

The State of Space Techniques in African French Speaking: Bottleneck and Future Perspective

Anas EMRAN (IS/UM5)

CRASTE-LF

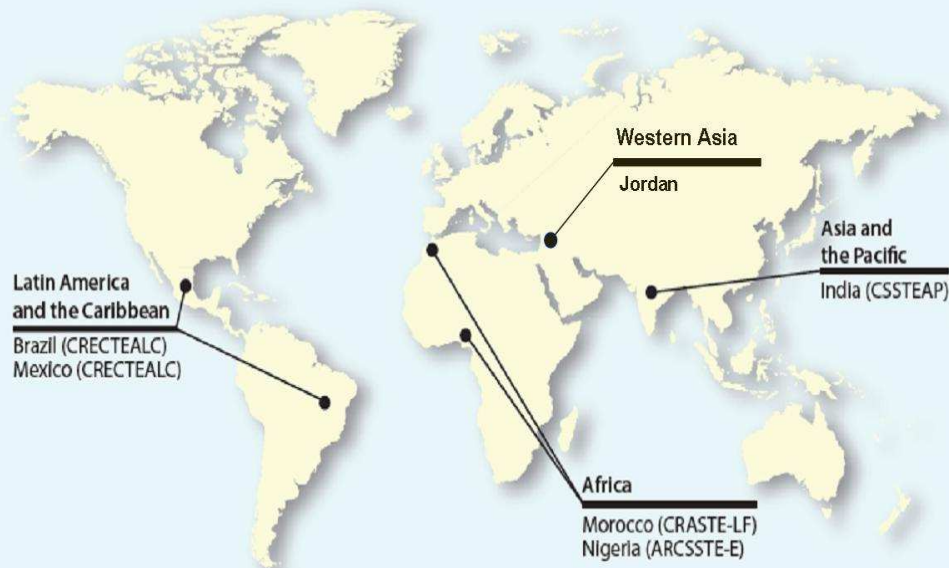
African Regional Centre for Space Science and
Technology Education, in French Language

1. Presentation of CRASTE-LF

The **CRASTE-LF** has been established, on the initiative of the UN-OOSA program on applied of the UN/G.A. Resolutions, in Rabat on October 23, 1998, by 11 African States.

United Nation General Assembly Resolutions

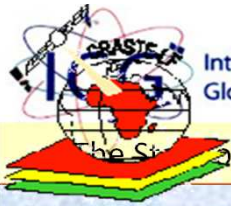
45/72 of 11th Nov. 1990
50/27 of 6th Dec. 1995 ,
International effort to create Regional Centers for Space Science and Technology Education, affiliated to U.N.



5 Centers affiliated to UN in activities in differences regions of the World :

1. **India (Asia & Pacific, 1995)**
2. **Morocco (Africa – French Language, 1998)**
3. **Nigeria (Africa – English Language, 1998)**
4. **Brazil – Mexico (Latin America & Caribbean, 2003)**
5. **Jordan (Western Asia, 2012, June)**

<http://crastelf.org.ma/>



1. Presentation of CRASTE-LF

Objectives of the Centre

- To **increase knowledge** in Space Sciences and Technologies by organizing Postgraduate and/or Short courses, Seminars, Workshops, Conferences at the Regional level.
- To improve the technical **competences** of the **experts, teachers, decision-makers** and to hold them informed about technical progress .
- To **assist** the countries of the region on the development of endogenous capacities in space tools.
- To **Strengthen** the Local and Regional Capacities.
- To promote **Cooperation** between the **Developed Countries** and **States Members** as well as among **these States**.
- To develop **expertise** in Space Sciences and Technology.

1. Presentation of CRASTE-LF

Contribution of Post Graduate Training on Space Science and Technology

13 Member States : Algeria,
Cameroon,
Cape Verde, Central African
R., Ivory Coast, D. R. of
Congo, Gabon, Morocco,
Mauritania, Niger, Senegal,
Togo and Tunisia.

Other countries non-member
can benefit from the services
offer by CRASTE-LF






Building of CRASTE-LF, Rabat, Morocco

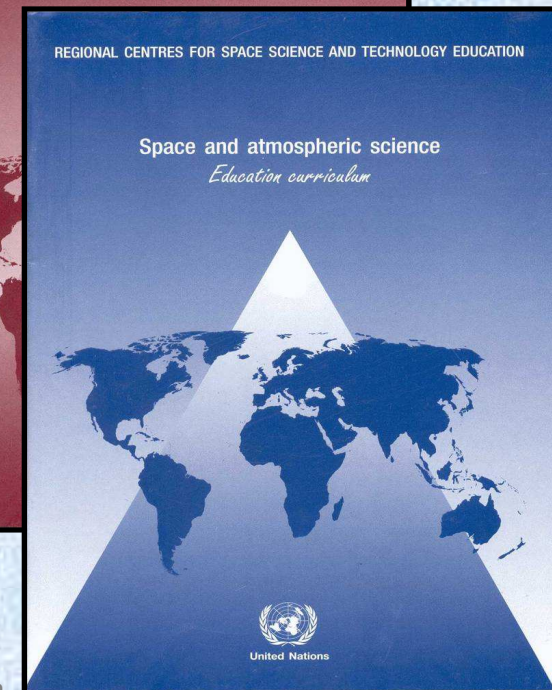
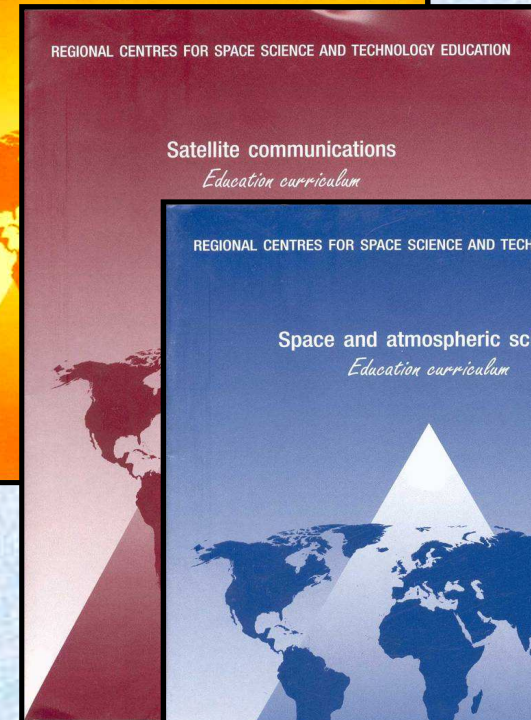
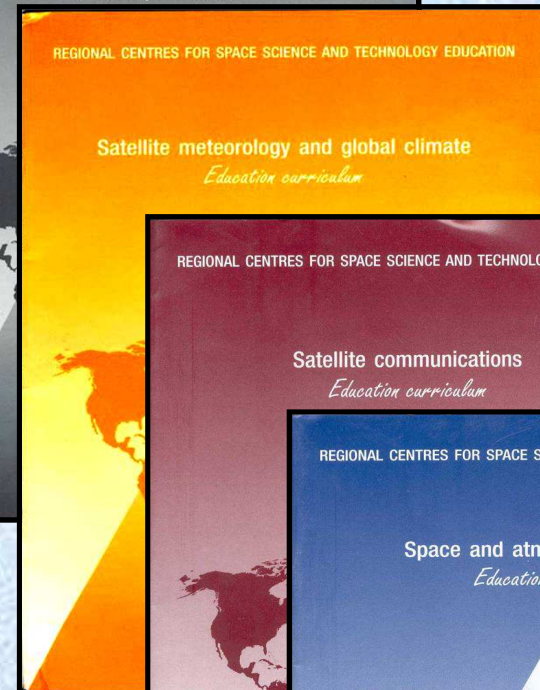
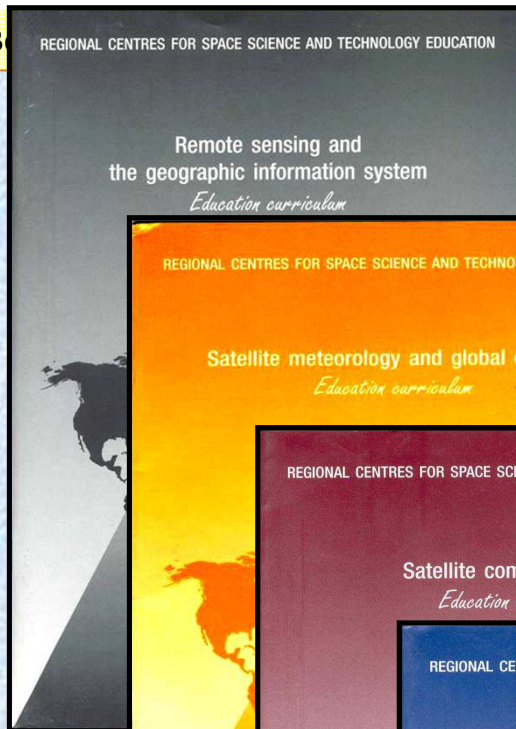
1. Presentation of CRASTE-LF

→ 1.1. Training Courses

Main Courses Programs (1)

Education Curricula established
and Published by UN-OOSA for
Regional Centres for Space
Science and Technology
Education in:

-  Remote Sensing & GIS
-  Satellite Communications
-  Satellite Meteorology & GC
-  Space and Atmospheric Science




1. Presentation of CRASTE-LF

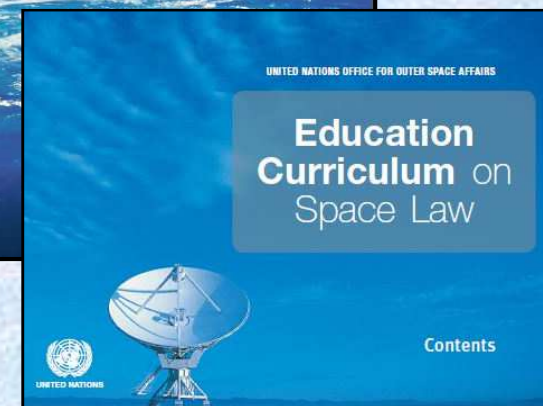
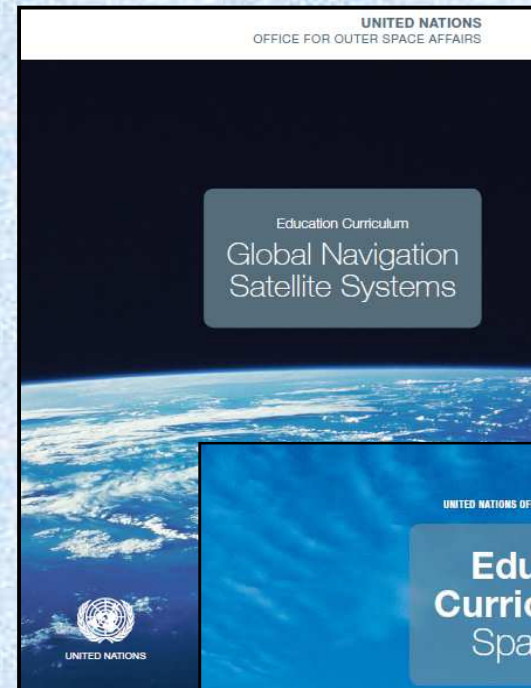
→ 1.1. Training Courses

Main Courses Programs (2)

**Education Curriculum established
and published by UN-OOSA for
Regional Centres for Space
Science and Technology
Education in:**

 **GNSS (Since 2012)**

 **Space Law**



1. Presentation of CRASTE-LF

1.1. Training Courses

Each Training Session takes place in 2 phases



Phase I : 9 to10 Months or 3 semesters , **in Centre**, theoretical and practical courses, land study and pilot project ~ 1000 h.



Phase II: 12 to 15 Months, achieve the Research Project **in their institution**.



End of phase II : Defense of Memoire **in Centre** (Jury Members are Professors and Experts) .

Detail of courses in Web Site:

www.crastelf.org.ma

- www.oosa.unvienna.org/SAP/centres/centres.htm
- www.unoosa.org/oosa/SAP/gnss/icg.htm

1. Presentation of CRASTE-LF

1.1. Training Courses



1. Presentation of CRASTE-LF

1.1. Training Courses



1. Presentation of CRASTE-LF

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1. Presentation of CRASTE-LF

1.1. Training Courses



1. Presentation of CRASTE-LF

1.1. Training Courses

Accreditation




In 2012 the CRASTE-LF launched of *Accredited Post-Graduate training in Space Sciences & Technology* with two options **Remote Sensing & GIS and Satellite Meteorology & Global Climate** in collaboration of Mohammed V University of Rabat.

This year there are the fourth postgraduate training courses accredited.

1. Presentation of CRASTE-LF

1.1. Training Courses

Realized Training Courses

 **11 training** courses in Remote Sensing and GIS, **Apr. 2000 - Sept. 2015**

250 trainees from
21 member and non member countries &
27 different institutes

1. Presentation of CRASTE-LF

1.1. Training Courses

Realized Training Courses



11 training courses in Remote Sensing and GIS, **Apr. 2000 - Sept. 2015**



6 training courses in Satellite Meteorology and Global Climate
Jan. 2002 -Sept. 2015

65 trainees from
10 member and non member countries &
16 different institutes

1. Presentation of CRASTE-LF

1.1. Training Courses

Realized Training Courses



11 training courses in Remote Sensing and GIS, **Apr. 2000 - Sept. 2015**



6 training courses in Satellite Meteorology and Global Climate
Jan. 2002 -Sept. 2015



3 training courses in Satellite Communications **Dec. 2000 - 2007**

33 trainees from
10 member and non member countries &
10 different institutes

1. Presentation of CRASTE-LF

1.1. Training Courses

Realized Training Courses



11 training courses in Remote Sensing and GIS, **Apr. 2000 - Sept. 2015**



6 training courses in Satellite Meteorology and Global Climate
Jan. 2002 -Sept. 2015



3 training courses in Satellite Communications **Dec. 2000 - 2007**



1 training courses on GNSS, **Nov. 2013**

12 trainees from
6 member and non member countries &
8 different institutes

'The State of Space Techniques in African French Speaking: Bottleneck and Future Perspective'

1. Presentation of CRASTE-LF → **1. 2. Short Training Courses**

le workshop
"L'Outil Spatial
des Catastrophes et de
Aspects Technique"

Organisé par
L'AGENCE SPATIALE
ORGANISME
EN COLLABORATION
Avec
LE CENTRE REGIONAL AFRICAIN DE
DE L'ESPACE (IVR)
L'ASSOCIATION ALGERIENNE DE
ET L'ENVIRONNEMENT
UN/ATELIER INTERNATIONALE

Changements
et Adaptation
le Rôle des Techn

Ecole Mohamm
Rabat (Maroc) le

Logos: CRASTE-LF, OOSA, EUMETSAT, innoterra, CNES (France), ESA-ECSL, ITHACA (Italie), etc.

République Algérienne Démocratique et Populaire

Sous le haut patronage de
Monsieur le Ministre
de l'Aménagement
du Territoire, de l'Environnement
et du Tourisme

Organisé par
L'AGENCE SPATIALE
ORGANISME
EN COLLABORATION
Avec
LE CENTRE REGIONAL AFRICAIN DE
DE L'ESPACE (IVR)
L'ASSOCIATION ALGERIENNE DE
ET L'ENVIRONNEMENT
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Changements
et Adaptation
le Rôle des Techn

Logos: CRASTE-LF, OOSA, EUMETSAT, innoterra, CNES (France), ESA-ECSL, ITHACA (Italie), etc.

Organisent une
**CONFERENCE
INTERNATIONALE**

**INFORMATIONS GEOGRAPHIQUES
EFFETS & IMPACTS
CHANGEMENTS CLIMATIQUES
AFRIQUE**

Les 30 Novembre, 01 et 02 Décembre
A l'Ecole Mohammadia d'Ingénierie

Logos: CRASTE-LF, UN-OOSA, ISESCO, EMI, etc.

SCHOOL ON SPACE WEATHER
RABAT / MAROC [December 5-16, 2011]
Organized by the French ISWI national committee
CRASTE - EMI - MENESFCRS

Logos: ISWI, CRASTE, EMI, MENESFCRS, etc.

The Sun is the source of many physical processes (radiations, winds, mass ejections, energetic particles) that may affect the terrestrial environment

Sunspot and magnetic loops at the surface of the Sun

Northern Lights

Objectives
-To learn about the solar processes influencing the terrestrial environment
-To learn how to use data obtained with the network of instruments in Africa

Program
Lectures and practical work
First week
Solar Physics: Solar radiation and its variability
Solar cycle and activity
Solar flares, Coronal mass ejection and solar energetic particles
Solar wind and its perturbations
Magnetosphere and Ionosphere of the Earth
Solar-terrestrial Physics and Space Weather

Instruments deployed in Africa in the context of the International Heliophysical Year IHY (2007-2009)

Program
Lectures and practical work
Second week
Upper Atmosphere
Ionospheric electric current
Earth's magnetic field
Atmospheric electricity
Precipitation systems
Chemistry and Transport in the atmosphere
Sounding of the earth's atmosphere by microwave radio instruments

Logos: EUMETSAT, innoterra, CNES (France), ESA-ECSL, ITHACA (Italie), etc.

'The State of Space Techniques in African French Speaking: Bottleneck and Future Perspective'

1. Presentation of CRASTE-LF

1. 2. Short Training Courses

**Establishment of the African Network on Earth
Observation and Climate Change**



Ouagadougou, Burkina Faso Nov. 2010



Lome - Republic of Togo, June 2010

1. Presentation of CRASTE-LF

1. 2. Short Training Courses

Training workshop and plenary Conference in Konakry Guinea 2013



'The State of Space Techniques in African French Speaking: Bottleneck and Future Perspective'

1. Presentation of CRASTE-LF

1. 2. Short Training Courses

Workshop with training organized in Yaoundé in Cameroon 2014



1. Presentation of CRASTE-LF

1. 2. Short Training Courses

Participants in Workshop organized in North Africa

Conference in Alger 2007, Clim. Chgt & Adapt in Africa



Conference in Rabat 2009, Disaster Management





1. Presentation of CRASTE-LF

1. 2. Short Training Courses

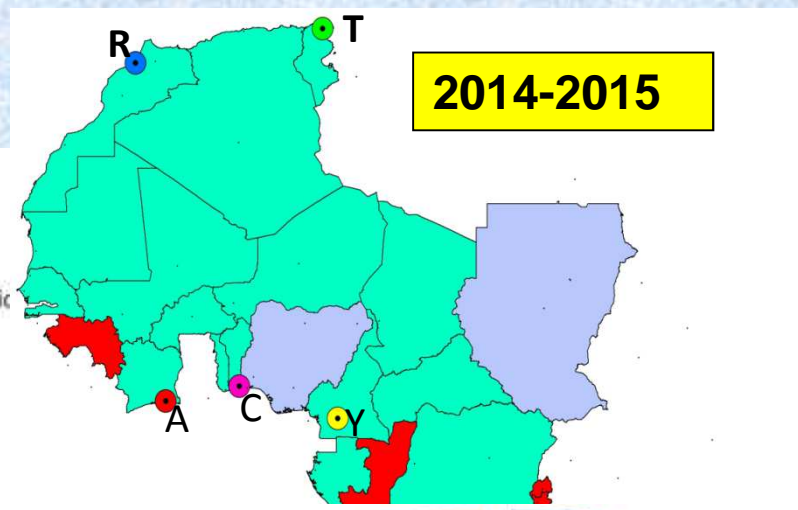
- ✓ 8 seminars in EO
- ✓ 5 CB Short Courses

✓ 203 participants followed short courses of EO CB - 17 countries.

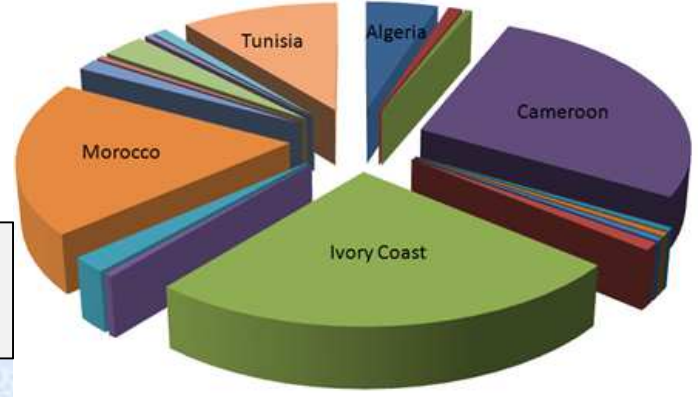
✓ 868 participants attended the seminars of EO -18 countries.

- ✓ Stakeholders
- ✓ Experts
- ✓ End Users

✓ The approach has convinced and opened a dialogue between the three components of the process.



- Algeria
- Benin
- Burkina faso
- Cameroon
- Centre Afrique Republic
- Chad
- Congo
- Gabon
- Ivory Coast
- Mali
- Mauritania
- Morocco
- Niger
- R.D. Congo
- Senegal
- Sudan
- Togo
- Tunisia



Participants in CB short Courses by country

1. Presentation of CRASTE-LF

1.2. Short Training Courses

5 realized on GNSS



Satellite Navigation and Location Based Services – Rabat, Morocco

28 September – 24 October 2009.

35 trainees - 19 Countries.



Navigation and Positioning Services Based on Satellite, - Lome , Togo

October 2011.

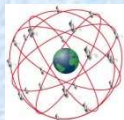
24 trainees - 6 Countries.



Post Graduate training courses on GNSS - Rabat, Morocco

November 2013 – Aug 2015

12 trainees - 6 Countries.



Space Weather & GNSS Applications - Rabat, Morocco

February 2015

29 trainees - 13 Countries.



The first project realized in ANCFCC (National Agency of Land Conservation, Cadastre and Cartography) by one trainee on “Design of a mobile application relating to plot recognition of land registration overall” has been presented in Sep. 2015 in Centre.

Realized Short Training Courses on GNSS (1)

1 training Short courses on “Satellite Navigation and Location Based Services”,
28 September – 24 October 2009, with participation of **35 trainees**
from **19 Countries** & from **32** different institutes supervised by **10** experts.



Cours International
Navigation et Services basés sur
le Positionnement par Satellites

Rabat, du 28 septembre au 24 Octobre 2009

organisé par
Le Centre Régional Africain des Sciences et Technologies de l'Espace
En Partenariat avec
Le Bureau des Affaires Spatiales de l'ONU à Vienne (UN-OOSA)
Le CIE GALILEO Morocco Group (Maroc)
L'Ecole Mohammadia d'Ingénieurs (EMI - Maroc)
L'Office National Des Aéroports (ONDA-Maroc)

Avec le Soutien de l'Agence Spatiale Européenne et des Etats Unis d'Amérique à travers le Comité International de Navigation Globale par Satellite (ICG)



Participation of trainees to the demonstration on live under the METIS project team at Mohamed V Airport.

Realized Short Training Courses GNSS (2) - Togo

Regional Training Workshop on Navigation and Positioning Services Based on Satellite, Organized in Lome , Togo in October 2011 with 24 participants from 6 African countries.



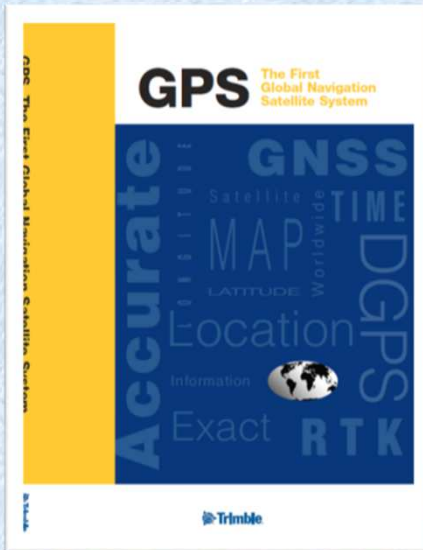
Boulder - 10th ICG-Meeting



'The State of Space Techniques in African French Speaking: Bottleneck and Future Perspective'

Realized Postgraduate Training Courses GNSS (3)

GPS Materials



The trainees supervised by four Experts from International Institute for GNSS Education of Beijing China,

GNSS BEIDOU Equipment



'The State of Space Techniques in African French Speaking: Bottleneck and Future Perspective'

Realized Training Courses (4)

Training Workshop (with ISWI/UNOOSA) on
"Space Weather & GNSS Applications", Feb
2015 with participation of **29** trainees from **13**
African Countries supervised by **8** teachers.



Realized Training Courses (5)

The first project realized in ANCFCC (National Agency of Land Conservation, Cadastre and Cartography) by one trainee on **“Design of a mobile application relating to plot recognition of land registration overall”** has been presented in September 2015 in the Centre.



The CRASTE-LF participate now in European Project H2020 to benefit of trainees and member States on using E-EGNOS for Intelligent Transportation Systems.
(us it participated before in three FP7 European project for analyzing state of use of Earth Observation and to promote to stakeholders the benefit for their countries to use this techniques, GEONETCAB, EOPOWER & IASON)

1. Presentation of CRASTE-LF

1.3. Dissemination & CB by the Web

The dissemination include all actions that promote the diffusion of EO & CB in AFSC



- By putting data and educational resources created in the scientific events on the CRASTE-LF website crastelf.org.ma :

crastelf.org.ma

The website CRASTE-LF is hosted by Mohammed V University

Centre Régional Africain des Sciences
et Technologie de l'Espace en Langue Française

Affilié à l'ONU

Accueil Formation Conseil d'administration Produits OT

Formation

Le programme de formation du centre est orienté vers la diffusion des connaissances dans le domaine des sciences et tech
l'espace. Initialement, le centre devra offrir un enseignement en profondeur, un programme global de formation et les bases
des projets pilotes , une formation continue, une perception et évaluation des programmes. Ce programme bénéficiera des
spécialistes et professionnelles touchant la technologie spatiale.

Le centre offre des cours de formation pour les universitaires, chercheurs, administrateurs
suivantes:

1. **Télétection et système d'information géographique**
2. **Télécommunications par satellite**

Scientifique >

Organisation

Géographique

Logiciels libres pour SIG

Antenne ICG

Antenne LANDSAT

rapports didactique

1. Presentation of CRASTE-LF

1.3. Dissemination & CB by the Web

- - By establishing the link with other geoportals such as the **GEOCAB, GEOSS etc**



The screenshot shows a web interface with a yellow header bar containing 'Conseil d'administration' and 'Produits OT'. A dropdown menu is open under 'Produits OT', listing several categories: 'Scientifique', 'Organisation', 'Géographique', and 'Rapports didactique'. A separate yellow box on the left lists various projects: 'Afromaison', 'IASON', 'EOPOWER', 'GEO / GEOSS', 'GeoNetcab', 'MEDINA', 'SIGMED', and 'SAWIS'.

1. Presentation of CRASTE-LF

1.3. Dissemination & CB by the Web

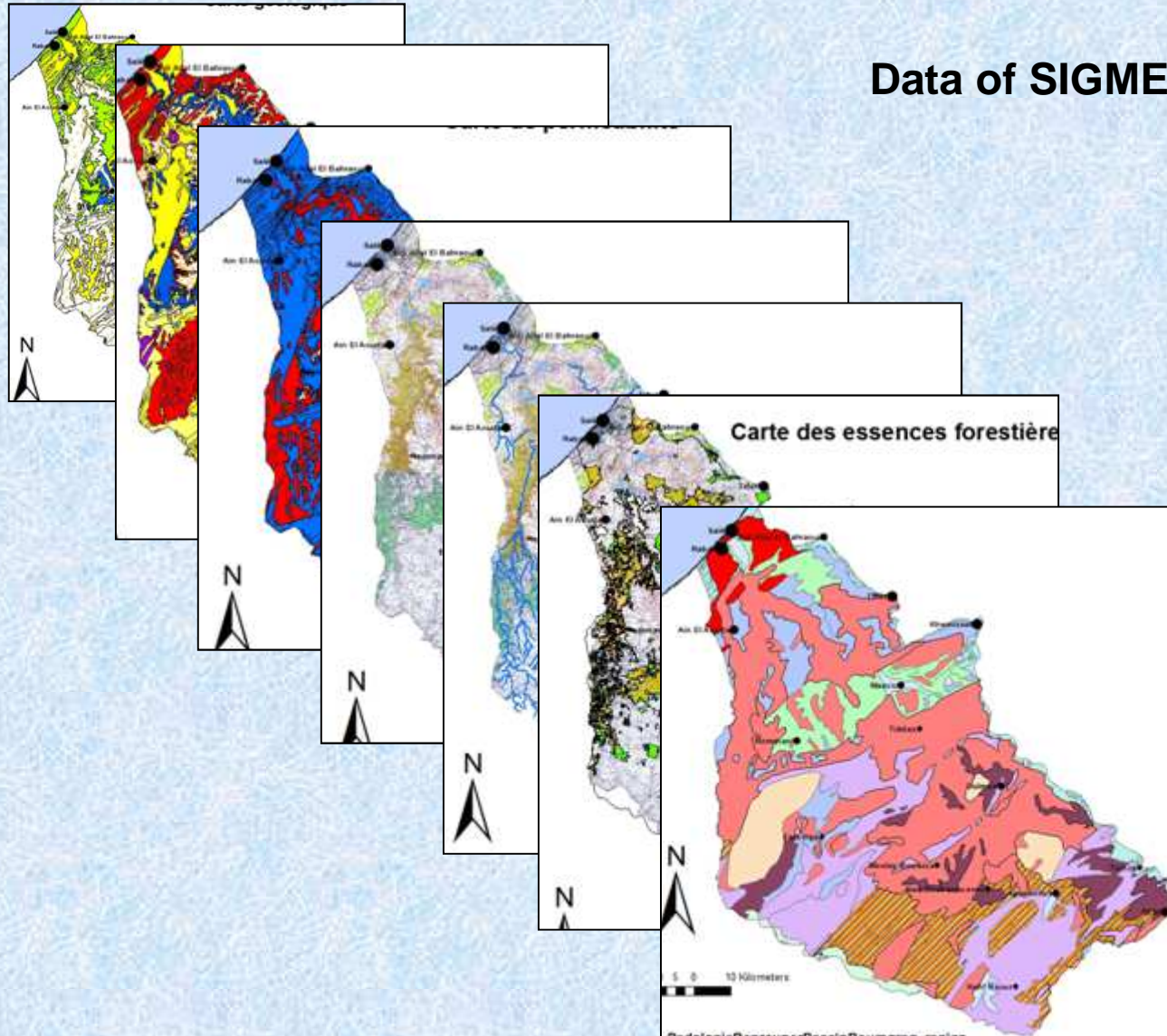
 - By developing Open **Geoportal Data**



The screenshot displays the SIGMED GEPORTAL website. At the top, there is a banner for 'HSM Hydrosources' and 'SIGMED'. Below the banner, the title reads 'Approche Spatialisée de l'Impact des activités agricoles au Maghreb sur les transports solides et les ressources en Eau De grands bassins versants'. There are language options for 'ENGLISH' and 'FRANÇAIS'. A navigation menu includes 'HOME' and 'PROJETS'. A yellow highlight box contains the text 'SIGMED GEPORTAL (Bouregreg Success Story - Morocco)'. Below this, a breadcrumb trail shows 'You are here: Accueil > Data and GIS > The maps'. The main section is titled 'The maps' and 'MAPS OF THE BOUREGREG BASSIN'. It features several map thumbnails with labels: 'The contour of the basin, click on:', 'Pedology, click on:', 'The hydrographic network click on:', 'Bouregreg Sub-basins click on:', 'Administrative divisions click on:', 'vegetation click on:', and 'Geology click on:'.

'The State of Space Techniques in African French Speaking: Bottleneck and Future Perspective'

Data of SIGMED GEOPORTAL



16 thematic layers

- Administrative Division
- Geology
- Soils
- Vegetation
- Pedology
- Hydrography Networks
-

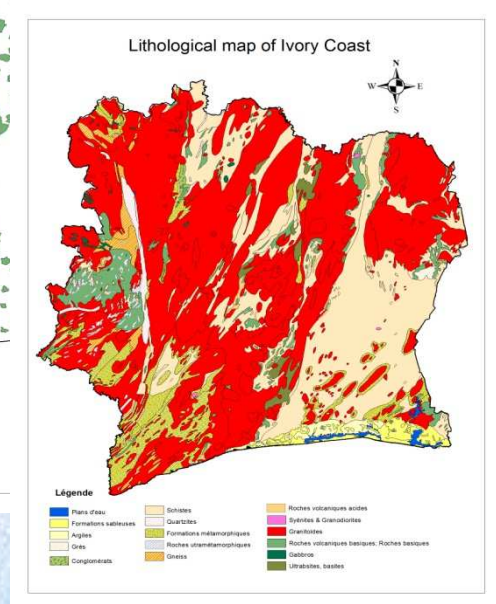
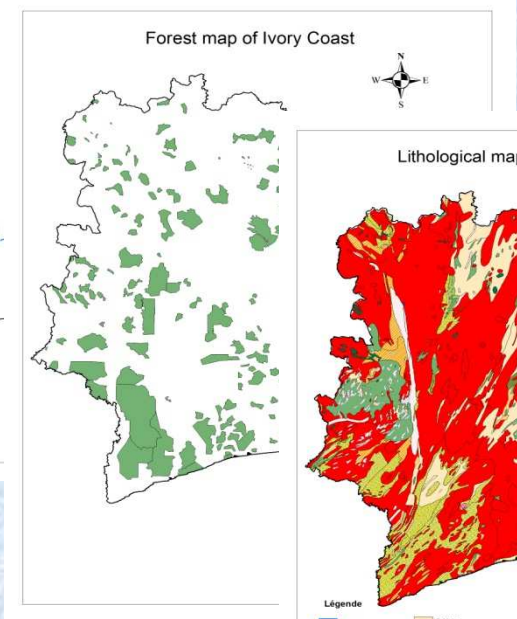
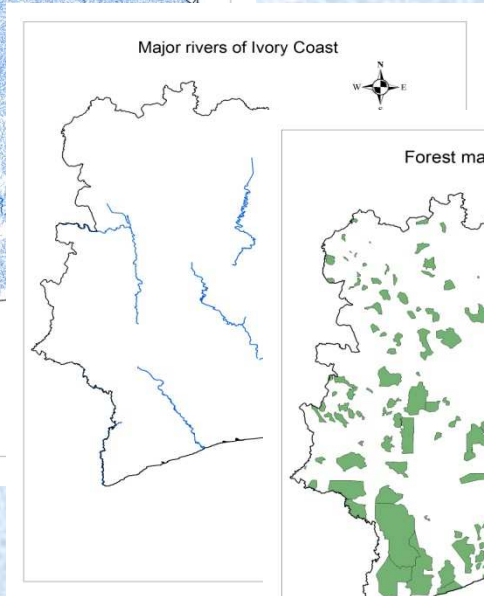
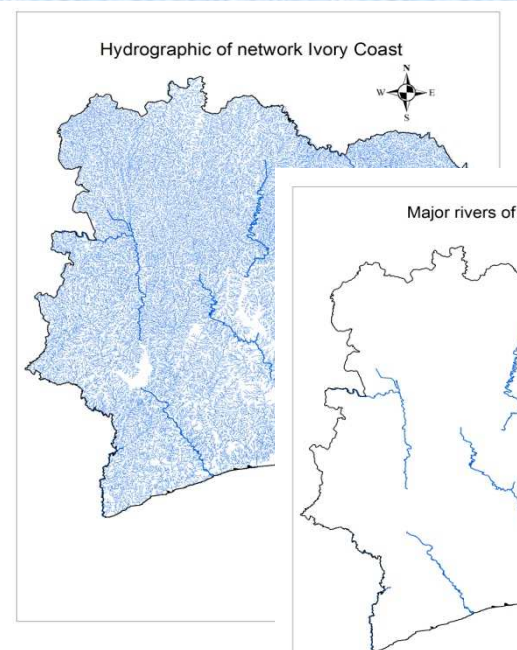
1. Presentation of CRASTE-LF

1.3. Dissemination & CB by the Web

- By developing Open Geoportal Data

'The State of Space Techniques in African French Speaking: Bottleneck and Future Perspective'

Data of CURAT GEOPORTAL



14 thematic layers

- Administrative Division
- Hydrology
- Lande Use
- Road Network
- Railways
-

2. Inventory of use the EO in African French-Speaking Countries 'AFSC'

- In order to understand the state of the EO in AFSC, CRASTE-LF lunched (2009-2015) an inventory of use the EO in AFSC with 3 European FP7 projects.



- **Objective** : achieve a better understanding of the EO in AFSC through an examination of the situation in AFSC (particularly in the 13 members states of CRASTE-LF).

- **Status of existing human resources: scientific, technological and institutional capacities in the EO** : undertaken and completed by an inventory of existing initiatives or capacity



2. Inventory of use the EO in African French-Speaking Countries 'AFSC'

The work should be done through:

- ✓ theoretical studies;
- ✓ report and missions in countries in representative regions of AFSC.

The second phase

- ✓ To compare the diagnosis with the best practices already in place,
- ✓ give an analysis of gaps and priority issues such as:
 - problem of access to resources for capacity building;
 - training needs at different levels of the population;
 - problem of awareness about programs, etc.

Diagnosis :

on the situation in the region of influence CRASTE-LF with an analysis of gaps and priorities

2. Inventory of use the EO in African French-Speaking Countries 'AFSC'

2.1. Inventory of Current situation of EO in AFSC

Ressources Inventory:

1. Questionnaires development

- ✓ Questionnaire to Competence
- ✓ Questionnaire to Institution

2. Sending of questionnaires

- ✓ Trainees of CRASTE-LF 188
- ✓ Experts identified on the web 617 <http://www.reseautd.auf.org/>
- ✓ institutions identified on the web 272

Sent to 1077

2.1. Inventory of Current situation of EO in AFSC

Countries	Total
Algérie	24
Bénin	2
Burkina Faso	1
Cameroun	20
Cap Vert	2
Centrafrique	6
Côte d'Ivoire	5
Gabon	1
Madagascar	1
Maroc	56
Mauritanie	21
Niger	10
R.D. Congo	11
Sénégal	14
Syrie	1
Tchad	1
Togo	6
Tunisie	6
Total général	188

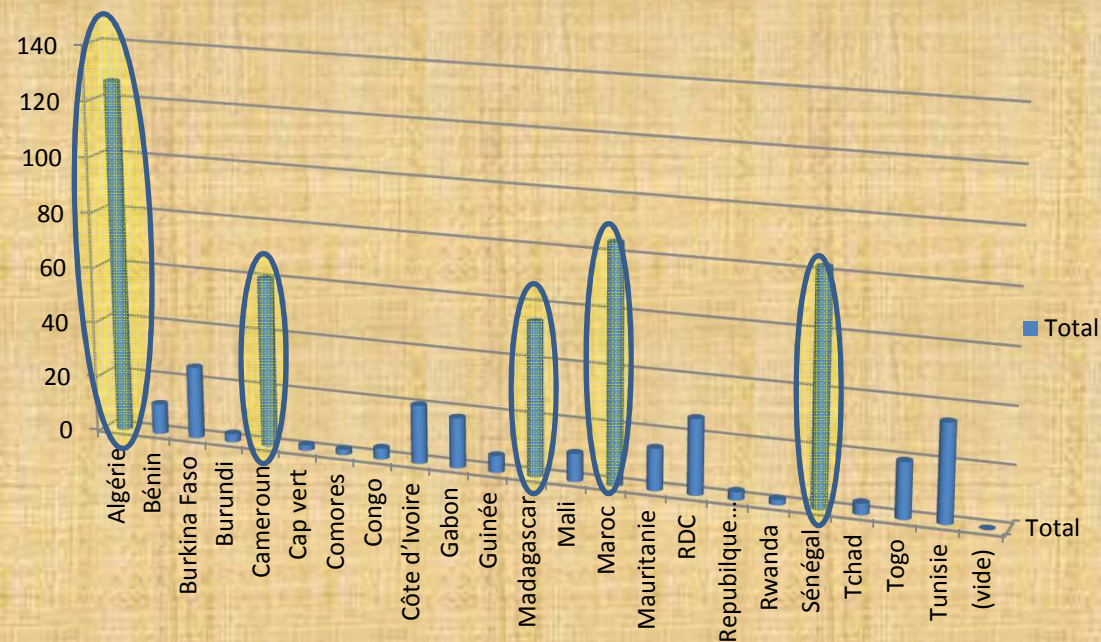


2.1. Inventory of Current situation of EO in AFSC

Countries	Total
Algérie	126
Bénin	11
Burkina Faso	26
Burundi	3
Cameroun	61
Cap vert	2
Comores	2
Congo	4
Côte d'Ivoire	21
Gabon	18
Guinée	6
Madagascar	55
Mali	9
Maroc	85
Mauritanie	15
RDC	27
Republique Centrafricaine	3
Rwanda	2
Sénégal	82
Tchad	4
Togo	20
Tunisie	35
Total	617

617 sendings

DB of AUF experts



2.1. Inventory of Current situation of EO in AFSC



Workshop in Cotonou (Benin) 21 to 23/12/2009 on EO and NR management



Mission in Senegal 26/4 au 02/05/2011



Workshop in Lome (Togo) from 21 to 24/06/2010 on EO and CC



Workshop in Ouagadougou - Burkina (Burkina Faso) 01 to 04/11/2010 on EO and CC

□ The level of use EO in the AFSC was mapped into 4 groups

2.1. Inventory of Current situation of EO in AFSC

4 High-level of the EO & structures in charge of the promotion of EO

✓ Algeria, Morocco and Tunisia

3 EO is developed in academic structures

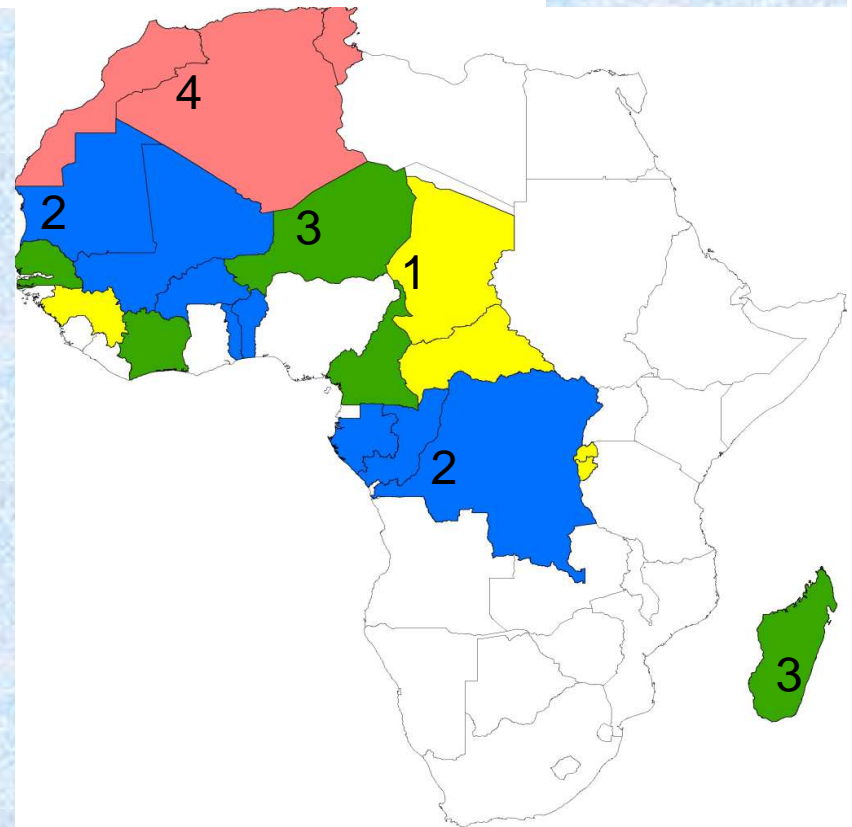
✓ Cameroon, Ivory Coast, Madagascar, Niger and Senegal

2 Moderately use of the EO

✓ Benin, Burkina Faso, Congo, Gabon, Mali, Mauritania,
✓ Togo and DR Congo

1 Low level of use of the EO

✓ Burundi, Cape Verde, Central Africa, Chad,
Guinea and Rwanda



2.1. Inventory of Current situation of EO in AFSC

Taking into account of this geographical distribution 4 tasks have been defined by CRASTE-LF for its activities in AFSC



- Development of the use of the EO, with actions focused on the zones 1 and 2....
- Development of advanced actions, with actions focused in promote the use of the EO in zones 3 and 4 ...
- Promotion EO Network with activities organized
- Dissemination by the extension of CB actions through the use of the web, including the website of CRASTE-LF and the portals of GEONetCab, GEO...

2. Inventory of use the EO in African French-Speaking Countries 'AFSC'

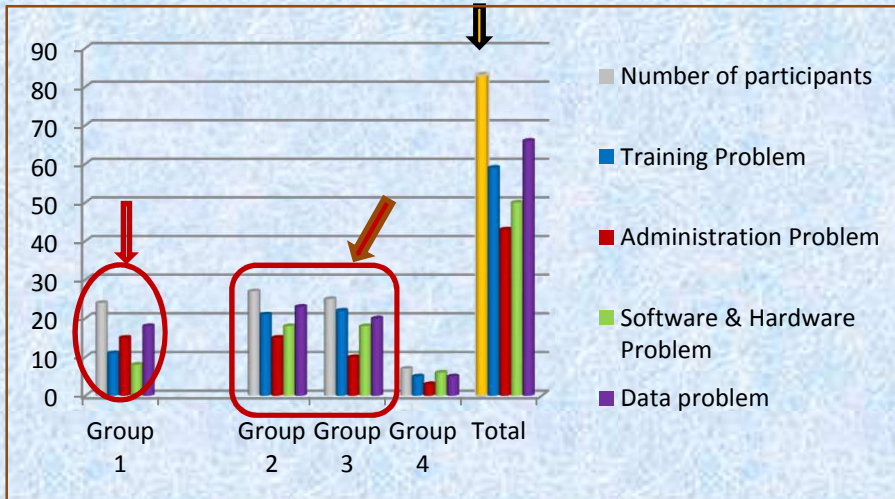
2.2. Identification of opportunities et and bottlenecks

Objectif : On the basis of the previous analysis of the results of inventory, the CRASTE-LF has identified the main problems impede the use of EO in the region and has compared those problems to the opportunities for capacity building that are offered.

A special focus is brought to the Social Benefit Areas : Food, Water, Health and Risk Management which are the areas deeply impacted by Climate Change in Africa

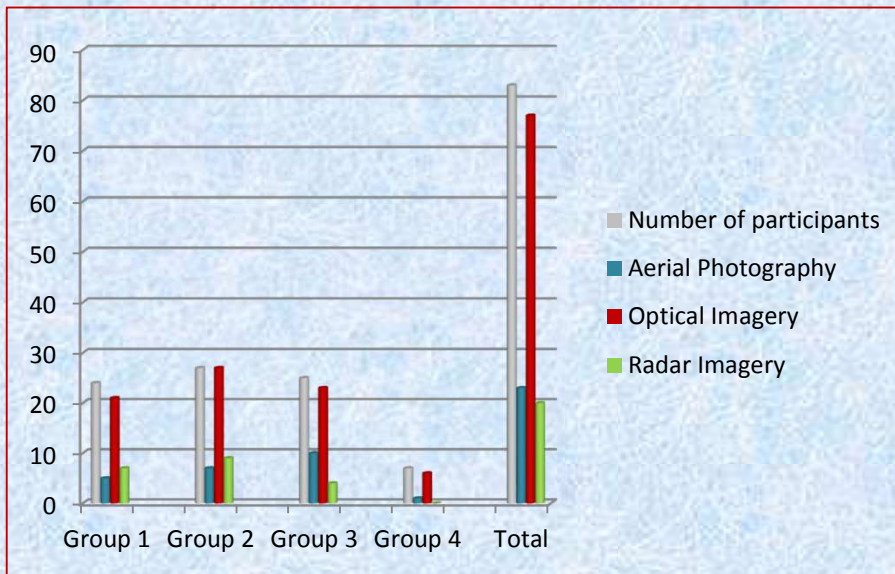
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Problems that hinder the development of EO



- ❑ In general the problems hindering the development of EO in the AFSC are in descending order the lack of: **1 Data > 2 specialized training in EO > 3 computer software and hardware > 4 Administration Problem.**
- ❑ For countries of group 1, the administration problem seems important; it is almost the same level as the problem of access to data.
- ❑ The main problem for groups 2 and 3 is the lack of data, software & hardware problem and training

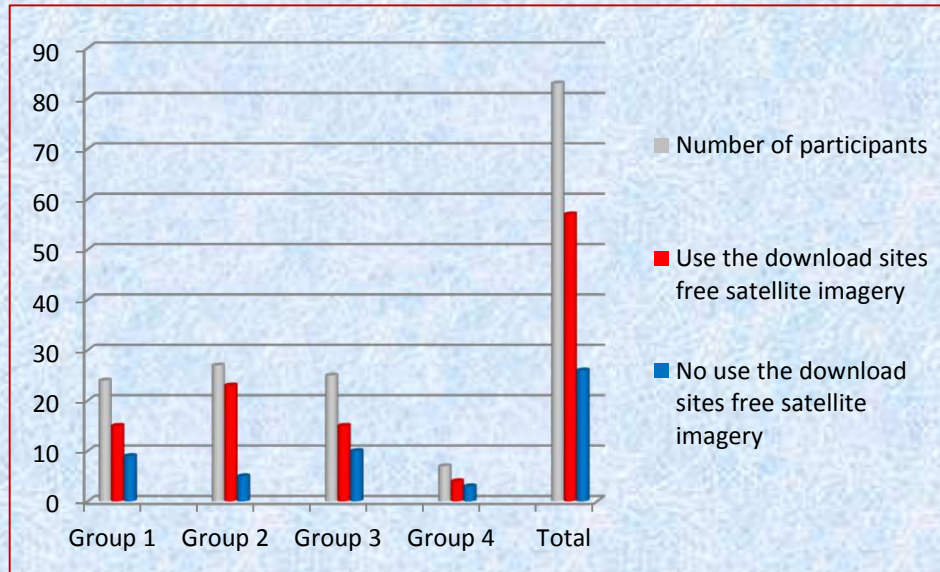
Type of data using



- ❑ The spatial data is a big bottleneck to the development of EO in Africa. Access to the data at low cost is still very difficult.
- ❑ However, and in relation to the initial situation:
 - ✓ the use of optical images has taken over from aerial photographs;
 - ✓ the use of radar images began, but it's still very low, despite the advantage its use in tropical and equatorial countries.

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Using a site free download satellite images



❑ The free downloading image via internet has become more widespread. Thus, of the 84 competencies identified, 57 reported using free download sites.

❑ This is the result of training workshops organized in the AFSC by CRASTE-LF.

❑ The webpage of CRASTE-LF has also contributed through its link interface with the main download sites from satellite images.

❑ But there is always the problem of internet speed in AFSC.

The main sites used for download:

<http://earthexplorer.usgs.gov/>

<http://glcf.umd.edu/>

<http://www.umd.edu/>

<http://www.nasa.gov/>

<http://glovis.usgs.gov>

<http://earth.esa.int>

<http://www.google.fr/intl/fr/earth/index.html>

<http://modis.gsfc.nasa.gov/>

<http://www.diva-gis.org/>

Earthexplorer

GLCF

University of Maryland

NASA

GLOVIS

ESA

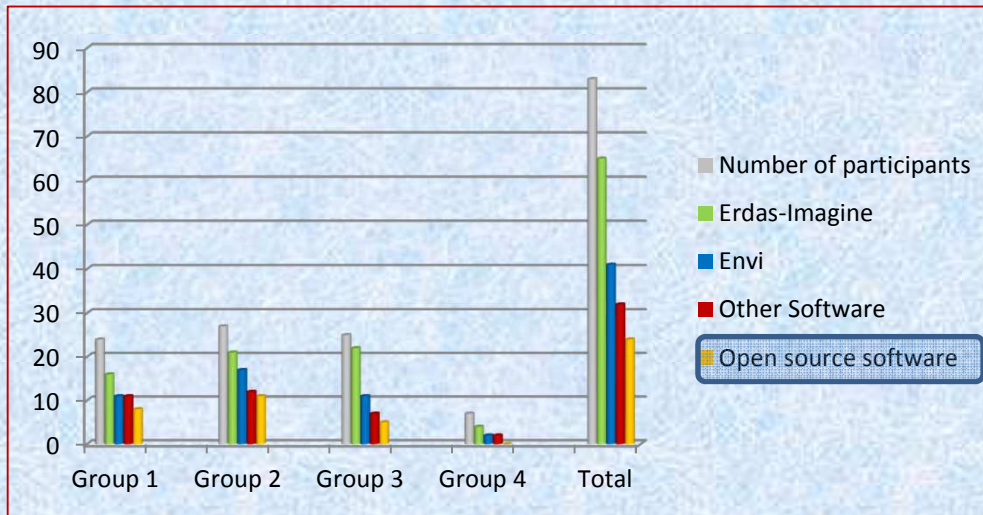
Google Earth

Modis

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Equipment and software problems

Types of processing software used in AFSC

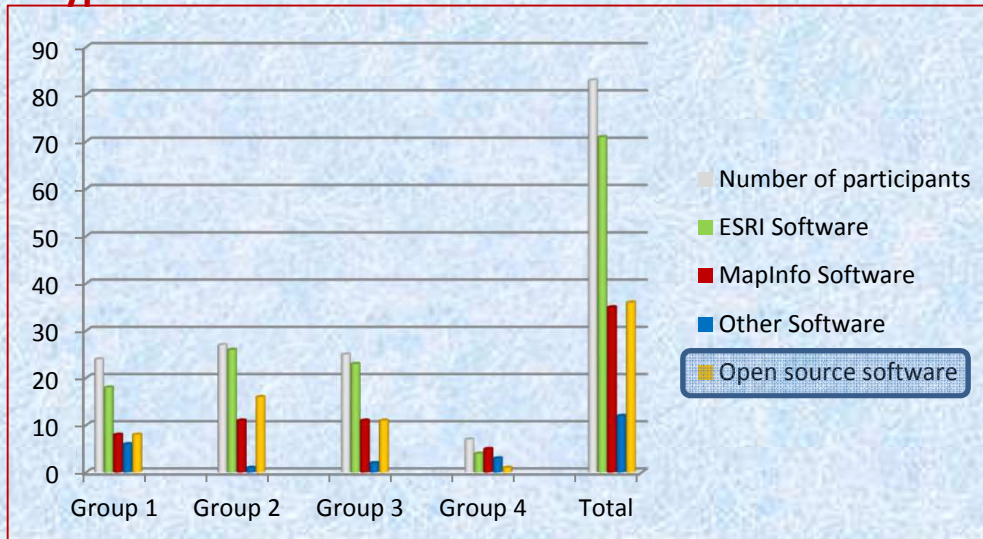


The cost of equipment and software is out of reach of the majority of AFSC. The use of commercial software is always on the agenda.

However, there has been a significant advance in the use of open source software, especially in countries in groups 2 and 3.

Which is exactly the outlook made at the beginning of the study.

Types of GIS software used in FSAC



6. Conclusions

- The space technology is now a major challenge as well as opportunity for AFSC.
- Since its establishment in 1998, the CRASTE-LF has always fulfilled its mission in capacity building through its activities in postgraduate training and the scientific events for the AFSC and for the formation of new African expertise for space sciences and technology.
- The inventory developed by the CRASTE-LF, it helped the Centre to improve its perception of the EO in the AFSC and to understand it better by opening up further to AFSC.
- We visited some countries to know their actual situation, and we approached some experts and users of the EO along with policy makers.
- CRASTE-LF was able to organize activities of CB outside its headquarter in Morocco, and it has increased their frequency.

6. Conclusions

- We are now nearer to the actual situation (reality) and we better perceive the real market opportunities for EO in the region. It is the same for the obstacles which hinder their development.
- We tried to solve some of these issues by taking action with decision makers and support African competencies in the use of the EO.
- However the AFSC still has a long run to go, and this is why CRASTE-LF decided to continue its activities in the region with dissemination actions through his website : crastelf.org.ma

Thank you

