

Updates of operational and research activities at JMA/MRI & MIROC



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History of JMA Operational Coupled Prediction System



JMA/MRI-CPS3 for Seasonal Prediction

Atm: T_L319 (~55 km, 0.5625 deg.) L100 (~0.01hPa)

Ocn: 0.25x0.25L60

2015 JMA/MRI-CPS2 for Seasonal Prediction

Atm: T_L159 (~110 km, 1.125 deg.)L60 (~0.1hPa)

Ocn: 1x(0.5-0.3)L52+BBL *Takaya et al. 2016, Submitted to Clim. Dyn.*



2010 JMA/MRI-CPS1 for Seasonal Prediction

2008 JMA/MRI-CPS1 for ENSO Outlook

Atm: T_L95 (~180 km, 1.875 deg.)L40 (~0.4hPa) Ocn: 1x(1-0.3)L50

2003 JMA-CGCM02 (GSM0103) for ENSO Outlook

Atm: T63 (~180 km, 1.875 deg.)L40 (~0.4hPa) Ocn: 2.5x(2-0.5)L20

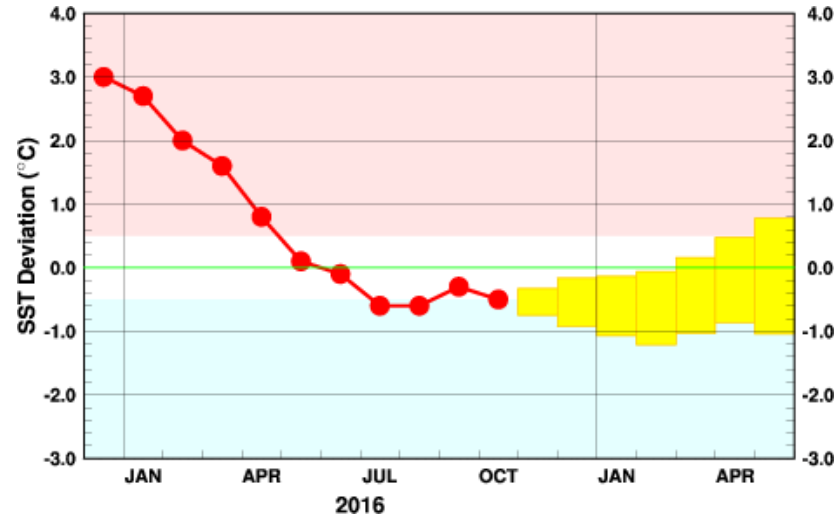
1999 JMA-CGCM01 (GSM8911) for ENSO Outlook

Atm: T42 (~250 km)L21 (~10 hPa) Ocn: 2.5x(2-0.5)L20

La Niña prediction

“El Nino Monitoring and Outlook” issued on 10th November, 2016

NINO3SST
JMA/MRI-CPS2 from
Nov.2016



ENSO forecast
probabilities
based on
JMA/MRI-CPS2

YEAR	MONTH	mean period	El Niño	ENSO neutral	La Niña
2016	SEP	JUL2016–NOV2016	10	90	
	OCT	AUG2016–DEC2016	30	70	
	NOV	SEP2016–JAN2017	30	70	
	DEC	OCT2016–FEB2017	40	60	
2017	JAN	NOV2016–MAR2017	40	60	
	FEB	DEC2016–APR2017	50	50	
	MAR	JAN2017–MAY2017	60	40	

■ El Niño
 ■ ENSO neutral
 ■ La Niña

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



Research-Base Seasonal to Decadal Predictions at MRI and MIROC

Model Configurations for decadal prediction (DCPP)

	<i>MRI (JMA)</i>	<i>AORI, JAMSTEC, and NIES</i>
Model Name	<i>MRI-ESM1.2</i>	<i>MIROC6</i>
Atmosphere	<i>TL159 (120m), Up to 0.01hPa</i>	<i>T85 (140km), Up to 0.004hPa</i>
Ocean	<i>1.0° (lon) x 0.3-0.5° (lat)</i>	<i>1.0° (lon) x 0.25-0.5° (lat)</i>



Assimilation System: EnKF

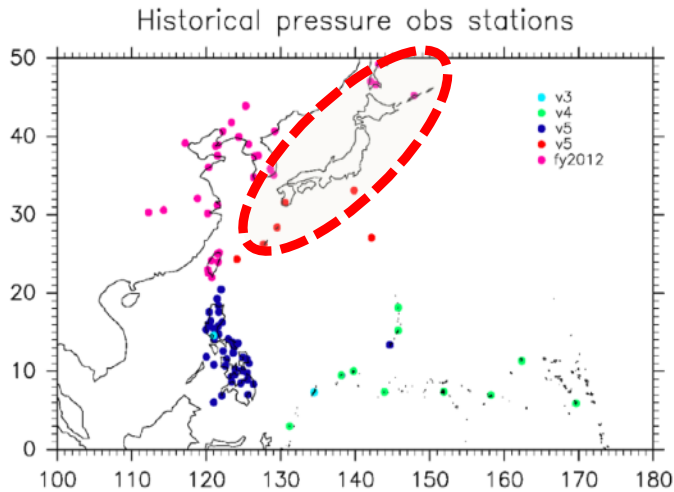
Initialization: Full data assimilation with surface pressure and ocean T and S (> 3000m) observations by using low-res models, interpolated to high-res for predictions.

M. Ishii



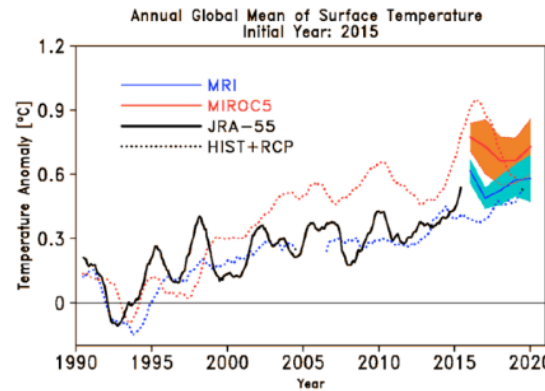
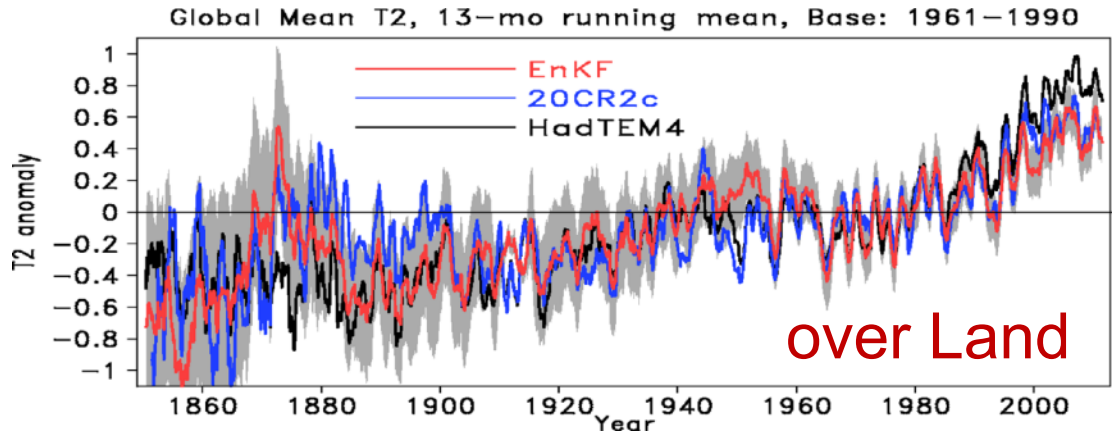
Research-Base Seasonal to Decadal Predictions at MRI and MIROC

150-year Climate Reanalysis with MIROC3 (T42 AGCM and $1^\circ \times 1^\circ$ OGCM) has been done.

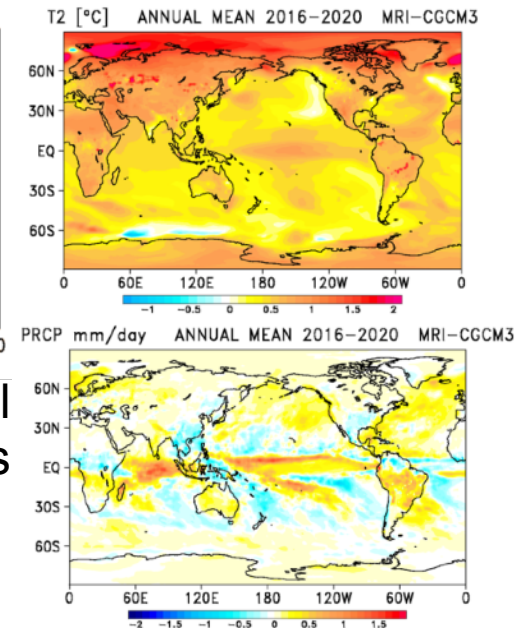


Data rescue of atmospheric and oceanic data around Japan.

Long-term climate reanalysis and prediction studies are now undertaken ... and for DCPP as well.



Latest decadal prediction experiments

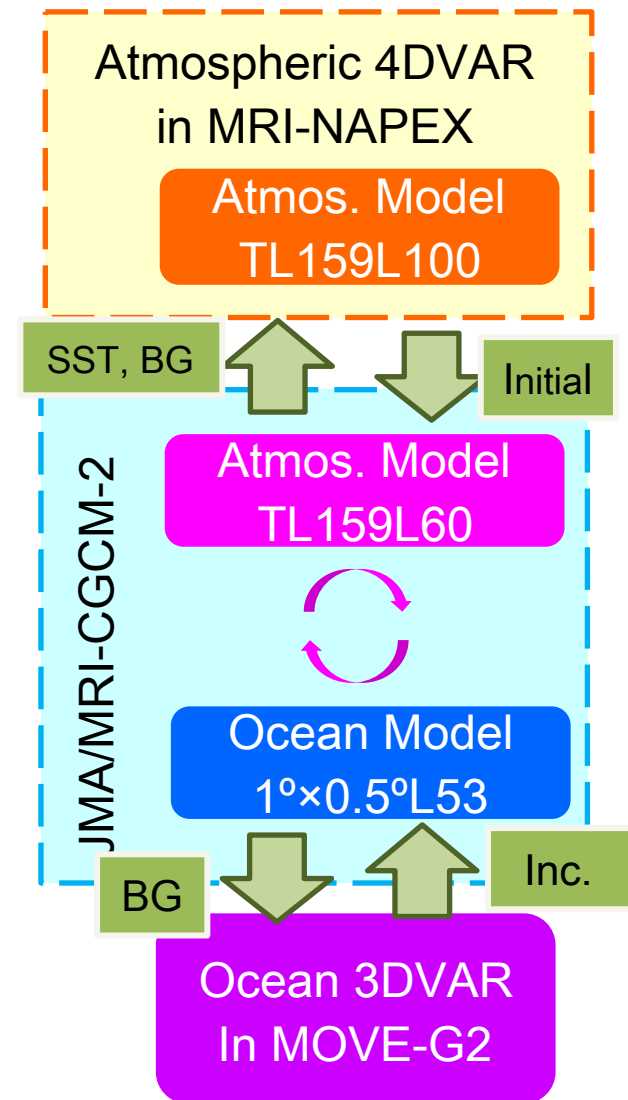


M. Ishii



Development of a weakly coupled data assimilation (CDA) system at JMA/MRI

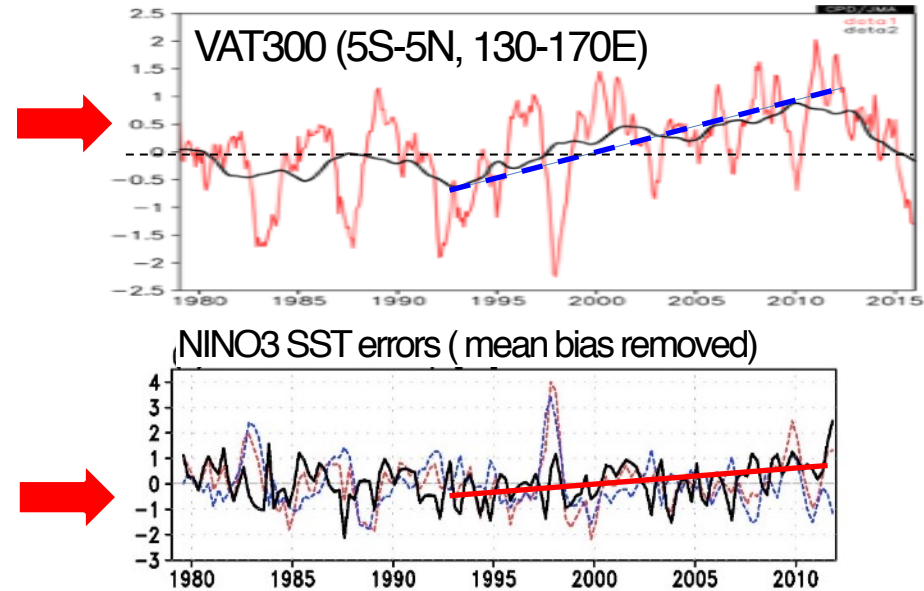
- ✓ A prototype has been built recently.
- ✓ Based on the operational atmospheric 4DVAR and the operational ocean data assimilation systems and the operational coupled model (JMA/MRI-CGCM2).
- ✓ The coupled model is used as the outer model for atmospheric 4DVAR (**Outer-Loop Coupling**).
- ✓ Adopting **different intervals of DA cycles** for the atmosphere (6 hours) and **ocean (10 days.)**
- ✓ A 1-year reanalysis experiment has been performed. Experiments of numerical weather prediction and seasonal prediction using the CDA system will be conducted.



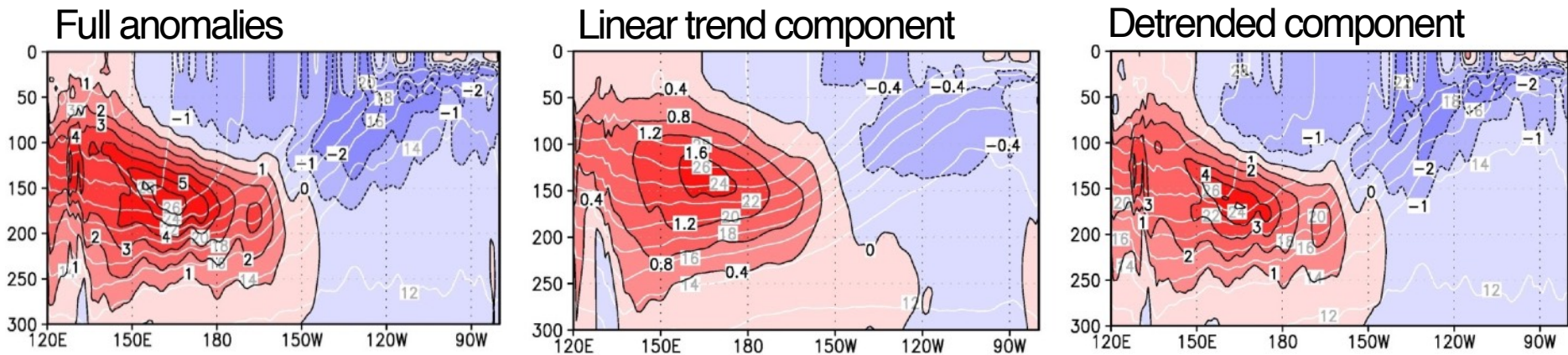
Y. Fujii

Impact of Decadal Trend in the Tropical Pacific Ocean on ENSO Prediction

- SST and ocean subsurface temperature has increased in the western equatorial Pacific during 1990s- to 2010s.



Trend and interannual anomalies on 27 January, 2011

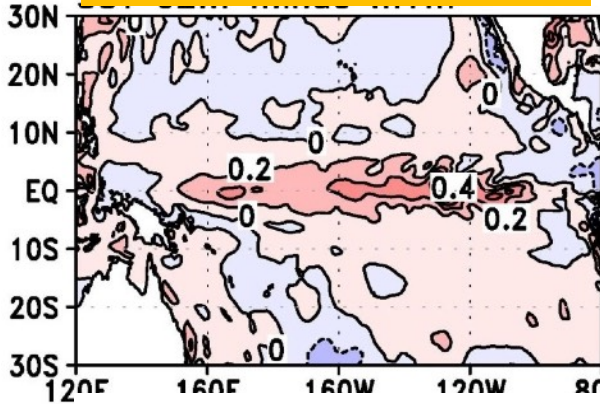


Surface temperature anomalies along the equatorial Pacific on 27 January, 2011

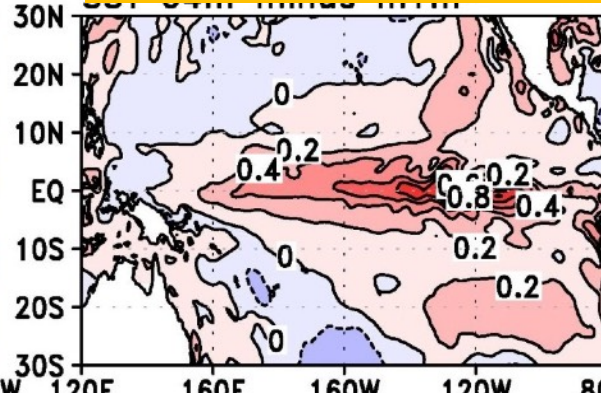
Impact of Decadal Trend in the Tropical Pacific Ocean on ENSO Prediction

Development of prediction errors (mean bias removed)
SST (2007-2011 mean)

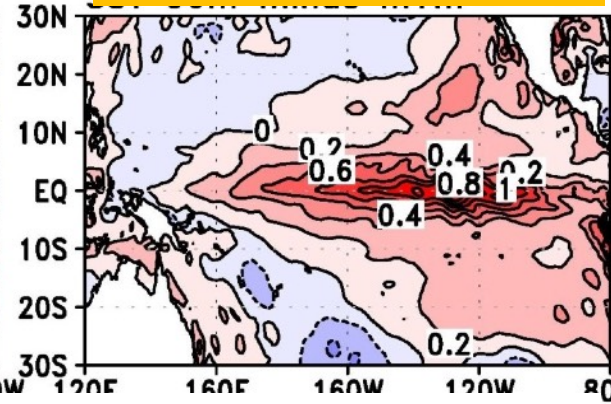
2-mo lead time



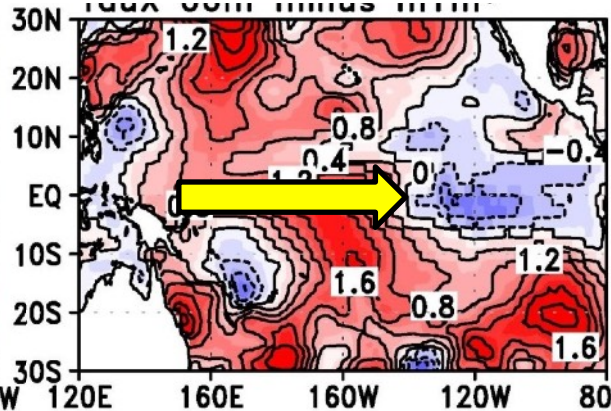
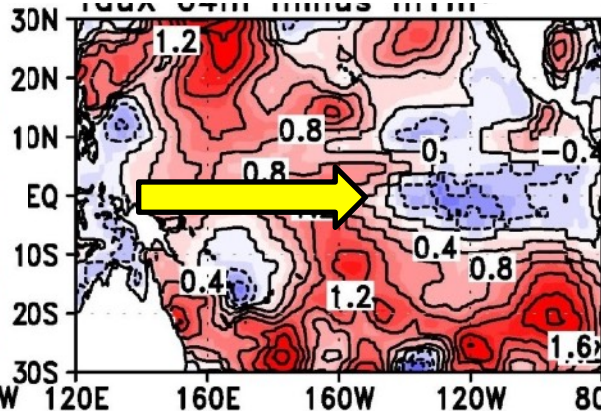
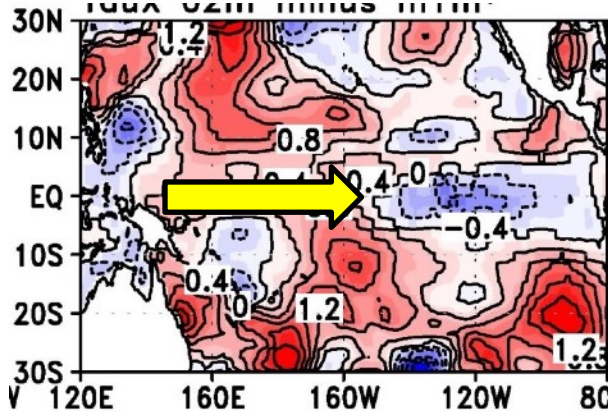
4-mo lead time



6-mo lead time



zonal wind stress (2007-2011 mean)

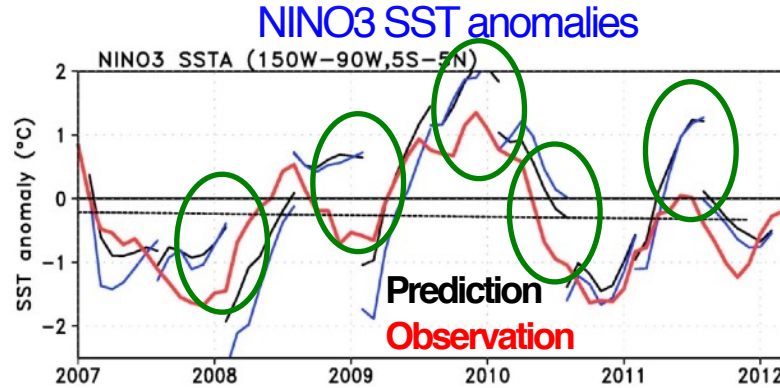
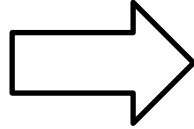
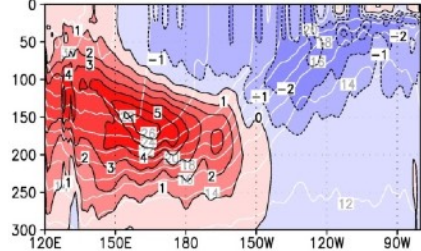


Impact of Decadal Trend in the Tropical Pacific Ocean on ENSO Prediction

Initial Condition

ENSO Prediction
by
JMAMRI-CPS1

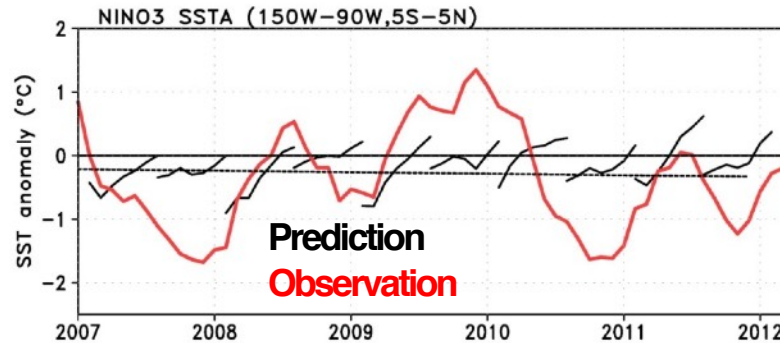
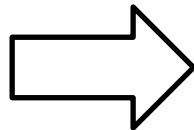
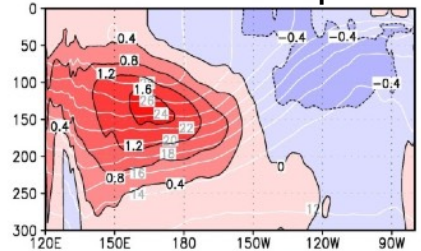
Full anomalies



positive
errors



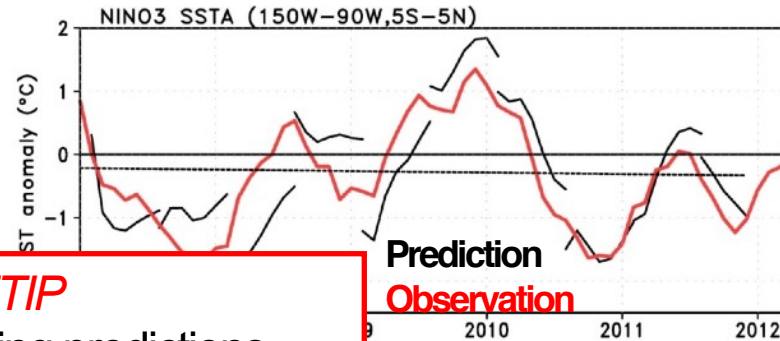
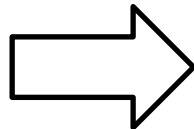
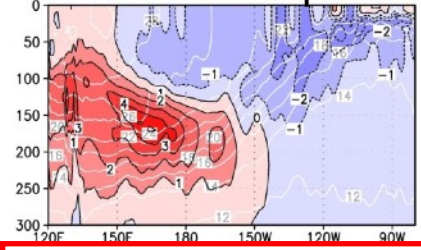
Linear trend component



Positive errors
due to
decadal trend



Detrended component



Errors due to
detrended
component

Future issues *Contribution to LRFTIP*

- evaluate the initial shock and drift during predictions
- analyze hindcast experiments of other models

