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REMOTE SENSING EDUCATION PROGRAMMES FOR A NEW UNIVERSITY IN FRENCH GUIANA

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ABSTRACT:

In response to development concerns, a new University is being established in French Guiana. Several research institutions that are working locally on Amazonian topics (biodiversity, geoscience, diseases, languages etc.) have been consulted to propose high level education programmes in the related fields. Since remote sensing is a key technology for the development of tropical regions, the remote sensing department of IRD (ex-ORSTOM) contributed to the design of specific modules at different levels. Two background elements were taken into account, namely, the specificities of the Amazonian region in terms of remote sensing implementation, and the employment market. Due to the isolation of French Guiana far from Europe, North America and South Brazil, the potential of distance learning is considered with interest as well as its limitations. Two modules, proposed at undergraduate and graduate levels, are presented here.

1. BACKGROUND

French Guiana is a small Amazonian territory located on the North coast of South America, between Suriname and the Amapa Brazilian state (figure 1). Its area is about 84,000 km^2 and its population is less than 200,000 people, concentrated along the coast. The largest part of the territory is covered by dense rain forest, which is an interesting resource in terms of biodiversity valorisation or ecotourism.

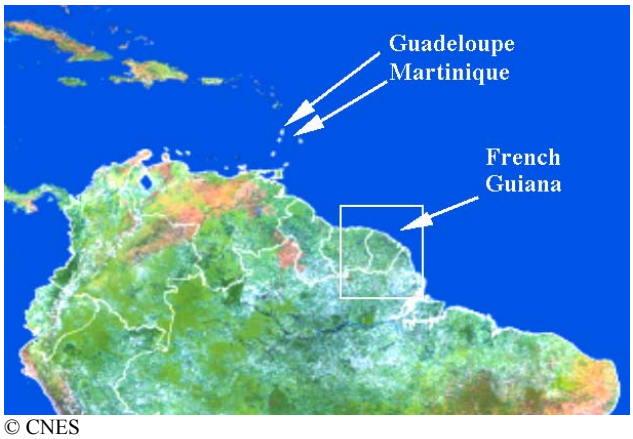

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Figure 1: location map

Apart from its natural resources, French Guiana has several advantages in terms of development opportunities, such as European financial support, and the presence of the Kourou space center and several research institutes. In spite of this advantageous situation, technology transfer remains very limited and severe development problems have to be faced, e.g. in terms of health, education, employment and environment. In many aspects, French Guiana can be considered as a developing country.

The fact that French rules are applied in the field of social protection makes French Guiana a very attrative place for people coming from neighboring countries (Haiti, Suriname, Guyana and Northern Brazil). Most immigrants have a very low education level and no financial income. This leads to an increasing immigration rate and to a serious concern in terms of employment for the next 10-20 years. Discussions at all levels revealed that education and research have to be reinforced and adapted to the local situation. For this reason, it was decided that the local University should be developed. This was a governmental decision, and a specific organization is being established.

In this article, the recent evolution of this University is described, and the case of remote sensing is considered. The potential and the limitation of distance learning technologies are discussed. Finally, the modules that have proposed at two levels are presented.

2. EVOLUTION OF THE LOCAL UNIVERSITY

At the moment, the local University is only an antenna of UAG (Université Antilles-Guyane), the other facilities of this University being located in the French carribean islands, namely, Guadeloupe and Martinique, and the headquarters are hosted by the Guadeloupe center.

The different departments of the University have been shared between the three facilities. Human sciences and geography are based in Martinique, geoscience and biology are based in Guadeloupe. As far as French Guiana is concerned, the presence of the Kourou space center has encouraged the establishment of technological curricula (electrical engineering, computer sciences and industrial engineering).

According to a governmental decision, the University of French Guiana will be developed with an increased autonomy, so that most curricula will be offered locally. In order to design a suitable education system, the research institutions have been consulted to identify priorities and propose curricula to which the scientists will be able to contribute.

In this context, the remote sensing department of IRD has undertaken the design of education modules.

3. THE CASE OF REMOTE SENSING EDUCATION

The complexity of Amazonian landscape, their spatial extension, the access difficulties, make remote sensing a key technology for many purposes, such as environmental monitoring, mapping and education. For this reason, the very first discussions about the education contents of this new University identified remote sensing as a curriculum to be included in priority.

None of the three existing facilities of UAG is entitled to centralize remote sensing programmes, and the fact is that the place and the level of remote sensing within the other curricula have remained very limited.

The remote sensing department of IRD (Laboratoire Régional de Télédétection) was involved in the discussions concerning the design of new modules. Apart from the availability of scientists for teaching, the contribution of this local research team had two advantages.

The first advantage is a scientific and technological skill in the field of remote sensing and geomatics as applied in an Amazonian context, both in theory and practice. Some difficulties are well known :

- the mathematical tools used to model geophysical, hydrological, biological or societal processes are not necessarily adapted to the complexity of natural and human landscapes in tropical areas ;
- the potential and limitation of each sensor or processing approach have to be evaluated in this specific context ;
- the issues and questions to which remote sensing is expected to bring an answer are specific too (for instance, the use of remote sensing in encourages for demography or epidemiology) ;
- specific implementation difficulties, such as the lack of ground control points, the rapid evolution of most landscapes or the seasonal variations of the cloud cover, require that the processing methods be adapted.

These regional specificities are empirically taken into account to ensure that the trainees will be able to apply remote sensing techniques in a suitable way.

The second advantage is the knowledge of the employment market for remote sensing trainees. In private companies or in public services, the training level of remote sensing users has a direct incidence on the way they will use these technologies. Consequently, any new education programme must take into account the technical, operational and cultural constraints of the main potential employers, and a close contact should even be taken with them so that they can :

- contribute to training ;
- provide operational tools ;
- specify their requirements.

However, a further study of the employment market will have to be carried out, so that the initial module proposal may be adjusted. A wide variety of professional remote sensing users have already been identified :

- fishery ;
- wood extraction ;
- agriculture and agriculture monitoring ;
- mining and mining monitoring ;
- coast and estuary management ;
- epidemiology ;
- urban planning and census ;
- security...

4. POTENTIAL AND LIMITATIONS OF DISTANCE LEARNING TOOLS IN THIS SITUATION

Distance learning tools are generally less efficient that human teachers but they can provide a cheaper solution, and they can rely on specific functions that are not available elsewhere. In other words, they can be recommended as a good complement to a more conventional training. Multimedia training tools still have limitations, mainly due to data flow, but also to the fact that many people use analog and digital products simultaneously in their professional activities. Some classical implementation errors can still be observed :

- a tendency to reproduce conventional training programmes on new devices, without taking advantage of multimedia potentialities ;
- sophisticated software developments with not enough training validation.

The isolation of French Guiana is a severe difficulty for reesearch and education. The areas where technology is produced (e.g. Europe, South Brazil or North America) are very far and the access to these areas (through either phone or travel) implies cost and time.

In this situation, distance learning technologies are very attractive. However, beyond their obvious pedagogical limitation, they will have two main drawbacks.

First, the data flow is still limited between French Guiana and the world, and this is very restrictive for remote sensing education due to the need for digital image transmission. However, the flow is about to be dramatically increased in a very near future and this particular problem should then be overcome.

Second, automated or remote teaching should be limited to very technical aspects and software handling. Indeed, the difficulties mentioned above concerning the limitations of remote sensing in tropical landscapes and for tropical issues, imply that specific modules should be designed and that the trainers should be aware of regional specificities.

5. PROPOSALS FOR 2 INTERNATIONAL MODULES

New modules have been proposed for remote sensing education, at two levels and in the frame of international partnership.

Level 1 is called “licence professionnelle”, i.e. an undergraduate diploma for technical staff, designed to provide short term trained people as required by public services and private companies in the area. Level 2 is called “diplôme d’études supérieures spécialisées”, i.e. a graduate diploma in a very narrow technical field. It will provide theorical knowledge to allow the assimilation of new sensors or processing tools in the future.

High level education programmes in the field of remote sensing would not be relevant without a strong partnership with neighboring countries, in particular the North Brazilian states : Amapa, Para and Maranhão. Indeed, the reduced number of students in French Guiana does not allow cost effective

education programme implementation. Moreover, the environmental and societal concerns are similar and joint research programmes are carried out in cooperation in several scientific fields, including remote sensing.
The 2 proposed modules are presented below.

LEVEL 1

		theory / practice (hours)	
Unit 1 **observation systems**	Spatial engineering : satellites, launchers, orbitography, ground segment Sensor design : optical, thermal, radar, lidar	40	40
Unit 2 **geodesy**	Projection systems Altimetry and levelling GPS positioning	15	35
Unit 3 **image processing**	Analog photointerpretation Digital image formats Remote sensing image quality assessment Radiometric and geometric preprocessing Classification and thematic mapping	40	120
Unit 4 **digital mapping**	Space map elaboration Digital elevation models GIS handling	25	100
Unit 5 **Remote sensing applications**	Overview Oceanography and fishery Agriculture and forestry Geological survey and mining Land administration Epidemiology	65	130
Unit 6 **General skills**	Foreign language (English or portuguese) Economy History and geography of Amazonia and Guyanas' shield Project management	50	60
Unit 7 : Individual project			200
total		235	685

LEVEL 2

		theory / practice (hours)	
Unit 1 **observation & positioning systems**	Spatial engineering : satellites, launchers, orbitography, ground segment Sensor design : optical, thermal, radar, lidar Geodesy and levelling	40	40
Unit 2 **physical background**	Electromagnetic wave propagation Physics and chemistry of the atmosphere Spectral signatures	25	35
Unit 3 **image processing**	Two-dimensional signal processing Digital image formats Remote sensing image quality assessment : from specification to control Radiometric and geometric preprocessing Image analysis : from classification to identification	45	115
Unit 4 **digital mapping**	Digital photogrammetry Digital elevation models GIS architecture	35	125
Unit 5 **Remote sensing applications**	Overview Oceanography and fishery Agriculture and forestry Geological survey and mining Land administration Epidemiology	35	50
Unit 6 **General skills**	Language (English or portuguese) Economy History and geography of Amazonia and Guyanas' shield Project management	50	60
Unit 7 : Individual project			4-6 months
total (without project)		230	425