



# ESA Climate Change Initiative Phase-II

## Sea Surface Temperature (SST)

[www.esa-sst-cci.org](http://www.esa-sst-cci.org)

# ESA CCI for SST: an overview

Chris Merchant



# Aims for SST CCI Climate Data Record:

1. INDEPENDENT of in situ SST measurements
2. Of useful, quantified ACCURACY and SENSITIVITY
3. With context-sensitive UNCERTAINTY estimates (at all spatio-temporal scales)
4. Harmonised to provide useful STABILITY
5. Able to be linked to the longer HISTORICAL RECORD
6. Generated by a ROBUST, SUSTAINABLE processing system in short delay mode

These aims drive the approach of the project and products created

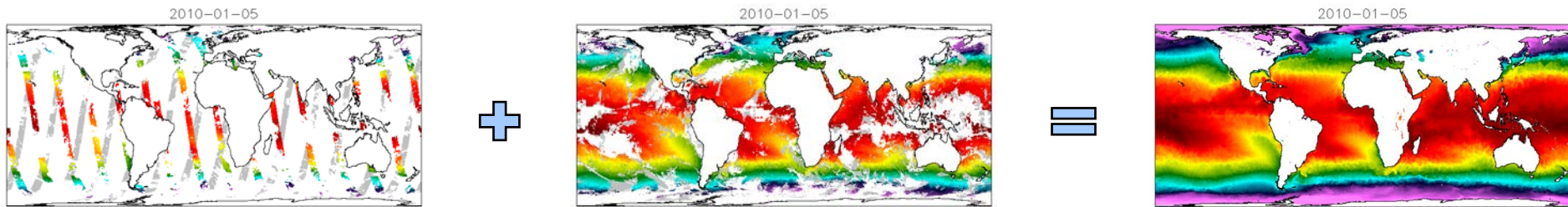


# Independence using Physics-based methods

- $\mathbf{y} = \{BT_{11\mu\text{m}}, BT_{12\mu\text{m}}, \dots\} \rightarrow x$  (SST)
- Traditionally the inverse has been defined empirically by regressing to *in situ* ...
- For independence, need to rely on the physics
  - Understand the sensors
  - Radiative transfer
  - Image classification
  - Near-surface ocean physics, inc. diurnal variability
  - Physics-based inverse



# Sea Surface Temperature CCI – key concept

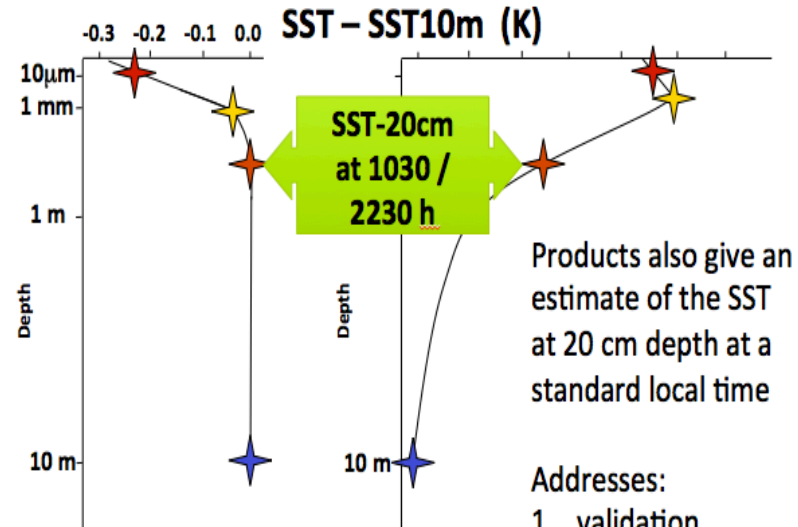
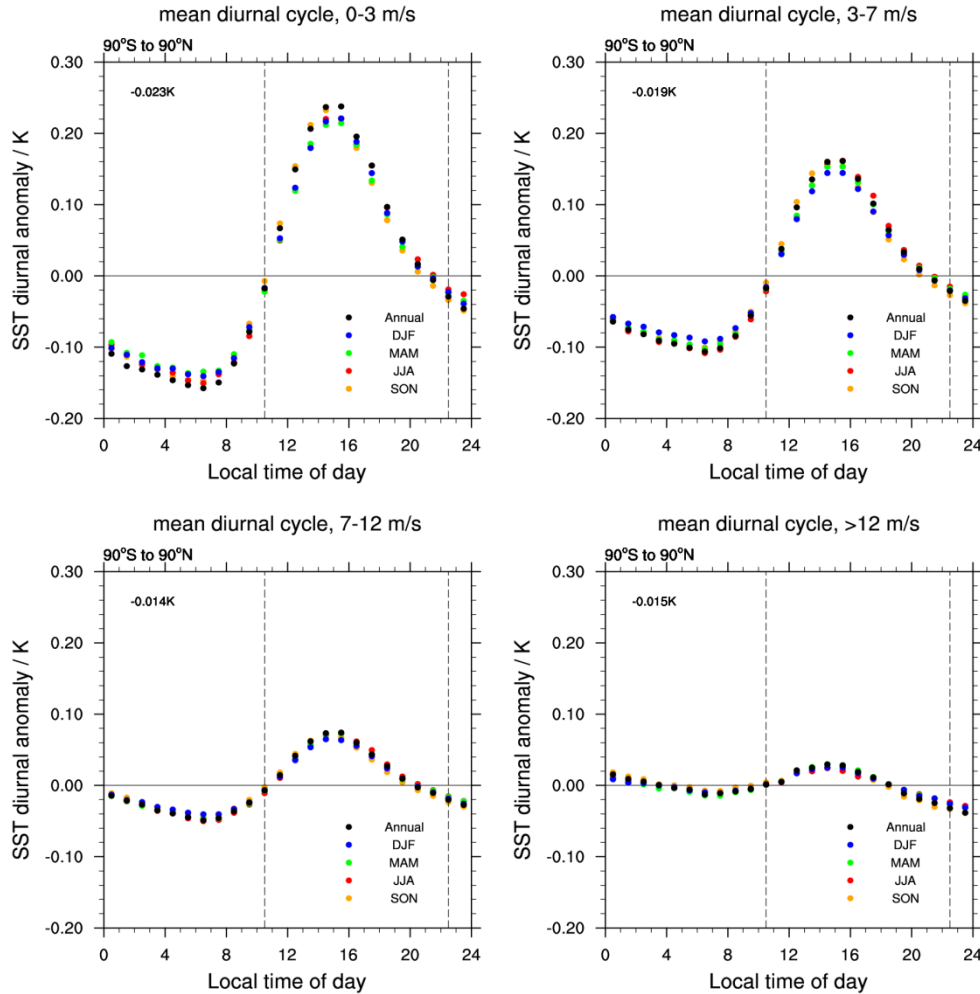


ATSRs: dual view,  
**stable & accurate.**  
Use as SST  
calibration  
reference.

AVHRRs: single  
view, not  
designed for  
climate, **good  
coverage** and a  
**longer history.**

ATSRs & AVHRRs  
are blended.  
Using an  
improved version of  
Met Office “OSTIA”.

# A depth estimate at standardised time of day



- Addresses:
1. validation
  2. orbit drift (stability)
  3. link to historical SST



■ HOSTACE project



# SST time-series: period covered

## Present datasets

ATSR L3U : 1991-2010

AVHRR L2P: 1991-2010

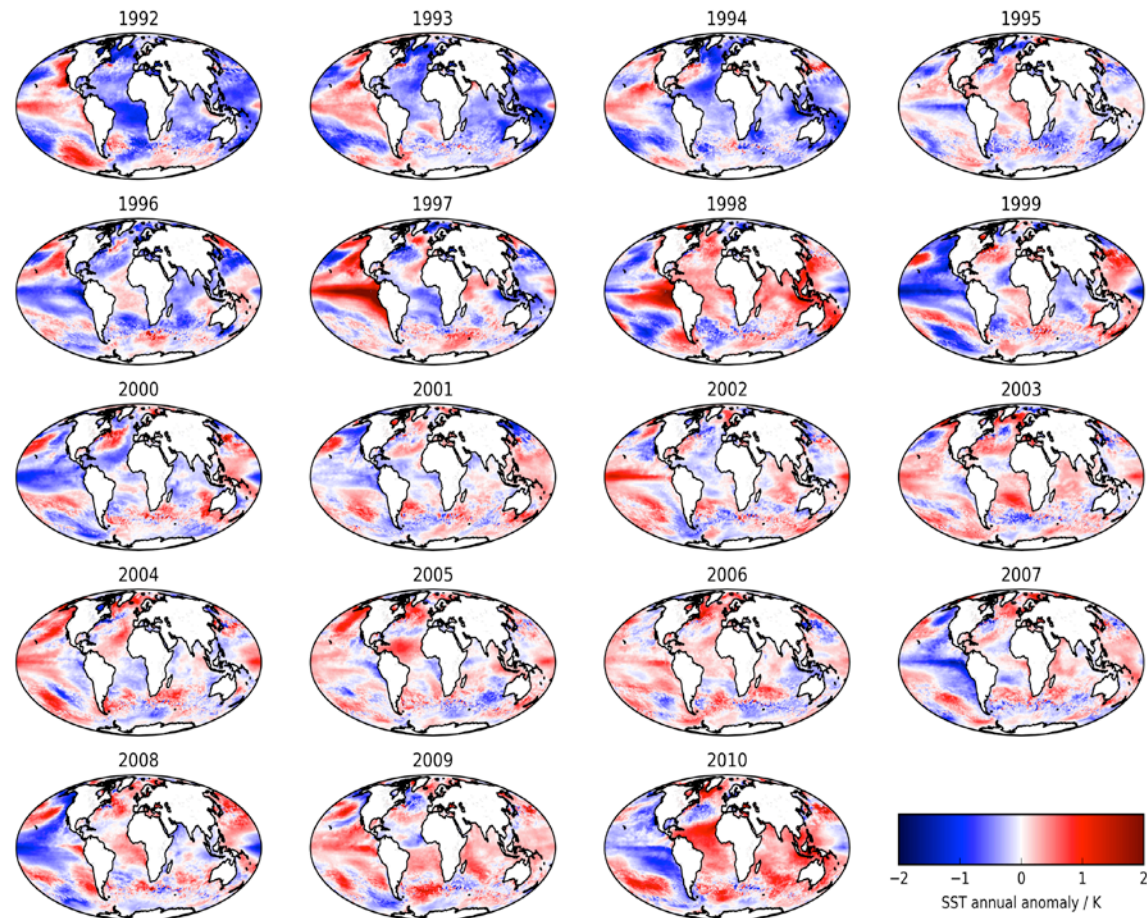
Analysis L4: 1991-2010

## By end of SST CCI project

ATSR L2/L3: 1991-2012

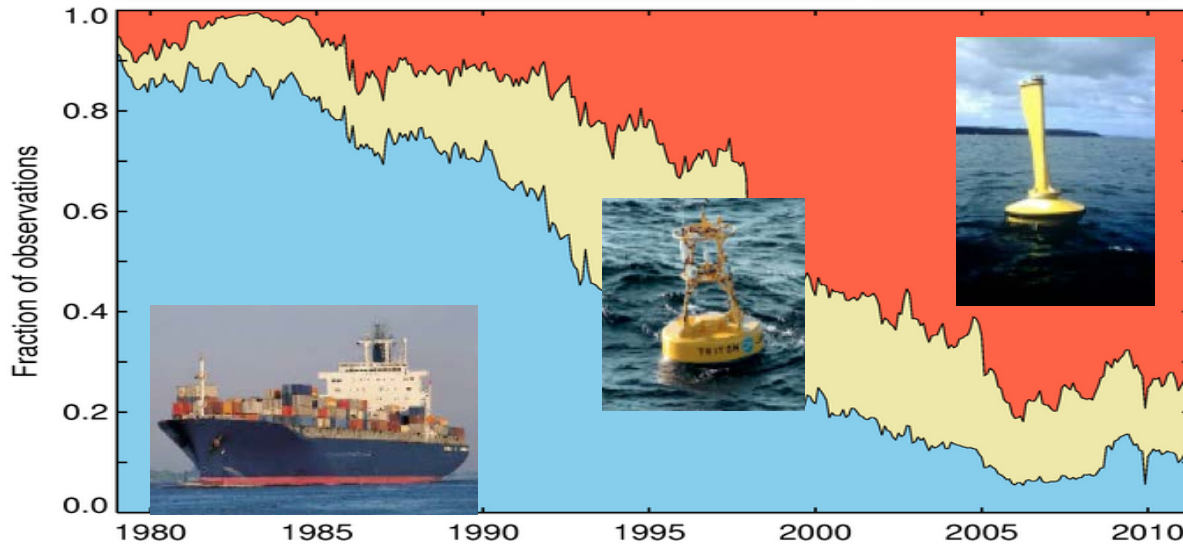
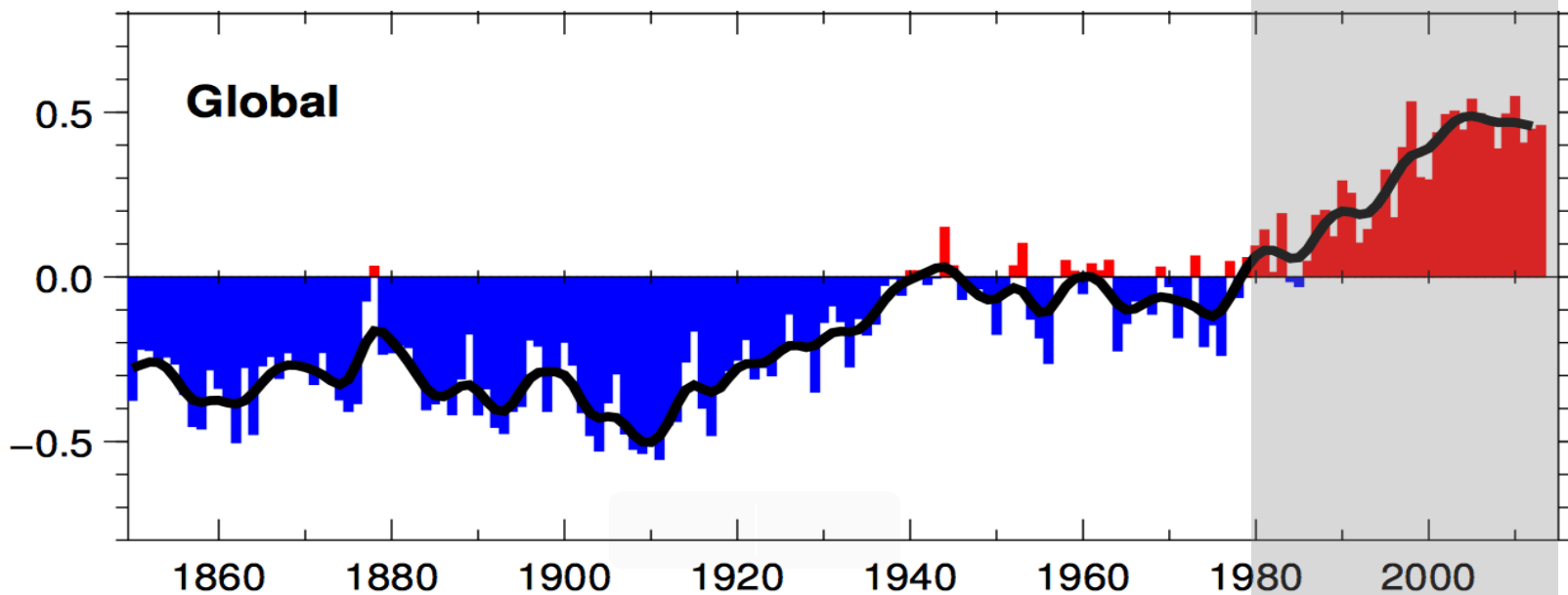
AVHRR L2P: 1981-2016

Analysis L4: 1981-2016



- Plus experimental SSTs for climate from MW radiometers and link to Sentinel 3 SLSTR

For data: Merchant et al (2014), GDJ doi: 10.1002/gdj3.20



John Kennedy, Met Office

SST\_cci Phase-II -- User Meeting on Uncertain



Reading

Met Office

BROCKMANN  
CONSULT



INSTITUTE

Toujours un temps d'avance

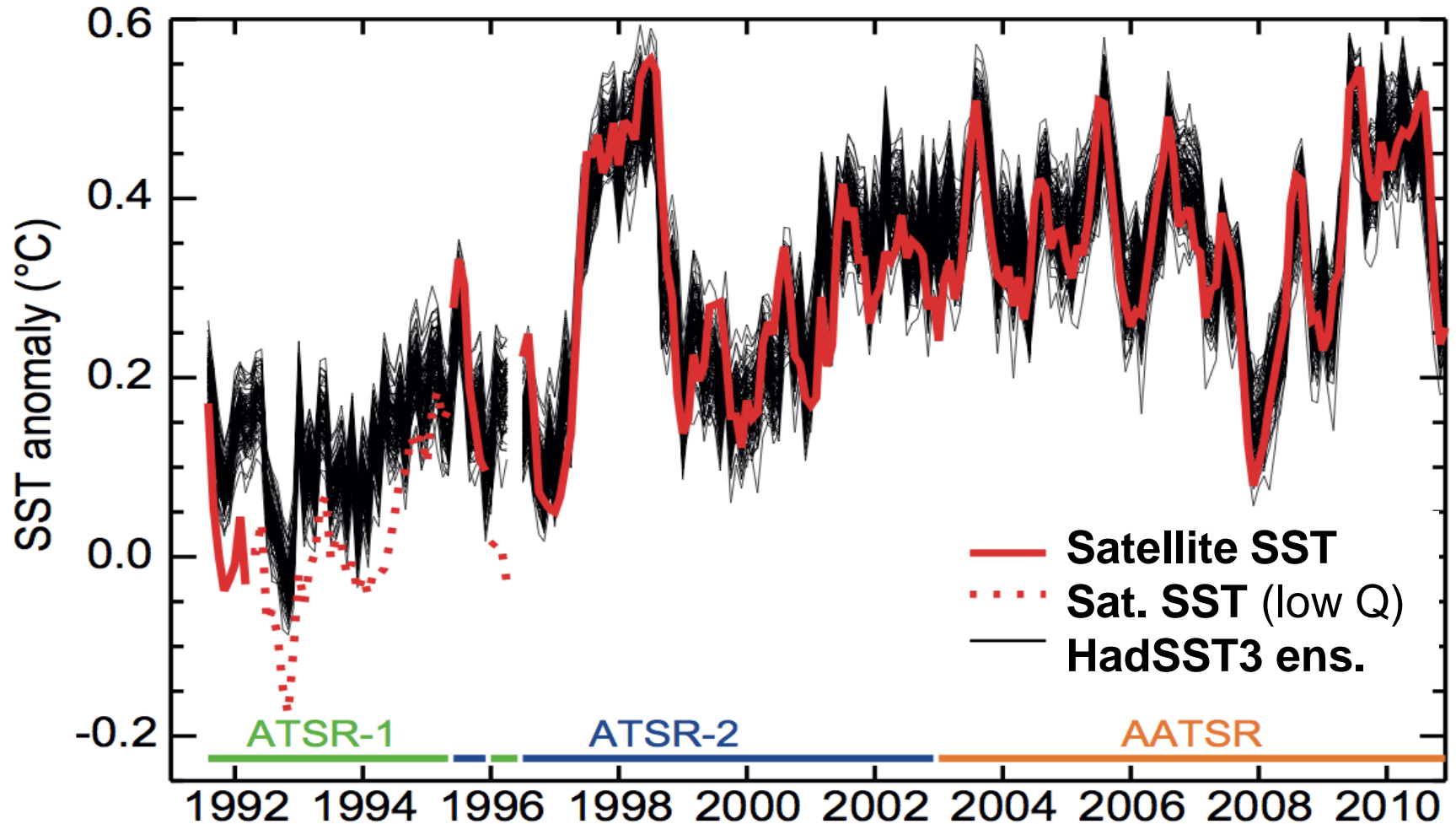
LEICESTER



2014

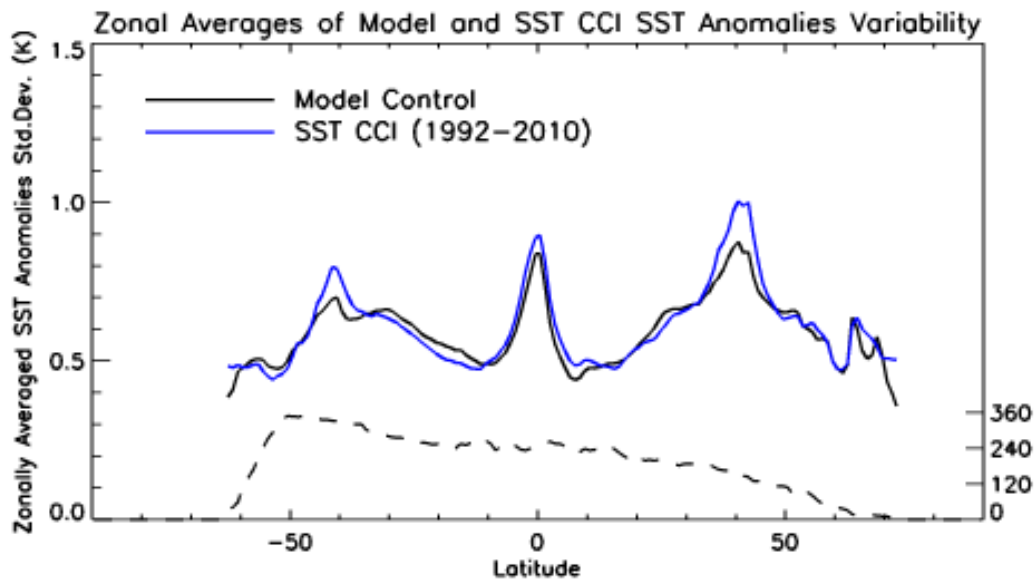
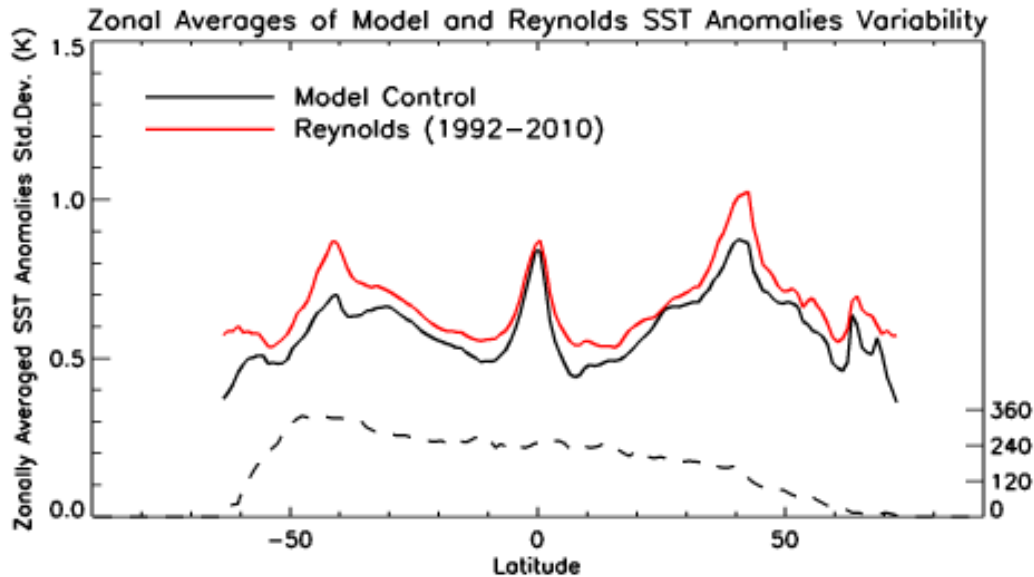
# Increased confidence in marine climate changes

IPCC AR5 Fig 2.17





# Evaluation of coupled model



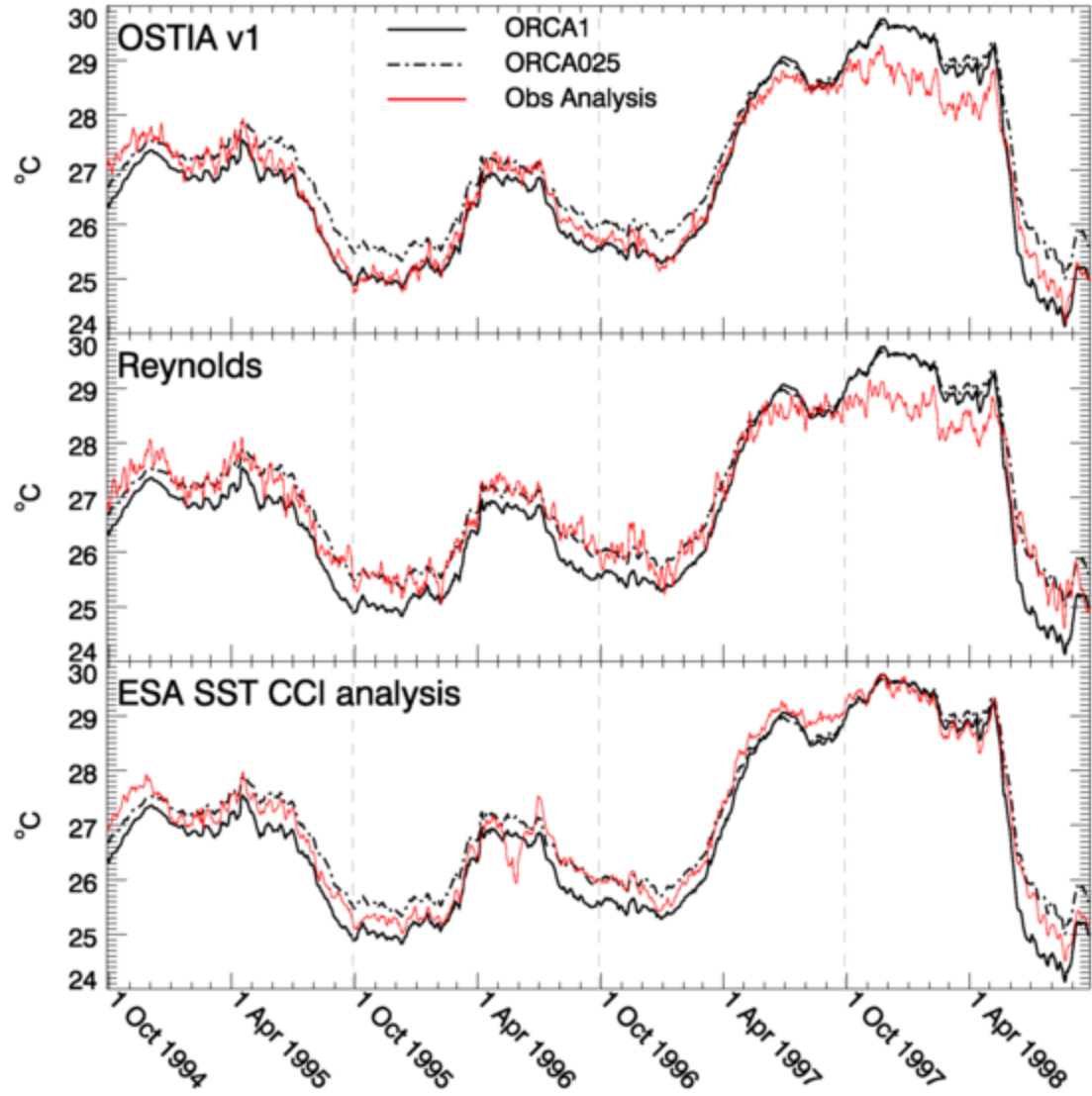
Evaluation of coupled models against SST CCI data, compared with the “standard” data set used for this at the Met Office Hadley Centre

Metric:  
Variability of Zonal Average SST Anomaly

More model-data agreement using SST CCI data

18-20 Nov 2014

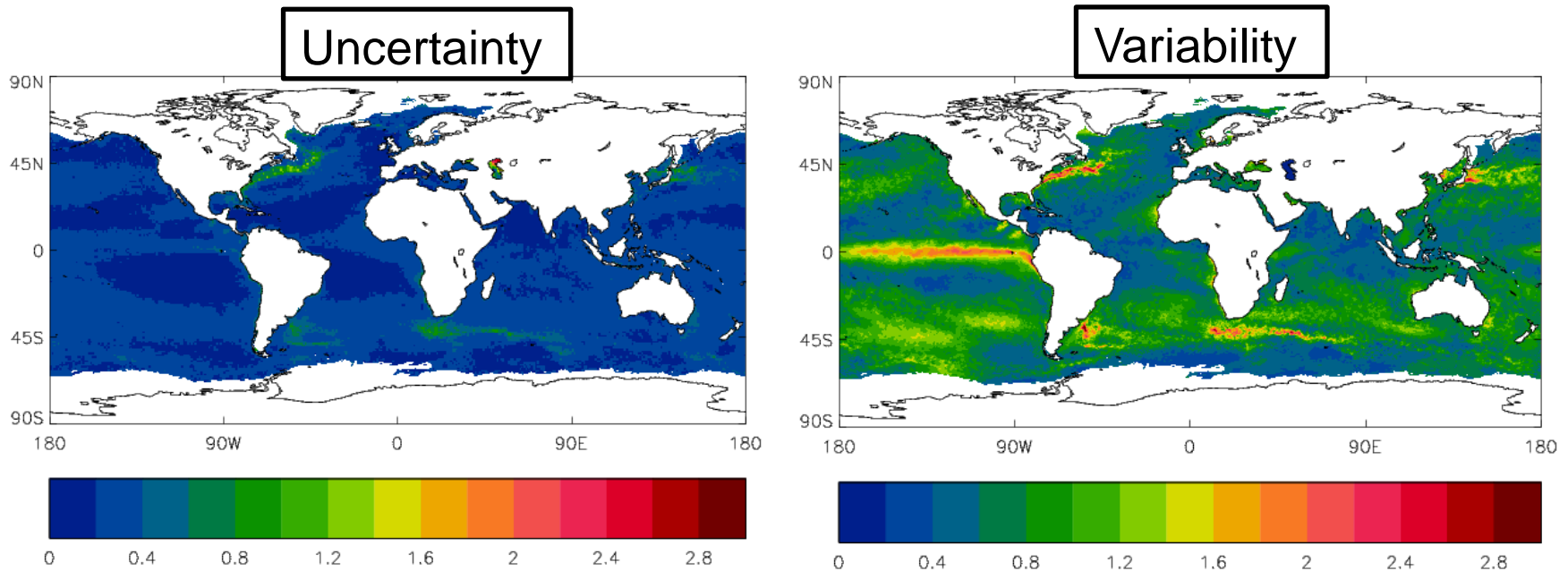
# Exploration of heat transport in ocean models via Pacific Tropical instability Waves



Improved agreement during the El Niño period

# Uncertainty compared to variability

SST CCI analysis for 1<sup>st</sup> Jan: mean uncertainty compared to standard deviation of SST field, for 1991-2010



Since uncertainty is less than natural variability, dataset is able to give a “clean” view of changes in SST.

## Further information

For ATSR techniques and results:

Embury et al., 2011, Rem Sens Env, doi: 10.1016/j.rse.2010.10.016

Embury and Merchant, 2011, RSE, doi: 10.1016/j.rse.2010.11.020

Embury et al., 2011, Rem Sens Env, doi: 10.1016/j.rse.2011.02.028

Merchant et al., 2012, JGR, 117, C12013, doi:10.1029/2012JC008400.

[www.neodc.rl.ac.uk](http://www.neodc.rl.ac.uk) → Browse → arc

For bias and sensitivity issues and SST retrieval for AVHRR

Merchant et al., 2009, GRL, doi: 10.1029/2009GL039843

For SST CCI project reports & products

[www.esa-sst-cci.org](http://www.esa-sst-cci.org) → Documents

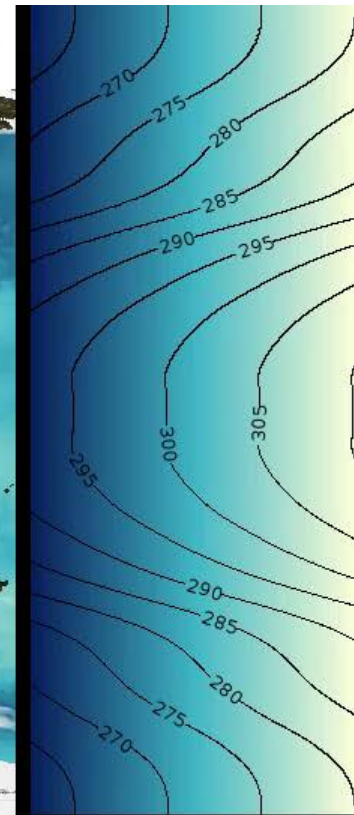
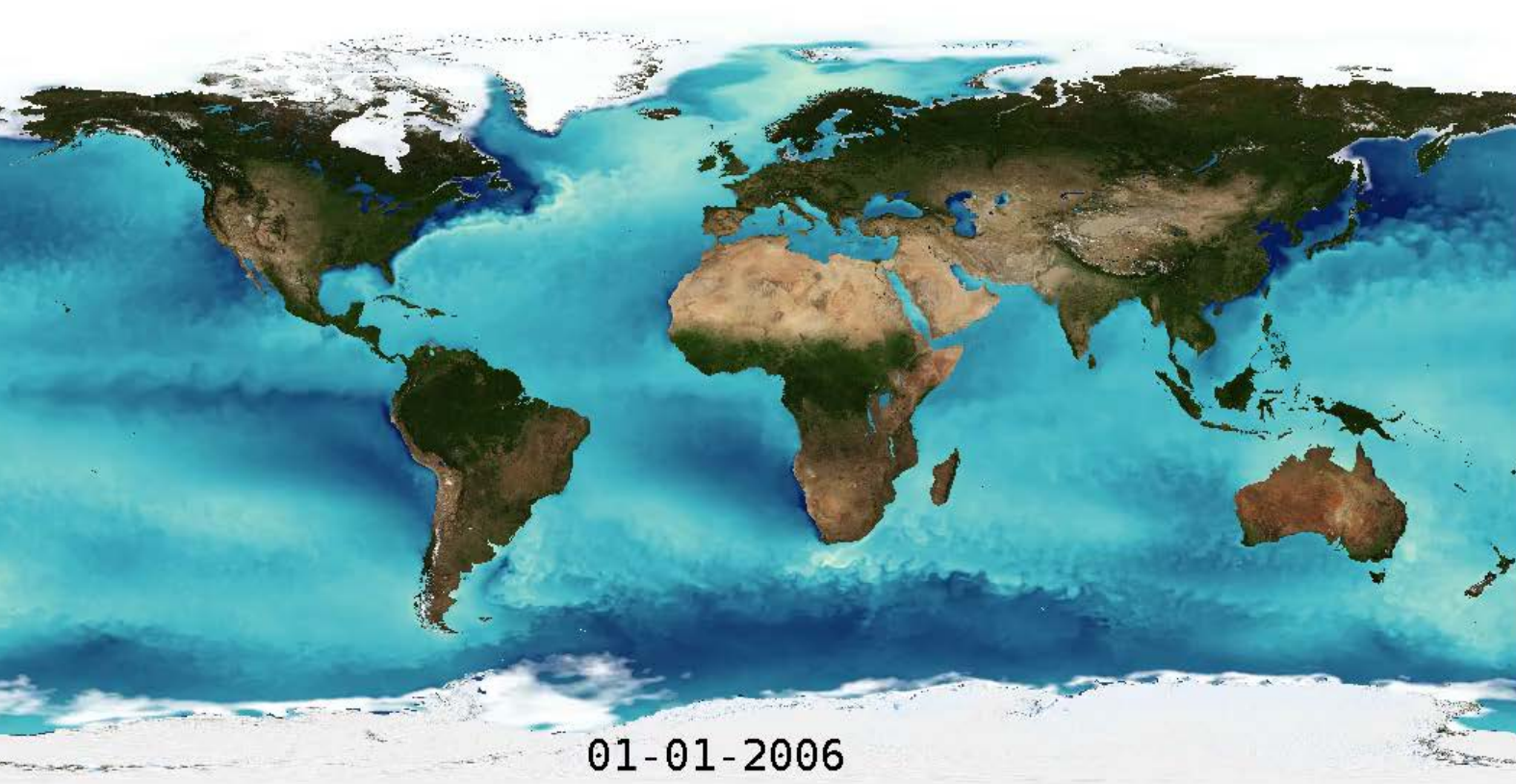
Merchant et al., 2014, doi/10.1002/gdj3.20/full

○ [www.neodc.rl.ac.uk](http://www.neodc.rl.ac.uk) → **Browse** → **esacci\_sst**





# SST CCI data: 1 month per second



Visualisation: Guy Griffiths, Reading E-Science Centre



University of  
**Reading**

SST / K

