



ESA Climate Change Initiative Phase-II

Sea Surface Temperature (SST)

www.esa-sst-cci.org

SST CCI: Phase 1 outcomes, Phase 2 plans

Chris Merchant



SST CCI Phase I Datasets

A linked, consistent set of L2P, L3U and L4 data are freely available

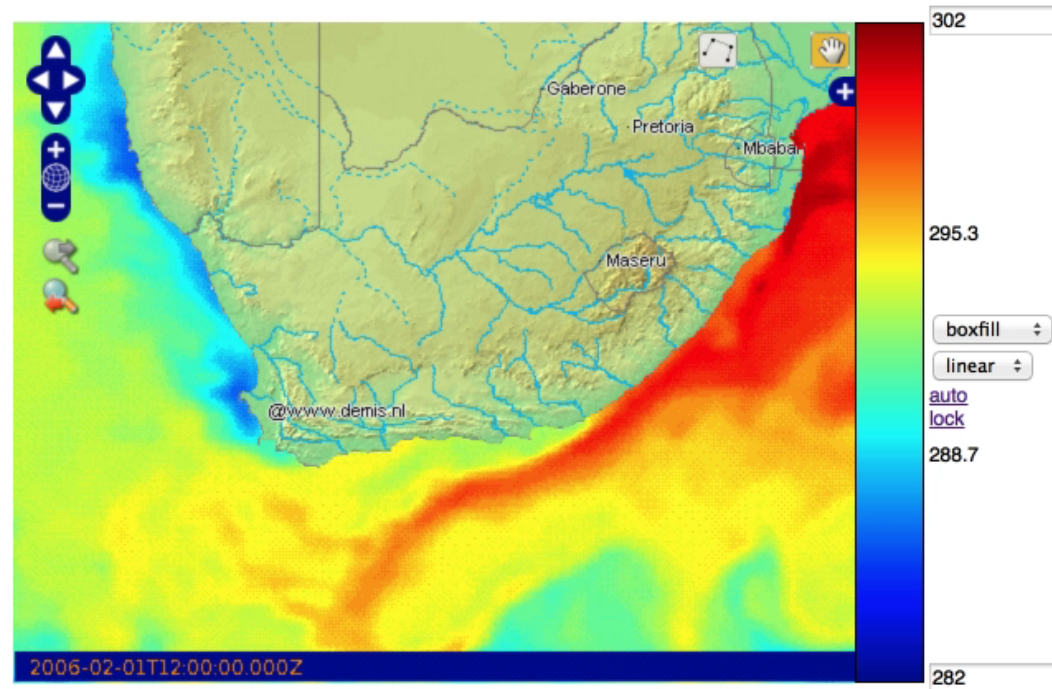
- AVHRRs: doi: 10.5285/782305d4-1ded-43f9-a0ed-40cb41ff0a43
- ATSRs: doi: 10.5285/fe7a9d81-cfc0-4023-90da-0be37b803bc7
- L4: doi: 10.5285/878bef44-d32a-40cd-a02d-49b6286f0ea4

Key points

- 1991 - 2010
- SST-skin at obs time, SST-20cm diurnal-cycle adjusted
- ATSR 0.05° L3U, by optimal estimation, tuned to ARC
- AVHRR GAC L2P, by optimal estimation, tuned to ARC
- SST CCI Analysis 0.05° , ATSR + AATSR, improved OSTIA



SST CCI Analysis v1.0

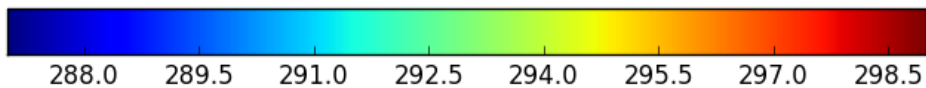
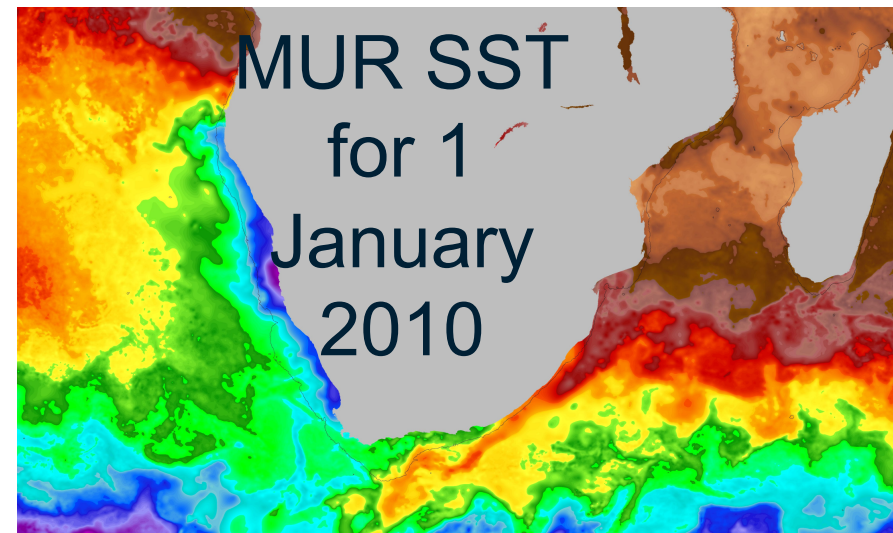
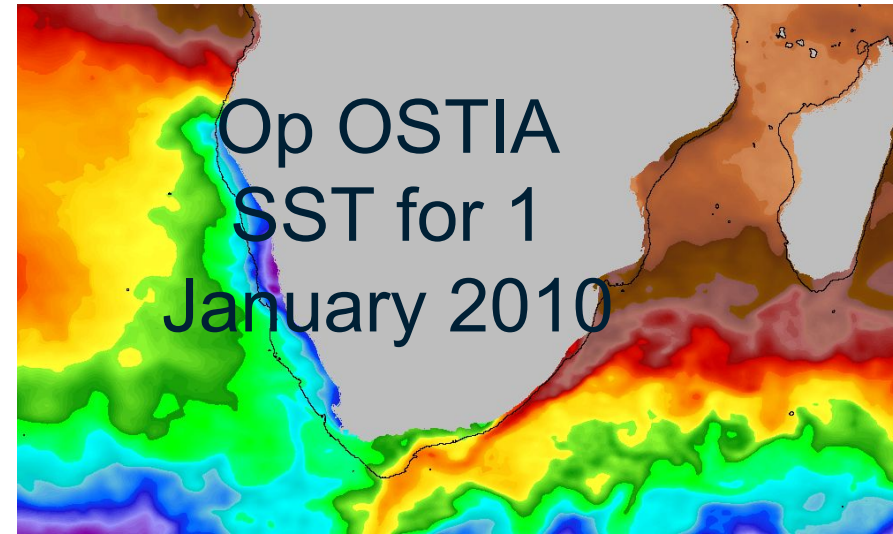
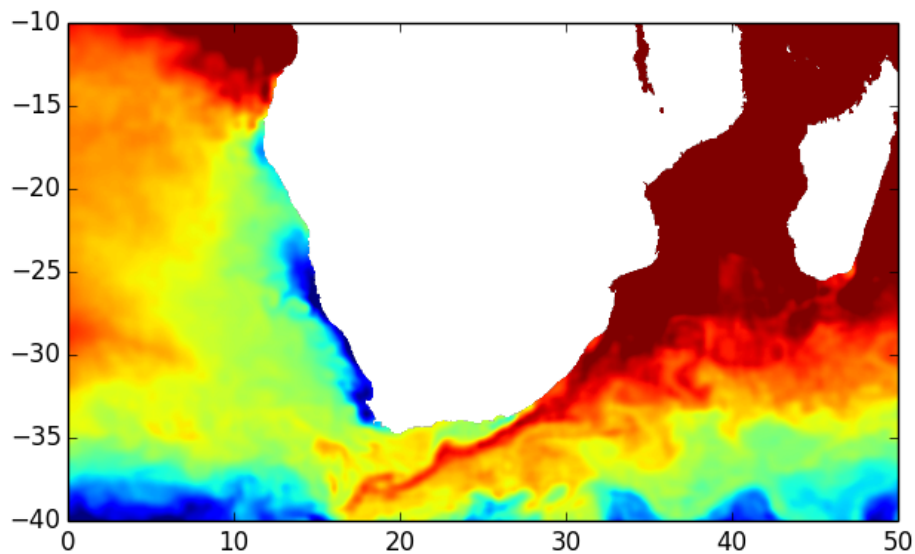


Feb – April 2006, 1 day per frame

Screenshot from SST CCI Analysis on LAS <http://cera.rdg.ac.uk/godiva2.html>

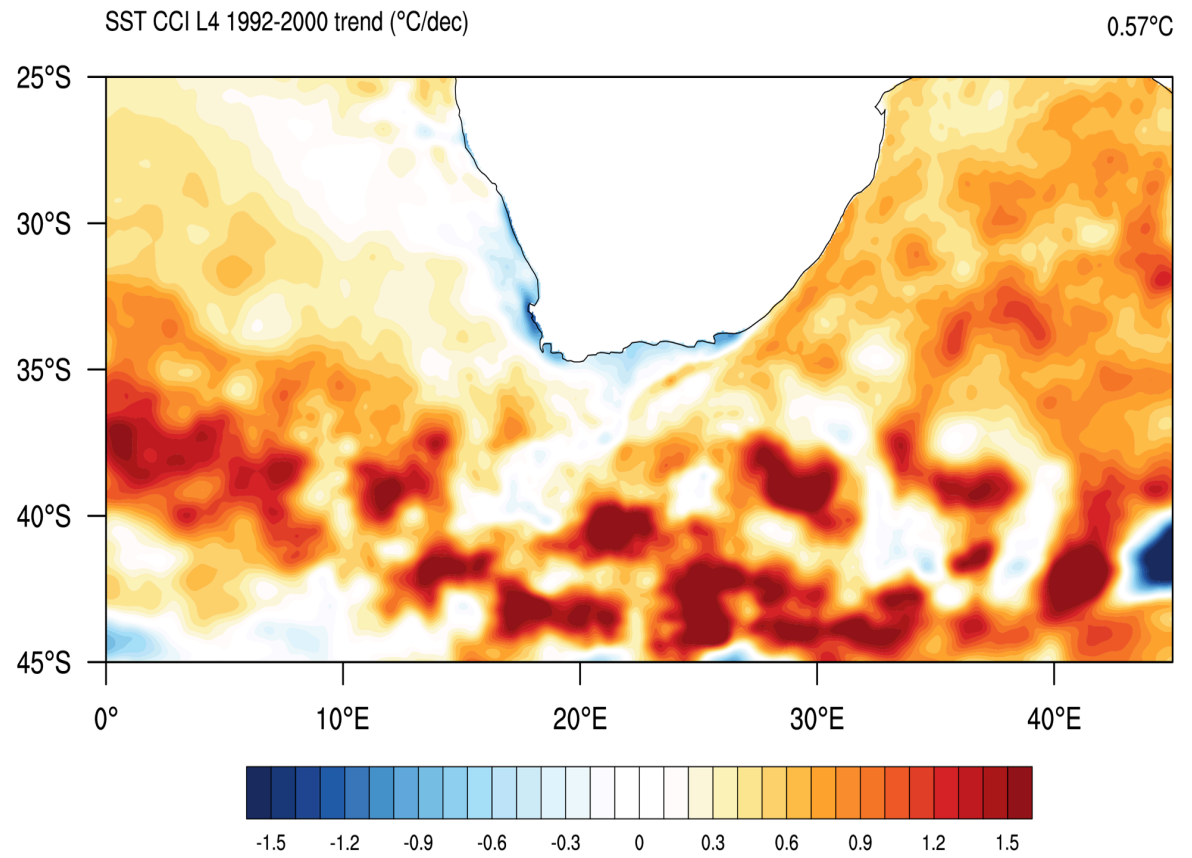
SST CCI Analysis

Feature resolution improved cf.
older operational OSTIA
and MyOcean Re-analysis



2 – 6 June 2014

Linear trend
1992-2010
in SST CCI analysis



SST CCI Analysis

Global Sea Surface Temperature

1 frame = 1 day

1 s = 1 month

ESA SST CCI Analysis



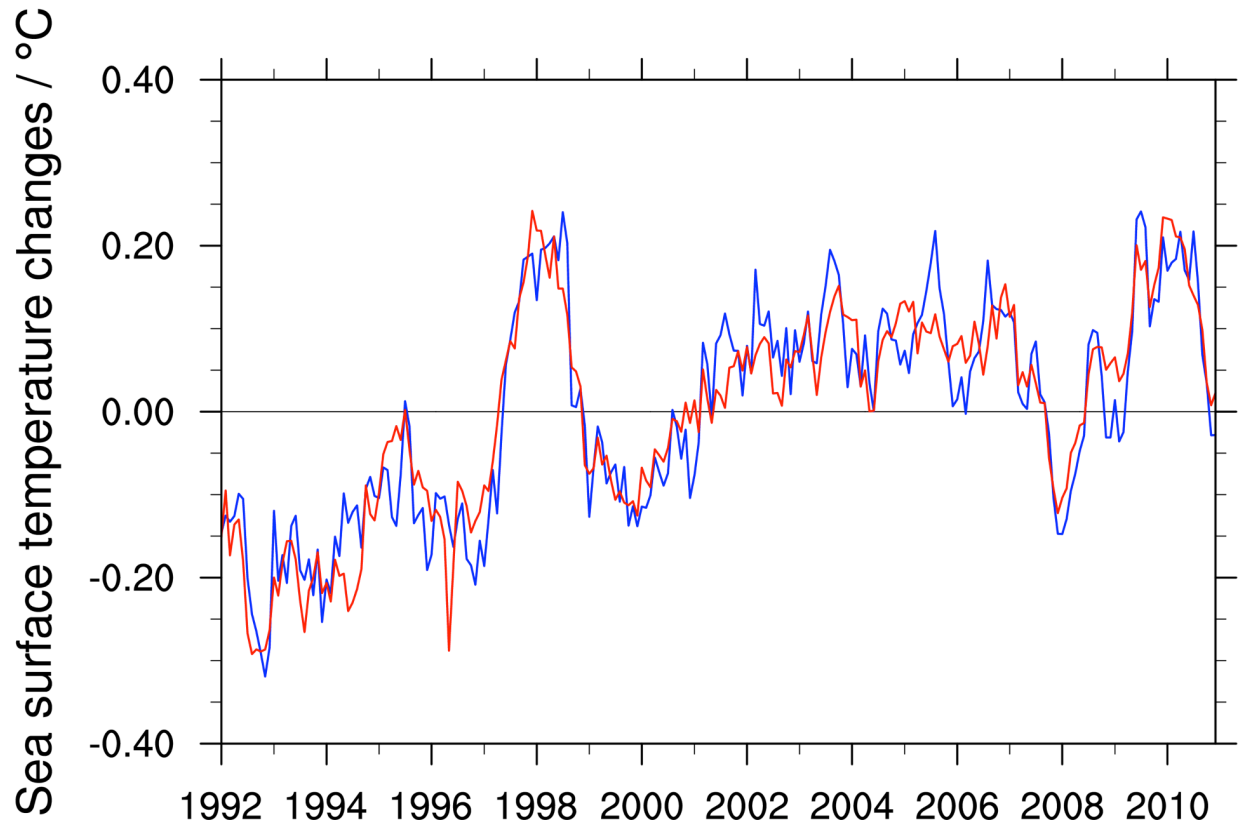
SST CCI: independent global-mean SSTA

Ultimately tied to radiative transfer done in ARC project

Therefore a near-independent test of “standard” surface temperature datasets

SST CCI time series built from $\sim 1/4$ trn SST measurements

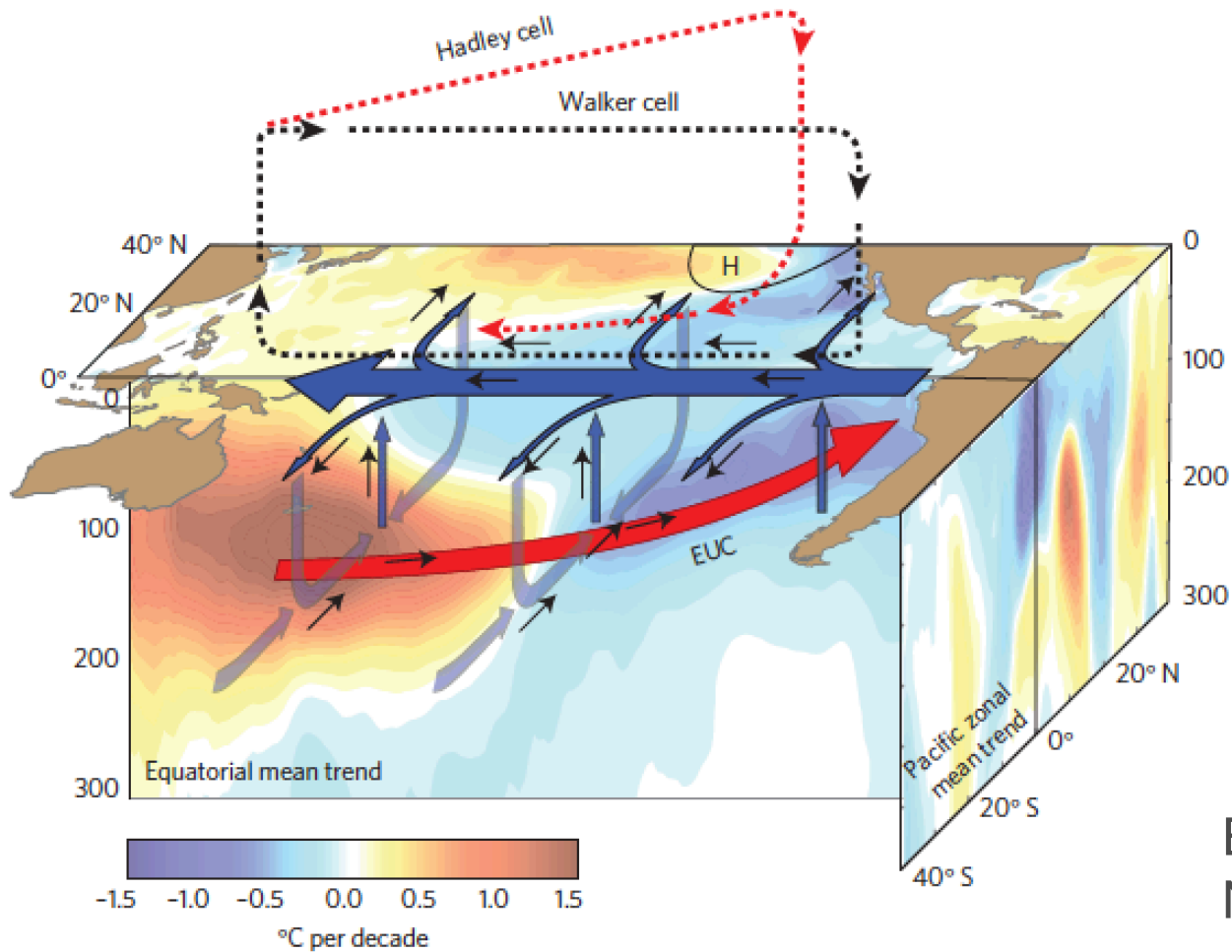
Supports \sim level global temperature since 2002



SST CCI v1.1 — Measurements from Space
HadSST3 — Measurements at Surface

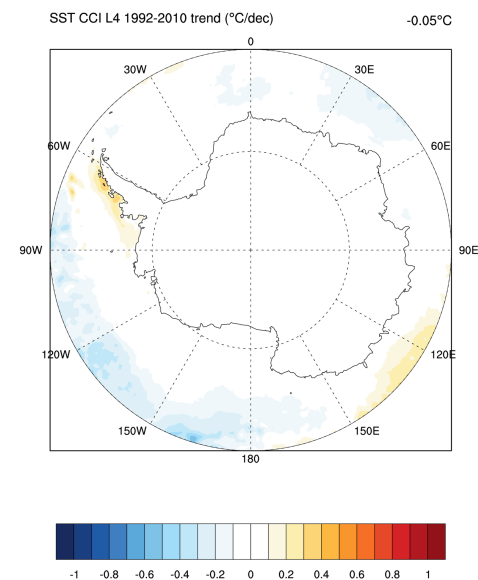
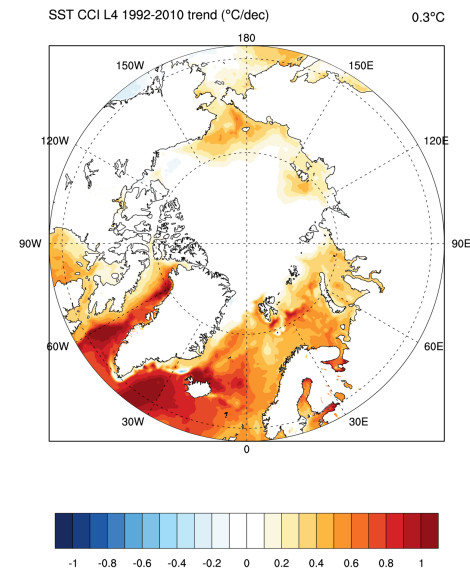
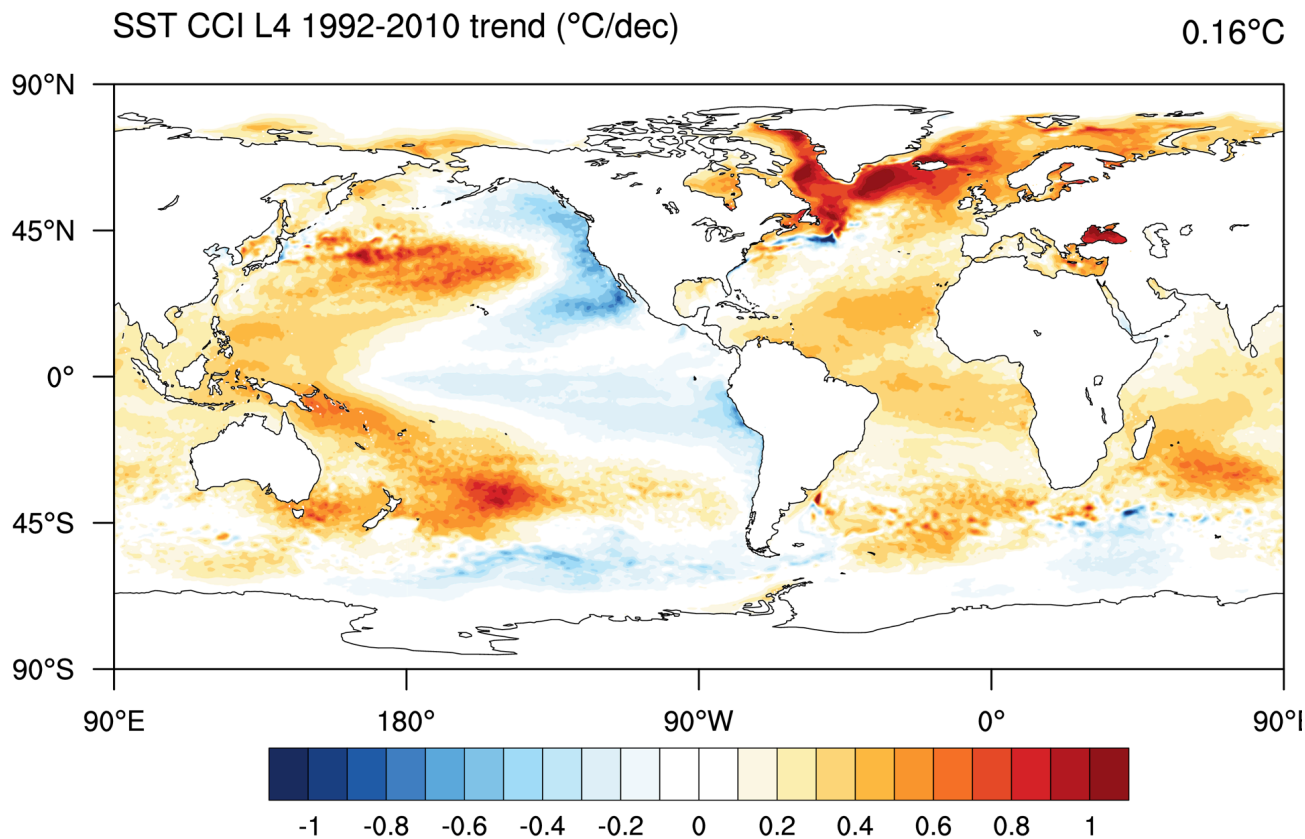


Global warming offset by Eq Pacific cooling?



England et al.,
NCC, 2014

Hiatus pattern in Pacific?



SST CCI Phase I Documents

- You can enjoy perusing 3000 pages of SST CCI Phase I documentation ...
- ... or you can select from among the following small selection those of most interest to you
 - Product User Guide and Quick Start Guide
 - Uncertainty Characterisation Report
 - Climate Assessment Report
 - Product Validation and Inter-comparison Report
 - User Requirements Document
 - Algorithm Theoretical Basis Document
 - Product Specification Document

<http://www.esa-sst-cci.org/PUG/documents>



University of
Reading



Met Office



BROCKMANN
CONSULT



DMI



Norwegian
Meteorological
Institute



METEO
FRANCE
Toujours un temps d'avance

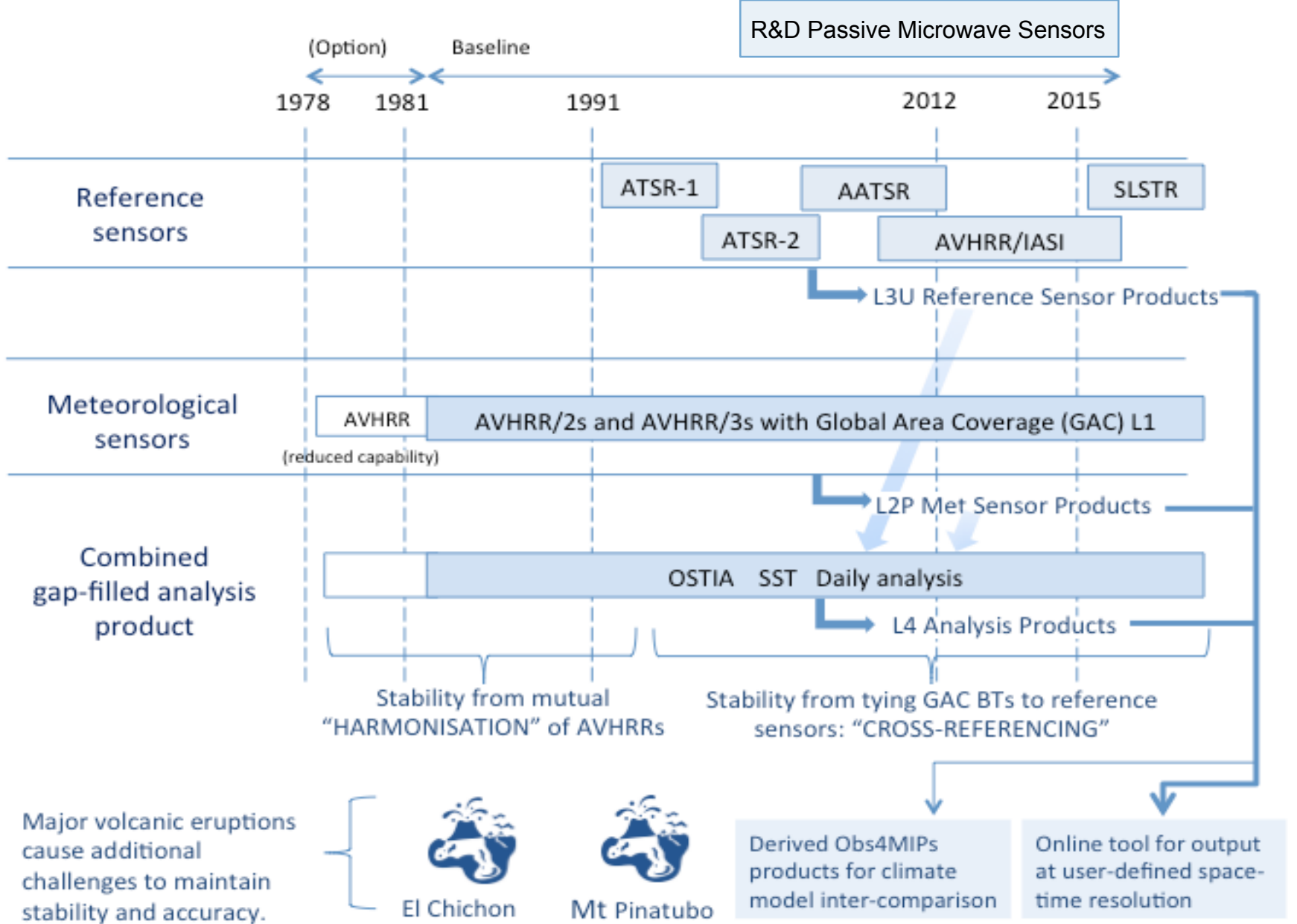


University of
Leicester



Requirement	GCOS (2011)	SST CCI URD L3/L4 breakthrough'	SST CCI Ph 1 result	SST CCI Ph2 target
Accuracy / demonstrated on scale	0.1 K / 100 km	0.02 K / 100 km	Generally ~0.2 K / regionally	0.1 K / 1000 km ATSR era, 0.2 K 1980s.
Precision	None	0.05 K / 100 km	Varies, quantify it	Varies, quantify it
Stability (retrospectively assessable against tropical moorings only, using current methods)	0.03 K / decade	0.02 K per decade; 0.05 K seasonally, diurnally	Mostly <0.05 K per decade for 1996 – 2010; seasonal stability generally ~0.2 K, locally greater	<0.05 K per decade for 1991 to present; ~0.1 K / decade overall
Spatial resolution	1 km	0.1 deg	0.05 deg	0.05 deg
Temporal resolution	Daily	Day/night (UTC)	Day/night on standardized local time (L2, L3); daily (L4)	Day/night standardized on local time; new adjustments (e.g., UTC daily mean)
Uncertainty information	None	Total uncertainty	Total and components	Total and components, corr. length scales
Type of SST	Blended	Skin & buoy-depth	Skin and buoy-depth	Skin and buoy-depth (R&D on sub-skin)
Period		~1980 - now	1991 - 2010	1981 - 2016





EO science priorities

- Make ATSR SSTs that **improve upon ARC** dataset in terms of bias and stability
- **Reduce ATSR-1 residual trend of ~ 0.1 K/yr post-Pinatubo**
- Cloud detection for GAC using Bayesian
- Smooth-atmosphere optimal estimation with aerosol robustness for single-view SST
- **Pre-ARC harmonisation of AVHRRs**
- **Stabilise AVHRR-A vs IASI** to act as bridging reference sensor
- SLSTR preparation
- **Develop and test an optimal estimator for AMSR-2**



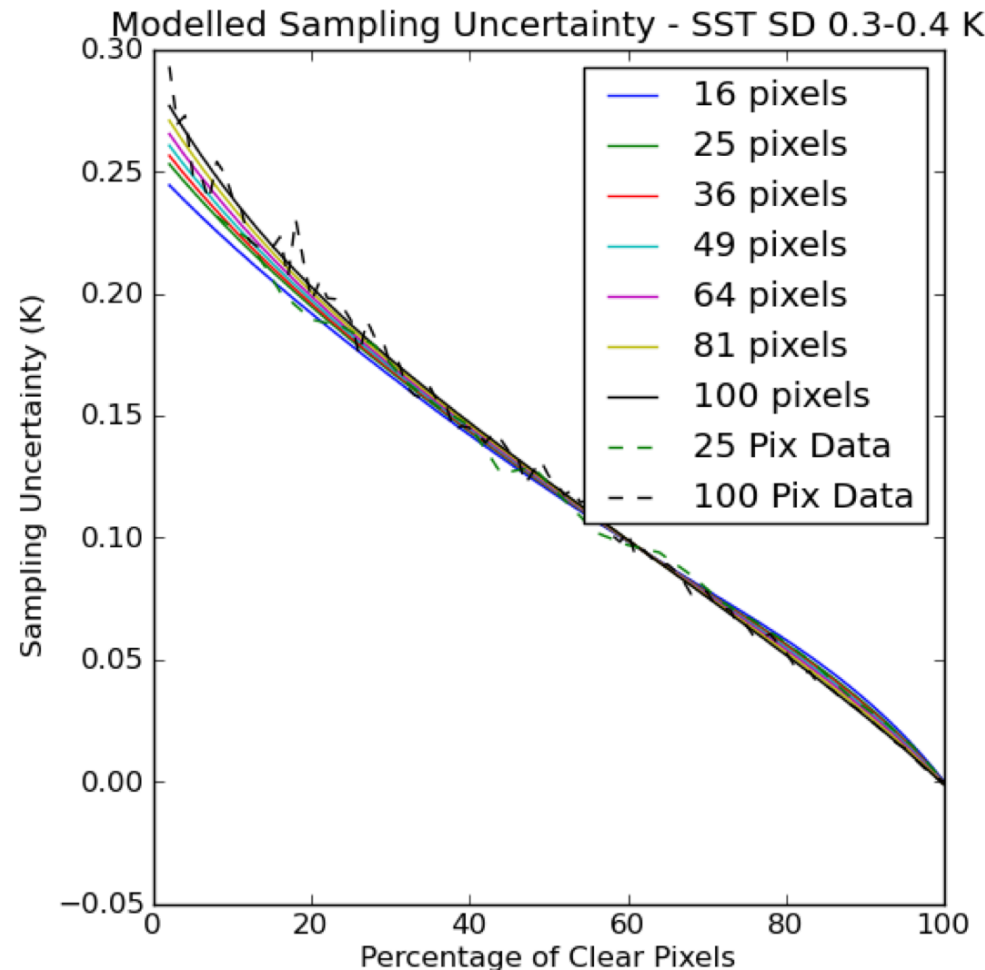
Aims for SST analysis in Phase II

- Switch to NEMOVAR analysis system and integrate with satellite processing chains
- Configuration in terms of data sub-sampling (may not be necessary on CEMS)
- Background error co-variances with adaptive correlation length scales based on SST gradients and/or data density
- Develop and test methods for use of uncertainty components from L2 and L3 data, accounting for correlation length scales (to be developed)



- Scientific development : improved sampling uncertainty model for L3
- New work on use of L2/L3 uncertainty components in L4
- User consultation meeting both to understand users' requirements, and inform users about new possibilities – November 2014**

Uncertainty aspects



SST CCI Phase II products timeline

Multi-sensor series	1st production (KO + 13)	2nd production ^A (KO + 22)	Final production (KO + 33)	Options
AVHRR GAC*	1991 - 2013	1981 - 1996	1981 - 2016	1978 - 1981
ATSR**	1991 - 2012	1991 - 1996	1991 - 2012	-
AVHRR Full Res	-	-	2007 - 2016	-
AMSR-E/2	-	-	-	2002 - 2016

* AVHRR GAC data cover 1981 to the present using the AVHRR/2 and AVHRR/3 instruments. AVHRR/1 data exist from 1978 onwards, which have potential for SST, although with reduced capability due to absence of the "split window".

** The new L1b archive (v2.1) for ATSRs will be used in Phase-II.

^A The 'pre-processed' data for 'interim processing' requires the use of the AVHRR GAC. This is the first experience on pre-ATSR AVHRRs, and will not yield publicly disseminated products.

SST CCI v2.0
L2P, L3U

SST CCI v3.0
L2P, L3U, (L3C,) L4



Principal challenges for SST CCI Phase II

- **To extend the SST CCI climate data record (CDR) before and after the period of the Along-Track Scanning Radiometers (ATSRs)**
 - To maximise quality of IR-based CDR
 - Explore potential of integrating IR-tuned MW SSTs
- **To evolve the existing prototype system into an implementation that is :**
 - sustainable in the long term
 - able to harness the best scientific SST R&D
 - able to provide necessary performance:
 - a ‘nimble’ improvement cycle for reprocessing
 - high-performance capacity to store and process relevant data flows now and in the coming era of Sentinel missions
- **Find a means actually to sustain the SST CCI system after Phase II, providing a short-delay climate service**

