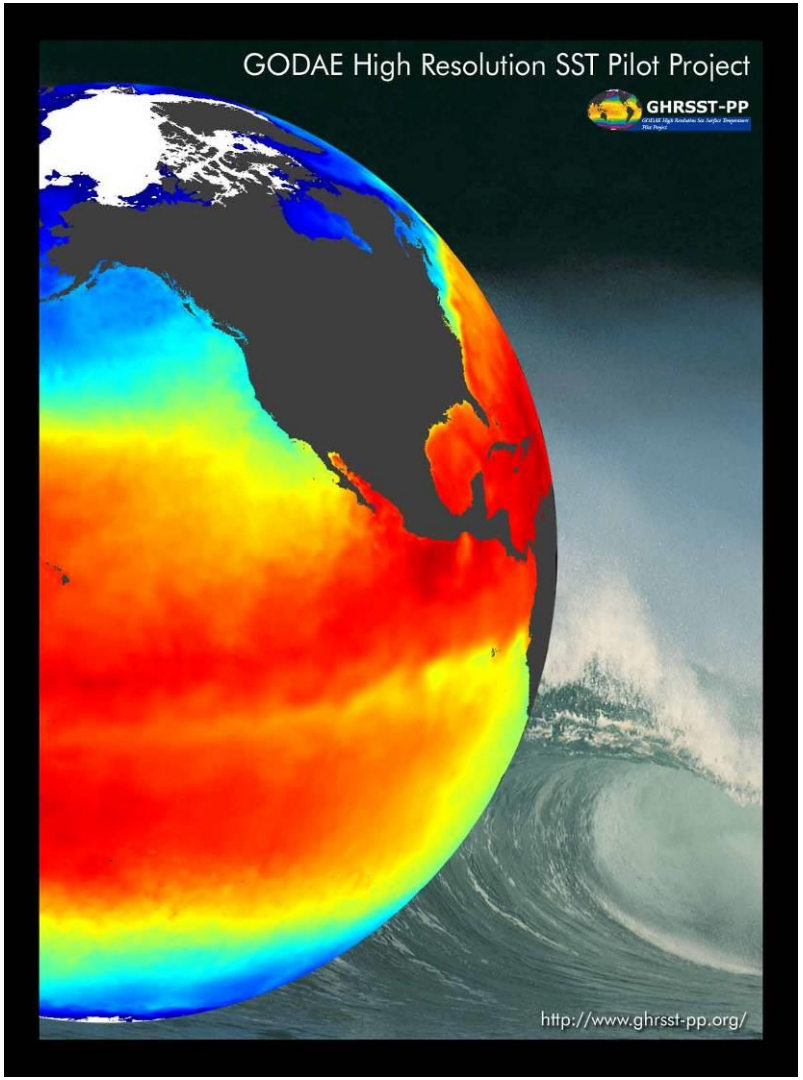
ESA support to the GHRSST Project Office or Delivering the GODAE Request

Dr. Craig Donlon
and
The International GHRSST Science-Team

Presented at XVIII GHRSST Science Team Meeting, Qingdao, China 5-11th June 2017

Outline

- Why?
- Requirements
- Implementation
- Why did it work?

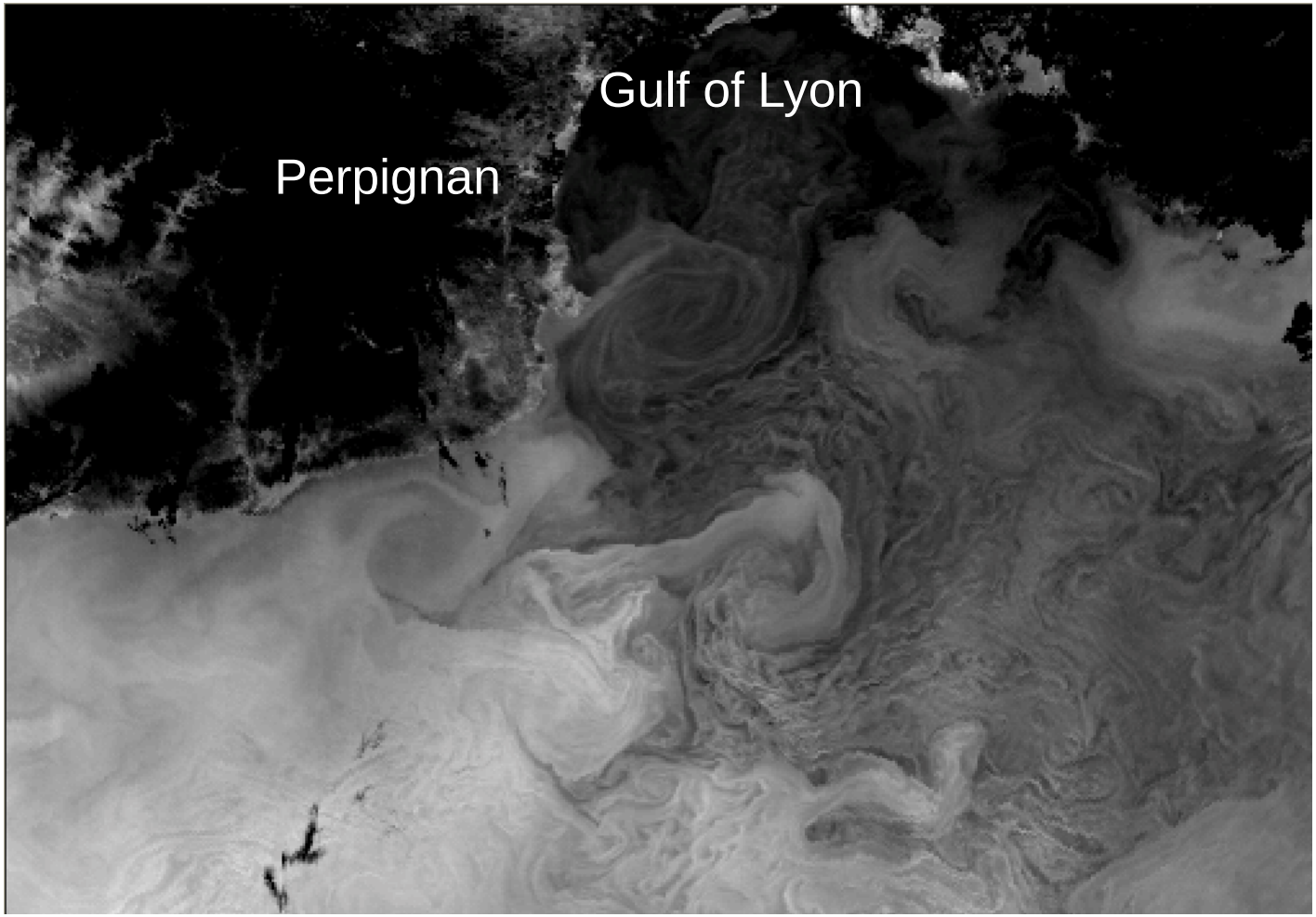


Why?

- In 2000 the Global Ocean Data Assimilation Experiment (GODAE) set out to take ocean forecasting to the next level
- 10 year project of international collaboration
- They needed better SST data to constrain ocean models
- A ‘prospectus’ for a GODAE HiRes SST Pilot Project was developed and proposed by Neville Smith (Chair of GODAE):

  - *Develop a global, high-resolution sea surface temperature analysis with proper consideration of the skin effect and sufficient temporal resolution to resolve the diurnal cycle, that is available in real-time for all environmental and climate applications.*

SST – A ‘done deal’ or not?



(ENVISAT AATSR)

Can **you** assimilate this information?

SST requirements for GHRSST-PP

- GODAE defined the minimum data specification required for use in operational ocean models:
  - global coverage
  - a spatial resolution of 10 km
  - an accuracy of 0.5ºC or better
  - updated every six hours
  - be available in near real time.
- GHRSST-PP data products should properly address the difficult issues of:
  - SST at the sea ice edge
  - diurnal variability
  - include uncertainty estimates to facilitate their use by data assimilation systems.

Long term SST user requirements…

- Sustained & meaningful products
  - Excellent Science
- Sustained and adaptive-user driven services
  - Excellent technology for users
- Support to international agencies
- Maintaining and nurturing the link between Science and Operations for SST
- Provide confidence in products and delivery (new instruments)
- Provide ease of access, easy documents
- **Maintain Solid standards, nomenclature, symbology for satellite SST**
- Provide a forum and community to develop (Science Team, UCM)
- Nurture a responsible, mature & dependable community: GHRSST-PP & supporting agencies now have a big responsibility

Implementation

In 2000, I volunteered to convene a meeting…

Space Applications Institute

GODAE Global Ocean Data Assimilation Experiment

JOINT RESEARCH CENTRE EUROPEAN COMMISSION

Marine Environment Unit

Dates: Monday, December 4th -> Wednesday December 6th, 2000

Preliminary list of attendance: (Yes indicates an intent to attend)

Neville Smith	BOM	Australia		Yes
Bob Evans	U.Miami/RMAS	USA		Yes
Ian Robinson	SOC/SOES	UK		Yes
Pierre-Yves Le Traon	??	France		Yes
Jorge Vazquez	JPL/NASA	USA		Yes
Doug May	US.Navy/NAVO	USA		Yes
Craig Donlon	CEC/JRC	Italy		Yes
[illegible]	[illegible]	[illegible]		?
Chelle Gentemann	RSS	USA		?
Trevor Guymer	SOC/JRD	UK		?
Ian Nabney	U.Birmingham	UK		?
Phil Watts	RAL	UK		?
Simon Keogh	UKMO	UK		?
Peter Schluessel	U.Munich		DE	?

Not attending

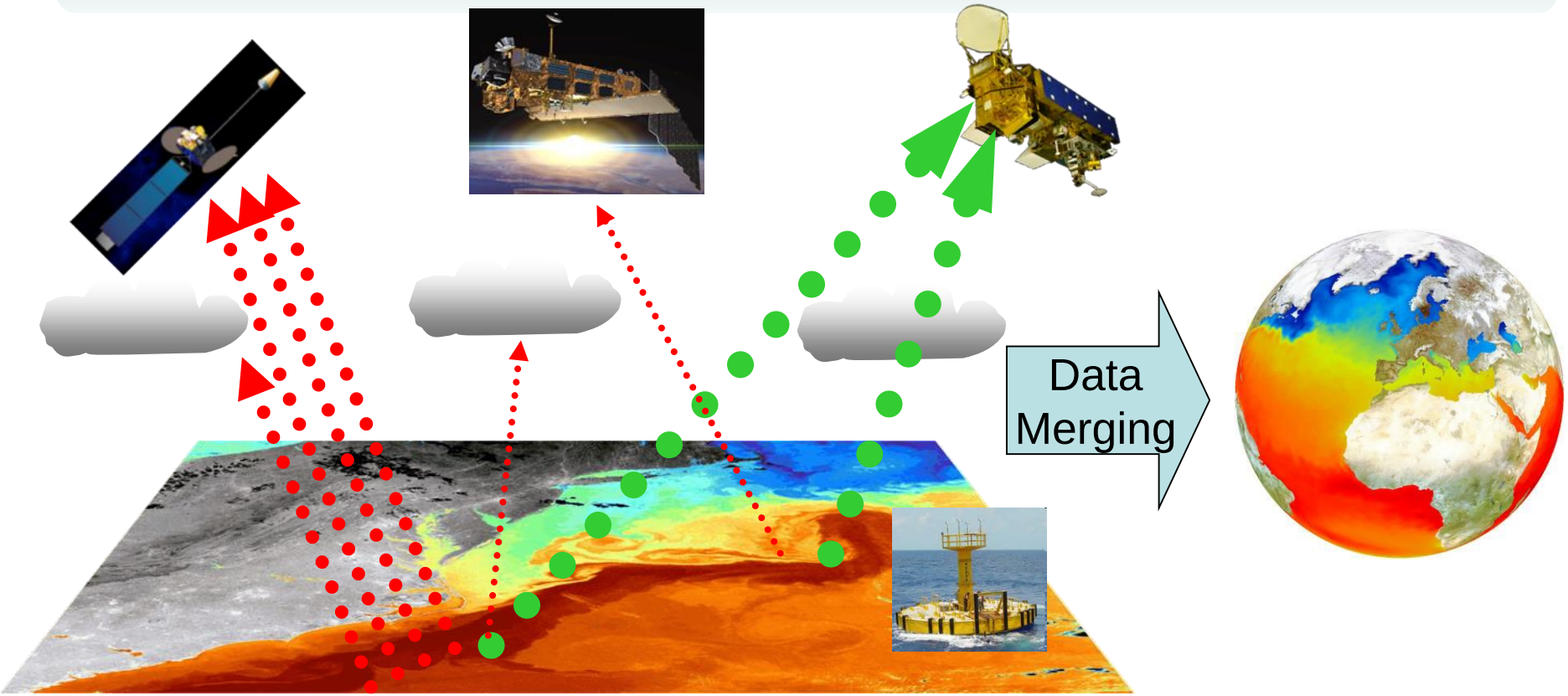
David Llewellyn-Jones	U.Leicecter/EOS	UK	No	Dates clsh
Hiroshi Kawamura	NASDA	Japan	No	Dates clash
Chris Merchant	U.Edinburgh	UK	No	Work overload at end of term
Bill Emery	U.Colorado	USA	No	PORSEC
Richard Reynolds	NOAA	USA	No	No intention
Peter Taylor	SOC/JRD	UK	No	No intention
John Turner	BAS	UK	No	No intention
Jo Murray	RAL	UK	No	Expecting baby !!!

2000: GODAE HiRes SST planning meeting

4 things requested at the GODAE HiRes SST Planning Meeting:

1. SST data assembly/delivery
2. Testing of SST data sources
3. Inter-comparison of SST
4. Data assimilation of SST

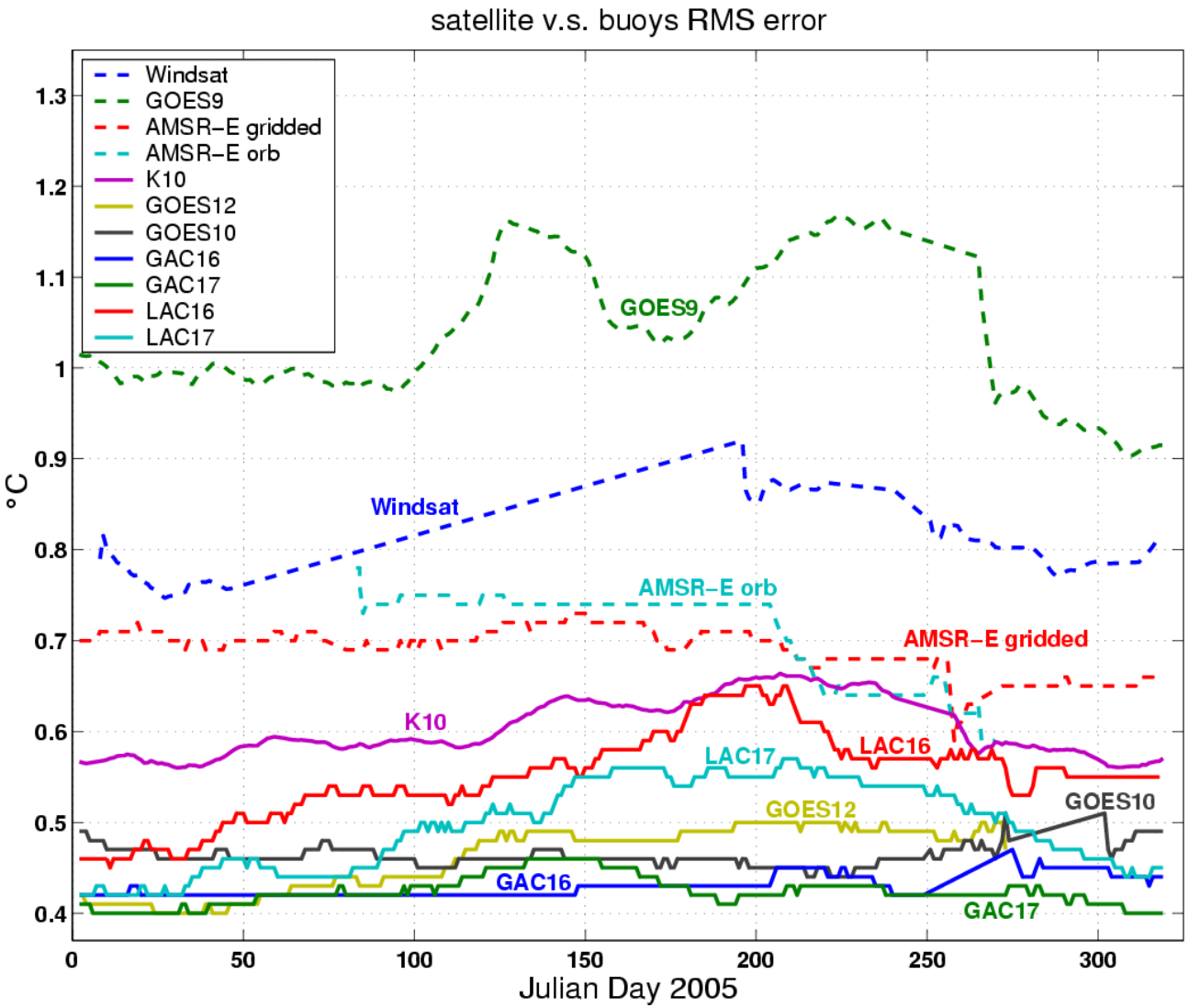
GHRSST-PP Builds on EO complementarities



- Polar Orbiting infrared has ***high accuracy & spatial resolution***
- Geostationary infrared has ***high temporal resolution***
- Microwave Polar orbiting has ***all-weather capability***
- In situ data provide ***reality in all weather conditions***

(A. Harris)

The need for Error statistics…



Doug May, NAVOCEANO)

Action!!!

- I arranged a inaugural meeting in Tokyo Hosted by JAXA…
- No plan…
- No money…
- Big city…
- There were Big expectations…
- Worst flight ever!

GHRSST-PP

GHRSST-PP Implementation

"Removing the barriers to the Implementation of the GHRSST-PP"

THIS IS A WORKING DOCUMENT

V0.2

GHRSST-PP Science Team, May 7th 2002, EORC, Tokyo, Japan

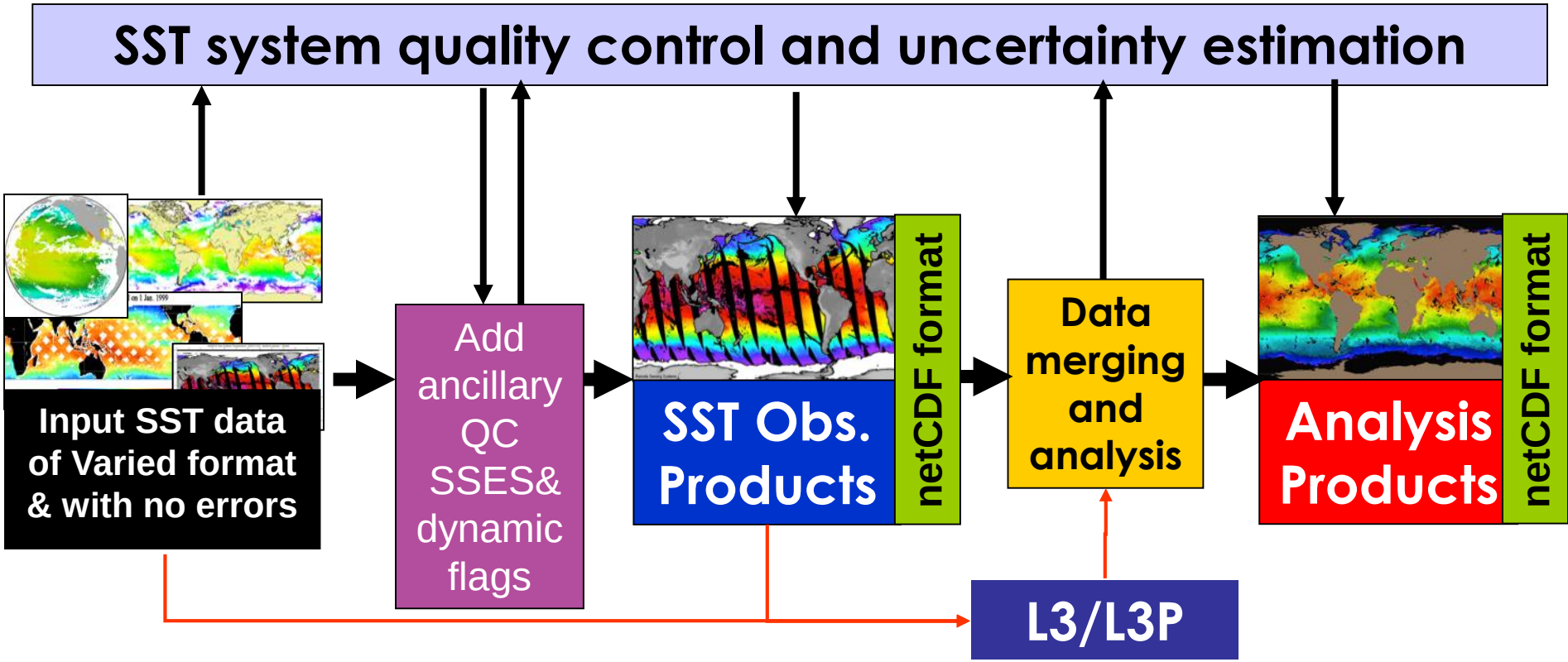
GHRSST-PP #1: Tokyo 2002

…A younger Science Team…

GoDAE

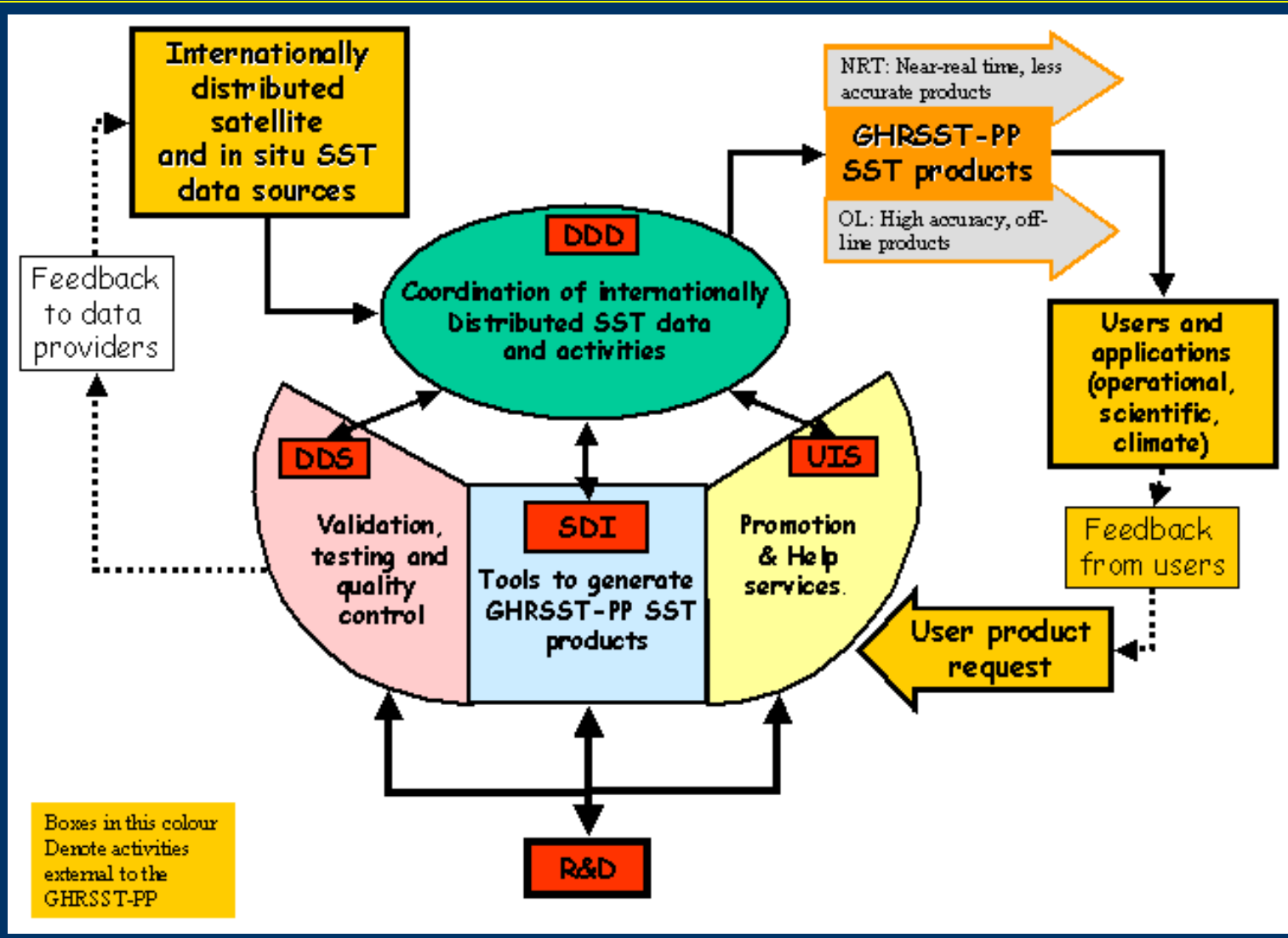
Global Ocean Data Assimilation Experiment

The GHRSST-PP Strategy



SST Observations → Applications

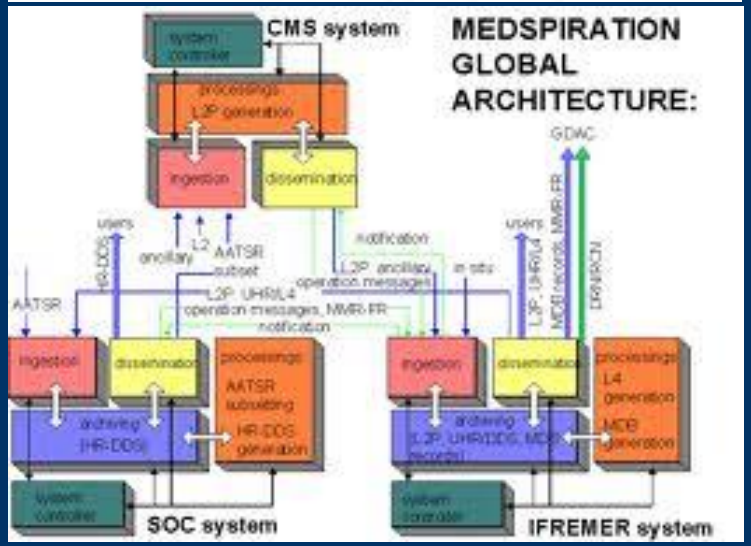
GHRSST-PP in a nutshell…



1 Meuro – a great help!

medspiration

EUROPEAN NODE FOR SEA SURFACE TEMPERATURE

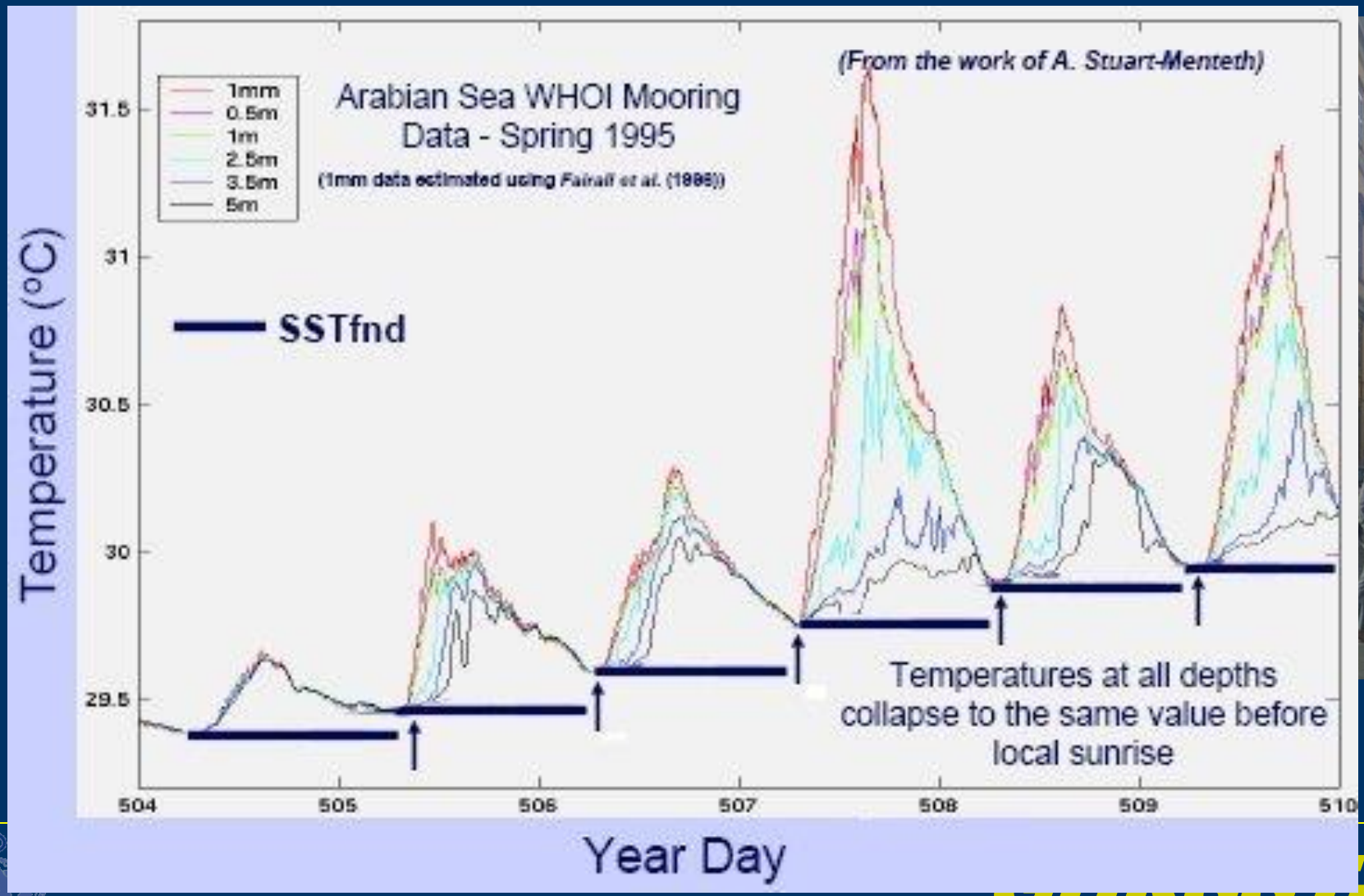


esa

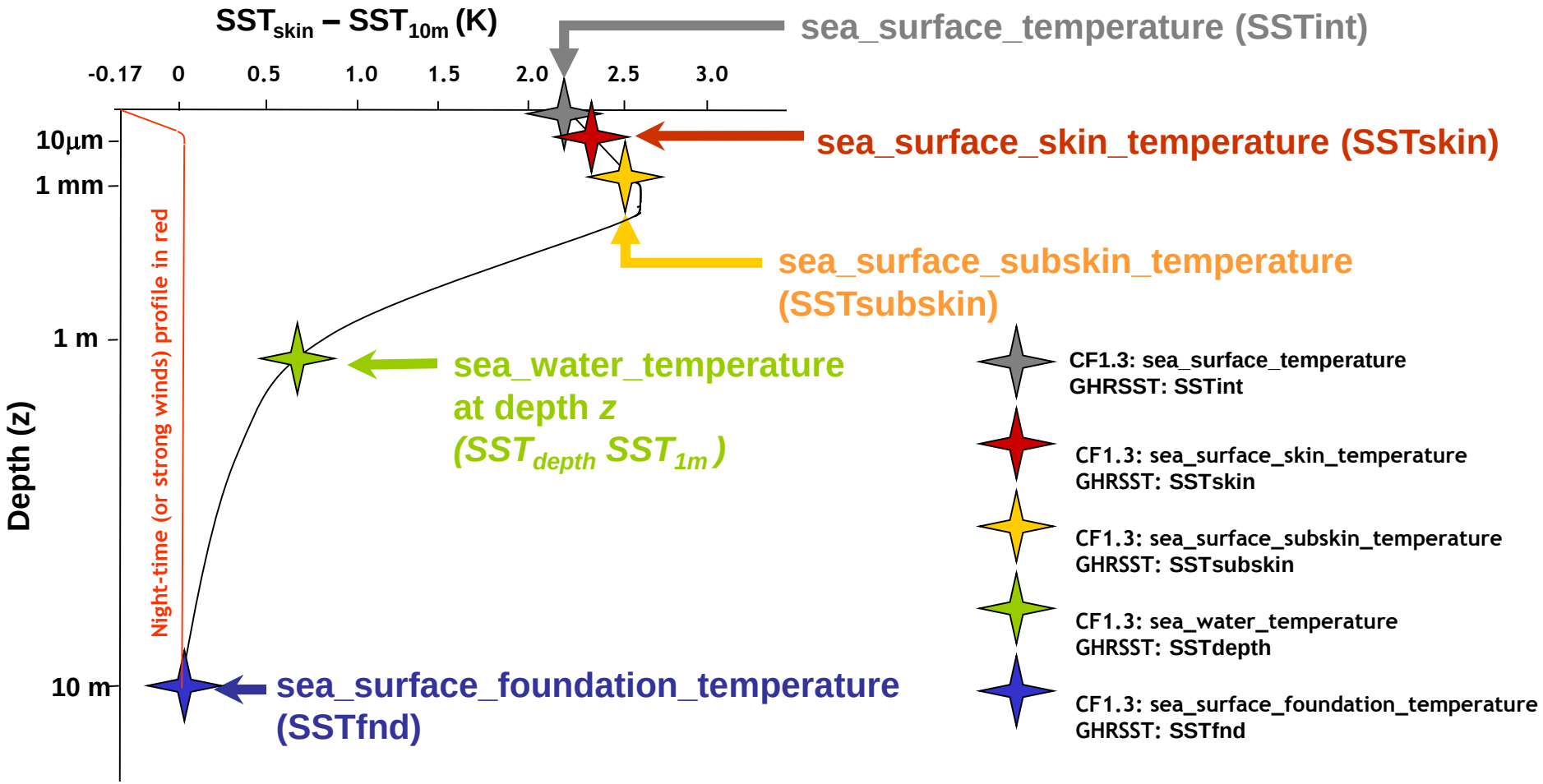
GHRSST-PP

GODAE High Resolution Sea Surface Temperature Pilot Project

Foundations…SSTfnd



CF1.3 standard names for SST



1. Night-time (or strong winds) profile in red
2. Day time situation, strong solar radiation and light winds shown in black

Making GHRSST Work

GCOS oversight of climate tasks

Euro
Prod
SST
SST
SST

C

& L4
Arch

HR

Error Stats.

M D B

in situ data

forecasting models

Global ocean forecasting models

User feedback

Quality oversight

Participation in GHRSST

MCS Products

End users & downstream services

JCOMM oversight of operational tasks

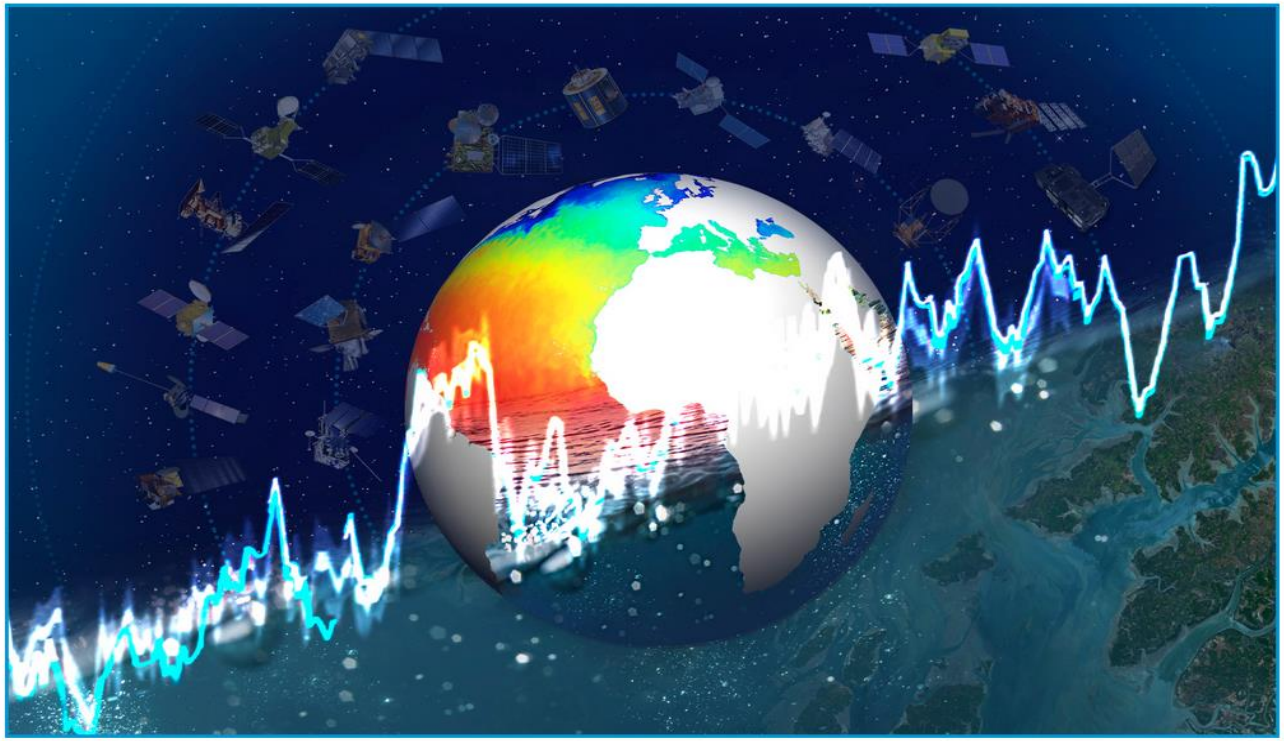
esa

ghrsst xvi
international science team meeting

European Space Agency

List of events

- Home
- Background
- Objectives
- Abstract Submission
- Calendar of Events
- Registration
- Venue
- Local Information
- Useful Links
- Contact



16th International Science Team Meeting (GHRSST XVI)

20th-24th July 2015

European Space Agency ESTEC, The Netherlands.

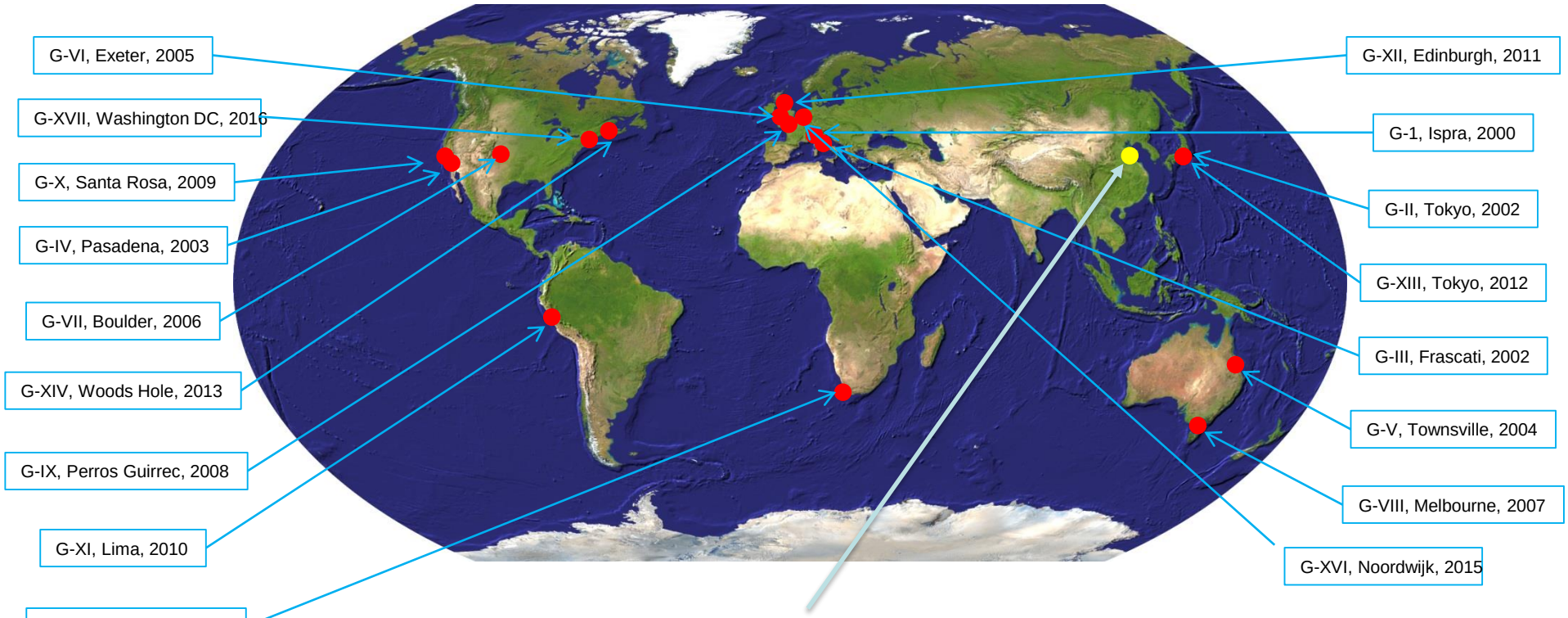
Where we were in 2002…

- Generally we had ideas, plans and a whole lot of enthusiasm – and not much money
- Two international workshops had been held (Italy, Japan) and there was promise for some funding in the EU
- A consensus on the product line had been reached
  - this continues to evolve in a useful manner (e.g., L2P core)
- The supporting infrastructure requirements for a global operational system was agreed
  - the so called 'Regional/Global Task Sharing (R/GTS)' framework
- Verification and diagnostics system requirements were well articulated, as was the importance of user feedback
- Uncertainty specification and methodology was basic but intended for operational implementation
  - a key area for GHRSST then and now
- R&D was focussed and had well defined outputs

Science Team today

- Large and multi-faceted –THEY need GHRSST!
- Each brings a different expertise to the project
- Remains dynamic and committed to the project
- Responsibilities taken seriously and effort invested to meet and develop actions
- PEOPLE are the key to success…

International Science Team Meetings



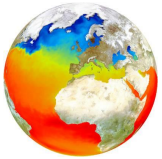
G-XVIII, Qingdao, 5-9 June 2017

Science Team Meetings are open to all

G-II: Tokyo 2002

Tokyo, 2002

G-V: Townsville 2004



Townsville, 2004

G-VII Boulder 2006

GHRSST annual science meeting

Boulder, 2006

G-VIII Melbourne 2007

Melbourne, 2007

G-IX Perros-Guirec 2008

Perros-Guirec, 2008

G-X Santa Rosa 2009

Santa Rosa, 2009

G-XI Lima 2010

G-XII Edinburgh 2011

Edinburgh, 2011

G-XIII Tokyo 2012

G-XIV Woods Hole 2013

G-XV CapeTown 2014

G-XVI Noordwijk 2015

G-XVI Noordwijk 2015

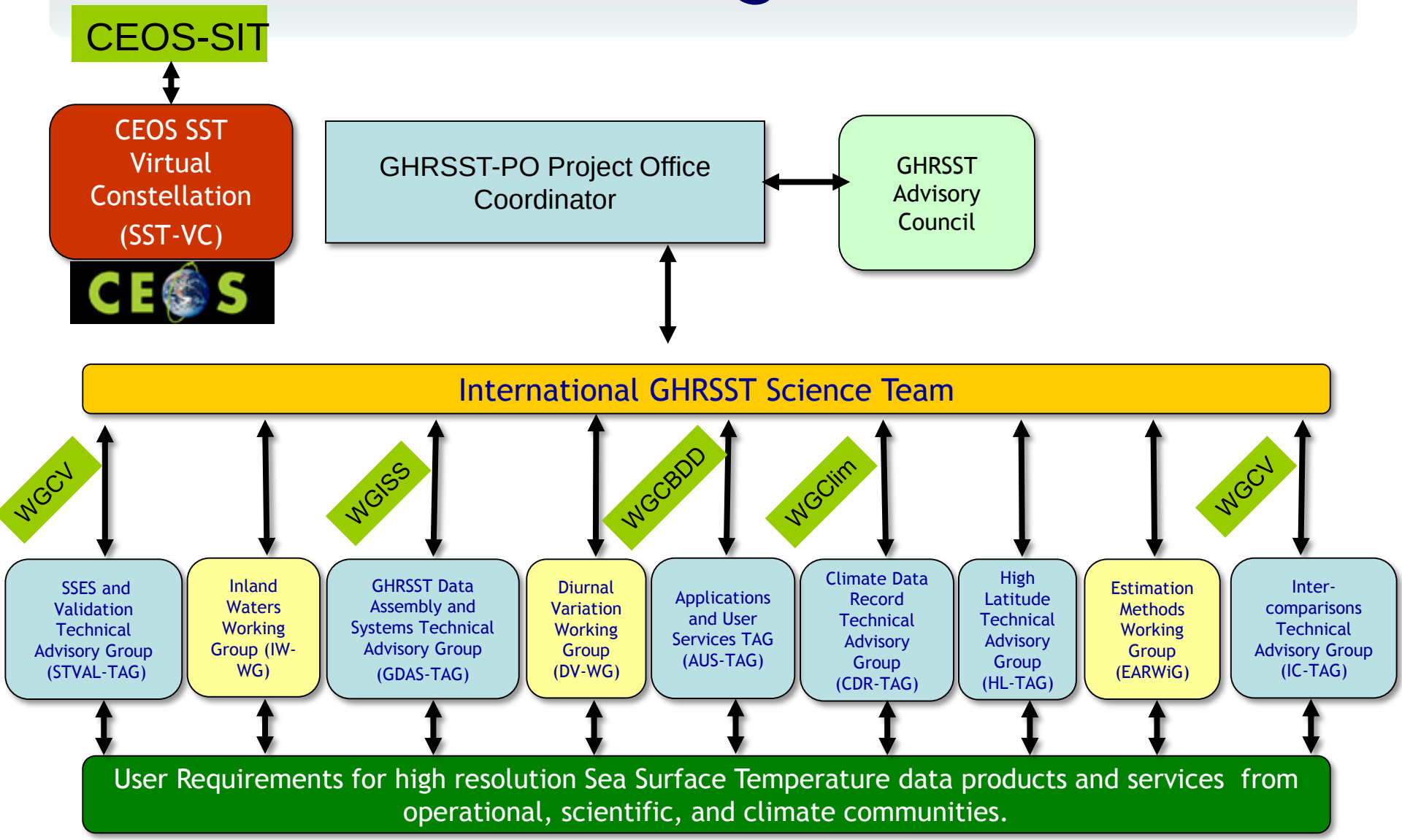
G-XVII Washington 2016

G-XVIII Qingdao, China, 2017

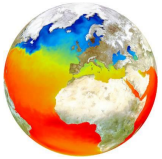
Summary of the Joint Workshop on Tropical Warm Pool and High Latitude SST Issues, Melbourne, 5-9 March 2012

Helen Beggs, Andrea Kaisser-Weiss, Jacob Hoyer, Andy Harris, Gary Corlett, Gary Wick, Sandra Castro and Paul Sandery

GHRSST ST Organisation



GHRSST CESO SST-VC Interaction



CEOS-SIT

CEOS SST Virtual Constellation (SST-VC)

GHRSST Project Office

GHRSST Advisory Council

International GHRSST Science Team

WGISS

WGEdu

User, Data and Services Technical Advisory Group

(UDS-TAG)

WGCV

Estimation and Validation Technical Advisory Group

(EV-TAG)

Analysis and Intercomparison Technical Advisory Group

(AI-TAG)

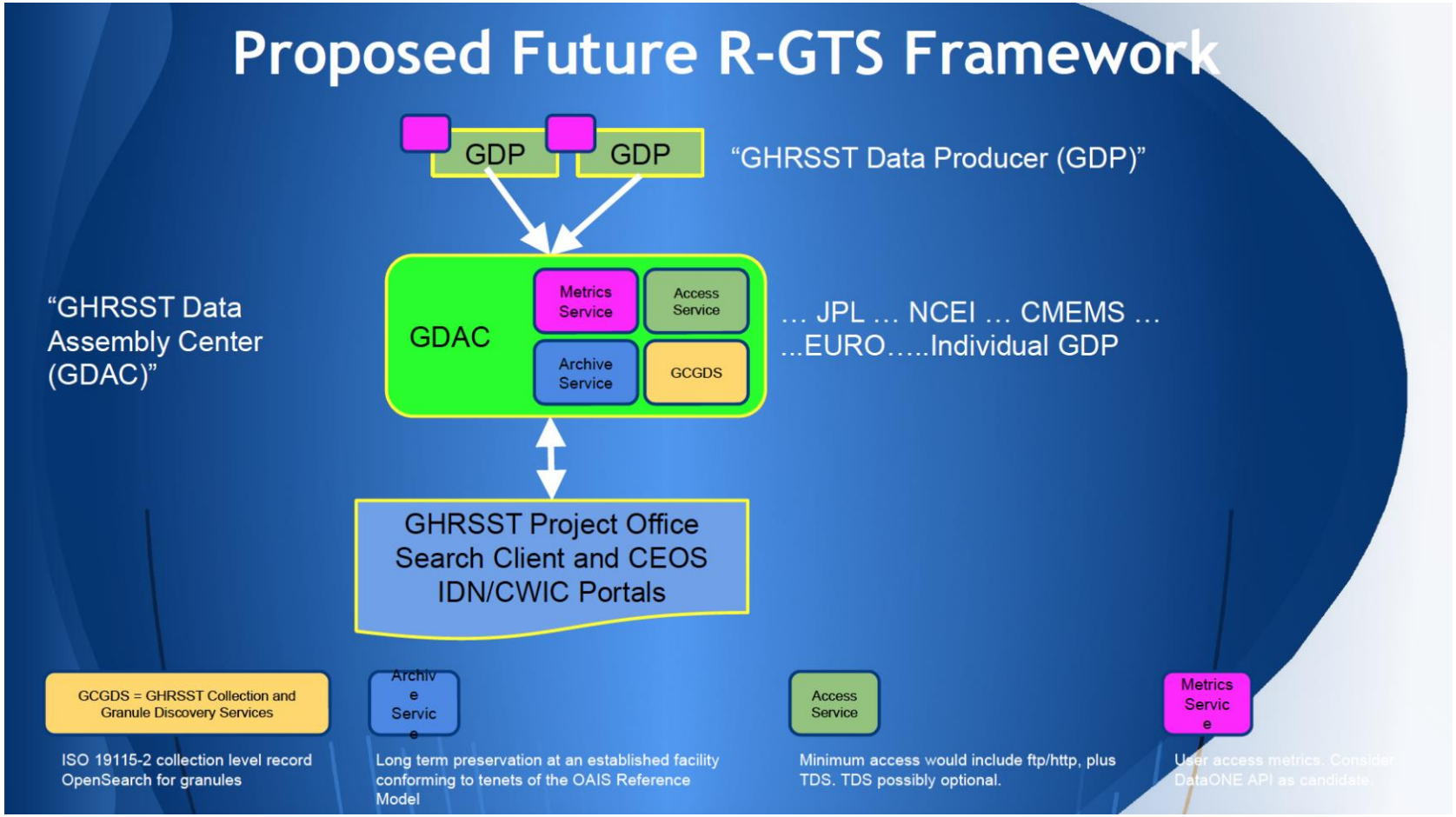
WGClim

Climate Data Records Technical Advisory Group

(CDR-TAG)

User requirements for high resolution sea surface temperature data products and services from operational, scientific and climate communities

R/GTS Evolution



GHRSST Data Processing Specification (GDS) - a Detailed Processing Model

- F
- C
- E
- E
- A
  t
- E

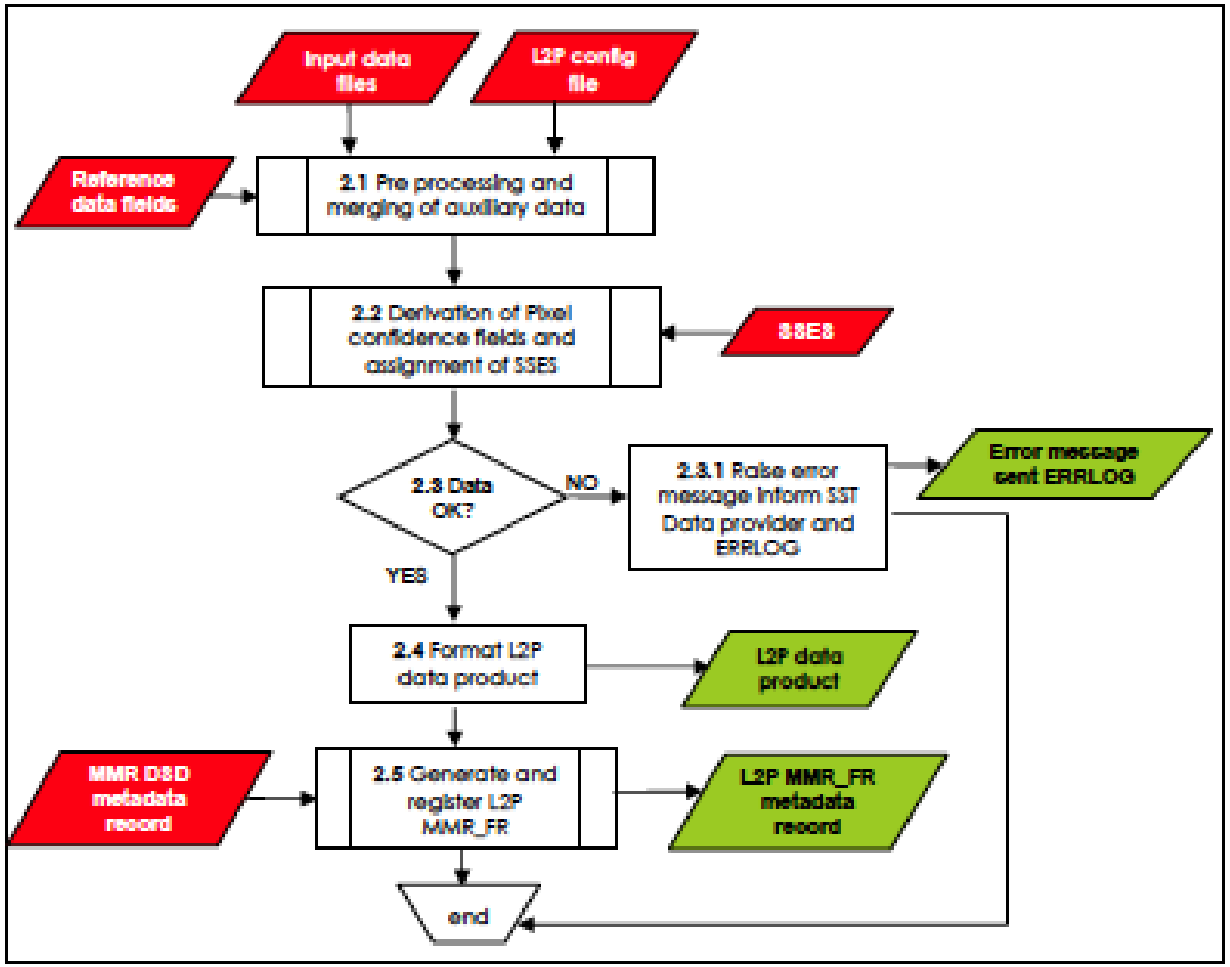
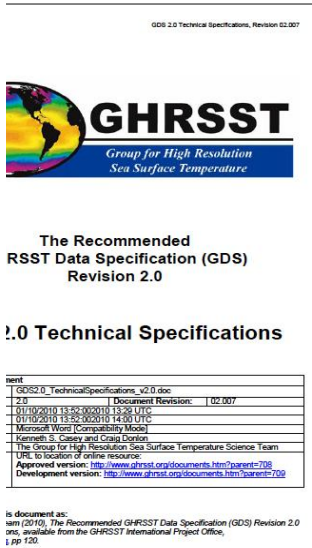


Figure 5.1 Functional breakdown of WP-ID2 identifying each major sub task.


GDS 2.0 Technical Specifications, Revision 02.007

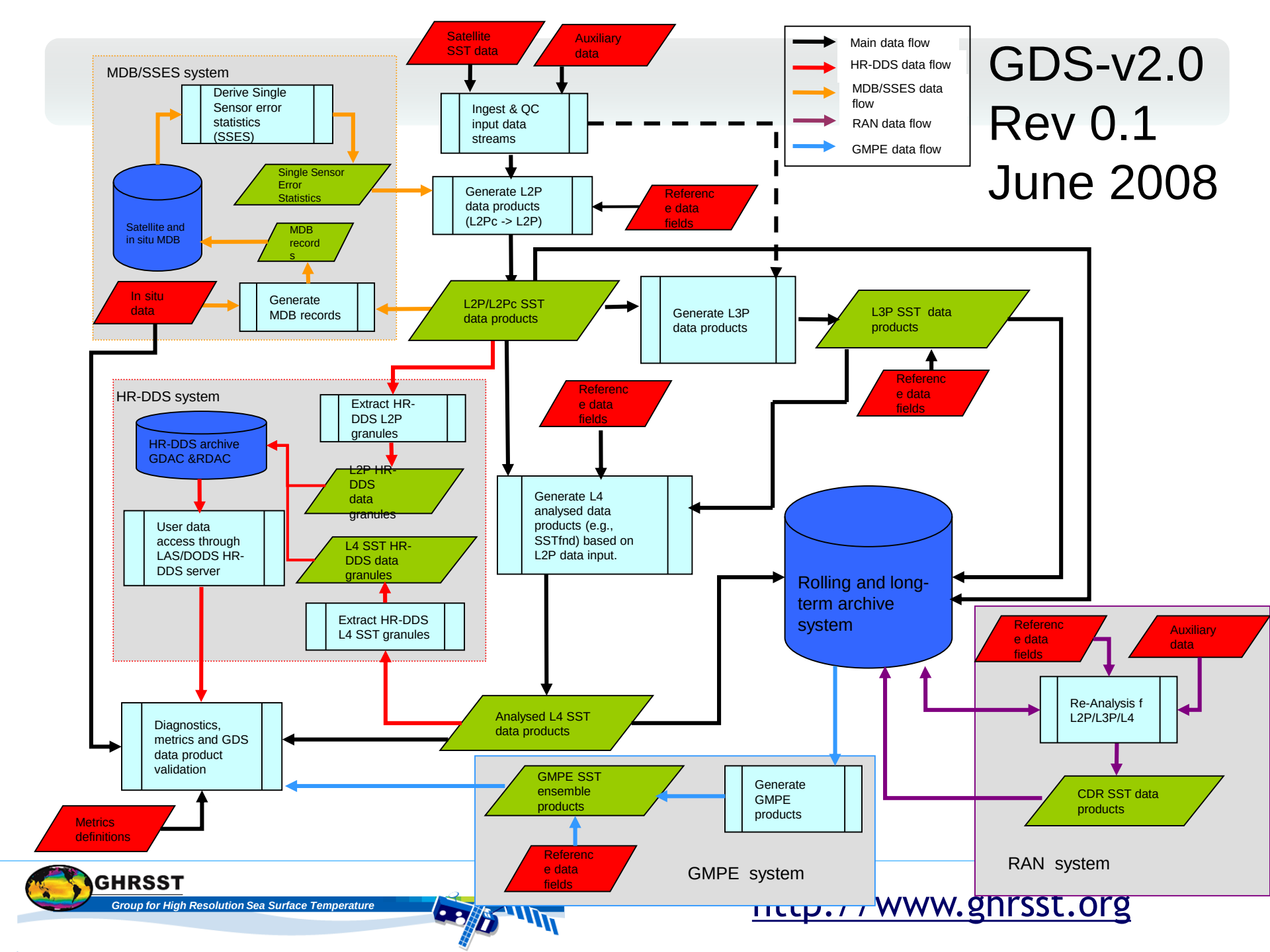
GHRSST
Group for High Resolution Sea Surface Temperature

The Recommended
RSST Data Specification (GDS)
Revision 2.0

2.0 Technical Specifications

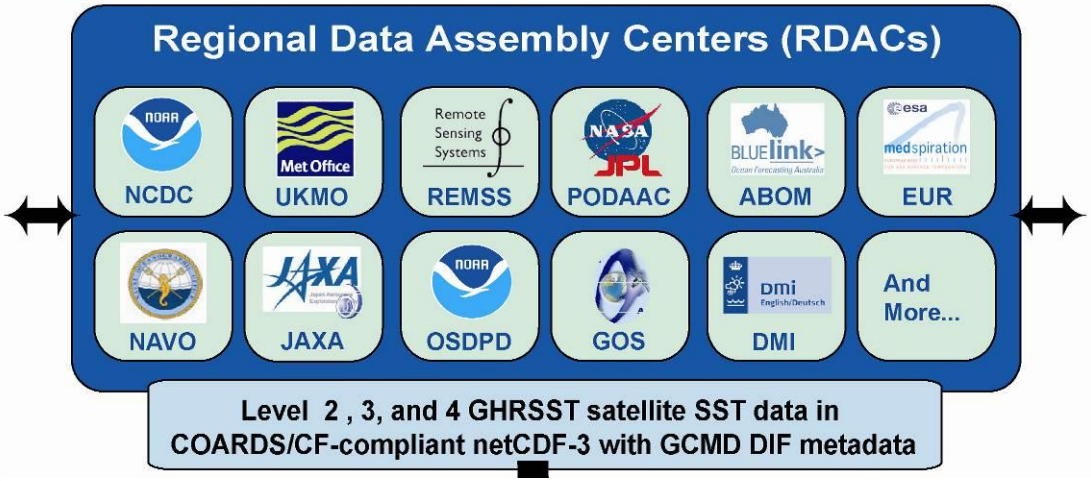
GDS2.0_TechnicalSpecifications_v2.0.doc	
2.0	Document Revision: 02.007
01/10/2010 13:52:00Z2010 13:52 UTC	
01/10/2010 13:52:00Z2010 14:00 UTC	
Microsoft Word [Compatibility Mode]	
Kenneth S. Casey and Craig Donlon	
The Group for High Resolution Sea Surface Temperature Science Team	
URL to location of online resource:	
Approved version: http://www.ghrsst.org/documents.htm?parent=708	
Development version: http://www.ghrsst.org/documents.htm?parent=709	

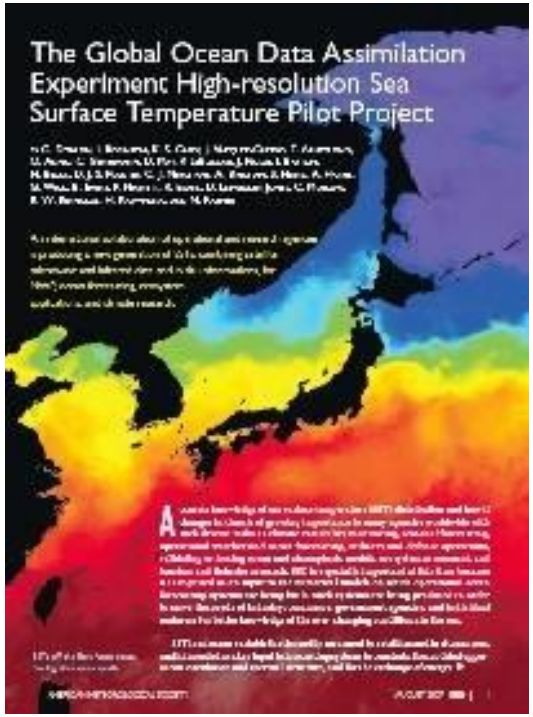
is document as:
am (2010), The Recommended GHRSST Data Specification (GDS) Revision 2.0
ons, available from the GHRSST International Project Office,
pp 120.


GDS-v2.0
Rev 0.1
June 2008
Main data flow
HR-DDS data flow
MDB/SSES data flow
RAN data flow
GMPE data flow
MDB/SSES system
Derive Single Sensor error statistics (SSES)
Single Sensor Error Statistics
Satellite and in situ MDB
MDB records
In situ data
Generate MDB records
Satellite SST data
Auxiliary data
Ingest & QC input data streams
Generate L2P data products (L2Pc -> L2P)
Reference data fields
L2P/L2Pc SST data products
Generate L3P data products
L3P SST data products
Reference data fields
HR-DDS system
HR-DDS archive GDAC &RDAC
Extract HR-DDS L2P granules
L2P HR-DDS data granules
User data access through LAS/DODS HR-DDS server
L4 SST HR-DDS data granules
Extract HR-DDS L4 SST granules
Reference data fields
Generate L4 analysed data products (e.g., SSTfnd) based on L2P data input.
Rolling and long-term archive system
Analysed L4 SST data products
Diagnostics, metrics and GDS data product validation
Metrics definitions
GMPE SST ensemble products
Generate GMPE products
Reference data fields
GMPE system
Reference data fields
Auxiliary data
Re-Analysis f L2P/L3P/L4
CDR SST data products
RAN system
GHRSST
Group for High Resolution Sea Surface Temperature
http://www.ghrsst.org

GHRSST-PP Regional/Global Task Sharing Framework

GODAE High Resolution Sea Surface Temperature Pilot Project



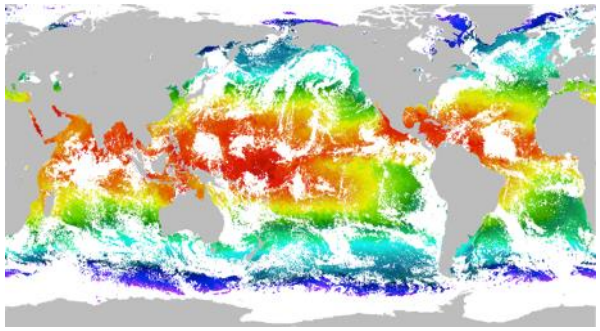


Donlon *et al*, 2007, BAMS, **88**, 1197–1213.

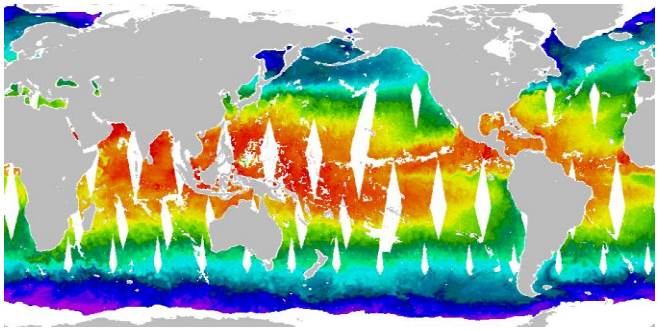
vw.ghrsst.org

L2P Common format with uncertainty

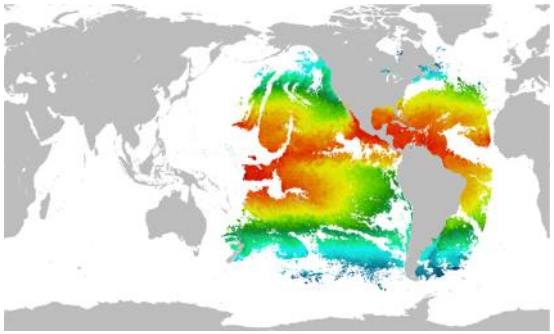
N-17/18
AVHRR GAC (9km)

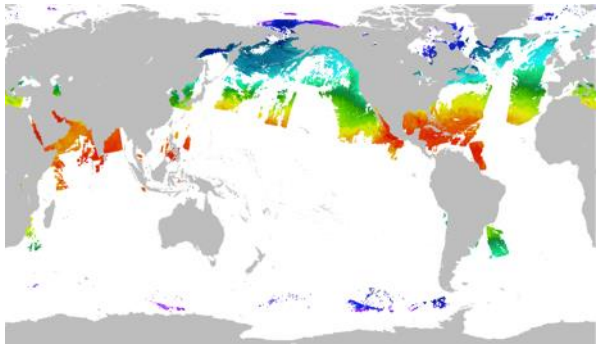


AMSRE (25/12km)

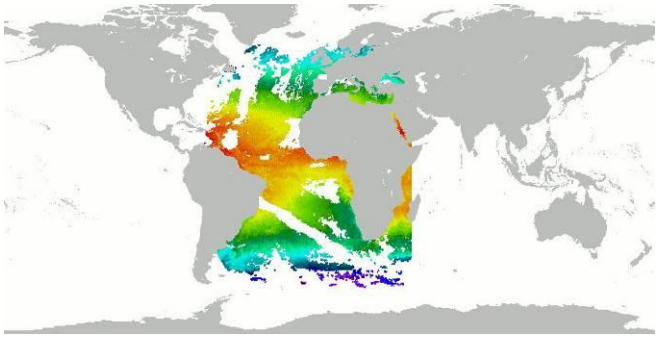


GOES-E/W (5km)

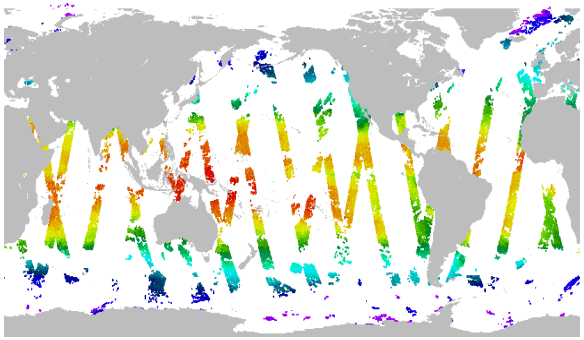




N-17/18
AVHRR LAC (1km)

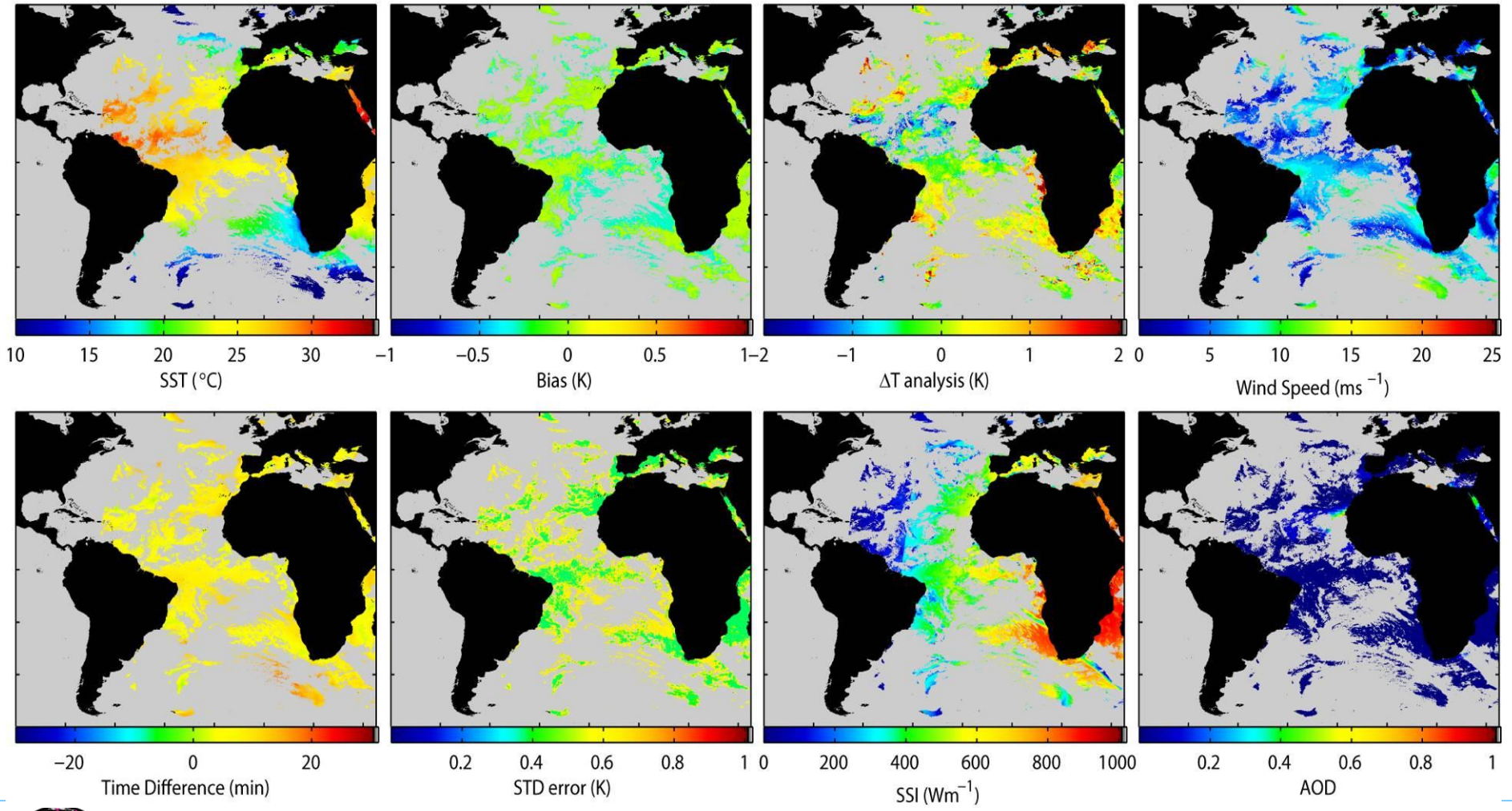


MSG (5/10km)

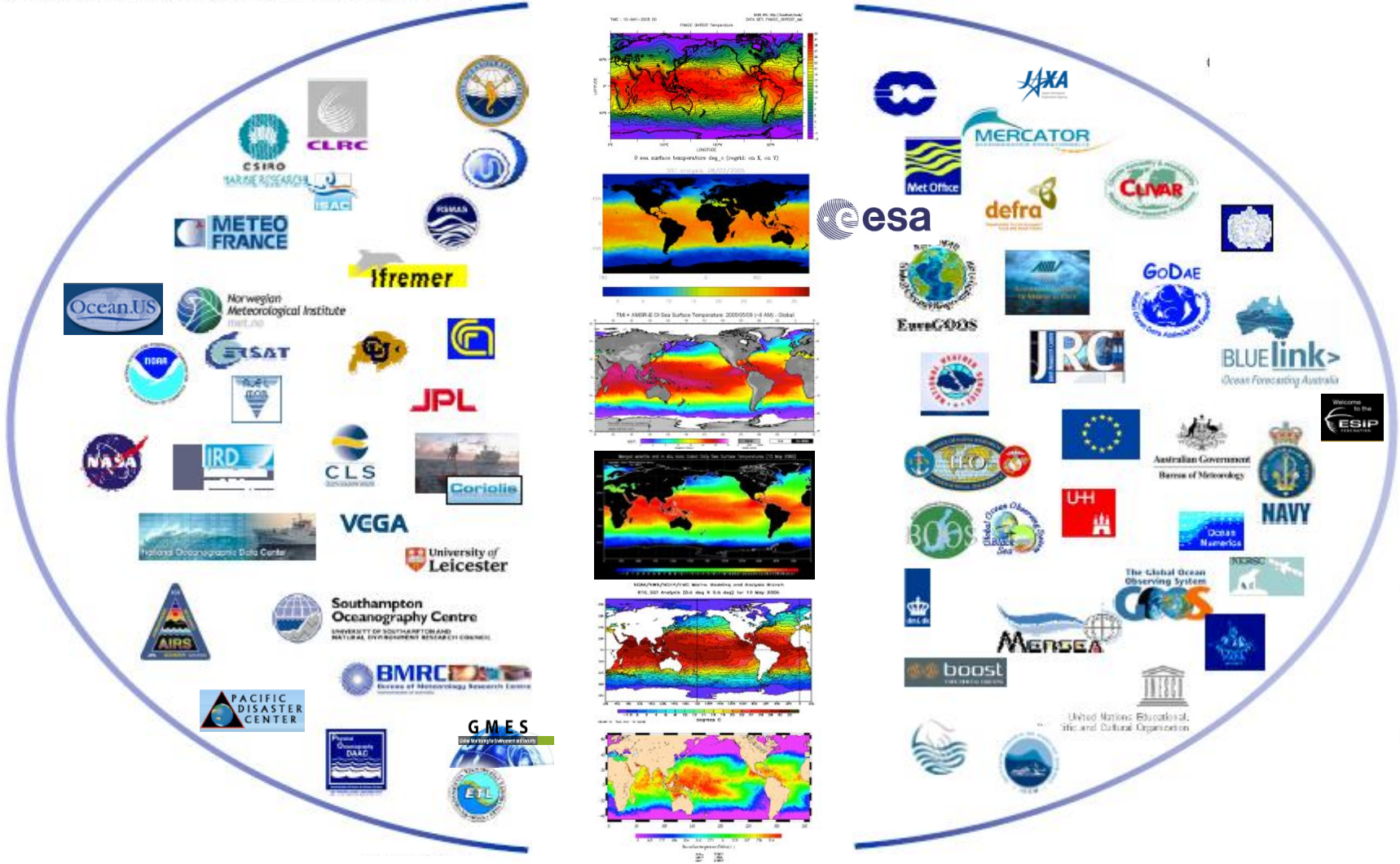


AATSR (1km)

Ancillary information in L2P products: Dynamic flags



Over $50 Million invested by the international GHRSST-PP community



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Group for High Resolution Sea Surface Temperature

http://www.ghrsst.org

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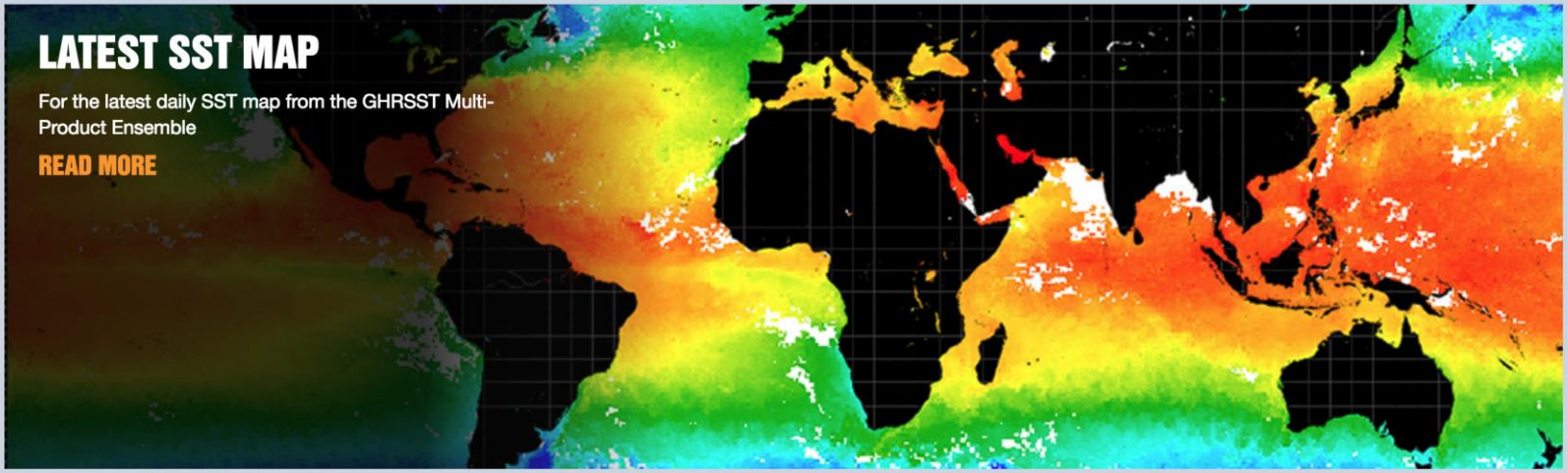
GROUP FOR HIGH RESOLUTION SEA SURFACE TEMPERATURE

Search

HOME | QUICK START GUIDE | LATEST SST MAP | ABOUT GHRSST | GHRSST DATA & SERVICES | RESOURCES

Latest: 2nd GHRSST Short Course on SST | G-XVIII - Registration extended to 15th May



LATEST SST MAP

QUICK START GUIDE

GROUP FOR HIGH RESOLUTION SEA SURFACE TEMPERATURE

GHRSST XVIII – AGENDA & EXTENDED REGISTRATION DEADLINE

2ND GHRSST SHORT COURSE ON SST

LATEST NEWS

Satellite Validation International Workshop
Added: 8 May 2017

5th ESA Advanced Training on Ocean Remote Sensing and Synergy
Added: 4 May 2017

EUMETSAT Training Event Using the

MEETINGS

18th International GHRSST Science Team Meeting (GHRSST XVIII)
Qingdao, China
5 - 9 June 2017

17th International GHRSST Science Team Meeting (GHRSST XVII)
Convene, Tysons Corner, VA, near

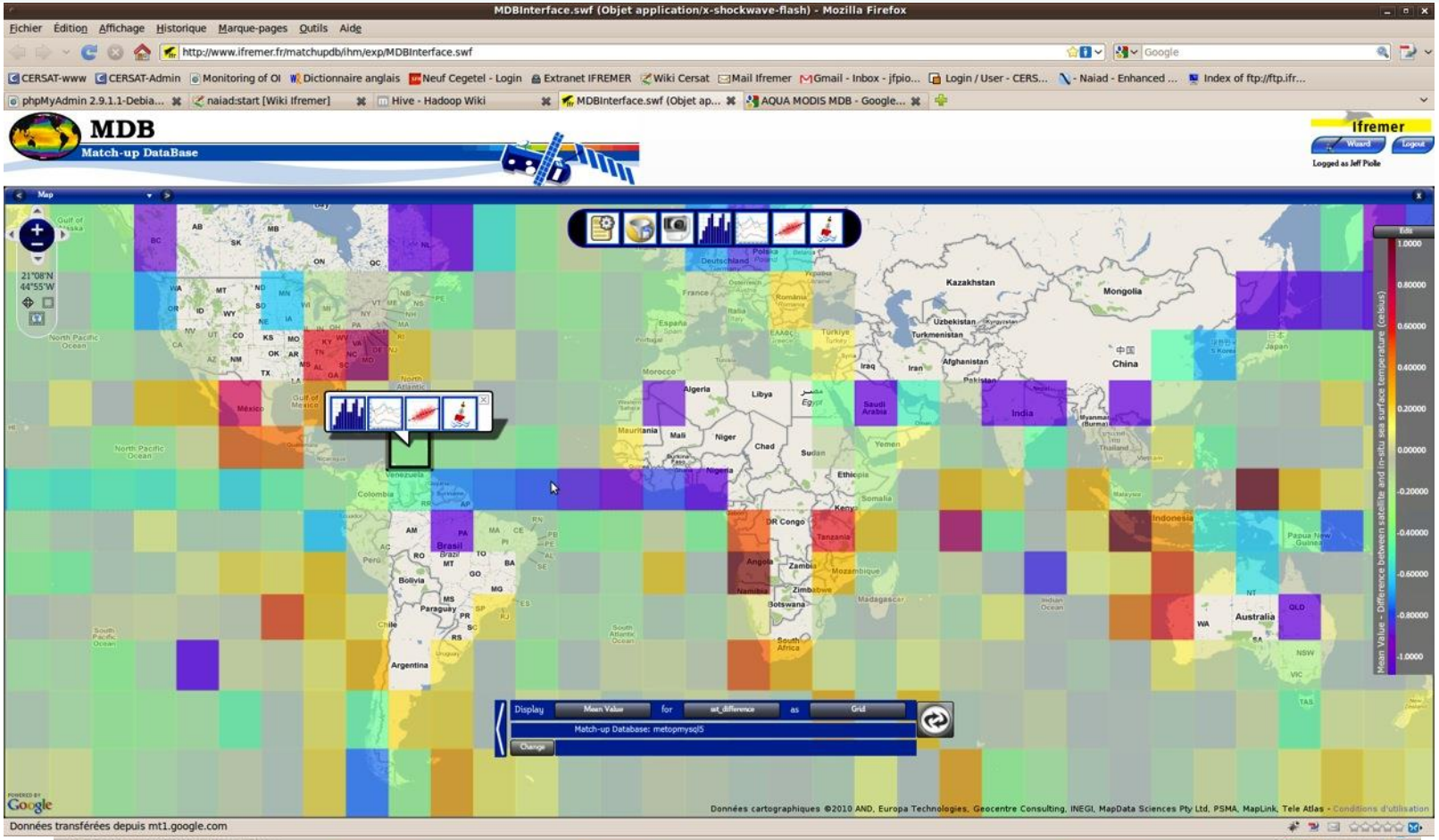
TWITTER

Want to learn about SST? Five days left to register for the GHRSST course in Qingdao.
https://t.co/ImH5KVAhoj https://t.co/XNmqBDCgIn
- 20 days ago

Only 3 days left to register for G-XVIII
https://t.co/rVGWVcq2BC
https://t.co/WB7Sqao4K2
- 32 days ago

Testing Data Sources and Diagnostic Data Sets (DDS)

GHRSS MDB system @ IFREMER



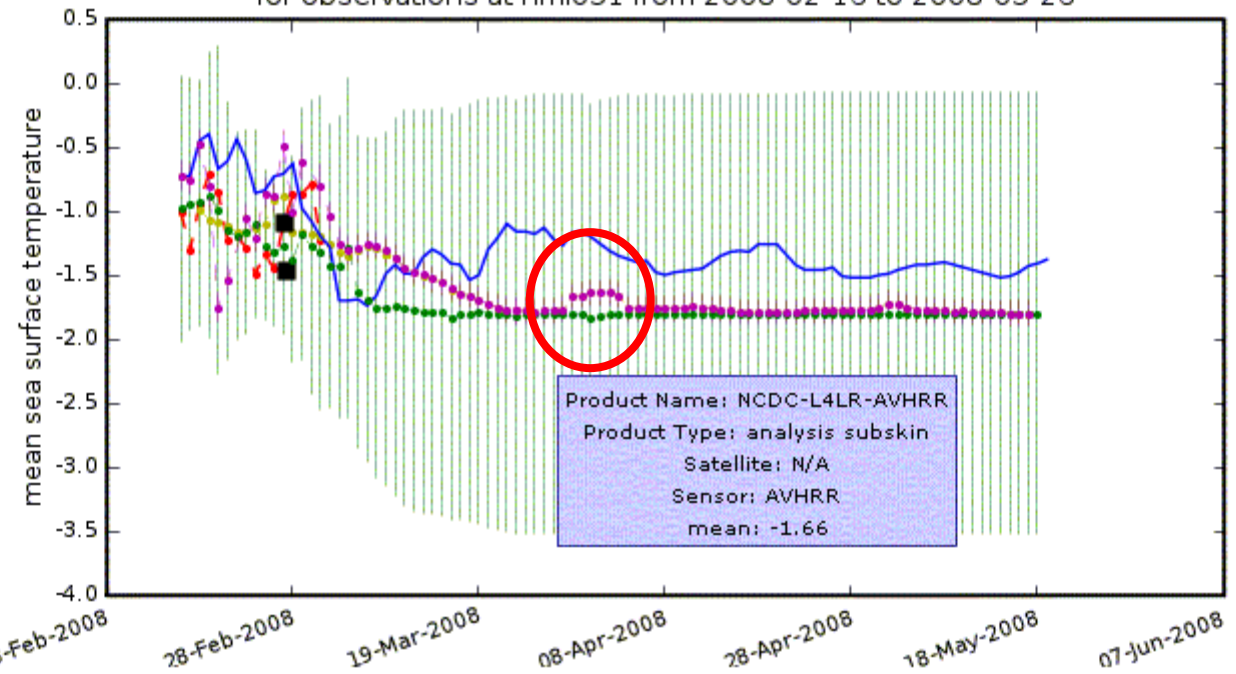
- Excellent progress and thanks to IFREMER MyOcean
  - http://www.ifremer.fr/matchupdb

Interactive SST results for site nmi051

Site nmi051 (Metno_Weddell_Sea_South): Centered on (-70° N, -30° E), 3° by 3&deg.

<- 1 Year-> <- 1 Month-> <- 1 Day->

Plot of the mean centre_best values of sea surface temperature
for observations at nmi051 from 2008-02-16 to 2008-05-26



Please click here for a legend of observations, here for a legend of other product types and here for a detailed legend.

Select y-axis maximum auto, an y-axis minimum auto and a minimum valid data percentage 5

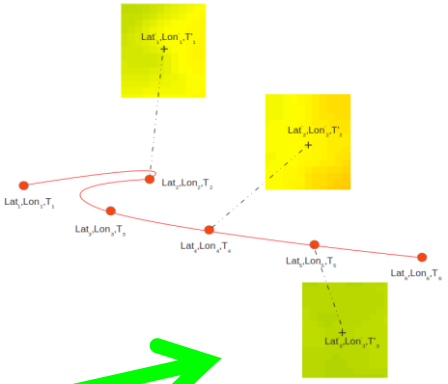
Note: Please enter no units for the above entries.

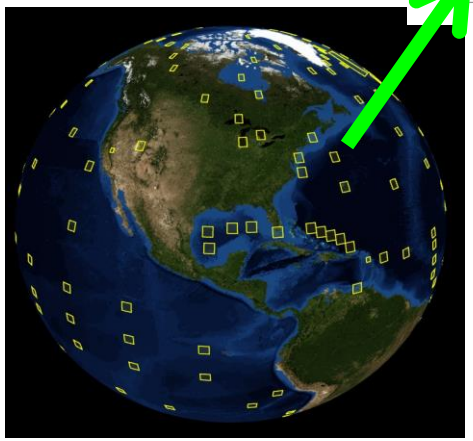
Parameter Type	Statistical Operator	Coverage and Quality
sea surface temperature	mean	centre area and best quality

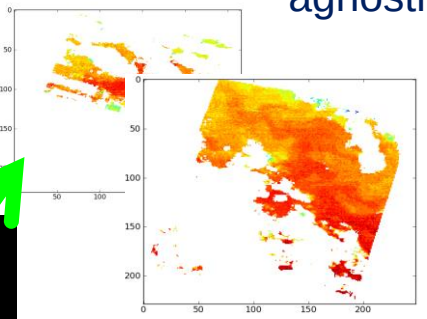
Site map:

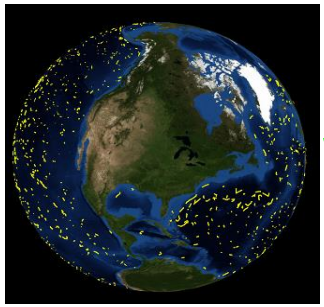
Community Tools: Felyx (http://hrdds.ifremer.fr)

- Designed for creating match-up databases and for EO product performance monitoring
- Extract and store subsets of large datasets over predefined static or dynamic (like buoy or ship trajectories) locations
- Process and disp[illegible]agnostics









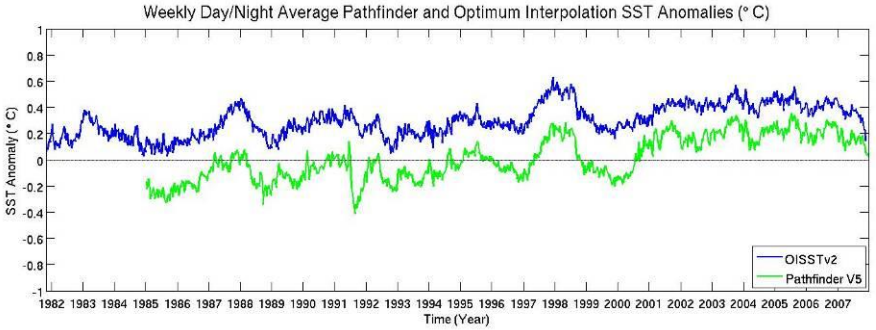
- Open source software implemented in python
- Works with all GDS format products - extensible through plugins to other datasets, new metrics,...

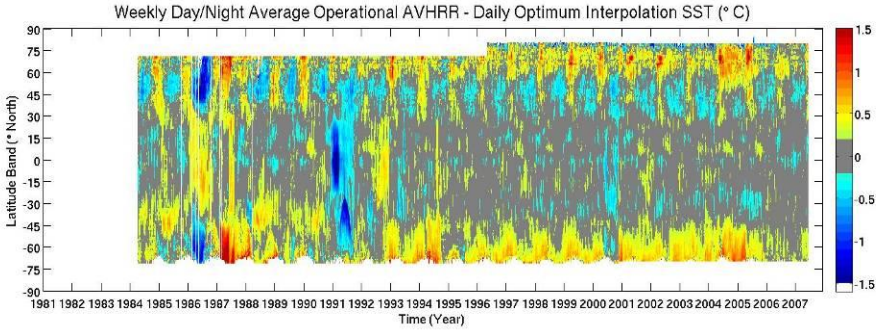
Ifremer

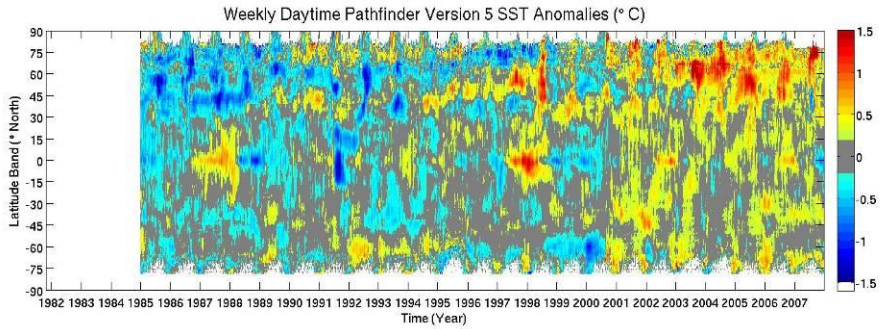
For further information see Jean Francois Piollé (jfpiolle@ifremer.fr)

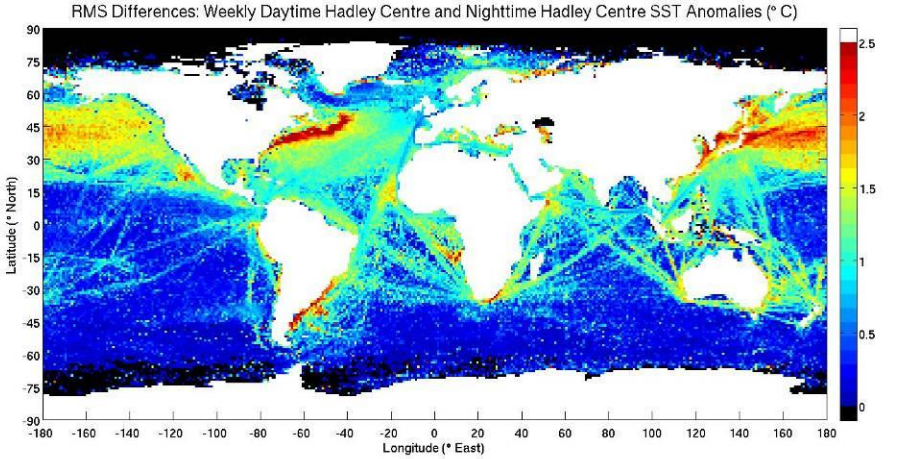
felyx

GCOS/GHRSST time series extensive inter-comparisons



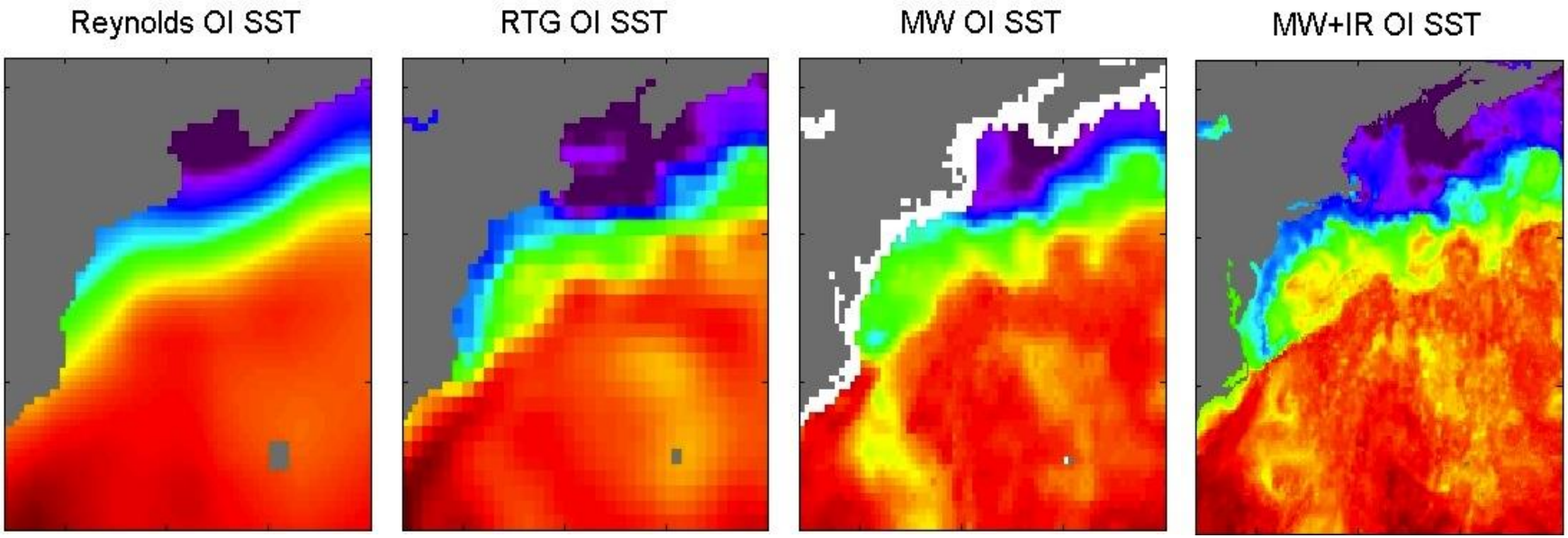






http://ghrsst.nodc.noaa.gov/intercomp.html

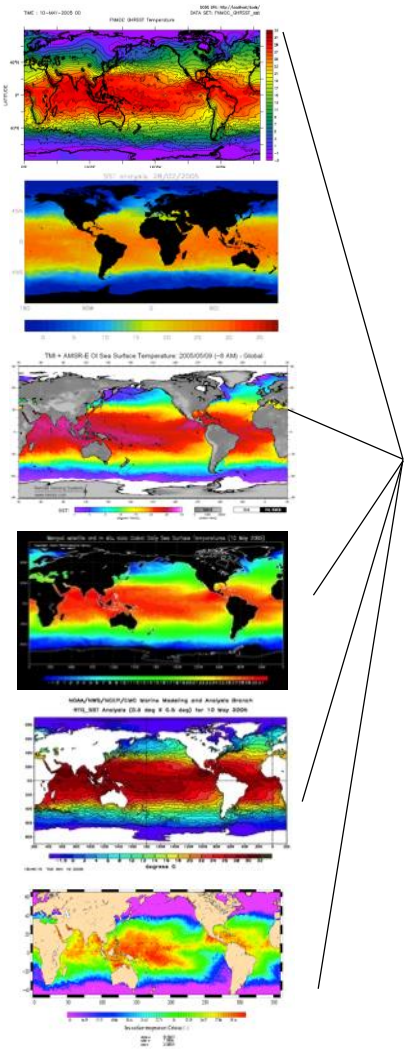
Gulf Stream Analyzed SSTs

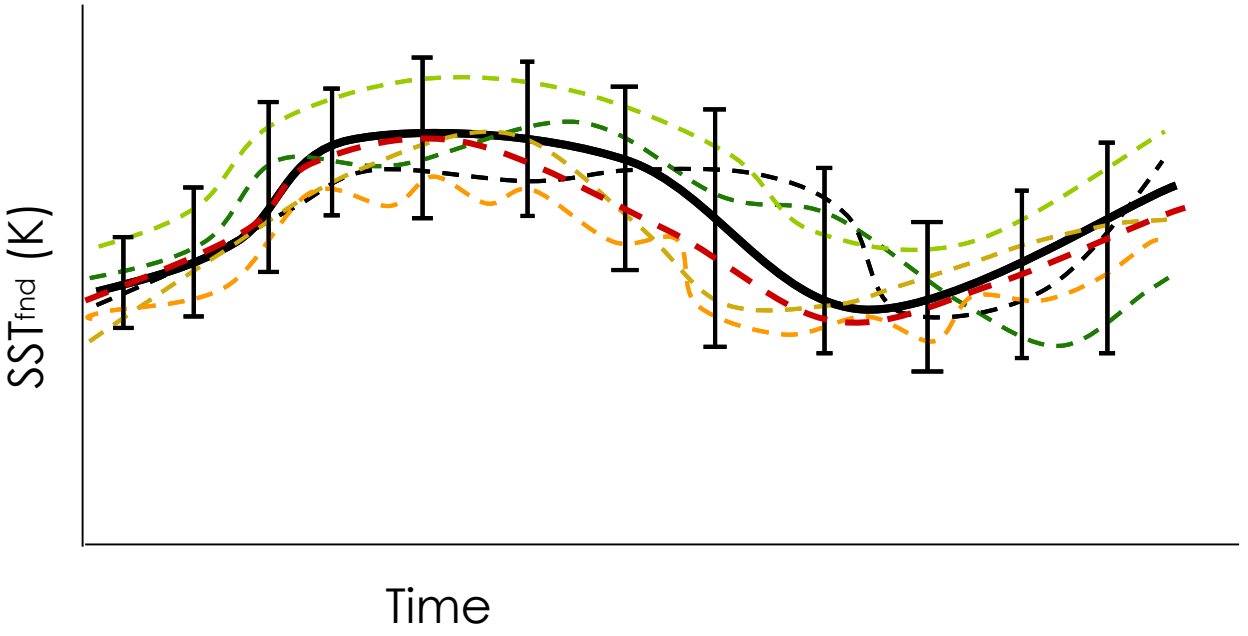


Access to more SST observations should lead to: increased resolution, accuracy, stability

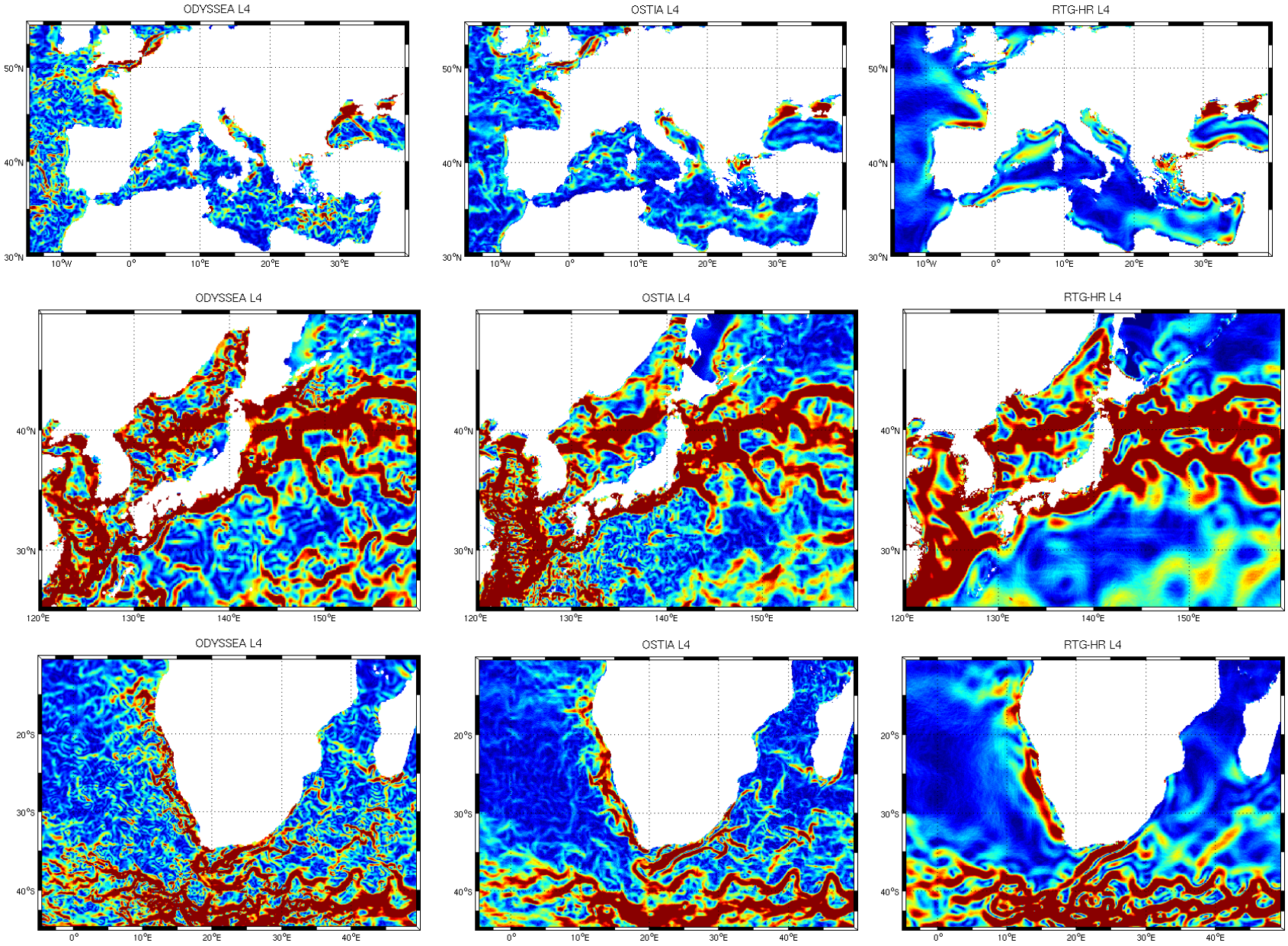
Should lead to better NWP, hurricane prediction, ocean modeling, air-sea interaction studies, research

Verification: PME/Inter-comparisons





- Optimal way forward - preserves regional autonomy maximises benefits to user community
- Requires a framework to deliver the ensemble product – L4 format descriptor
- Stimulates better products and scientific/production interactions



http://www.mersea.eu.org/Satellite/sst_validation_l4_glob_oi.html

iQuam - in situ SST quality monitoring - Mozilla Firefox

File Edit View History Bookmarks Tools Help

iQuam - in situ SST quality monitoring

www.star.nesdis.noaa.gov/sod/sst/iquam/

NOAA NESDIS STAR

iQUAM *in situ* SST quality monitor

NOAA / NESDIS / STAR

Home Data About Contact FAQ Links

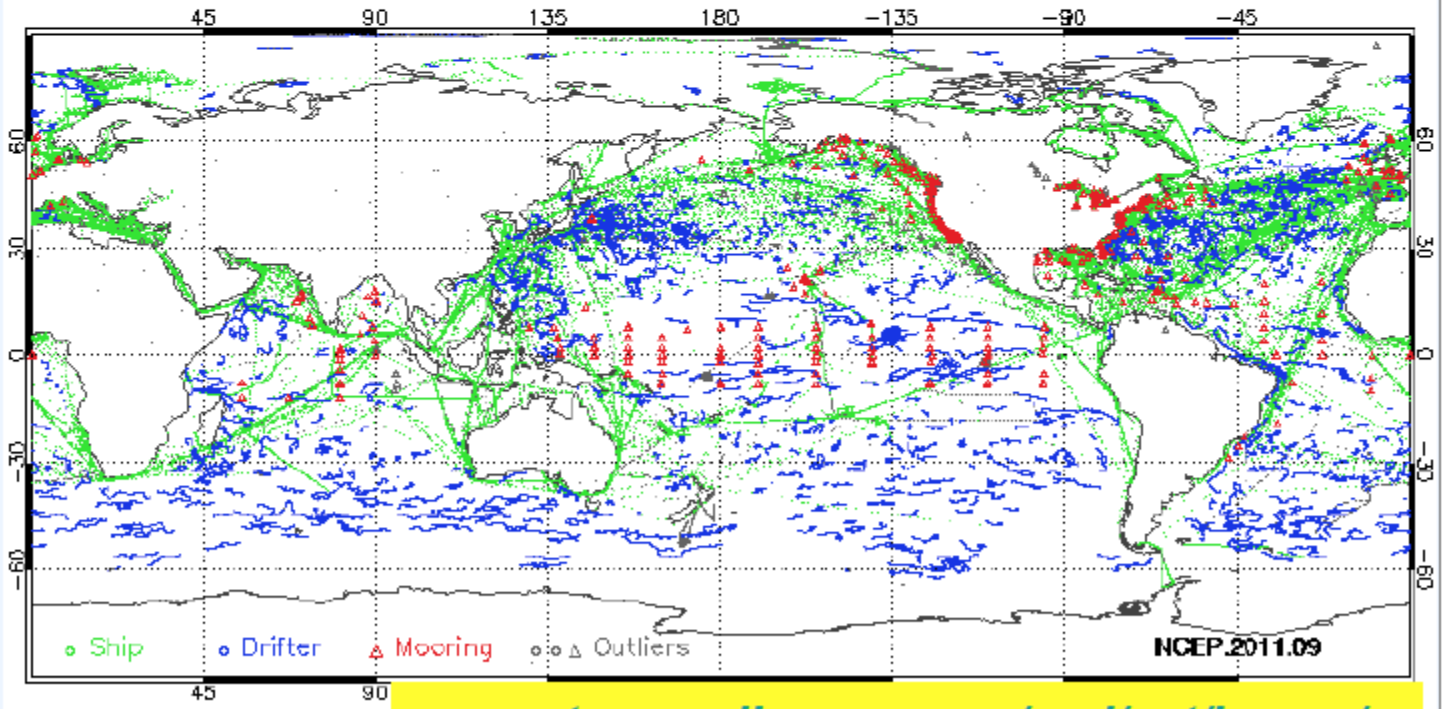
Maps
Statistics
Time-series
Platforms

< 09 2011 >

Different platform types are shown in different colors, with outliers (erroneous observations) shown in gray. Each symbol stands for one observation.

Tropical moorings include TAO/TRITON, PIRATA, RAMA etc. Coastal moorings are all other moorings.

Global map of measurements



www.star.nesdis.noaa.gov/sod/sst/iquam/

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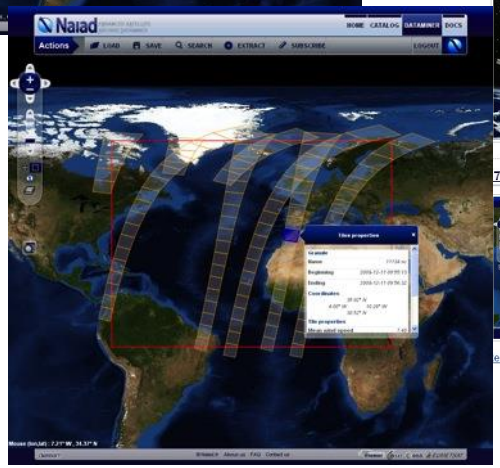
Data Assembly and Distribution

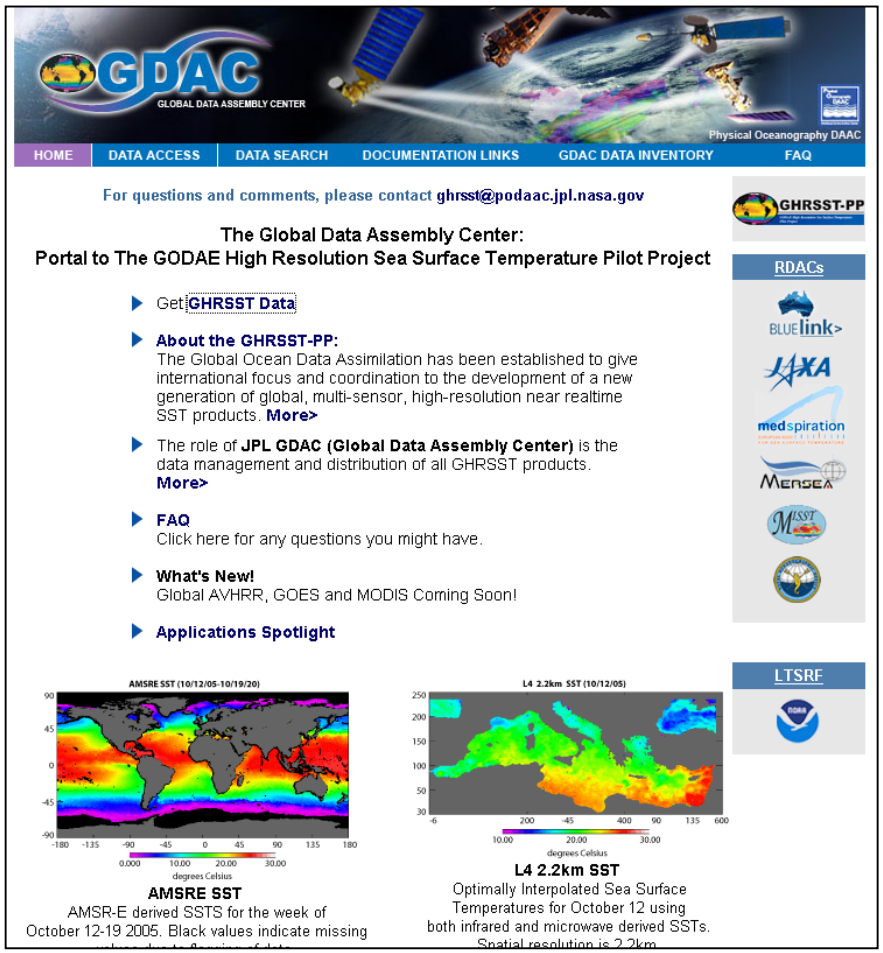
(Free and immediate access)

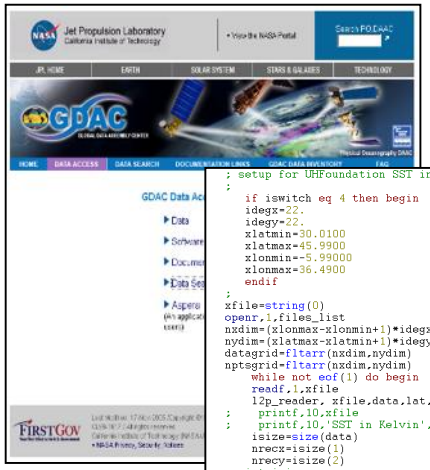
User tools and Services

- NAIAD and dataminer
- IFREMER and JPL
- SQUAM
- GMPE
- HRDDS
- WMS
- G1 OurOcean
- DataCasting
- ….

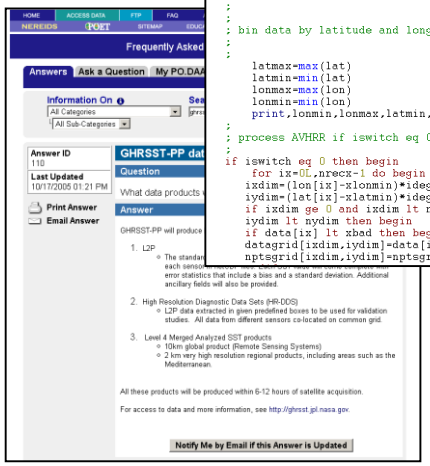


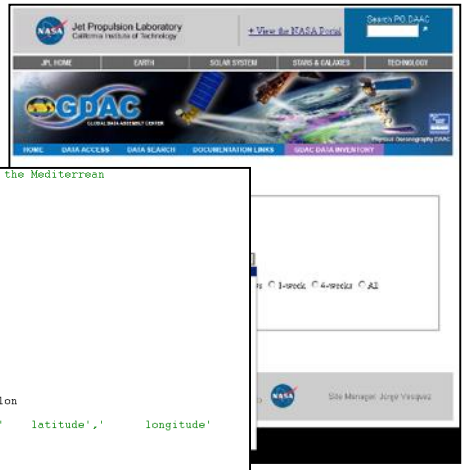
GHRSST-PP Global Data Services





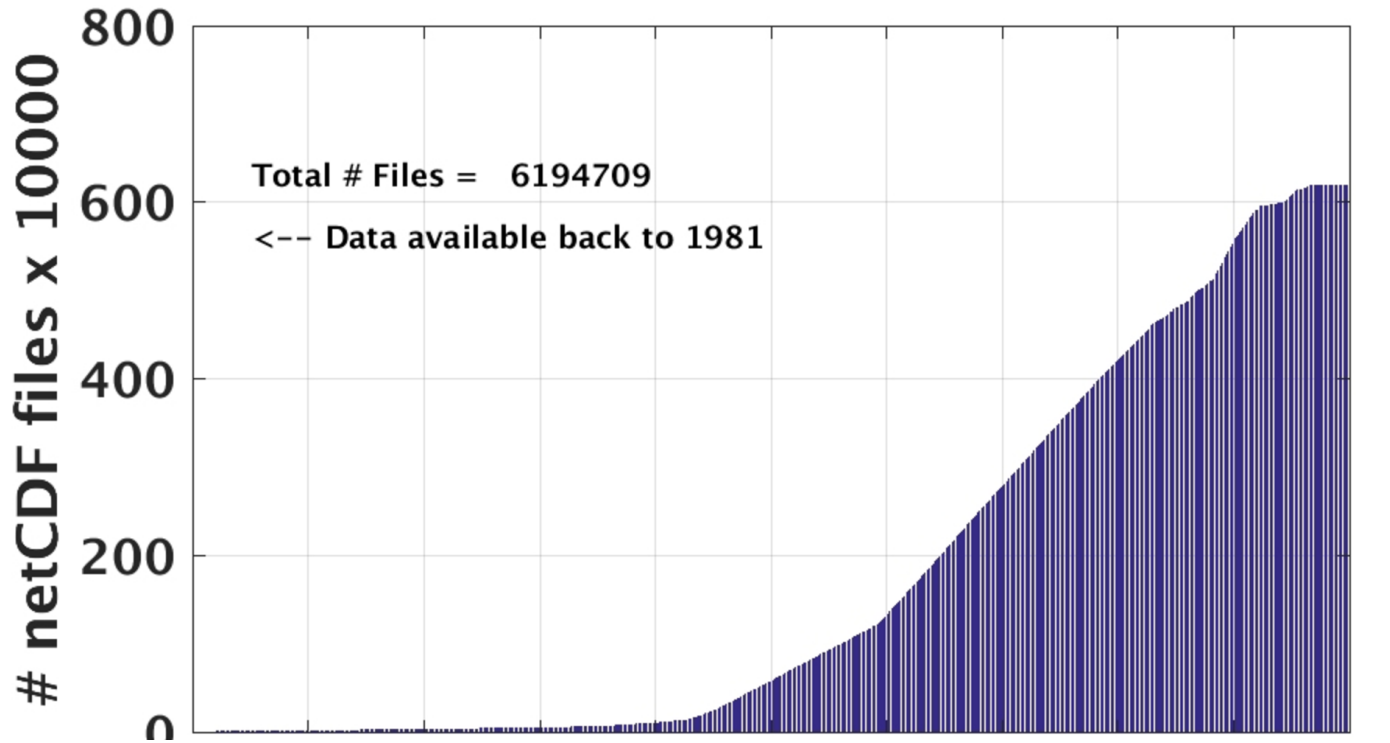

```
; setup for UHFoundation SST in the Mediterrean
;
   if iswitch eq 4 then begin
   idegx=22.
   idegy=22.
   xlatmin=30.0100
   xlatmax=45.9900
   xlonmin=-5.99000
   xlonmax=36.4900
   endif
;
xfile=string(0)
openr,1,files_list
nxdim=(xlonmax-xlonmin+1)*idegx
nydim=(xlatmax-xlatmin+1)*idegy
datagrid=fltarr(nxdim,nydim)
nptsgrid=fltarr(nxdim,nydim)
    while not eof(1) do begin
    readf,1,xfile
    l2p_reader, xfile,data,lat,lon
;    printf,10,xfile
;    printf,10,'SST in Kelvin','    latitude','      longitude'
    isize=size(data)
    nrecx=isize(1)
    nrecy=isize(2)
;print,isize
;print,size(lat)
;
;
; bin data by latitude and longitude
;
;
    latmax=max(lat)
    latmin=min(lat)
    lonmax=max(lon)
    lonmin=min(lon)
    print,lonmin,lonmax,latmin,latmax
;
; process AVHRR if iswitch eq 0
;
if iswitch eq 0 then begin
   for ix=0L,nrecx-1 do begin
   ixdim=(lon[ix]-xlonmin)*idegx
   iydim=(lat[ix]-xlatmin)*idegy
   if ixdim ge 0 and ixdim lt nxdim and iydim ge 0 and $
   iydim lt nydim then begin
   if data[ix] lt xbad then begin
   datagrid[ixdim,iydim]=data[ix]+datagrid[ixdim,iydim]
   nptsgrid[ixdim,iydim]=nptsgrid[ixdim,iydim]+1
```



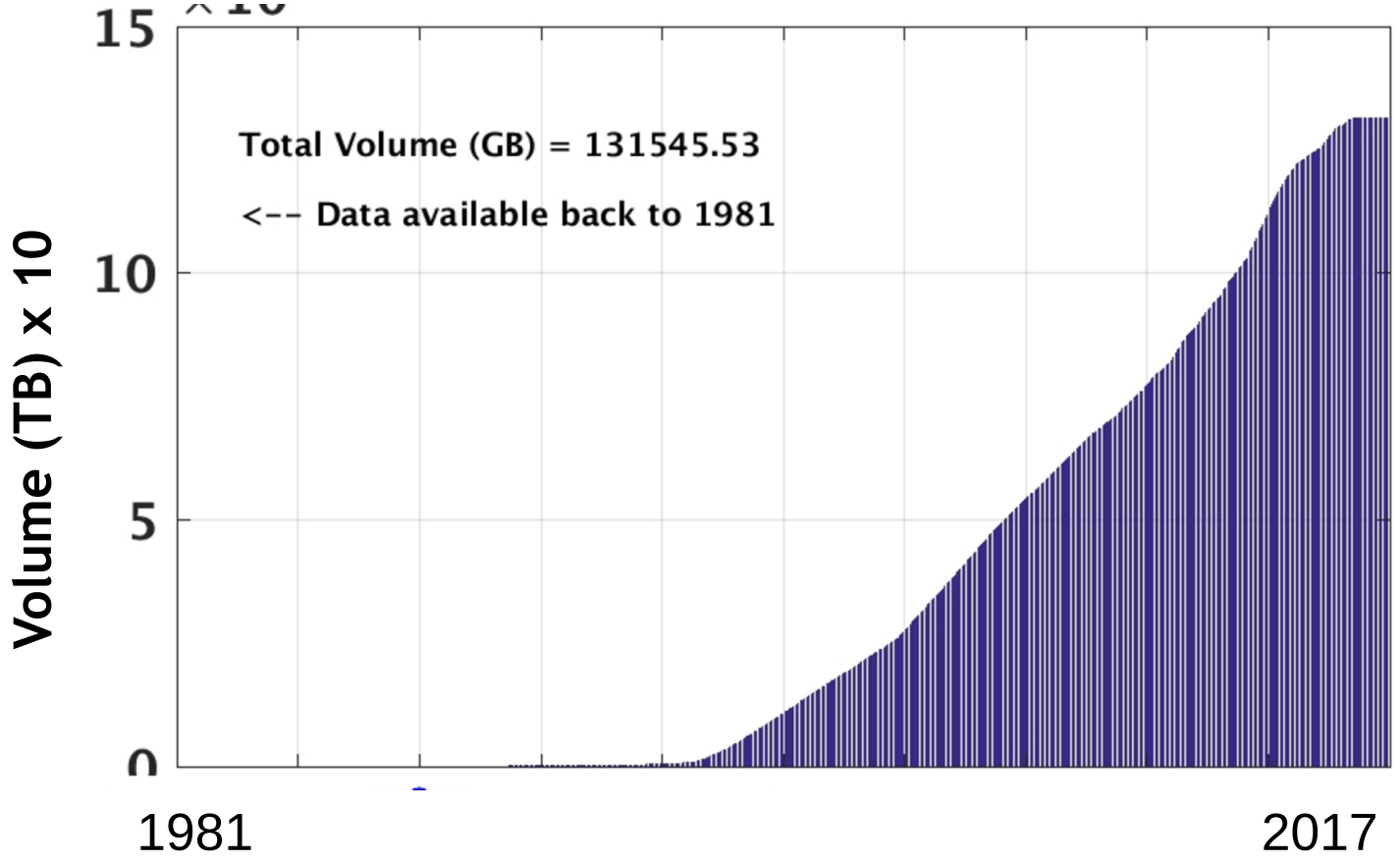


- http://gdac.jpl.nasa.gov

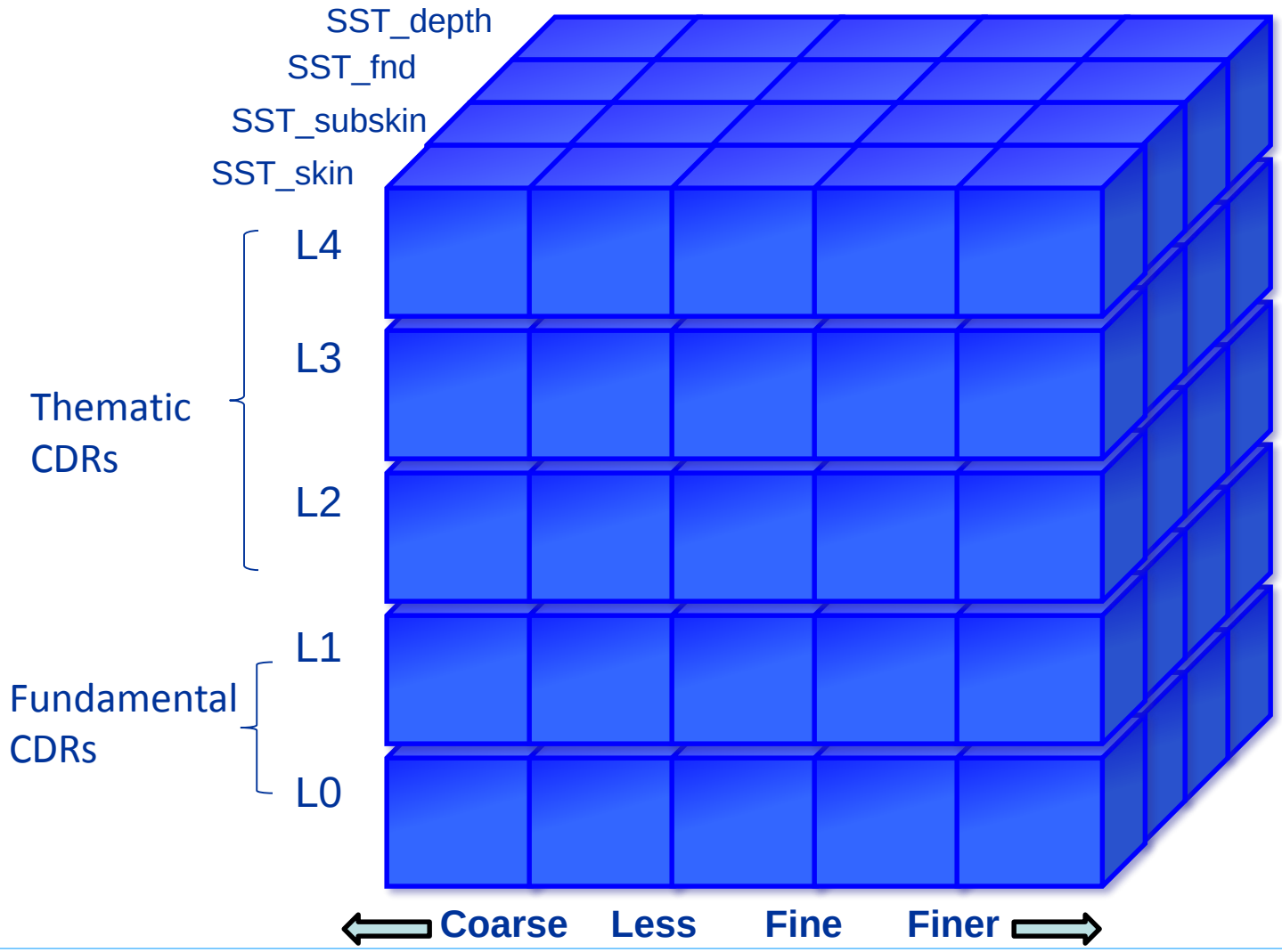
LTSRF Progress



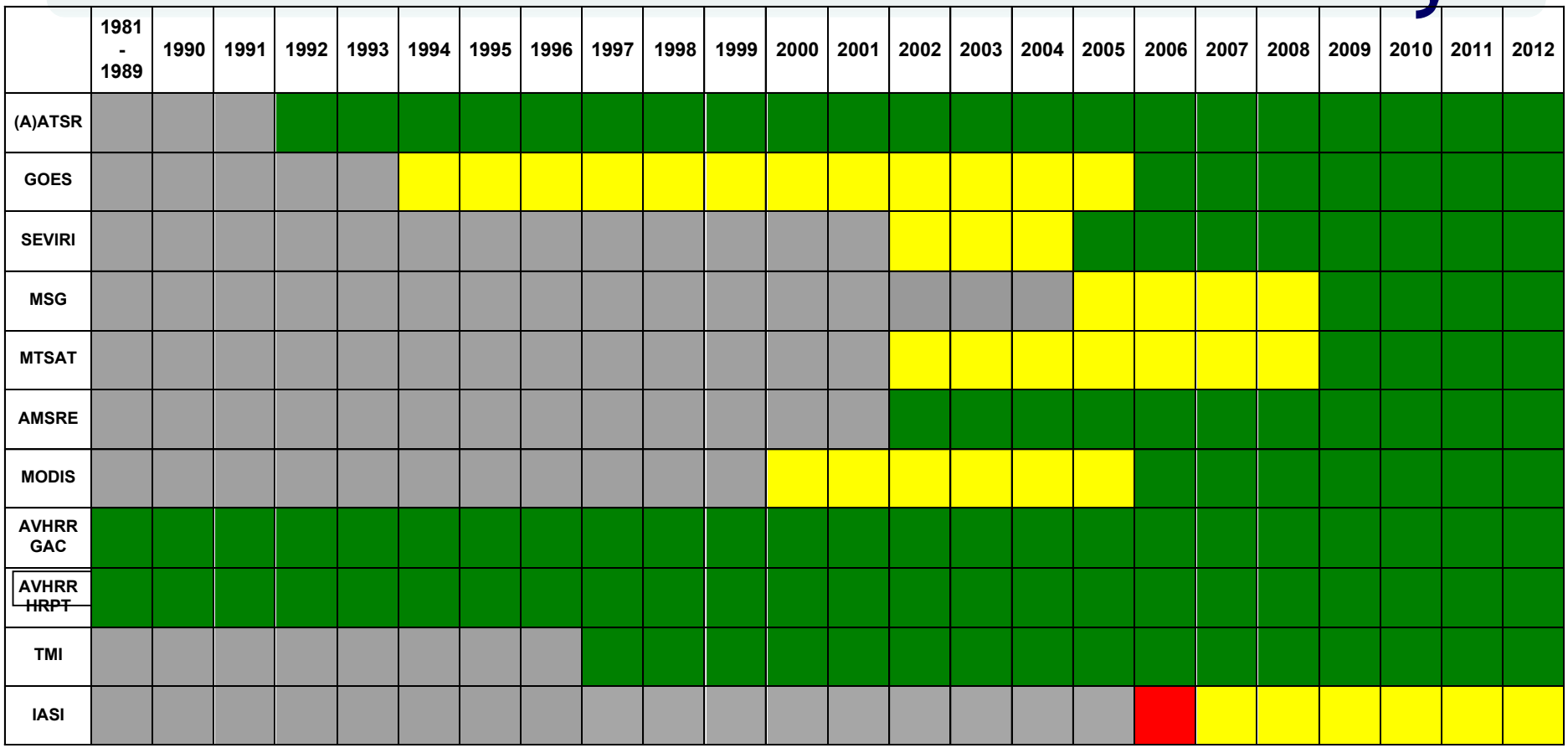
LTSRF Progress



SST ECV Conceptual Framework



2012 GHRSST Data Availability



Sensor not in operation or capable of SST observations	
No plans yet for GHRSST L2P/L3C	
Efforts underway or proposed for GHRSST L2P/L3C	
Data available in GHRSST L2P/L3C	

GHRSST
Group for High Resolution Sea Surface Temperature

http://www.ghrsst.org

SST_cci

Chris Merchant
The University of Edinburgh

s
e
p

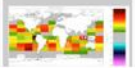
GCOS Requirement Verification Matrix: Example SST

Requirement	GCOS(2011)	SST CCI Phase 1
Accuracy	0.1 K on scale of 100 km	0.1 K * demonstrated on 1000 km
Precision	Not specified	Varies, quantify it *
Stability	0.03 K / decade	0.05 K / decade *
Spatial resolution	10 km [~0.1°]	0.05° §
Temporal resolution	Daily	Daily, day & night, standardized local time *§
Uncertainty information	Develop an approach	Total and uncertainty components *§
Type of SST	SST_{skin}	SST_{skin} & $SST_{buoy\text{-}depth}$ *§
Period	From start of AVHRR (30+ years)	20 years
Independence (not tuned to *in situ* measurements)	Not specified	Yes *§

* SST CCI is unique and/or world-leading in this regard

§ SST CCI goes beyond GCOS in response to user requirements survey

Table 5.2.2: Comparison of metrics related to SST estimation for day-time AATSR observations, globally.

Table 5.2.2 AATSR Day	ARC	Optimal Estimation v1	Optimal Estimation v2	ORAC	Weight
Bias (mean discrepancy)	0.082 K	-0.023 K	0.087 K	0.206 K	Very High
Bias (median discrepancy)	0.094 K	0.003 K	0.101 K	0.221 K	Very High
Bias (mean discrepancy map)					Very High
Bias (median discrepancy map)					Very High
Table 5.2.2 AATSR Day	**ARC**	**Optimal Estimation v1**	**Optimal Estimation v2**	**ORAC**	**Weight**
Precision map (SD of discrepancy)					Medium
Precision map (RSD of discrepancy)					Medium
Precision (mean of cell SDs)	0.463 K	0.432 K	0.434 K	0.497 K	Medium
Precision (median of cell RSDs)	0.306 K	0.269 K	0.264 K	0.349 K	Medium
Stability with respect to trend	*-0.003 ± 0.002* K/yr	*-0.001 ± 0.003* K/yr	*0.000 ± 0.003* K/yr	-0.008 ± 0.003 K/yr	Very High
Stability with respect to season (amplitude of cycle)	North: *0.139 ± 0.600* K Equator: *0.076 ± 0.543* K South: *0.067 ± 0.775* K	North: *0.211 ± 0.615* K Equator: *0.110 ± 0.526* K South: *0.067 ± 0.770* K	North: *0.171 ± 0.612* K Equator: *0.087 ± 0.508* K South: *0.063 ± 0.698* K	North: *0.140 ± 0.570* K Equator: *0.112 ± 0.737* K South: *0.084 ± 0.754* K	Medium
Stability between day and night	Day-Night: *-0.005 ± 0.011* K. Trend: *0.007 ± 0.004* K/yr	Day-Night: 0.127 ± 0.01 K. Trend: *0.000 ± 0.004* K/yr	Day-Night: *-0.004 ± 0.010* K. Trend: *0.001 ± 0.004* K/yr.	N/A	Medium
Independence from in situ	SST retrieval fully independent.	Indirect dependence via use of NWP for forward model, but negligible in practice.	Indirect dependence via use of NWP for forward model, but negligible in practice.	Indirect dependence via use of NWP for forward model, but negligible in practice.	High
Map SST sensitivity				Not supplied but likely to be high (close to 1.0)	High
Generality	Coefficient design is specific to ATSRs.	General approach applicable to many sensors.	General approach applicable to many sensors, assuming matched high-quality reference SSTs are available.	General approach applicable to many sensors, but only envisaged for day time scenes at current time.	Medium
Improvability	Reason to expect a full radiative transfer model upgrade may be beneficial. Otherwise, no obvious method to improve SST coefficients improvement.	Improvements will derive from improving fast radiative transfer and knowledge of error covariance characteristics of NWP and sensors.	Improvements will derive from improving fast radiative transfer and knowledge of error covariance characteristics of NWP and sensors.	Improvements will derive from improving fast radiative transfer and knowledge of error covariance characteristics of NWP, sensors (visible channels in particular), and particularly aerosol modes.	Medium
Difficulty	Already implemented with modules and auxiliary coefficient files available.	Feasible in context of Bayesian cloud detection, since same simulations are required.	Feasible in context of Bayesian cloud detection, since same simulations are required. Requires new auxiliary information on simulation biases when applied to a new sensor.	Some adaptation and recoding required.	Low
Number of matches	31659	30848	31053	27992	

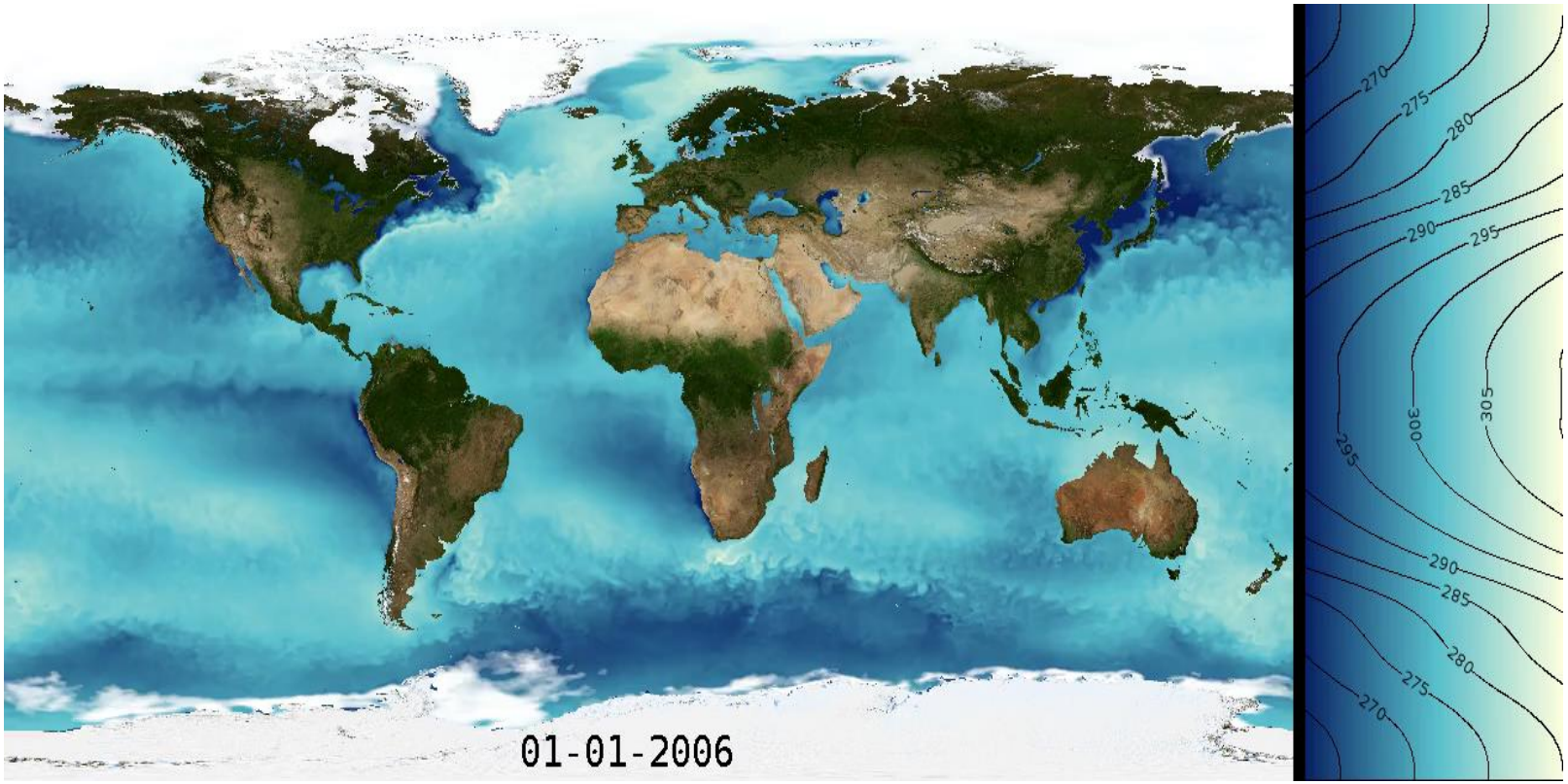
Algorithm Selection Report

One global metric table for one sensor under one observational scenario, showing four competitor algorithms

Comprehensive 304pp

Recommendation for future: streamline the process of making the results accessible

ESA SST_CCI L4 analysis



http://dx.doi.org/10.6084/m9.figshare.1246151

SST-VC-1 Meeting
Tokyo, Japan
June 6-7, 2012

CEOS SST-VC and GHRSST

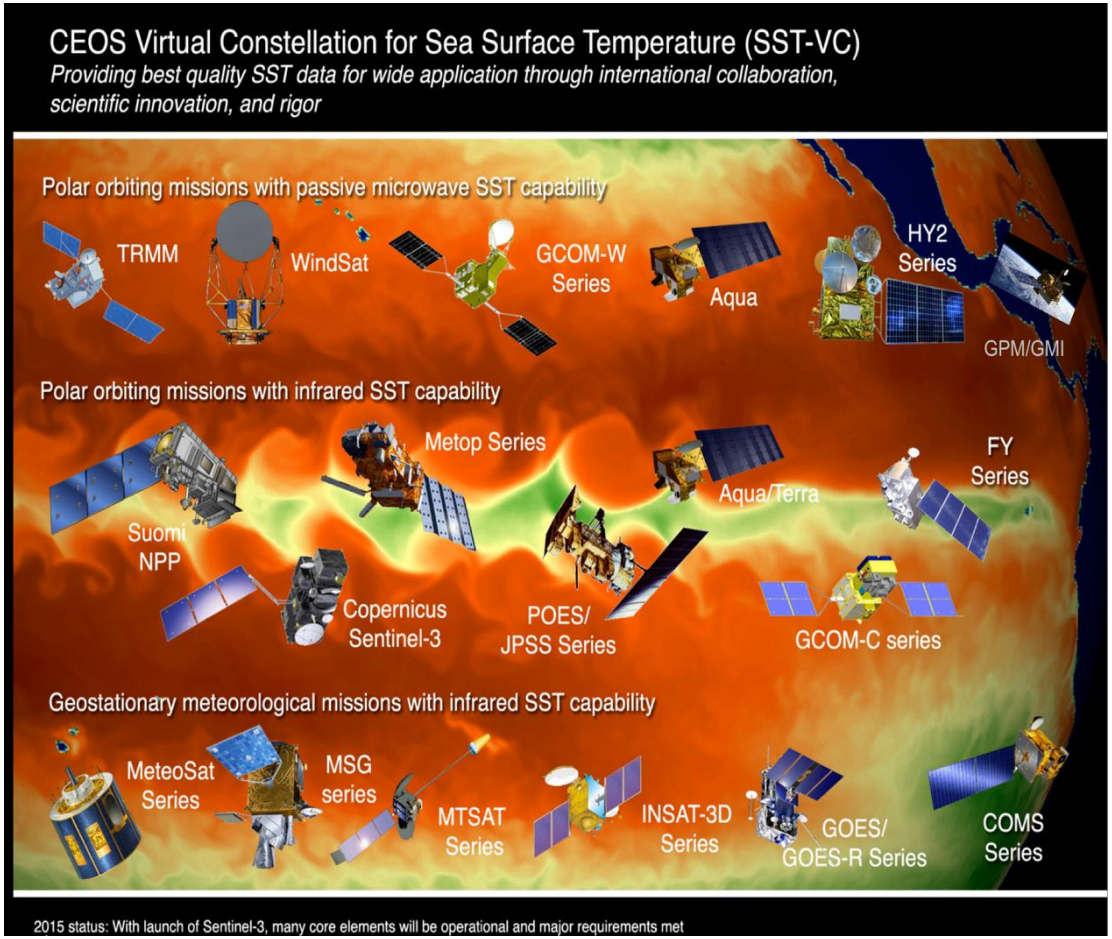
The First Iron bridge in the world, Shropshire, United Kingdom,
Built by Abraham Darby, 1781

The aim of the CEOS SST-VC is:

To foster the best quality sea surface temperature data for applications in short, medium, and climate time scales in the most cost effective and efficient manner through international collaboration, scientific innovation, and rigor

CEOS SST-VC ToR, 2012

CEOS SST-VC


CEOS Virtual Constellation for Sea Surface Temperature (SST-VC)
Providing best quality SST data for wide application through international collaboration, scientific innovation, and rigor
Polar orbiting missions with passive microwave SST capability
TRMM
WindSat
GCOM-W Series
Aqua
HY2 Series
GPM/GMI
Polar orbiting missions with infrared SST capability
Metop Series
Aqua/Terra
FY Series
Suomi NPP
Copernicus Sentinel-3
POES/ JPSS Series
GCOM-C series
Geostationary meteorological missions with infrared SST capability
MeteoSat Series
MSG series
MTSAT Series
INSAT-3D Series
GOES/ GOES-R Series
COMS Series
2015 status: With launch of Sentinel-3, many core elements will be operational and major requirements met

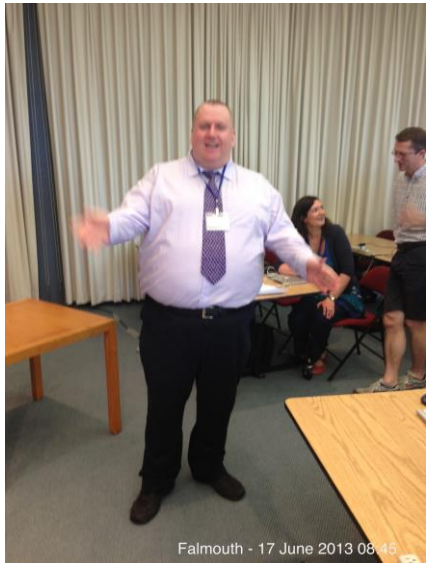
Sustainability: GHRSST-PP -> GHRSST

- Move from GHRSST-PP to GHRSST
  - ***Phase-I:*** An International pilot project tasked to develop and implement a distributed system to deliver integrated high resolution SST and Sea Ice (SI) data products in a sustainable manner (Complete)
  - ***Phase-II:*** Develop a sustained R/GTS system for SST&SI and Manage the ongoing evaluation and evolution of the system (Complete: Operating)
  - ***Phase-III: Transition to self sustained activities supporting Operational & Science communities*** (Complete)
  - ***Phase-IV:*** Deliver SST & SI Climate Data Records (CDR) in support of CEOS and GCOS climate objectives (Underway)
- More user driven Science and applications!!

User needs are key to success

- Sustained & meaningful SST **products**
  - Excellent Science
- Sustained and adaptive-user driven **services** for SST
  - Excellent technology for users
- **Better confidence** in SST products and their delivery (new instruments)
- **Ease of access**, easy documentation
- **Proven standards**, nomenclature, symbology
- An **international forum** for practitioner and user communities (Science Team, User Consultation)

GHRSST PO



2000-2010

2010-2012

2012-

esa esa esa EUMETSAT

From R&D to **……** **……** **Operations**

GHRSST Scientific and Technical Reports?

- The IOCCG has developed a set of 11 consensus reports on Ocean Colour
- These are excellent reference documents

- Can GHRSST do the same for SST?
- Cal/Val plan?

If you want a “GHRSST” of your own…

- **Have real users and connect with them**
- **Give users what they want**
- **Have clear requirements – a good stakeholder (GODAE)**
- **Build and maintain user/producer communities**
- **Build from the bottom up**
- **Keep data focused and not programmatic**
- **Maintain Solid standards, nomenclature, symbology for satellite SST**
- Have regular meetings to build and maintain the community

If you want a GHRSST…

- Have good documentation (practical, professional, and relevant)
- Have an excellent web site
- Do promotion at all levels
- Don't worry about the money – the money will follow a community with drive and vision
- Know and believe in what you want
- Never give up
- **Have strong leaders**
- **Look after your people – always.**

ESA Ocean Training 2017, Porto Portugal 11-15th September 2017

eo science for society

	Monday	Tuesday	Wednesday	Thursday	Friday
Ocean Synergy Challenge [	Mesoscale and sub-mesoscale Structures ☐	Sea Level and Ocean Surface Transport ☐	Wind Waves and Wave/current interaction ☐	Salinity and Marine Inorganic Carbon ☐	Climate Change and Polar Oceans ☐
08:30	*Registration*	**Lecture 3:** Sea Level and ocean heat content from space	**Lecture 5:** Wind waves and wave current interaction from space	**Lecture 6:** Measuring ocean surface salinity from space	**Lecture-8:** Polar oceans and Climate change from space
09:00	*Official Welcome*				
09:15	*Course introduction*				
09:30	**Lecture-1:** Measuring the ocean using different satellite instruments in synergy	**Interactive Lecture 4:** What can an ocean altimeter do for me?	**Interactive Lecture 8:** How to measure ocean waves from space [1]	**Interactive Lecture 12:** Investigating sea surface salinity from space [1]	**Interactive Lecture 16:** Understanding the polar oceans from space
09:45					
10:00					
10:15					
10:30	Coffee	Coffee	Coffee	Coffee	Coffee
11:00	**Interactive Lecture 1:** Exploring the ocean mesoscale and sub-mesoscale using thermal and optical imagery	**Interactive Lecture 5:** Investigating sea level and ocean heat content using satellite altimeters	**Interactive Lecture 9:** How to measure ocean waves from space [2]	**Interactive Lecture 13:** Investigating sea surface salinity from space [1]	**Interactive Lecture 17:** Climate impact and the polar oceans
11:15					
11:30					
11:45					
12:00					
12:15	**Lecture-2:** Ocean Biology from Space				
12:30					
12:45					
13:00	Lunch	Lunch	Lunch	Lunch	Lunch

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Team Work

University of Leicester

Dr Gary Corlett
GHRSST Project Office

Connecting with
Ocean Colour
(Bryan Franz)