



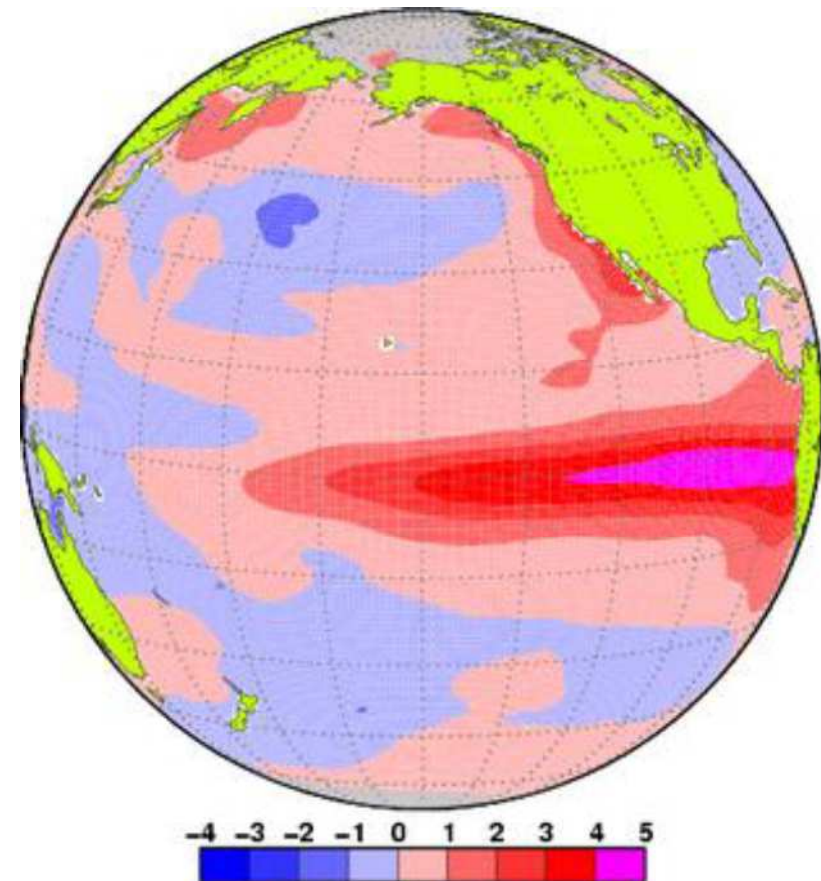
Monitoring and prediction of El Niño and La Niña

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Climate Prediction Division

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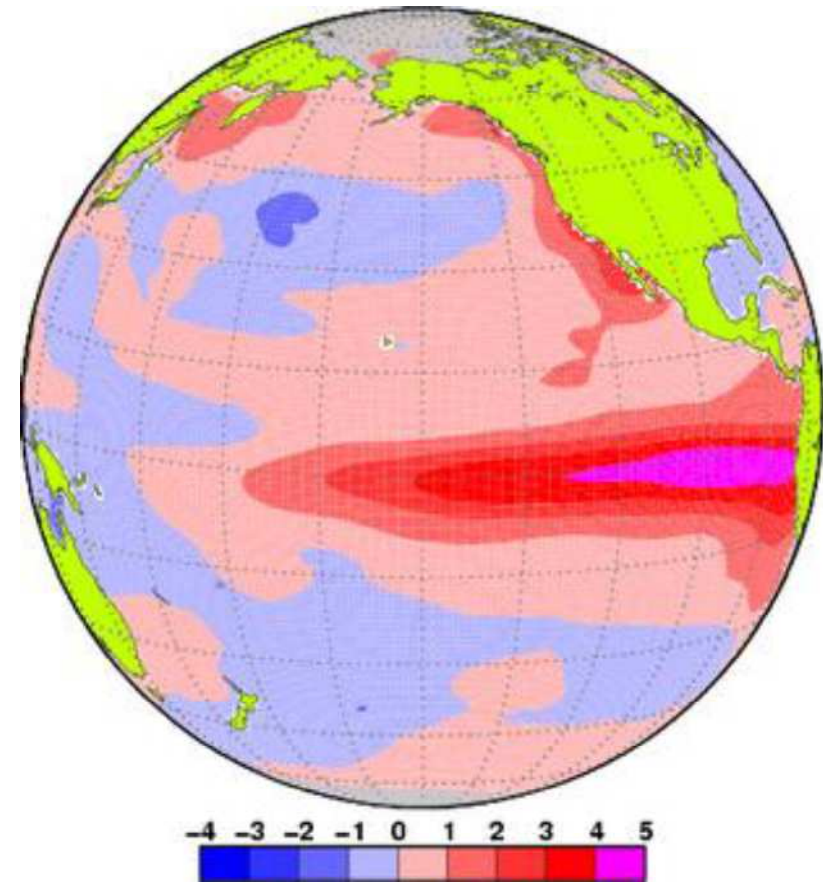


Outline

1. Introduction of El Niño and La Niña phenomena
2. JMA's system for El Niño monitoring and prediction
3. Current conditions and outlook
4. TCC products for El Niño monitoring and prediction



1. Introduction of El Niño and La Niña phenomena





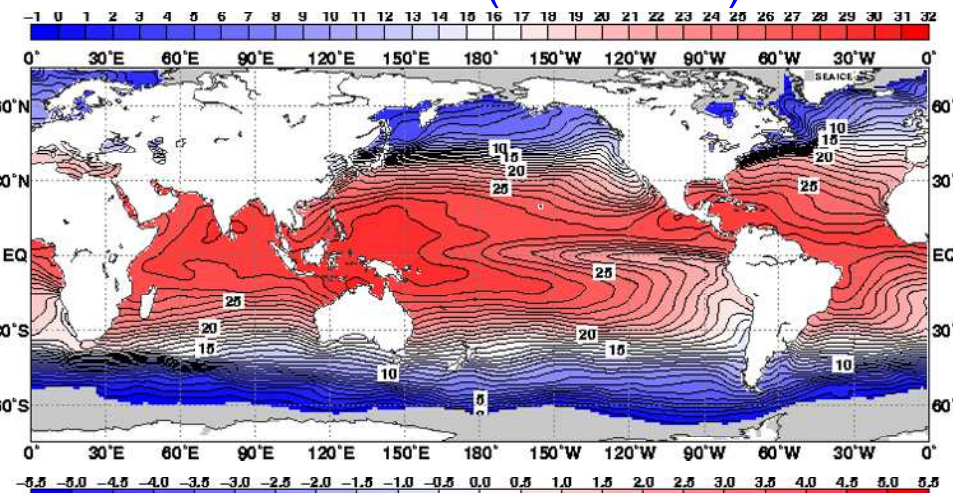
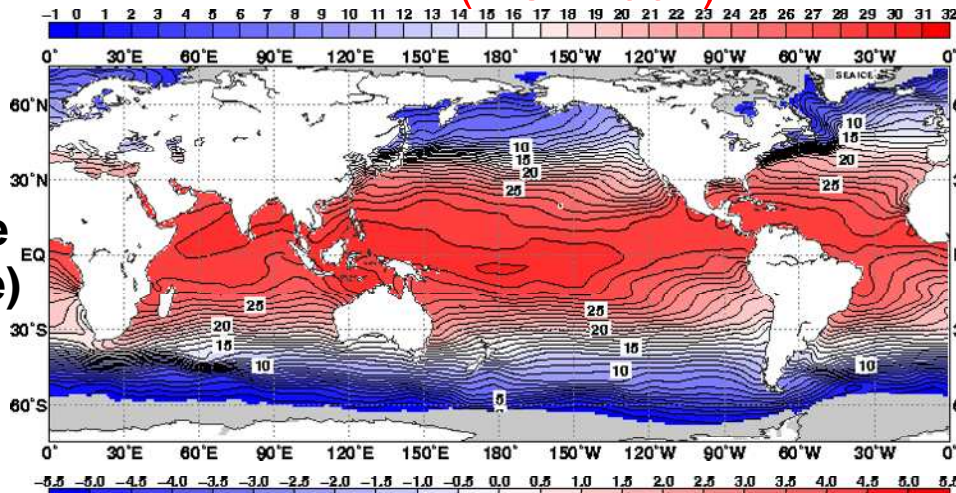
“El Niño” (“La Niña”) refers to:

Large-scale ocean phenomena in which eastern equatorial Pacific (off the coast of Peru) SSTs are warmer(cooler) **than normal**.

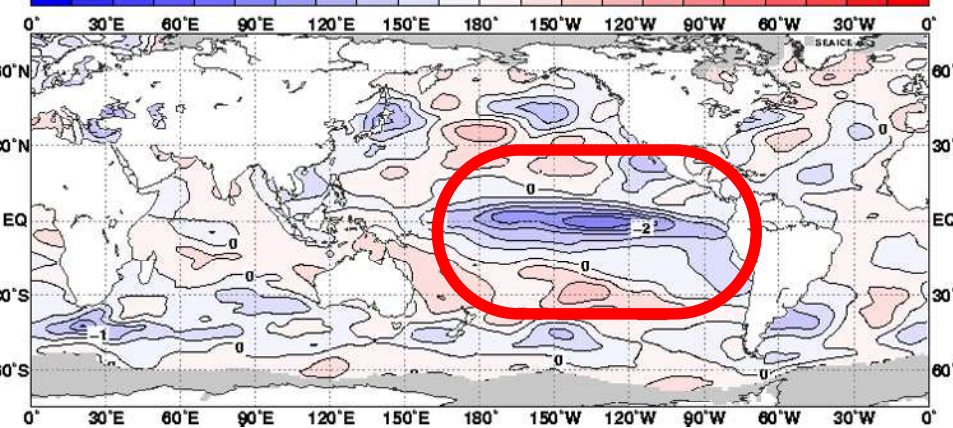
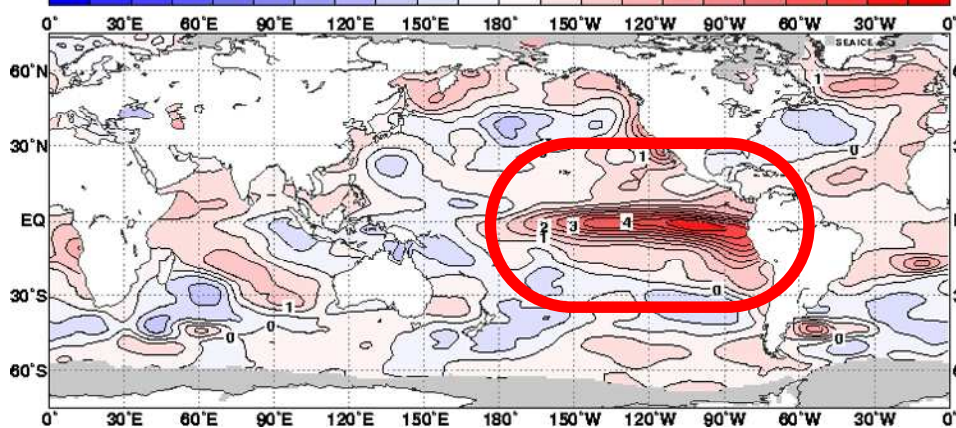
El Niño (NOV1997)

La Niña (NOV1988)

SST
(sea surface
temperature)



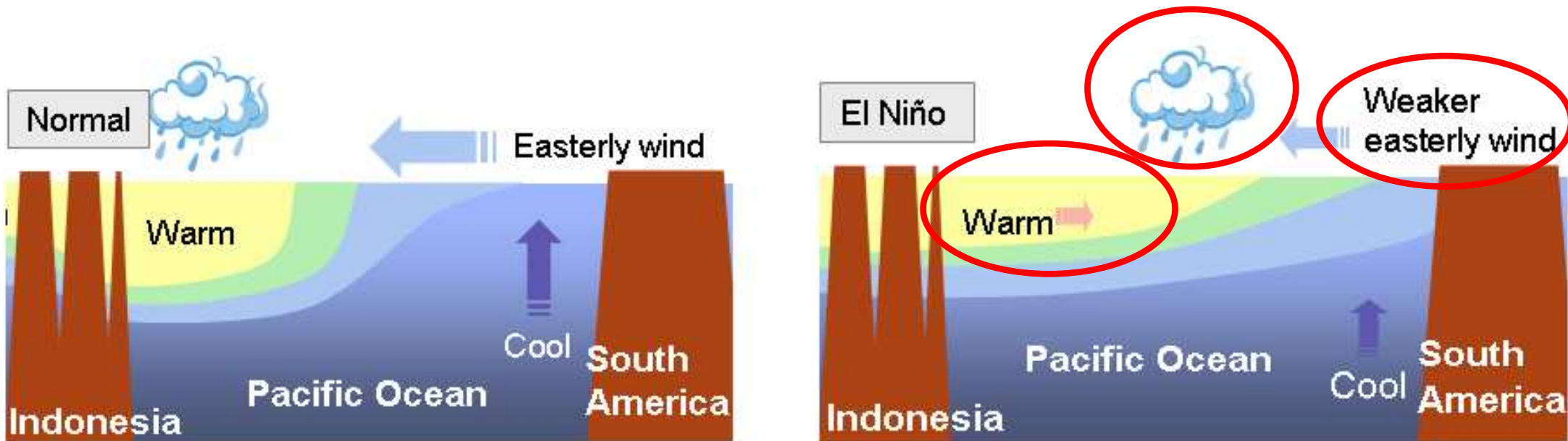
SST
anomaly



What happens during El Niño?

In the equatorial pacific,

- ① The easterly **wind** weaken.
 - ② **Warm water** move eastward.
 - ③ The region of heaviest **rainfall** moves eastward.
- **We have to monitor these characteristics.**



Normal condition

El Niño

schematic figures of longitude-depth cross section along the equator

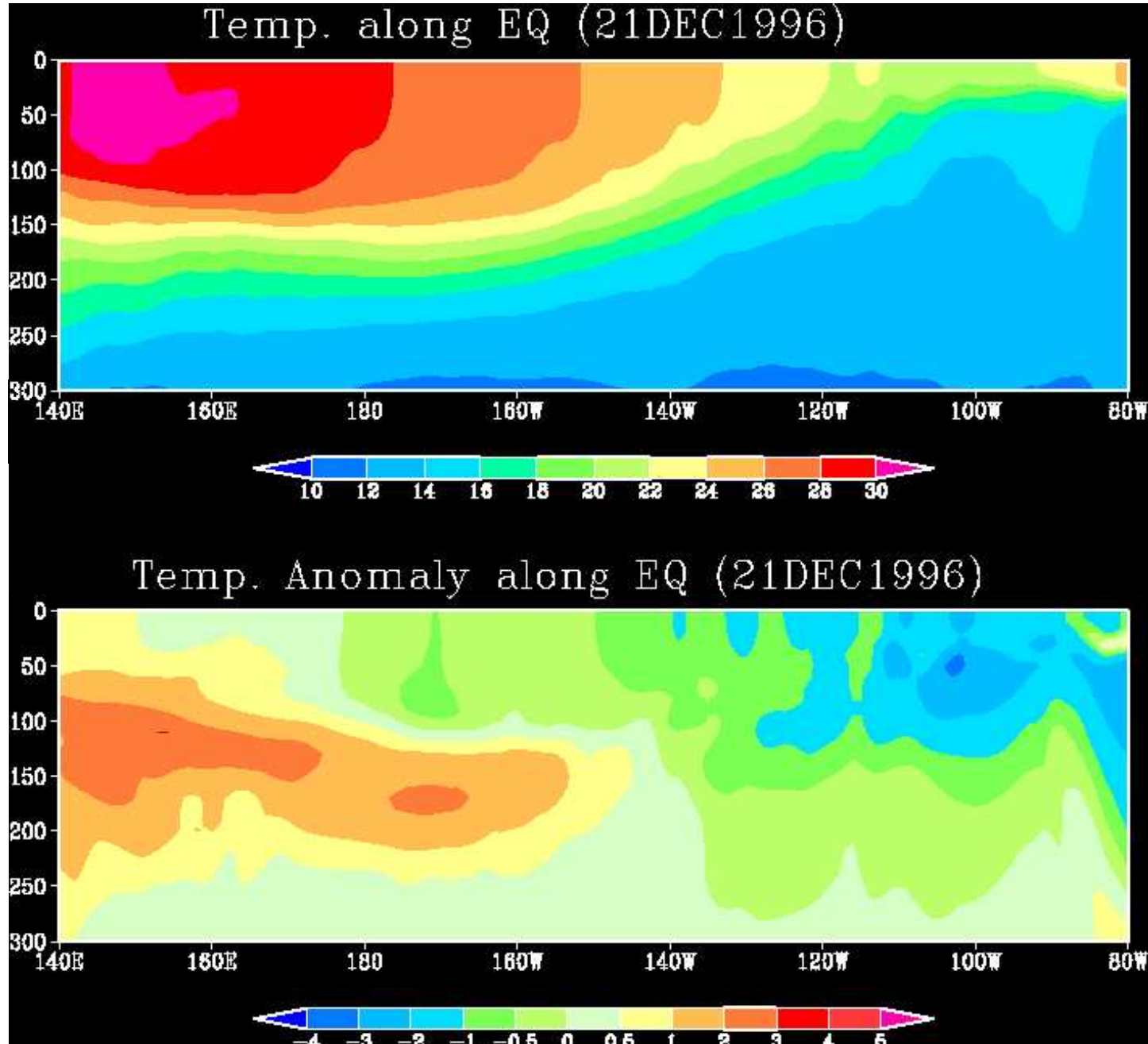


Look deep into the sea – developing 1997/98 El Niño

Cross section of
Subsurface tem.
along the
equatorial Pacific

1997/98 El Niño
From **Apr. 1997**
To **May 1998**

anomalies



Quantitative definition of El Niño (La Niña) event

- Definition by JMA

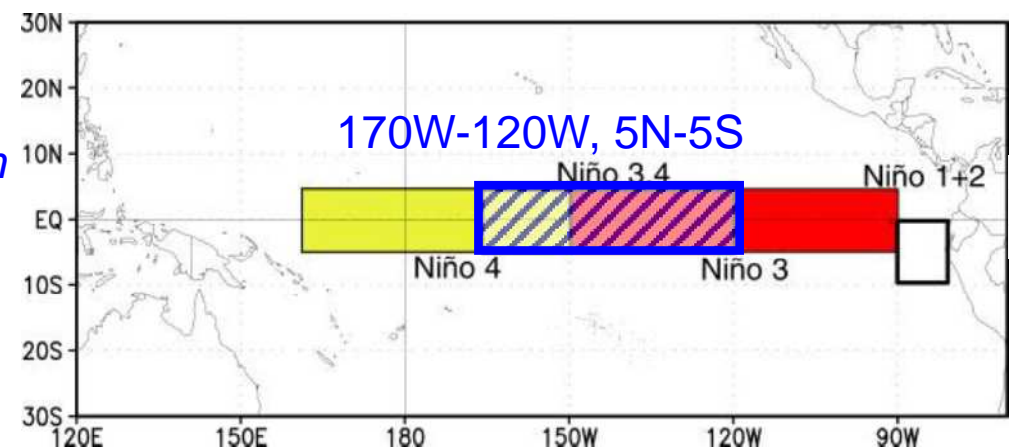
5-month running mean of NINO.3 (5N-5S, 150W-90W) SST deviation stays 0.5K or higher (-0.5K or lower) for 6 consecutive months or longer.

NINO.3 SST deviation is defined as deviation from the latest 30-year (e.g. 1982-2011 for the year 2012) average (not from 1981-2010 normal).

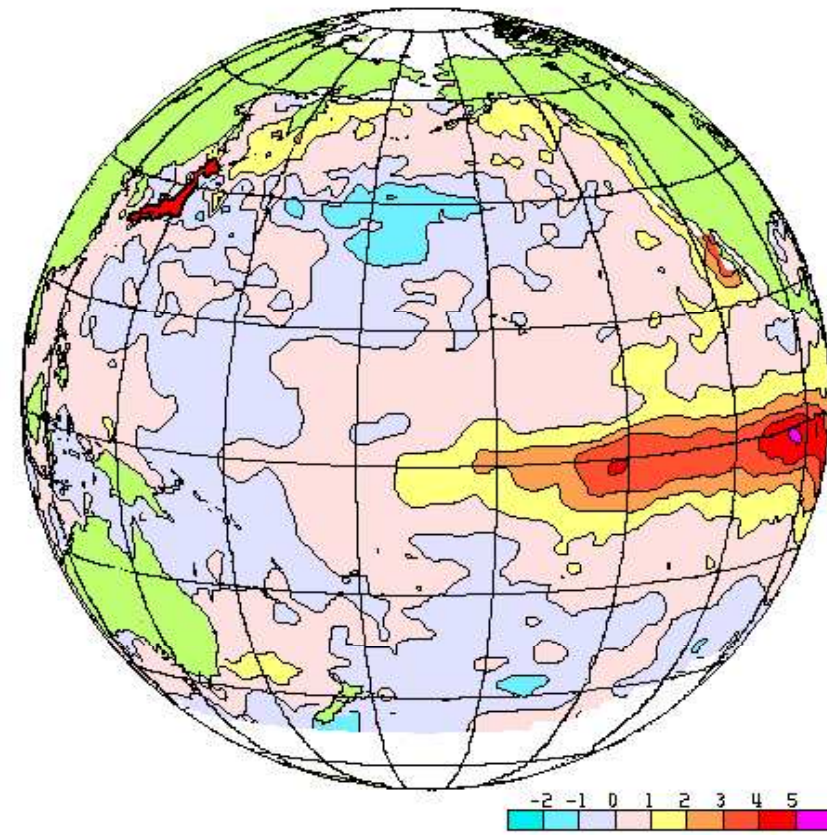
By use of sliding normal, long term trends is eliminated.

Definition by NOAA

3-month running mean of NINO.3.4 SST deviation from normal stays more than 0.5K (less than -0.5K) for the consecutive period longer than 5 months.

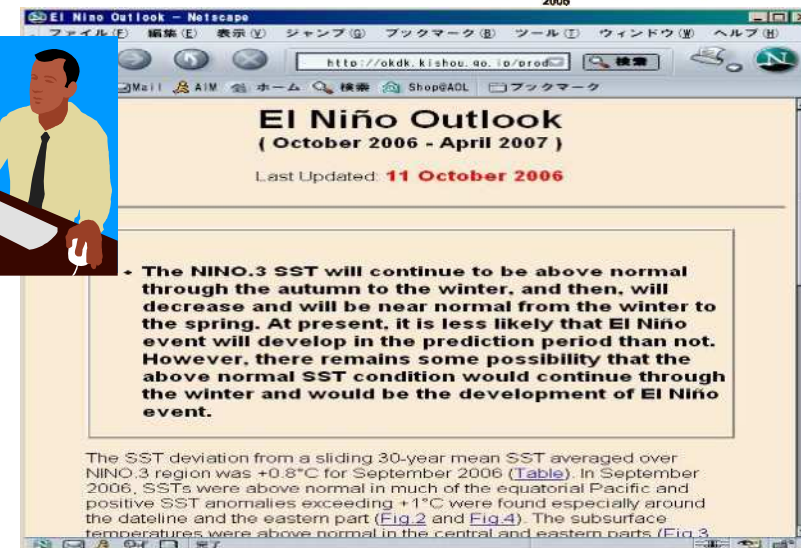
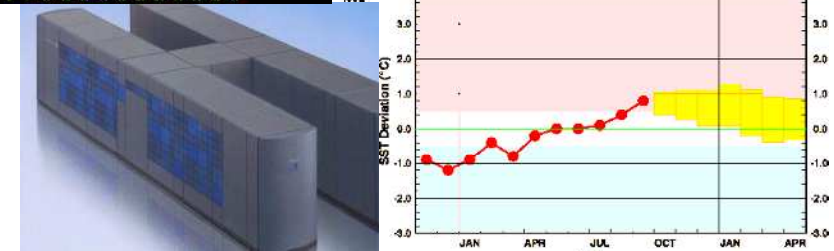
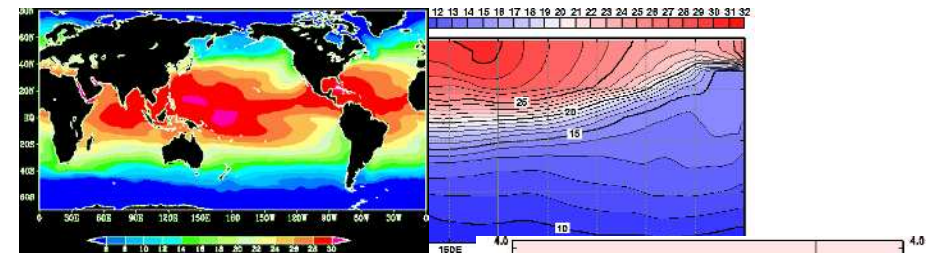
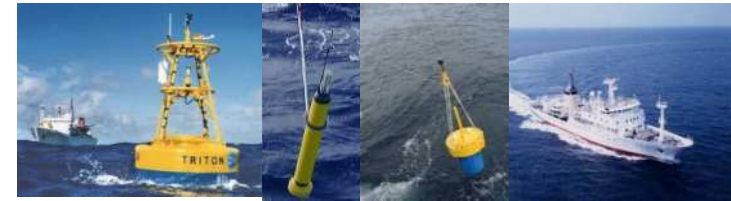


2. JMA's system for El Niño monitoring and prediction



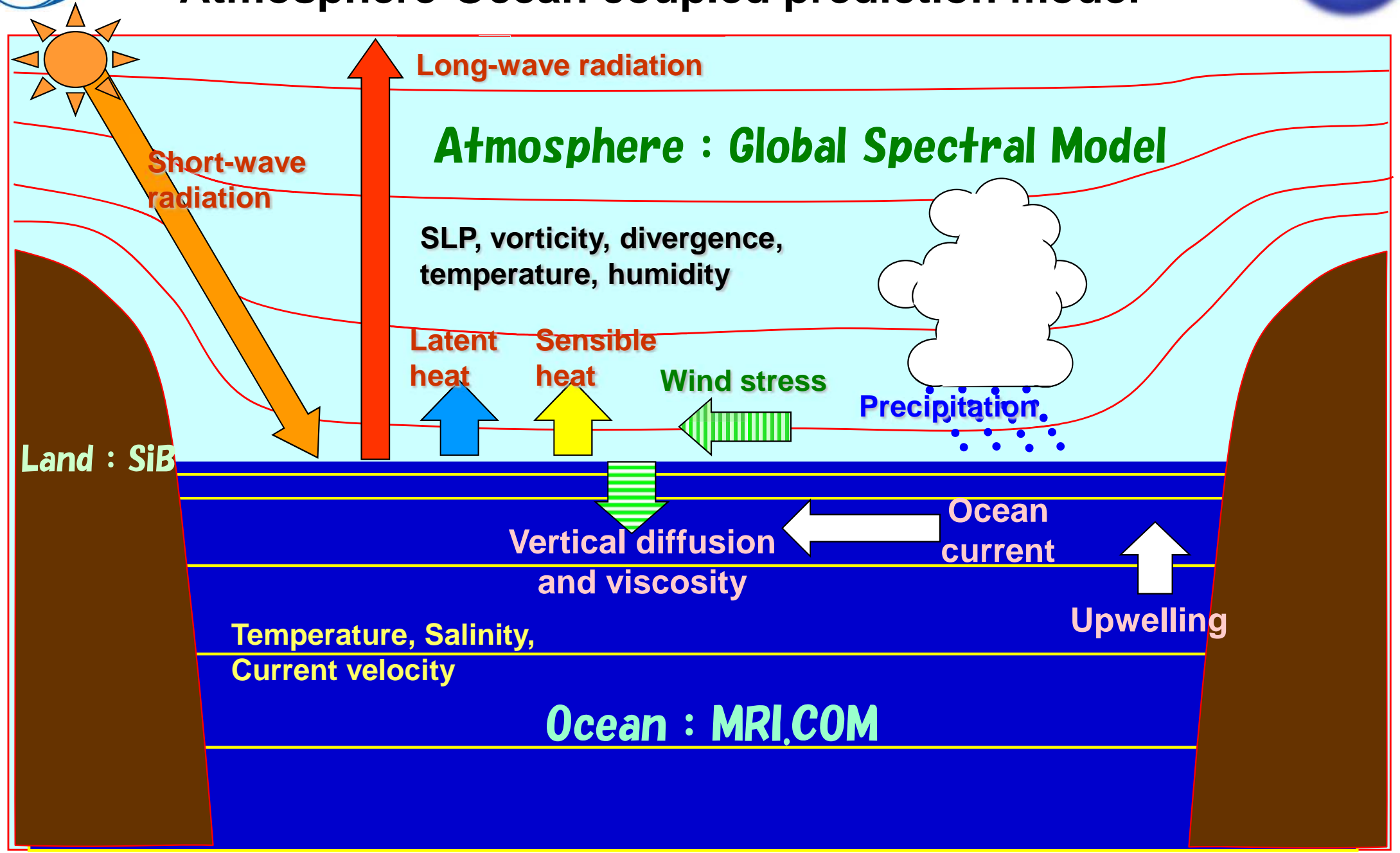
Workflow for monitoring and prediction

1. Acquiring observing data
(temperature, salinity)
- ↓
2. Data quality control & assimilation
into the regular grids
- ↓
3. Numerical prediction
(Atmosphere-Ocean coupled model)
- ↓
4. Analysis & examination of the
model results
- ↓
5. Products publication



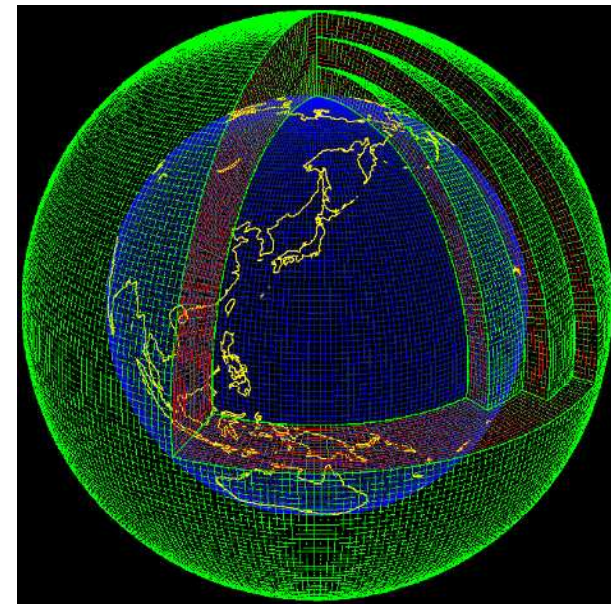


Atmosphere-Ocean coupled prediction model



Prediction model specifications

- Atmospheric component : spectral model (T_L95 , 192x96 grids, 40 vertical levels)
- Ocean component : grid model (1deg x 0.3 to 1deg, 50 vertical levels)
- Initial condition :
 - [atmosphere] provided by JCDAS (JMA Climate Data Assimilation System)
 - [ocean] provided by MOVE-G
- Prediction period : up to 7 months ahead
- 51-member ensemble forecast

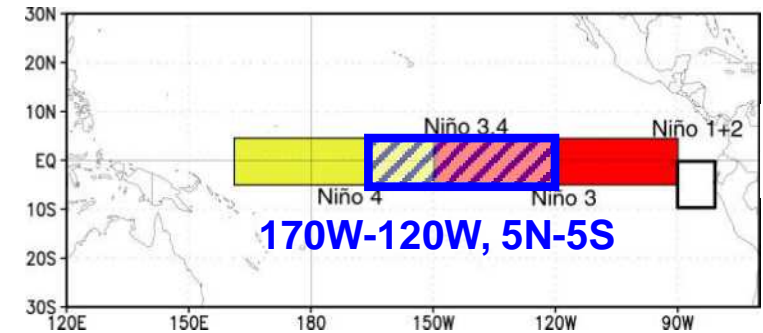
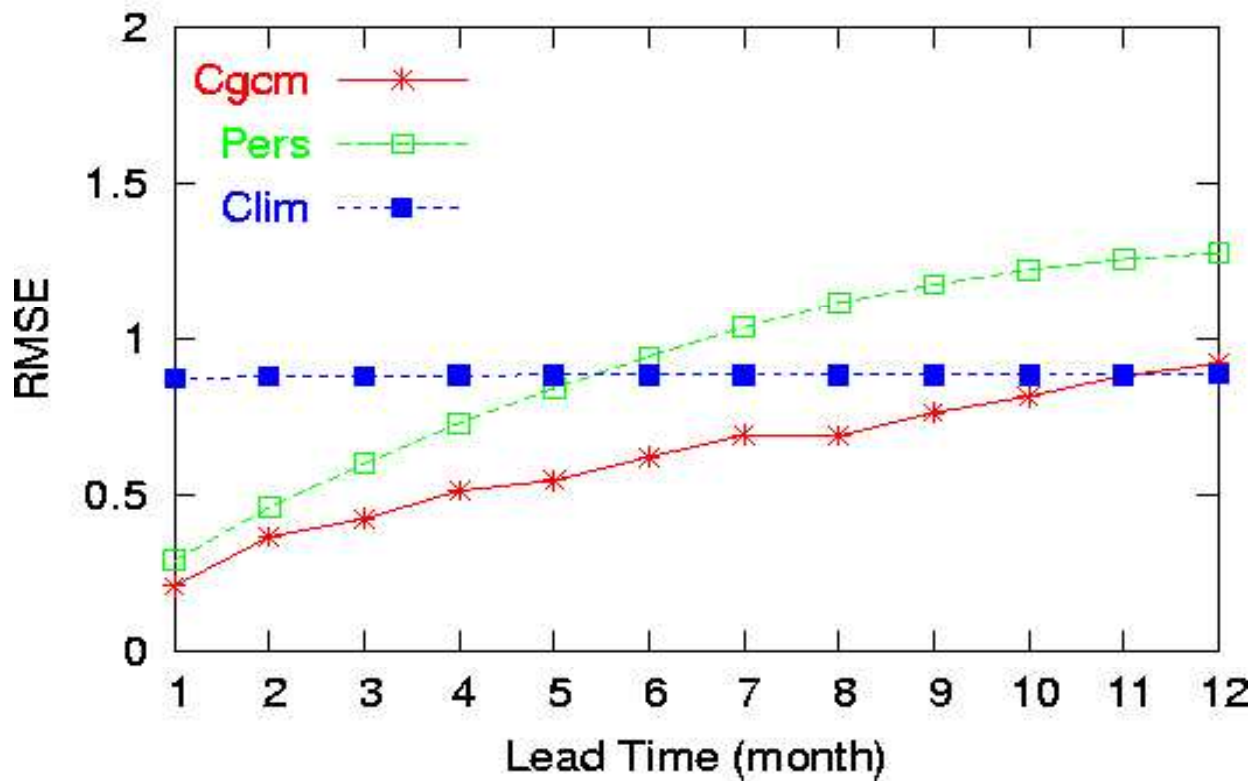




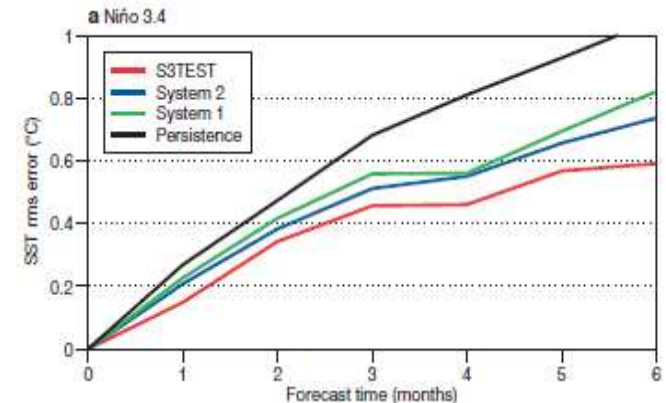
Prediction model performance

JMA/MRI-CGCM
1979-2007

NINO 3.4 Forecast Skill



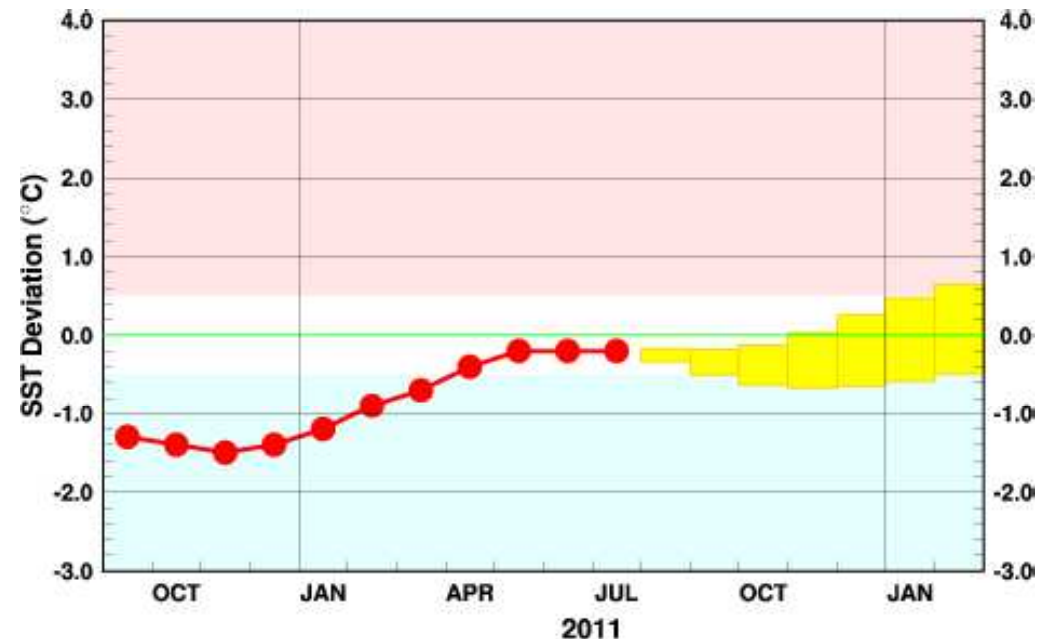
ECMWF System 3
1987-2002



From ECMWF Newsletter No. 110

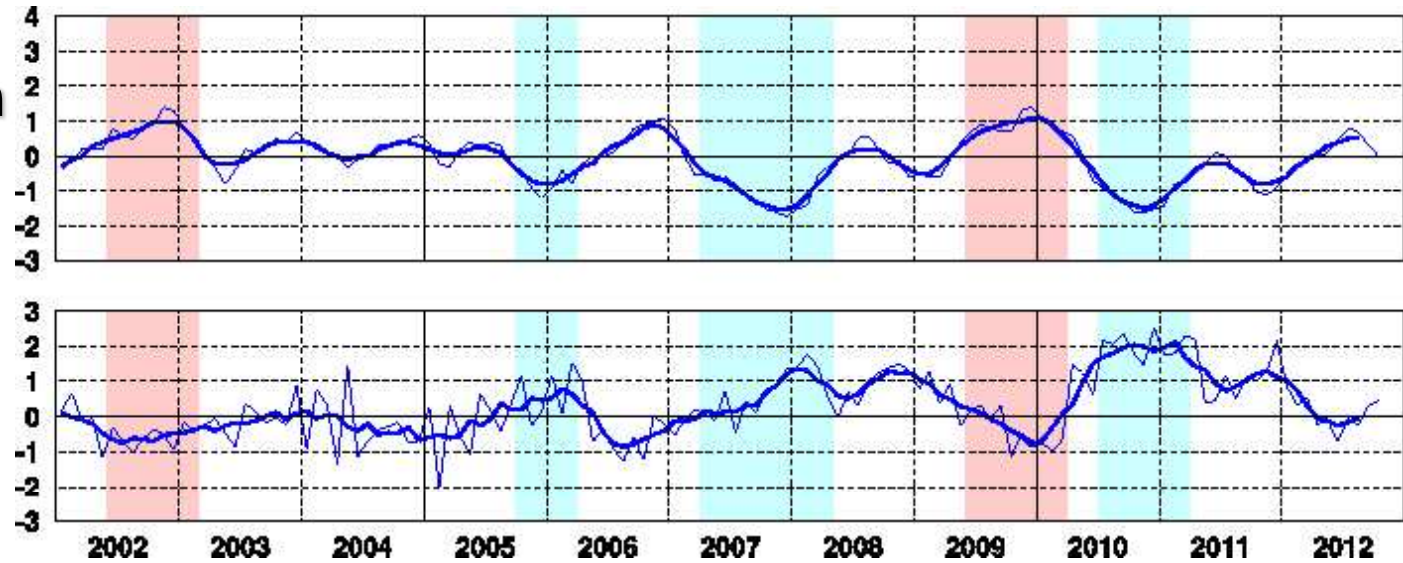


3. Current conditions and outlook



ENSO monitoring indices

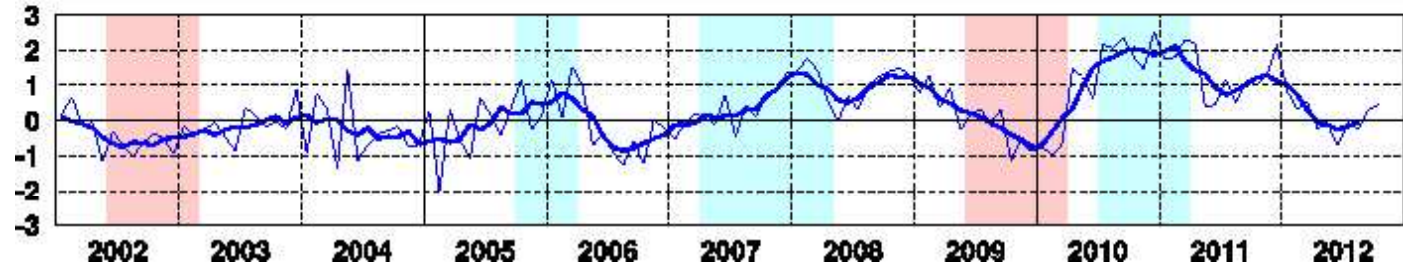
NINO.3 SST deviation from 30-year sliding mean



OCT2012

↓
+0.0°C

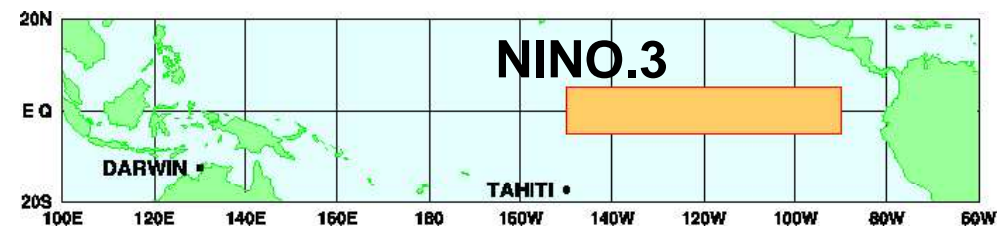
Southern Oscillation Index



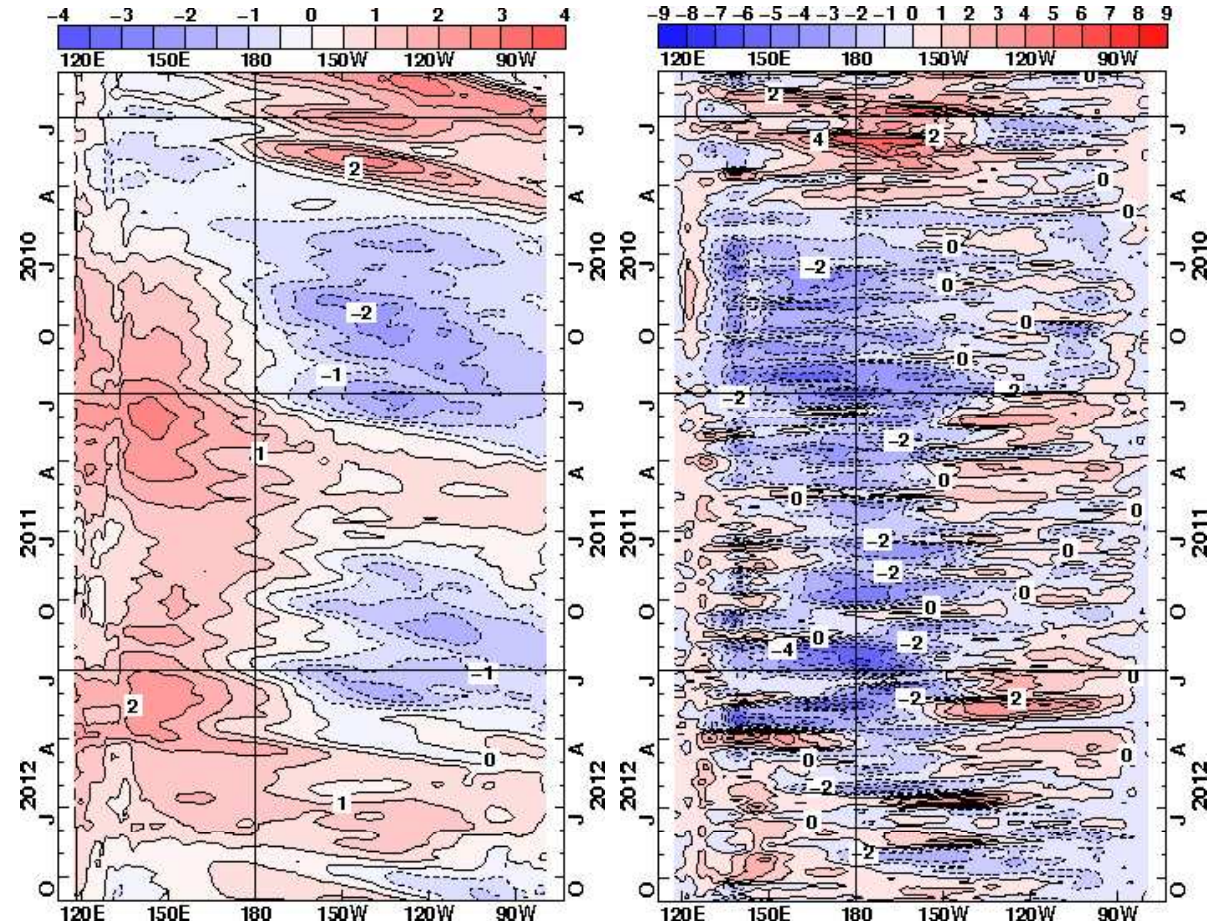
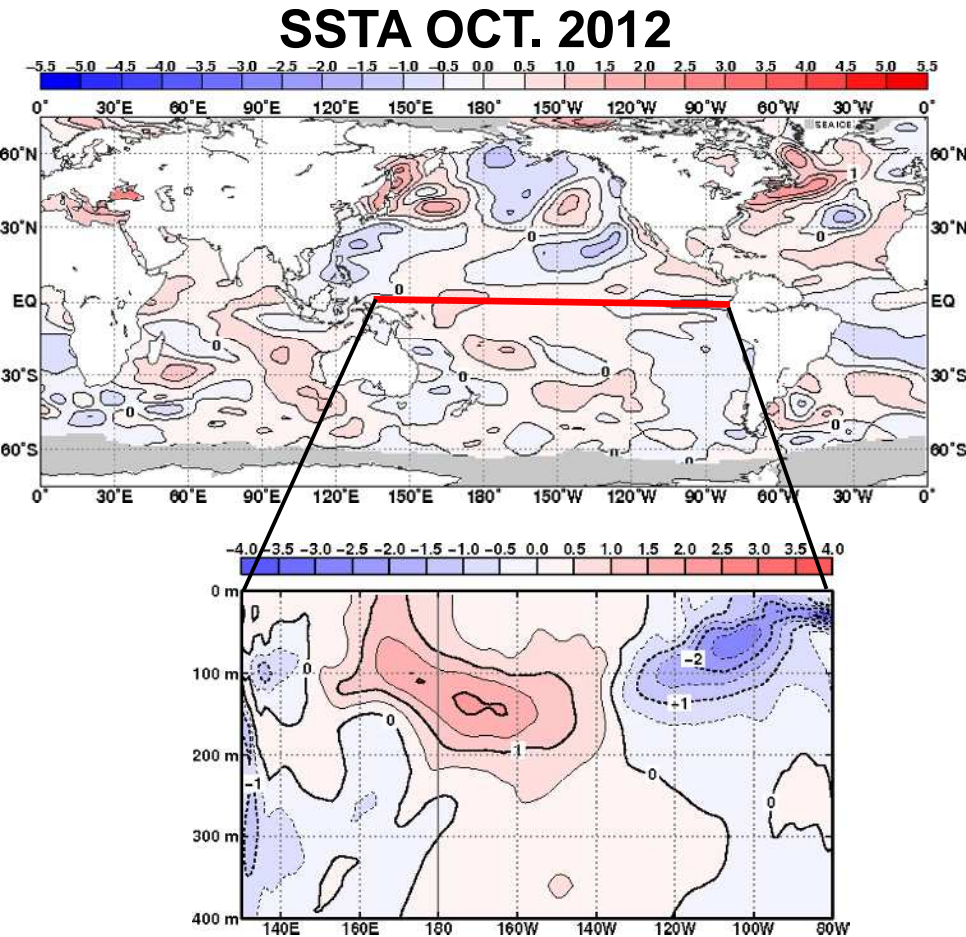
+0.5

Red shade: El Nino event

Blue shade: La Nina event



The latest conditions in the equatorial Pacific Ocean



Analyses of the equatorial Pacific Ocean conditions for Oct, 2012. SSTA anomaly (left, upper) and vertical section of temperature anomaly along the equator (left, lower), longitude-time section of OHC anomaly (center), longitude-time section of wind stress anomaly (right).

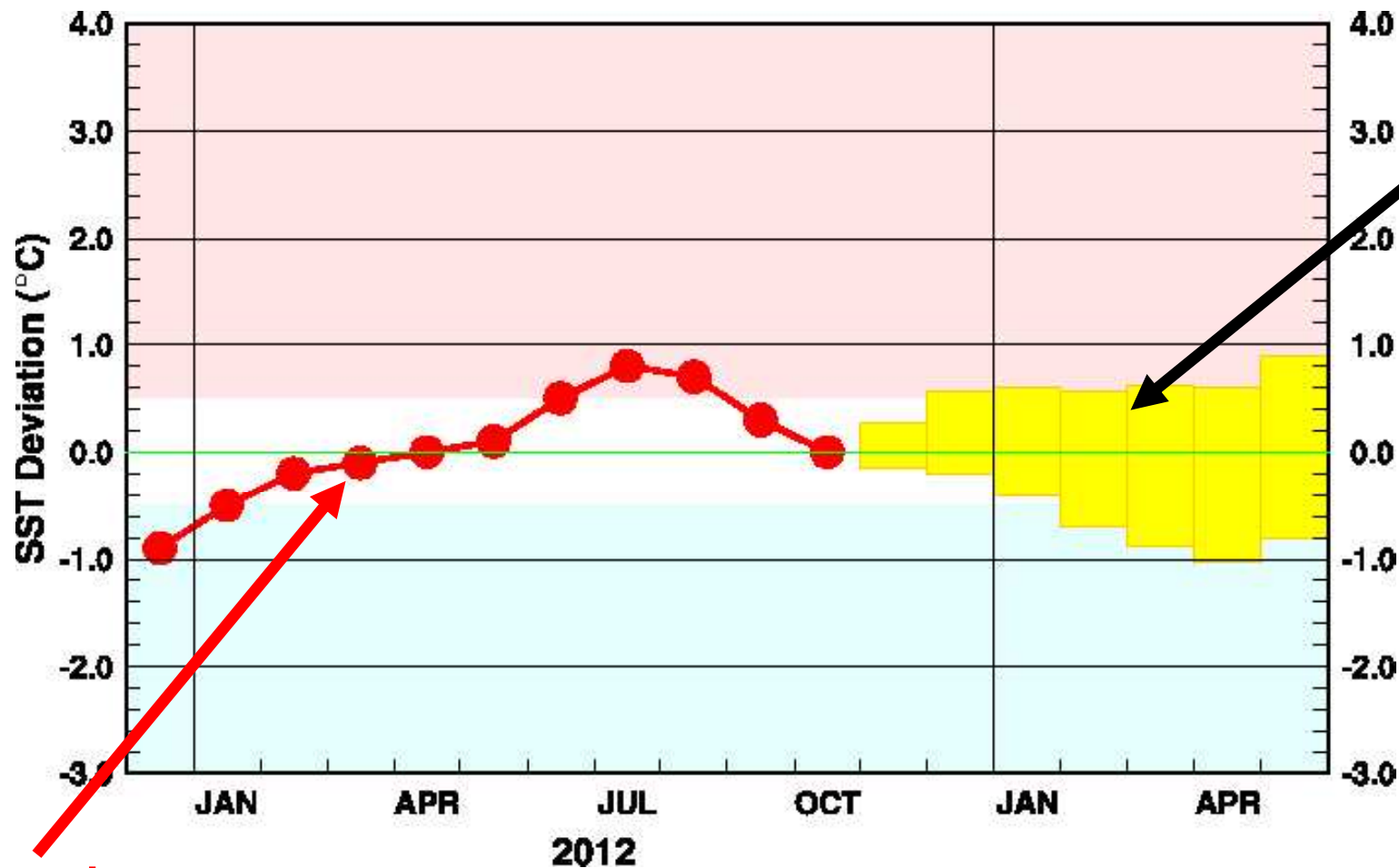
OHC(ocean heat content) : water temperature vertically averaged from the surface to 300m depth.



Model prediction (JMA/MRI-CGCM)

http://ds.data.jma.go.jp/tcc/tcc/products/el_nino/outlook.html

NINO.3 SST deviation from 30-year sliding mean



Observation.

NINO.3 SST will be near normal during the prediction period.

The latest El Niño outlook from JMA (Nov.2012)

- El Niño conditions transitioned to ENSO neutral conditions in the equatorial Pacific.
- It is likely that ENSO neutral conditions will continue until the northern hemisphere spring.

<http://ds.data.jma.go.jp/tcc/tcc/products/elnino/outlook.html>

Outlook by NOAA CPC

Synopsis: ENSO-neutral is favored through the Northern Hemisphere winter 2012-13.

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.pdf

4. TCC products for El Niño monitoring and prediction

You can get a lot of information on El Niño or La Niña in the TCC web site. You can monitor the current conditions of El Niño or La Niña and get the prediction of El Niño or La Niña as I mentioned before.

Figures in TCC HP

http://ds.data.jma.go.jp/tcc/tcc/products/el_nino/ocean/index_tcc.html

Home	World Climate	Climate System Monitoring	El Niño Monitoring	NWP Model Prediction	Global Warming	Climate in Japan	Training Module	Press release	Links
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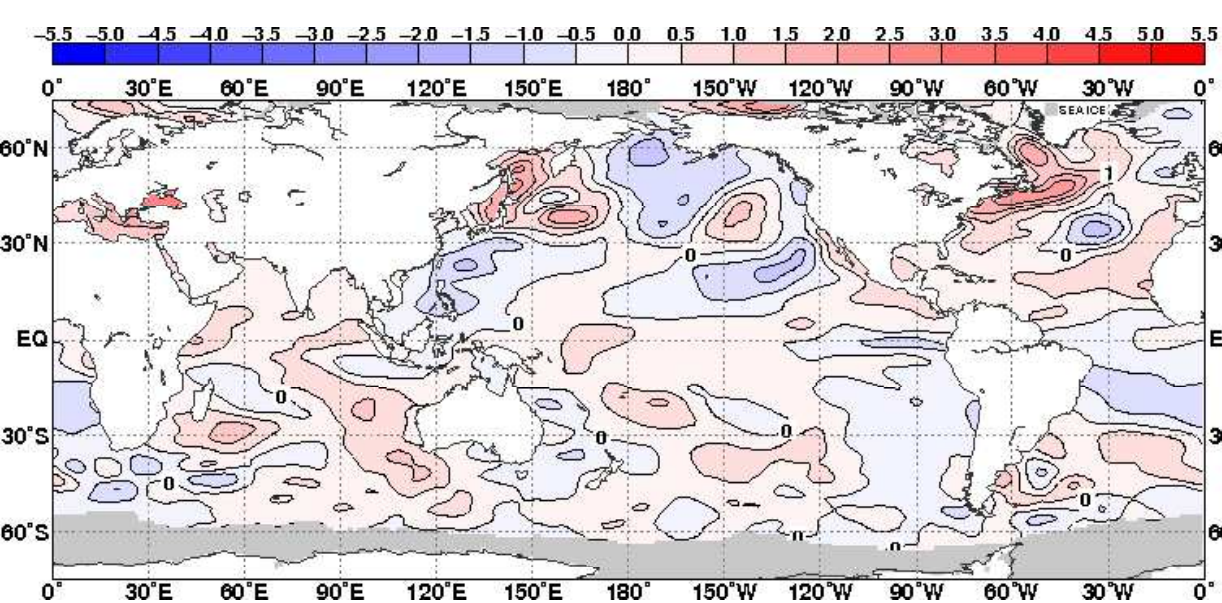
HOME > [El Niño Monitoring](#) > Figures of Oceanographic Condition

Figures of Oceanographic Condition

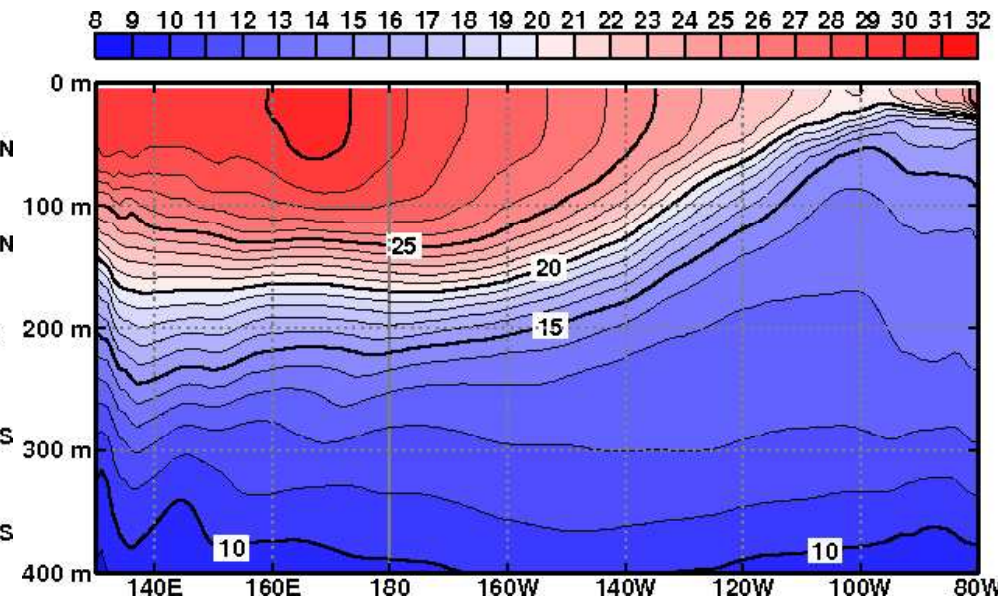
Global	<p>Monthly Mean Sea Surface Temperature</p> <p>Monthly Mean Sea Surface Temperature Anomalies</p> <p>3-Month Mean Sea Surface Temperature</p> <p>3-Month Mean Sea Surface Temperature Anomalies</p>
The equatorial Pacific	<p>Sea Surface Temperature and Anomalies along the Equator (Time - Longitude)</p> <p>Temperature and Anomalies along the Equator (Depth - Longitude)</p> <p>Sub-surface Temperature along the Equator (Depth - Time)</p> <p>20°C Depth and Anomalies along the Equator (Time - Longitude)</p> <p>Ocean Heat Content and Anomalies along the Equator (Time - Longitude)</p> <p>Ocean Heat Content and Anomalies along 6°N (Time - Longitude)</p> <p>Ocean Heat Content and Anomalies along 6°S (Time - Longitude)</p> <p>Surface Zonal Wind Stress and Anomalies along the Equator (Time - Longitude)</p>

Figures in TCC HP

http://ds.data.jma.go.jp/tcc/tcc/products/elnino/ocean/index_tcc.html



Monthly Mean Sea Surface Temperature Anomalies



Depth-Longitude Cross Sections of Temperature along the Equator in the Pacific Ocean

Figures in TCC HP

http://ds.data.jma.go.jp/tcc/tcc/products/elnino/ocean/index_tcc.html

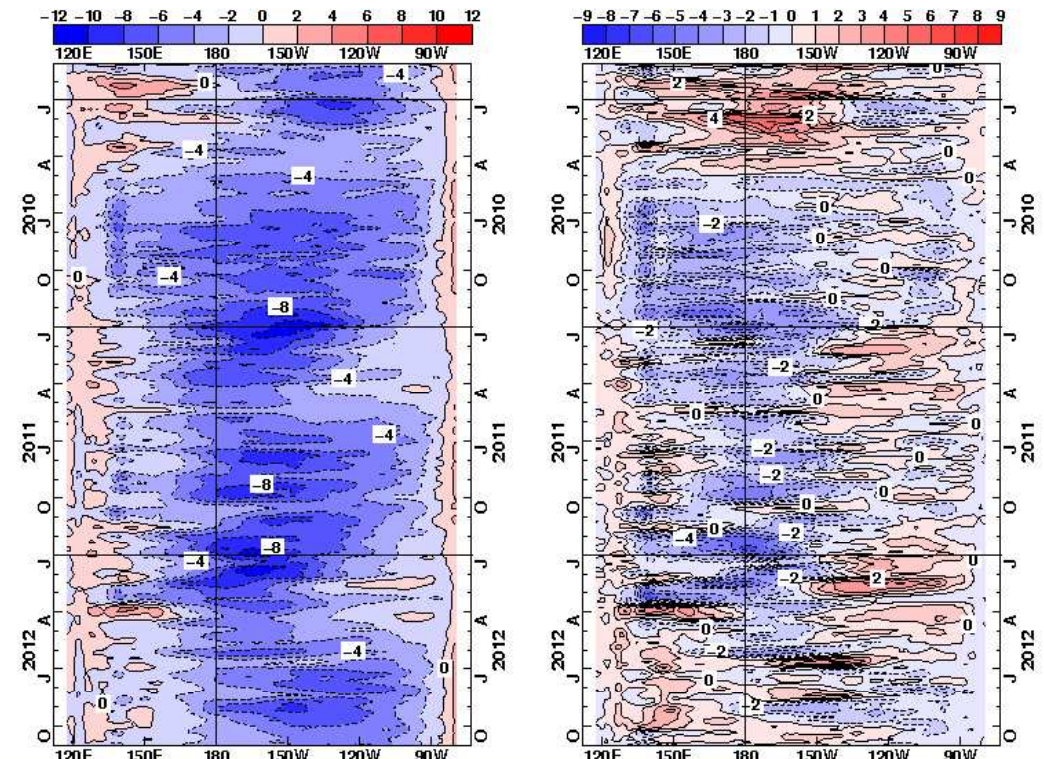
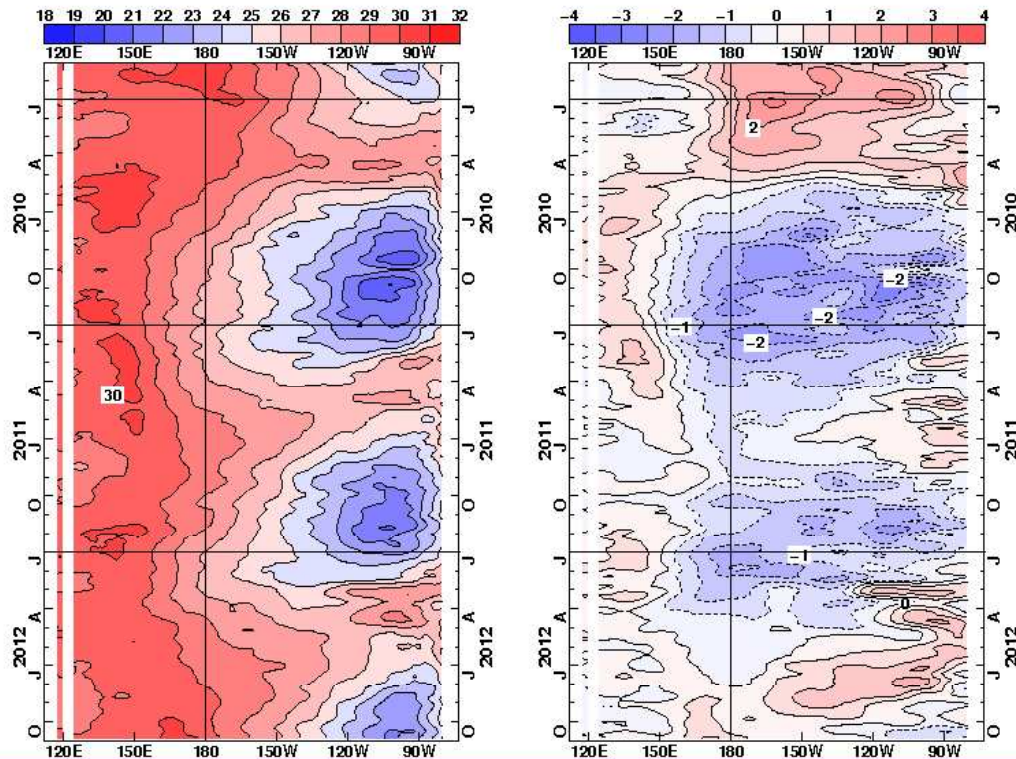
Time-Longitude Cross Sections of Sea Surface Temperature (Left) and Anom...

Time-Longitude Cross Sections of Surface Zonal Wind Stress (Left) and Anor...

The contour intervals are 1°C (left) and 0.5°C (right). Anomalies are departures from the JMA cl... The contour intervals are 0.02N/m² (left) and 0.01N/m² (right). Anomalies are departures from

2012 year 10 month < select >

2012 year 10 month < select >



Time-Longitude Cross Sections of SST(left) and wind stress(right) along the Equator in the Pacific Ocean

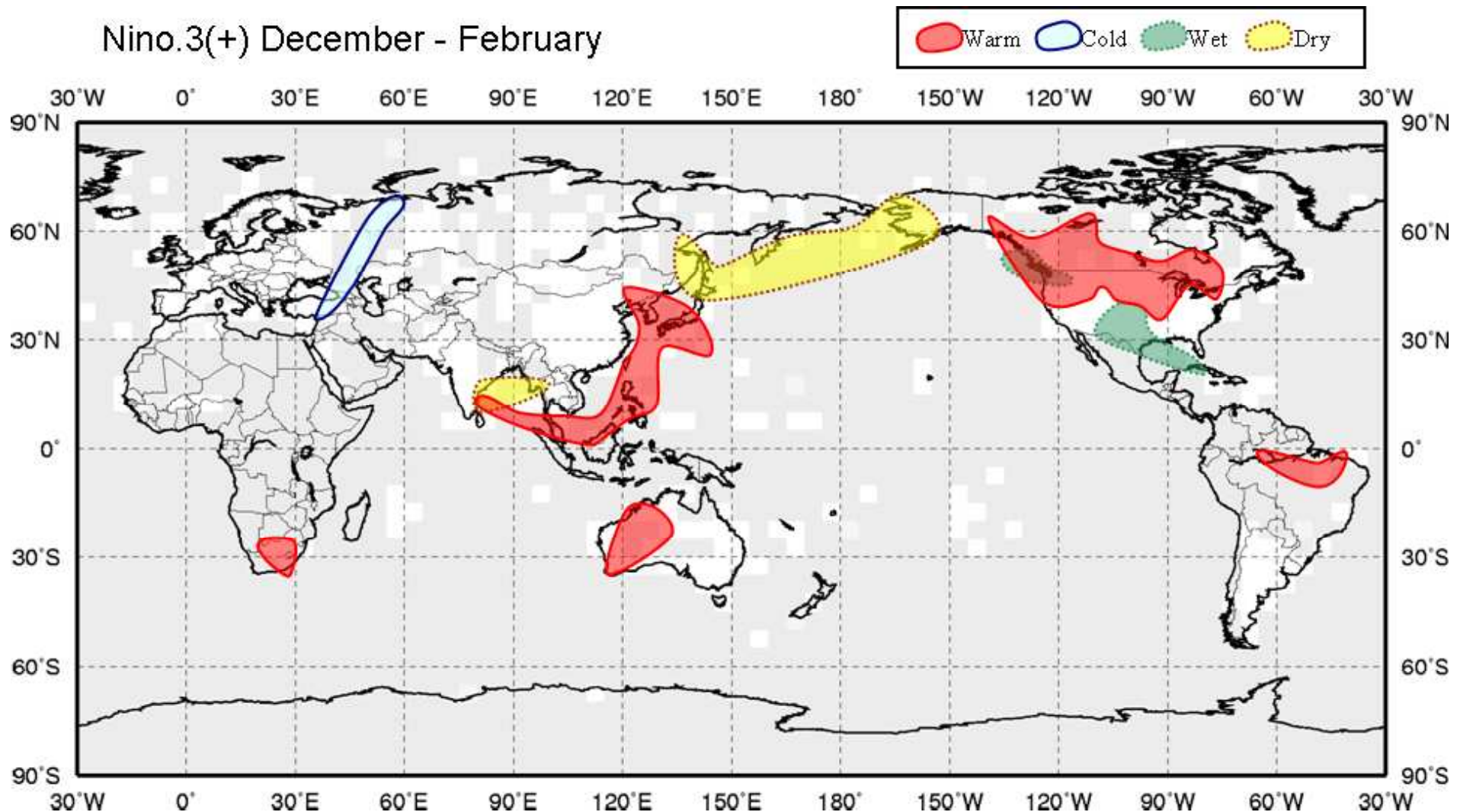


Figures in TCC HP

<http://ds.data.jma.go.jp/tcc/tcc/products/climate/ENSO/index.htm>

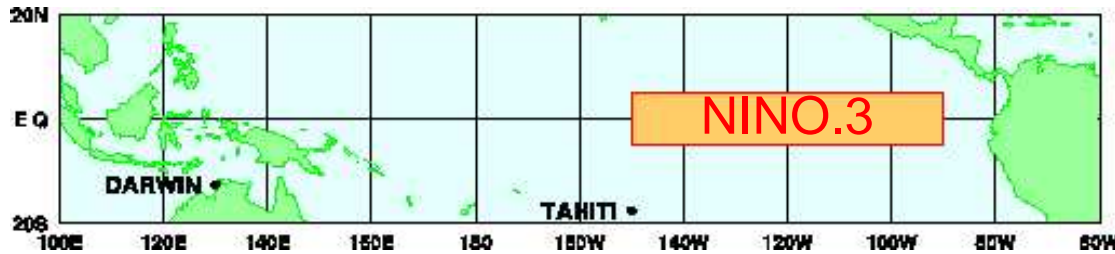
El Niño impact on the world climate

Nino.3(+) December - February

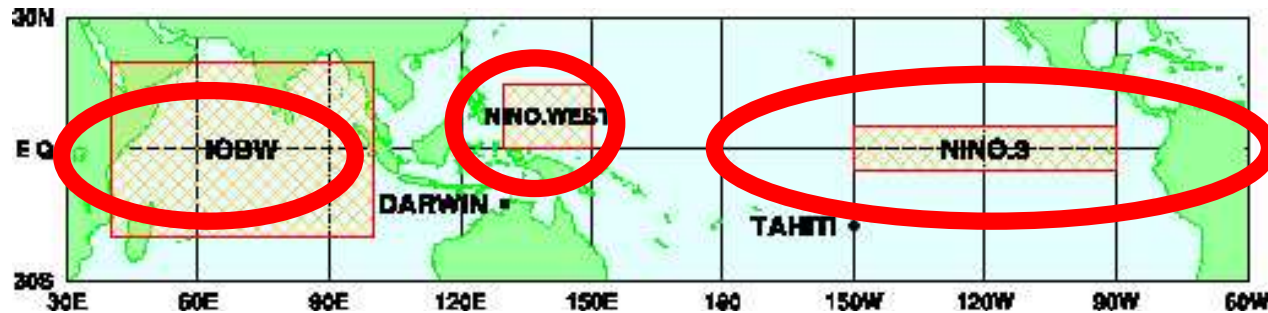
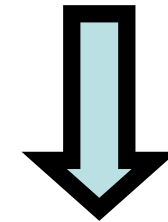
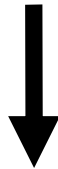


The map shows the regions where climate tendencies observed during El Niño episodes is statistically significant in boreal winter.

Information on oceanic conditions in the western equatorial Pacific and the Indian Ocean



- Model and assimilation improved
- Ocean observations increased

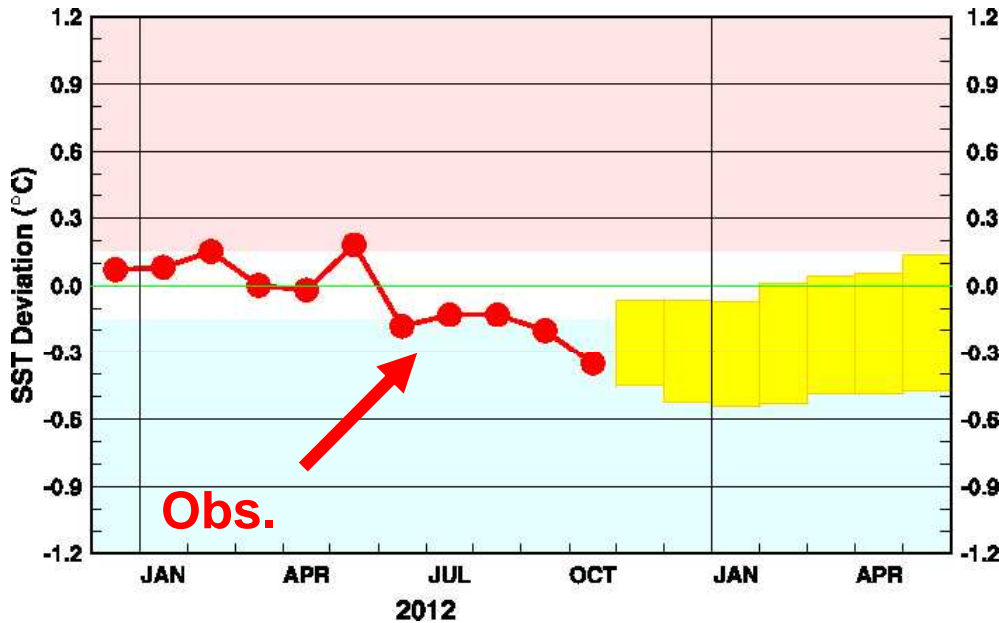


Region for monitoring and outlook was expanded in 2009

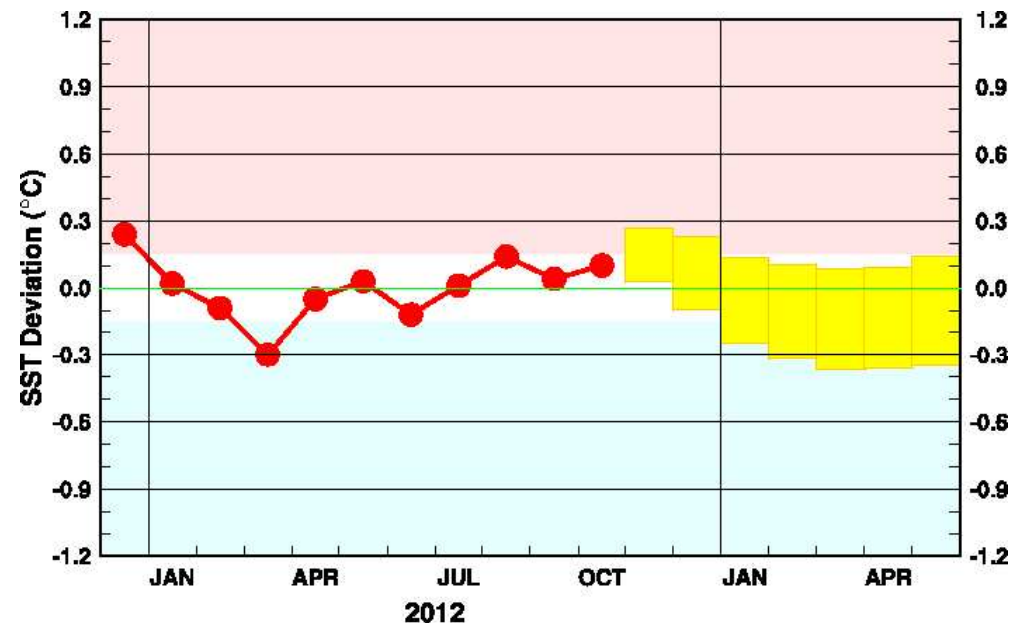
IOBW SST deviation tends to lag about a couple of months behind NINO.3.

NINO.WEST SST deviation tends to vary with NINO.3, with an opposite sign.

Prediction of NINO.WEST and IOBW



SST deviations for **NINO.WEST** after removed the linear trend in 30years



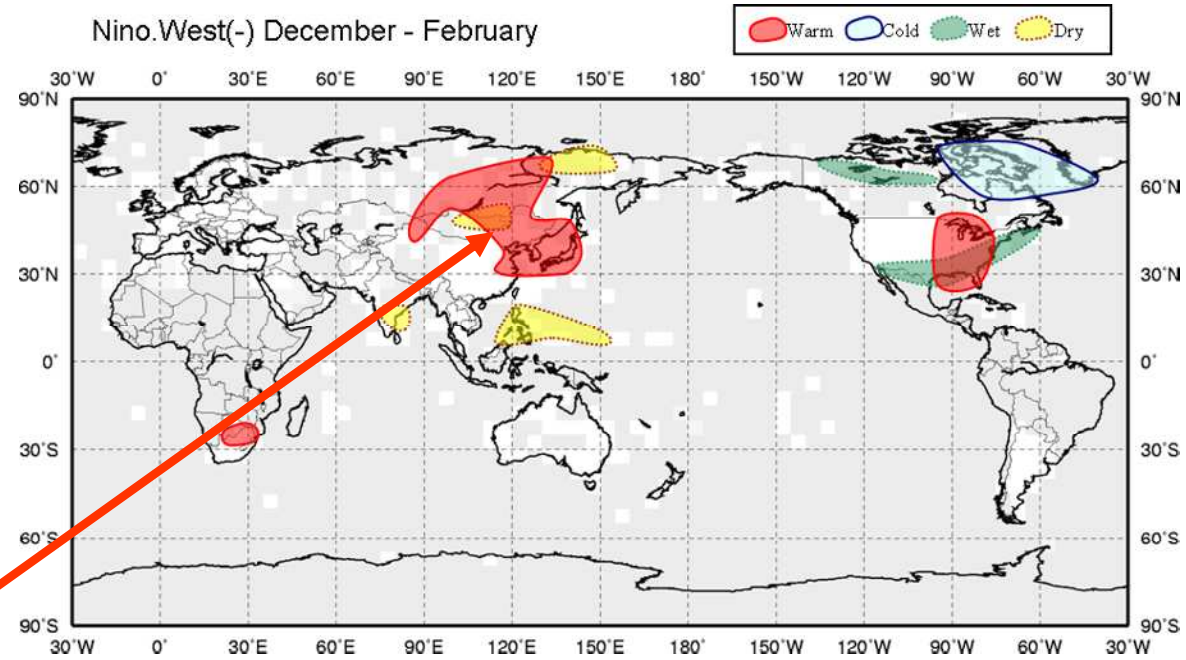
SST deviations for **IOBW** after removed the linear trend in 30years

It is likely that the NINO.WEST SST will be near normal or below normal in the months ahead.

It is likely that the IOBW SST will be near normal in the months ahead.

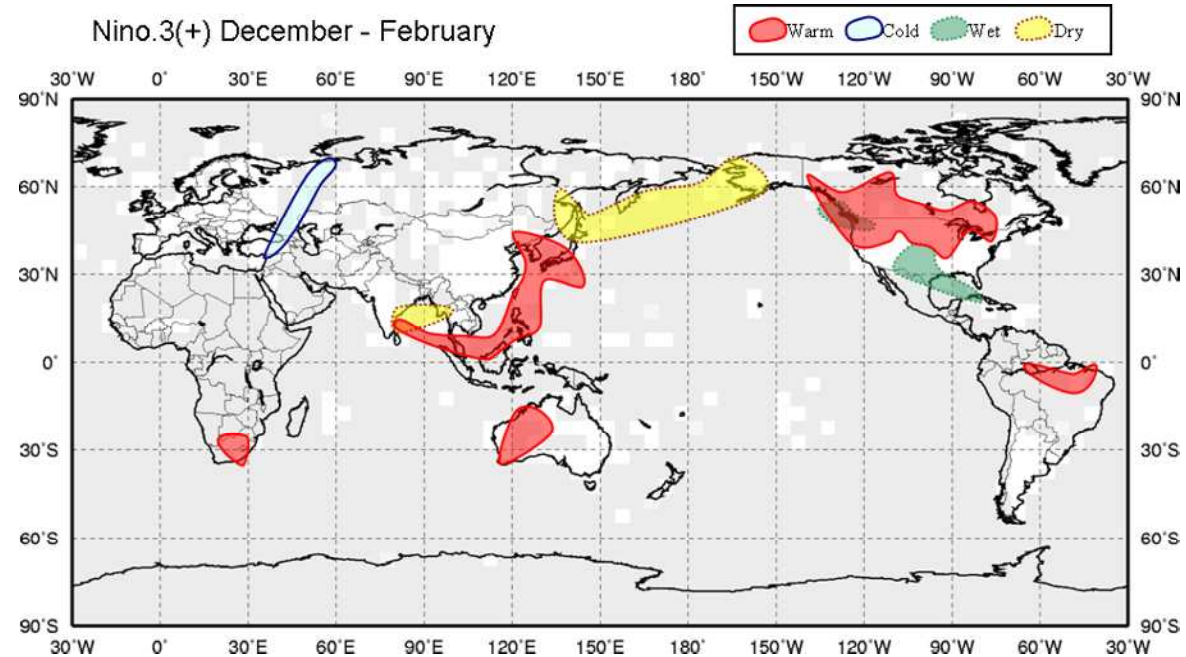
Impact of NINO.WEST on world climate (DJF)

Impact of below-normal NINO.WEST on world climate in boreal winter



Warmer tendency in the East Asia is clearer in the NINO.WEST impact than in the NINO.3 impact.

Impact of above-normal NINO.3 on world climate in boreal winter

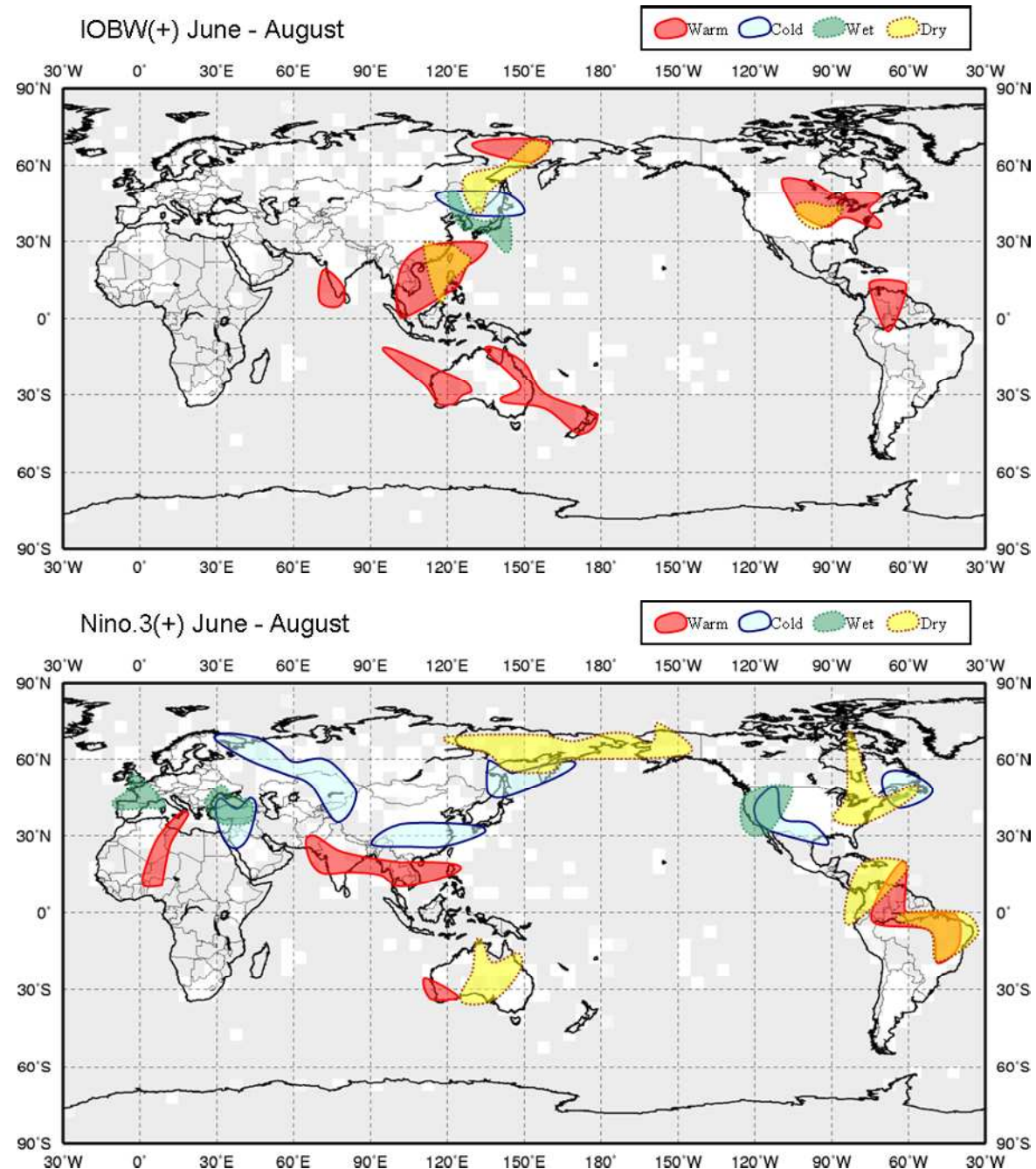


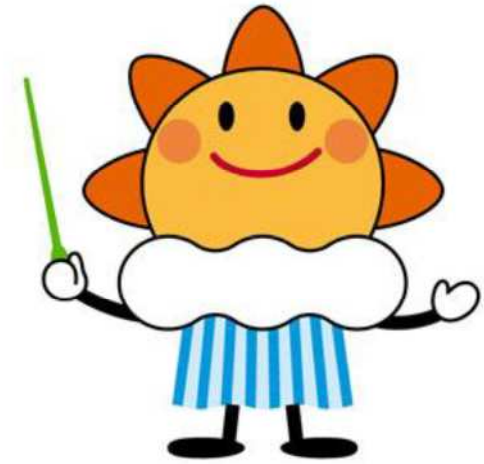
Impact of IOBW on world climate (JJA)

Impact of above-normal IOBW on world climate in boreal summer

When above-normal IOBW SST persists through post-El Niño summer, impacts like the upper panel are expected.

Impact of above-normal NINO.3 on world climate in boreal summer





Thank you for your attention

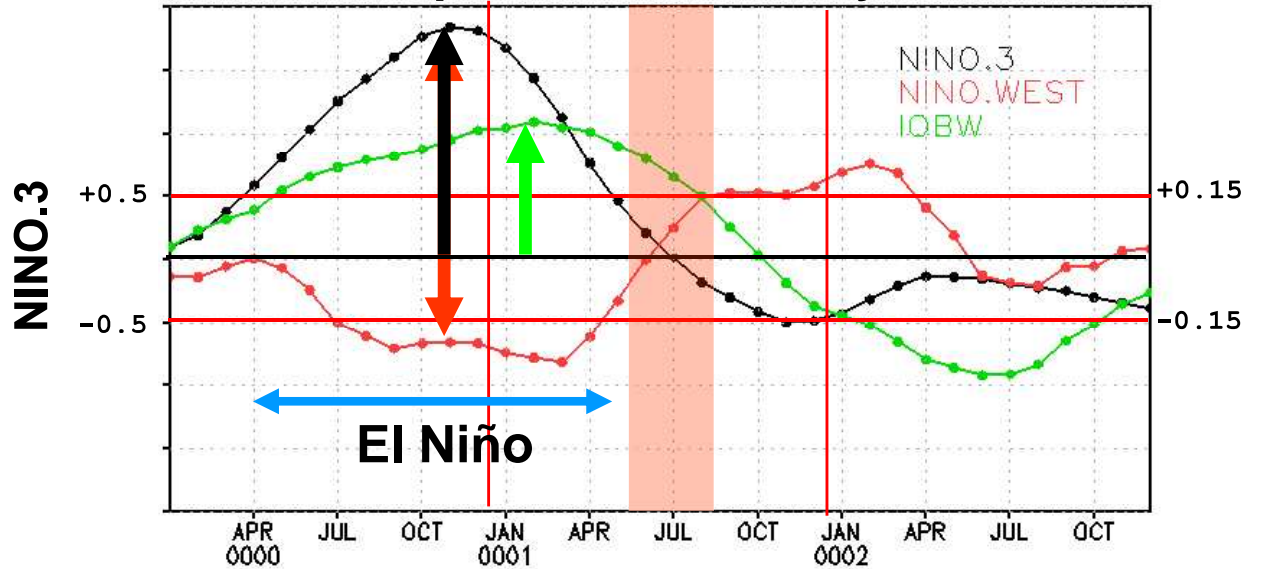
IOBW / NINO.WEST and ENSO

NINO.WEST SST deviation tends to vary with NINO.3, with an opposite sign.

IOBW SST deviation tends to lag about a couple of months behind NINO.3.

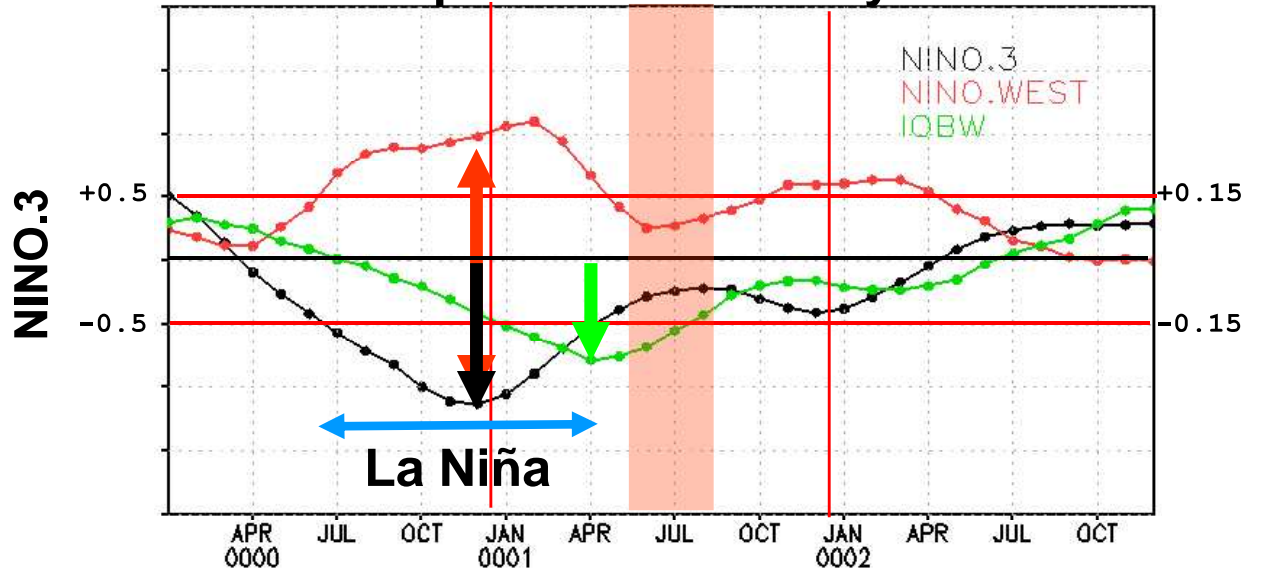
After end of **El Niño** (**La Niña**) in spring, IOBW tends to stay **above** (**below**) normal in summer.

Composite of El Niño years



IOBW / NINO.WEST

Composite of La Niña years



IOBW / NINO.WEST

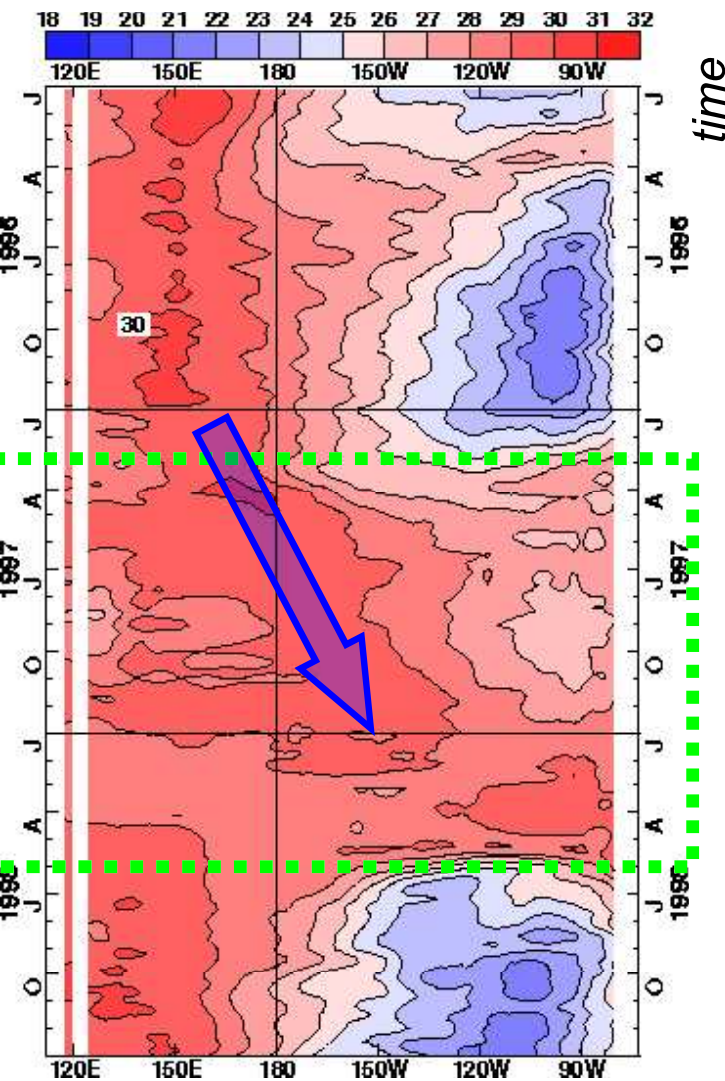


Positive feedback

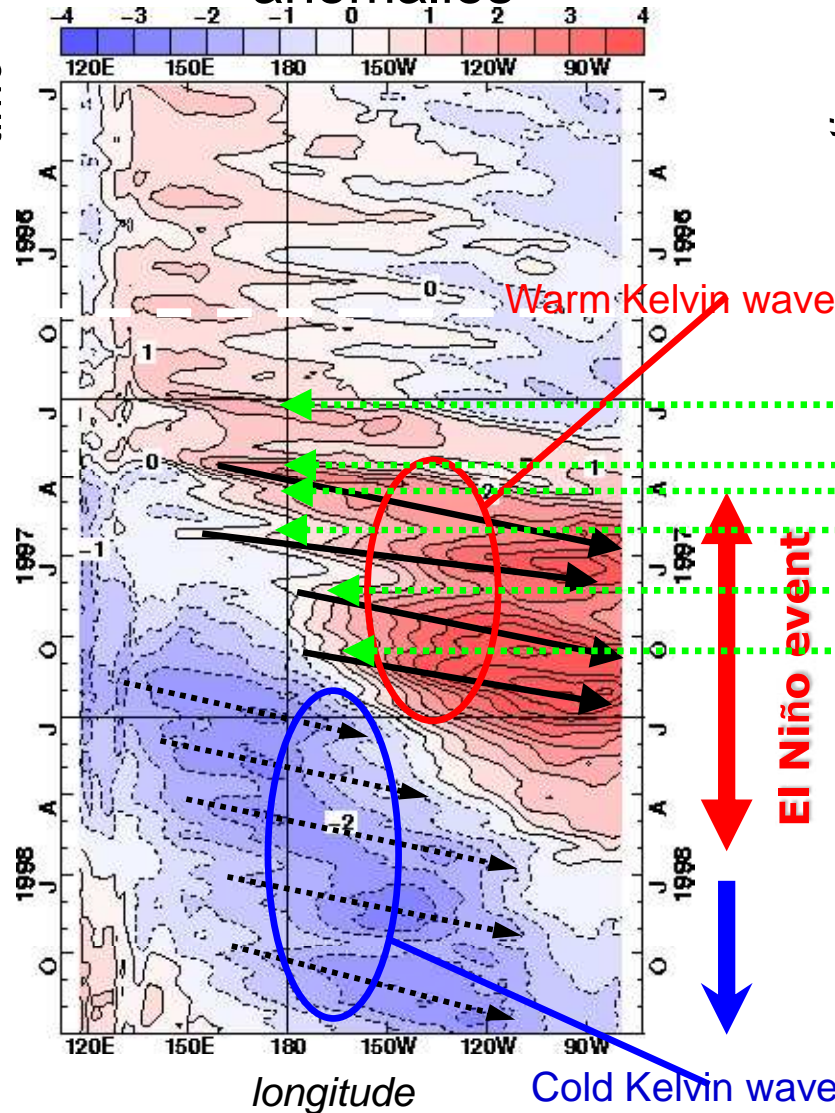


Hövmöeller (Longitude-time section) in equatorial Pacific

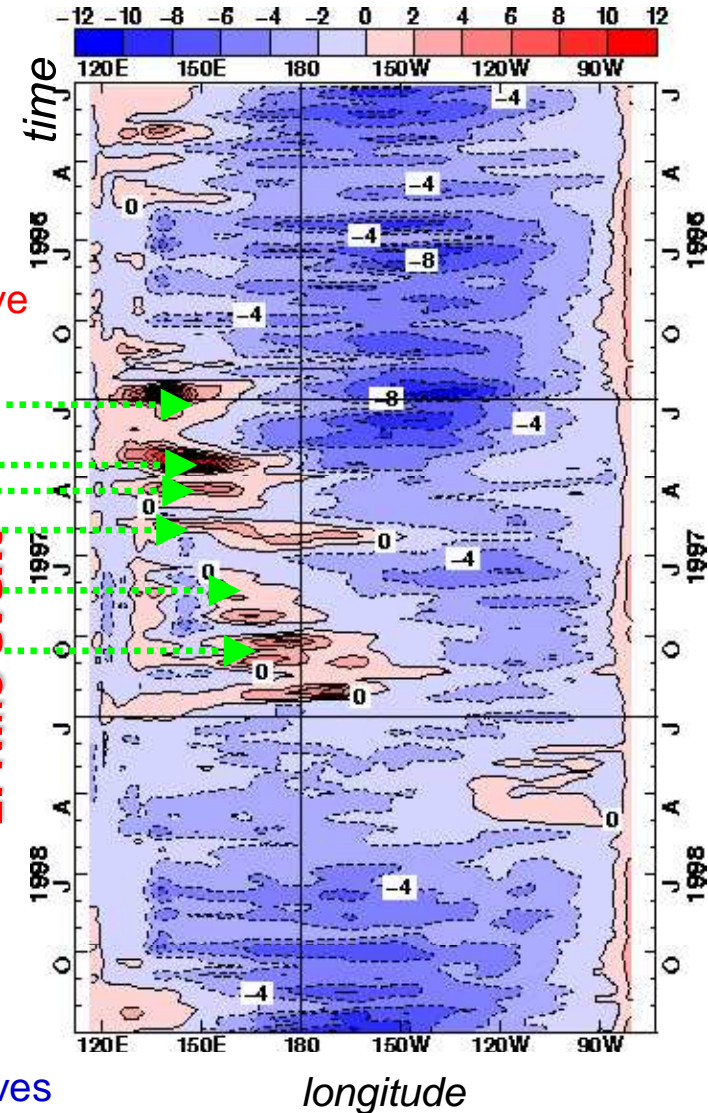
SST



OHC (Ocean Heat Content)
anomalies



Wind stress



OHCs are defined as vertically averaged temperatures from sea surface to 300-m depth.