



# OSTIA reanalysis: A high resolution SST and sea-ice reanalysis

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# Overview

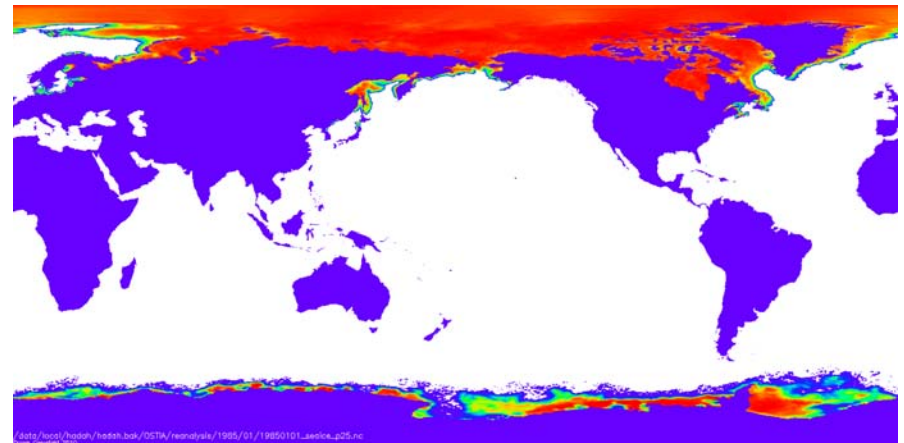
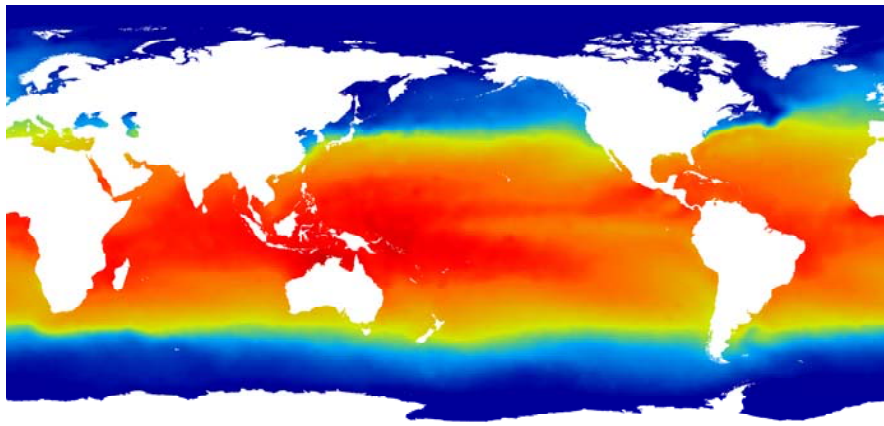
## **OSTIA reanalysis**

- Introduction to the OSTIA reanalysis
- OSTIA reanalysis data sources
- OSTIA reanalysis system
- Assessment of the OSTIA reanalysis
- Summary and conclusions



# Introduction to OSTIA reanalysis

- A high resolution, homogenous SST and sea-ice reanalysis has been produced using the Operational Sea surface Temperature and sea-Ice Analysis (OSTIA) system.
- Produces daily, global SST and sea-ice fields on  $1/20^\circ$  grid.
- SST is foundation SST.
- Runs for 23 years and covers the satellite period from 1985-2007.
- Intended for use in seasonal and decadal forecasting applications and to test climate models.





# SST Data Sources

**The 4km AVHRR Pathfinder V5 data** was reprocessed by NODC at NOAA.

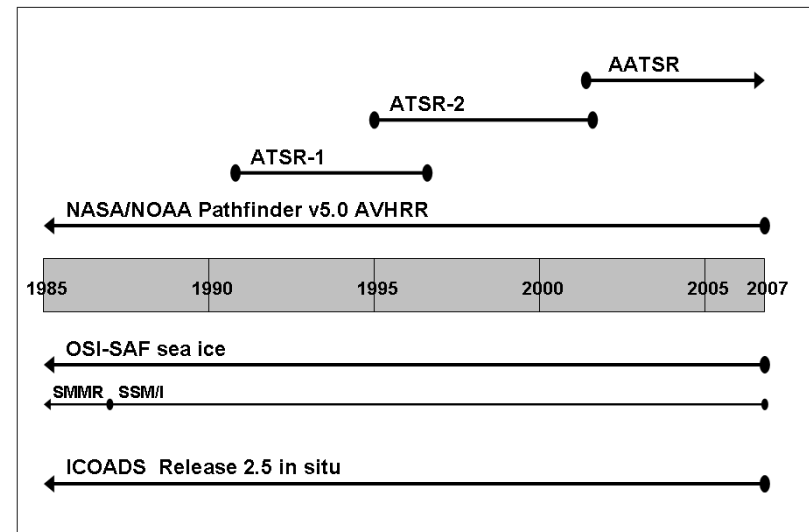
- Night time data only is used, data of quality flag 4,5,6,or 7 is used.

**The 1km multi-mission (A)ATSR data** has been reprocessed by the Rutherford Appleton Laboratory (RAL) and the University of Leicester.

- It comprises three missions ATSR-1, ATSR-2 and AATSR, the most recent mission is used in periods of overlap, a diurnal variability check is carried out in the OSTIA QC.
- For ATSR-1 mission data of quality flag 3, 4 and 5 are used. The ATSR-2 and AATSR highest quality flag 5 data only are used as reference in BC.

**In-situ data is extracted from the ICOADS archive.**

- Moored and drifting buoys and ship observations resolved to  $1/10^\circ$  (~12km), night time only observations are used, undergone a no. of QC checks prior to inclusion in the reanalysis.

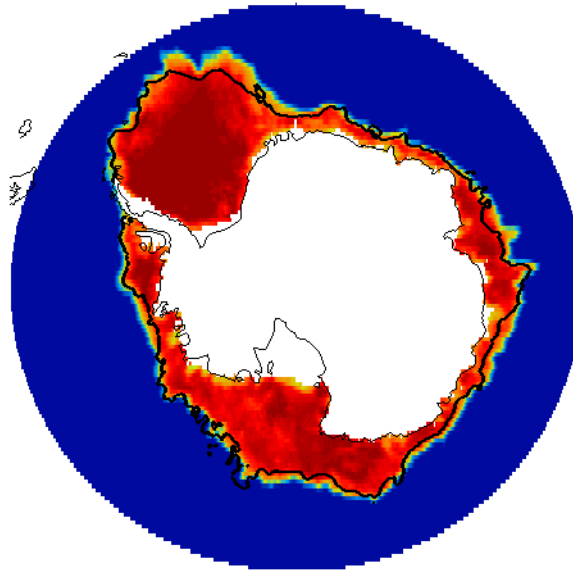




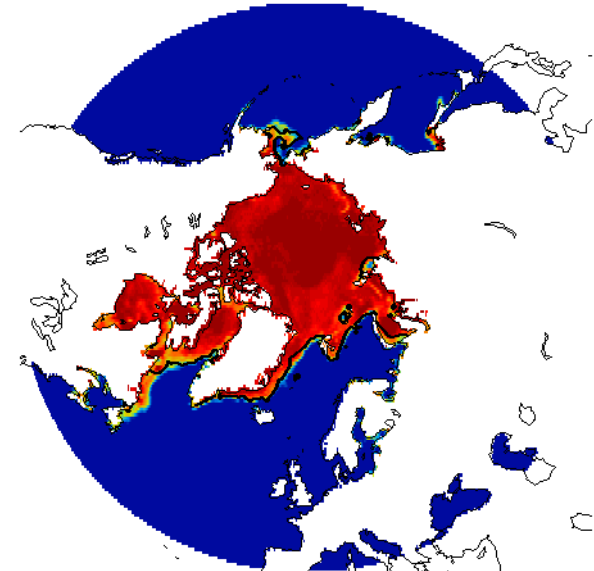
# OSI-SAF sea-ice concentration reprocessing data

- Sea ice concentration field taken from OSI-SAF 10km polar stereographic reprocessing data.
- Bi-linearly interpolated onto the OSTIA grid
- Large gaps in the data (7 days or more), the first file available after the outage has been copied to the date in the middle of the outage.

Example fields  
from 17/05/1992



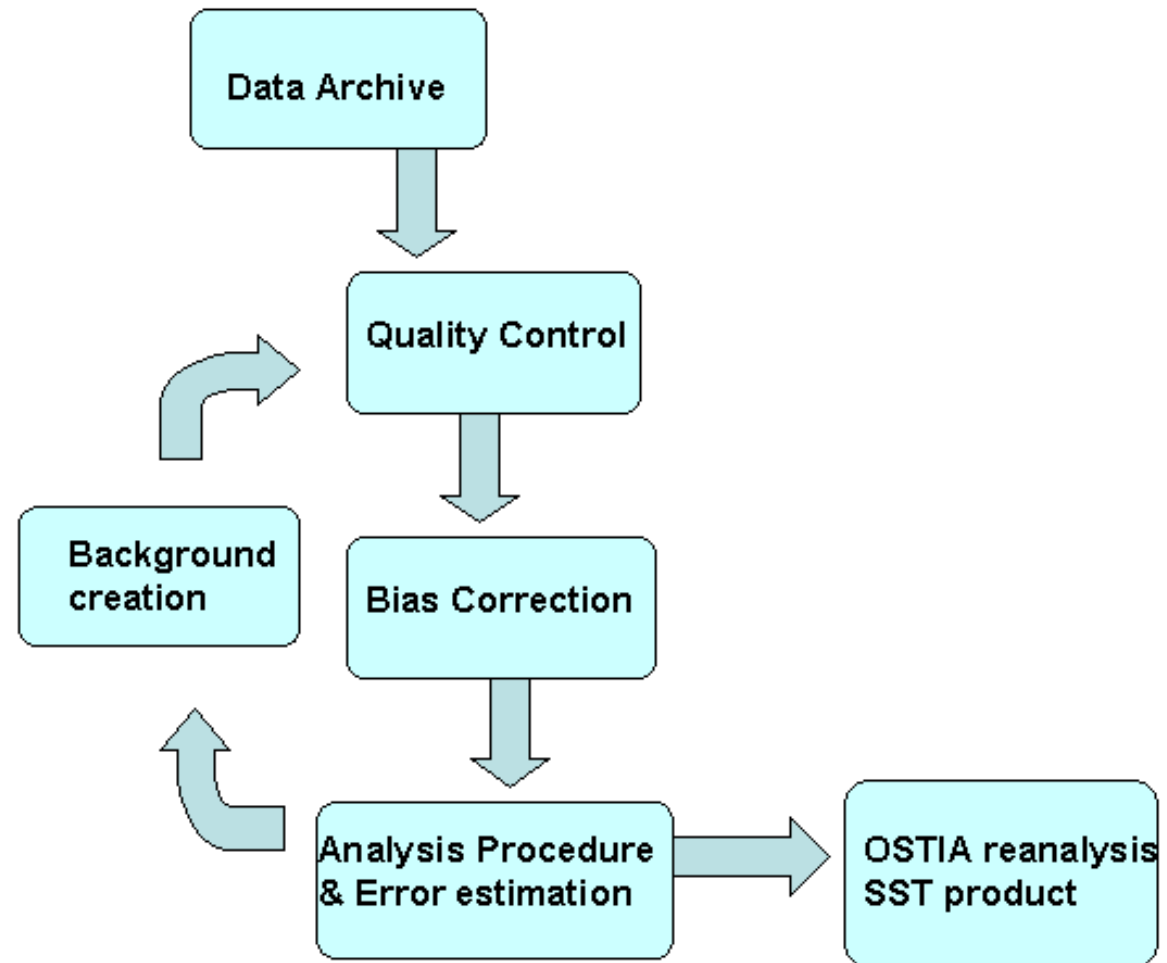
SH



NH



# OSTIA SST system architecture

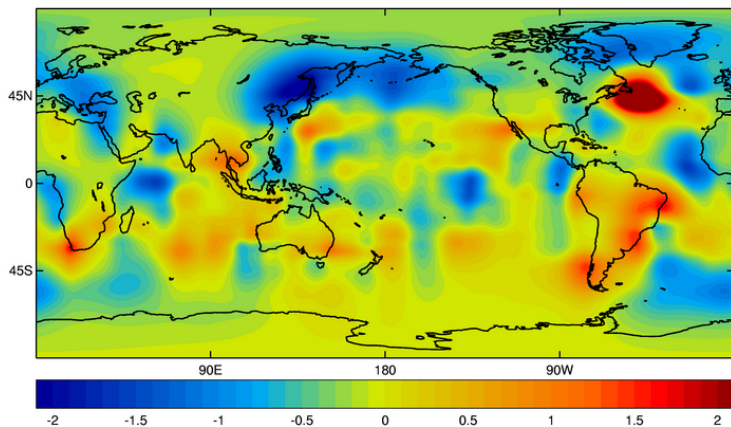




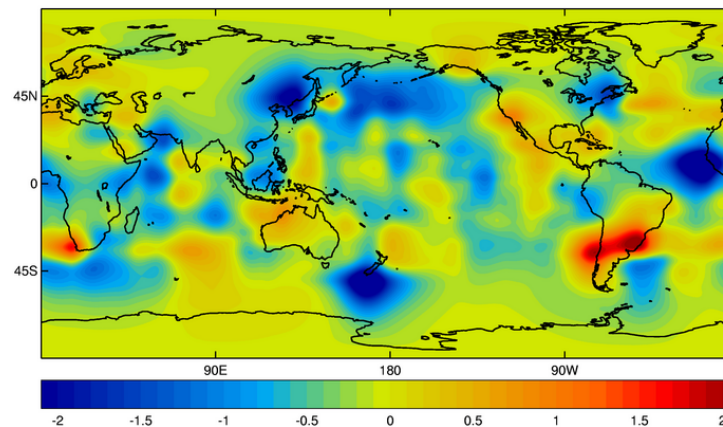
# SST bias correction

- AVHRR Pathfinder data and ATSR-1 data are bias corrected using in-situ data as reference data set.
- The ATSR-2 and AATSR data are added to this reference data set when they become available.
- Daily bias field calculated from 3 days of match-ups between the satellite and reference data.
- Bias correction uses a larger scale version of the O.I. scheme used in the SST assimilation.

ATSR-1 bias field



AVHRR bias field



Example bias fields from 14/04/1994

# SST bias correction o-b statistics

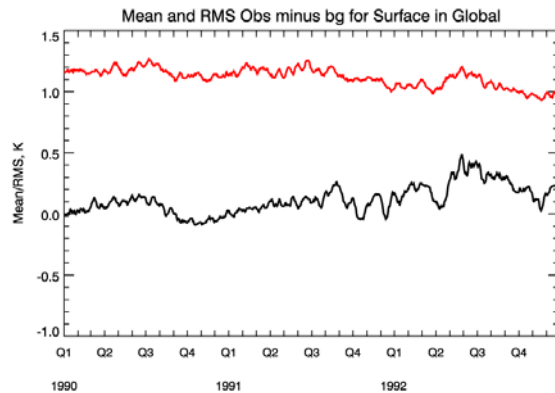
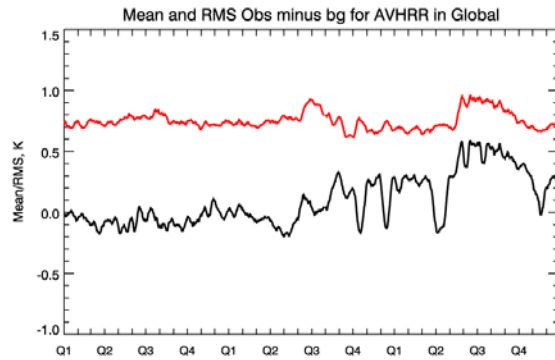
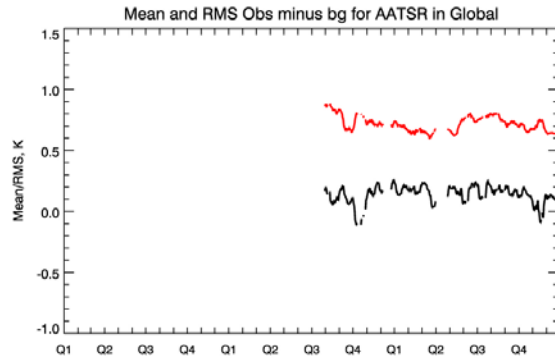


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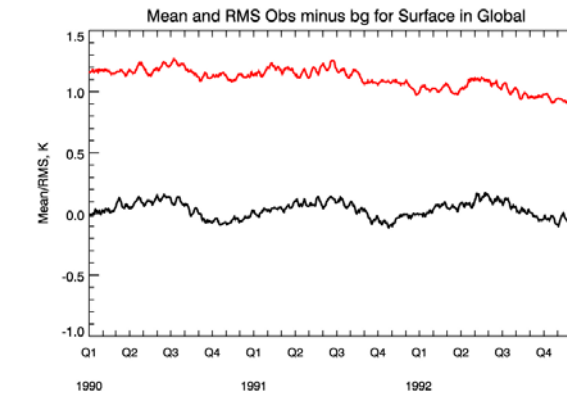
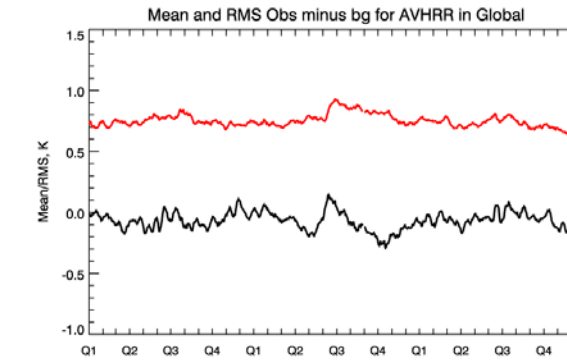
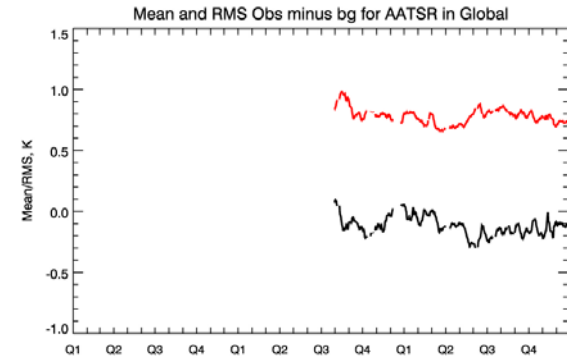
AATSR

AATSR

Surface



Using ATSR-1 as BC reference.



Correcting ATSR-1 to in-situ only reference.

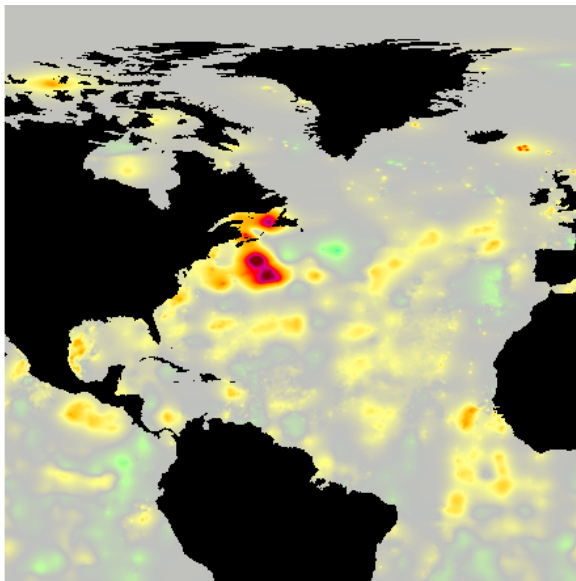




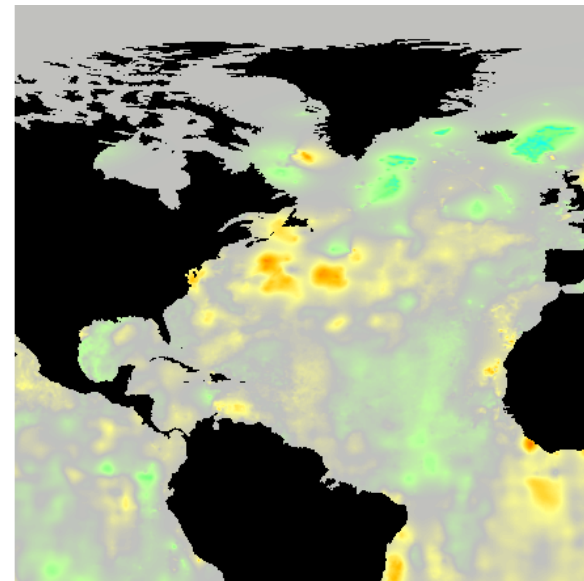
# SST assimilation scheme

- Iterative scheme which approximates a multi-scale Optimal Interpolation.
- Assimilation window of 3 days centred on 1200UTC on the analysis day.

Daily SST increments for June 1995.



1 day assimilation window



3 day assimilation window



# OSTIA reanalysis product suite

**OSTIA reanalysis data freely available through MyOcean project:**  
<http://www.myocean.eu.org>

- **High resolution (1/20°) daily OSTIA reanalysis.** Contain the foundation SST, SST analysis error, sea-ice concentration and land/sea/ice mask fields.
- **Reduced resolution (1/4°) daily anomaly.** Contain the SST anomaly from the AVHRR Pathfinder climatology, foundation SST and the sea-ice concentration fields.
- **High resolution daily OSTIA reanalysis climatology.** Contain the daily mean foundation SST, SST standard deviation, mean sea-ice concentration, sea-ice standard deviation and land/sea/ice mask fields.
- **Reduced resolution daily OSTIA reanalysis climatology.**
- **High resolution monthly OSTIA reanalysis climatology.**
- **Reduced resolution monthly OSTIA reanalysis climatology.**



# OSTIA reanalysis assessment

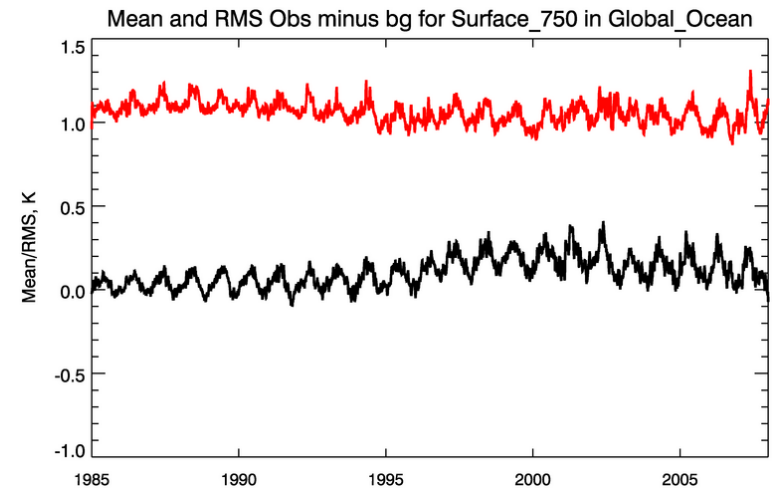
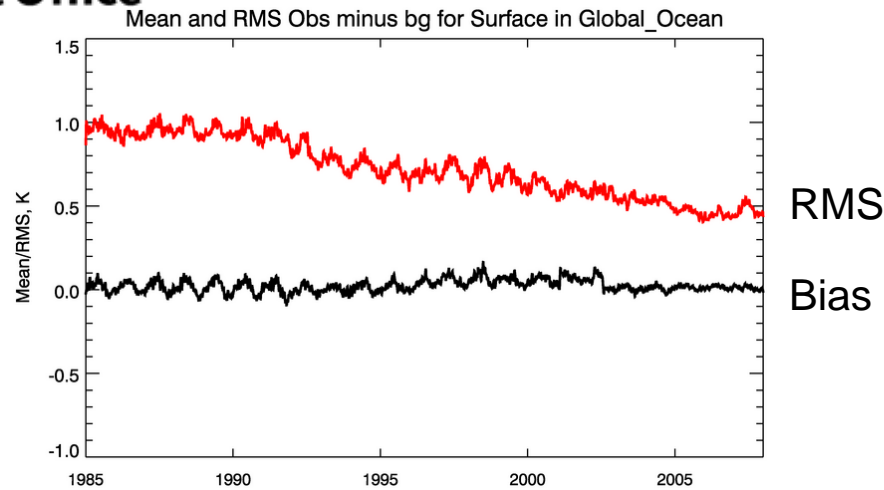
- Validation statistics
- Impact of Mount Pinatubo eruption
- Comparisons to independent Argo data
- High latitude validation
- Comparisons with other reanalysis products



# In-situ o-b validation statistics

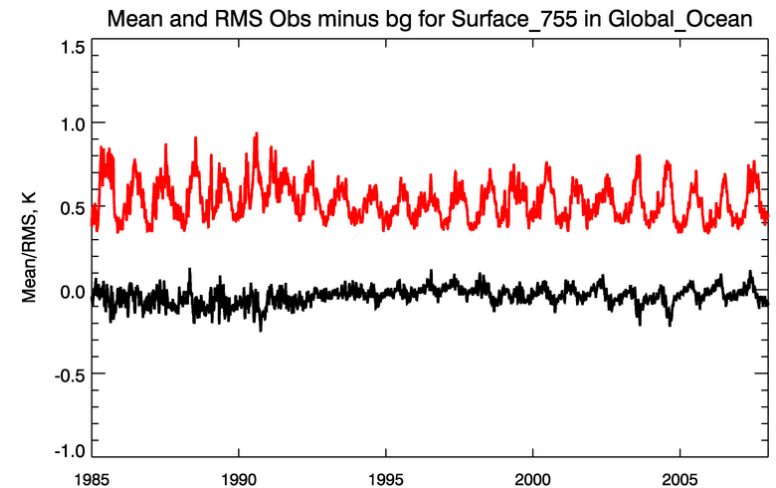
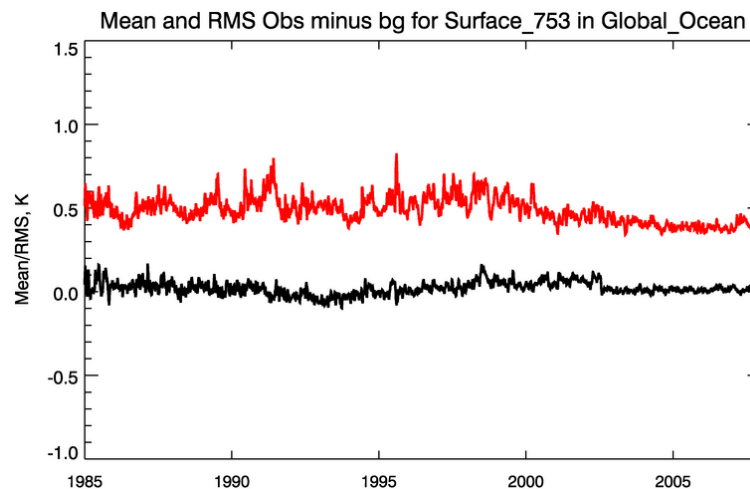
All in-situ data

Ship data



Drifting buoy data

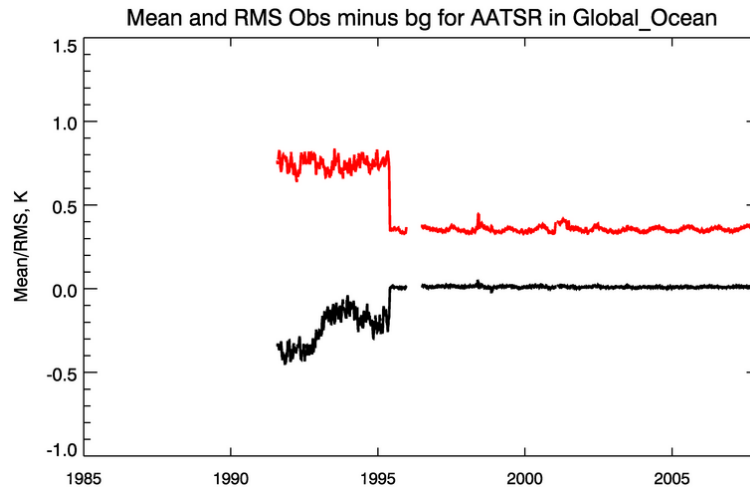
Moored buoy data



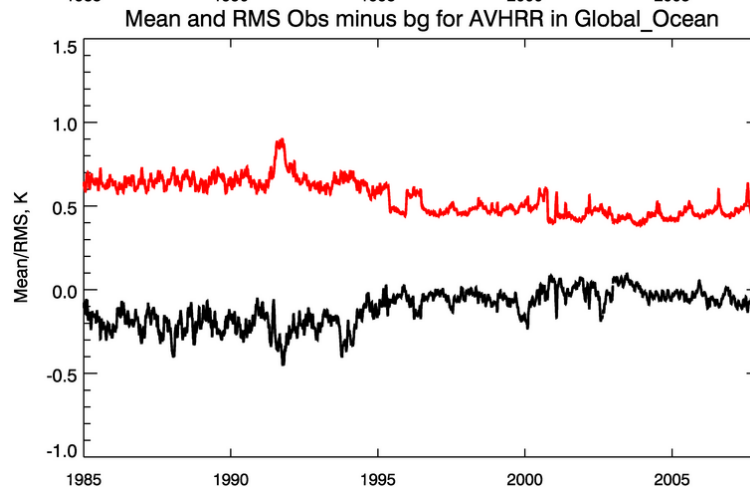


# Satellite o-b validation statistics

(A)ATSR



AVHRR



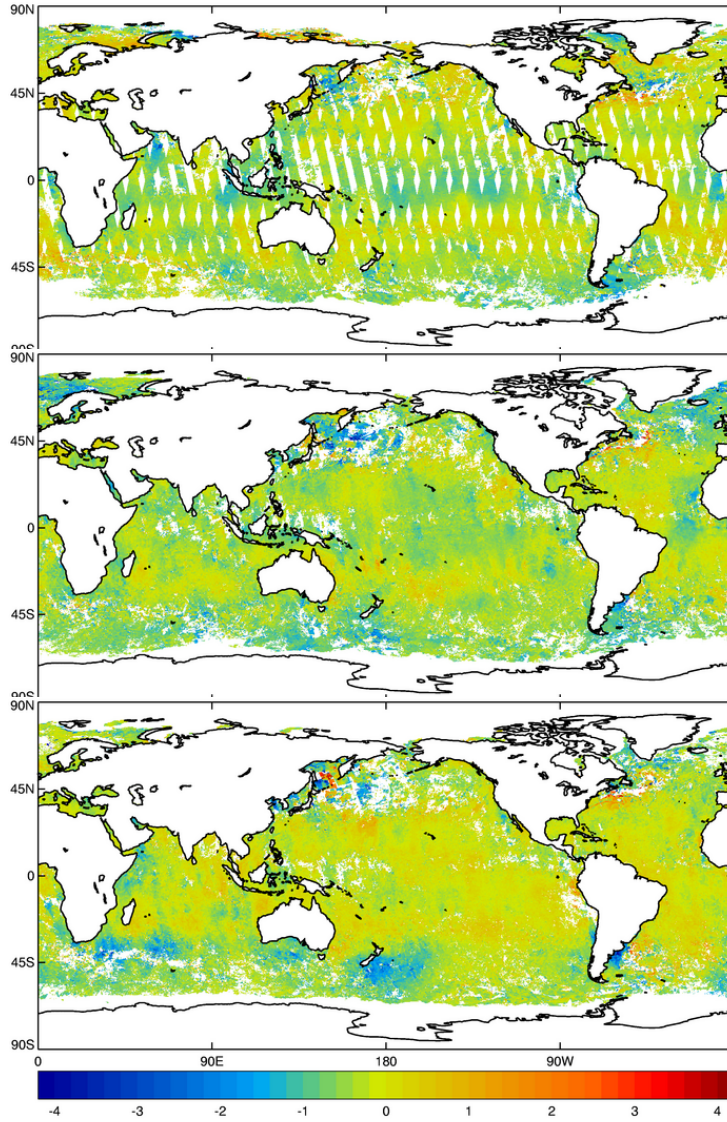
- Step change in RMS and bias once ATRIS-2 data comes online.
- Positive impact of ATSR-2 and AATSR data on AVHRR stats.
- Impact of Mount Pinatubo eruption discerned in global stats of both satellites.



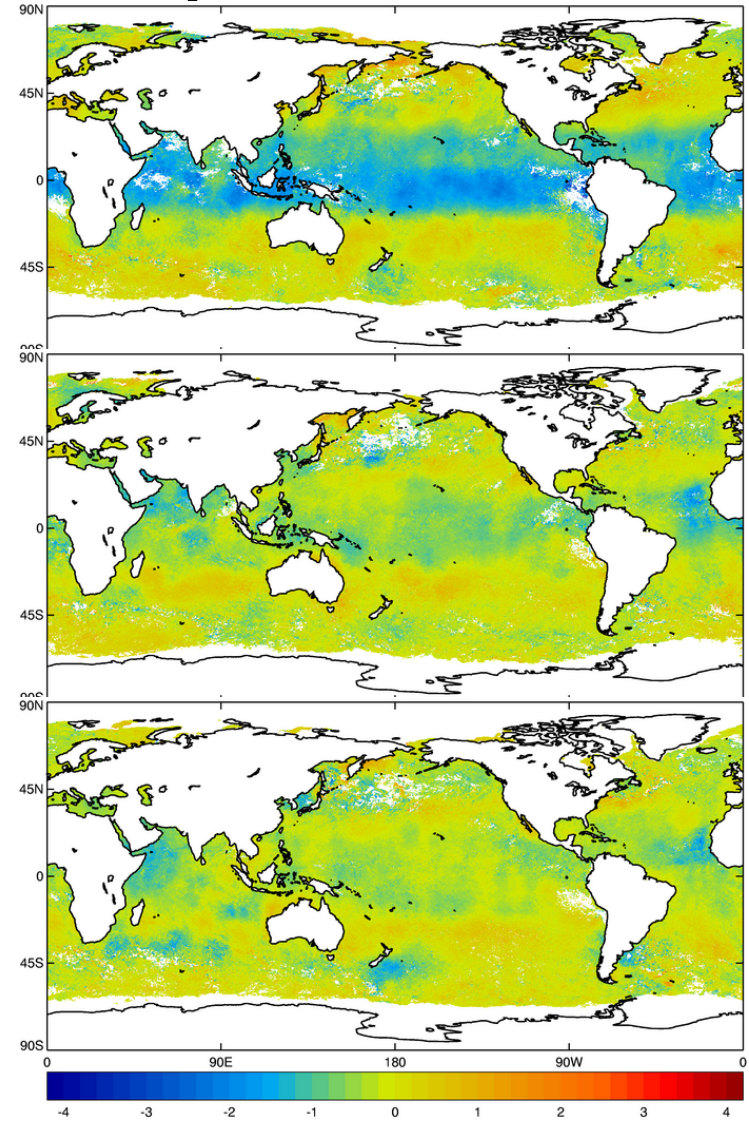
Met Office

1991-08

# Mount Pinatubo eruption



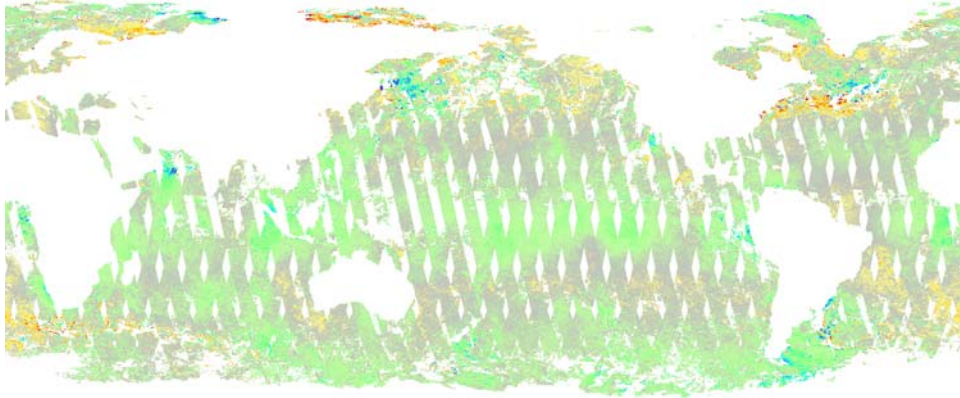
(A)ATSR



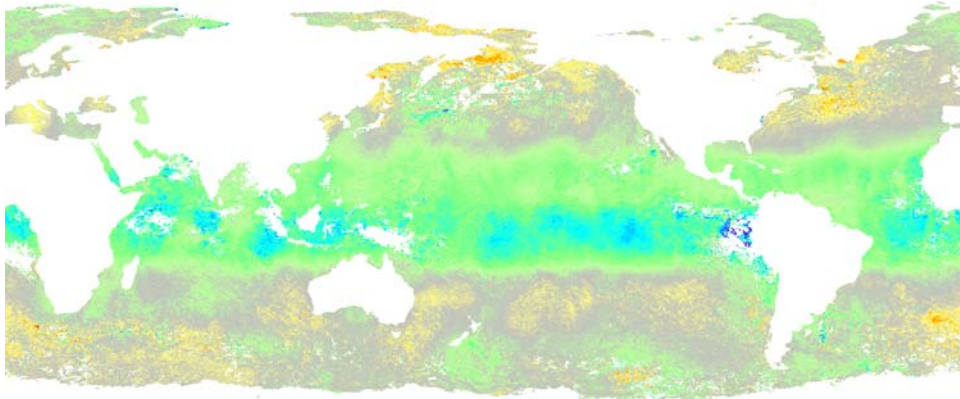
AVHRR



# Mount Pinatubo eruption



ATSR-1



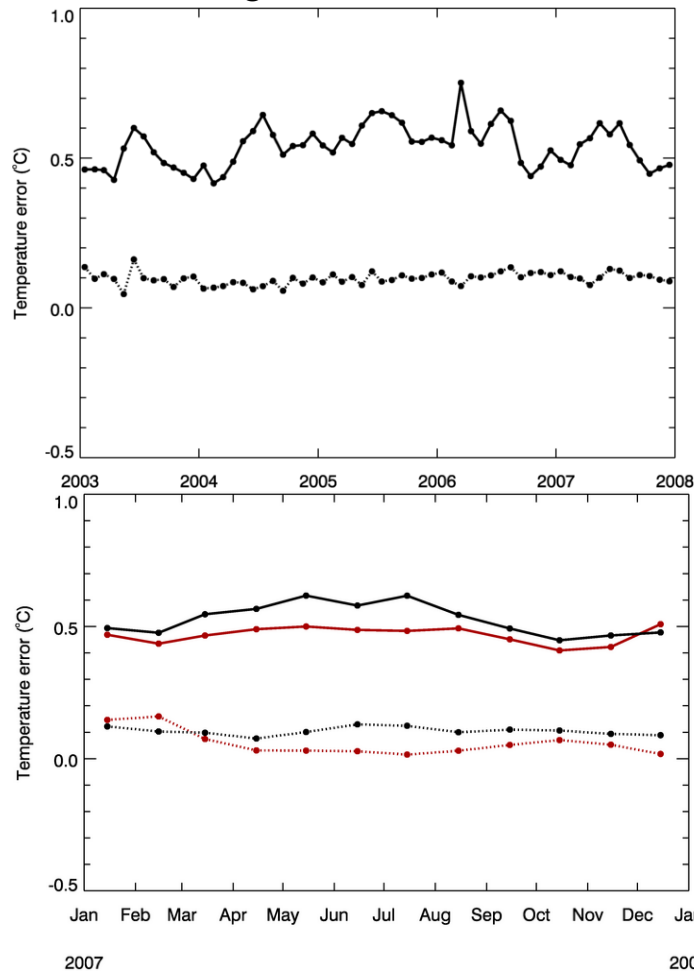
AVHRR

- Latitudinal band of negative bias around the tropics in both satellites.
- Pattern of biases match.
- Initially low volumes of ATSR-1 data.
- Bias disperses latitudinally.
- Takes almost 2 years for recovery.
- Animation runs from 08/1991 to 06/1993.



# Argo o-a validation

**Met Office** Argo – OSTIA statistics



Top level (3-5m) Argo data used as independent validation set for 2003-2007.

- Reanalysis has global s.d of  $\sim 0.55^{\circ}\text{C}$  with a cold bias of  $\sim 0.1^{\circ}\text{C}$ .

Comparison with NRT OSTIA system carried out for 2007.

- Bias and s.d. w.r.t. Argo data reduced in the NRT OSTIA system compared to reanalysis.

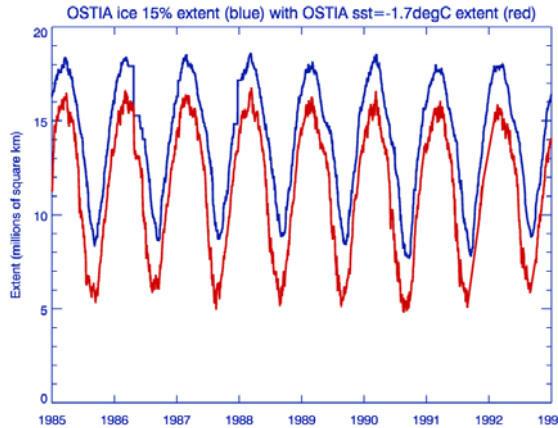
OSTIA reanalysis (black) and NRT (red).



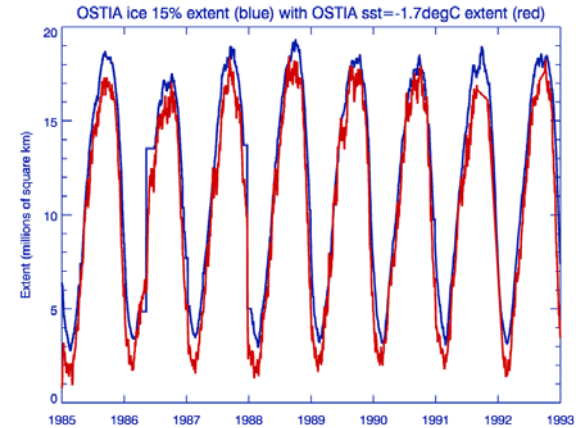


# Consistency of SST and sea-ice at high latitudes

Consistency between SST and sea-ice fields better in SH than NH

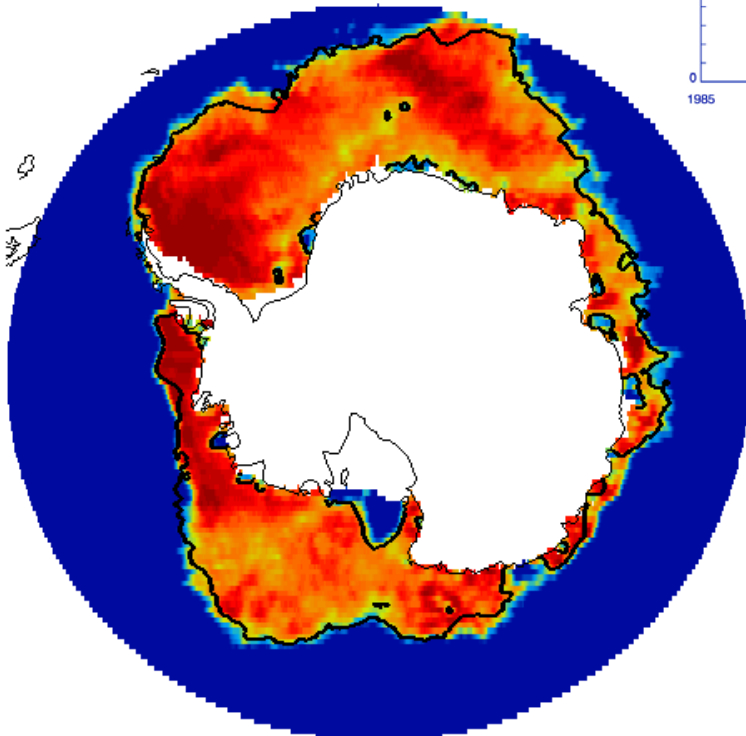


NH



SH

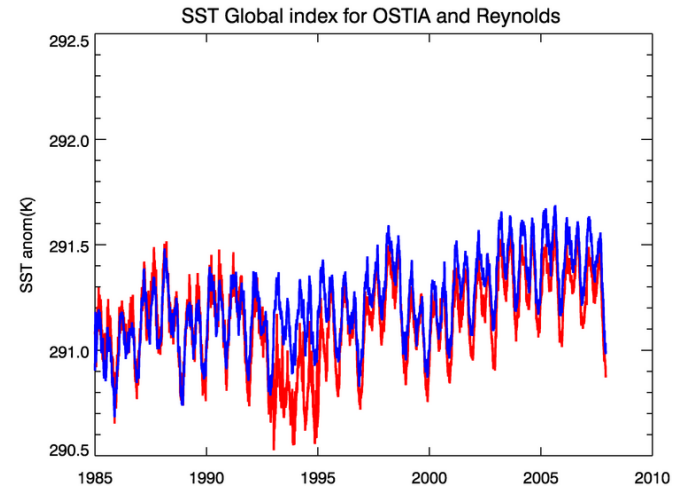
Consistency between SST and sea-ice maintained during SH winter break up in 1988





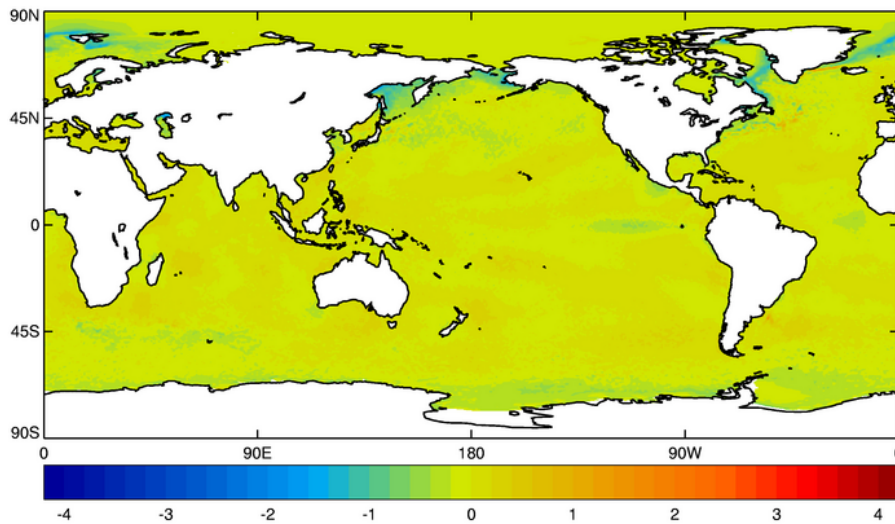
# Comparison with Reynolds O.I. reanalysis

- (A)ATSR data has cooling effect on OSTIA.
- Differences exist around the ice edge.
- Slight differences at high latitudes.
- Differences in high gradient SST regions.
- Corrupt AVHRR data lead to differences in NH Summer at high latitudes.

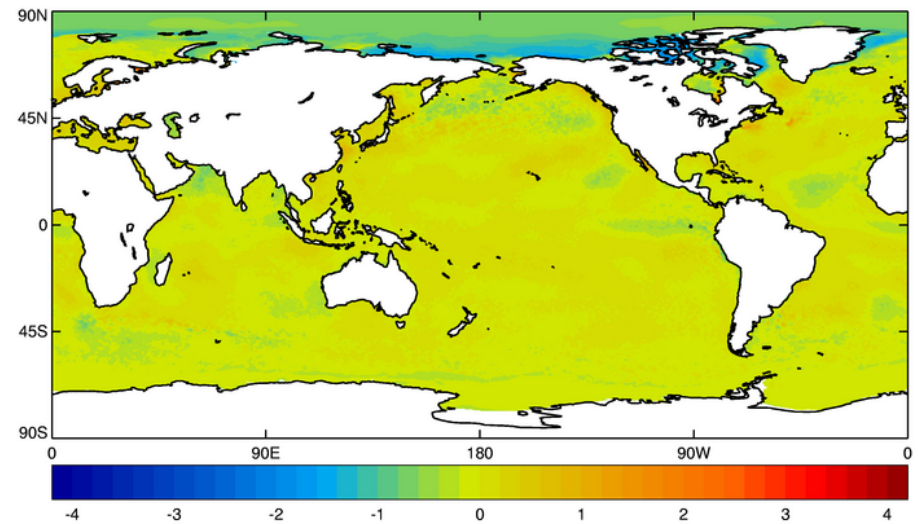


Global SST OSTIA (red) and Reynolds OI (blue).

Climatological comparison



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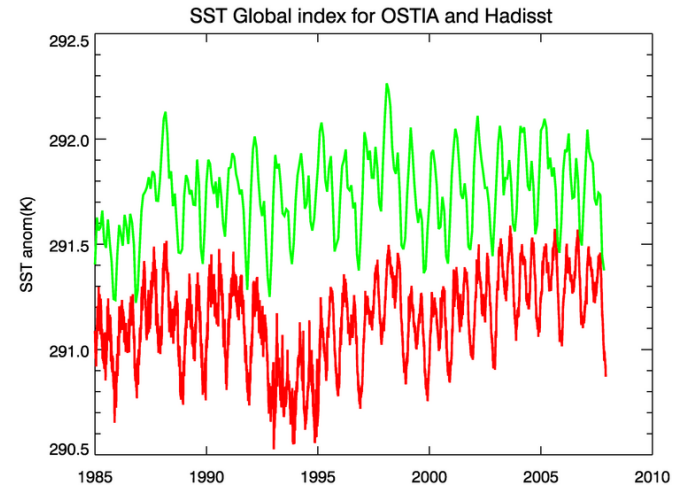


July



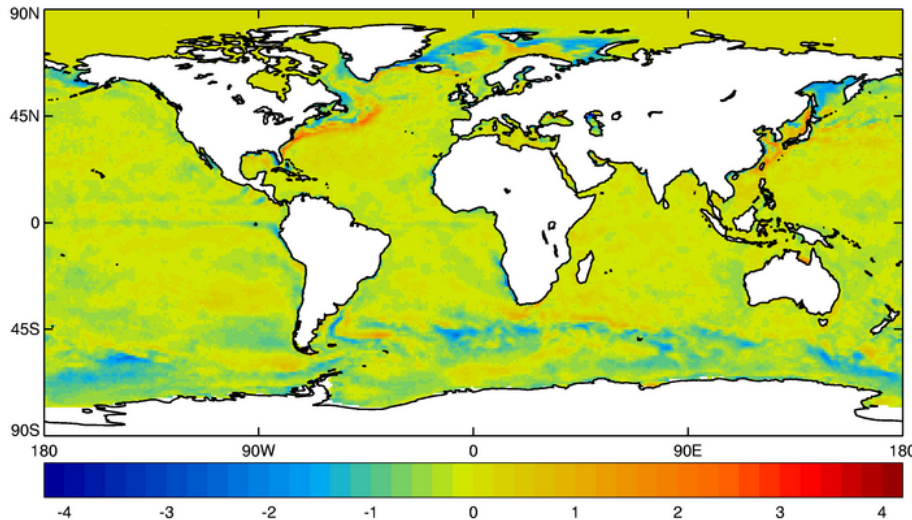
# Comparison with HadISST reanalysis

- Large global bias ( $\sim 0.5^{\circ}\text{C}$ ) w.r.t. HadISST
- Differences exist around the ice edge.
- Differences at HL in summer hemisphere.
- Differences in high gradient SST regions.

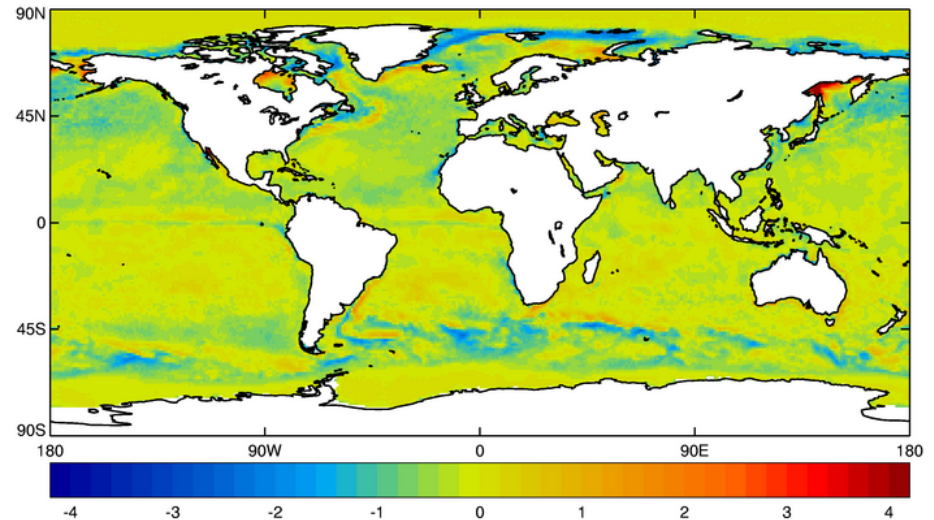


Global SST OSTIA (red) and HadISST (green).

## Climatological comparison



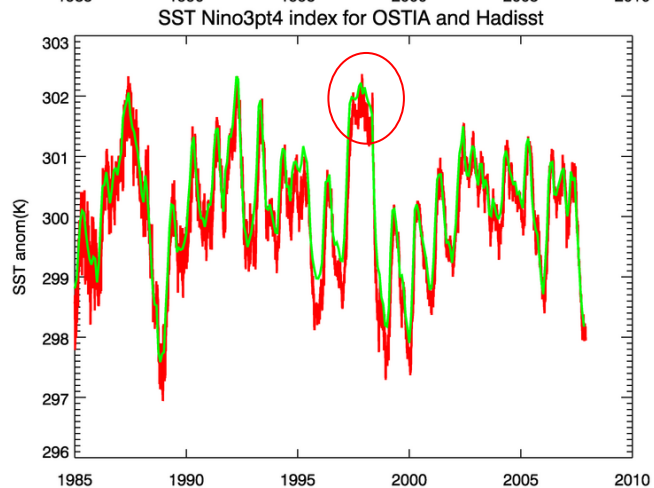
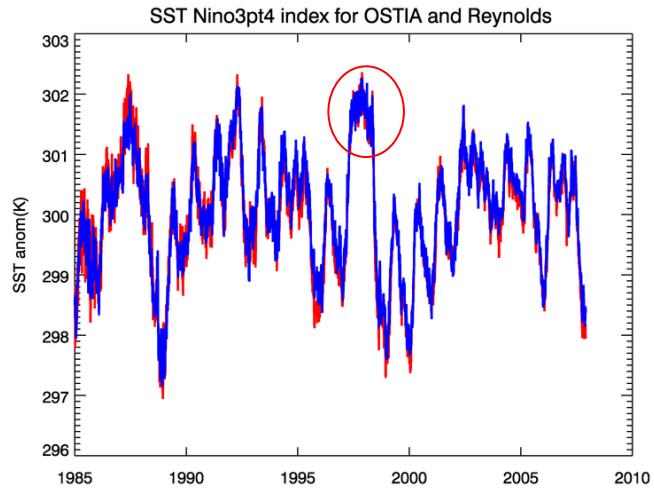
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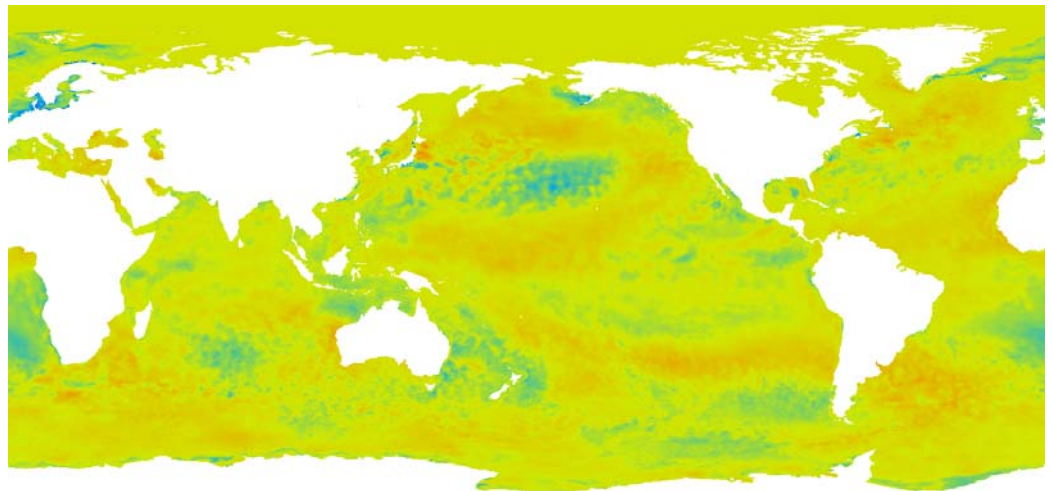
July



# Climate signals in the OSTIA reanalysis in Nino 3.4 region



- General agreement in SST's in the Nino 3.4 region.
- Slight negative bias in OSTIA w.r.t. HadISST



Animation of SST anomalies showing the strong 1997/98 El-Nino. Runs from 01/1997-07/1998.

Nino 3.4 SST OSTIA (red), Reynolds OI (blue) and HadISST (green).



# Summary and conclusions

- OSTIA reanalysis provides daily, high resolution global SST and sea-ice analysis for 01/01/1985- 31/12/2007.
- Data sources and OSTIA system have been described.
- Analysis accuracy (w.r.t in-situ observations) improves throughout the analysis period.
- ATSR-2 and AATSR data shown to have positive impact on the AVHRR statistics.
- Global impact of Mount Pinatubo eruption on satellite data is discerned.
- OSTIA reanalysis is slightly cold bias w.r.t. independent Argo data.
- Good agreement between OSTIA reanalysis and Reynolds OI.
- OSTIA reanalysis is cold bias w.r.t. HadISST reanalysis.



Questions??  
Don't forget data available from  
<http://www.myocean.eu.org>