



CPC ENSO Update: El Niño 2015-2016

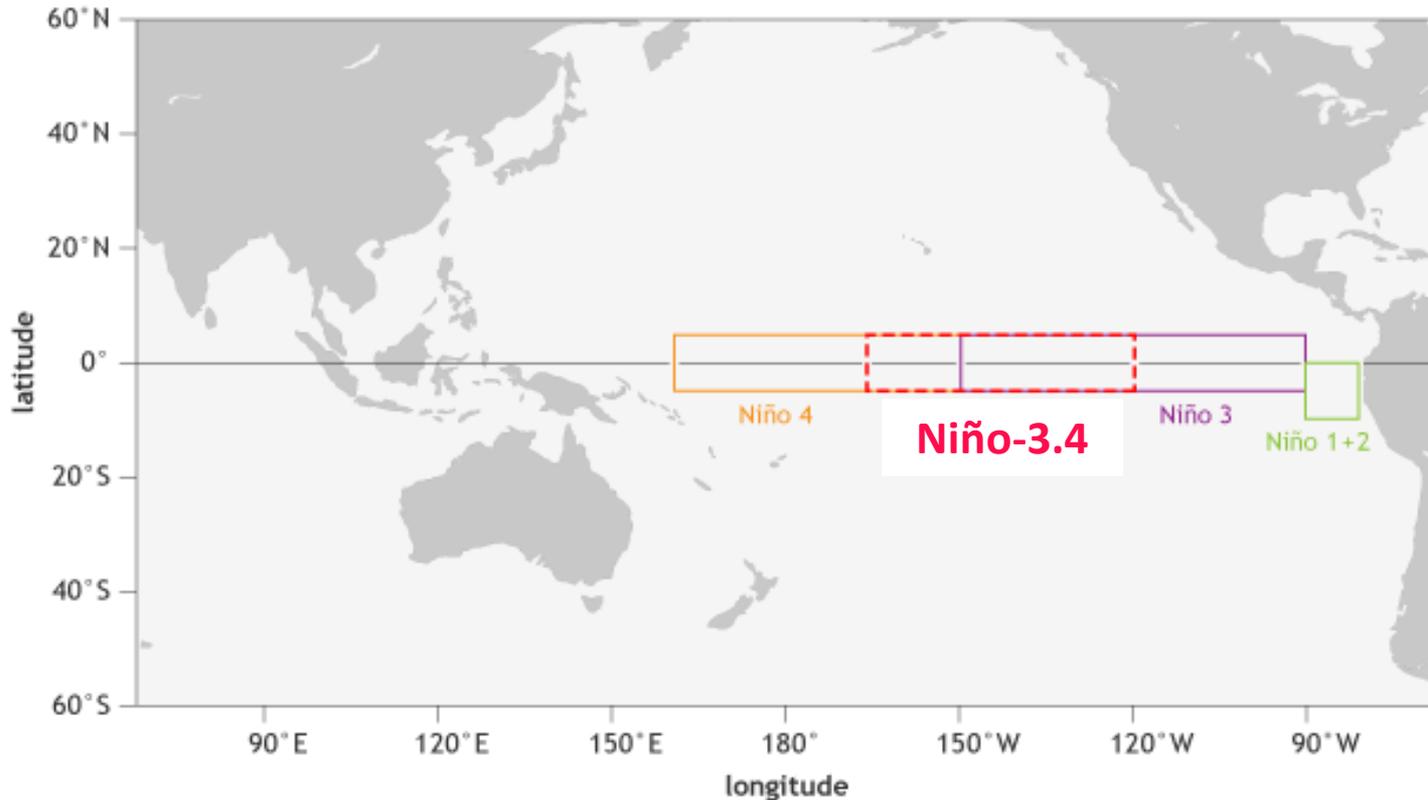
Michelle L'Heureux
Climate Prediction Center (CPC)

NWS National Climate Services Meeting
May 2016

CPC/IRI ENSO Team: Tony Barnston*, Emily Becker*, Gerry Bell, Tom Di Liberto*, Jon Gottschalck, Mike Halpert*, Zeng-Zhen Hu, Vern Kousky, Wanqiu Wang, Yan Xue

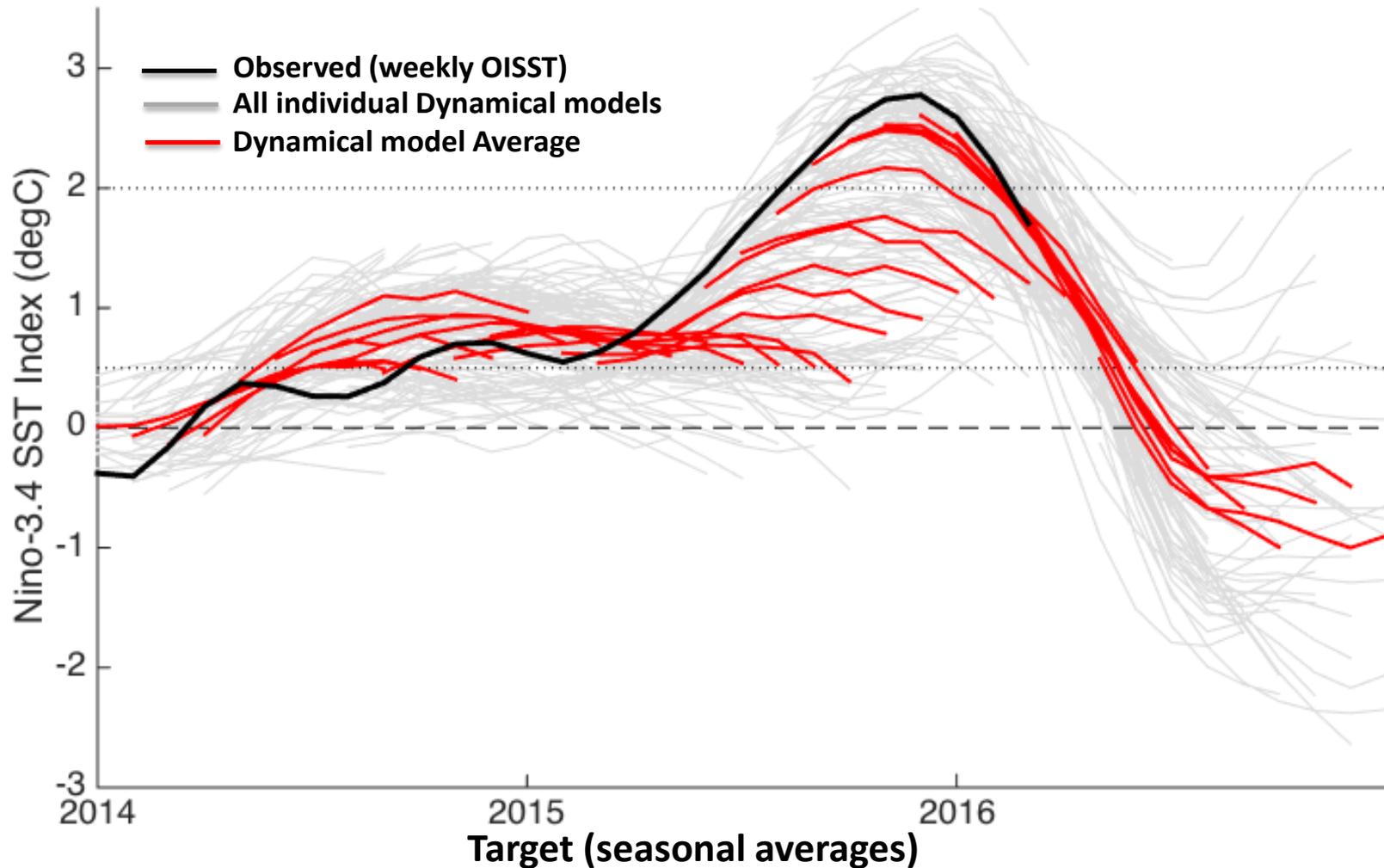
* ENSO Blog sponsored by NOAA CPO/climate.gov

“Niño Regions” of Sea Surface Temperatures (SST)



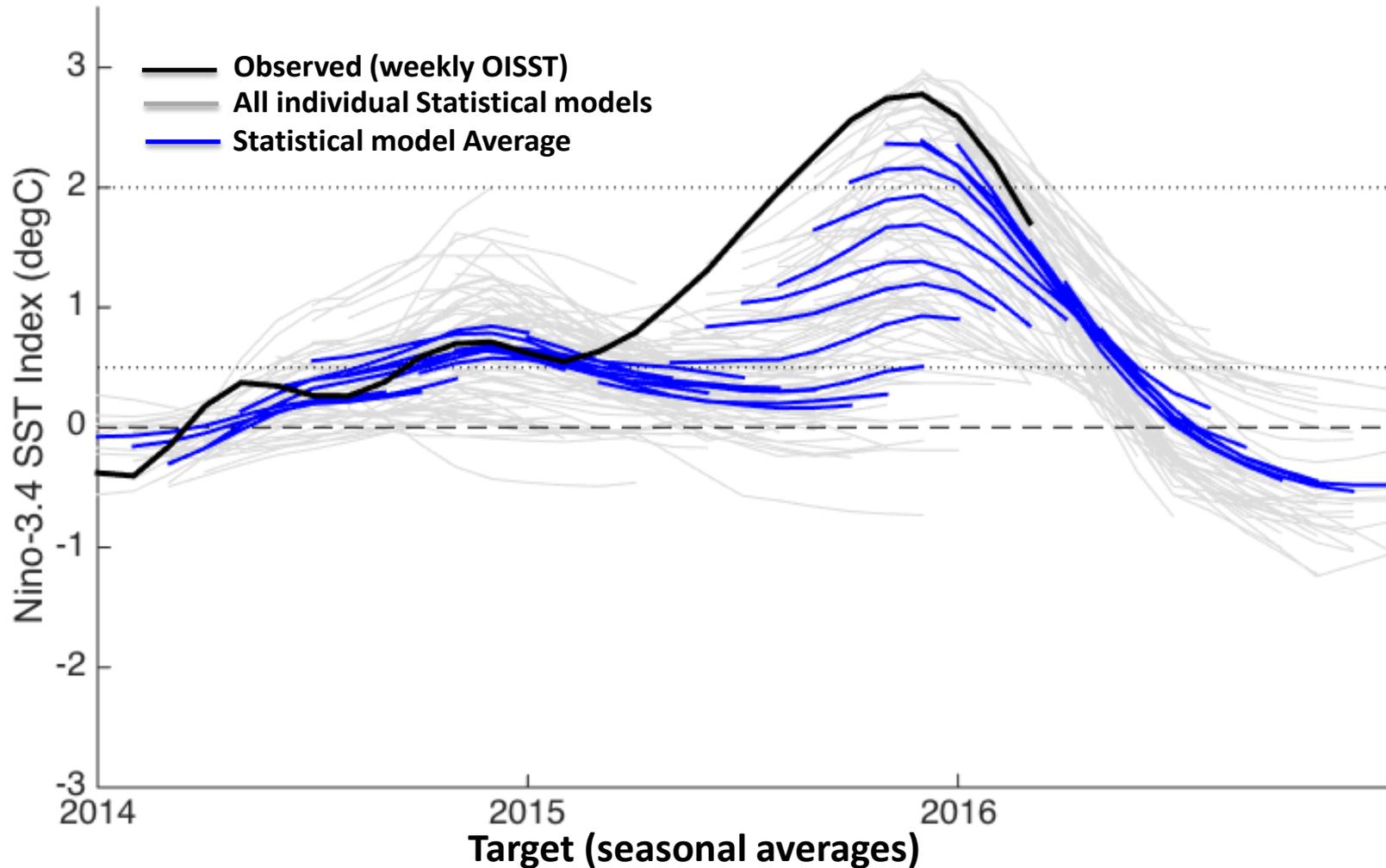
- Borderline El Niño/Neutral during the 2014-15 Northern Hemisphere winter (warm SSTs, but lackluster atmospheric response)
- El Niño Advisory declared by NOAA in March 2015. Strong event anticipated by June.
- Seasonal Niño-3.4 SST values predicted by NOAA to be in excess of 2.0°C (Top 3 event) by early August 2015.

IRI/CPC Dynamical Models (All Leads)



- Dynamical models were generally too warm for target forecasts in 2014.
- Forecasts were better during 2015-16, but still underestimated the peak.

IRI/CPC Statistical Models (All Leads)

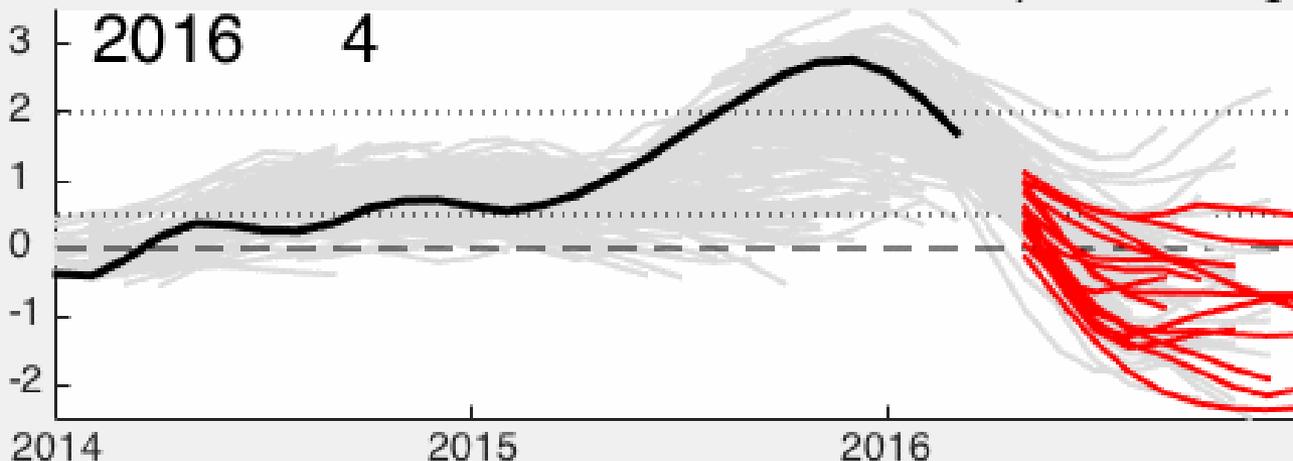


- Statistical model average performed better in 2014 than Dynamical.
- Statistical Models were *much slower* to pick up on El Niño growth in 2015 and also underestimated peak strength.

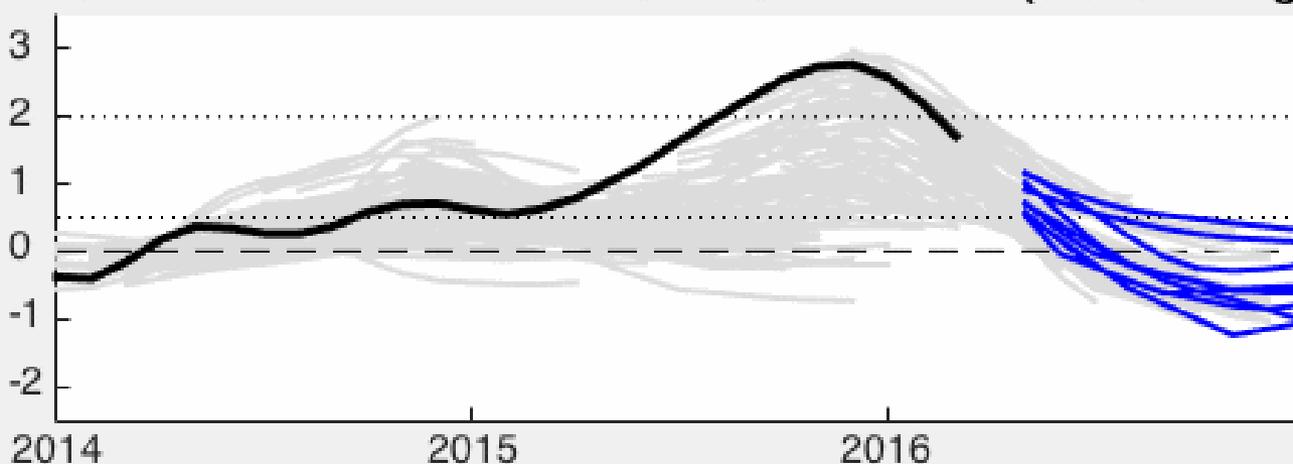
Animation of Model Forecasts over the Past 2+ Years

- Observed (weekly OISST)
- Past individual model forecasts
- All Individual Statistical models
- All Individual Dynamical models

Ensemble Mean IRI/CPC Plume DYNAMICAL Fcsts (Seasonal Avgs)



Ensemble Mean IRI/CPC Plume STATISTICAL Fcsts (Seasonal Avgs)

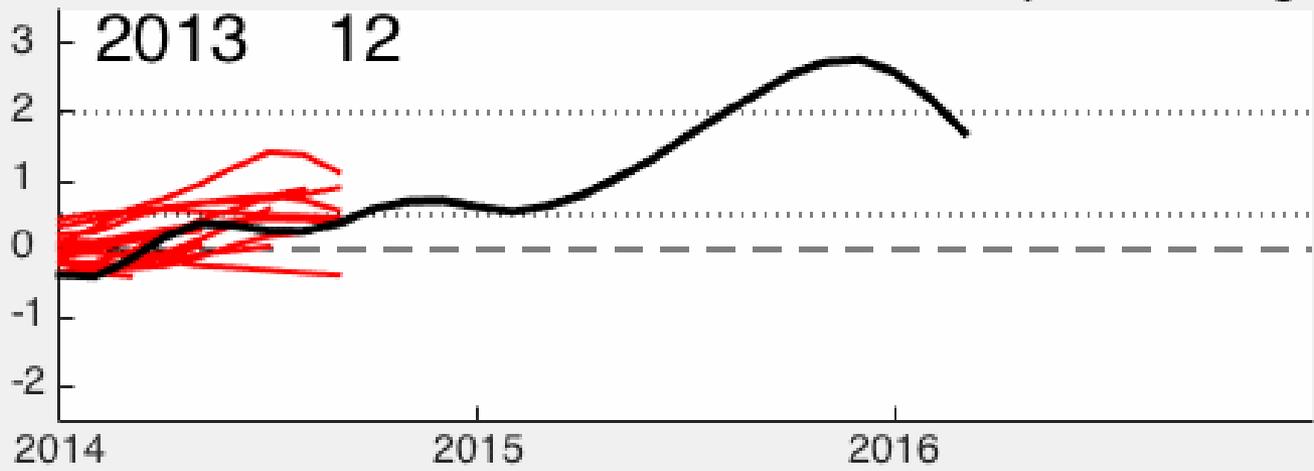


Target (seasonal averages)

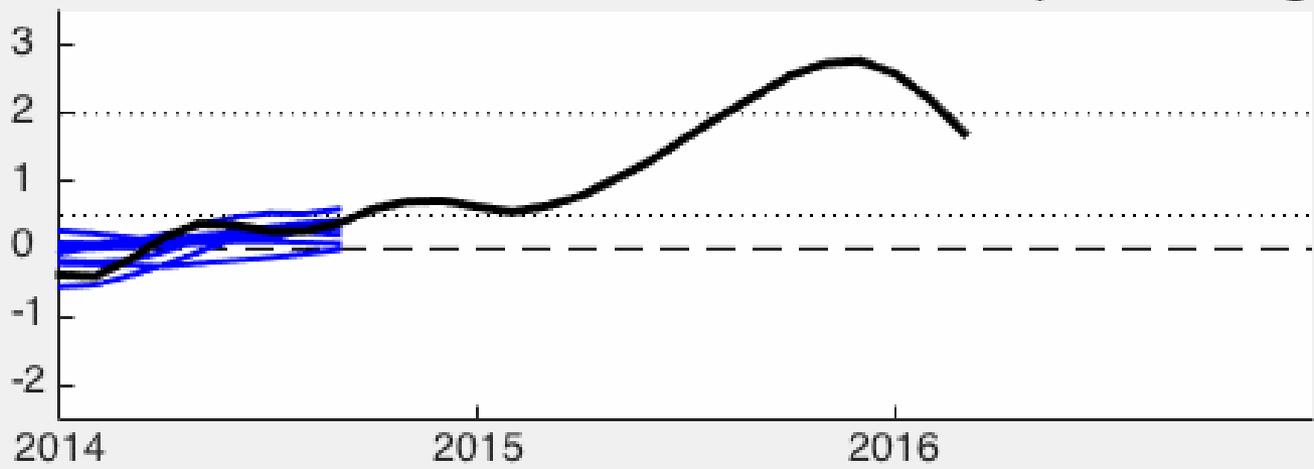
Animation of Model Forecasts over the Past 2+ Years

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Ensemble Mean IRI/CPC Plume DYNAMICAL Fcsts (Seasonal Avgs)

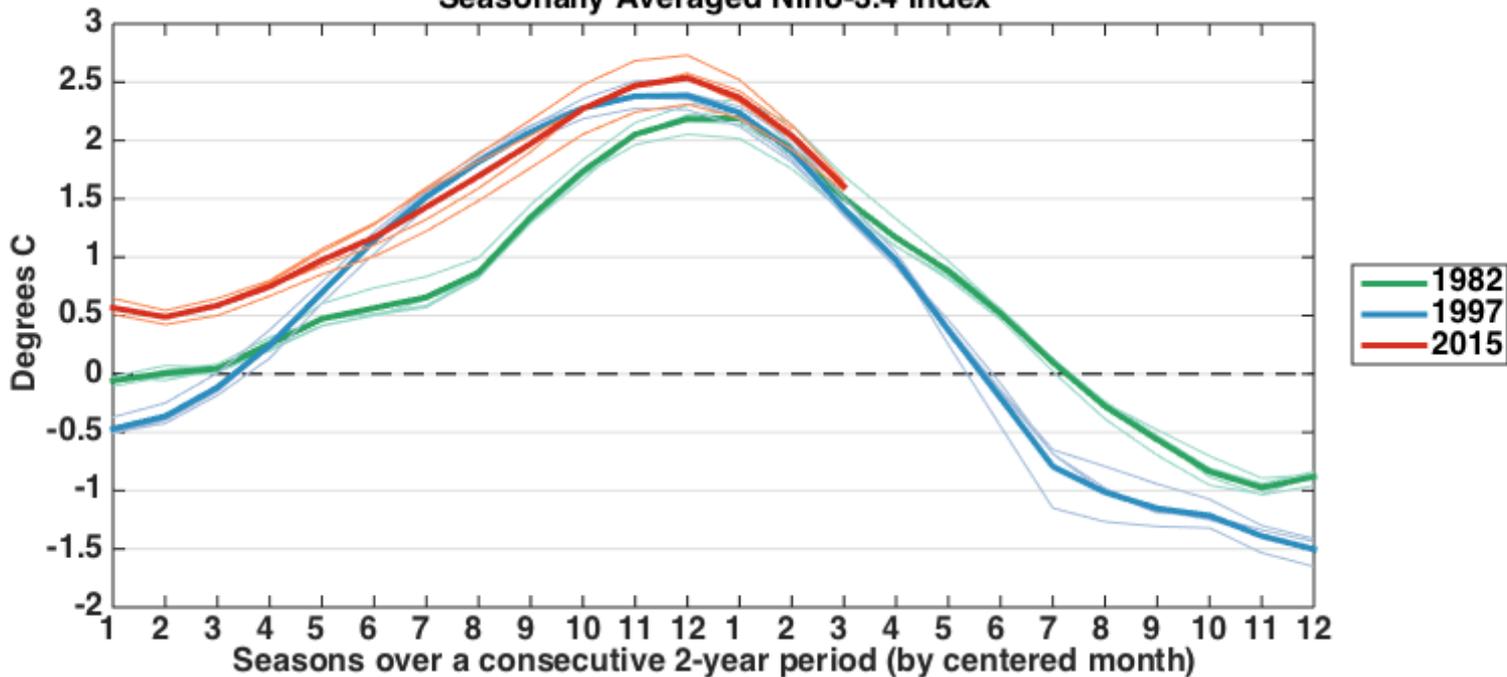


Ensemble Mean IRI/CPC Plume STATISTICAL Fcsts (Seasonal Avgs)

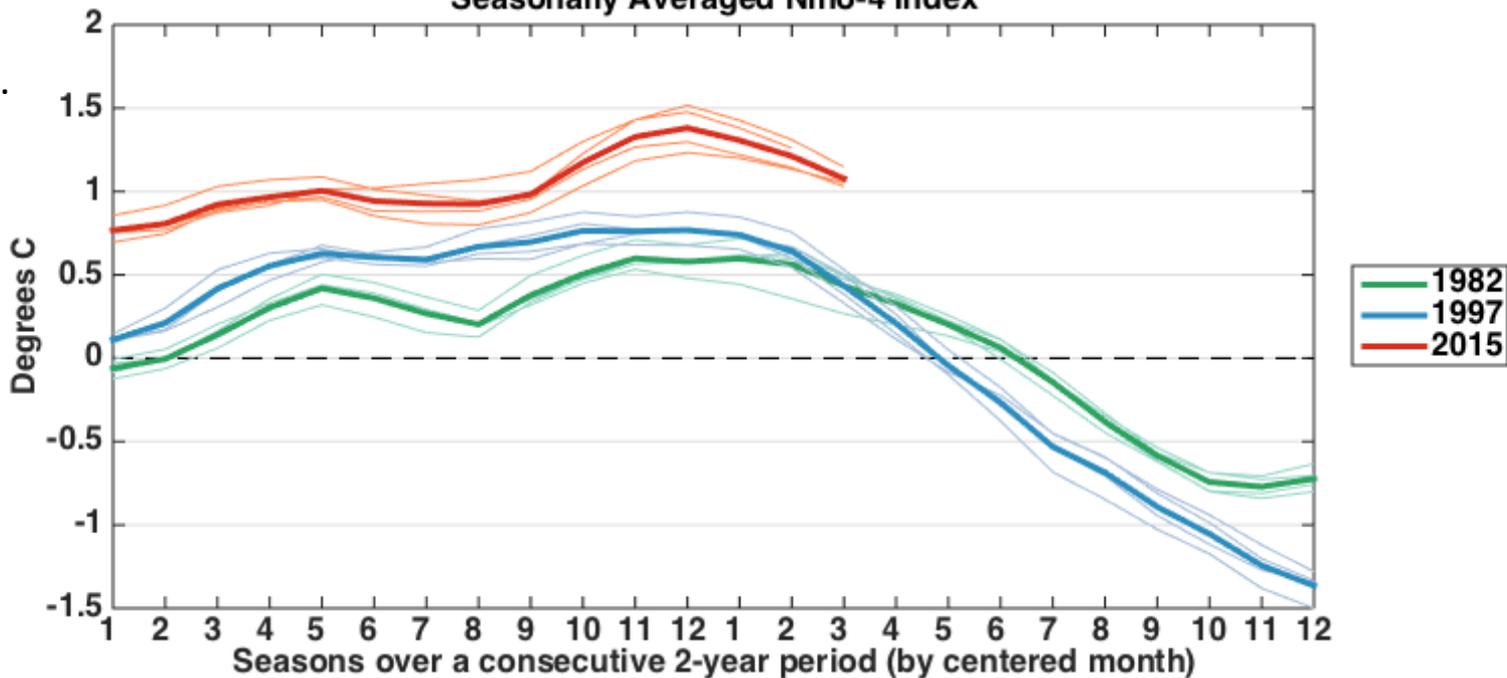


Target (seasonal averages)

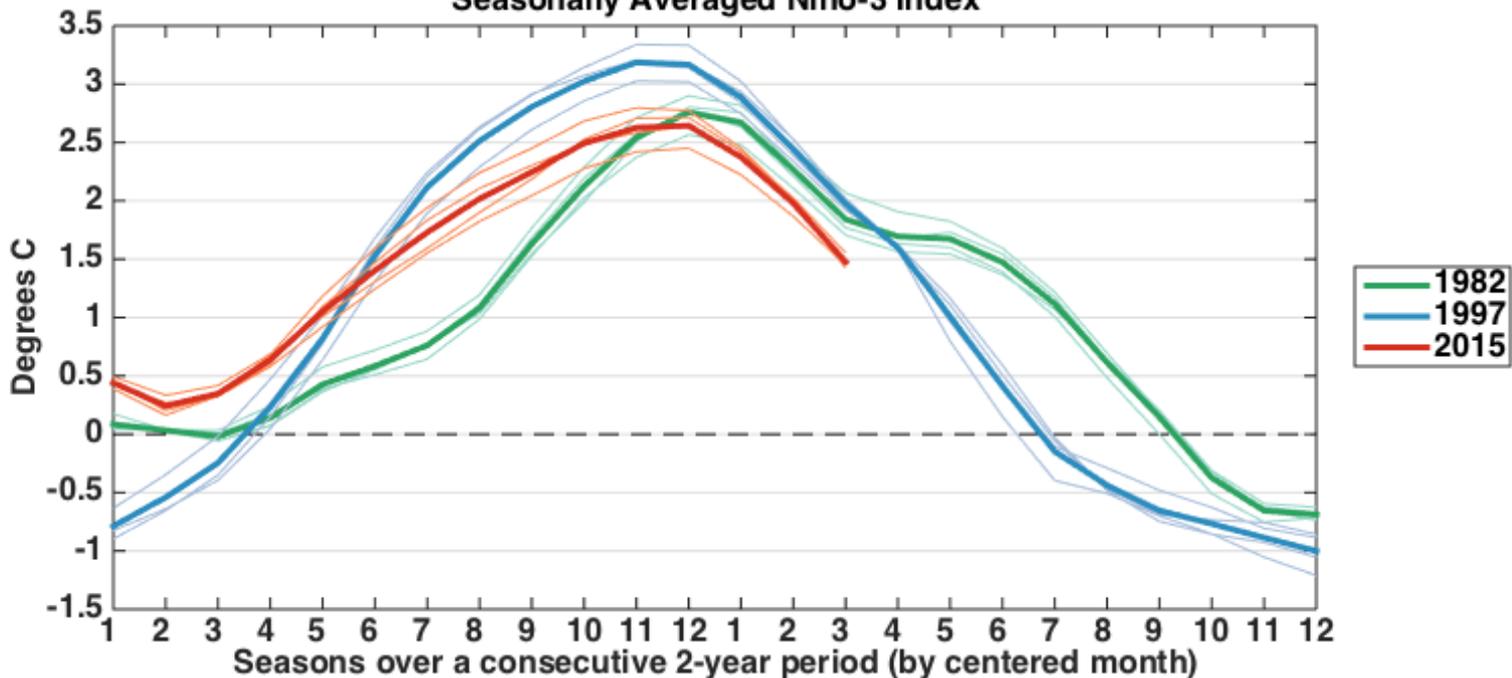
Seasonally Averaged Niño-3.4 Index



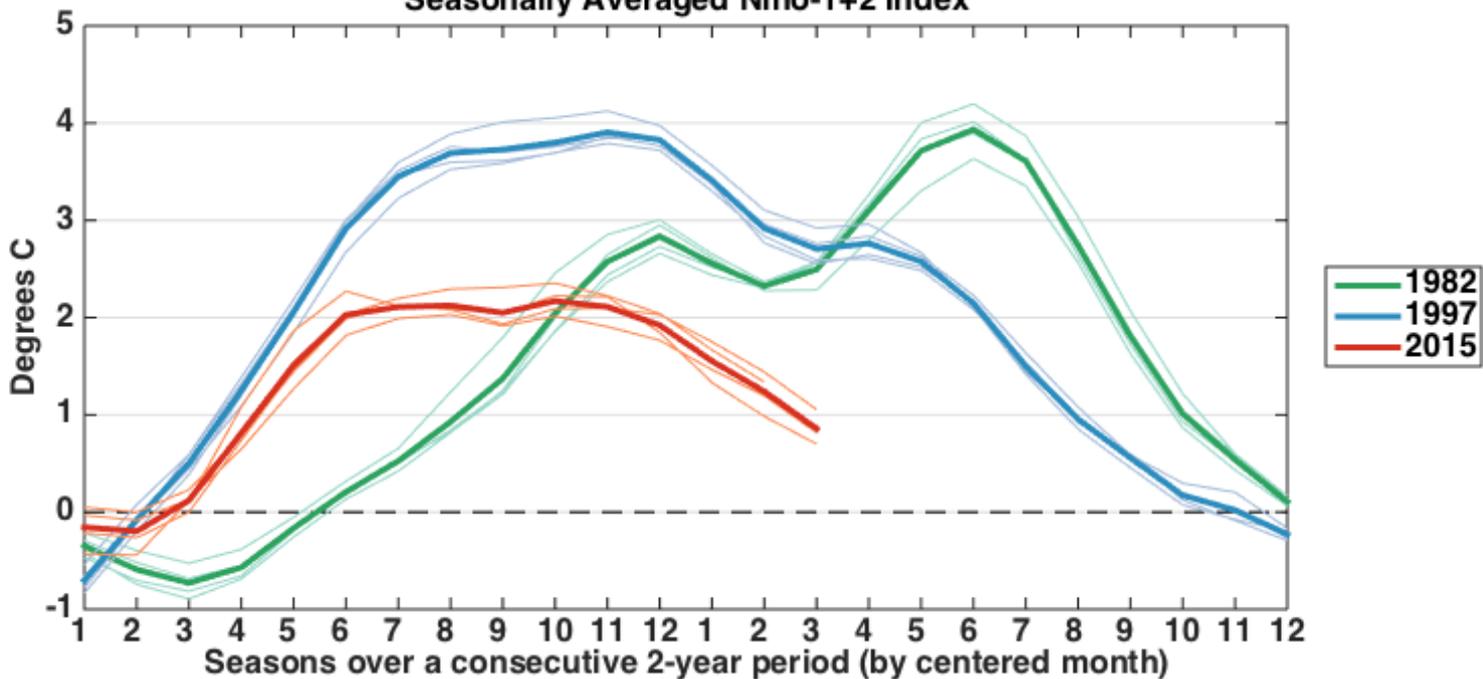
Seasonally Averaged Niño-4 Index



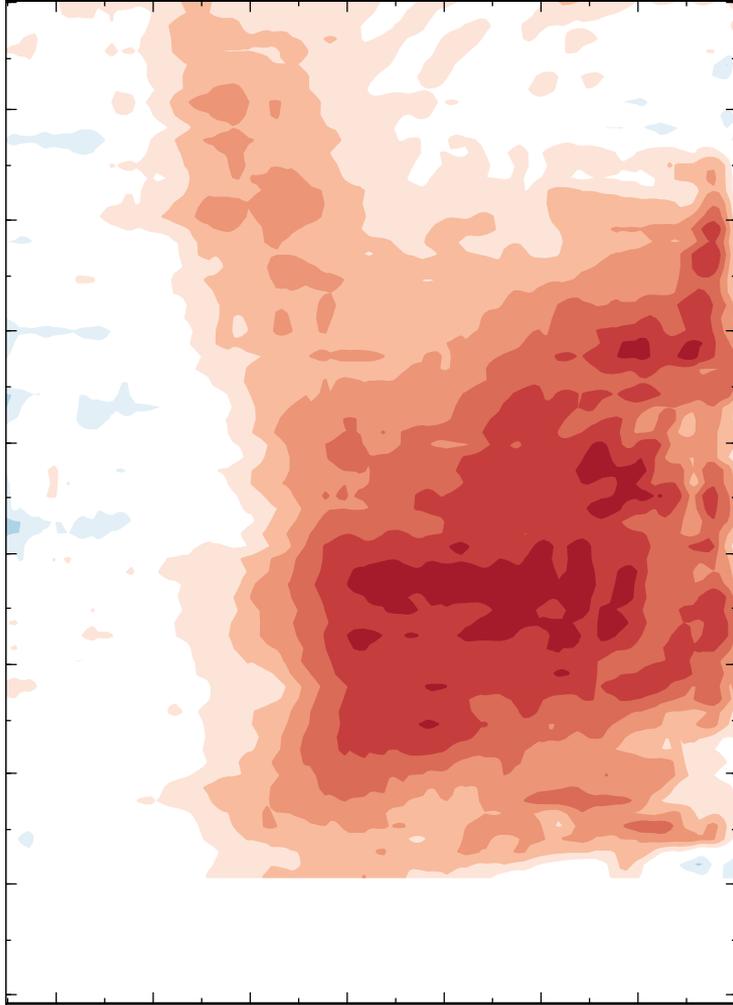
Seasonally Averaged Niño-3 Index



Seasonally Averaged Niño-1+2 Index

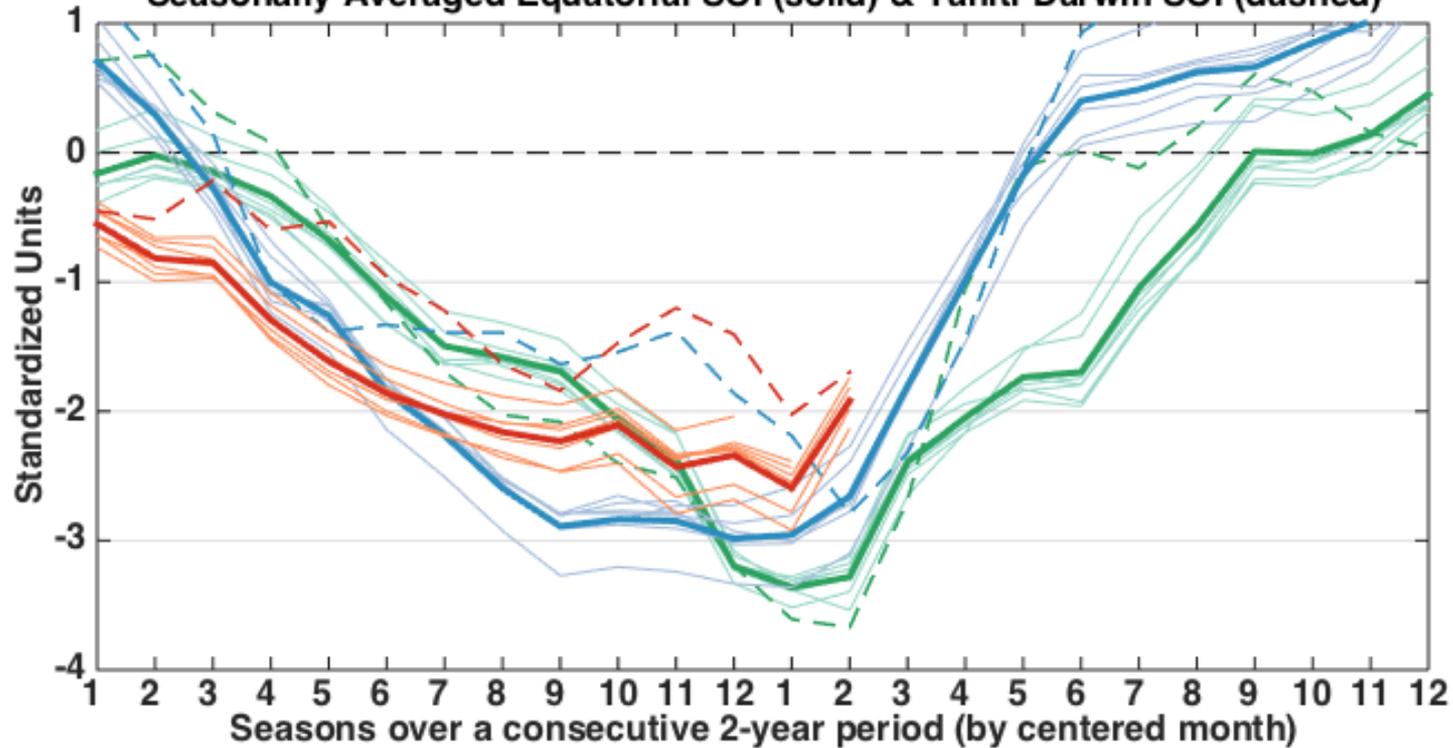


1997-1998



Courtesy of Tom Di Liberto

Seasonally Averaged Equatorial SOI (solid) & Tahiti-Darwin SOI (dashed)

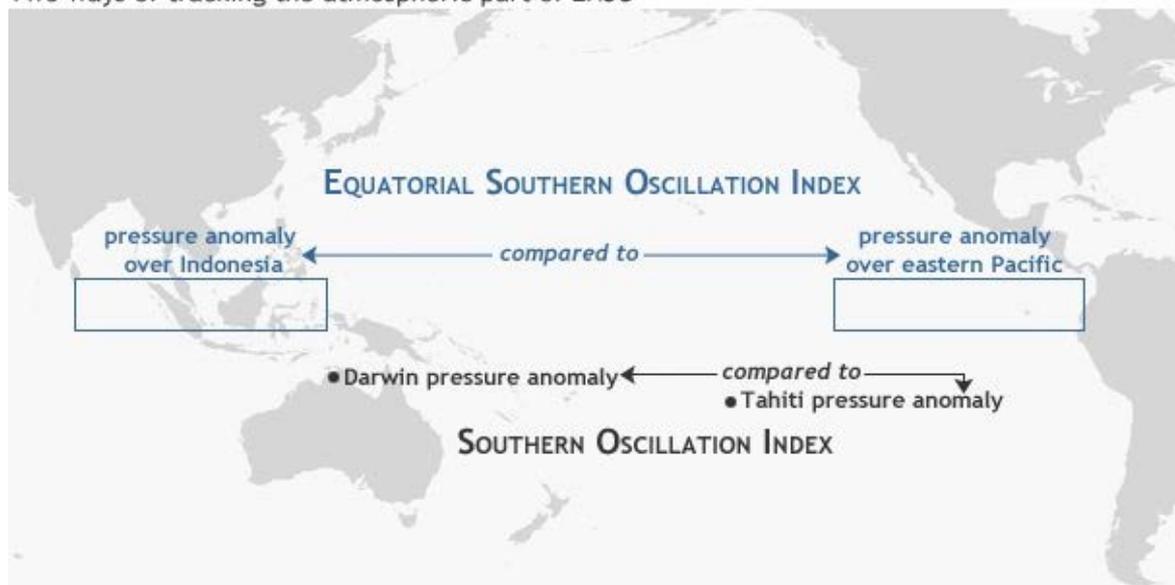


Thin Lines:
 NCEP R1
 R2, CFSR,
 NASA
 MERRA1,
 MERRA2,
 JMA-55,
 ERA-Int

Thick Line:
 All dataset
 Avg.

1982
 1997
 2015

Two ways of tracking the atmospheric part of ENSO



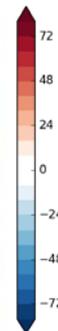
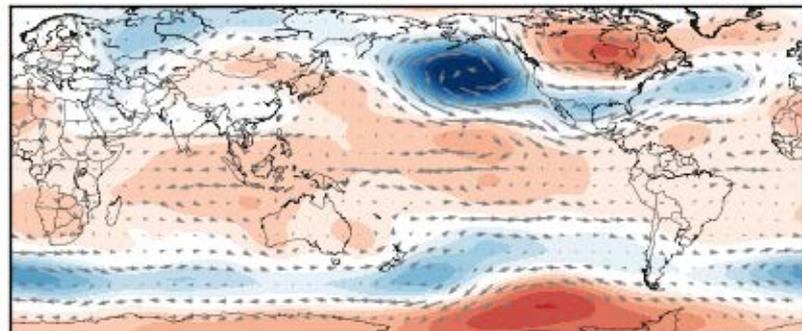
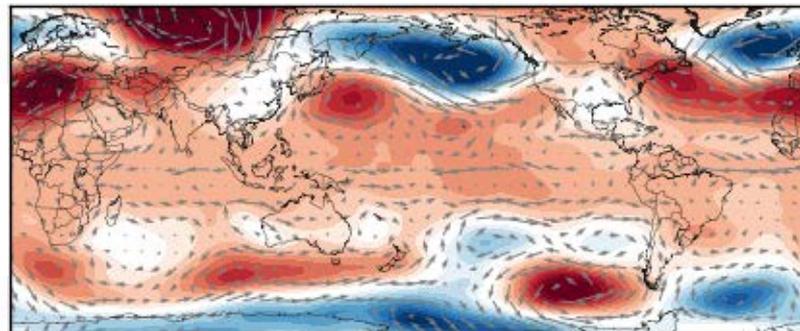
December- February Observations (left) & typical El Niño Pattern (right)

2015/16

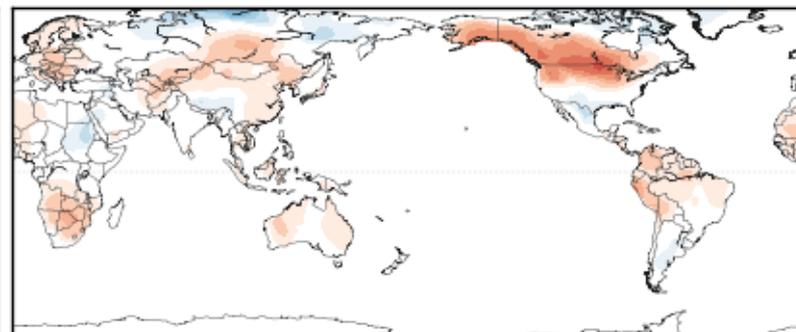
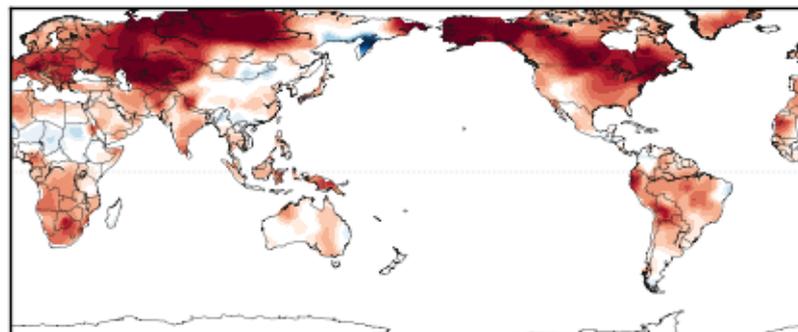
ENSO

$r = 0.42$

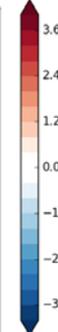
500mb
GPH/wi
nds



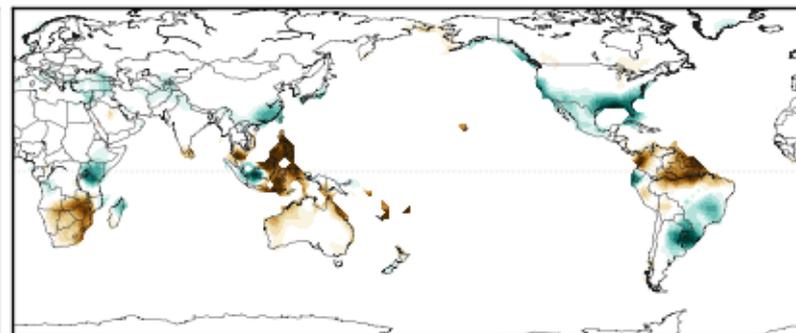
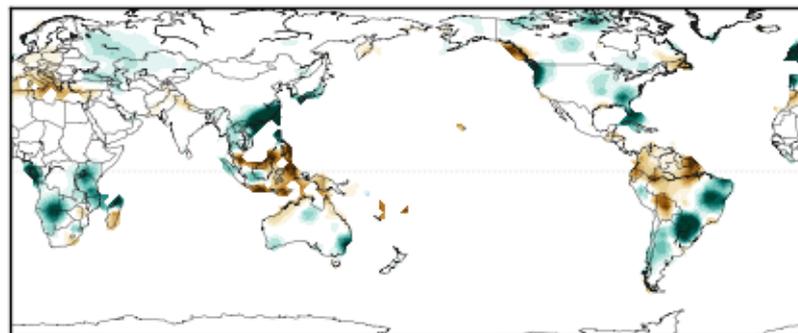
Surface
Temp.



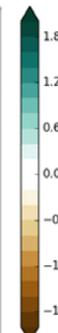
$r = 0.33$



Precip.



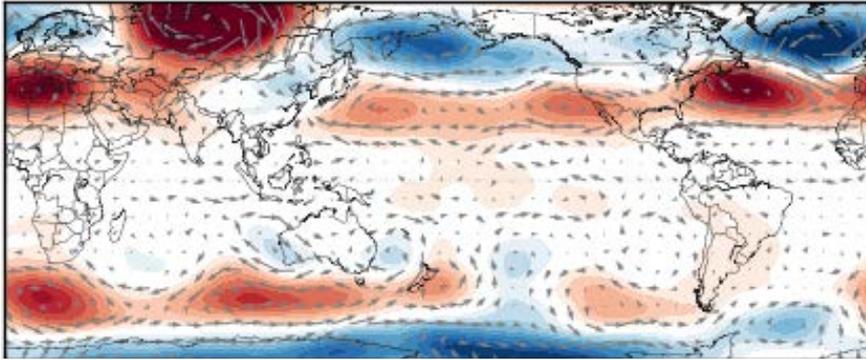
$r = 0.49$



Data: NCEP/NCAR Reanalysis, CAMS+GHCN temp., CPC Unified Gauge precip.

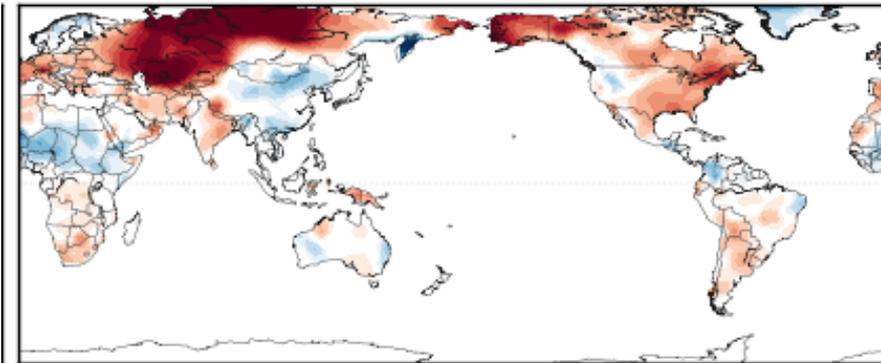
December- February Anomalies Not Related to El Niño+Trend (Residual)

$r = 0.78$



These are the DJF anomalies that cannot be explained by linear ENSO + Trend signals.

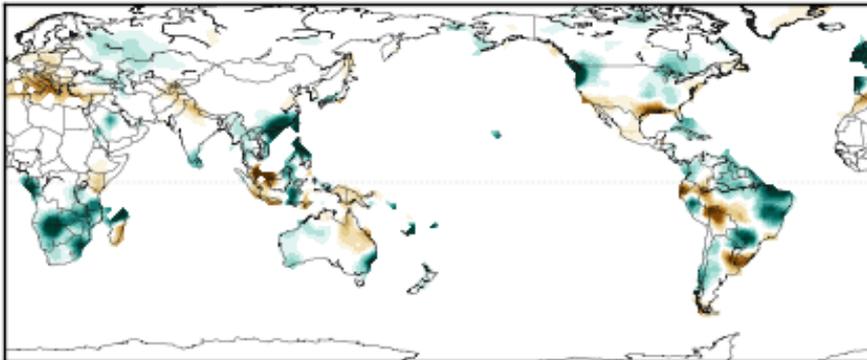
$r = 0.82$



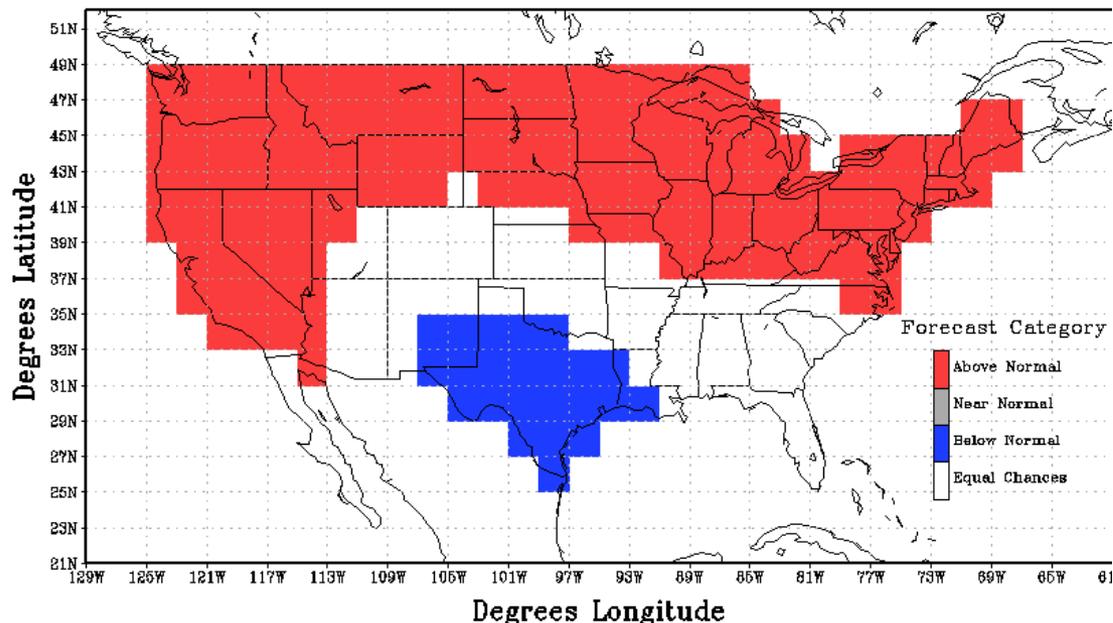
What is leftover?

Poleward shift of jets.
Lots of mid-to-high latitude warmth.
Precip anomalies La Niña-ish.

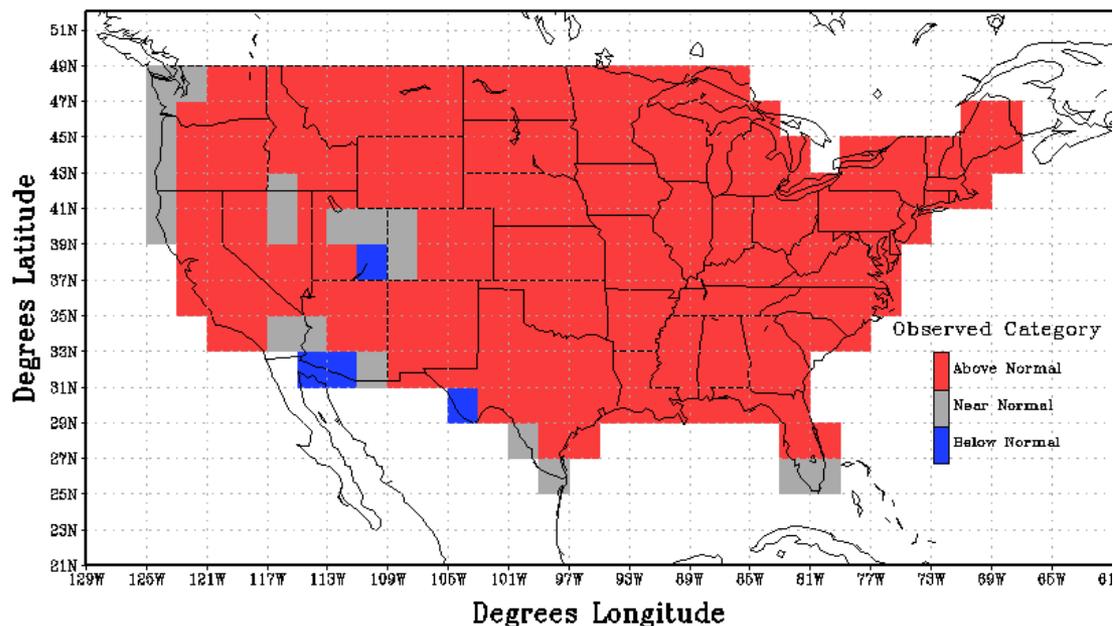
$r = 0.55$



Categorical Temperature Official Forecast
Issued: Nov 2015 Valid: Dec-Jan-Feb 2015-16



Categorical Temperature Observations
Valid: Dec-Jan-Feb 2015-16



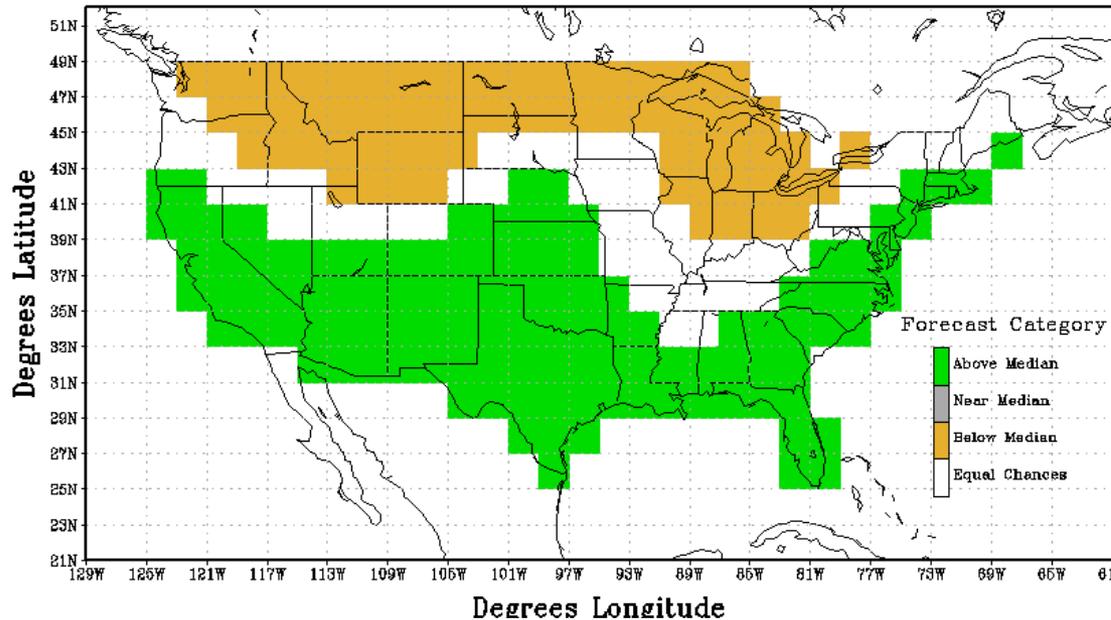
December-January-February (DJF)
Temperature Outlook/Verification

Heidke Skill Score (HSS):
HSS > 0 Skillful Forecast
HSS = 0 Random Chance

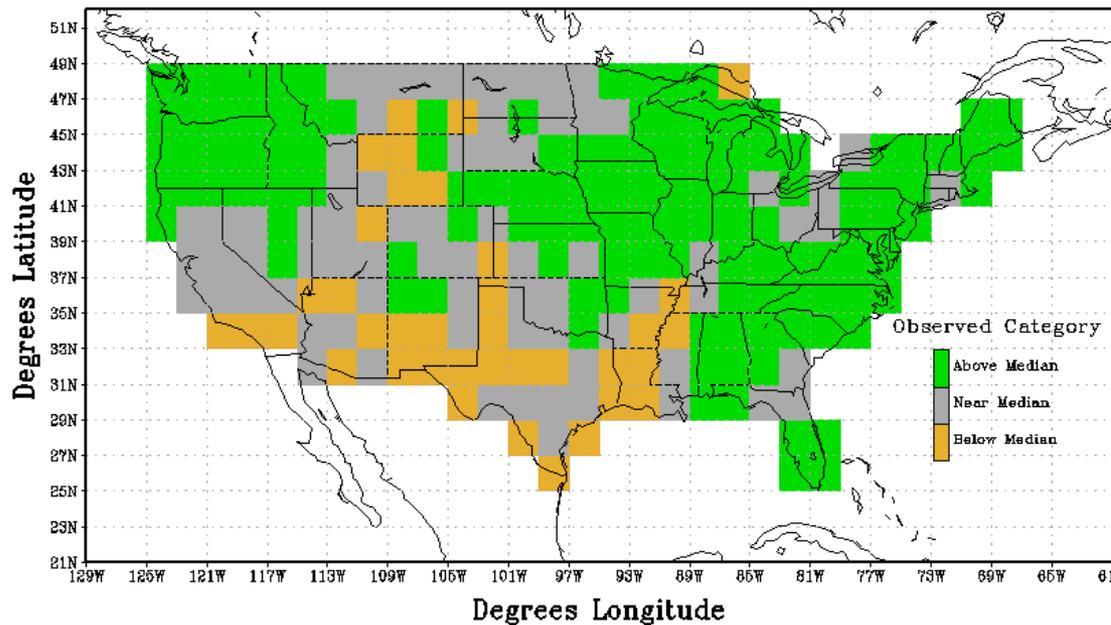
Non-Equal Chances: +69
Entire Area: +49

Credit: CPC Seasonal Forecast Team

Categorical Precipitation Official Forecast
 Issued: Nov 2015 Valid: Dec-Jan-Feb 2015-16



Categorical Precipitation Observations
 Valid: Dec-Jan-Feb 2015-16



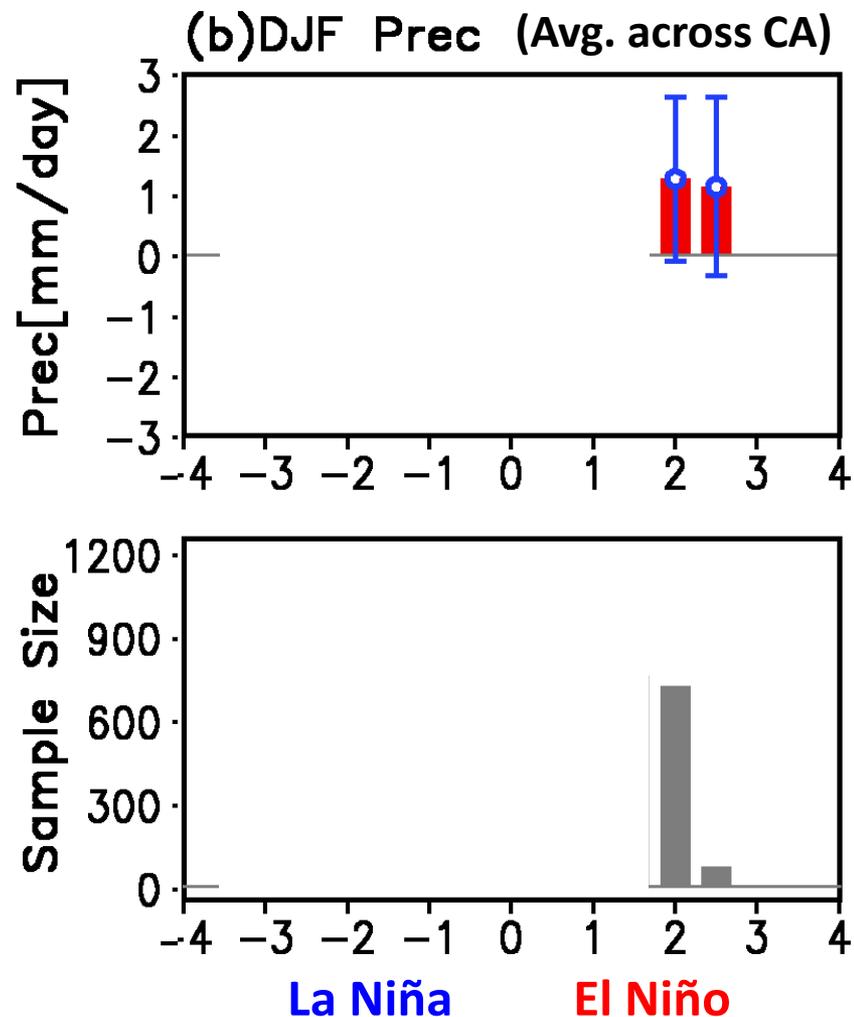
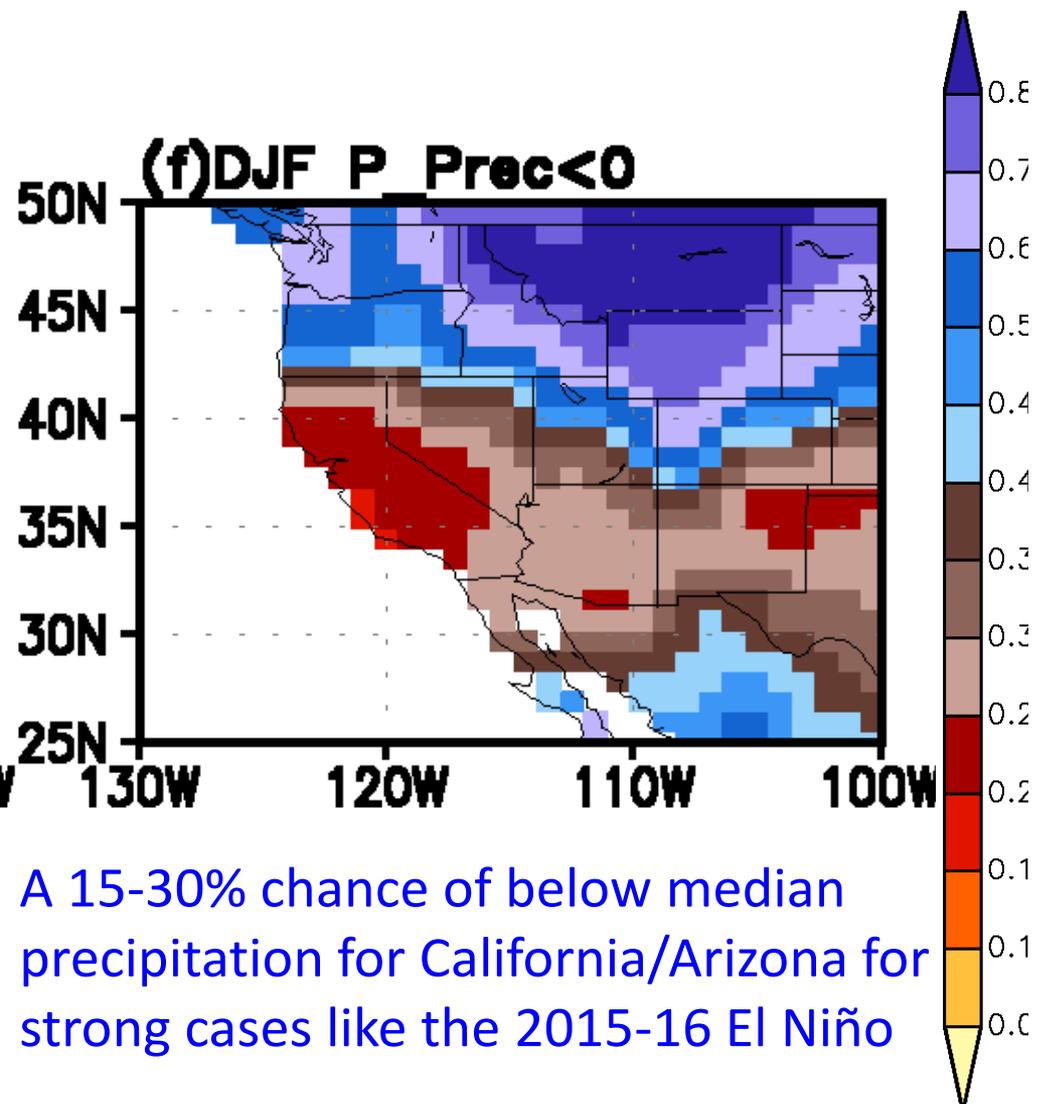
December-January-February (DJF)
Precipitation Outlook/Verification

Heidke Skill Score (HSS):
 HSS > 0 Skillful Forecast
 HSS = 0 Random Chance

Non-Equal Chances: -8
 Entire Area: -6

Chance of Precipitation for Strong El Niño winters (Dec-Feb)

Analysis provided by Mingyue Chen and Arun Kumar, CPC



Estimated from **NCEP CFSv2 model** (316 members over 1982-2015)



Wrap-Up



- IRI/CPC dynamical models (and NMME) overestimated degree of warming in Niño-3.4 observed in 2014. Performed markedly better in 2015.
- The only Godzilla-like feature of this ENSO are the west-central equatorial Pacific SSTs (Niño-4). Other Niño regions and atmospheric anomalies within Top 3, but not records.
- Wintertime anomalies of circulation, precipitation, and temperature only weakly relate to ENSO pattern. Strong warming dominated mid-to-high latitudes with poleward shifted jets across both hemispheres.
- No clear predictable “cause” so far for dry southern California and Arizona during winter. Important to recognize that even for strong El Niño events, there is still some chance (%) for rainfall to be opposite of what is expected.

ENSO Monthly Diagnostics Discussion:

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/index.shtml

ENSO BLOG: <https://www.climate.gov/news-features/departments/enso-blog>