

The Role of Buoy and Argo Observations in ENSO in two SST Analyses in the Tropical Pacific

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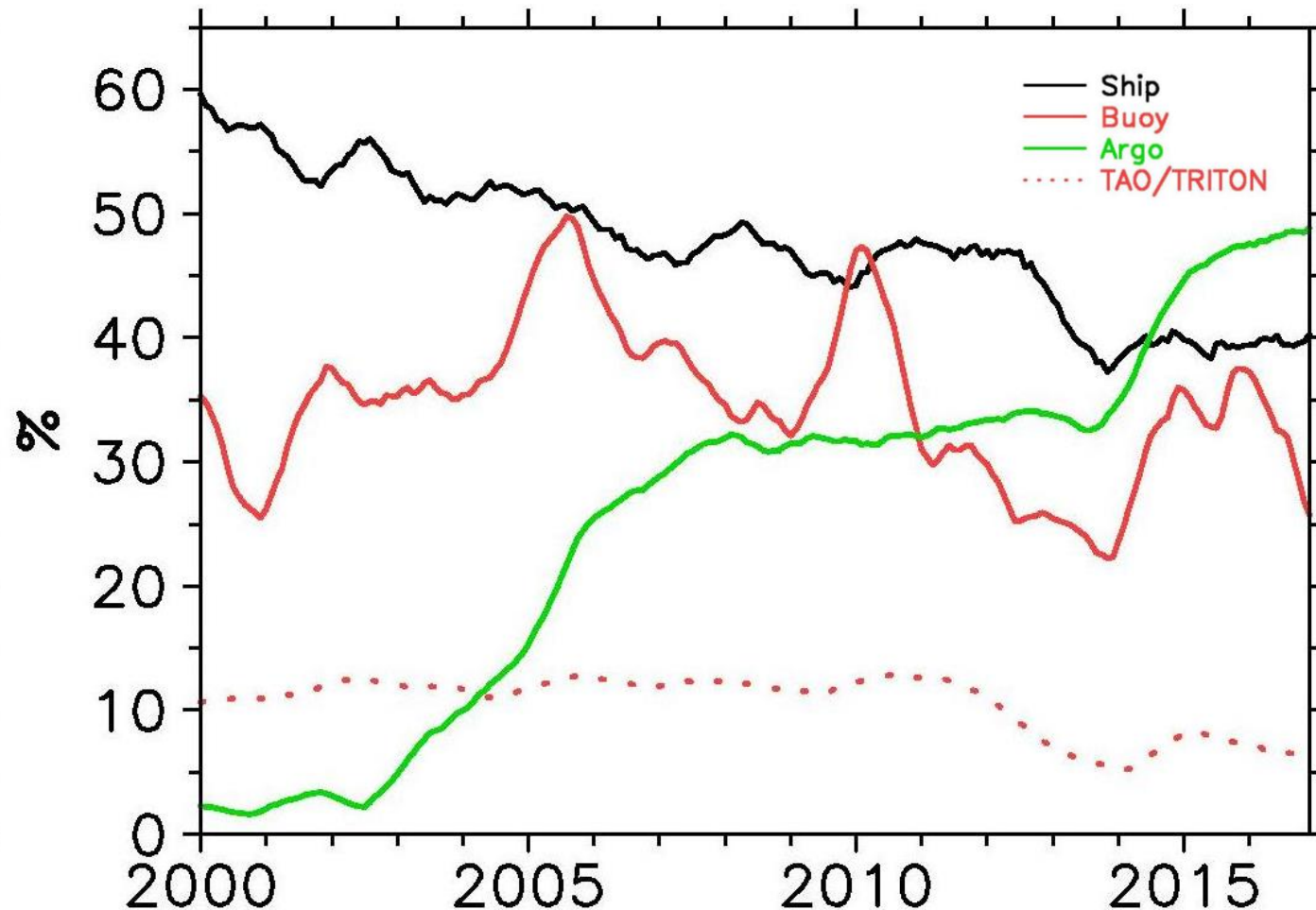
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Introduction

- ❖ SST analysis relies on observations, commonly from ships, buoys, Argo floats, (and satellites).
- ❖ Observations are changing in space and time.
- ❖ What are the impacts of observations on SST analysis?

Observation area coverages in the tropical Pacific (8S-8N, 120E-70W)

Area coverage is based on monthly 2x2 data



ERSSTv5

(Huang et al. 2017)

❖ **Observations:** Ships, Buoys, and Argo floats.

No satellite observations are included.

❖ **Methods:**

LF components: $25^\circ \times 25^\circ$ 15-year filter.

HF components: EOT (localized EOF) decomposition.

Biases of Ship SST was corrected

relative to NMAT before 1985 and

relative to buoy SST after 1985.

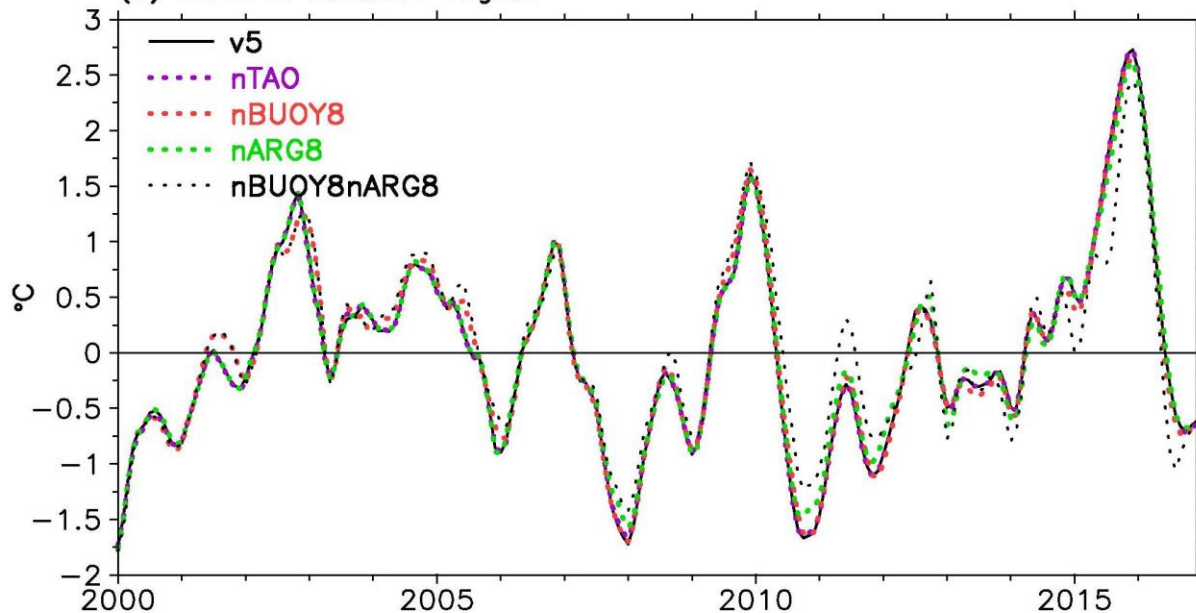
❖ **Resolution:** Monthly $2^\circ \times 2^\circ$ from 1854 to the present

2000-2016 in this presentation.

ERSSTv5 Experiments in The tropical Pacific (8°S–8°N and 120°E–70°W)

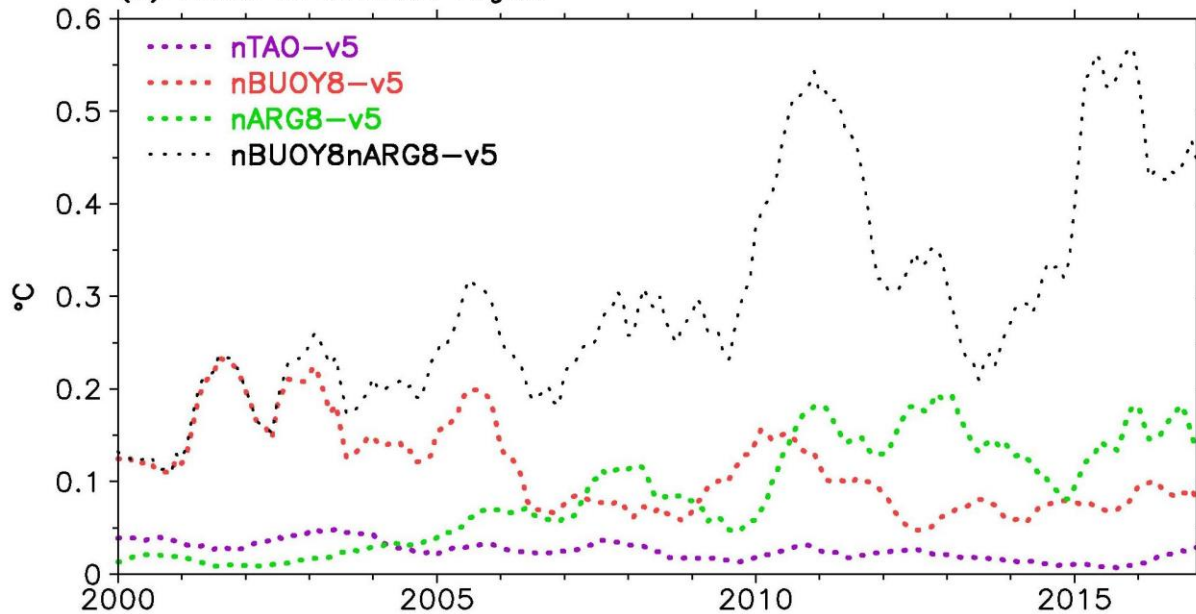
ERSSTv5	Operational ERSSTv5
nTAO	Excluding TAO/TRITON SSTs
nBUOY8	Excluding all buoy SSTs
nARG8	Excluding Argo SSTs
nBUOY8nARG8	Excluding buoy and Argo SSTs

(a) SSTA in NINO3.4 region



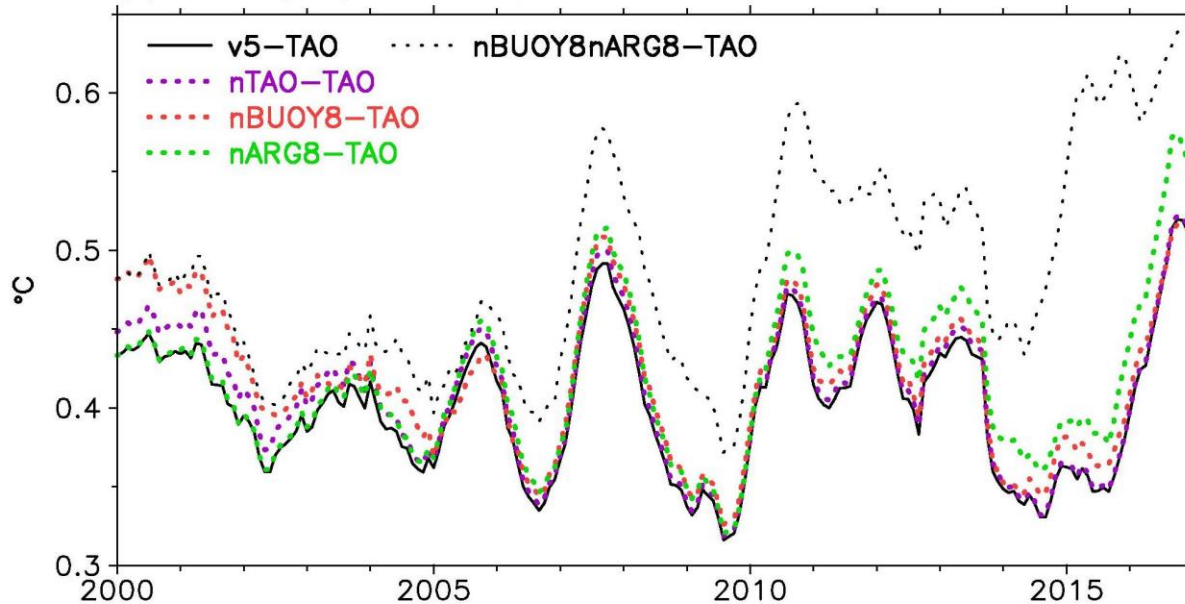
Nino3.4

(b) RMSD in NINO3.4 region



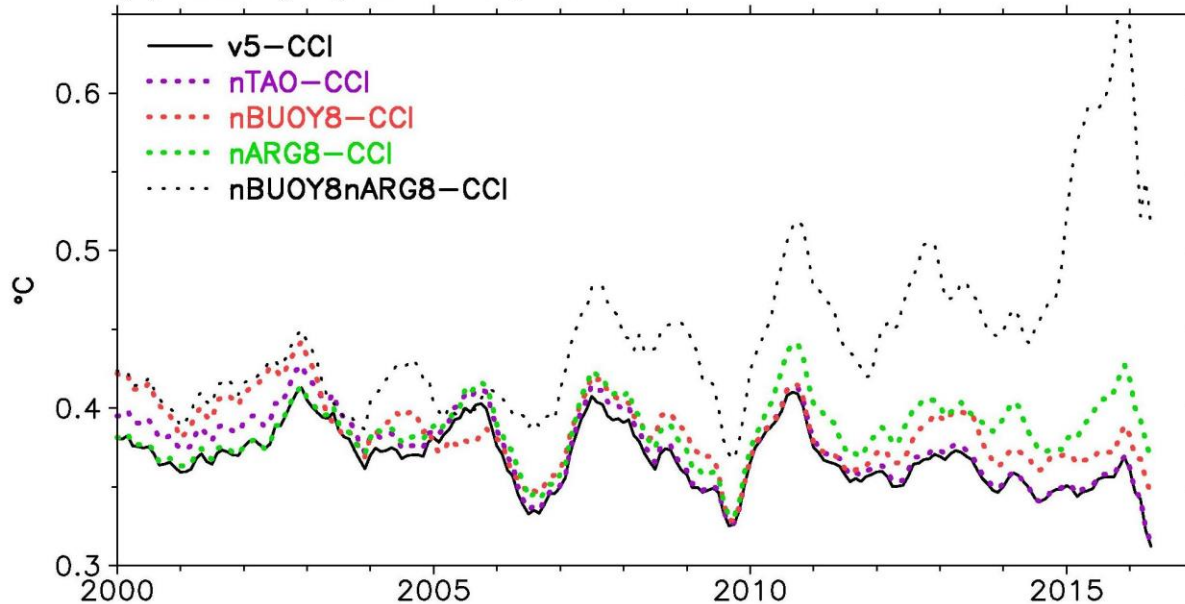
**RMSD
relative to v5**

(a) RMSD (TAO) in 8S-8N, 120E-70W



**RMSD
Relative to TAO/TRITON**

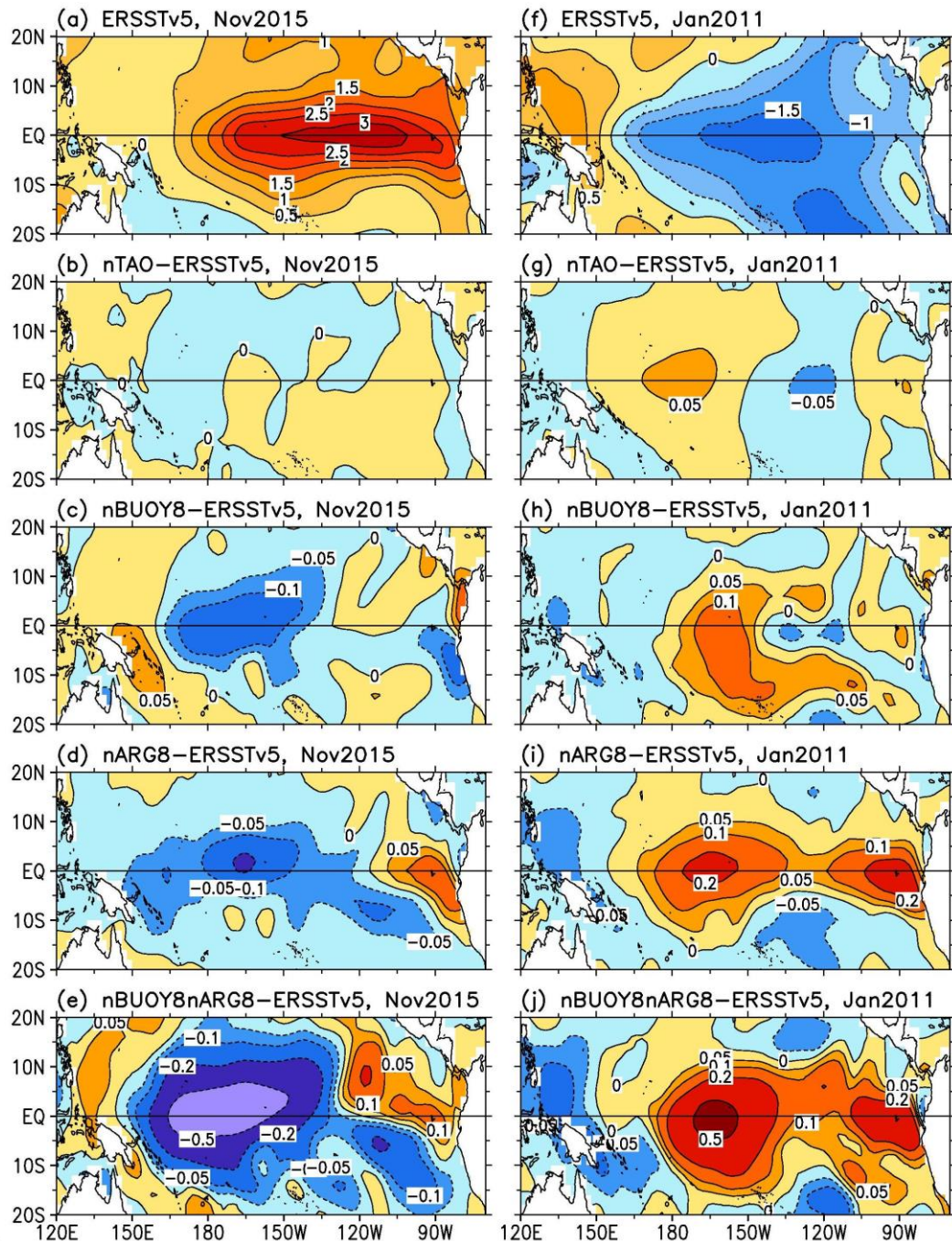
(b) RMSD (CCI) in 8S-8N, 120E-70W



**RMSD
relative to ESA CCI**

CCI: ESA
Climate Change Initiative
Merchant et al. 2013





2015 El Nino (left) and 2011 La Nina (right) examples in ERSST

TAO/TRITON impact is very small on El Nino but notable on La Nina.

Individual impact of buoy and Argo is small, and almost equivalent.

Combined impact of buoy and Argo are large.

Less observations results in weaker ENSO magnitude.

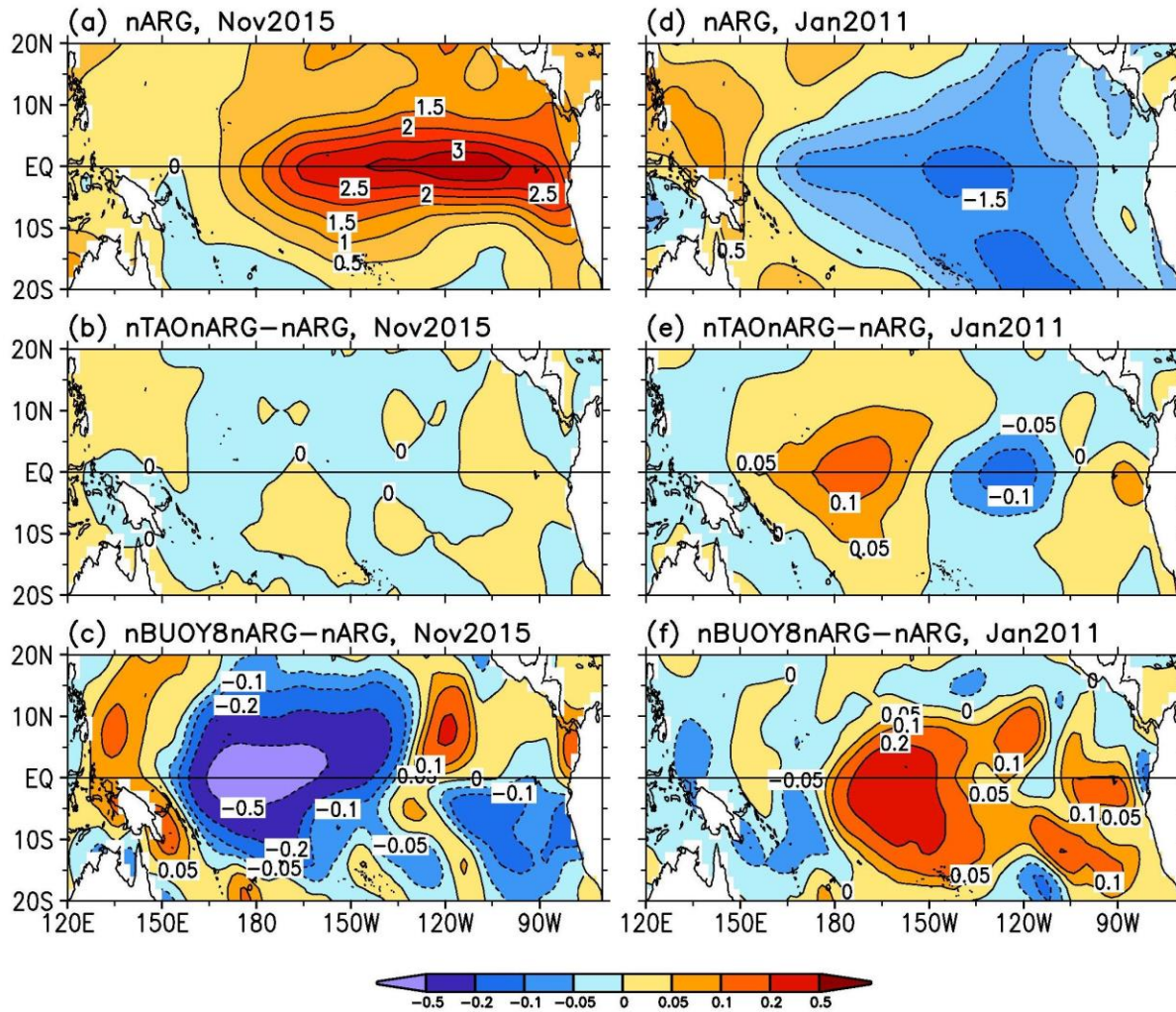


Question:

- ❖ Will TAO/TRITON impact on La Nina be large when Argo observations are not included?

Experiments of ERSSTv5 with no Argo (nARG)

ERSSTv5nARG	ERSSTv5 excluding Argo
nTAOnARG	Excluding Argo & TAO/TRITON SSTs
nBUOY8nARG	Excluding Argo & all buoy SSTs



2015 El Nino (left) and 2011 La Nina (right) when Argo is excluded in ERSST.

TAO/TRITON impact remains very small on El Nino, and increases on La Nina.

Combined impact of buoy and Argo are large.

Question:

- ❖ How reliable are the ERSST Experiments?
- ❖ Why the impact of TAO to La Nina and El Nino is different?

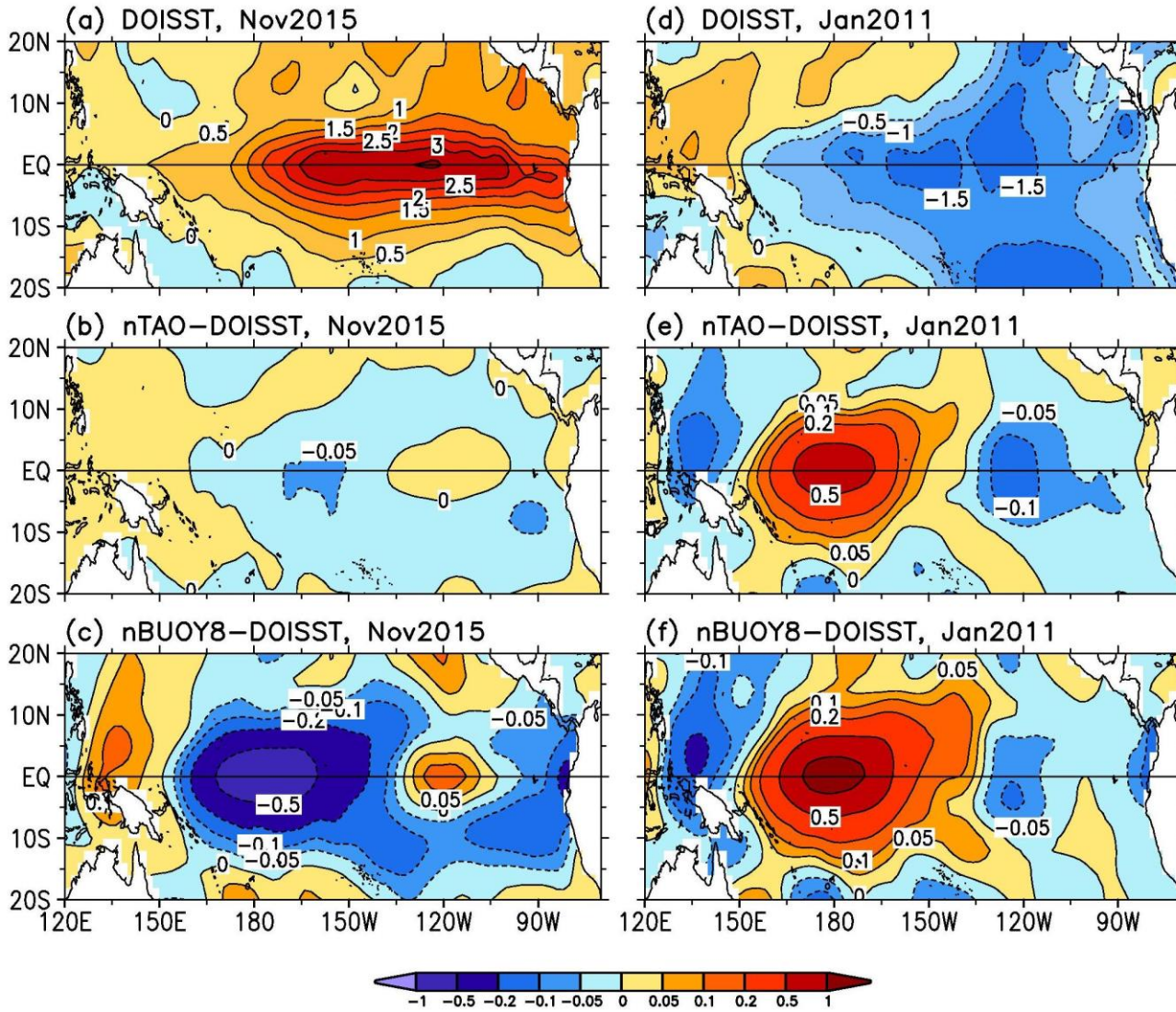
DOISST

(Reynolds et al. 2007, J. Climate)

- ❖ Daily $0.25^{\circ} \times 0.25^{\circ}$ SST analysis from Sep 1981 to present.
- ❖ Ship, buoys, and AVHRR observations are include, but not Argo float.
- ❖ Bias of ship SSTs is corrected by subtracting 0.14C.
- ❖ Biases of AVHRR observations are corrected according ship and buoy observations within 15-day data window.

DOISST Experiments

DOISST	Operational DOISST
nTAO	Excluding TAO/TRITON SSTs
nBUOY8	Excluding buoy & TAO/TRITON SSTs

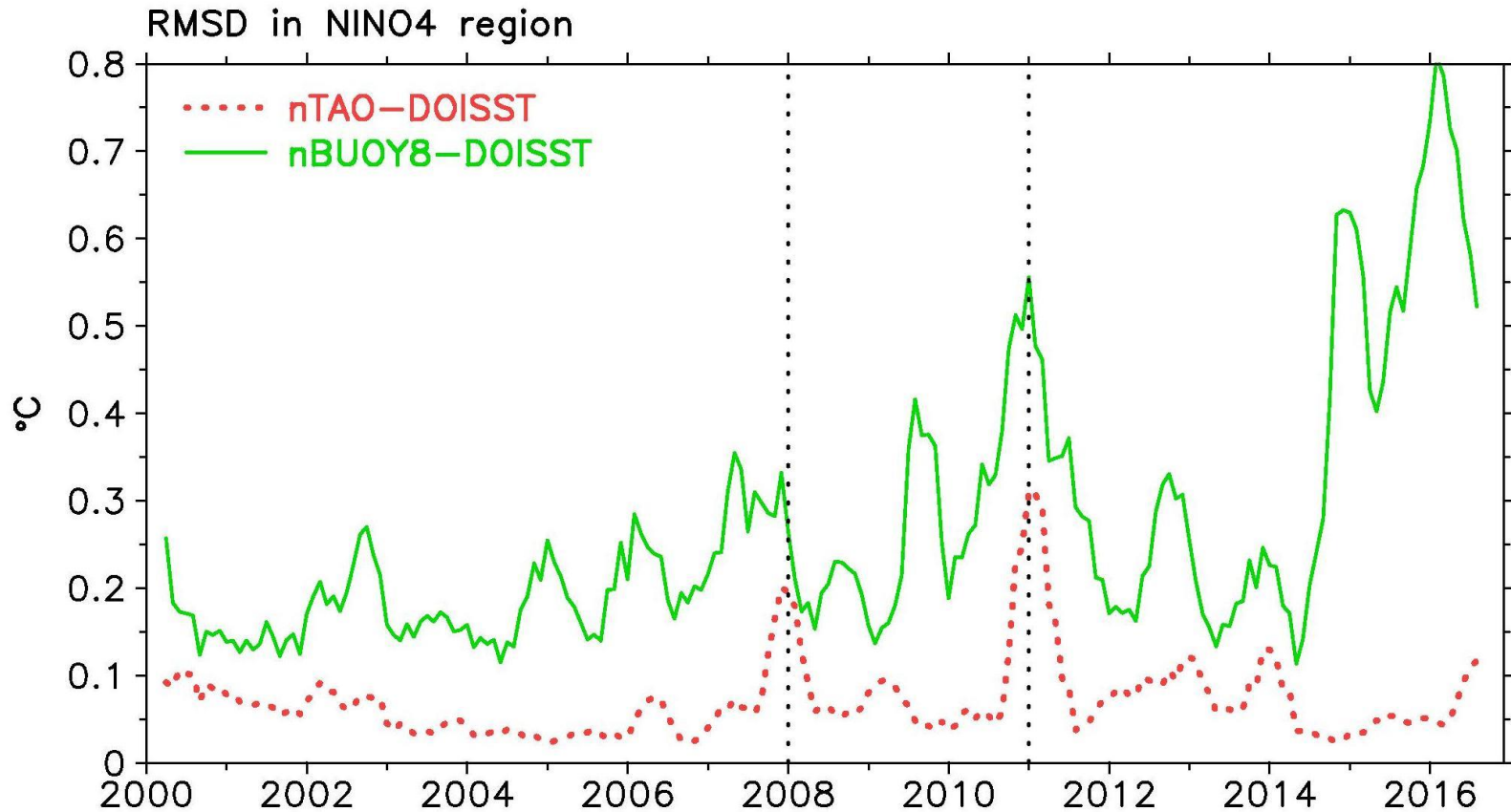


2015 El Nino (left) and 2011 La Nina (right) in DOISST

TAO/TRITON impact remains very small on El Nino, but becomes more evident on La Nina.

Combined impact of buoy and Argo are large on El Nino and La Nina.

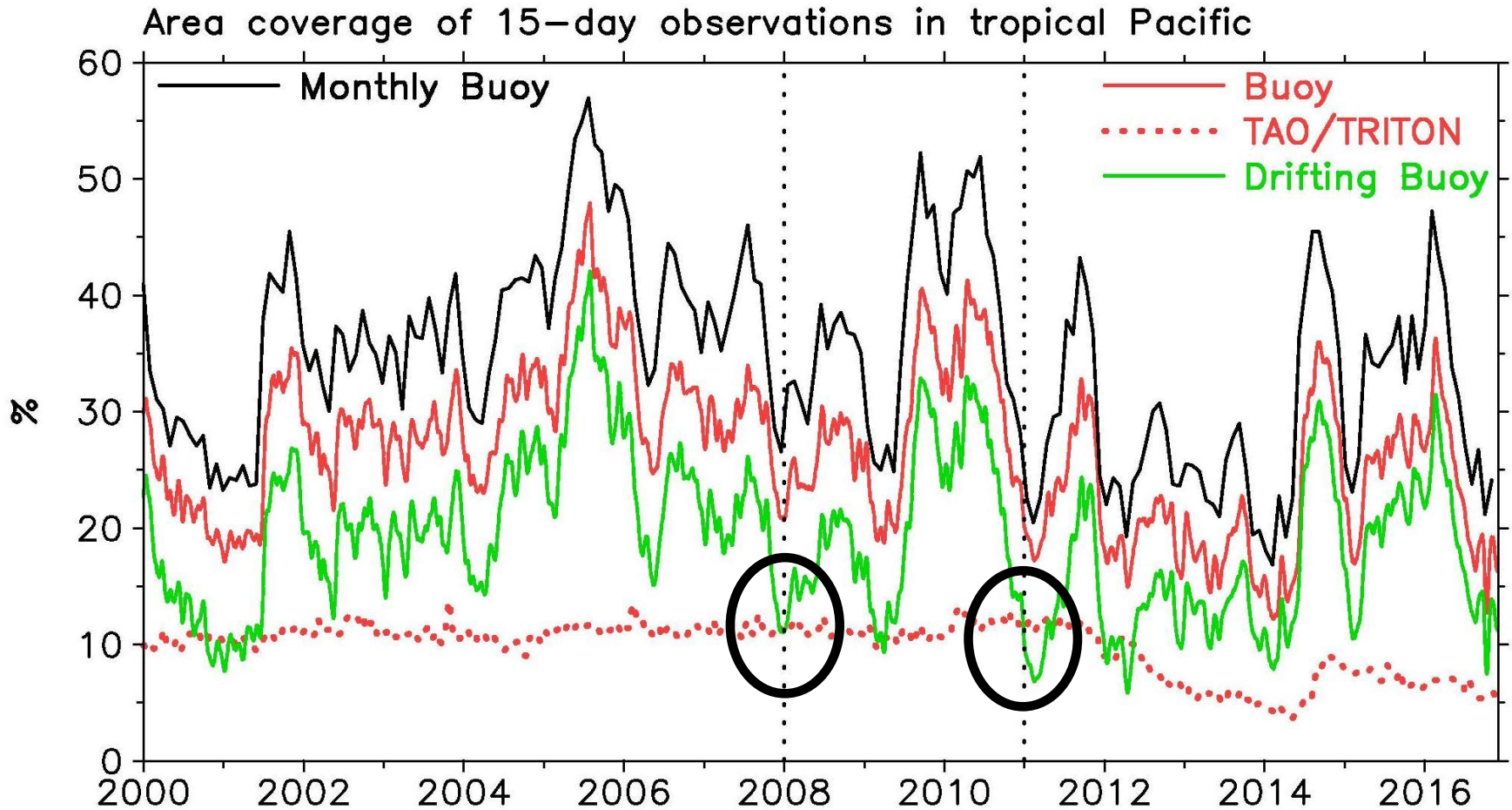
Average and STD of SSTA in Nino4 region and tropical Pacific



The impact of TAO/TRITON is large in La Nino events in Jan 2008 and Jan 2011.

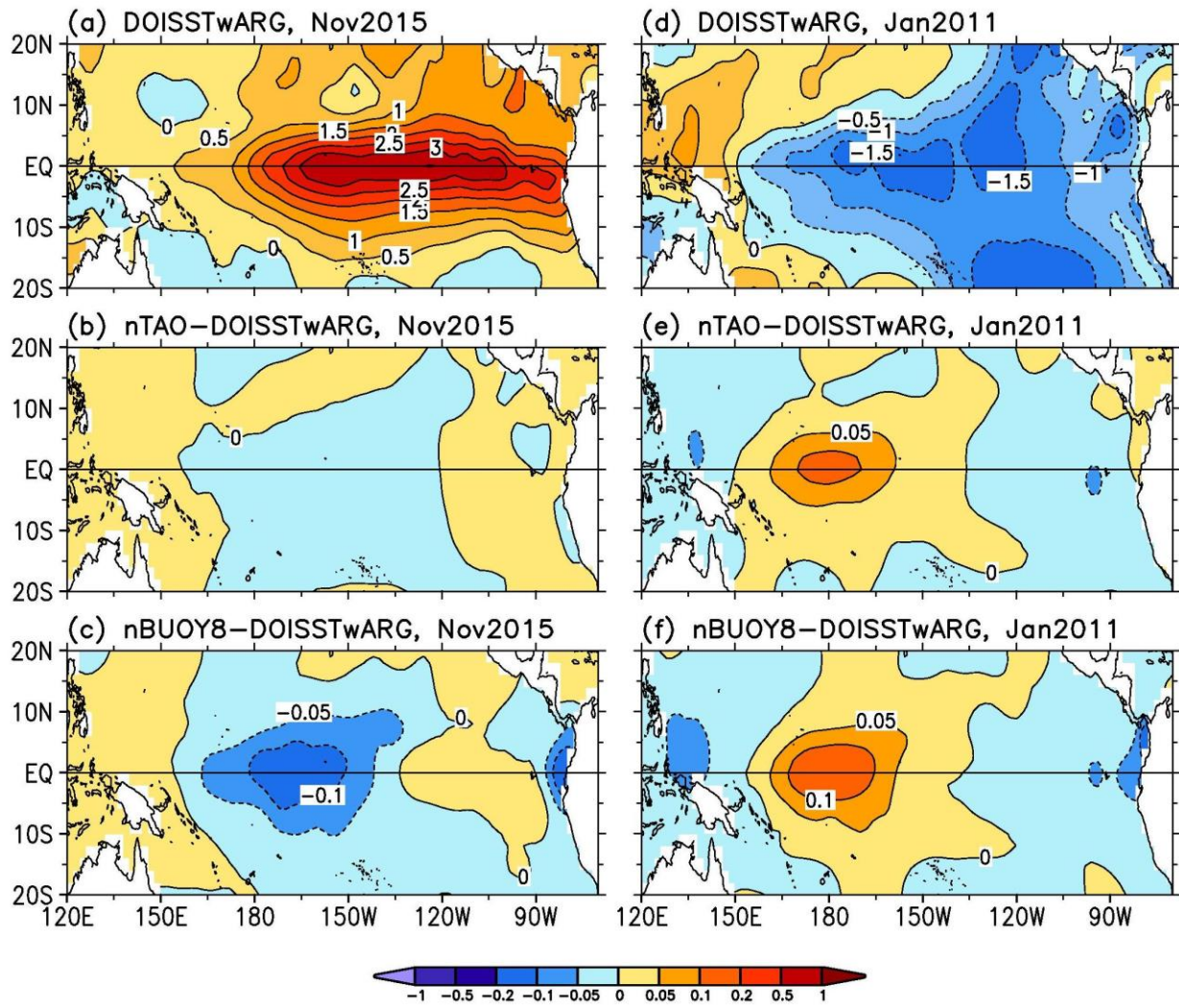
Question:

- ❖ Why does TAO/TRITON impact on La Nina become large in DOISST?



Experiments of DOISST with Argo (wARG) observations

DOISSTwARG	DOISST but with extra Argo SSTs
nTAOWARG	nTAO but with extra Argo SSTs
nBUOY8wARG	nBUOY8 but with extra Argo SSTs



El Niño (left) and La Niña (right) examples in DOISST with Argo obs.

TAO/TRITON impact remains very small on El Niño, and becomes small on La Niña.

Impact of buoy is small on El Niño and La Niña.

Results are consistent with ERSSTv5.

Summary

- ❖ Overall, the impact of individual type of buoy and Argo observations is comparable and small in the tropical Pacific, but large when combined.
- ❖ The impact of TAO/TRITON is very small in normal and El Nino years, and may be small (**or large**) in La Nina years when Argo observations are included (**are not**).
- ❖ The large/**small** impact of TAO/TRITON on La Nina / **El Nino** is associated with a low/**high** area coverage of drifting buoy in the tropical Pacific due to strong/**weak** off-equatorial divergent current by the trade winds.