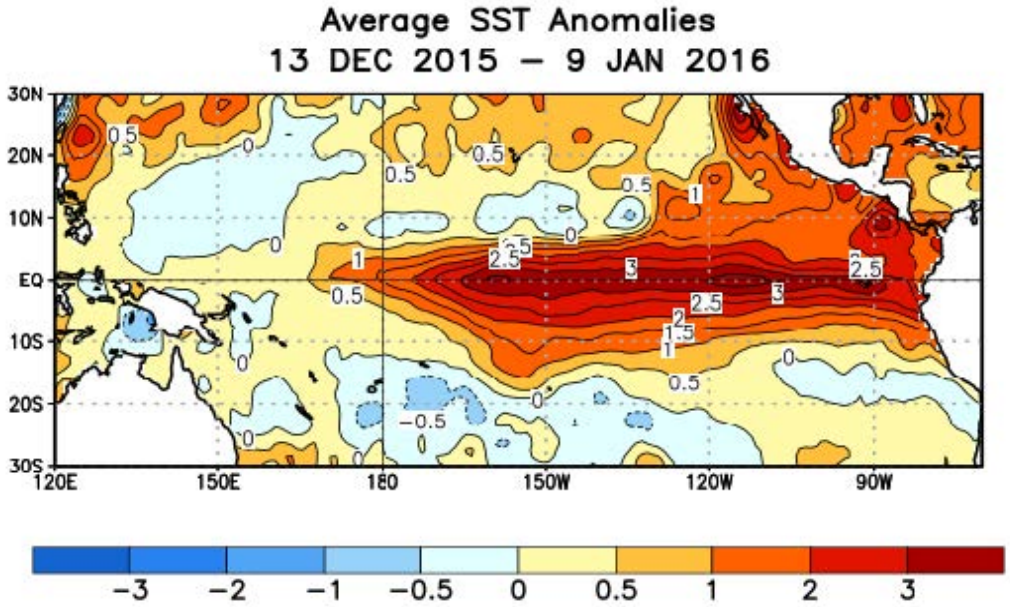
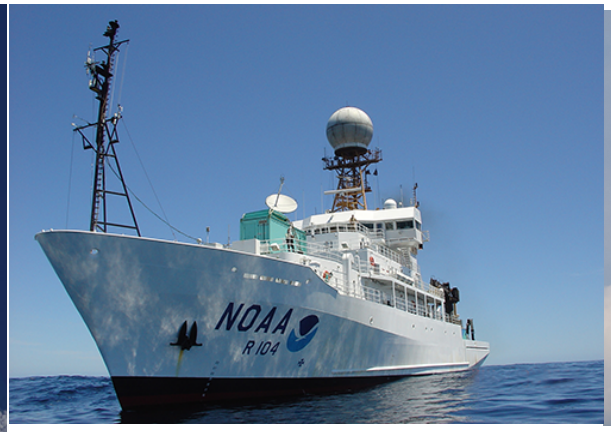
2016 NOAA El Nino Rapid Response Field Campaign

Science Overview

Randall Dole

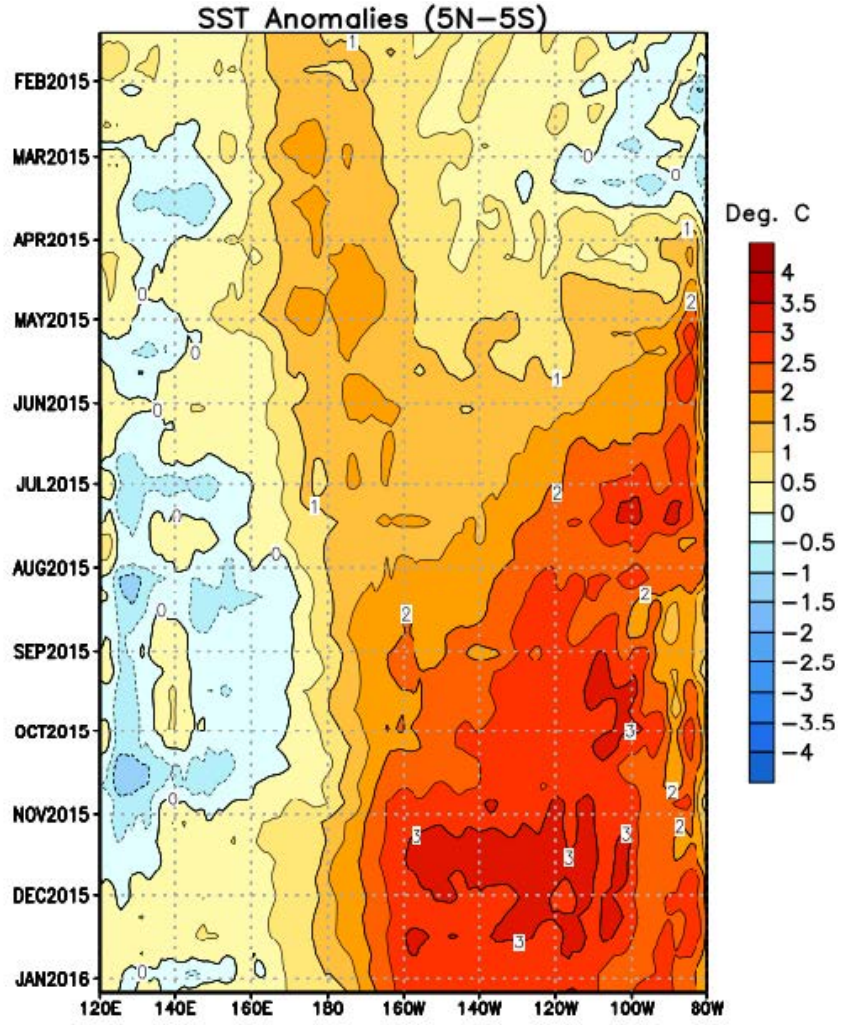




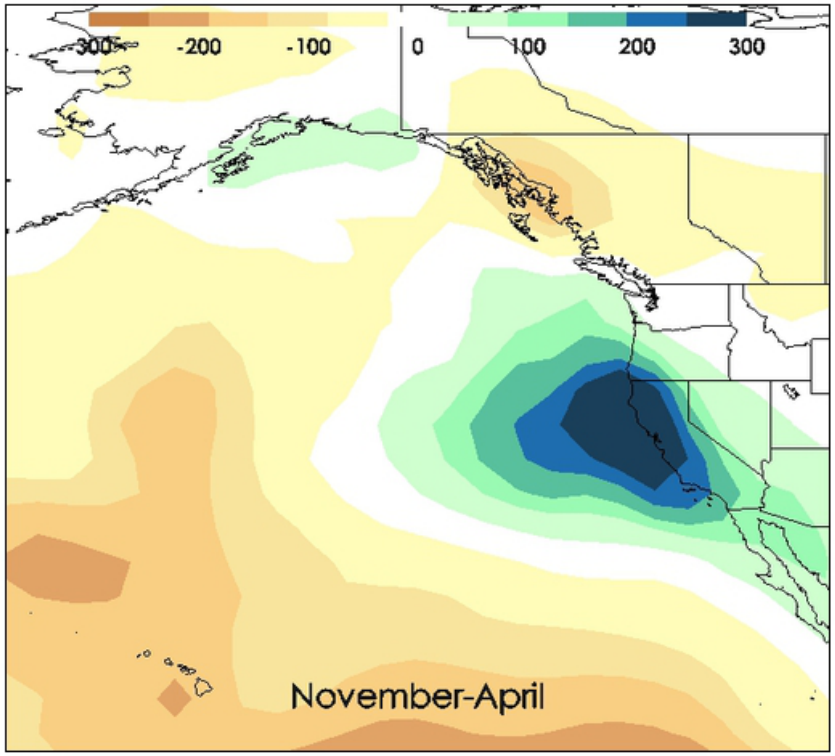
Current Status

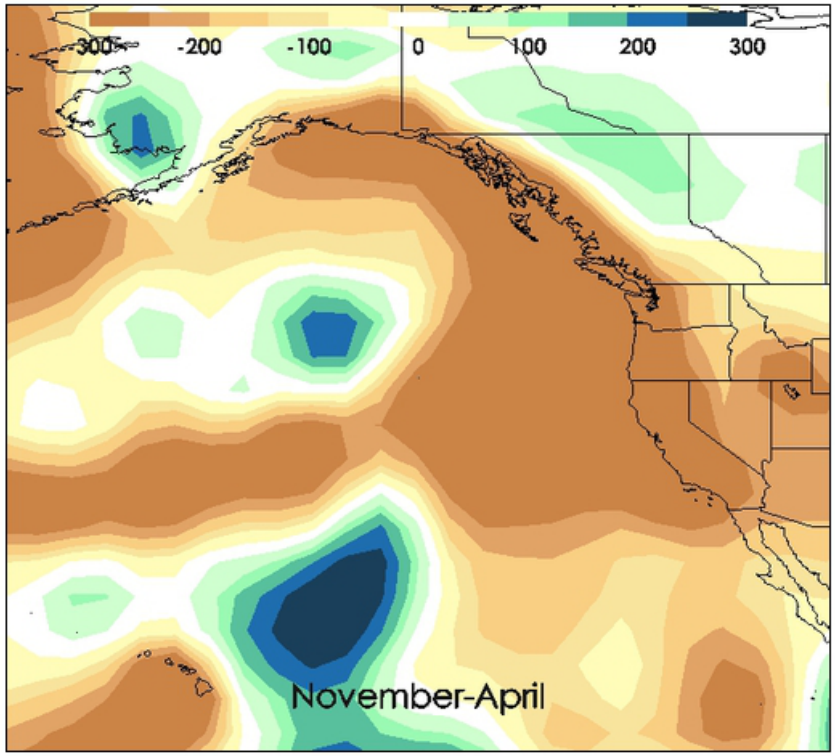
(NOAA NCEP Climate Prediction Center)

- Strong El Niño continues
- Current event is among top three on record. Interesting differences – this event more central Pacific focus
- Substantial intraseasonal variability is also ongoing in the tropical Pacific. Strong MJO, Tropical Storm Pali
- CPC: Strong El Niño conditions are expected to continue through the winter, weakening in late spring

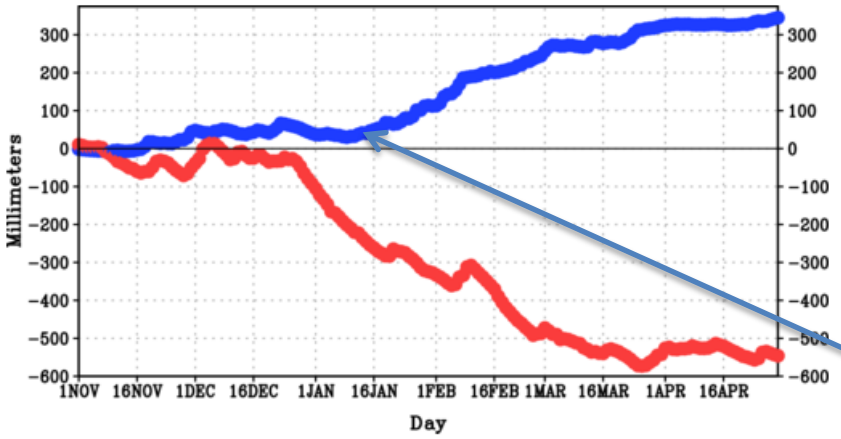


Driver: The Impacts





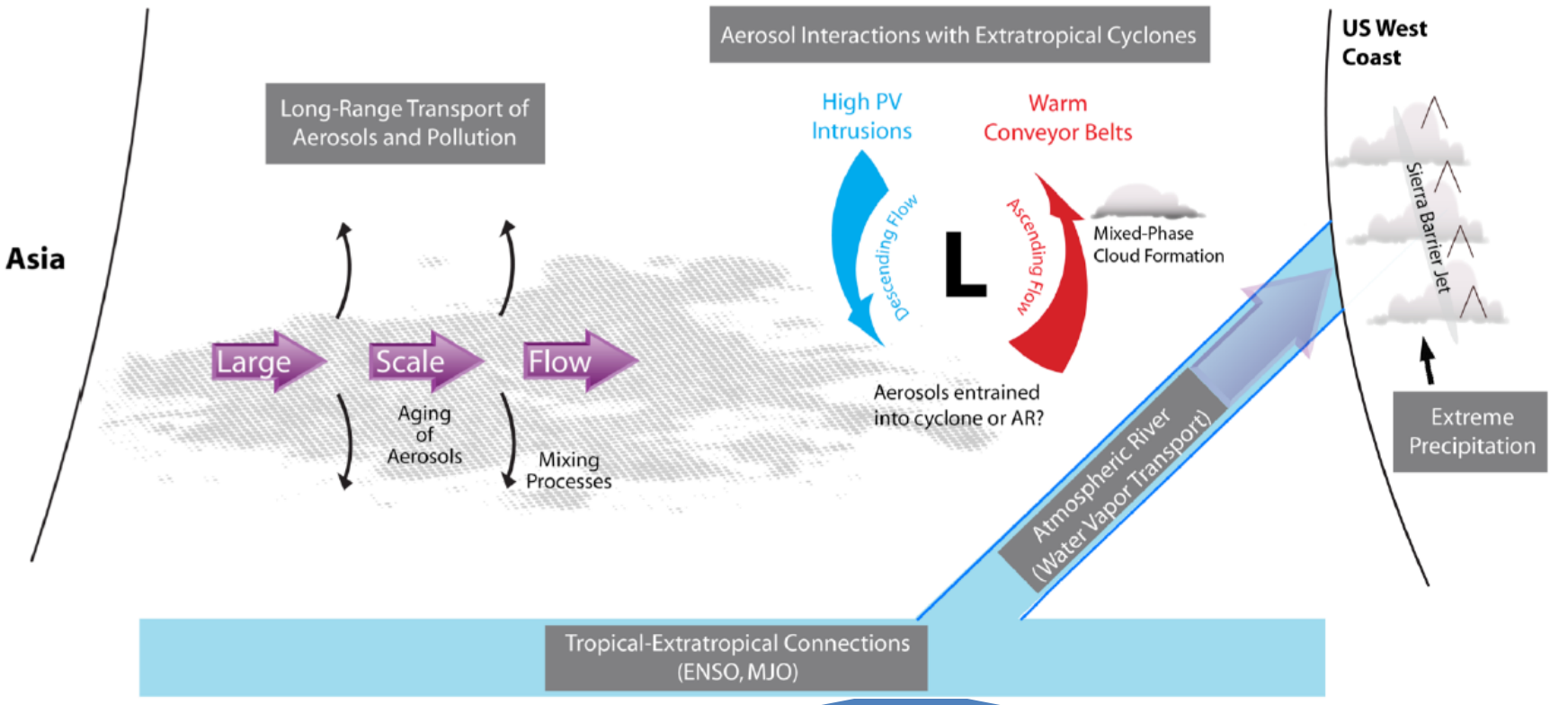
Blue: 1982-83, 1997-98 El Niño-related Precipitation Anomalies



Red: Last Four of Drought Precipitation Anomalies

El Niño ramp up begins early to mid-January

Research Focus



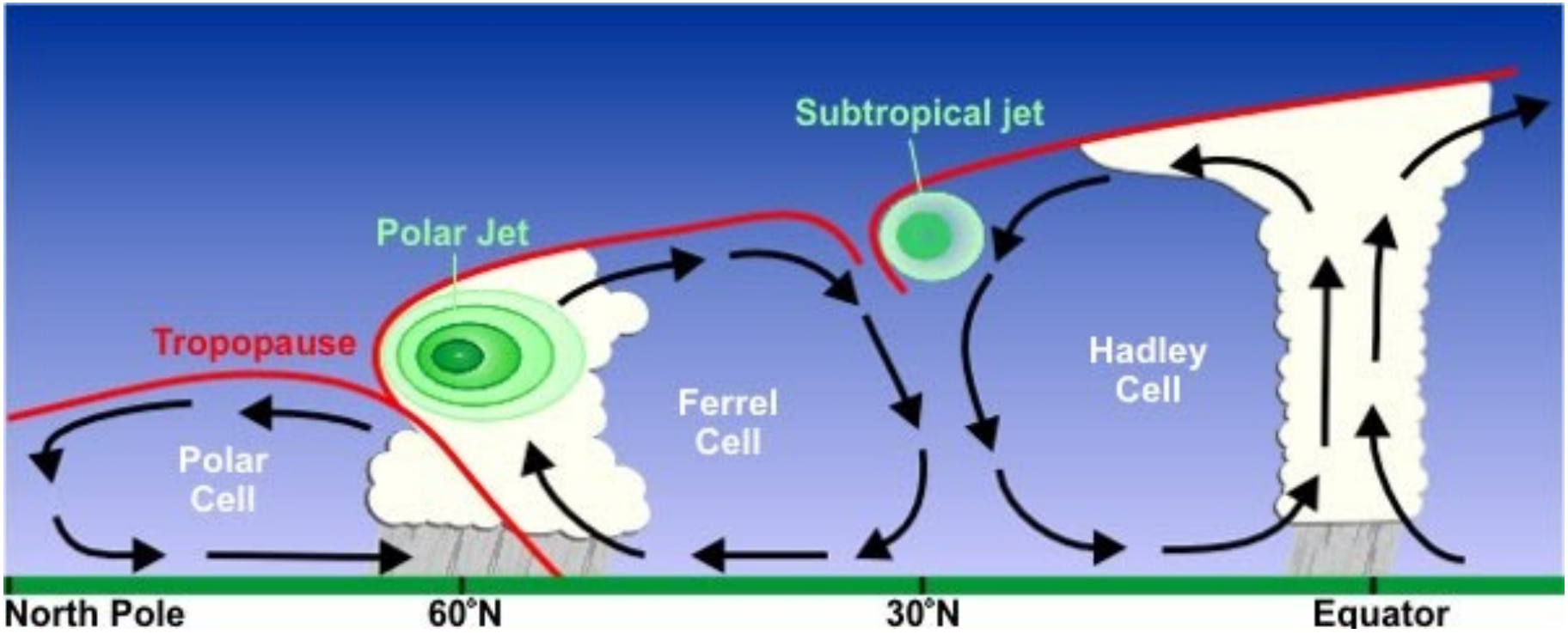
Courtesy of J. R. Spackman, NOAA Earth System Research Laboratory

Tropical Pacific convection

The initial atmospheric response in the chain linking El Niño to its tropical & extratropical impacts

Goal

Determine the tropical convective response to a major El Niño and its implications for predicting extratropical storms and west coast rainfall



- Intensified and eastward-displaced convection leads to subtropical jet intensification
- Episodic variations in convection act as effective Rossby wave sources that further modulate the zonal extent and strength of the subtropical jet over the eastern Pacific.
- These changes alter the frequency and intensity of storms impacting the U.S. west coast

Hypotheses

- West coast rainfall regimes during this El Niño will be modulated by the intensity, zonal extent, and location of tropical Pacific convection, with higher west coast rainfall following eastward extension and intensification of convection

- Models will diverge rapidly from vertical thermal/dynamical structures obtained from high resolution aircraft observations

- Prediction errors in response to El Niño will result from deficiencies in representation of physical processes and data assimilation over the central and eastern tropical Pacific

Questions

- How does tropical convection over the east-central Pacific vary during this event?
- What are the implications for changes in the subtropical jet structure, Rossby wave activity, and west coast rainfall?
- How well do models replicate the convective/dynamical response during this major El Nino?
- To what extent are predictions over the US sensitive to errors emanating from the tropics?
- What observations and forecast system improvements are required to reduce those errors?

Mission Objectives

- Determine the atmospheric boundary layer and vertical thermal/wind structures related to El Niño and assess the adequacy or limitations of NOAA forecast systems in simulating the response to the anomalous SSTs
- Obtain high horizontal and vertical resolution observational data required to estimate tropical convective heating and divergent flow and effects on the subtropical jet and extratropical storm activity
- Make the available in real-time through GTS as input into NOAA forecast models
- Assess specific forecast system sensitivities to uncertainties in model physics, data assimilation or observations related to tropical convection
- Increase NOAA's situational awareness and early warning capabilities in response to this potentially high impact climate event

Outcomes

The rapid response field campaign will provide an unprecedented data set of high resolution tropical observations for a very strong El Niño event. Central Pacific convection during El Niño has never been explicitly targeted in a prior field campaign**. It will also provide coordinated observations over the extratropical North Pacific to identify linkages between the tropics, extratropics, and U.S. impacts**

The data will be used to:

- Determine atmospheric responses to El Niño over the tropical Pacific
- Increase understanding of tropical-extratropical linkages during El Niño
- Provide a long-term data set for evaluating and improving model physical processes and data assimilation methods in weather and climate models
- Support real-time predictions by NOAA and other global centers
- Increase situational awareness in NOAA forecast offices
- Evaluate satellite retrievals in an otherwise sparsely observed region