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Session 4: Climate Models, Weather Forecasting, and Disaster Risk Reduction: “Reginal Climate Pattern”

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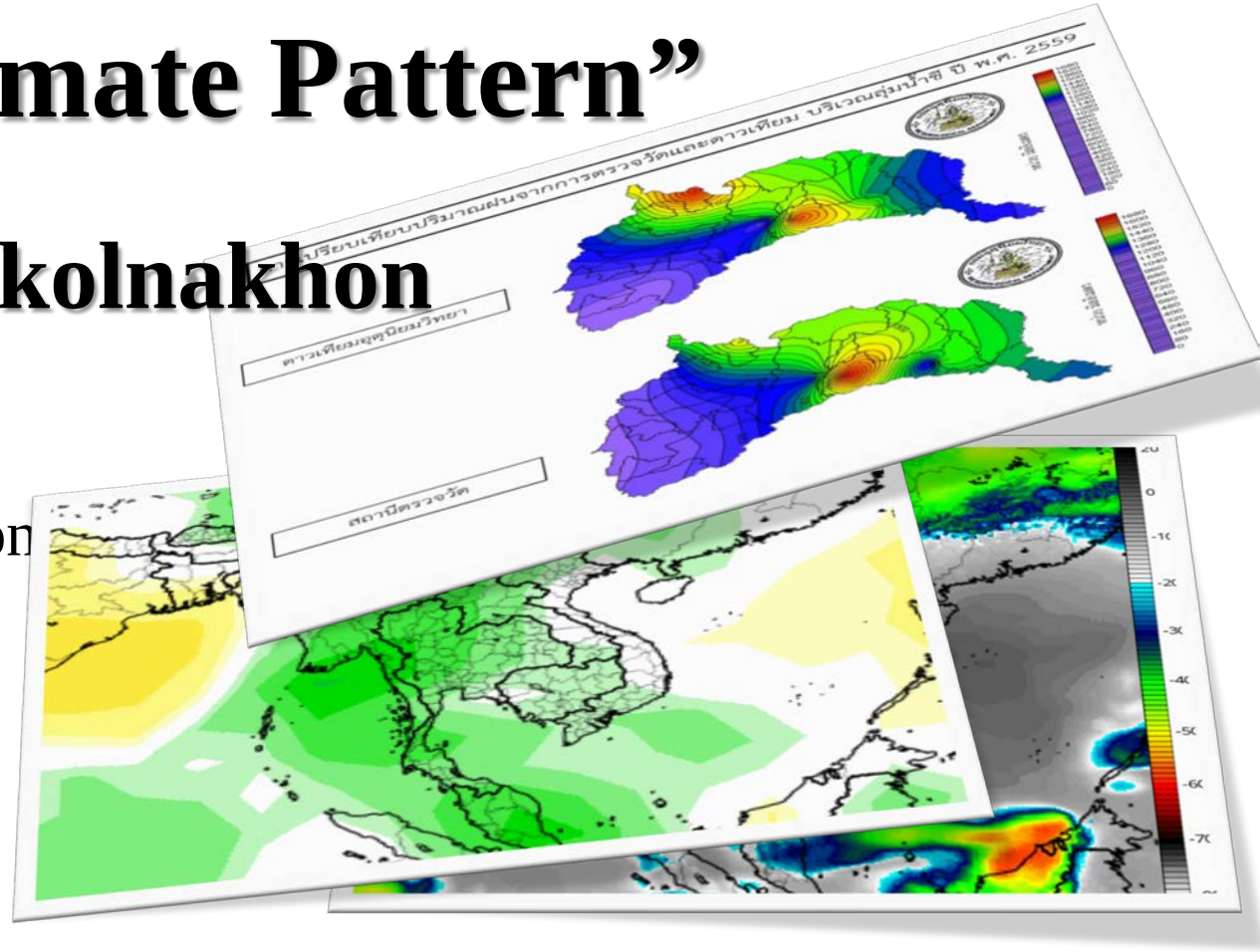
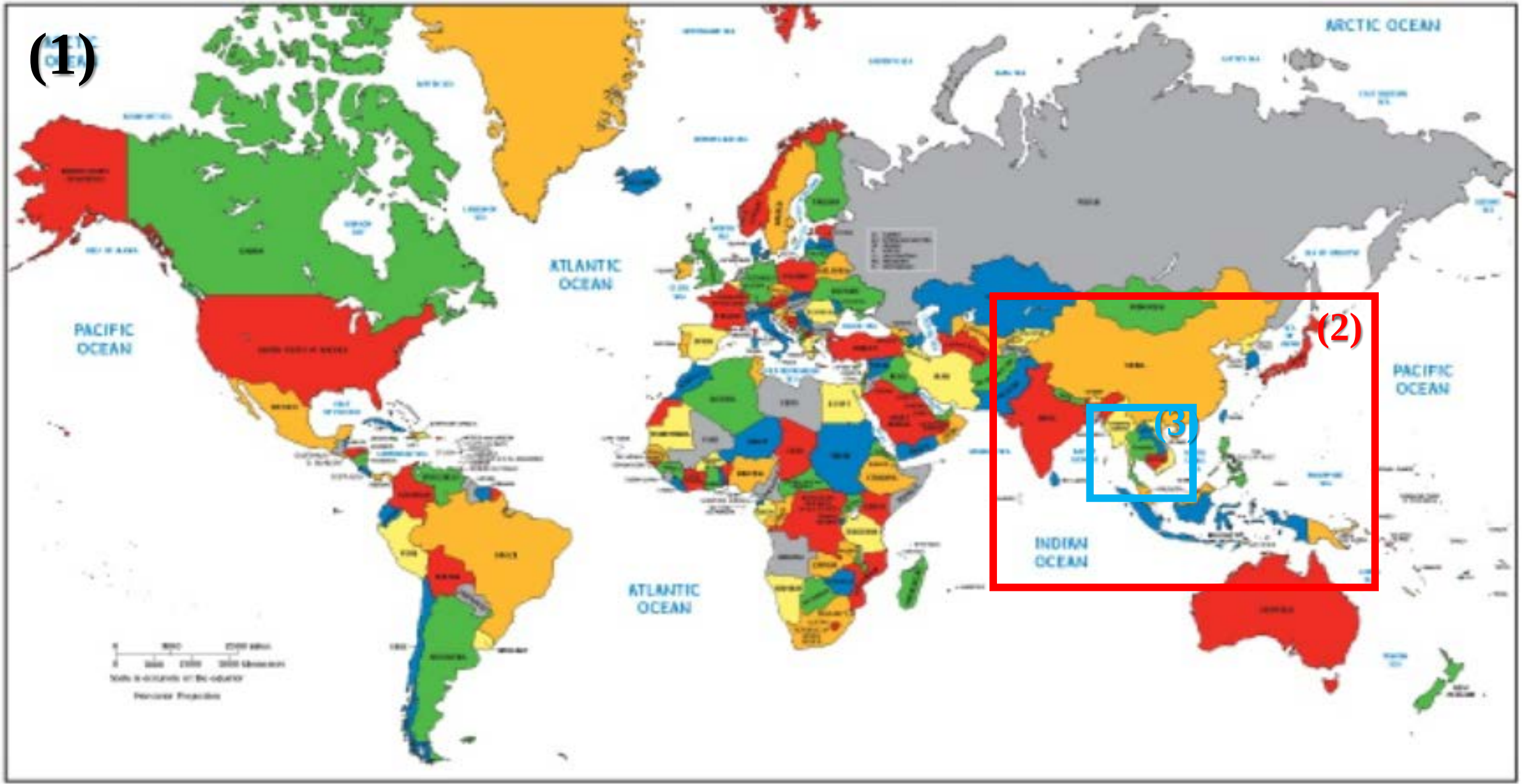


Outline

- **Global Climate,**
- **Reginal Climate,**
- **Local Climate**
- **Number TC/Frequency TC**
- **Weather Forecast**
- Innovation
- Future Work.

Domain: Global (1), Reginal (2) and Fine (3)



How a bout World Change

The Greenhouse Effect

Greenhouse gases let short-wavelength radiation come into the Earth's atmosphere from the sun. However, they absorb and re-radiate Earth's long-wavelength radiation back towards to Earth's surface keeping the temperature on Earth warm enough to inhabit.

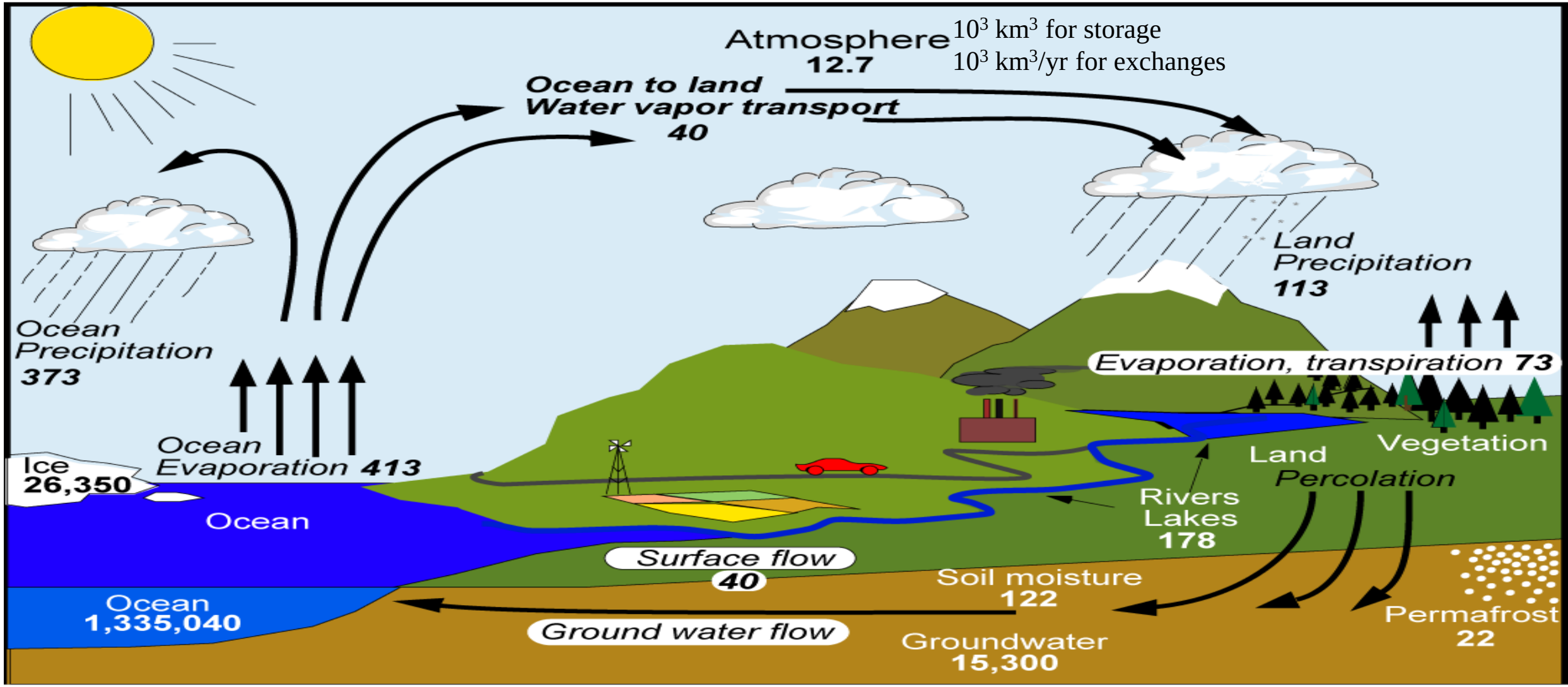
32 Articles

Sprawling Shanghai
Antarctic Ozone Hole
Coastline Change
Columbia Glacier, Alaska
Water Level in Lake Powell
Burn Recovery in Yellowstone
Shrinking Aral Sea
Padma River
Growing Deltas in Atchafalaya Bay
Recovery at Mt. St. Helens
Antarctic Sea Ice
Arctic Sea Ice
Snowpack in the Sierra Nevada
Athabasca Oil Sands
Ice Loss in Glacier National Park
Mountaintop Mining, West Virginia
Development of Orlando, Florida

Global Temperatures
Amazon Deforestation
Fire in Etosha National Park
Green Seasons of Maine
Drought Cycles in Australia
Severe Storms
Seasons of the Indus River
Urbanization of Dubai
Seasons of Lake Tahoe
Solar Activity
Larsen-B Ice Shelf
Mesopotamia Marshes
Yellow River Delta
El Niño, La Niña, and Rainfall
Global Biosphere

https://earthobservatory.nasa.gov/world-of-change/SeaIce

Hydrological cycle



- Movements and changes in states of water between major components of the Earth.
- It plays a central role in the Earth's energy cycle and closely connects to climate change.

Source: Trenberth et al. (2007)

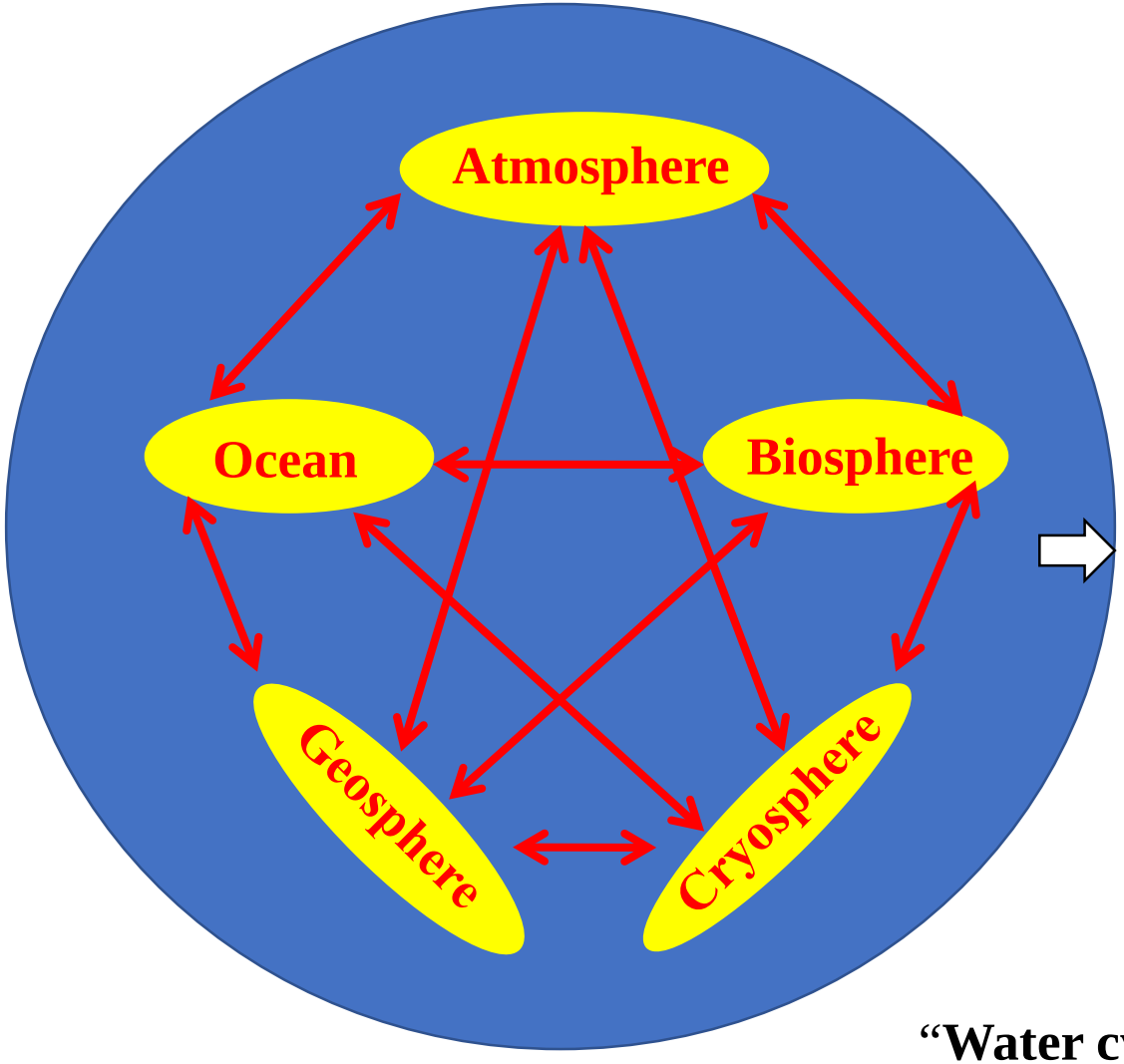
Global climate system under anthropogenic & natural influences

Natural Forcing

- Sun's strength changes
- Earth's orbital changes
- Volcanic eruptions

Anthropogenic Forcing

- **GHG gases**



Climate variations

Temperature increase

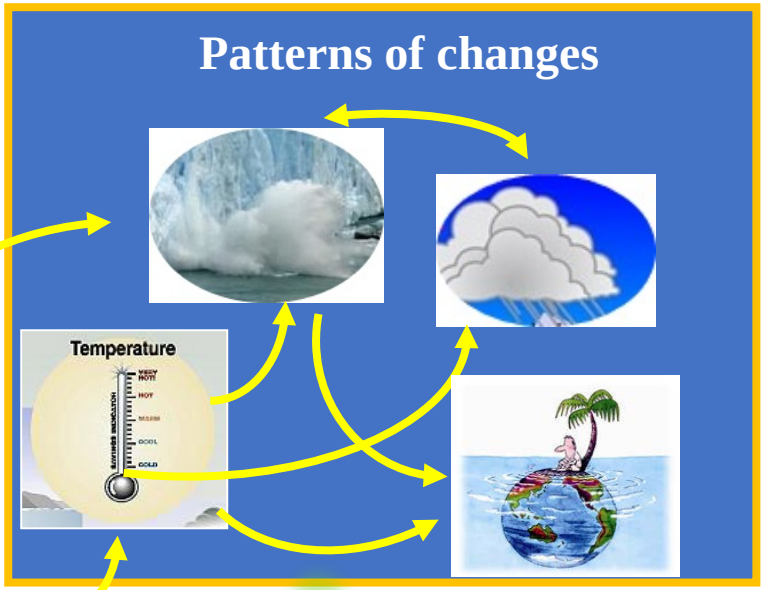
Climate is changing

"Water cycle must also be changing as a consequence"

Anthropogenic climate change processes

Carbon cycle disturbances

Greenhouse effect



CO_2 N_2O CH_4

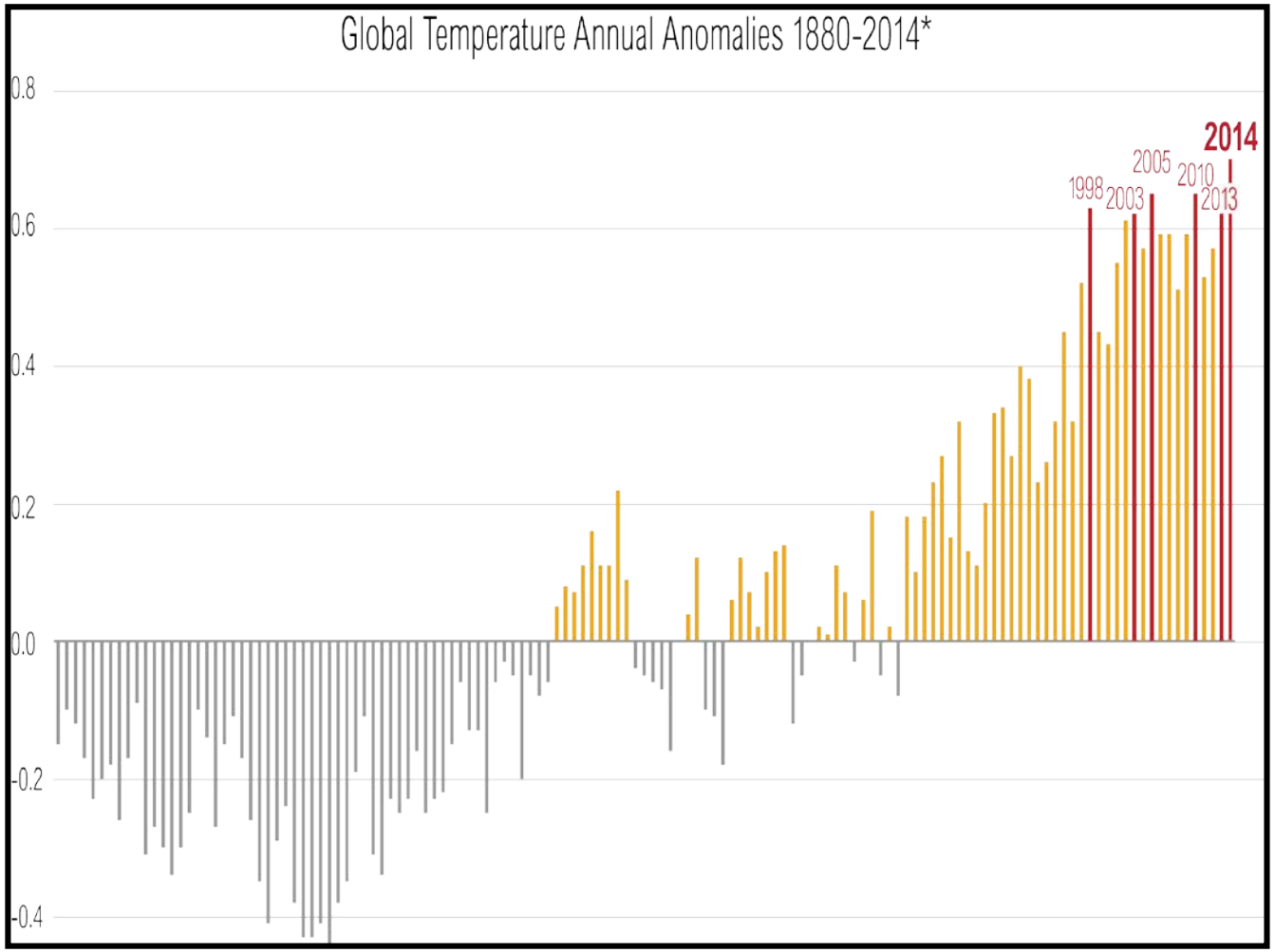
GHG

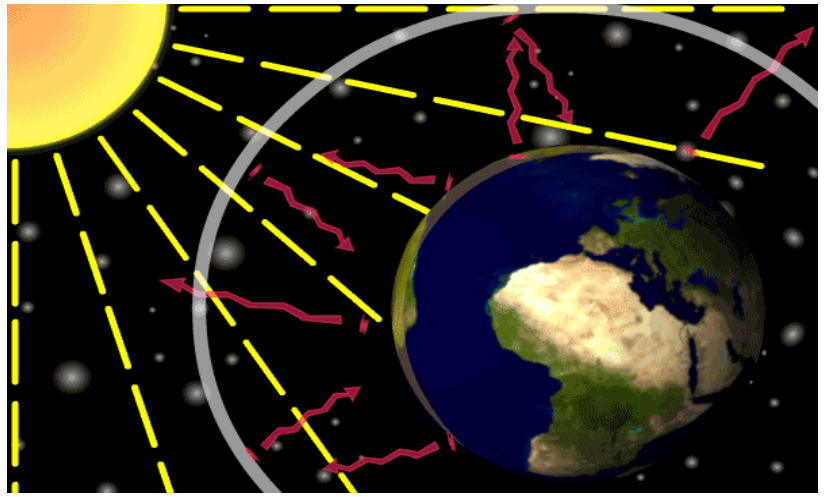
Human activities

- Land use change
- Fossil fuel burning

Impact & disaster

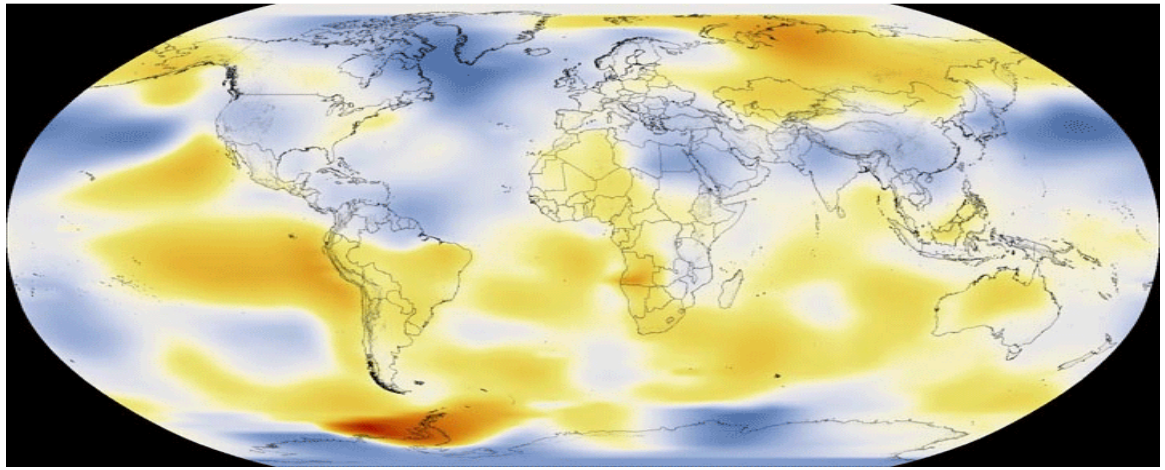
Earth is heating up





Data source: NASA/GISS
Credit: NASA Scientific Visualization Studio

1986

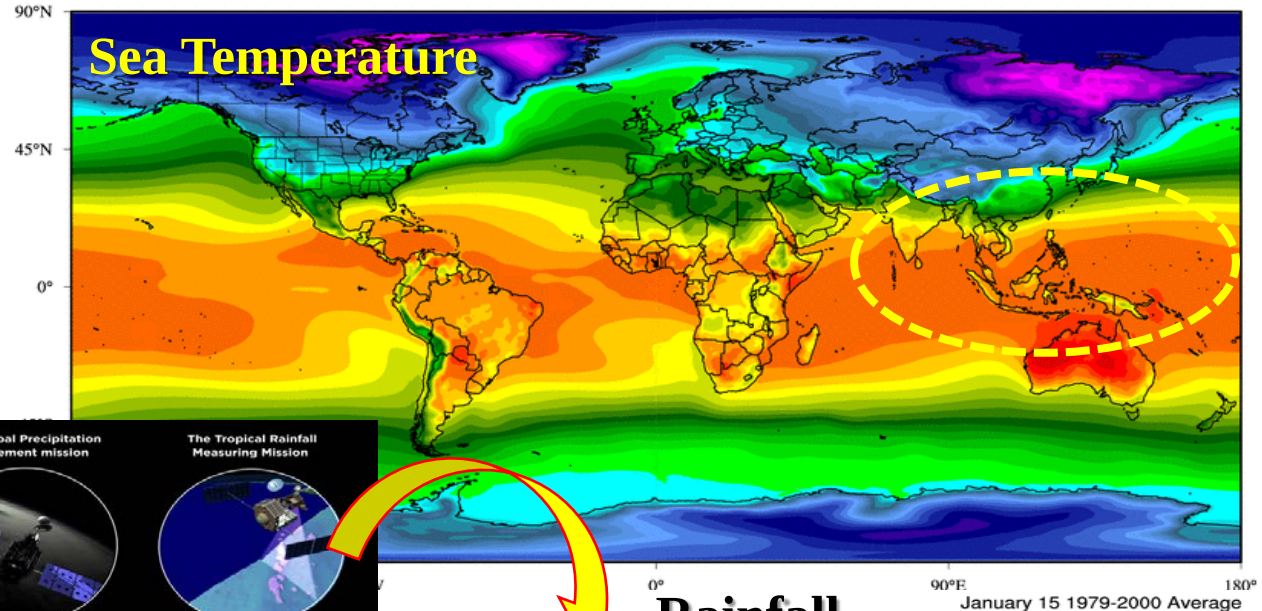


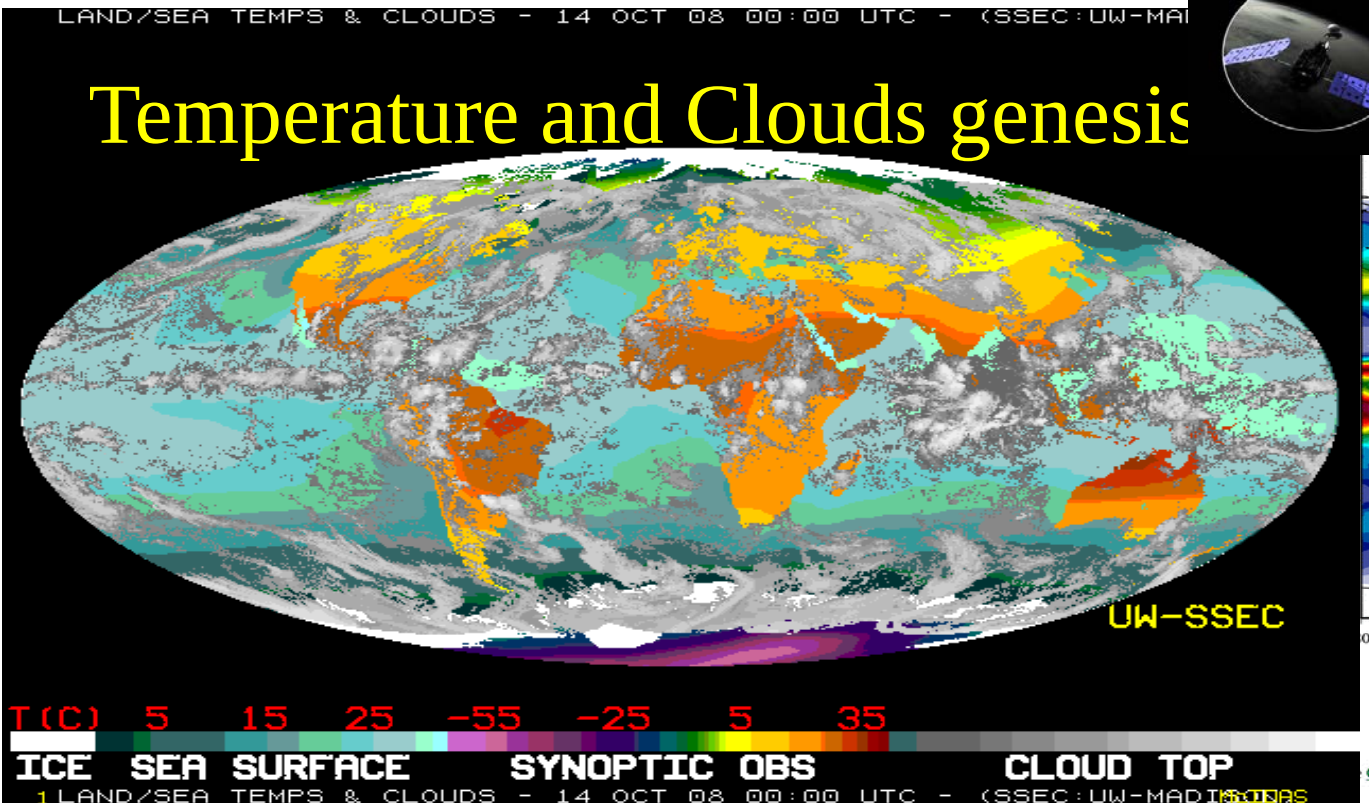
- Global surface temperature show a warming of 0.85 °C over 1880 – 2012.
- The 1983–2012 was likely the warmest 30-year period of the last 1400 years.

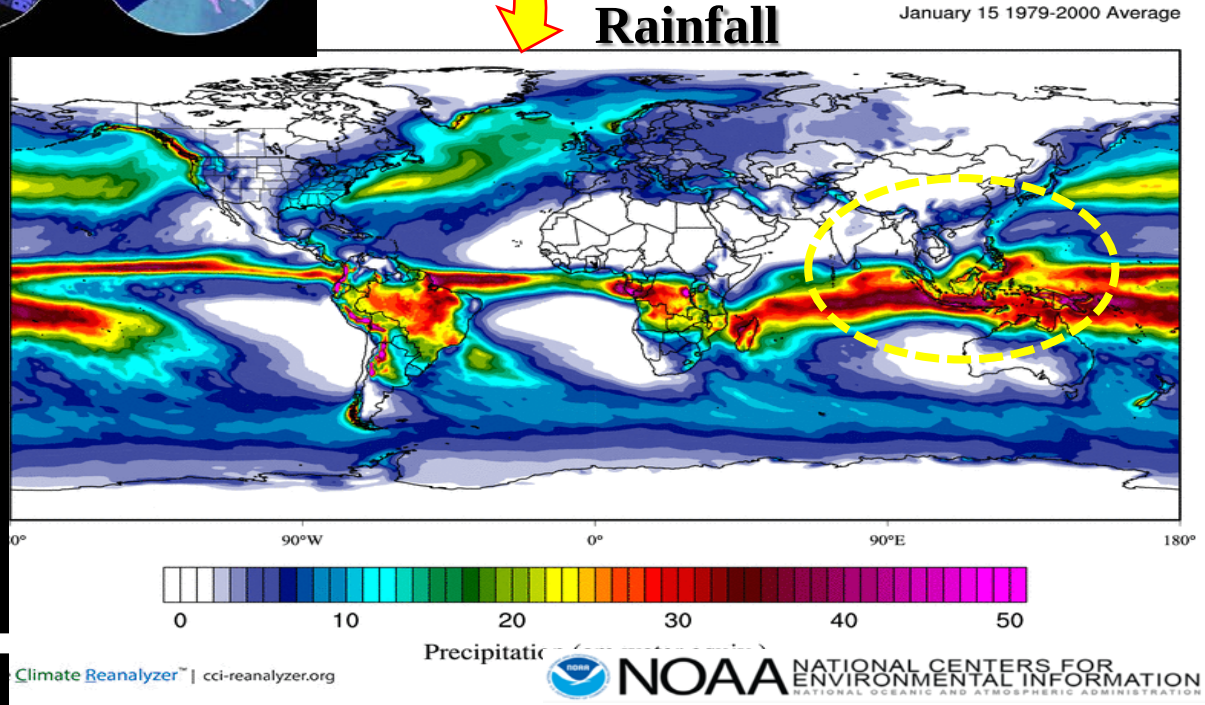
Source: NOAA

Global Climatology

The Global Historical Climatology Network–monthly (GHCNm) dataset is a set of monthly climate summaries from thousands of weather stations around the world.

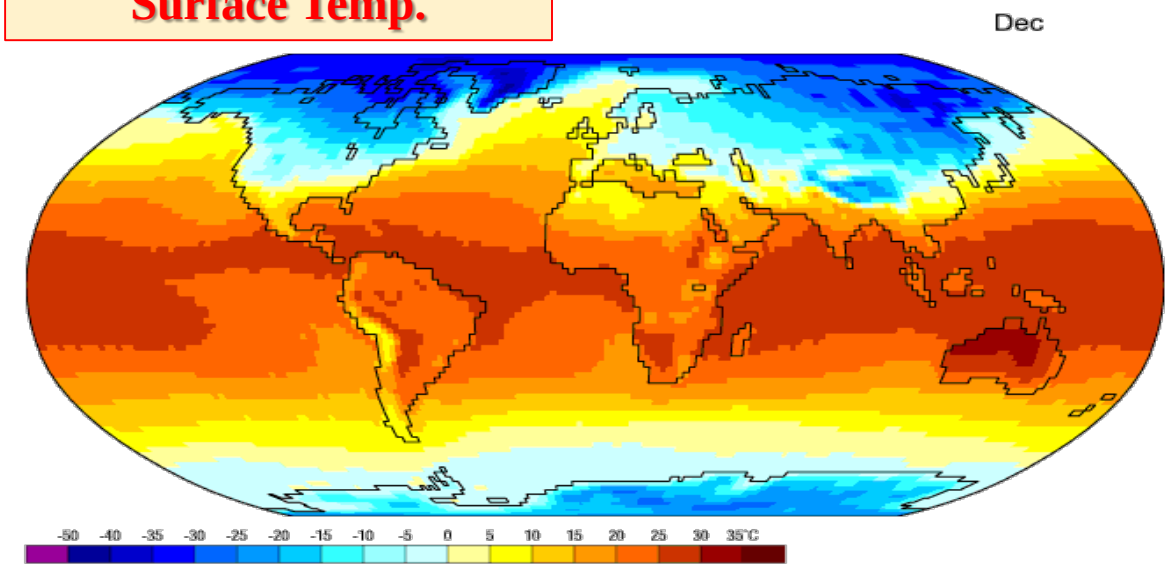




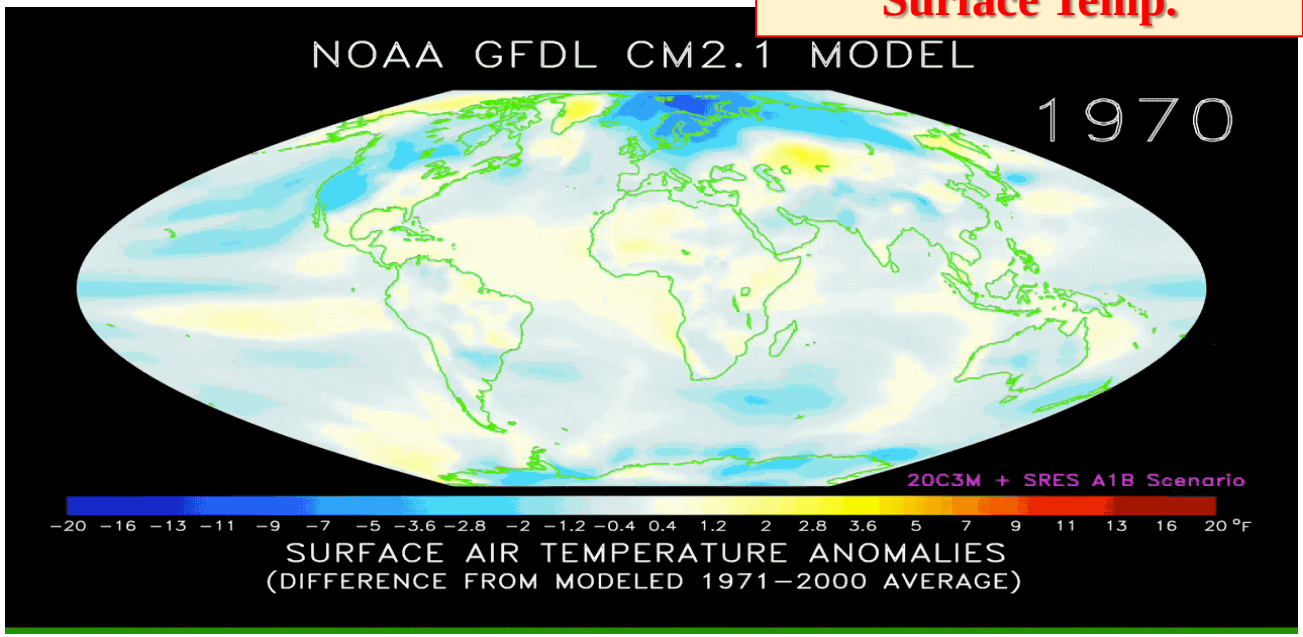


Climate Change

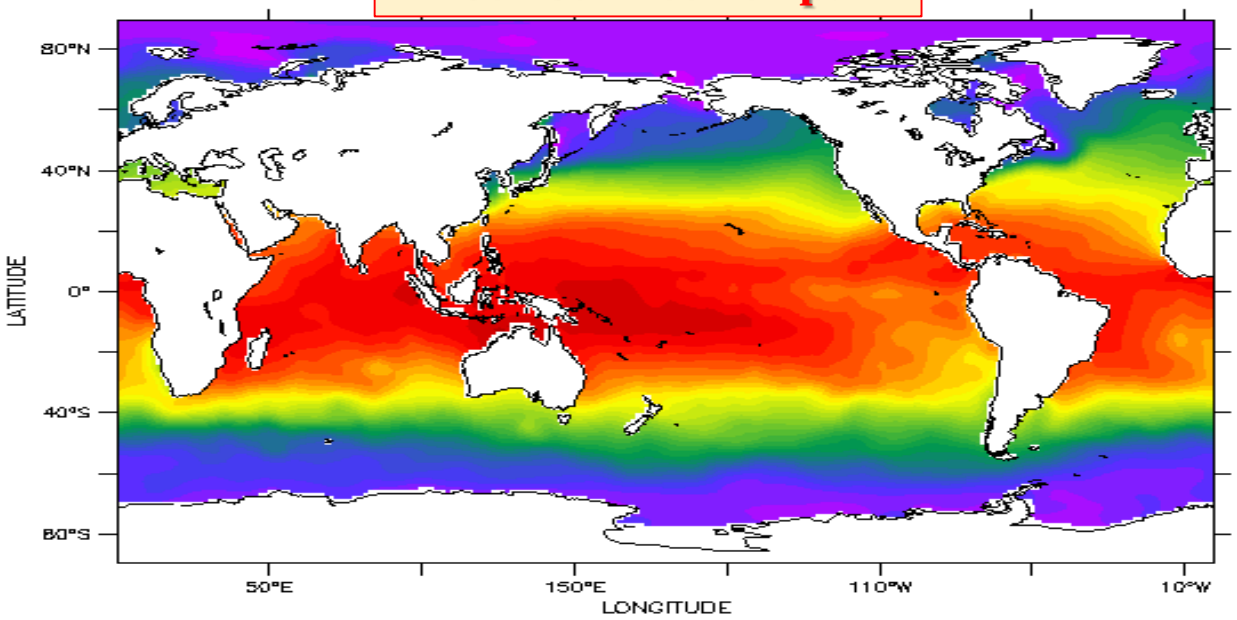
Surface Temp.



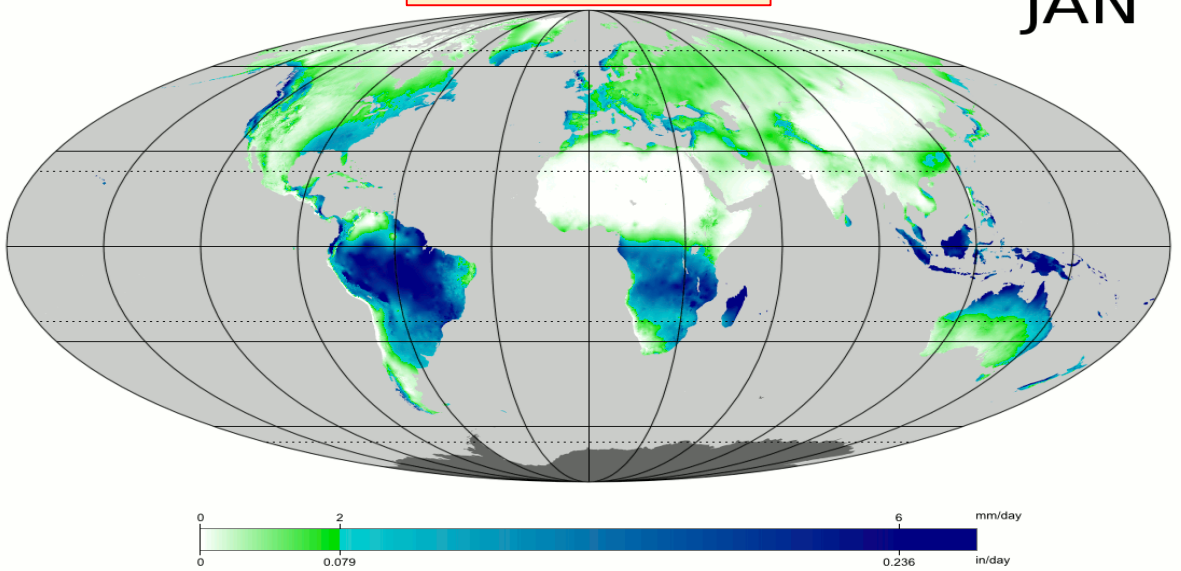
Surface Temp.



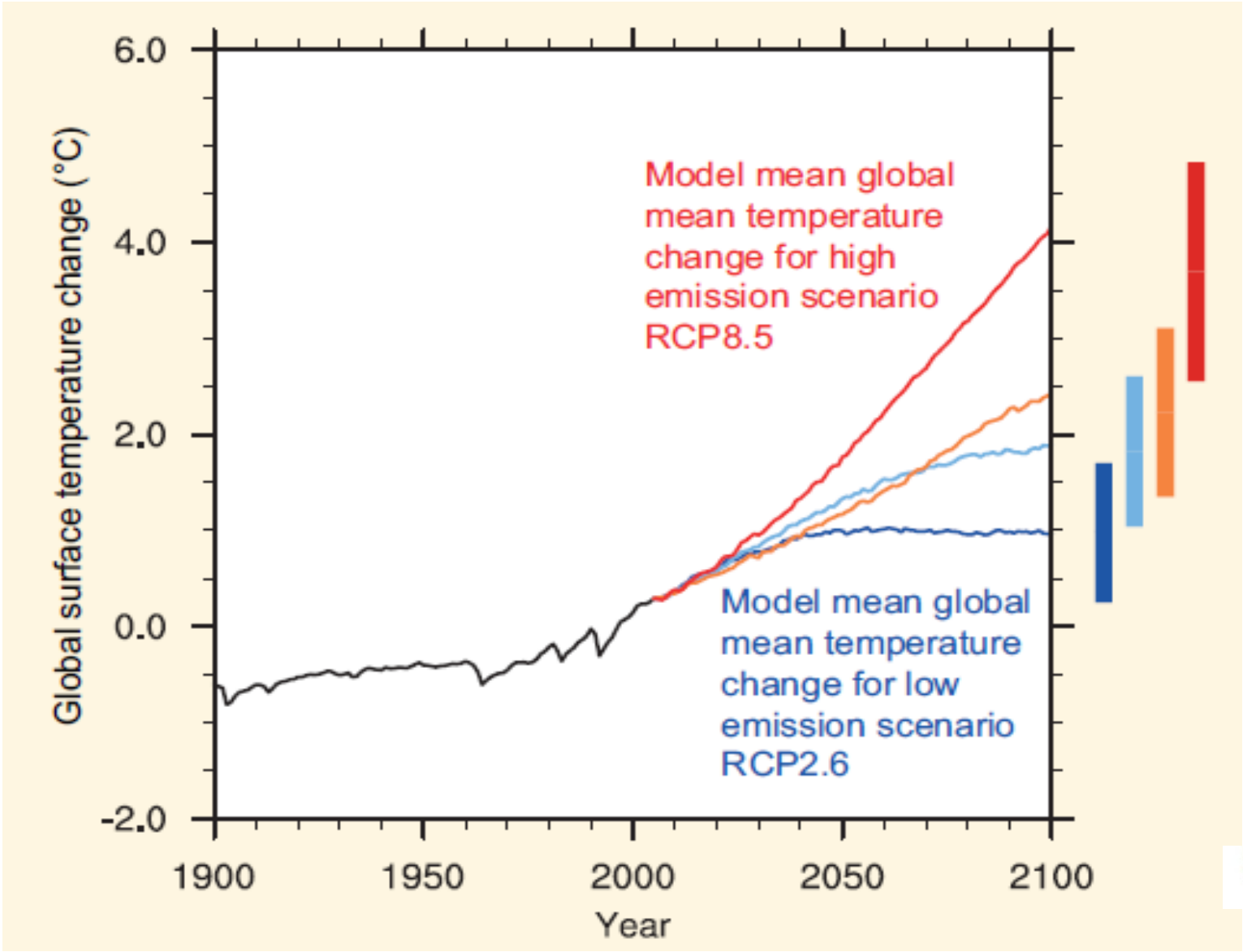
Sea Surface Temp.



Rain pattern

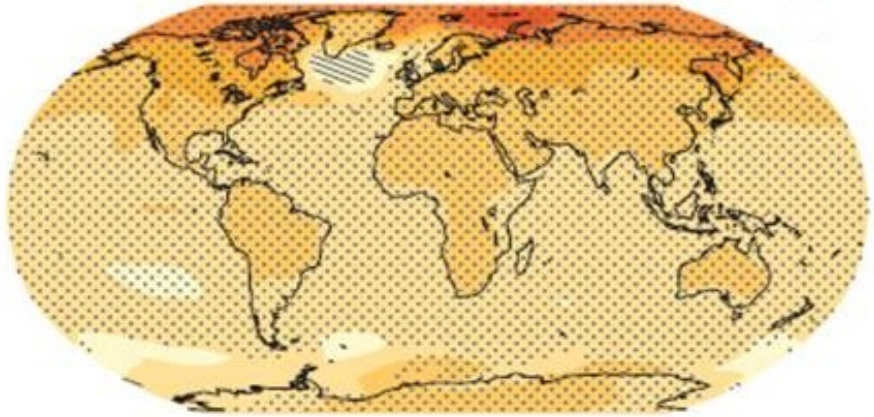


Projected global temperature change

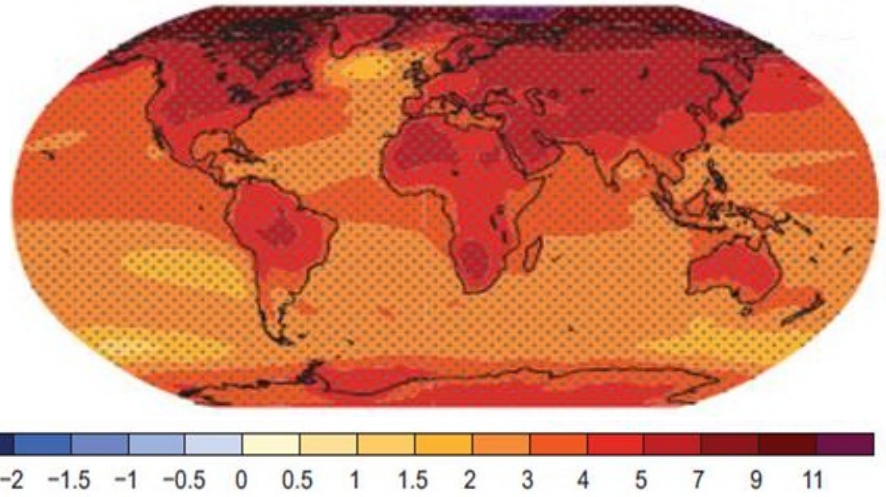


Change in average surface temperature (1986–2005 to 2081–2100)

RCP 2.6



RCP 8.5



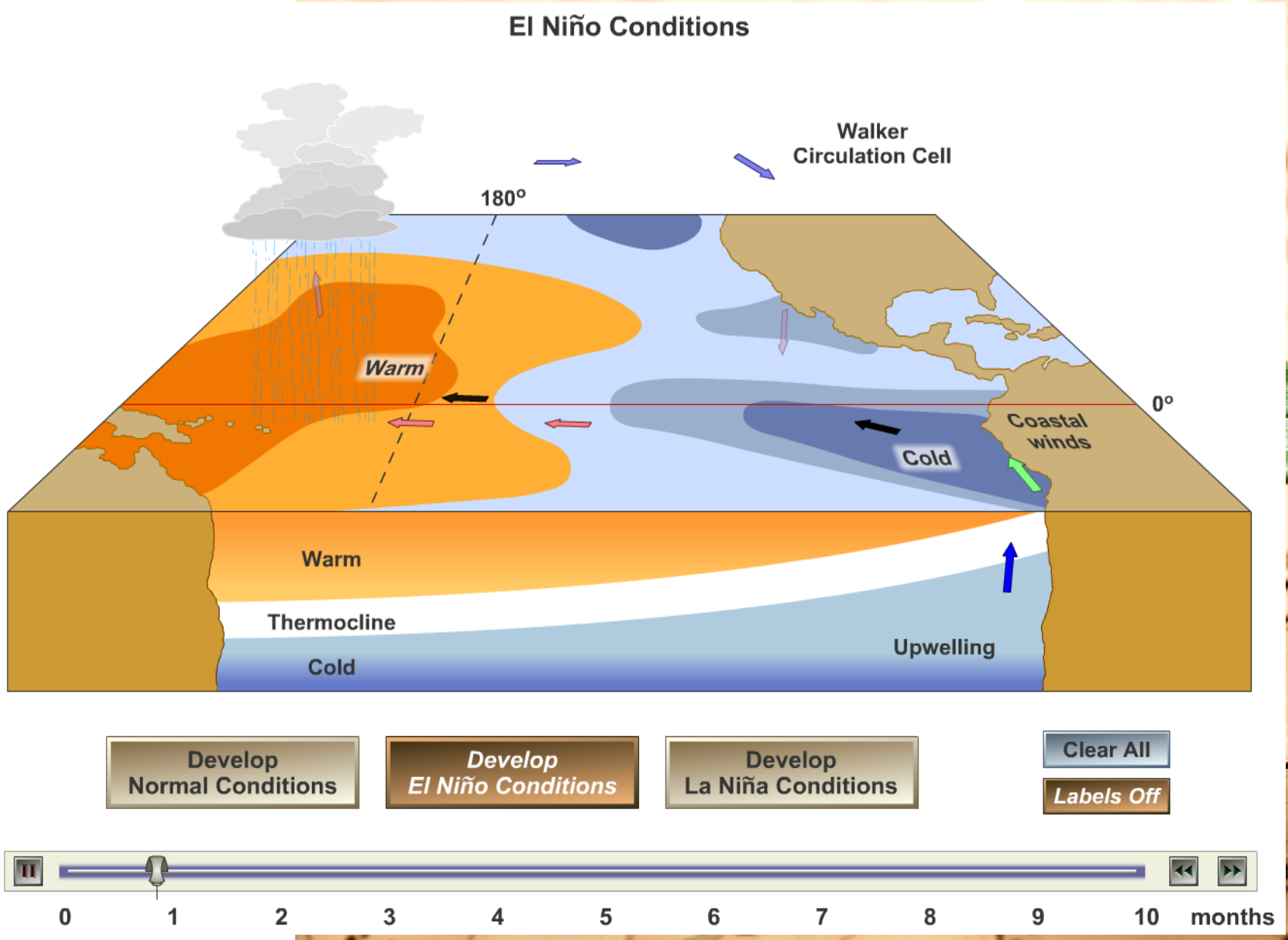
Source: IPCC-WGI's AR5

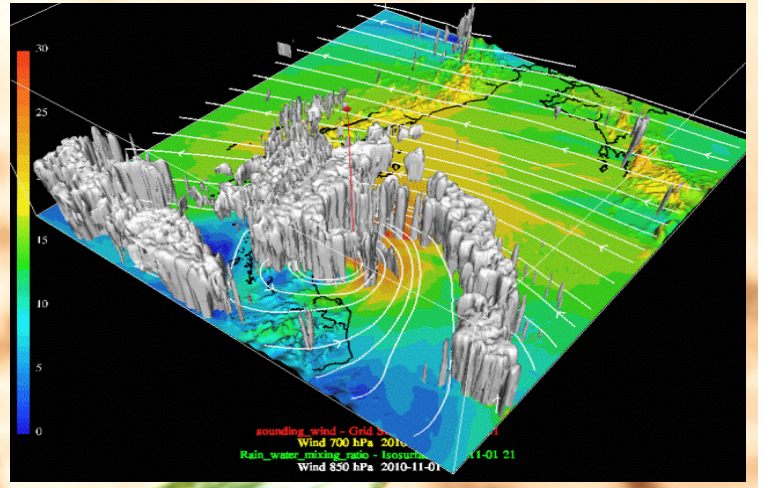
Global Temperature

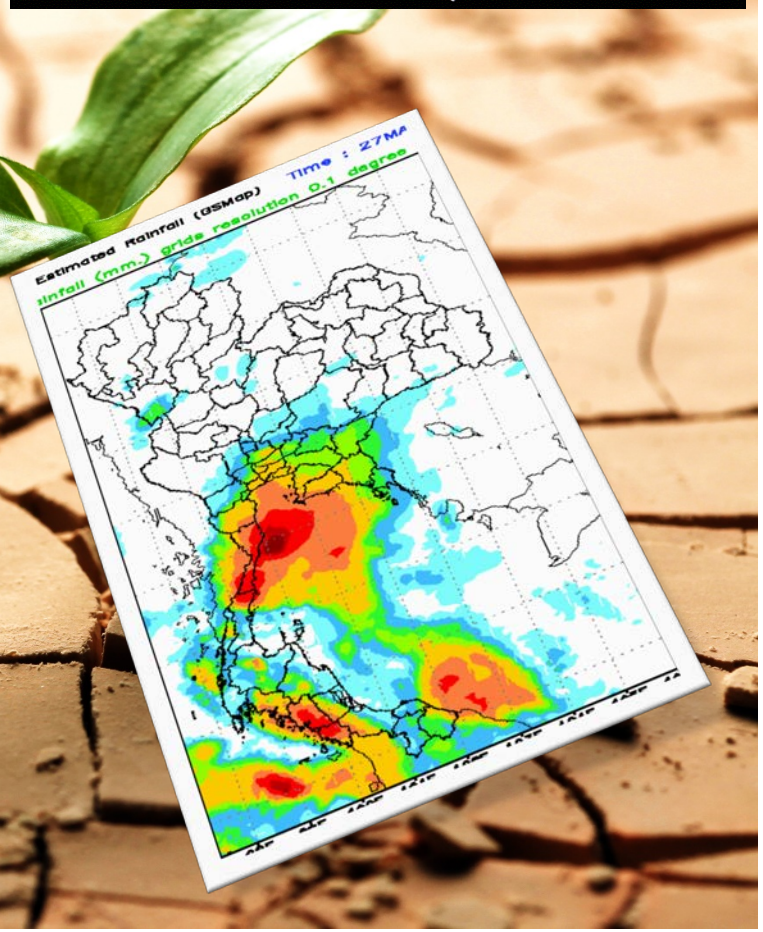
The global land and ocean surface temperature highest May avg. temperature. Since global records began in 1880.

- **May 2015 (+0.89°C)**
- **Mays 2016 (+0.93°C)**
- **May 2017 (+0.87°C)**
- **May 2019 (+0.85°C)**

1. El Niño / La Nina Phenomena

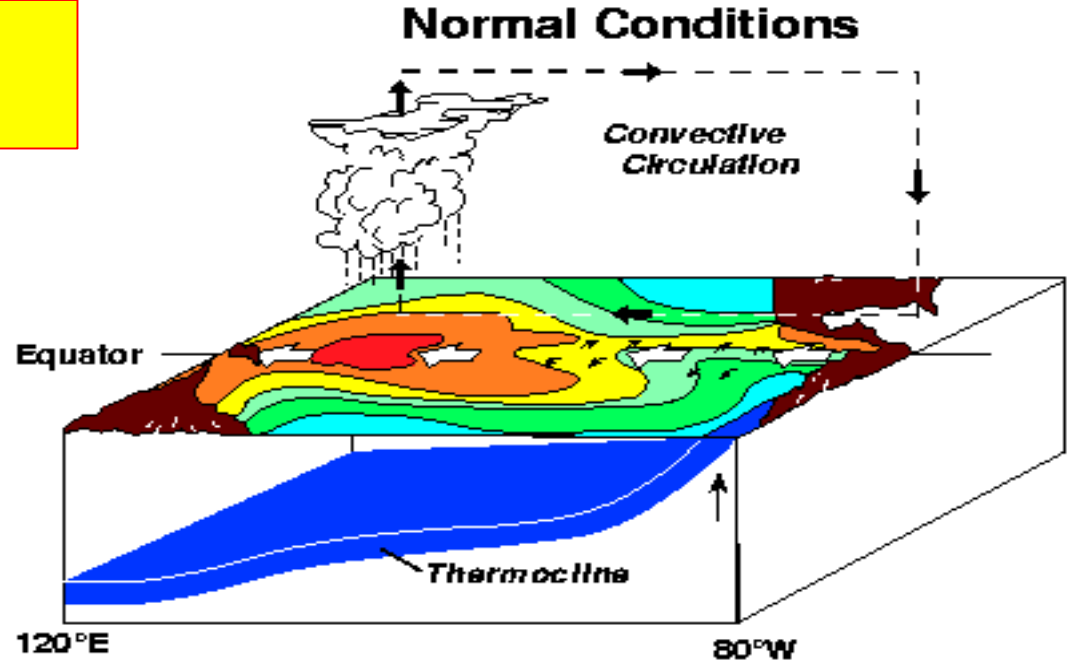


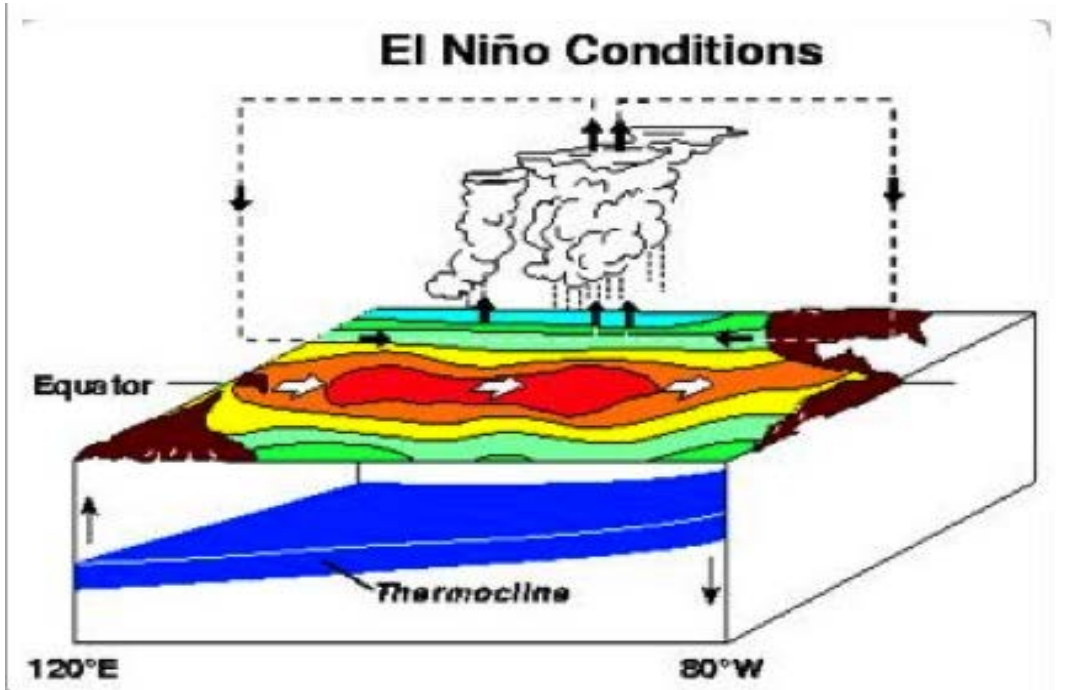




El Niño Phenomena

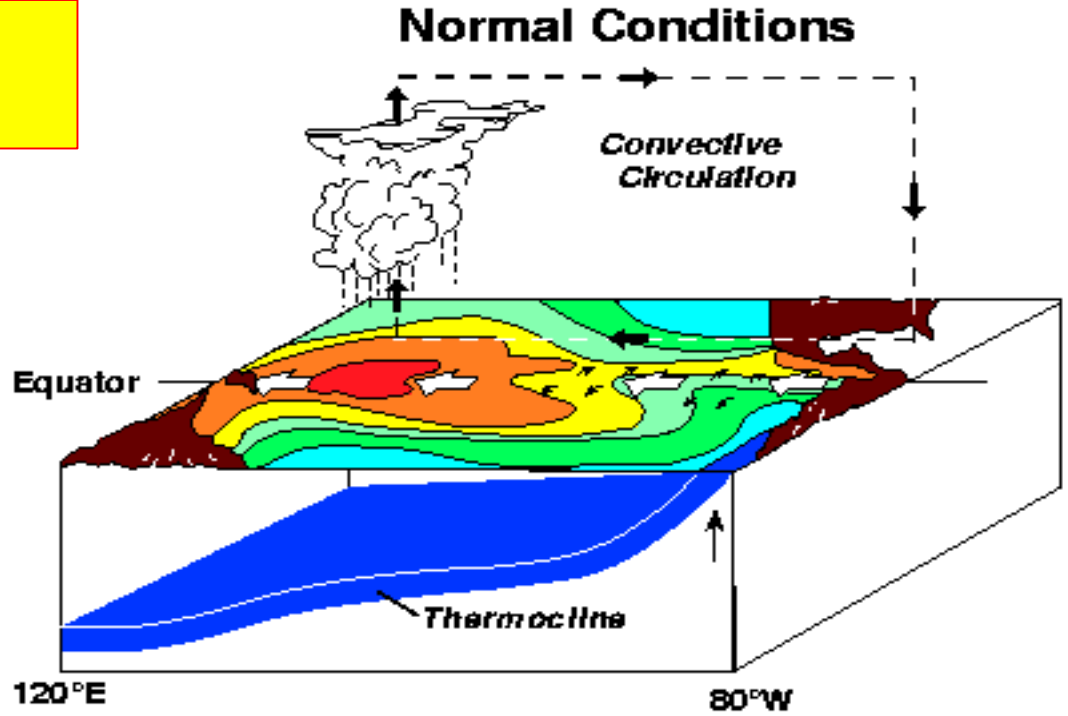
El Niño occurs when warm water builds up along the equator in the eastern Pacific. ***The warm ocean surface warms the atmosphere, which allows moisture-rich air to rise and develop into rainstorms.*** El Nino affects the global climate and disrupts normal weather patterns, ***which as a result can lead to intense storms in some places and droughts in others.***

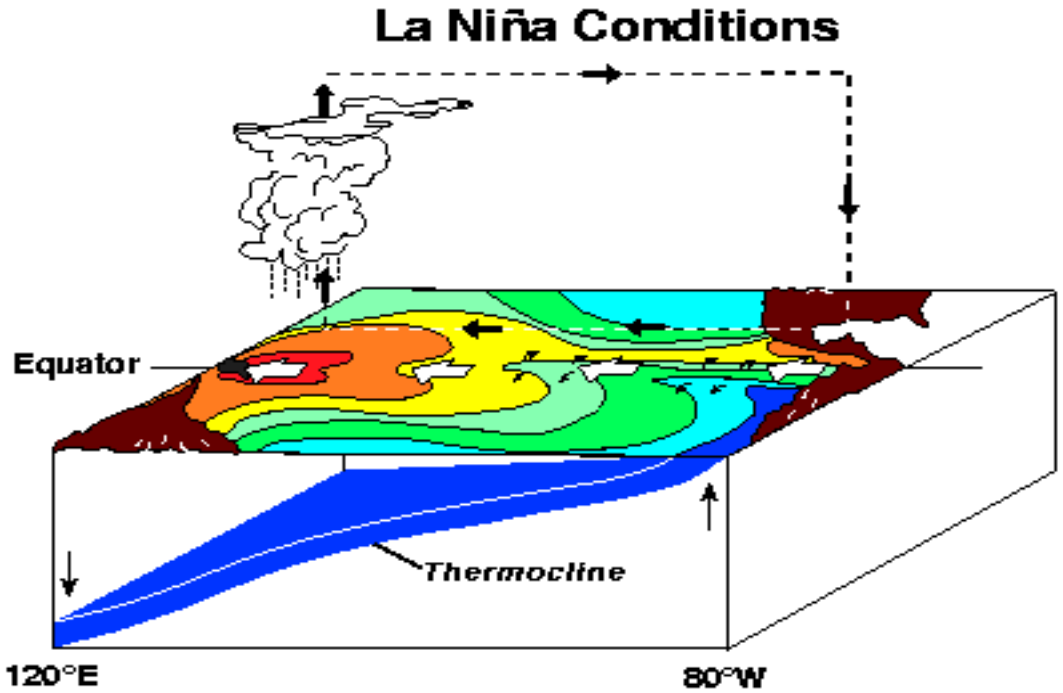




La Niña Phenomena

La Niña is the build up of cool waters in the equatorial eastern Pacific, ***La Niña's impacts are opposite those of El Niño. The atmosphere cools in response to the cold ocean surface, and less water evaporates. The cooler, dry air is dense. It doesn't rise or form storms.*****.**



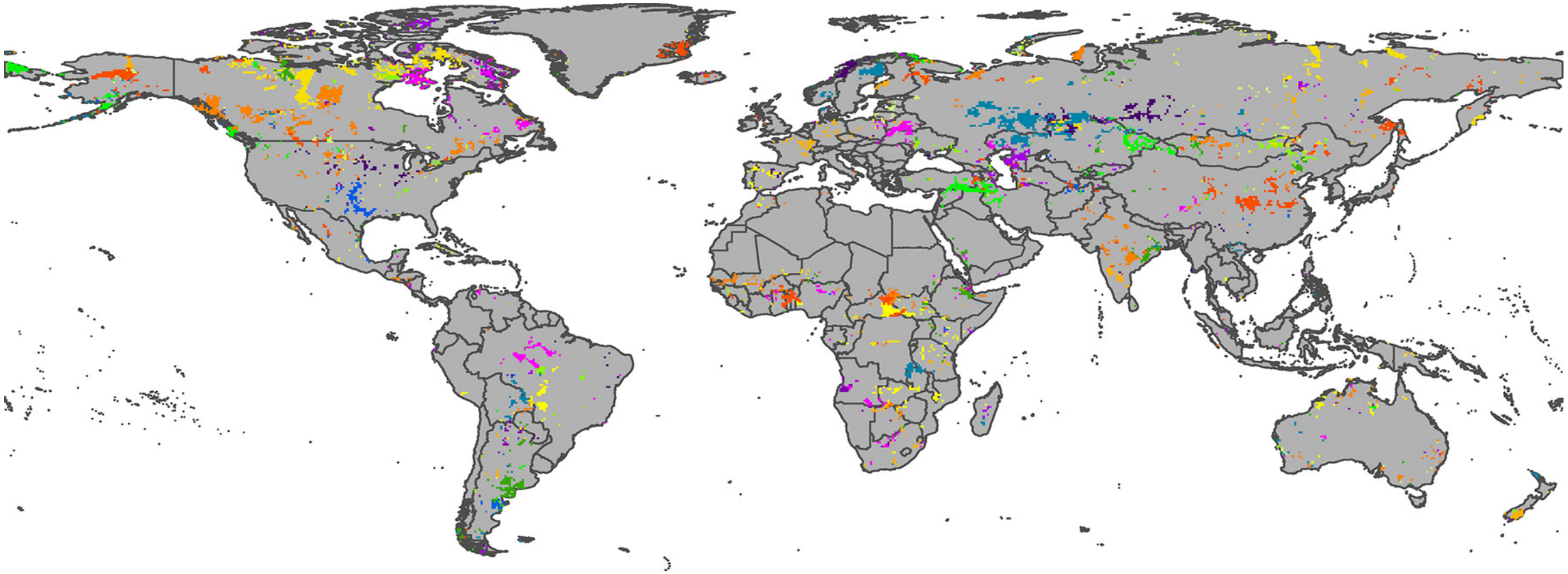


History El Niño / La Nina Index

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2010	1.5	1.3	0.9	0.4	-0.1	-0.6	-1.0	-1.4	-1.6	-1.7	-1.7	-1.6
2011	-1.4	-1.1	-0.8	-0.6	-0.5	-0.4	-0.5	-0.7	-0.9	-1.1	-1.1	-1.0
2012	-0.8	-0.6	-0.5	-0.4	-0.2	0.1	0.3	0.3	0.3	0.2	0.0	-0.2
2013	-0.4	-0.3	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.2	-0.3
2014	-0.4	-0.4	-0.2	0.1	0.3	0.2	0.1	0.0	0.2	0.4	0.6	0.7
2015	0.6	0.6	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.5	2.6
2016	2.5	2.2	1.7	1.0	0.5	0.0	-0.3	-0.6	-0.7	-0.7	-0.7	-0.6
2017	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.1	-0.4	-0.7	-0.9	-1.0
2018	-0.9	-0.8	-0.6	-0.4	-0.1	0.1	0.1	0.2	0.4	0.7	0.9	0.8
2019	0.8	0.8	0.8	0.8	0.6	0.5	0.3	0.1	0.1	0.3		

El Niño is strongly 2015 / La Nina Index is strongly 2011

El Nino affects the global climate

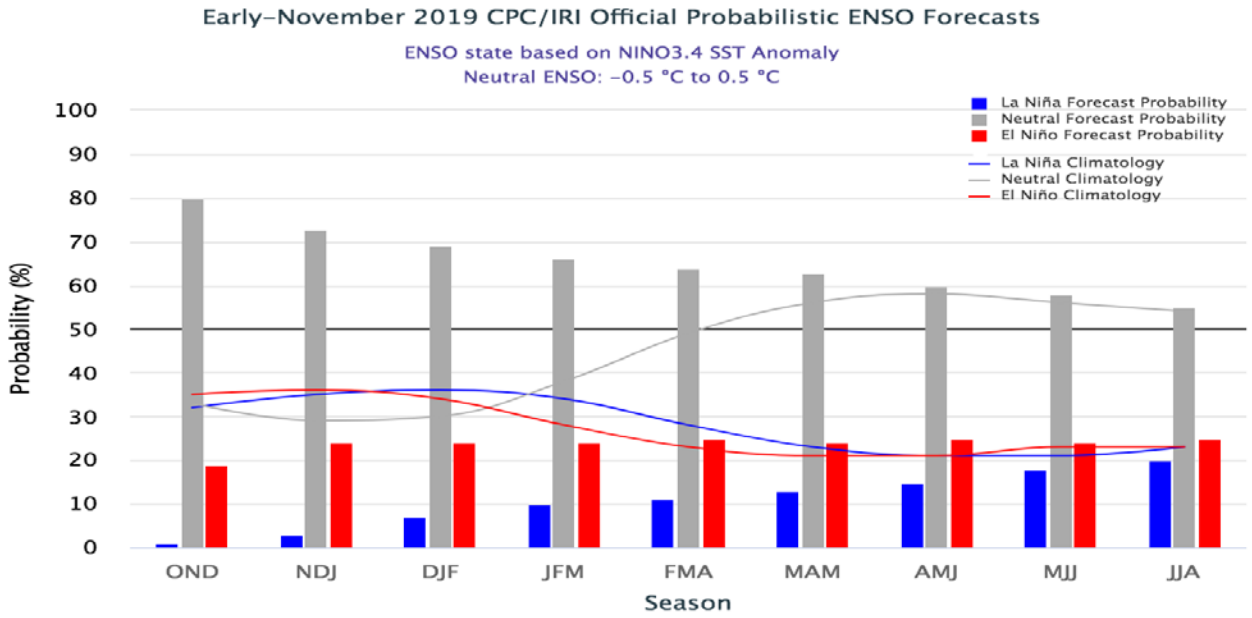


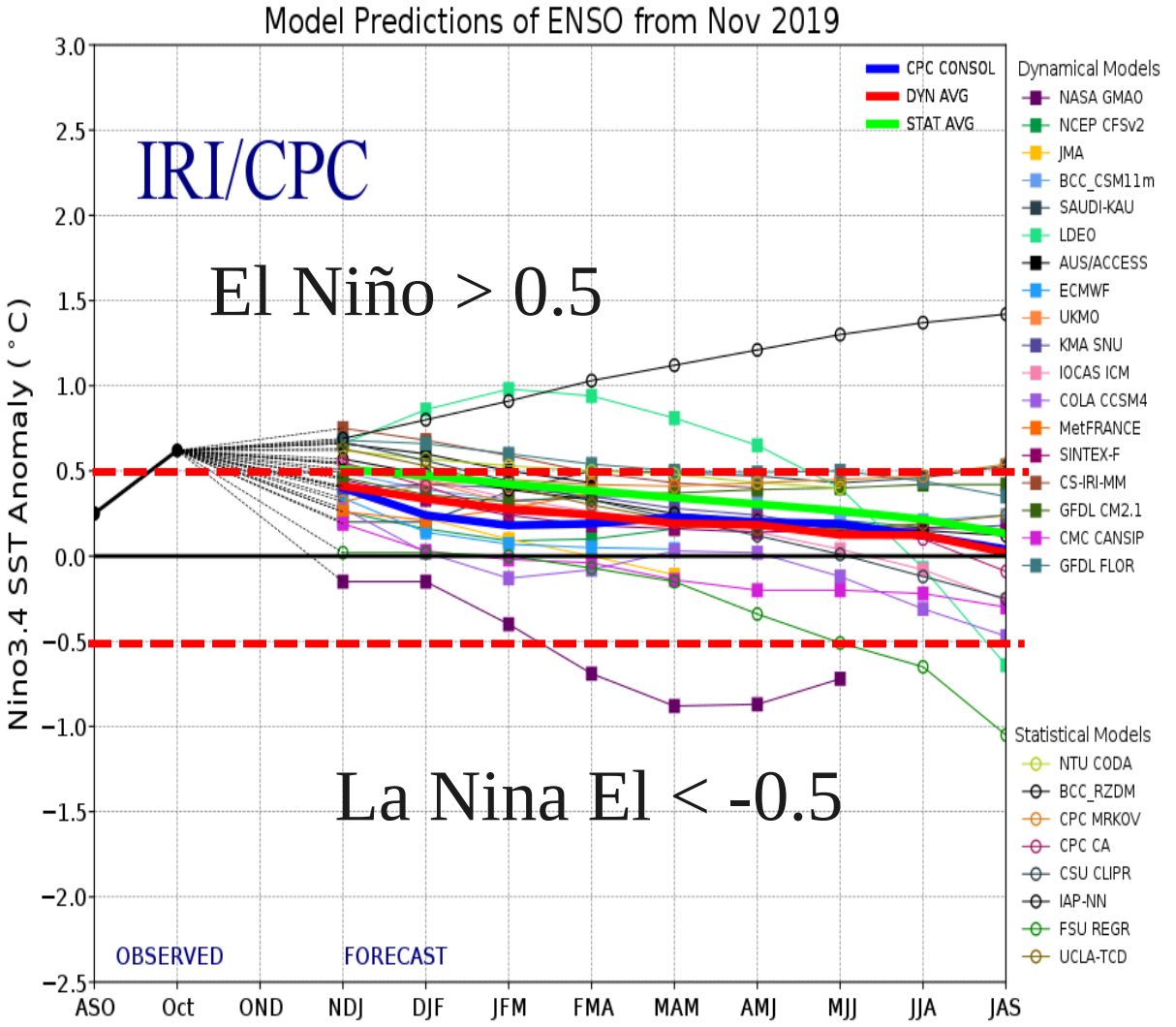
Spatial pattern of extreme drought-induced ecosystem function loss (AVE)

2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

El Niño / La Nina Index Forecast

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2007	0.7	0.3	0.0	-0.2	-0.3	-0.4	-0.5	-0.8	-1.1	-1.4	-1.5	-1.6
2008	-1.6	-1.4	-1.2	-0.9	-0.8	-0.5	-0.4	-0.3	-0.3	-0.4	-0.6	-0.7
2009	-0.8	-0.7	-0.5	-0.2	0.1	0.4	0.5	0.5	0.7	1.0	1.3	1.6
2010	1.5	1.3	0.9	0.4	-0.1	-0.6	-1.0	-1.4	-1.6	-1.7	-1.7	-1.6
2011	-1.4	-1.1	-0.8	-0.6	-0.5	-0.4	-0.5	-0.7	-0.9	-1.1	-1.1	-1.0
2012	-0.8	-0.6	-0.5	-0.4	-0.2	0.1	0.3	0.3	0.3	0.2	0.0	-0.2
2013	-0.4	-0.3	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.2	-0.3
2014	-0.4	-0.4	-0.2	0.1	0.3	0.2	0.1	0.0	0.2	0.4	0.6	0.7
2015	0.6	0.6	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.5	2.6
2016	2.5	2.2	1.7	1.0	0.5	0.0	-0.3	-0.6	-0.7	-0.7	-0.7	-0.6
2017	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.1	-0.4	-0.7	-0.9	-1.0
2018	-0.9	-0.8	-0.6	-0.4	-0.1	0.1	0.1	0.2	0.4	0.7	0.9	0.8
2019	0.8	0.8	0.8	0.8	0.6	0.5	0.3	0.1	0.1	0.3		





A majority of models favor ENSO-neutral through Northern Hemisphere summer 2020.

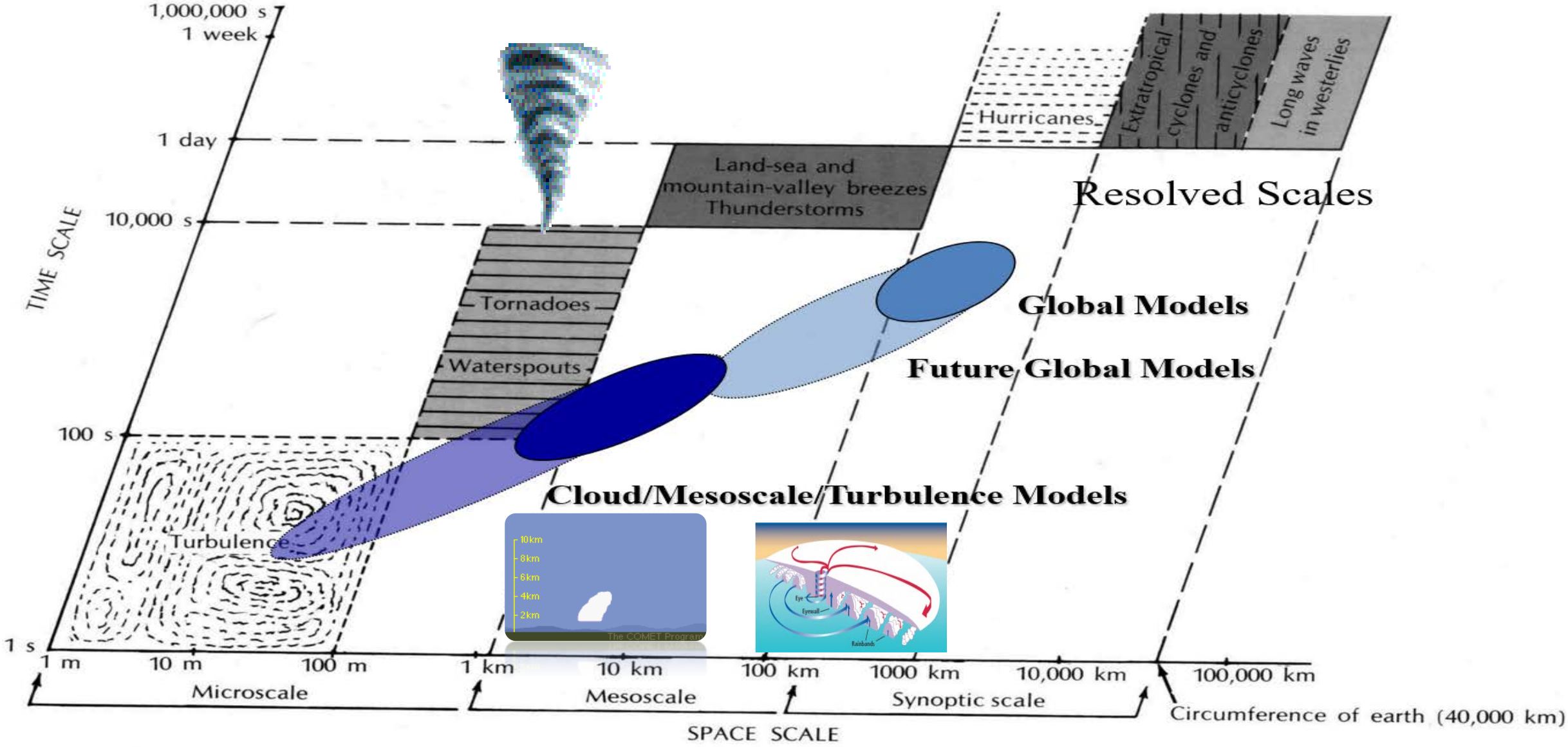
https://www.cpc.ncep.noaa.gov/

Regional impacts from El Nino/La Nina

The impacts that generally do occur during most El Niño events include below-average rainfall over Indonesia and northern South America*, while above average rainfall occurs in southeastern South America, eastern equatorial Africa, and the southern United States*

La Nina : As warm water spreads from the west Pacific and the Indian Ocean, it takes the rain with it, ***causing extensive drought in the western Pacific and rainfall in the normally dry eastern Pacific.***

Weather forecast must be know scale of phenomena

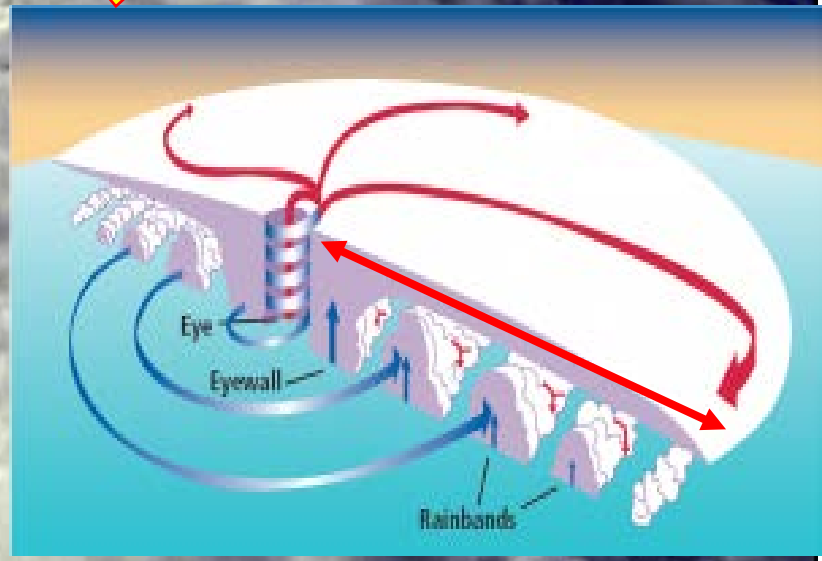


Tropical Cyclone or Hurricane

Scale about 100 – 1,000 km

Eye: Dim. 30-50km

Disturbance: radian. 50-300km

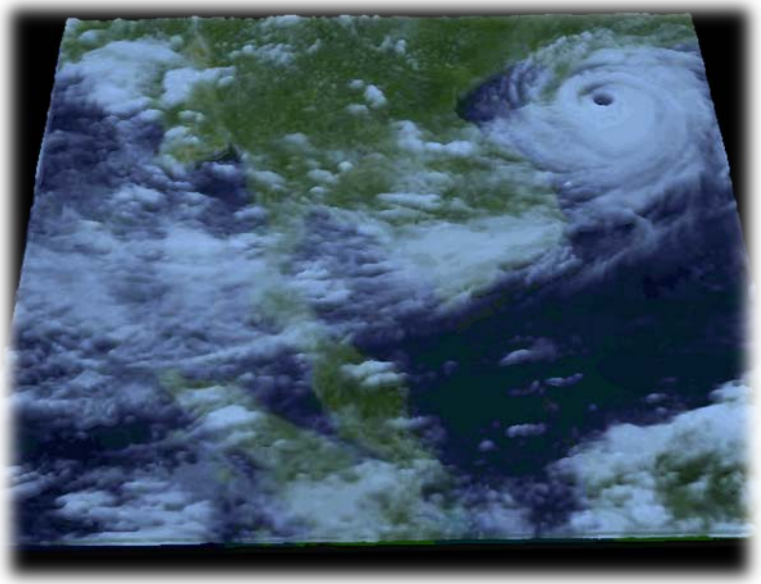


1. Tropical Cyclones

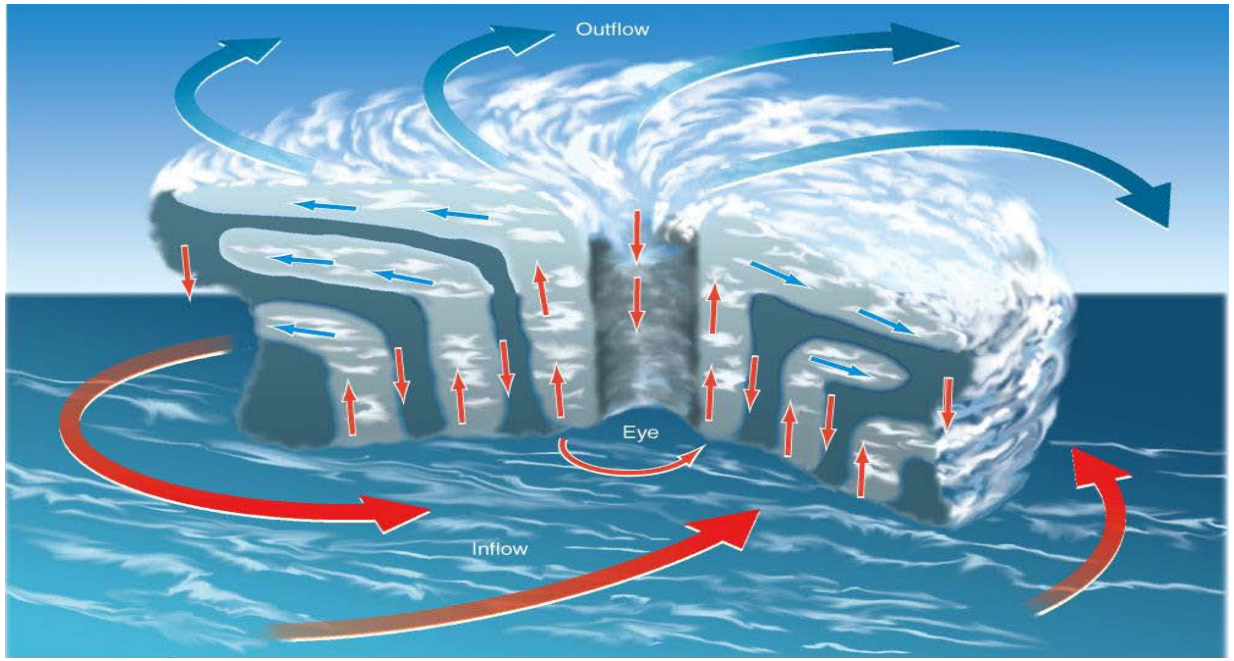
- Tropical Depression
  max. winds 34knots (63km/h)

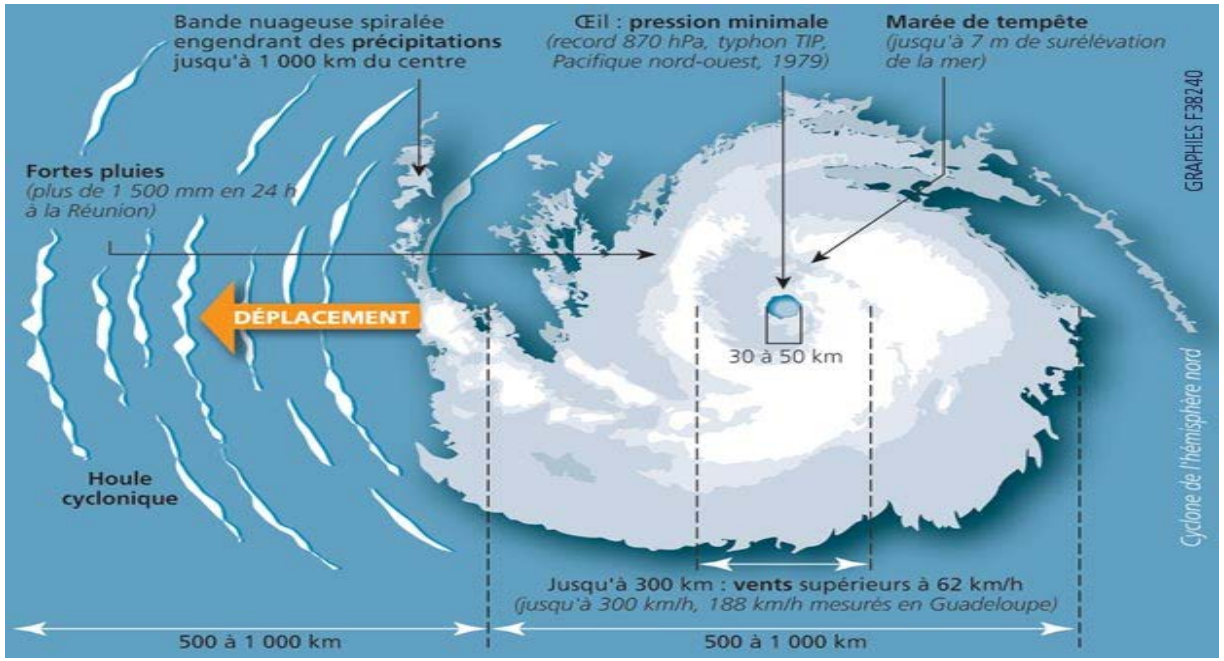
- Tropical Cyclone
  Max. winds 35knots (63km/h) to 63knots (118km/h)

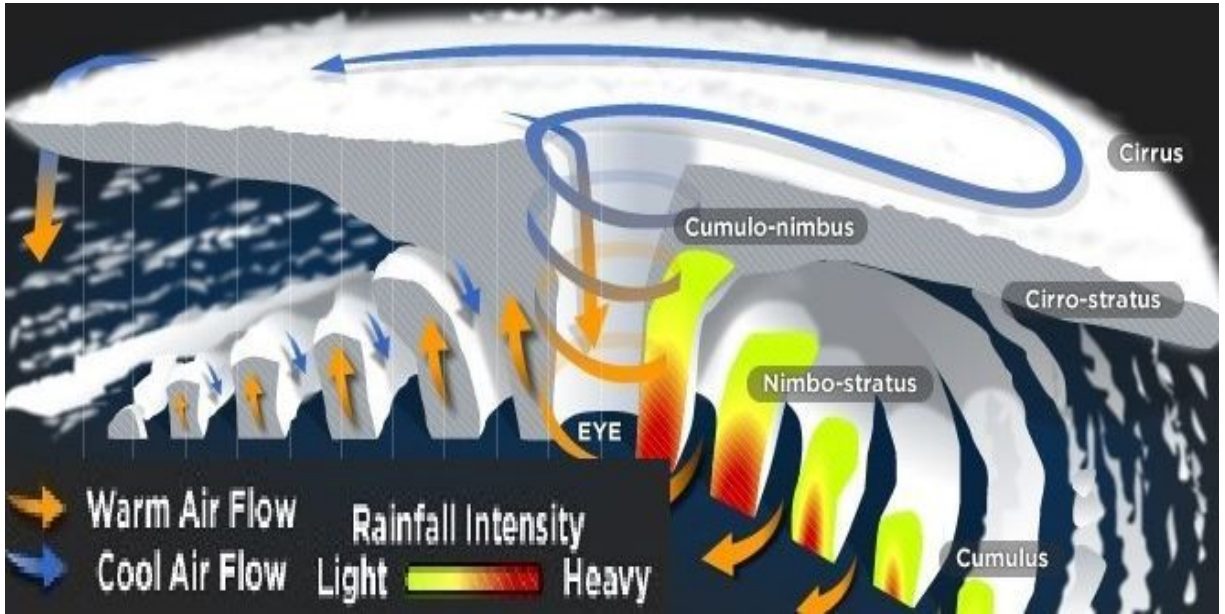
- Typhoon
  max. winds 64knots (118km/h)

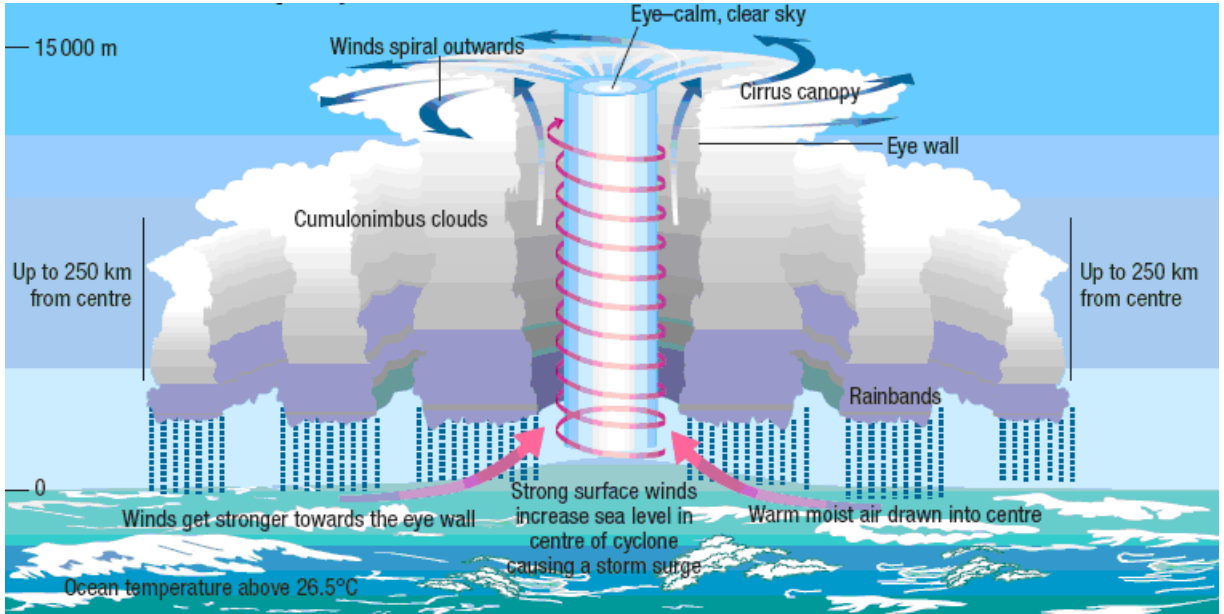


Characteristics Tropical Cyclone Structure



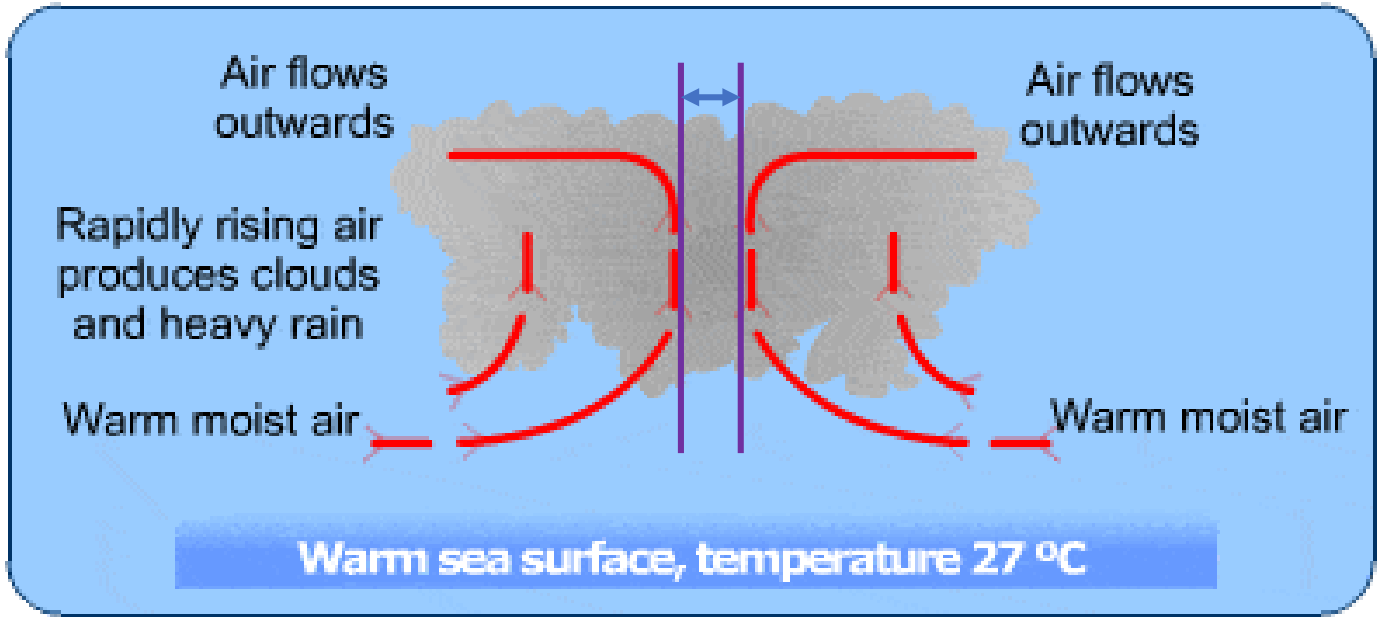






Structure of typhoon / hurricanes

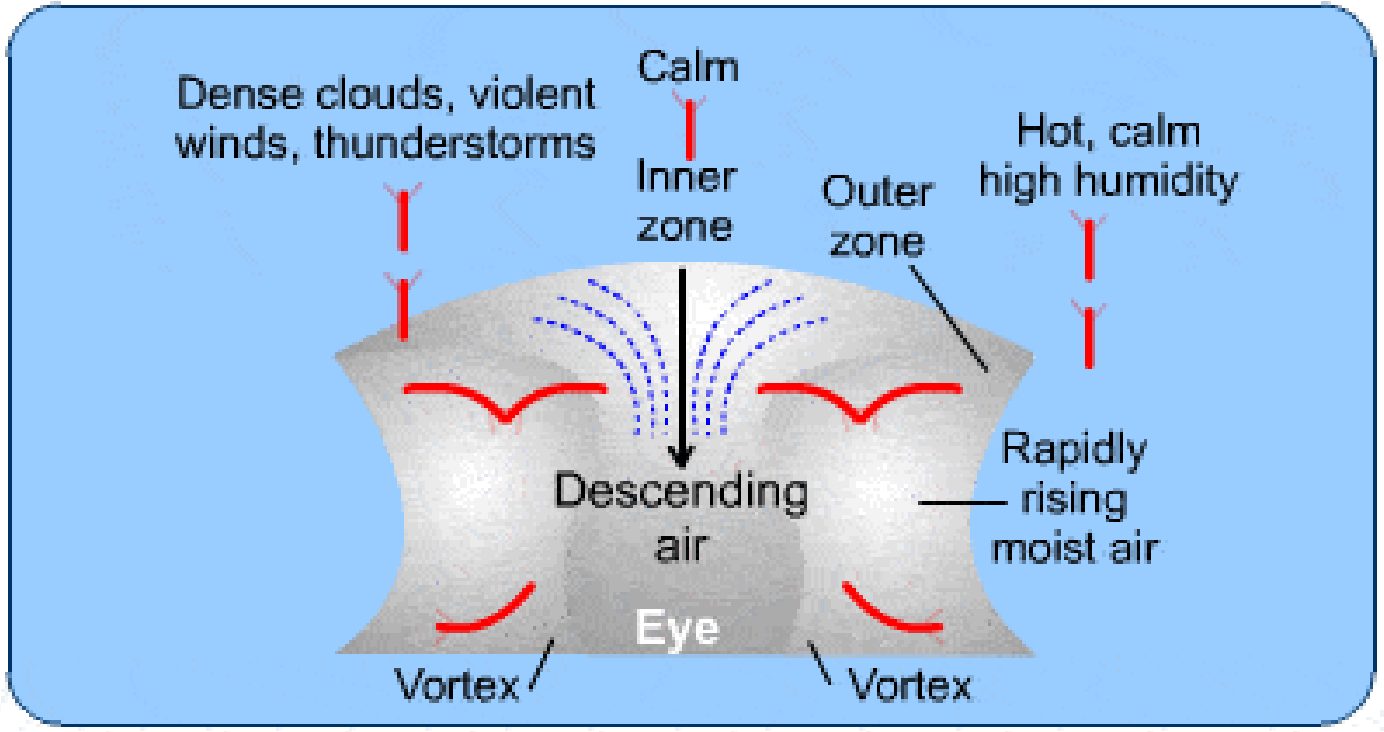
Hurricanes have several distinctive features which are outlined in the diagram below:



A: The eye is 20-60km across, ***existing in centre of the hurricane where conditions are calm and clear.***

B: Intense rainfall due to rapidly cooling and rising air. Amount can be up to 25cm a day.

C : Strong winds. In order to be classified as a hurricane they must average 119km per hour.



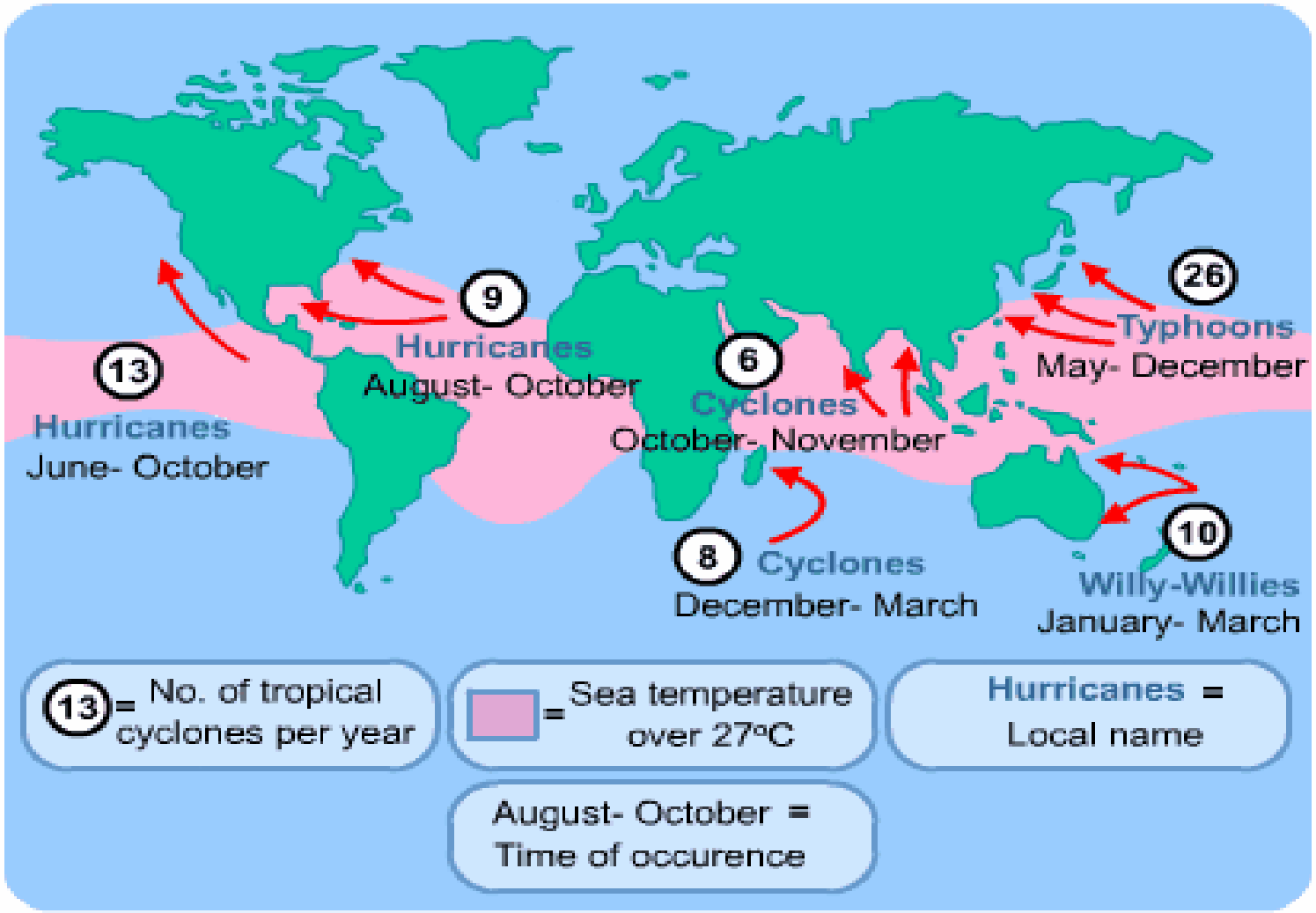
Tropical Cyclone Region

Original

Atlantic = Hurricane
Pacific = Typhoon
India = Cyclone

Condition TC develop

- Sea surface temp. > 26 C
- Active low pressure,
- Convergence at low level
- Unstable airmass.



Tropical cyclones in Pacific region

Tropical cyclones are now classified in four **categories**:

Super Typhoon

max. wind nearly center > 105 kts. (200km/h)

Typhoon (TY)

max. wind nearly center 64 kts. (118km/h) to 105 kts (200km/h)

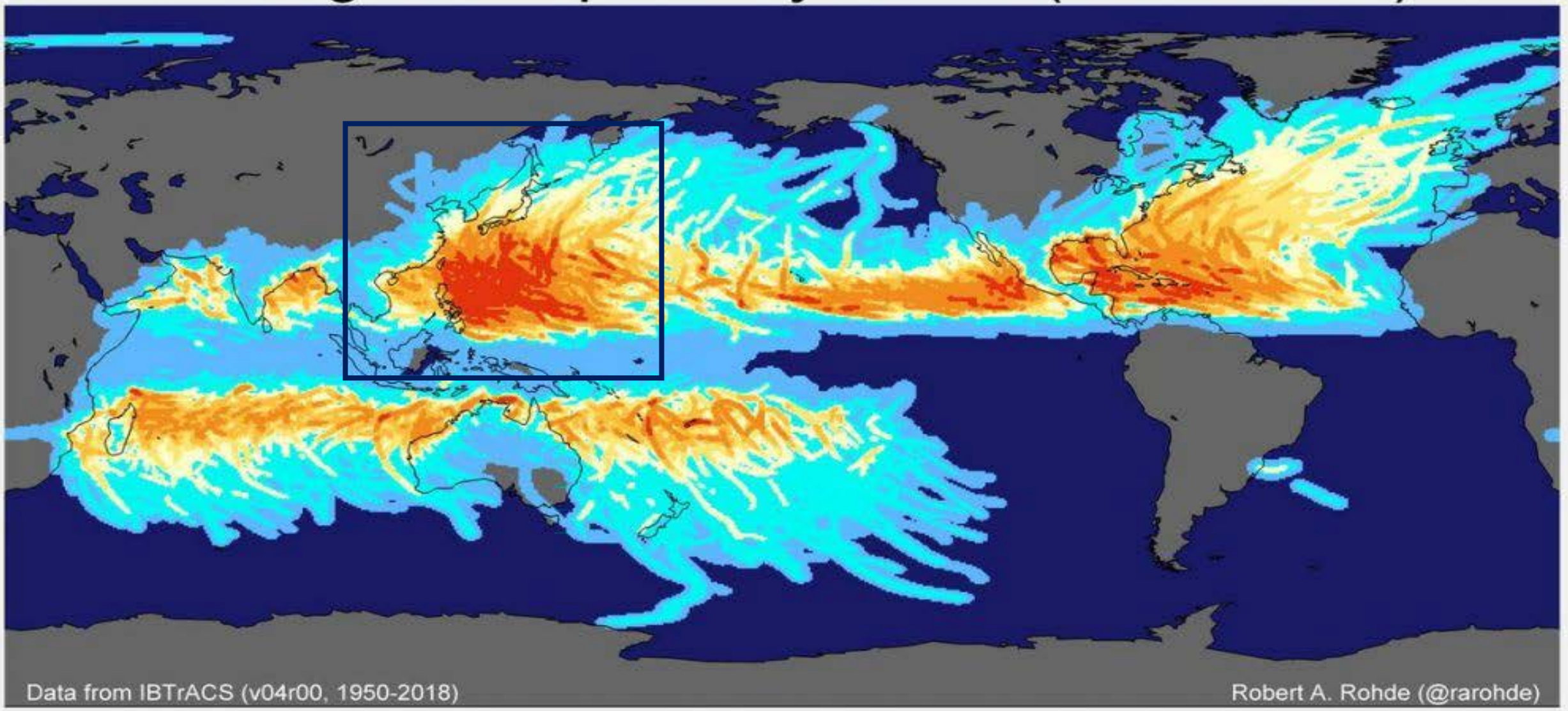
Tropical Storm (TS)

max. wind nearly center 35 kts. (64km/h) to 63 kts (118km/h)

Tropical Depression (TD)

max. wind nearly center 34 kts. (64km/h)

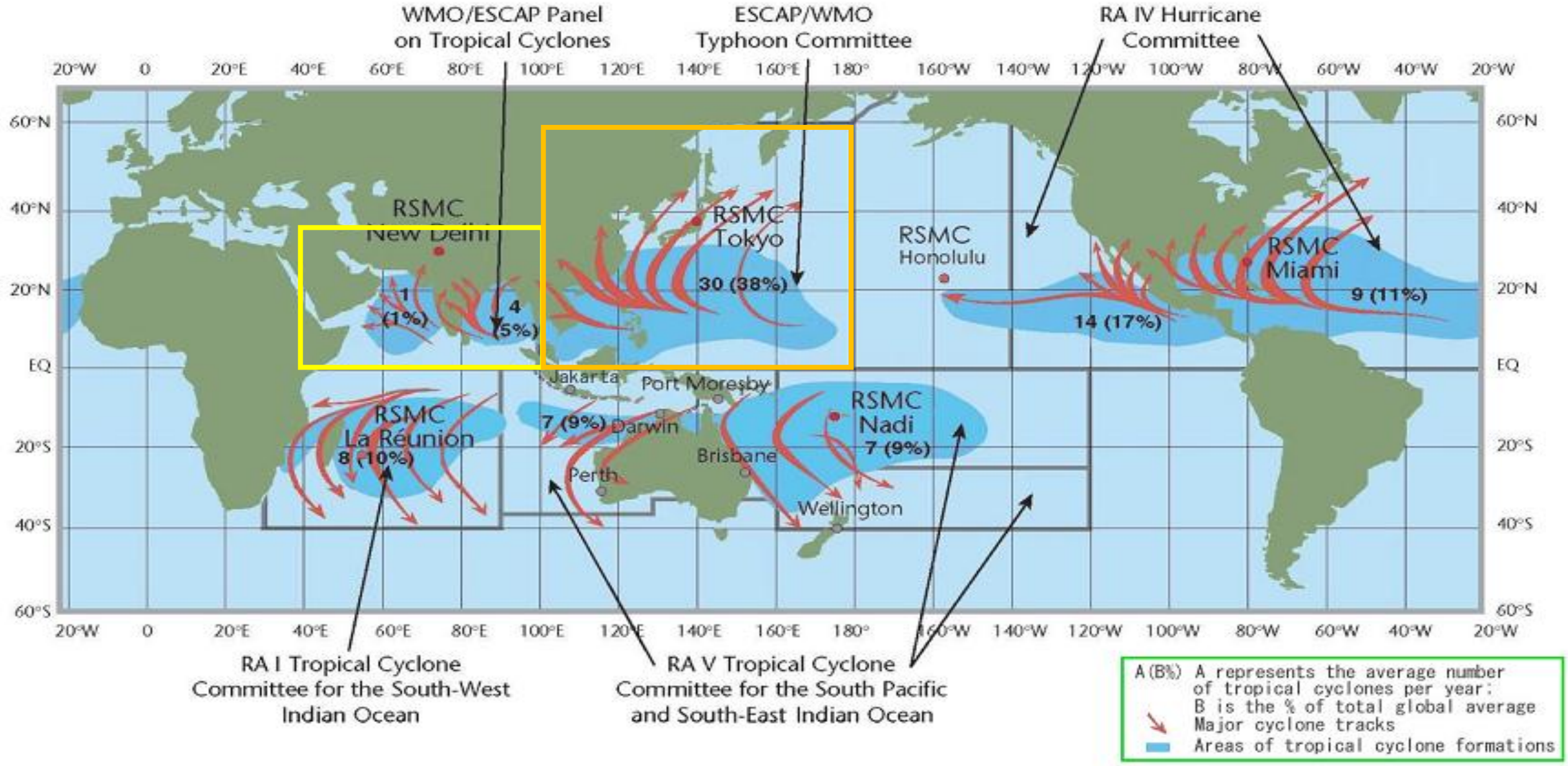
Strongest Tropical Cyclones (1950-2018)



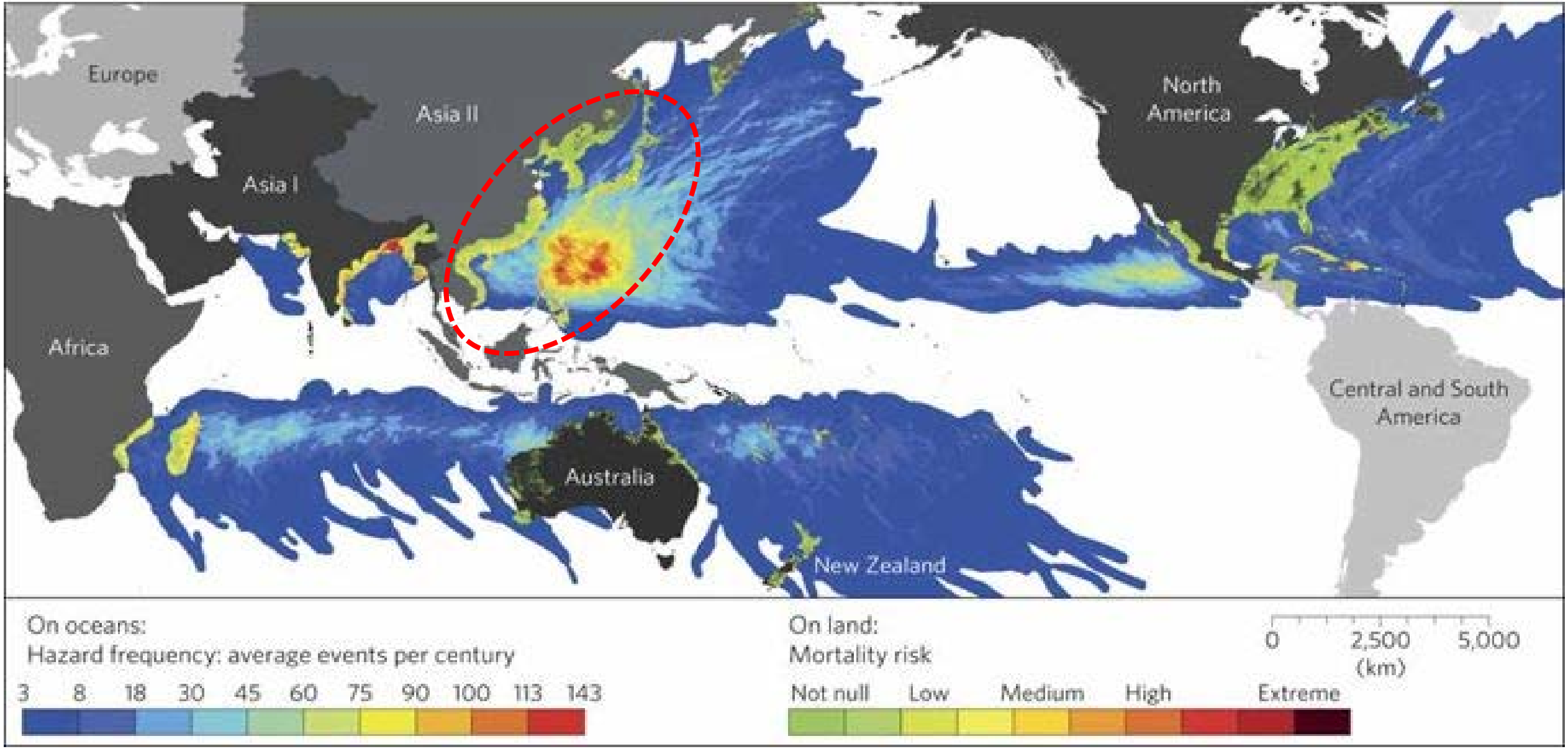
TD | TS | 1 | 2 | 3 | 4 | 5

Saffir-Simpson Storm Category

Design tropical cyclones were responsibility area

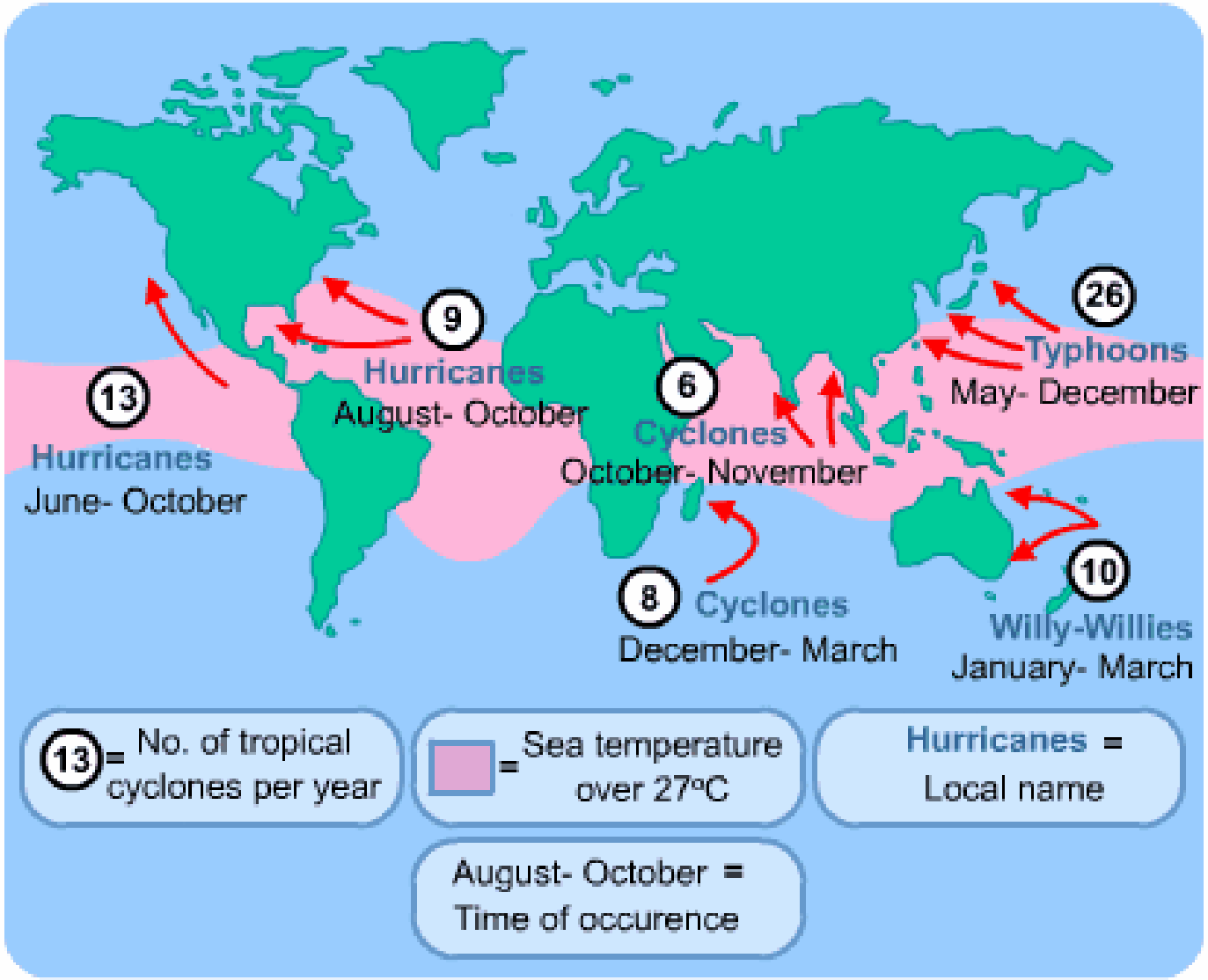


Tropical Cyclone Frequency



They are extremely powerful low-pressure systems, and are believed to be responsible for a greater number of deaths than any other natural hazard. Ocean temperatures are at there highest.

There is some evidence to suggest that their frequency and severity is increasing as a result of global warming.

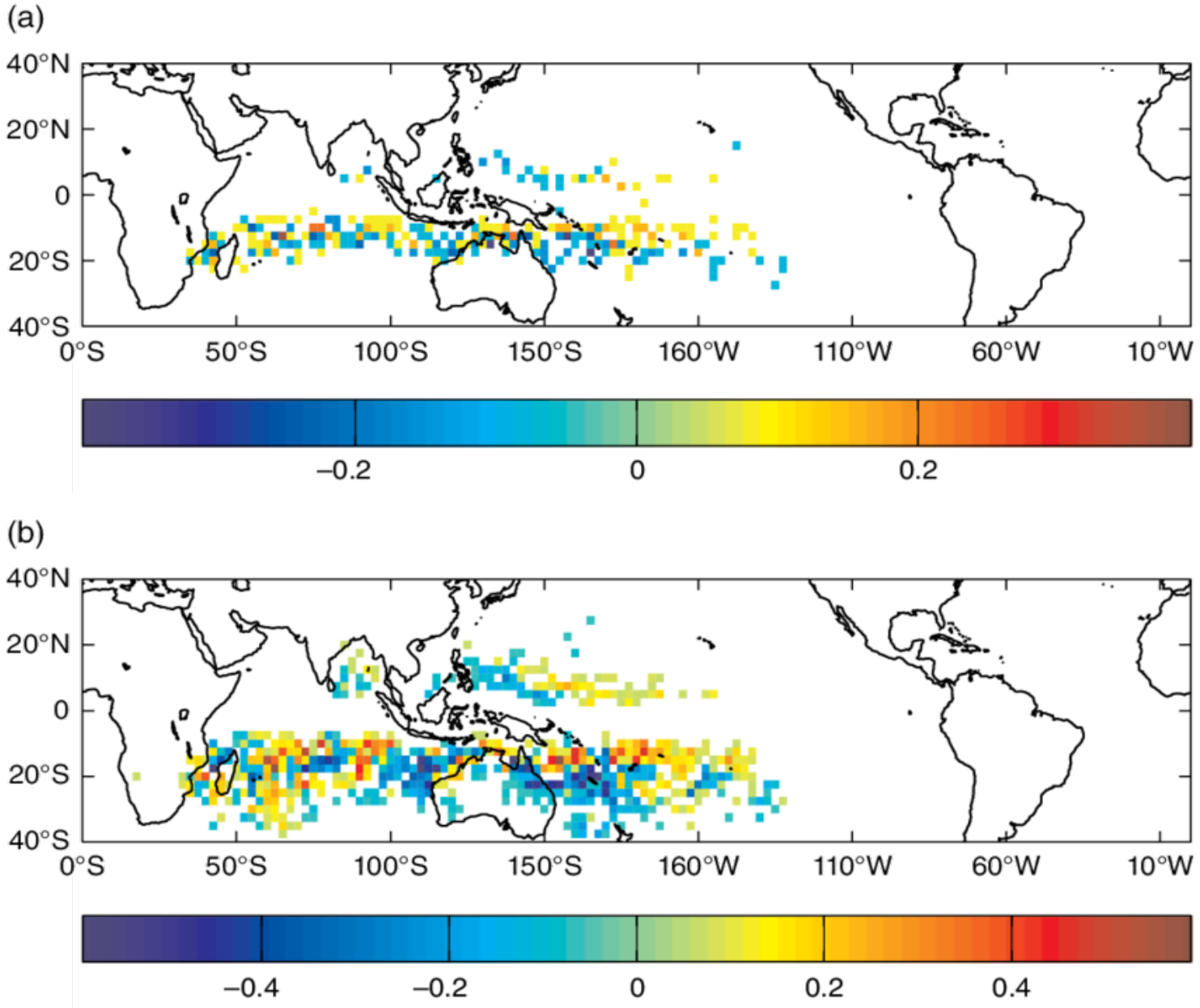


Tropical Cyclone Track Intensity: El Nino/La Nina

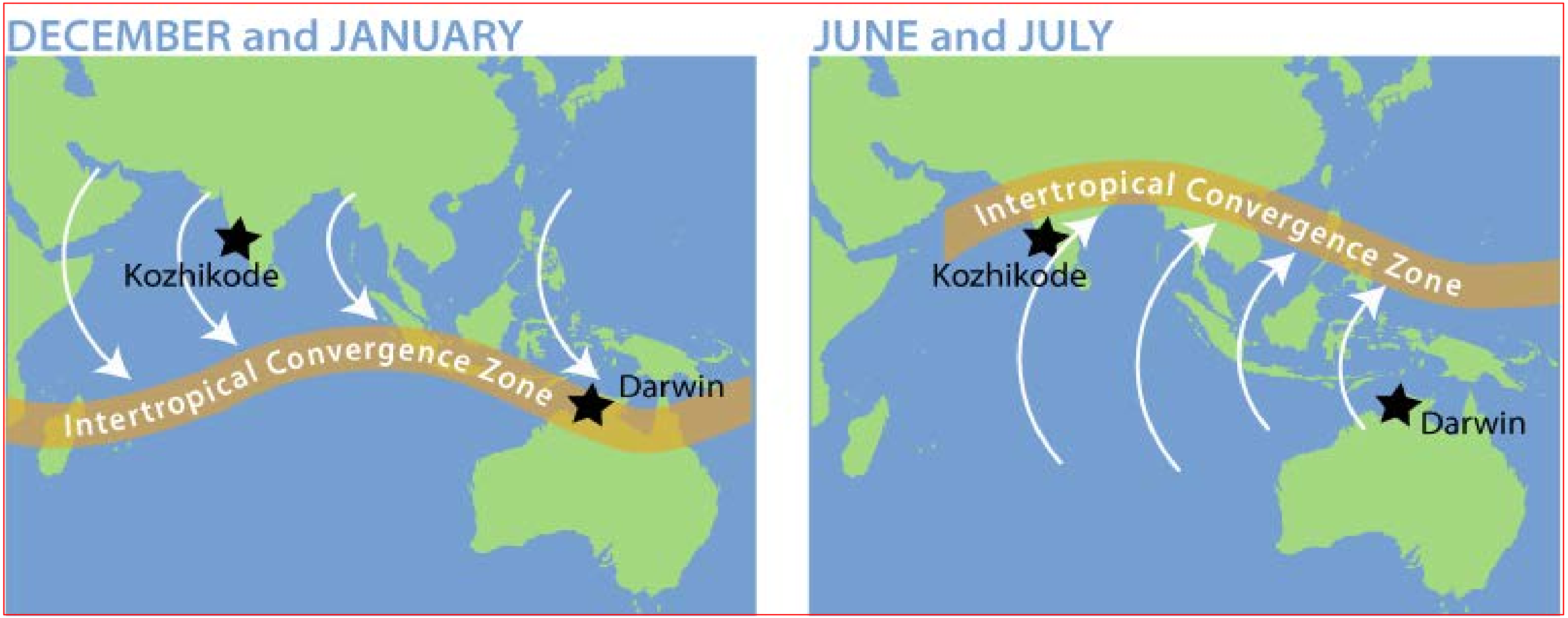
7 Difference between anomalies in El Niño and La Niña years of :

(a) Genesis density

(b) Track density in January–March (JFM).

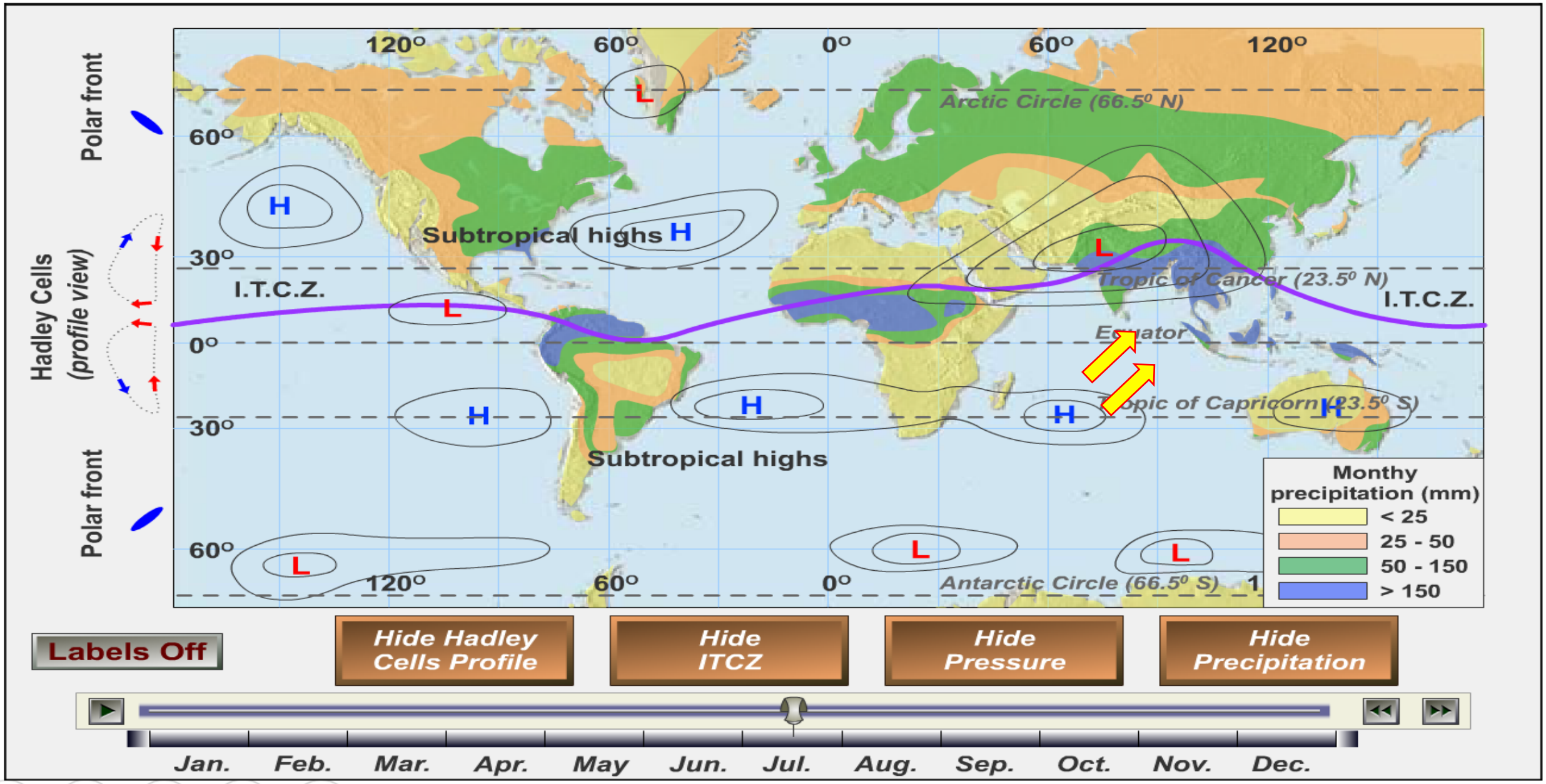


The Inter Tropical Convergence Zone (ITCZ)

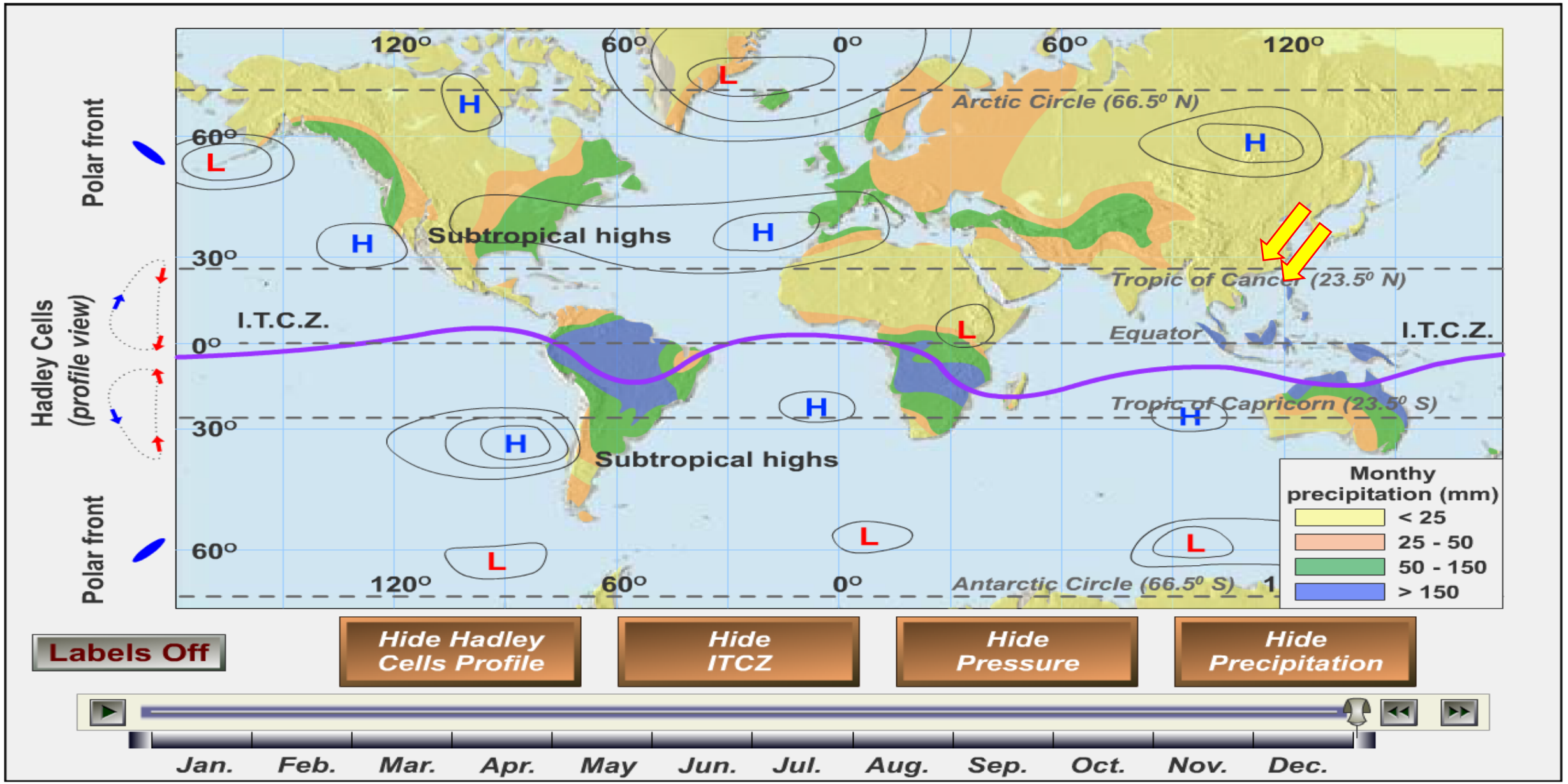


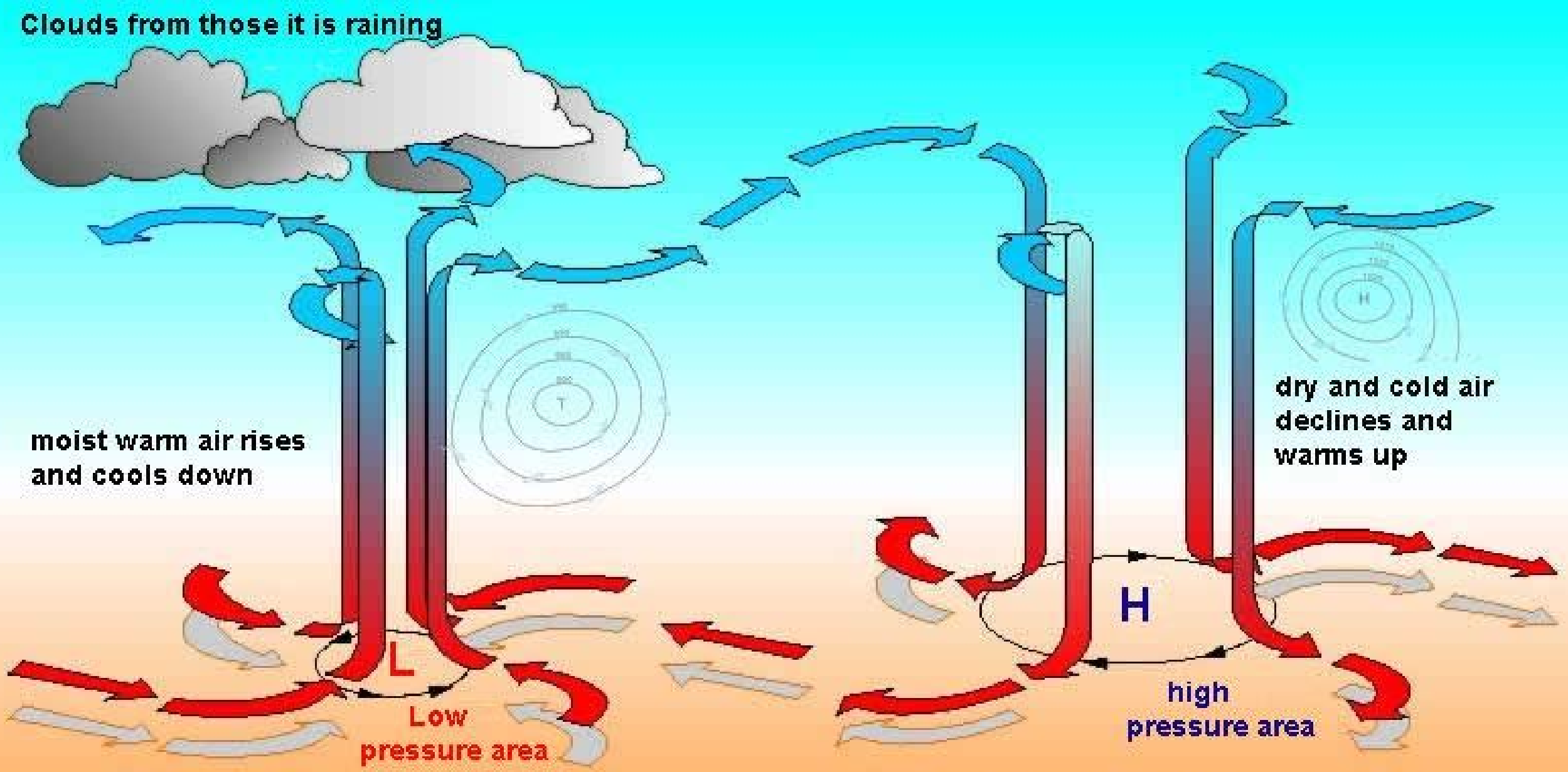
The Inter Tropical Convergence Zone (ITCZ) is a belt of low pressure which circles the Earth generally near the equator where the trade winds of the Northern and Southern Hemispheres come together. It is characterised by convective activity which generates often vigorous thunderstorms over large areas.

Climate Circulation: Southwest Monsoon



Climate Circulation: Northeast Monsoon





Low pressure

High pressure

Climate Thailand

Thailand is located in the influence zone of the monsoon. Thailand has different seasons, namely, rainy season and dry season, consisting of 3 seasons.

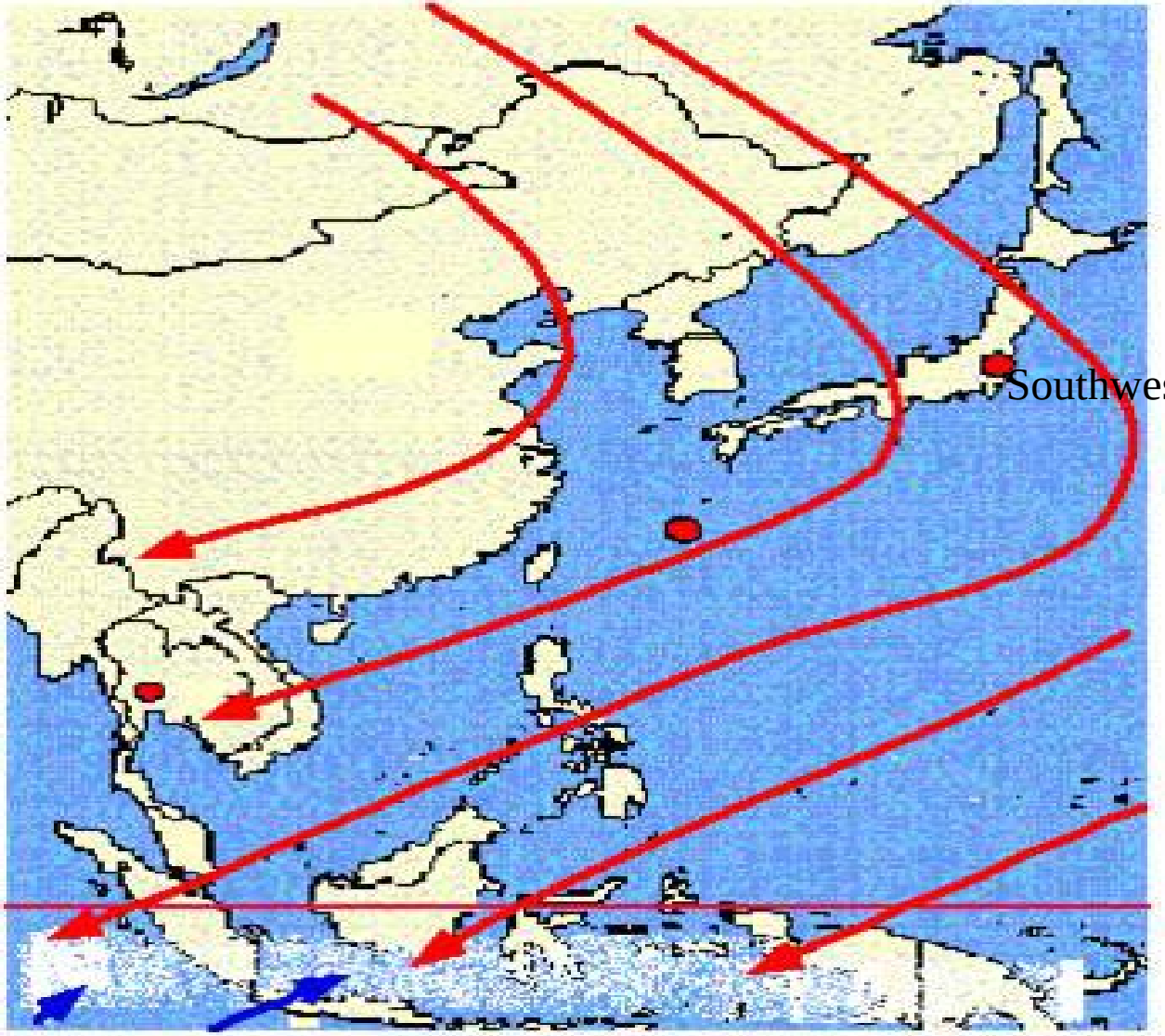
- Summer Season (mid Feb – mid May)
- Rainy Season (mid May – mid Oct)
- Winter season (mid Oct – mid Feb)

Which has 2 monsoons

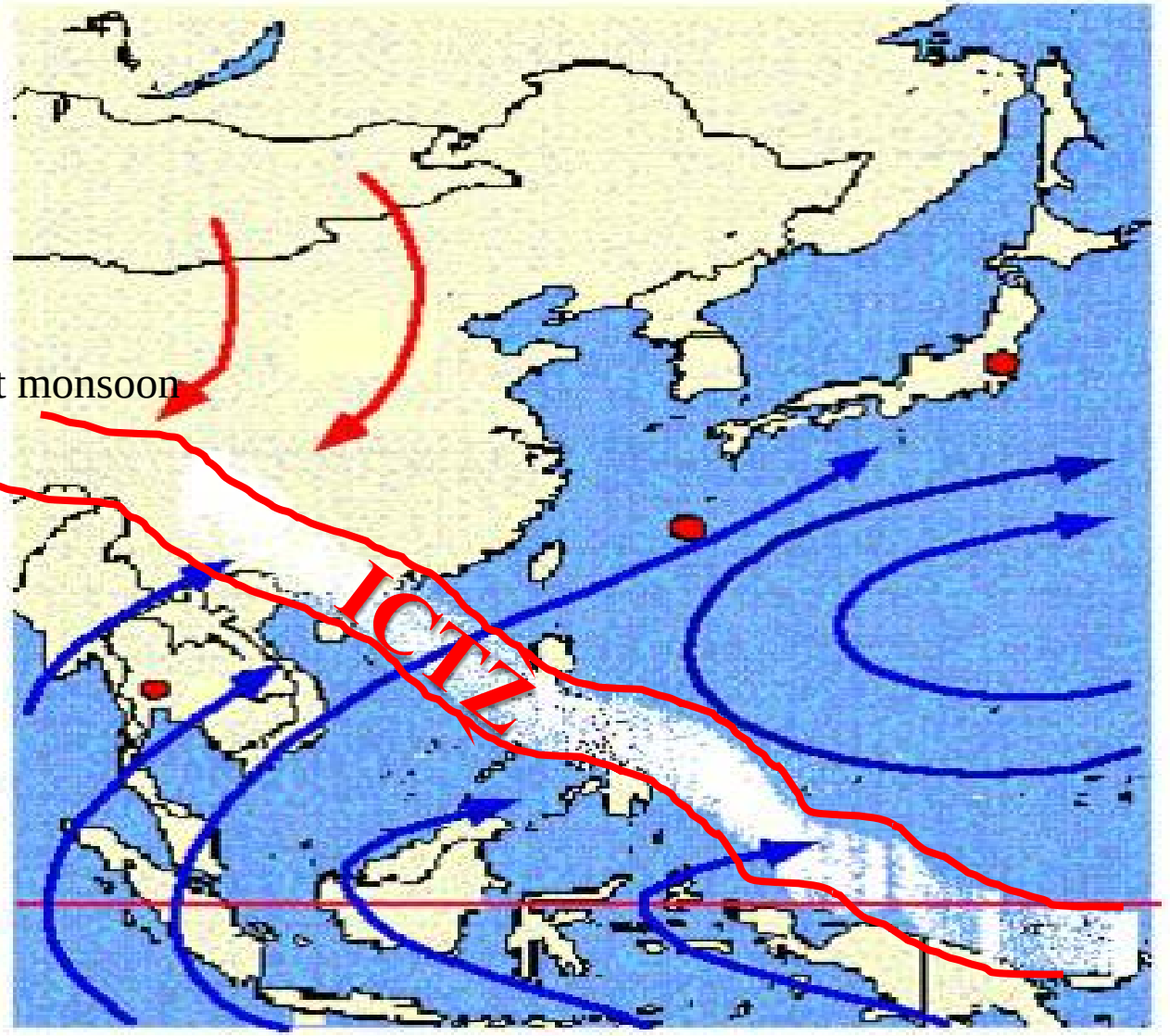
- Southwest
- Northeast

Southwest / Winter Monsoon

Winter season (mid Oct – mid Feb)



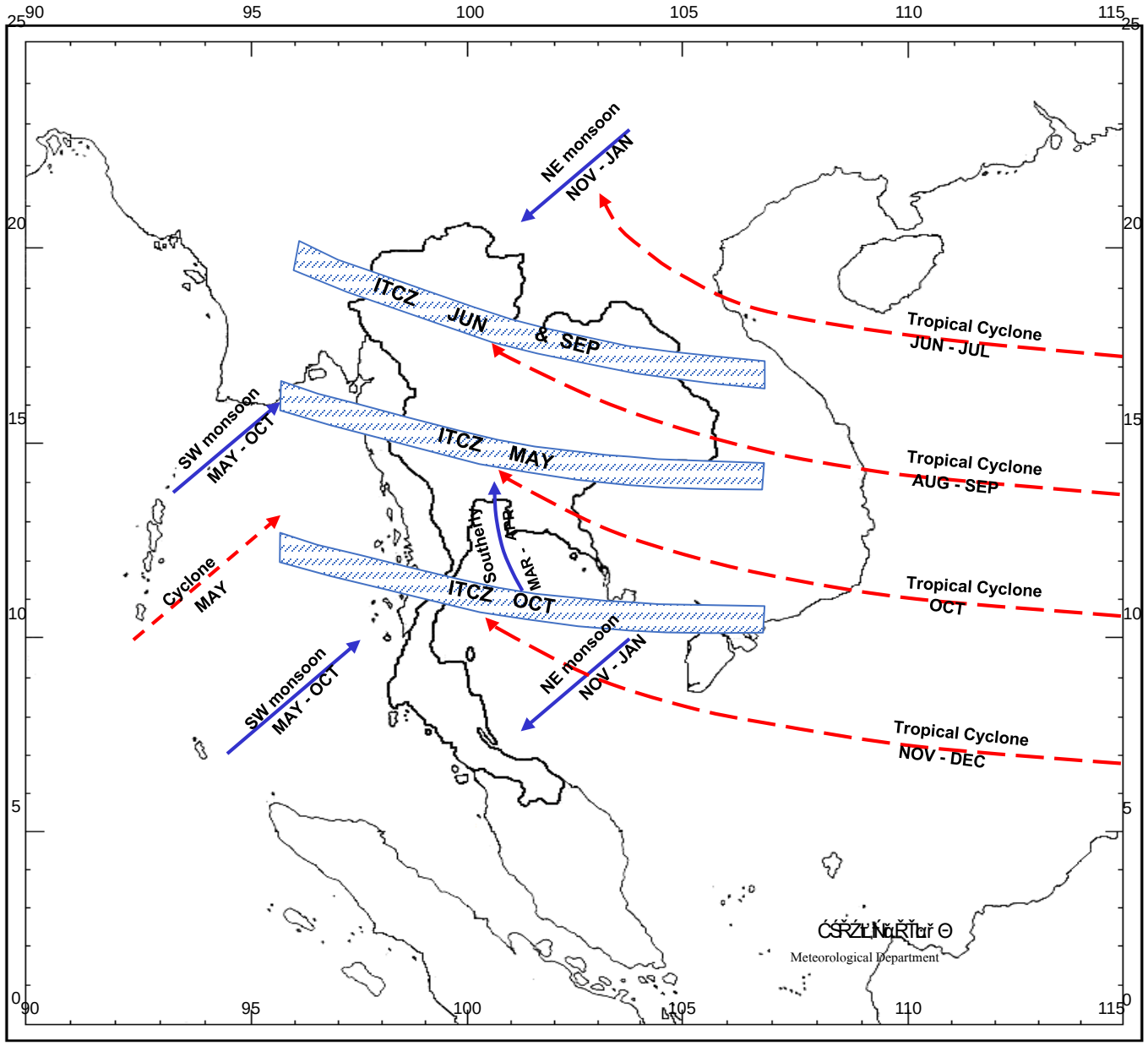
Rainy season (mid May – mid Oct

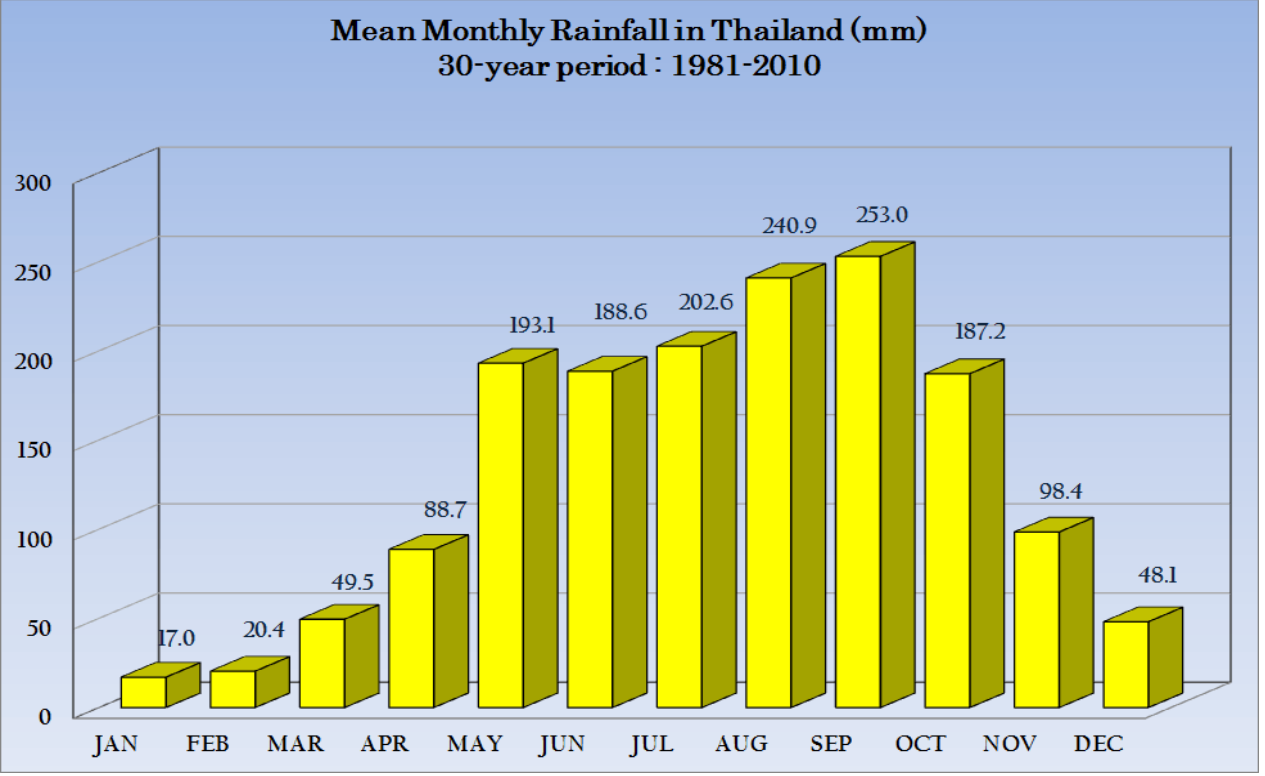


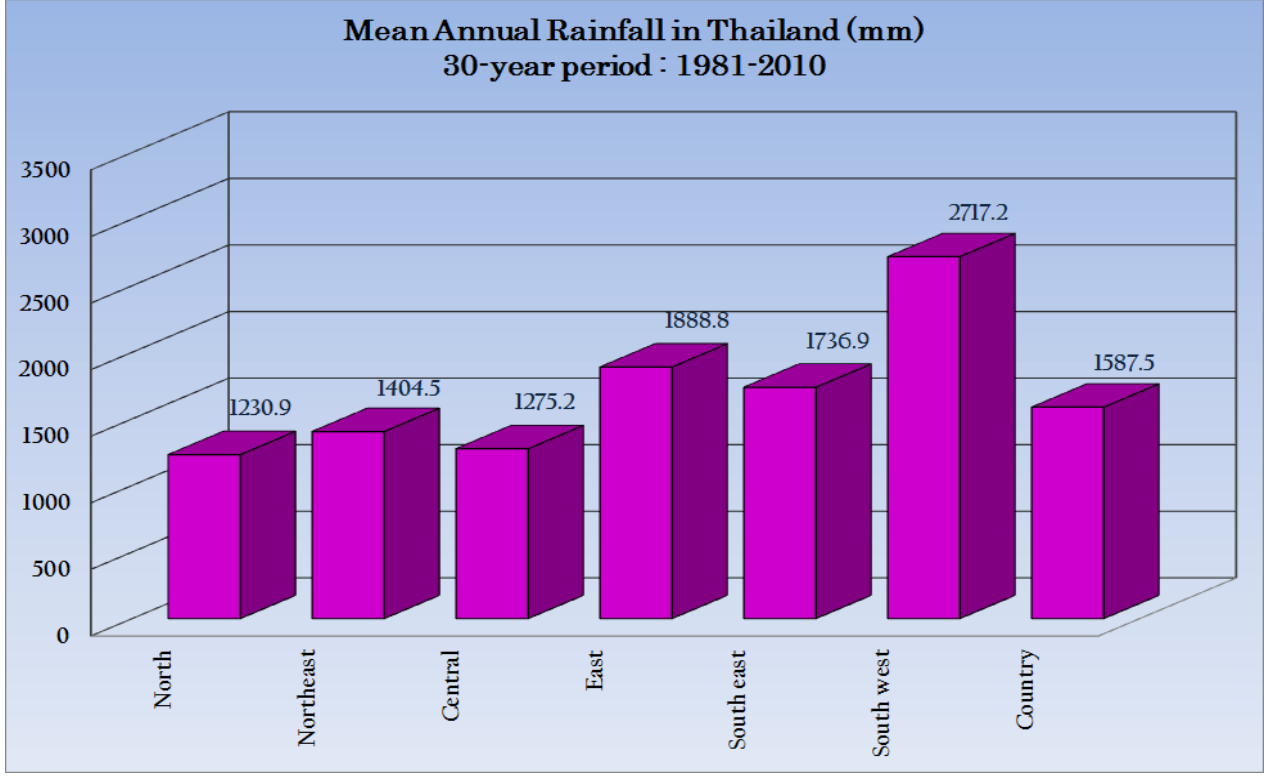
Flooding over Mae Khong Basin

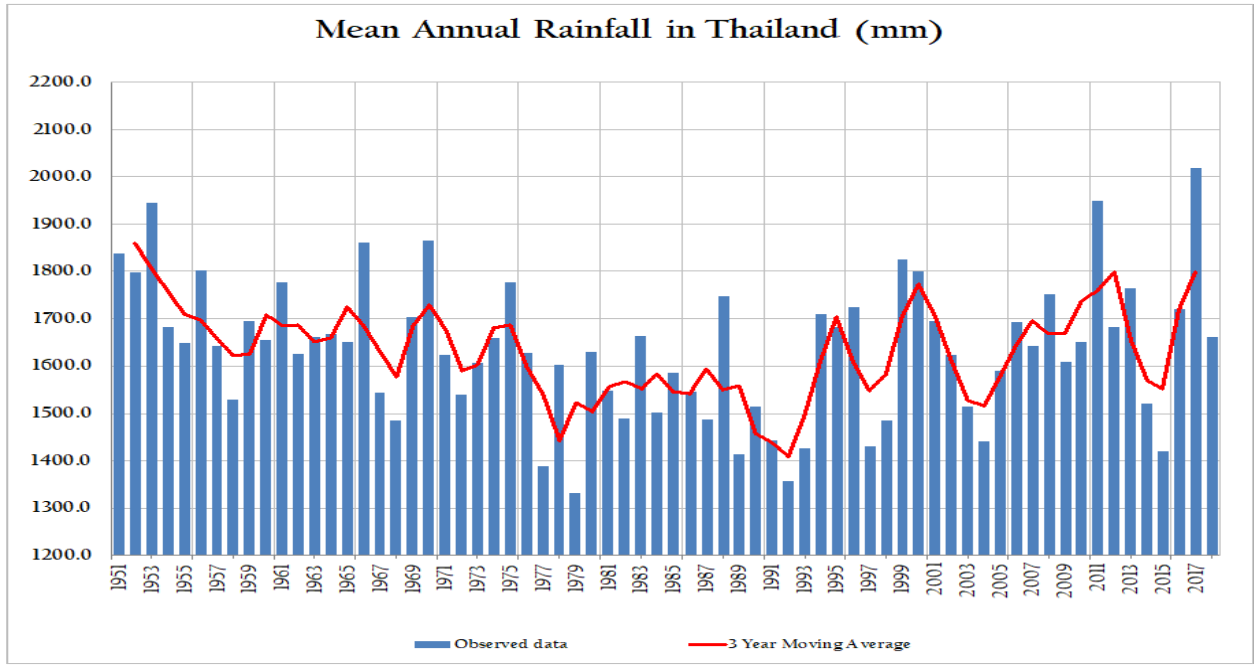
Cause of flood

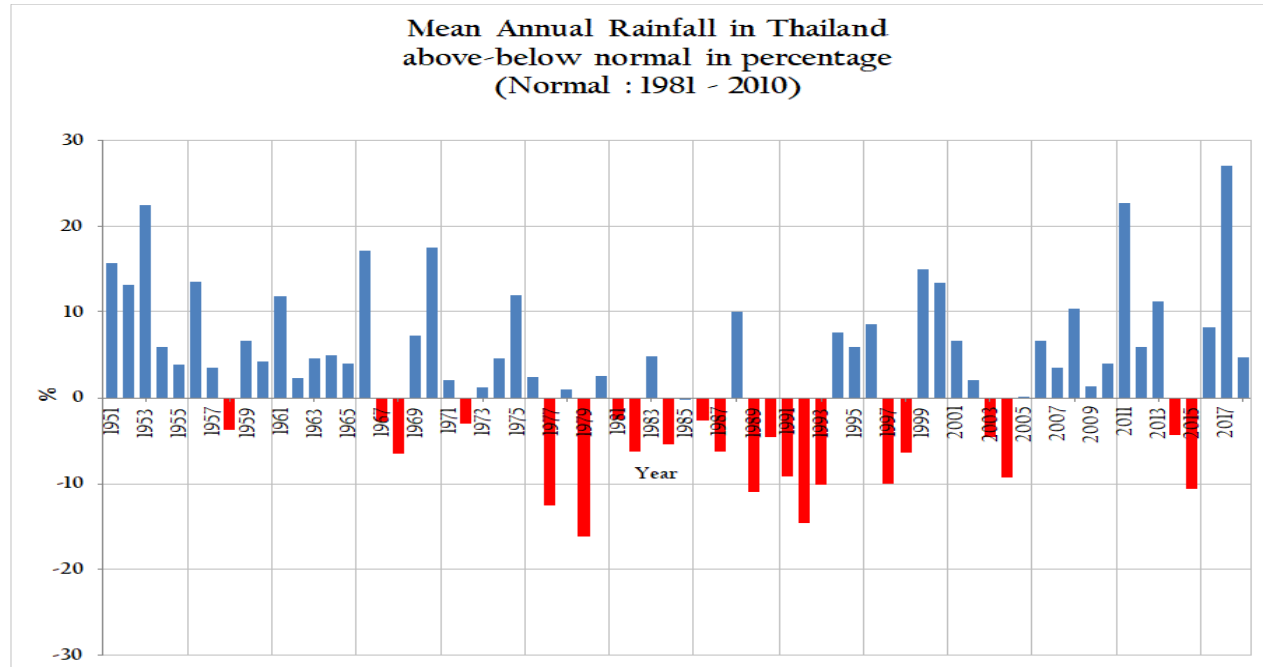
- ICTZ,
- Active Low pressure,
- Tropical Cyclone,
- Northeast Monsoon,
- Southwest Monsoon



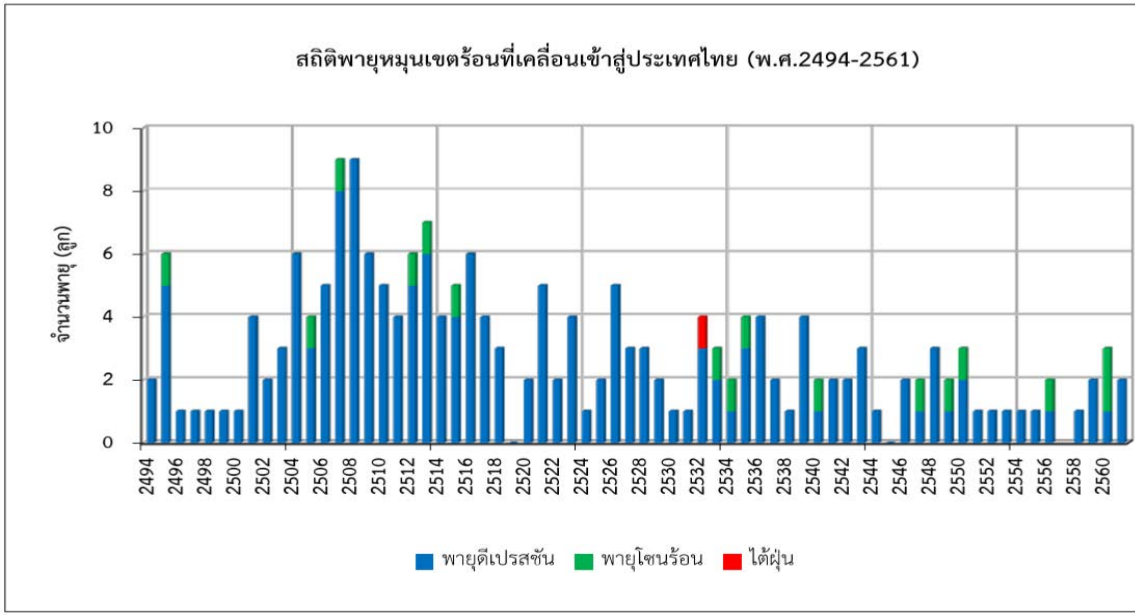

Mean Monthly Rainfall in Thailand (mm)
30-year period : 1981-2010
300
250
200
150
100
50
0
17.0
20.4
49.5
88.7
193.1
188.6
202.6
240.9
253.0
187.2
98.4
48.1
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

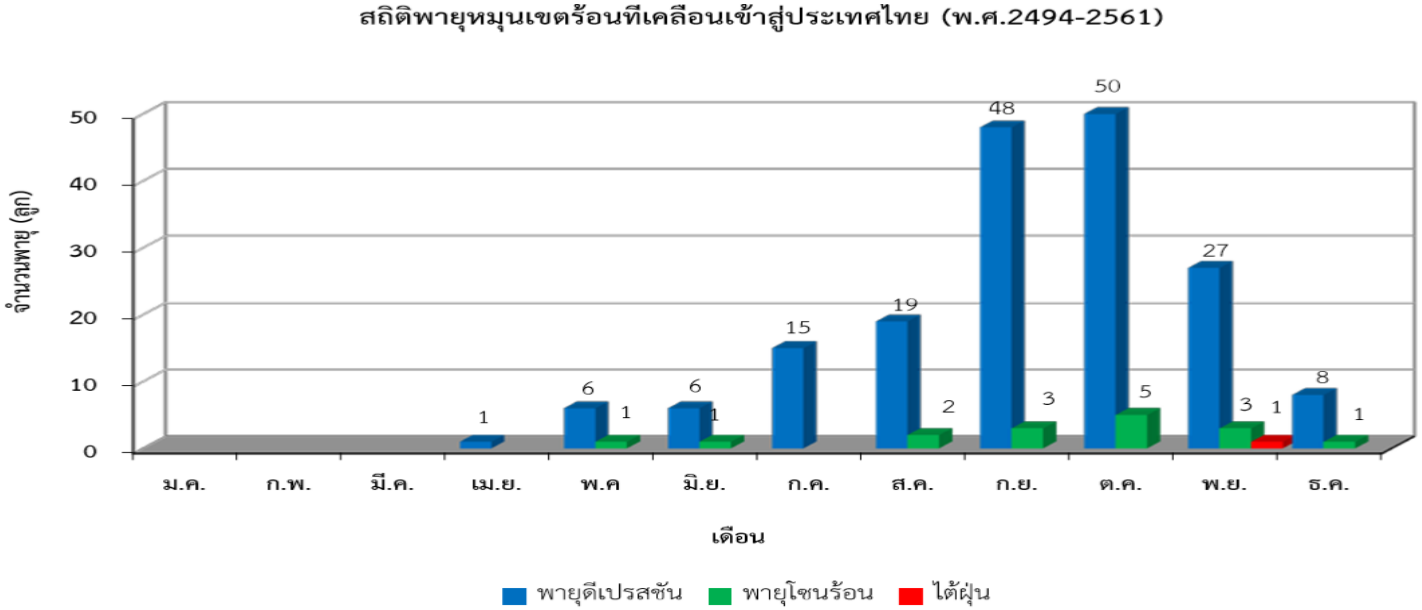

Mean Annual Rainfall in Thailand (mm)
30-year period : 1981-2010
3500
3000
2500
2000
1500
1000
500
0
1230.9
1404.5
1275.2
1888.8
1736.9
2717.2
1587.5
North
Northeast
Central
East
South east
South west
Country

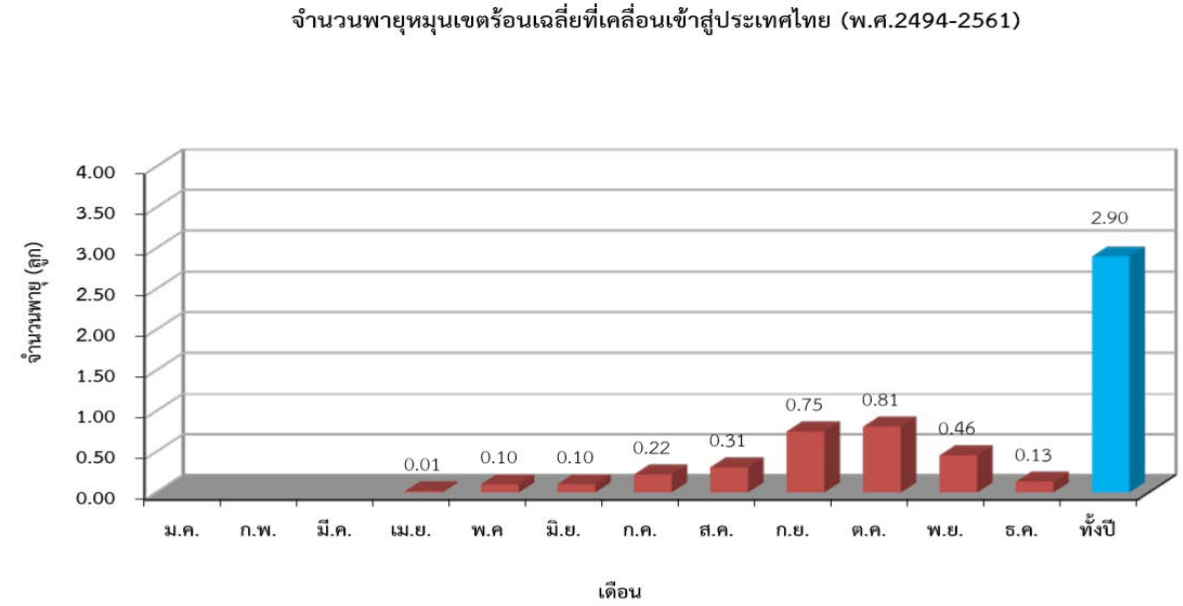

Mean Annual Rainfall in Thailand (mm)
2200.0
2100.0
2000.0
1900.0
1800.0
1700.0
1600.0
1500.0
1400.0
1300.0
1200.0
Observed data
3 Year Moving Average

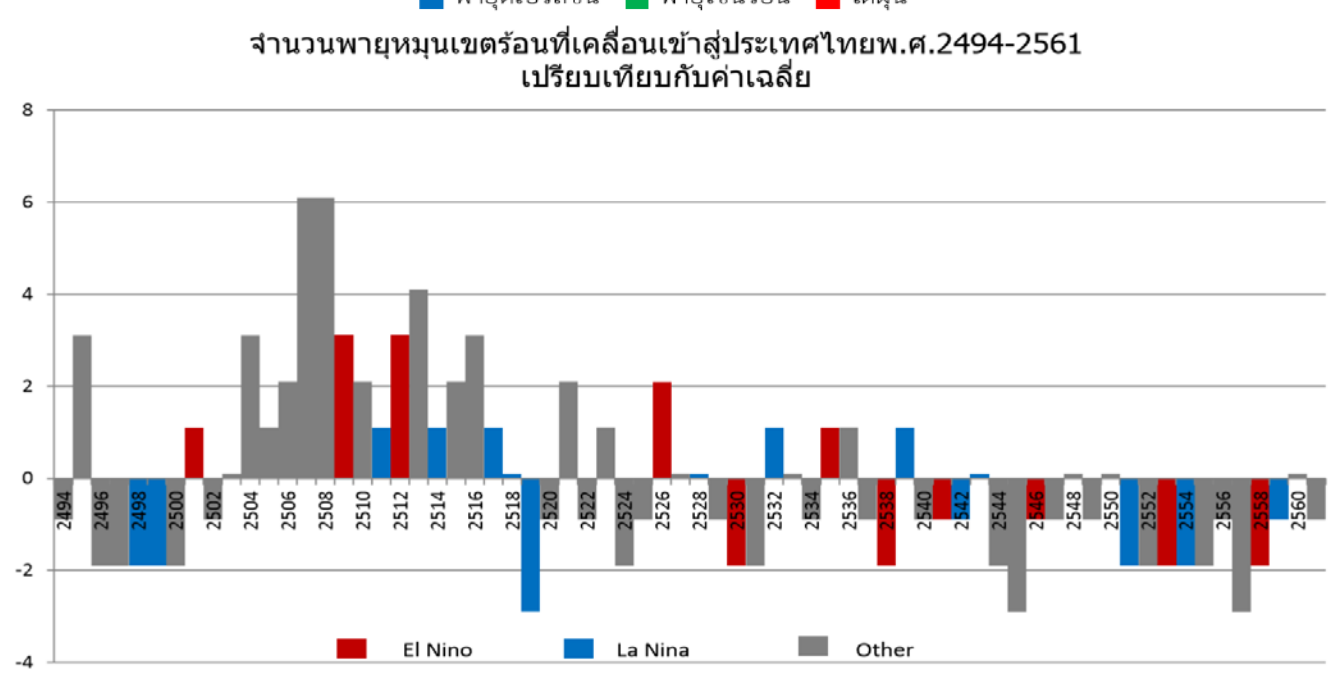

Mean Annual Rainfall in Thailand
above-below normal in percentage
(Normal : 1981 - 2010)
30
20
10
0
-10
-20
-30
%
Year

Number Tropical Cyclone / Track: Thailand

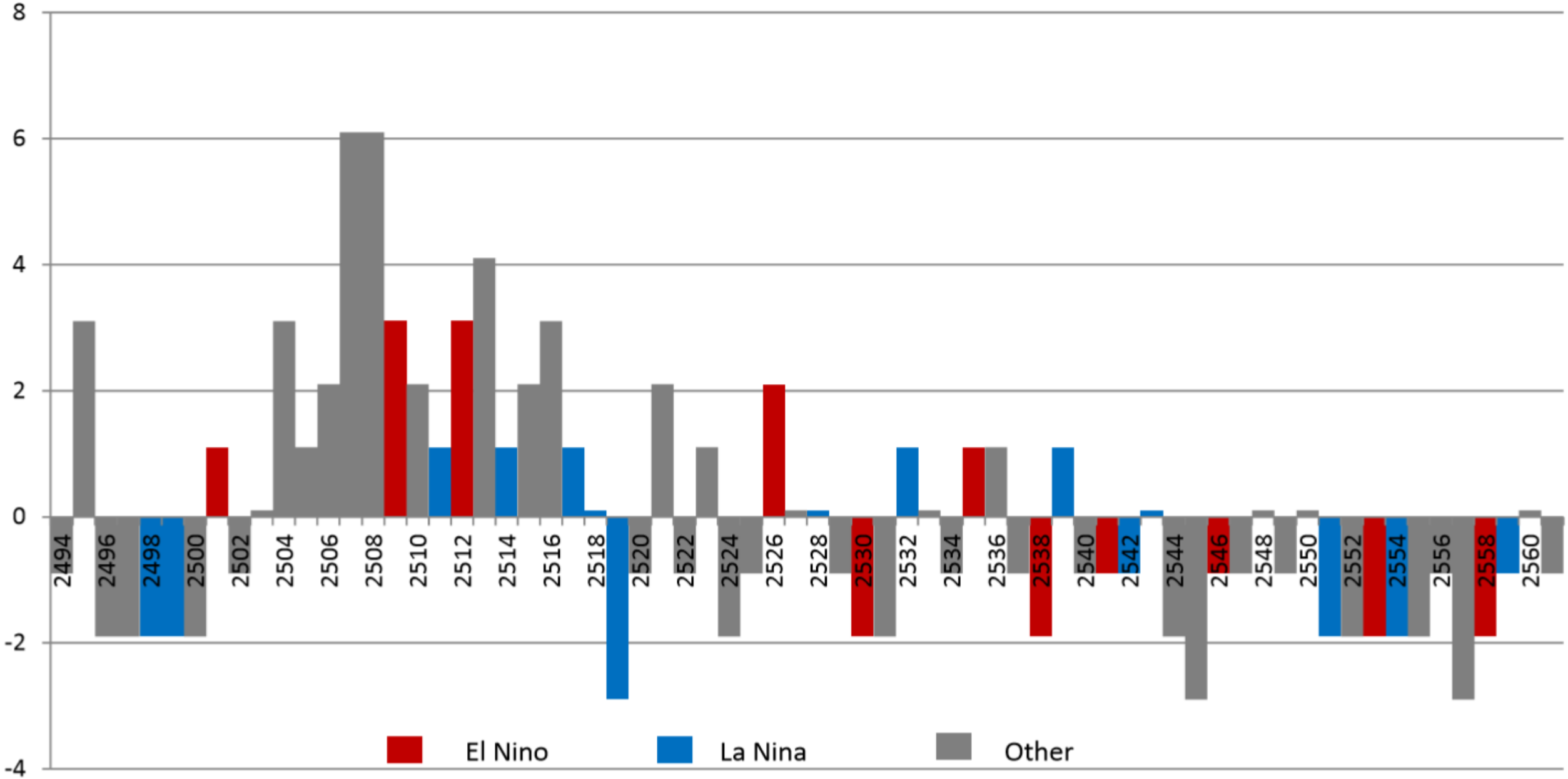






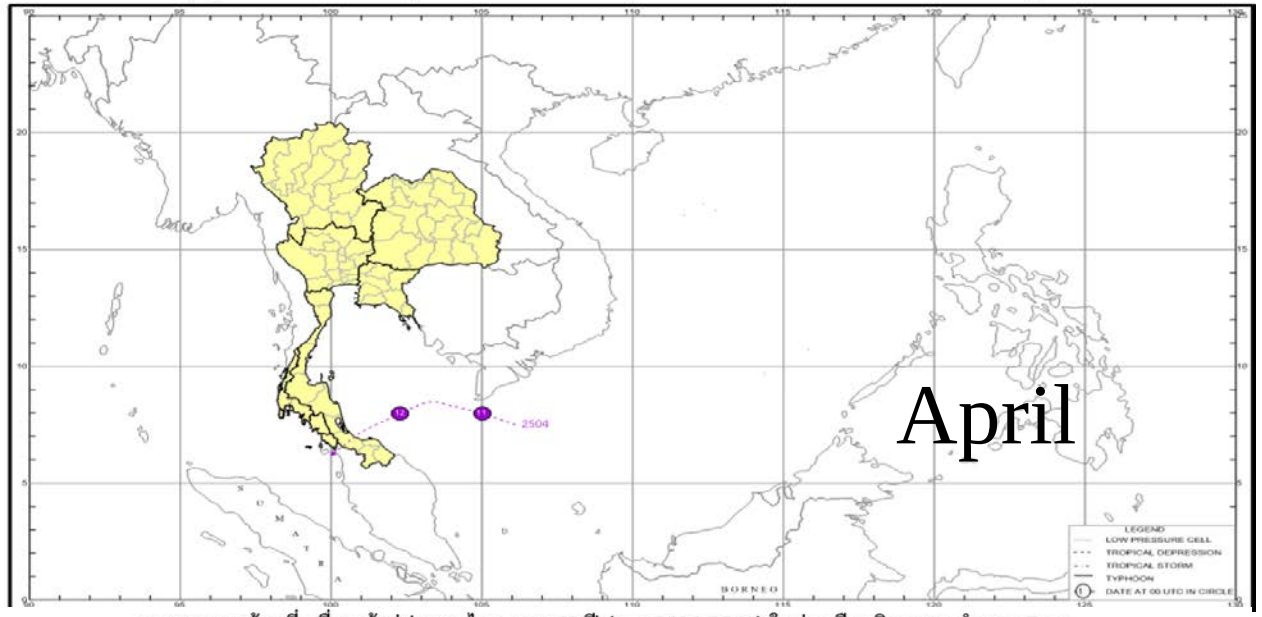


จำนวนพายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทยพ.ศ.2494-2561
เปรียบเทียบกับค่าเฉลี่ย



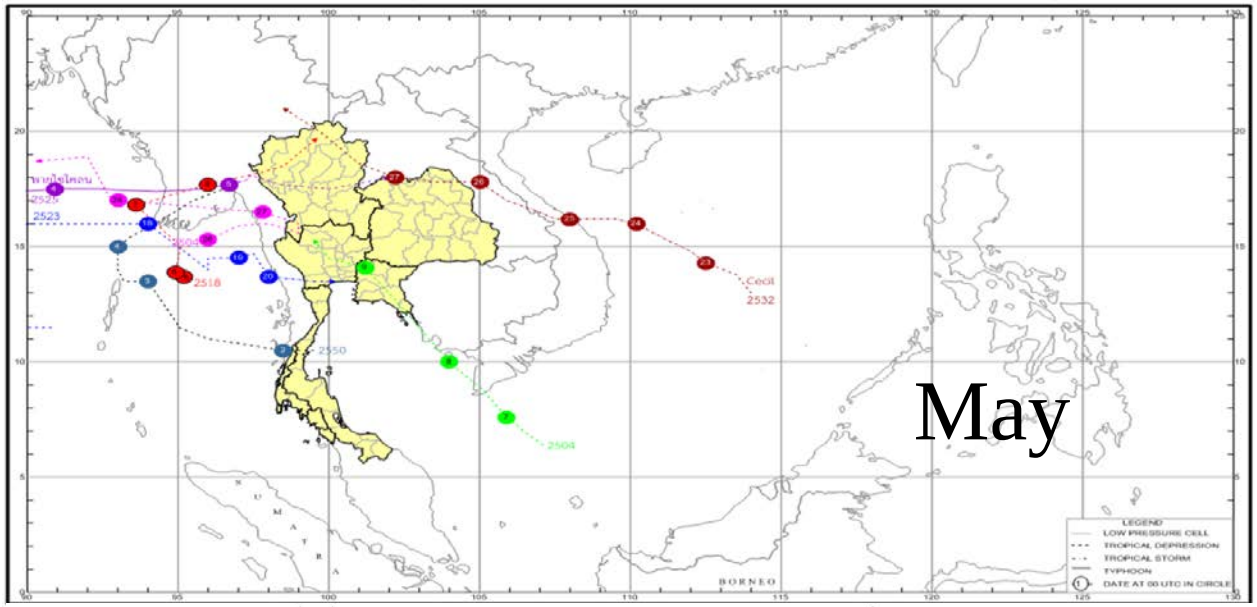
Tropical Cyclone Track in each month (68 years): Thailand

พายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทย คาบ 68 ปี (พ.ศ.2494-2561) ในเดือนเมษายน จำนวน 1 ลูก



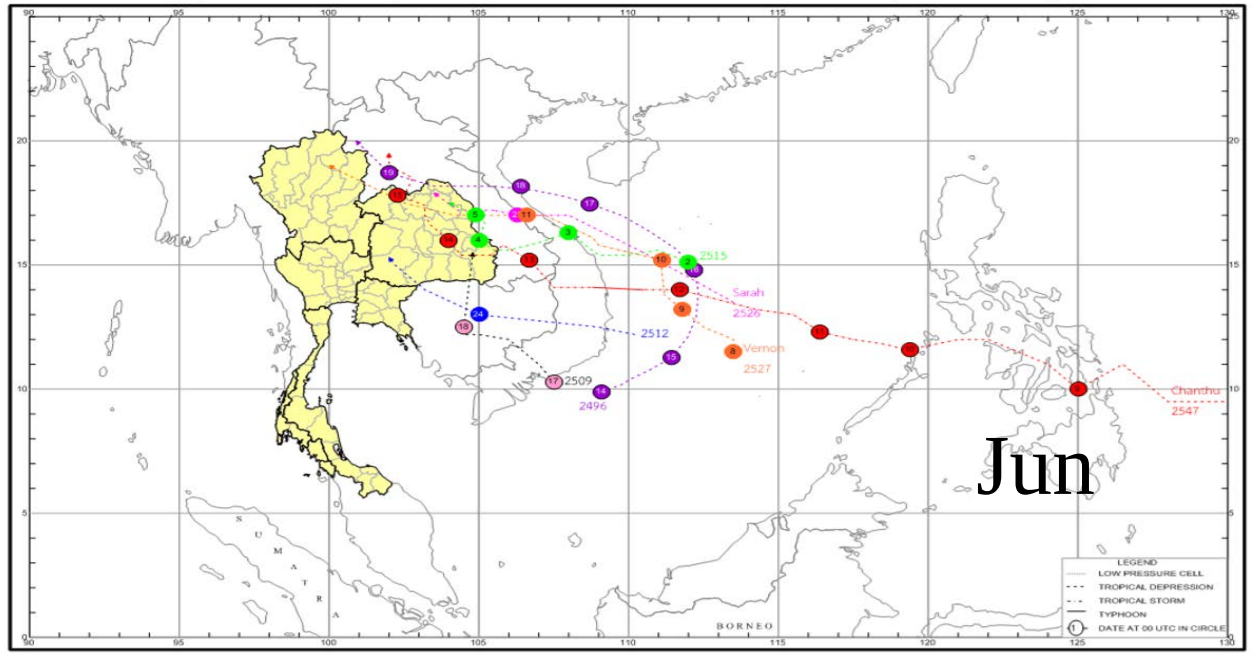
April

พายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทย คาบ 68 ปี (พ.ศ.2494-2561) ในเดือนพฤษภาคม จำนวน 7 ลูก



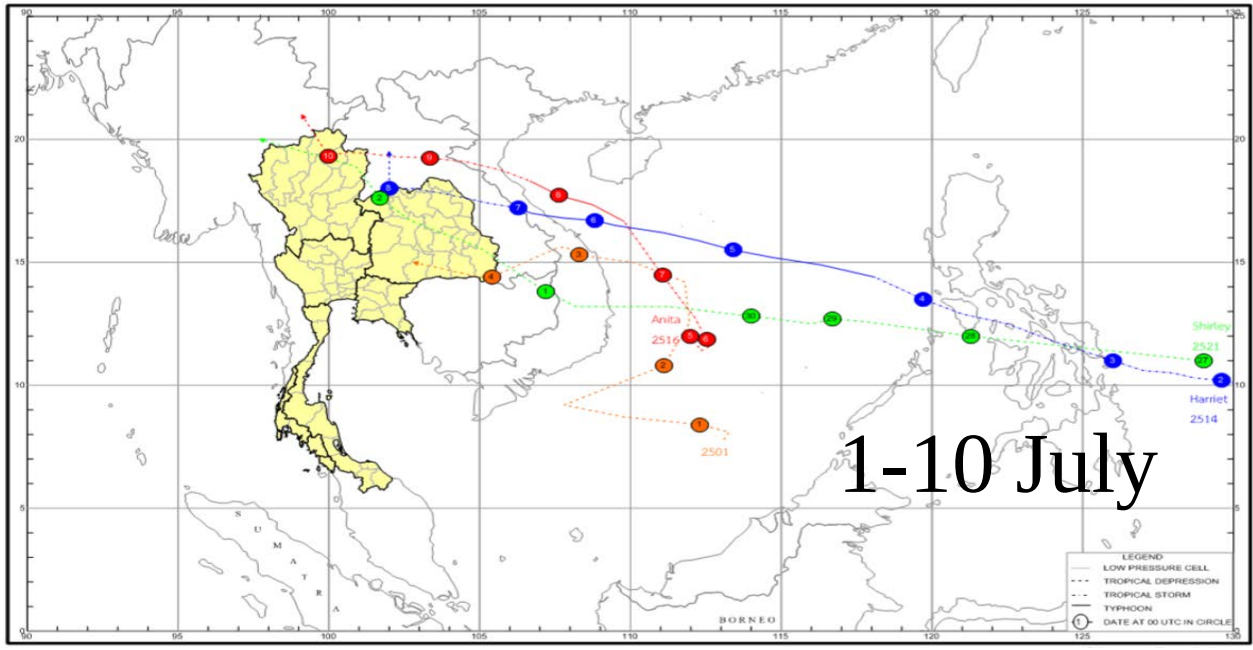
May

พายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทย คาบ 68 ปี (พ.ศ.2494-2561) ในช่วงเดือนมิถุนายน จำนวน 7 ลูก



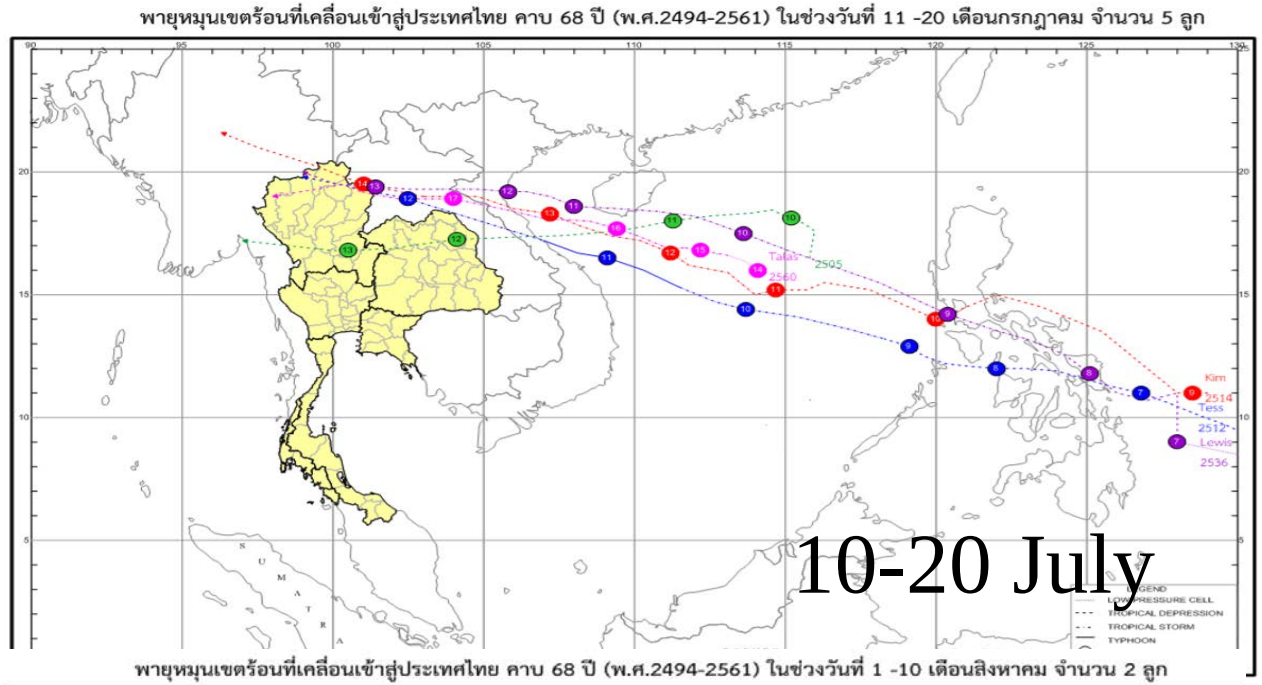
Jun

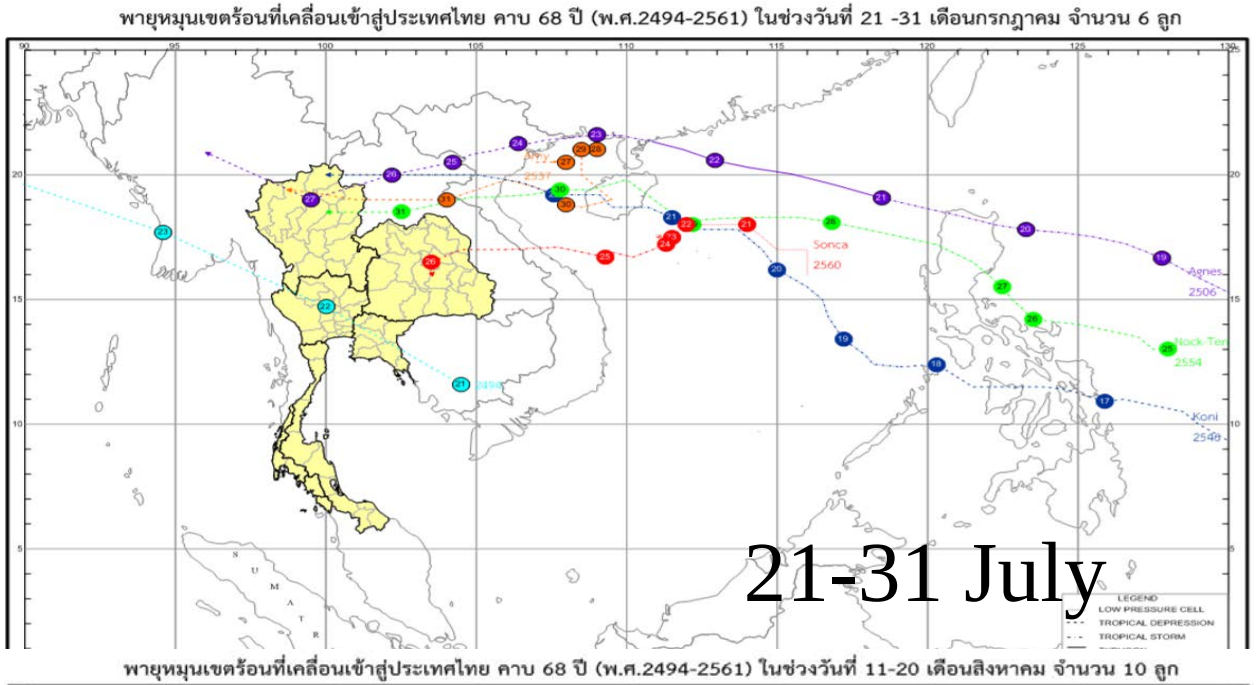
พายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทย คาบ 68 ปี (พ.ศ.2494-2561) ในช่วงวันที่ 1 -10 เดือนกรกฎาคม จำนวน 4 ลูก

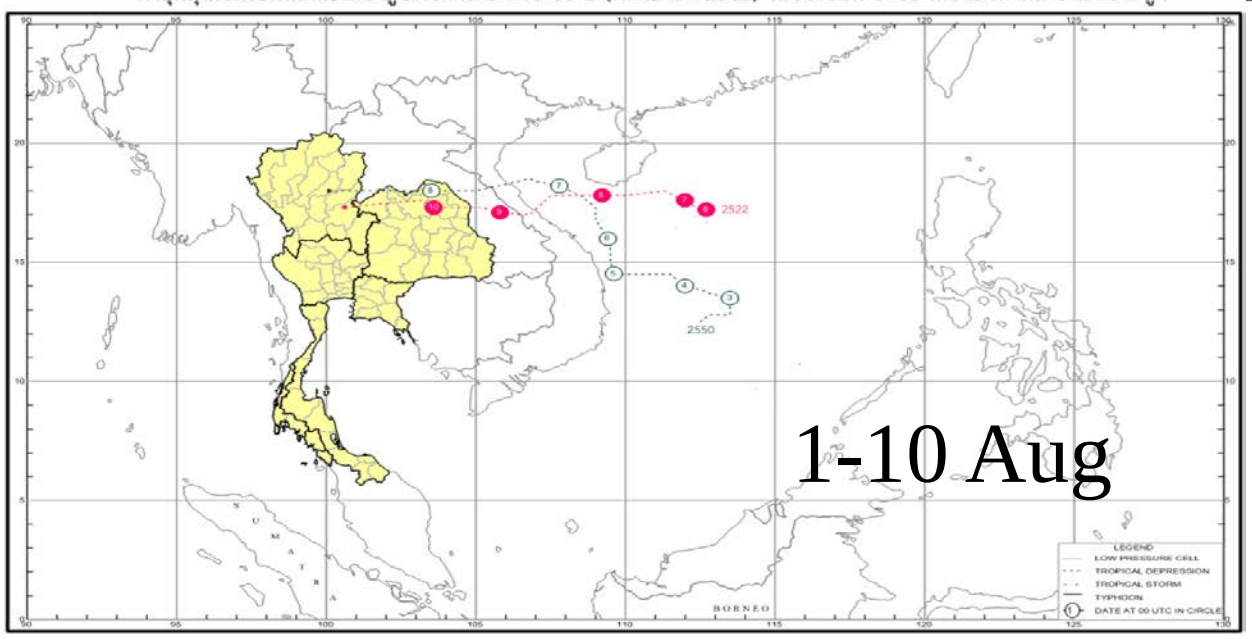


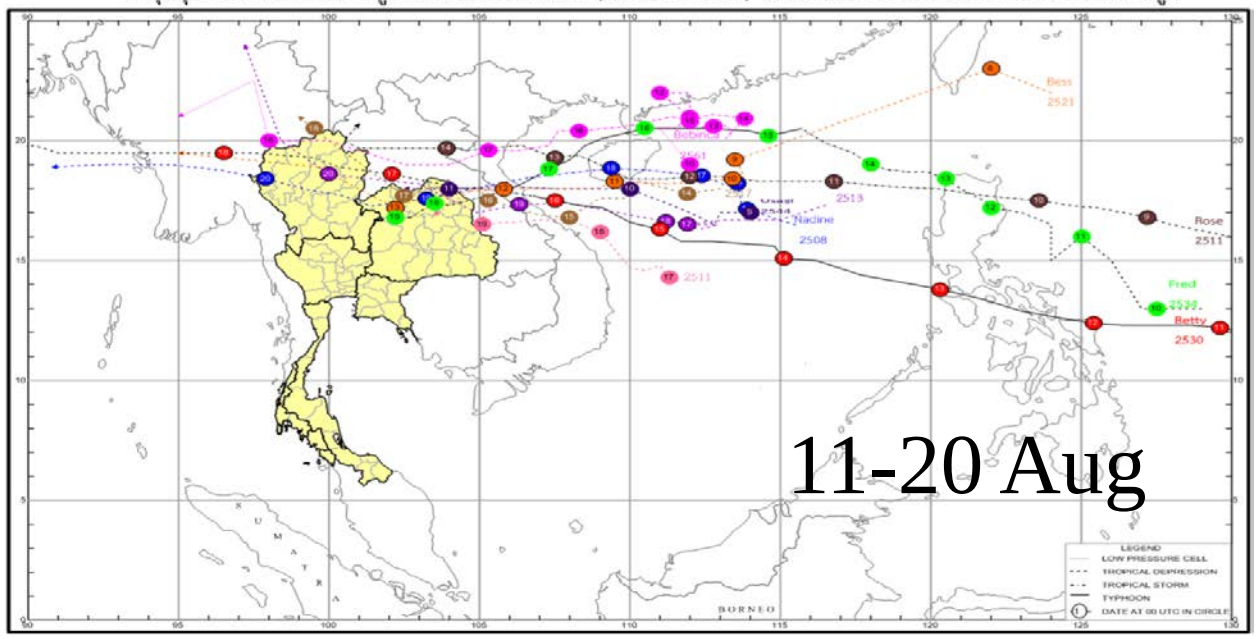
1-10 July

Tropical Cyclone Track in each month (68 years): Thailand



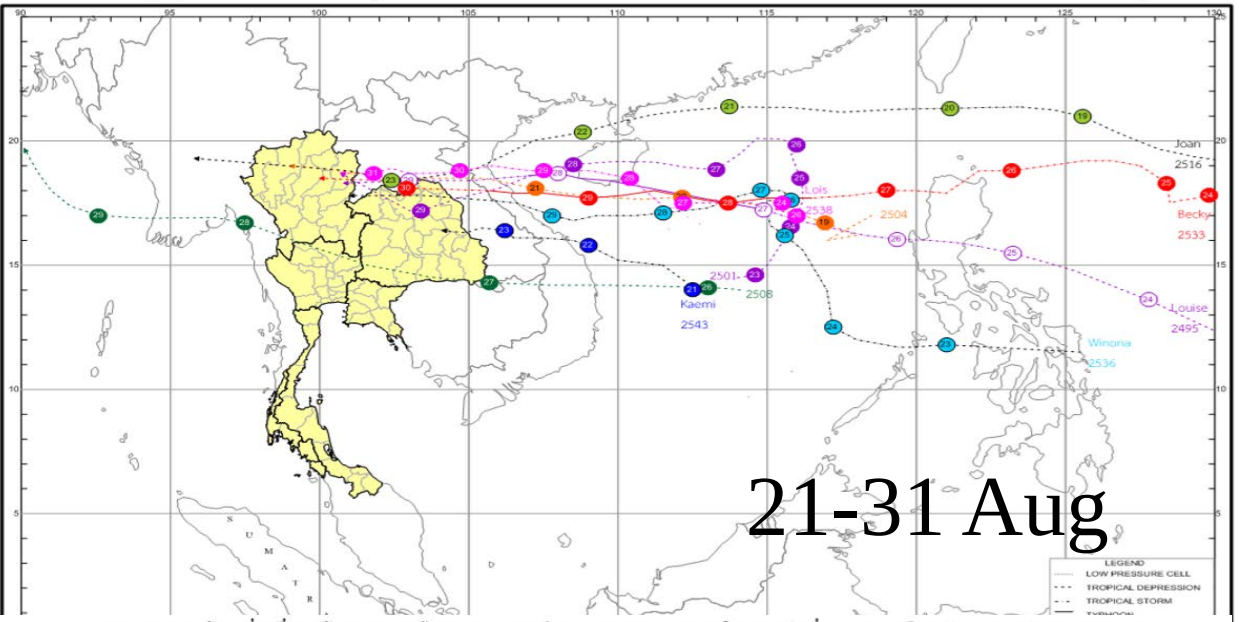






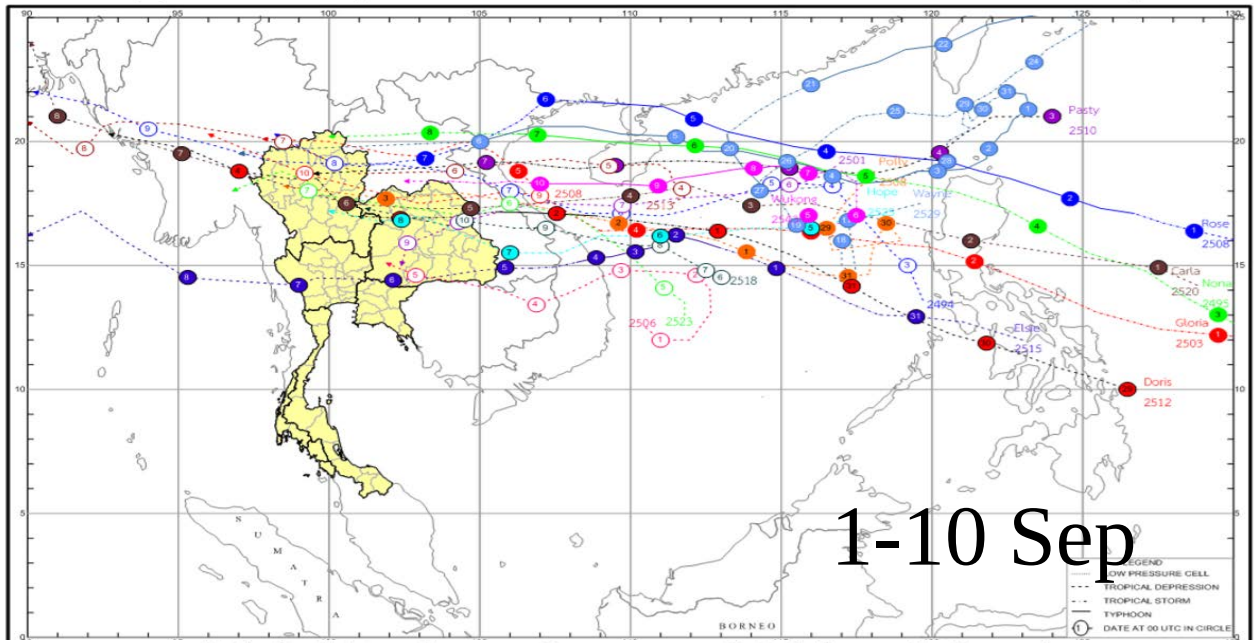
Tropical Cyclone Track in each month (68 years): Thailand

พายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทย คาบ 68 ปี (พ.ศ.2494-2561) ในช่วงวันที่ 21 -31 เดือนสิงหาคม จำนวน 9 ลูก



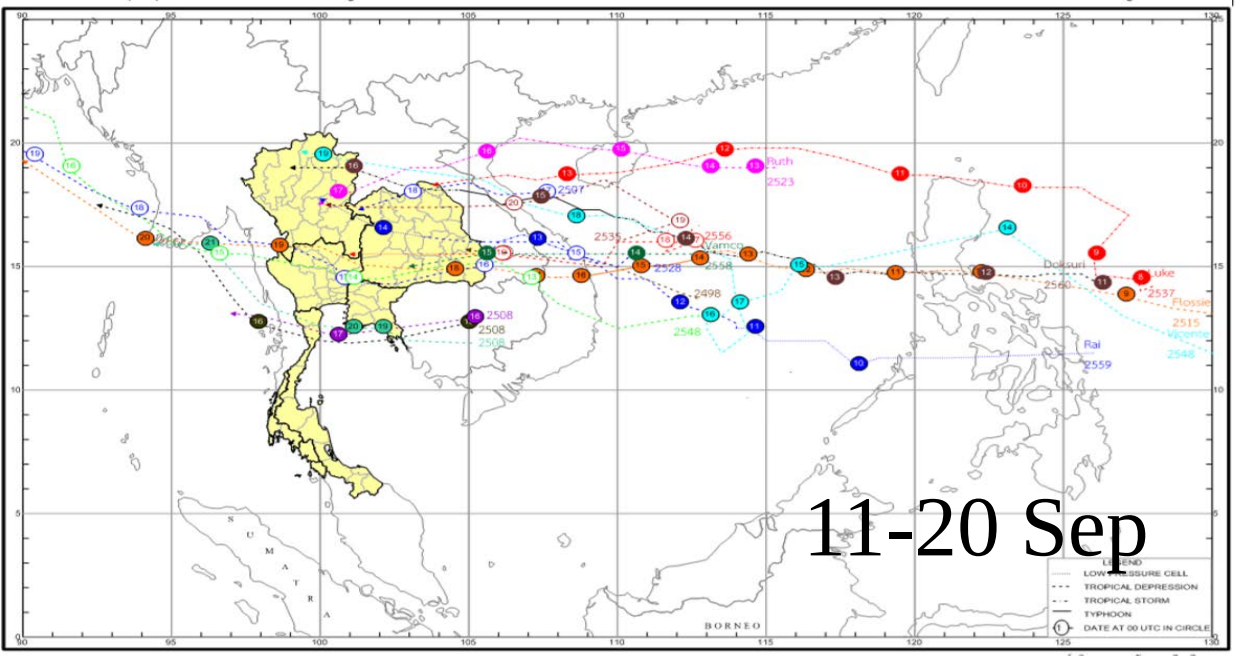
21-31 Aug

พายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทย คาบ 68 ปี (พ.ศ.2494-2561) ในช่วงวันที่ 1 -10 เดือนกันยายน จำนวน 18 ลูก



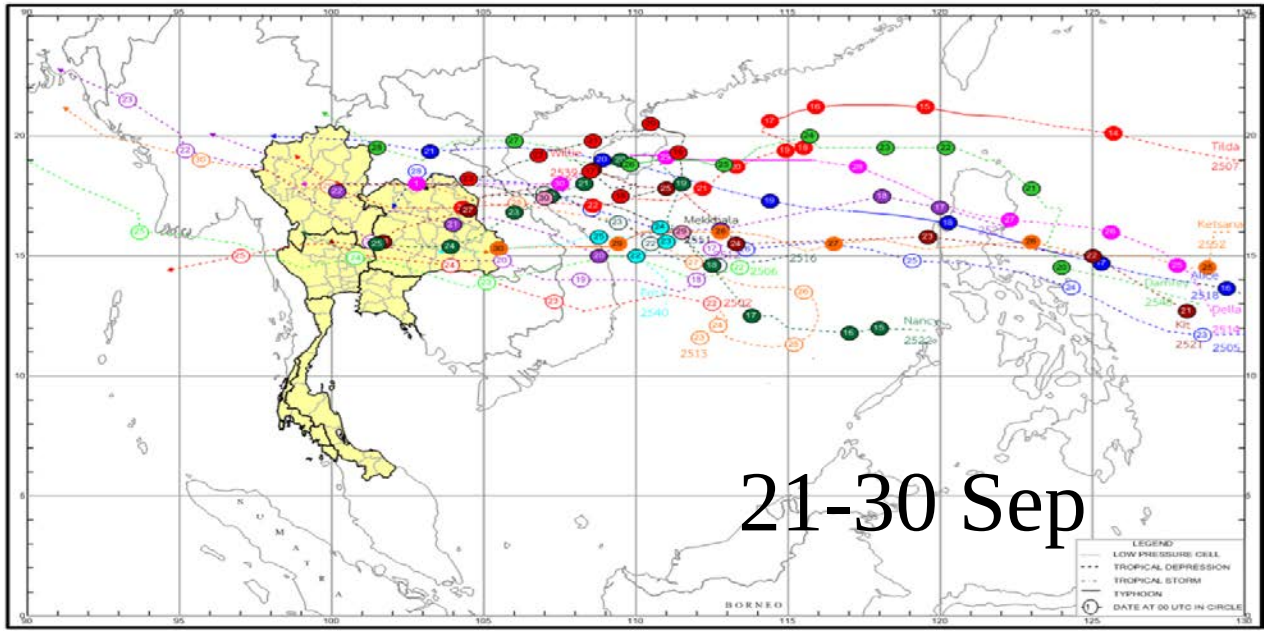
1-10 Sep

พายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทย คาบ 68 ปี (พ.ศ.2494-2561) ในช่วงวันที่ 11 -20 เดือนกันยายน จำนวน 16 ลูก



11-20 Sep

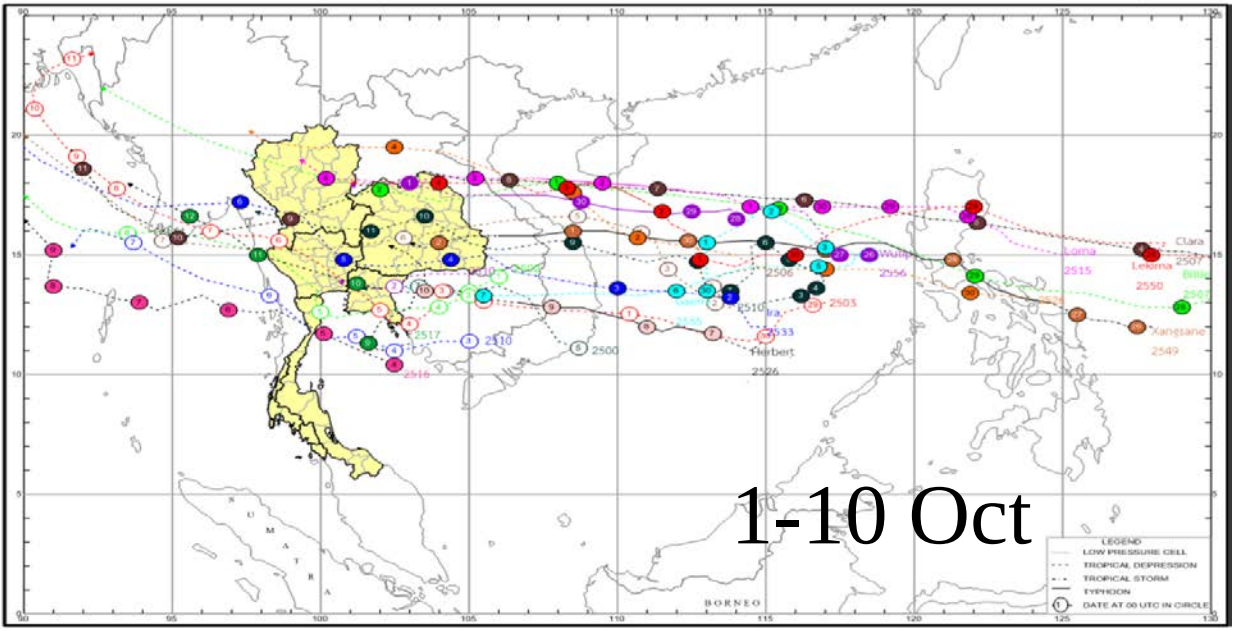
พายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทย คาบ 68 ปี (พ.ศ.2494-2561) ในช่วงวันที่ 21 -30 เดือนกันยายน จำนวน 17 ลูก



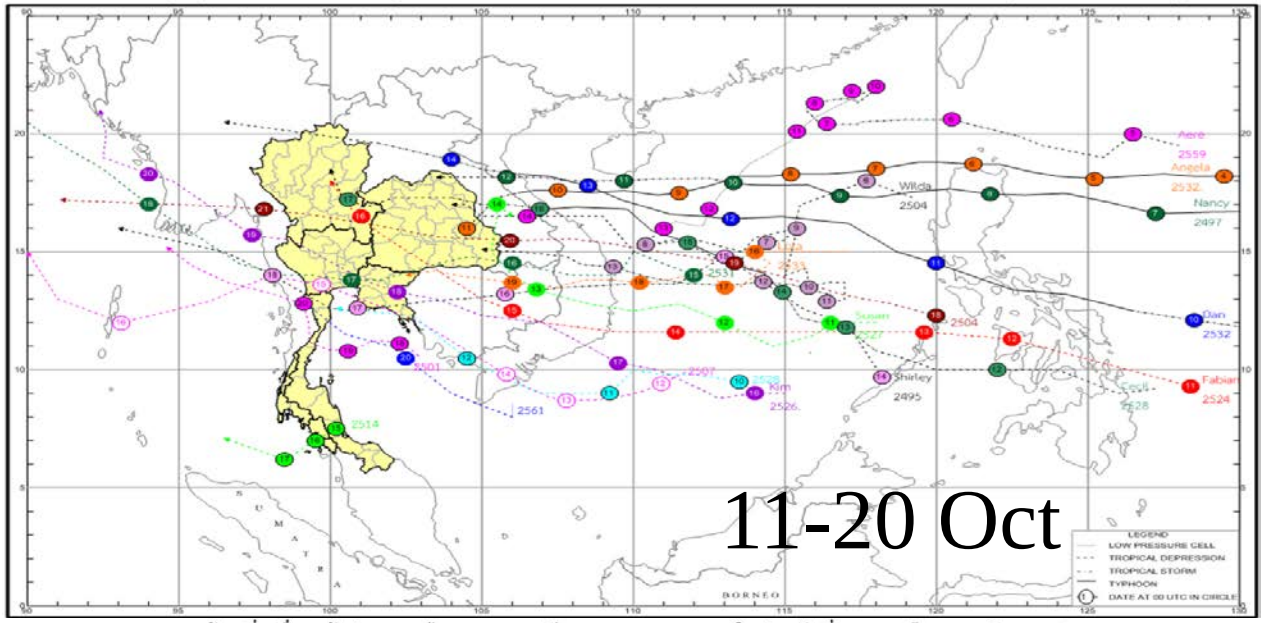
21-30 Sep

Tropical Cyclone Track in each month (68 years): Thailand

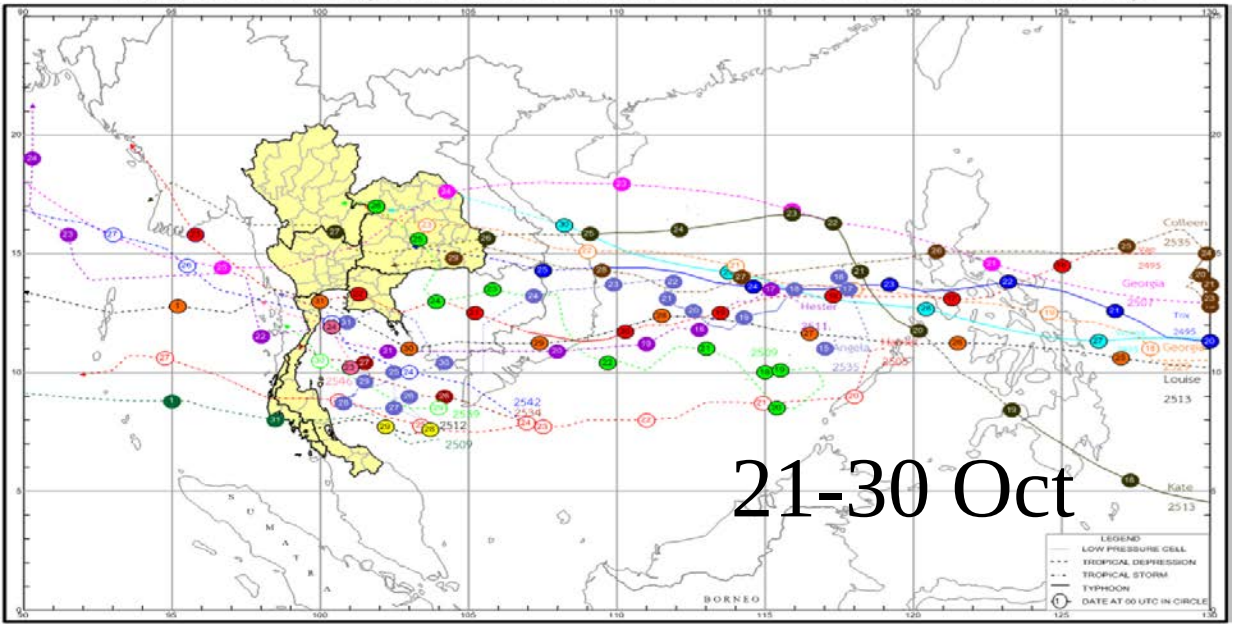
พายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทย คาบ 68 ปี (พ.ศ.2494-2561) ในช่วงวันที่ 1 -10 เดือนตุลาคม จำนวน 19 ลูก



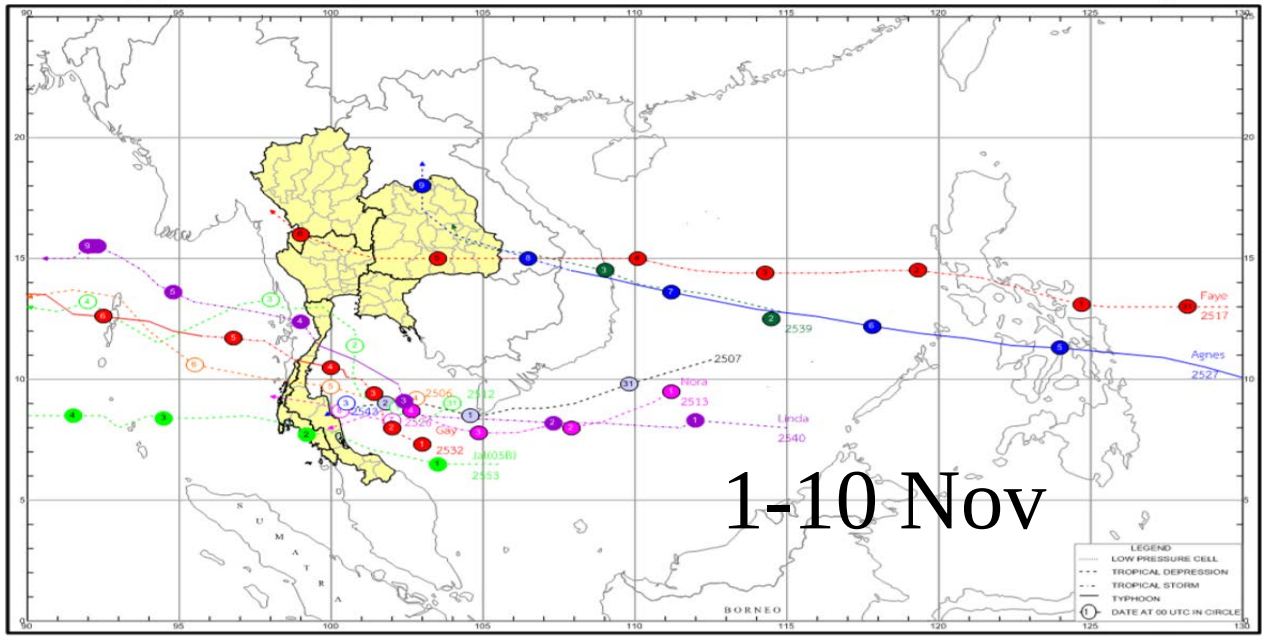
พายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทย คาบ 68 ปี (พ.ศ.2494-2561) ในช่วงวันที่ 11 -20 เดือนตุลาคม จำนวน 18 ลูก



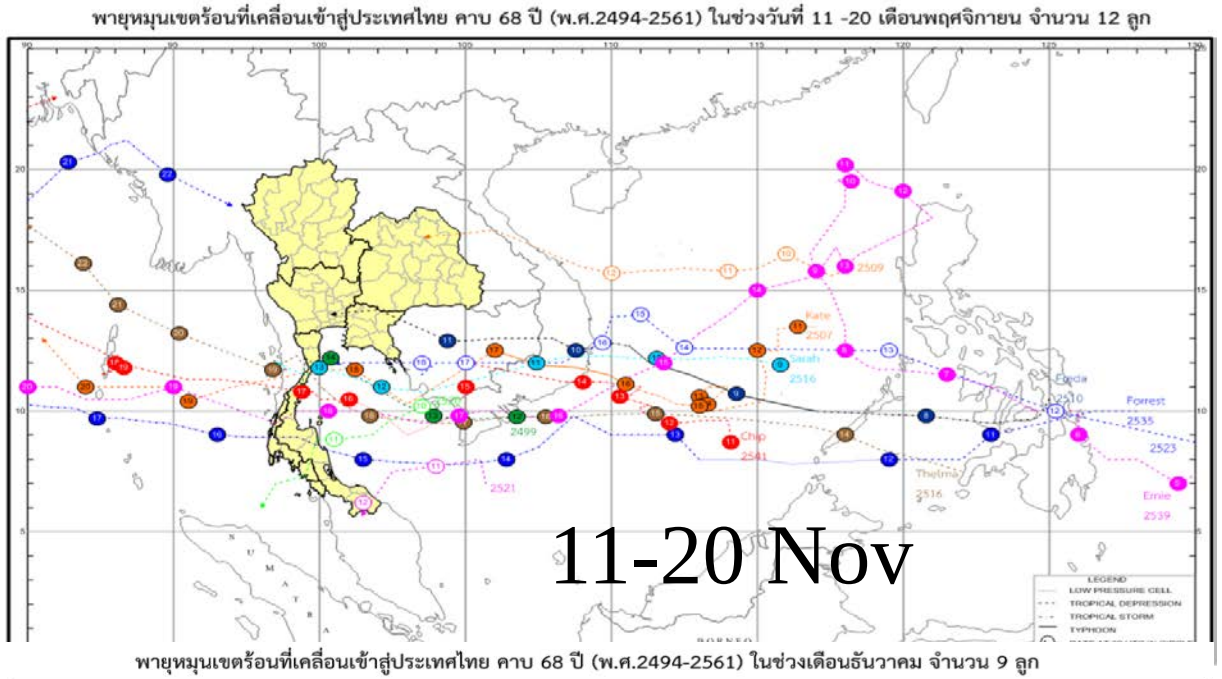
พายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทย คาบ 68 ปี (พ.ศ.2494-2561) ในช่วงวันที่ 21 -31 เดือนตุลาคม จำนวน 18 ลูก

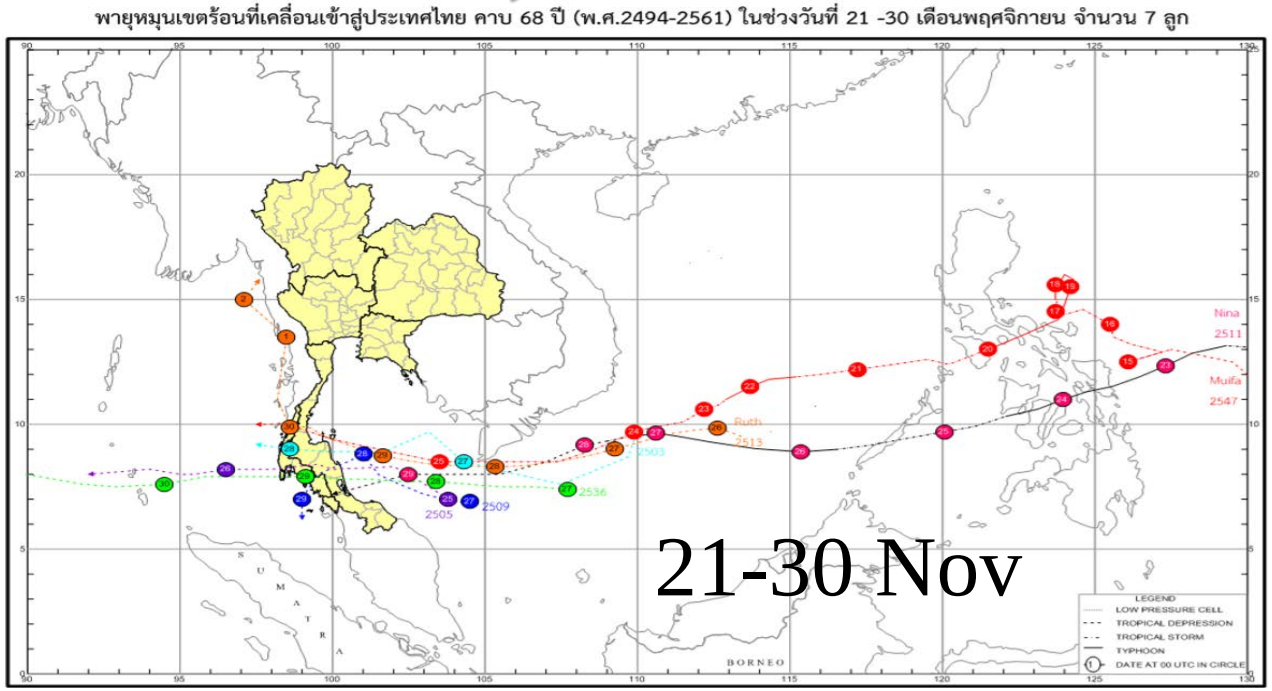


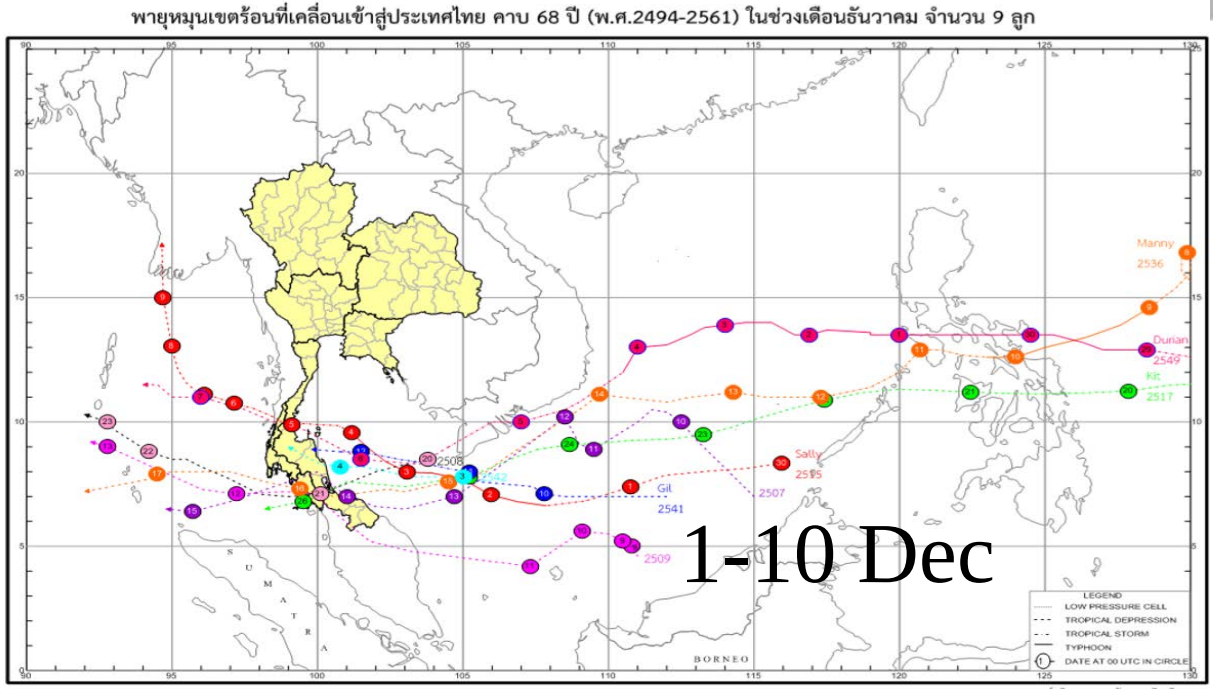
พายุหมุนเขตร้อนที่เคลื่อนเข้าสู่ประเทศไทย คาบ 68 ปี (พ.ศ.2494-2561) ในช่วงวันที่ 1 -10 เดือนพฤศจิกายน จำนวน 12 ลูก



Tropical Cyclone Track in each month (68 years): Thailand

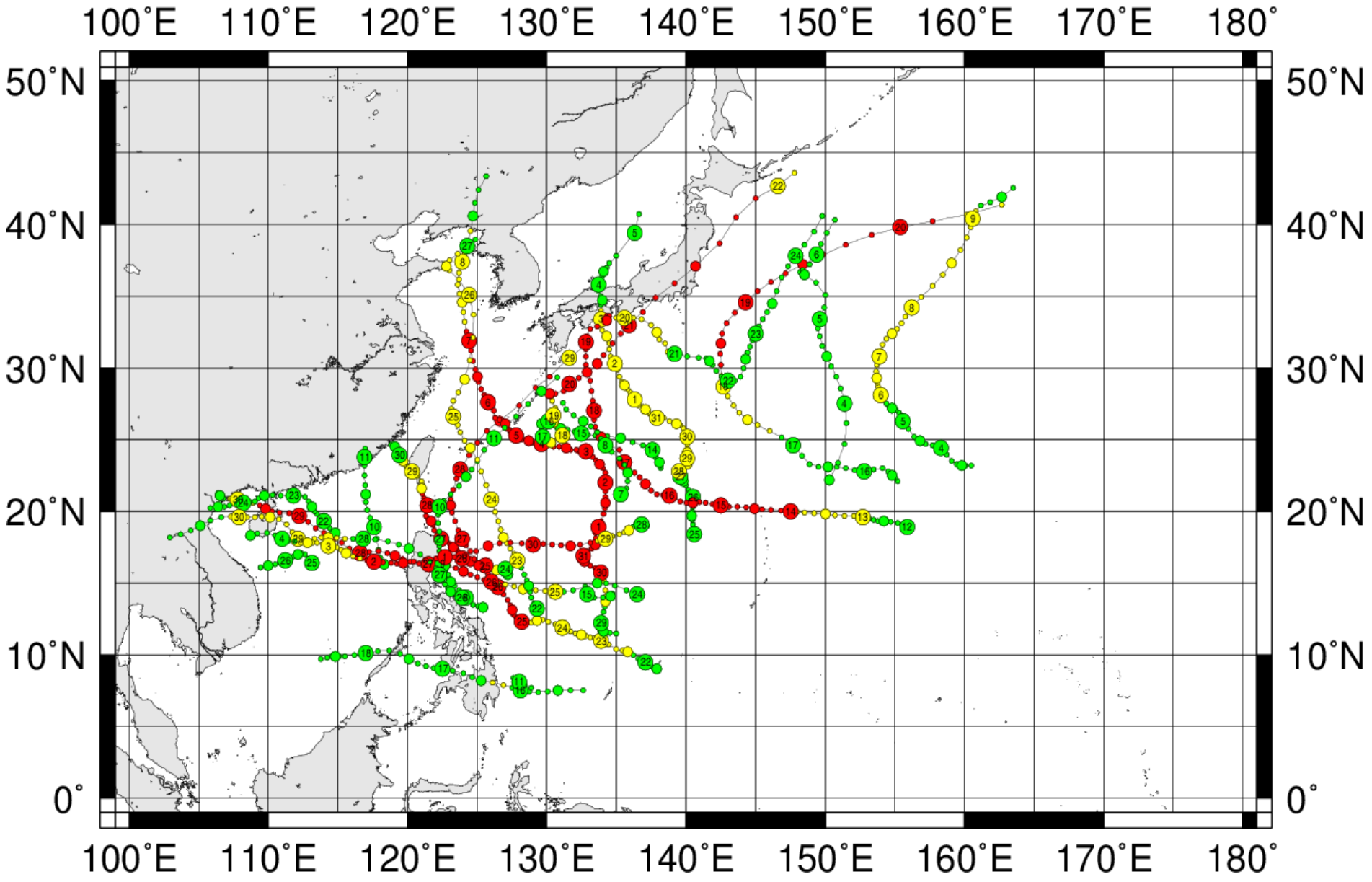




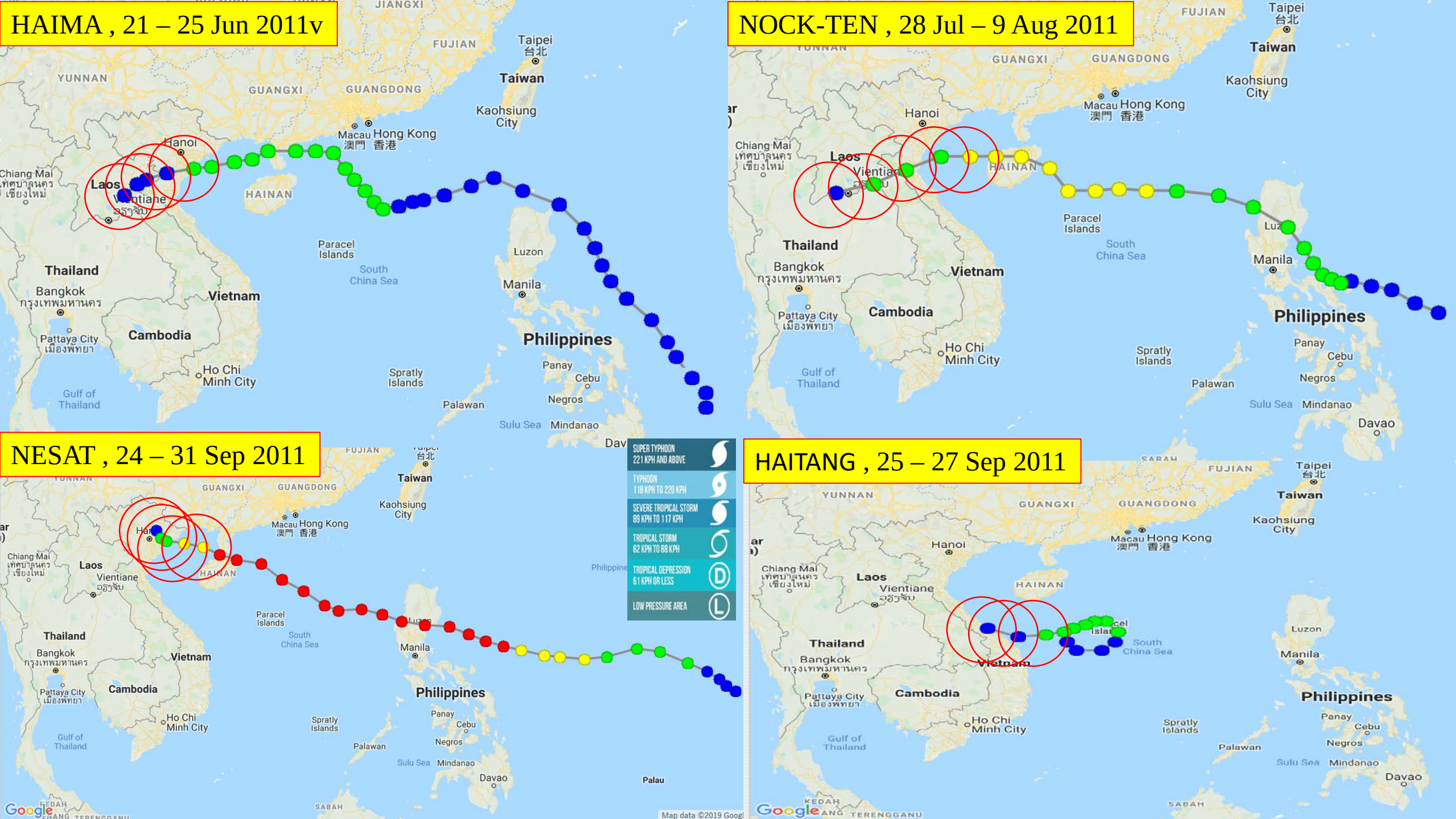


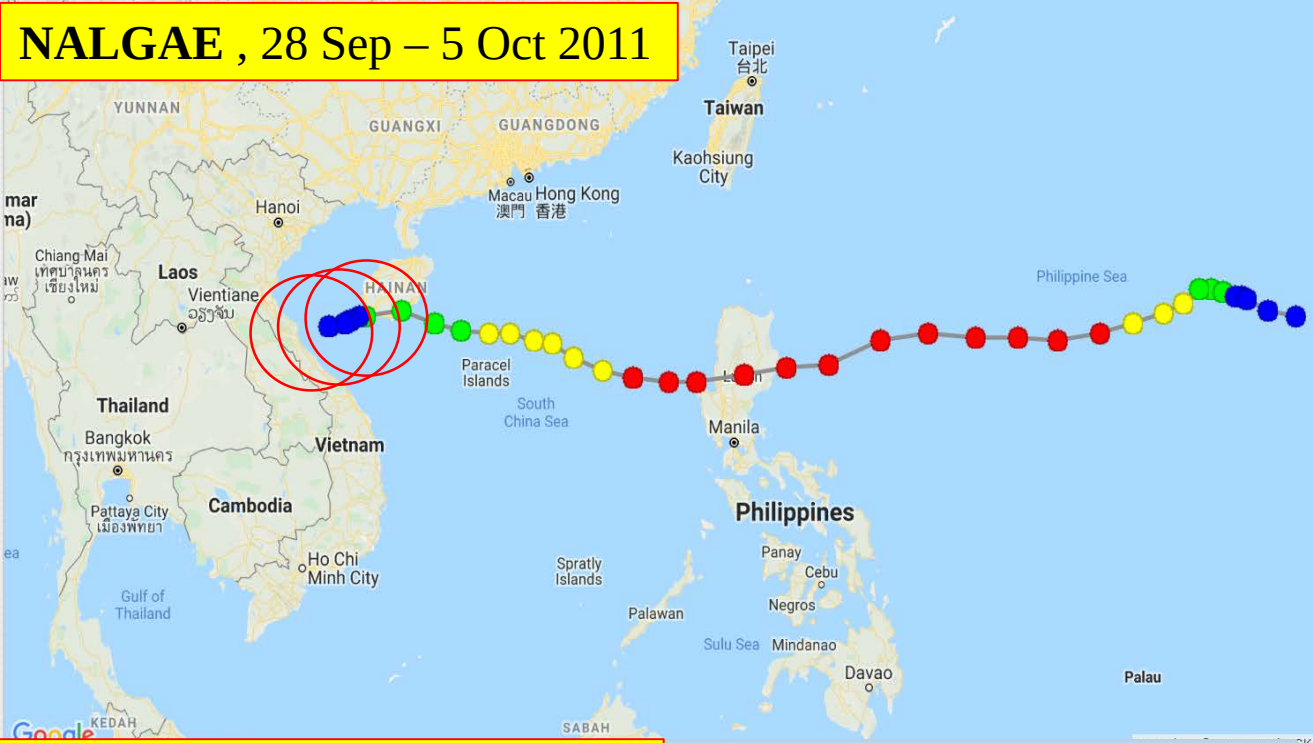
Mostly Tropical Cyclone Track form TC in the Pacific ocean moves to the south China Sea during May - October

Name Tropical Cyclone / Track (21) in 2011: North West Pacific (NW): La Nina strongly year



http://agora.ex.nii.ac.jp/digital-typhoon/latest/track/


HAIMA , 21 – 25 Jun 2011v
NOCK-TEN , 28 Jul – 9 Aug 2011
NESAT , 24 – 31 Sep 2011
HAITANG , 25 – 27 Sep 2011
SUPER TYPHOON
221 KPH AND ABOVE
TYPHOON
118 KPH TO 220 KPH
SEVERE TROPICAL STORM
89 KPH TO 117 KPH
TROPICAL STORM
62 KPH TO 88 KPH
TROPICAL DEPRESSION
61 KPH OR LESS
LOW PRESSURE AREA
Taipei
台北
Taiwan
Kaohsiung City
Macau
澳門
Hong Kong
香港
Hanoi
Chiang Mai
เชียงใหม่
Laos
Vientiane
ວຽງຈັນ
HAINAN
Paracel Islands
South China Sea
Luzon
Manila
Philippines
Thailand
Bangkok
กรุงเทพมหานคร
Vietnam
Cambodia
Pattaya City
เมืองพัทยา
Ho Chi Minh City
Gulf of Thailand
Spratly Islands
Panay
Cebu
Negros
Palawan
Sulu Sea
Mindanao
Davao
Palau
YUNNAN
GUANGXI
GUANGDONG
FUJIAN
JIANGXI
SABAH
KEDAH
TERENGGANU
Google
Map data ©2019 Google



Tropical Cyclones affected in Indochina

- HAIMA
- **NOCH-TEN**
- NESAT
- HAIHANG
- NALGAE

Severe Flooding 2011

Severe **flooding** occurred during the **2011** monsoon season in Thailand. The **flooding** began at the end of July triggered by the landfall of Tropical Storm Nock-ten. These **floods** soon spread through the provinces of northern, northeastern, and central Thailand along the Mekong and Chao Phraya river basins

Severe Flooding 2011

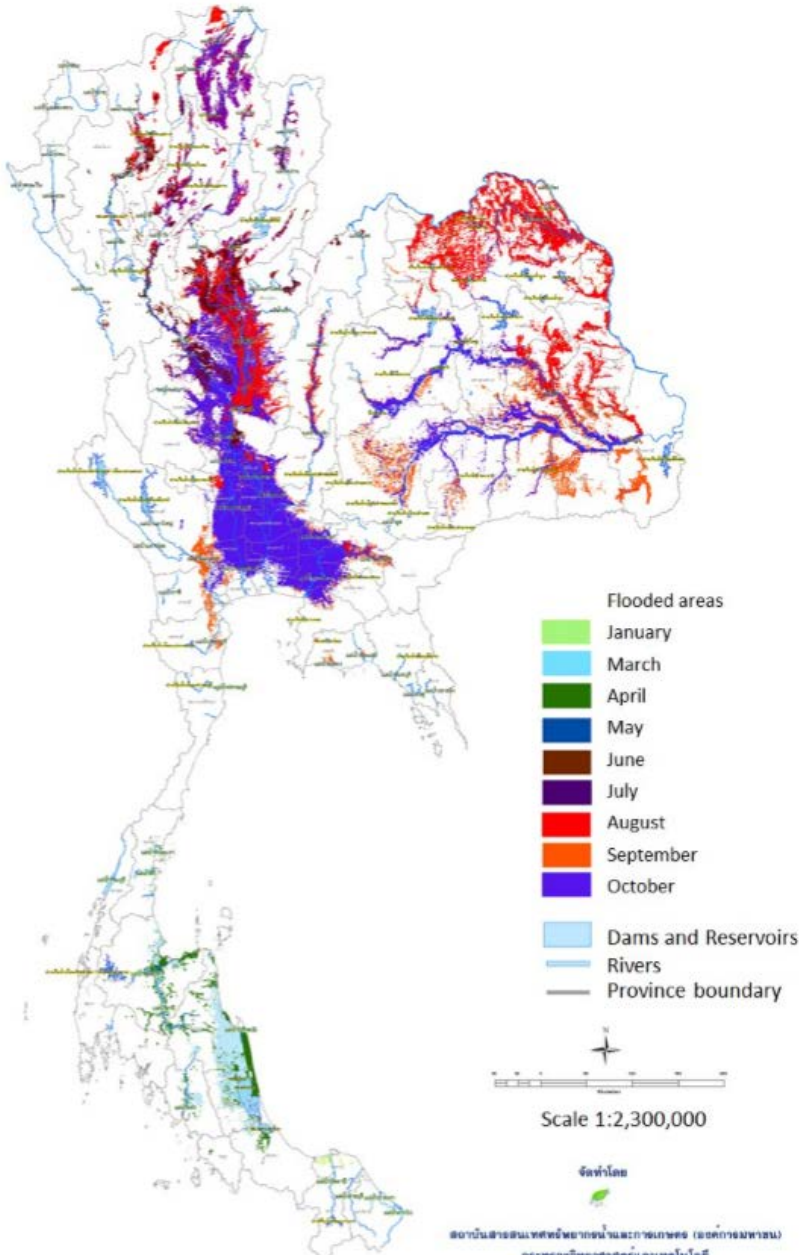
The accumulated precipitation from January to October 2011 was 35% higher than average in consequence of **La Niña—a phenomenon** that, as a result of lower surface ocean temperatures, usually brings increased moisture. In this case, earlier than expected precipitation—, five key tropical storms, and monsoon troughs. Heavy rainfall raises the level of water in waterways, producing overflowing and flooding to adjoining areas.

http://www.thaiwater.net/web/attachments/379_thailand%20flood%20es%20v2.pdf

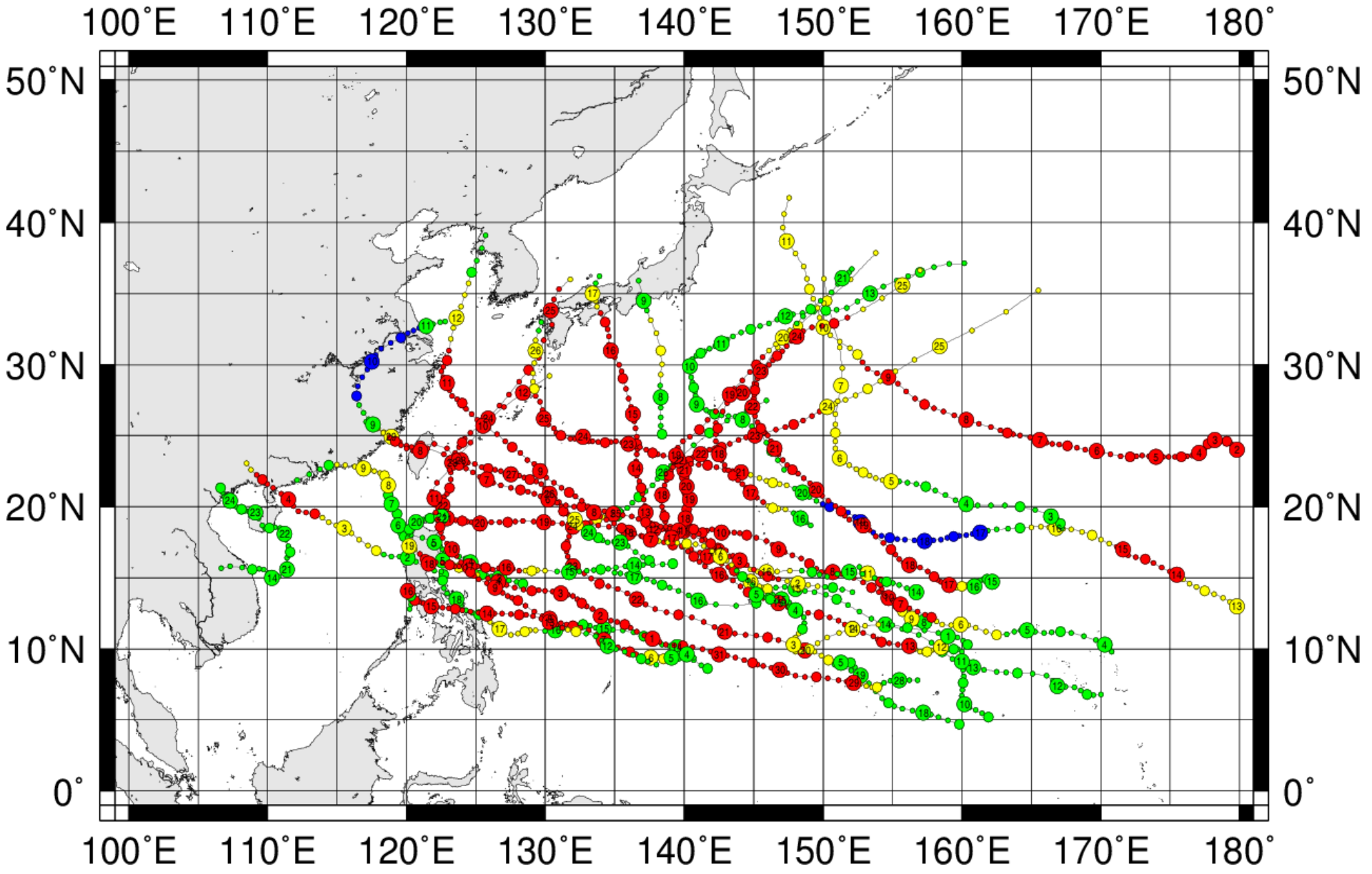
Severe Flooding 2011

Table of 2011 Monthly Flooded Areas

Month	Area (Square kilometer)	Area (Rai)
January	189,607,196.54	118,504.50
February	-	-
March	1,963,221,266.48	1,227,013.29
April	22,925,700,697.00	14,328,562.94
May	122,616,438.84	76,635.27
June	739,073,358.93	461,920.85
July	1,415,716,433.11	884,822.77
August	9,100,495,393.35	5,687,809.62
September	24,604,894,396.54	15,378,059.00
October	29,591,106,876.98	18,494,441.77
Total	**90,652,432,057.77**	**56,657,770.01**



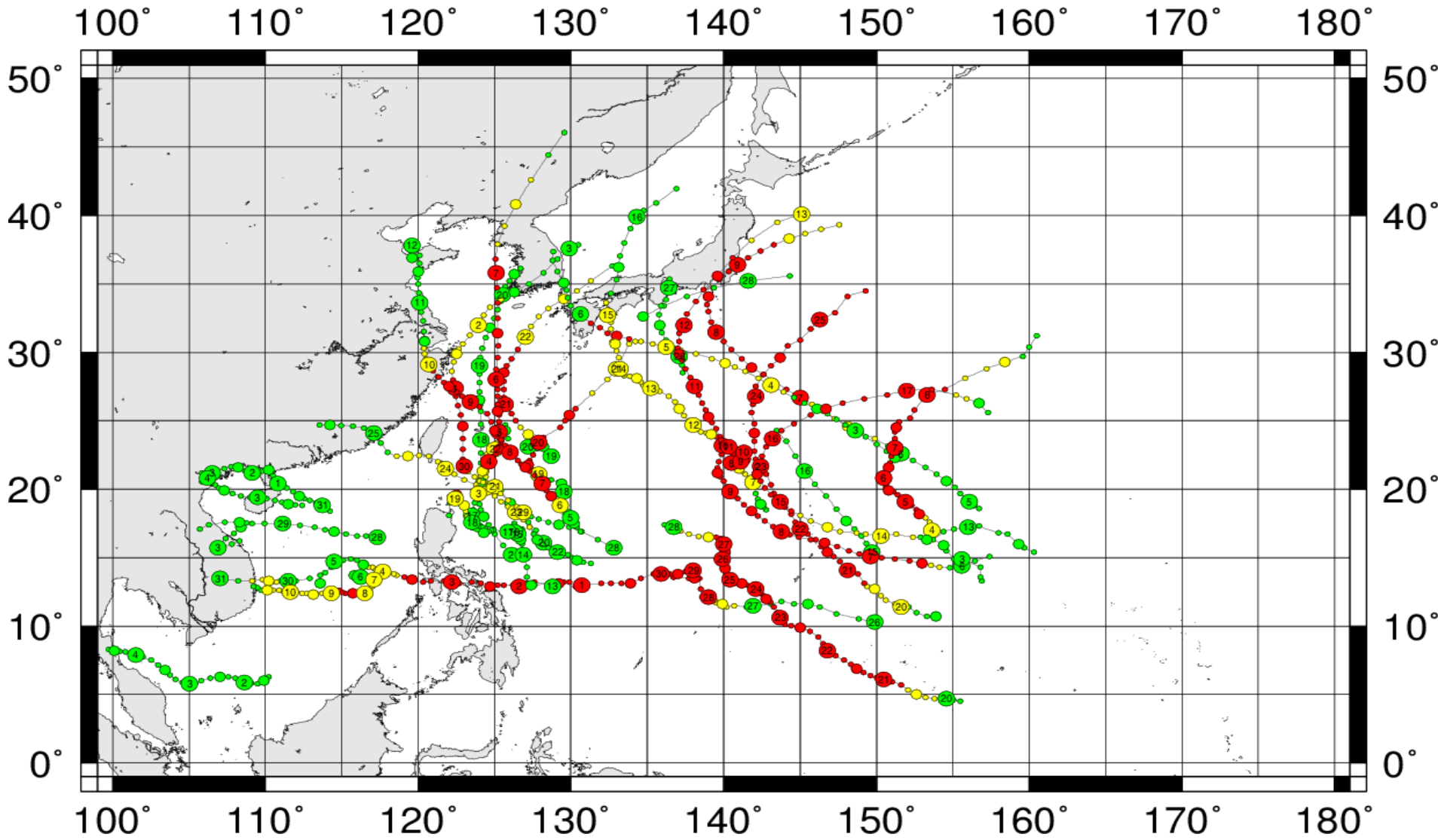
Name Tropical Cyclone / Track (27) in 2015: North West Pacific (NW): El Nino strongly year



http://agora.ex.nii.ac.jp/digital-typhoon/latest/track/

Name Tropical Cyclone / Track (28) in 2019: North West Pacific (NW)):

Weak El Nino year

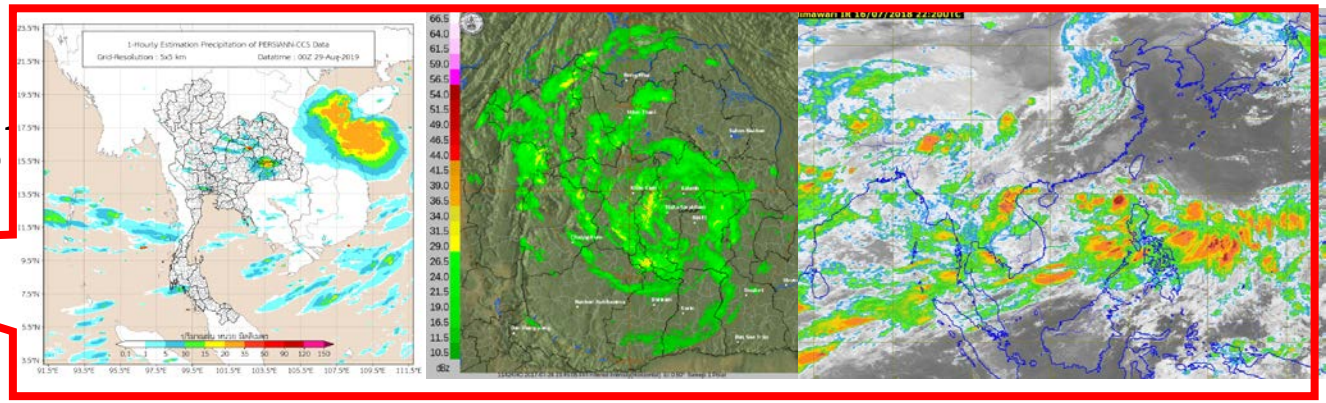


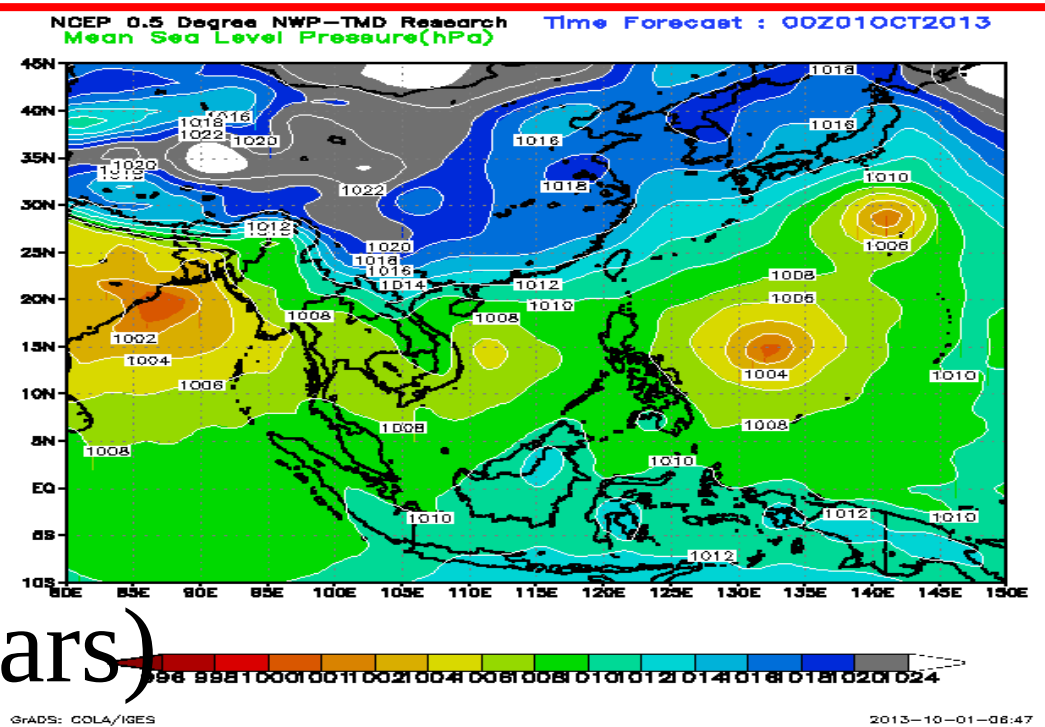
http://agora.ex.nii.ac.jp/digital-typhoon/latest/track/

Weather Forecasting

Weather Forecasting can separate 4 part

1. Very short Range Forecast (1-6 hr.),
2. Short Range Forecast (1-3 days),
3. Medium Range Forecast (1-10days),
4. Long Range Forecast (1, 3, 6 month, 1 year, 100 years)



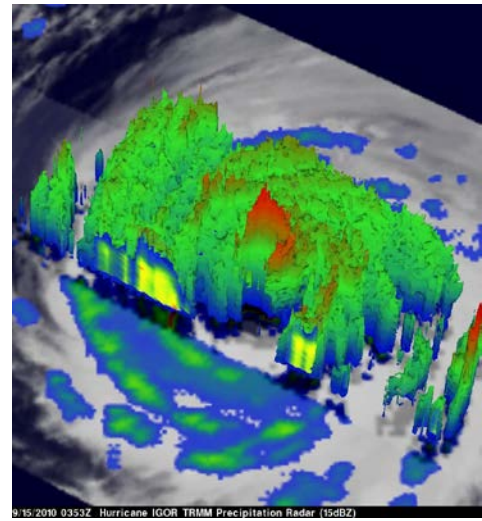


Weather Forecasting

- Very short range forecast: mostly used Remote Sensing are Meteorological Satellite and Weather Radar
    1. Meteorological Satellite for monitoring and also the quantitative precipitation estimation (Quantitative Precipitation Estimation: QPE):
        - the Global Satellite Mapping Precipitation (GSMaP)
        - PERSIANNs
    2. Weather radar
- **Short-term, Medium-term and long-term forecast**: mostly used ***the dynamics model and the statistics model***, high performance computer (HPC) compute.

Climate Change Affects Tropical Storms

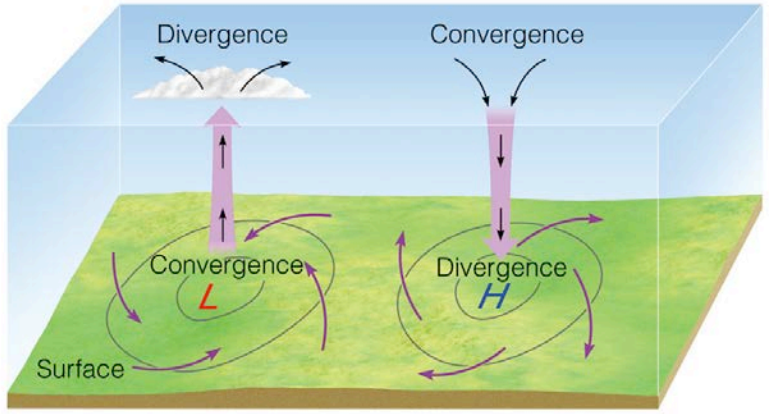
- Sea surface temperature > 26.5C
- ***The intensity of tropical storms increasing by 2-11% as higher ocean temperatures generate more energy***
- The number of tropical storms may remain largely the same ,but there might be a greater number of extremely intensity storms.



- **An increasing of up to 20% in the amount of rainfall within 100 km. of the eye of the storm.**

Review Paper

Dynamic and thermodynamic characteristics of all the tropical cyclones.



- Environmental vorticity,

- Divergence,

- Thermal winds,

- Convergence winds in the lower layer.

Except *the convergence within the lower layer of tropical cyclones in the South China Sea was significantly larger than that in the open western North Pacific.*

Convergence enhanced by greater terrain friction in the South China Sea strengthened the disturbance and then contributed to the shorter oscillation periods".

https://phys.org/news/2018-02-high-frequency-oscillations-tropical-cyclones-vary.html

Conclusion

The climate pattern must be link El Niño / La Nina Phenomena, that are concern of wind circulation and sea temperature.

- **Wind circulation in any layers,**
- **Convection,**
- **Vortex,**
- **Sea surface temperature,**

That are very complicate to study.

https://oxfordre.com/naturalhazardscience/view/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-79

Conclusion

The meteorological and climate community has come a long way in understanding of the global and regional climatological features of tropical cyclones, as well as some aspects of the broader relationship between tropical cyclones and climate,

They are still hindered by temporal inconsistencies within the historical record of storm data, particularly pertaining to tropical cyclone intensity.

https://oxfordre.com/naturalhazardscience/view/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-79

Conclusion

Scientist efforts to homogenize the historical record using Met. Satellite derived intensity tropical cyclone genersis.

The relatively makes it difficult to discern secular trends due to anthropogenic climate change from *natural trends occurring on decadal to multidecadal time scales*.

https://oxfordre.com/naturalhazardscience/view/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-79

Conclusion

However, climate change make high of sea surface temperature and also more moisture, then it be come low pressure area generate: convective clouds, then make rainfall.

The structure of the tropical cyclone is quite complex, so it must be examined with dynamic models.

https://oxfordre.com/naturalhazardscience/view/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-79

Conclusion

TC will come Mae Khong Basin every year, must to consider season in the climate, in normally May- October have:

- **The Inter Tropical Convergence Zone (ITCZ),**
- **Active low pressure,**
- **Monsoon.**

https://oxfordre.com/naturalhazardscience/view/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-79

Useful Website

www.tmd.go.th

www.satda.tmd.go.th

Accumulate Precipitation Forecast

- http://www.satda.tmd.go.th/NCEP2/?icon_size=180&d=./SumRain
- http://www.satda.tmd.go.th/NCEP2
- http://www.satda.tmd.go.th/NCEP2/?icon_size=180&d=./Rain