

Icare Data and Services Center

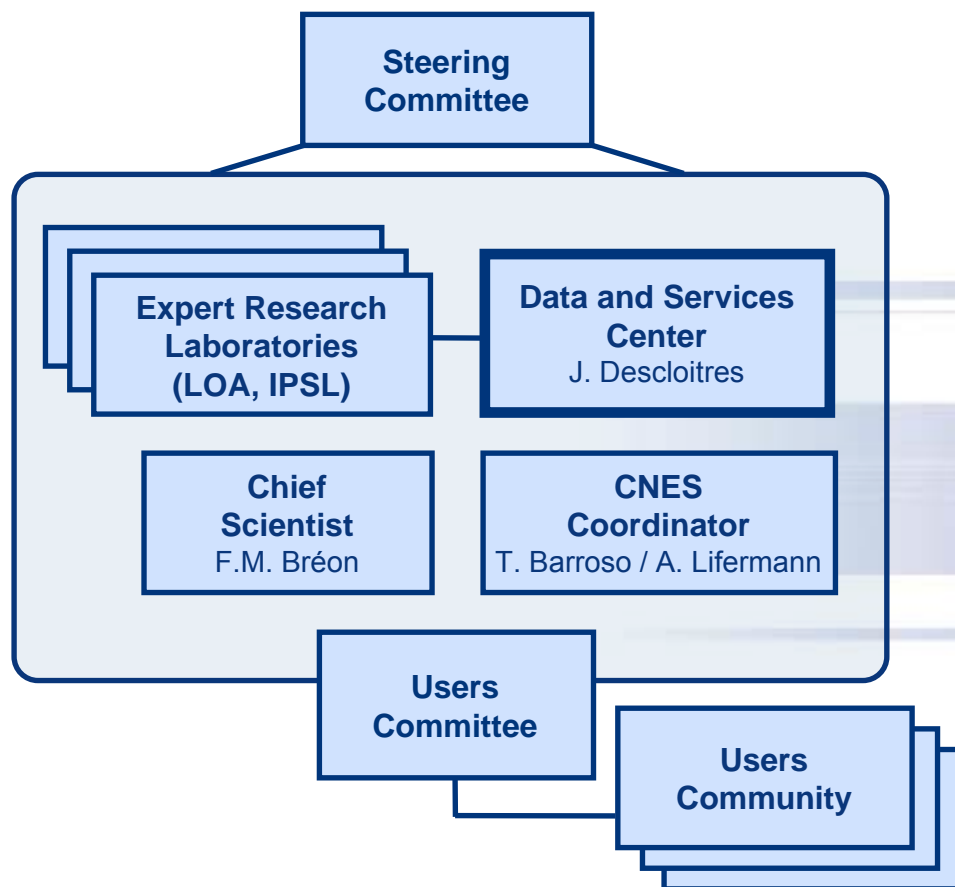
on aerosols, clouds and water cycle
Computing facility and user interfaces

*Loredana Focsa, Jean-Marc Nicolas, Jacques Descloitres
And the ICARE team*

Table of Contents

- ICARE – a French Thematic Center
 - Hardware Architecture
 - System Architecture Design
- Production and Storage Mechanism
 - ICARE – Data Holdings
 - Distribution Services

Icare Thematic Center (1/3)



- ICARE is a structure created in 2003 to coordinate research and observations within a specific thematic perimeter: about **aerosols, clouds, water cycle, radiative transfer in the atmosphere**
- Its key mission is to provide data, products and services to the international scientific community

ICARE governance is : CNES, CNRS/INSU, University of Lille and Nord-Pas-de-Calais Regional Council

Icare Thematic Center (2/3)

▪ ICARE activities :

- Provide development services and tools
- Develop and maintain computing facilities (hardware, software, distribution services)
- Level 2 and 3 ground segment for current (PARASOL) or future missions (Megha-Tropique)

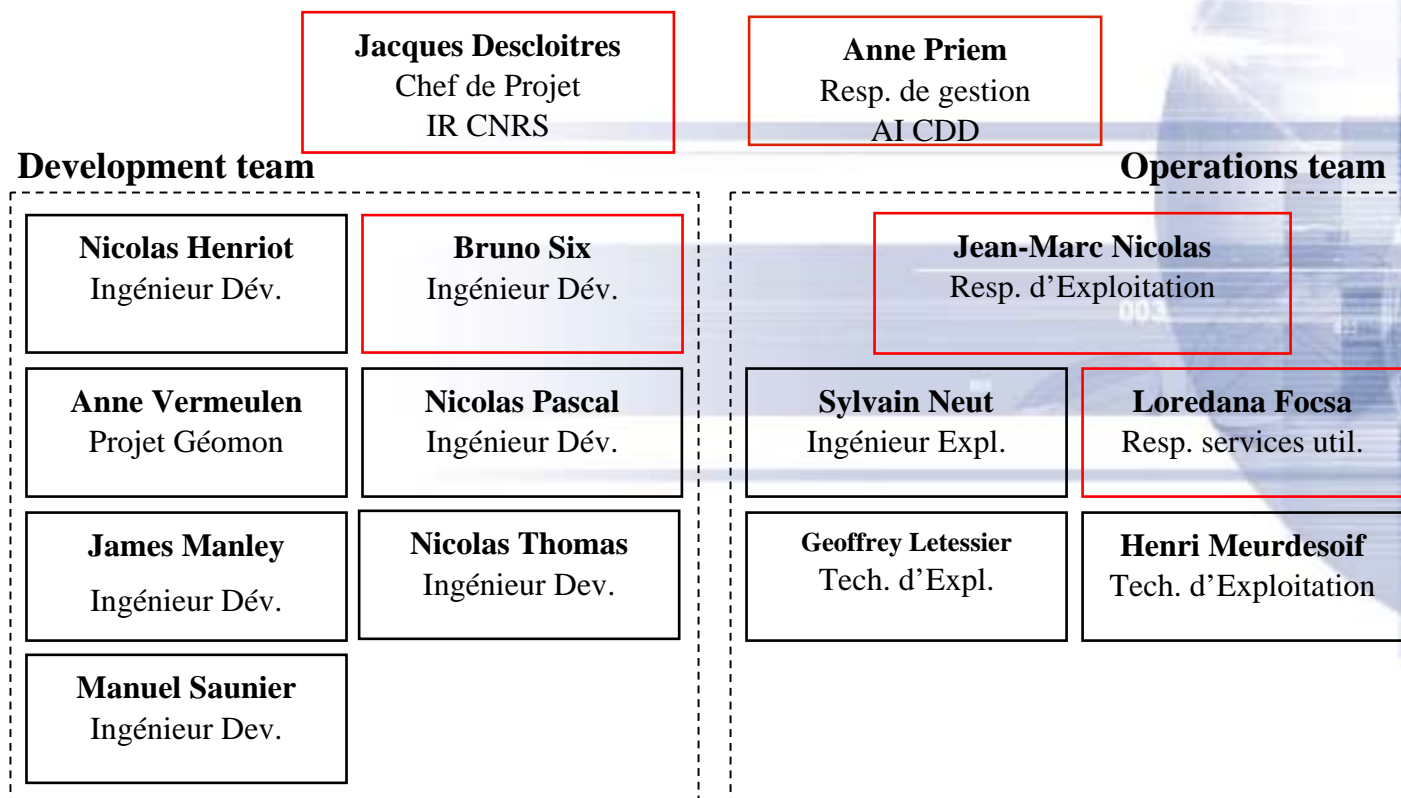
▪ Some ICARE Services :

- operational processing
- data collection from other providers
- archive and distribution
- science code development
- visualization and analysis tools
- documentation and user support

- **ICARE's key concept** is a symbiotic relationship between research labs and the Data and Services Center

Icare Thematic Center (3/3)

A relatively small unit based on a development team and an operations team :

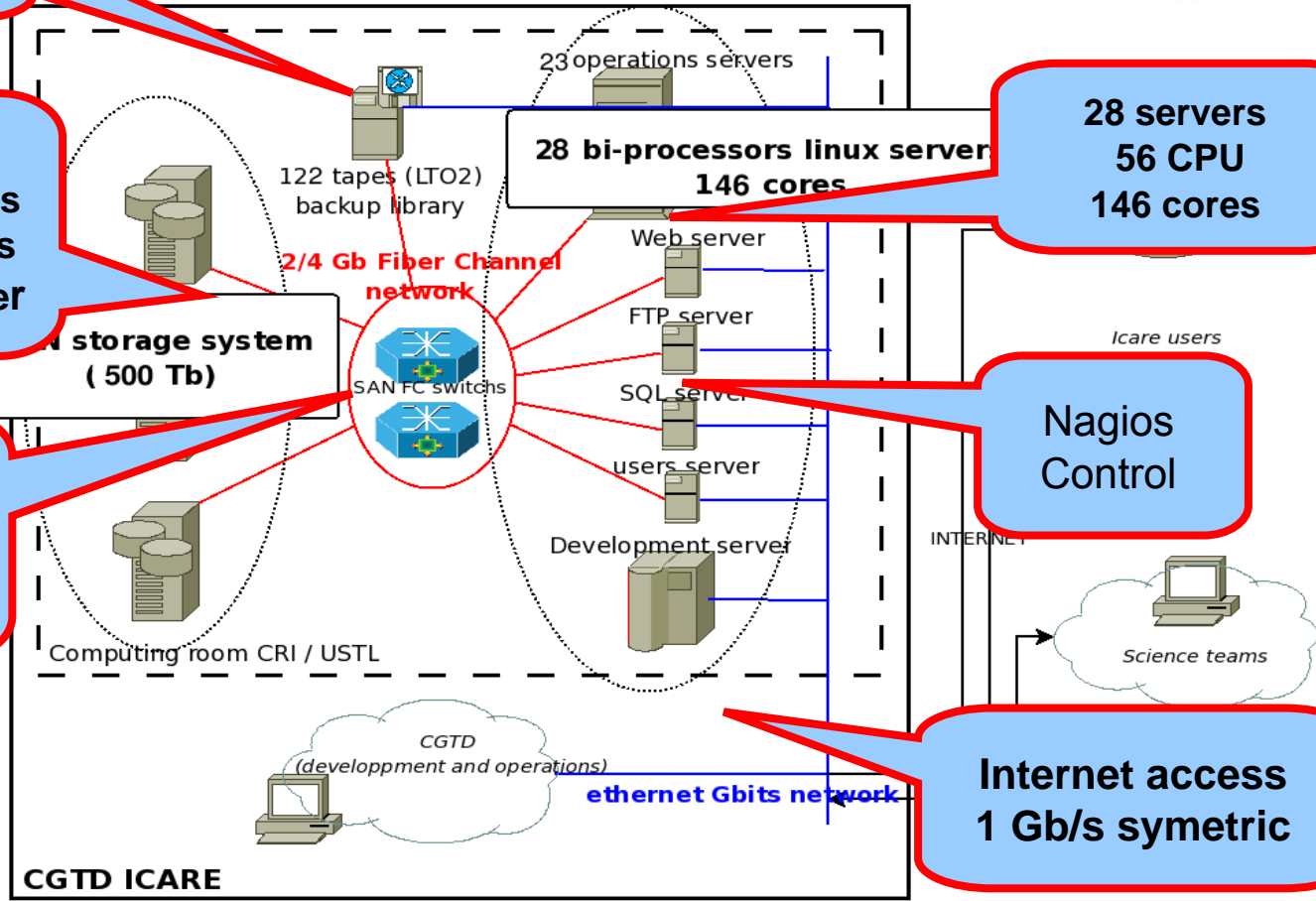


Hardware Architecture (1/2)

2 LTO libraries
(backup)

500 TB
15 storage arrays
1033 Hard Disks
1 km optical fiber

2 x 4 FC
switch
2 SVC nodes



28 servers
56 CPU
146 cores

Nagios
Control

Internet access
1 Gb/s symetric

Hardware Architecture (2/2)

SAN Storage System heterogeneous : IBM and Dell/EMC²

13 IBM System Storage Disk Arrays DS4000,
DS4700, DS4800
2 Dell/EMC (CX3-20 and CX4-240)

2 IBM BladeCenter with 20 servers-based blade
5 IBM Xseries



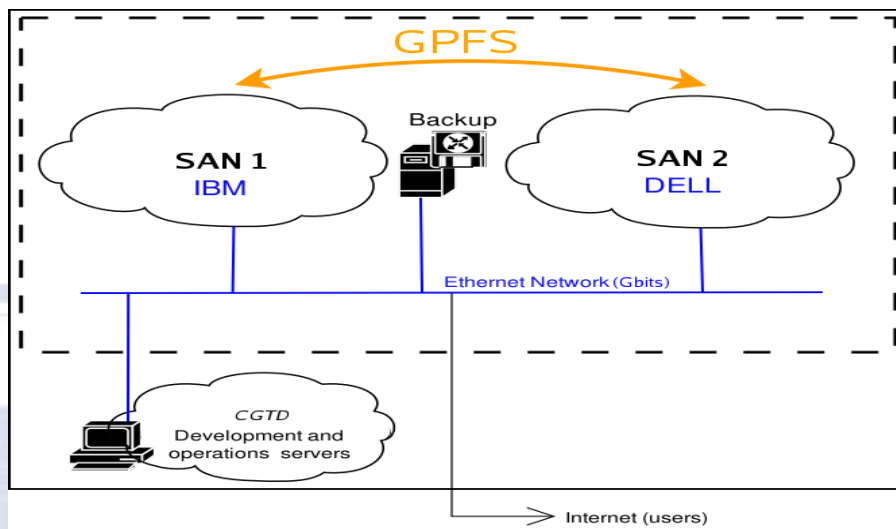
Storage clustering using IBM solution GPFS (General Parallel File System)

Two distinct high-performance storage clusters are connected using GPFS through network.

GPFS allows large filesystems (many PetaB) and servers shared access

2 configurations :

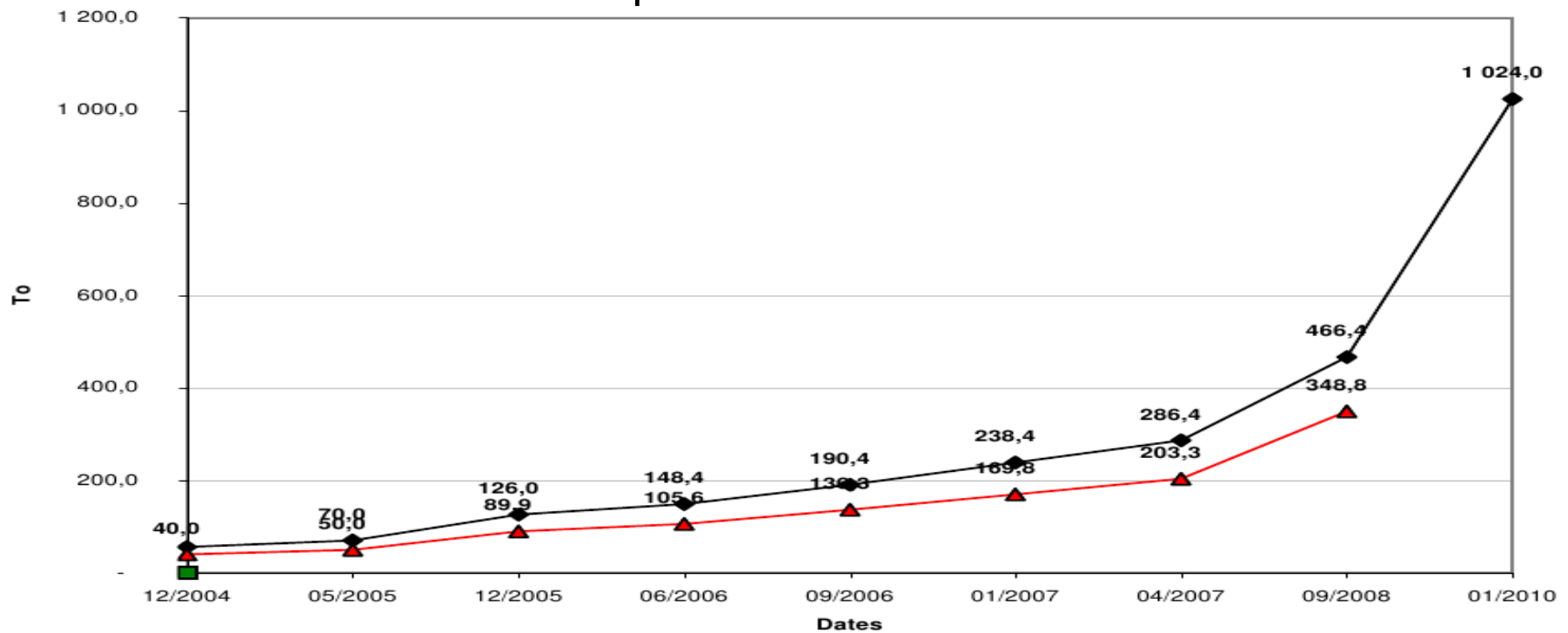
- > **Direct access** (FiberChannel) : all disks are SAN-attached to all nodes
- > **Network Access** : nodes not directly attached to the disk can access FS using **NSD(Network Shared Disk)** server



430 TB available on 33 filesystems

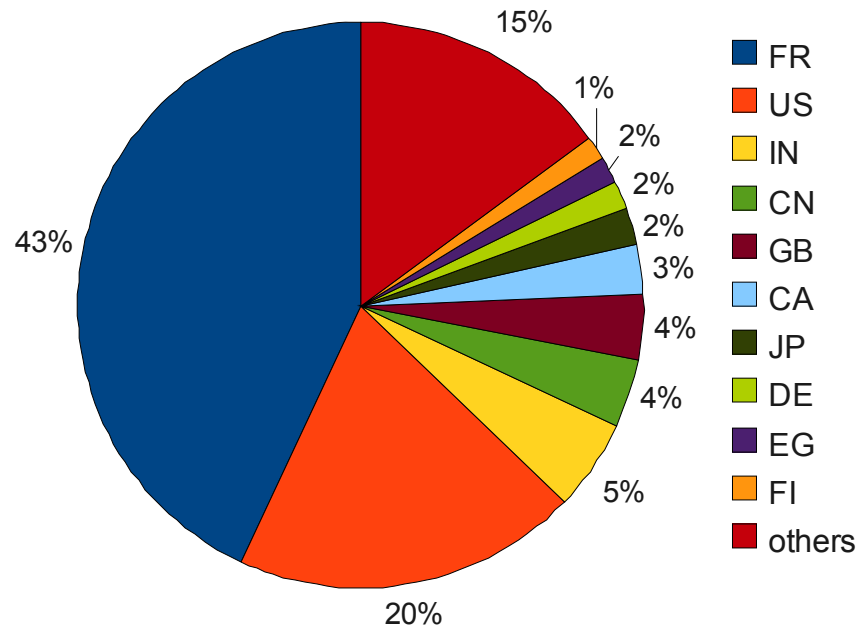
The tapes are used for backup only (IBM TS3310 LTO 3 with 3 drives, 122 storage slots) ~ **800 LTO3**

Exponential storage volume for last four years Up to 1 PetaB in 2011



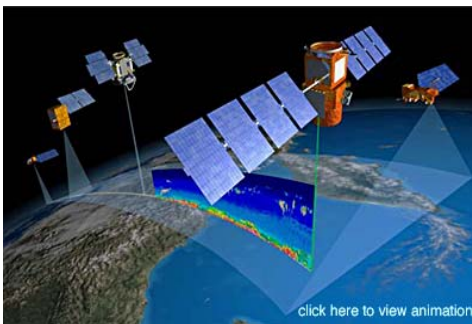
Evolution of storage capacity of ICARE archive

390 registered users at ICARE

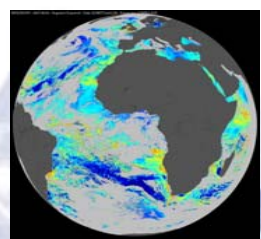
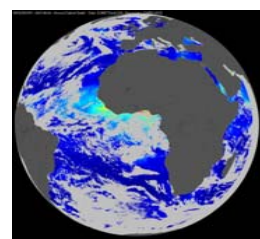
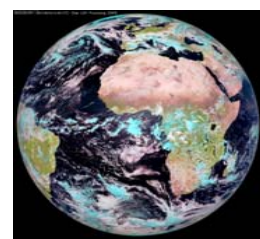


- Free registration
- But every user should be registered
- All users can access all open datasets (including MODIS, CALIPSO, PARASOL, AMSU, ...)
- Access data from ftp / web or user server.

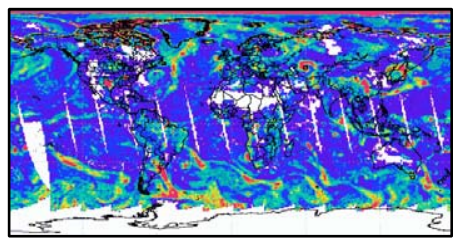
Data Holdings (1/4)



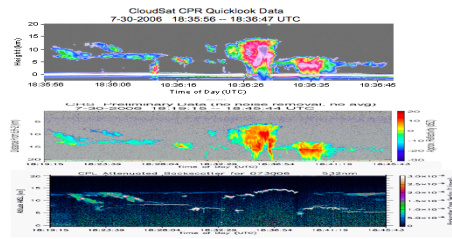
A-Train:
 PARASOL/POLDER-3
 Aqua/MODIS
 CALIPSO/CALIOP
 CALIPSO/IIR
 CALIPSO/WFC
 CloudSat/CPR
 Aura/OMI



MSG/SEVIRI (aerosol products)



MODIS

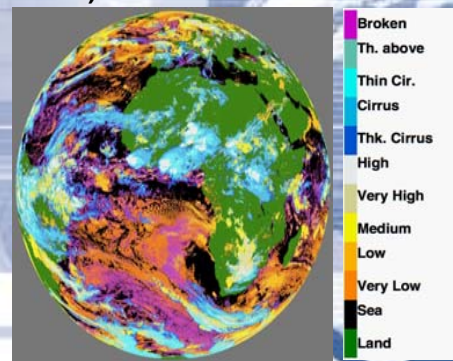


CLOUDSAT

Geostationary:
 MSG/SEVIRI
 METEOSAT-7
 GOES-E
 GOES-W
 GOES-SA
 MTSAT
 FY-2C

Microwave:

Aqua/AMSR-E
 TRMM/TMI
 DMSP/SSMI
 DMSP/SSMI/S
 METOP/AMSU-A
 METOP/AMSU-B/MHS
 NOAA/AMSU-A
 NOAA/AMSU-B
 Megha-Tropiques/SAPHIR
 Megha-Tropiques/MADRAS
 Megha-Tropiques/ScaRaB



Ancillary:
 ECMWF
 GMAO

No operator – a fully automated system developed at ICARE. **110 data sets** from over 20 satellite missions collected from **15 distant data providers**

Sources	Access	Products	Nb. pr	Delay	Rolling period	Nb. files/d	Volume Go/d
CNES	ftp	PARASOL L1/exo	4	D+1 to D	8 days	65	8.5
NASA/ASDC	ftp	CALIPSO	15	D+2 to D	15 days	400	28.0
NASA/LADS	ftp	MODIS	13	D+2 to D	15 days (L1) / 7	2400	90.0
Colorado St. U	ftp	CloudSat	10	D+3 to D	3 years	120	10.0
CMS / satmos	ftp	Geostationnaires	8	D+1 to D	20 days	2600	35.0
NOAA	ftp	AMSU (A/B), HIRS	29	D+2 to D	8 days	400	2.5
ESA	ftp	MERIS	2	D+1	8 days	75	18.0
Autres	ftp	OMI, TMI, AMSR_	12	D+2 to D	Mission lifetime	150	3.0
Total						6210	195.0

Data Holdings (3/4)

32 processing algorithms in operation

91 derived products and 54 associated “quicklook” produced by 40 processing code

<i>Products</i>	<i>Nb. processing codes</i>	<i>Nb.files / day</i>	<i>Vol./day (Go)</i>
PARASOL Aer	2 (L2/L3)	30	0.01
PARASOL Nuages	2 (L2/L3)	15	0.30
PARASOL Terre	2 (L2/L3)	15	0.30
PARASOL Browsers	1 (L1/L2/L3)	450	0.03
CALIPSO browse	1 (L1,2)	105	0.20
IIR inter-etal.	2 (L1_c)	30	6.50
IIR L2	1 (L2)	90	3.50
CALIOP extraction	1 (L2)	30	0.80
CloudSat extraction	1 (L2)	105	1.60
Caliop-Cloudsat	1 (L2)	14	6.00

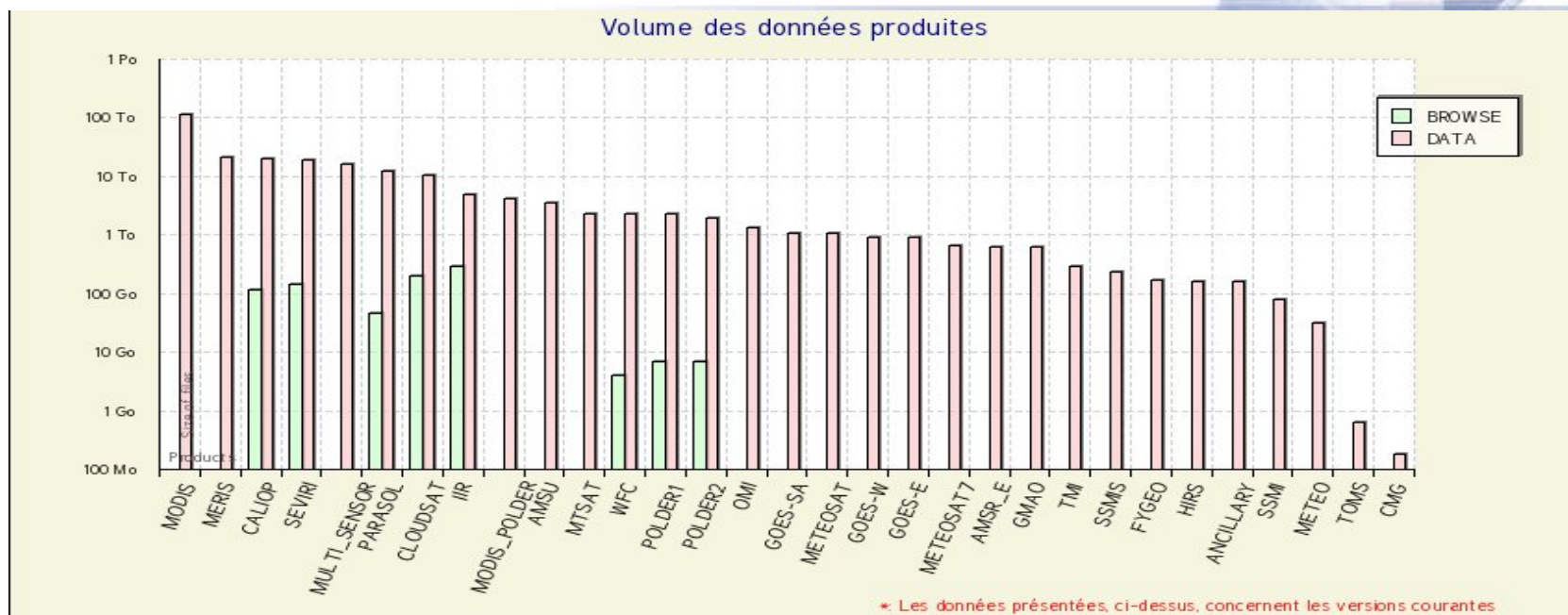
<i>Products</i>	<i>Nb.processing codes</i>	<i>Nb.files / day</i>	<i>Vol./day (Go)</i>
PARASOL-MODIS	1 (L2)	45	3.00
MSG aerosol (mer)	2 (L2/3)	96	0.10
MSG nuages	2 (L2)	96	4.00
SAF_NWC	1(L2)	2040	3.00
Brain	1 (L1)	140	15.50
Geo2hdf	1 (L1_c)	2000	12.00
AMSU	1 (L1_c)	150	1.00
EPSAT-SG	3 (L2/3)		
Total	26	5376	54.83

Data Holdings (4)

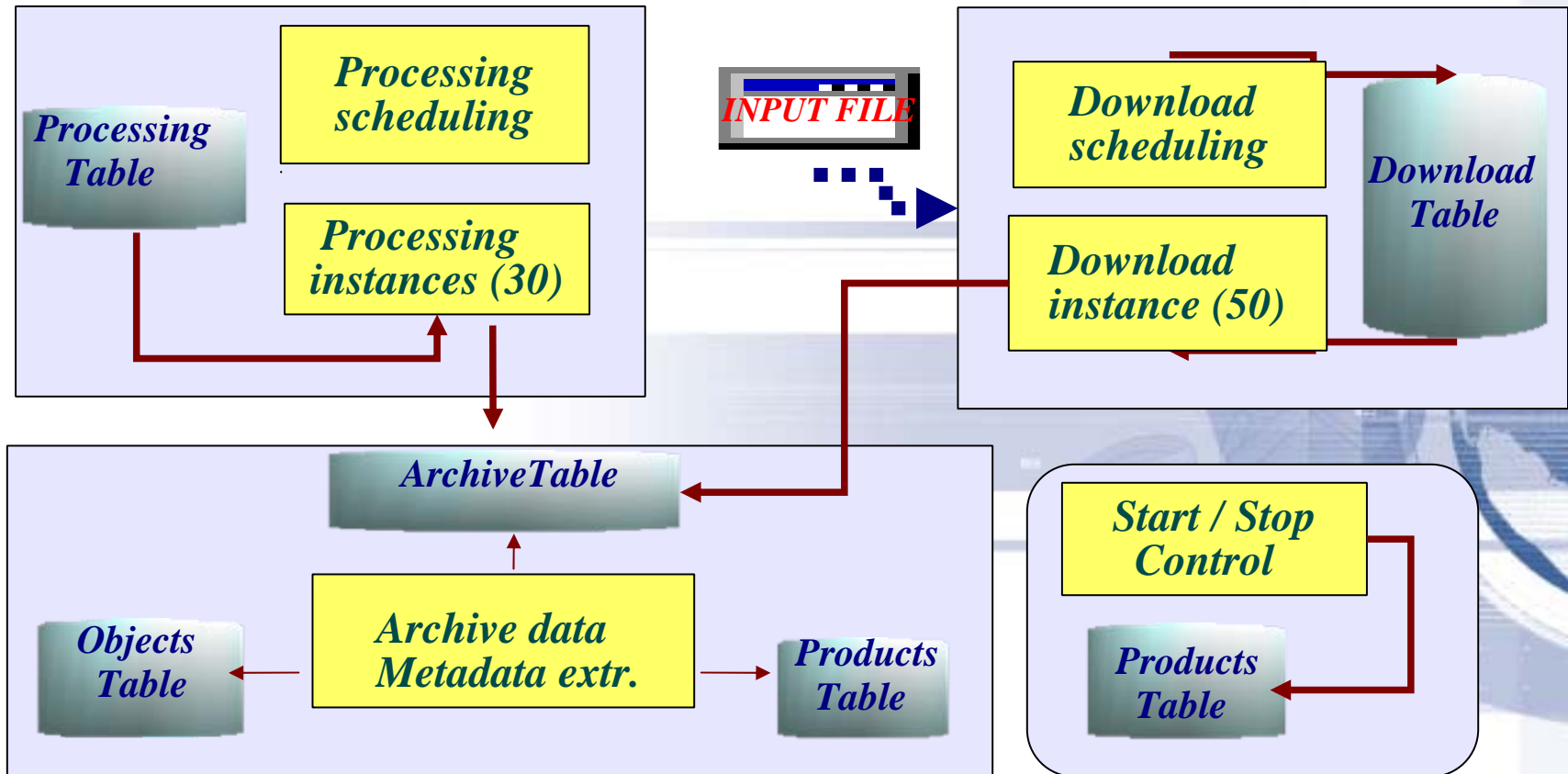
All data sets are available online by FTP, WEB and SSH

MODIS is the most voluminous of all data sets of Icare archive

Total volume per mission is variable, ~ 300 TB archived / distributed today



Production and Storage Mechanism



Distribution data catalogue/ Access Control

Distribution Services (1/3)

ICARE developed various distribution services with primary focus on:

- Data search and access
 - **Online archive**
 - **FTP** access for most products
 - Automatic product catalogue
 - Query interface
 - Distant computing resources for registered users (SSH access)
- Visualization and analysis tools
 - Browse imagery for all products
 - Browse-and-order approach
 - Visualization tools to display collocated products over the same grid
- 213 products archived and distributed – 53 associated “quicklook” products
- 390 registered users
- ~1TB distributed each month

Distribution Services (2/3)

Online catalogue of all products distributed by ICARE

- Synoptic information about current product version, last update, and last data received
- Calendar layout for each product, with indication of daily data availability
- Direct access to online archive
- The catalogue is updated automatically

Sensor	Product	Current version	Product Description
PARASOL	L1_B	C2	Top-of-the-atmosphere Radiance - Level 1
	L1_C	C2	Top-of-the-atmosphere Radiance - Calibrated track subset - Level 1
	L1D	C2	Daily Aerosol Product over Land - Level 2
	OC2	C2	Daily Aerosol Product over Ocean - Level 2
	RB2	C2	Monthly Cloud & Radiative budget Products - Level 2
	AC3	C2	Monthly Aerosol Product over Land - Level 3
	OC3	C2	Monthly Aerosol Product over Ocean - Level 3
	RB3	C2	Monthly Cloud & Radiative budget Products - Level 3
CALIOP	PR_ATM	C2	Gridded Atmosphere Products - Level 3
	CAL_LID_L1	C3	Lidar Vertical Profile - Level 1
	VFM	v2.0	Vertical Feature Mask - Level 2
IR	333mCLay	C3	333m-Resolution Cloud Layers - Level 2
	01kmCLay	C3	1km-Resolution Cloud Layers - Level 2
	05kmCLay	C3	5km-Resolution Aerosol Layers - Level 2
	05kmCLay	C3	5km-Resolution Cloud Layers - Level 2
	05kmCPro	C3	5km-Resolution Cloud Products - Level 2
WFC	CAL_IR_L1	C2	Imaging Infrared Radiometer - Level 1
	CAL_IR_L2	v1.20	Imaging Infrared Radiometer - Level 2
	EPH	X	Ephemeris
CLOUDSAT	WFC_L1_125m	v1.10	125m-Resolution Wide Field Camera Reflectance - Level 1
	WFC_L1_10m	v1.10	10m-Resolution Wide Field Camera Reflectance - Level 1
	WFC_L1_3R	C2	3R-Grid Wide Field Camera Reflectance - Level 1
CLOUDSAT	1B-CPR	C2	Radar Backscatter Profiles - Level 1
	2B-CLDCLASS	C1	Cloud Classification - Level 2
	2B-FLXHR	C1	Reflective Fluxes and Heating Rates - Level 2
	2B-GEOPROF	C1	Cloud Mask and Radar Reflectivities - Level 2
	2B-TAU	v03.02	Cloud Optical Depth - Level 2

Product Version Catalogue

Month	Su	Mo	Tu	We	Th	Fr	Sa
February 2008						1	2
January 2008	1	2	3	4	5		
December 2007							1
November 2007							1
October 2007	1	2	3	4	5		
September 2007	1	2	3	4	5		
August 2007	1	2	3	4	5		
July 2007	1	2	3	4	5		
June 2007	1	2	3	4	5		
May 2007	1	2	3	4	5		
April 2007	1	2	3	4	5		
March 2007	1	2	3	4	5		

Product Daily Availability

File Name	Size	Last Modified
PIL2T00C009147.B.ang.18km.png	21228	Jan 12 2007 17:07
PIL2T00C009147.B.ang.37km.png	26562	Jan 12 2007 17:07
PIL2T00C009147.B.jpge.alpha.jpg	62736	Dec 05 2006 23:21
PIL2T00C009147.B.jpge.alpha.jpg	62912	Dec 05 2006 23:21
PIL2T00C009147.B.taux.18km.png	22888	Jan 12 2007 17:07
PIL2T00C009147.B.taux.37km.png	27567	Jan 12 2007 17:07
PIL2T00C009147.B.tauxfn.18km.png	20019	Jan 12 2007 17:07
PIL2T00C009147.B.tauxfn.37km.png	24881	Jan 12 2007 17:07
PIL2T00C009146.D	258250	Nov 29 2006 06:54
PIL2T00C009146.L	29520	Nov 28 2006 06:56
PIL2T00C009147.B.ang.18km.png	18234	Jan 12 2007 17:07
PIL2T00C009147.B.ang.37km.png	26073	Jan 12 2007 17:07
PIL2T00C009147.B.jpge.alpha.jpg	60712	Dec 05 2006 23:21
PIL2T00C009147.B.jpge.alpha.jpg	60859	Dec 05 2006 23:21
PIL2T00C009147.B.taux.18km.png	19995	Jan 12 2007 17:07
PIL2T00C009147.B.taux.37km.png	26695	Jan 12 2007 17:07
PIL2T00C009147.B.tauxfn.18km.png	18567	Jan 12 2007 17:07

Product Catalogue and Web Access

Distribution Services (3/3)

Search and order for A-train products

Multi-sensor,
multi-product
selection

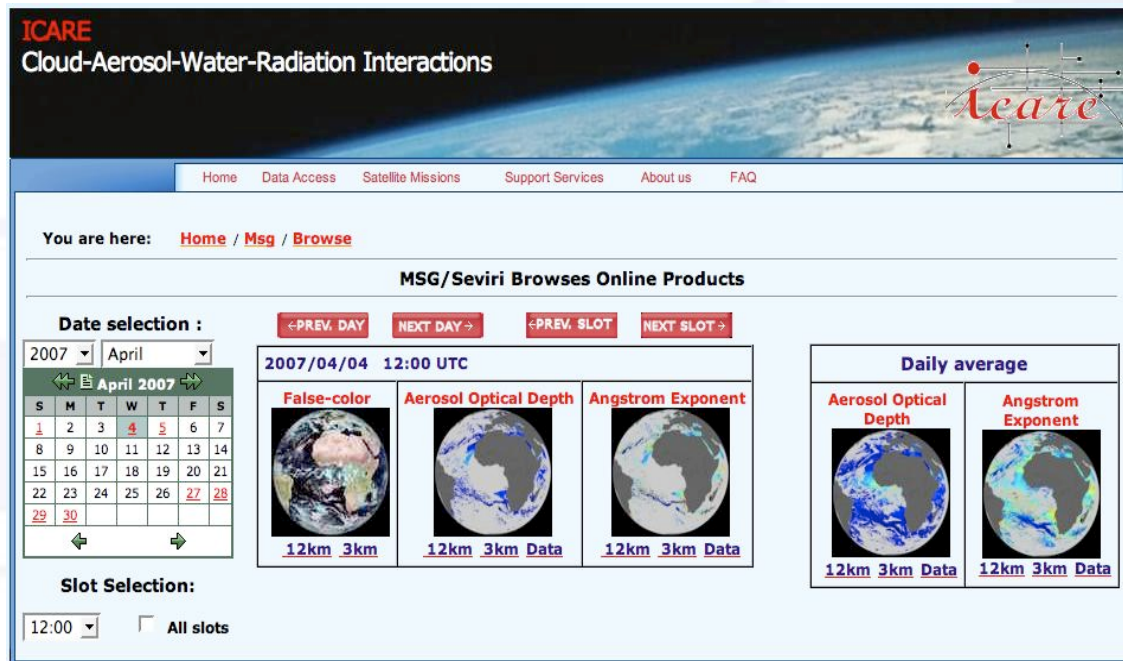
Date and
time selection

Spatial
selection

Visualisation Services (1/4)

MSG/SEVIRI aerosols browser :

- True-color L1 composite (0.6, 0.8, 1.6 microns)
- Aerosol optical thickness (charge) and angstrom coefficient (~ particle size)
- For each slot and daily synthesis
- Zooming capabilities



ICARE
Cloud-Aerosol-Water-Radiation Interactions

Home Data Access Satellite Missions Support Services About us FAQ

You are here: [Home](#) / [Msg](#) / [Browse](#)

MSG/Seviri Browses Online Products


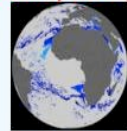
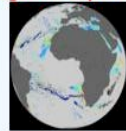
Date selection : 2007 April

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Slot Selection: 12:00 All slots

2007/04/04 12:00 UTC

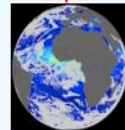
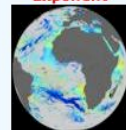
[False-color](#) [Aerosol Optical Depth](#) [Angstrom Exponent](#)

[12km 3km](#) [12km 3km Data](#) [12km 3km Data](#)

Daily average

[Aerosol Optical Depth](#) [Angstrom Exponent](#)

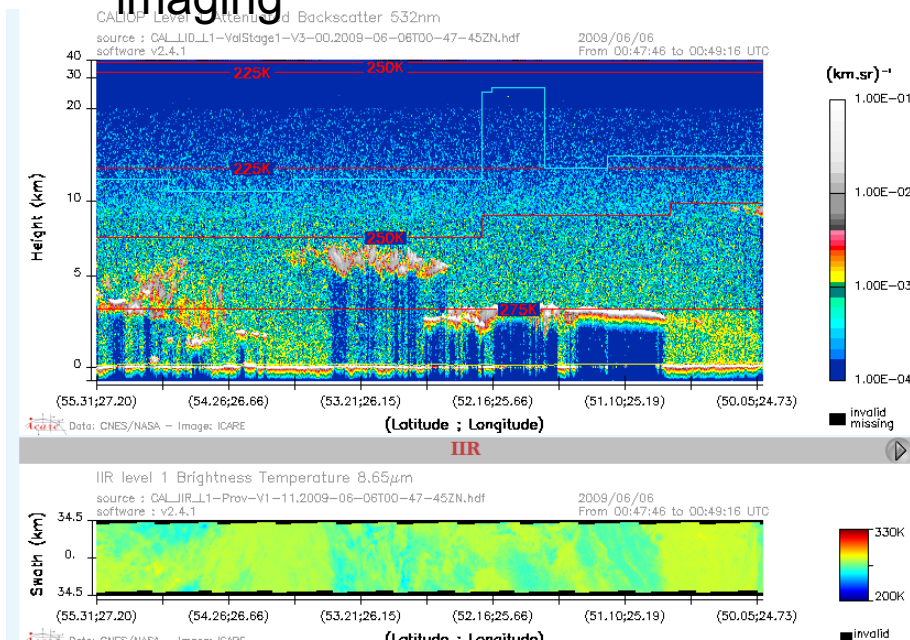



[12km 3km Data](#) [12km 3km Data](#)

Visualisation Services (2/4)

CALIPSO (Lidar + VIS and TIR camera) :

- Calendar, orbit and scene selection
- Lidar profile + VIS/TIR imaging



You are here: [Home](#)

June 2009

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

Display Thumbnails Background Product

Products

lidar

LID L1

Backscatter532

iir

IIR L1

BT_08_65

BT_10_60

BT_12_05

BTD_08_12

BTD_10_12

IIR L2 Swath

BT_08_65

BT_10_60

BT_12_05

Visualisation Services (3/4)

POLDER/PARASOL browser

Zooming on each orbit (centered)

Calendar selection for the three POLDER sensors

Physical parameter selection

You are here: [Home](#) / [Parasol](#) / [Browse](#)

PARASOL Browse Online Products

Date selection: 2008 April

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Product selection: Level 1

Daily Products

- Cloud Cor O2 pressure
- Cloud Mean SW Albedo
- Cloud Phase
- Cloud Cover
- Cloud Optical Thickness
- Fine Mode AOT 865nm over land
- Angstrom Coefficient over land
- 865 nm Optical Thickness over ocean
- Angstrom Coefficient over ocean
- Fine Mode AOT 865nm over ocean

Date: 04/12/2008 Level 1 : Version ...

12 April 2008
Version: 161632 Created: 20080503

[Click for higher resolution and individual orbit selection.](#)

Date: 04/12/2008 Cloud Cover : Version ...

12 April 2008
Version: 161632 Created: 20080503

[Click for higher resolution.](#)

Date: 04/12/2008 Cloud Shortwave Albedo Monthly Mean : Version K

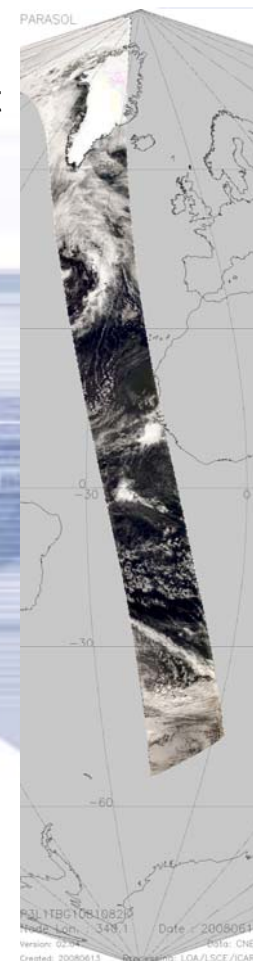
April 2008
P3L3TRIG080415K
Version: 07020 Created: 20080513

[Click for higher resolution.](#)

Date: 04/12/2008 Fine Mode AOT 865nm Monthly Mean over land-ocean : Version ...

April 2008
P3L3TRIG080415K
Version: 060420 Created: 20080502

[Click for higher resolution.](#)



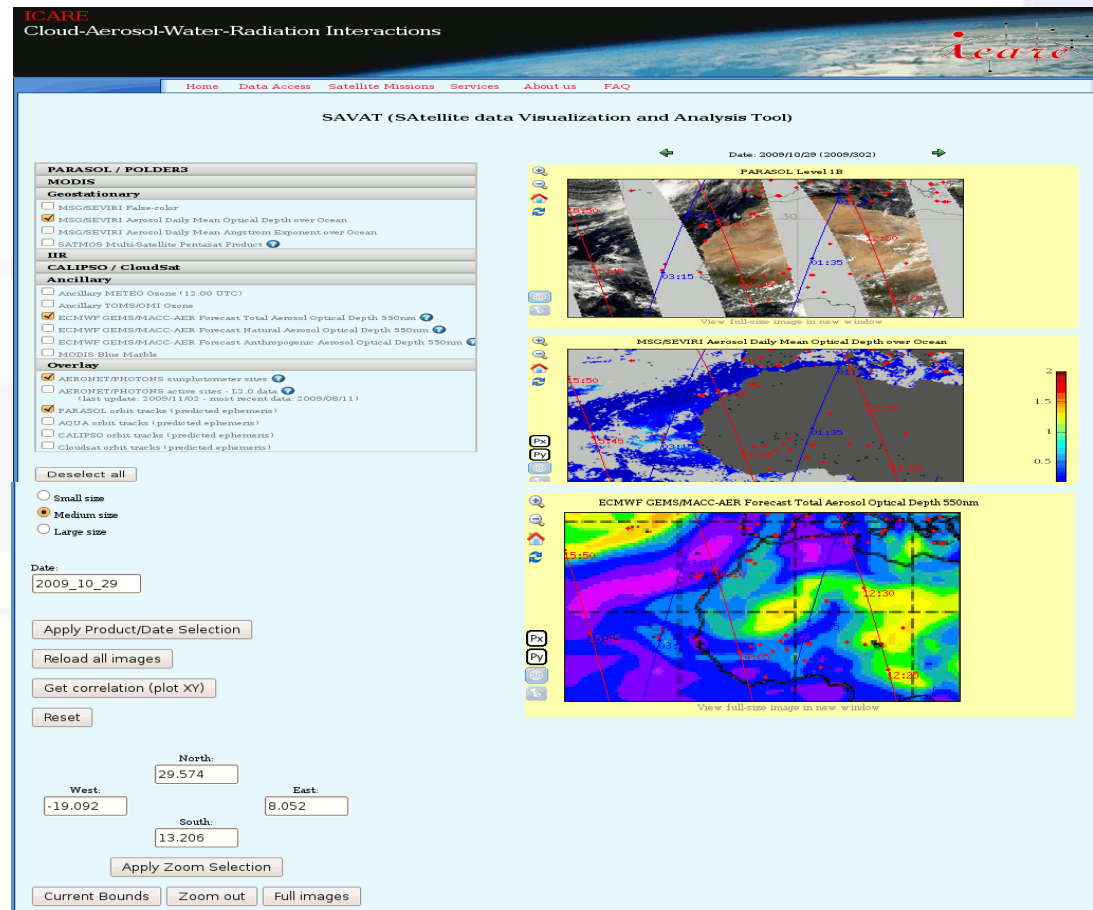
Visualisation Services (4/4)

Multi-sensor visualisation interfaces :

- L1/L2/L3 satellite data
- Models / analysis data
- Satellite overpath
- In-situ data (aerosols measurements from AERONET)
- Zooming capabilities
- X vs Y plotting availability

Under development :

- Access to real data in user-friendly formats (HDF, NetCDF)
- Projection issues



**For more information and
all ICARE data and services access:**

<http://www.icare.univ-lille1.fr>

Loredana.focsa@univ-lille1.fr

Jean-Marc.Nicolas@univ-lille1.fr

Jacques.Descloitres@univ-lille1.fr