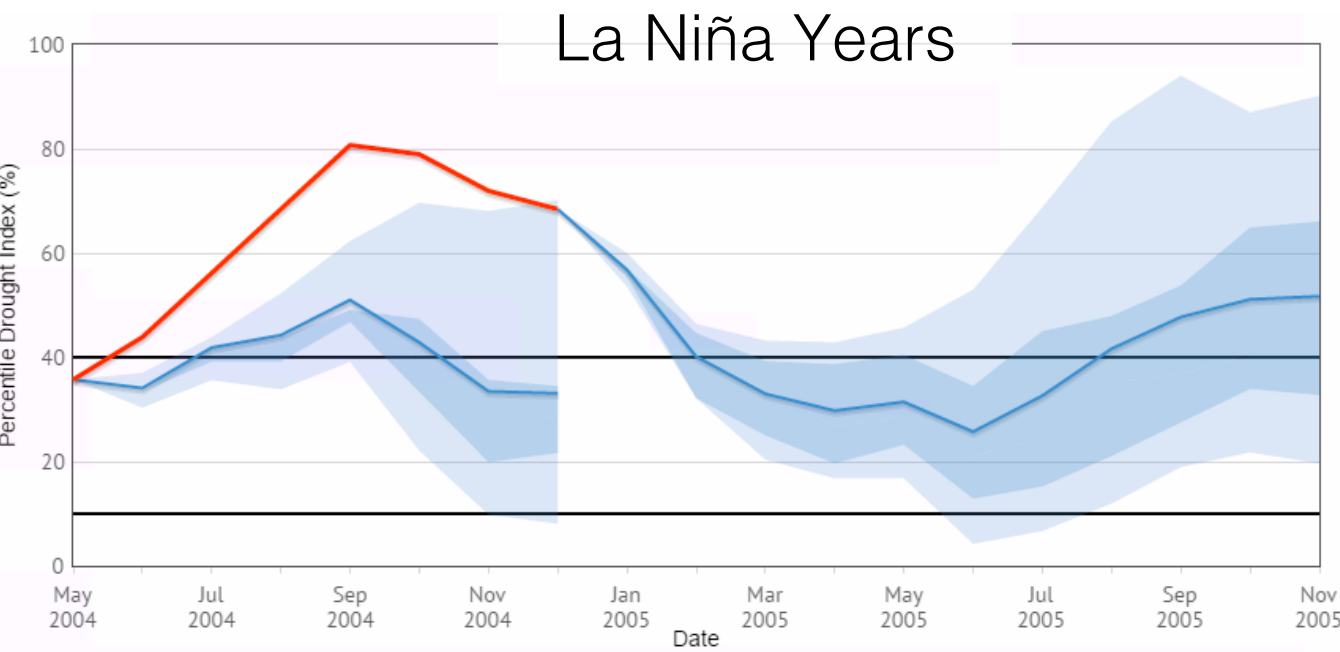
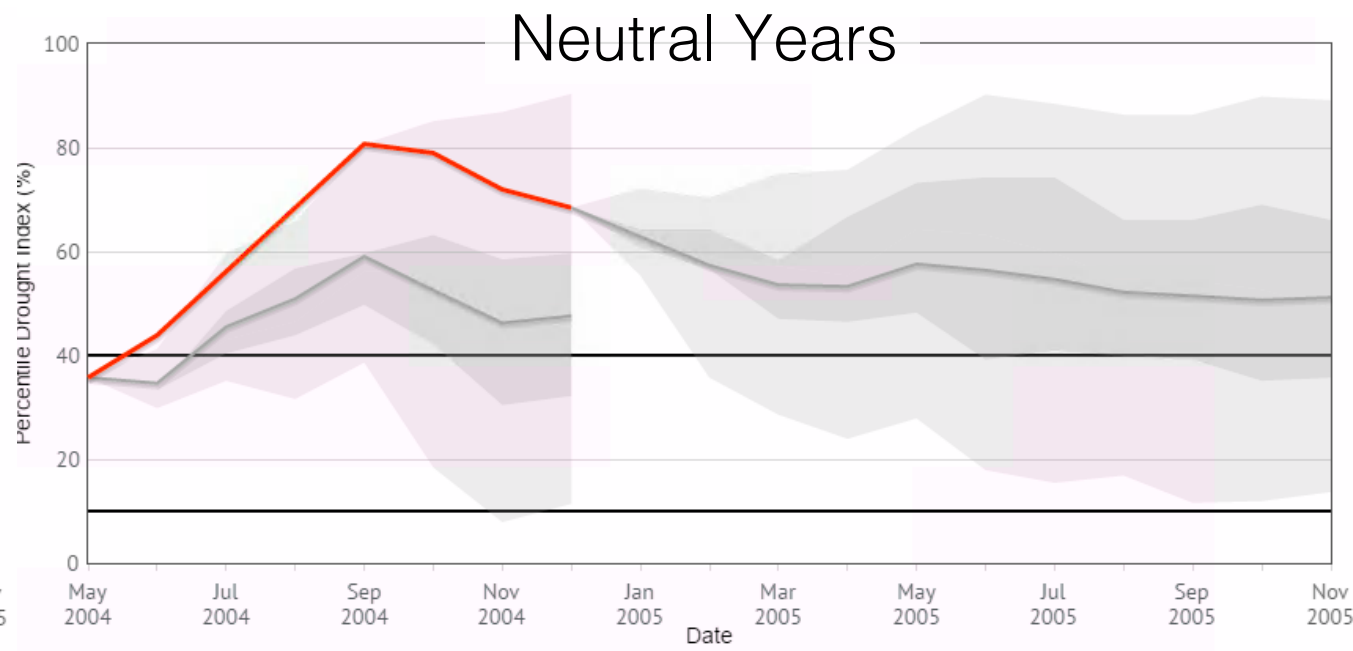
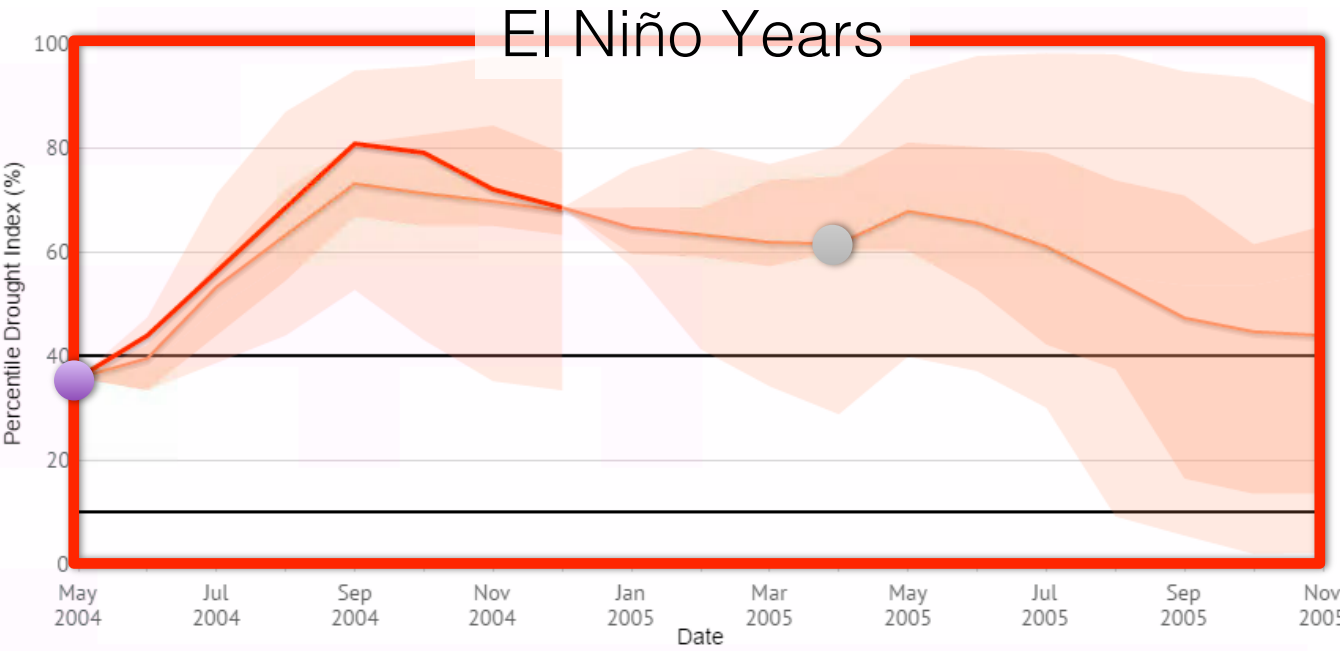
All Years



Warning Starting Jan 2004

Six month drought analysis (Kiribati)

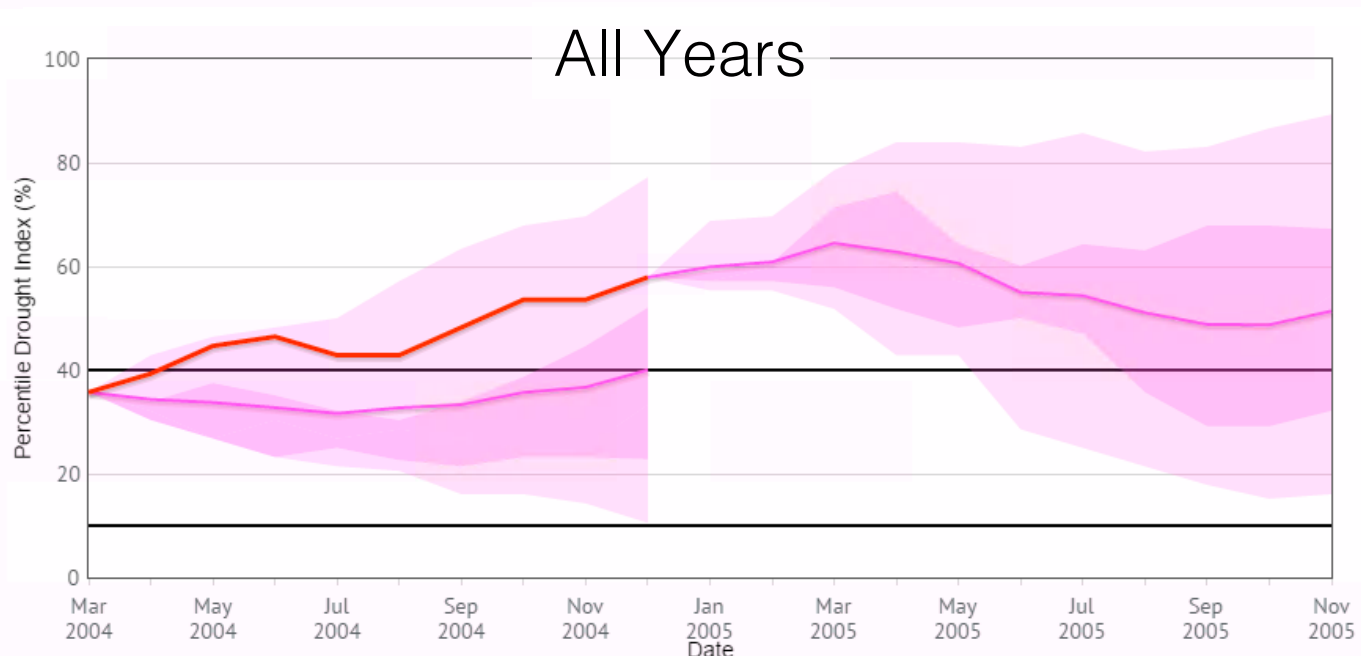
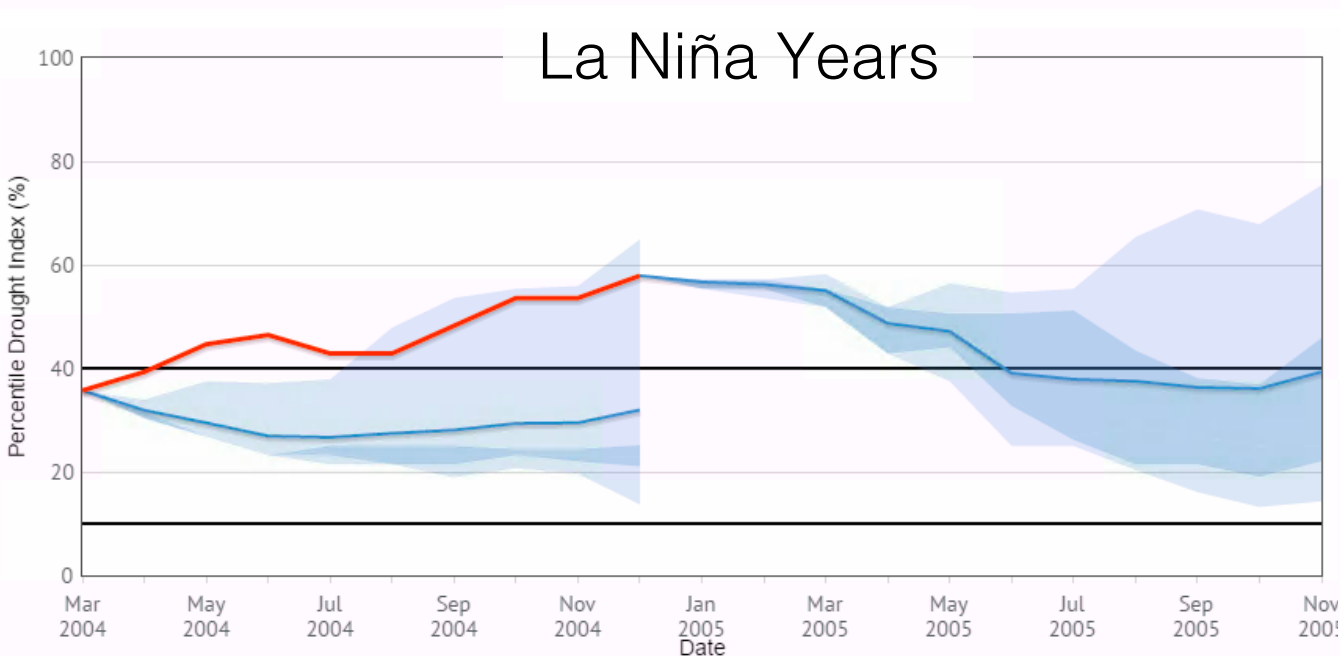
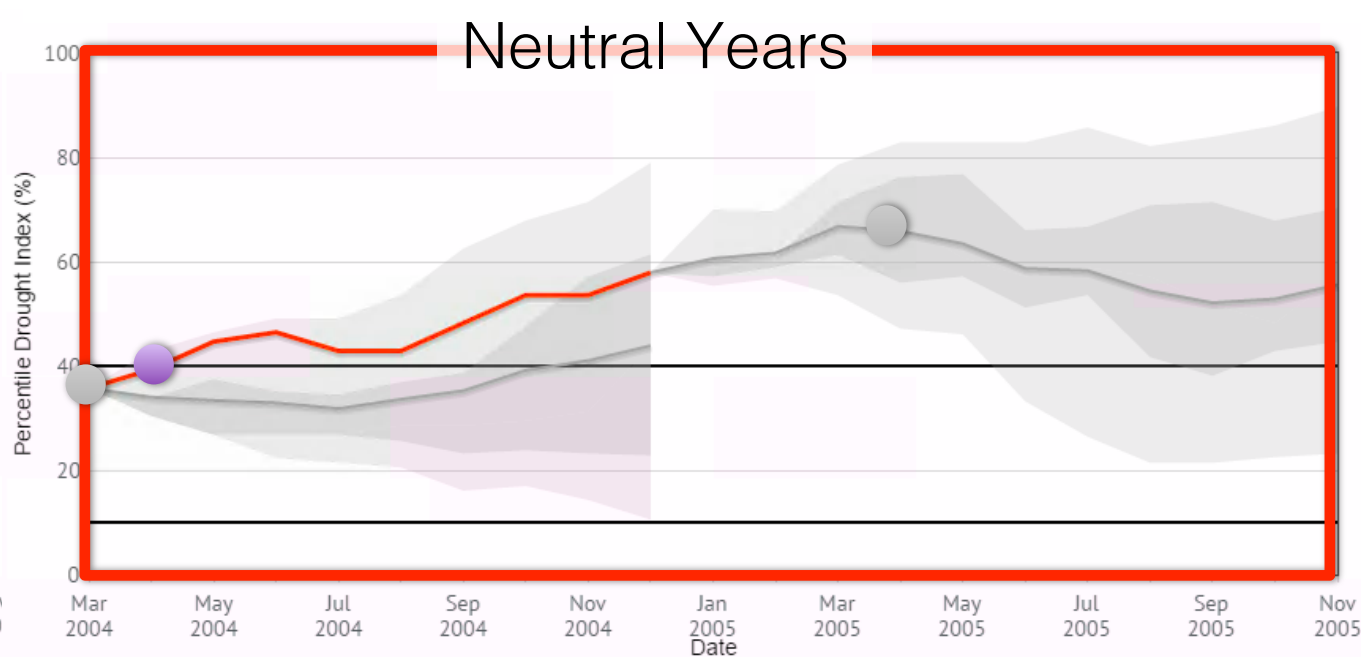
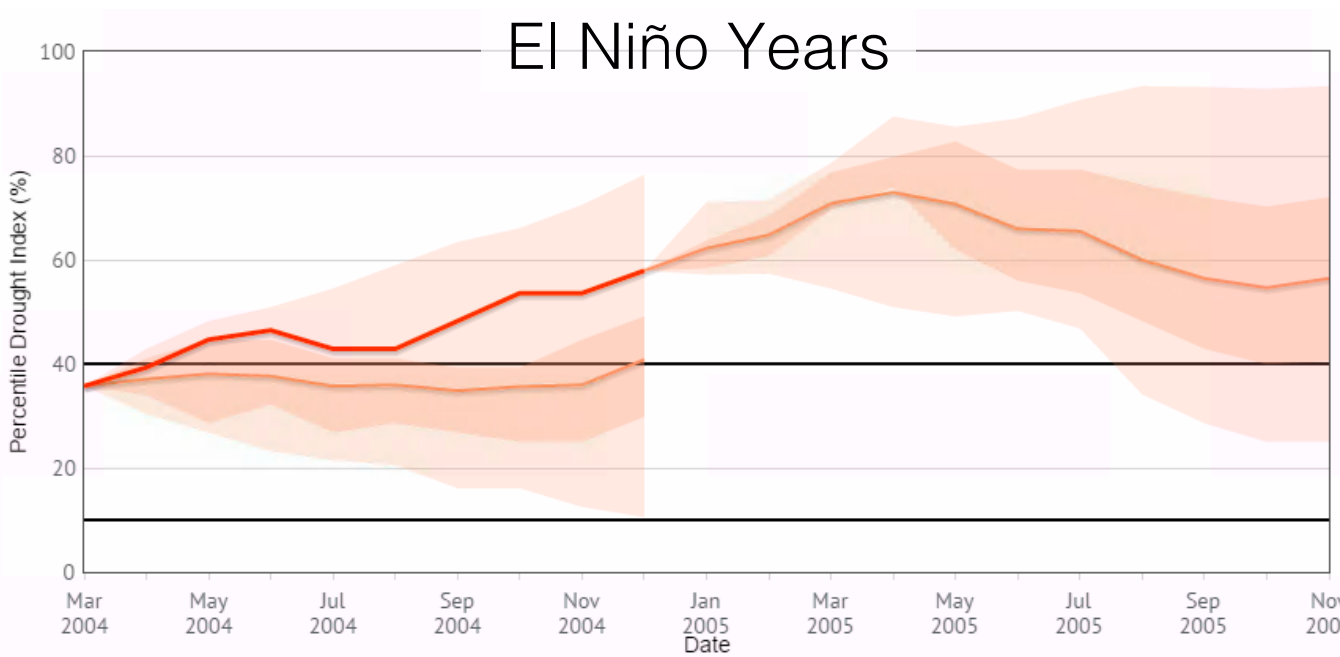
- ENSO Legend
- 2004-2005: El Niño
 - 2005-2006: Neutral



Warning Starting Jan 2004

12-month drought analysis (Kiribati)

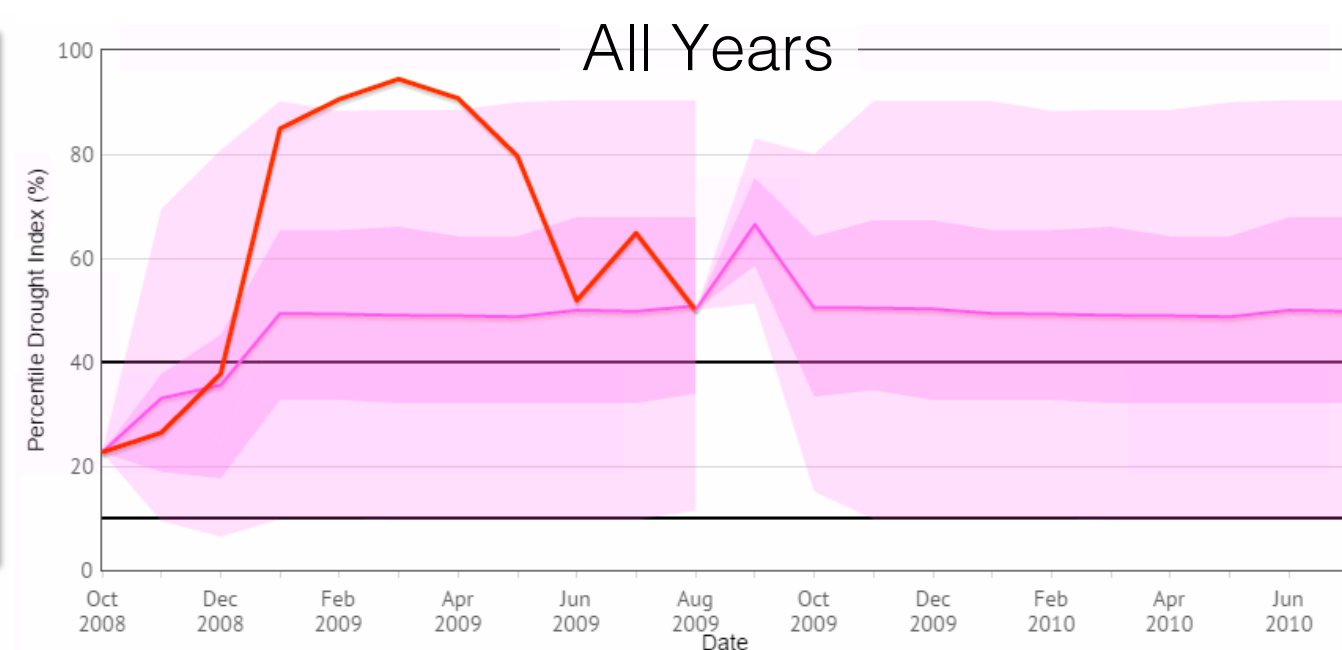
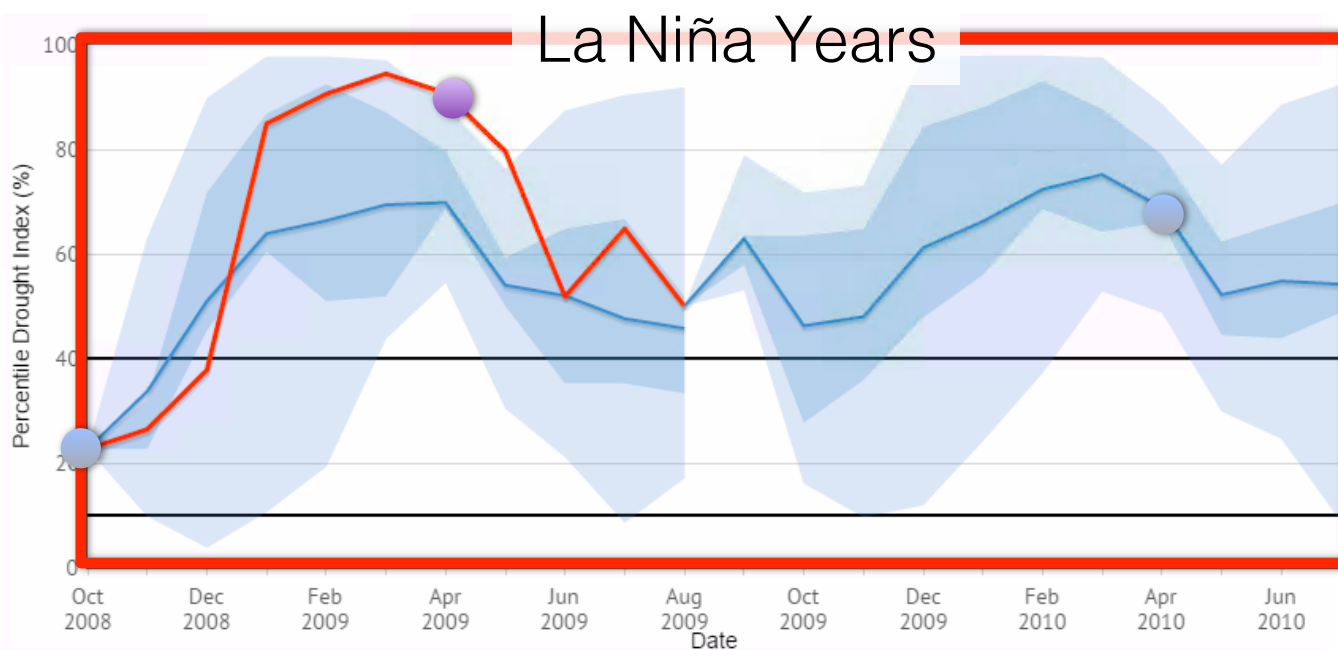
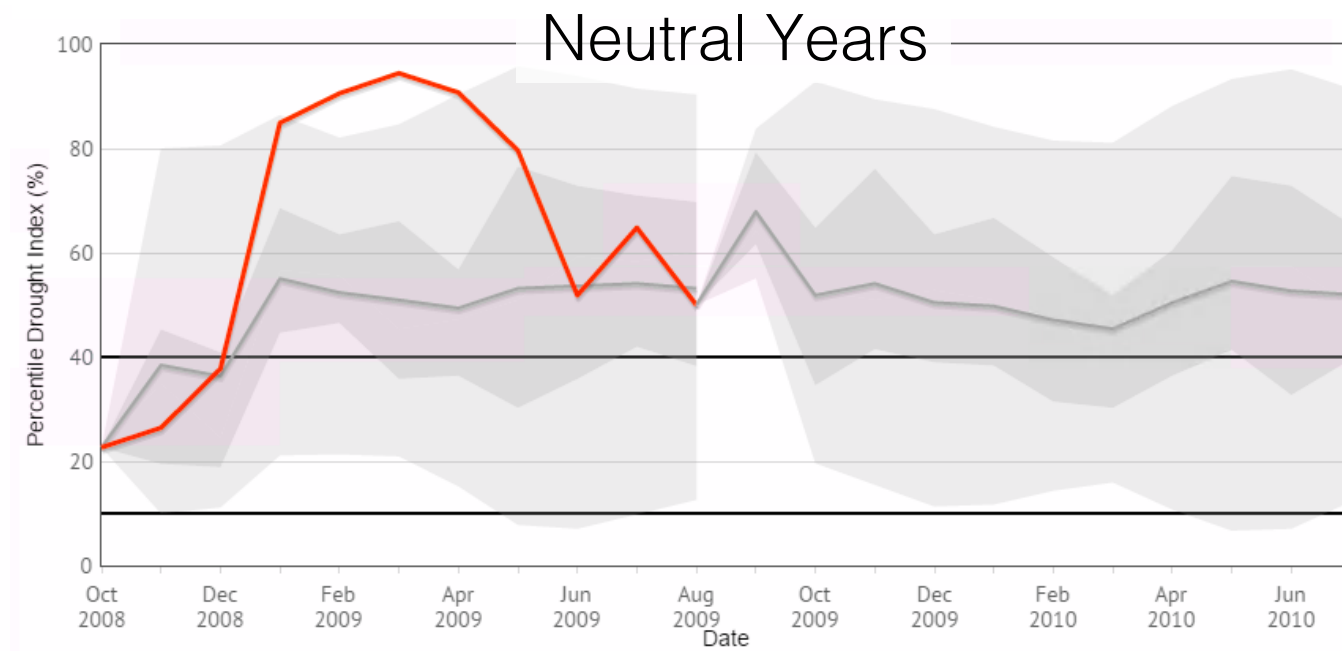
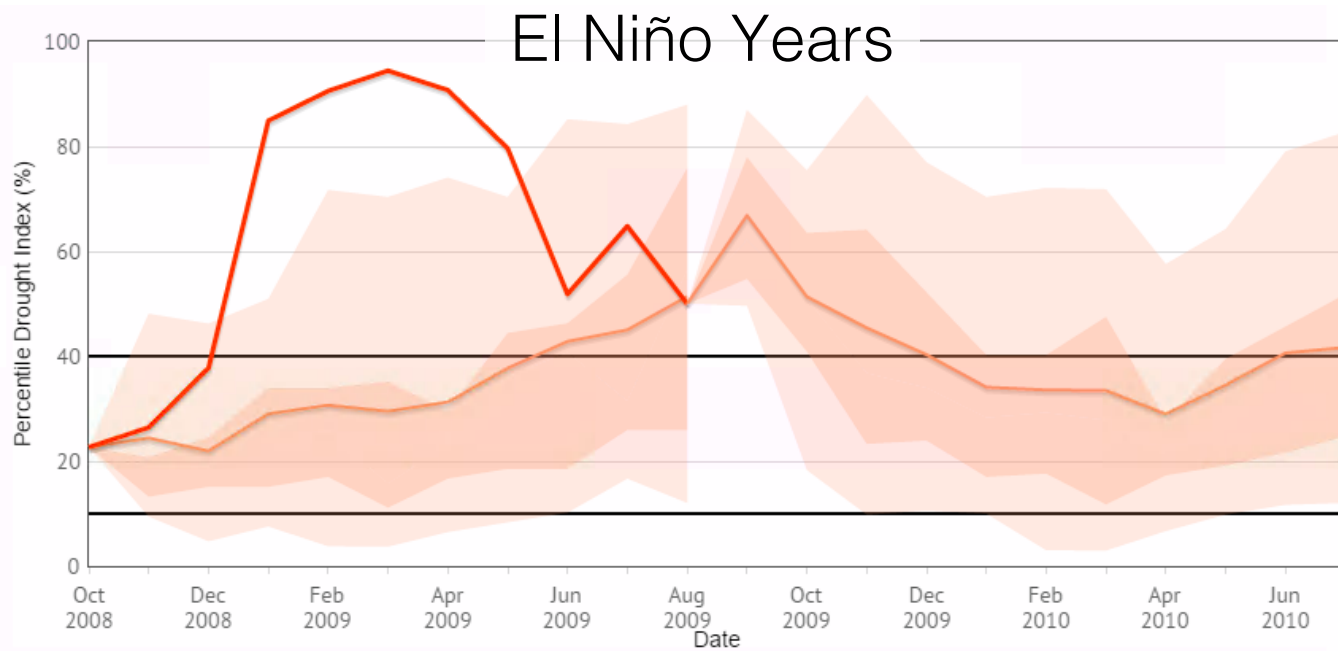
- ENSO Legend
- 2003-2004: Neutral
 - 2004-2005: El Niño
 - 2005-2006: Neutral



Warning Starting Mar 2004

Three month drought analysis(Solomon Islands)

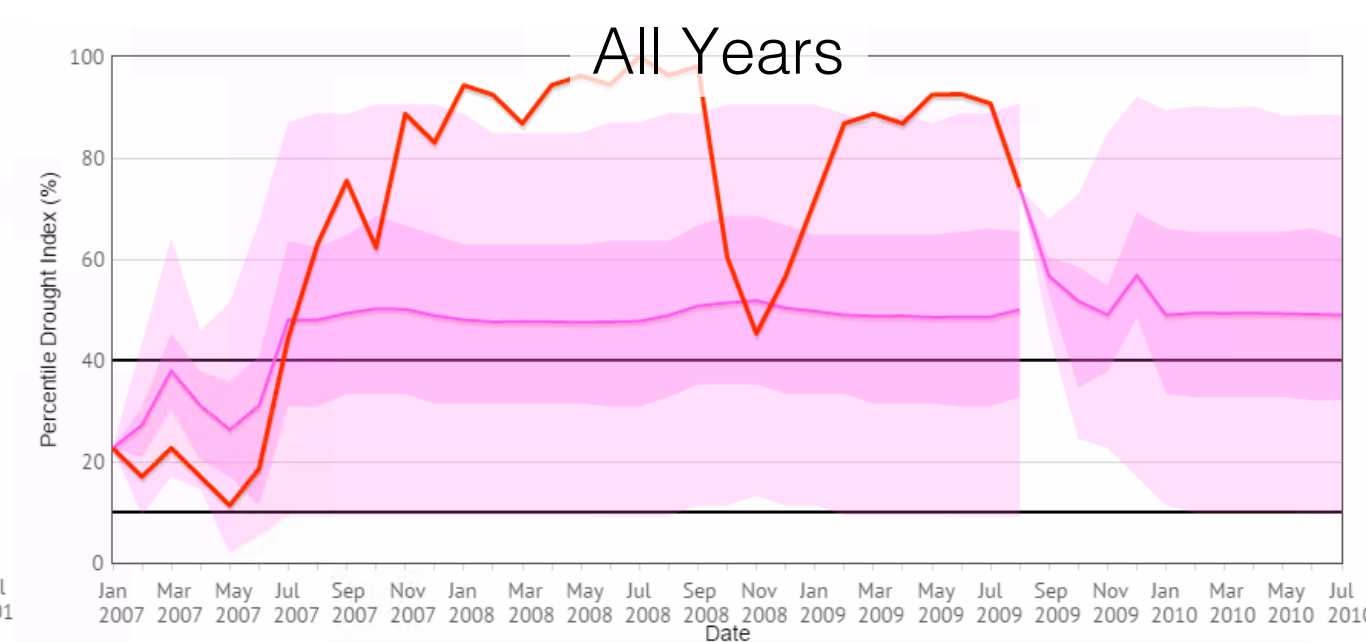
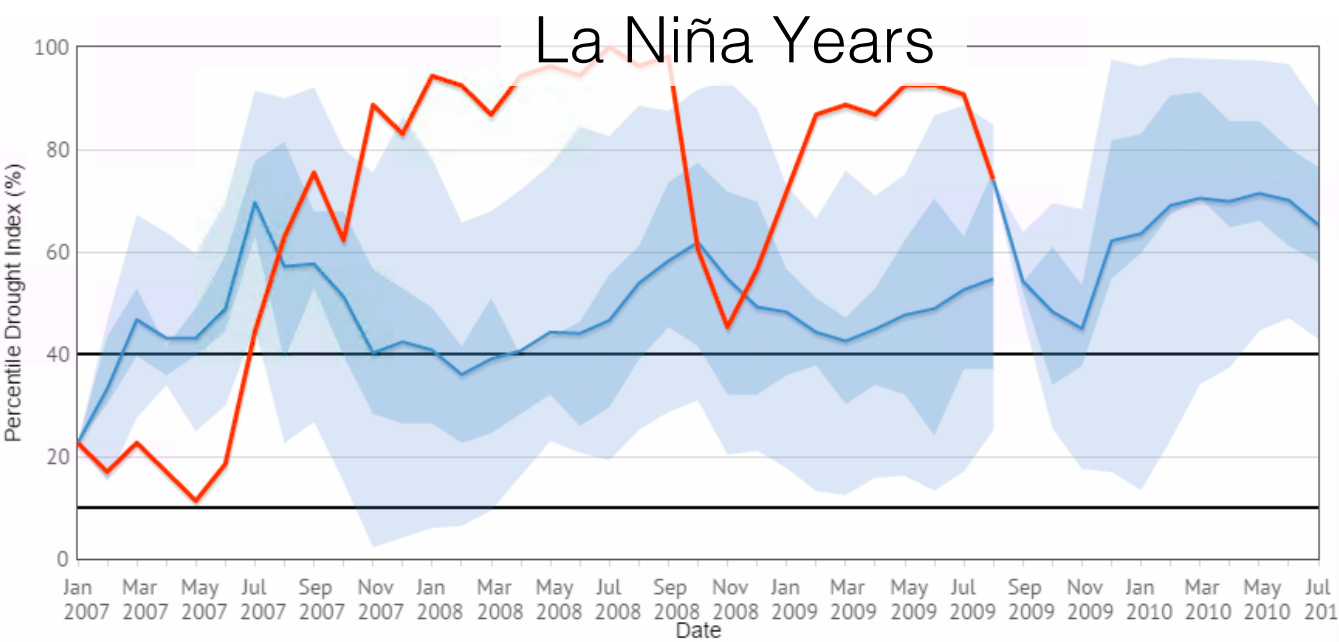
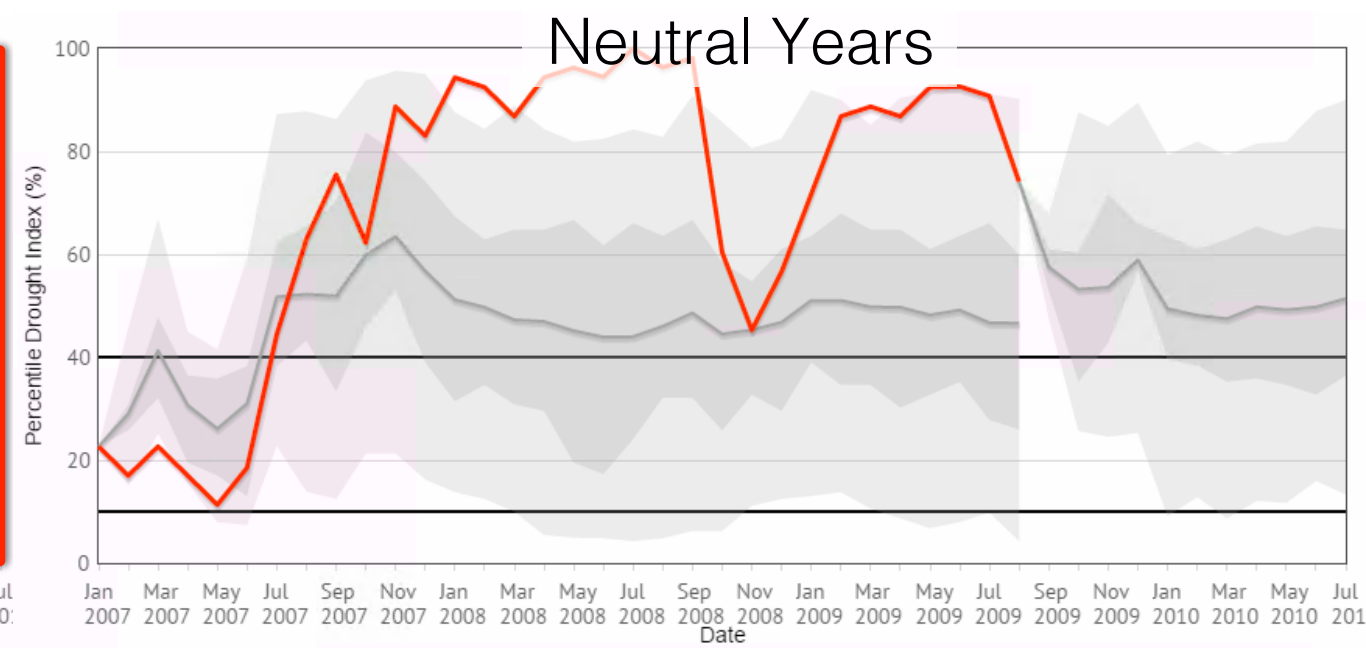
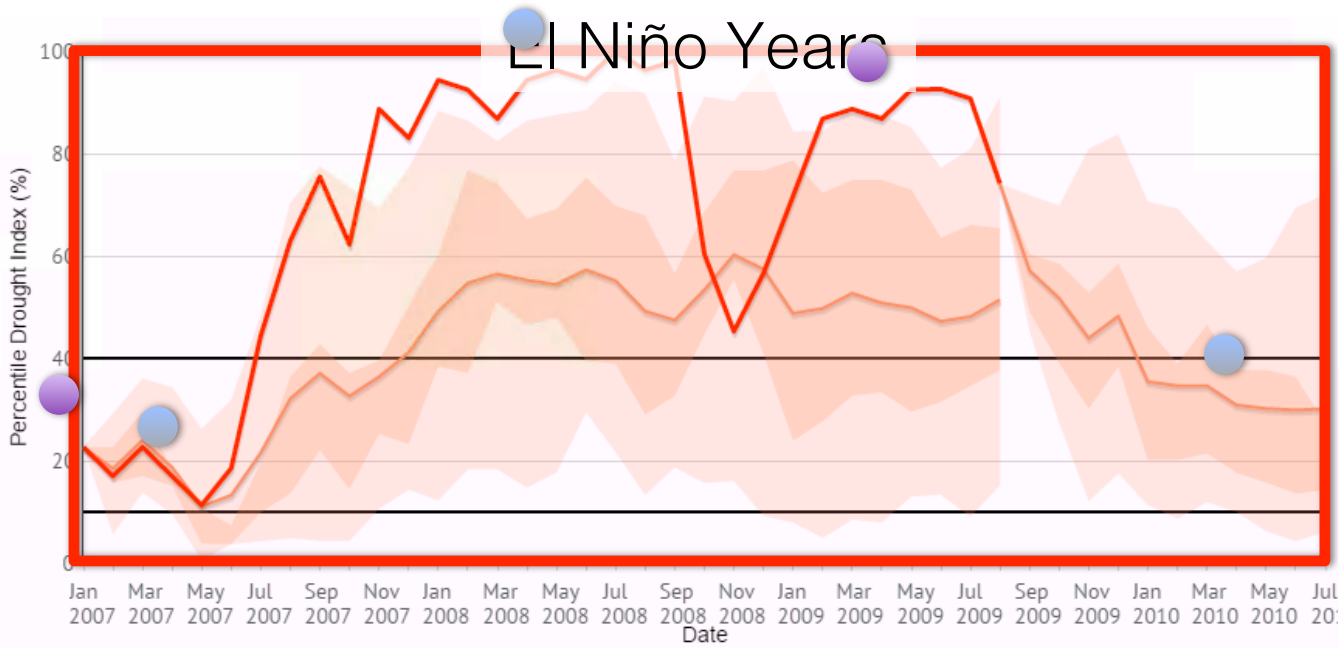
- ENSO Legend
- 2008-2009: La Niña
 - 2009-2010: El Niño
 - 2010-2011: La Niña



Warning Starting Oct 2008

Six month drought analysis (Solomon Islands)

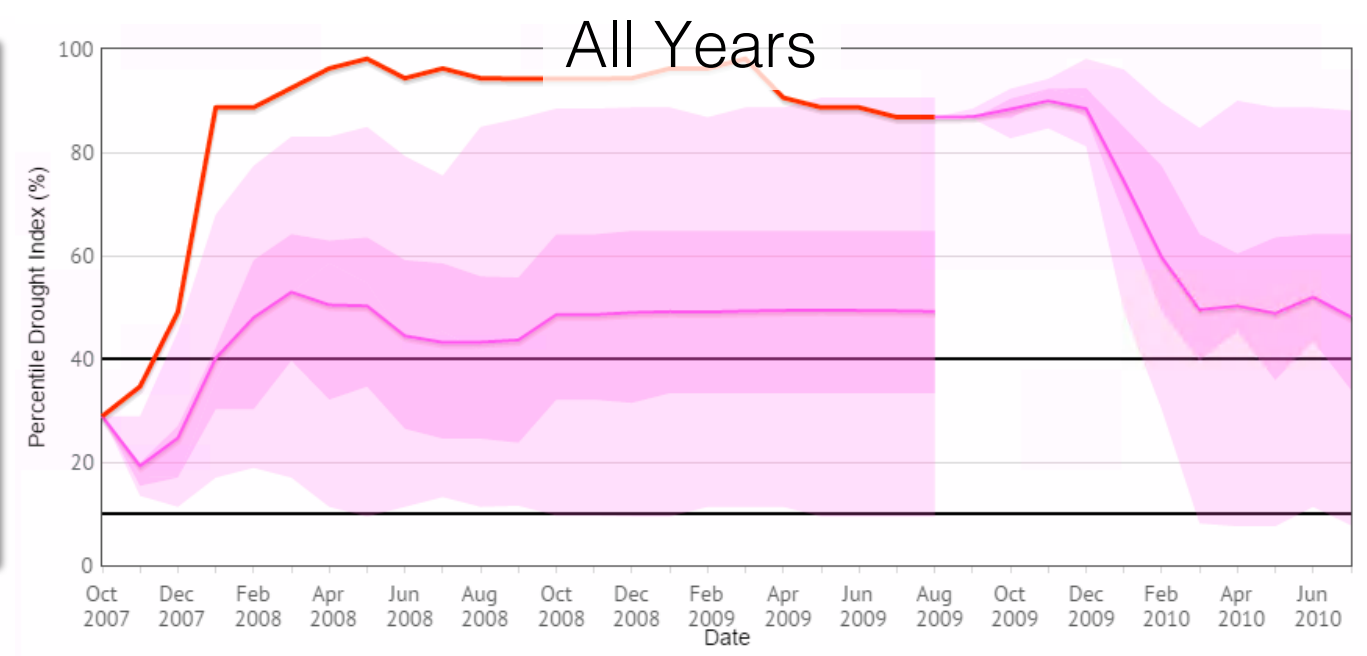
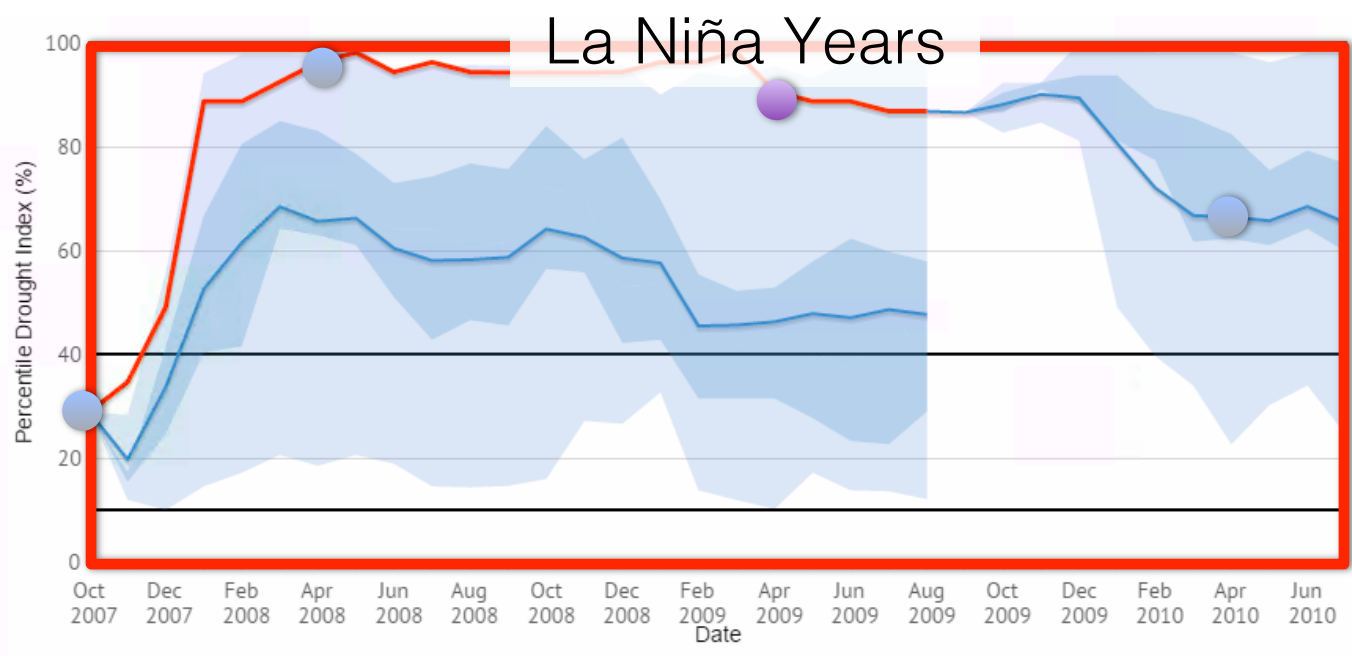
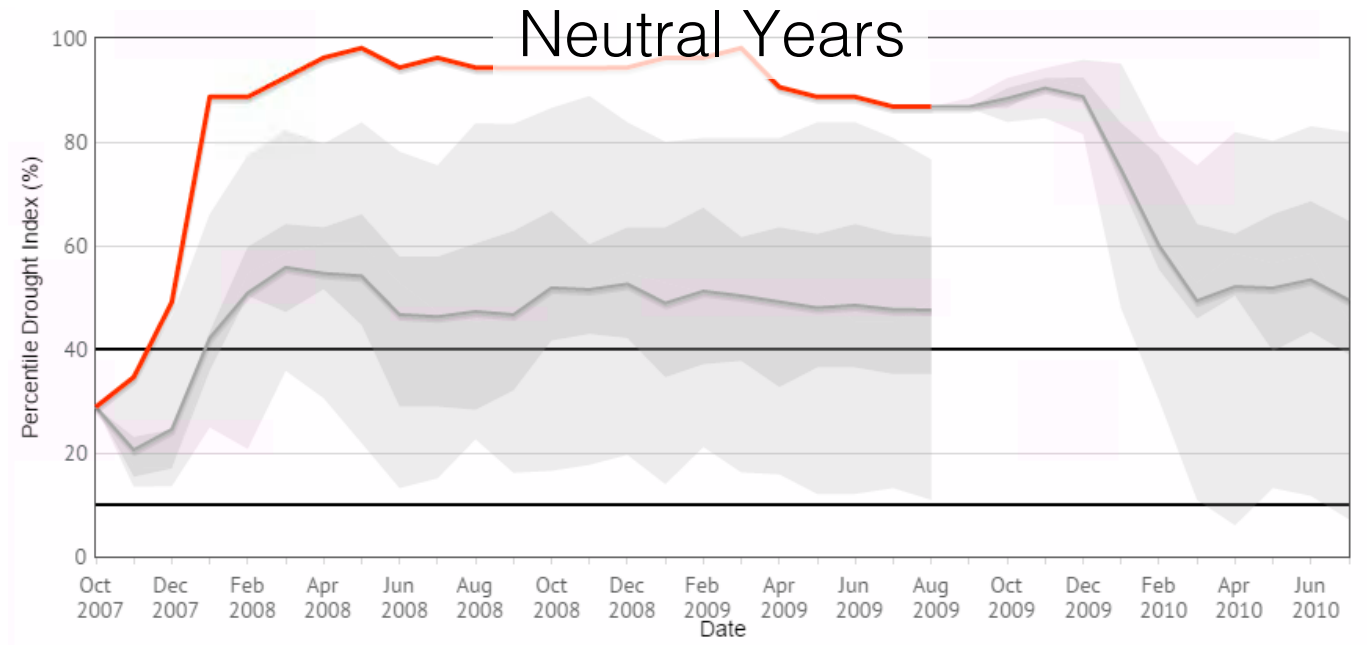
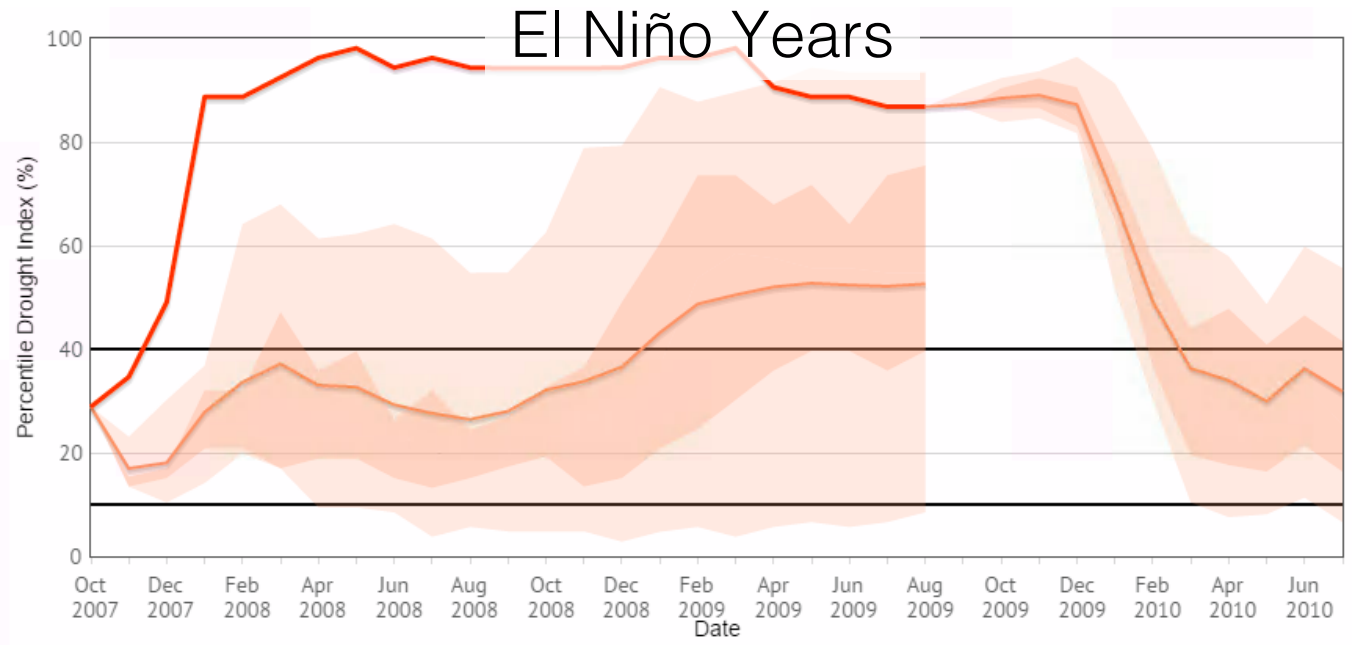
- ENSO Legend**
- 2006-2007: El Niño
 - 2007-2008: La Niña
 - 2008-2009: La Niña
 - 2009-2010: El Niño
 - 2010-2011: La Niña



Warning Starting Jan 2007

12 month drought analysis(Solomon Islands)

- ENSO Legend**
- 2007-2008: La Niña
 - 2008-2009: La Niña
 - 2009-2010: El Niño
 - 2010-2011: La Niña



Warning Starting Oct 2007

Conclusions

- In the Pacific Islands drought warning events leading to drought are highly correlated during ENSO events.
- This has application in developing a drought early warning system for the Pacific Island Countries.
- Due to direct impact of drought on a water, agriculture, health and renewable energy sectors, a drought early warning system could assist in mitigation of adverse impacts in the most vulnerable countries.