

Pacific Region ENSO UPDATE AND SEASONAL OUTLOOK

UPDATED 2 February 2015

PREPARED BY THE PEAC CENTER



Synopsis

Current Conditions

- Current ENSO status is **NEUTRAL**
- SST anomalies meander about the El Niño Threshold
- Most large-scale atmospheric anomalies weak

Impacts

- Tropical Cyclone activity resembles what is expected during El Niño!
 - Atlantic, quiet season
 - Pacific, TC genesis shifted east with TCs affecting Micronesia, Guam
 - East Pac Genesis shifted west and storms tracking further west near Hawaii
- Sea levels have fallen across the Western Pacific

Forecast

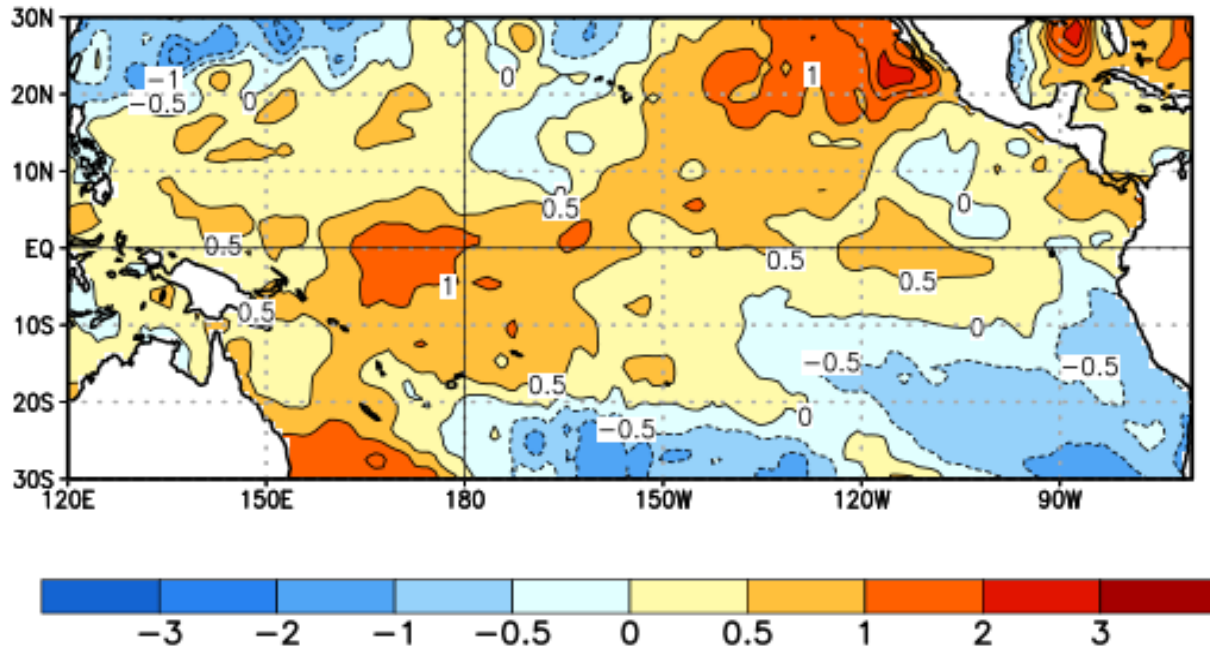
- Probability of El Niño developing over the next 2 months is ~50% and falling
- Rainfall Expected to be near normal
- Sea level expected to be near to below normal over the Western Pacific through mid 2015
- TC activity expected to be near normal

Current Conditions

General State of the Ocean and Atmosphere

During the last four weeks, equatorial SSTs were above average across the Pacific Ocean

Average SST Anomalies
28 DEC 2014 – 24 JAN 2015



Average sea surface temperature (SST) anomalies ($^{\circ}$ C). Over the past week, Warm SST anomalies were prevalent over the western central and eastern Pacific Ocean.

Development of SST anomalies over the past 4 weeks.

During the last four weeks

- Positive SST anomalies persisted along the equator from Papua New Guinea eastward
- Positive SST anomalies off the Peruvian Coast turned negative

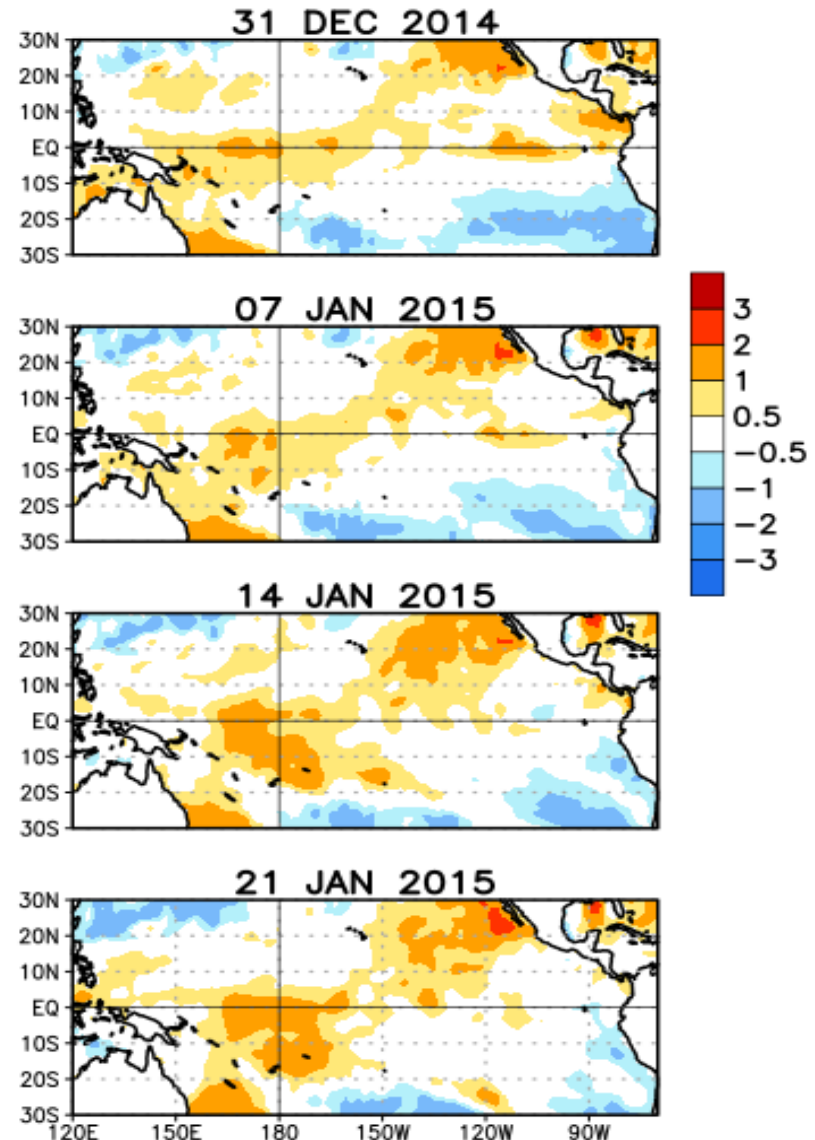
Sea Surface Temperature and Subsurface temperatures are all supportive of

Weak El Niño conditions

Large scale atmospheric signatures are very weak

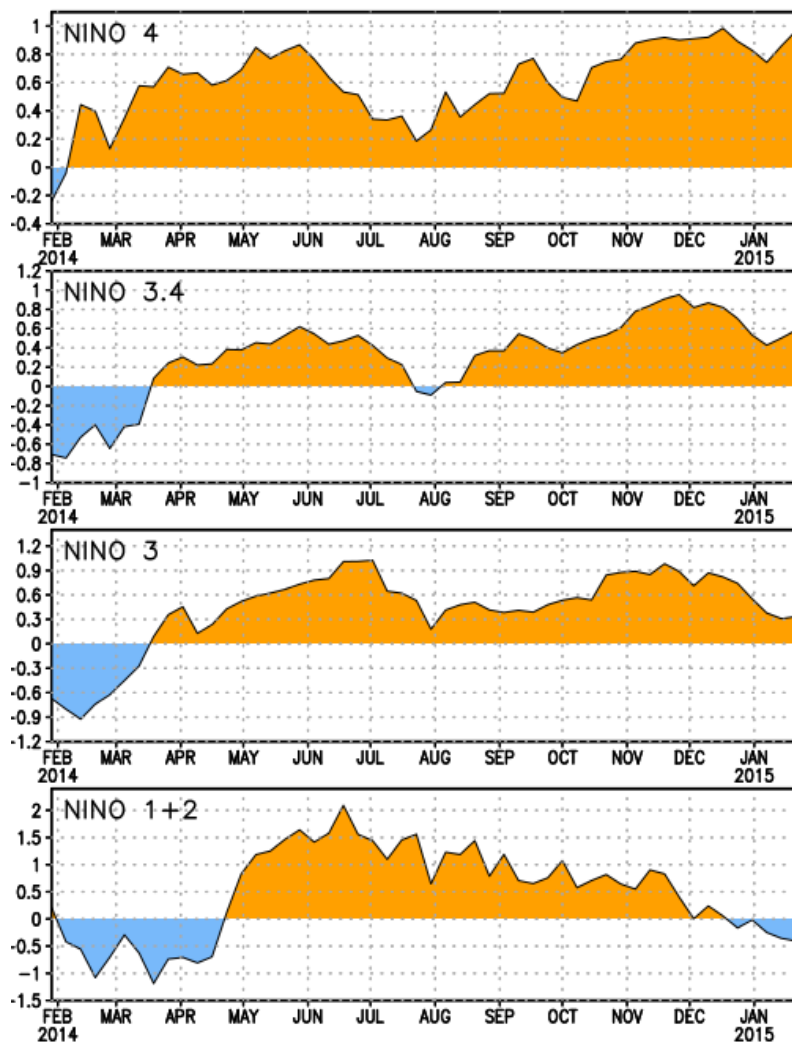
Figure From
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/ens_o_evolution-status-fcsts-web.ppt

Weekly SST Anomalies (DEG C)



SST DEPARTURES AND UPPER OCEAN (0 - 300m) HEAT CONTENT ANOMOLY

SST Anomalies



The latest weekly SST departures are:

Niño 4 1°C

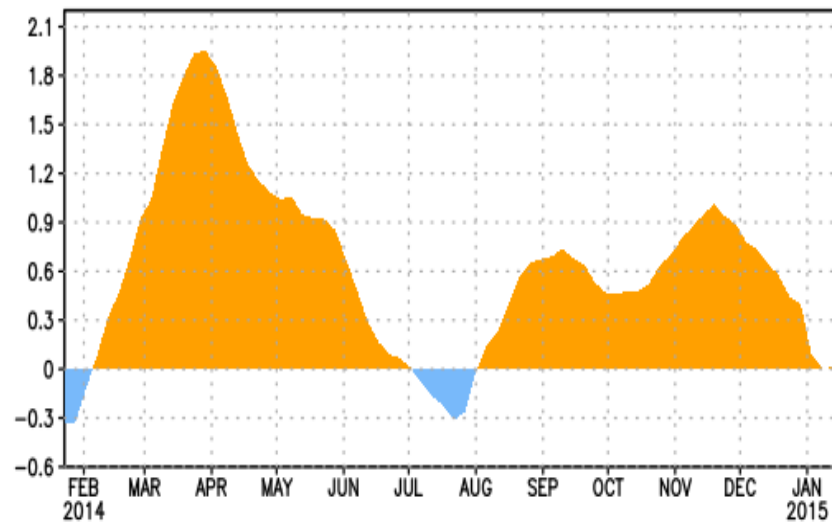
Niño 3.4 0.6°C

Niño 3 0.3°C

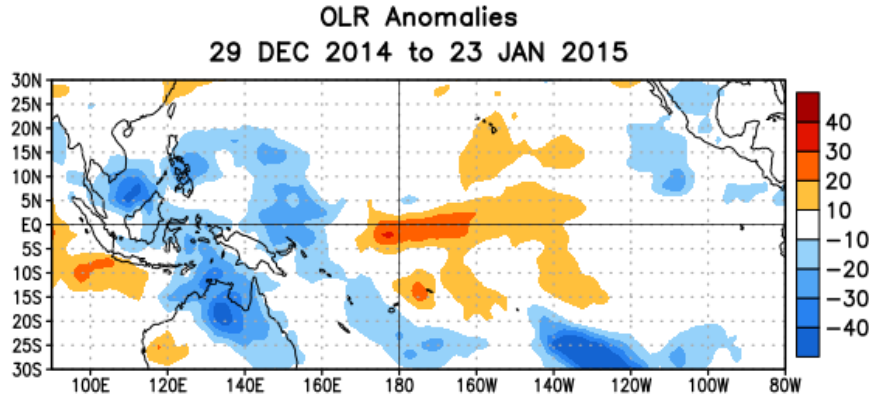
Niño 1+2 -0.4°C

Central & Eastern Pacific Upper-Ocean (0-300 m)
Weekly Heat Content Anomalies

EQ. Upper-Ocean Heat Anoms. (deg C) for 180–100W



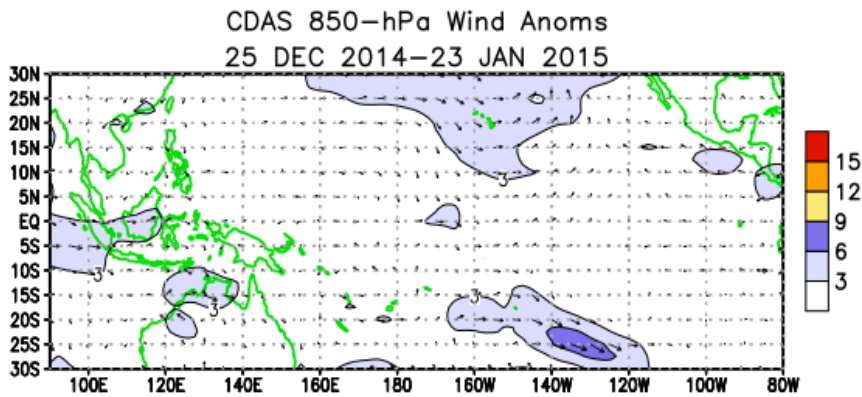
OLR and Wind Anomalies for Past 30 Days



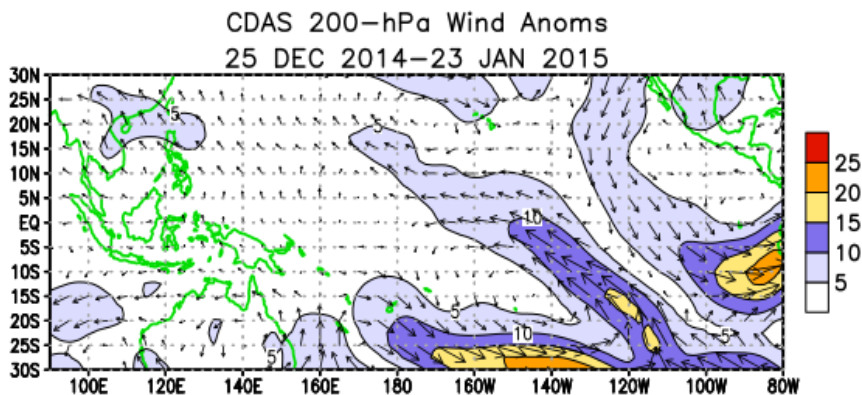
- Above average deep convection (- OLR anomalies)
 - Western Pacific
 - Maritime Continent
 - SPCZ
- Below average precipitation (+ OLR anomalies)
 - Central pacific extending eastward

Rainfall anomalies over the Maritime continent shifted quickly from persistent dry conditions (up to Dec 2014) to wet conditions

Low level winds over the past month have been close to normal.



Upper level winds show predominant easterly winds east of the date line and near normal winds to the west.



EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

ENSO Alert System Status: **El Niño Watch**

Synopsis:

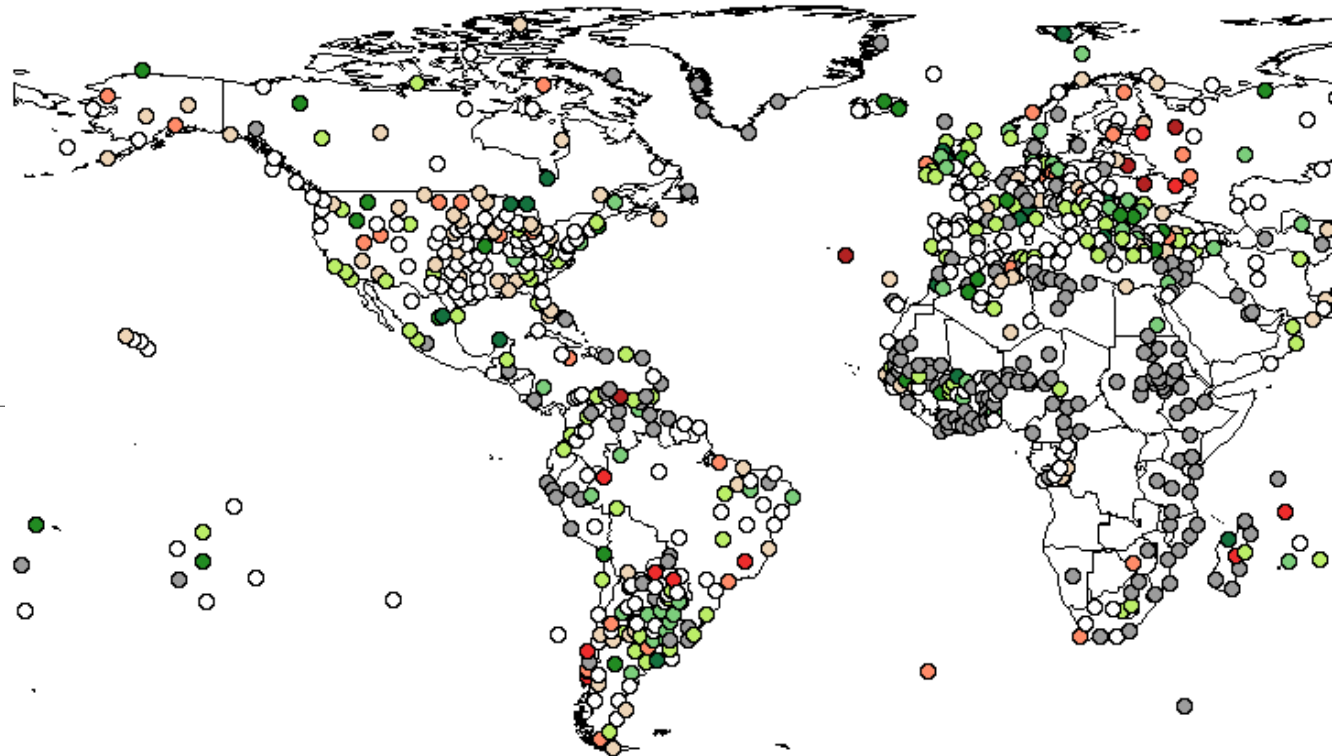
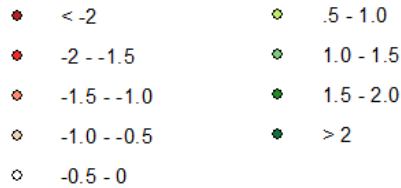
- During December 2014 and January 2015, above-average sea surface temperatures (SST) were maintained over the Central and West Pacific and weakened over the East Pacific
- Niño 3.4 index dipped below $+0.5^{\circ}\text{C}$ for the first time in three months at the beginning of January and is now back to $+0.6^{\circ}\text{C}$, Niño 1+2 index values are currently negative
- Positive subsurface heat content anomalies decreased during December
- Equatorial low-level winds were largely near average
- Upper-level winds
 - Easterly anomalies dominated over the central-eastern tropical Pacific
 - Northwesterly winds were observed towards the Peruvian coast
 - Near normal over the Western Pacific
- Rainfall was below normal near date line and above normal over Indonesia
- The Southern Oscillation Index has remained slightly negative
- The lack of coherent atmospheric and oceanic features indicates the continuation of **ENSO-neutral**.

Impacts

Rainfall, Sea Level, Tropical Cyclones and
Societal Impacts

Rainfall impacts: Drought

Global 3 Month SPI



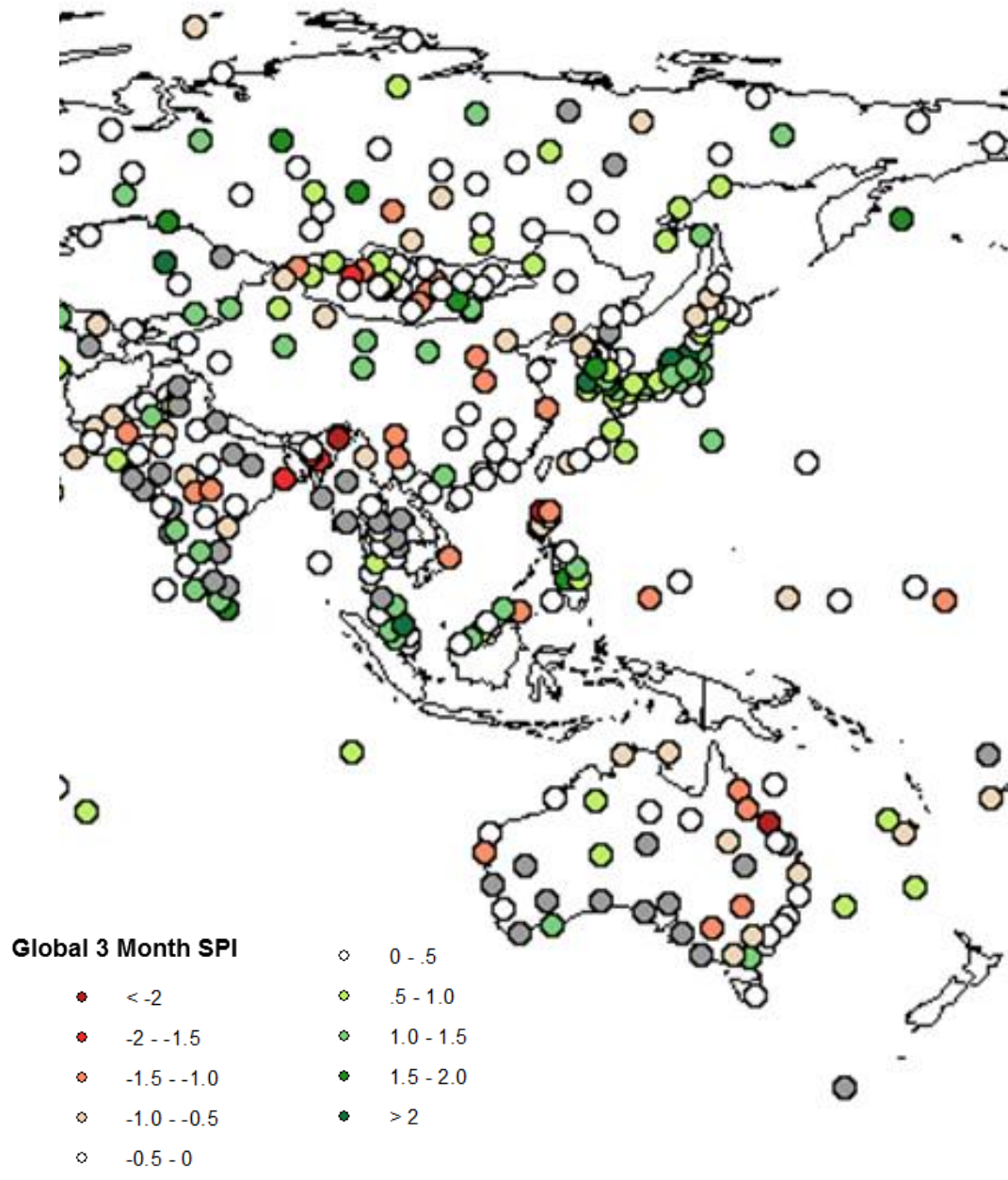
From the Global Drought Information System (<http://www.drought.gov/gdm/content/welcome>)

In December 2014, drought eased slightly across the globe. In Africa, drought eased in the south while conditions along the central Mediterranean are still drier than normal. In North America, drought conditions improved slightly in the central and western part of the continent. In South America, drought conditions eased in Brazil and intensified along the southern Andes.

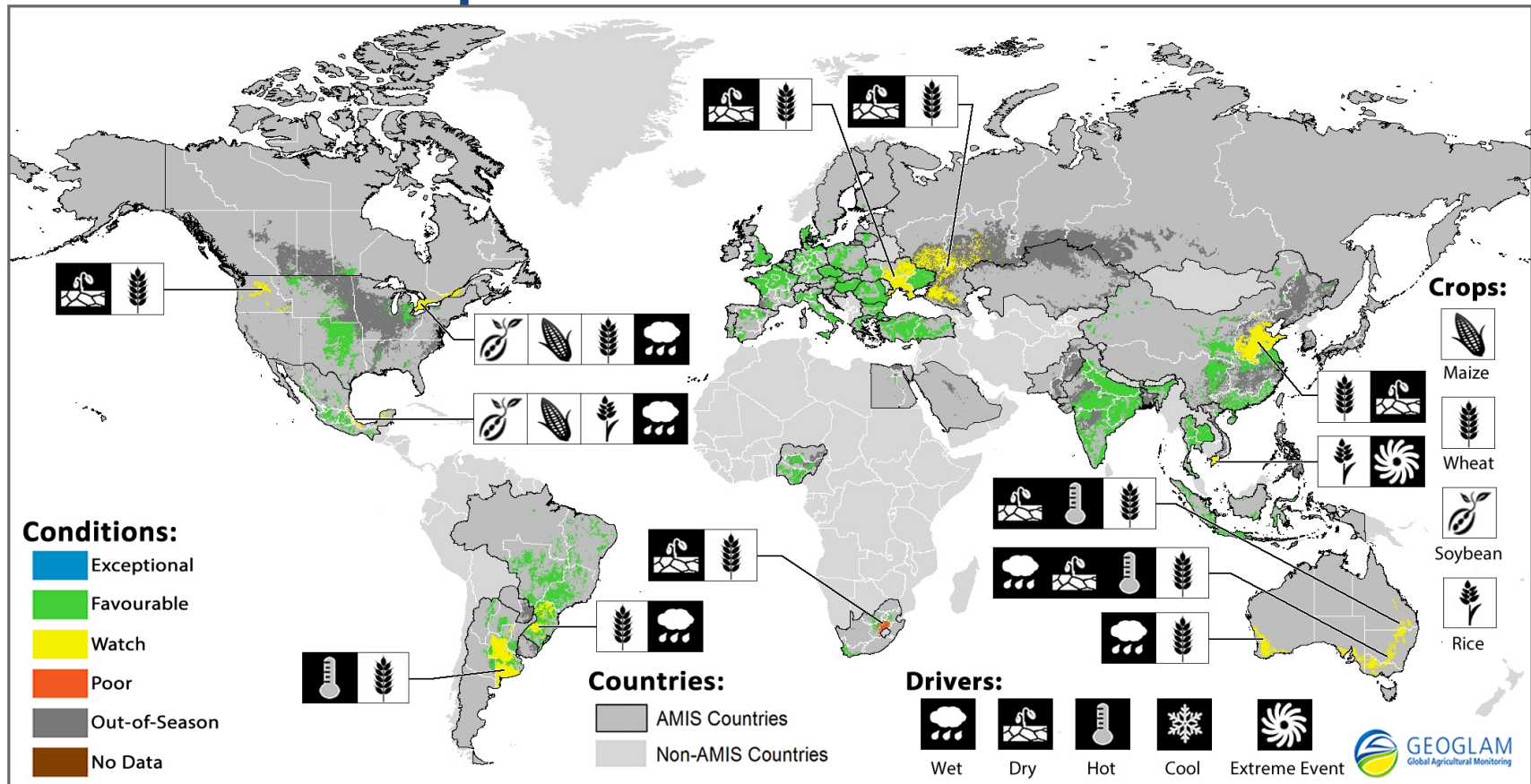
Rainfall impacts:

Drought in Asia and the Pacific

- Asia saw improved conditions in the central and western part of the continent
- Drought continues to grip areas of India and around Mongolia.
- In Thailand, drought will cut the off-season rice crop by 30%.
- Australia, drought continues unabated in the southern and eastern parts of the country while conditions in the central part of the continent improved slightly.
- New Zealand the multi-year drought is limiting the number of lambs because of ewe nourishment problems.



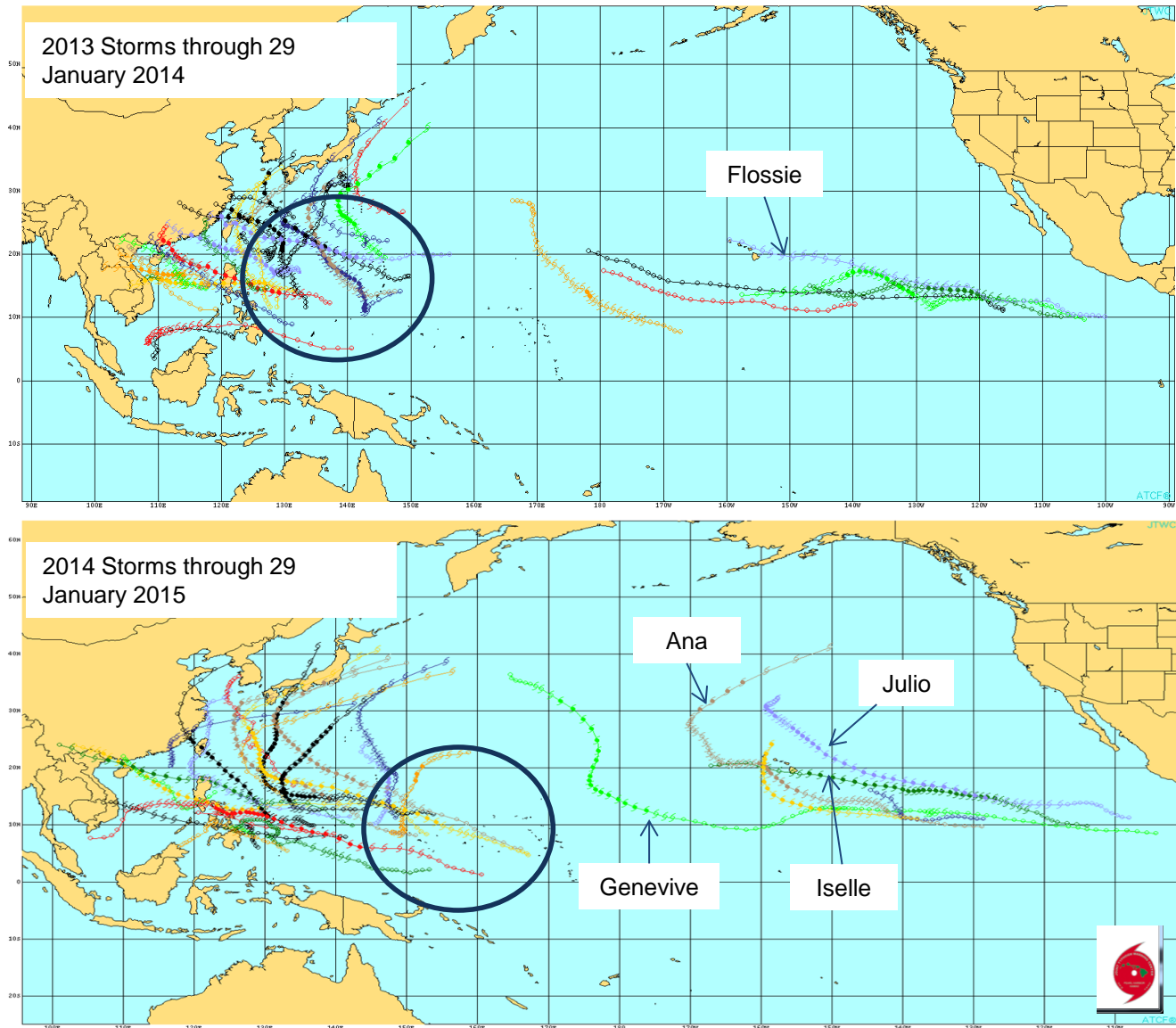
Global crops



From GEOGLAM Crop Monitor <http://www.geoglam-crop-monitor.org/> Latest information up to Nov 28th 2014.

- Potential impacts of a weak El Niño should be considered nonetheless.
 - below-normal rainfall in parts of Asia, Southern Africa, and Australia, potentially affecting rice, maize, and wheat.
 - In major regions of South America, likely above-average rainfall may potentially benefit maize, soy and wheat.

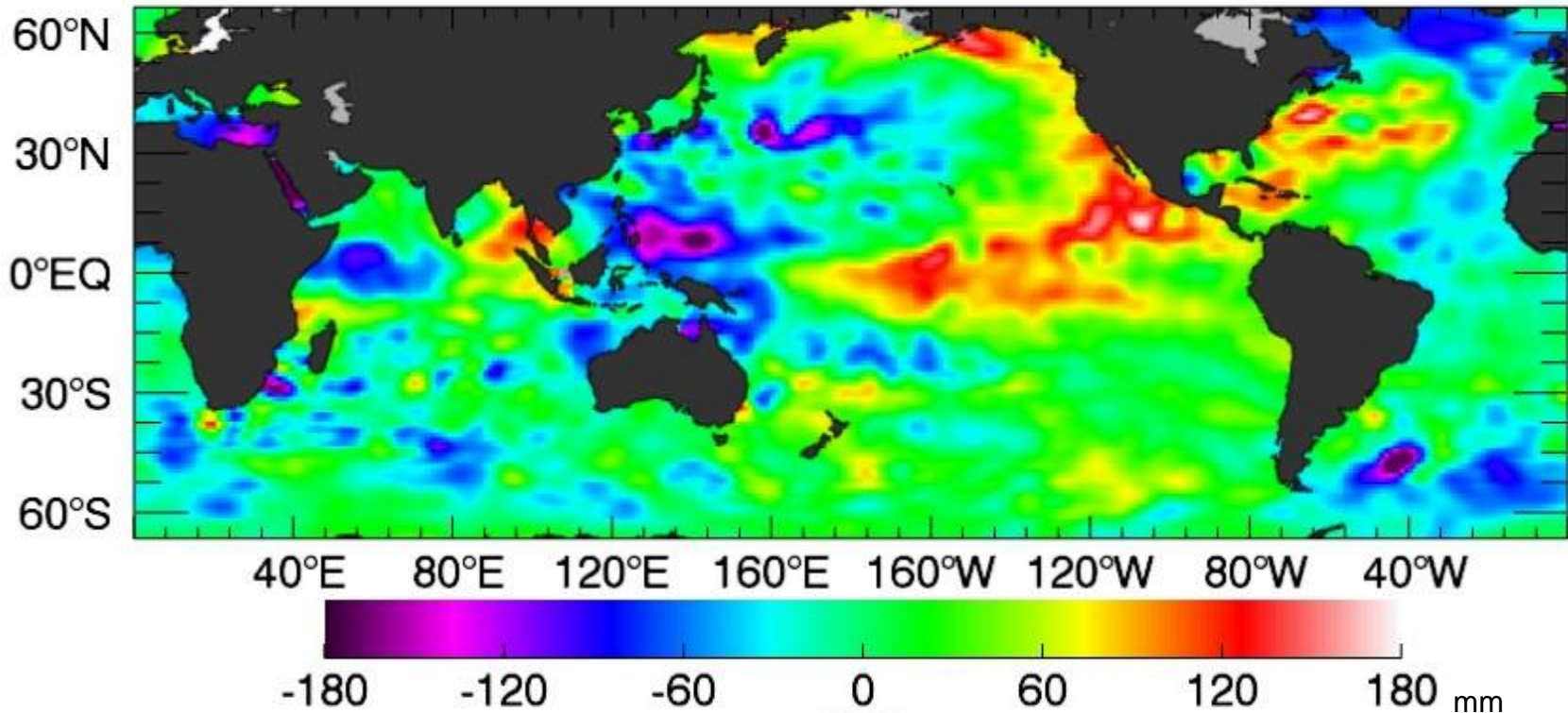
Tropical Cyclones



- West Pacific
 - 2013, 33 TCs, 5 Super Typhoons
 - 2014, 23 TCs, 8 Super Typhoons
 - Tropical Cyclone genesis region has shifted eastward near and to the east of Guam
- East/Central Pac.
 - 2013, 6 TCs form or move over the Central Pac, none of hurricane intensity
 - 2014, 6 TCs form or move over the Central Pac., 5 of which attain Hurricane intensity
- This behavior is consistent with El Niño conditions

Sea Level Observation

Jason-2 Sea Level Residuals JAN 19 2015



Sea Levels have been

- Low over the western part of the Pacific Basin and
- Slightly above average over the Central and Eastern Pacific

PEAC Sea Level Stations

US Affiliated Pacific Islands

Tide Gauge Station	SD of OND (mean)	Monthly mean ¹ deviations			SD of OND (max)	Monthly max ² deviations		
		Observed rise/fall				Observed rise/fall		
		Oct	Nov	Dec		Oct	Nov	Dec
Marianas, Guam	4.1	-1	+1.4	**	4.2	+14	+18	+20
Malakal, Palau	4.5	-1.4	0	+1.5	5.2	+36	+36	+37
Yap, FSM	4.6	-1.6	+0.4	+3.5	4.8	+25	+25	+54
Chuuk, FSM	*	*	*	*	*	*	*	*
Pohnpei, FSM	4.7	*	*	*	4.2	+27	+31	
Majuro, RMI	3.5	+1.7	-1	*	3.0	+42	+39	*
Kwajalein, RMI	3.6	+1.5	-1	-1	3.8	+39	+36	+39
Pago Pago, American Samoa	3.1	+10	+8.7	+7.9	3.8	+35	+32	+31
Honolulu, Hawaii	1.7	+3.4	+1	+1	2.3	+20	+21	+21
Hilo, Hawaii	1.8	+2	+2.5	0	2.8	+22	+25	+25

Remarks:

As compared to previous months, the monthly mean sea level in December remained stable in most of the stations

Palau, Yap recorded slight rise

All stations, except Pago Pago, are near normal

Kwajalein is marginally below normal (+/- 1 inch)

Honolulu and Hilo are also normal

The monthly maximum values registered rise for most of the stations. The rise in Yap is a subject for further investigation

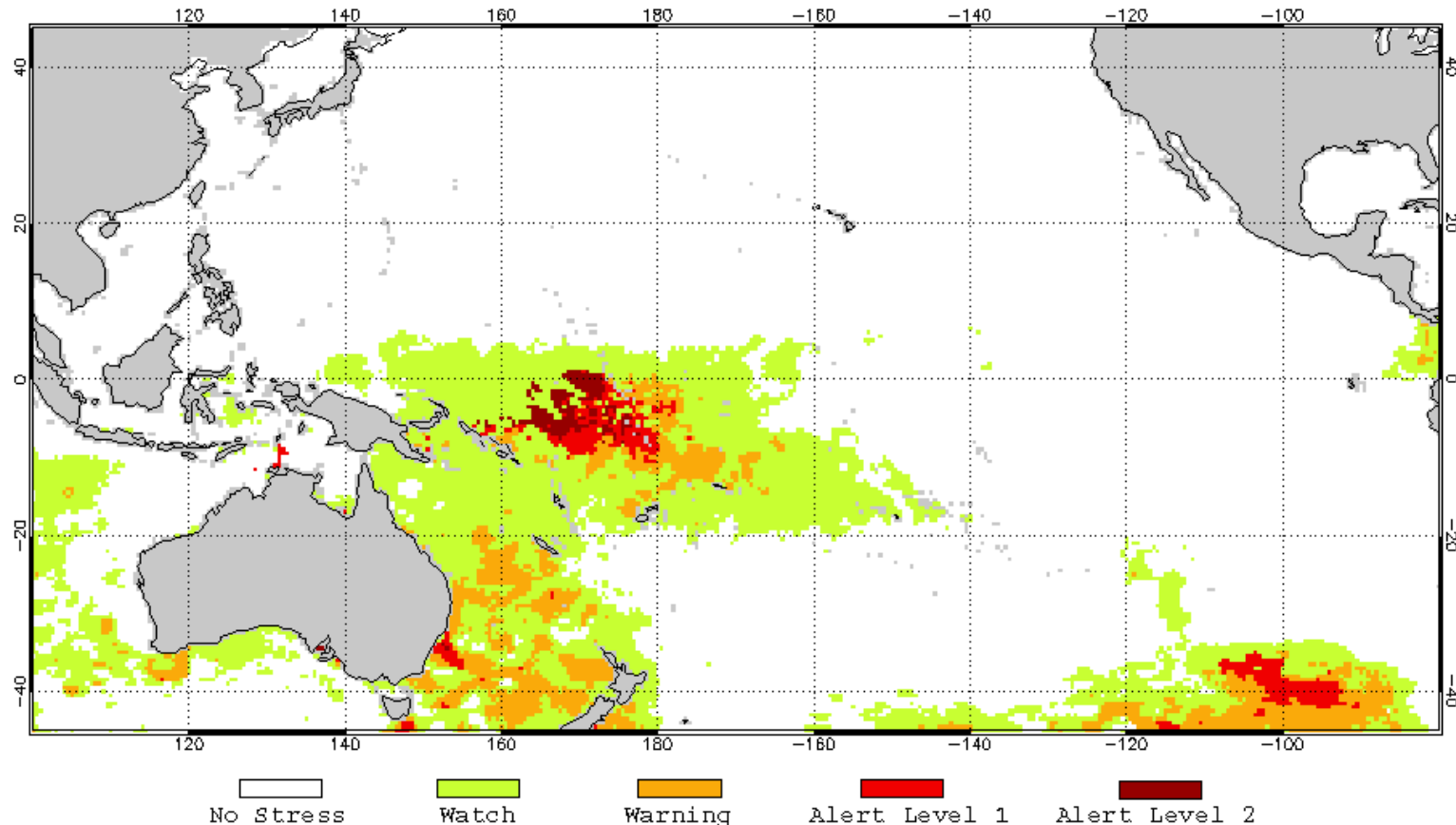
+/- indicate positive anomaly (rise) and negative anomaly (fall) respectively. Note that any changes between (0~ ±1) inch is considered to be negligible. Also note that changes within the range of (+/-) 2 inches are unlikely to cause any adverse climatic impact. ** Guesstimated values, * Data currently unavailable; Figures in parenthesis are year-to-year seasonal anomaly.

1: Difference between the mean sea level for the given month and the 1983 through 2001 mean sea level value at each station (seasonal cycle removed); 2: Same as 1 except for maxima; SD stands for standard deviations. **Red: Falling trend**, **Black: Stable SL**, and **Blue: Rising trend**

Coral Bleaching

Alert Areas

NOAA Coral Reef Watch Satellite Coral Bleaching Alert Area
26 Jan 2015



From Coral Reef Watch <http://coralreefwatch.noaa.gov/satellite/baa.php>

- Large areas across the Pacific Basin are under Watch status, mostly over the eastern part of the basin
- Alert level areas collocated with warmest SST anomalies and low sea levels

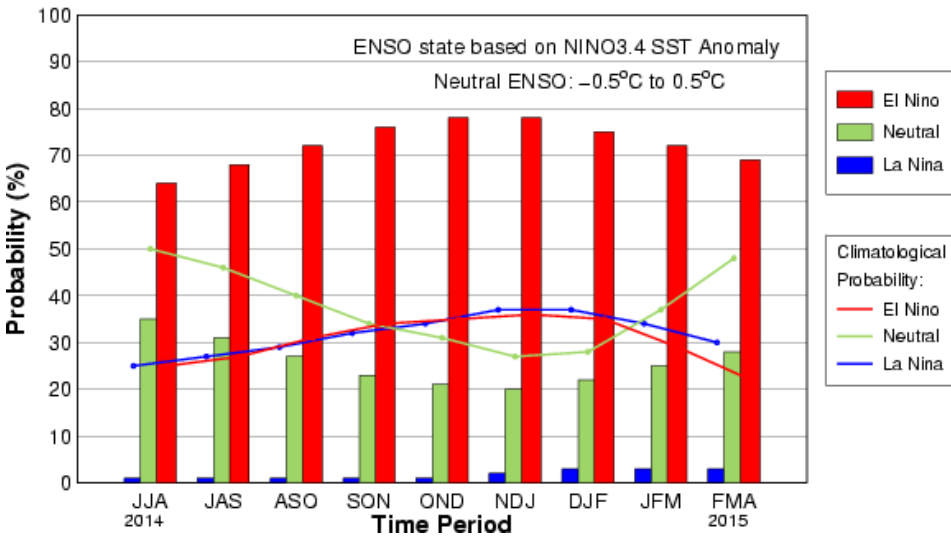
Forecast

ENSO forecasts

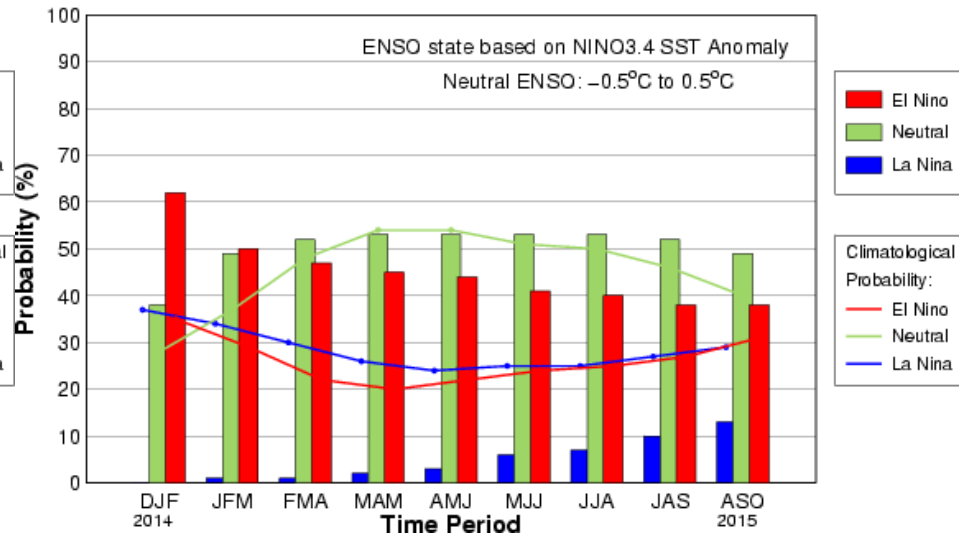
Rainfall, Sea level, Tropical Cyclones and
Coral Bleaching

CPC/IRI ENSO Forecast

Early-Jul CPC/IRI Consensus Probabilistic ENSO Forecast



Early-Jan CPC/IRI Consensus Probabilistic ENSO Forecast



CPC/IRI EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

Expected Conditions

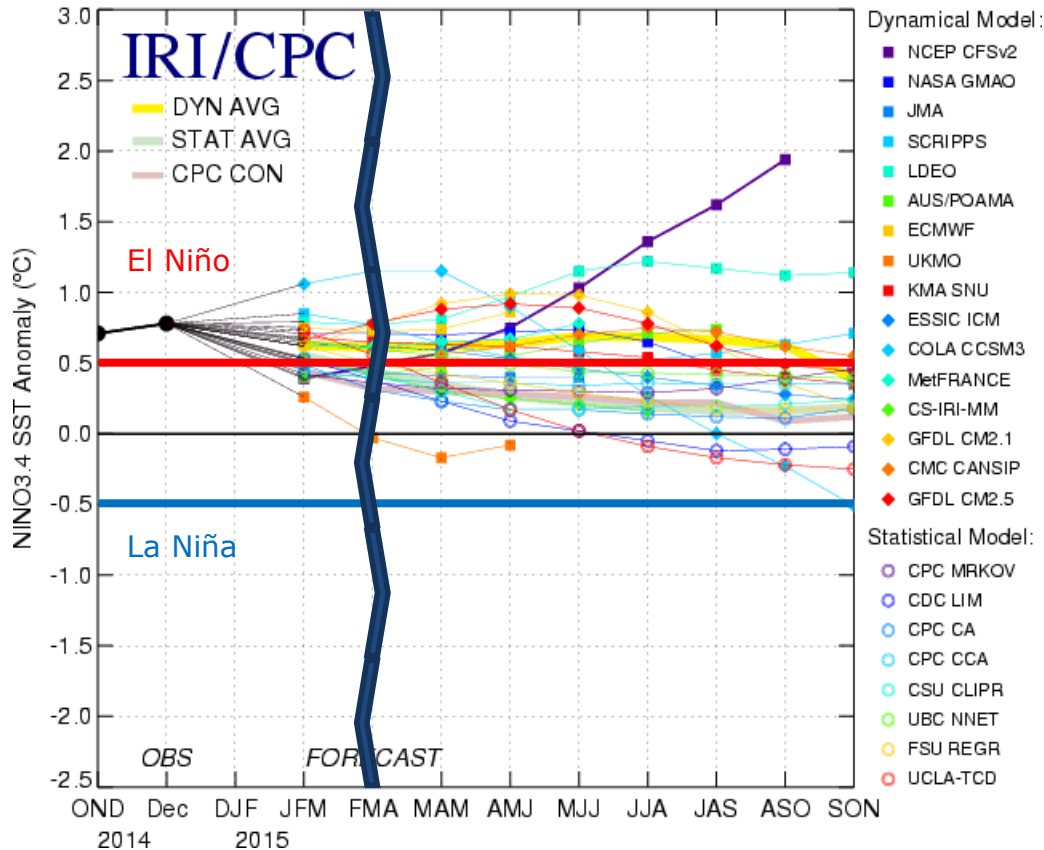
- The consensus of forecasters indicates a ~60% chance of El Niño during the January-March 2015 season
- The probability of drops off very quickly afterwards

Climate Prediction Center
National Centers for Environmental Prediction
NOAA/National Weather Service
College Park, MD 20740

Season	La Niña	Neutral	El Niño
DJF 2014	~0%	38%	62%
JFM 2015	1%	49%	50%
FMA 2015	1%	52%	47%
MAM 2015	2%	53%	45%
AMJ 2015	3%	53%	44%
MJJ 2015	6%	53%	41%
JJA 2015	7%	53%	40%
JAS 2015	10%	52%	38%
ASO 2015	13%	49%	38%

CPC/IRI ENSO Forecast

Mid-Jan 2015 Plume of Model ENSO Predictions



CPC/IRI EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

Expected Conditions

- Most models predict the SST anomalies to remain at weak El Niño levels during December-February 2014-15
- Lasting into the Northern Hemisphere spring 2015
- El Niño, if declared at all, will likely remain weak throughout its duration

Climate Prediction Center
 National Centers for Environmental Prediction
 NOAA/National Weather Service
 College Park, MD 20740

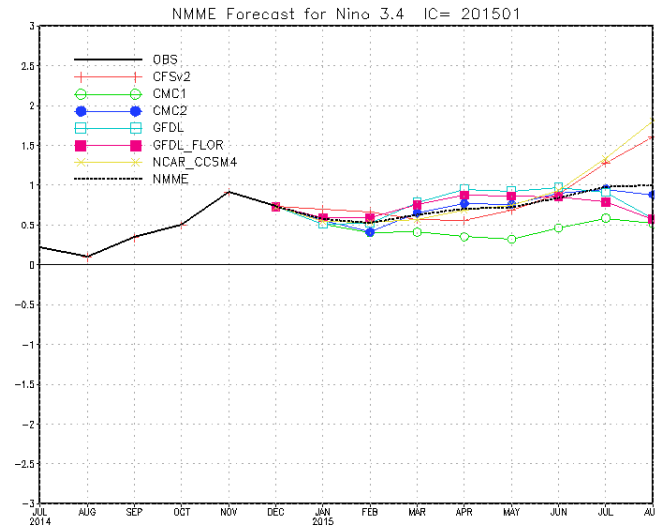
Average Niño 3.4 SST Anomaly Forecast

	JFM	FMA	MAM
Dynamical	0.6	0.6	0.6
Statistical	0.6	0.4	0.3
All Models	0.6	0.6	0.5

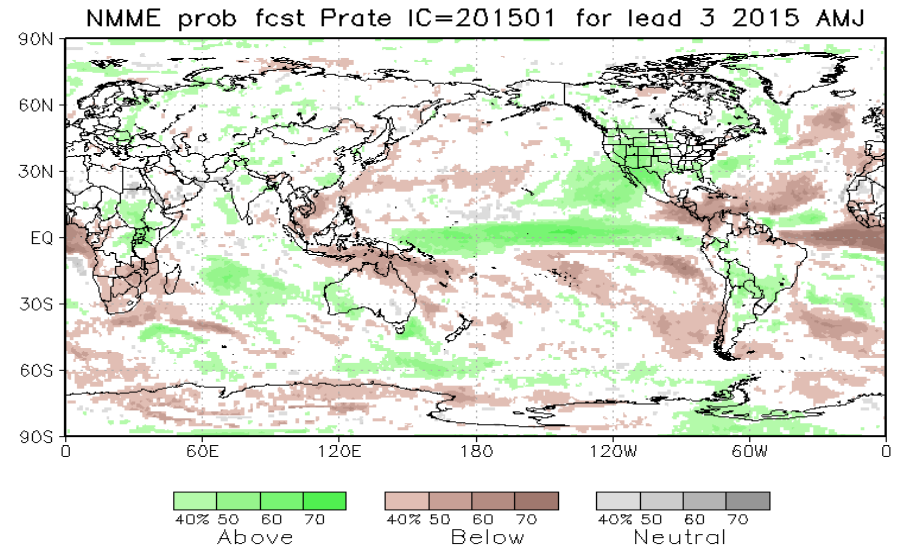
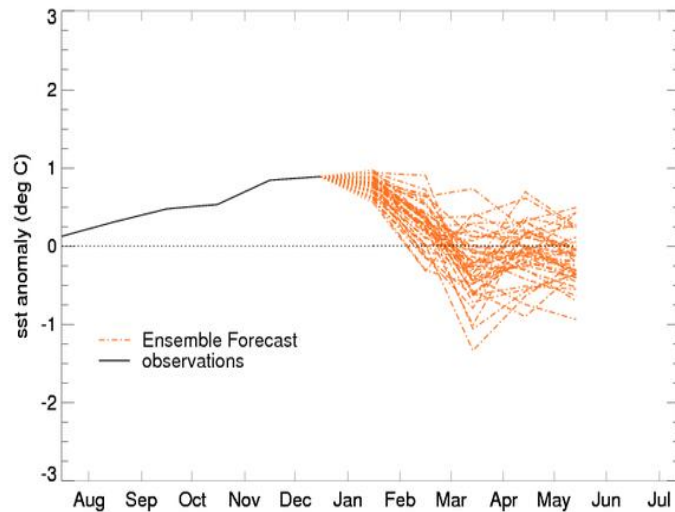
http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/?enso_tab=enso-cpc_update
http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/?enso_tab=enso-sst_table
http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/?enso_tab=enso-iri_update
http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/?enso_tab=enso-sst_table

What do the more extreme scenarios represent

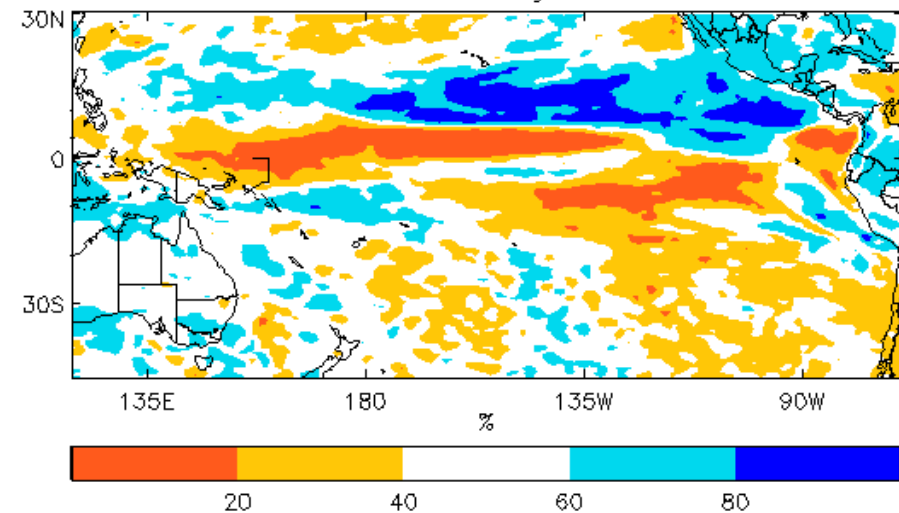
NMME
Peak SST
during JJA



UKMO
Projecting
cold SST
anomalies

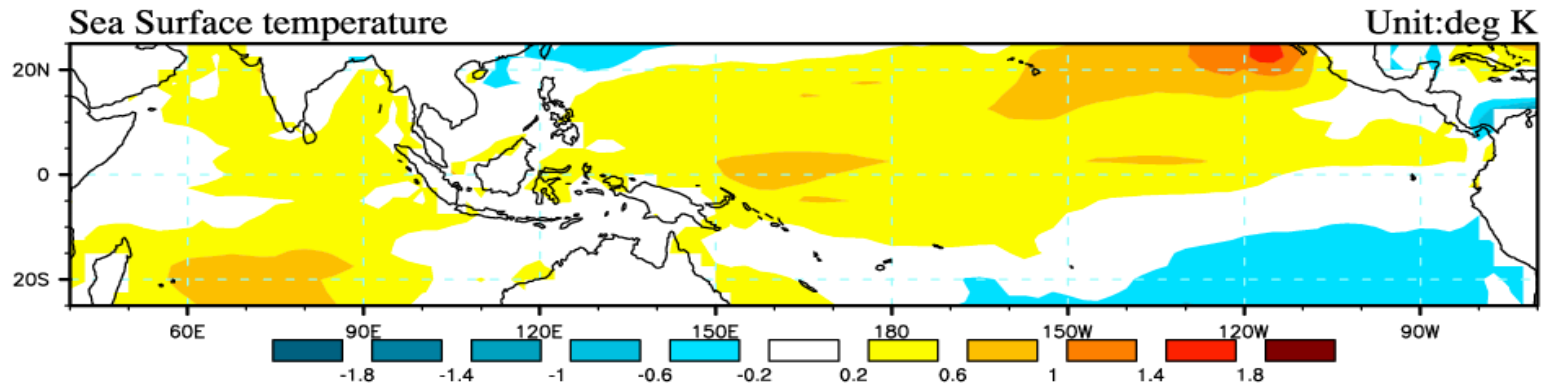


F Probability of above average precipitation Apr/May/June
Issued January 2015

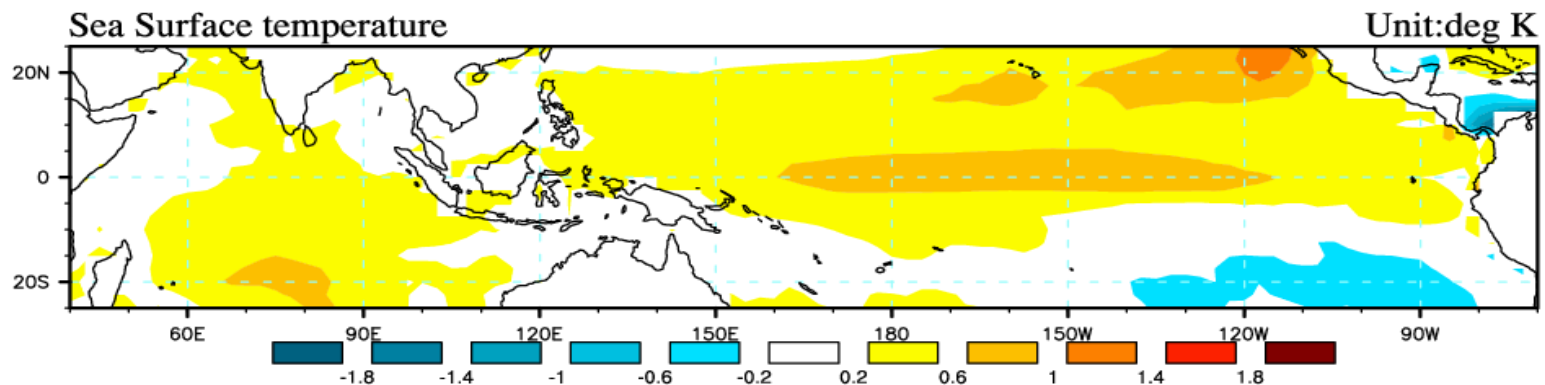


Forecast for continuing weak El Nino like conditions

SST Anomaly for FMA 2015



SST Anomaly for MJJ 2015



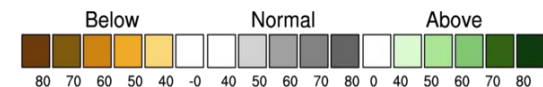
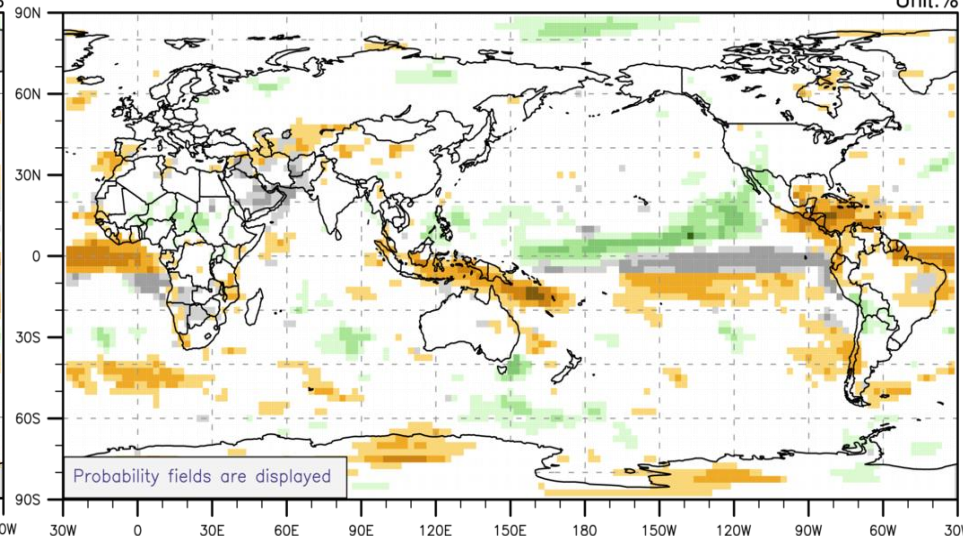
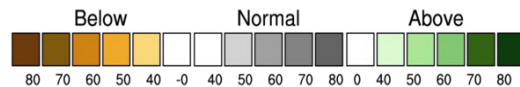
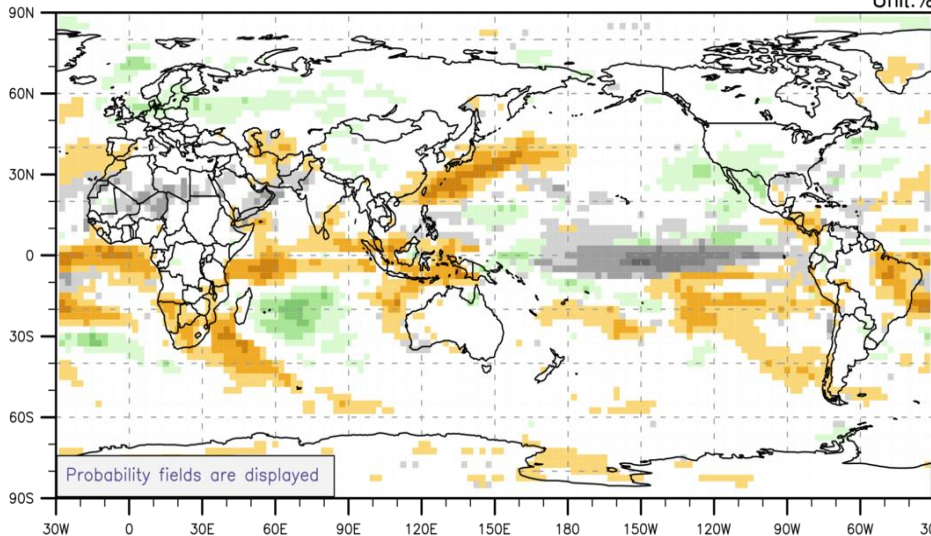
Tropical Rainfall Forecasts (Feb 2014-Jul 2015)

FMA

MJJ

Unit: %

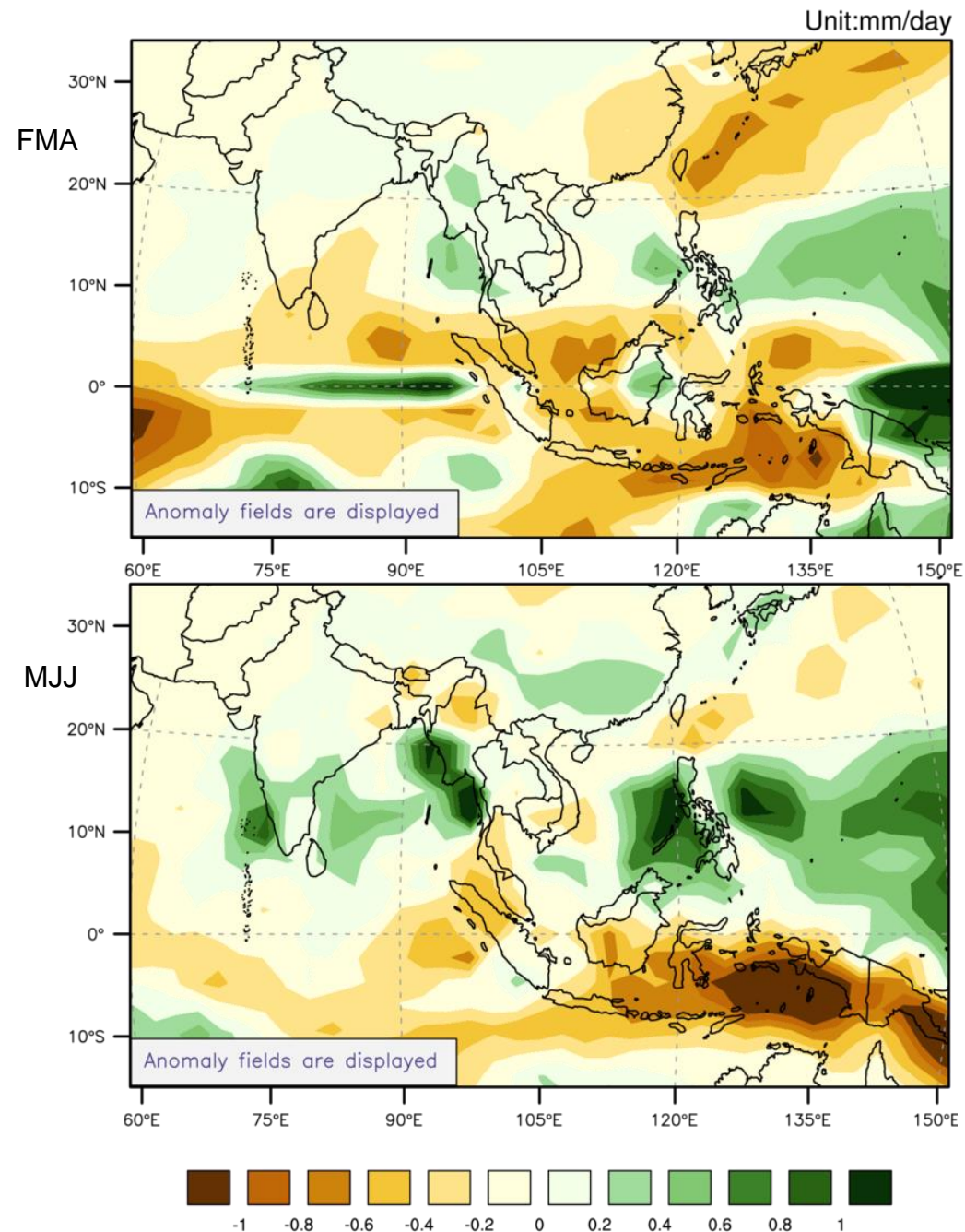
Unit: %



- Central Pacific Rainfall near normal during FMA and above during MJJ
This is a response to warm SSTs developing in the area
- Hawaii likely to get near normal rainfall
- Central And Northern South American likely to see worsening dry conditions

Asia Pacific

- Wet conditions intensify over the tropical Western North Pacific
 - Western Pacific Islands near normal to slightly dry
- China, dry conditions recently observed likely to give way to normal conditions
- India,
 - Dry in the Ganges-Bramaputra-Meghna area
 - Wet conditions to the south
- Philippines projected to receive more rain (unusual during El Nino)
- Thailand and Burma likely to receive more rainfall
- Indonesia may see very dry conditions



US Affiliated Pacific Islands

Rainfall and Sea level forecast

- JFM season rainfall
 - Normal to below normal rainfall for the westernmost stations
 - Normal to Above Normal rainfall for the Central Pacific
 - Dryer than normal conditions for Hawaii
- Sea level is expected to be average to marginally above average and stable

Tide Gauge	Seasonal Mean Anomalies			Forecast Probability
	JFM	FMA	MAM	
Lead time	0M	1M	2M	Outlook
Marianas, Guam	+1	+1	+1	Average
Malakal, Palau	-1	-1	0	Average
Yap, FSM	-1	0	0	Average
Chuuk, FSM	-1	0	0	Average
Pohnpei, FSM	+2	+2	+2	Marginal Above
Majuro, RMI	+2	+2	+2	Marginal Above
Kwajalein, RMI	+2	+2	+2	Marginal Above
Pago-Pago	+2	+2	+2	Average
Honolulu	+1	+1	+1	Average
Hilo	+2	+1	+1	Average

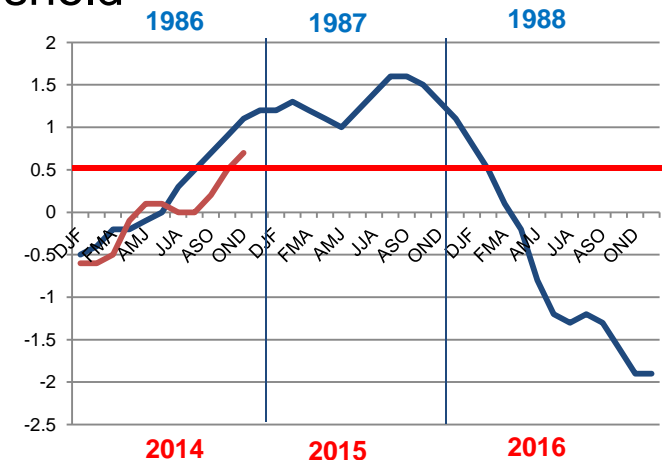
Tropical Cyclone Forecast

- **Western Pacific Basin** (Based on City University of Hong Kong Forecast)
 - February to March, minimum TC activity in this basin
- **US Affiliated Pacific Islands** (Based on PEAC Center Forecast)
 - Near normal risk of TC Landfall for the US affiliated Pacific Islands
 - There are currently no strong factors present that are known to reliably affect the upcoming tropical cyclone distribution in the region
 - no outlooks for regionally tropical cyclone activity are offered at this time
 - American Samoa, 41% increase in TC risk, specially during weak/moderate events
- **Australia** (Based on Australian BOM Forecast)
 - Average to Below Average Cyclone season, Nov 1 – Apr 30
- **Indian Ocean**
 - April and May, pre-monsoon active period, no strong link to El Niño

Synopsis

Current Conditions

- Current ENSO status is **NEUTRAL**
- SST anomalies meandering near El Niño threshold
- Large scale atmospheric anomalies weak
- It is rare for an event to peak during summer/fall
 - 1986-87-88 event:



Observed Impacts

- Somewhat consistent with an El Niño
 - Dry conditions over India, and the North of South America
 - The Maritime Continent and Australia shifted quickly from dry (El Niño like) to wet (La Niña like)
 - Tropical Cyclone activity resembles what is expected during El Niño
 - Atlantic, quiet season
 - Pacific, TC genesis moved east with TCs affecting Micronesia and Guam
 - Enhanced TC activity near Hawaii
 - Low sea levels across the Western Pacific

Forecast Summary

General El Niño Forecast

- Most of the models continue to predict El Niño to develop during January-March (~50%)
- Forecasts favor a weak El Niño

Forecast Impacts

- Rainfall
 - Below average Rainfall in Northern Australia, Thailand
 - Near normal rainfall over most of Asia
 - USAPIs likely near normal to below normal
- Sea Level
 - Likely to remain near to below normal over the western Pacific Basin through May rising afterwards
- TCs
 - Near normal risk for most USAPIs, above for American Samoa
 - Least active part of the year for the Western Pacific
 - April and May usually active over the Indian Ocean



The PEAC Center

The Pacific ENSO Applications Climate
Center

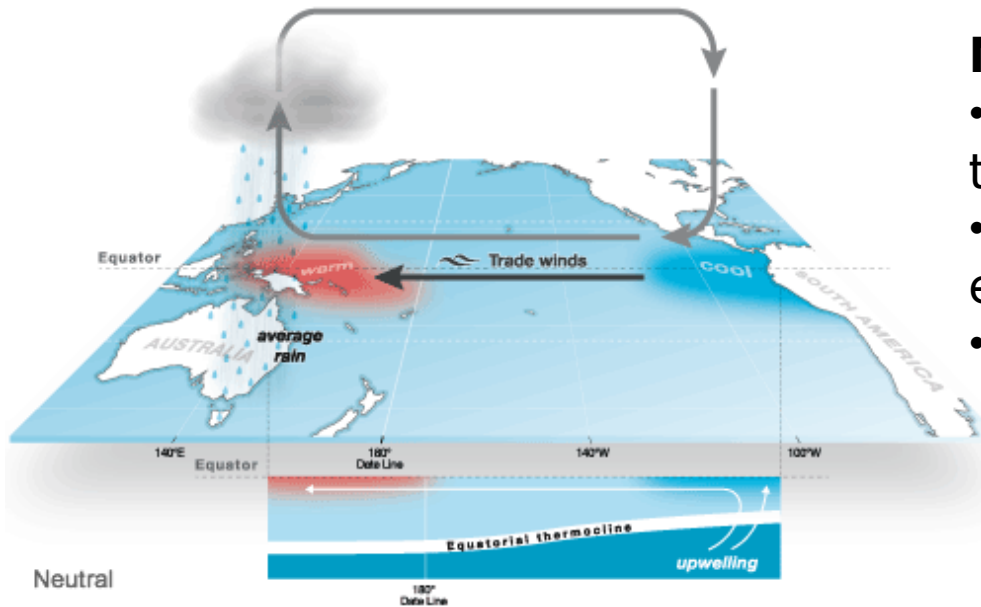


Photo courtesy of Lt.
Charlene Felkley

SUPPORT SLIDES

El Niño general characteristics, and other useful information

El Niño in a nutshell

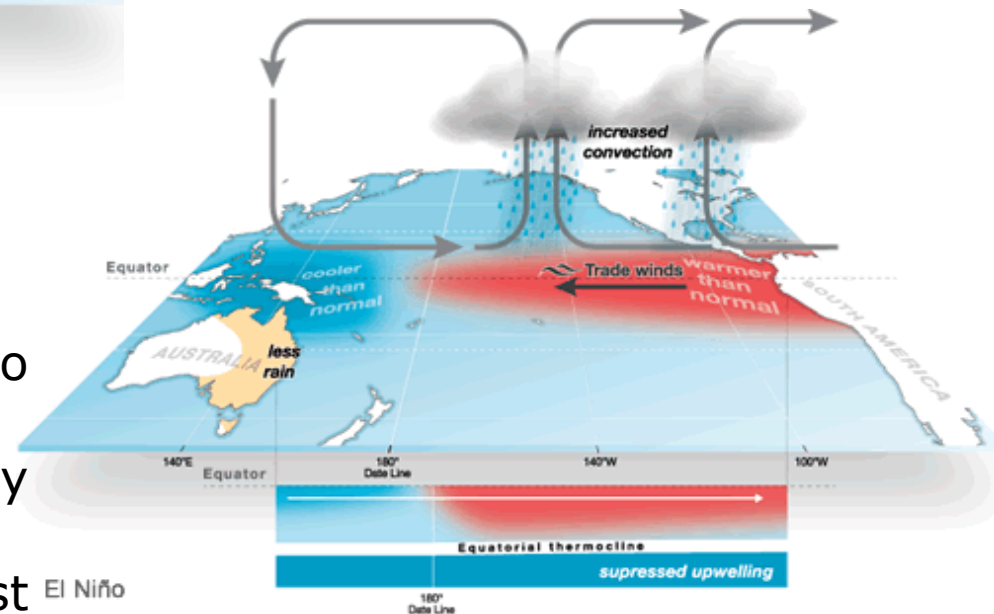


Neutral Conditions:

- Cold sea surface temperatures to the east and warm to the west
- Strong trade winds blowing from east to west
- Rainfall over the Western Pacific

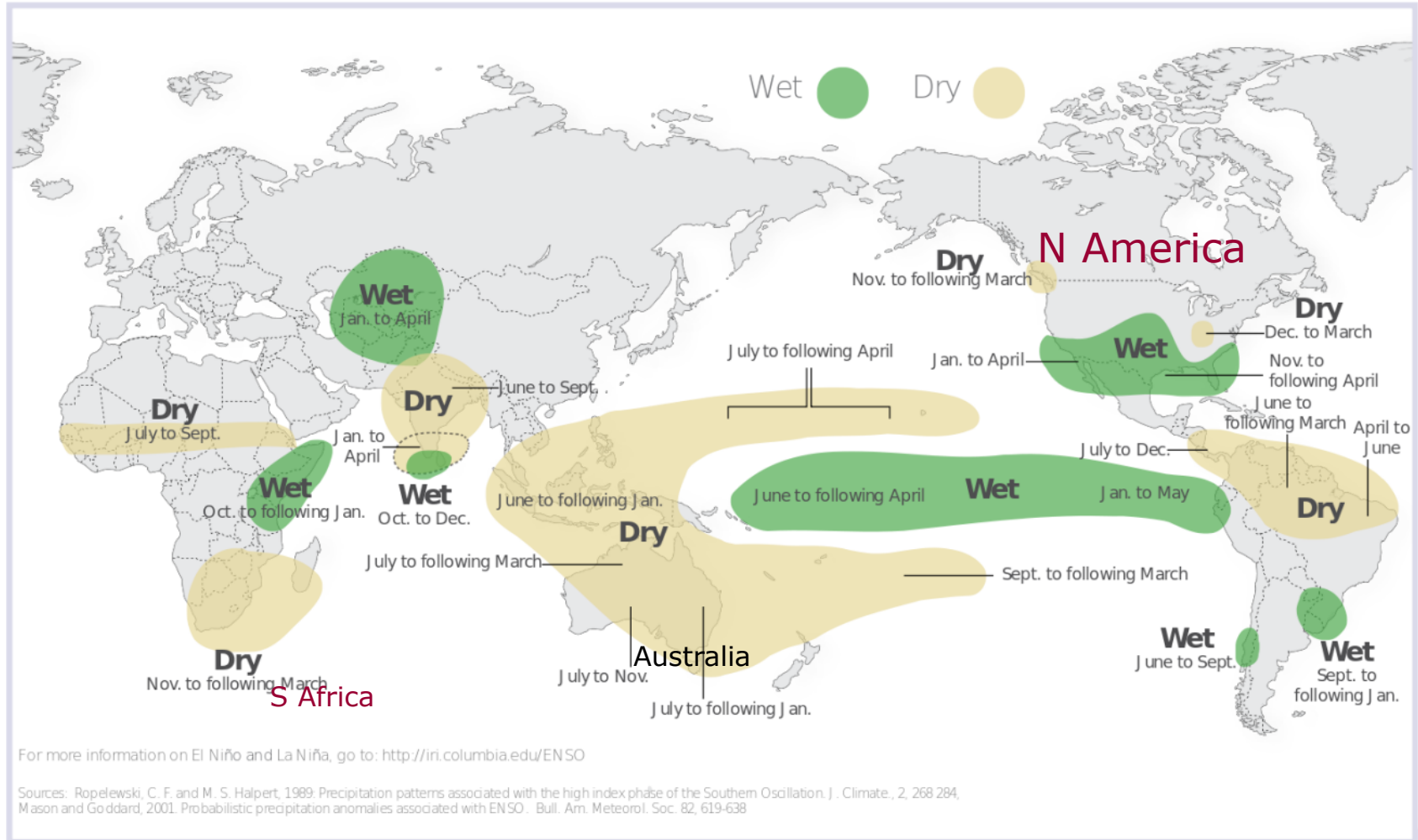
El Niño Conditions:

- Warm sea surface temperatures to the east and cold to the west
- Weakened trade winds, westerly winds over east Pacific
- Rainfall over the Central and East Pacific



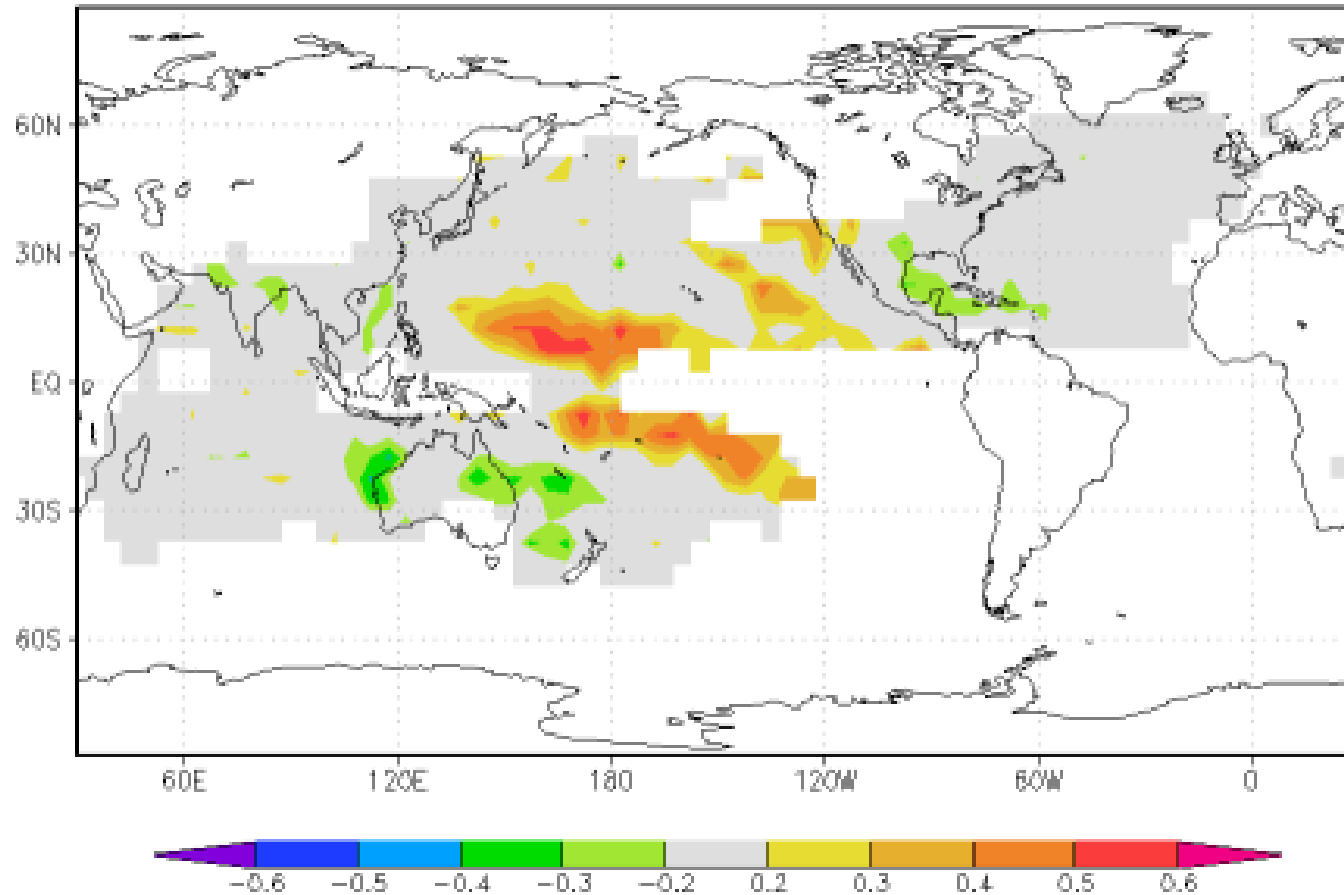
El Niño and Rainfall

El Niño conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. Although they vary somewhat from one El Niño to the next, the strongest shifts remain fairly consistent in the regions and seasons shown on the map below.



El Niño and Tropical Cyclones

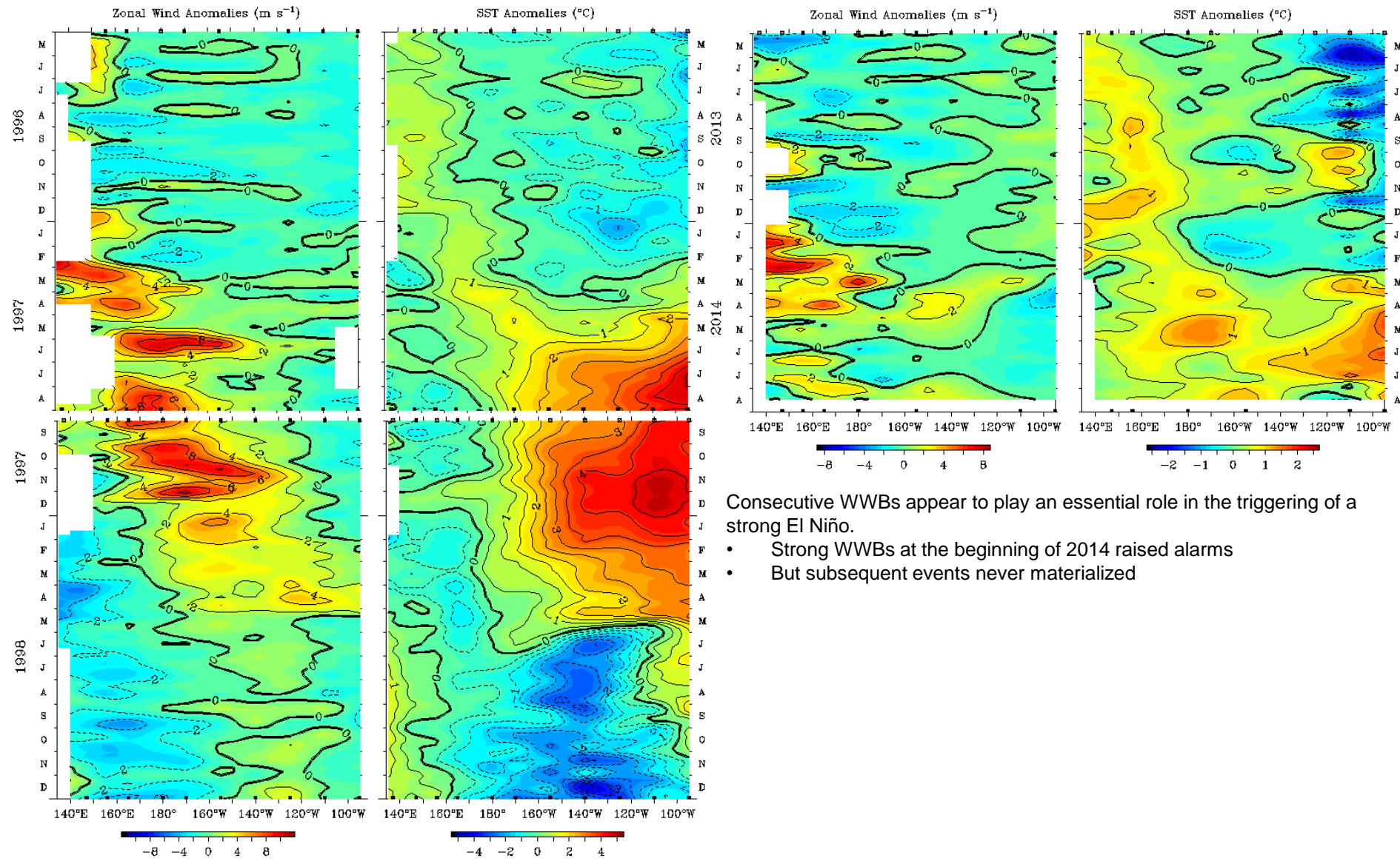
corr Jul–Jun averaged NINO3.4 index
with Jul–Jun averaged MIT #TS tracks 1856:2004



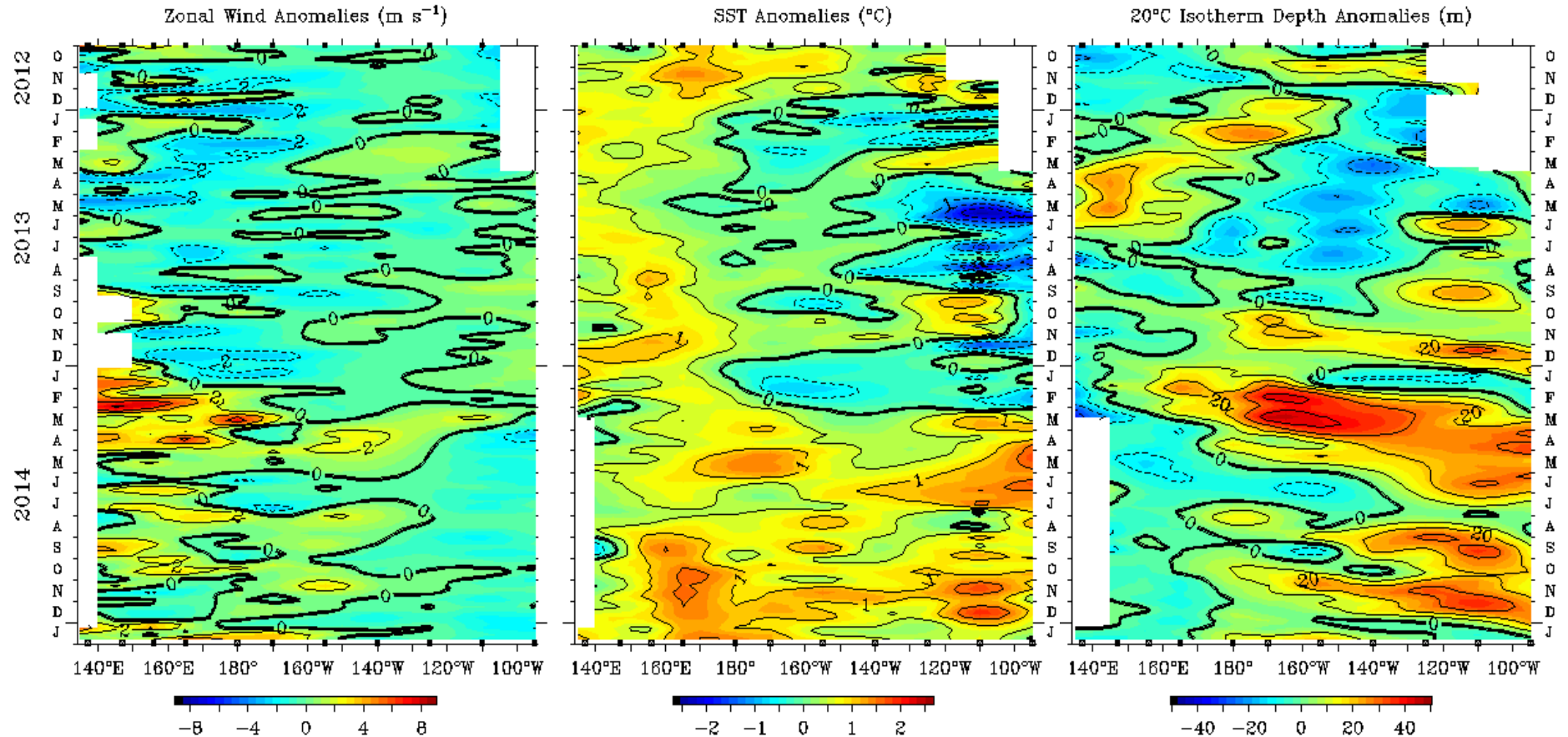
El Niño shifts TC genesis Eastward over the North and South Western Pacific

- Less TC activity
 - Australia
 - Philippines
- More TC activity
 - Tropical Pacific
 - Hawaii
 - American Samoa

Westerly Wind and Ocean Response: 1997-98 vs Now



TAO ARRAY EQUATORIAL SSTs & ZONAL WIND



© Project Office/PMEL/NOAA

Jan 26 20

Jan 26 201.

The lack of westerly equatorial winds April 2014 appears to have hindered the development of a strong El Niño event during this year.

The thermocline in recent weeks has become shallower over the eastern Pacific, between 120°W and 100°W, shutting off warm SST anomalies of the coast of Peru.

http://www.pmel.noaa.gov/tao/jsdisplay/plots/gif/uwnd_sst_iso20_anom_nocap.gif

5 Day EQ UWND SST 20C Anomalies

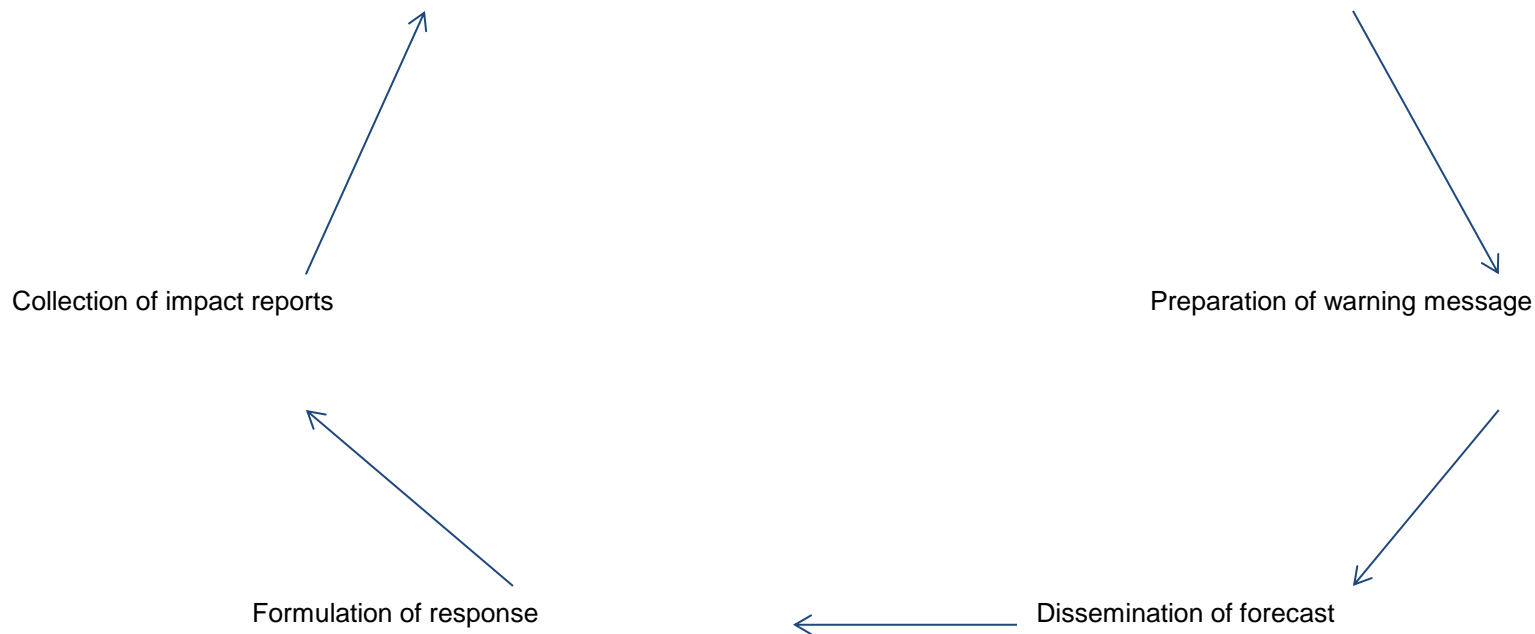
PEAC OUTREACH

From forecast onward

PEAC Center: Forecast-to-Verification

- The PEAC Center is involved in all stages of the forecast to mitigation process

Articulation of general ENSO forecasts and USAPI specific forecast



PEAC Center and the 2014 El Niño

- When the early signs of a developing El Niño were clear during early 2014
 - The development of El Niño was discussed in our conference call as early as February
 - Reaching PEAC Contributors
 - Special issue of the PEAC Newsletter sent out to our users during April
 - Reaching PEAC Newsletter recipients ~400
 - PEAC site visit was programmed for July
 - Directly reaching local government officials and decision makers
 - Also served as an internal evaluation of PEAC Operations



PEAC partnership

- The PEAC Center strives to foster a sense of community and partnership with the communities we serve
 - This is specially important to effectively reach local governments and decision makers and affect local adaptation and mitigation policy
 - PEAC Center contributors are an integral part of the PEAC Forecasts-to-Feedback process



PEAC contacts

- Pacific ENSO Applications Climate (PEAC) Center:

LTJG Carl Noblitt, PEAC Outreach Officer, at [808-956-2324](tel:808-956-2324) for information on PEAC, the Pacific ENSO Update and ENSO-related climate data for the Pacific Islands.

Dr. Rashed Chowdhury, Principal Research Scientist, at 808-956-2324 for information on ENSO and sea-level variability in the USAPI.

Alejandro Ludert, Graduate Research Assistant and Webmaster, at 808-956-2324 for information related to the PEAC website.

- Weather Forecast Office (WFO) Guam:

Chip Guard, Warning Coordination Meteorologist, at 671-472-0900 for information on tropical cyclones and climate in the USAPI.

- University of Guam - Water and Environmental Research Institute (WERI):

Dr. Mark Lander, PEAC Meteorologist, at 671-735-2685 for information on tropical cyclones and climate in the USAPI.

- University of Hawai'i - Joint Institute of Marine and Atmospheric Research (JIMAR), School of Ocean and Earth Science and Technology (SOEST), Department of Oceanography:

Dr. Mark Merrifield, PEAC Principal Investigator at 808-956-6161 for more information on sea level and climate in Hawai'i.

- NOAA National Weather Service, Weather Forecast Office (WFO) Honolulu:

Tom Evans, PEAC Director, at 808-973-5270 NOAA National Weather Service

Sea Level Forecasts

POAMA Model Forecasts

- Sea Level across the Western Pacific Basin is predicted to
 - Continue falling for the next few months
 - Stay well below normal through June 2015
- These forecast anomalies seem too strong!

