

# OSEval-TT Community papers - 2014

## Assessing the impact of observations on ocean forecasts and reanalyses: Part 2, Regional applications

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## Assessing the impact of observations on ocean forecasts and reanalyses: Part 1, Global studies

*Peter R. Oke<sup>1\*+</sup>, Gilles Larnicol<sup>2+</sup>, Yosuke Fujii<sup>3+</sup>, Gregory C. Smith<sup>4+</sup>, Daniel Lea<sup>5+</sup>, Stephanie Guinehut<sup>2</sup>, Elisabeth Remy<sup>6+</sup>, Magdalena Alonso Balmaseda<sup>7</sup>, Tatiana Rykova<sup>1</sup>, Dorina Surcel-Colan<sup>4</sup>, Matthew J. Martin<sup>5+</sup>, Alistair A. Sellar<sup>5</sup>, Victor Turpin<sup>6</sup>*

## Evaluation of the Tropical Pacific Observing System from the Ocean Data Assimilation Perspective

*Yosuke Fujii<sup>1</sup>, James Cummings<sup>2</sup>, Yan Xue<sup>3</sup>, Andreas Schiller<sup>4</sup>, Tong Lee<sup>5</sup>, Magdalena Alonso Balmaseda<sup>6</sup>, Elisabeth Rémy<sup>7</sup>, Shuhei Masuda<sup>8</sup>, Gary Brassington<sup>9</sup>, Oscar Alves<sup>9</sup>, Bruce Cornuelle<sup>10</sup>, Matthew Martin<sup>11</sup>, Peter Oke<sup>4</sup>, Gregory Smith<sup>12</sup>, Xiaosong Yang<sup>13</sup>*

**GODAE OceanView**



# Talk Outline

- Engagement
- Summary of community papers
  - Types of studies
  - Types of analyses
  - Questions asked
  - Reviewers' comments
  - Evaluating OSEs – what's best practice?

# Engagement

- Two OSEval community papers (global & regional):
  - CSIRO, CLS, JMA/MRI, EnvCan, MetOff, Mercator, ECMWF, UMiami, NERSC (Norway), UFBA (Brazil), UCSC (Brazil), SOCIB (Spain), CMRE (Italy), INGV (Italy), BoM, NOAA, Legos
    - ... 17 different institutions
    - ... 18 independent contributions
- TPOS: Fujii et al.
  - MRI, NRL, NOAA, CSIRO, JPL, ECMWF, Mercator, JAMSTEC, BoM, SIO, MetOff, EnvCan, GFDL Princeton
    - ... 14 different institutions

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## Assessing the impact of observations on ocean forecasts and reanalyses: Part 2, Regional applications

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<sup>6</sup>Physics Institute, Federal University of Bahia (UFBA), Salvador, Brazil

<sup>7</sup>Department of Ocean Sciences, University of California, Santa Cruz, CA USA

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<sup>9</sup>Centre for Maritime Research and Experimentation, La Spezia, Italy

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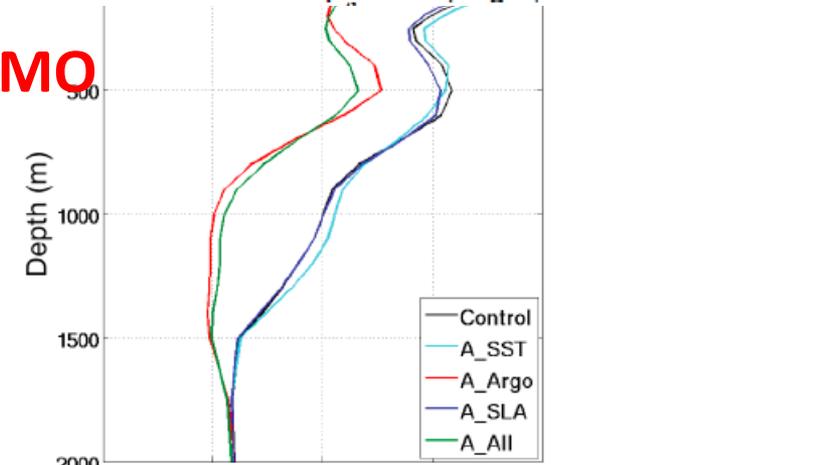
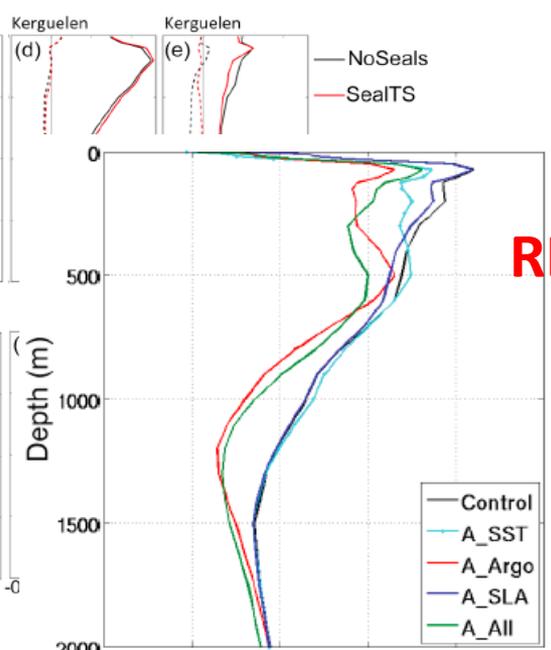
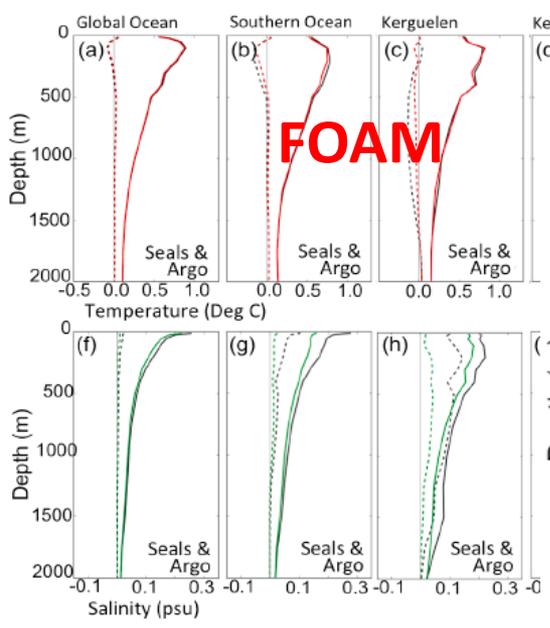
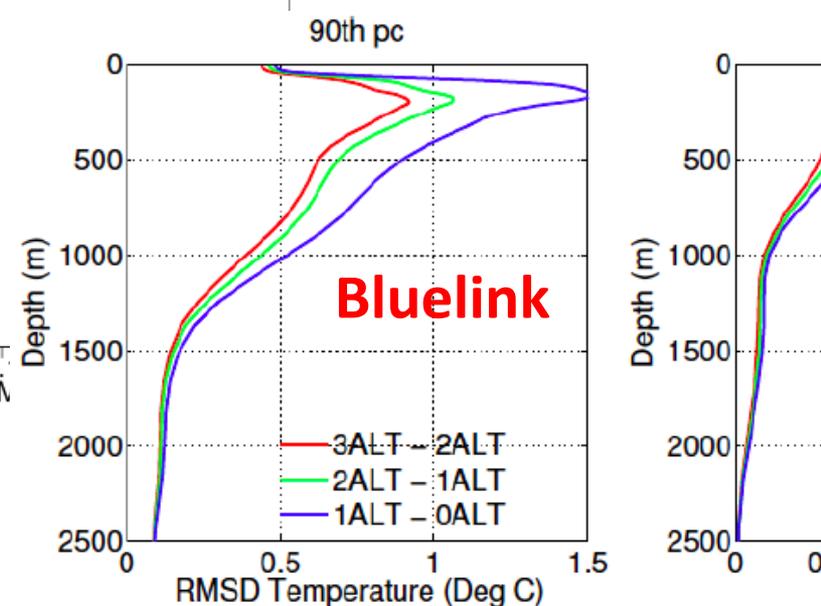
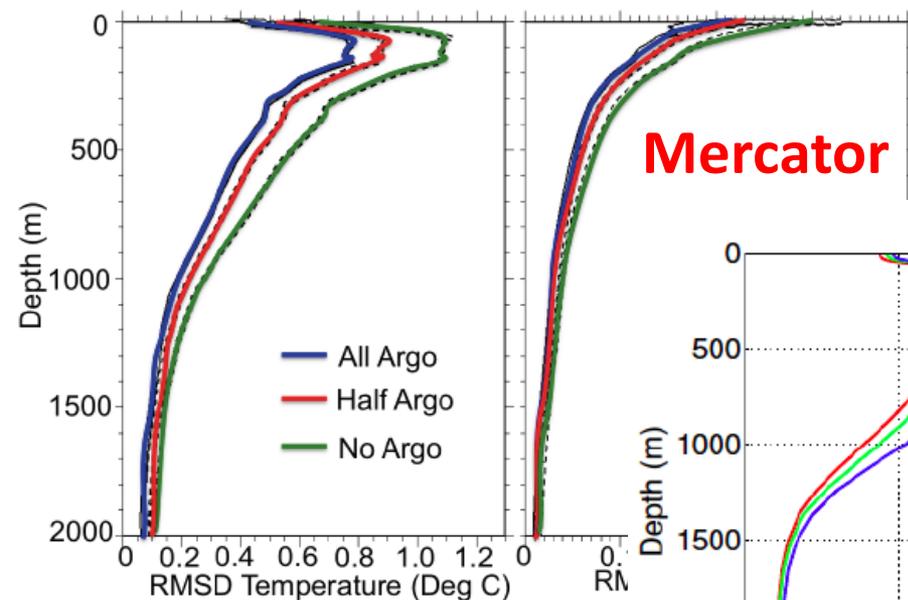
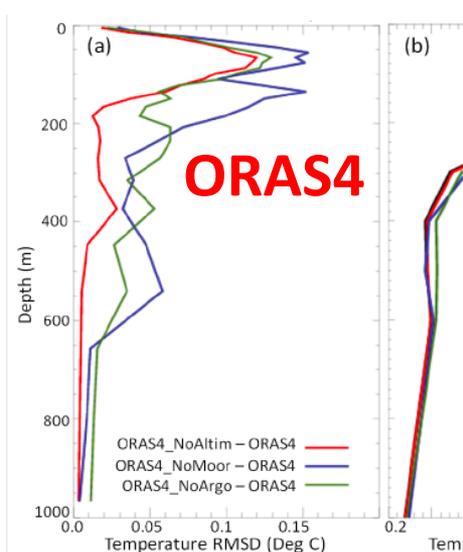
<sup>11</sup>Bureau of Meteorology, Melbourne, Victoria, Australia

<sup>12</sup>NOAA/AOML, 4301 Rickenbacker Causeway, Miami, FL, 33149, USA

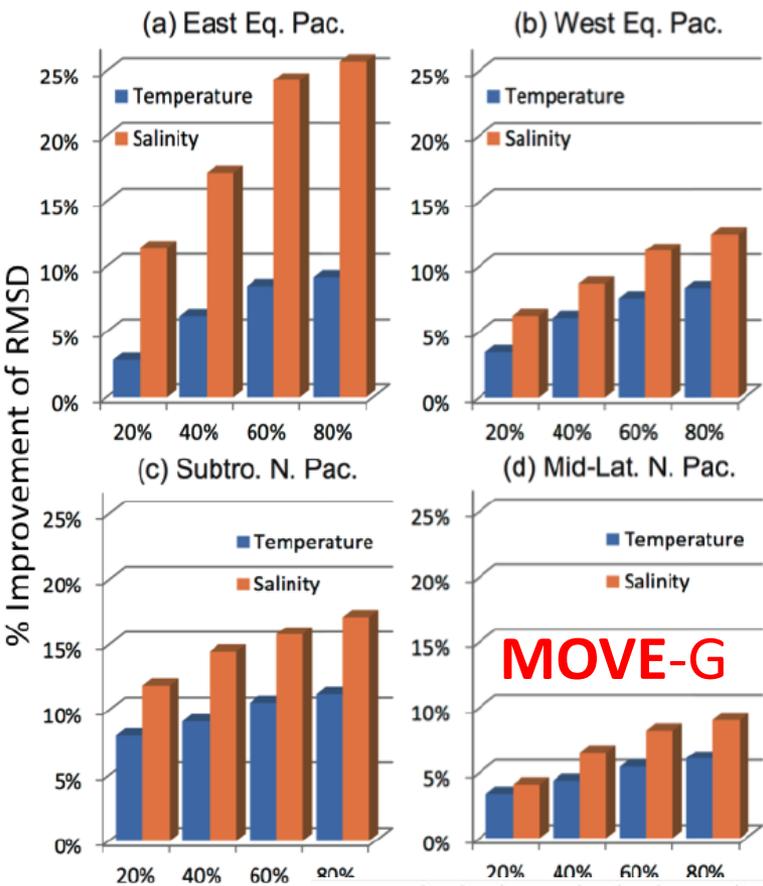
<sup>13</sup>Centre for Maritime Research and Experimentation, La Spezia, Italy

<sup>14</sup>LEGOS, CNRS/IRD/CNES/UPS, Toulouse, France

# OSEs → what are the impacts on model-obs mis-fits?

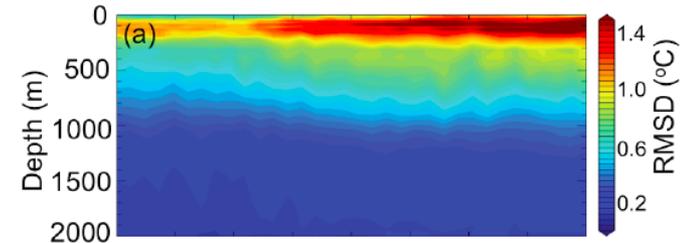


# OSEs → what are the impacts on model-obs mis-fits?



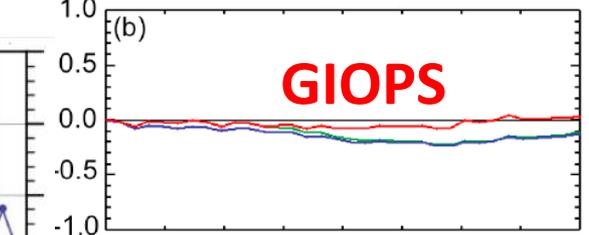
	No XBT	No TAO	No J2	No ALT	No SST	No Argo
<b>Number of with-held observations</b>						
	128K	816K	495K	1.1M	8.8M	1.3M
<b>T100: Global (Deg C)</b>						
90th pc	0.080	0.105	0.511	0.805	0.120	0.698
Mean	0.037	0.050	0.187	0.290	0.048	0.270
Max	5.421	7.228	9.848	11.080	6.628	10.529
<b>T100: Tropical Pacific (Deg C)</b>						
90th pc	0.112	0.429	0.583	1.050	0.134	0.872
Mean	0.046	0.167	0.255	0.452	0.055	0.374
Max	3.024	6.005	6.275	9.098	3.153	4.786

**FOAM**

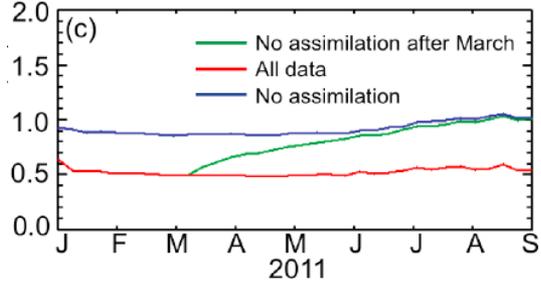
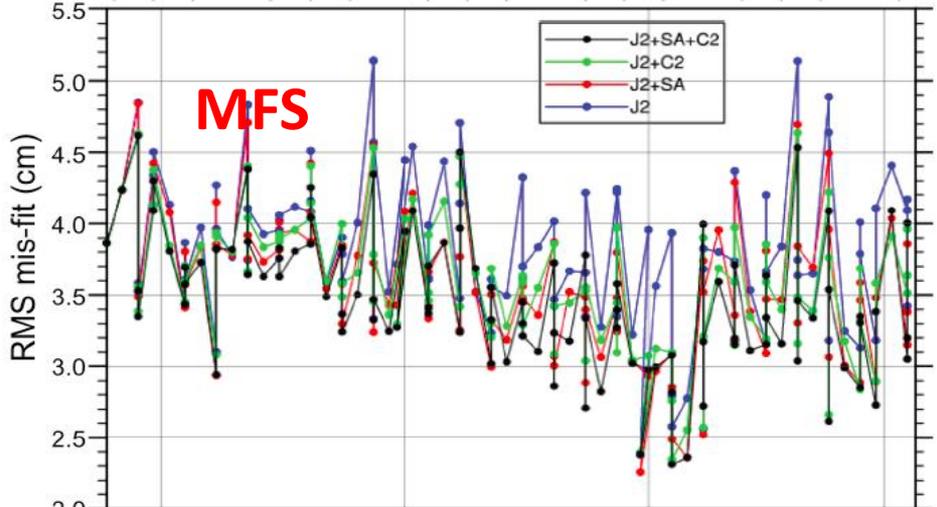


**MOVE-G**

**GIOPS**

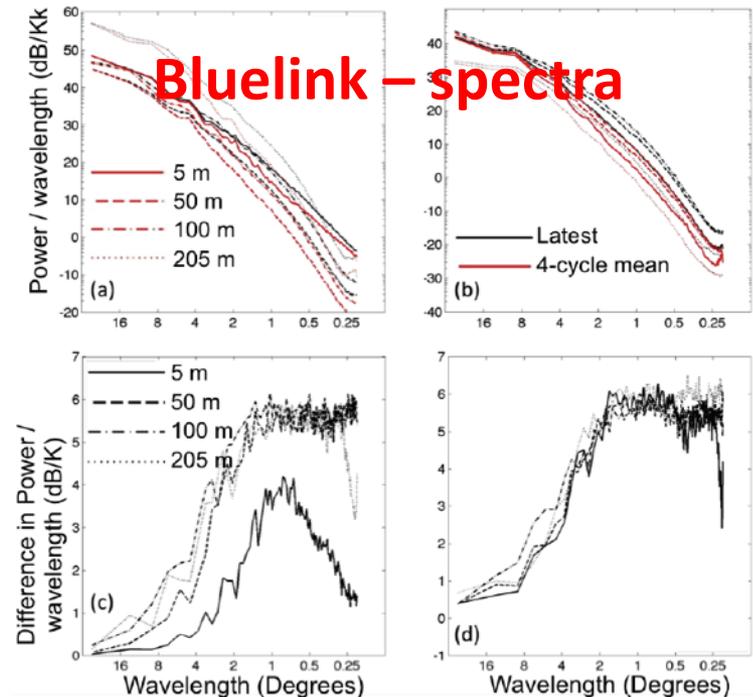
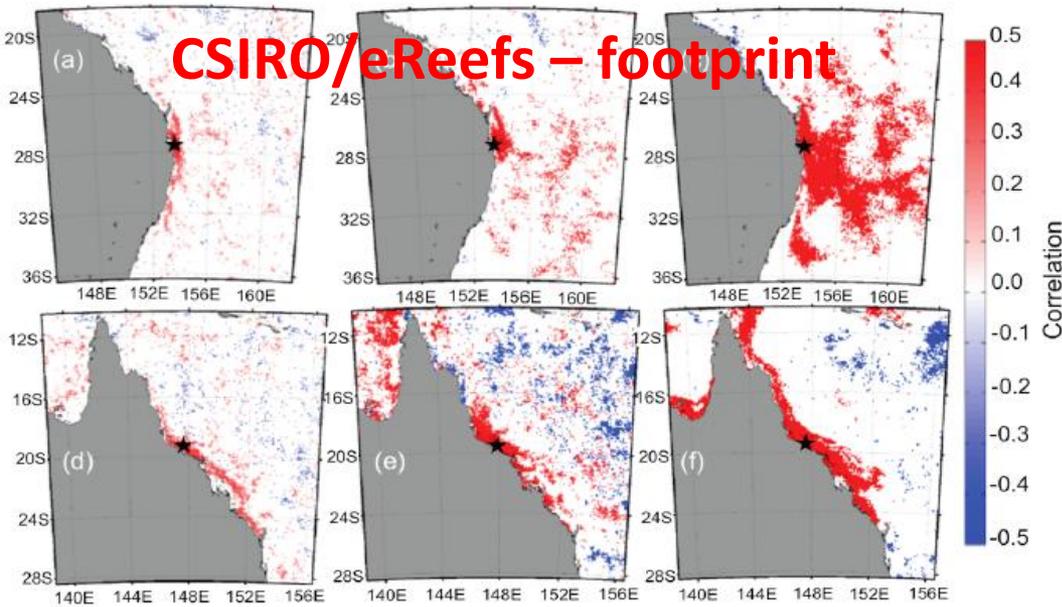
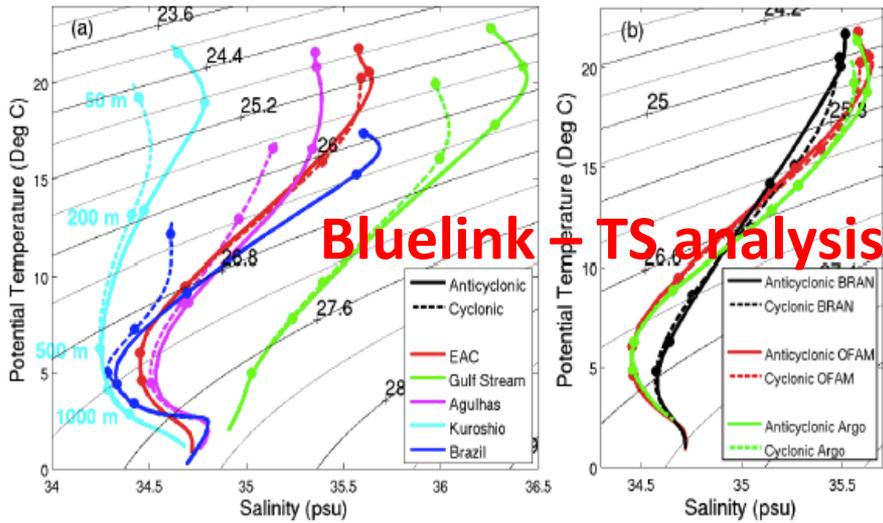


**MFS**



# Other methods

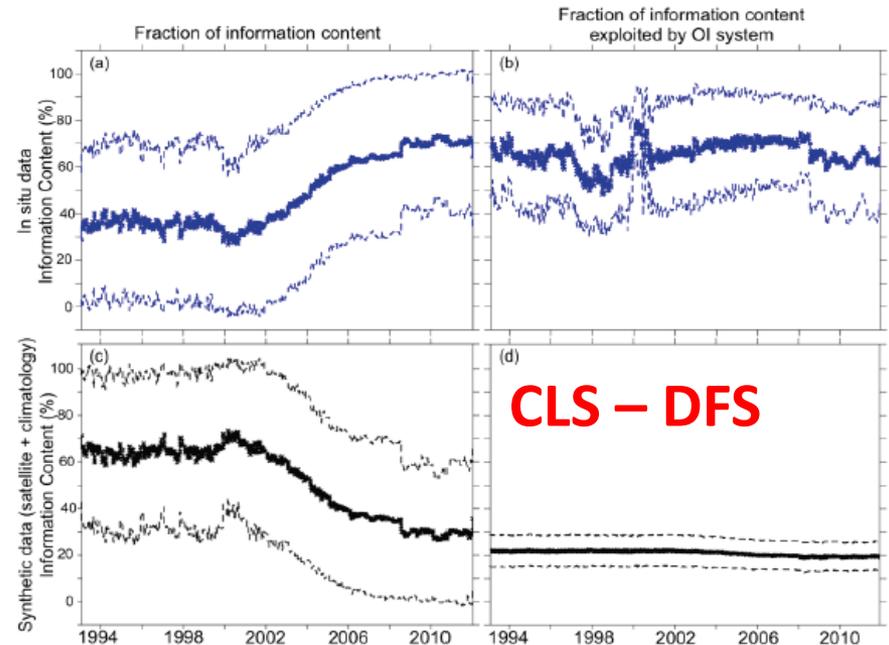
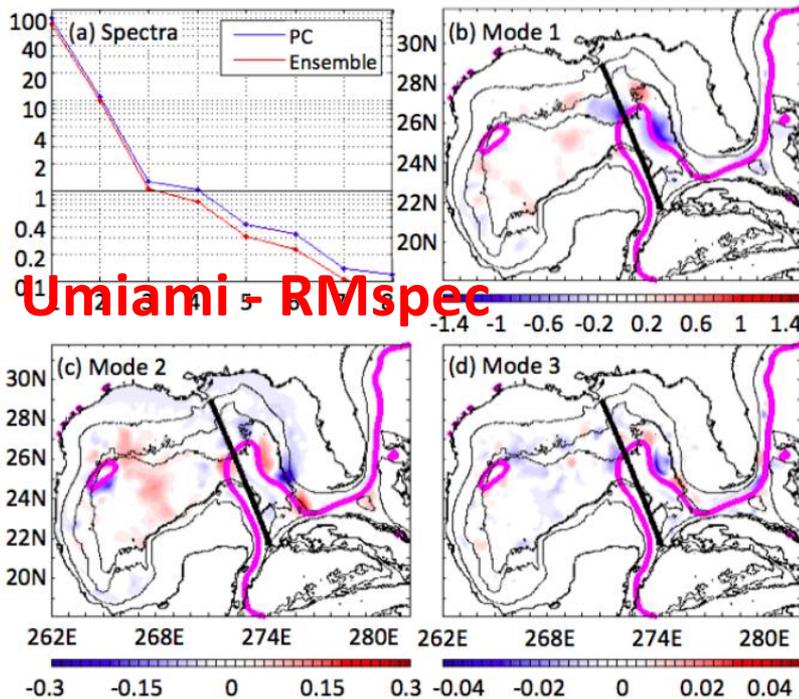
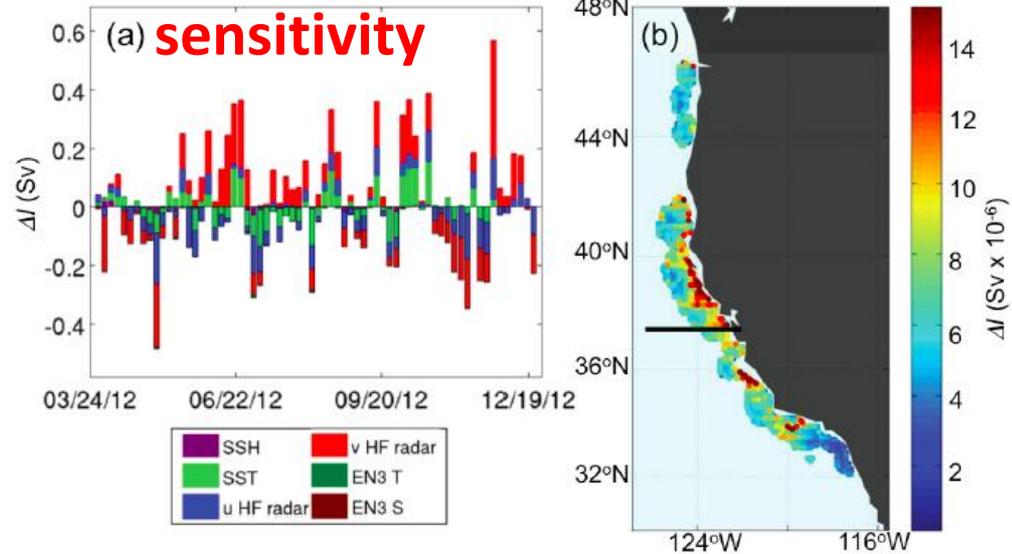
- What properties are constrained?
- What regions are monitored?
- What frequencies are resolved?



# Other methods

→ What is the relative information content from different observations?

## UCSC – 4dVar



# Variety of methods used

- Bluelink OSEs
- MFS OSEs
- REMO OSEs
- FOAM OSEs (mammals)
- UMiami OSSEs
- Ligurian Sea ROMS OSSEs
- UCSC ROMS 4dVar sensitivity
- Umiami RMspect
- CSIRO/eReefs biological footprint
- Bluelink spectra
- Mercator OSEs
- FOAM NRT OSEs
- GIOPS OSEs
- Bluelink TS analysis
- CLS DFS
- ECMWF OSEs
- MOVE-F OSEs
- OSEs x9
- OSSEs x2
- 4dVar sensitivity
- Rmspec
- Bio footprint
- Spectra
- TS analysis
- DFS

# Reviewers' Comments

# Summary of key points from reviewers of the **global** study

- The topic is **not really new** but interesting, and the paper should well fit into the *Journal of Operational Oceanography*.
  - **Multivariate impacts:** the authors show how the Argo data impact on the spatial and temporal representation of the temperature and salinity. I would like to know the impact in term of sea level as it is made by the FOAM group.
  - The paper describes **OSEs by different global ocean model operators**; these experiments vary in their implementation but (mostly) **produce similar results** - that each component of the GOOS plays a role in improving the quality of ocean model simulations.

# Summary of key points from reviewers of the **regional** study

- *The paper provides a summary of GODAE OceanView observation impact studies at regional scales. This is an interesting and useful paper that provides a good summary of regional OSEs and OSSEs studies. The paper is structured as a series of results from different groups. This is fine but there should be **more discussion on transverse issues** (methodological aspects and "robust results and recommendations" that can be derived from the different experiments).*

# Summary of key points from reviewers of the **regional** study

*Comment on ... the development of **regional ocean observing systems to complement GOOS** at regional scales (e.g. GOOS regional alliances).*

The following sentences were added:

- “Regional observation platforms include mooring arrays, land-based high-frequency (HF) radar arrays and repeat glider deployments and are organised under projects such as EuroGOOS ([www.eurogoos.org](http://www.eurogoos.org)), USGOOS ([www.ioc-goos.org/usgoos](http://www.ioc-goos.org/usgoos)) or IOOS ([www.ioos.noaa.gov](http://www.ioos.noaa.gov)), IOGOOS ([www.incois.gov.in/Incois/iogoos/intro.jsp](http://www.incois.gov.in/Incois/iogoos/intro.jsp)), and IMOS ([www.imos.org.au](http://www.imos.org.au)), and other partnerships.”

# Summary of key points from reviewers of the **regional** study

*I am unsure how to proceed with this paper. It has **no scientific merit on its own**, rather it serves to point the reader to other works. Taken as a whole, **it provides no information about how observations impact forecasts or state estimates because each section merely describes that data were withheld and assimilated and compare the two. Haven't we grown beyond this as a field?***

# Summary of key points from reviewers of the regional study

*I am unsure how to proceed with this paper. It has **no scientific merit on its own**, rather it serves to point the reader to other works. Taken as a whole, **it provides no information about how observations impact forecasts** or state estimates because each section merely describes that data were withheld and assimilated and compare the two. **Haven't we grown beyond this as a field?***

## Response

The methods showcased in this community paper include:

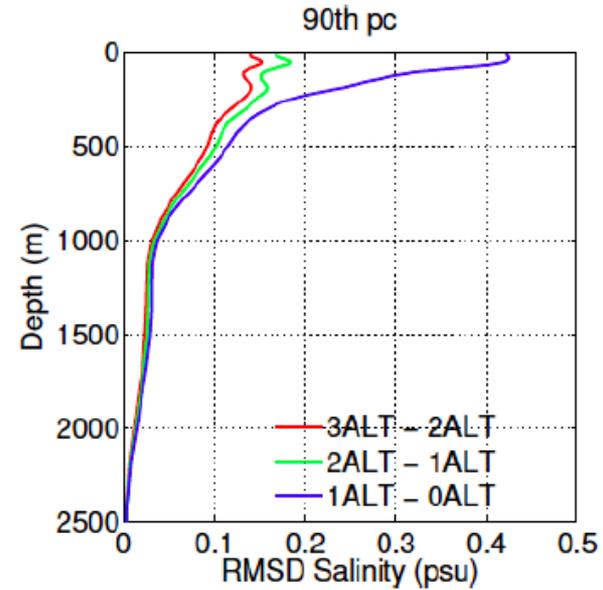
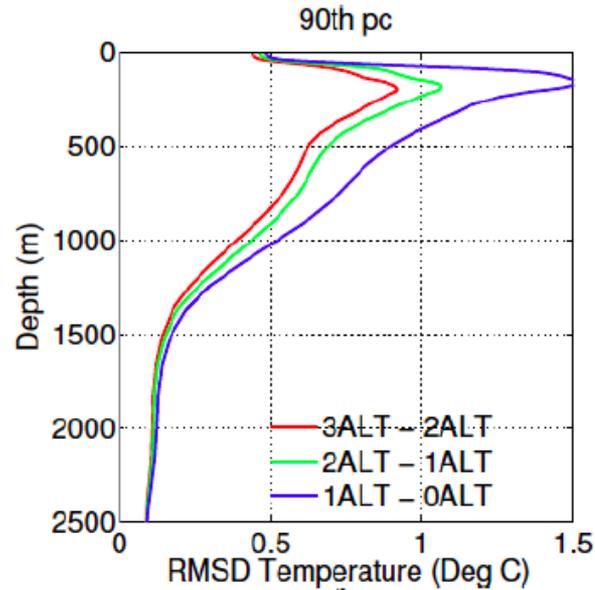
- Observing System Experiments (OSE)
- Observing System Simulation Experiments (OSSE)
- Adjoint sensitivity analysis (ASA)
- Analysis of the Resonance Matrix Spectrum (RMspect) using Polynomial Chaos (PC) theory;
- Observation footprint estimation; and
- Spectral analysis.

I still don't find it a particularly useful contribution 😞

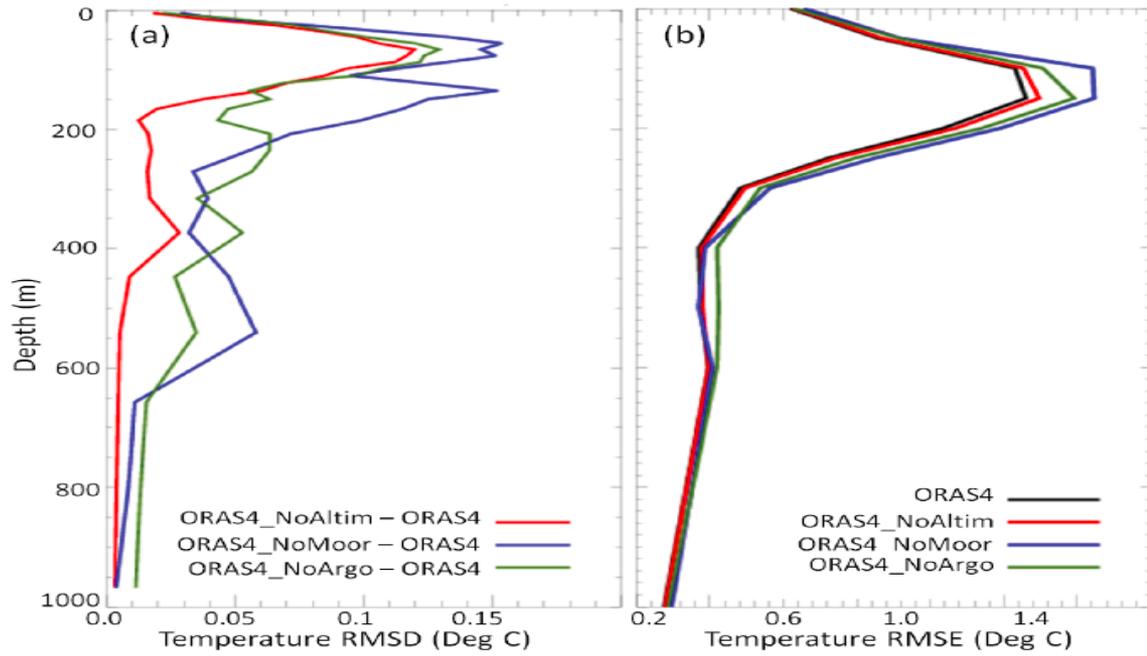
We don't agree that ... *"each section merely describes that data were withheld and assimilated and compare the two"*.

# Evaluating OSEs

➤ Explain why you are using here a 90th percentile of the RMS difference (to estimate the maximum values).



➤ Note that changes in  $T$  and  $S$  fields do not necessarily mean here improved  $T&S$  fields.





# Evaluating OSEs

“Suppose we compare the difference between two OSE simulations, where  $OSE_{X+Y}$  assimilates observation types “X” and “Y”, and  $OSE_Y$  that assimilates only observation type “Y”. The difference between  $OSE_{X+Y}$  and  $OSE_Y$  does not necessarily quantify the “improvement” attributable to observation type “X”. However, it does faithfully quantify the “impact” of observation type “X”. It is preferable to quantify the improvement, not just the impact, but the availability of sufficient independent observations is a common problem for systems that seek to assimilate all available observations.”

# Reviewers' Comments

- Not really new;
- Multivariate impacts;
- OSEs from different systems produce similar results;
- Discussion on transverse issues;
- Regional observations compliment the GOOS;
- Haven't we grown beyond this as a field?
- What's best practice for evaluating OSEs?

# Discussion

- What's best practice for evaluating OSEs?
- How are OSSE and OSE results best disseminated?
- Are our methods acceptable? How can we improve/refine?