African Regional Centre for Space Science and Technology Education, in French Language (CRASTE-LF)

Capacity Building on GNSS in CRASTE-LF for African French Speaking Countries

CRASTE-LF

Boulder, 1-6 November 2015
Network of Regional Centres for Space Science and Technology Education

Regional Centres for Space Science and Technology Education (affiliated to the United Nations)

Central America
Mexico (CRECTEALC)

South America
Brazil (CRECTEALC)

Africa
Morocco (CRASTE-LF), Nigeria (ARCESSTE-E)

Asia
China (RCSSTEAP), India (CSSTEAP), Jordan (RCSSTEWA)

6 Centres affiliated to UN in activities through a World regions:
- India (CSSTEAP, Asia & the Pacific)
- Morocco (CRASTE-LF, Africa in French Language)
- Nigeria (ARCESSTE-E, Africa in English Language)
- Brazil Campus & Mexico Campus (CRECTEALC, Latino America & Caribbean)
- Jordan (RCSSTEWA, Western Asia)
- China (RCSSTEAP, Asia & the Pacifico).
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.

**Thirteen Member States**:

Other countries non-member can benefit from the services offer by 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 endogens 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.
Functioning of the Centre

Financial Resources
Members States, Regional and International Institutions, Projects

Human Resources
Experts and Institutions Network, Teachers, Supervisor for projects, ...

CRASTE-LF

Target Public
Academics (Professors,...) Researchers, Engineers, Administrators and Managers

Recovering Sectors
Universities, Research Institutes, Professional and Private Institutes and Administrations
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.
Education Curriculum established and published by UN-OOSA for Regional Centres for Space Science and Technology Education in:

- GNSS (Since 2012),
- Space Law
Each Training Session takes place in 2 phases

**Phase I**: 9 to 10 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).

**Détail of courses in Web Site:**

- [www.crastelf.org.ma](http://www.crastelf.org.ma)
- [www.oosa.unvienna.org/SAP/centres/centres.htm](http://www.oosa.unvienna.org/SAP/centres/centres.htm)
- [www.unoosa.org/oosa/SAP/gnss/icg.htm](http://www.unoosa.org/oosa/SAP/gnss/icg.htm)
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 Mohamed V University of Rabat.

This year there are the fourth postgraduate training courses accredited.
1) Post-graduate Training on Space Science and Technology

Option : «Global Navigation by Satellite System- GNSS»
The training courses is based on the document entitled "Global navigation satellite systems, education curriculum" prepared by UNOOSA in cooperation with the ICG (International Committee on Global Navigation Satellite Systems).


The training takes into account the characteristics of the region and priorities of the member States of CRASTE-LF in terms of GNSS applications and qualified human resources needs.
## Conduct of Training Courses

### Theoretical Teaching
- 690 hours
- 9 Modules
- Courses, supervised work and thematic seminar.

### Practical Works
- 200 hours
- Practical Works and projects related to GNSS applications

### Pilot Project
- During 12 weeks
- Pilot Project on GNSS

### Research Project/ Memoire
- 12 – 15 months
- A research project carried out by the candidate in his home country (Institution, ..) on an issue related to GNSS applications.
Curriculum on GNSS

1. Upgrade courses in the Basic Module:
   - Mathematics,
   - Physics,
   - Computer Sciences.

2. Courses topics related to GNSS:
   - Fundamentals of geodesy and surveying,
   - Basic concepts in geodesy and topography,
   - Basics positioning satellite,
   - Study of current and future GNSS systems,
   - Satellite Positioning and Navigation techniques,
   - Receivers and complementary systems.

3. GIS & Mapping:
   - GIS,
   - Mapping,
   - Cartography and Web-Mapping

4. GNSS thematic Applications.
Laboratory experiments, practical Exercises

Practical work enables the candidates to practice the theoretical concepts learned.

The practical works will focus on three aspects:

- handling of GNSS receivers,
- use of GNSS software,
- design and development of applications related to the use of GNSS.
Project Pilot (~10 weeks)

- The pilot project is an opportunity for the candidate to carry out a comprehensive project in GNSS, from planning to implementation:

- The theme of the pilot project has to be chosen by the candidate with his administration.

- The following themes are given for information only:
  - GNSS and GIS to improve the management of Lands.
  - Integration of GNSS signals and mobile telephony.
  - Improvement of the positioning by integration of inertial systems.
  - GNSS and web-mapping (online tracking of vehicles movement).
  - Embedded Application for public services.
  - Integration of GNSS and GIS to improve the management of the land heritage.
  - GNSS Application for the management of natural resources.
  - GNSS Application for disaster relief purposes.

- A project report must be submitted by each candidate.
The final step of the Master is to carry out a research project. Each candidate will have to conduct a thesis in GNSS on a theme corresponding to the needs of his institution in his country. The research project has duration of 12 to 15 months and will lead to the development of a thesis document that will be presented in the CRASTE-LF.
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.

Participation of trainees to the demonstration on live under the METIS project team at Mohamed V Airport.
The contribution by the demonstration of the use of the EGNOS, organized under the METIS (European project) team in partnership with National Office of Airports of Morocco (ONDA) at the Mohamed V Airport in Casablanca (Morocco) and which trainees had attended, is a real example of support for capacity building GNSS applications, indeed:

- this training has seen the participation of stakeholders,
- The awareness of the use of GNSS and augmented systems for development,
- the development of Human Resources in the use of GNSS services,
- the benefit of African countries through the transfer of these technologies,
- support for training course by the assistance of expertise and equipments,
Realized Short Training Courses GNSS (3) - 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.
1 Post Graduate training courses on GNSS, Nov. 2013 – Aug 2015
12 trainees from 6 member Countries & 8 different institutes

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

GPS Materials

GNSS BEIDOU Equipment
Realized Training Courses (4)

Training Workshop on “Space Weather & GNSS Applications”, Feb 2015 with participation of 29 trainees from 13 African Countries supervised by 8 teachers.
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)
2) Post-graduate Training on Space Science and Technology

Option:
Remote Sensing & GIS,
Satellite Communications,
Satellite Meteorology & Global Climate.
Realized Training Courses


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


65 trainees from 10 member countries & 16 different institutes.


33 trainees from 10 member Countries & 10 different institutes.

1 training courses on GNSS, Nov. 2013

12 trainees from 6 member Countries & 8 different institutes.
1ère Promotion accréditée de Master STE/T-SIG & MSCM

Photo de la promotion en présence des conférenciers

Etudiants de la 8ème promotion Master Télédétection -SI

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Boulder - 10th ICG-Meeting

Photo of 1st Session GNSS 2013 – 2014
Trainees Profiles

R.S. and G.I.S

- Engineer in Geodesic Sciences
- Engineer in topography
- Engineer in Agro meteorology
- Engineer in Cartography
- Master in Applied mathematics
- Master in Geography
- Doctorate in Geography
- Doctorate in Physics

S.M.G.C.

- Engineer in Meteorology,
- Mechanical Engineer,
- Forest Engineer,
- Master in Signal Processing
- Computer Engineer,
- Master on Environment,
- Master en Communication
- Doctorate d'état on Sciences Physiques

S.C. & GNSS

- Engineer on Communications,
- Engineer on Mechanical engineering,
- Master on Signal Processing,
- Engineer on Electromechanically,
- Master on Electronics and
- Master on Communications
- Bachelor on theoretical Physics
- Engineer Multimedia Designer
- Doctorate on Communications
- Doctorate on Physics (electro-optics),
- Teachers & researchers,
- Professionals

Countries: Morocco, Algeria, Tunisia, Mauritania, Senegal, Niger, Chad, Ivory Coast, Togo, Cameroon, Cape Verde, R.D. Congo, Central Africa, Gabon, Syria, Madagascar, Mali, Benin, Burkina Faso, R. of Congo
Research Projects for prepare the memoire of Master Degree in Space Sciences et Technologies cover almost all the applications: 1) Mapping, Urban, Agriculture, Geology, Water and Natural Resource Management, Ecology, forest, desert progress, Coast Management, migration of populations, etc...

2) Communications, Image reception, Ground Station reception, Telemedicine, Television reception via Satellite, Tele Education, Micro Satellite, Study of the European satellite navigation system Galileo and compared to the GPS system etc..

3) Climate Change Model, Desert Progress, Forest Fire, Epidemiology Vectors, Health, etc...

Boulder - 10th ICG-Meeting
October 2007
International Conference « Climate Change & Adaptation in Africa – role of space technology

November 2008
international Workshop "The Spatial tool for disaster management and emergency situations in Africa"

June 2010 international workshop on Space Law
GNSS Training Short Courses

Conference in Rabat 2009, Disaster Management

Conference in Alger 2007, Clim Chgt & Adapt in Africa

GNSS Training Short Courses

Boulder - 10th ICG-Meeting

17-Nov-15
Workshop of Launching of ROACC Network "
Launch of the African Network of Experts on the Earth Observation and Climate Change.
Ouagadougou, Burkina Faso November 2010

Regional Workshop" Creation of the Network and its application for scientific purposes in Africa”
establishment of the African Network on Earth Observation and Climate Change
Lome - Republic of Togo, June 2010
SCHOOL ON SPACE WEATHER
RABAT / MAROC [December 5-16, 2011]
Organized by the French ISWI national committee
CRASTE – EMI – MENESCRS

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

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 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 currents
Earth’s magnetic field
Atmospheric electricity
Precipitation Systems
Chemistry and Transport in the atmosphere
Soundings of the earth’s atmosphere by microwave radio instruments

The community of users of space weather products from Bell Laboratories Lucent Technologies

Context of the school
International Space Weather Initiative (ISWI) 2010-2012

Registration before April 30, 2011 at the two addresses

christine.amare@lp.polytechnique.fr

Boulder - 10th ICG-Meeting

17-Nov-15

International Conference on Geospatial Information, effects and impacts of the CC in Africa
Rabat from 30/11 to 02/12 2011

Organisent une

CONFERENCE INTERNATIONALE

INFORMATIONS GEOSPATIALES : EFFETS & IMPACTS DES CHANGEMENTS CLIMATIQUES EN AFRIQUE

Les 30 Novembre, 01 et 02 Décembre 2011
A l’École Mohammed d’Ingénieurs, Rabat - Maroc
Training workshop and plenary Conference in Cameroon
Photo of participants in Workshop organized in Cameroon
Until now, more than 350 trainees followed or follow postgraduate courses in the CRASTE-LF from 21 countries and, near 110 Master Diploma in Space Sciences and Technology have been delivered by the Centre in various fields.

Scientific Animation

Until now, more than 1700 experts from over 50 countries from Africa, Europe, Middle East and North America attended different Conferences and Workshops organized by the Centre in each fields in Space Technologies and in 10 African Counties.
- 20th session on Satellite Communications (SC) and GNSS, September 2016.

- Will be organize 3 workshops (April 2016) and 2 in Morocco (June and Sept. 2016) on use Earth Observation Techniques (Remote Sensing & GIS, Meteorology by Satellite and GNSS).
Success stories

- 350 trainees
- Professionals become a part in the higher management in their institutions
- Up 90% go back to their home countries (original institution or others)
- Themes of research projects in connection with local problematic
- In many cases, the trainees generated new activities related to space technology in their country (courses in local universities: trainers, projects, …): snow ball effect
- Creation of an Expert Network through the all Africa
- Substantial contribution in rising the awareness of the utility of space technologies for development.
THANK YOU FOR YOUR ATTENTION

www.crastelf.org.ma