

# Medspiration and SST activities at Ifremer

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**Olivier Arino & Craig Donlon**, European Space Agency

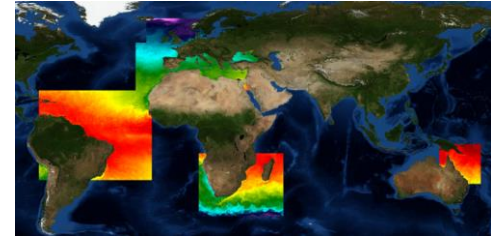
[jfpiolle@ifremer.fr](mailto:jfpiolle@ifremer.fr)

# Medspiration Evolution

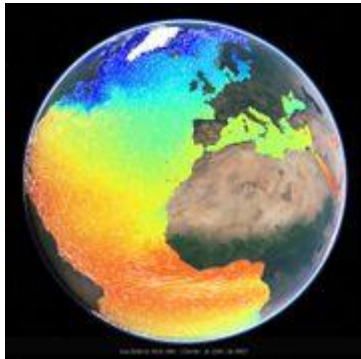


Foster on Medspiration assets to reach further user community

Sustain and develop new products

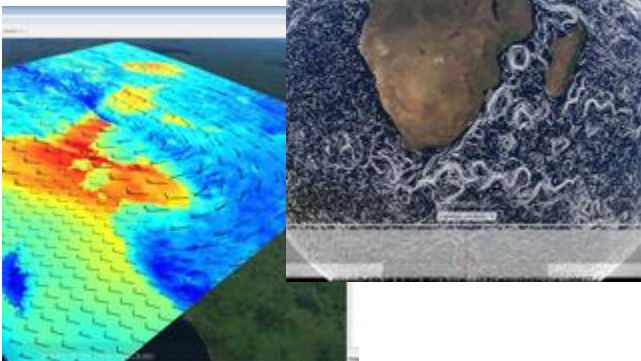
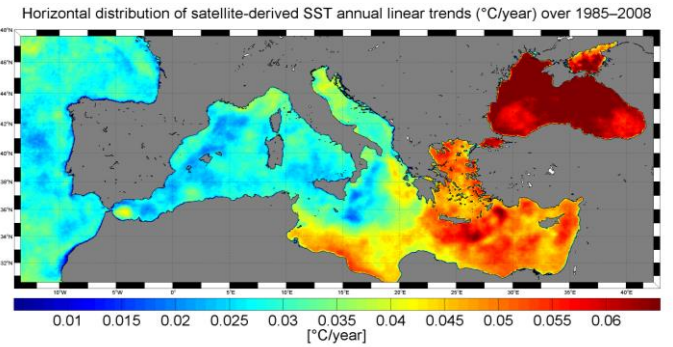
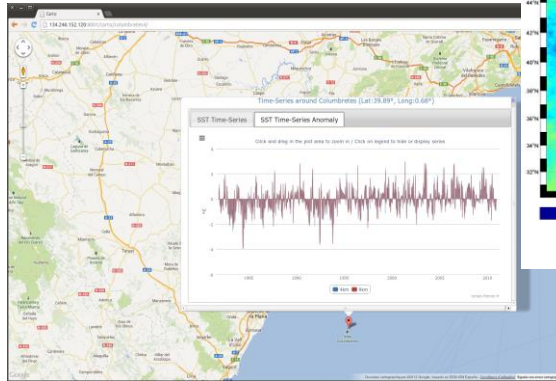


Outreach



User applications

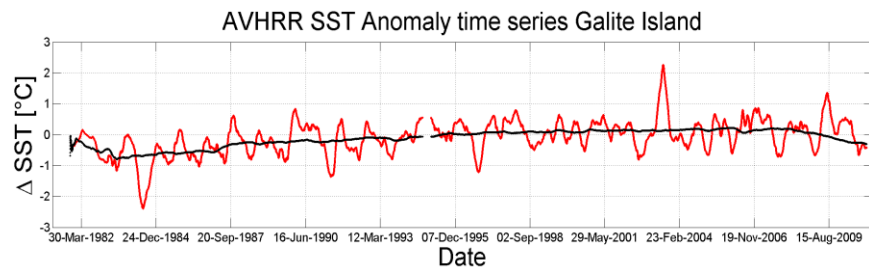
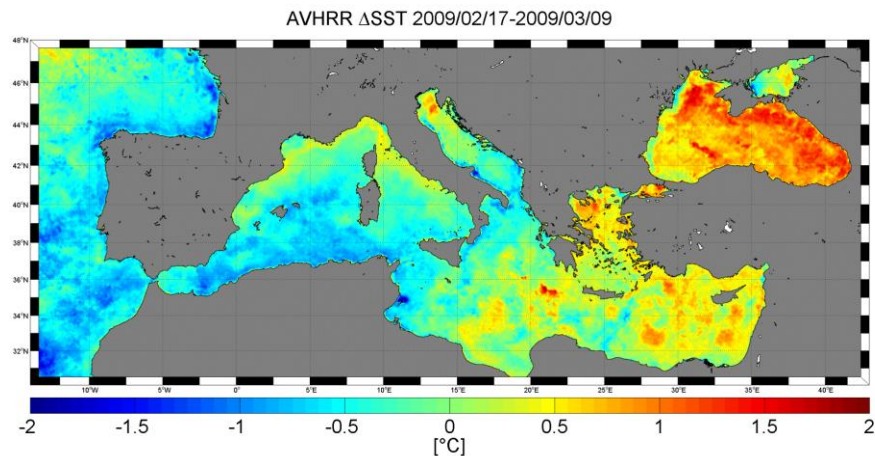
Analytics



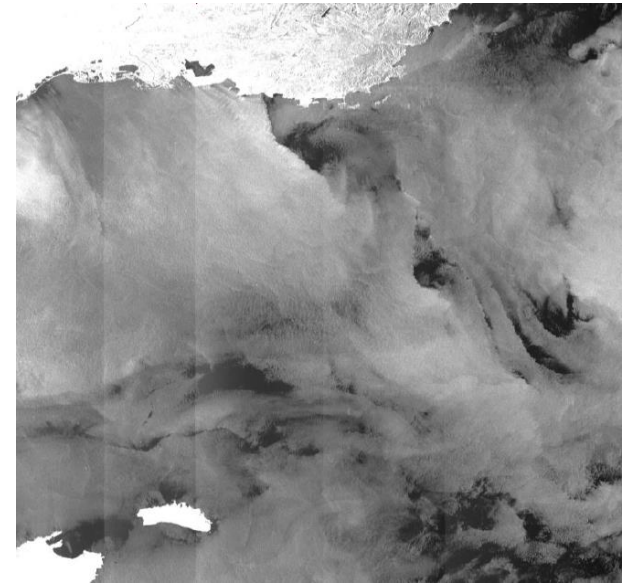
# Medspiration Evolution Applications



Local and regional indexes of the  
Mediterranean Sea warming

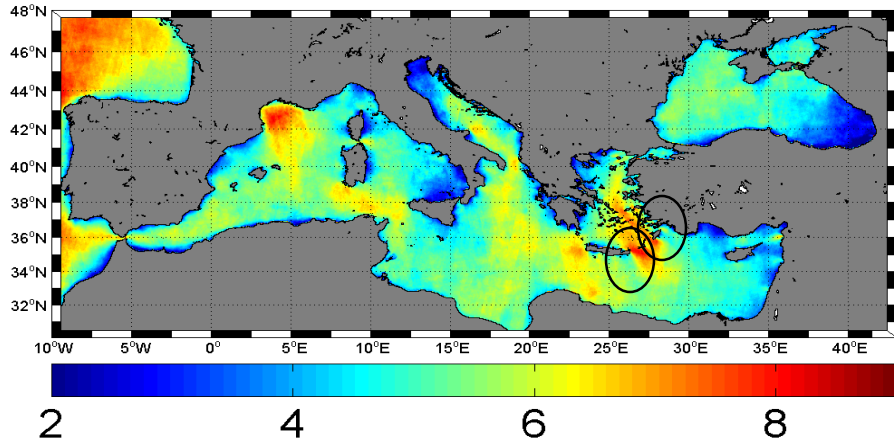


Interactions between sea surface  
temperature and strong atmospheric  
events (High Evaporation and  
Precipitation Events and cyclogenesis)

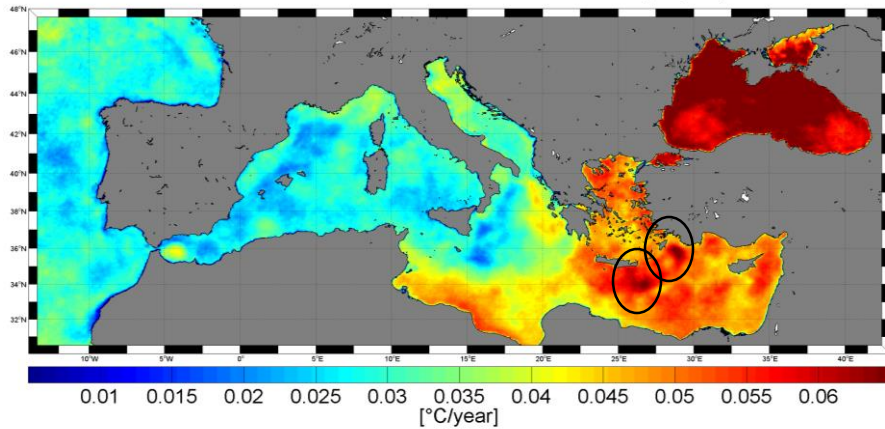


**Dedicated user consultation to be organised around each thematic**

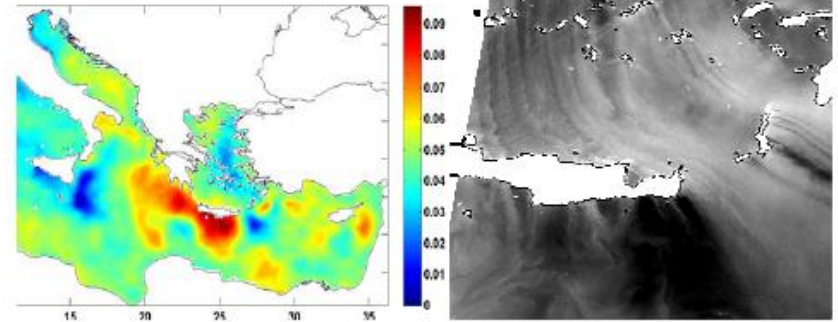
# Medspiration Evolution Applications



Horizontal distribution of satellite-derived SST annual linear trends (°C/year) over 1985–2008



Highest warming Rates found in the Lee of Crete & Rhodes

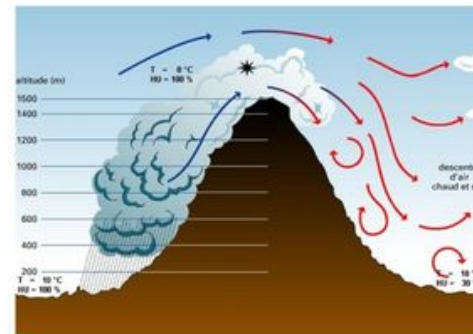


## L'Effet de Föhn au passage d'un relief

C'est un vent froid et humide qui devient chaud et sec au passage d'un relief

En amont, l'air est soulevé, se refroidit, se condense. Un nuage se Cree .

Il pleut sur le versant au vent, la quantité d'eau dans le nuage diminue, de la chaleur se libère.



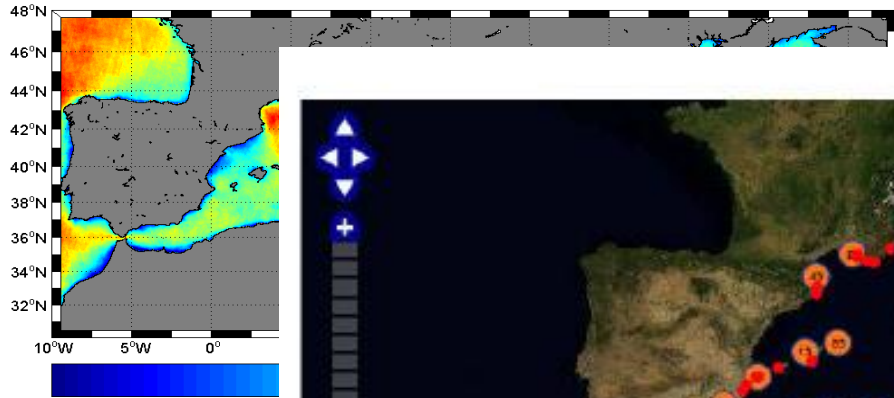
De l'autre côté de la montagne (sous le vent), l'air redescend, plus sec (les gouttelettes d'eau s'évaporent et le nuage disparaît). On assiste également à un réchauffement notable.

Cet effet de Föhn est observé au pied des Pyrénées (par vent de sud à sud-ouest), sur l'Alsace (par vent d'ouest à sud-ouest) ou encore sur la côte méditerranéenne (par vent de nord à nord-ouest).

© Alain Morel

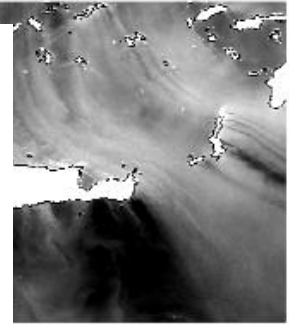
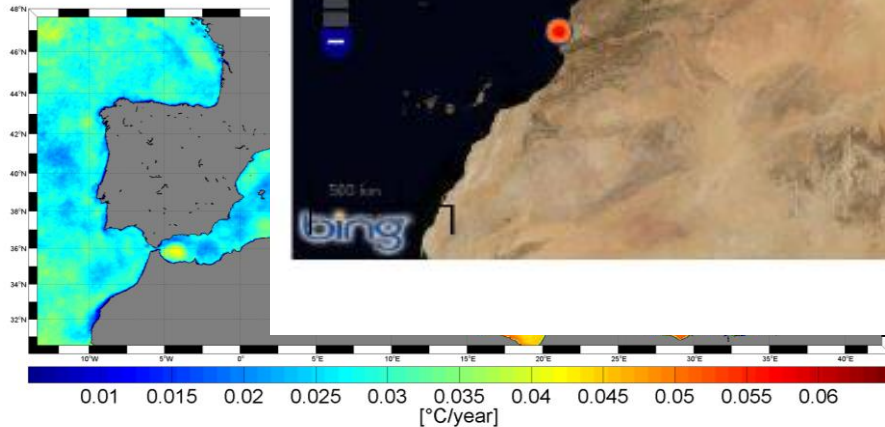
Need to investigate high resolution time series for local effects

# Medspiration Evolution Applications



2

Horizontal distribution of s



## f'un relief

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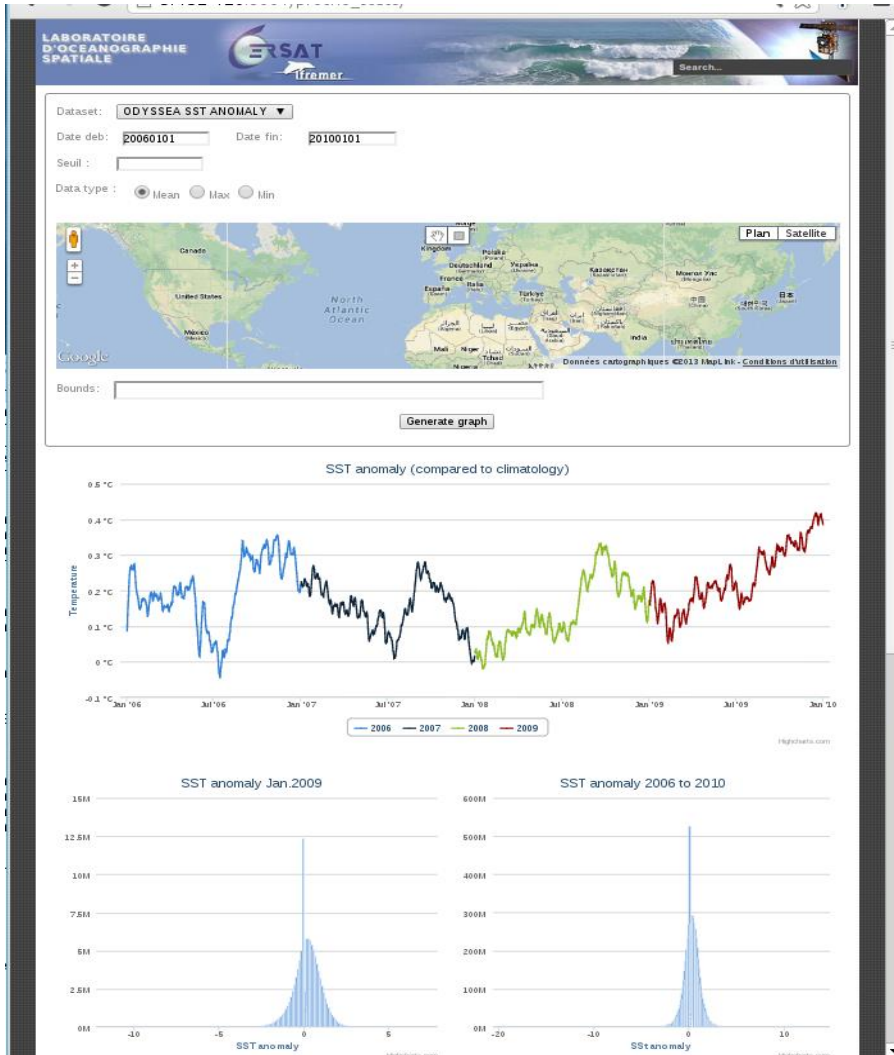
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© Alain Morel

Highest warming Rates found in the Lee of Crete & Rhodes

Need to investigate high resolution time series for local effects

# Analytics



Tools are required to investigate the content of large datasets, to detect trends, patterns and teleconnections

+

New technologies allow fast processing of large volumes

• An online datamining application will be provided to support user community

- ✓ Selection of area, time frame and indicators
- ✓ Multi variate cross analysis
- ✓ Occurrences and distribution of patterns through histograms, time series, trends, heat maps,...

• Distributed processing using Hadoop framework allowing easy scaling of processing over multiple nodes

Fostering on new technologies allows to focus on science alleviating the scientist from programming & processing time issues

# Medspiration Evolution

## Regional products

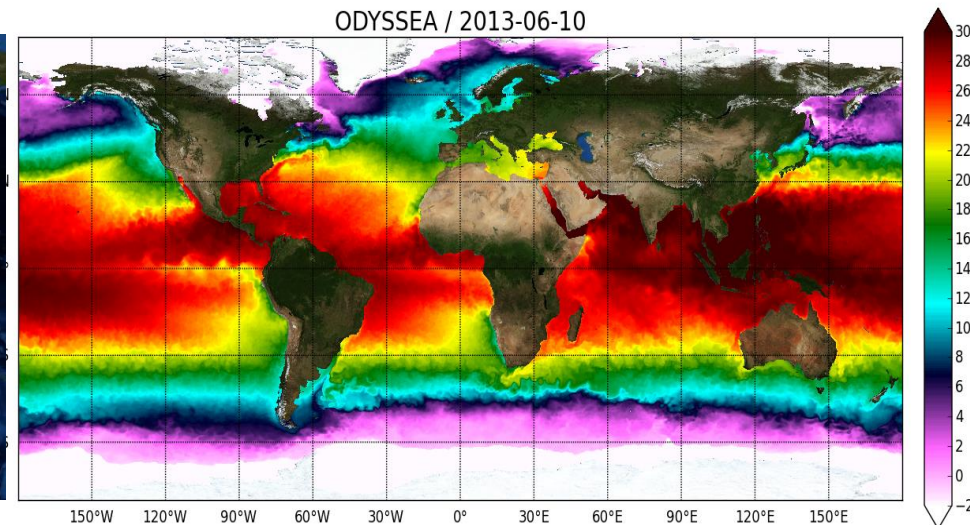
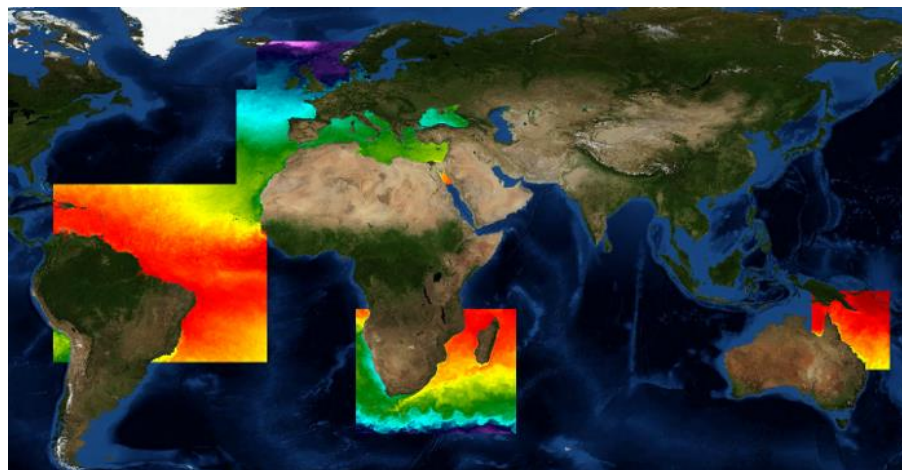
Ultra-high resolution (2km), daily, gap free, multi-sensor merged maps of SST in support to user requests :

- ✓ Mediterranean Sea, reprocessed since 2006 (being extended to 2001, then 1991)
- ✓ South-Africa,
- ✓ N-E Australia,
- ✓ E Tropical Atlantic (Brazil)

available the next day before 12:00

**New product** : Ultra-high resolution 2km analysis

- ✓ Motivated by different user requests
- ✓ Use the same methodology as regional products, applied to global scale
- ✓ Will be processed in NRT + one year backlog
- ✓ Replacing eventually regional products
- ✓ Available 4th Quarter 2013

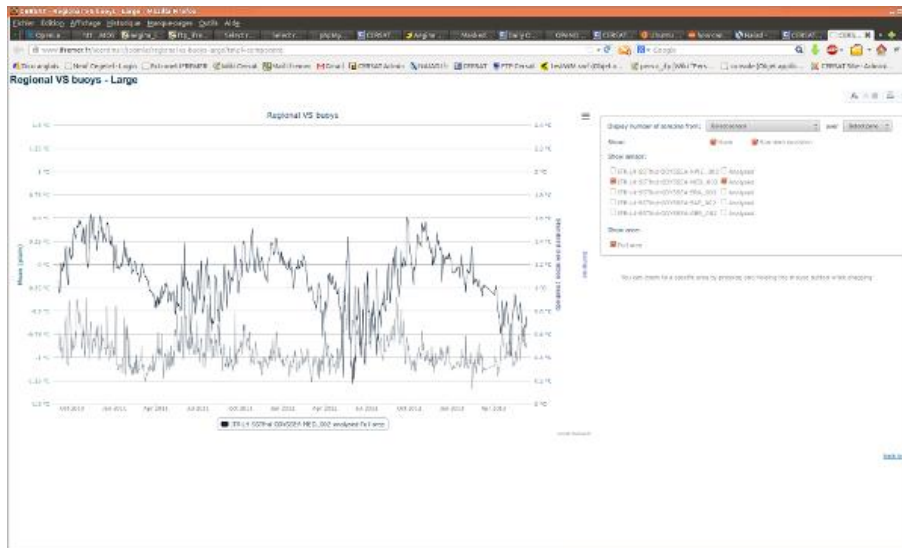


# Medspiration Evolution

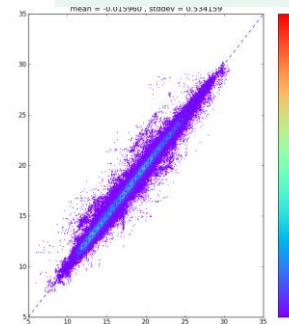
## Regional products



Data quality is assessed and monitored though daily updated comparisons with drifting buoys



	Mean	Std dev
Mediterranean	-0.058	0.57
Mediterranean (reprocessing)	-0.016	0.53
Brazil	-0.14	0.41
Australia	-0.079	0.525
South-Africa	-0.051	0.717



<http://www.ifremer.fr/vcerdmz1/joomla/data/products/cal-val/myocean-sst-qc>

### Access

Data are accessible through FTP, OpenDAP, WMS

Static and dynamic visualisation available

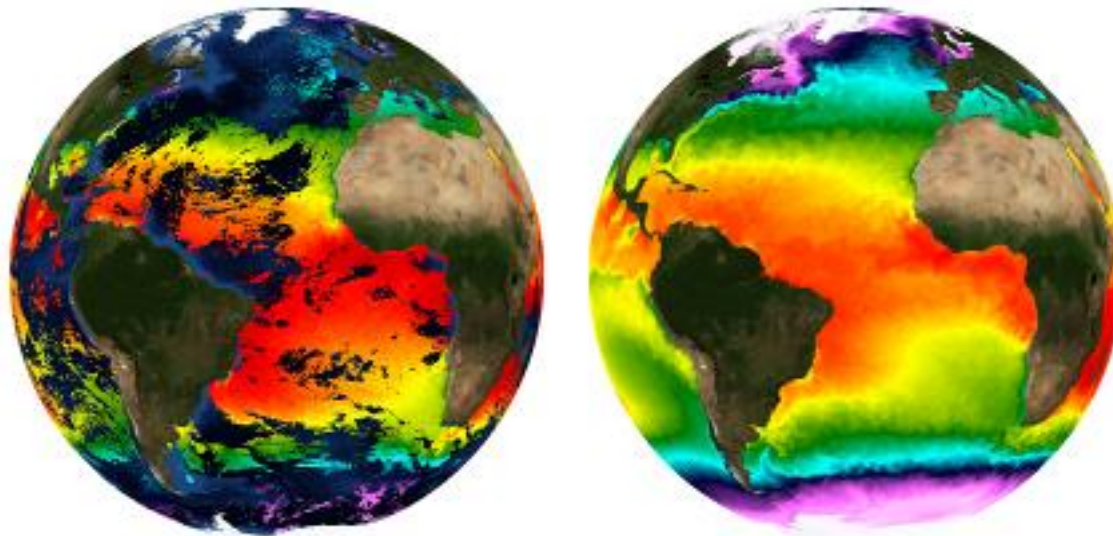
Details at : <http://www.medspiration.org>



## Global ODYSSEA multi-sensor products

ODYSSEA Daily 0.1 degree resolution multi-sensor analysis

- ✓ METOP, AVHRR 19, MODIS, SEVIRI
- ✓ Correction of sensor bias against a multi-sensor large scale reference field (L3)
- ✓ Optimal interpolation for gap free maps (L4)
- ✓ Reprocessing over 2006-2010 was performed. Extension back to 1991 ongoing
- ✓ Previous analysis as first guess



	Mean	Std dev
L3	-0.111	0.499
L4	-0.078	0.587
L4 reprocessing	0.013	0.55

# GHRSSST match-up database current status

- MDB submitted by O&SI SAF :

- ✓METOP
- ✓MSG/SEVIRI
- ✓GOES-13

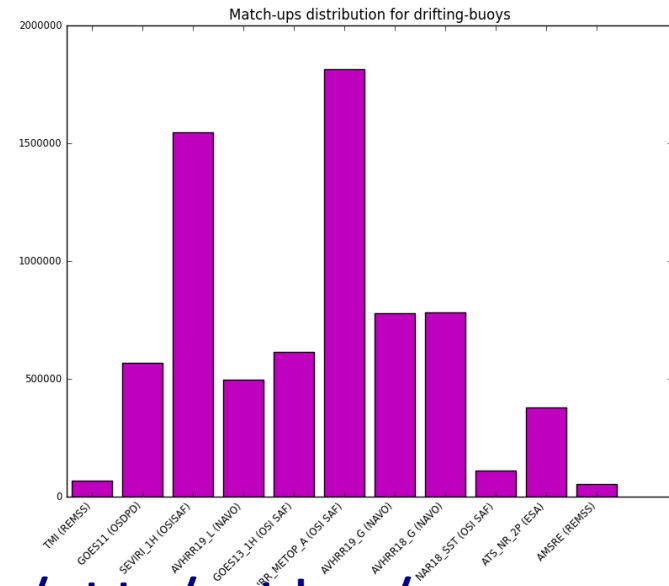
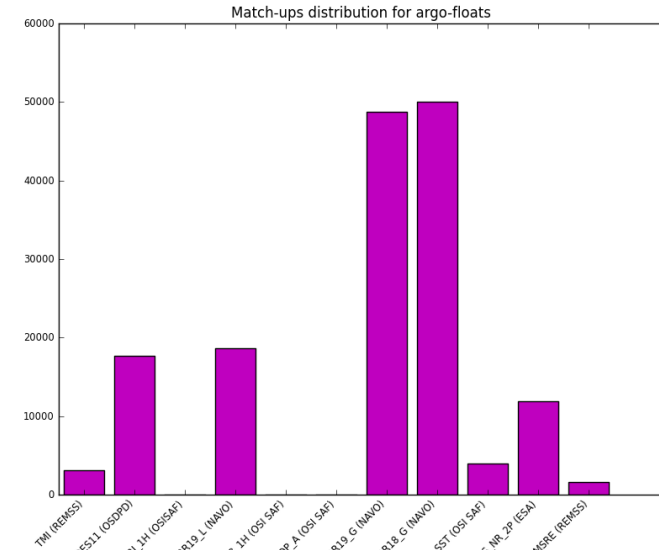
- MDB processed for other GHRSSST L2P :

- ✓AMSRE
- ✓TMI
- ✓AATSR
- ✓AVHRR19 GAC & LAC
- ✓AVHRR18 GAC
- ✓GOES-11

- Uses Coriolis in situ database :

- ✓drifting buoys
- ✓Argo floats
- ✓ship data
- ✓moored buoys

<ftp://ftp.ifremer.fr/ifremer/cersat/projects/myocean/sst-tac/matchups/>



# GHRSSST match-up database

## New framework

*felyx* is an ESA funded project to provide an open source analytics tool based on HR-DDS concept

<http://www.felyx.org>



Felyx will support :

- ✓ extraction of static HR-DDS
- ✓ extraction along trajectories (e.g. in situ)

It will be used to generate :

- ✓ Satellite/in situ match-ups (MDB)
- ✓ Multi-sensor MDB

### Inputs

- ✓ All L2P GHRSSST datafiles. Will be supported by European GDAC online archive.
- ✓ iSQUAM in situ data (buoys, ships and argo floats)
- ✓ Complete time series will be processed, resulting in comprehensive and consistent GHRSSST MDB
- ✓ Initial processing back-end will be ready September 2013, complete system by February 2014



# Nephelae big data platform



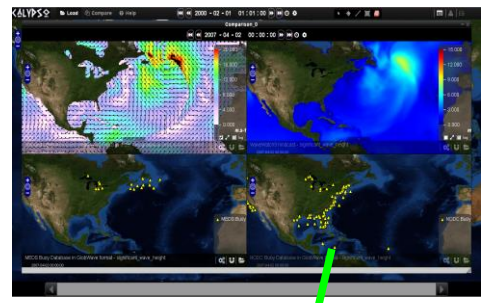
ERS  
ENVISAT  
LandSat

MSG  
GOES  
series

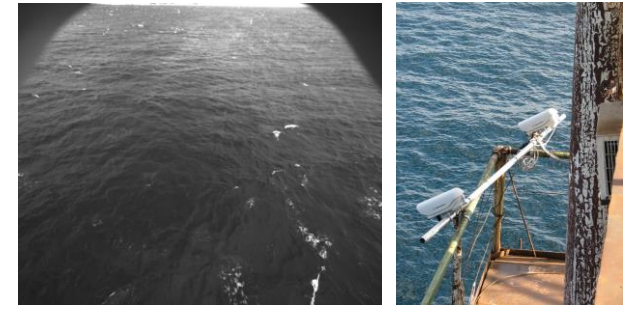
series NOAA  
series METOP

AQUA  
SMOS  
ADEOS  
JASON  
TOPEX  
CryoSat  
GFO  
AltiKa

TRMM  
QuikSCAT  
OceanSat  
HY2



Analysis, comparison and synergy tools



Stereo video camera



Nephelae



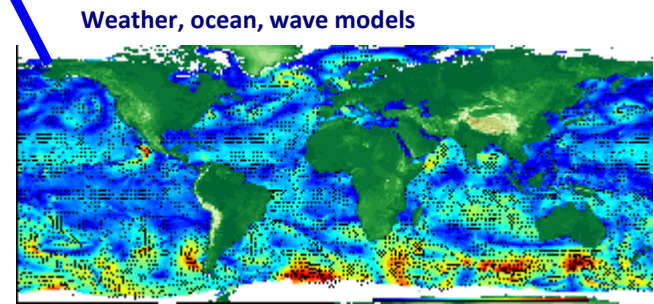
Buoys, floats

1.5 PB  
600 processing cores  
2.5 TB memory

Liste des Jobs Gogollet:

ID	nom	date de début	date de fin	durée	statut	pourcentage	commentaire
31	workspace_20120209_000002	2012-02-09 15:30:04	2012-02-09 15:30:47	43	Terminé	100,0%	00 (00/00) / 1,471
32	workspace_20120209_000003	2012-02-09 15:30:52			Terminé	100,0%	00 (00/00) / 1,471
33	workspace_20120209_000004	2012-02-09 15:31:01			Terminé	100,0%	00 (00/00) / 1,471
34	workspace_20120209_000005	2012-02-09 15:31:04			Terminé	100,0%	00 (00/00) / 1,471
35	workspace_20120209_000006	2012-02-09 15:31:08	2012-02-09 15:31:46	38	Terminé	100,0%	00 (00/00) / 1,471
36	workspace_20120209_000007	2012-02-09 15:31:45	2012-02-09 15:36:46	51	Terminé	100,0%	00 (00/00) / 1,471
37	workspace_20120209_000008	2012-02-09 15:31:45	2012-02-09 15:37:26	41	Terminé	100,0%	00 (00/00) / 1,471
38	workspace_20120209_000009	2012-02-09 15:31:45	2012-02-09 15:38:07	22	Terminé	100,0%	00 (00/00) / 1,471
39	workspace_20120209_000010	2012-02-09 15:31:45	2012-02-09 15:38:07	22	Terminé	100,0%	00 (00/00) / 1,471
40	workspace_20120209_000011	2012-02-09 15:31:45	2012-02-09 15:38:07	22	Terminé	100,0%	00 (00/00) / 1,471

Processing tools



Weather, ocean, wave models

## Nephelae in support to GHRSSST



Need at Ifremer/CERSAT for a (at least partial) copy of GHRSSST archives :

- ✓ Global (re)analysis
- ✓ HR-DDS, MDB & MMDB generation
- ✓ User application requiring intensive data access and processing (OceanFlux project, uses 3 archives of SST)

GHRSSST Archive :

- ✓ complete GHRSSST L2P datasets, converted to NetCDF4
- ✓ European L3 and L4 products
- ✓ historical OSI SAF data (Goes, Seviri) converted to GDS
- ✓ new OSI SAF datasets (incl. L2P METOP, L3P NAR NOAA-19 & METOP, L3P GLOB METOP in GDS v2)
- ✓ To be extended for the purpose of felyx demonstration
- ✓ **Total : 22 TB** => makes transfer to user for large scale applications impossible
- ✓ Mid-term archive for MyOcean (latest months of compressed NetCDF-3 L2P) remains accessible too.

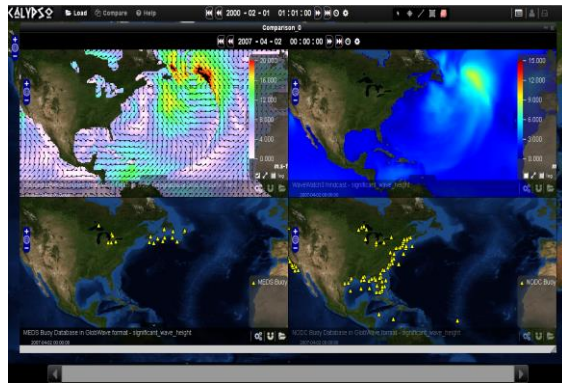
**OpenDAP** : <http://www.ifremer.fr/opendap/cerdap1/ghrsst/>  
**FTP** : <ftp://eftp.ifremer.fr/ghrsst>

(login : g1e9b2 , password : K0mpkKVW or request to fpaf@ifremer.fr)

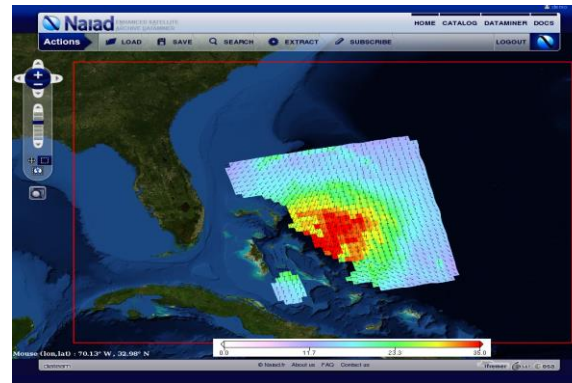
Product catalogue at : <http://www.ifremer.fr/vcerdmz1/joomla/data/collections/ghrsst>

**Access to virtual machines and distributed processing capabilities is freely possible on agreement with CERSAT (contact [jfpiolle@ifremer.fr](mailto:jfpiolle@ifremer.fr)). Approach has been tested successfully in multi partner projects over the last two years. Big data and cloud computing are key element for the future sustainability and usage of multi-mission archives.**

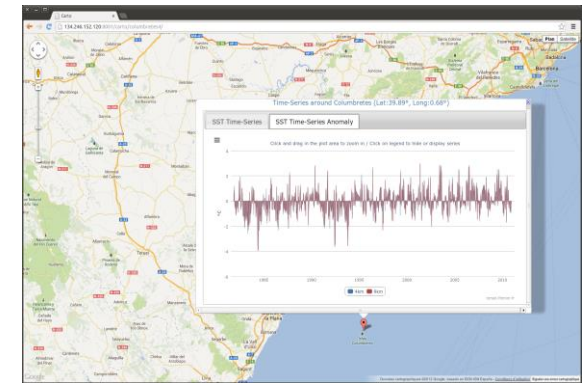
# Supporting tools for data search and analysis



**Calypso** : integrated access and multidimensional intercomparison of EO data



**Naiad** : satellite data indexing/search/selection tool



**Medspiration Evolution** : datamining tool (based on Hadoop) to search patterns, occurrences and trends in EO data

 **felyx**



<http://www.felyx.org>

**Felyx** : ESA funded analytics tool to analyse and intercompare large collections of EO datasets

## Naiad : access through web services

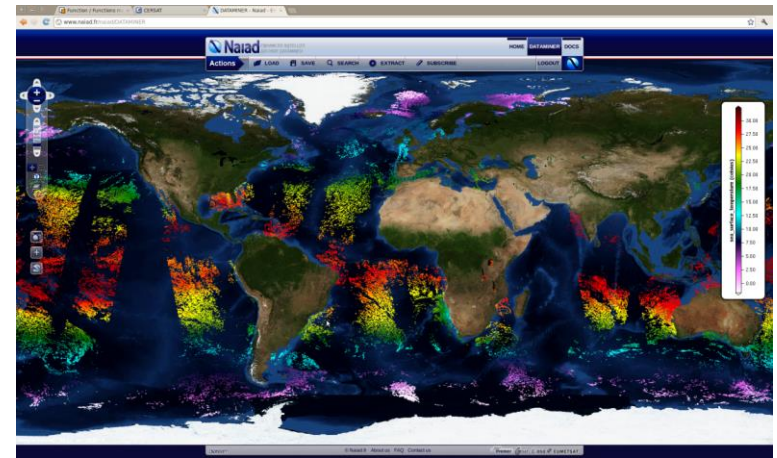
Naiad tool allows L2P selection, extraction and visualisation

<http://naiad.ifremer.fr>

- ✓ METOP-A
- ✓ MODIS/Aqua
- ✓ AVHRR19\_G
- ✓ AVHRR19\_L
- ✓ AATSR

Currently being added (available end of summer)

- ✓ AVHRR17 LAC & GAC
- ✓ AVHRR18 LAC & GAC
- ✓ MSG
- ✓ GOES-11, 12, 13
- ✓ AMSRE, AMSR-2 (when available publically)



- Also supported in the new Summer '13 release :
- ✓ Cached access to pre-generated images for fast visualization
  - ✓ Improved WMS access for integration in GIS application
  - ✓ Direct download link or list of download links for FTP and OpenDAP
  - ✓ Improved workflow for fast extraction
  - ✓ Distributed processing on the cloud

## Short term plans

- Provide demonstration application and reach out new user communities
- Deliver and extend Medspiration/ODYSSEA reprocessed datasets
- Make usage of European GDAC mirror for :
  - Consistent MDB processing for all GHRSSST L2P datasets using felyx system
  - Allow user defined selection and extraction through Naiad for archive and NRT data
  - Support data intensive user applications
  - Allow user friendly and online data analysis through the usage of new technologies for mass data processing and analytics, datamining