El Nino: Current Progress, Possibility & Severity of Occurrence in 2015

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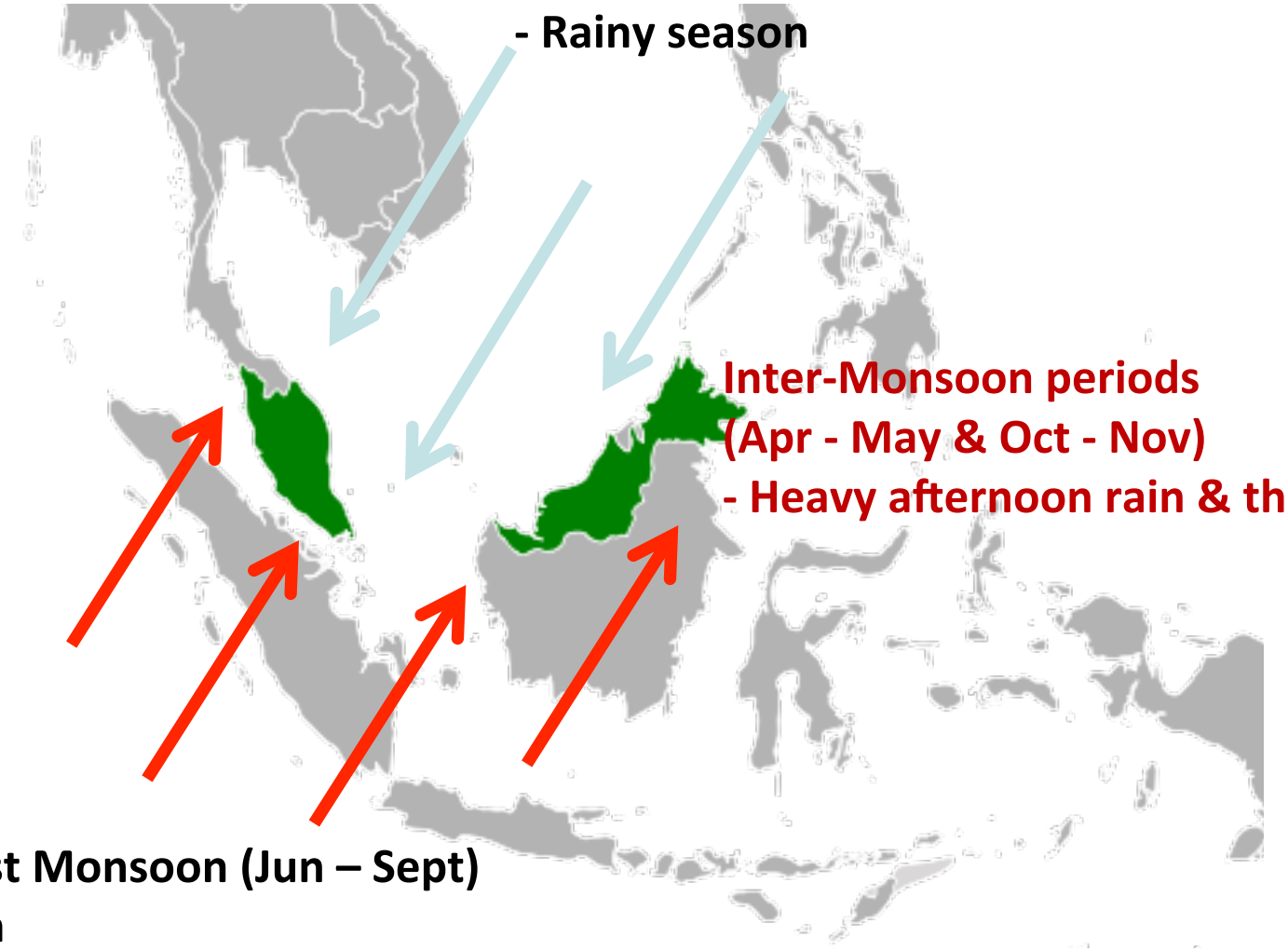
El Nino: The Good, Bad and the Ugly of 2015
22 September 2015

Contents

- Introduction
- What is El-Nino/ENSO?
- El-Nino Current Condition
- Impact to Malaysia Weather
- Forecast
- Conclusions

Malaysia Weather

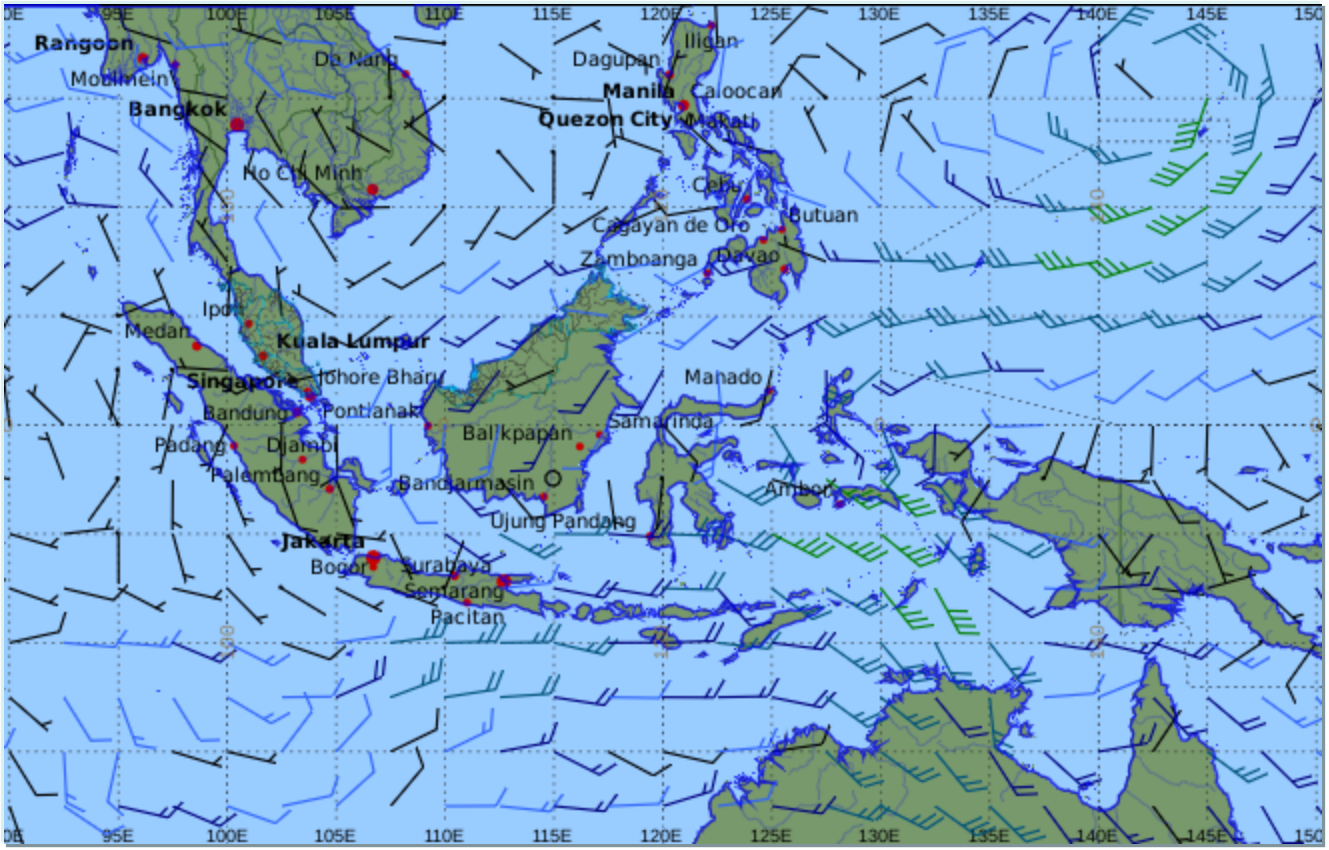
Northeast Monsoon (Nov – Mar)
- Rainy season



Inter-Monsoon periods
(Apr - May & Oct - Nov)
- Heavy afternoon rain & thunderstorm

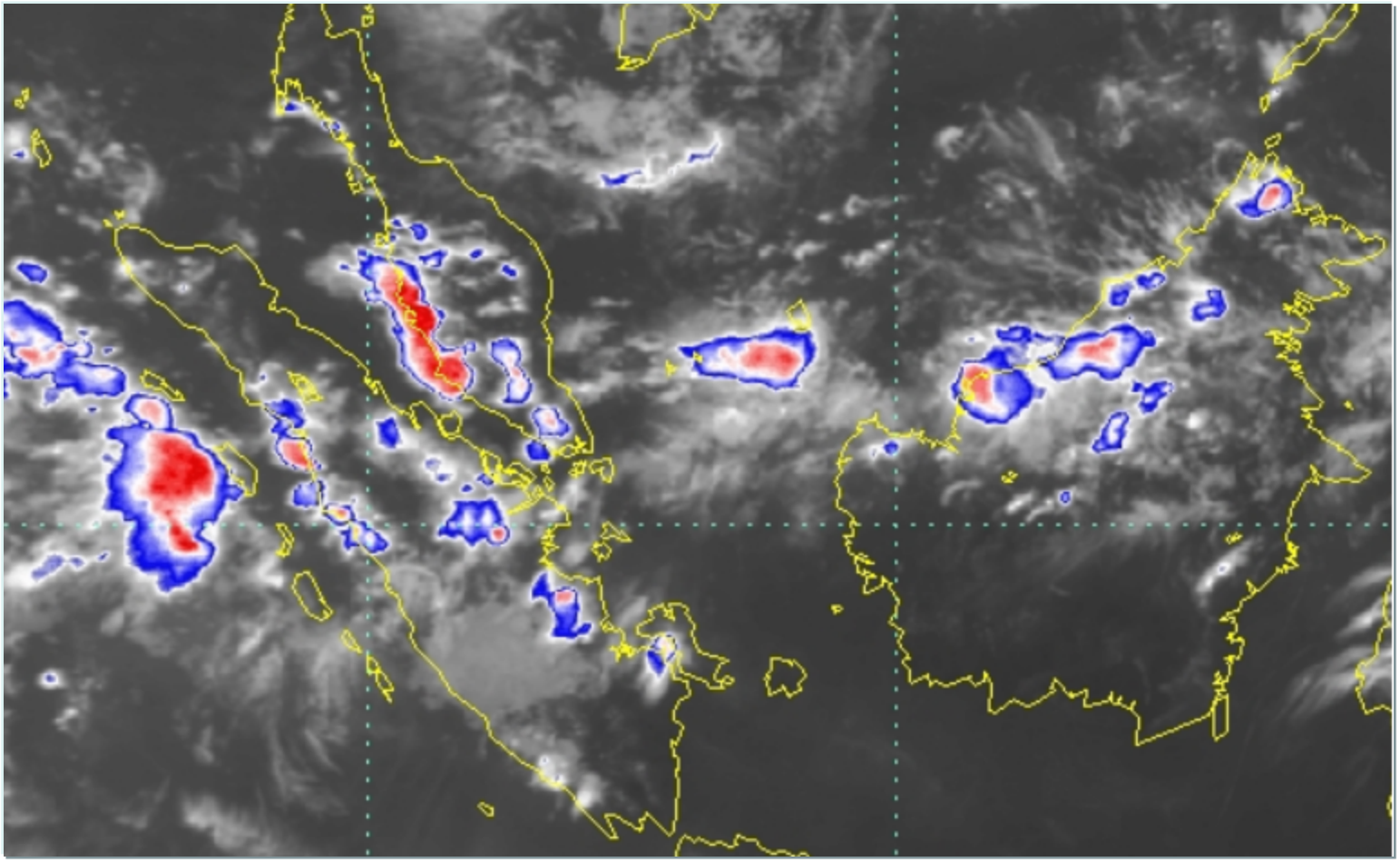
Southwest Monsoon (Jun – Sept)
- Less rain

We are experiencing Intermonsoon Period since 20th September 2015

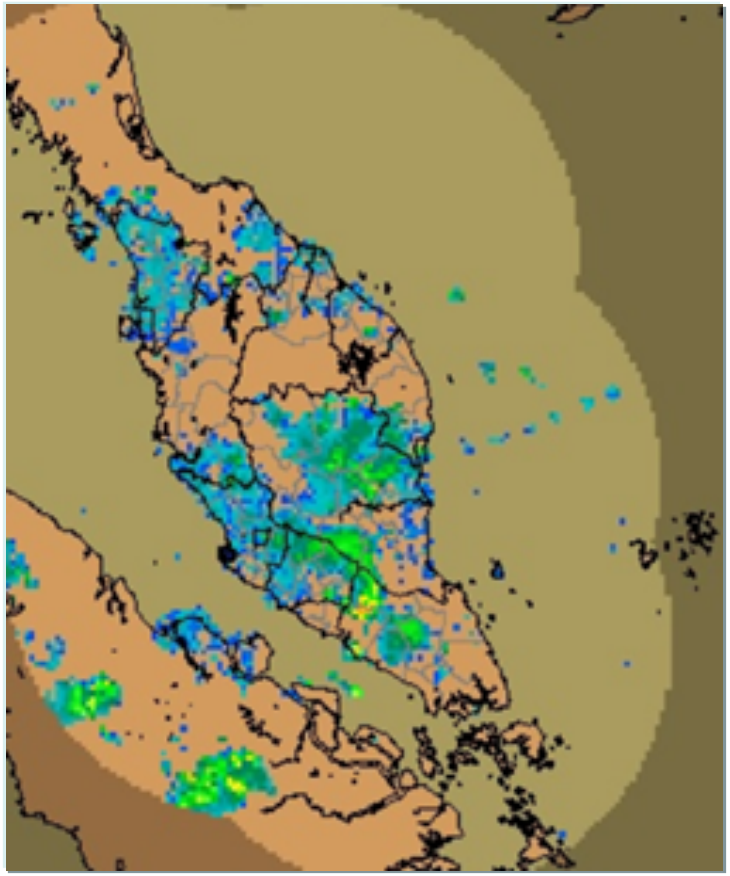


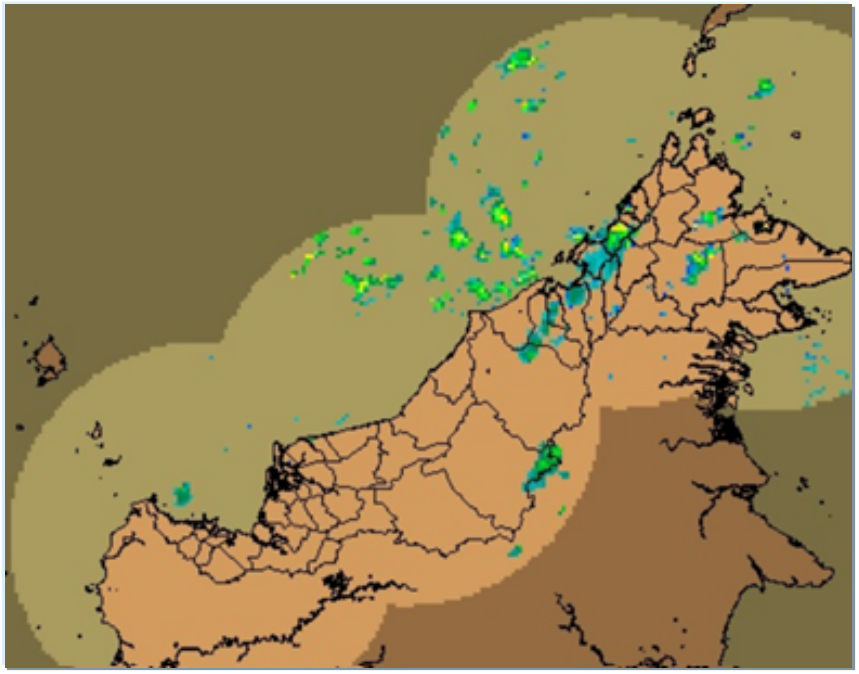
- Normally variable wind
- Afternoon/evening thunderstorms especially over the west coast of Peninsular

Satellite Image at 6.00 pm 21 September 2015

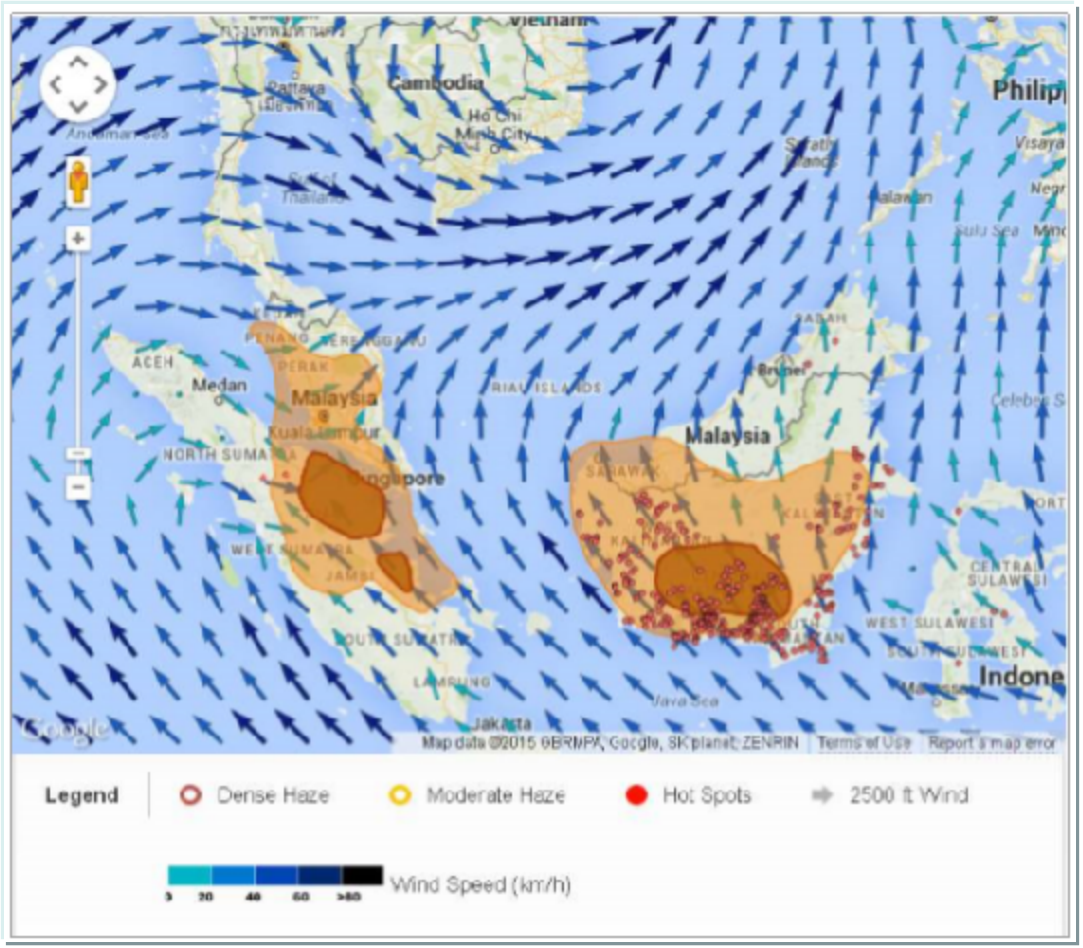


Radar picture at 8.00 pm 21 September 2015

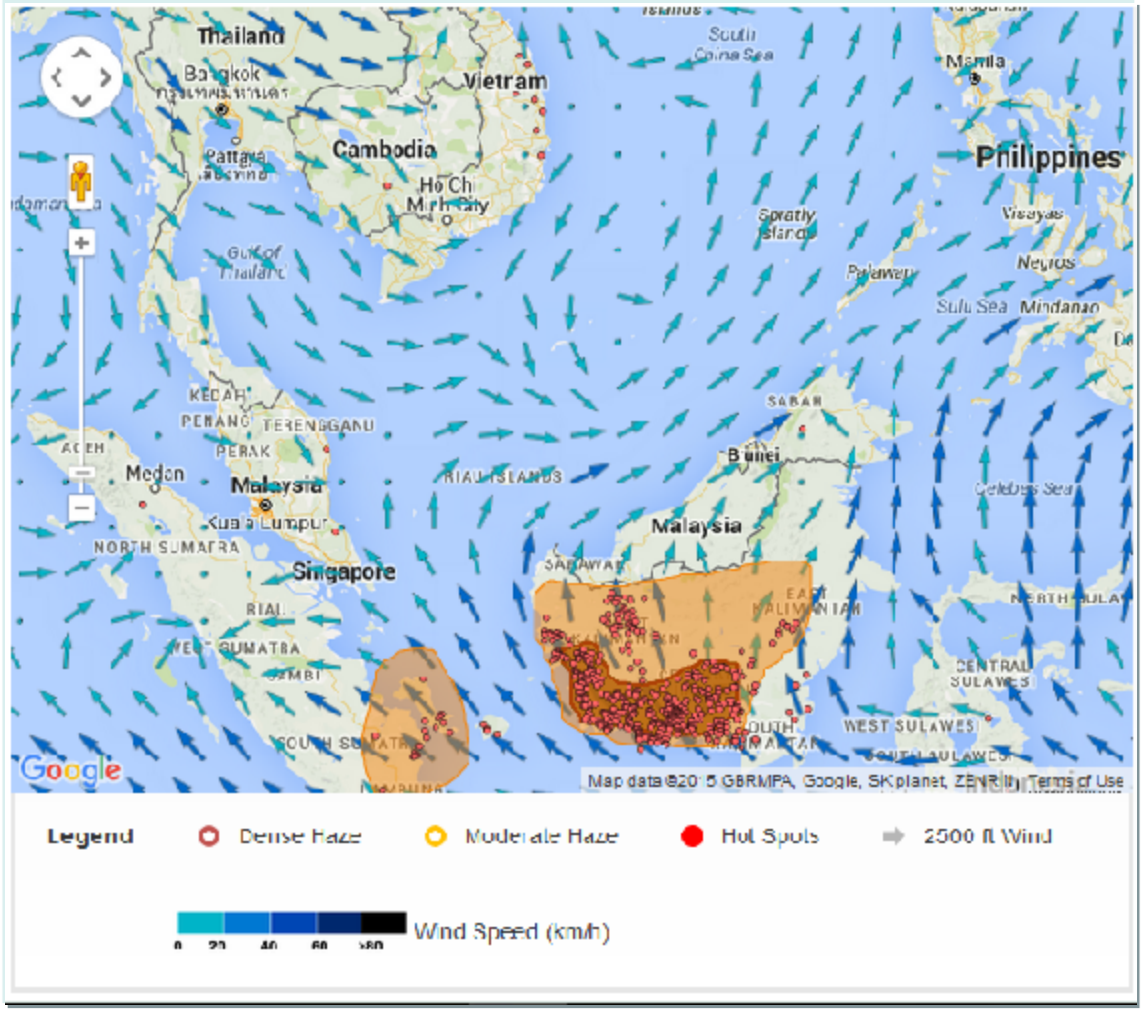




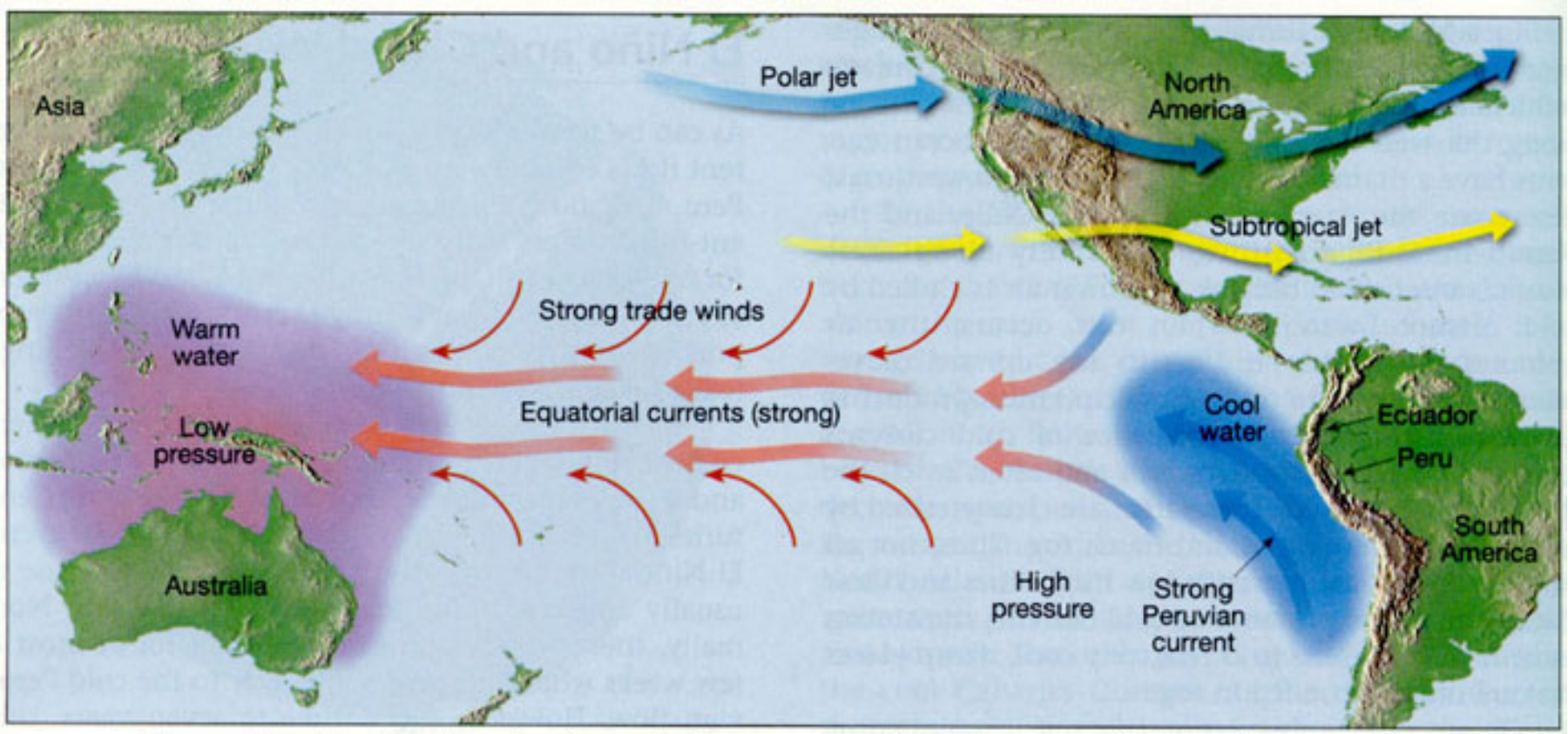
Haze Situation on 15 September 2015



Haze Situation on 21 September 2015 (night)

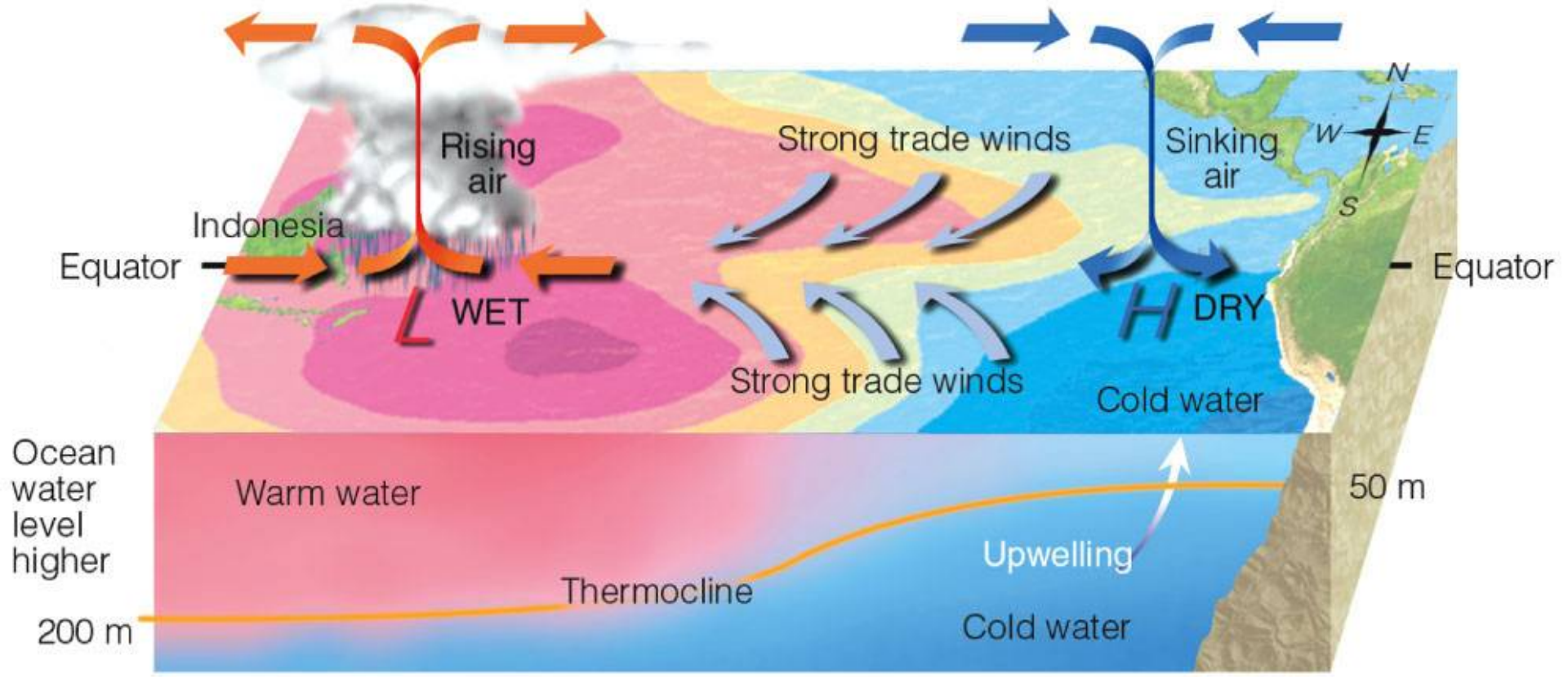


What is El-Nino?

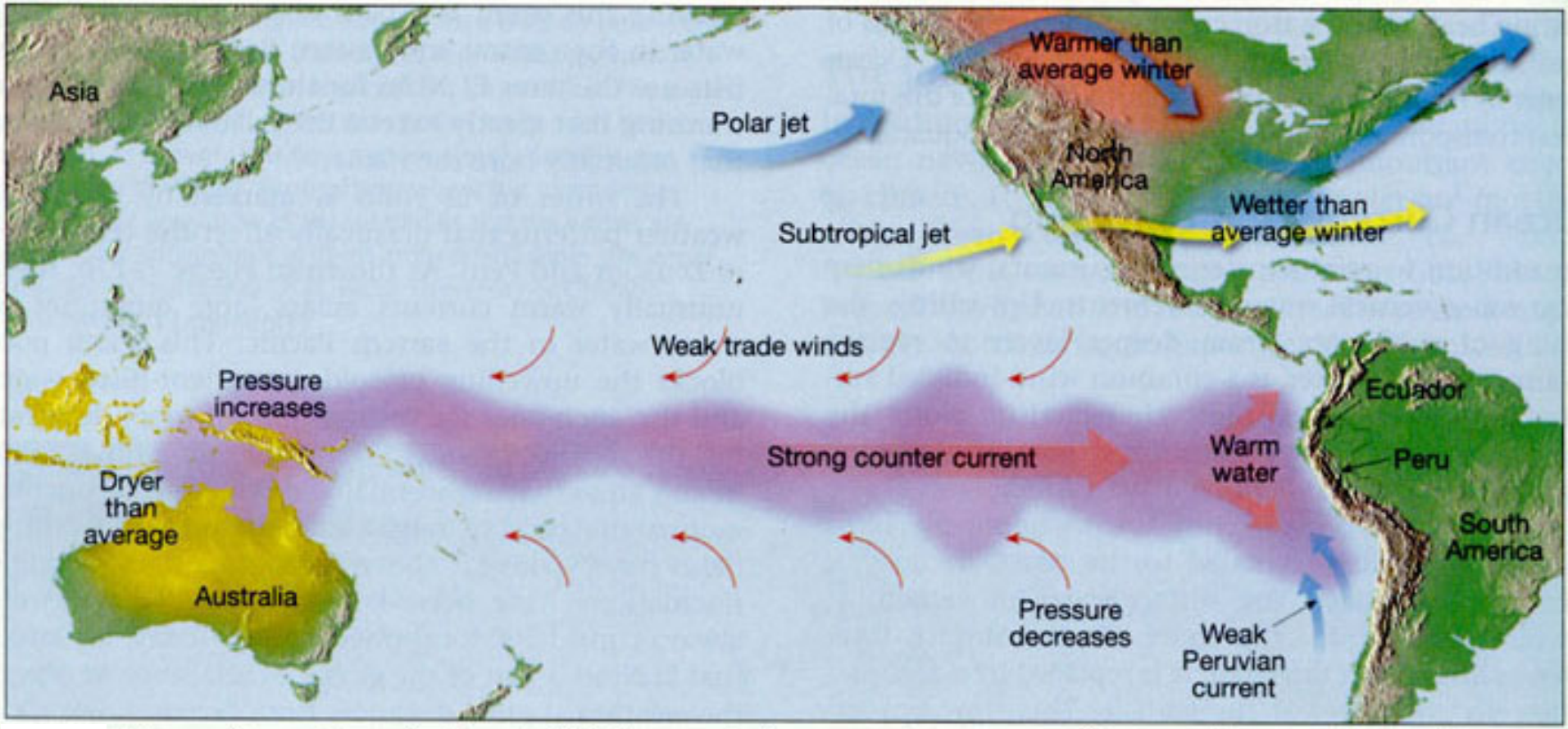


Normally, the trade winds and strong equatorial currents flow toward the west. At the same time, an intense Peruvian current causes upwelling of cold water along the west coast of South America.

Air-Sea Interaction (Normal)

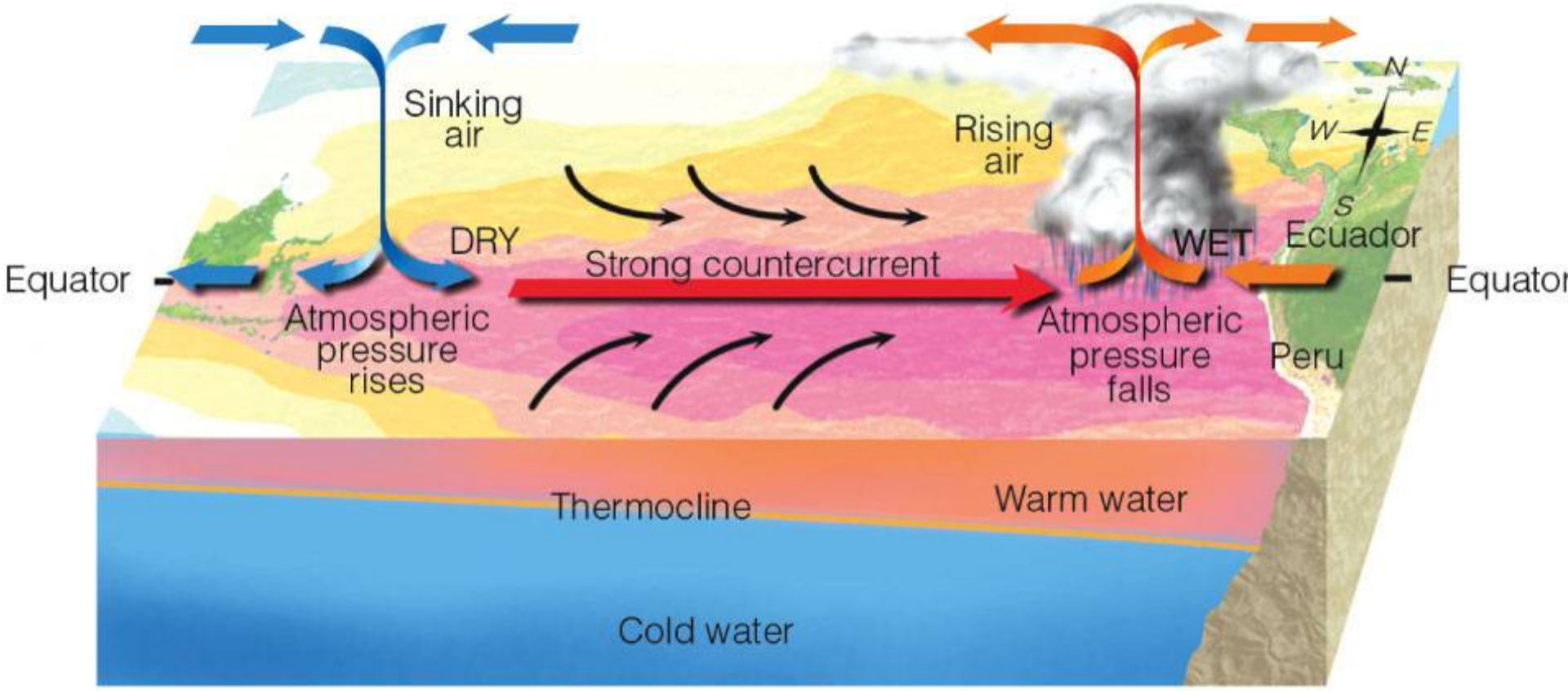


What is El-Nino?

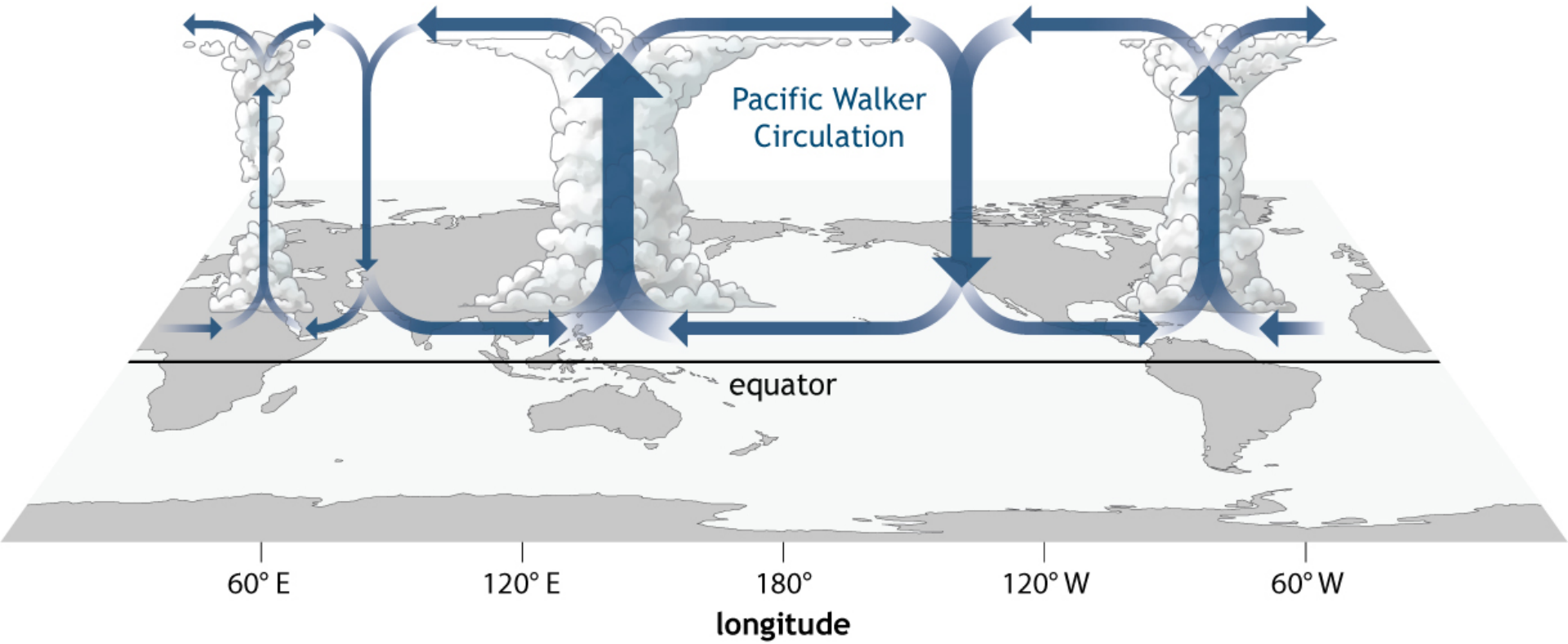


Upon the advent of an ENSO event, the pressure over the eastern and western Pacific flip-flops. This causes the trade winds to diminish, leading to an eastward movement of warm water along the equator. As a result, the surface waters of the central and eastern Pacific warm, with far-reaching consequences to weather patterns.

Air-Sea Interaction (El-Nino)

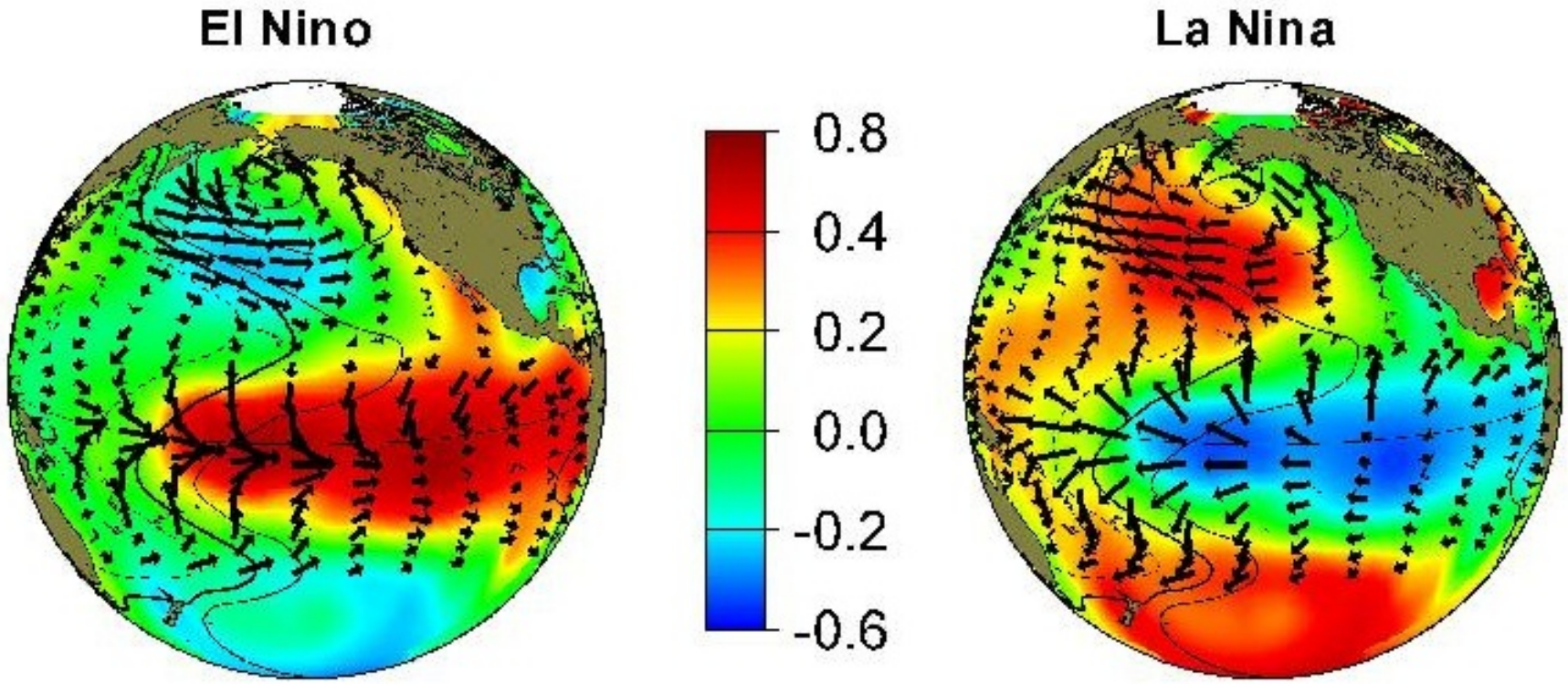


Walker Circulation

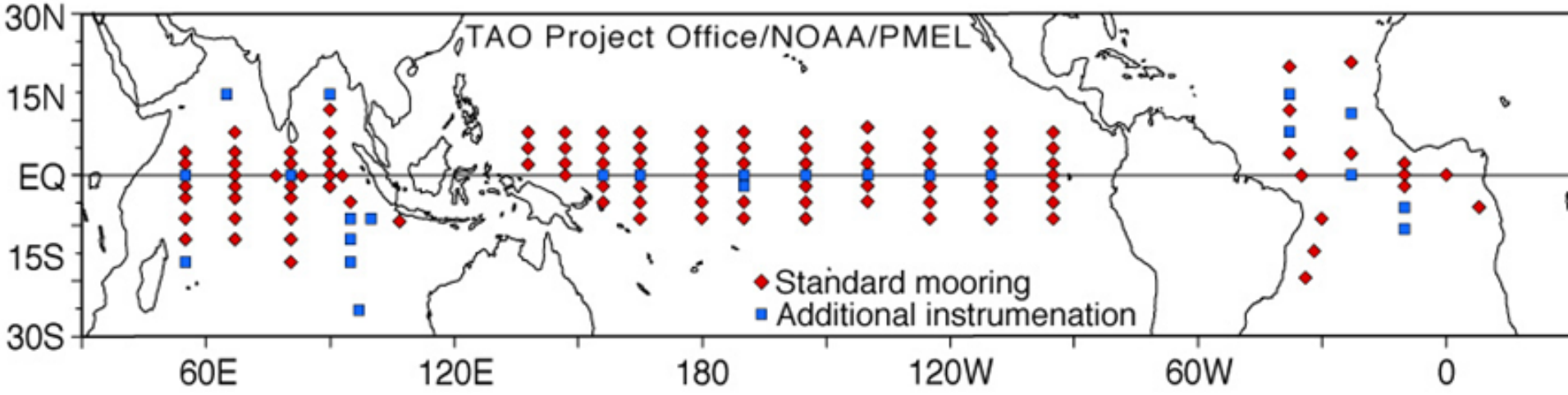


Sir Gilbert Walker (1923) & Jacob Bjerknes (1969)

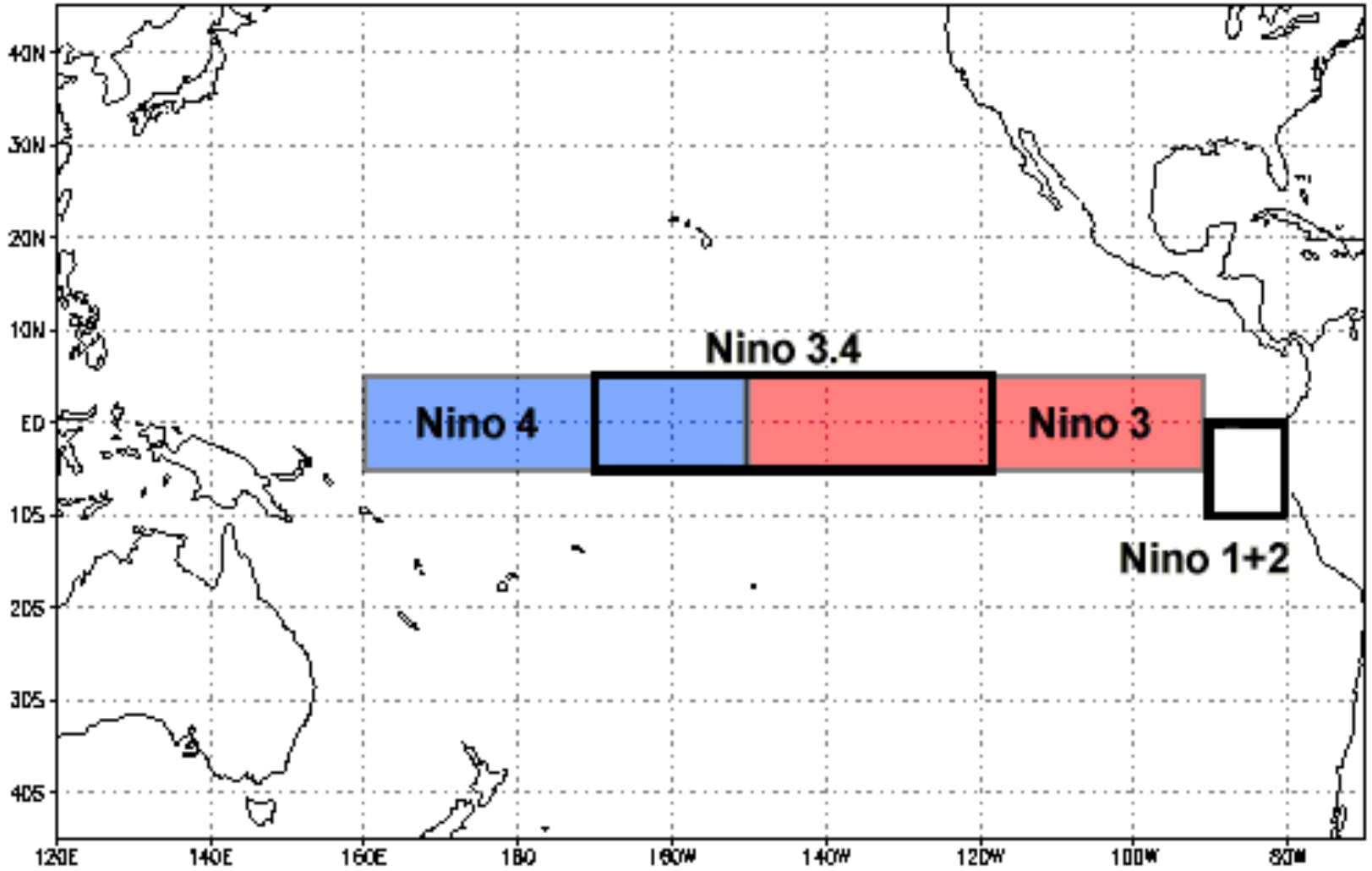
➢ What is El-Nino/ENSO?



2 – 7 years cycle of warm and cold temperatures, as measured by SST of the tropical central and eastern Pacific Ocean



The establishment of the Tropical Atmosphere Ocean (TAO) Array in 1994 under the Tropical Ocean-Global Atmosphere (TOGA) programme initiated by NOAA


40N
30N
20N
10N
ED
10S
20S
30S
40S
120E
140E
160E
180
160W
140W
120W
100W
80W
Nino 3.4
Nino 4
Nino 3
Nino 1+2

How to Determine El-Nino Year?

Catalogue of Indices and Definitions of El Niño and La Niña in Operational Use by WMO Members

WMO Commission for Climatology
CCl-XIII (2005) Expert Team on El Niño and La Niña Definitions
Fiona Horsfall, Ph.D., Chair

WORLD METEOROLOGICAL ORGANIZATION

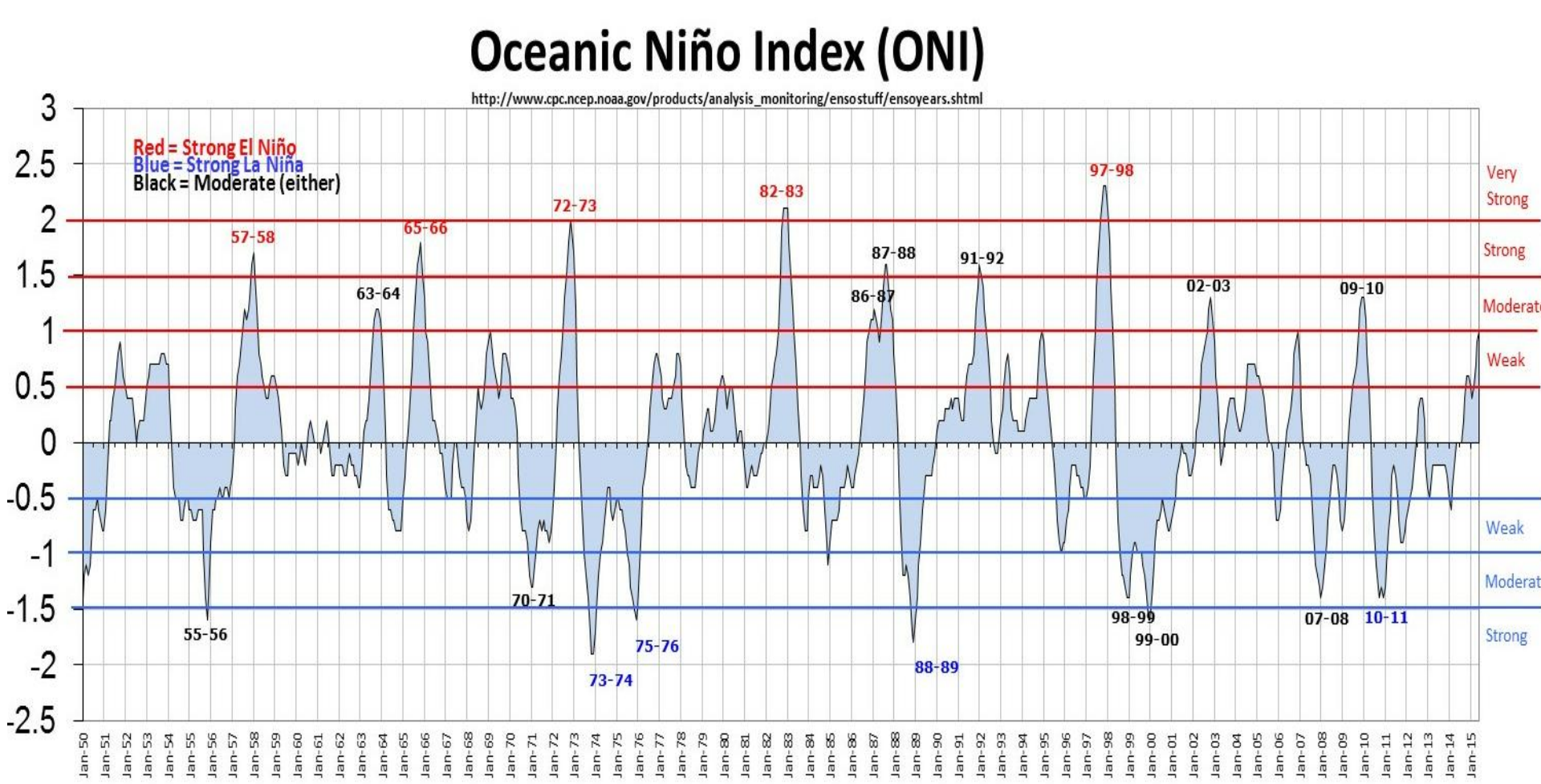
June 2006

ONI ENSO INDEX

The 3-month running mean SST anomalies at NINO 3.4 are equal or greater/less than +/- 0.5°C for five consecutive months

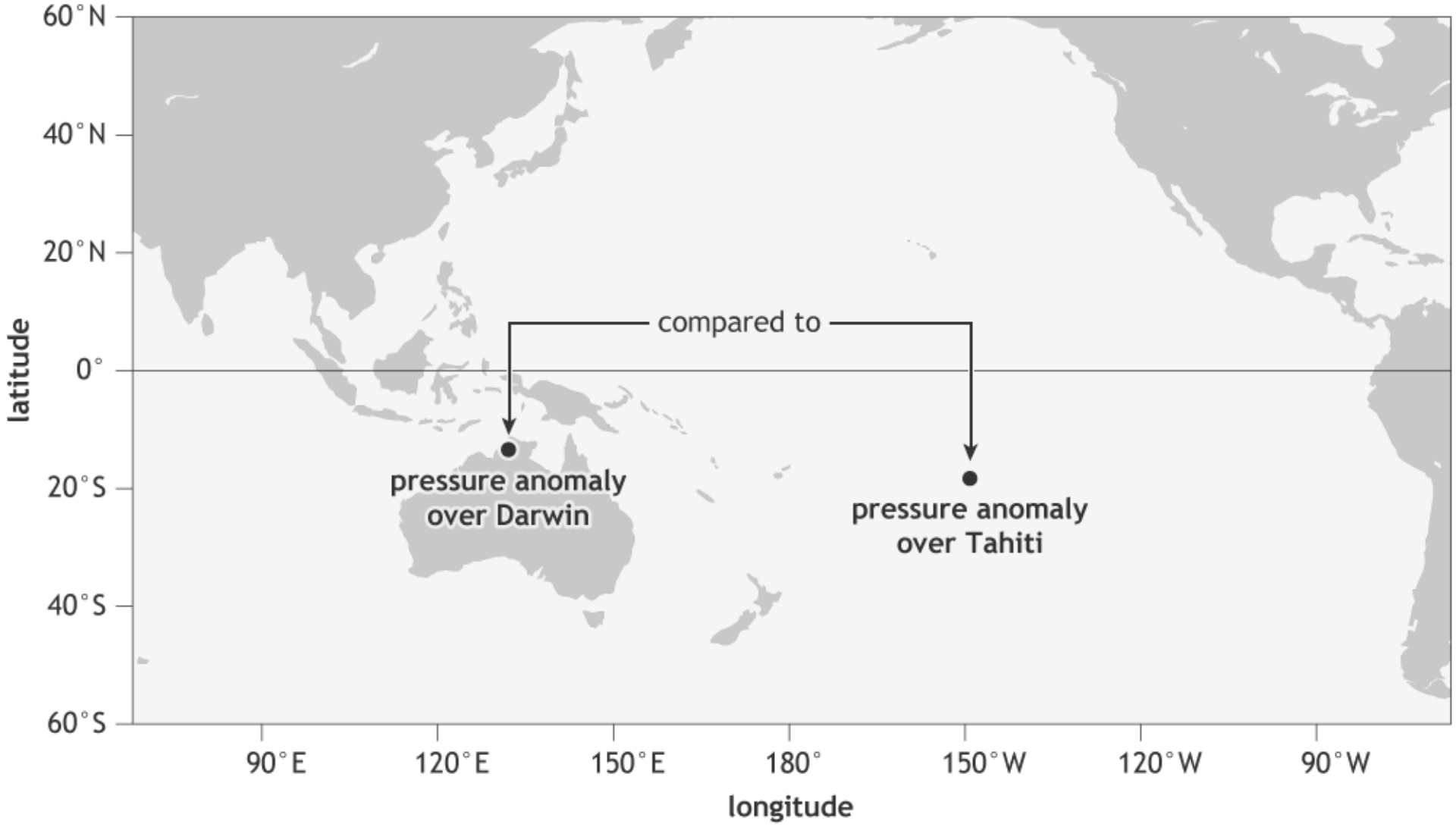
Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2003	0.9	0.6	0.4	0.0	-0.2	-0.1	0.1	0.2	0.3	0.4	0.4	0.4
2004	0.3	0.2	0.1	0.1	0.2	0.3	0.5	0.7	0.7	0.7	0.7	0.7
2005	0.6	0.6	0.5	0.5	0.4	0.2	0.1	0.0	0.0	-0.1	-0.4	-0.7
2006	-0.7	-0.6	-0.4	-0.2	0.0	0.1	0.2	0.3	0.5	0.8	0.9	1.0
2007	0.7	0.3	0.0	-0.1	-0.2	-0.2	-0.3	-0.6	-0.8	-1.1	-1.2	-1.3
2008	-1.4	-1.3	-1.1	-0.9	-0.7	-0.5	-0.3	-0.2	-0.2	-0.3	-0.5	-0.7
2009	-0.8	-0.7	-0.4	-0.1	0.2	0.4	0.5	0.6	0.7	1.0	1.2	1.3
2010	1.3	1.1	0.8	0.5	0.0	-0.4	-0.8	-1.1	-1.3	-1.4	-1.3	-1.4
2011	-1.3	-1.1	-0.8	-0.6	-0.3	-0.2	-0.3	-0.5	-0.7	-0.9	-0.9	-0.8
2012	-0.7	-0.6	-0.5	-0.4	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.2
2013	-0.4	-0.5	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3
2014	-0.5	-0.6	-0.4	-0.2	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.6
2015	0.5	0.4	0.5	0.7	0.9	1.0	1.2					

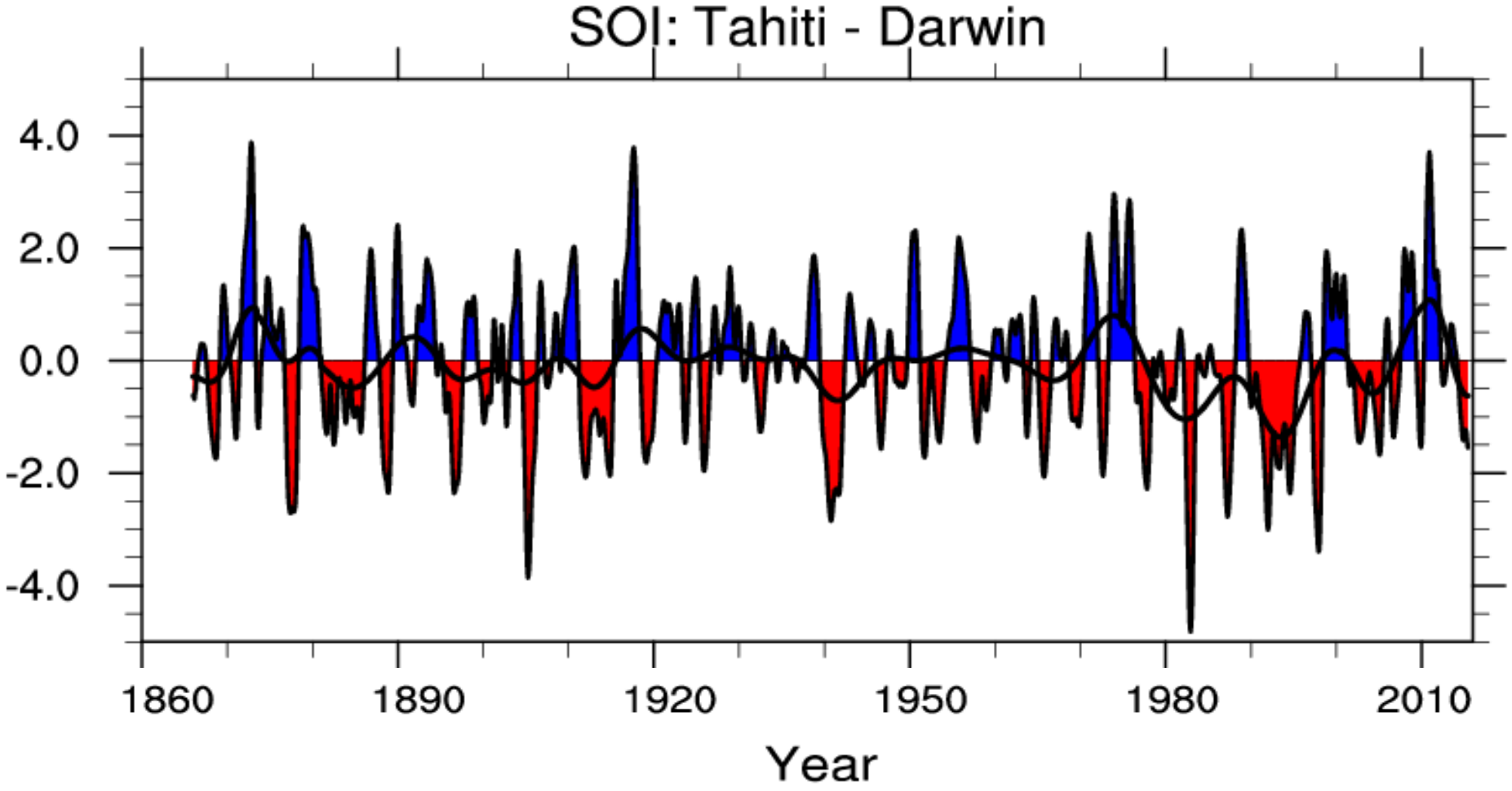
Source: NOAA



The 3-month running mean SST anomalies at NINO 3.4 are equal or greater/less than +/- 0.5°C for five consecutive months

SOUTHERN OSCILLATION INDEX (SOI)

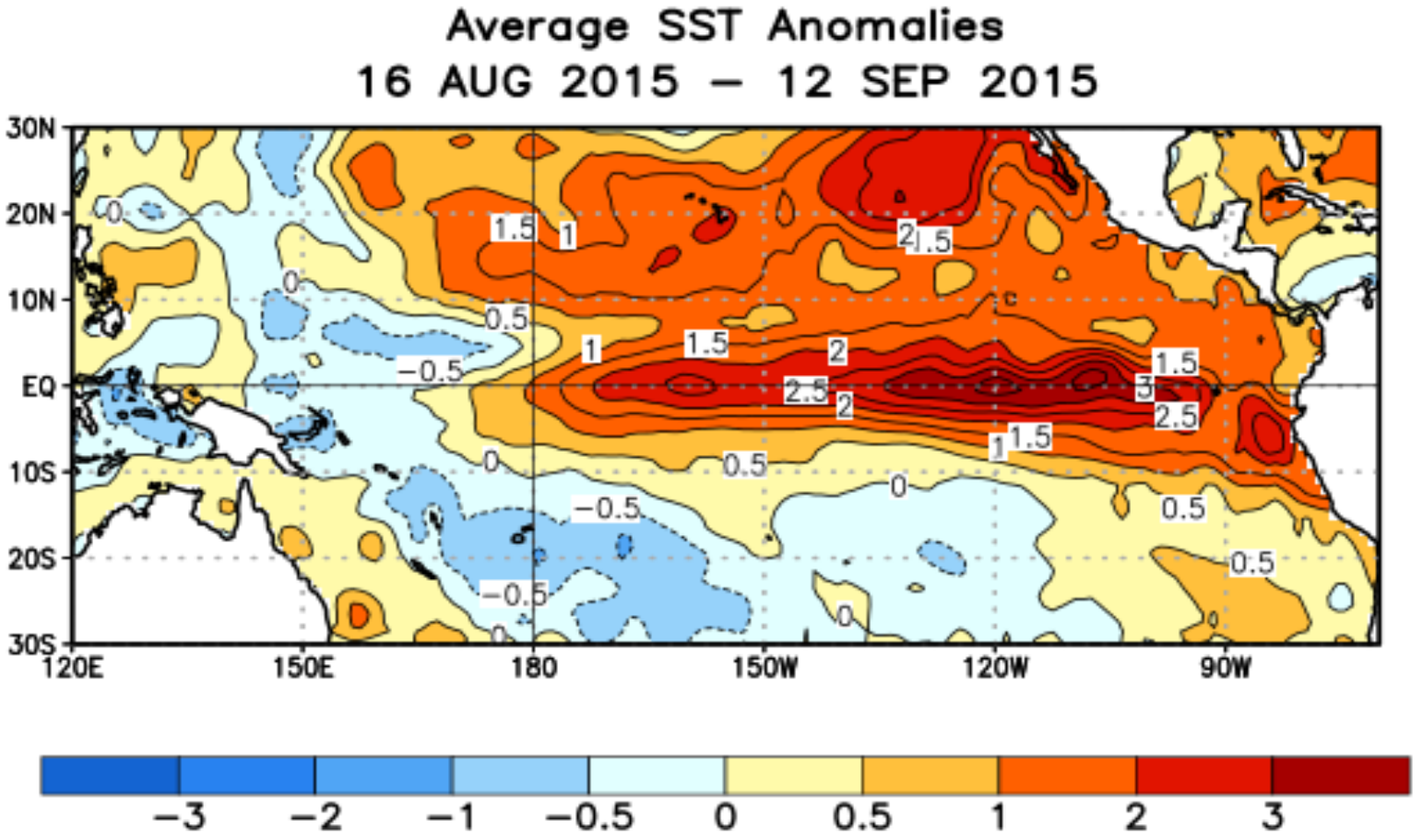



SOI: Tahiti - Darwin
4.0
2.0
0.0
-2.0
-4.0
1860
1890
1920
1950
1980
2010
Year

El-Nino & La-Nina Years

El Niño				La Niña		
Weak	Mod	Strong	Very Strong	Weak	Mod	Strong
1951-52	1963-64	1957-58	1982-83	1950-51	1955-56	1973-74
1952-53	1986-87	1965-66	1997-98	1954-55	1970-71	1975-76
1953-54	1987-88	1972-73		1964-65	1998-99	1988-89
1958-59	1991-92			1967-68	1999-00	
1968-69	2002-03			1971-72	2007-08	
1969-70	2009-10			1974-75	2010-11	
1976-77				1983-84		
1977-78				1984-85		
1979-80				1995-96		
1994-95				2000-01		
2004-05				2011-12		
2006-07						

El-Nino Current Condition

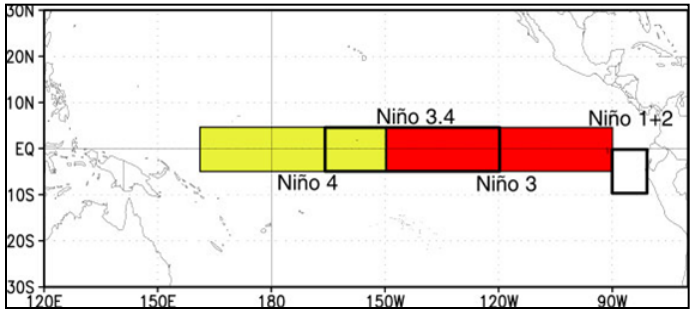


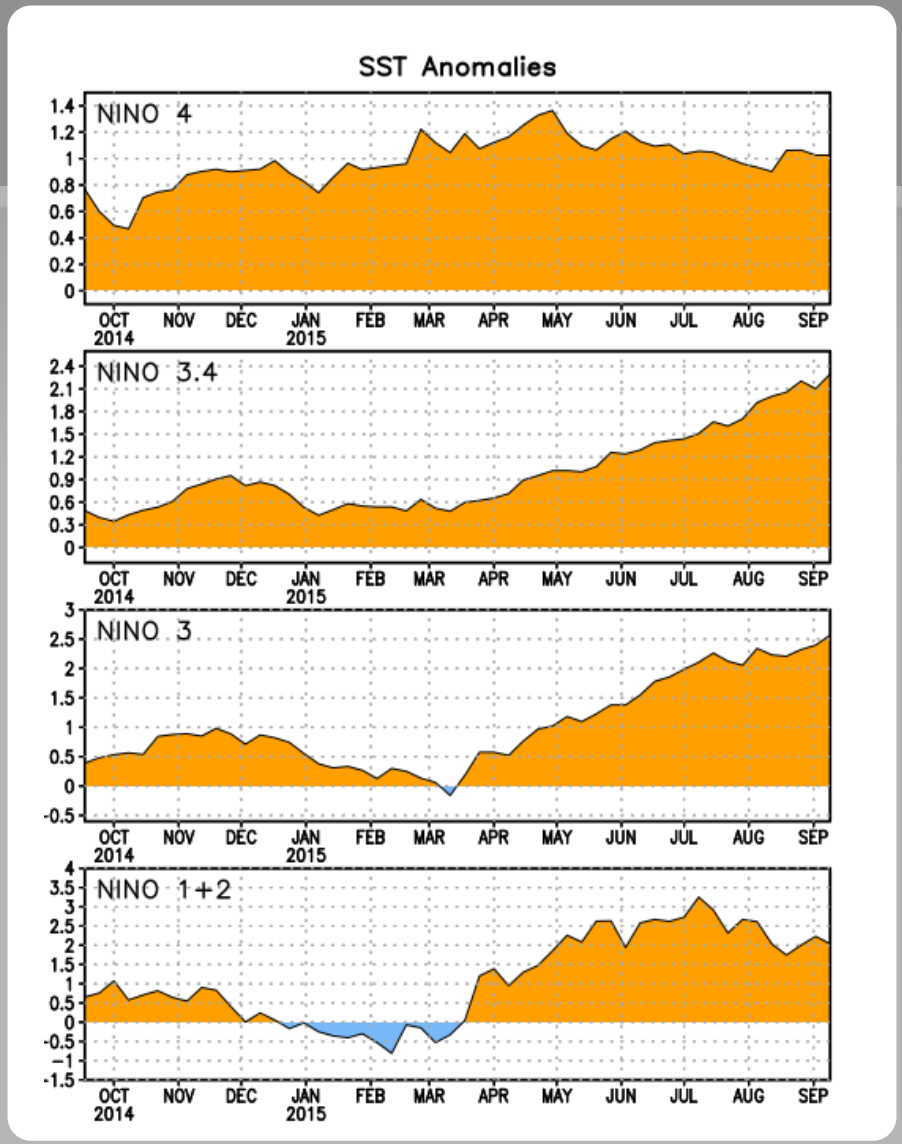
Source: NOAA

Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

Niño 4	1.0ºC
Niño 3.4	2.3ºC
Niño 3	2.6ºC
Niño 1+2	2.0ºC

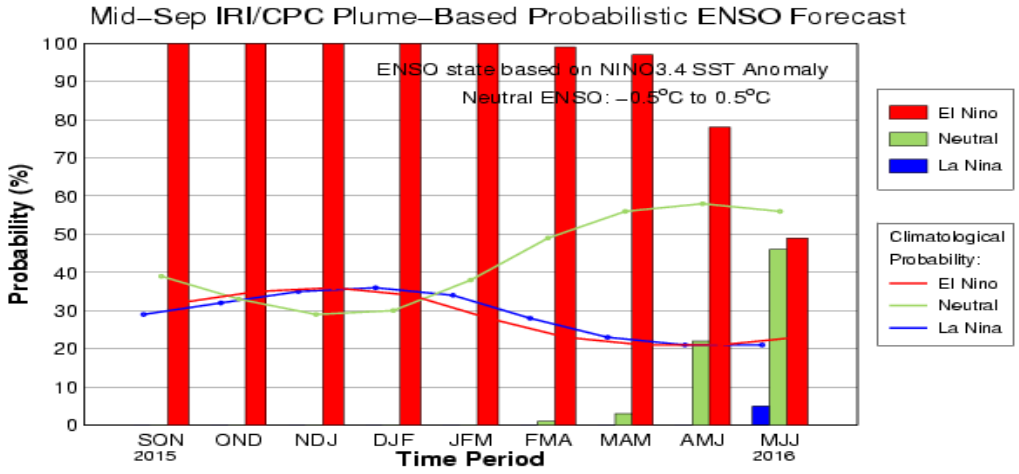




Source: NOAA

El-Nino Forecast

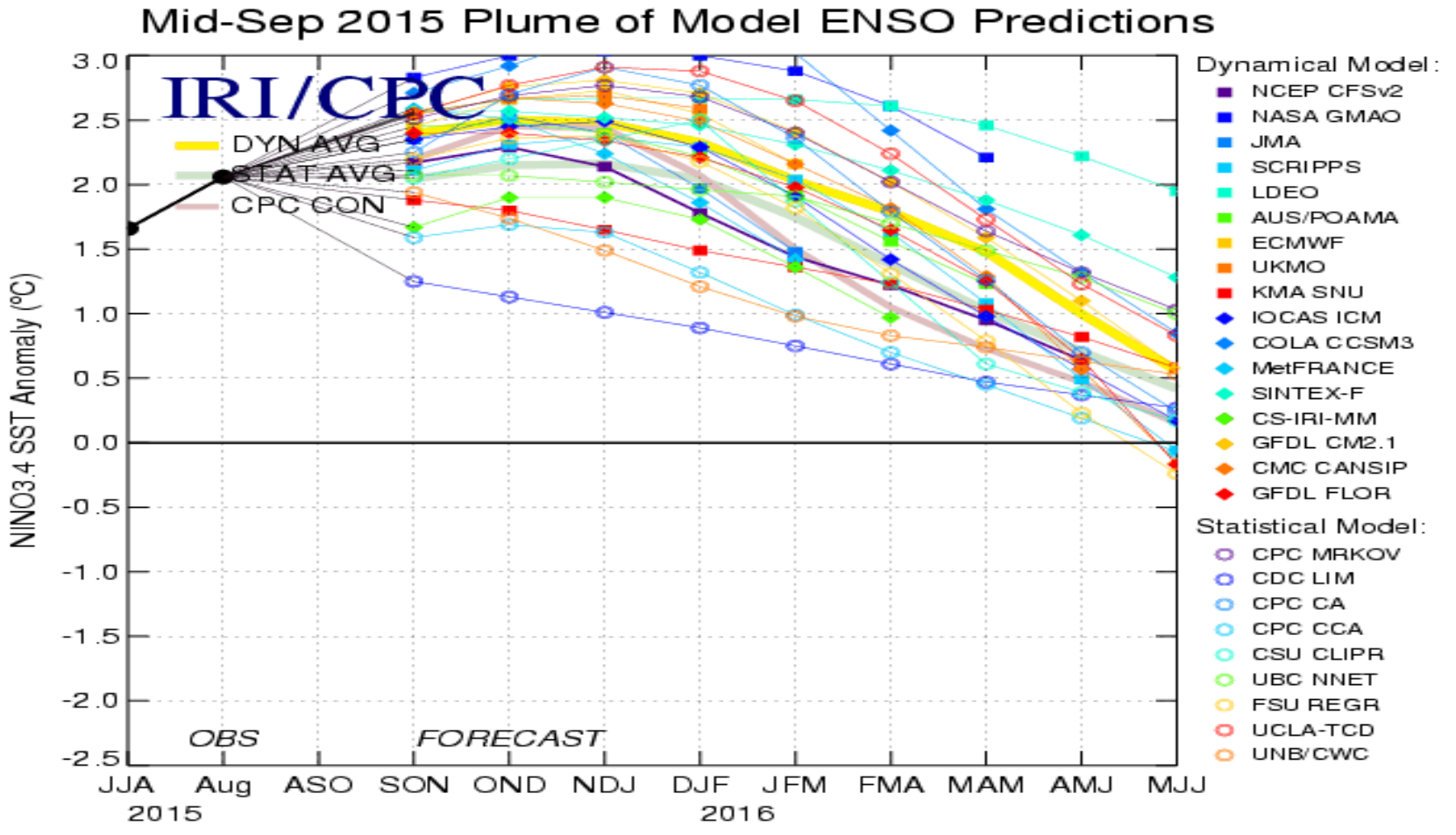
The chance of El Niño is greater than 90% through Northern Hemisphere winter and spring (MAM) 2016.



IRI/CPC Mid-Month Plume-Based ENSO Forecast Probabilities

Season	La Niña	Neutral	El Niño
SON 2015	~0%	~0%	100%
OND 2015	~0%	~0%	100%
NDJ 2015	~0%	~0%	100%
DJF 2015	~0%	~0%	100%
JFM 2016	~0%	~0%	100%
FMA 2016	~0%	1%	99%
MAM 2016	~0%	3%	97%
AMJ 2016	~0%	22%	78%
MJJ 2016	5%	46%	49%

Source: IRI

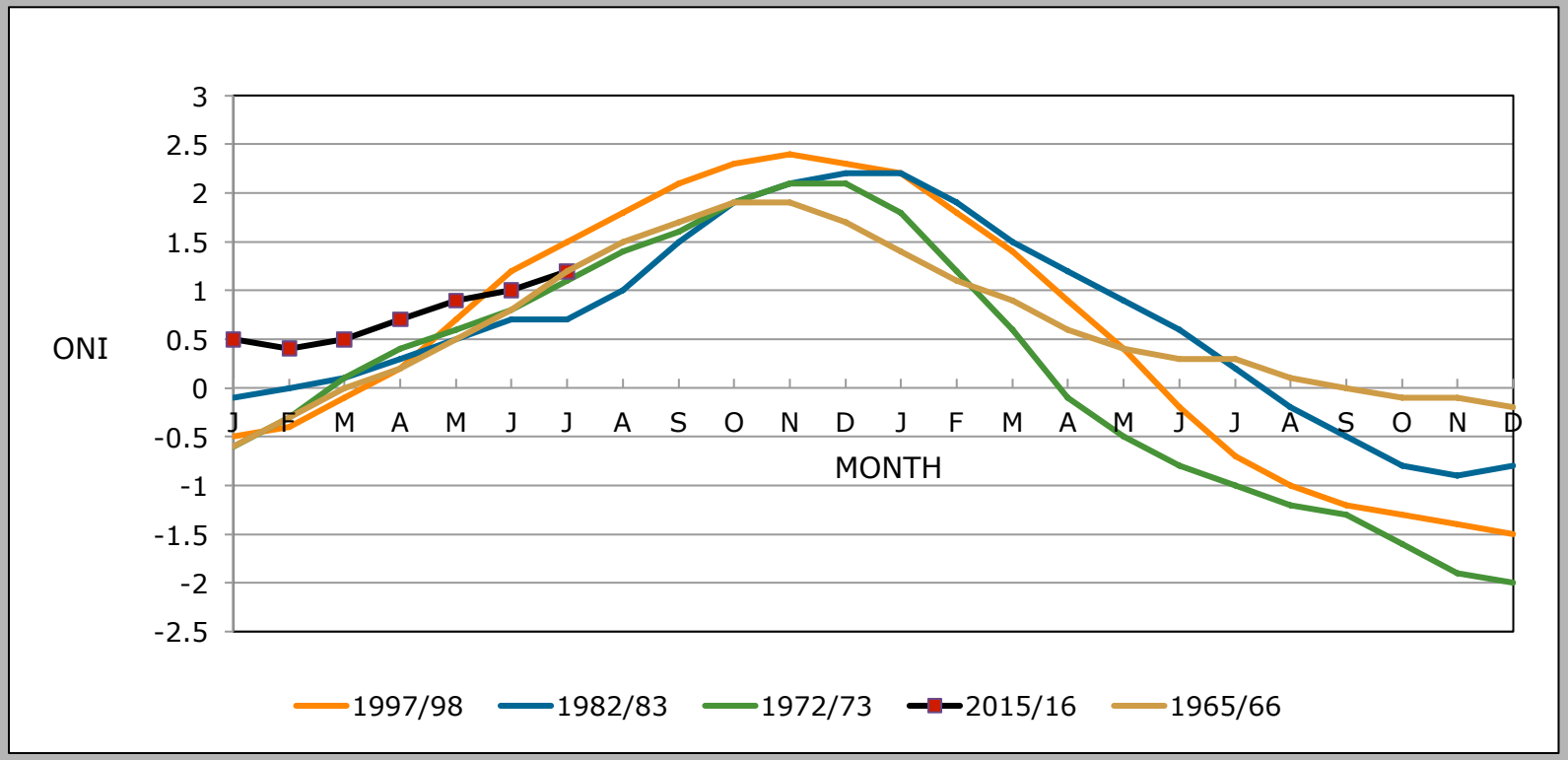


All models indicate Niño 3.4 SST anomalies will remain greater than or equal to +0.5°C through FMA 2016.

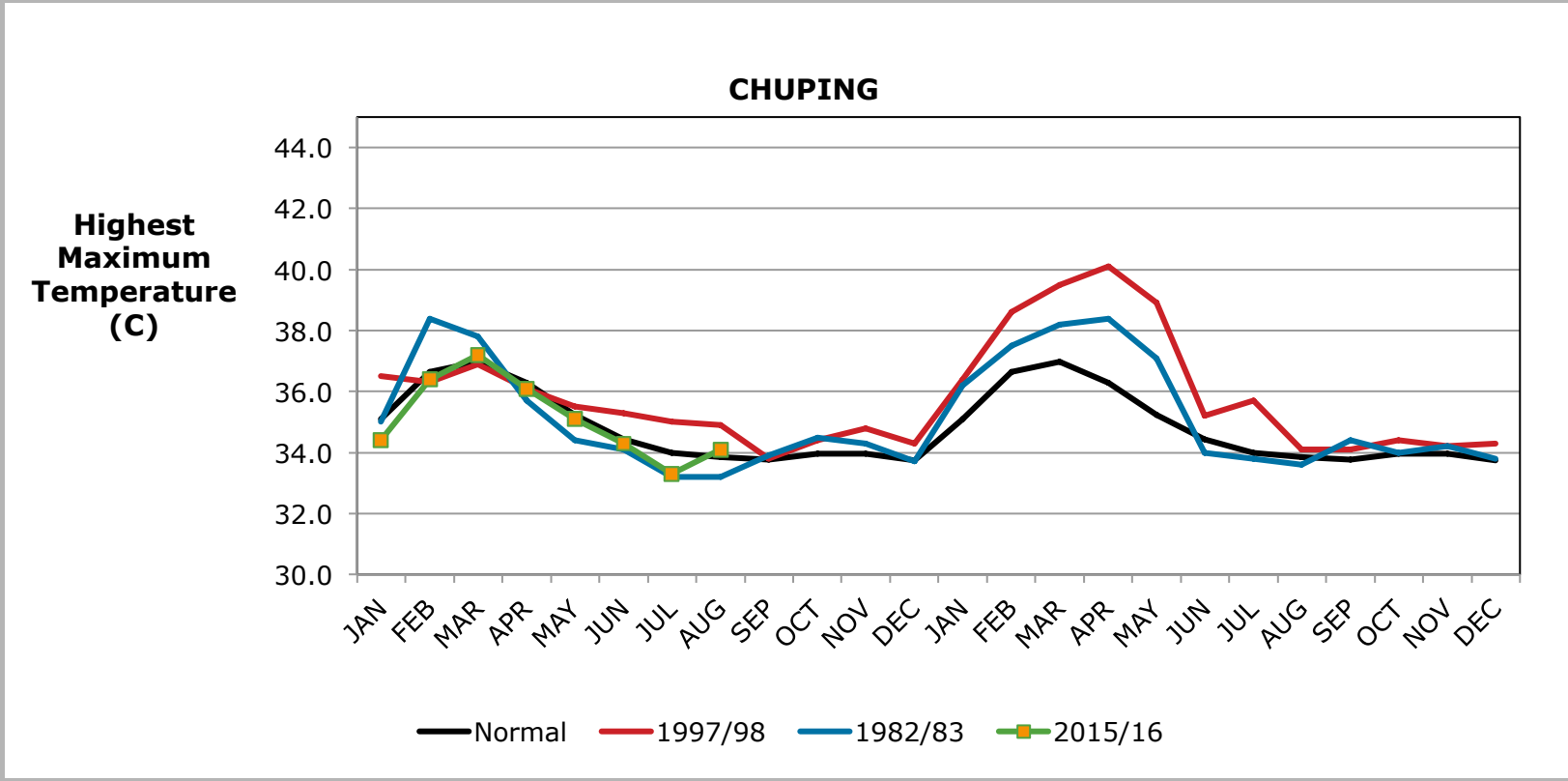
All multi-model averages indicate that Niño 3.4 will be above +1.5°C (a "strong" El Niño) during late 2015 into early 2016.

Source: IRI

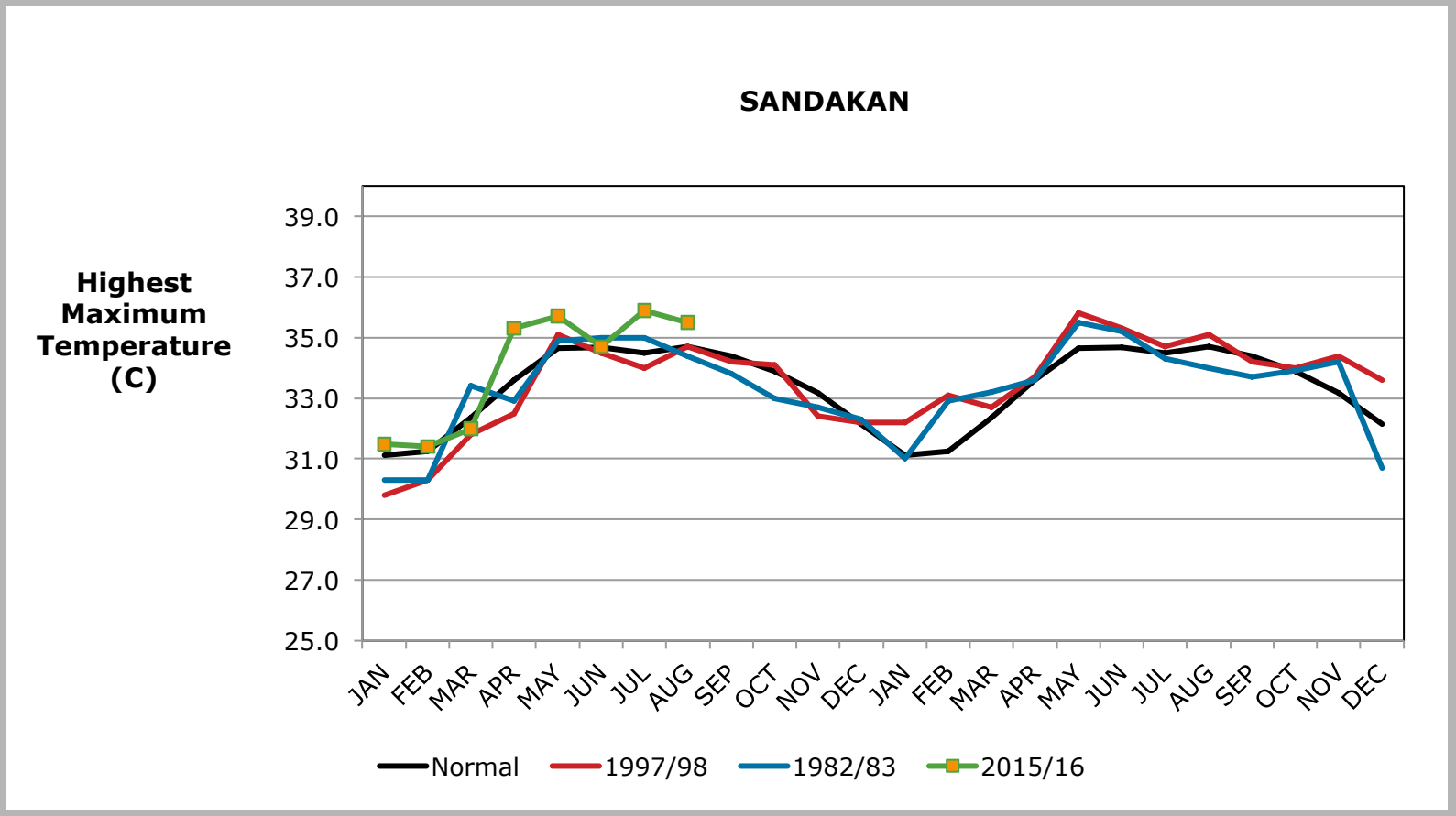
Comparison between 2015/16 ONI with Previous Strong El-Nino



Comparison between 2015/16 Highest Maximum Temperature with Previous Strong El-Nino and Normal



Comparison between 2015/16 Highest Maximum Temperature with Previous Strong El-Nino and Normal

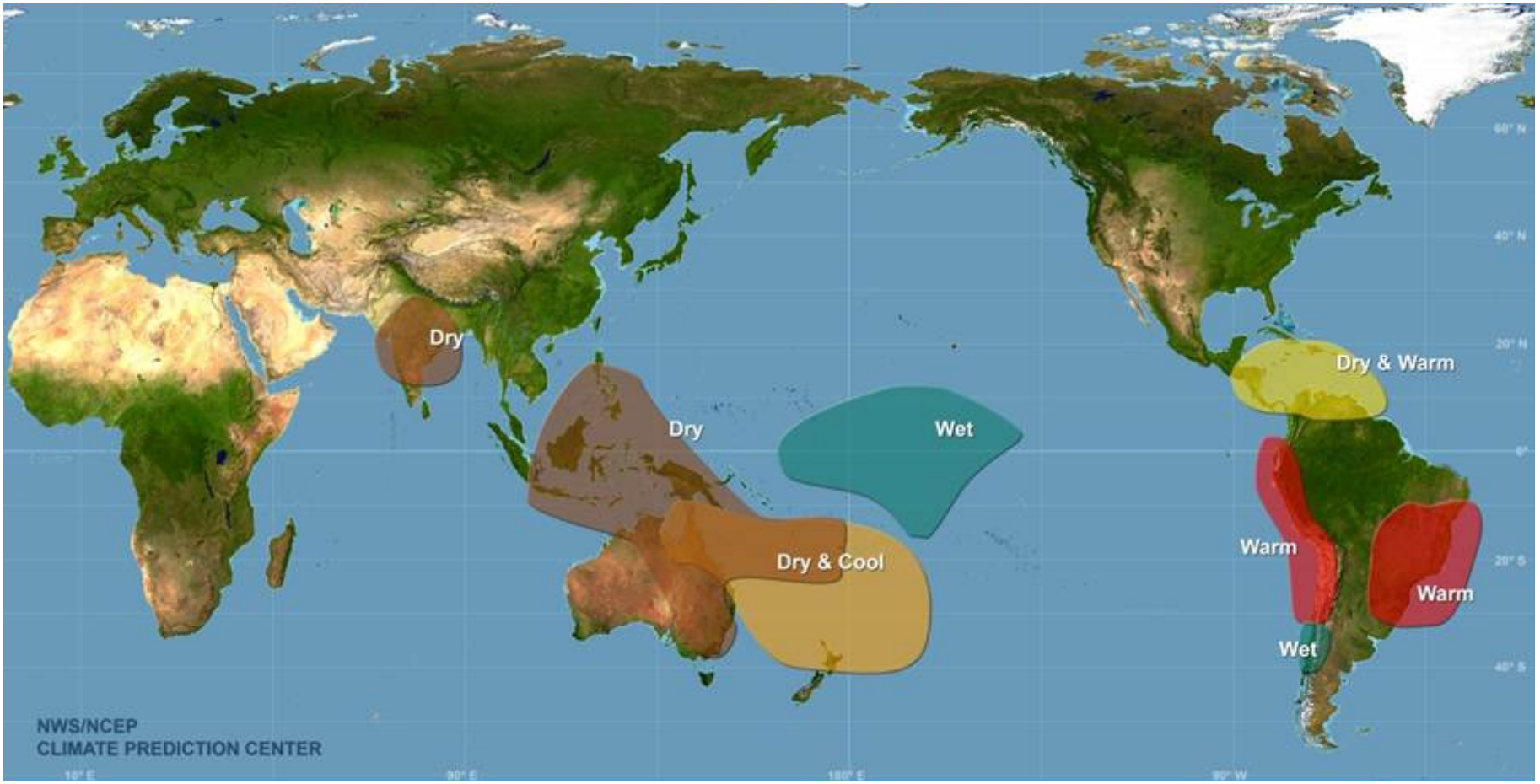


Status El Niño
(Kemaskini 15 September 2015)

- El Niño sederhana sedang berlaku. Suhu di kawasan tropika timur Lautan Pasifik terus menunjukkan peningkatan berbanding minggu sebelumnya.
- Anomali suhu mingguan di kawasan pemantauan NINO3.4 untuk minggu kedua September 2015 pada 2.3°C di atas purata, manakala Oceanic Niño Indeks (ONI) bagi bulan Julai 2015 (anomali purata SST bagi Jun-Julai-Ogos) adalah 1.2°C.
- Berdasarkan apa yang berlaku sekarang, kebanyakan model-model iklim antarabangsa kini menjangkakan kemungkinan **El Niño yang sederhana meningkat menjadi kuat tidak lama lagi (September 2015)** dan ia boleh berterusan sehingga suku pertama 2016.
- Kesan El Niño kepada Negara setakat ini tidak signifikan. Walau bagaimana pun, El Niño yang kuat **kadangkala** boleh meningkatkan suhu antara 0.5°C-2°C di seluruh negara terutamanya pada suku pertama tahun berikutnya dan boleh mennyebabkan pengurangan jumlah hujan terutamanya di Sabah dan utara Sarawak.

Disediakan oleh:
Pusat Iklim Nasional
Jabatan Meteorologi Malaysia
Kementerian Sains, Teknologi dan Inovasi

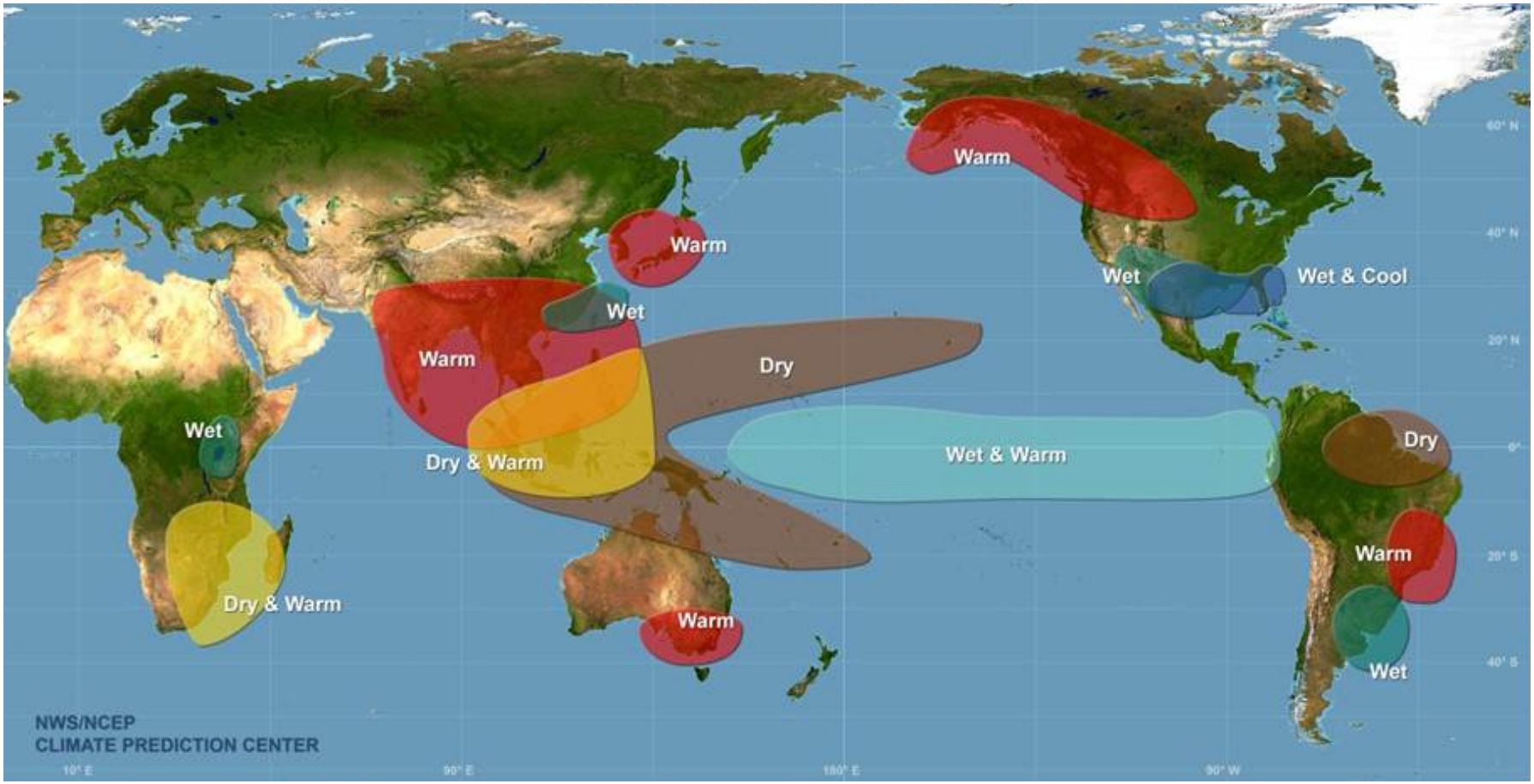
Impact to Malaysia Weather



Northern Hemisphere Summer (Jun-Aug)

Source: NOAA

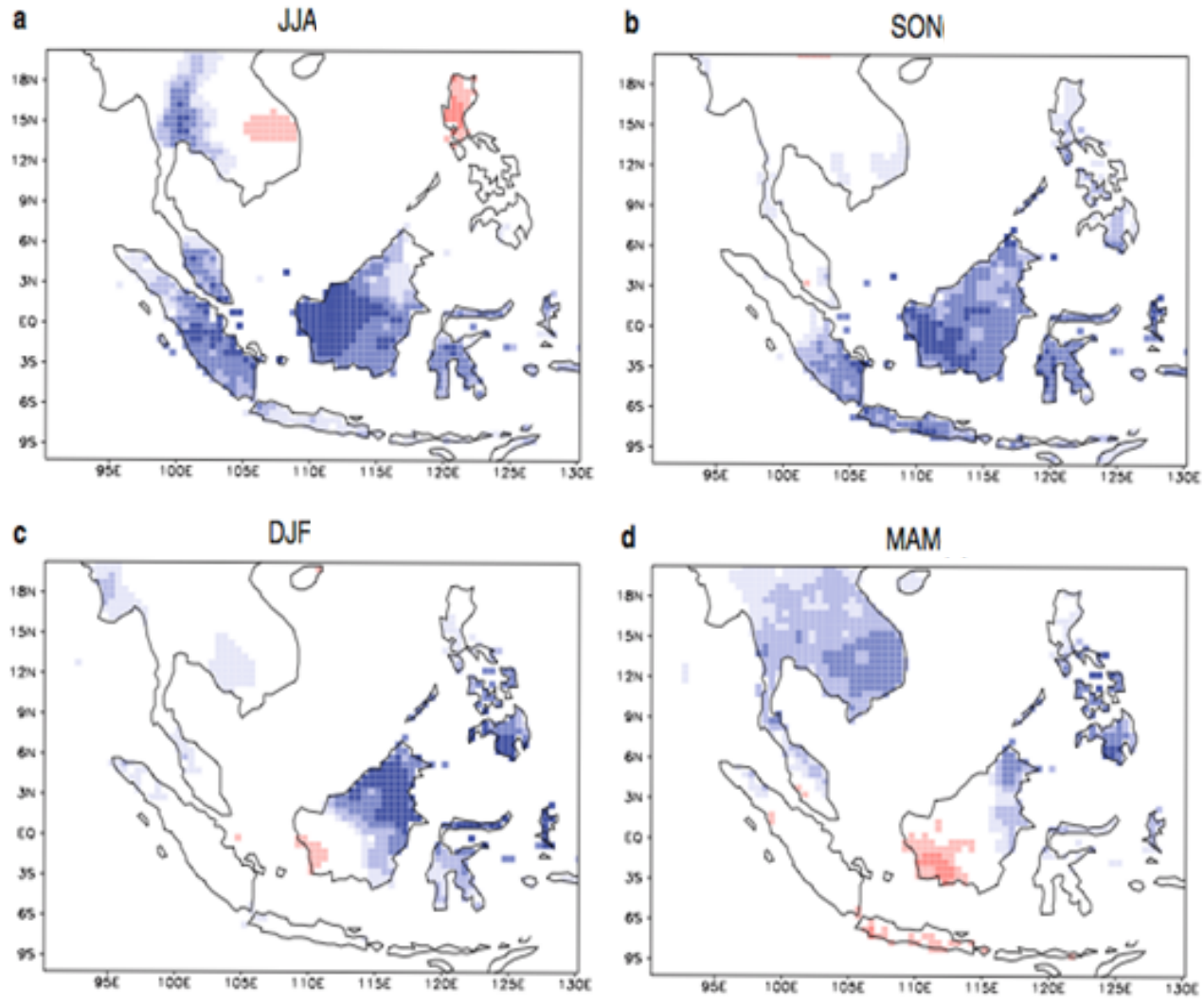
Impact to Malaysia Weather



Northern Hemisphere Winter
(Dec - Feb)

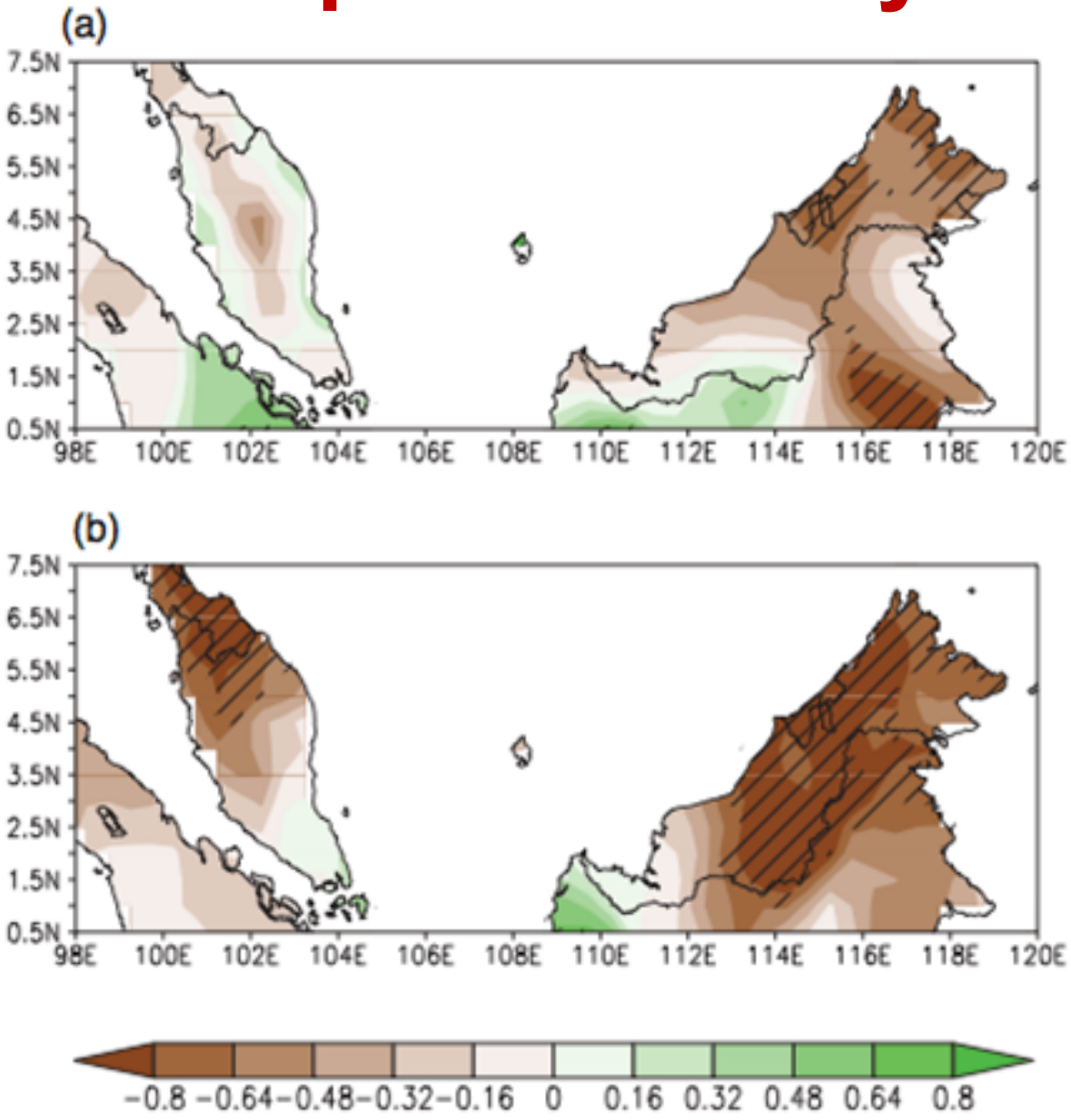
Source: NOAA

Impact to Malaysia Weather



Juneng & Tangang (2005)

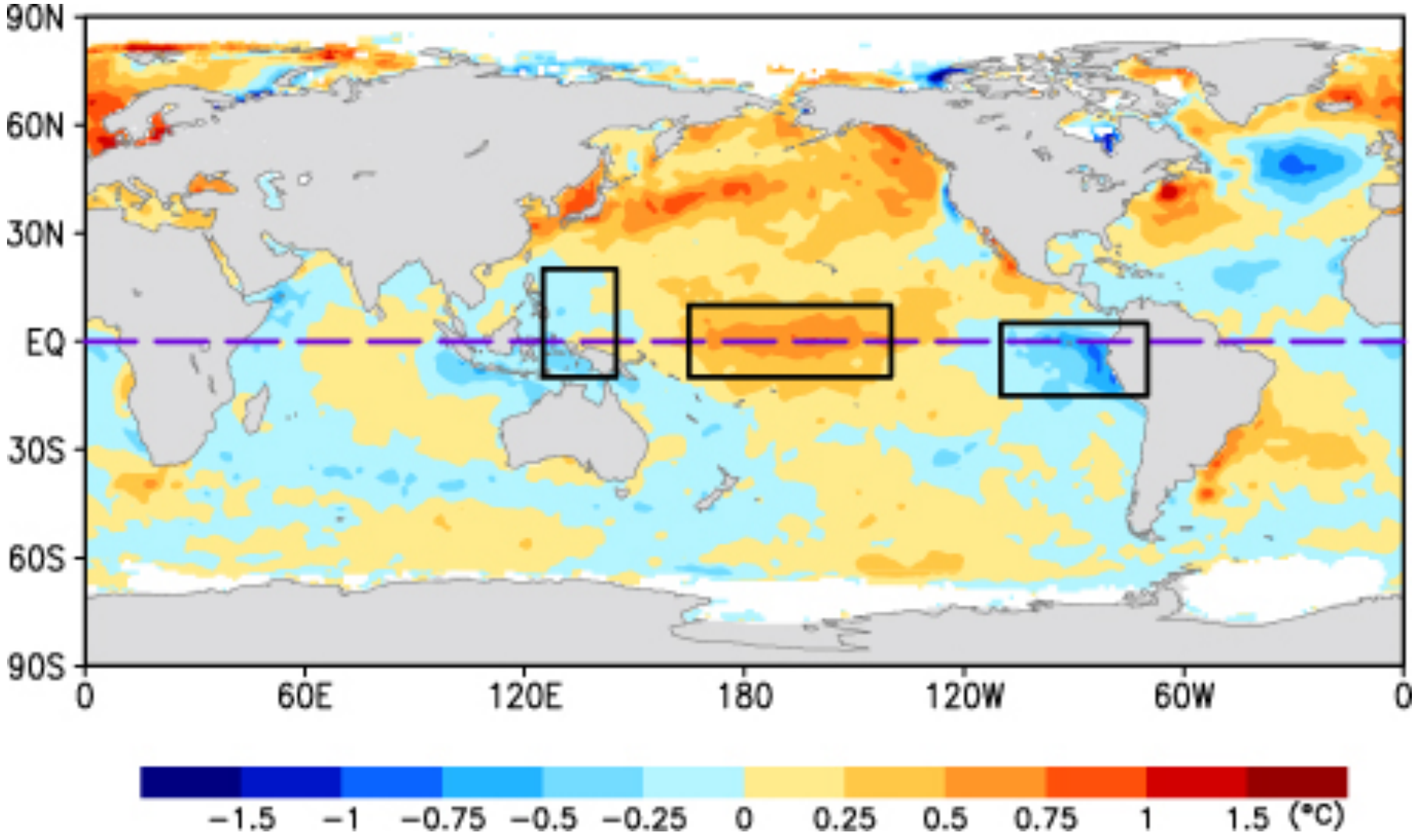
Impact to Malaysia Weather



The composite of December-January-February rainfall anomalies for a) Conventional El Niño, b) El Niño Modoki. Hatched region indicates significant at 95% level

(Salimun et al., 2014)

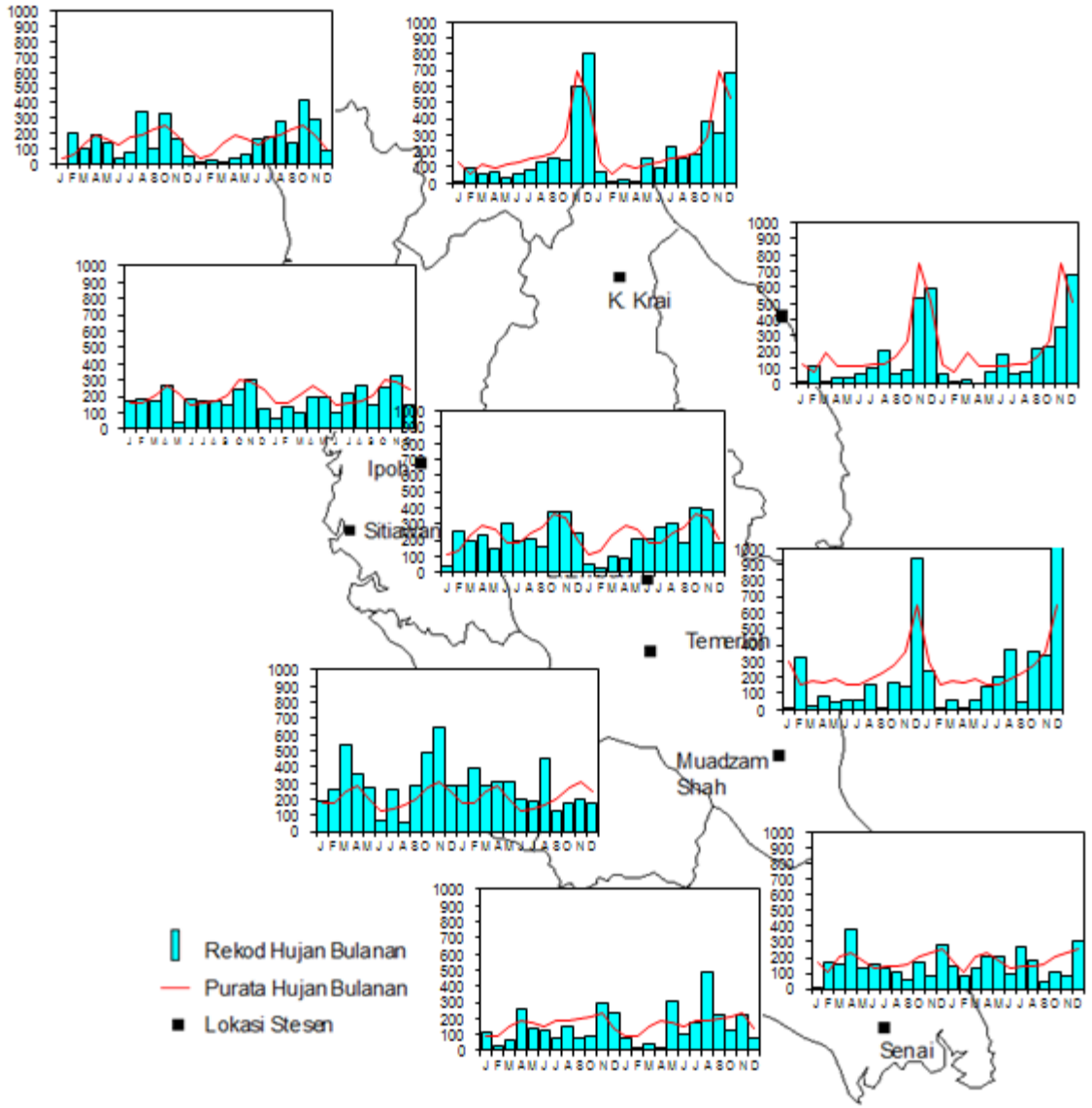
Impact to Malaysia Weather



El-Nino Modoki (Ashok and Yamagata, 2009)

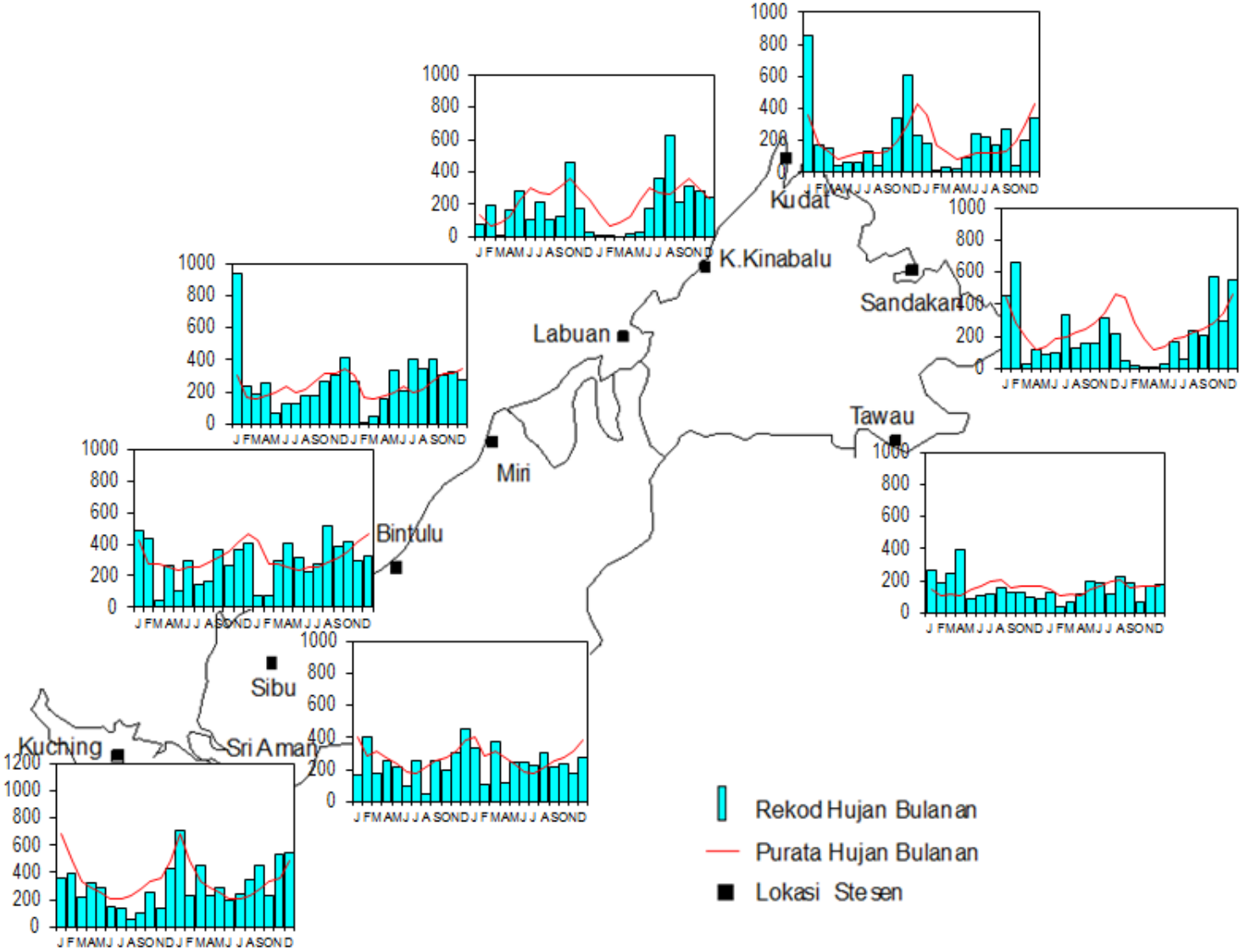
Impact to Malaysia Weather

Monthly Rainfall (mm) Distribution during Strong El Niño Episode 1997/98



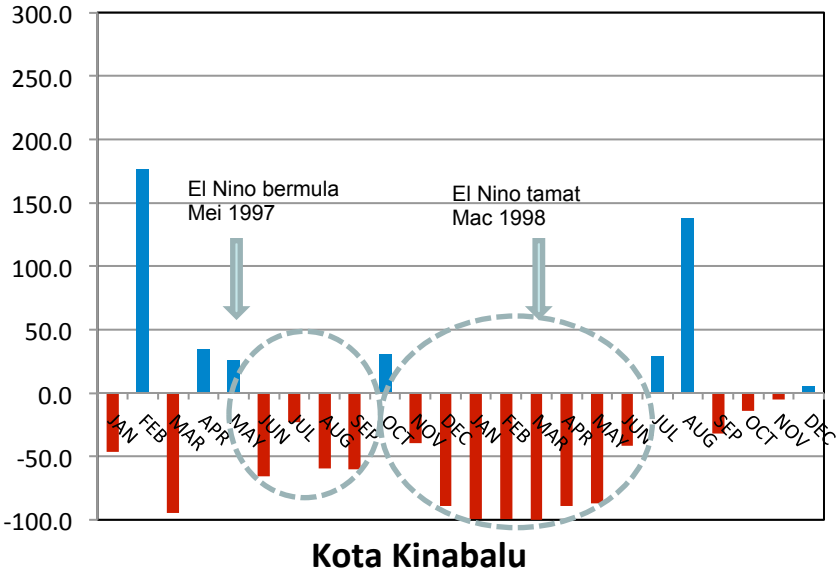
Impact to Malaysia Weather

Monthly Rainfall (mm) Distribution during Strong El Niño Episode 1997/98

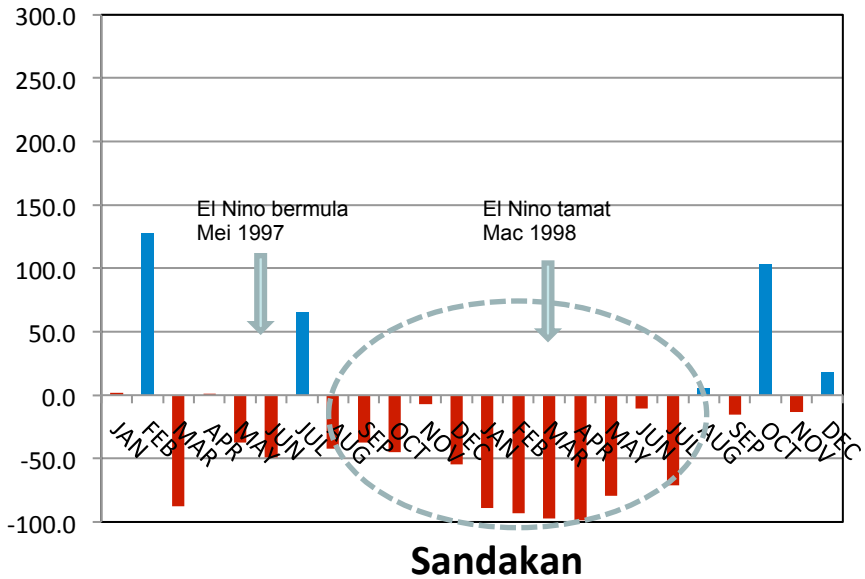


Impact to Malaysia Weather

Percentage of monthly rainfall anomaly during strong El Niño episode of 1997/1998



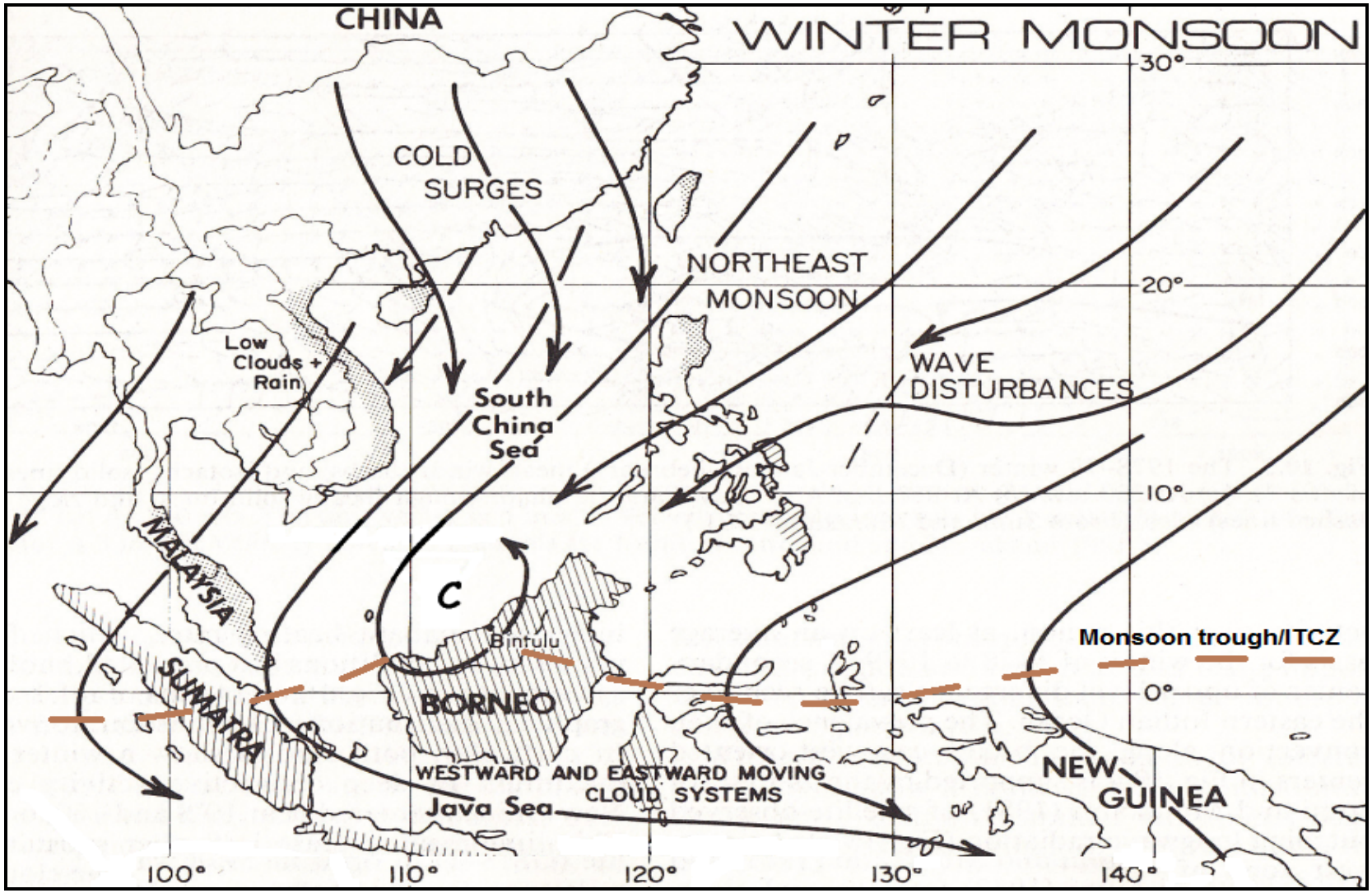
Kota Kinabalu



Sandakan

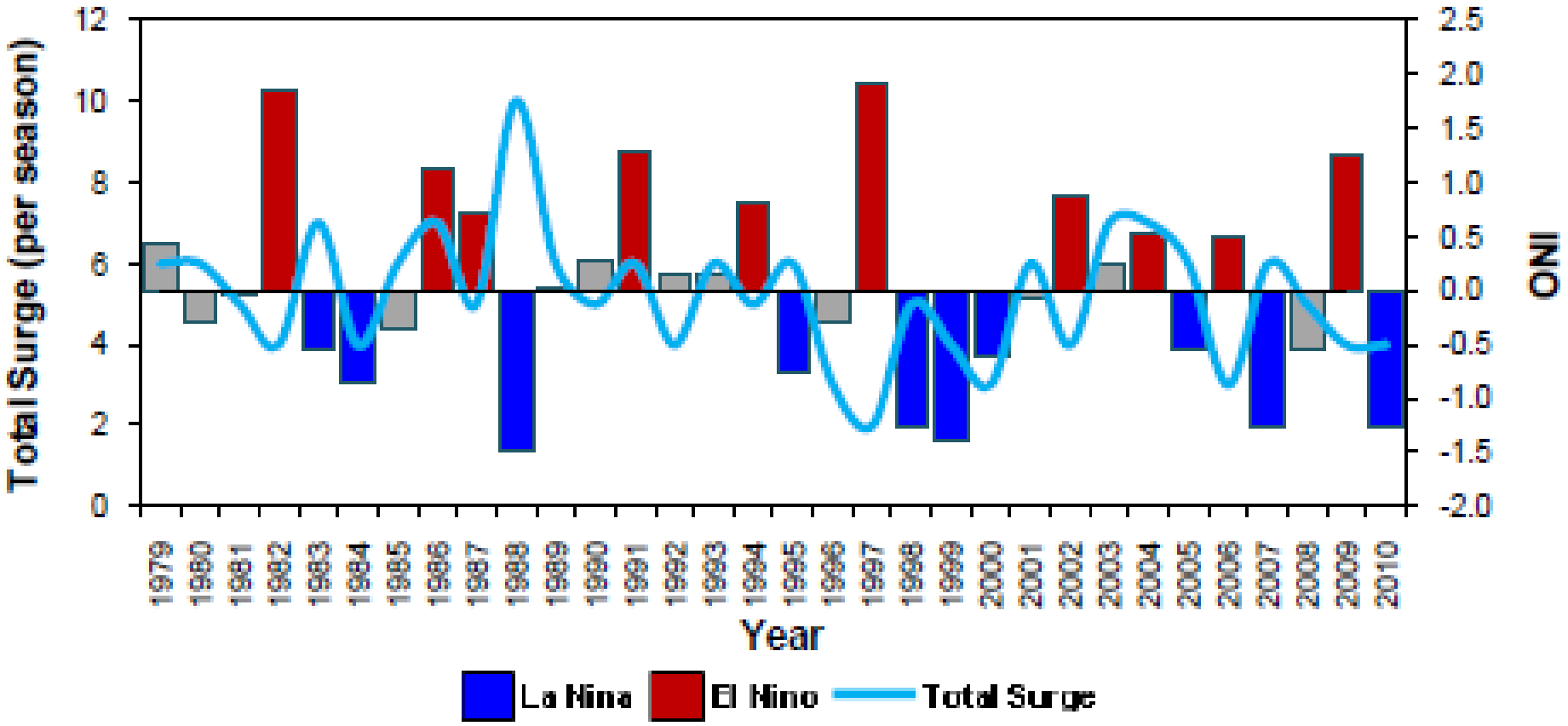
The decrease in rainfall amount is significant during strong El-Nino episode

Other Impact to Malaysia Weather



Johnson & Zimmerman (1986)

NE Monsoon Cold Surge



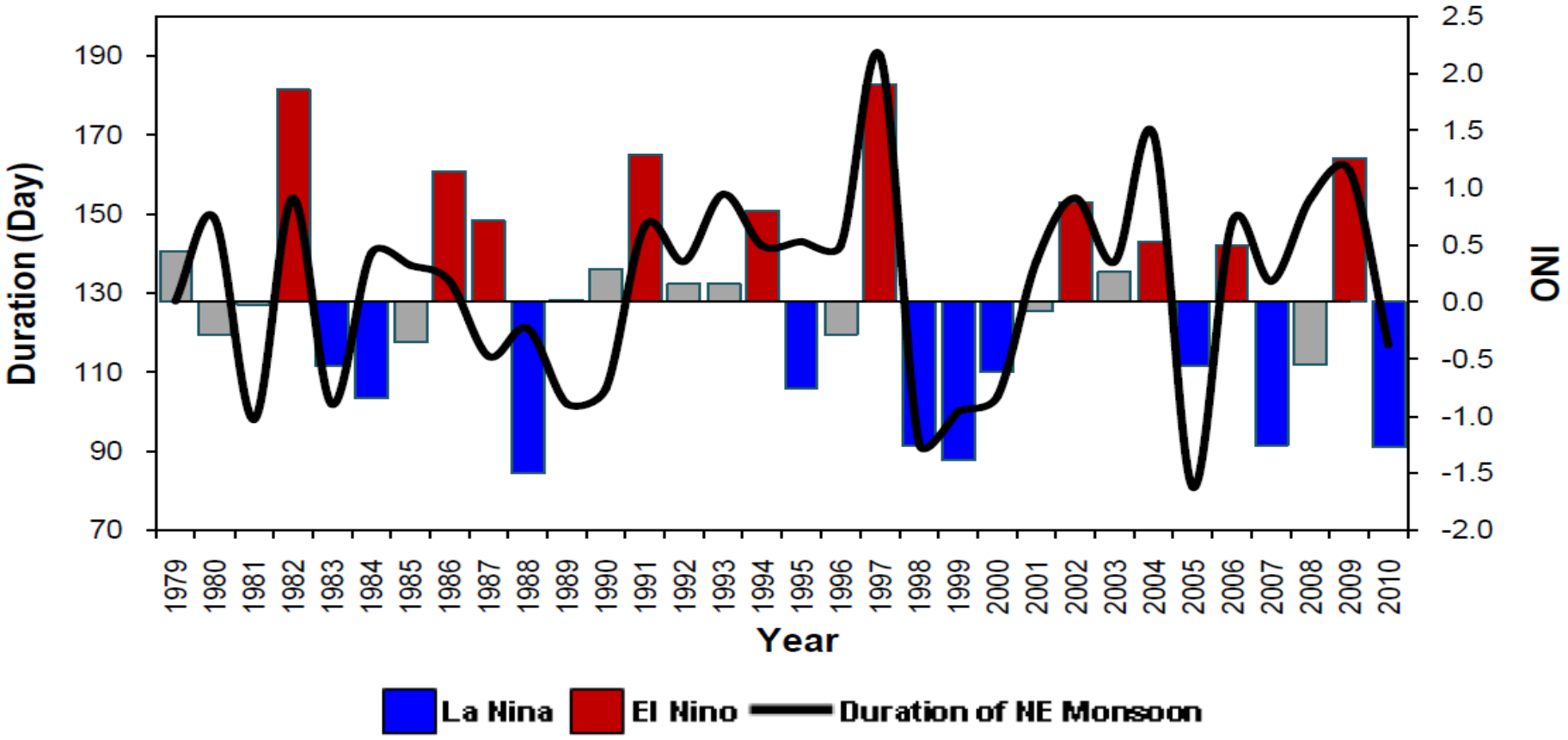
More (Less) number of Northeast Monsoon cold surges during El-Nino (La-Nina) years (Subramanium et al., 2012)

NE Monsoon Borneo Vortex

	All	EN	LN	NEU
No. of seasons	41	10	10	21
Total vortices	2,278	508	619	1151
Vortices per season	55.6	50.8	61.9*	54.8

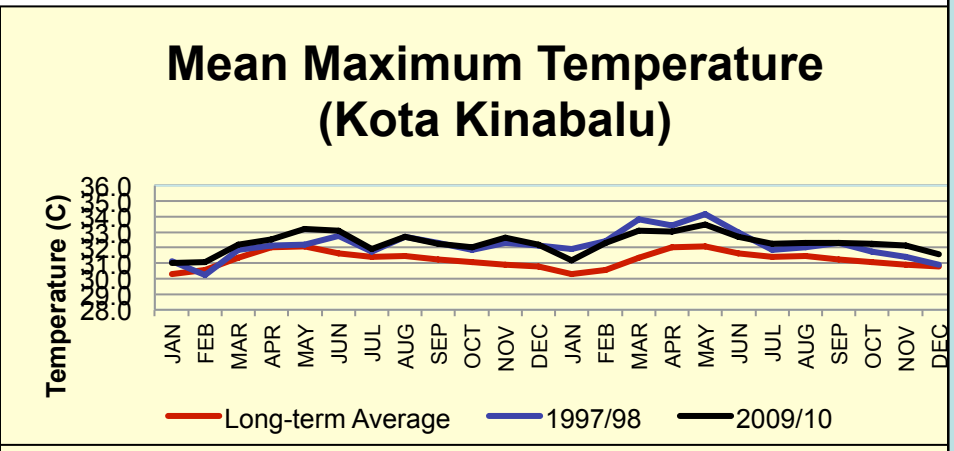
Less (More) number of Northeast Monsoon Borneo Vortices during El-Nino (La-Nina) years (Hisham, 2012)

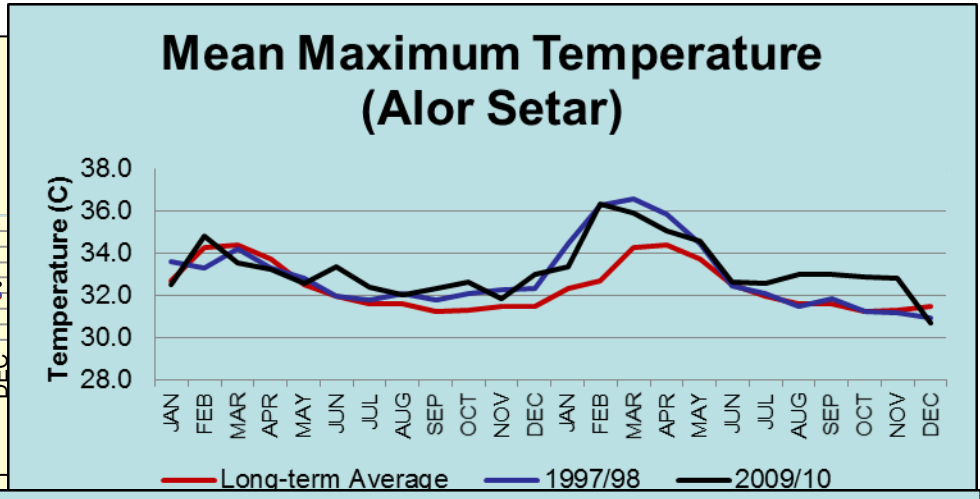
NE Monsoon Duration

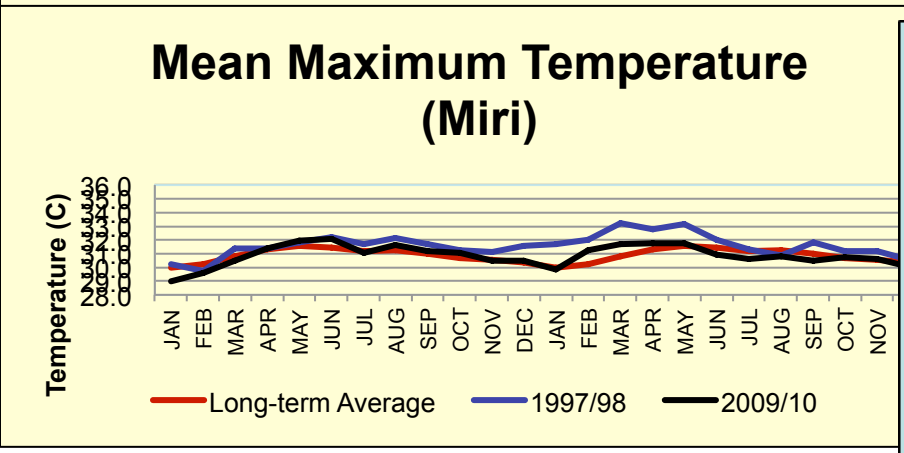


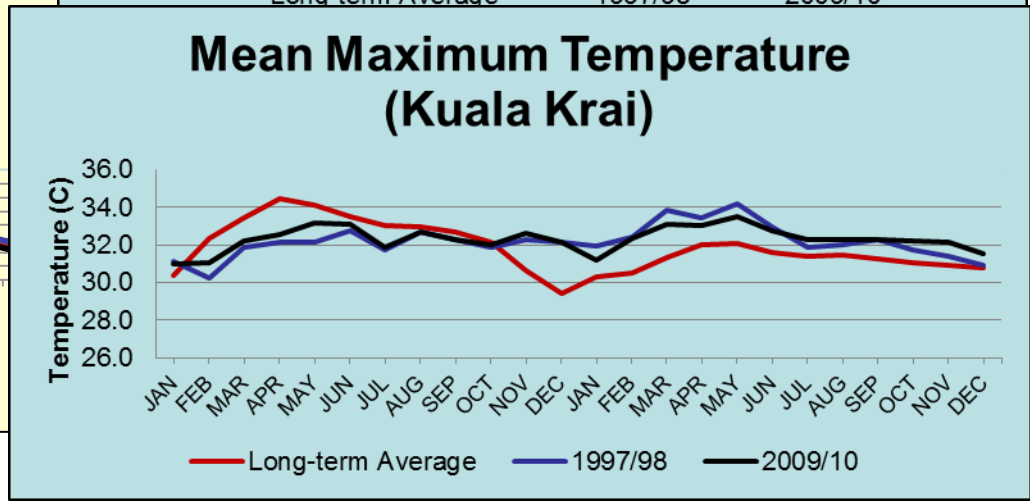
Duration (days) of Northeast Monsoon seasons were longer (shorter) during El-Nino (La-Nina) years, but less (more) intensity (Subramanium et al., 2012)

Other Impact to Malaysia Weather









Maximum air temperature increases by 0.5^{o}C to 2^{o}C during El Niño Episode

Other Impact to Malaysia Weather

No of Town Affected by Heat Wave By Year		
Year	**No. of Town**	**Status**
1998	19	El Nino (Very Strong)
2005	12	El Nino (Weak)
1983	8	El Nino (Very Strong)
2010	8	El Nino (Moderate)
1992	5	El Nino Moderate)
2002	5	El Nino (Moderate)
1987	4	El Nino (Moderate)
1990	4	Normal
1979	3	Normal
1980	2	Normal
1985	2	La Nina
1991	2	El Nino
1997	2	El Nino
2009	2	El Nino
1958	1	El Nino
1963	1	El Nino
1964	1	El Nino
1970	1	La Nina
1972	1	El Nino
1976	1	La Nina
1995	1	El Nino
1996	1	La Nina
2001	1	La Nina
2003	1	El Nino
2004	1	El Nino
2006	1	El Nino
2007	1	La Nina
2008	1	La Nina
2011	1	La Nina
2012	1	La Nina
2013	1	Normal

Heatwave:
89% occur during El Nino year

Defination:

Five (5) consecutive days with maximum temperature equal or exceeding 35 °C AND 2°C exceeding the long-term mean maximum temperature ,

OR

Three (3) consecutive days with maximum temperature equal or exceeding 37°C.

Other Impact to Malaysia Weather

Table 4. Total Number and Percentage of Tropical Cyclone Occurrence in the SSCS by Month for the Period 1960–2006, Following the ENSO Year Definition Used Here (Beginning With October)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total	4	21	18	1	1	1	2	2	0	0	0	0	50
Percent	8	42	36	2	2	2	4	4	0	0	0	0	100

Table 5. Average Annual Tropical Cyclone ACTIVITY Separated by El Niño Years for All Tropical Cyclones (All), Typhoons (TY), Tropical Storms, Tropical Depressions (TD), and Tropical Cyclones of Local Origin

	All	TY	TS	TD	Local Origin
Neutral	1.1	0.3	0.6	0.3	0.6
El Niño	0.4	0.2	0.2	0	0.3
La Niña	1.6	0.1	1.2	0.3	1.0
All years	1.0	0.2	0.6	0.2	0.6

Less (More) occurrence of tropical cyclones during El-Nino (La-Nina) years over Malaysia region (Zuki & Lupo, 2008)

Indian Ocean Dipole (IOD)

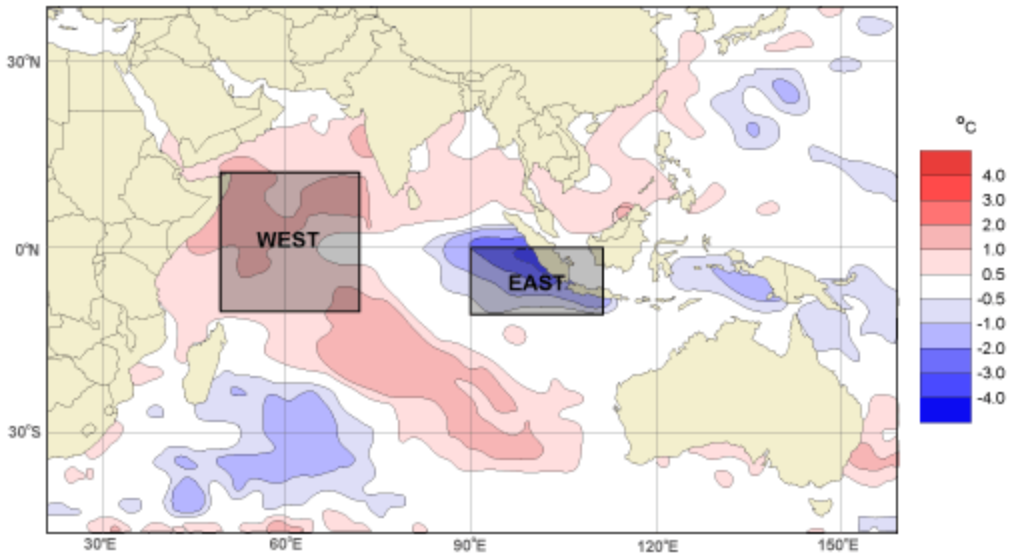
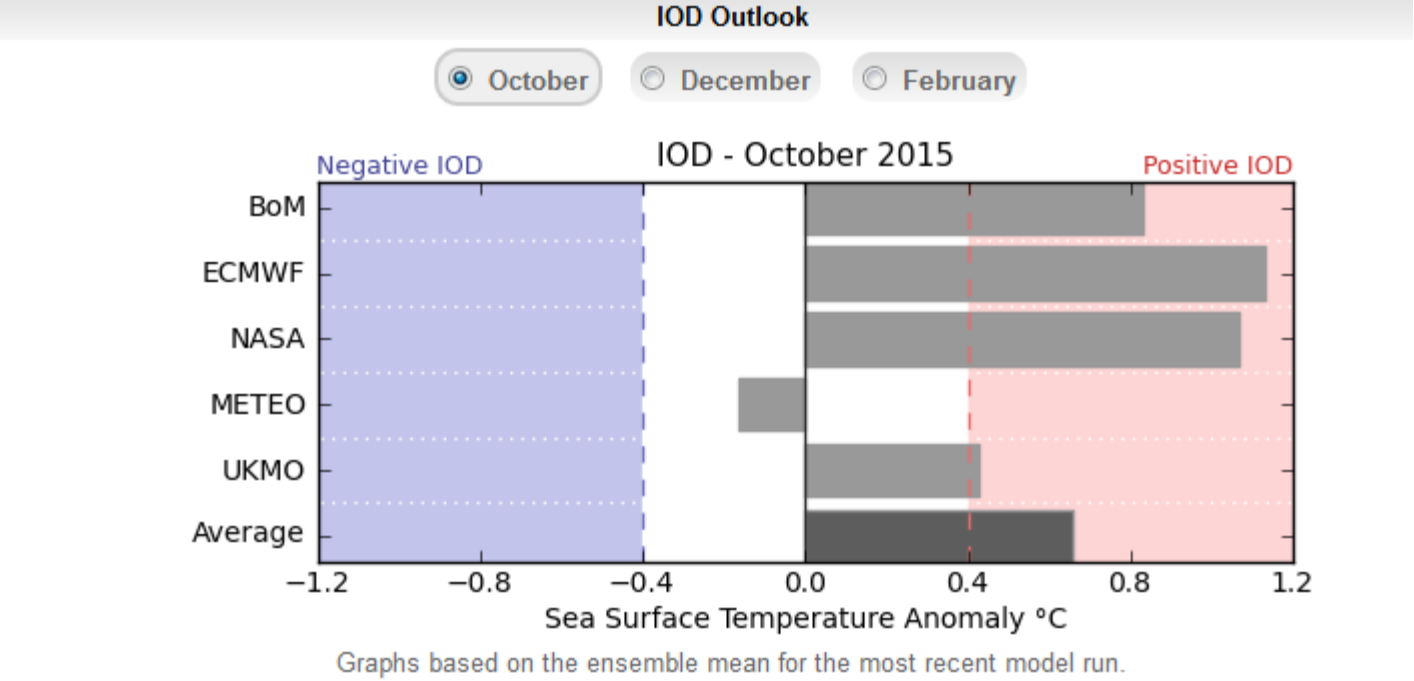


Figure 1: Map shows departures from average ocean surface temperatures in November 1997 at the height of the 1997 positive IOD event. The east and west poles of the IOD are marked with black boxes.

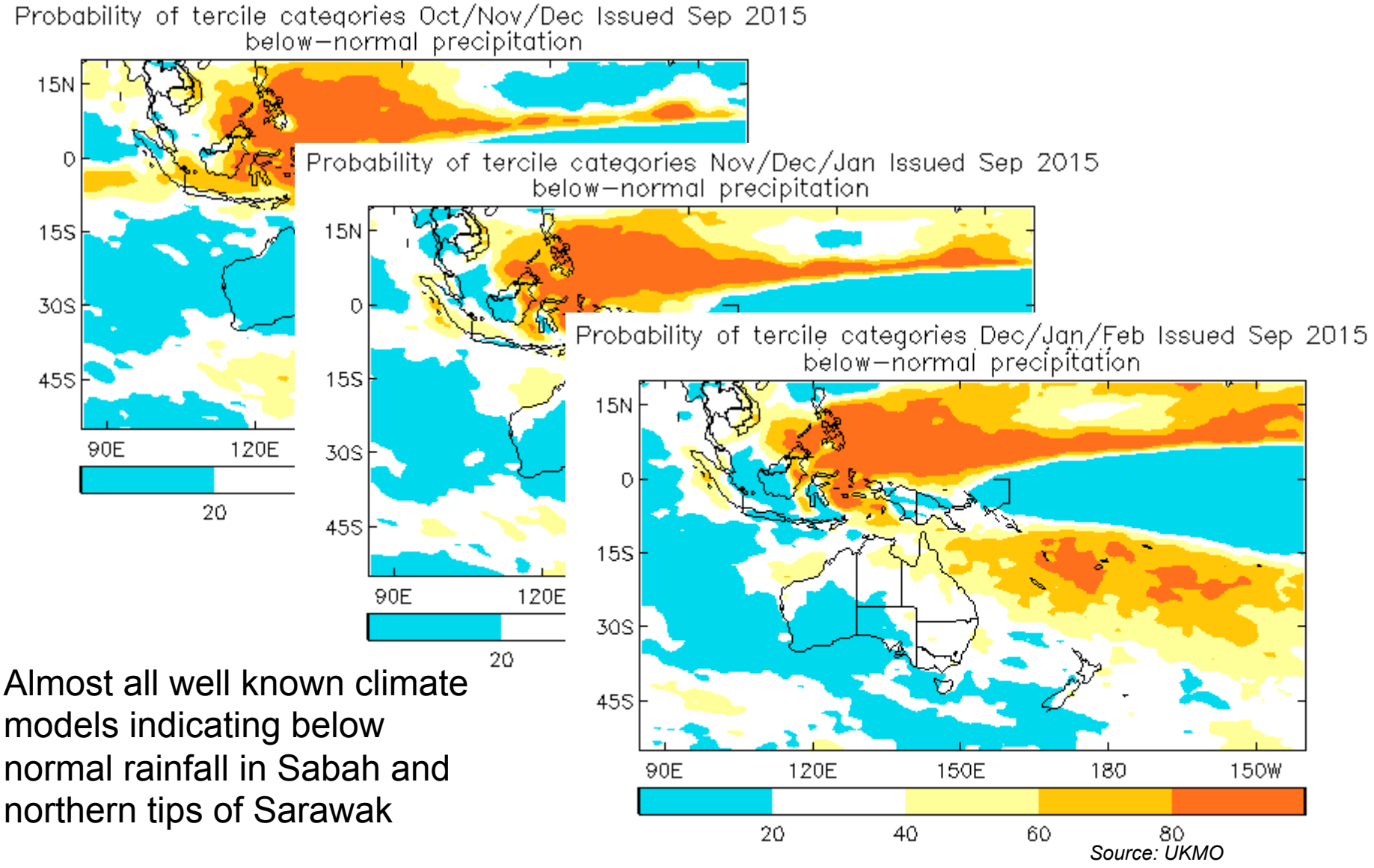
Source: BoM

Indian Ocean Dipole (IOD)



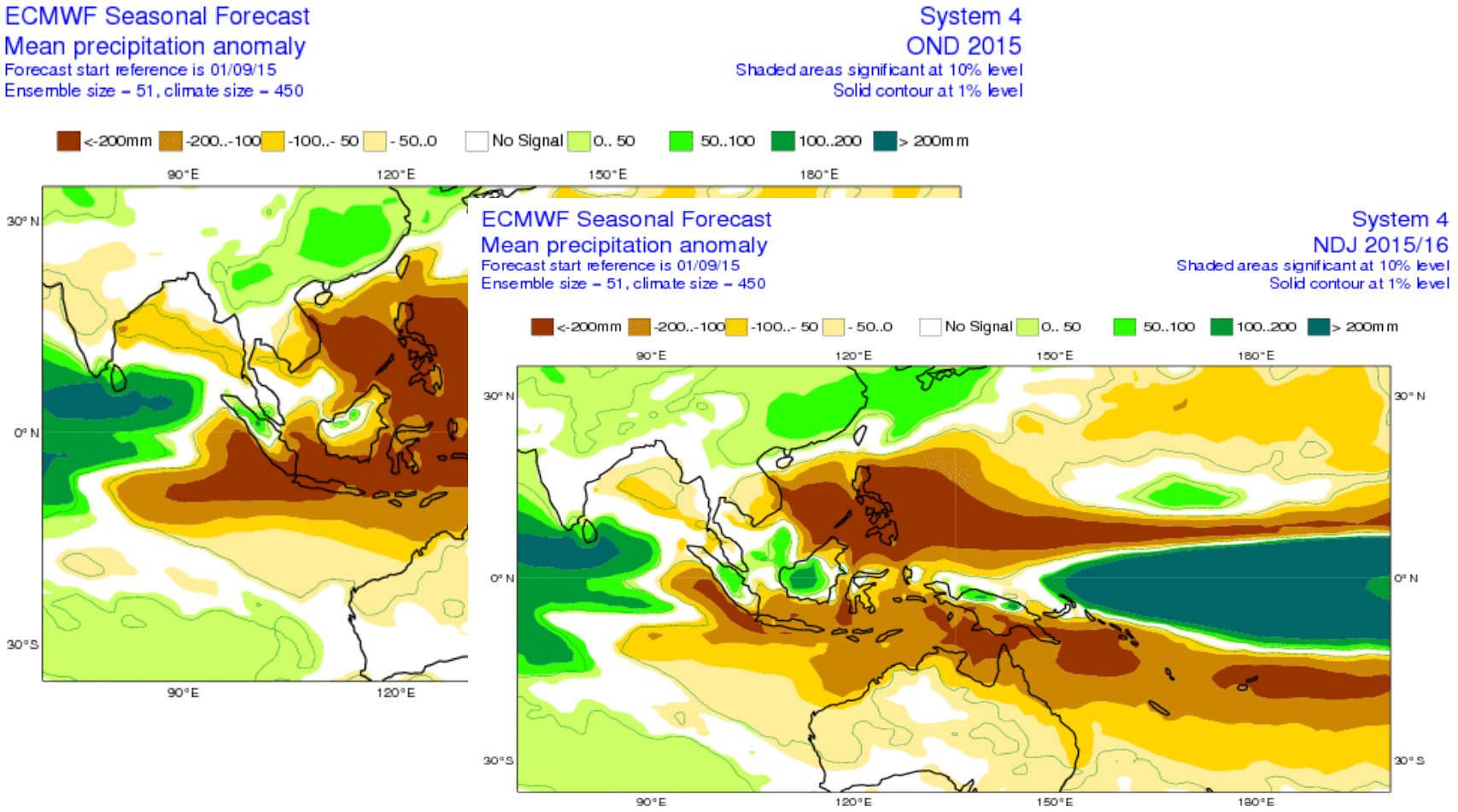
Source: BoM

What to Expect (Weather)



Almost all well known climate models indicating below normal rainfall in Sabah and northern tips of Sarawak

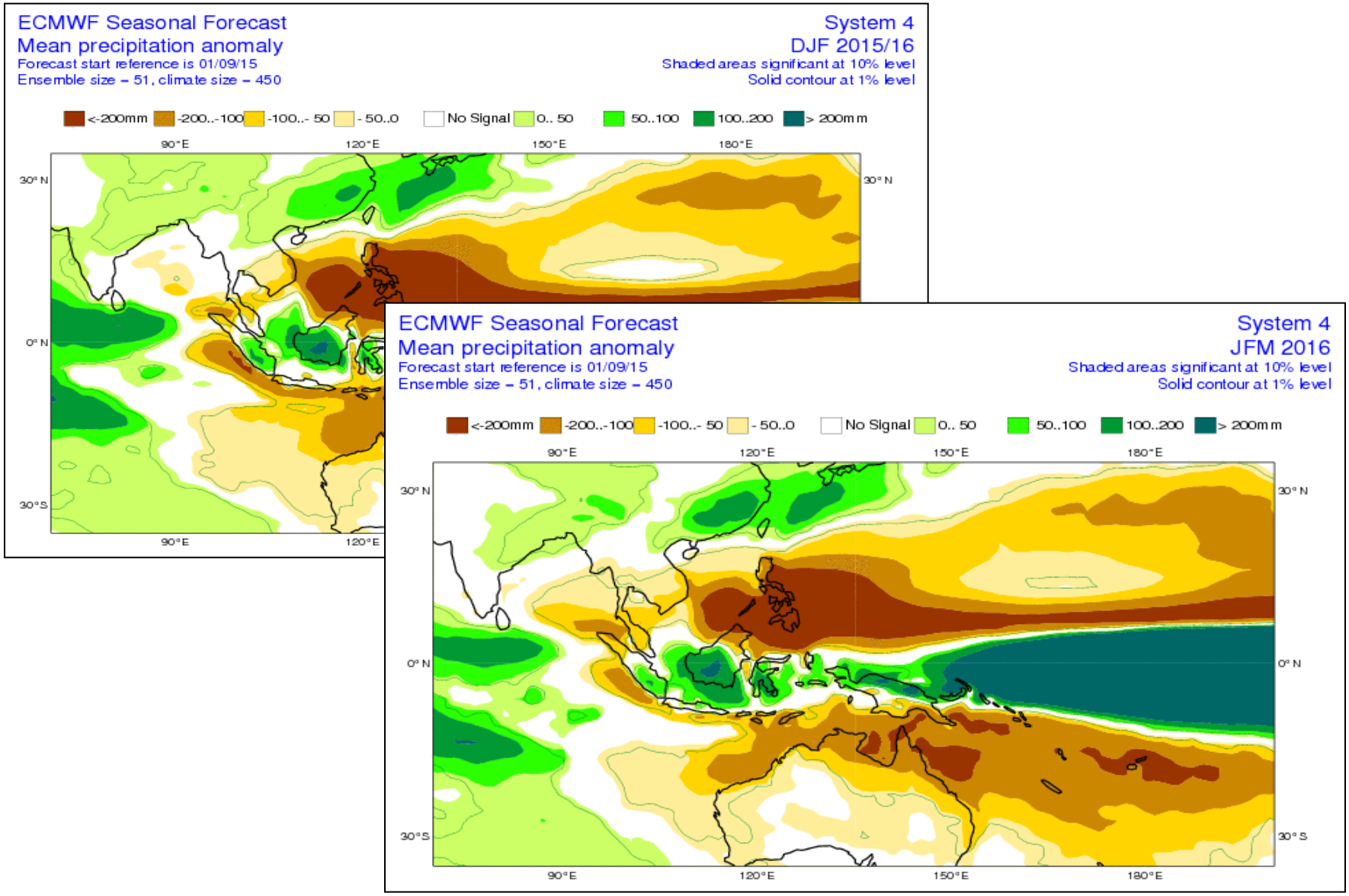
Source: UKMO



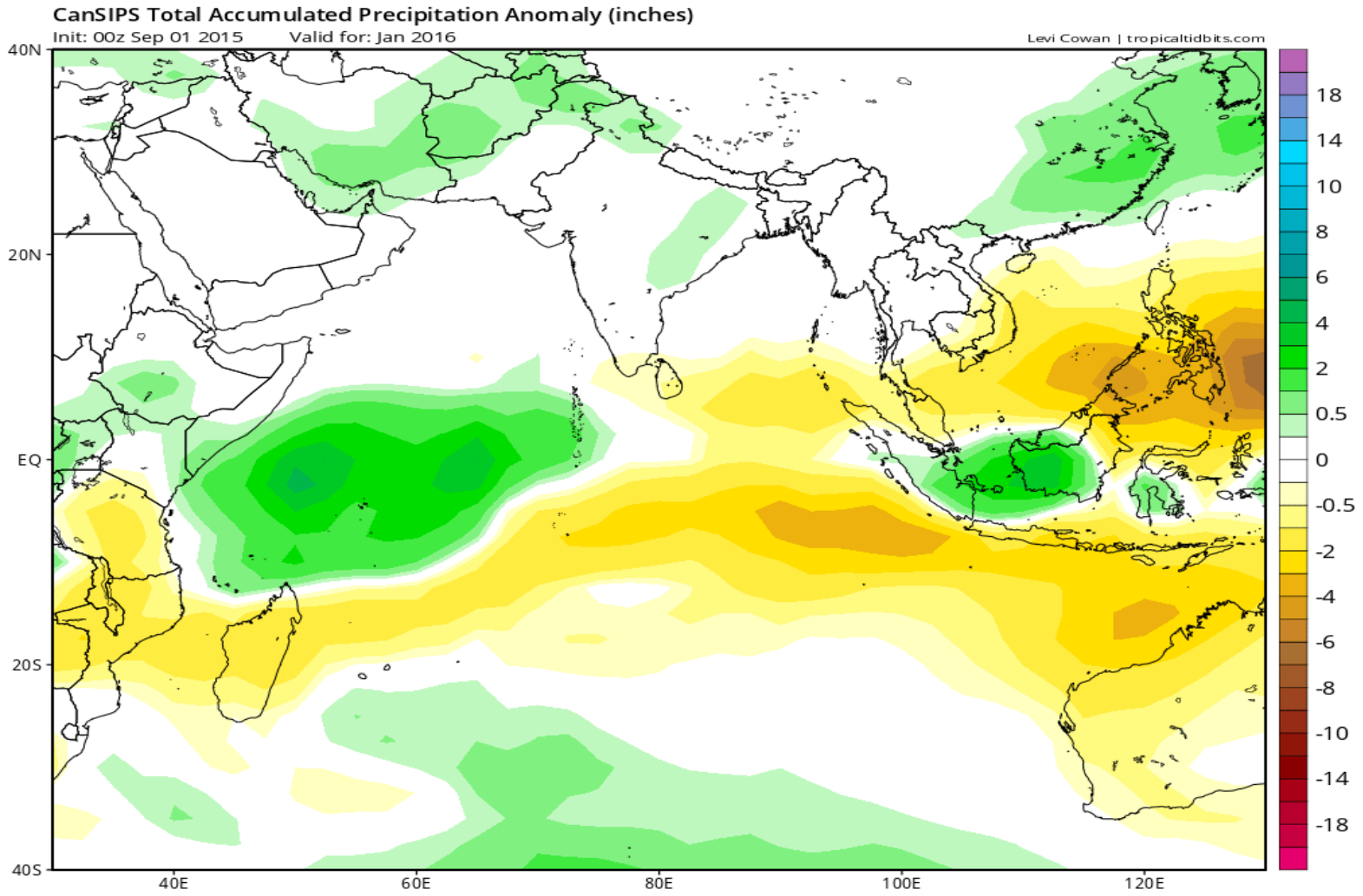
Almost all well known climate models indicating below normal rainfall in Sabah and northern tips of Sarawak until March.

Source: ECMWF

Continued…….



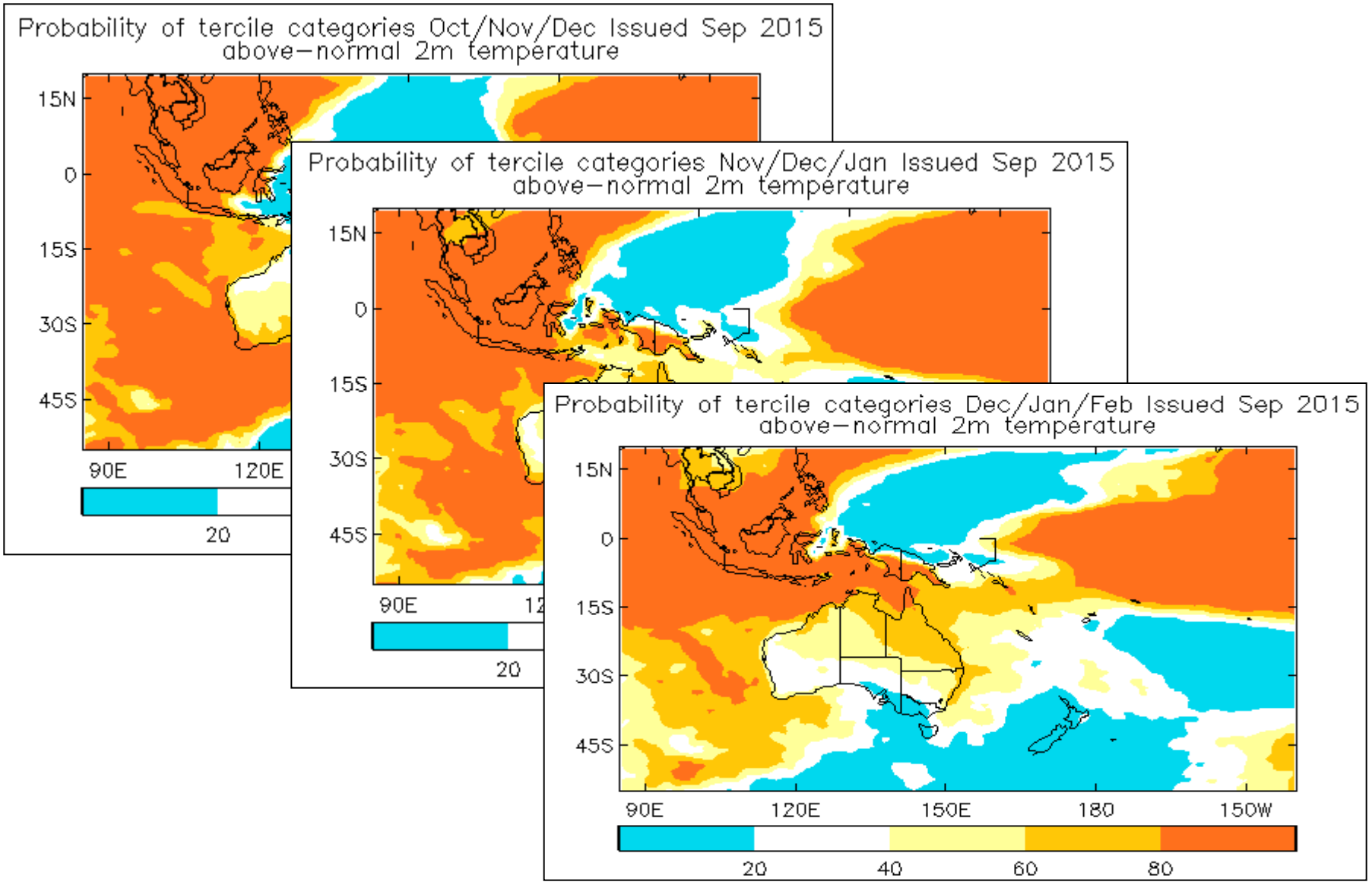
Source: ECMWF



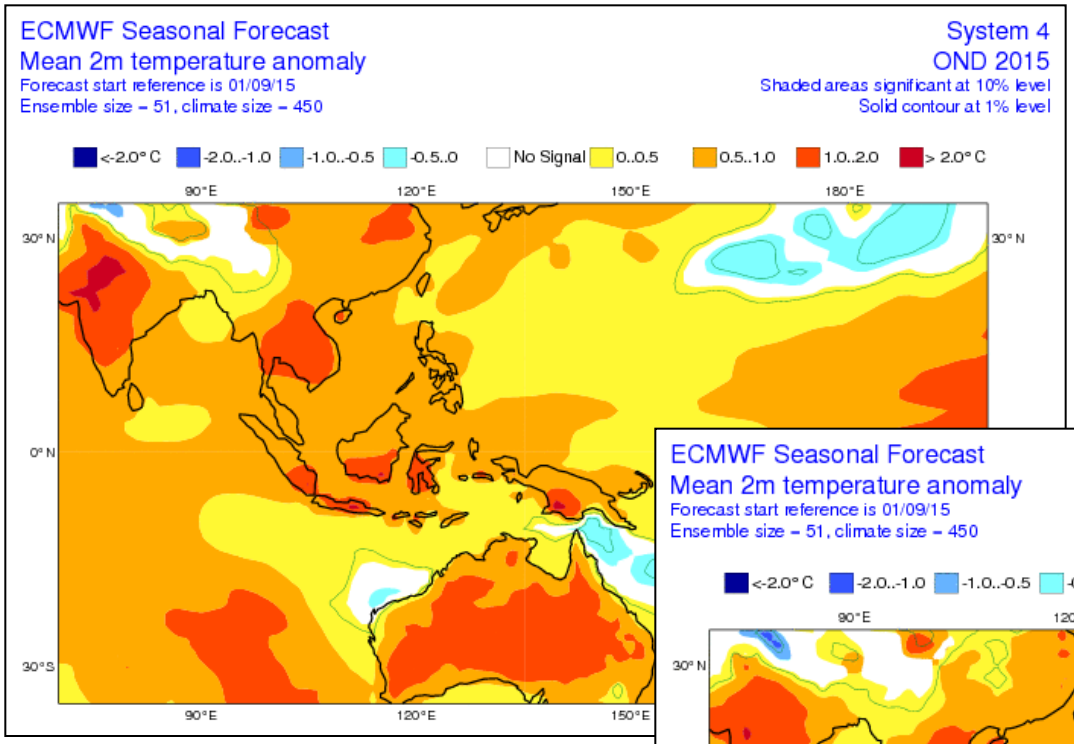
Strangely, almost all well known climate models also indicating above normal rainfall in southern Sarawak in January.

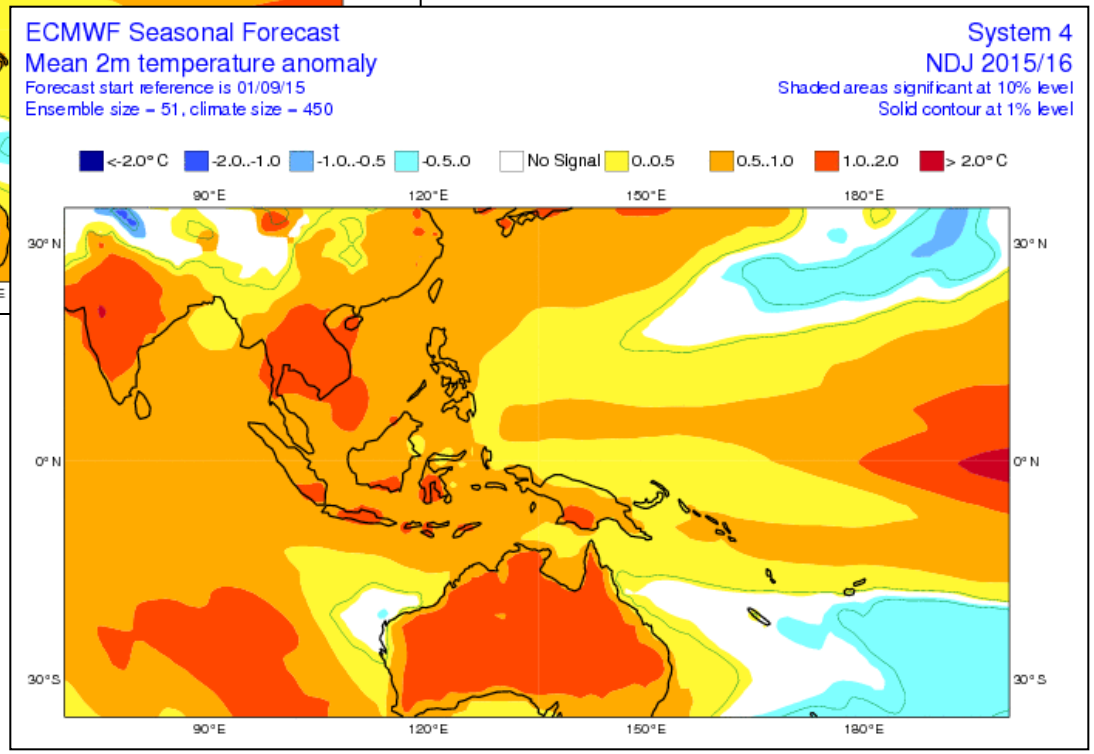
Source: Tropical Tidbits

Almost all well known climate models indicating above normal temperature in most Southeast Asean Region until April.

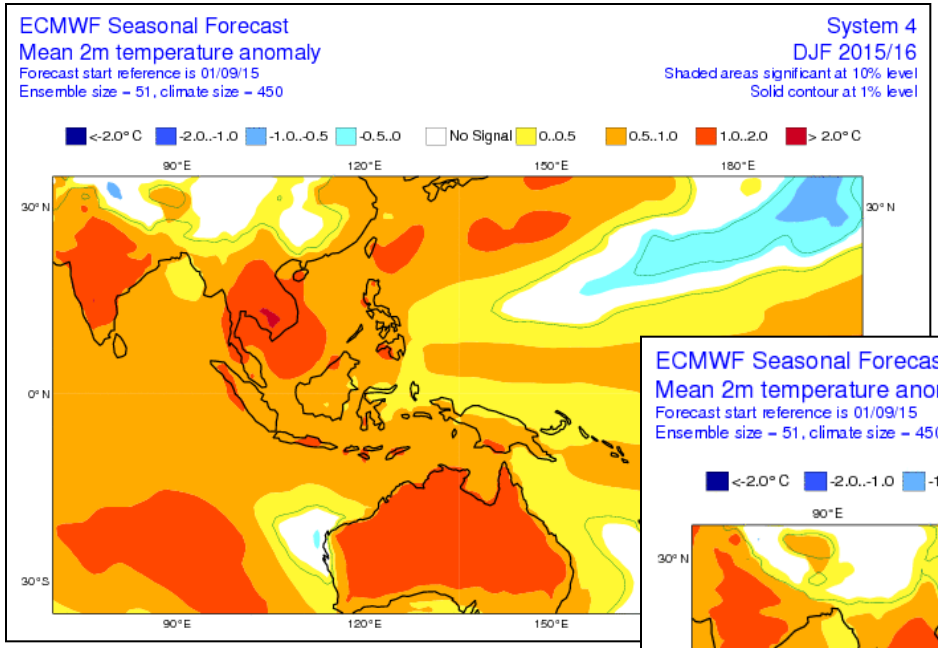


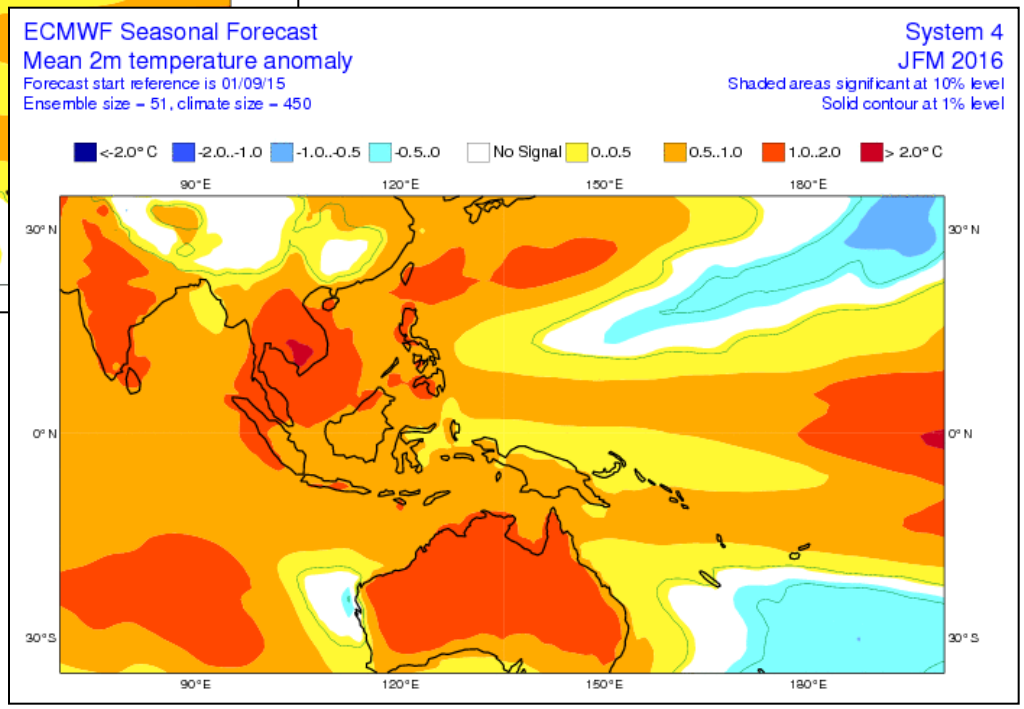
Temperature in Malaysia is expected to increase between 0.5-1.0°C between November to January.





Temperature in Malaysia is expected to increase between 0.5-2.0°C between January to April.





Conclusions

- El Nino is considered as one of the natural climate variability that occurs every 2 to 7 years through a very complex air-sea interactions.

- Current SST over the central tropical Pacific Ocean shows that moderate El Nino is present, and all indicators is suggesting it will strengthen to strong El Nino in the next few weeks, which could lead to a significant change in weather pattern over certain part of the world, including Malaysia

- Based on historical records, the impacts of strong El Nino are normally felt by Malaysia towards the end of the year and 1st quarter of next year

- In general, less rainfall in certain part of the country particularly in Sabah and northern Sarawak and warmer temperature throughout the country are expected (0.5-2.0 C) in the presence of strong El Nino phenomena

- The effect of transboundary haze are expected to be less especially in the Peninsular as Intermonsoon Season progresses. However, there will be some occasional hazy situation in Sarawak as the source still very much available in southern Kalimantan. It will be diminished as Northeast Monsoon set in in early November. .

Thank You