Use of Argo in operational oceanography systems

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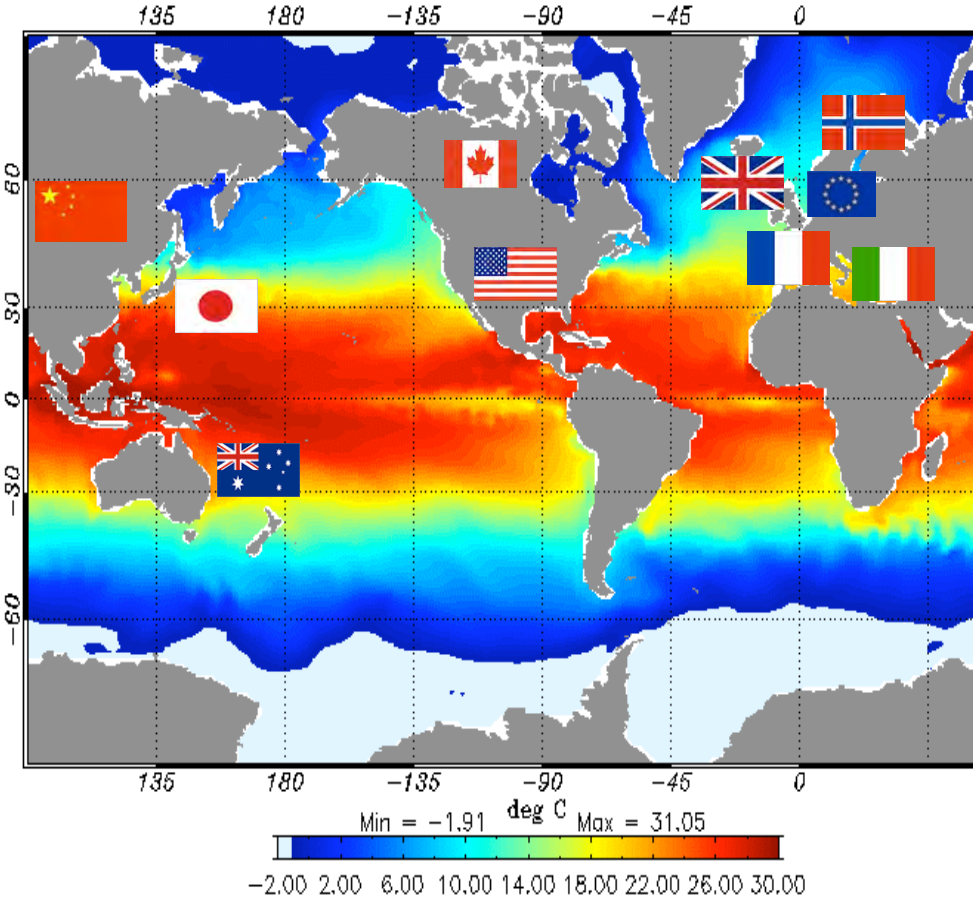
OSE/OSSE
GODAE/OOPC
workshop

Nov. 2007

2007 - 2013

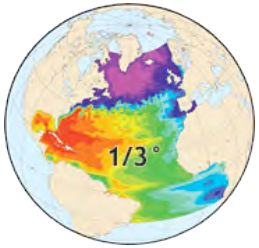
GODAE Modelling/Forecasting systems



- National systems involving research & operational institutes
  - BlueLink – Australia
  - Canadian consortium
  - NLOM and NCOM - USA
  - HYCOM consortium - USA
  - Move & COMPASS-K systems – Japan
  - MERCATOR – France
  - MFS - Italy
  - NCOF (FOAM) – UK
  - TOPAZ - Norway
- European coordination
  - MERSEA, GMES (My Ocean)

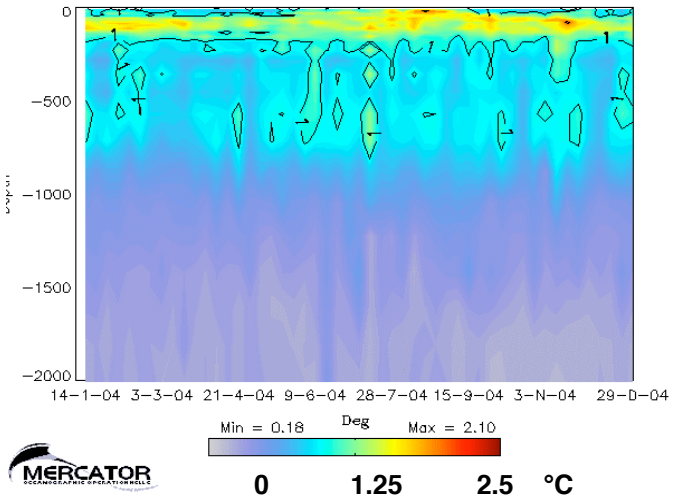
Impact of Argo data on MERCATOR PSY1V2 system

- Two experiments performed during the year 2004:
  - **REFERENCE** run assimilated all obs (SLA, SST, T/S)
  - **NO_TS** run assimilated only (SLA, SST)

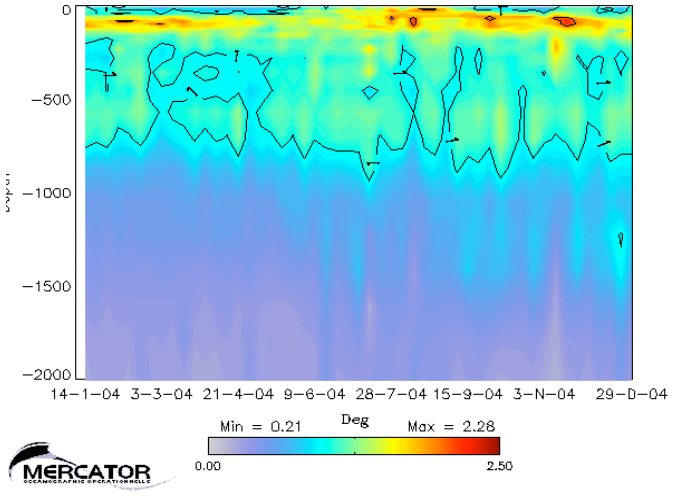


Temperature : Rms of the differences between the in-situ profiles and the model 7-days forecast

REFERENCE



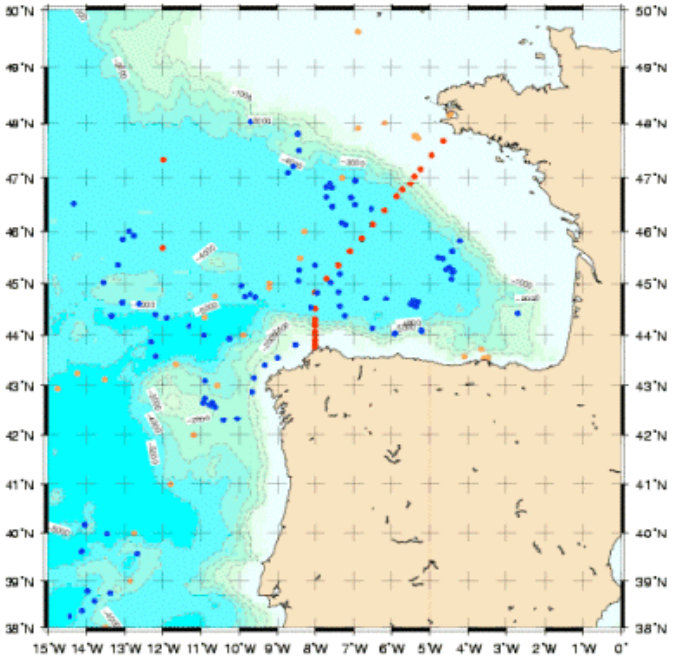
NO_TS



- Instantaneous development of large biases (0.3 °C) in the 300-700 m layer
- Over time, at deeper depths, the model drifts from the climatology
- SST data still constraint the surface layer

Impact of Argo data on MERCATOR PSY2V2 system

- PSY2V2 assimilates SLA, SST and T/S profiles



Argo floats : blue

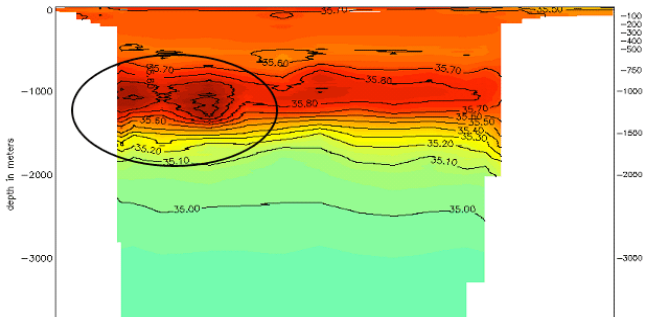
CTD : red

XBT: orange

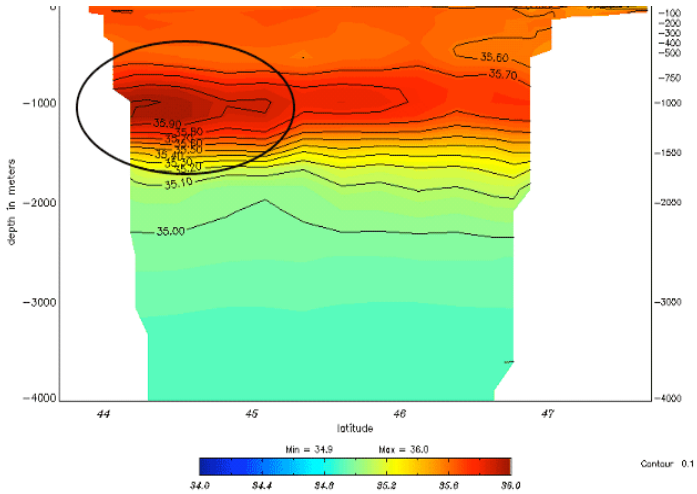
J.-M. Lellouche, M. Drévillon and S. Baudel: How ocean forecasting benefits from Argo, Argonautics number 7, June 2006.

Impact of Argo data on MERCATOR PSY2V2 system : Comparison with PSY2V1

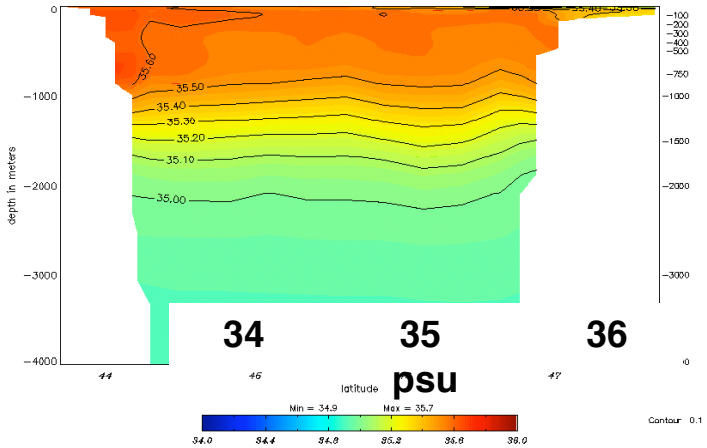
Measured Salinity section



Salinity section from PSY2V2



Salinity section from PSY2V1



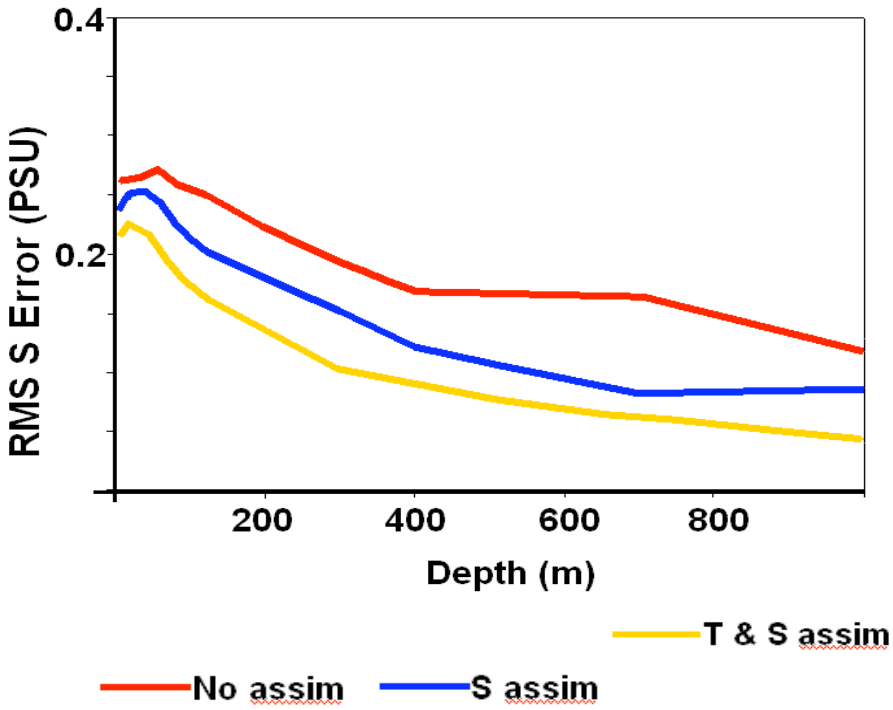
- Great improvement of the performance of the system
- Better reconstruction of the Mediterranean Water
  - At the correct depth, with correct value
  - + Saltier values at the surface, + more small scale features

J.-M. Lellouche, M. Drévillon and S. Baudel: How ocean forecasting benefits from Argo, Argonautics number 7, June 2006.

Impact of Argo on FOAM salinity analyses

NCOF

- Assimilating only Argo salinity data into the FOAM system significantly improves the salinity analyses when compared with independent observations.
- Assimilating both temperature and salinity further improves the salinity analyses.
- Argo salinity data is also very useful for validating the FOAM salinity fields, and for improving the automatic quality control system.

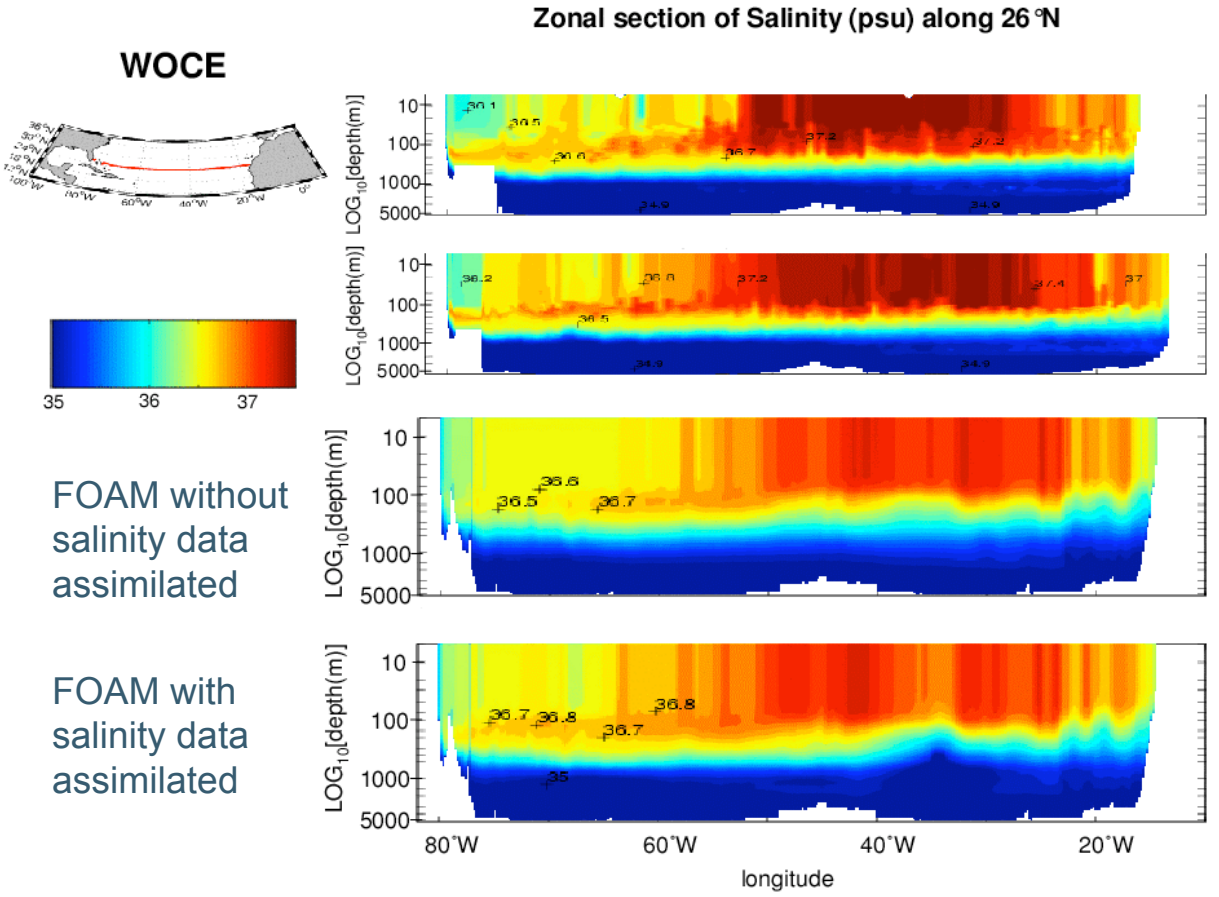


Met Office
2007 - 2013

Impact of Argo on FOAM salinity analyses

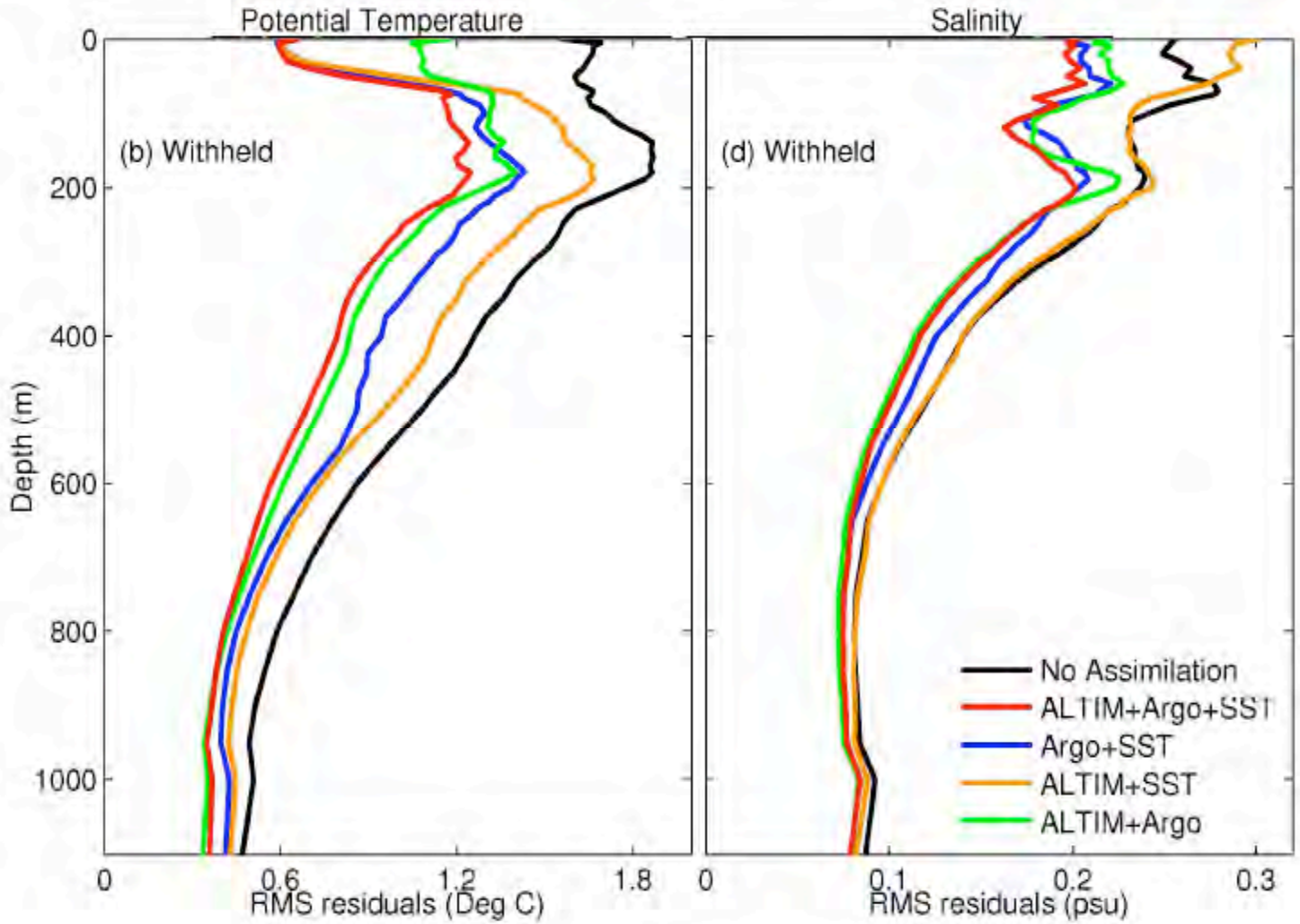
NCOF

Comparison of FOAM analyses before and after assimilation of Argo salinity data with observations of salinity show a much improved westward extension of the deep salinity maximum in the tropical Atlantic.



Met Office

Observing System Experiments: Impact on T(z) and S(z)



600 profiles withheld

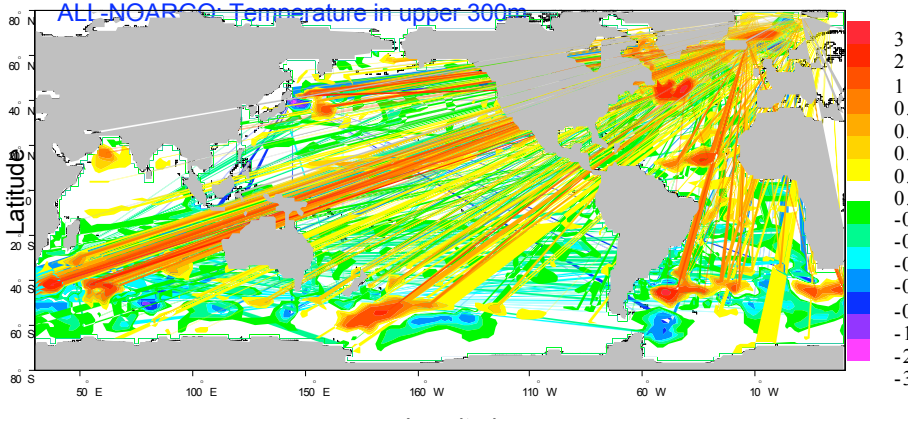
Observing System experiments with ECWMF operational ocean analysis (ORA-S3) (M. Balmaseda)

- **The new ECMWF operational ocean analysis system**
  - Historical reanalysis and real time
  - The ORA-S3 analysis system
  - Impacts of data assimilation (mean/variability/forecast skill)

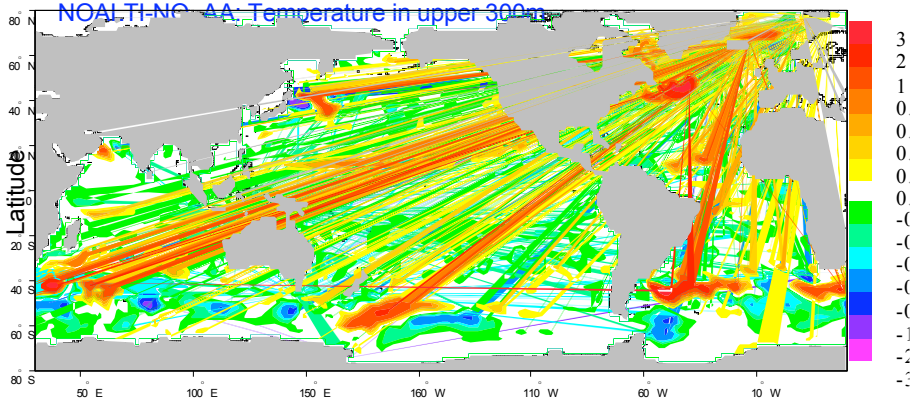
- **Results from OSEs**
  - Impact on the ocean state
  - Impact on forecasts
  - Impact on climate variability

OSEs:Effect on T300

Effect of ARGO when Alti is present



Effect of ARGO when Alti is NOT present

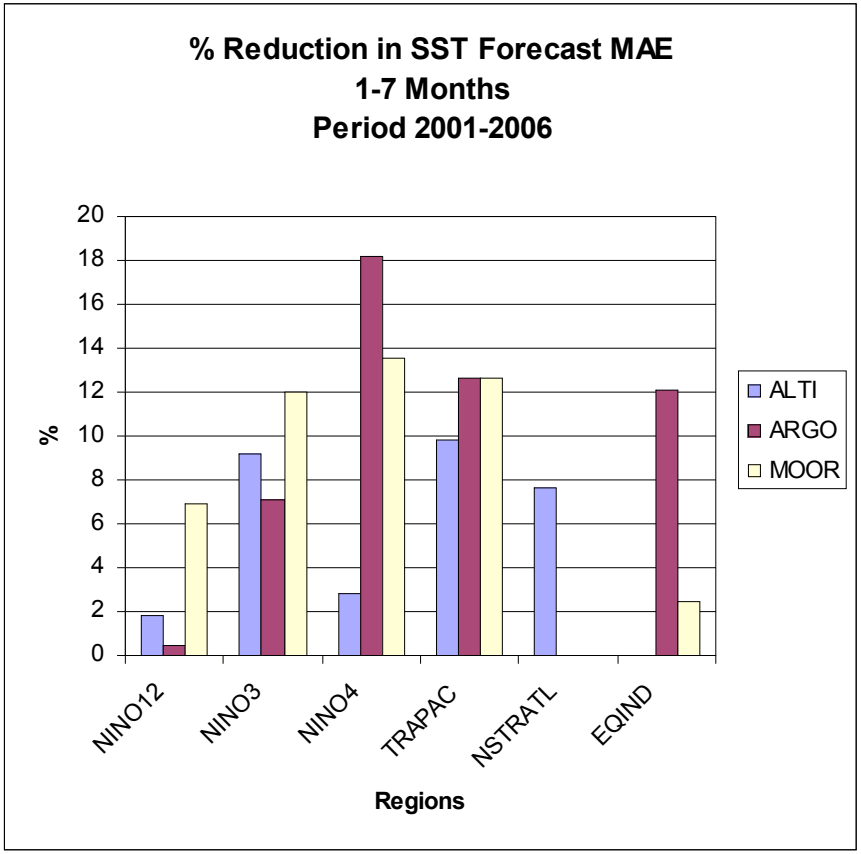


Impact on Seasonal Forecast skill

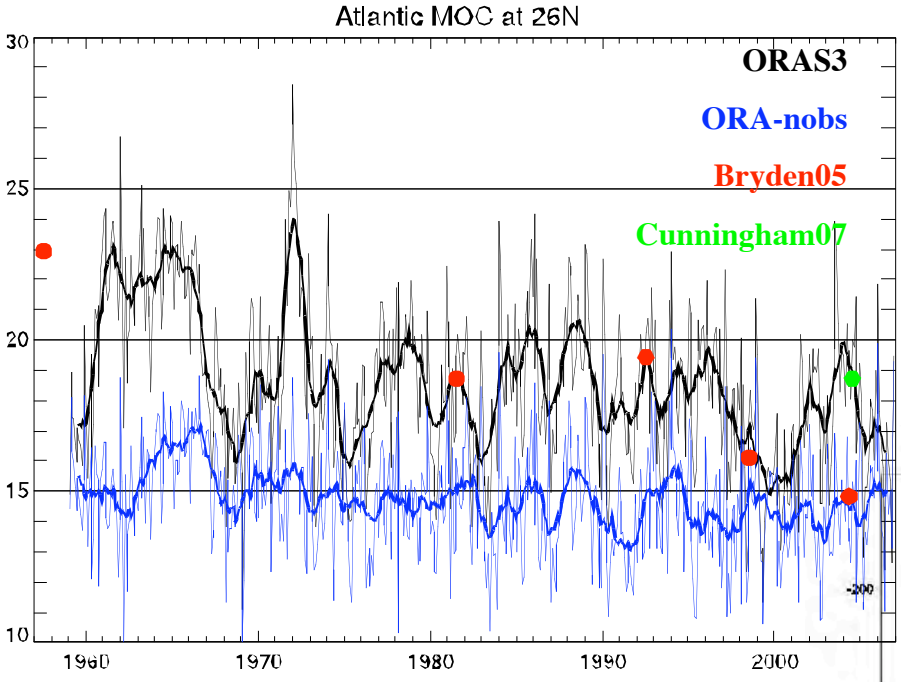
•Moorings: only the effect of anomalies is measured, since the effect of the mean state is included indirectly in the altimeter assimilation.

•Observing systems are complementary

- •Altimeter has larger effect on Atlantic and Eastern Pacific
- •Argo has larger effect on Indian Ocean and Western Pacific

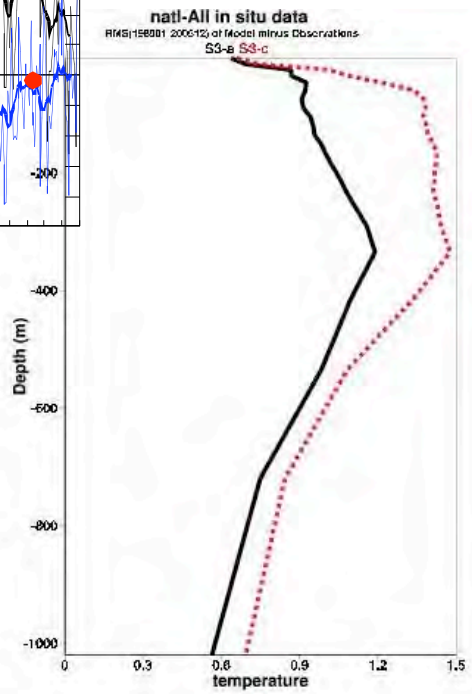


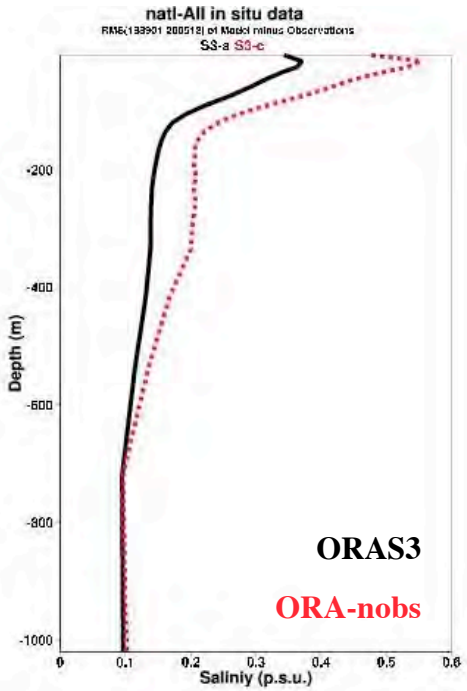
Impact of data assimilation in the MOC



- Assimilation improves the estimation of the MOC
- Downward trend ~4% decade in ORAS3, ~2% decade in ORA-nobs

RMS fit to observations in the NATL

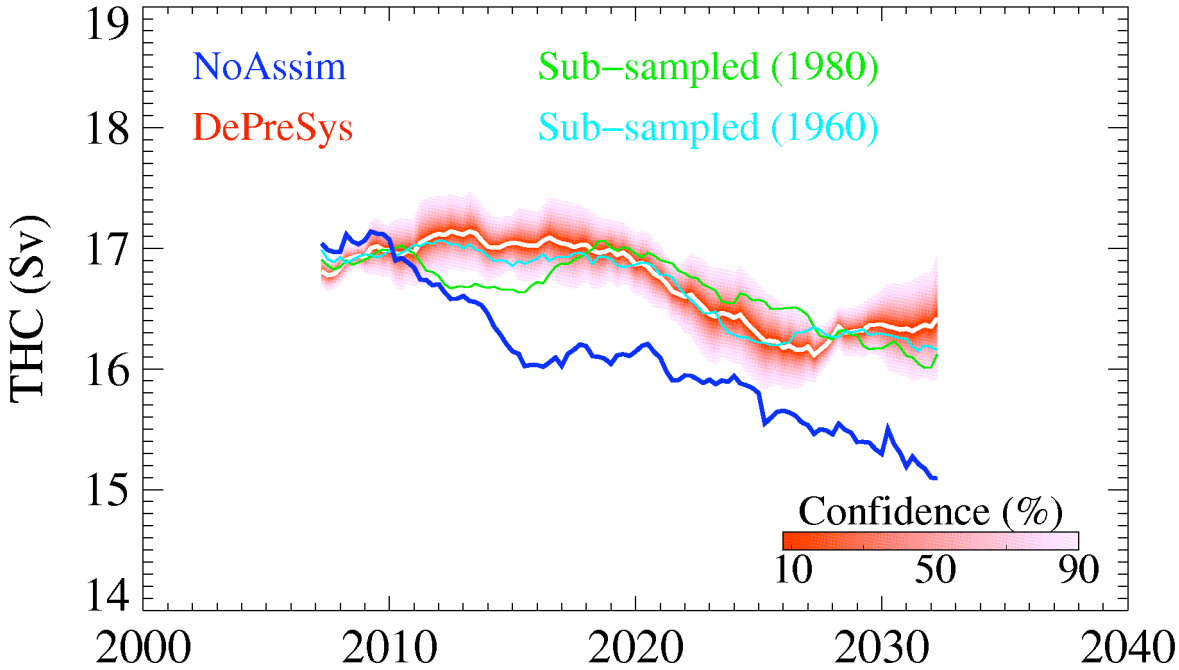




Balmaseda et al, GRL 2007

Impact of Argo on THC

- Forecast from March 2007
- Sub -sampled = with 1980s or 1960s obs
- 5-year running means
- Shading = confidence of ensemble mean
- 10 members DePreSys and sub - sampled, 4 members NoAssim
- Max overturning at 30N



Links Argo/Euro Argo and operational oceanography

- International: GODAE will transition as an international body for coordination of research and operation (through JCOMM) of OO
  - Working groups : OSE/OSSEs, GODAE/IMBER, Coastal, links with GSOP/CLIVAR
  - Links with Argo science team
- Europe : GMES and My Ocean
  - Links with Euro-Argo

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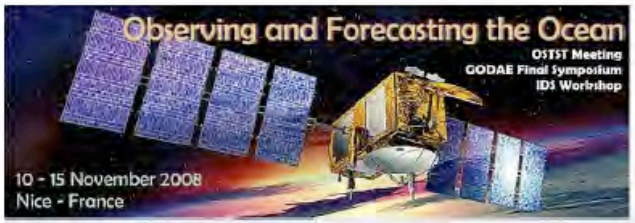
GODAE Final Symposium 2008

The revolution in global ocean forecasting

http://www.ostst-godae-2008.com



GODAE Final Symposium 2008

"The revolution in global ocean forecasting GODAE: 10 years of achievement"

12—15 November 2008
Palais des Congrès Acropolis, Nice, France

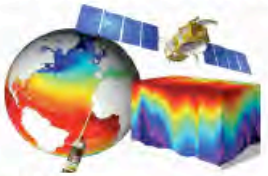
You are cordially invited to attend the GODAE Final Symposium for a celebration and review of the outcome and achievements of the Global Ocean Data Assimilation Experiment (GODAE).

The Symposium is organised in six core sessions, highlighting all important aspects of GODAE.

- Introduction
  - Operational Oceanography infrastructure
    - Demonstrating feasibility
      - Key scientific & technological achievements
        - Applications
          - The future of GODAE

The symposium is organised by CNES in collaboration with the GODAE Project Office, May 2008

The Symposium will provide an opportunity to review the key achievements of GODAE over the last 10 years, to celebrate the outstanding successes, to critically examine the outcomes, and to discuss the future of operational ocean analysis and forecasting, and proposals for its international coordination.



Call for papers

Online *submission of abstracts for poster presentations* are now being invited (please visit: http://www.ostst-godae-2008.com).

The accepted contributions will be published in the abstracts volume for distribution at the symposium. The deadline for abstract submissions is **30 June 2008**.

See "Second announcement — GODAE Final Symposium" on http://www.godae.org/announcement-II.html for more details.

The Symposium will consist of **multi-author plenary review papers and poster sessions** over a 3-day period. It follows the 2.5 day Ocean Surface Topography Mission (OSTM) meeting (November 10-12).

The GODAE Final Symposium will be held at the *Palais des Congrès Acropolis* in Nice, France from 12-15 November 2008. Online registration will open soon on http://www.ostst-godae-2008.com

Abstract (posters – Argo related session) – deadline June 30

2007 - 2013

Summary

- **State estimation:**
  - Both ARGO temperature and salinity have a large information content.
  - Argo is instrumental in correcting the salinity of the ORA-S3 analysis
  - The ARGO data is best used in combination with the altimeter information.

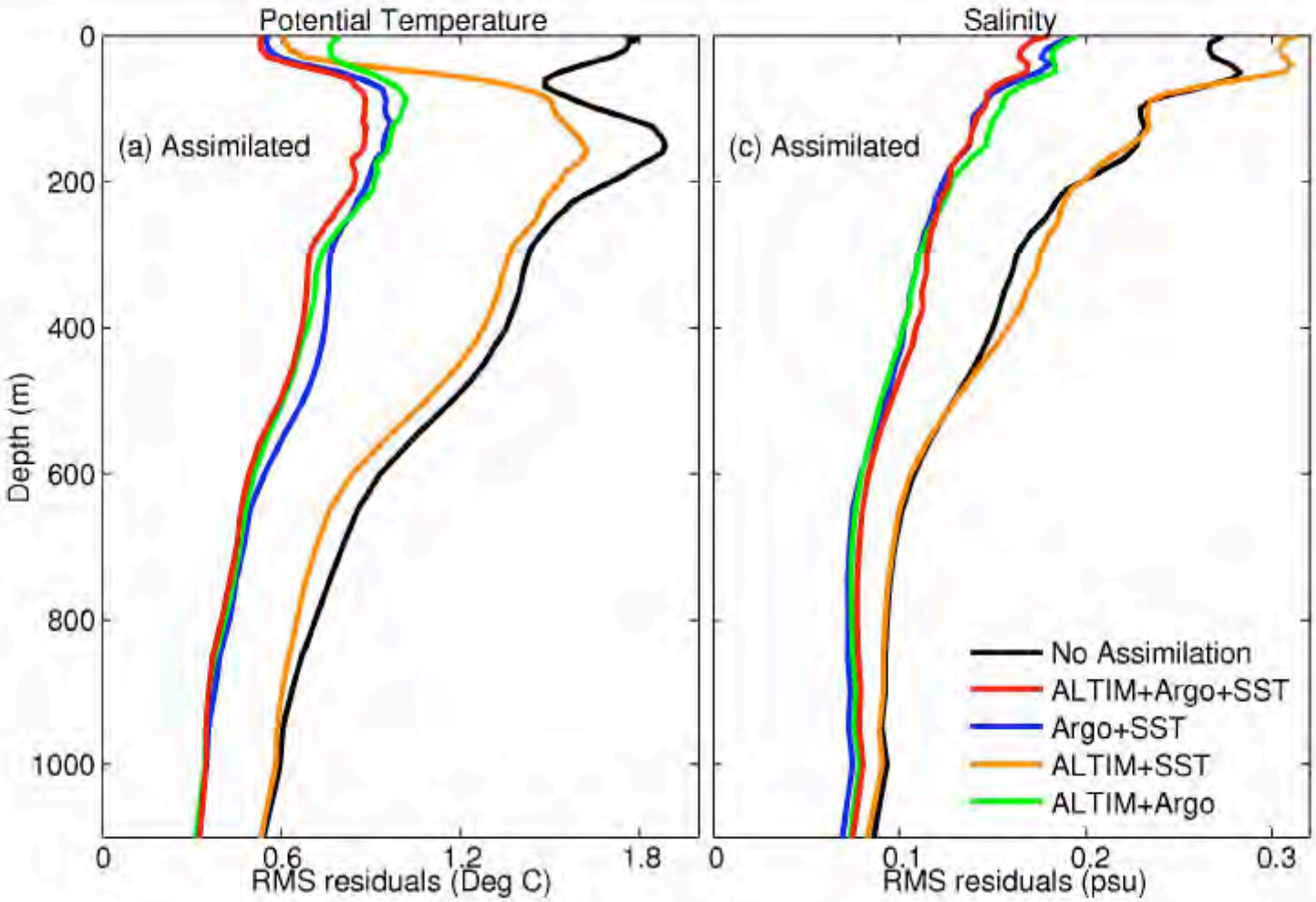
- **Seasonal forecast skill:**
  - Argo/Altimeter/Moorings contribute to the improvement of the skill of seasonal forecast of SST.
  - Their contribution is often complementary: Argo has larger effect in the Western Pacific and Indian Ocean. Altimeter's impact is larger in Atlantic and Eastern Pacific

- **Climate variability:**
  - The profound impact of Argo on the analysis should be taken into account when analysing the climate variability from ORA-S3.
  - OSEs indicate a deceleration in the ocean warming and global SH after 2003.
  - The variability in the ORA-S3 salinity may not be reliable

- **Other comments:**
  - A new observing system SHOULD NEVER HAVE a negative impact.

ECMWF

Observing System Experiments: Impact on T(z) and S(z)



3159 profiles assimilated

Impact of Observing System in the climate variability

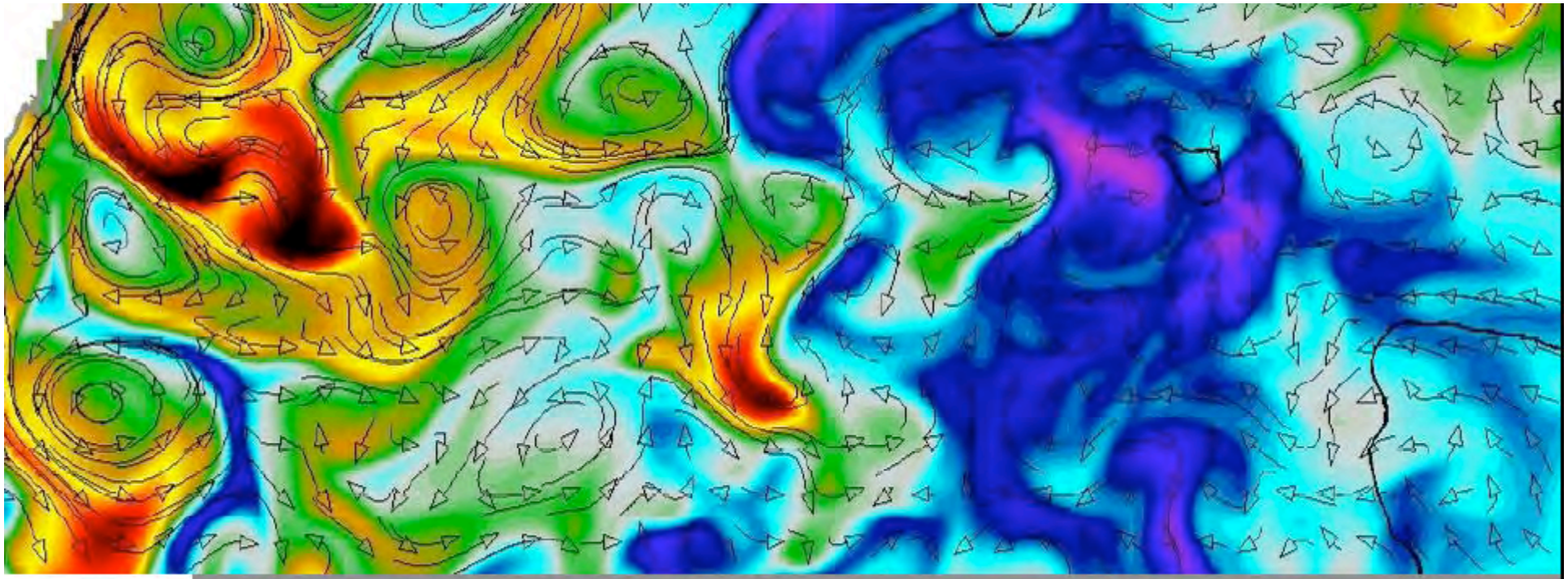
ORA-S3 = Ocean reanalysis using “all” observing system

ORA-nobs= Ocean model forced by surface fluxes

NOARGO = No Argo data 2001-2006

NOSOLO = No SOLO/FSI floats 2001-2006

- Heat content
- Attribution of Sea Level Change
- Salinity



Impact of Argo, SST and altimeter data on an eddy-resolving ocean reanalysis

Peter Oke and Andreas Schiller

November 2007

CSIRO Marine and Atmospheric Research

www.cmar.csiro.au/bluelink/