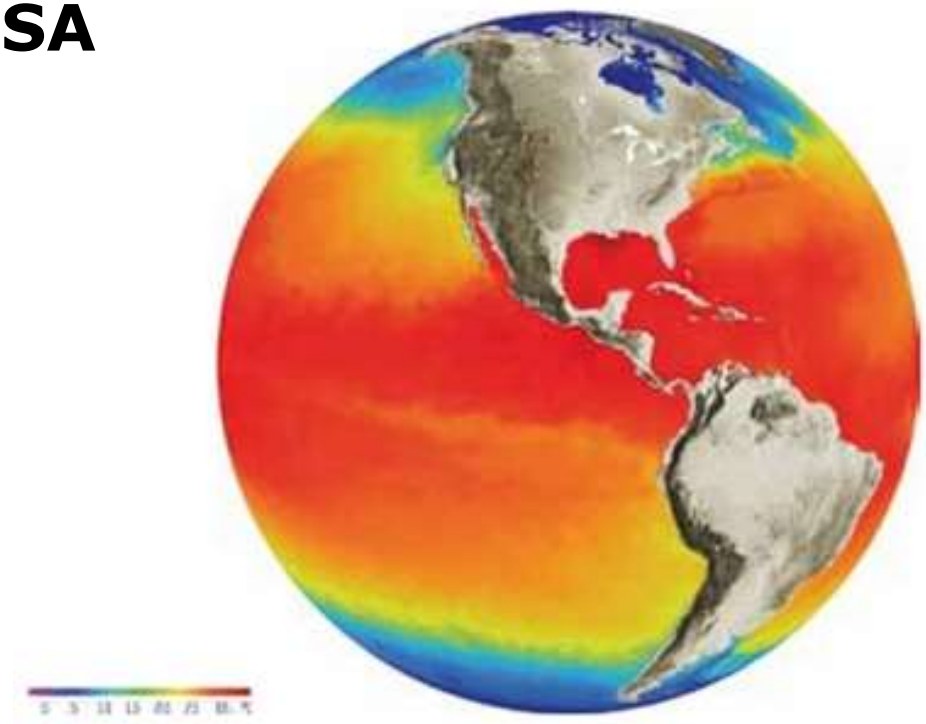
Sea Surface Temperature Developments at ESA



Craig Donlon (plus many more contributors)
European Space Agency, ESTEC, The Netherlands

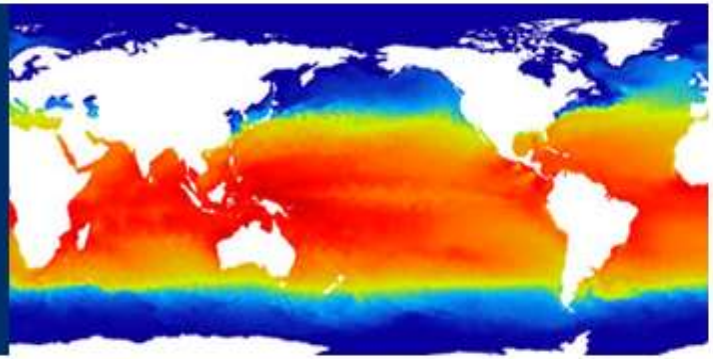
GHRSST XVII Science Team Meeting, Tysons Corner, VA, USA, 6-12th June 2016

Overview

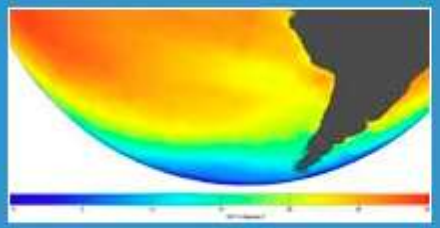
Integrated SST Data Products

The Group for High-Resolution Sea Surface Temperature (SST) (GHRSST) provides a new generation of global high-resolution (<10km) SST products to the operational oceanographic, meteorological, climate and general scientific community.

In a hurry to use SST?



Data



- Latest SST map
- Real-time
- Historical data
- RDAC Data Servers
- Data Descriptions
- GHRSST Data Tools
- Operational Announcements

GHRSST Science

- SST definitions
- What is GHRSST?
- Organisation
- Science Team Members 2012/2013
- Science Team & Groups
- Product Validation
- GHRSST Publications
- Documents
- Meetings and workshops

Users & Partners

- Applications
- CEOS SST VC
- GHRSST related projects
- Sponsors
- Community links
- New Satellite Programs
- Input data streams
- User Requirements
- Education

Login

Email: craig.donlon@esa.int

Password: ••••••••

News

Ocean Flux Science Workshop
Added: 12-Jun-2013

GOV Symposium – Abstracts & Registration
Added: 12-Jun-2013

Final agenda for G-XIV
Added: 11-Jun-2013

Release of Turbulent Flux analyses by Ifremer
Added: 06-Jun-2013

Links to recordings of GHRSST Webinar
Added: 06-Jun-2013

GHRSST XIV - Latest draft agenda (4th June 2013)
Added: 04-Jun-2013

OSISAF - LEO SST format change from GDS V1 to GDS V2
Added: 30-May-2013

Earth Observation in ESA

Meteorological Programme

Copernicus Programme

Earth Observation Envelope Programme

Copernicus Overview

A Programme of the European Union

www.copernicus.eu

European Commission

- Overall Programme Management
- Coordination of the Services Component
- Cross-cutting user-uptake activities

EUMETSAT

- Operations of S3 (marine part), S4, S5, S 6 and Jason-3

esa
European Space Agency

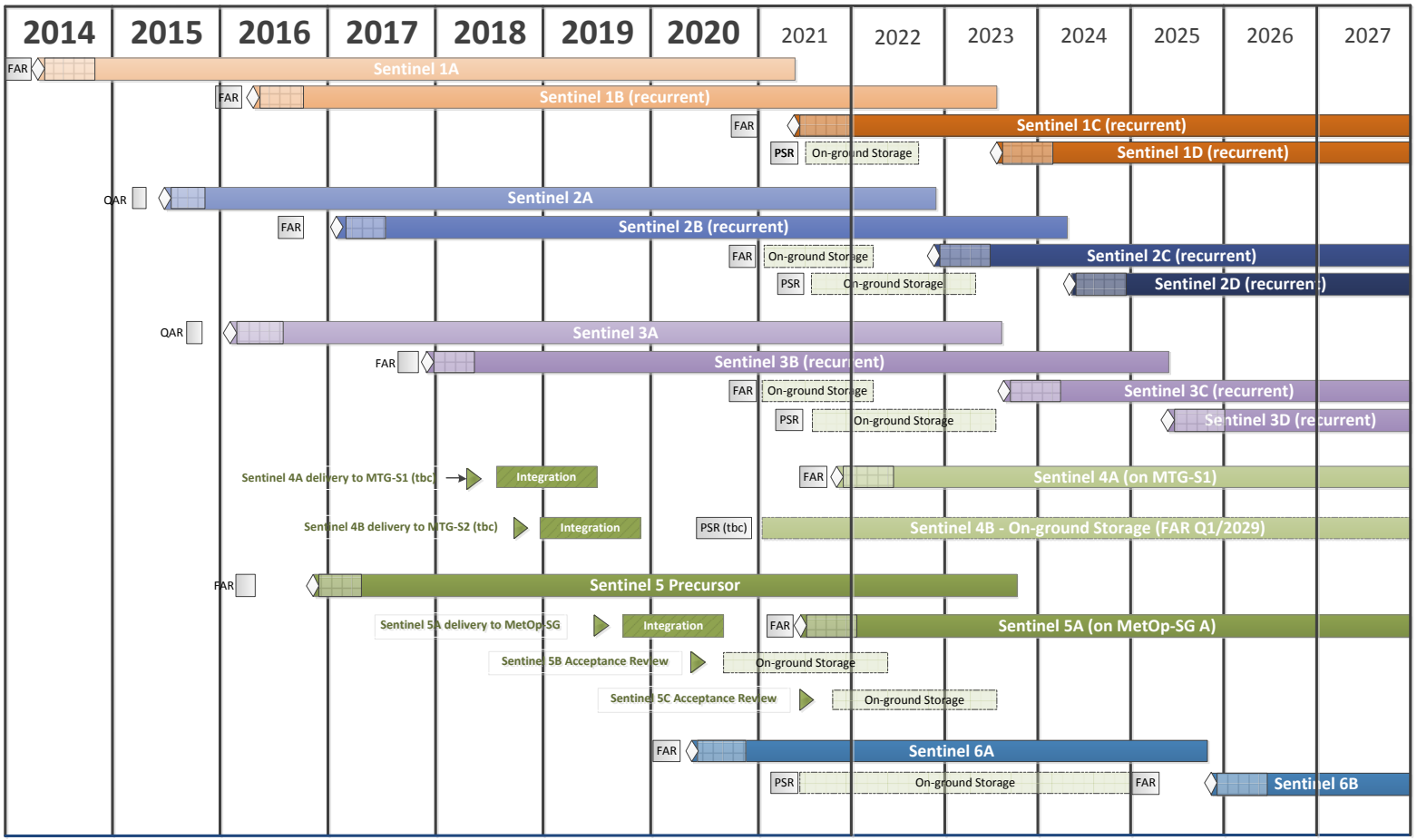
- Technical coordination of the Space Component
- Development and procurement of Copernicus Sentinel missions
- Coordination and procurement of Contributing Missions data
- Operations of S1, S2, S3 (land part), S5P

In-situ component not represented here

…plus other partners…

Sentinels constellation deployment schedule

Copernicus Constellation Deployment Schedule



Climate Change Initiative

esa

Papers on SST uncertainties
Submitted by SCL webmaster on Thu, 2016-03-31 10:42
The SST CCI project has produced three papers on various aspects of SST uncertainties, published in *Remote*
Estimating background error covariance parameters and assessing their impact in

Updated SST CCI Analysis
Submitted by SCL webma
The SST CCI Analysis pr
Compared to v1.0, inte
directly using the sea ic
e SST inputs as analysis v1.0.
corrected. For users not

SST CCI User Tools
Submitted by SCL webma
The ESA SST CCI project
coarser raster and the reg
generate an additional unc
f the SST data products to a
e uncertainty information and

SST video for COP21
Submitted by SCL webmaste
To coincide with COP21 in Pa
mate variables, including this one about sea surface temperature.

Very easy download of b CCI data
Submitted by SCL webmaster on Mon, 2015-06-29 11:53
If you want some of our data in the simplest possible form, head to our newRead more »

See Poster 40: REQUIREMENTS FOR SEA SURFACE TEMPERATURE DATA SETS FOR CLIMATE RESEARCH AND SERVICES

http://www.esa-sst-cci.org/

CEOS esa

fiducial reference temperature measurements

FRM4STS: Fiducial Reference ments for validation of Surfa tellites (cec

See Poster 10: AN ESA INITIATIVE TO ESTABLISH AN IN SITU REFERENCE FRAMEWORK FOR SATELLITE SST VALIDATION: FRM4STS

Aim
glob
satel
valida
and h
sustai

NPL National Physical Laboratory | Centre for Carbon Measurement

University of Southampton

Science & Technology Facilities Council

PTB

KIT Karlsruhe Institute of Technology

DMI

Working Group on Calibration and Validation

SI traceability: LCE (June 2016)

Necessary for all participants to assess biases to SI under Laboratory conditions **18 participants inc 2 from Australia**

ITS-90

50 – 325 K

acuum

for sky

e

NPL Rad (AMBER)

See Poster 29: DRIFTING BUOYS WITHIN THE ESA INITIATIVE TO ESTABLISH AN IN SITU REFERENCE FRAMEWORK FOR SATELLITE SST VALIDATION: FRM4STS

Rad 4

Rad n

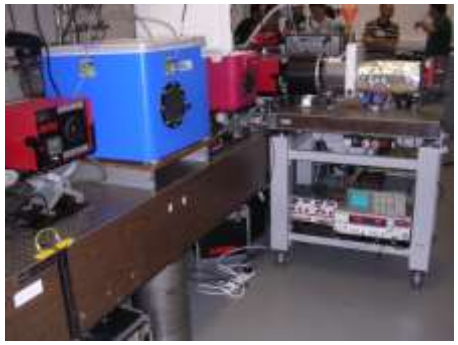
BB1

BB 2

BB 3

BB 4

BB n



Room Environment with variable T

Water Surface Temp (near NPL) (Jun/Jul 2016)

NPL National Physical Laboratory

The floating platform from which WST measurements are due to take place is in the middle of the Wraysbury reservoir. The depth of the reservoir is 20 m.

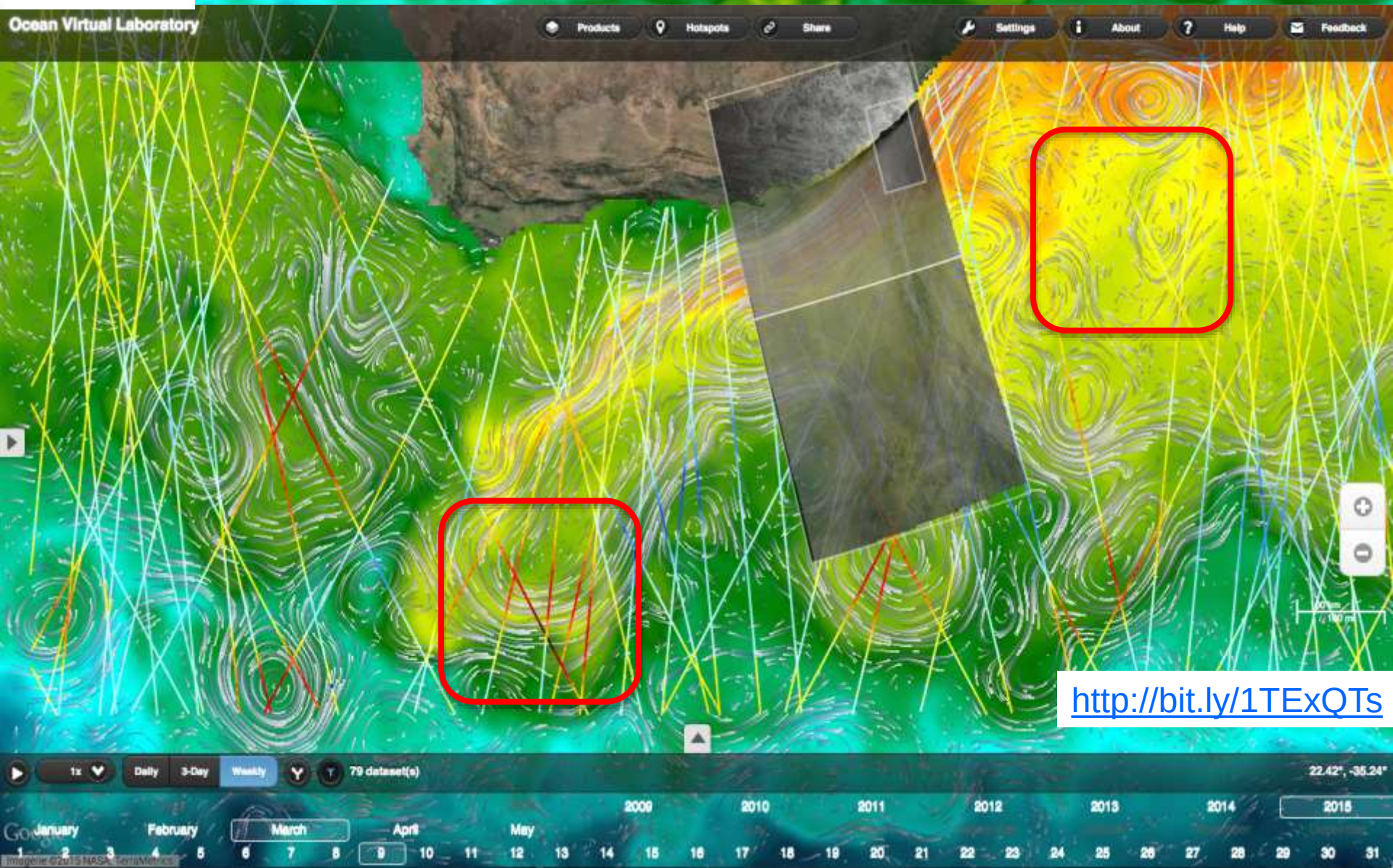
Ocean Virtual Laboratory

Ocean Virtual Lab

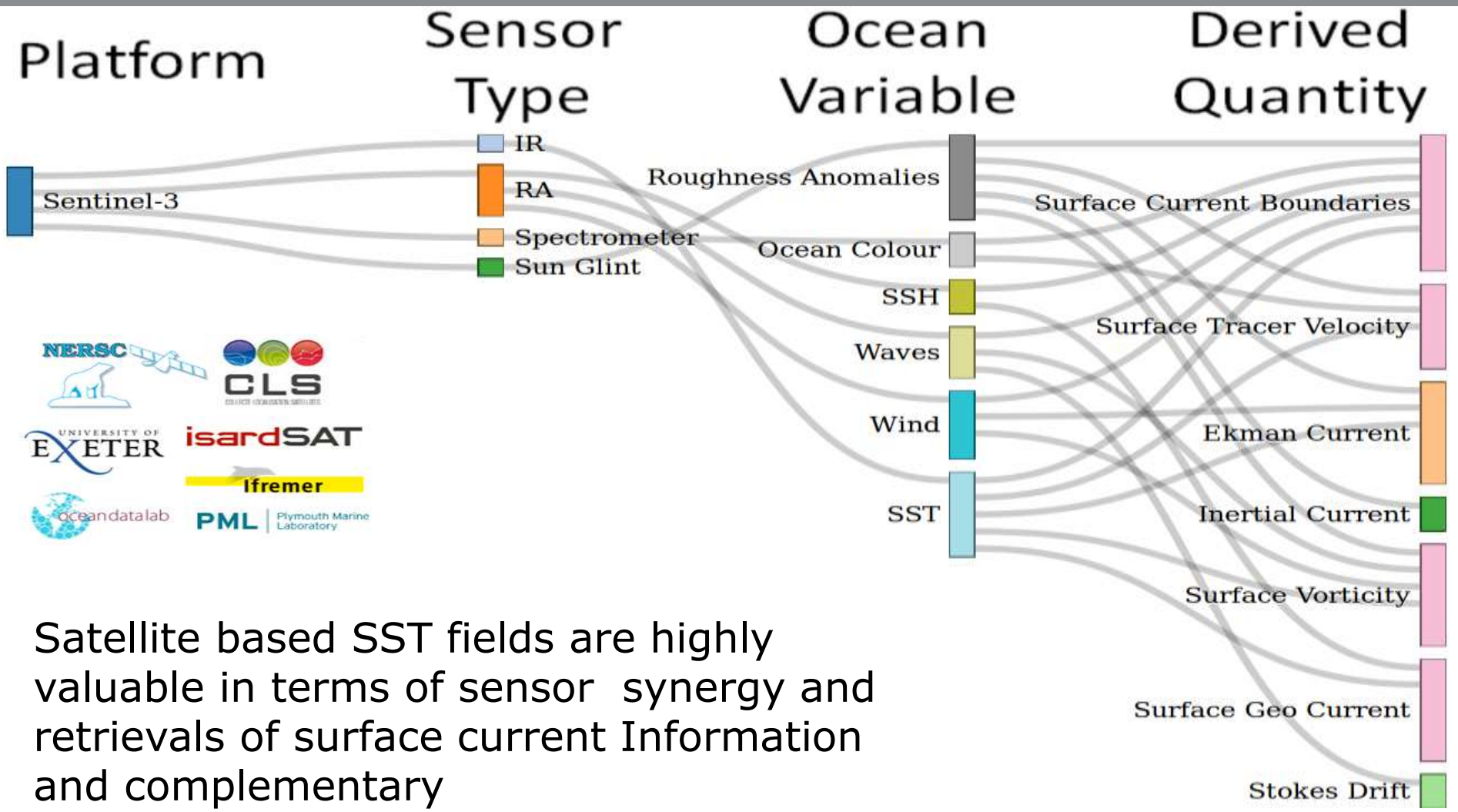
oceandatalab
making sense of the deep blue sea

seom
scientific exploitation of operational missions

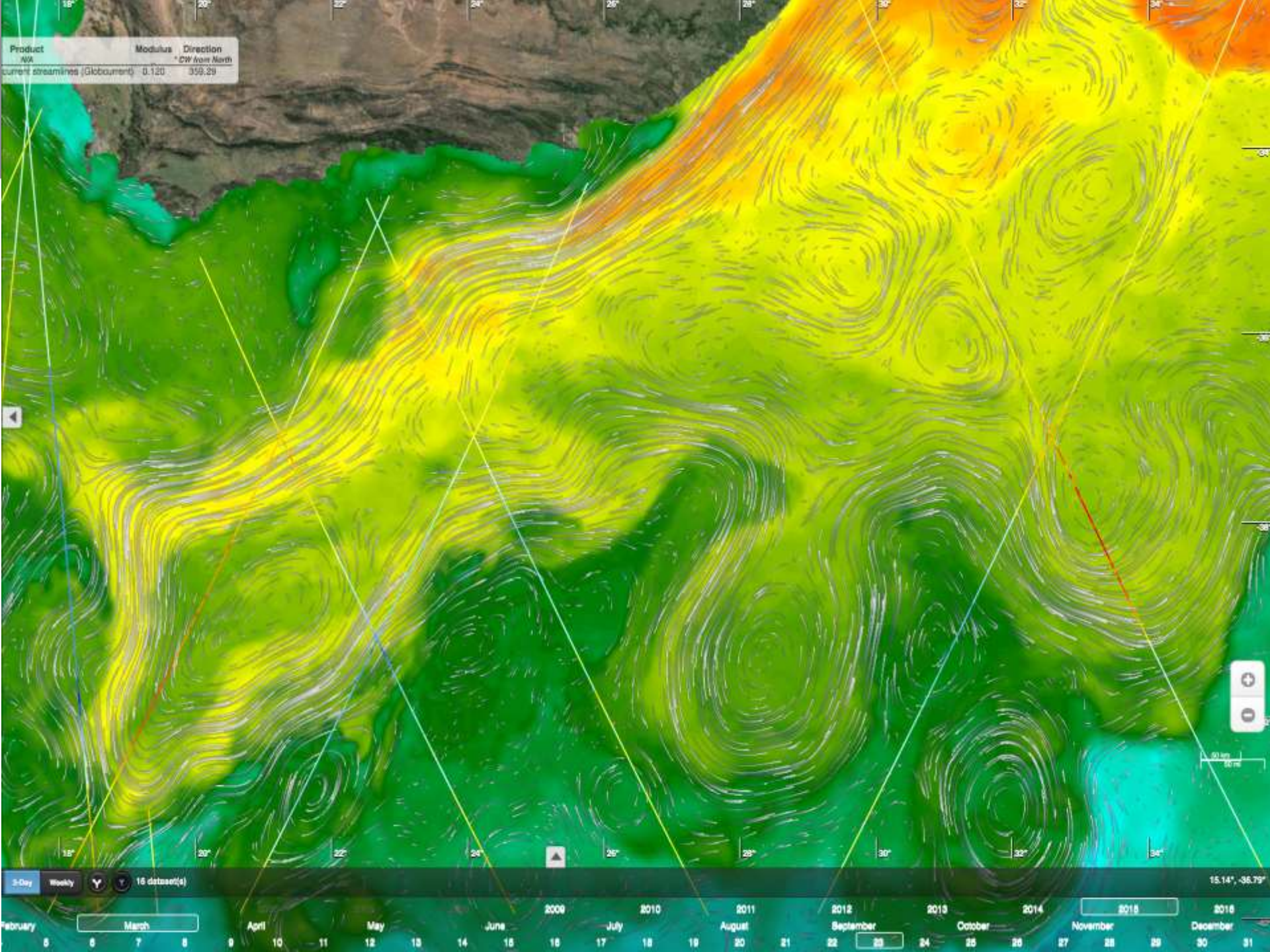
https://www.oceandatalab.com

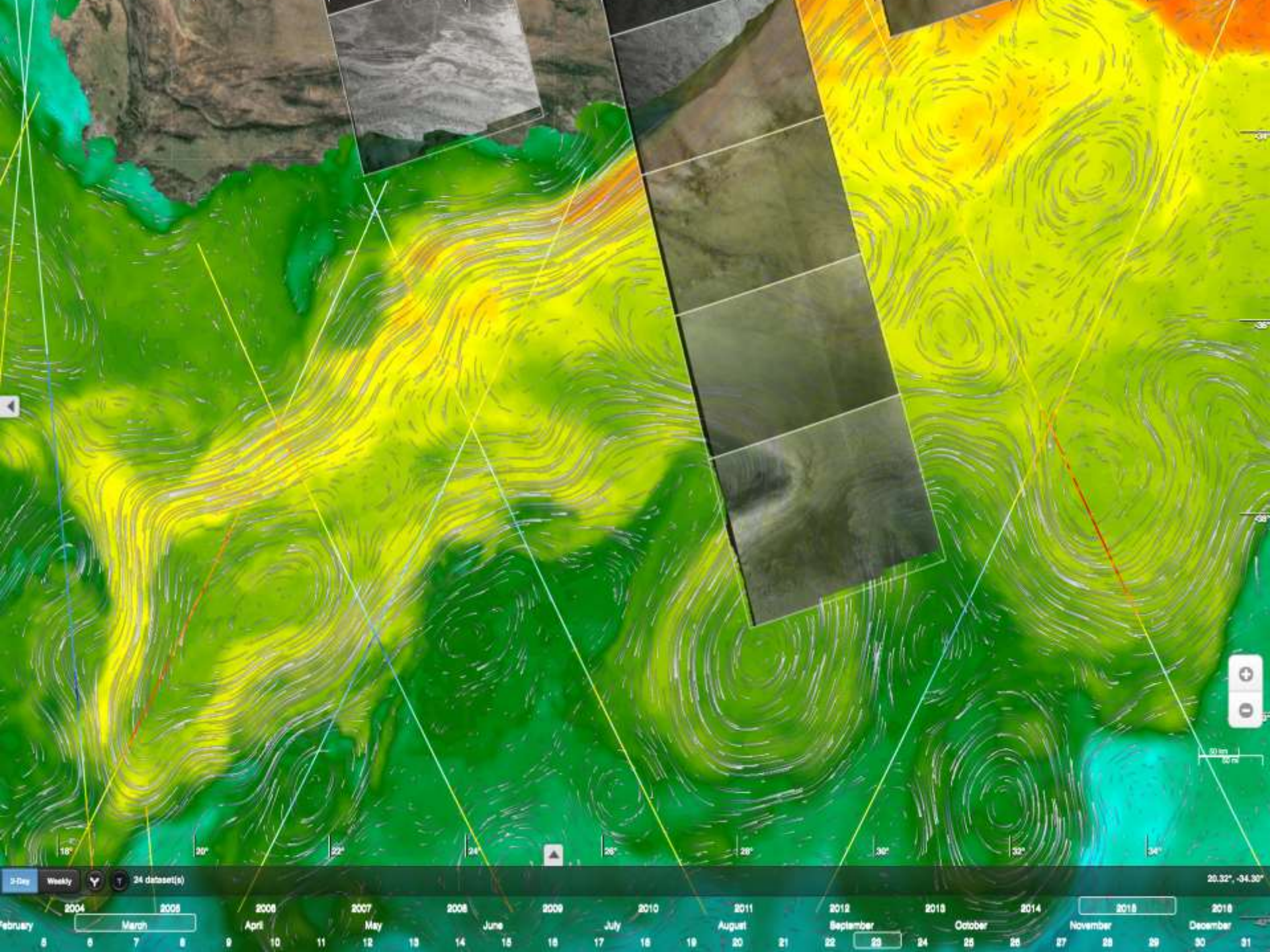


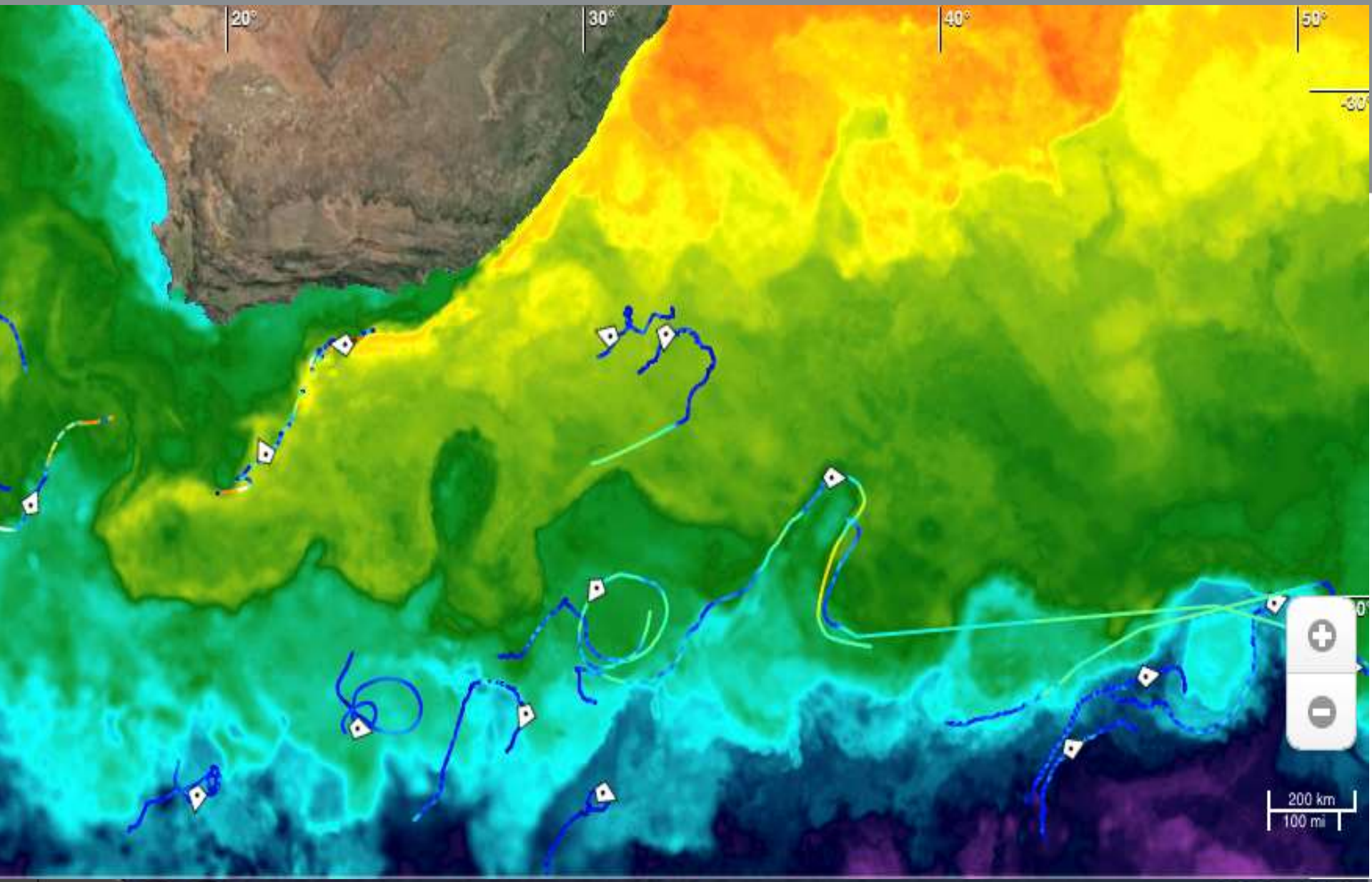
http://bit.ly/1TExQTs



Satellite based SST fields are highly valuable in terms of sensor synergy and retrievals of surface current Information and complementary derived quantities.

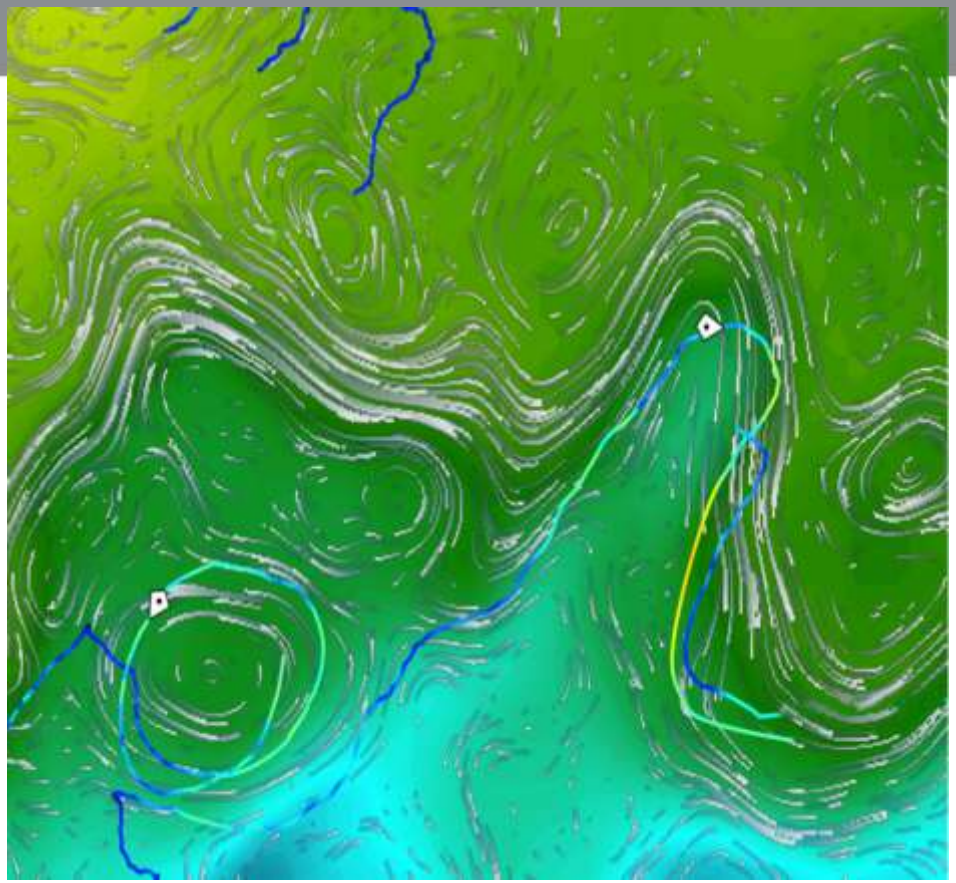

Product
Modulus
Direction
° CW from North
N/A
current streamlines (Globoumont)
0.120
359.29
15°
20°
22°
24°
26°
28°
30°
32°
34°
3-Day
Weekly
16 dataset(s)
15.14°, -36.79°
February
March
April
May
June
July
August
September
October
November
December
2009
2010
2011
2012
2013
2014
2015
2016

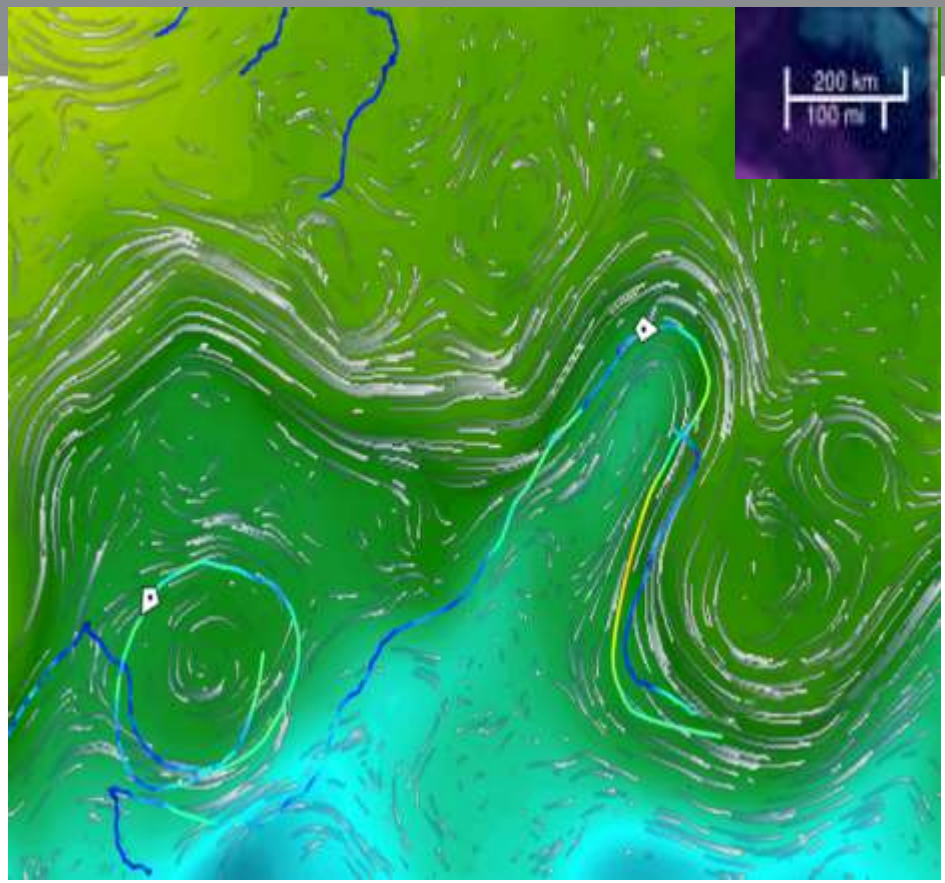

2-Day
Weekly
24 dataset(s)
20.32°, -34.30°
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
February
March
April
May
June
July
August
September
October
November
December
18°
20°
22°
24°
26°
28°
30°
32°
34°


20°
30°
40°
50°
-30°
200 km
100 mi
Weekly
1 dataset(s)
38.88°, -37.94°
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
April
May
June
July
August
September
October
November
December
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
-50°

24 April 2015, Uncorrected velocity field

24 April 2015, Corrected velocity field



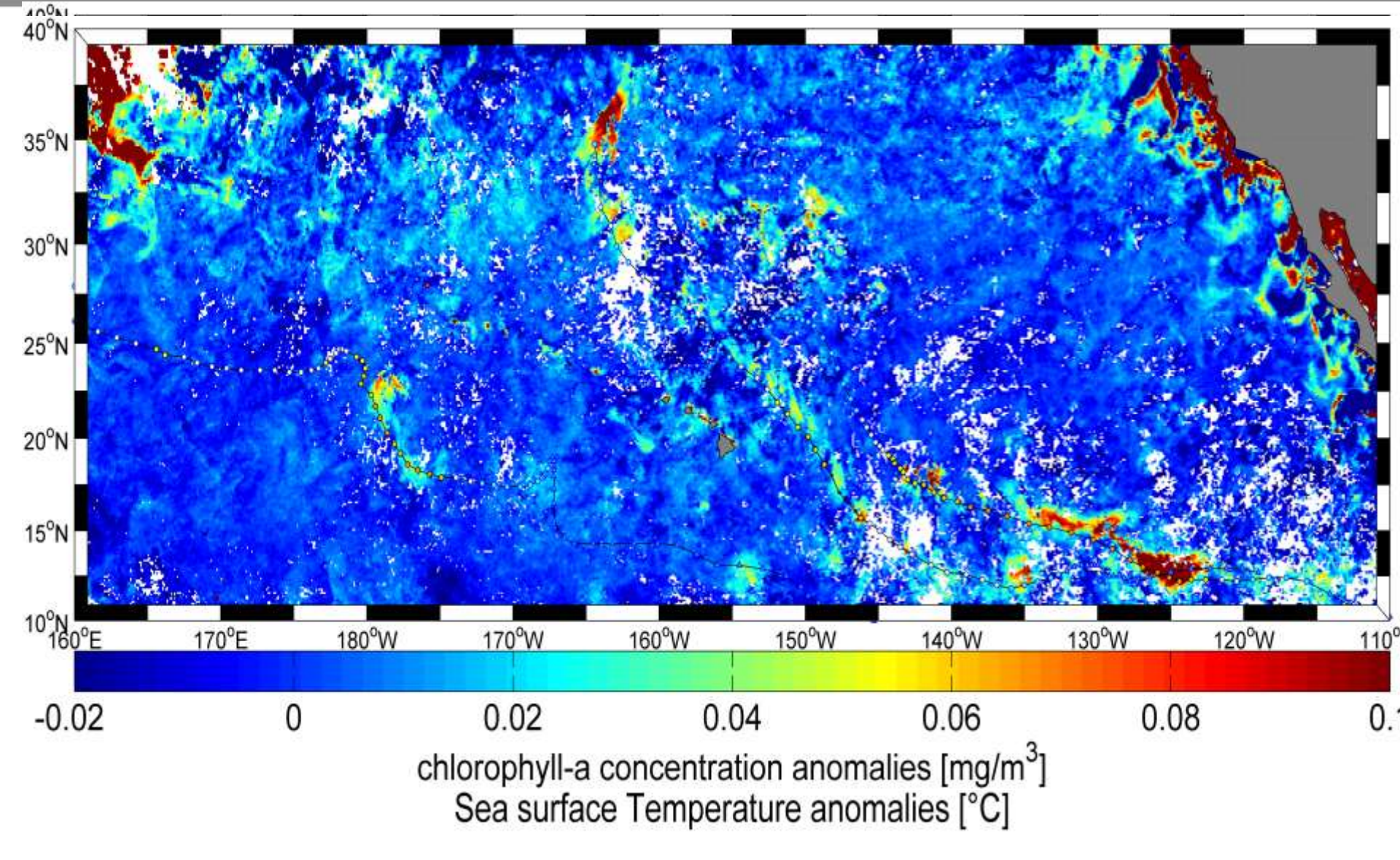


Streamlines of altimeter derived velocities overlaid microwave SST and drifters.

Streamlines of corrected velocities using SST plotted with microwave SST and drifters.

Courtesy Lucille Gaultier, OceanDataLab

SMOS+ STORMS: Air-sea interaction from space



→ 4472 FISH CAGES IN THE WESTERN MEDITERRANEAN SEA

Seabass & seabream cages, Cannes (France).
Pleiades image on 24/12/2011, CNES.

Example of mussels aquaculture on racks, Spain

Seabass & seabream cages, St Paul's Bay (Malta).
By Frank Vincentz, via Wikimedia Commons.

SST Medspiration 01/09/2015 (deg.C)

< 17.0	20.6	29.0
17.0	22.4	31
18.8	26.0	
19.5	27.8	

Cages detected, Sentinel 1

innovators smart

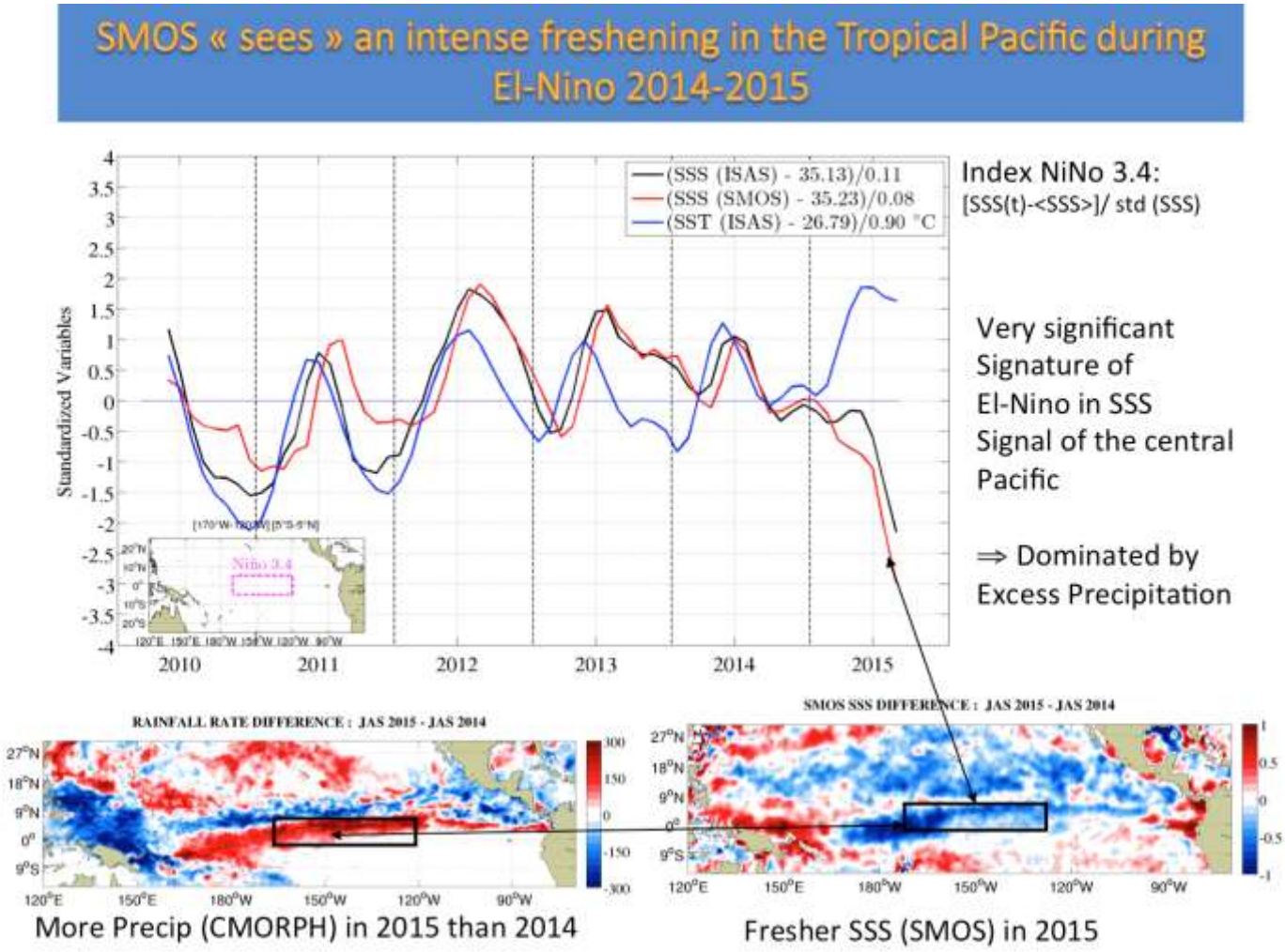
ACRI ST

BLUEFARM

www.smart-eo.eu

New Project: STSE SMOS Nino15 250KEuro

- ESA Support to GODAE OceanView Task Team for Observing System simulation Experiments (OSEVal-TT)
- ***Conduct an Observing System Experiment to assess the impact of satellite Sea Surface Salinity for the El Niño 2015/16 event.***
- ***KO in Q3 2016***



(credit: N. Reul, IFREMER)

OceanFlux and Workshop

- Global CO2 air-sea flux Climatology
- Paper accepted on how to handle temperature for pCO2 fluxes
- FluxEngine is still active
- Final Workshop
- 75 abstracts submitted,
- 110 people have already registered!

profiles in the water column and changes in the aqueous concentration act primarily through the partitioning of the carbonate system. Climatological calculations of flux require attention to variability in the upper ocean and to the limited validity of assuming "constant chemistry" in transforming measurements to climatological values. Contrary to some recent analysis, it is shown that the effect on CO_2 fluxes of a cool skin on the sea surface is large and ubiquitous. An opposing effect on calculated fluxes is related to the occurrence of warm layers near the surface; this effect can be locally large but will usually coincide with periods of low exchange. A salty skin and salinity anomalies in the upper ocean also affect CO_2 flux calculations, though these haline effects are generally weaker than the thermal effects.

Sentinel-3

Sentinel-3a launch from Plesetsk Cosmodrome 16th February 2016

(Credit: Antero Isola)

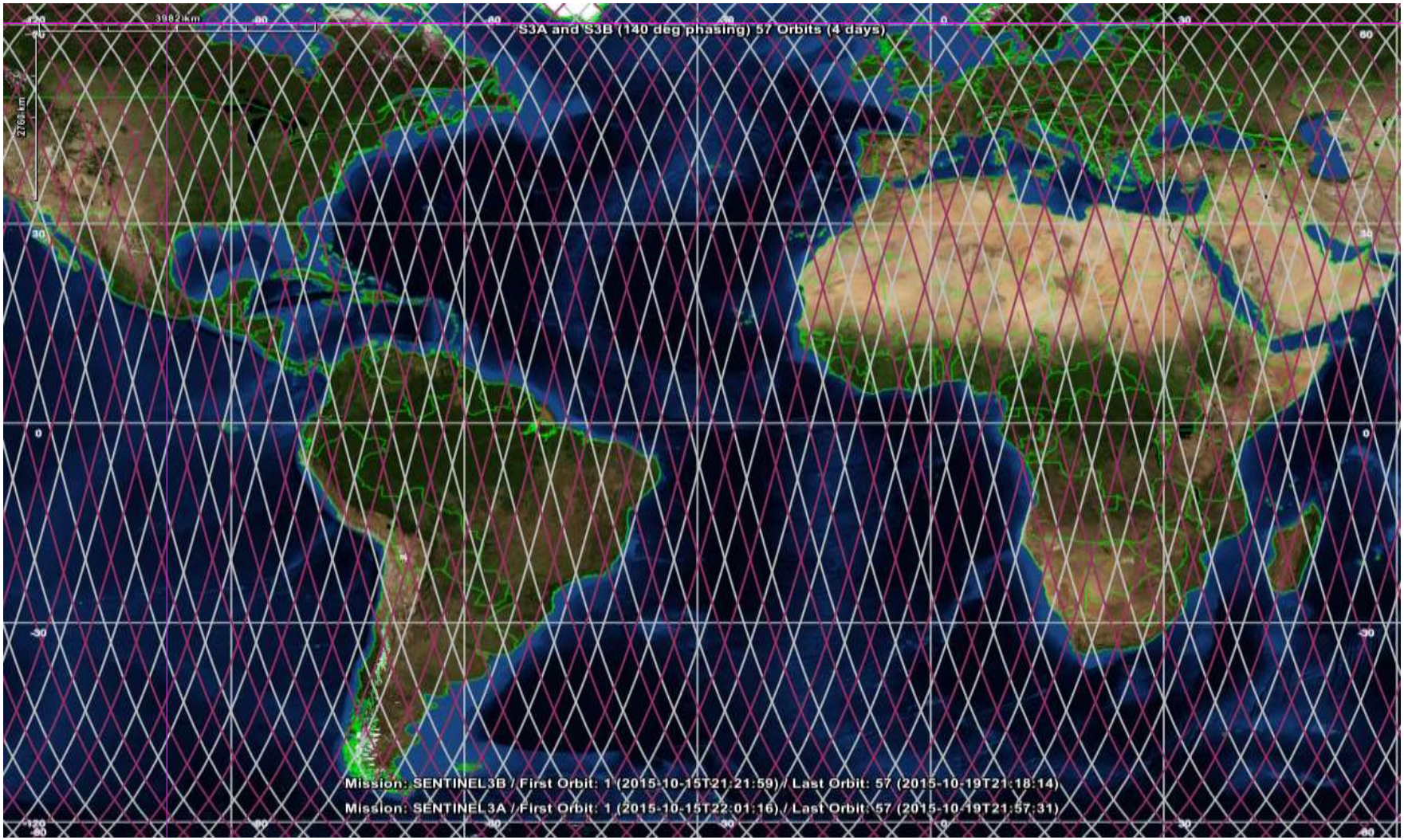
Current status of Commissioning

Spacecraft and all instruments in nominal operational mode and functioning well.

Weekly mission status on https://sentinel.esa.int/web/sentinel/missions/sentinel-3/mission-status

16 Feb	Successful Launch
18 Feb	LEOP phase concluded successfully in 47 hrs, thanks to ✓ Perfect orbit injection from the launcher ✓ Rapid and smooth Solar Array deployment ✓ No need for collision avoidance manouvre ✓ Only one minor anomaly encountered (Star Tracker depointing due to incorrect quaternion data), rapidly identified and corrected
26 Feb	Platform In-Orbit Verification completed
4 March	Payload In-Orbit Verification completed ✓ Sentinel-3A already flying in its reference orbit ✓ All instrument ON and operating (except SLSTR in decontamination mode, as planned) ✓ Level-0 products being generated
7 March	Cal/Val Phase of S3 commences
April/May	**Mid-Term-Reviews for OLCI, SLSTR and SRAL,** ✓ Confirming functionalities and key performance of all Instrument ✓ Authorising release of first data/products to expert users

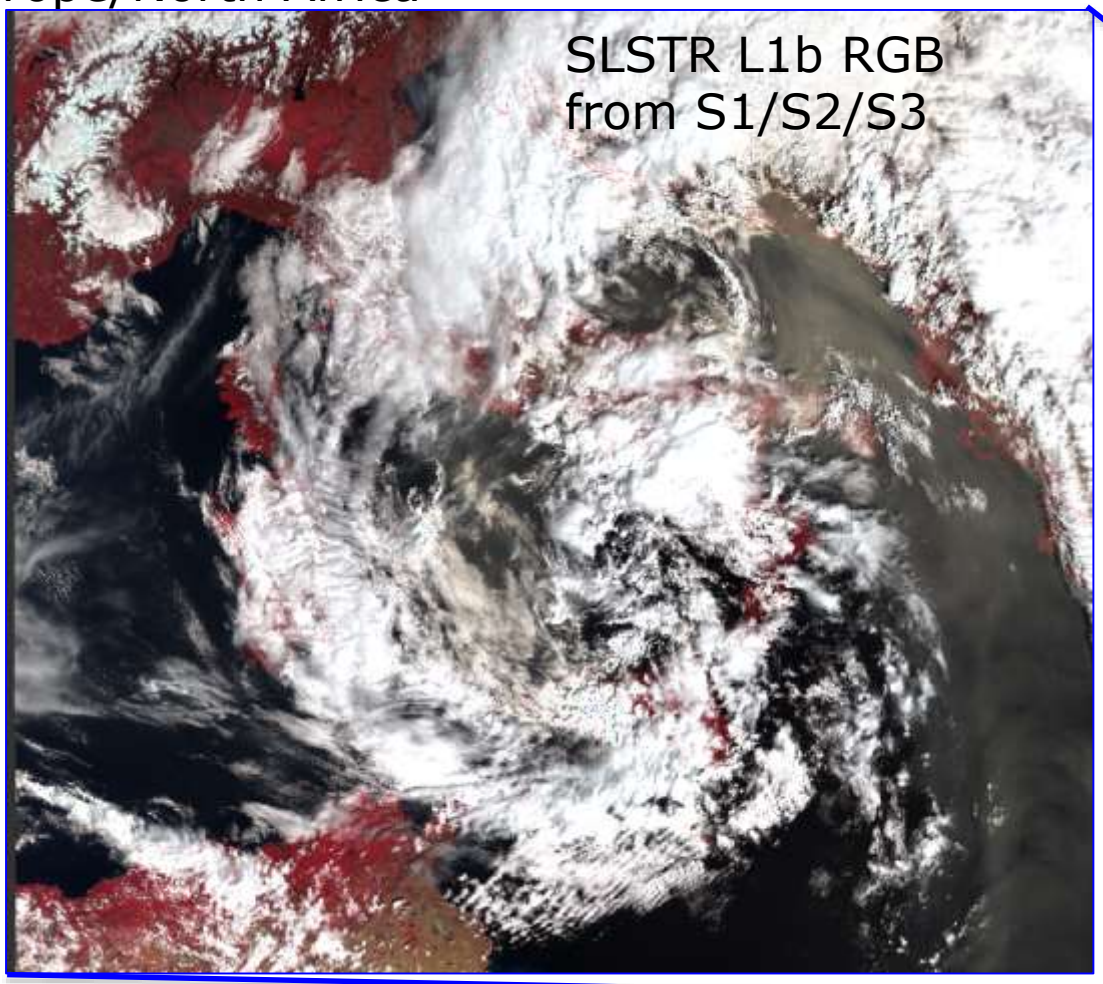
Optimising the Constellation: Sentinel-3B phasing to 140˚ (instead of 180˚) after 4 days

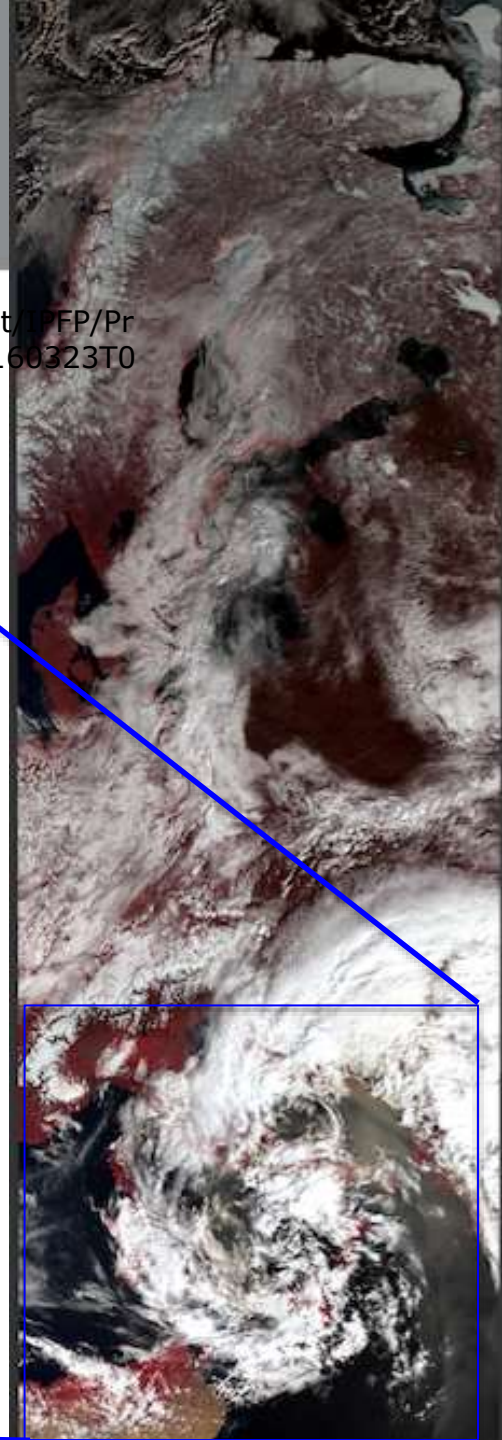


SLSTR IR channels switch on 23-Mar-2016

Sentinel-3 SLSTR First IR Image over Europe/North Africa

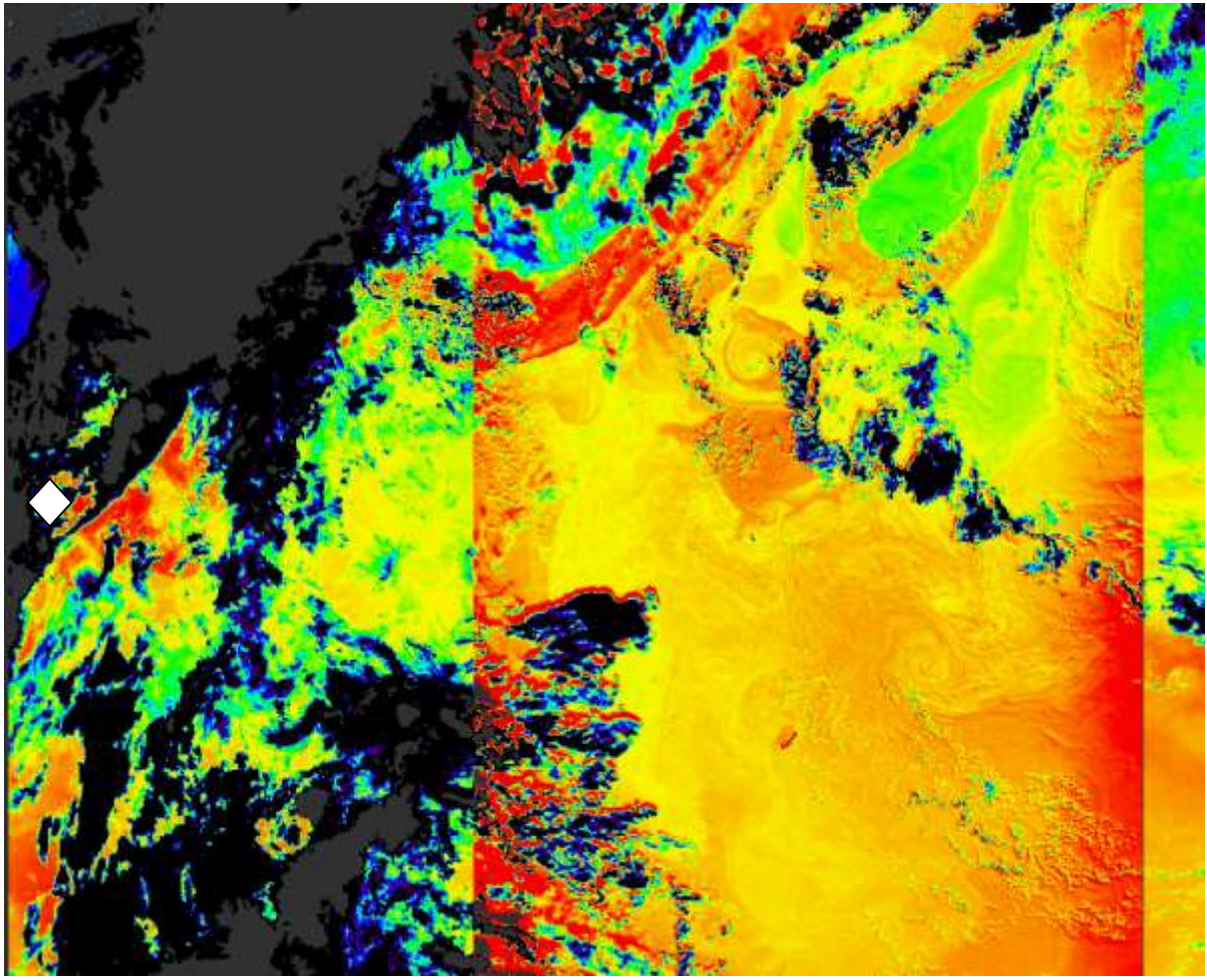
ftp://s3a-commteam@commissioning.sentinel3.esa.int/Output/IPFP/Products/LI_005_ROI_Europe/20160323T091429_20160323T092523





Sentinel-3 L2P SST

- SLSTR data are provided in GHRSST L2P format
- "Best" available SSTs so uses dual-view and Nadir only SST's in the same product
- Ground Segment and product verification progress with full operational capability in ~8 months
- **See ESA and EUMETSAT posters on early performance of SLSTR on orbit and initial L1 and L2**



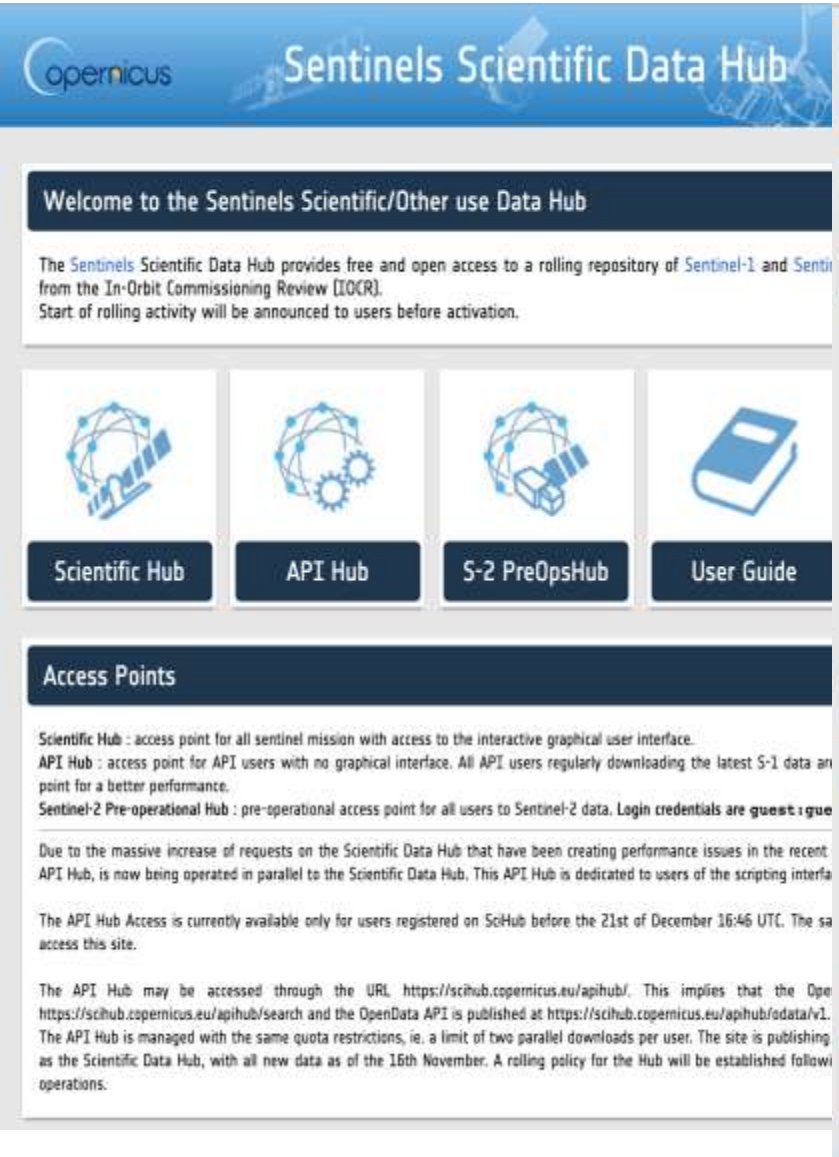
Sentinel data

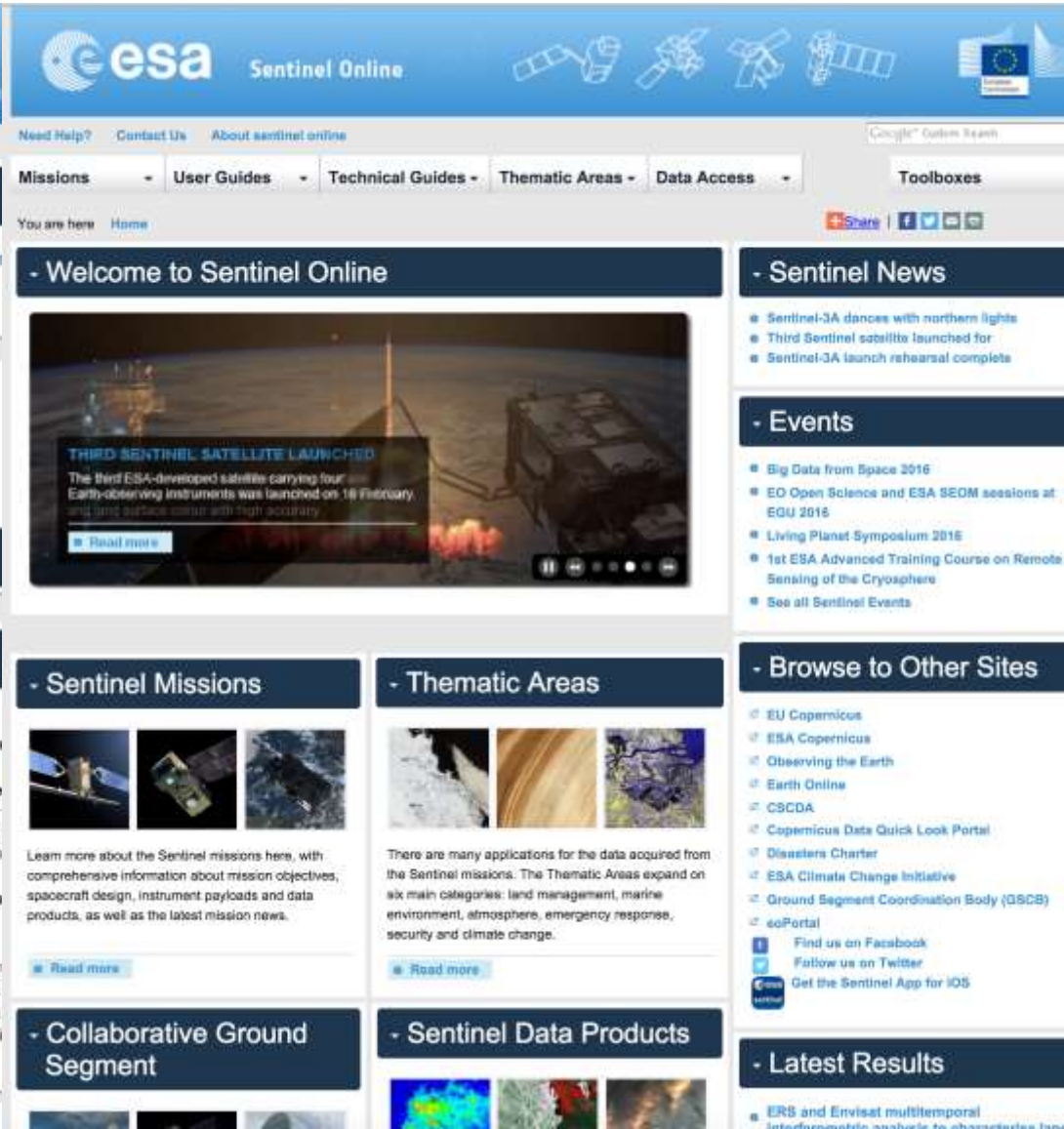
Sentinel data are available:

- ❑ **Open and free**
- ❑ **Over very long term**
- ❑ **Systematically, in an operational fashion**

Open and Free data access policy

https://sentinels.copernicus.eu
https://scihub.copernicus.eu/





Sentinel data access tools @ ESA

Data Hub Web graphic Interface
http://scihub.copernicus.

APIs interface: scripting for automatic data

SNAP Sentinel toolbox

Data Hub Server available as open source software

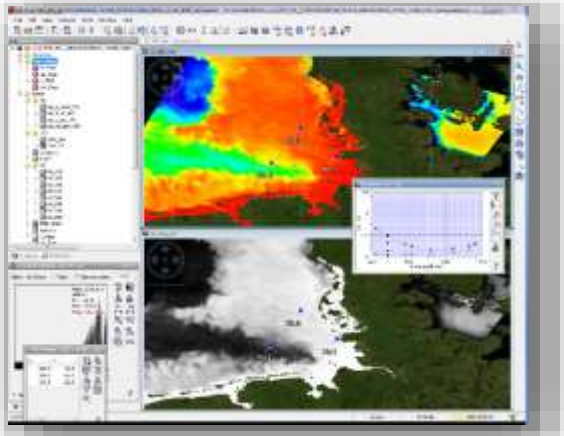
https://github.com/SentinelDataHub/DataHubSystem

Sentinel Toolbox available as open source software
https://github.com/senbox-org

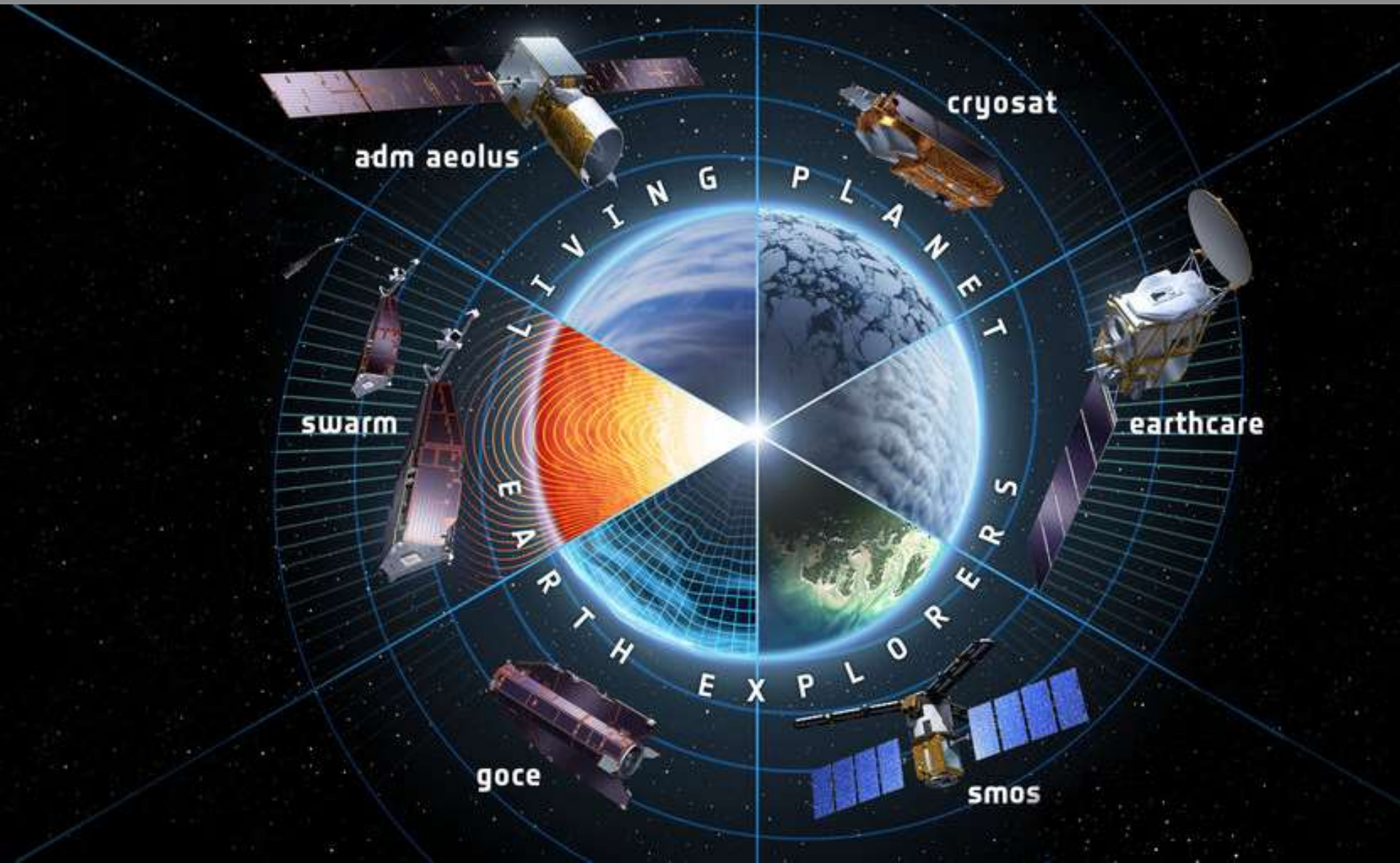
Sentinel-3 Toolbox:

- Visualisation & processing of **Sentinel-3 OLCI and SLSTR data** and other optical data
- Uncertainty visualization and exploitation
- Remote in-situ database access
- Synergistic use of OLCI and SLSTR
- Various OLCI and SLSTR data processors

http://step.esa.int/

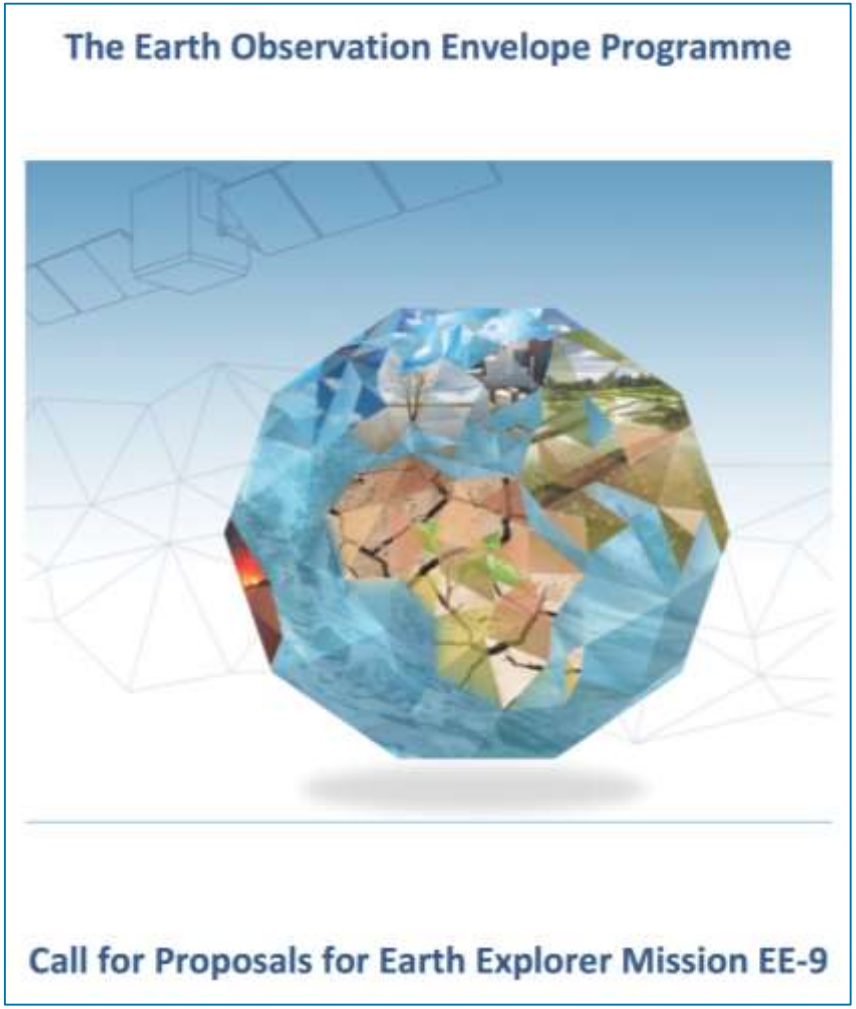


Earth Explorer 9 Call for new Missions



Earth Explorer 9 Call for new Missions: Now open at http://explorercall.esa.int

- Respond with new missions that scientifically address ESA's new Earth Observation Science Strategy, its key elements and strategic science goals
- Maximum industrial cost of 120M€ (at 2016 ec.) for the space segment and mission specific ground segment excluding launcher, operations, generic ground segment, level 2 processor and ESA internal costs.
- 31 Letters of intent and proposals due by 24th June 2016
- C-band Passive microwave radiometers are competing.



GHRSST Project Office (GPO)

- The GPO remains a cornerstone of the GHRSST activity
- It is the glue that keeps GHRSST together on a day-to-day basis
- Challenging job!
- ESA maintains funding at this moment
- Will be shared by EUM next year
- **A Director Role is required**

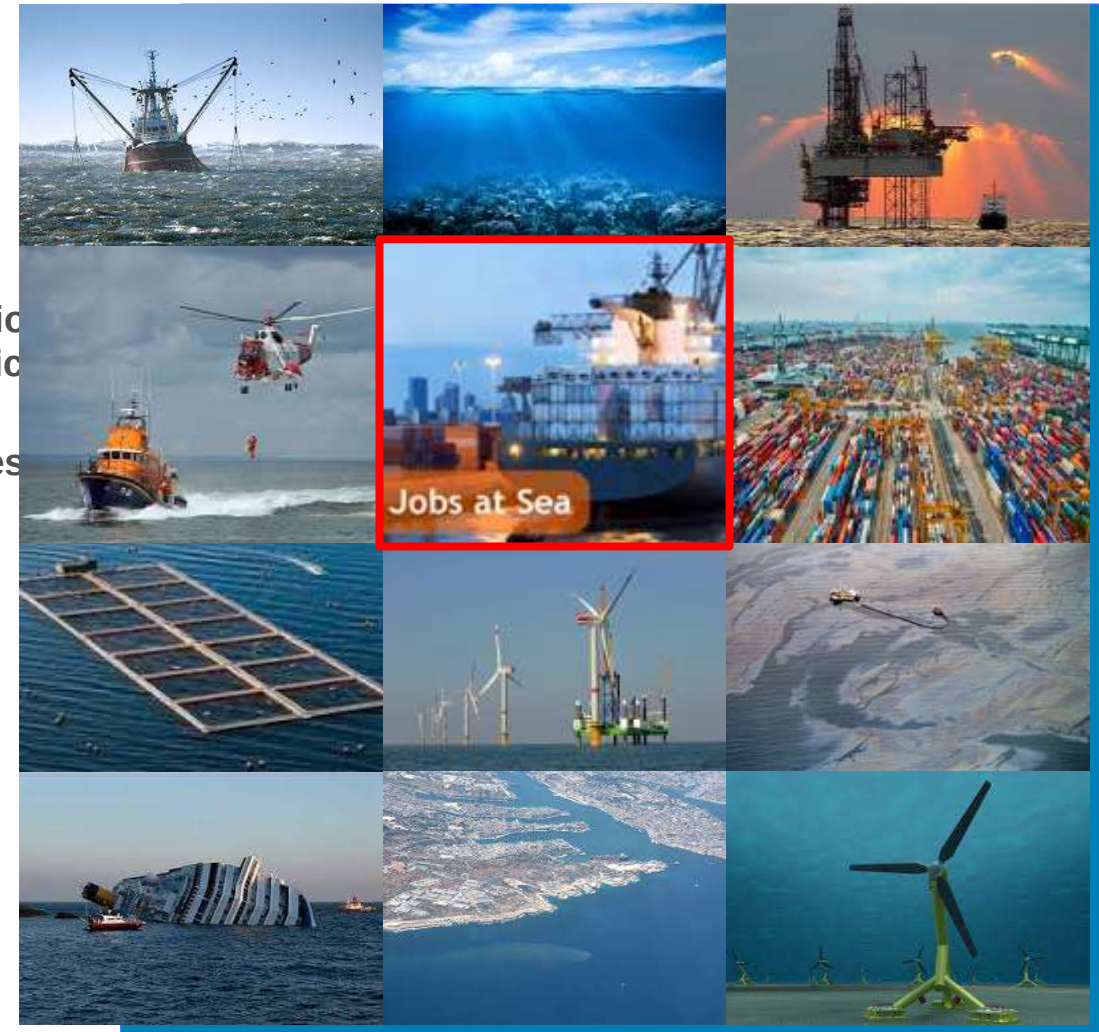
A new Statement of Work is being developed now – **please talk to Gary, Anne and Craig if you have specific comments to help the GPO provide the best support to your GHRSST activities.**

GHRSST and the Science Team is an ambassador for SST in applications

We need to demonstrate the impacts of our SST products
With the end –user communities
Suggest a GHRSST User Applications Workshop in 2017?

User Communities…

- Shipping
- Aquaculture and fisheries
- Offshore energy
- MetOcean Services
- Oil and Gas Industries
- Numerical Weather Predictio and Numerical Ocean Predic (NWP/NOP)
- Coastguard, Search and Res (GMDSS)
- Maritime Pollution services
- Ports and Harbours
- Hydrographic survey
- Insurance Industry
- Offshore sailing
- Ice Services
- Local authorities
- Government
- Space Agencies
- Defence agencies



Sentinel-3a launch from Plesetsk Cosmodrome 16th February 2016

Thank you - any questions?

For more information http://www.esa.int

Contact: craig.donlon@esa.int