# **Rapid Mapping at I-Cube SERTIT**





## Within the EMS Copernicus Service and the International Charter and Major Disaster frameworks

## Dr Hervé Yésou,

With inputs from S. Clandillon, R. Faivre, S. Battiston....







### Strasbourg, heart of Europe





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# ICube, a multidisciplinary laboratory

A MAJOR DRIVING FORCE FOR RESEARCH IN STRASBOURG (> 620 PEOPLE)

ICube is since 01/01/2013 :

 A research laboratory in the Engineering, Computing and Imaging sciences with biomedical engineering, environment and sustainable development as privileged sectors.



- A joint research unit (UMR7357) of the University of Strasbourg, the CNRS, the ENGEES and the INSA of Strasbourg.
- 4 departments with 16 labs and 7 plateforms

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**iCU3E** 



#### SERvice Regional de Traitement d'Image et de Télédétection

More than 35 years of valorization and technological transfer in Space Techniques and Earth Observation applications

Technological Platform of ICube, Université de Strasbourg (2015)

#### **Applications**

- Land management and urban planning
- Natural resources and Environment monitoring
- Disaster / Risk management and security

#### **Services**

- Specific R&D studies
- Expertise, Assistance
- Geo-information production
- Operational Service 24/7: Rapid Mapping





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## Rapid mapping ... what is it?

### Rapid production of crisis geoinformation from satellite images

### For who

Civil security services Humanitarian Institutions, NGOs Prevention and forecasting services Insurance, agro-forestry



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International Charter Space and Major Disasters Copernicus EMS Rapid Mapping Bilateral agreement (VA Pleiades), Demonstration projects



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## **Rapid mapping activity**

### What disasters?



## Rapid mapping at SERTIT: +30 years of experience First flooding mapping applications



## **1990 Ill River Flood**



## Gandia Flooding 1996, Spain

SPOT-1

1st rapid mapping demonstrator Request of European Council An illustration, very raw map

#### COUNCIL OF EUROPE











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### Interest of rapid maping action: keep the memory Niamey, Niger, September 2012



### Interest of rapid maping action: keep the memory



### Interest of rapid maping action: keep the memory



## Copernicus services



#### https://www.copernicus.eu/fr/services/urgences





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## **SERTIT & Copernicus**



#### Copernicus

- A Copernicus Emergency Management Service Provider (CEMS):
  - Rapid Mapping,
  - Risk & Recovery Mapping
- A Copernicus Relay for the Grand Est Region of France











# **EMERGENCY SERVICE**











## **Copernicus services**

#### Early Warning & Monitoring

Copernicus EMS Early Warning and Monitoring offers critical geospatial information at European and global level through continuous observations and forecasts for floods, droughts and forest fires.

#### Floods

The European Flood Awareness Systems (EFAS) and Global Flood Awareness Systems (GloFAS) provide complementary flood forecast information to relevant stakeholders that support flood risk management at the national, regional and global level.



#### **Fires**

The European Forest Fire Information System (EFFIS) monitors forest fire activity in near-real time. EFFIS supports wildfire management at the national and regional level for EU member states and across the Middle East and North Africa.





The Drought Observatory (DO) provides drought-

relevant information and early-warnings for

Europe (EDO) and globally (GDO). The service

publishes short analytical reports (Drought News)

in anticipation of an imminent drought.

#### Will be discussed during the training courses







Droughts



## Copernicus services



#### On demand mapping

**Copernicus EMS On Demand Mapping** provides on-demand detailed information for selected emergency situations that arise from natural or man-made disasters anywhere in the world.



#### **Rapid Mapping**

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**Rapid Mapping** provides geospatial information within hours or days of a service request in order to support emergency management activities in the immediate aftermath of a disaster.

#### **Risk and Recovery Mapping**

**Risk & Recovery Mapping** supplies geospatial information in support of Disaster Management activities including prevention, preparedness, risk reduction and recovery phases.











# **EMERGENCY SERVICE**





## **RM PORTFOLIO : REFERENCE PRODUCTS**



#### **Reference product (REF)**

#### > Outside Europe





#### **Emergency Management Service**







# **RM PORTFOLIO : FIRST ESTIMANTE**







Emergency Management Service







# **RM PORTFOLIO : DELINEATION**



#### **Delineation product (DEL)**

- > ExtExtension of the event
- Possibility to make follow-up products (DEL MONIT)



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**Emergency Management Service** 





# **RM PORTFOLIO : GRADING**



Impact of the event by gradation of damage on the infrastructures

Possibility to make followup products (GRA MONIT)





Emergency Management Service

## Grading product (GRA)









# **EMS PRODUCT DISEMINATION**

Content and format of standardized products

Vector package

Set of vector layers used in the main map

Formats shapefile, GeoJSON, KML + SLD (style)

Ready-to-print map (RTP)

https://emergency.copernicus.eu/mapping/listof-components/EMSR452

On the whole AOI + zooms if necessary

Formats JPEG, PDF













### ICube- SERTIT's rapid mapping set-up

**16 rapid mapping members** for production & management activities

- Availability 24/7/365
- 5 people on-call per day in 2 teams
- 1 contact point at all times
- 2 managers every day (day/night) during On-duty Operator weeks
  - Managing 3 to 5 production teams

New dedicated crisis room Main involvement periods are afternoon & evening 40% activity during the week end







### ICube- SERTIT's rapid mapping set-up

#### EQUIPE DE CARTOGRAPHIE RAPIDE – Du 22 au 28 avril 2022

Astreinte CEMS RM ODO + PS 24/7 + autres cadres

ODO	Vendredi	Samedi	Dimanche	Lundi	Mardi	Mercredi	Jeudi	
Jour 8-20h	Stéphanie Hervé		Stephen			Henri		
Nuit 20-8h		Nadine		Henri	Hervé			
BU 10-22h		Mathias			Claire			
PS 24/7	Vendredi	Samedi	Dimanche	Lundi	Mardi	Mercredi	Jeudi	
PC 7-19h	Ari			Thomas Mathias			hias	
IN 7-19h	Thomas	Danielle	Henri	Ari Michal			hal	
PC 19-7h	Mic	hal	Stéphanie	Danielle				
IN 19-7h	Sabrine		Maxime		Ari			
	Vendredi	Samedi	Dimanche	Lundi	Mardi	Mercredi	Jeudi	

	venureur	Sameur	Dimanche	Lunui	Marui	Mercreur	Jeuui	
PM 7-7h		Mathilde					Stéphanie	
IN 7-7h	-	Robin			-	-		





# SUMMER 2021: A RECORD OF ACTIVITY

Production records:

- number of parallel activations
- number of production sites involved  $\succ$
- number of products produced per day



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Number of Products Versus Number of PS's







# LOT OF ACTIVATIONS ON FOREST FIRE



## CEMS INFORMATION BULLETIN

The Copernicus Emergency Management Service monitors fire events in the Mediterranean region



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#### MS - MAPPING

- Who can use the service
- How to use the servicePortfolio: Rapid Mapping
- Portfolio: Risk and Recovery
- Quality control
- User Guide

#### RAPID MAPPING

- List of Activations
- Map of Activations
- GeoRSS Feed
- Online Manual

#### RISK AND RECOVER

- List of Activations
- Map of Activations
- GeoRSS Feed
- Online Manual

#### OTHER

- Map of Activations of Other
   Organizations
- Meetings, Workshops
- Citation Guidelines
- Citations
- Press Mentions
- Calls for Tender

Follow @CopernicusEMS

Follow CEMS Mapping News



#### **List of EMS Rapid Mapping Activations**

Title	Event Type	EV	ent Date (UTC	:) A	ffected Countries	
Contains	Drought	Sta	art date	[	Afghanistan	^
	Epidemic				Albania	
Activation Sta	tus Extreme temperatur	E.g.	"2022-06-20 d data		Algeria	
- Any -		20	22.05.21	—	Australia	
	Infestation	E.0.			Austria	~
Apply	set	219	, 2022 00 20	s	Rahamac elect multiple countries with Ctrl	l/Cmd
Act. Code	Title		Event Date	Туре	Country/Terr.	Feed
EMSR574	Flood in Queensland, Austra	lia	2022-05-13	Flood	Australia	🔇 🥝
EMSR573	Wildfire in Prosna, Poland		2022-05-12	Wildfire	Poland	o 🔊
EMSR572	Flood in Bosnia and Herzego	vina	2022-04-01	Flood	Bosnia and Herze	o 🔊
EMSR571	Wildfires in Mexico		2022-03-25	Wildfire	Mexico	o 🔊
EMSR570	Flood in New South Wales, Australia		2022-03-29	Flood	Australia	o 🎉
EMSR569	Flood in Valencian Communi Spain	ty,	2022-03-21	Flood	Spain	🔇 🎑
EMSR568	Cyclone Gombe in Mozambig	ue	2022-03-11	Flood	Mozambique	ؼ 🥝
EMSR567	Floods in Queensland, Austr	alia	2022-02-26	Flood	Australia	o 🔊
EMSR565	Tropical Cyclone Emnati in Madagascar		2022-02-22	Storm	Madagascar	🔊 📡
EMSR564	Tropical Cyclone Batsirai in Madagascar		2022-02-05	Storm	Madagascar	🔊 📡
EMSR563	Tropical Cyclone BATSIRAI i Réunion	n	2022-02-02	Storm	Reunion	🔇 🎑
EMSR562	Floods in Australia		2022-01-29	Flood	Australia	ؼ 🥝
EMSR561	Floods in Malawi		2022-01-24	Flood	Malawi	o 🎉
EMSR560	Wildfire in Broken Island, Falkland Islands		2022-01-21	Wildfire	Falkland Islands	o 🎉
EMSR559	Flood in Madagascar		2022-01-18	Flood	Madagascar	冬 🎉
EMSR558	Volcano eruption in Tonga		2022-01-15	Volcanic ad	ctiv Tonga	🔕 🎉
EMSR557	Floods in Norway		2022-01-13	Flood	Norway	🔕 🎉
EMSR556	Super Typhoon Rai, Philippin	ies	2021-12-13	Storm	Philippines	🔕 🎉
EMSR555	Flood in the Ebro river basin Spain	۱,	2021-12-10	Flood	Spain	69 🎉
EMSR554	Floods in Queensland, Austr	alia	2021-12-01	Flood	Australia	🔊 📡
EMSR552	Windstorm in Norway		2021-11-19	Storm	Norway	冬 🎉
EMSR551	Flood in Sulaymaniyah Distr Iraq	ict,	2021-11-20	Flood	Iraq	🔇 🎑
EMSR550	Flood in New South Wales,		2021-11-10	Flood	Australia	🔊 📡

rtit Icube

## EMS Copernicus over Lebanon

List of Activations

	COPERNICUS			COPERICUS Europe's eyes on Earth	
European Commission	Emergency Mana	gement Service - N	lapping		
Home   What is Copernie	cus?   What is CEMS	- Mapping?   Link t	to Early Warning	Systems News 🔊	
LATEST NEWS · 2022-03-01	[EMSN124] Ground deform	nation in La Palma Island	, Spain (continuation	n of EMSN112)	
EMS - MAPPING	List of EMS	Rapid Mappi	ng Activat	ions	
<ul> <li>Who can use the service</li> <li>How to use the service</li> <li>Portfolio: Rapid Mapping</li> <li>Portfolio: Risk and Recovery</li> <li>Quality control</li> <li>User Guide</li> </ul>	Title Contains Activation Status Apply Reset	Event Type Even Drought Star Epidemic Extreme temperatur Humanitarian Infestation E.g., 2 E.g., 2	nt Date (UTC) et date 2022-06-20 date 205-21 2022-06-20	Affected Countries Itaiy Jordan Kenya Laos Latvia Lebanon Select multiple countries with Ctrl/Cmd	
RAPID MAPPING	Act. Code▼ Title		Event Date Typ	e Country/Terr. Feed	
<ul> <li>List of Activations</li> <li>Map of Activations</li> </ul>	EMSR452 Explosio EMSR396 Fires in	n in Beirut, Lebanon Lebanon	2020-08-04 Indu 2019-10-15 Wild	istrial acc Lebanon 🛛 🚳 💥 fire Lebanon 🚳 🎉	Europe's eyes on Earth
GeoRSS Feed		Displayin	ig 1 - 2 of 2 items		
Online Manual					
		Home What is Coperin LATEST NEWS - 2022-05-18   EMS - MAPPING • Who can use the service • How to use the service • Portfolio: Rapid Mapping • Portfolio: Risk and Recovery • Quality control • User Guide RAPID MAPPING • List of Activations • Map of Activations • GeoRSS Feed • Online Manual	CCUS?       What is CEM:         [EMSN128] Multi-risk an         List of EMS         Title         Contains         Act. Status         -Any -         Apply         Reset         Act. Code         Title         EMSN087         Reconstr         EMSN081         EXPNO81	S - Mapping?       Link to Early Warnin         Indyses for Delphi and Ancient Olympia archa         Risk and Recovery Ma         Event Type         Drought         Epidemic         Extreme temperatur         Humanitarian         Infestation         Extreme temperatur         Humanitarian         Infestation         Extreme temperatur         Humanitarian         Infestation         Eg. 2022-06-20         End date         Eg. 2022-06-20         Extreme temperatur         Humanitarian         Infestation         Extreme temperatur         Humanitarian         Infestation         Euler Control         End date         Eg. 2022-06-20         End date         Eg. 2022-06-20         Extreme temperatur         End date         Eg. 2022-06-20         Extreme temperatur         End date         Eg. 2022-06-20         Extreme temperatur         Extreme temperatur         Eg. 2022-06-20         Extreme temperatur         Extreme temperatur         Extreme temper	g Systems       News       News         ecological sites in Greece         appling Activations         barbard       State         Jany       Image         Italy       Image         Italy       Image         Italy       Image         Italy       Image         Italy       Image         Select multiple countries with Ctrl/Cmd         Image August       Lebanon         struction       Image August         Image August       Lebanon         struction       Image August         Image August       Lebanon         Image August       Image August         Image August       Image August
	Theia	RISK AND RECOVERY		Displaying 1 - 2 of 2 items	

## **Regional Flood Mapping: a Copernicus downstream service**

#### Service purpose

- Synergistic exploitation of Earth Observation SAR (S-1) & Optical Images (S-2) and local data for
- mapping & monitoring of local & regional flood event (mid size events)
- collecting geo-information related to on-going or historical hydrological ever

#### **Service Utility**

Flood situation management

- Flood Event Memory & Flood Atlas
- **Flood Risk Prevention**

Flood Modelization (calibration, validation) & Forecasting

Water & Environment management (humid areas)

#### Users

Actors in charge of

- River Basin, Wetlands, Water & Flood Management
- Land Planning & Environmental Management
- Local / Regional Authorities & State Services
- Insurance sector



-15.29%

-10,41%

26,729

685

-9,71%

-7,93%

25,14

-36,599

-38,26%

-64,275

507



-31.82%

-23.28%

53.067

5047,2269

Union's Horizon 2020 research and innovation programme under grant agreement No 730150



-26,54%

-19.97%

49,43%

2616







### The January 2018 Flood Events in France (Storm Eleanor)



Storm Eleanor impacted Western Europe on the 2 and 3 of January 2018, bringing strong winds and heavy rains which lasted nearly all the month



The French CP activated EMS Rapid Mapping over the Northern part of France for the Seine, Marne and main tributaries' river flooding (EMSR265)

The regional flood mapping service monitored the evolution of the situation of the main rivers in NE France with the exploitation of Sentinel-1 data

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### Historical plain flood monitoring with S -1 archives









## Multitemporal Approach: Sentinel1 Flood January 2018





## Near daily acquisitions with S1A and S1B









#### Copernicus Downstream Services: Grand Est Regional flood mapping and monitoring



FRANCE - Grand Est Region Meuse river **Commercy and Saint-Mihiel area** Flood map Situation the 27/01/2018



Water observed the 27/01/2018 Reference water (BD TOPO © IGN)

Sentinel-1A data (acquired the 27/01/2018 at 05:42 UTC, GSD 10m) provided under COPERNICUS by the European Union and ESA.

2.5 Km

Map produced the 29th of January 2018 by SERTIT within the EUGENIUS H2020 project.







Meuse river

Flood map

Situation the 29/01/2018









# **Risk & Recovery frameworks**



#### **CEOS Recovery Observatory**

**RO Demonstrator** Several use cases in Nepal and Malawi

**RO Haiti** 4-year project to support the post-Matthew recovery phase in Haiti

cnes

**Generic RO** On-call project manager and value-adder for short-term RO activations



**ESA EO Clinic** 

### esa

3 "on-call" pre-qualified consortia **System of Request for Proposals** 



To development banks and agencies

Université





### COPERNICUS EMERGENCY MANAGEMENT SERVICE RISK & RECOVERY MAPPING



Emergency Management Service



#### 115 activations since 2012

- Roles and partners similar to CEMS RM
- SERTIT in the consortium:
- >TPoC/SRM (activation management),
- >PS (production site)

### Service STANDARD (STD)

- 8/7 production, from 2 to 15 days according the product
- 1 consortium : eGeos (leader), SERTIT, GAF, SIRS, ITHACA, GMV, TPZ Iberica, IABG
- 20 different products, distributed wrt partner's skills

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#### Service FLEX

- > 8/7 production, usually 20 days
- > 2 consortia incl. IABG (leader), eGeos, SERTIT, GAF, GMV → system of ITT
- Tailored products according the request form





### COPERNICUS EMERGENCY MANAGEMENT SERVICE RISK & RECOVERY MAPPING: EXAMPLE



LATEST NEWS · 2022-02-16 | [EMSN123] Nation-wide asset mapping for Austria based on Basic European Assets Map (BEAM)

#### EMS - MAPPING

- Who can use the service
- How to use the service
- Portfolio: Rapid Mapping
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#### OTHER

- Map of Activations of Other Organizations
- Meetings, Workshops
- Citation Guidelines
- Citations

#### EMSR452: Explosion in Beirut, Lebanon

Event Time (UTC): 2020-08-04 15:00 Event Time (LOC): 2020-08-04 18:00 Event Type: Industrial accident (Explosion) Activation Time (UTC): 2020-08-04 18:36 Activation Status: Closed Affected Countries/Territories: Lebanese Republic Service Output: 2 products (3 maps) Grading: 2 products (3 maps) Authorised User:

EC Services|DG ECHO

#### Activation Reason:

A large explosion rocked the Lebanese capital of Beirut, damaging buildings and offices around the city. The blast appears to have been centered on the city's port area and at least 100 people were killed in the explosion.





EMSR452 - Activation Extent Map 7 Release: r04 - Version: v1 - Delivered: 2020-08-08 12:57 View as: EMSR452-AEM-JPG - EMSR452-AEM-KMZ - EMSR452-AEM

#### Related activation(s):

[EMSN087] Reconstruction monitoring in Beirut, Lebanon, following August 2020 explosion, for the Reform, Recovery and Reconstruction Framework (3RF)

[EMSN081] Explosion in Beirut, Lebanon: detailed damage and impact assessment analyses



\*\*\*\*

### COPERNICUS EMERGENCY MANAGEMENT SERVICE RISK & RECOVERY MAPPING: EXAMPLE

COPERNICUS RISK AND RECOVERY MAPPING ACTIVATION					
AC	TIVATION DETAILS				
Activation Name	EMSN081: Explosion in Beirut, Lebanon: detailed damage and impact assessment analyses				
Authorized User	DG ECHO, European Emergency Response Coordination Centre-ERCC				
Date and Time of Activation (UTC)	05.08.2020 15:31 UTC				
EVENT DETAILS					
Event Type(s)	Humanitarian crisis				
Location	Beirut, Lebanon				
Date and Time of the Event (UTC) 04.08.2020 15:00 UTC					



### **COPERNICUS EMERGENCY MANAGEMENT SERVICE RISK & RECOVERY MAPPING - EXAMPLES**

#### EMSN063: Crop change detection in conflict areas, Nigeria EMSN083: Crop change detection in conflict areas, Nigeria, October 2020





- Triggered by the World Food Program
- Boko-Haram is very active since 2009
- Food security issues in NE Nigeria
- The area has not been accessed for several years •
- **Request for:** •
  - Crop change analysis (2010-2019-2020) •
  - Statistics on affected population





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### COPERNICUS EMERGENCY MANAGEMENT SERVICE RISK & RECOVERY MAPPING - EXAMPLES

#### EMSN063: Crop change detection in conflict areas, Nigeria EMSN083: Crop change detection in conflict areas, Nigeria, October 2020

**I**heid







### **COPERNICUS EMERGENCY MANAGEMENT SERVICE RISK & RECOVERY MAPPING - EXAMPLES**

EMSN063: Crop change detection in conflict areas, Nigeria EMSN083: Crop change detection in conflict areas, Nigeria, October 2020 EMSN113: Crop change detection in conflict-affected areas of Nigeria, agricultural season 2021







- Update of populated places using VHR data
- Type assigned according the visible size
- Creation of polygons according the type
- Use of HRSL data (Facebook Columbia Univ.)
- Population aggregated per area

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### **CEOS RECOVERY OBSERVATORY + CEMS RRM - EXAMPLES**

EMSN084: ETA and IOTA hurricanes effects in Honduras EMSN094: Hurricanes ETA and IOTA, Nicaragua EMSN104: ETA and IOTA hurricanes effects in Guatemala

- Flood delineation & temporal evolution
- Detailed damaged assessments
- Landslide risk













## The Space and Major disaster framework







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## The Space and Major disaster framework



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## Latest Charter Activations



13 APRIL 2022

05 APRIL 2022

Flood in Brazil >

25 FEBRUARY 2022

Cyclone Emnati in Madagascar >

**Tropical Storm** Megi in the Philippines >



13 APRIL 2022

Landslide and flooding in South Africa >



Cyclone Gombe in Mozambique ►



landslide in Brazil >

Flood and



04 FEBRUARY 2022

**Tropical Cyclone** Batsirai in Madagascar >



01 FEBRUARY 2022

Flooding in Ecuador >



MADAGASCAR





The Space and

**Major disaster** 



## Charter activations over Lebanon

2020, August, industrial accident

2019, October, fires in Lebanon and Syria

2006, July, Oil spill

2001; Oil spill







## **Rapid mapping activation map**

### Where have we worked?



#### 30 activations related to the Charter in 2020

#### http://sertit.unistra.fr/









## **Rapid mapping activation map**

### Where have we worked?



#### 30 activations related to the Charter in 2020

Theia

http://sertit.unistra.fr/









ACCUEIL CARTOGRAPHIE RAPIDE PRESTA

#### https://sertit.unistra.fr/rms/?action=697&product=01

### CHARTE CALL 765 (ID 664) - ACCIDENT INDUSTRIEL AU LIBAN

### 01 - CARTE D'IMPACT



TÉLÉCHARGER CARTE TÉLÉCHARGER VECTEURS



Localisation : Beyrouth, Liban Echelle : 1:6500 Image principale : Image Pléiades acquise le 05/08/2020 Date de production : 05/08/2020





#### http://sertit.unistra.fr/





### **Training at ICube SERTIT: worldwide**

- Athens Polytechnicum Paris, INSA Strasbourg, Teppsiques, International Space University
  Bulgarisk
- •ESA Land Training: Lisbonne, Prague, Cracovie, Athènes, Bucarest, Leicester
- CNES: OTB & Qgis Haïti, Mexique
- •ESA DRAGON training: Wuhan, Lanzhou, Beijing Nanchang, Kunming, Chongquing
- Catachina, RMS Bangkok
- Vietnam: SAR Hanoi 2007 , EO Do Song 2014, Quy Nhon 2019

Theia

- •Marocco, Algeria
- Ivory Coast, Gabon, Chad
- •Iran, India (THEIA)













## **Training at ICube SERTIT: worldwide**

Client	Public	Période
Ambassade française en Algérie	DPGC Algérie	2016, 2017
CNES	CNIGS	2014, 2015, 2018
ISU	Master	2018
Airbus DS GEO	GISTDA	2021, 2022
CRTS Maroc	CRTS Maroc	2022
ESA-CNES	ESSTI Ethiopie	2021
ESA-CNES	Candidatures ouvertes (collectivités, étudiants)	2021





Thank you for your attention Merci pour votre attention

# http://sertit.unistra.fr/

# herve.yesou@unistra.fr









### « Ask them how to look at it ... everything here is upside down ! »

![](_page_52_Picture_2.jpeg)

![](_page_52_Picture_3.jpeg)

![](_page_52_Picture_4.jpeg)