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MEDITERRANEAN ACTION PLAN

First Meeting of RAC/ERS Focal Points

Palermo, 9-11 September 1994

REPORT OF THE FIRST ORDINARY MEETING OF RAC/ERS FOCAL POINTS

UNEP
Palermo, 1994

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INTRODUCTION

1. The Contracting Parties to the Barcelona Convention at their Eighth Ordinary Meeting held in Antalya from 12 to 15 October 1993, unanimously agreed to establish a new Regional Activity Centre for Environment Remote Sensing (RAC/ERS) in the framework of MAP as proposed by the Italian Government.

2. As a follow up to this decision, the newly established Centre intensively worked with the MAP Coordinating Unit and the other RACs to identify the lines of work which could contribute to the fulfilment of the MAP objectives as well as its mandate.

3. Immediate contacts were also established with the Contracting Parties and the nomination of the Focal Points was solicited as a priority.

4. As a result, the First Meeting of the Focal Points to RAC/ERS was convened in Palermo from 9 to 11 September 1994.

Participants

5. All the nominated Focal Points were invited to attend the Meeting as well as all the MAP/RACs. The Focal Points, or their representatives, of the following countries participated at the Meeting: Albania, Croatia, Egypt, European Union, France, Greece, Israel, Italy, Libya, Malta, Morocco, Spain, Tunisia and Turkey. In addition, the representatives of three Regional Activity Centres of MAP attended the Meeting (see annex I for the list of Participants).

Agenda item 1. Opening of the meeting

6. Mr Michele Raimondi, Director of RAC/ERS, opened the Meeting and welcomed the participants.
Mr Ferruccio Marri Caciotti on behalf of the Italian Ministry for Foreign Affairs welcomed the participants and stressed the importance the Ministry attibuted to the activities of the Center for the benefit of MAP.
Mr Lucien Chabason, Coordinator of MAP, in thanking the national and local authorities for hosting the Meeting, reiterated the value that the introduction of the remote sensing technologies may have for the Mediterranean Action Plan. He underlined that such activities could represent an excellent base to cooperate and carry out joint activities between RACs and national and international institutions since the remote sensing methodologies had the capacity to extend and supplement the results of virtually all the activities of MAP. However, he stressed the need to ensure that, in implementing specific activities, the experience already gained by individual countries in the application of remote sensing techniques be taken into account to avoid the risk of duplication of work and waste of resources. He concluded by reminding the participants of the major role that the Focal Points had in the efforts to

optimize the available resources and he assured that the Coordinating Unit was ready to spare no efforts to assist RAC/ERS in fulfilling its tasks.

7. Mr Arturo Spataro, Minister of Public Works for the Province of Palermo, welcomed the participants on behalf of Mr Francesco Musotto, President of the Province of Palermo. He underlined the great satisfaction of the local Government for hosting such an important Centre and he assured the participants that no efforts will be spared to assist the Centre in fulfilling its international role in the framework of the Mediterranean Action Plan.

Agenda item 2. Background and scope of the meeting

8. Mr Raimondi, briefly recalled the events which lead to the nomination of the Centre as Regional Activity Centre as well as the follow up activities which were carried out.

9. Mr Franceso Saverio Civili, First Officer of MAP, briefly reminded the participants of the structure of MAP, of its components and the role that RAC/ERS had in this framework. Mr Civili also recalled that the Meeting was the only Meeting of the Focal Points which was going to be held before the Joint Meeting of the Socio-Economic and Scientific and Technical Committee of MAP (January 1995) and before the Nineth Contracting Parties' Meeting (June 1995). Therefore, this was the only opportunity the Focal Points had, to agree on the workplan of activities to be carried out in the biennium 1996-1997 which was going to be submitted to the Contracting Parties for adoption.

Agenda item 3. Election of officers

10. The meeting unanimously elected the following officers:

Chairman:	Mr Chokri Turki (Tunisia)
Vice-Chairman:	Mr Ferruccio Marri Caciotti (Italy)
Rapporteur:	Ms Anna Spiteri (Malta)

Agenda item 4. Adoption of the agenda and organization of work

11. The Meeting examined the provisional Agenda and the proposed organization of work (UNEP(OCA/MED WG 83/1) which were adopted with no changes (see annex II).

Agenda item 5. Programme and activities of RAC/ERS for 1994-1995

12. Mr Raimondi introduced document UNEP(OCA)/MED WG.83/3 which contained a description of the activities carried out and ongoing since the nomination of the Centre as RAC. He also presented the structure of CTM and its role in the framework of MAP. Some slides on remotely sensed images were shown to demonstrate the numerous possibilities of this technique.

5.1 Activities of CTM in the Mediterranean Region

13. Mr Raimondi presented the ongoing project named COSMOS, a method to gather information on main environmental problems in order to determine parameters to be monitored by the use of remote sensing techniques. The presentation was followed by an interesting discussion with the various representatives of the participant Countries. He underlined that this activity could contribute to those of the Mediterranean Observatory.

14. Mr Roberto Ligi, on behalf of CTM, presented the ongoing MARE Project (Marine Resource Evaluation) which aims among others at identifying the relationships between the hydrological characteristics and chlorophyll-like pigment distributions, useful to fish stock assessment.

15. Mr Raimondi stressed that the results of those activities, carried out within programmes different than MAP, could be made available to MAP.

16. The participants of the meeting were invited to visit the Scanzano Telecommunication and Remote Sensing Station where CTM activities on remote sensing research and projects were shown.

5.2. Activities of RAC/ERS in the framework of MAP

17. Ms Monique Viel, RAC/ERS, presented an ongoing project on the classification and monitoring of vegetation in the Mediterranean Region.

18. Ms Sabina Carnemolla, RAC/ERS, presented the RAIS project (Remote Sensing Activities Inventory System) aimed at creating an archive of the Centres based in the Mediterranean coastal countries involved in remote sensing activities.

19. Ms Viel presented the present involvement of RAC/ERS in the CAMPs and described the cooperation activities with other RACs related to the ongoing projects in Albania, Sfax (Tunisia) and Fuka (Egypt).

20. Mr Raimondi concluded the presentations recalling the importance given to remote sensing in the Mediterranean Agenda 21 document to be submitted to the Conference MED 21 to be held in Tunis next November.

21. Mr Raimondi also briefly described the training activities carried out during the 1993-1994.

22. A detailed description of the activities presented under 5.1 and 5.2 is attached to this report as annex III.

23. After the presentation of the activities of RAC/ERS, several delegates expressed their satisfaction for the work carried out by the Centre. In particular, the Focal point for France considered the project on the classification of Mediterranean vegetation especially useful. He noted that, in addition to the study of the Mediterranean vegetation ecosystem and the monitoring of the vegetation cover, the study could also be applied to the monitoring of the state of the vegetation, of the areas affected by droughts and of the physical stress of the vegetation during the dry season, the study of the restoration of areas burnt by fire and the analysis of the situation at different seasons.

Agenda item 6. Definition of potential areas of cooperation in the framework of MAP

24. Under this Agenda item, a number of Focal Points briefly described the activities which were being carried out by their country at national and international level. A summary of their presentations is attached as annex IV to this report.

25. The participants took note of the specific experiences of each country which could provide very useful indications for the formulation of the reccommendations for the activities to be carried out by RAC/ERS in 1996-1997.

Agenda item 7. Recommendations for activities of RAC/ERS for 1996-1997

26. Mr Raimondi introduced document UNEP(OCA)/MED WG.83/4 which contained draft recommendations for the activities related to remote sensing to be carried out in the framework of MAP in the biennium 1996-1997.

27. Mr Raimondi reminded the participants that the Meeting's recommendations would be transmitted to the Joint Meeting of the Socio-Economic and Scientific and Technical Committees in January 1995 and subsequently to the Contracting Parties' Meeting in June 1995.

28. After a lengthy debate, the Focal Points agreed on the recommendations which appear in annex V to this report.

Agenda item 8. Other business

29. The representative of Malta informed the Meeting that the European Association of Remote Sensing Laboratories (EARSEL) will be holding their next

General Assembly and Workshop in Malta in May 1996. This may prove a good opportunity for RAC/ERS together with the focal points, to actively participate in this EARSEL conference. The theme of the meeting will focus on the Mediterranean and will enable European and Mediterranean remote sensing scientists to come together to discuss issues of mutual interest.

30. Mr Raimondi briefly introduced the involvement of the CTM RAC/ERS in a project of technical assistance to Malta government and in a joint proposal with the Satellite Observing System (UK) for the use of ERS-2 satellite in the monitoring of marine oil pollution.

Agenda item 9. Adoption of the report

31. The Meeting unanimously adopted its report on Sunday 11 September 1994.

Agenda item 10. Closure of the Meeting

32. The representative of Israel on behalf of all the participants thanked the Director of RAC/ERS, the Chairman, the vice-Chairman, the Rapporteur and all the staff for the good running of the Meeting.

33. Mr Turky thanked RAC/ERS for the effective organization of the meeting and the local authorities for their kind welcome to the participants.

34. Mr Civili thanked RAC/ERS and pointed out the importance of Remote sensing for the environmental observation and study. He remarked the importance of the cooperation of Focal Points. He expressed the proudness of MAP to have a new Center to which he wished every success.

35. Mr Raimondi thanked all the participants for coming and expressed his willingness of continuing the common committment towards a closer cooperation.

36. After the customary exchange of curtesy, the Chairman declared the Meeting closed on Sunday, 11 September 1994, at 11,45 a.m..

ANNEX I

LIST OF PARTICIPANTS

LISTE DES PARTICIPANTS

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UNITE DE COORDINATION DU PLAN D'ACTION POUR LA MEDITERRANEE

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ANNEX II

AGENDA

1. Opening of the meeting
2. Background and scope of the meeting
3. Election of officers
4. Adoption of the Agenda and organization of work
5. Programme and activities of RAC/ERS for 1994-1995
    - 5.1 Activities of CTM in the Mediterranean Region
    - 5.2 Activities of RAC/ERS in the framework of MAP
6. Definition of potential areas of cooperation in the framework of MAP
7. Recommendations for activities of RAC/ERS for 1996-1997
8. Other business
9. Adoption of the report
10. Closure of the meeting

ANNEX III

ACTIVITIES OF CTM - RAC/ERS

ACTIVITES DU CTM - CAR/TDE

(Presented Transparencies)

(copie des transparents présentés)

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CTM
Centro di Telerilevamento Mediterraneo

CENTRO DI RICERCA PER IL TELERILEVAMENTO

REMOTE-SENSING RESEARCH CENTER

SEDE LEGALE/*HEAD OFFICE* : PALERMO

SEDE OPERATIVA/*OPERATIVE CENTER* : SCANZANO (PA)

THE COMPANY

THE CTM - CENTRO DI TELERILEVAMENTO MEDITERRANEO IS A CONSORTIUM

SHAREHOLDERS ARE:

- **TELESPAZIO** spa 51% (IRI/STET GROUP)
- **ESPI** spa 49% (FINANCIAL HOLDING OF THE SICILIAN REGION GOVERNMENT)

THE CTM CAPITAL IS OF 3.5 MILLIARDS LIRE (2.3 MILLION US$)

HEADQUARTERS ARE LOCATED IN PALERMO

OPERATIONAL FACILITIES ARE BASED IN THE SPACE TELECOMMUNICATION AND REMOTE SENSING STATION OF SCANZANO (45 KM FROM TOWN)

CTM

FINALITIES

CTM HAS BEEN CONSTITUTED IN ORDER TO:

- ❑ CREATE THE STRUCTURE OF A REMOTE SENSING CENTRE

- ❑ DEVELOPE MULTIANNUAL RESEARCH PROGRAMMES ON REMOTE SENSING TECHNOLOGIES AND METHODS

CTM

ACTIVITIES

- REMOTE SENSING DATA ACQUIRING, ARCHIVING AND PROCESSING
- REMOTE SENSING AND CONVENTIONAL DATA INTEGRATION
- MODELLING OF PHENOMENA RELATED TO ENVIRONMENTAL CHANGES
- EXPERIMENTATION AND PILOT PROJECTS
- GEOGRAPHIC INFORMATION SISTEMS APPLICATIONS
- TRAINING AND ASSISTANCE

STRUCTURE

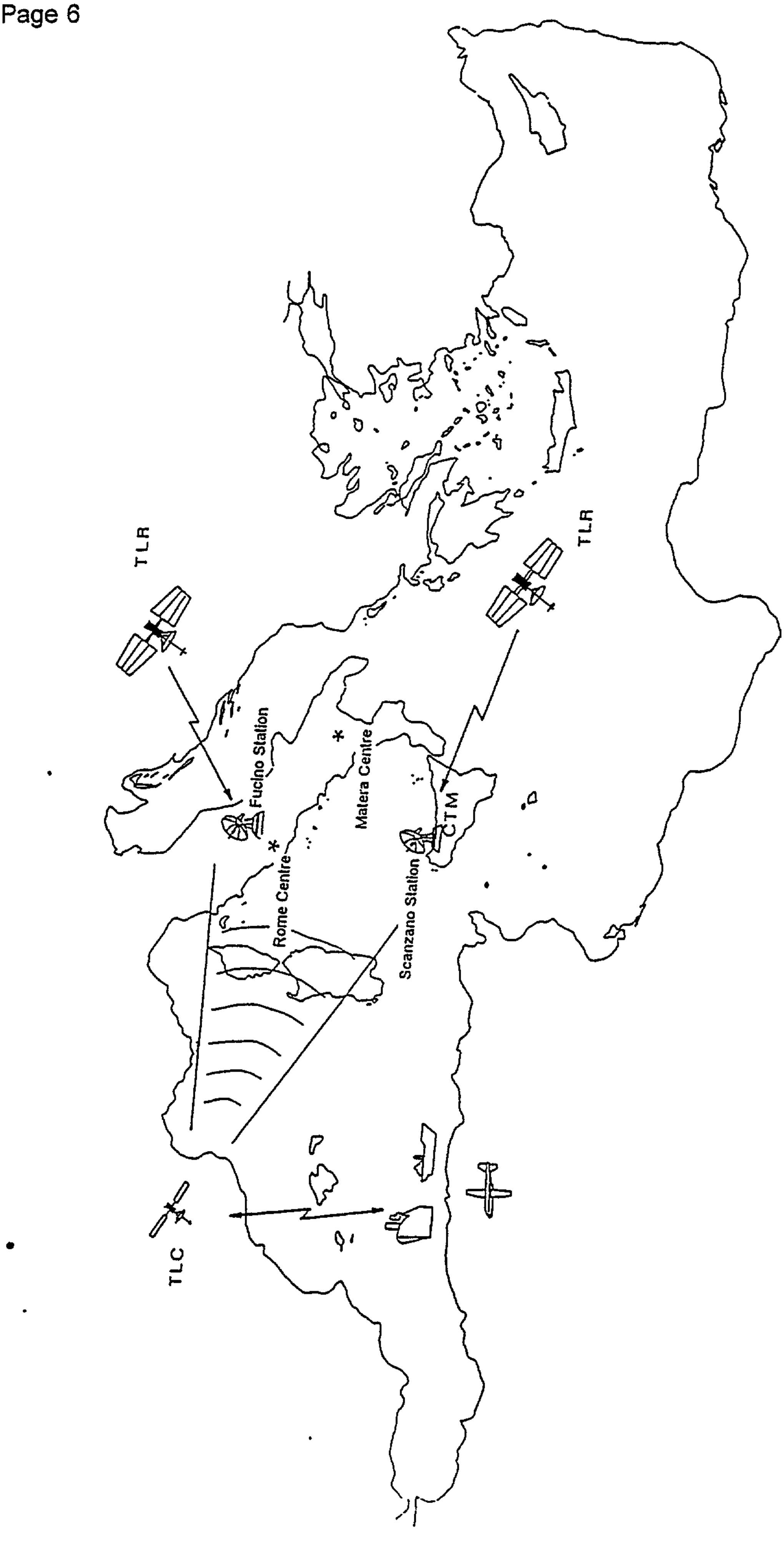
THE CTM CAN RELY ON:

- ❑ SATELLITE DATA ACQUIRING ANTENNAS
- ❑ SATELLITE DATA PRE-PROCESSING AND ARCHIVING SYSTEMS
- ❑ DATA PROCESSING FACILITIES
- ❑ SATELLITE TELECOMMUNICATION SYSTEMS

THE CTM HAS BEEN CONCEIVED AS A POLE OF A WIDER NETWORK OF SATELLITE AND CONVENTIONAL DATA ACQUISITION AND PROCESSING FACILITIES, LINKED TOGETHER BY MEANS OF SATELLITE TELECOMMUNICATION AND LOCATED AT:

- FUCINO STATION
- MATERA CENTER
- ROME CENTER

EACH ONE OF THEM CAN AVAIL ITSELF OF THE TECHNICAL RESOURCES OF THE OTHER ONES.


TLR
TLR
Fucino Station
Matera Centre
CTM
Rome Centre
Scanzano Station
TLC

CTM

HISTORY

IN **1985**, IN THE OCCASION OF THE FOURTH ORDINARY **MEETING OF THE CONTRACTING PARTIES** TO THE BARCELONA CONVENTION FOR THE PROTECTION OF THE MEDITERRANEAN ENVIRONMENT

THE **PROPOSAL FOR THE INSTITUTION OF A REMOTE SENSING CENTRE** DEVOTED TO THE OBSERVATION OF THE MEDITERRANEAN BASIN WAS MADE:

- BY THE ITALIAN MINISTER FOR ENVIRONMENT

- AS A CONTRIBUTION BY ITALY TO THE MEDITERRANEAN ACTION PLAN OF THE UNITED NATIONS ENVIRONMENT PROGRAMME (MAP/UNEP)

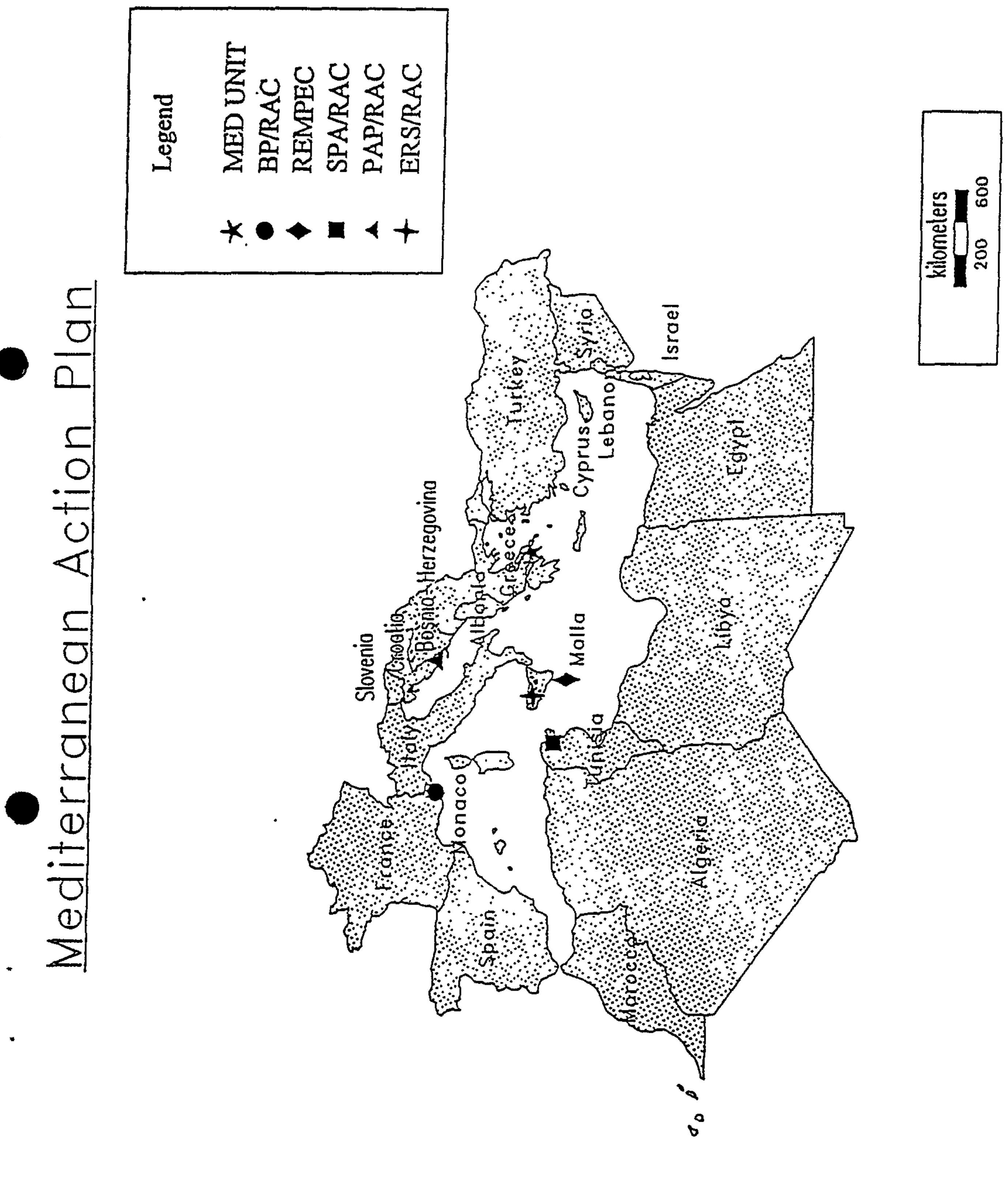
CTM

RAC/ERS
MAP/UNEP

IN THE EIGHTH MEETING OF THE CONTRACTING PARTIES (OCTOBER 1993, ANTALYA-TURKEY), **ALL THE MEDITERRANEAN COASTAL COUNTRIES AND THE EUROPEAN COMMUNITY FINALLY APPROVED** THE ITALIAN PROPOSAL, PRESENTED BY THE ITALIAN MINISTRY FOR FOREIGN AFFAIRS, SO **THE CTM BECAME REGIONAL ACTIVITY CENTER FOR ENVIRONMENT REMOTE SENSING(RAC/ERS) IN THE MEDITERRANEAN AREA**

IN THE FRAMEWORK OF MAP/UNEP INITIATIVES, THE CTM RAC/ERS WILL CO-OPERATE WITH THE OTHER MAP CENTRES LOCATED IN:

- FRANCE : PLAN BLEU - BP/RAC
- CROATIA: PRIORITY ACTIONS PROGRAMME - PAP/RAC
- MALTA: REGIONAL MARINE POLLUTION EMERGENCY CENTER - REMPEC
- TUNISIA: SPECIALLY PROTECTED AREAS - SPA/RAC


Mediterranean Action Plan
Legend
MED UNIT
BP/RAC
REMPEC
SPA/RAC
PAP/RAC
ERS/RAC
kilometers
200
600
Slovenia
Croatia
Bosnia-Herzegovina
Albania
Greece
Turkey
Syria
Israel
Lebanon
Cyprus
Egypt
Libya
Malta
Tunisia
Algeria
Morocco
Spain
France
Monaco
Italy

RAC ERS

IN THE ROLE OF RAC/ERS OF MAP/UNEP, THE CTM IS ENTRUSTED, AMONG THE OTHERS, WITH :

- MONITORING AND STUDYING OF THE MEDITERRANEAN ENVIRONMENT THROUGH THE USE OF REMOTE SENSING TECHNIQUES, AS WELL AS DISSEMINATING AND EXCHANGING INFORMATION AMONG THE MEDITERRANEAN COASTAL STATES

- ASSISTING ALL THE COASTAL COUNTRIES WITH TECHNICAL SUPPORT AND COOPERATING WITH THEM IN THEIR INITIATIVES BASED ON THE USE OF REMOTE SENSING, PREVENTING DUPLICATION AND WASTE OF RESOURCES

- CARRYING-OUT OF THE COASTAL AREAS MANAGEMENT PROGRAMMES (**CAMPS**) IN THE PRESENTLY STUDIED AREAS OF:
  - ALBANIA
  - EGYPT (FUKA MATROUH)
  - TUNISIA (SFAX)

  AS WELL AS IN THE FUTURE ONES

- PARTICIPATING AND CONTRIBUTING - ALSO IN COOPERATION WITH OTHER RACs - TO REGIONAL PROJECTS OF MAP AND OTHER INTERNATIONAL ORGANIZATIONS TOWARDS THE SUSTAINABLE DEVELOPMENT OF INDIVIDUAL COUNTRIES AND THE MEDITERRANEAN AS A WHOLE

- ARRANGING TRAINING COURSES AND MEETINGS FOR TECHNICAL REPRESENTATIVES OF COASTAL COUNTRIES

CTM
Centro di Telerilevamento Mediterraneo
United Nations Environment Programme
Mediterranean Action Plan
RAC/ERS
Regional Activity Centre for Environment Remote Sensing

OUTLINE

REMOTE-SENSING:

A NECESSARY TOOL FOR EFFECTIVE ENVIRONMENT MONITORING

The term "Remote-sensing" means the techniques and methods used to acquire and process information about an object which we wish to observe and study, without getting physically in touch with it.

The space remote-sensing technology makes use of orbiting satellite platforms on which are installed "sensors" devoted to acquire information about observed objects (targets): ground surface, atmosphere, sea and so on.

As a matter of fact, sensors receive the electromagnetic energy which the object reflects or emits in the field of visible, infrared or microwaves frequencies.
These sensed informations, converted into digital format, are then trasmitted to ground stations where they are acquired through parabolic antennas and recording systems; then they are processed and used for studies or analysis, as well as being displayed or rendered as images for a direct view.

Remote-sensing satellites, depending on orbit parameters and onboard instrumentation, allow us to observe the same part of the ground surface with a stated time period: for instance every half an hour in the case of Meteosat meteorological satellite (orbiting 36.000 km high), every 16 days as far as the Landsat satellites are concerned (orbiting 700 km high).

Repetitive observation, as well as the full overlay of different images acquired in subsequent times, allow a permanent monitoring of the conditions *and modifications of targets, and consequently of environmental phenomena.*

CTM
Centro di Telerilevamento Mediterraneo
United Nations Environment Programme
Mediterranean Action Plan
RAC/ERS
Regional Activity Centre for Environment Remote Sensing

The smallest dimensions that can be identified (geometric resolution) mainly depend on the type of sensor and the satellite running orbit.
For example the SPOT satellite (880 km high) allows us to obtain a 10 m resolution, that is to identify square objects with a 10 m side, while NOAA-TIROS satellite gives about 1 km resolution and Landsat satellite a maximum of 30 m resolution.

The satellite remotely sensed "scenes" cover about 180 km by 180 km for Landsat, 60 km by 60 km for SPOT, 2700 km each side for NOAA-TIROS, about one emisphere for Meteosat.

Such features are greatly important if we need to **survey a wide area at the same instant (synopticity).**
No other technique can obtain comparable results, airborne photogrammetry, for instance, due to its proper characteristics, could not cover in the same instant such extended areas.

The analysis of remote sensing data allows, furthermore, the identification and classification, with great precision, of significant parameters, as water surface temperature, sea colour, sea roughness, and so on.
As a matter of fact , it should be considered that sensors, which operate in different frequency bands of the electromagnetic spectrum (visible, infrared, microwaves) give us the possibility of a deep analysis of data and, consequently, of images thus identifying the type and characteristics of the monitored object with greater precision than human eye, which only operates in the visible spectrum.

On the other hand, all satellites which operate in visible and infrared spectrum, are not capable of observing the earth surface with some particular weather conditions, such as in presence of cloud coverage, while satellites equipped with microwave sensors onboard, as the european satellite ERS-1, can operate even under adverse atmospherical conditions.

As to the applicational point of view, it must be said that satellite remote sensing gives a digital representation of the observed area, useful to create a geographical-referred basis upon which can be overlaid - graphically and using computer-aided technologies (i.e. GIS) - further environmental thematic information (administrative boundaries, density of built-up areas, pollution rates and so on) .

So it becomes clear that remote sensing data may be usefully used both as a direct information source and as a reference system where conventional data can be read in an updated context.

- by overlaying the existing digital maps and remote sensing images, properly geocoded, variations in environmental conditions can be estimated, suggesting the need for further ground investigations or for priority in maps uptodating, which is a complex and expensive operation where the best results have to be searched for;

- through phenomena which are revealed in remote sensing images (water or atmosphere transparency, for instance), omogenous areas can be identified, as well as the extention of related phenomena (i.e. pollution) can be better evaluated, where otherwise measured data are only available in few places in which needful samplings have been carried out.

It is in this way that satellite remote sensing is usefully applied to many environmental managment and control actions .
In fact remote sensing data can be used, completed by other conventional information (in situ remarks, mapping statistics), to face several problems, that range from the creation and managment of natural reserves, to caves monitoring, to land use and protection, to the crops production assessment and so forth.

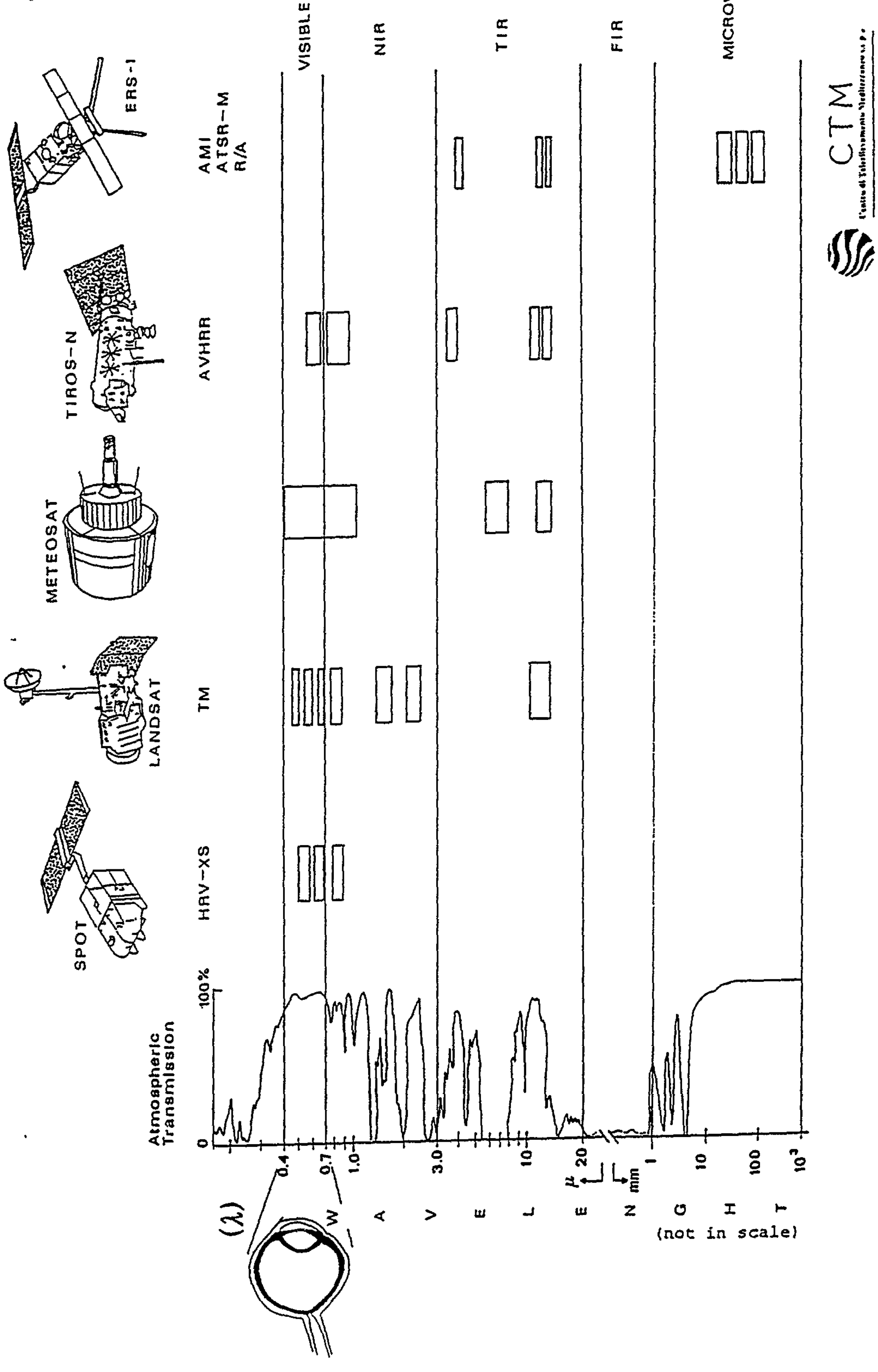
Among the available information coming from the analysis of remote sensing data, must be included updated indications on localization and extention of industrial and built-up areas that cause anthropic pressure and potentially modify the environmental balance.

It can be also noticed the civil structures growth (roads, railways, dams) and the land cover (cultivated, forested or bare areas) and the possible presence of degradation phenomena (deforestation, soil erosion, vegetation cover changes) can be identified as well

Moreover, the use of remote sensing allows us to obtain data on erosion phenomena, orography alterations, watercourse diversion, and to receive information about the water current dynamics and the sea transparency near the coast.

As far as air conditions are concerned, the industrial smokes, the ozone layer and so on can be also identified and analized.

In all these fields great scientific efforts are being made and increasing researches aim at strengthening - through remote sensing - the effective understanding of environmental conditions and changes. As a result a great number of applications are fully and usefully operational worldwide


VISIBLE
NIR
TIR
FIR
MICROWAVES
SPOT
HRV-XS
LANDSAT
TM
METEOSAT
TIROS-N
AVHRR
ERS-1
AMI
ATSR-M
R/A
Atmospheric Transmission
100%
0
0.4
0.7
1.0
3.0
10
20
μ
mm
1
10
100
10^3
(λ)
WAVELENGTH
(not in scale)
CTM

REMOTE SENSED DATA

sea colour
sea surface temperature
sea roughness
wave height
wind direction
pedology
geology
geomorfology
land use
....

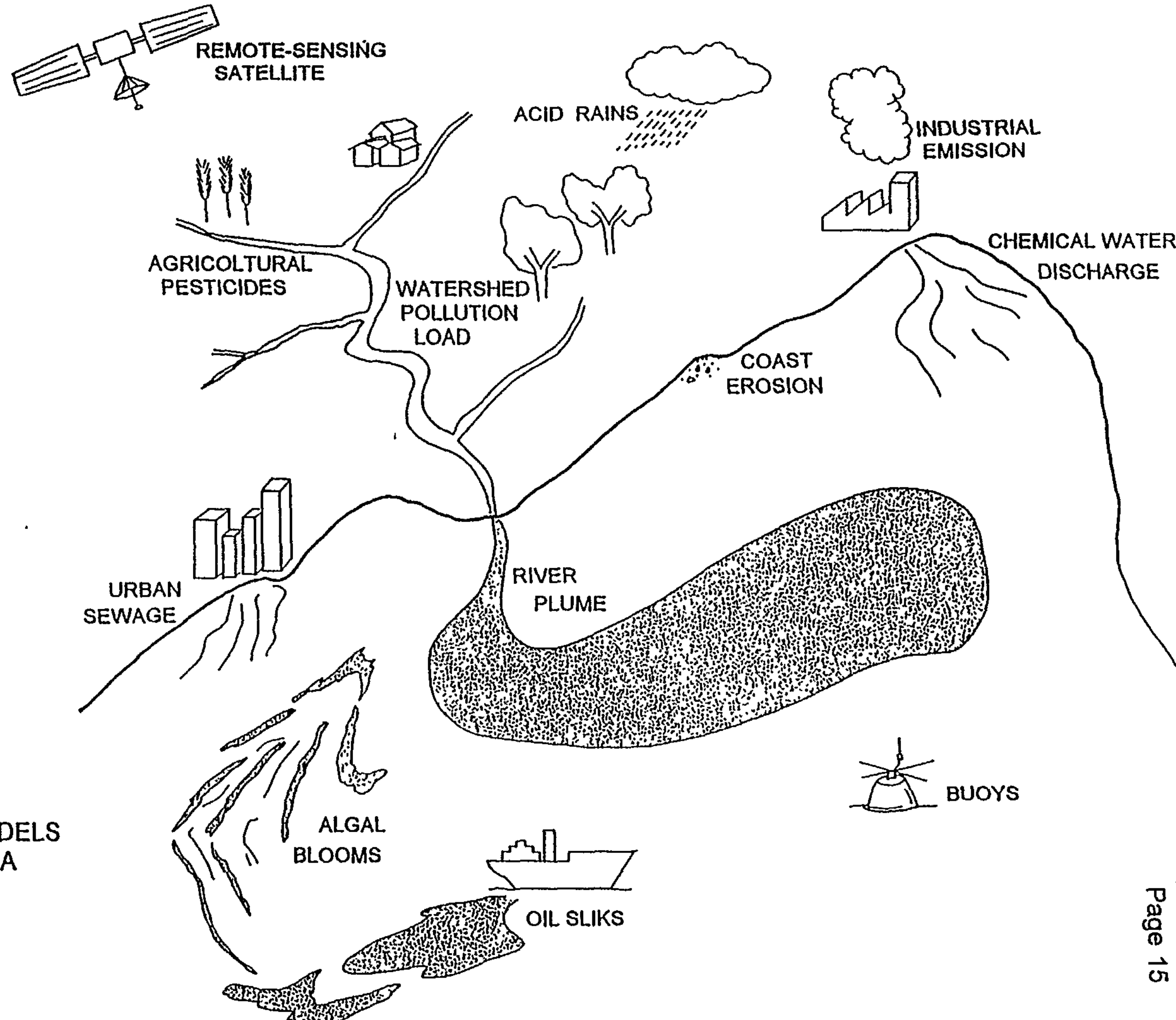
+

CONVENTIONAL DATA

geographic data
statistic data
socio-economica data
laboratory analysis
in situ investigations
hydrological data
....

⇩

SEA WATER QUALITY
SEA WATER CIRCULATION MODELS
EUTROPHICATION PHENOMENA
SEA WATER POLLUTION
DESERTIFICATION
COASTAL EROSION
HYDRODYNAMIC MODELS
....



COSMOS

CRITERIA FOR AN OPERATIONAL SETTING UP OF A MEDITERRANEAN OBSERVATION SYSTEM

CTM

MANY ATTEMPTS
HAVE BEEN AND ARE BEING MADE
IN ORDER TO
CONCEIVE, PLAN, CARRY OUT
MULTI-DISCIPLINARY OBSERVATORIES
OF THE MEDITERRANEAN REGION,
WICH IS A VERY SIGNIFICANT TEST AREA

THE GOAL OF A

REGIONAL ENVIRONMENTAL OBSERVATORY

COULD BE:

TO RENDER GLOBAL UPDATE INFORMATION
ON THE ENVIRONMENTAL BALANCE AND DYNAMIC,
TAKING INTO ACCOUNT THE HUGE NUMBER OF
CONNECTIONS
LINKING CAUSES AND EFFECTS

WICH IS:

GREATLY COMPLEX, EXPENSIVE AND TIME
CONSUMING

CTM

............MULTI-DISCIPLINARY

OBSERVATORY.................

?

CTM

OUR APPROACH IS:

TO CLEARLY INDIVIDUATE

FEW BUT SIGNIFICANT PARAMETERS

TO BE MONITORED

THAT CHARACTERIZE THE ENVIRONMENT

AS FUNDAMENTAL INDICATORS OF A SYSTEM

WHICH LINKS THEM EACH OTHER

THROUGH EVEN COMPLEX CONNECTIONS

TO THIS PURPOSE

THE REMOTE SENSING TECHNIQUE

MIGHT UNDOUBTELY PLAY

AN EFFECTIVE ROLE

BY PROVIDING ITS ADVANCED TOOLS AND APPLICATIONS

AT PRESENT ***CTM*** IS CARRYING OUT A PROGRAM

NAMED ***COSMOS***

OPEN TO ANY INTEGRATION

FROM SEVERAL APPROACHES

CTM

COSMOS

CRITERIA FOR AN OPERATIONAL SETTING UP OF A MEDITERRANEAN OBSERVATION SYSTEM

CTM

THE SYSTEM IS CONCEIVED TO GRANT:

- SYNOPTIC SURVEY AT REGIONAL SCALE
- REPETITIVE OBSERVATION
- LOW COST SERVICE
- HOMOGENEUS MEASUREMENTS AT REGIONAL SCALE
- COMPARABLE INFORMATION AT REGIONAL SCALE
- FULL SPACE COVERAGE OF THE REGION
- SYNTHETIC DATA AT REGIONAL SCALE
- GENERAL DIRECTIONS FOR FURTHER EITHER LOCAL OR PUNCTUAL INVESTIGATIONS
- FUNDAMENTAL INFORMATION THAT ALLOW THE PLANNINIG AND DEVELOPING OF ACTIVITIES OF REAL COMMON INTEREST AT MEDITERRANEAN SCALE, TO BE CARRIED OUT USING REMOTE SENSING TECHNIQUES

CTM

STEPS FOR THE IMPLEMENTATION OF THE SYSTEM

A) ANALYSIS OF **LOCAL/NATIONAL PRIORITY NEEDS** CONCERNING ENVIRONMENTAL CONDITIONS AND CHANGES

B) IMPLEMENTATION OF A **MATRIX:**
"ENVIRONMENTAL/ANTHROPIC COMPONENTS
IMPACT CAUSES"

C) APPLICATION OF A **METHOD** FOR FILLING IN THE MATRIXES

D) IDENTIFICATION OF **ENVIRONMENTAL INDICATORS** OF PRIORITY REGIONAL INTEREST TO BE MONITORED

E) SELECTION OF MONITORING **TOOLS**

UTILIZATION OF SATELLITE DATA FOR MARINE RESOURCES EVALUATION IN THE MEDITERRANEAN BASIN

(*MARE* PROJECT)

CTM

RATIONALE

Technical reasons

FISH SHOALS CANNOT BE OBSERVED DIRECTLY BY EXISTING EARTH OBSERVING SATELLITES

DIFFERENT OBSERVABLE SURFACE CONDITIONS CAN BE RELATED TO THE PHYSICAL, CHEMICAL AND BIOLOGICAL PROCESSES RELEVANT TO REPRODUCTIONS, NATURAL FLUCTUATION AND MOVEMENTS OF FISH POPULATION

OBJECTIVES

UNDERSTANDING OF THE LOCAL RELATIONSHIP BETWEEN SATELLITE DETERMINED PARAMETERS AND BIOLOGICAL DISTRIBUTION PARAMETERS

DEFINITION OF SYNTHETIC INFORMATION USEFUL TO SUPPORT:

- CAPTURE AND SURVEILLANCE OF COMMERCIAL FISHERIES
- PLANNING, DEVELOPING AND MANAGEMENT OF FISHERY ACTIVITIES

EVALUATION OF THE TRUE POTENTIALITY OF THE AVAILABLE REMOTE SENSING DATA INTEGRATED WITH OTHER INFORMATION

METHOD

OBSERVATION OF PHYSICAL SEA SURFACE PARAMETERS AND STUDY OF THE RELATIONSHIP OF THESE OBSERVATIONS TO THE PRESENCE OF MARINE RESOURCES

Hypothesis

1) THE AREAS WITH HIGH PROBABILITY OF PRESENCE OF FISHERY RESOURCES ARE STRONGLY RELATED TO AREAS WITH HIGH PRIMARY PRODUCTIVITY

2) BIOLOGICAL DISTRIBUTION RESPONDS TO THE PRESENCE OF FRONTS, MESOSCALE EDDIES AND OTHER DYNAMIC FEATURES

THE ACTIVITY

THE ACTIVITY IS PLANNED IN THREE PHASES:

1) HISTORICAL DATA ANALYSIS IN ORDER TO INDIVIDUATE THE SPATIAL AND TEMPORAL DISTRIBUTION OF PRIMARY PRODUCTIVITY AND THE POSSIBLE CORRELATION WITH GEOPHYSICAL AND OCEANOGRAPHYCAL FACTORS WHICH INFLUENCE ITS VARIABILITY

2) VERIFICATION OF THE RELATIONSHIP DEFINED IN THE FIRST PHASE UTILIZING NEW SATELLITE DATA AND IN-SITU DATA EVENTUALLY ACQUIRED WITH AD-HOC CAMPAIGNS

3) INDIVIDUATION OF SYNTHESIS INFORMATION AND EXPERIMENTATION OF A DISSEMINATION SERVICE

SATELLITE OBSERVATIONS

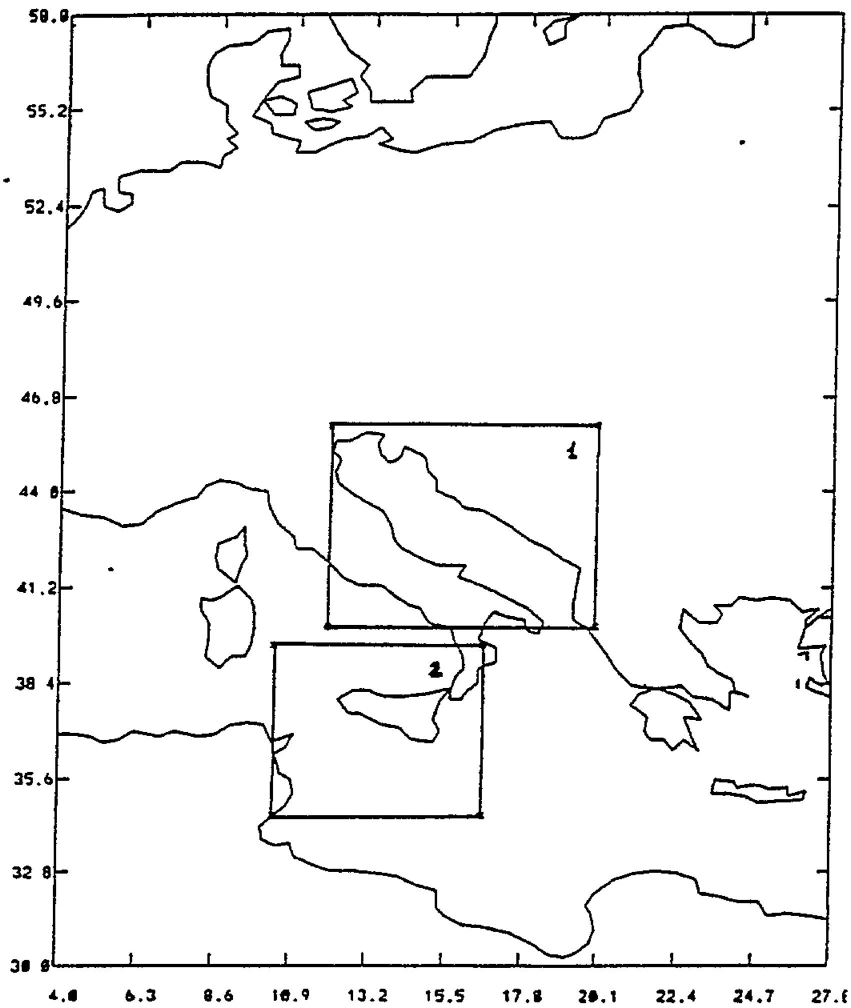
DIRECT OBSERVATIONS	INSTRUMENT	INDIRECT OBSERVATIONS
Ocean Color data	CZCS Sea WiFS	Clorophyll concentration Marine primary productivity
Sea surface temperature maps	NOAA-AVHRR	Dynamic features (frontal boundaries, upwelling areas, filaments)
Microwave backscatter data	ERS-1 scatterometer	Sea surface wind Sea waves

SATELLITE DATA HAVE CHARACTERISTICS OF HOMOGENEITY, RIPETITIVITY AND OBSERVATION OF GREAT AREAS SUCH TO BE COMPLEMENTARY TO THE GROUND OBSERVATIONS

SELECTED TEST AREAS

1 ADRIATIC SEA

2 SICILY CHANNEL



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DEVELOPMENT OF THE FIRST PHASE

1) INDIVIDUATION OF SEA AREAS WITH WELL-DEFINED CHARACTERISTICS (PERSISTENT PATTERNS OF NUTRIENTS)

2) HISTORICAL ANALYSIS CONSIDERING THE FOLLOWING SATELLITE INSTRUMENTS:

- CZCS (Ocean Color)
- AVHRR (Sea Surface Temperature)
- ERS-1 (Scatterometer)

3) SELECTED PERIOD: 1985-1986 (CZCS STOPPED THE ACQUISITION IN JUNE 1986)

4) INTERPRETATION TAKING INTO ACCOUNT THE RELATIONSHIP BETWEEN PRIMARY PRODUCTIVITY AND THE FACTORS WHICH INFLUENCE ITS VARIABILITY:

- *THERMAL FRONTS*
- *BATIMETRY*
- *WIND STRESS*
- *UPWELLING AND OTHER COLD WATER AREAS*
- *WAVE CHARACTERISTICS*

5) VALIDATION AND CALIBRATION CONSIDERING IN-SITU EXISTING OCEANOGRAPHIC DATA

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RESULTS

Short Term (Jan.-Mar. 1995)

RELATIONSHIP BETWEEN SPACE-TEMPORAL VARIABILITY OF HIGH PRODUCTIVITY AREAS AND POSSIBLE CAUSES

INDIVIDUATION (WITHIN THE TEST AREAS) OF AREAS WITH STRONG PRESENCE OF NUTRIENTS AND STUDY OF THE CORRELATION WITH SEA SURFACE TEMPERATURE PATTERNS

OBSERVATION AND STUDY (IN SICILY CHANNEL) OF AREAS WITH PERSISTENT PATTERNS LIKE COLD WATER FILAMENTS (RICH OF NUTRIENTS)

Medium Term

SET UP OF A MODEL OF PRIMARY PRODUCTIVITY FOR SELECTED AREAS

Long Term

EXTENSION OF THE DEVELOPED METHODOLOGY OUT OF THE TEST AREAS, POSSIBLY IN THE OVERALL MEDITERRANEAN SEA

USE OF THESE RESULTS IN AN OPERATIONAL CONTEXT, CONSIDERING THE LAUNCH OF THE FUTURE SEAWIFS OCEAN COLOR INSTRUMENT

CONSTITUTION OF A NETWORK FOR THE DISSEMINATION OF SIGNIFICANT INFORMATION IN SUITABLE FORMAT FOR IMMEDIATE EXPLOITATION BY FIELD OPERATORS

CLASSIFICATION ET CONTROLE DE LA VEGETATION MEDITERRANEENNE SUR LA BASE DE DONNEES SATELLITAIRES

CTM

OBJECTIFS PRINCIPAUX

- ◻ CLASSIFICATION DE LA VEGETATION DE LA MEDITERRANEE BASEE SUR L'EVOLUTION PLURIANNUELLE DE SON ACTIVITE PHOTOSYNTHETIQUE MESUREE PAR SATELLITE.

- ◻ CREATION D'UNE BASE DE DONNEES UTILE POUR LE CONTROLE CONTINU DE LA VEGETATION.

$$\Longrightarrow$$

- ◻ CREATION D'UN INSTRUMENT PERMETTANT DE:
  - ▼ DEFINIR LES PRINCIPAUX TYPES DE COUVERTURE VEGETALE (NATURELLE ET CULTIVEE)
  - ▼ ANALYSER DE MANIERE RAPIDE TOUTE VARIATION, A COURT TERME ET A LONG TERME, ENREGISTREE PAR LE COUVERT VEGETAL

MOTIFS

- AUGMENTATION DES PHENOMENES DE DEGRADATION DE LA VEGETATION NATURELLE EN MEDITERRANEE

- BESOINS DE PLUS EN PLUS CROISSANT D'UNE GESTION RATIONNELLE DES RESSOURCES VEGETALES NATURELLES ET CULTIVEES EN MEDITERRANEE

⟹

NECESSITE

- DE DEFINIR LA STRATIFICATION DE LA COUVERTURE VEGETALE

- DE SUIVRE LE COMPORTEMENT DANS LE TEMPS DES COMMUNAUTES VEGETALES.

INTRODUCTION DE LA TELEDETECTION DANS L'ETUDE DE LA VEGETATION.

- METHODES TRADITIONNELLES (mesures in situ et modélisation successive) IMPLIQUENT UN INVESTISSEMENT DE TEMPS ET D'ARGENT ELEVE.

- AU TRAVERS DE LA REPONSE RADIOMETRIQUE (ENERGIE LUMINEUSE RESTITUEE) D'UNE PLANTE, ON PEUT:
  - CONNAITRE:
    - SON EFFICACITE PHOTOSYNTHETIQUE
    - SON COMPORTMENT AU COURS DE L'ENTIERE SAISON DE CROISSANCE
  - ENREGISTRER:
    - SA REACTION AU STRESS ET/OU AUX CONTRAINTES METEOROLOGIQUES (RADIATION SOLAIRE, TEMPERATURE ET DISPONIBILITE HYDRIQUE)

- DES 1980, DEVELOPPEMENT DE RECHERCHES SUR L'UTILISATION DU SATELLITE POUR L'ETUDE DE LA VEGETATION

- LES SATELLITES DE LA SERIE NOAA SONT CONSIDERES LES MEILLEURS POUR CE TYPE DE RECHERCHES / CARACTERISTIQUES:
  - INSTRUMENT DE MESURE RADIOMETRIQUE TRES PRECIS
  - FREQUENCE ELEVEE D'ACQUISITION (2 FOIS PAR JOUR)
  - ACQUISITION DE VASTE COUVERTURE TERRITORIALE A CHAQUE PASSAGE (2600 x 2600 KM)

    EXEMPLE: STATION DE SCANZANO (SICILE):
    IMAGE = 4000 KM (LAT.)x5000 km (LONG.)

QUELQUES CARACTERISTIQUES DES SATELLITES NOAA

- RESOLUTION GEOMETRIQUE
  - **1.1km** (format d'acquisition LAC: Local Area Coverage) pour les images acquises au Nadir;
  - 4 km (format d'acquisition GAC: Global Area Coverage) pour les images enregistrées et acquises successivement en Virginie ⇒ elaboration **GVI** (15-30 km) .

- RADIOMETRE AVHRR (Advanced Very High Resolution Radiometer) ANALYSE ET MESURE CINQ BANDES DU SPECTRE LUMINEUX

  - canal 1: 0.58-0.68 µm (visible)
  - canal 2: 0.725 -1.1 µm (proche infrarouge)
  - canal 3: 3.55- 3.93 µm (infrarouge thermique)
  - canal 4: 10.3-11.3 µm (infrarouge thermique)
  - canal 6: 11.5 -12.5 µm (infrarouge thermique)

INDICE DE VEGETATION

- LA PARAMETRISATION DE LA REPONSE RADIOMETRIQUE EST FAITE PAR LE CALCUL D'INDICES DE LA VEGETATION, COMME LE NDVI (Normalized Difference Vegetation Index) :

$$\frac{\text{canal2} - \text{canal1}}{\text{canal2} + \text{canal1}}$$

- NDVI FLUCTUE entre -1 et +1

- NDVI = 0.1 ≅ SOL NU

- NDVI = 0.2 ≅ ACTIVITE PHOTOSYNTHETIQUE MINIMALE

POURQUOI UTILISER L'INDICE DE VEGETATION

- INTENSITE ET "FORME" DU CYCLE ANNUEL DU NDVI VARIENT EN FONCTION DE L'ESPECE VEGETALE

⟹

CLASSIFICATION ET STRATIFICATION DE LA VEGETATION

- ▼ DIFFICULTE: CYCLES SIMILAIRES POUR DIVERSES ESPECES VEGETALES (IMPOSSIBILITE DE DISCRIMINATION)

⟹

- ▼ NECESSITE D'UNE VALIDATION C'EST A DIRE UN CONTROLE DES ESPECES EN SE BASANT:
  - INTEGRATION D'INFORMATION CARTOGRAPHIQUES EXISTANTES (VEGETATION, UTILISATION DU SOL)
  - EXAMEN SUR LE TERRAIN DE ZONES ECHANTILLONS ET DEFINITION DE L'ESPECE LA PLUS REPRESENTEE (DONT LA REPONSE SPECTRALE EST DOMINANTE)

- INTENSITE ET EVOLUTION DU CYCLE ANNUEL DU NDVI D'UNE MEME ESPECE VARIABLE EN FONCTION DES CARACTERISTIQUES CLIMATOLOGIQUES DE L'ANNEE D'OBSERVATION.

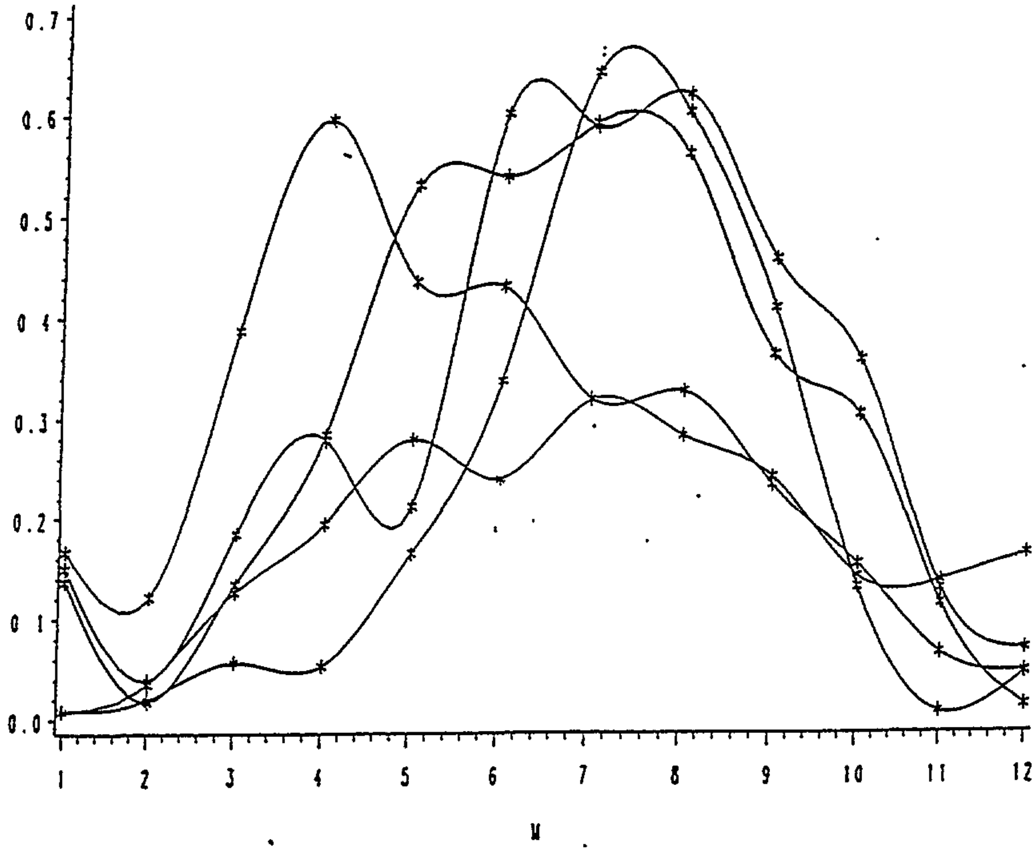
⟹

UTILISATION COMME CONTROLE DES VARIATIONS

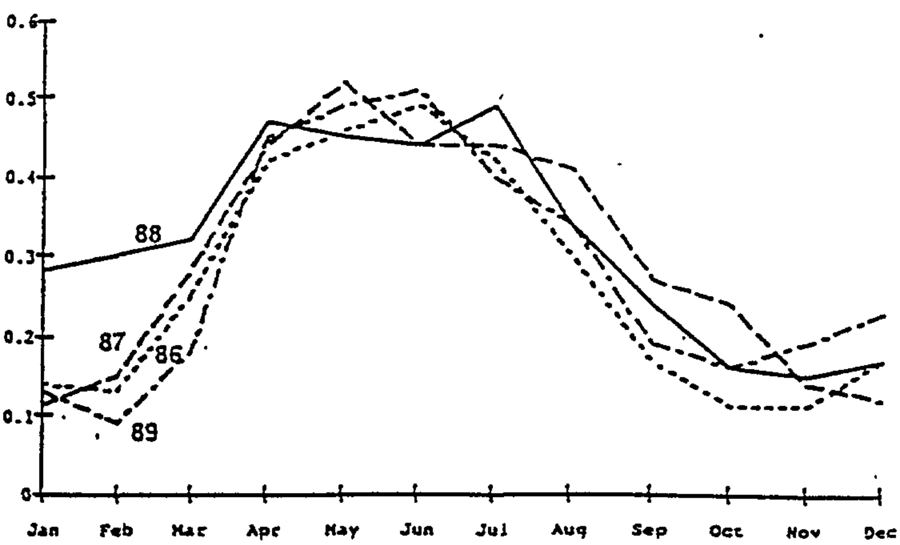
- ▼ DIFFICULTE: REPRESENTATIVITE DE LA CLASSIFICATION / UNE ANNEE D'OBSERVATION ?

- ▼ DEFINITION D'UN CYCLE ANNUEL MOYEN BASE SUR L'INTEGRATION DE PLUSIEURS ANNEES D'OBSERVATION. CYCLE SERVANT SUCCESSIVEMENT DE REFERENCE POUR LES ACTIVITES DE CONTROLE CONTINU.

1987 ITALY NDVI PROFILES



Appennino Ligure Alpi Liguri
Rice Cultivation Milan Sub-urbs
Fiora Plain



Single year monthly 1986/89 NDVI profiles for Po valley agricultural area.

FROM BENEDETTI et al, 1983

ARTICULATION DU PROJET

- EXTENSION GEOGRAPHIQUE
  LES PAYS COTIERS DE LA MEDITERRANEE

- PHASES DU PROJET.

  - I. ITALIE
    - PREMIERE CLASSIFICATION DEJA REALISEE SUR L'ELABORATION DES DONNEES JOURNALIERES DE NDVI SUR QUATRE ANNEES D'OBSERVATION (1986-1990, 1600 IMAGES NOAA).
      RESULTAT: CARTE PRODUITE A ECHELLE 1:1.000.000 AVEC IDENTIFICATION DE 17 CLASSES DE VEGETATION.

    - AMPLIFICATION SUR HUIT ANNEES D'OBSERVATION (1986-1993), RI-ELABORATION D'UNE CLASSIFICATION ET PRODUCTION D'UNE CARTOGRAPHIE A 1:1.000.000.

    - VALIDATION DE CETTE CLASSIFICATION:
      - <u>RELEVES IN SITU:</u>
        DETERMINATION SUR DES ZONES ECHANTILLONS (3 KM x 3 KM) DES ESPECES DOMINANTES
        RECONNAISSANCE DES ESPECES VEGETALES ET DE LEUR STRATIFICATION EN FONCTION DE L'ALTITUDE
      - <u>COMPARAISON AVEC CARTOGRAPHIE EXISTANTES:</u>
        UTILISATION DU SOL A 1:250.000 (1960-1970)
        VEGETATION A 1:1000.000 (1992)

FIN ACTIVITE: DECEMBRE 1994

CTM

▼ II. BASSIN MEDITERRANEEN

- ELABORATION DE NDVI JOURNALIER SUR UNE ANNEE (1992 o 1993)
- RESULTAT: PREMIERE CLASSIFICATION AVEC ATTRIBUTION DE LA LEGENDE / RESULTATS OBTENUS EN ITALIE ET INFORMATIONS DISPONIBLES PROVENANT DES AUTRES PAYS.
- DISPONIBILITE DES DONNEES POUR TOUT PAYS QUI LE DEMANDE
- FIN ACTIVITE: MAI 1995

CETTE PREMIERE CLASSIFICATION BASEE SUR UNE ANNEE D'OBSERVATION DOIT ETRE CONSIDERER COMME LE PREMIER PAS VERS LA MISE AU POINT D'UN SYSTEME DE CONNAISSANCE ET DE CONTROLE.

□ NOM DONNE AU PROJET : DAPHNE

MEDITERRANEAN

REMOTE SENSING ACTIVITIES INVENTORY SYSTEM

NOTE: THE INVENTORY IS STILL IN PROGRESS SINCE BASED ON QUESTIONNAIRES RETURNED TO RAC/ERS WITHIN JULY 1994

CTM

MEDITERRANEAN

REMOTE SENSING
ACTIVITIES
INVENTORY
SYSTEM

THE RAC/ERS' MANDATE

RECEIVED BY ALL THE MEDITERRANEAN COASTAL COUNTRIES AND THE EU

CONSIST IN CONTRIBUTING TO THE MEDITERRANEAN ACTION PLAN

BY:

- IMPLEMENTING ACTIONS BASED ON REMOTE SENSING TECHNIQUES FOR THE OBSERVATION AND STUDY OF THE MEDITERRANEAN ENVIRONMENT

- PROMOTING THE HOMOGENIZATION OF INITIATIVES IN THIS FIELD

- ENHANCING CO-OPERATION AND SYNERGIES AMONG THE COASTAL COUNTRIES THEMSELVES

MEDITERRANEAN

REMOTE SENSING
ACTIVITIES
INVENTORY
SYSTEM

TO FULFIL THIS TASK

RAC/ERS HAS FIRST OF ALL TO KNOW:

- ALREADY CARRIED OUT OR PRESENTLY ONGOING AND PLANNED ACTIVITIES ALL OVER THE MEDITERRANEAN REGION
- EXISTING AVAILABLE EQUIPMENT AND EXPERTISE
- PRIORITY DEMANDS OF COASTAL COUNTRIES

MEDITERRANEAN

REMOTE SENSING
ACTIVITIES
INVENTORY
SYSTEM

THE "RAIS" PROJECT HAS BEEN CONCEIVED JUST TO ALLOW THE RAC/ERS TO PERFORM THE FOLLOWING TASKS:

COGNITION

TO KNOW WHO IS DOING WHAT AND WHERE IN ORDER TO:

- AVOID DUPLICATION AND WASTE OF RESOURCES
- GATHER UPDATED AND COMPLETE INFORMATION ABOUT EXISTING REMOTE SENSING APPLICATIONS AND DATA IN ANY AREA TO BE MONITORED

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MEDITERRANEAN

REMOTE SENSING
ACTIVITIES
INVENTORY
SYSTEM

COOPERATION

- TO FAVOUR THE ACCESS TO THE DIFFERENT EXPERIENCES OF THE CENTERS AS WELL AS TO THE CARRIED OUT APPLICATIONS AND AVAILABLE EQUIPMENT

- TO MERGE THOSE INFORMATION AND DATA IN ORDER TO:
  - ☐ PUT THE BASIS FOR THE DEVELOPMENT OF A POSSIBLE INTEGRATED PROJECT COVERING THE WHOLE MEDITERRANEAN REGION
  - ☐ TO SUPPORT THE WIDENING OF THE EXISTING PROJECTS

MEDITERRANEAN

REMOTE SENSING
ACTIVITIES
INVENTORY
SYSTEM

ASSISTANCE

AIMS AT PROVIDING:

- THE EXCHANGE OF KNOWLEDGES
- MUTUAL SUPPORT IN SPECIFIC TECHNICAL FIELDS
- JOINT PLANS FOR PROFESSIONAL GROWTH
- EDUCATIONAL ACTIVITIES

MEDITERRANEAN

REMOTE SENSING
ACTIVITIES
INVENTORY
SYSTEM

IN ORDER TO SUPPORT THE RAC/ERS IN IMPLEMENTING THE ABOVE MENTIONED FUNCTIONS,

MED-U, RACs, FOCAL POINTS AND CENTERS

SHOULD:

- ENLIVEN THE FLOW OF INFORMATION CONCERNING "REMOTE SENSING" INTO/FROM THE RAC/ERS
- APPLY TO RAC/ERS FOR CONSULTATION WHENEVER A NEW MONITORING PLAN SHOULD BE SET UP

MEDITERRANEAN
REMOTE SENSING
ACTIVITIES
INVENTORY
SYSTEM

SYSTEM'S ARCHITECTURE

The system is structured as follows:

DATA BASE IMPLEMENTATION:

DATA COLLECTION THROUGH THE SETTING UP OF A QUESTIONNAIRE MAILED TO THE REMOTE SENSING CENTERS BASED IN THE MEDITERRANEAN COASTAL COUNTRIES

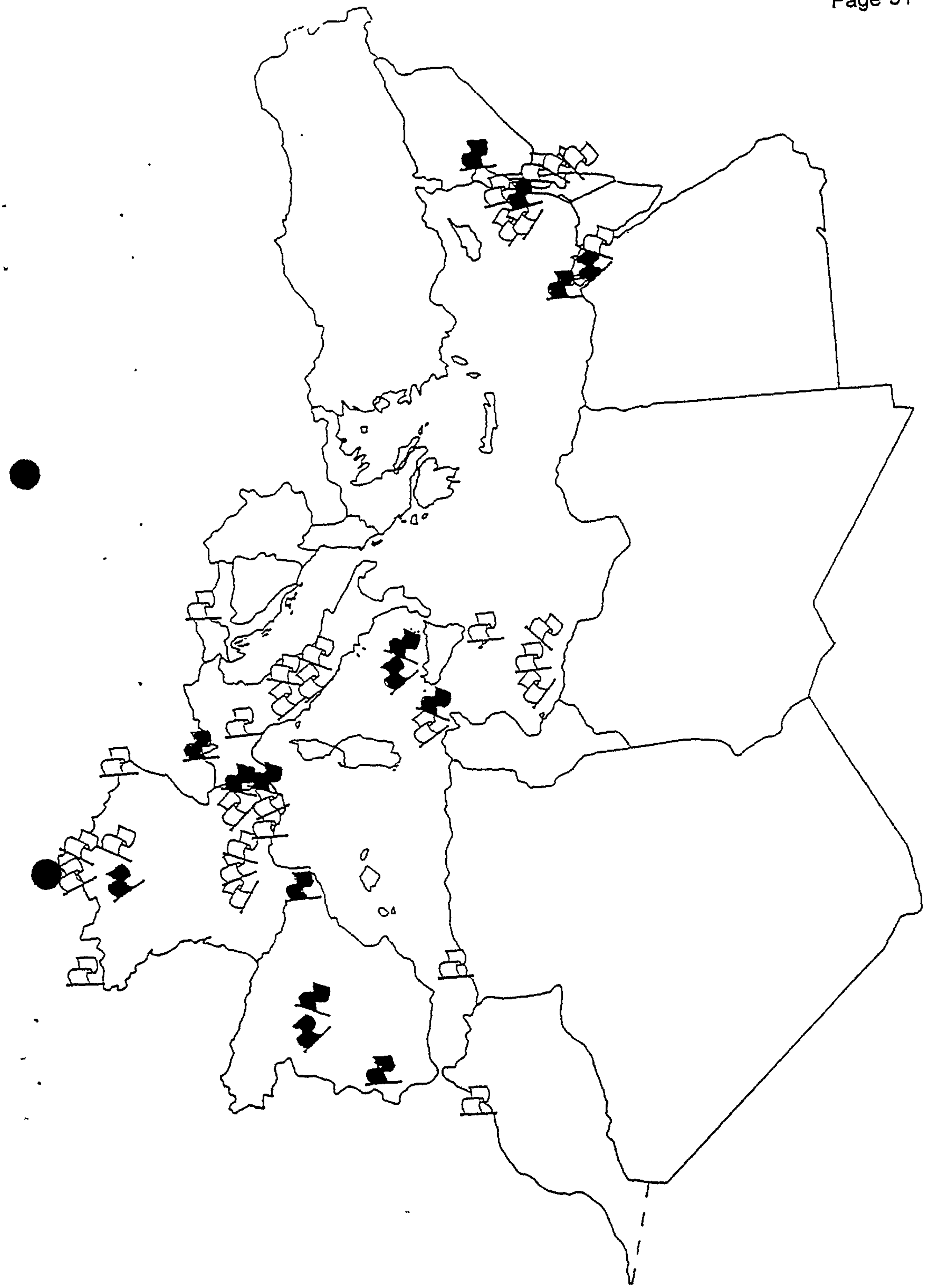
DATA RECORDING AND MANAGEMENT IN ORDER TO GROUP AND SYNTHESIZE INFORMATION ON:

- CARRIED OUT APPLICATIONS
- ACQUIRED EXPERIENCES
- AVAILABLE SKILLS
- AVAILABLE EQUIPMENT AND FACILITIES

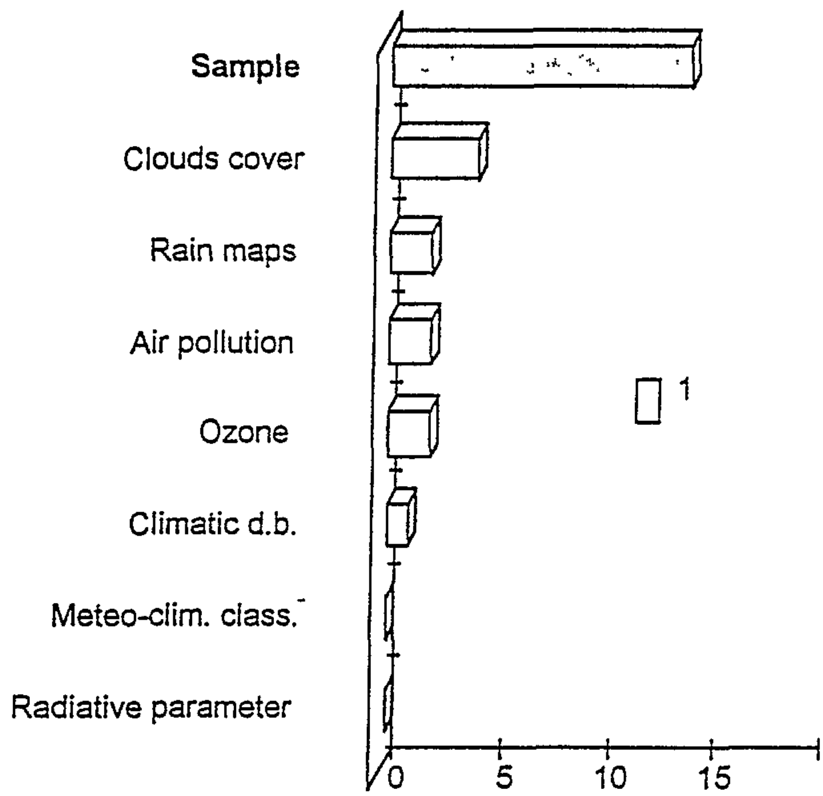
DATA DIFFUSION:

THE INVENTORY IS ACCESSIBLE TO THE WHOLE MEDITERRANEAN COMMUNITY WHILE IT IS CONTINOUSLY UPDATED DUE TO THE FLOWING IN OF INFORMATION FROM THE COOPERATING PARTIES

CTM

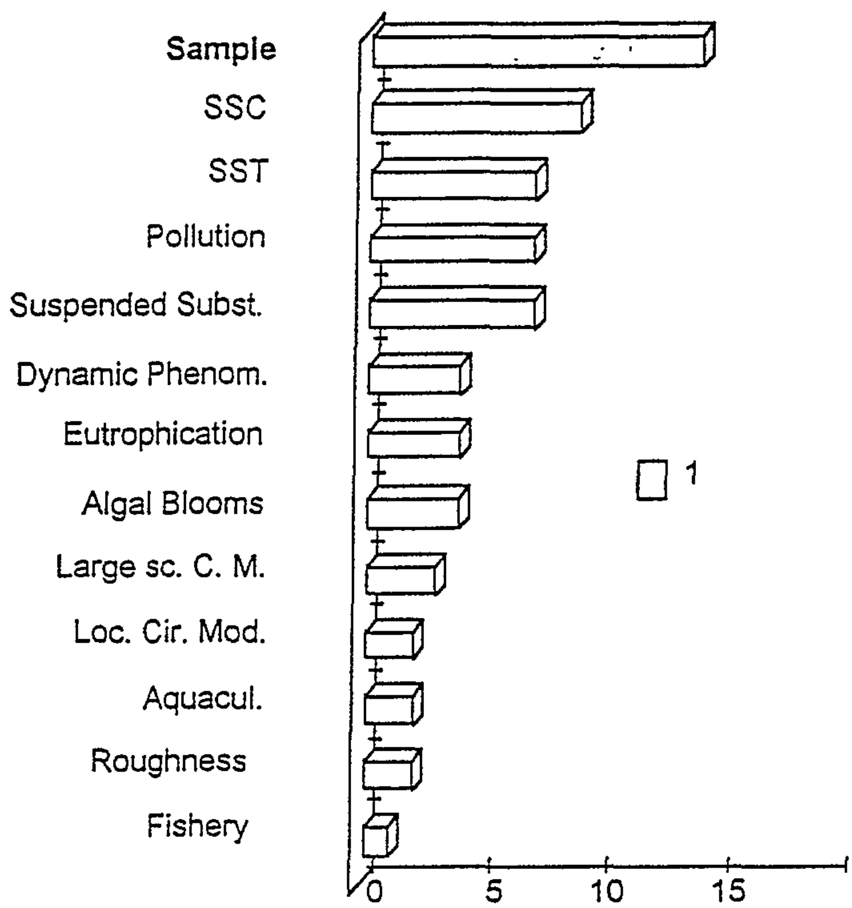


ATMOSPHERE

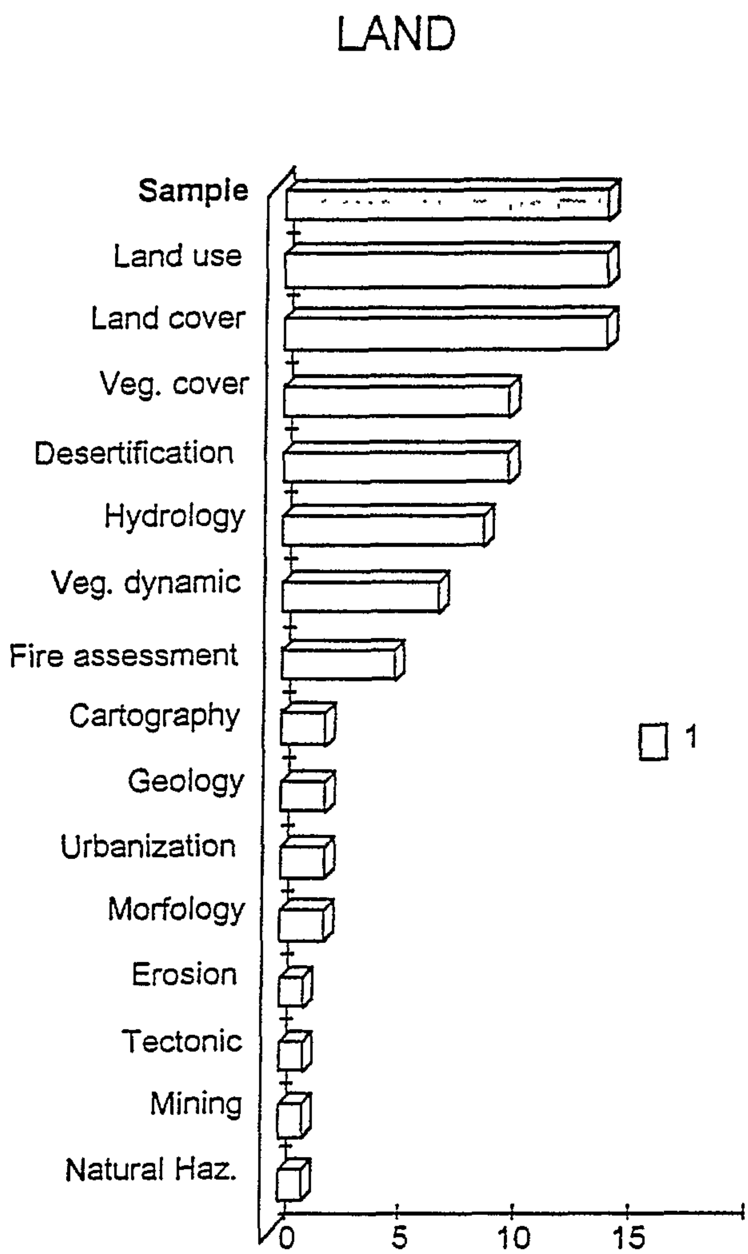


- Number of Centers involved in each research area (with reference to the 14 questionnaires already collected)

SEA

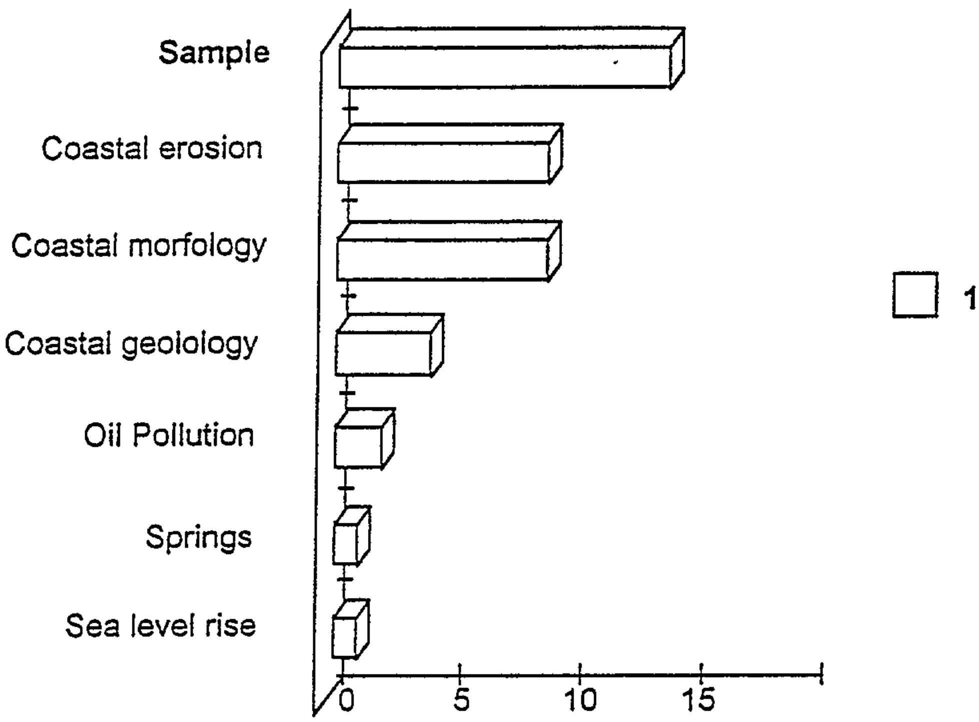


- Number of Centers involved in each research area (with reference to the 14 questionnaires already collected)



- Number of Centers involved in each research area (with reference to the 14 questionnaires already collected)

COAST



- Number of Centers involved in each research area (with reference to the 14 questionnaires already collected)

CAMP/PAC

COASTAL AREA MANAGEMENT PROGRAM

PROGRAMME D'AMENAGEMENT COTIER

CTM

CAMP/PAC
COASTAL AREA MANAGEMENT PROGRAM
PROGRAMME D'AMENAGEMENT COTIER

- PROGRAMMES REALISES DANS DES ZONES COTIERES PARTICULIEREMENT VULNERABLES OU DEGRADEES, SUR LA BASE D'ACCORDS ENTRE LES ETATS INTERESSES ET LE MAP,

- LES DIVERSES ACTIVITES / TRAVAIL ET RECHERCHES
  - DES REPRESENTANTS DU MAP
  - DES DIFFERENTS CENTRES D'ACTIVITES REGIONALES
  - D'EXPERTS NATIONAUX ET INTERNATIONAUX.

- DUREE MOYENNE DE DEUX ANS.

CAMP/PAC

- LES SUJETS PRINCIPALEMENT ABORDES ET DEVELOPPES SONT:
  - ✦ ETUDES DE CARACTERE GENERAL
    - ▼ Analyse systémique et prospective pour la définition de scénarios développement/environnement;
    - ▼ Introduction d'instruments légaux et institutionnels pour la protection de l'environnement;
    - ▼ Définition des impacts possibles sur les écosystèmes dus à des changements climatiques prévisibles;
  - ✦ ETUDES DE DETAIL/
    - ▼ aux problèmes environnementaux plus aigus
  - ✦ PROPOSITION DE PLAN D'AMENAGEMENT DE LA ZONE COTIERE.

- UNE PLACE FONDAMENTALE:
  - ✦ A LA FORMATION
  - ✦ A LA MISE EN PLACE DE METHODOLOGIES

⇒ DONNER LES MOYENS ET LES POTENTIALITES POUR D'AUTRES INTERVENTIONS DE CE TYPE A L'INTERIEUR DU PAYS.

CAMP/PAC

- LES PREMIERS PAC/CAMPS COMMENCES A LA FIN DE 1990 ET AUJOURD'HUI TERMINES SONT CEUX DE:

    - ✦ BAIE D'IZMIR (TURQUIE)
    - ✦ ILE DE RHODES
    - ✦ BAIE DE KASTELA (EX-YOUGOSLAVIE)
    - ✦ COTE SYRIENNE.

- LES PAC/CAMPS ACTUELS SONT CEUX DE:

    - ✦ COTE ALBANAISE.
    - ✦ FUKA-MATROUH (EGYPTE)
    - ✦ SFAX (TUNISIE)

ROLE DU CAR/TDE (RAC/ERS).

- PROMOUVOIR LE ROLE DE LA TELEDECTION COMME INSTRUMENT D'ETUDES ET DE CONNAISSANCES

- CONTRIBUER A UNE MEILLEURE CONNAISSANCE DES DYNAMIQUES DES TRANSFORMATIONS DE L'ENVIRONNEMENT.

- ETUDIER ET SUGGERER DES SYSTEMES DE CONTROLE CONTINU DE L'ENVIRONNEMENT, NECESSAIRES POUR UNE MEILLEURE GESTION ET UNE PLUS EFFICACE PROTECTION.

- LES INTERVENTIONS DE CAR/TDE SONT:
  - PLANIFIEES EN ACCORD AVEC L'UNITE DE COORDINATION D'ATHENES (MEDU)
  - REALISEES EN COLLABORATION AVEC LES AUTRE CENTRES D'ACTIVITES REGIONALES.

PAC ALBANIE

❑ SUJET:

- DEFINITION DES CHANGEMENTS MACROSCOPIQUES DE LA LIGNE COTIERE AU TRAVERS DE LA TELEDETECTION.

❑ POURQUOI:

- LIGNE DE RIVAGE ALBANAIS FORTEMENT SOUMIS A DES MOUVEMENTS DE REGRESSION OU DE PROGRESSION.

- CONTROLE NECESSAIRE SURTOUT DANS L'OPTIQUE DE FUTURS AMENAGEMENTS COTIERS, EN PARTICULIER TOURISTIQUE.

❑ BUT:

- DEMONTRER L'UTILITE ET LES POTENTIALITES DE LA TELEDETECTION A HAUTE RESOLUTION

- VERIFIER L'AMPLEUR ACTUELLE DES MODIFICATIONS DE LA LIGNE DE RIVAGE

- FOURNIR DES DONNEES A JOUR

- INTRODUIRE DES EXPERTS ALBANAIS A L'UTILISATION DE LA TELEDETECTION

- MISE AU POINT EVENTUELLE D'UN SYSTEME DE CONTROLE PERIODIQUE SUR BASES DE DONNEES SATELLITAIRES A HAUTE RESOLUTION.

PAC ALBANIE

❑ ZONE TEST:

- ◆ LAGUNE DE KARAVASTA
- ◆ EMBOUCHURES DES FLEUVES SEMANI ET SHKUMBIN.

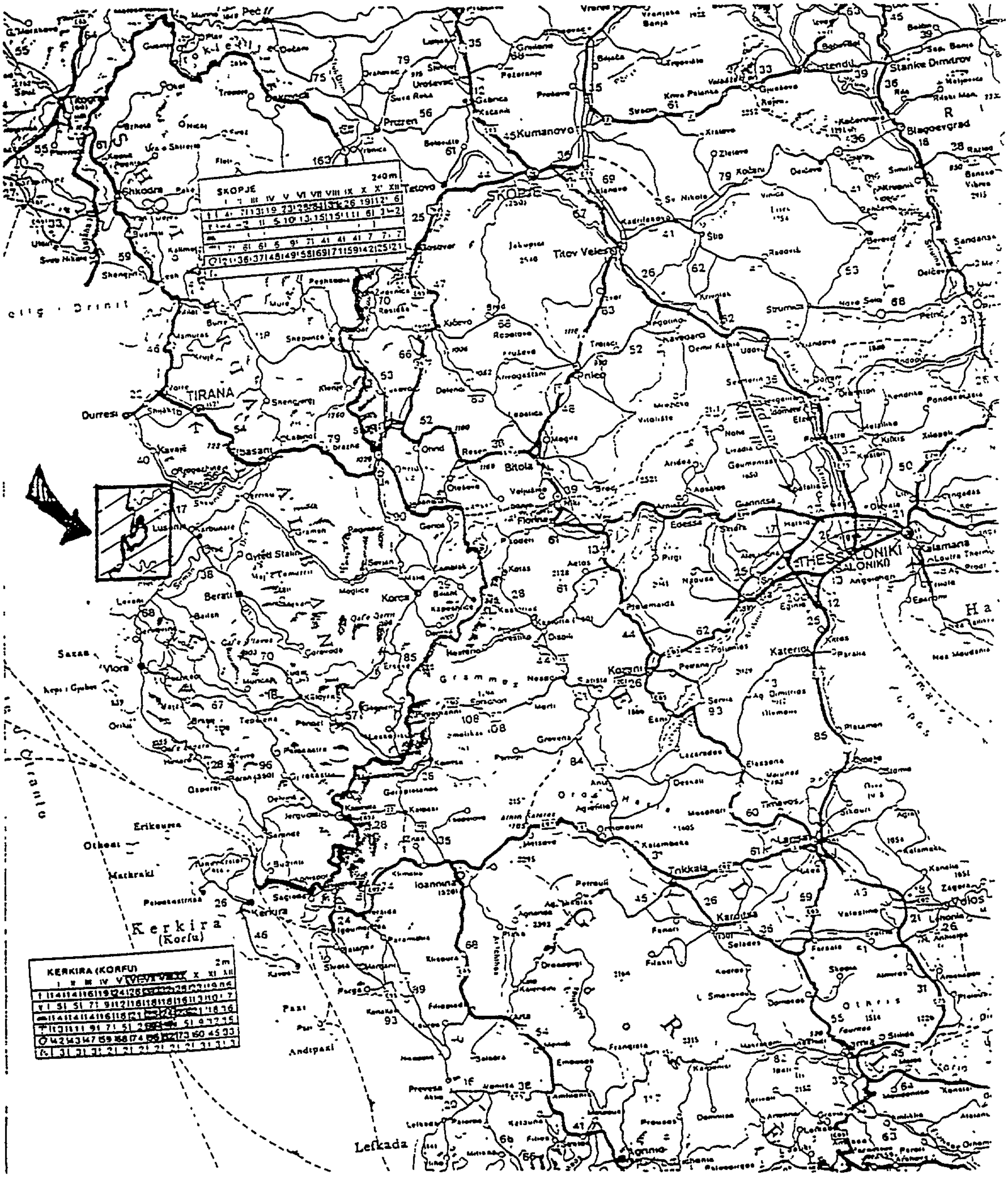
❑ METHODOLOGIE:

- ◆ ANALYSE D'IMAGES SPOT PANCHROMATIQUE (RESOLUTION AU SOL:10M) PRISES A INTERVALLE DE DIVERSES ANNEES (1988- 1993)
- ◆ CARTOGRAPHIES EXISTANTES
- ◆ COMPARAISON / SIG (Système d'information Géographique) DE LA LIGNE DE RIVAGE RELEVEE SUR LES DIFFERENTS SUPPORTS

❑ COLLABORATION:

- ◆ CEPP (COMMITTEE OF ENVIRONMENTAL PRESERVATION AND PROTECTION)
- ◆ INSTITUT D'HYDROMETEOROLOGIE DE TIRANA.
- ◆ PAP/RAC (PROGRAMMES D'ACTIONS PRIORITAIRES)

❑ FIN PREVU DU PROJET: FEVRIER 1995


SKOPJE
Tetovo
Kumanovo
Prizren
Titov Veles
Stip
Shkodra
TIRANA
Durresi
Elbasani
Bitola
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Korca
Berati
Vlora
Edessa
Kozani
THESSALONIKI
Katerini
Larisa
Trikkala
Karditsa
Ioannina
Kerkira
Kerkira (Korfu)
KERKIRA (KORFU)
Preveza
Lefkada
Blagoevgrad
Stanke Dimitrov
Andipaxi

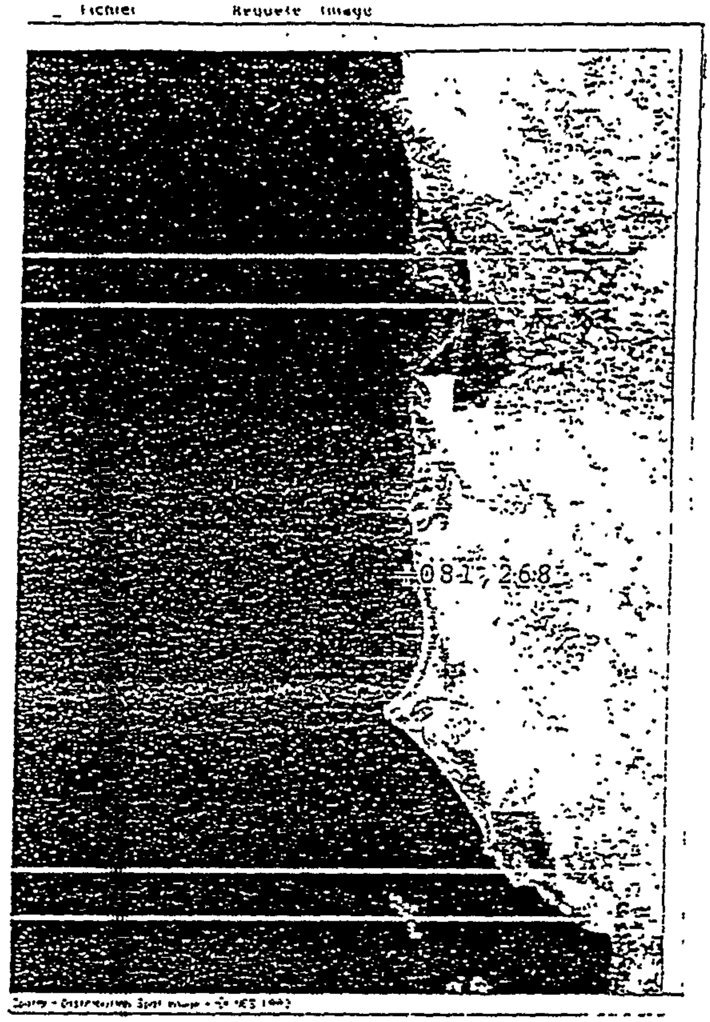
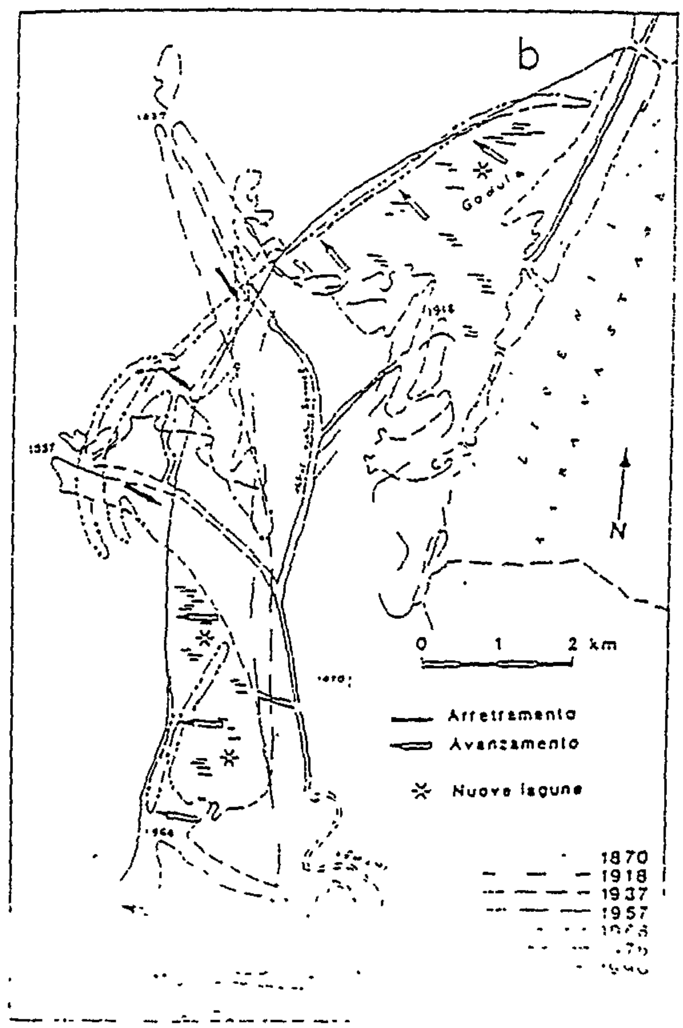


IMAGE SPOT
juillet 1992



Embouchure du fleuve Semani: variations entre 1870 et 1990

(de Boçy, 1994)

PAC FUKA-MATROUH
(OUEST EGYPTE)

❒ SUJET:

- CONTRIBUTION DE LA TELEDETECTION A L'ETUDE DE L'EROSION DES SOLS ET AUX PROBLEMES DE LA DESERTIFICATION.

❒ POURQUOI:

- AUGMENTATION DE LA SEDENTARISATION DES TRIBUS NOMADES
- AUGMENTATION DE LA DEMANDE EN TERRES AGRICOLES
- ZONE PARTICULIEREMENT FRAGILE (CLIMAT SEMI-ARIDE) AVEC SUPERFICIES CULTIVABLES NATURELLEMENT FAIBLES.
- PROCESSUS DE DEGRADATION DES SOLS (SALINISATION, EROSION EOLIENNE ET HYDRIQUE) "IN ATTO".

❒ BUT:

- INTRODUIRE UNE METHODOLOGIE INTEGREE D'ETUDES DU SOL / DEFINITION DES UNITES DE TERRE BASEE SUR LES CARACTERISTIQUES GEOMORPHOLOGIQUES, PEDOLOGIQUES ET DE LA VEGETATION DU TERRITOIRE.
- FORMER DES EXPERT EGYPTIENS SUR CETTE METHODE, EN PARTICULIER SUR L'INTERPRETATION DES DONNEES SATELLITAIRES
- FOURNIR DE NOUVELLES DONNEES SUR LES CARACTERISTIQUES DE CE TERRITOIRE PAR L'ANALYSE D'IMAGES SATELLITES A HAUTE RESOLUTION (LANDSAT).

PAC FUKA-MATROUH
(OUEST EGYPTE)

❑ ZONE:

- ZONE DE FUKA-MATROUH (100 KM COSTA x 30 KM)

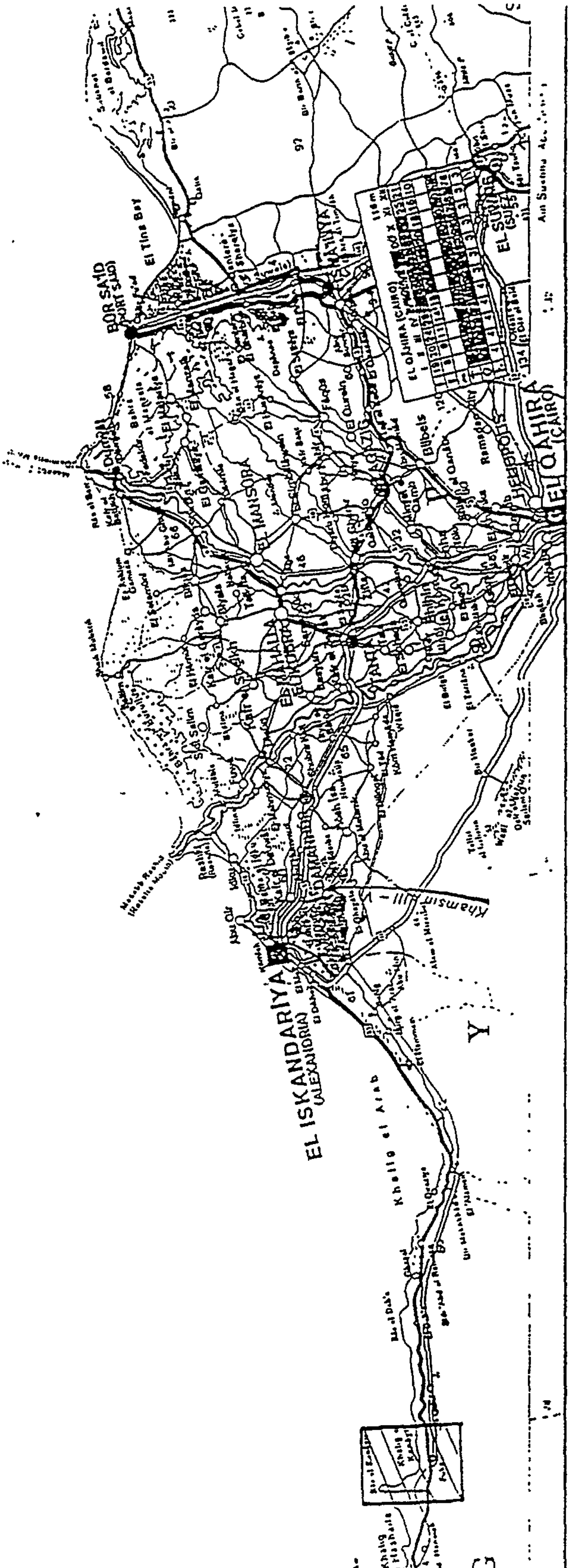
❑ METHODOLOGIE

- ACQUISITION ET ANALYSE D'IMAGES LANDSAT
- DEFINITION DES UNITES DE TERRE (PREMIER NIVEAU)
- TRANSFERT DES DONNEES INTERPRETEES DANS LA BASE DE DONNEES CREE PAR PAP/RAC
- INTEGRATION AVEC DONNEES PRELEVEES SUR LE TERRAIN (erosion du sol)

❑ COLLABORATION

- EEAA (EGYPTIAN ENVIRONMENTAL AGENCY AFFAIRS)
- REMOTE SENSING LABORATORY OF UNIV ALEXANDRIA
- PAP/RAC EXPERTS

❑ FIN PREVU DU PROJET: AUTOMNE 1995


EL ISKANDARIYA
(ALEXANDRIA)
EL QAHIRA
(CAIRO)
BOR SAID
(PORT SAID)
El Tina Bay
Khalig el Arab
Khamsin

PAC SFAX

- IDEES-GUIDE DU PROJET:
  - ✦ APPLICATION DE LA METHODE SUIVIE PAR COSMOS (OBSERVATOIRE)

    ⇒

    - ▼ DETERMINATION DES PARAMETRES OU COMPOSANTES A ETUDIER
    - ▼ EXEMPLES D'APPLICATION DE LA TELEDETECTION EN SE BASANT SUR DES IMAGES CONTENUES DANS NOS ARCHIVES OU ARCHIVES DU CENTRE DE TELEDETECTION TUNISIEN
  - ✦ ESSAI D'INTEGRATION AVEC LA METHODOLOGIE SUIVIE PAR PLAN-BLEU
- COLLABORATION (A DEFINIR)
  - ✦ ANPE (AGENCE NATIONALE POUR LA PROTECTION DE L'ENVIRONNEMENT)/ FORMATION DE DEUX EXPERTS TUNISIENS (JUIN 1994)
  - ✦ CENTRE NATIONAL DE TELEDETECTION - TUNIS
  - ✦ PLAN BLEU
- FIN PREVU DU PROJET: HIVER 1995-1996

AGENDA 21
FOR THE MEDITERRANEAN REGION

AGENDA 21
IN WHICH MORE THAN 150 STATES COMMITTED THEMSELVES IN RIO, EXPRESSES
A WORLDWIDE CONSENSUS AND A POLITICAL INVOLVEMENT
TO INTEGRATE
ENVIRONMENT AND DEVELOPMENT RELATED MATTERS
AND TO MAKE
SUSTAINABLE DEVELOPMENT
A REALITY OF THE 21ST CENTURY

THE STRATEGIES, WHICH HAVE TO BE IMPLEMENTED BY THE GOVERNMENTS
IN ORDER TO ACHIEVE THE OBJECTIVES OF AGENDA 21 ,
MUST BE ARMONIZED
WITHIN THE FRAMEWORK OF AN INTERNATIONAL COOPERATION
TO BE COORDINATED BY THE UNITED NATIONS

THE MEDITERRANEAN COASTAL COUNTRIES ARE A GOOD EXAMPLE
OF AN ECOREGION
LIKELY TO CONSTITUTE A PILOT AREA FOR A
REGIONAL REVIEW
OF THE DECISIONS TAKEN IN RIO ON A WORLDWIDE SCALE

CONFERENCE "MED 21"
ON SUSTAINABLE DEVELOPMENT IN THE MEDITERRANEAN REGION
TO BE HELD IN TUNIS 1 NOVEMBER 1994

FIRST MEETING OF A PREPARATORY COMMITTEE OF THE
CONFERENCE "MED 21"
TUNIS 16 - 20 MAY

DOCUMENT MED 21/PC/2 10 APRIL 1994 :
DRAFT OF AGENDA 21 FOR THE MEDITERRANEAN REGION,
REPORTS,AMONG THE OTHERS, THE FOLLOWING STATEMENTS :

....- AT THE SCALE OF THE MEDITERRANEAN REGION, THE STATES SHOULD: - DEVELOP INVENTORY AND FOLLOW UP MECHANISM THROUGH THE REMOTE SENSING OF THE MAIN MEDITERRANEAN AGROSYSTEMS; -....... (PAGE 29)

....INDIVIDUAL STATES OF THE MEDITERRANEAN SHOULD: - ESTABLISH, DEVELOP AND MAINTAIN INFORMATION SYSTEMS, OR OBSERVATORIES, IN ORDER TO EVALUATE AND MANAGE THE COASTAL REGIONS AND THE EXPLOITATION OF THEIR RESOURCES;.....(PAGE 36)

....AT THE LEVEL OF THE MEDITERRANEAN REGION: - DATA RELATING TO REMOTE SENSING SHOULD BE SUPPLIED TO THE STATES AND COLLECTIVITIES. .....(PAGE 58)

...AT THE LEVEL OF THE MEDITERRANEAN REGION, THE FOLLOWING MEASURES SHOULD BE CONSIDERED:
- TO ENSURE WIDER DISSEMINATION OF THE AVAILABLE TOOLS OF MEASURING (OBSERVATOIRES, REMOTE SENSING) AND ORGANIZE WORKSHOPS WITH THIS RESPECT, IN EACH COUNTRY OR FOR A GROUP OF COUNTRIES IN ORDER TO MAKE THEM MORE ACCESSIBLE TO INDIVIDUALS, NGOs, YOUTH AND EDUCATORS. ....(PAGE 82)
- THE MEDITERRANEAN COUNTRIES SHOULD MAKE AN INVENTORY OF INFORMATION SOURCE USEFUL TO SUSTAINABLE DEVELOPMENT, ENHANCE CAPACITIES AND MECHANISMS OF ACCESSING TO, PROCESSING AND EXCHANGE OF INFORMATION IN THE PERSPECTIVE OF MEDITERRANEAN OBJECTIVES MOBILIZING THE SEVERAL HOLDERS OF INFORMATION. .... (PAGE 83)

A STRATEGIC LAND MANAGEMENT PLANNING SYSTEM FOR MALTA

THE PROJECT IS AIMED AT
PROVIDING
THE PLANNING AUTHORITY OF MALTA
WITH
THE TECHNICAL ASSISTANCE NECESSARY TO DEVELOP
A DYNAMIC SYSTEM FOR LAND MANAGEMENT PLANNING
OF THE MALTESE ISLANDS AS AN INTEGRAL PART OF THE NATIONAL
PLANNING PROCESS.

THE PROJECT RELIES ON THE TECHNICAL EXPERTISE
THE CTM CAN COUNT ON
TO PROVIDE A FRAMEWORK
FOR THE VARIOUS SOURCES OF INFORMATION
REQUIRED TO DEVELOP LAND MANAGEMENT POLICIES
TO ENSURE A SUSTAINABLE DEVELOPMENT APPROACH
TO THE MANAGEMENT OF THE ISLAND'S RESOURCES

THE TOOLS OF THE PROJECT WILL CONSIST OF TECHNIQUES SUCH
AS REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS.

THE RESULTING SYSTEM WILL ALLOW
THE DEVELOPMENT OF PROCESSES
FOR THE CONSTANT MONITORING OF ENVIRONMENTAL CHANGES
IN THE MALTESE ISLANDS
AND SERVE AS A REFERENCE FOR SIMILAR INITIATIVES
IN THE MEDITERRANEAN

TRAINING COURSES

1993: TWO-MONTH TRAINIINING COURSE IN ITALY FOR TWO EGYPTIAN EXPERTS

1994: ONE-WEEK TRAINING COURSE IN ITALY FOR TWO TUNISIAN EXPERTS

TRAINING COURSE

ON

REMOTE SENSING TECHNIQUES AND APPLICATION

Attendants: Mr T. Gargouri
Mrs S. Krichen

Italy, 20 - 24 June 1994

1. *Fundamentals of remote sensing*
1.1 Phisical principles
1.2 Space platforms and their orbits
1.3 Sensors on satellites
1,4 Data acquisition and dissemination
1.5 Principles of image processing

2. *Cartography*
2.1 General aspects
2,2 Geographic maps and their classification
2.3 Rectification of remotely sensed images

3. *Case studies on remote sensing applications*
3,1 Observation and study of coastal conditions and changes
3.2 Monitoring of sea circulation and conditions in coastal areas
3,3 Monitoring of marine pollution
3.4 Protected areas mapping: a georeferred data base

CTM

TRAINING COURSE

ON

REMOTE SENSING TECHNICS AND METHODOLOGIES

Attendants: Mr Khalid M. A. Dewidar
Mr Gaber M.Hassan

Italy, 8 March - 4 May 1993

TRAINING COURSE CONTENTS

MODULE: REMOTE SENSING

Contents: 1. FUNDAMENTALS OF REMOTE SENSING
1.1 Physical principles
1.2 Space platform and their orbits
1.3 Sensors on satellites
1.4 Data acquisition and dissemination
1.5 Principles of image processing

2. OCEANOGRAPHIC APPLICATIONS OF REMOTE SENSING
2.1 Reflective spectral region: the ocean colour
2.2 Emissive spectral region: sea surface temperature
2.3 Microwave spectral region:
2.3.1 Passive sensors: the radiometer
2.3.2 Active sensors: SAR, altimeter, scatterometer

MODULE: CARTOGRAPHY

Contents: 1. General aspects
2. Geographyc maps and their classification
3. Rectification of remotely sensed images

MODULE: SOFTWARE ERDAS

Contents:
- ERDAS 7.5
- ERDAS IMAGINE 8.0.1
- Some concepts of ERDAS IMAGINE: Virtual Room, Virtual LUT, Geographyc Links, Dinamic Mosaic, On-line Help.
- Applications "hand-on", Image Rectification, Spatial Modeller, Map Composer, others applications.

MODULE: SOFTWARE ARC/INFO

Contents:
- Spatial data
- Geographyc data
- Coverages: description and drawing
- Data base automation
- Map features
- Projection management
- ARC command
- ARCEDIT
- ARCPLOT
- Data conversion
- TIN
- AML (ARC Macro Language)

MODULE : TRAINING ON THE JOB

Contents: 1. TRAINING WITHIN AN OPERATIVE PROJECT

1.1 Basis of processing of NOAA satellite
1.2 Processing of NOAA infrared images
1.3 Interpretation of NOAA infrared images aiming to identify thermal fronts
1.4 Final products generation

2. SUPPORT AND FIRST ACTIVITIES IN THE ELABORATION OF THE PROJECT "APPLICATION OF REMOTE SENSING IN THE FIELD OF COASTAL EROSION"

2.1 Bibliographic analysis on application od remote sensing in the field of coastal erosion
2.2 Analysis of some high resolution images (LANDSAT-TM) in order to evidentiate various features on the coast
2.3 Analysis of different algorithms for bathymetric determination in shallow waters through remote sensing techniques
2.4 Processing of multi-temporal series of high resolution images on a test area where bathymetric maps are available
2.5 Digitization of bathymetric maps
2.6 Comparison of various output
2.7 Drawing up of an activity report

The training programme has also included visits to the Scanzano telecommunication and remote sensing Station (CTM operative Center) and to Telespazio Fucino Station, the first in the world for space communication functions and equipments; contacts have been promoted with the University of Palermo and with experts in the field of remote sensing applied to the environment observation and study.

SAR (SYNTHETIC APERTURE RADAR) MONITORING OF THE MEDITERRANEAN SEA

A JOINT PROPOSAL BY

CTM - CENTRO DI TELERILEVAMENTO MEDITERRANEO
(RAC/ERS - MAP/UNEP),
FIS-FOUNDATION OF INTERNATIONAL STUDIES - MALTA
(OPA - OPEN PARTIALLY AGREEMENT, COUNCIL OF EUROPE),
SOS - SATELLITE OBSERVING SYSTEMS - UK.

THE OBJECTIVE IS TO IMPLEMENT A SYSTEMATIC PROGRAMME
OF SAR MONITORING
OF SELECTED AREAS IN THE MEDITERRANEAN REGION
TO ASCERTAIN:

i) THE EFFECTIVENESS OF SATELLITE RADAR IMAGERY
IN ASSESSING THE LEVEL OF SURFACE POLLUTION
ESPECIALLY FROM OIL DISCHARGES .

ii) THE PRESENCE, EVOLUTION AND DISSIPATION OF
NATURAL FEATURES
SUCH AS OCEAN FRONTS, EDDIES AND INTERNAL WAVES

iii) THE FEASIBILITY OF ENHANCING THE RADAR EFFECTIVENESS
THROUGH THE ADDITION OF INFORMATION
ON SURFACE TEMPERATURE AND COLOUR
DERIVED FROM OTHER SATELLITE SENSORS..

FUTURE REVOLUTION IN REMOTE SENSING ACHIEVEMENTS

DUE TO THE OPENING OF NEW TECHNOLOGICAL FRONTIERS (THE US GOVERNMENT RECENTLY HAS MADE STUDIES CARRIED OUT IN THE FRAMEWORK OF DEFENCE PROGRAMMES AVAILABLE FOR COMMERCIAL USES) AND GEO-POLITICAL FRONTIERS (OF WESTERN EUROPE), A NEW GENERATION OF SATELLITES IS OPENING UP. THE FIELD OF REMOTE SENSING TO A REAL REVOLUTION

1997: "EYEGLASS GLOBAL IMAGERY INFORMATION SYSTEM" - USA
ELIO-SYNCHRONOUS ORBIT 700 KM HIGH
RESOLUTION: 1 METER AT NADIR
PANCHROMATIC BAND
STEREOSCOPIC SHOTS

1995: "WORLDVIEW"- USA
ORBIT 470KM (ON SHUTTLE)
3 METERS RESOLUTION PANCHROMATIC (SCENES 6 X 6 KM)
15 M RESOLUTION, 3 BANDS VISIBLE/INFRARED, SCENES 30 X 30 KM

1995: SEAWIFS - SEASTAR - USA
1 KM RESOLUTION
8 BANDS VISIBLE
MAINLY DEVOTED TO OCEANOGRAPHIC STUDIES

1995: MOMS-2P - DEUTSCHE AEROSPACE
ORBIT 400 KM (MIR - PRIRODA, RUSSIA)
4 BANDS VISIBLE
1 PANCHROMATIC BAND STEREO
GEOMETRIC RESOLUTION 5,5 - 16,5 M

1974-1994: PRIRODA - RUSSIA
KFA-3000 CAMERA - 2 M RESOLUTION
KFA 1000 CAMERA - 5 M RESOLUTION
MK4 CAMERA - 4 BANDS VIS/NEAR IR, 8 M RESOLUTION
KATE - 200 CAMERA - 3 BANDS VIS/NIR, 20 M RESOLUTION
ORBIT 240/270 KM - MISSION LENGTH 30 DAYS - WORKING TIME 17 DAYS

SOVINFORM SPUTNIK
TK-350: 10 M RESOLUTION PANCHROMATIC, SCENES 180 X 270 KM
KVR-1000: 2 M RESOLUTION, COLOUR/PANCHR, SCENES 40 X 40 KM

ANNEX IV

PRESENTATION REPORTS OF FOCAL POINTS

DOCUMENTS DE PRESENTATION DES POINTS FOCAUX

Report on National Remote Sensing Activities in Egypt

First Meeting of Focal Points
(Palermo, Sept.,1994)

M.El-Raey

Remote sensing activities in Egypt started as early as 1972 by the establishment of the Remote Sensing Center at the Academy of Scientific Research and Technology in Cairo. Since then the center has carried a number of large scale projects on the national and international scales.

As early as 1983, it became evident that it is necessary to establish multidisciplinary education in remote sensing and its applications with particular emphasis on environmental studies. The Institute of Graduate Studies of University of Alexandria has launched a program in Environmental Studies on the postgraduate level centered around remote sensing and information systems . The educational system has found a strong support through the high need for well qualified cadres in the Egyptian market. In addition to other environment courses, the program involves remote sensing courses on three levels:

a- Descriptive applications: for all first year multidisciplinary graduates.

b- Image processing theory and techniques: for students of physical and technological background.

c- Advanced remote sensing and geographic information systems and applications: for a number of selected advanced M.Sc. students.

The Remote Sensing Laboratory at University of Alexandria has utilized 486 microcomputers, however, upgrading to use a Silicon Graphics Workstation with advanced ERDAS/ARC/INFO Software on a network, is in progress. (Both financial and technical support is needed here).

The Laboratory has been mainly concerned with environmental problems with special emphasis on coastal areas. The following projects have been completed or are in progress at this time:

(1) **Impact of Sea Level Rise Over the Governorate of Alexandria.**

The project aims at assessing impacts of SLR over the governorate by using remote sensing techniques to classify land use over the coastal area, and using topographic and ground based socioeconomic data in a GIS to produce multilayered geographic maps.

A quantitative assessment of impact on each sector (population, beaches, agricultural land, industrial land, archeological sites, ,...) has been obtained. A program to update results is now in progress.

(2) **Monitoring of Coastal Erosion at Rosetta Promontory.**

The objective of this work was to develop and use a technique to determine rates of erosion of the Rosetta promontory and compare it to ground based measurements.

Satellite images and aerial photographs of the years 1972,1976,1977,1978,1983,1985,1991, were analyzed for changes using principal component analysis. Results were found in complete agreement with ground- based observations and revealed high erosional rates. The technique was found very effective, and is usable for future monitoring and for other coastal areas.

(3) A Contingency Plan for Protection of Ras Mohamed Coastal Area (on the Red Sea).

The main objective of this study is to use remote sensing and GIS technique to identify, classify and assess topographic features of Ras Mohamed protected area at the tip of Sinai Peninsula, and its associated coral reefs.

Results identified various types of coral reefs and produced coastal sensitivity maps of the area.

A suggested contingency plan for protection of the area against oil spills is presented.

(4) Bathymmetry, Water Quality Assessment and Change Analysis of Lake Manzala.

The main objective of this study is to estimate and assess changes of Lake Manzala near Suez Canal.

Old maps, aerial photographs and recent satellite images were registered using well identified control points. Changes of the area from 1922 to 1993 were analyzed. Bathymmetric estimation was carried out based on correlations to ground observations. Water quality conditions in various parts of the lake, were determined.

(5) Change Detection and Bathymmetric Studies of Lake Burullus.

The objective of this study is to use satellite images and ground based bathymmetric measurements to determine and assess changes, water budget and environmental conditions in and around Lake Burullus.

Results indicated the validity and effectiveness of the technique for bathymmetric analysis.

(6) Correlation of Ground Surveys With Satellite Data of Marine Pollution in Abu-Kir Bay.

The main objective of this work is to assess the capabilities and validity of satellite images to predict marine pollution.

Cross correlations of accurate ground observations of various pollutants in the bay, with various channels of Landsat (MSS) images taken simultaneously, were carried out. Empirical relationships were derived.

(7) Remote Sensing of Marine Pollution Near Alexandria.

The objective of this work is to identify and assess location, extension and possibly types of marine pollution around Alexandria.

Results have indicated several hot spots. A change detection analysis, using change vector technique, is in progress to assess changes of pollution conditions and effectiveness of control measures.

(8) Study of Waterlogging Problems Over the Coast of Alexandria.

Waterlogging problems have been noticed to increase over many areas of the coast. Increased urbanization with out proper sewage systems, salt water intrusion, excessive surface irrigation and lack of awareness of water shortages are most important reasons.

The objective of this work is to carry out a change detection analysis to identify, assess and estimate areas of waterlogging. The impact on urban development of the area is in progress.

In addition, there are a number of other projects concerned mainly with coastal zone problems of the Mediterranean region.

Presentation of the European Union

Exposé de l'Union Europeennee

Contribution of the Joint Research Centre ISPRA, Institute for Remote Sensing Applications, to environmental issues in the Mediterranean Basin.

1. MONITORING OF THE MARINE ENVIRONMENT.

The main actions concern:

Coastal Upwelling (main area investigated up to now is off the North West Atlantic Coast of Marocco)

* spatial and temporal time series of sea surface temperature
* primary productivity estimation

Ocean Colour European Archive Network (OCEAN Project) in collaboration with the European Space Agency

* exploitation of sea colour data from the CZCS satellite sensor up to June 1986 (end of life of CZCS)
* network of institutes working on ocean colour
* contribution towards the use of future ocean colour data (in particular Seawifs sensor to be launched in 1995)

2. GLOBAL CHANGE IN THE MARINE ENVIRONMENT.

The main actions are:

- primary productivity and ocean-atmosphere carbon cycle
- marine bio-geochemical processes and their role in global oceanic chemical interactions
- modelling of marine transport processes
- biological primary productivity
- air-sea interface
- numerical modelling of major controlling processes

3. MEDITERRANEAN LAND DEGRADATION MAPPING AND DESERTIFICATION MONITORING.

The general objectives are:

* mapping and continuous monitoring of vegetation and soil conditions in the Mediterranean Basin and in particular in the Mediterranean Member States of the European Union
* identification of the extension and time dynamics of degradation and desertification processes

The "natural" mediterranean landscapes under threat or process of degradation (because of human pressure and misuse of the land) are complex areas where vegetation (often with less than 50% ground coverage), soils and parent rock outcrops are simultaneously present.

Methods and operational satellite data are now available (Landsat Thematic Mapper from 1984, SPOT4 to be lauched in 1997) to precisely map those areas (maximum scale 1/100,000 to 1/50,000) in terms of vegetation abundance and soil conditions (from well developped soils to degraded, severely degreaded and irreversibly eroded soils).

Time series of more than 10 years are now existing and authorise the monitoring of on going processes and the detection of abnormal situations, provided a series of well chosen "desertification control areas" are set up and folowed around the Mediterranean Basin.

The set up and monitoring of this network of control areas could be a valid contributon to the "Observatory for the Mediterranean" discussed and proposed by RAC/ERS-Palermo.

This monitoring exercise must of course be imbedded in the continuous (in space and time) monitoring of the Mediterranean Basin (based on distinct criteria) with NOAA AVHRR data.

TRAVAUX DE TELEDETECTION SPATIALE REALISES AU MINISTERE DE L'ENVIRONNEMENT EN FRANCE.

THEME : Variation de l'indice de végétation sur l'ensemble du pays,

- **aux 4 saisons** : - connaître la localisation, la répartition, l'importance et les variations de la phytomasse comme aide à la réflexion pour une politique nationale de la verdure Etat phytosanitaire, stress hydrique, régénération des zones brûlées.

- **à des dates voisines de deux étés** : - repérer la localisation et l'importance relative de la sécheresse.

THEME : Littoral : - découpage du territoire en écozones, occupation du sol à deux dates (5 ans d'écart ou plus) sur une profondeur de 20 km par tranche d'éloignement par rapport à la côte, matrice d'évolution par catégorie, projections

- Nature physique du linéaire côtier,
- Caractéristique des eaux côtières sur une bande de 5 km profondeur, turbidité, végétation aquatique.
- Essai de substitution de la télédétection à l'inventaire permanent du littoral (IPLI) réalisé par interprétation de photos aériennes et abandonné en raison des coûts et délais Recherche d'une nomenclature raccordable à l'IPLI et à Corine-Land Cover développée aux niveaux 4 et 5.
- Observation périodique des estuaires et deltas.

THEME : Planification écologique : - Occupation du sol pour la planification écologique du territoire par région ou département.

THEME : Parcs Nationaux et Régionaux : - Découpage du territoire en écozones, examen de l'adéquation des limites administratives existantes ou en projet avec les limites écologiques, repérage des zones remarquables ou sensibles à protéger

- Occupation du sol et son évolution (friches notamment)
- Indice de végétation en fonction des catégories d'occupation du sol
- Intégration des résultats dans un SIG
- Types de végétation liés à la date de fonte du couvert neigeux en montagne.

THEME : Déprise agricole : - Etat et évolution des friches en fonction de l'occupation du sol précédente, de l'environnement paysager et du type de végétation (bruyères, genêts, fougères, broussailles, landes...) sur les friches.

THEME : Zones humides : - Etat et évolution par catégorie
- Zones de concentration d'étangs :
  * état et évolution de l'occupation et de l'humidité du sol du proche bassin versant,
  * caractéristiques de l'eau : profondeur selon la nature des fonds, turbidité minérale et organique, végétation aquatique au-dessus, au dessous et aux abords de l'eau, température de surface . typologie des étangs selon ces caractéristiques

- Caractéristiques de l'eau des golfes et grands étangs saumâtres.

THEME : Zones inondables et drainage dans le bassin de débordement des fleuves :
- Surface des zones inondées et terres imprégnées d'eau en fonction de l'occupation du sol, drainage et réseaux d'écoulement. Utilisation pour la cartographie des zones inondables et constructibles.

THEME : Lit majeur et élargi des grands fleuves, zones aquatiques liées :
- Etat et évolution des unités paysagères, de l'occupation et de l'humidité du sol, végétation aquatique, géomorphologie, repérage des zones riveraines sensibles ou à problèmes

THEME : Incidences du drainage : - A partir d'images enregistrées avant et après les travaux, observations des changements d'occupation et d'humidité du sol, et de qualité de végétation.

THEME : Foret

- **dépérissement** - repérer les zones atteintes (à plus de 15 ou 20 %) et évaluer l'importance des dégâts pour l'ensemble des feuillus et pour les résineux répartis en classes d'âge, au moyen de l'indice de végétation étudié à plusieurs dates à la même époque
- **Mitage de la forets à proximité des zones urbanisées**

- **Foret dunaire et sur zones érodées**

- **Régénération sur les zones brûlées** - bien observée sans qu'il soit possible de distinguer les espèces.

- **Repérage des seuils critiques de risques d'incendies** - de juin à septembre au rythme de la semaine ou de la décade, au moyen de l'indice de végétation, de la température au sol, de l'indice hydrique, pour mieux répartir les moyens de lutte et d'observation du sol détaillée sur le couvert végétal.

- **Niveau d'inflammabilité potentielle de la végétation et modélisation de la propagation du feu** - Etablies en fonction du point de départ de l'incendie, de la sensibilité de la végétation au feu, de la force et de la direction du vent, de la pente et de l'orientation (MNT) ainsi qu'à partir de l'occupation détaillée du couvert végétal.

THEME : Zones d'habitat potentiel pour certains types de faune (ou de flore) - Etablies en fonction des catégories d'occupation du sol, des voies de communication, des points d'eau, de la pente et de l'altitude et de l'orientation... Essais concluants pour les anatidés, les cervidés, la bécasse.
- *Base de sondage pour procéder à des comptages au sol.*

THEME : Aide à la gestion intégrée de l'occupation du sol et de la faune sauvage et de la flore : - A partir de l'occupation du sol et des données localisées disponibles sur la faune et la flore et d'un MNT :

* contrôle de l'adéquation des ZNIEFF * et de leurs limites
* *contrôle de l'adéquation des limites des zones protégées*
* base de sondage pour constater l'utilisation effective des habitats potentiels,
* aide à la gestion coordonnée de l'occupation du sol et de la faune et de la flore

* (ZNIEFF : Zones Nationales d'Intérêt Ecologique pour la Faune et la Flore).

THEME : Etude des paysages pour aide à la gestion - Extraction des éléments d'un paysage à partir d'une image satellite et d'un MNT pour obtenir l'occupation biophysique du sol en 3D et rechercher les éléments linéaires, les types de couverts et formations végétales, les zones humides, les différences de richesse de végétation, les zones de transition, les secteurs d'ouverture directionnels, ...

- A partir de changements observés dans le temps et d'un MNT , essai de modélisation des mutations à l'aide de modèles de contagion de pixels déterministes ou probabilistes pour expliquer et prévoir l'évolution en fonction des substrats, des routes, des formes de développement urbain, ...

- Conséquences de l'abandon d'activités minières.

THEME : Etude rapide des grandes inondations accidentelles - Comparaison de situations normale et de crise sur les endroits atteints dans les délais les plus brefs.

THEME : Aide à l'élaboration d'un plan de prévention des risques naturels par bassin versant - cartographie des zones à risque de glissement de terrain et d'inondation par commune en zone accidentée à l'aide d'images et d'un MNT.

THEME : Repérage des zones à risque d'accident hydrogéologique par sous-bassin versant, en milieu accidenté méditerranéen - Interprétation à des fins hydrogéologiques de plusieurs images avec un MNT. Recherche de la densité et de la qualité du couvert végétal de la pente et de l'orientation des parcelles, du drainage et de la perméabilité des sols et des signes d'érosion dus au ruissellement.

THEME : Evaluation, suivi et constat d'impact des grands travaux d'équipement - Aide à la localisation des ouvrages, aide à l'évaluation de l'impact probable (zones critiques et sensibles. vue globale comparative de variantes, franchissement des écozones)

- Géomorphologie. aptitude des sols. repérage des gisements de matériaux de construction à proximité

- Unités paysagères et occupation biophysique et qualité du sol sur les zones ou couloirs susceptibles de recevoir les ouvrages

- Evaluation de la consommation des différentes catégories d'occupation du sol et du couvert végétal. et rareté relative du tapis végétal entamé par rapport au voisinage. impact paysager en 3D

- Renseignements sur la dynamique de la végétation à moyen terme . zones agricoles en voie d'abandon. zones à risques d'érosion ...

- Repérage des espaces urbanisés à proximité pour les problèmes de bruit et de risque. et des directions dominantes du parcellaire agricole pour réduire les frais de remembrement ultérieurs

- Dans le cas de constat d'impact réel. vérification de l'adéquation de l'étude d'impact classique, de l'exécution de l'étude d'impact classique, de l'exécution des mesures compensatoires et des effets induits à proximité de l'ouvrage.

THEME : Evaluation des atteintes à l'intégrité de l'espace et de son compartimentage par les équipements linéaires - Recherche des paramètres d'encombrement et de division de l'espace par les réseaux.

THEME : Ecosystèmes des grandes agglomérations de 100.000 habitants et plus - Etat et évolution des zones urbaines réparties selon l'homogénéité suivant une nomenclature d'occupation biophysique du sol en 50 catégories environ tenant compte :

* de l'association et des parts relatives en bâtiments. végétation. voies de communication (indices de végétation et minéralisation. filtres)...)
* de l'ancienneté et de la nature des matériaux des bâtiments
* de la forme et de la hauteur des bâtiments

- Les résultats mis sous forme de fichier géocodé sont destinés à être fusionnés avec d'autres données exogènes sur SIG pour :

* aider à la gestion de l'environnement urbain de l'agglomération
* constituer une série d'indicateurs d'environnement urbains (ratios liés à la densité. la proximité ...)
* surveiller les changements et chantiers dans l'occupation du sol, élaborer des scénarios et projets de développement et aménagement.

- Répartition. intensité et diffusion de la pollution atmosphérique (aérosols et températures) selon différentes situations climatologiques.

משרד המדע והאמנויות
הסוכנות הישראלית לנצול החלל
THE MINISTRY OF SCIENCE AND THE ARTS
ISRAEL SPACE AGENCY

REMOTE SENSING IN ISRAEL - 1994

YAHEL FINAL REPORTS

JUNE 27 - 28, 1994
HERZLIA, ISRAEL

CONTENTS

Note: The reports are arranged in the order of their presentation at the Remote Sensing in Israel - 1994 conference.

FOREWORD

Satellite remote sensing is a unique tool for gathering data needed to monitor and understand the processes going on in our planet's biosphere which are of crucial importance to the future of mankind. Satellite imagery for environment, agriculture and land resources monitoring and management is of growing importance even for small countries such as Israel.

The promotion of satellite remote sensing and the development of applications by users in Israel, have a high priority on the Israel Space Agency (ISA) agenda. In the framework of our programme to advance this important subject, the ISA Ground Station has been receiving the French Spot satellite data since 1991 and will be receiving the European ERS-I satellite by the end of this year. Furthermore remote sensing is included as one of the subjects in the agreement for cooperation signed recently between ISA and CNES.

This conference, reporting on Spot applications pilot projects conducted in Israel under a joint ISA/Spot-Image programme demonstrates the uses of Spot Imagery in subjects of interest to Israeli users and is very important for increasing user awareness and interest and development of the satellite remote sensing field in our country.

I would like to express the appreciation of the Israel Space Agency to the efforts made by Spot Image and by the YAHEL researchers, towards the success of this conference.

Dr. Marcel Klajn
ISA Director

Landuse and urban density mapping using remotely sensed data: the case study of Haifa, Israel.

Maxim Shoshany and Eran Wechsler
Department of Geography, Bar-Ilan University

Introduction

Analysis and mapping of landuses and landcovers represent one of the most dynamic fields of remote sensing applications (Townshend, 1990). In urban regions, for example, Weber and Hirsh (1992) have assessed urban life qualities and Gomarasca et al, (1993) monitored longterm changes in the built up areas. In the rural-urban fringe Jensen and Toll (1982) detected development of residential areas; Quarmby and Cushnie (1989) monitored changes in the use of agricultural lands. Recent developments of methodologies for recognizing landuses have moved from the classical multispectral approach to techniques utilizing spatial and temporal information. Gong and Howarth (1992) for example , developed frequency- based contextual classification for landuse identification. Jewell (1989) for example , used temporal changes in reflectance for differentiating between types of landcovers.

The use of remote sensing methodologies for estimating urban densities is well described in the literature. Most of these works were based on manual interpretation (see review in Lindgreen, 1985). Individual objects such as buildings and chimneies were mapped and counted. The results were shown to be of high accuracy relative to census data. However, manual interpretation requires long tedious processes thus limiting the size of the regions which could be monitored. Only in few works there was an attempt to map densities throught the use of satellite images and computerized techniques. Results reported by Forster (1985) and Keersmaecker (1990) have indicated difficulties in achieving good results due to the relatively low resolution of those images.

The Metropolitan area of Haifa represents one of the most complex spatial composition of landuses together with massive expansion during the last decade due to the large immigration waves. The objective of this study was the development of computerized methodologies for differentiating between commercial/ industrial and residential areas, for identifying areas belonging to different urbanization stages and for mapping different urban densities.

Haifa : description of the region

The Mount Carmel and Haifa region is characterized by high natural variability with wide range of urban patterns both in mountainous and flat areas . On its boundary, Haifa is surrounded by shorelines, rural areas, natural reserves, ports, industrial areas and fields. The population in the area is over 250,000 people representing wide range of socio-economic classes, from the lower classes living mainly in the lower parts of the Carmel Mountain to the much higher socio-economic classes living in the neighborhoods located at the upper parts of the mountain. Various building types are represented , from the Turkisch times, British Mandate, neighborhoods built for the high immigration waves of the 1950's and the expansion of different types of neighborhoods during the last three decades both in the Mountain area and in the Haifa Bay area. Soffer and Kipnis (1980) recognize seven major stages in the urban development of Haifa (up to 1978) : 1. prior to 1855; 2. 1855-1908; 3. 1909-1929; 4. 1930-1948; 5. 1949-1962; 6. 1963-1970; and 7. 1971-1978. Two types of urbanization processes have taken place during these stages: infilling processes , where the built areas were expanded within the city boundaries and and intermittent building, where new neighborhoods were established outside of these boundaries. Those urbanization processes can be inferred and analyzed from the map provided by Soffer and Kipnis (1980) giving a classification of areas in Haifa according to their corresponding stage of development. Commercial and industrial areas were developed in different locations around the port and the CBD has been moving from the down-Town (Sub-quarter no. 62) to Hadar region (Sub-quarter no. 32) and then few of its functions were moved the Chek-Post area.

Remote sensing data calibration and geometric rectification

Three SPOT images were provided for our study within the framework of the Yahel project of the Israeli Space Agency:

- a panchromatic SPOT images of 10 x 10 meters resolution acquired on the 4th of October 1992.
- a multispectral SPOT images of 20 x 20 meters resolution acquired on the 4th of October 1992.
- a multispectral SPOT images of 20 x 20 meters resolution acquired on the 20th of January1993.

The multispectral images represent the end of the summer with the highest effect of vegetation drying and the middle of the winter with high growth of young vegetation.

The images were calibrated using a linear regression of the following form:

$$R[\lambda]_k = a[\lambda] + b[\lambda] * DN[\lambda]_k$$

where $R[\lambda]_k$ is the spectral reflectance measured in the field and $DN[\lambda]_k$ is the digital number recorded in the image for the corresponding calibration sites.

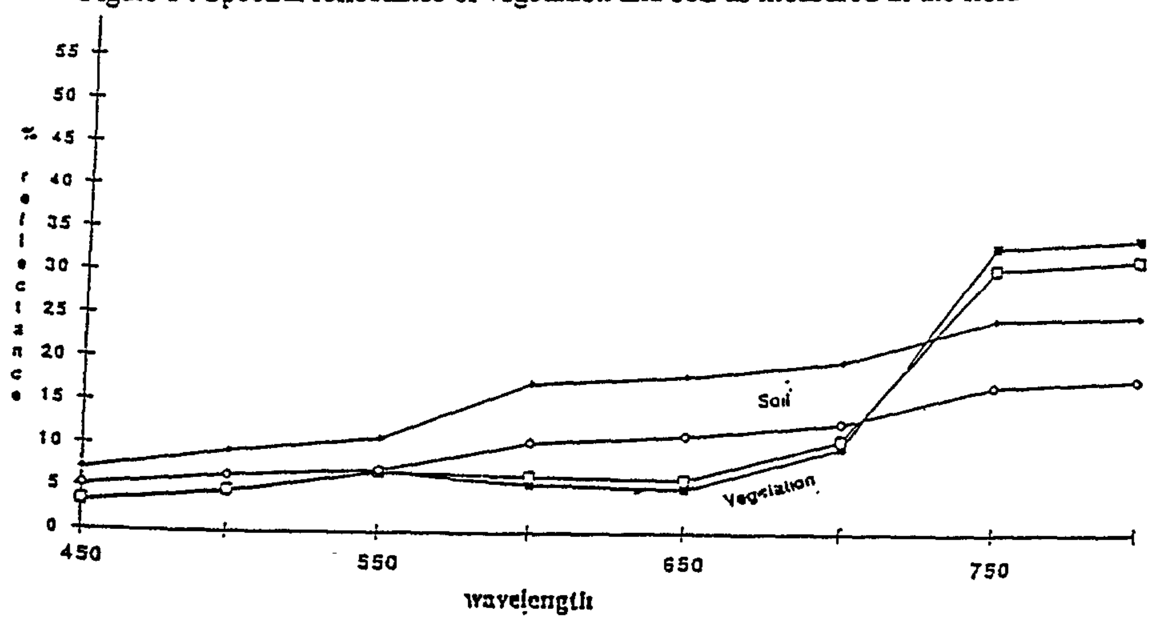
The reflectance in the field (fig.1) was measured using a CROPSCAN radiometer with eight spectral channels (Table 1).

Table 1 : The spectral channels of the CROPSCAN radiometer

Channel no.	1	2	3	4	5	6	7	8
Spectral half power width (in nanometer)	447-473	491-521	546-570	624-652	670-702	690-722	746-774	797-829

The coefficients $a[\lambda]$ and $b[\lambda]$ provide the correction of the radiometric effects of the atmosphere and the gain and offset of the corresponding spectral SPOT channels.

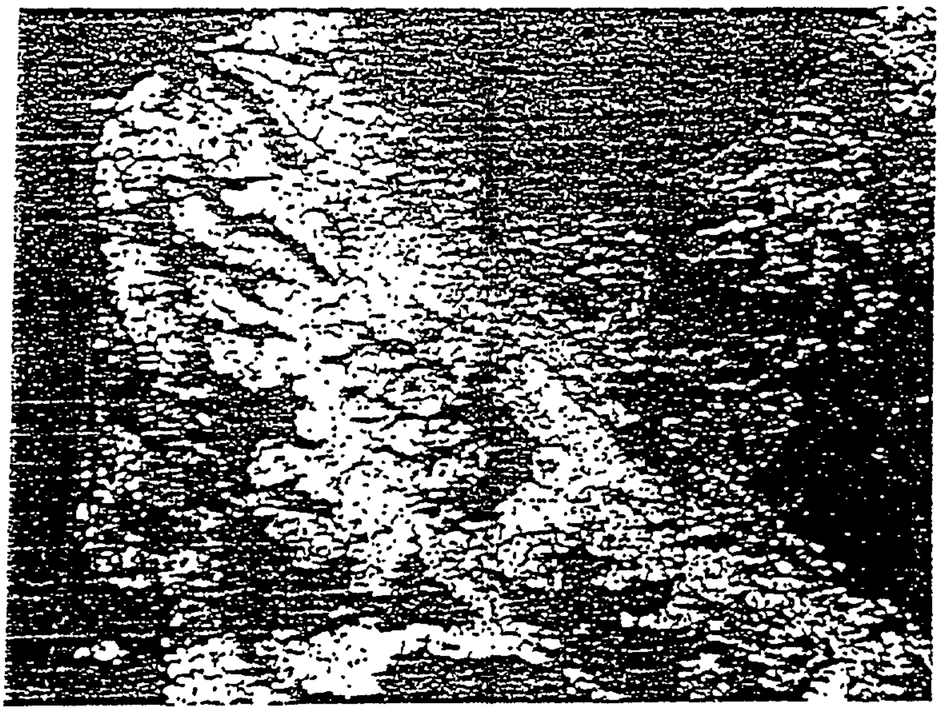
Figure 1 : Spectral reflectance of vegetation and soil as measured in the field



The geometric rectification was conducted using 60 control points derived from 1:50,000 scale maps. The root mean square (RMS) error of 1.5 pixels which was achieved provided sufficient accuracy for the present study.

Using a combination of texture parameters derived from the multispectral data and the panchromatic data it was possible to derive an image allowing good differentiation between commercial / industrial areas and residential areas (fig. 8).

Figure 8 : An image formed by the fusion of data derived from SPOT multispectral and panchromatic data.



Summary and conclusions

This study provides a new framework of three folded relationships between characteristic urban patterns, their floor area densities and their indicators. Within this framework important, geographical information concerning the spatial distribution of urban patterns and densities can be identified , mapped and analyzed. The good results obtained from the empirical assessment of these relationships in Haifa area with its wide variability of urban patterns suggest that the multiscale textural parameter developed and the urban - image density model formalized based on this parameter may facilitate a wider generalization of these relationships within the context of urban geography. For this purpose there is a need to further extend the empirical basis of this work including wider range of scales and pattern types existing in other regions of the world.

Acknowledgment

To the Israeli Space Agency who provided the needed satellite images and to the Ministry of the Environment for their financial support

Data processing

The methodology developed here was based on the search for a combination of spectral and textural features which will allow the differentiation between the following landuse types:

1. Commercial / industrial areas
2. Residential areas with the separation between different urban densities and major phases of the urbanization processes.

For this purpose there were calculated 24 layers representing textural features (Gotlieb and Kreitzig, *1989) from the individual channels, reflectances differences between the* summer and the winter and various ratios between channels.

The effect of the different textural processing can be demonstrated by analyzing the differences between the images given in figures 2 and 3. It is possible to observe for example that the refineries area have disappeared in figure 3, thus indicating that it has a characteristic spatial signature.

Figure 2: Texture image derived from the seasonal reflectance differences

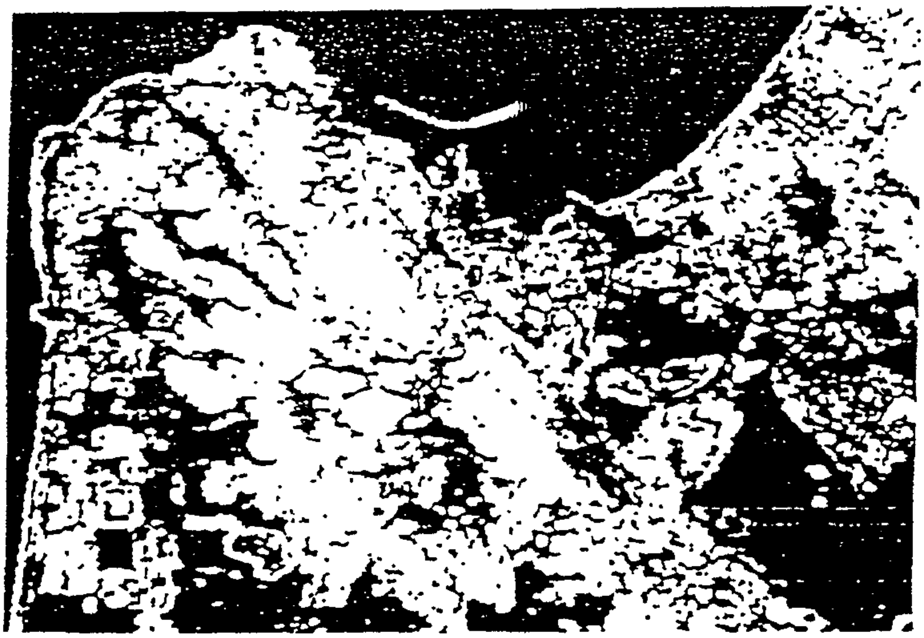
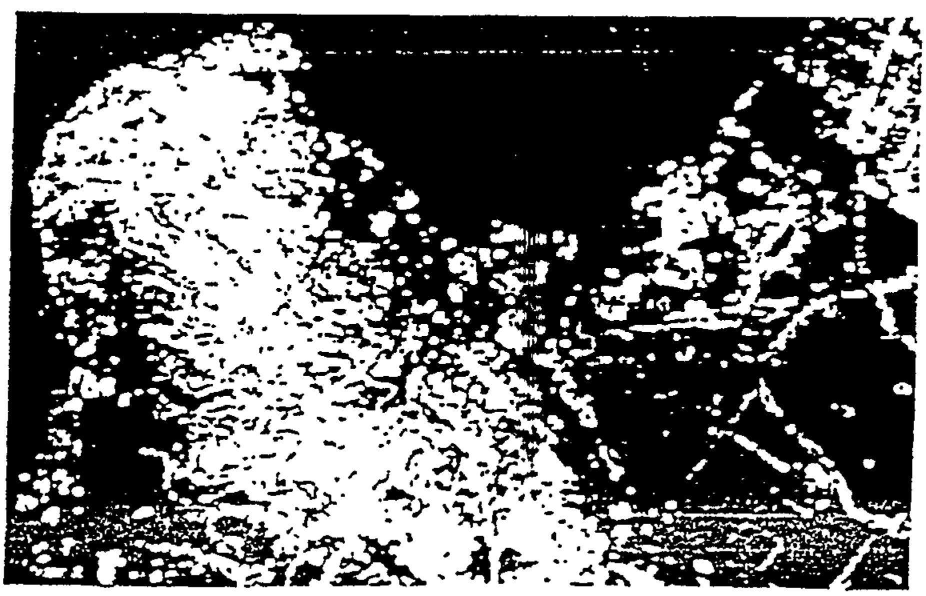


Figure 3 : Texture image derived from ratios between channels.

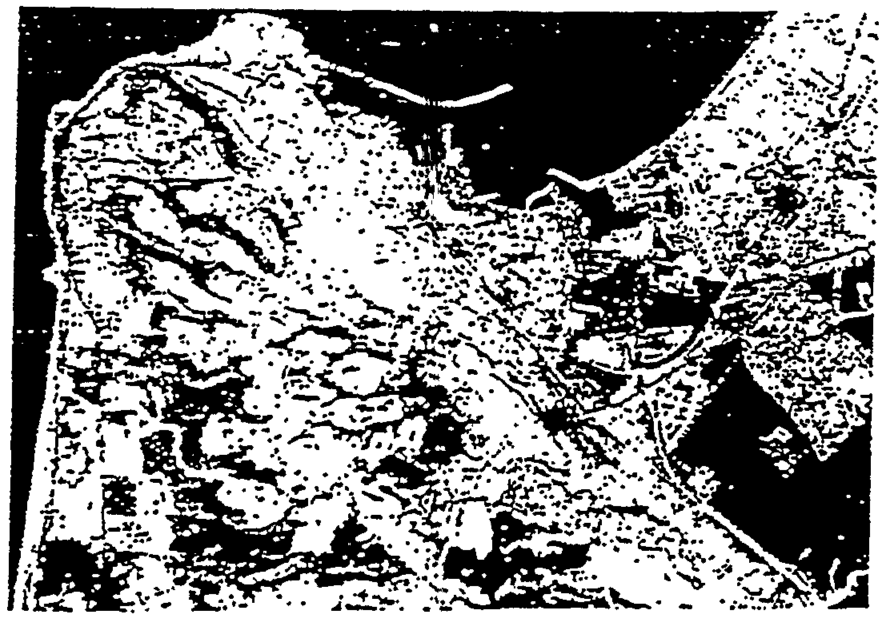


Additional processing of the panchromatic data was needed for allowing the determination of urban densities. Since buildings have relatively higher reflectance than their surrounding (e.g: roads. vegetation) and as a result of shadowing, their appearance in the panchromatic SPOT image is relatively clear . For allowing a computerized discrimination between the built objects and background the image was firstly enhanced in the spatial frequency domain and then the brightness values of built objects and 'background' were characterized. The enhancement was achieved by applying a high - pass filter over the image: every pixel was convolved using a kernel of the following type (ERDAS, 1992):

$$\begin{matrix} -1 & -1 & -1 \\ -1 & 9 & -1 \\ -1 & -1 & -1 \end{matrix}$$

In this way the brightness differences between the buildings and their background were sharpened. An investigation of the brightness histogram of the enhanced image showed that the built objects had then much higher values than those of the background. Consequently a binary image was formed where background pixels were assigned a value of 0 and pixels with brightness characteristic to built objects were assigned a value of 1. Examination of the resulting image (fig. 4) relative to an aerial photography have indicated that over 96% of the buildings were discriminated. Other objects such as segments of roads were found to be present in the image in less than 2% of the total image.

Figure 4: The image formed by applying the high pass filter on the panchromatic SPOT image.



Urban density is inherently a scale dependent phenomena (Degani, 1975; 1977): assuming urban areas to represent spatial heterogeneity of landuse and landcover, their density will vary with the size and location of the area under consideration. The density changes then according to the urban structure and patterns which govern the heterogeneity of the cities, towns and metropolitan areas. While different patterns may have similar densities in a specific scale, it is hypothesized here that the magnitude and way of change of the density with changing the scale are strongly linked to the type of urban pattern .

Since pixels belonging to built objects were assigned a value of 1, the image density corresponding to the projected urban density was determined in the following way:

$$D_{i,j} = 100 * \frac{\sum_{k=i-m/2}^{k=i+m/2} \sum_{l=j-m/2}^{l=j+m/2} B_{k,l}}{m^2}$$

where $D_{i,j}$ is the image density (in precentage) at the pixel position i,j , $B_{k,l}$ is the binary image value given in the image formed following the use of the high pass filter and m is the image window size.

Using this equation for 9 different window sizes between 5x5 and 21x21 pixels, there were formed 9 urban density images (Figure 5a-b).

Figure 5a: Image density formed with a 7x7 pixels window.

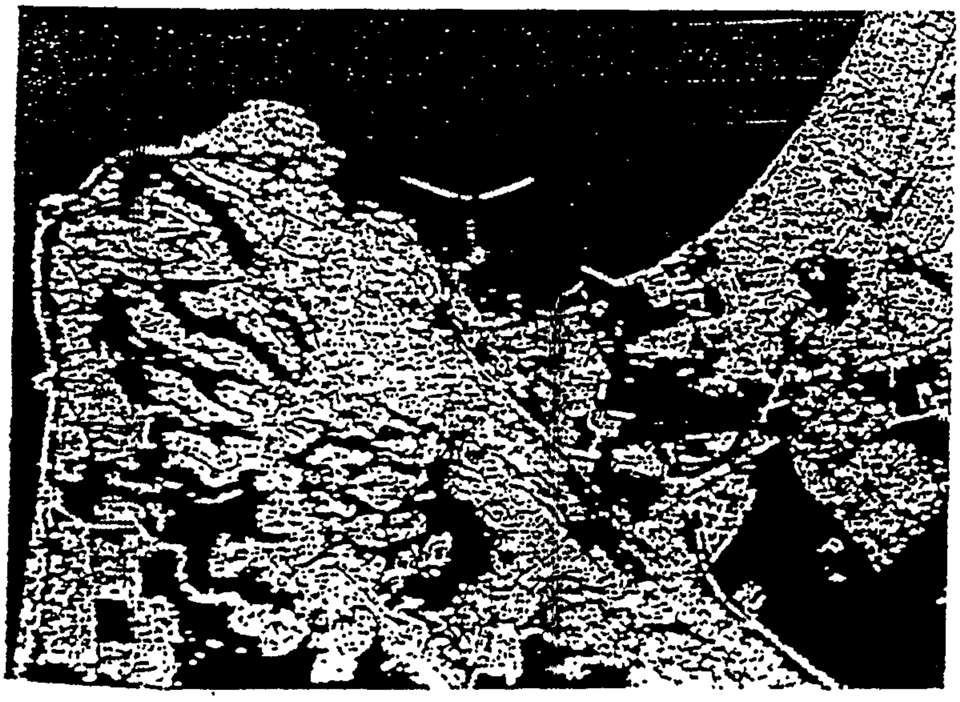


Figure 5b: Image density formed with a 21x21 pixels window.

The Haifa Municipality is recording the urban areas in three categories: dwelling, industrial/ commercial and governmental. Annual tax payments provide the basic data source, and Population Census (last one was conducted in 1983) and local surveys which are taken every few years allow the assessment of the accuracy of the Municipality data. The urban density data is provided by the geographical grouping of the data records for sub-quarters regions . This process is performed by the Department for Statistics and Information of the Municipality

For allowing the integration of image density with data sources the polygons of the sub-quarters in Haifa sub-quarter Map had to be rasterized (according to the SPOT image pixel size) and both sources had to be georeferenced.The map was georeferenced using the coordinates mesh-points marked on the map with an RMS error of 20 meters.The positional inaccuracies are of negligible magnitude considering the objectives of this work.

Results

Assessment of a scatterdiagram of Sub-quarters (fig.6) according to their texture value indicate that it is possible to differentiate three clusters. These clusters represent Sub-quarters with a majority of buildings from the same urbanization stage (Soffer and Kipnis, 1980). Cluster A is characterized by areas built before 1930 , those including Haifa's CBD and parts of its margins. This cluster have the highest range of densities and highest rate of change of texture values. Clusters B represent areas built mainly between 1930 and 1948 with lower distributions of both floor area density and of the homogeneity factor. Cluster C includes areas built mainly since 1949 representing a major change in the relationships between urban densities and their corresponding patterns. In these regions limited range of floor densities between low and moderate values were found to be characterized by wide range of texture values representing high variability of urban patterns. It is therefore possible to conclude that the texture parameterization used contains important geographical information regarding urban patterns and their change between stages of the urbanization processes. An expression containing a parameter representing the multiscale changes of the texture values was then used for modelling the urban-image density relationships . The resulting model was found to be highly significant (fig. 7).

Figure 6 : A scatterdiagram of Sub-quarters according to their corresponding density (y-axis) and texture (x- axis) values.

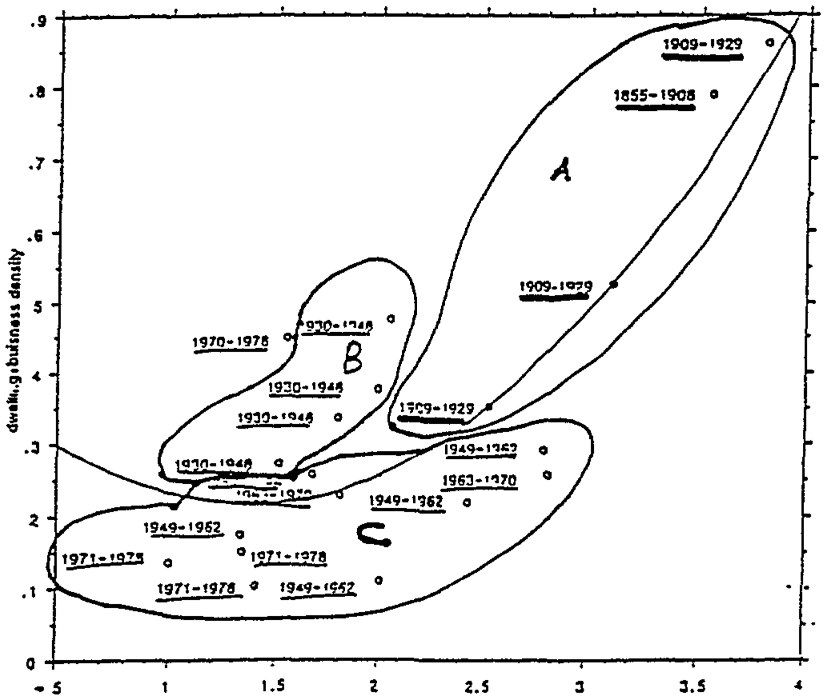
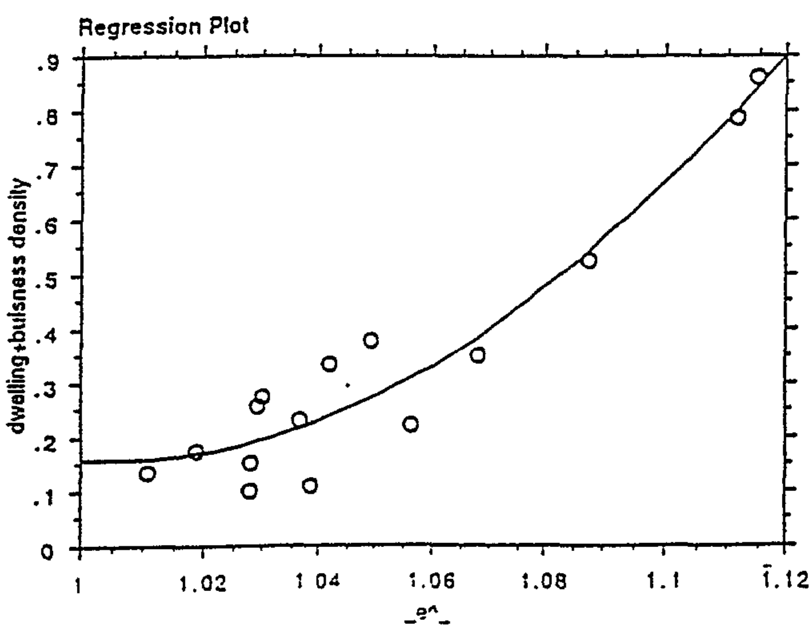


Figure 7 : Urban - Image density model



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Airborne hyperspectral remote sensing in Italy

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ABSTRACT

The Italian National Research Council (CNR) in the framework of its "Strategic Project for Climate and Environment in Southern Italy" established a new laboratory for airborne hyperspectral imaging devoted to environmental problems. Since the end of last june 1994, the LARA (Laboratorio Aereo per Ricerche Ambientali - Airborne Laboratory for Environmental Studies) Project is fully operative to provide hyperspectral data to the national and international scientific community by means of deployments of its CASA-212 aircraft carrying the Daedalus AA5000 MIVIS (Multispectral Infrared and Visible Imaging Spectrometer) system. MIVIS is a modular instrument consisting of 102 spectral channels that use independent optical sensors simultaneously sampled and recorded onto a compact computer compatible magnetic tape medium with a data capacity of 10.2 Gbytes. To support the preprocessing and production pipeline of the large hyperspectral data sets CNR housed in Pomezia, a town close to Rome, a ground based computer system with a software designed to handle MIVIS data. The software (MIDAS-Multispectral Interactive Data Analysis System), besides the data production management, gives to users a powerful and highly extensible hyperspectral analysis system. The Pomezia's ground station is designed to maintain and check the MIVIS instrument performance through the evaluation of data quality (like spectral accuracy, signal to noise performance, signal variations, etc.), and to produce, archive, and diffuse MIVIS data in the form of geometrically and radiometrically corrected data sets on low cost and easy access CC media.

2. INTRODUCTION

Hyperspectral imaging offers a powerful tool for significant advancement in the understanding of our Earth and its environment. The Mediterranean Area is characterized by high diversity of topography, lithology, soils, microclimates, vegetation, sea water characteristics, resulting in a range of various ecosystems, and Remote Sensing techniques, especially imaging spectrometry, appear to have the potential for providing data for environmental studies at regional or even global scales on this part of the world. The Italian National Research Council (CNR) established a new laboratory for airborne hyperspectral imaging devoted to environmental studies. The airborne laboratory is mainly equipped with the AA5000 MIVIS instrument, that with 4 spectrometers designed to collect radiation from the earth's surface in the Visible (20 channels), Near-IR (8 channels), Mid-IR (64 channels), and Thermal-IR (10 channels) can be considered a second generation imaging Spectrometer developed for use in Environmental Remote Sensing studies across a broad spectrum of scientific disciplines.

Simultaneous multispectral imaging in the wide range from Visible to Thermal-IR regions of the spectrum, with a high spectral resolution and high number of channels, required the use of leading edge technologies for optics, detectors, signal processing electronics and data recording. For MIVIS, where the combination of high spectral resolution in the Mid-IR region of the spectrum, with good sensitivity in the Thermal-IR region, some difficulties in system design had to be solved. The most effective approach to producing such a system was the use of a mechanically scanned optical system with a detector for each spectral band and with the use of a common Field Stop for all channels. In this way it was also solved the pixel aligning problem that generally affects other hyperspectral instruments that use more spectrometers.

Channel spectral bandwidths and locations are chosen to meet the needs of scientific research for advanced applications of remote sensing data. Through knowledgeable application of the system and analysis of the data collected, MIVIS can make significant contributions to solving problems in many diverse areas such as geologic exploration, land use studies, mineralogy, agricultural crop studies, energy loss analysis, pollution assessment, vulcanology, and forest fire management. The broad spectral range and the many discrete narrow channels of MIVIS provide a fine quantization of spectral information that permits accurate definition of absorption features from a variety of materials, allowing the extraction of chemical and physical information of our environment. The availability of a such hyperspectral imager, that will operate mainly in the Mediterranean area, at the present represents a unique opportunity for those who are involved on environmental studies and land-management to collect systematically large-scale and high spectral/spatial resolution data of this part of the world. Nevertheless, MIVIS deployments will touch other parts of the world, where a major interest from the international scientific community is present.

During last July 1994 a MIVIS test deployment has been carried out in Sicily in cooperation with national and international institutions on a variety of sites, including active volcanoes (Mt. Etna and Eolian Islands), coastlines (Gela, Acireale, Taormina), ocean (Messina Straits and Marsala lagoon), vegetated areas (Mt. Etna slopes), waste discharges (Acireale), and archeological sites (Selinunte, Alesa and Acireale).

3. MIVIS SYSTEM

The MIVIS technical characteristics are:

- *102 spectral bands: simultaneously sampled and recorded*
- *Spectral coverage: 20 bands from 0.43 - 0.83 μm,*
  8 bands from 1.15 - 1.55 μm,
  64 bands from 1.985 - 2.479 μm,
  10 bands from 8.21 - 12.7 μm.
- *Two built in reference sources thermally controlled in the range 15°C below and 45°C above ambient temperature*
- *Spatial registration of all spectral bands due to a common field stop optical design (2.0 mrad IFOV)*
- *Sample rate (angular step): 1.64 mrad*
- *Digitized Field of View (FOV): 71.059°*
- *12 bits data quantization*
- *Pixels per scan line: 755*
- *Scan rotational speeds: 25, 16.7, 12.5, 8.3 and 6.25 scans/sec*
- *Computer aided data quality check for all 102 channels in real time*
- *Thermally compensated optical-mechanical design*
- *Large dynamic range: 1200°C maximum scene temperature*
- *Computer interfaced data recording system. VHS cassette media (10.2 Gbytes capacity)*
- *Built in aircraft Position and Attitude Sensor (PAS) using a GPS receiver, a roll/pitch gyro and a flux gate compass for aircraft heading sensor. Real time aircraft roll correction (±15°)*
- *Simple operator interface using a touch screen display and menu system*
- *Built in system monitors: Moving Window image on CRT, and oscilloscope*
- *Automatic built in subsystem testing*
- *Scan head size 67 x 52 x 71 cm*
- *Electronics size 103 x 48 x 64 cm*

The complete scanner system consists of an electro-optical sensor assembly (Scan Head/Spectrometer) and four electronics chassis interconnected by electrical cables. The Scan

Head/Spectrometer component is mounted to have a clear opening through the aircraft skin to the ground below. The electronic chassis components are mounted within a standard rack inside the aircraft cabin for access by the system operator. Data from the sensors is amplified in the spectrometer and passed to the electronics where it is digitized, combined with ancillary data and recorded. The electronics chassis contain the operator interface, the GPS receiver and other supporting subsystems. The principle MIVIS subsystem components are:

- *Scan Head and Spectrometer*
- *Moving Window Display and Monitor*
- *Digitizer*
- *VLDS (Very Large Data Store) Tape Recorder*
- *Power Distributor*

Three of the MIVIS subsystems contain embedded control computers that supervise and monitor operations for which that subsystem is responsible. Commands and status information is passed between these three subsystems through a local communication network. System startup automatically initiates a series of self tests to verify that the system is ready for use.

The Scan Head consists of the optical elements comprising the primary collecting telescope, a rotating scan mirror, the motor-encoder assembly, two controlled thermal references, and an Invar^R steel and aluminum structure. The structure holds these components, maintains their critical dimensions, shields the optics from stray radiation, and provides the interface to the spectrometer. The scene energy collected by the scan mirror is focused by a paraboloid and directed onto the IFOV defining aperture. Energy passing though the aperture is collimated and reflected out of the scan head to the spectrometer. The two reference sources contained within the scan head are viewed once per scan mirror revolution.

The Spectrometer accepts the collimated energy from the Scan Head and divides it into 4 optical ports. Each port contains a diffraction grating, imaging lens, detector array and preamplifier electronics. Each spectrometer port uses optical materials, coatings and detectors that are optimized for its specific wavelength region of operation. Selectable electronic gains and/or optical attenuations are implemented in the spectrometer to maximize SNR for a wide range of input radiance levels. The optical attenuation system allows to record scene temperatures up to 1200°C without electronics saturation. The output of the spectrometer is 102 electrical signals, each from a different detector, representing, as already seen, a segment of the spectrum between 0.43 and 12.7 μm.

The Moving Window Display (MWD) contains a display monitor CRT assembly, a wave-form monitoring oscilloscope, and a DC to AC power inverter. The principal function of this unit is to provide a visual real time image of the scene being recorded to the operator. This function serves to assess areal coverage, monitor the system integrity and provide an estimate of data quality. The MWD is capable of operating in either real time during the data collection, or after flight in data playback. The display monitor receives RS-170 or CCIR video from the digitizer and the CRT displays video data from one or two video channels. Display functions are controlled by touch screen menu selections from digitizer system component. The oscilloscope provides a functional check for operator, and represents a system maintenance tool. The inverter provides from the 28 volt DC aircraft power the 115 volt 60 Hz AC power for use by the VLDS data recorder and the MWD CRT.

The principle Digitizer function is to provide 102 channels of analog to 12 bit digital conversion, format this data and write it to tape. This process is synchronized to the scan mirror rotation by signals from the optical encoder on the motor. The Digitizer is also the location for peripheral functions which are designed to accomplish important system features. All Digitizer functions are supervised by an embedded computer and control software. The Digitizer contains the Touch Screen which is the principal interface to the instrument. Touch screen operation, supervised by an embedded control computer, is based on a matrix of infrared light beams that match optical detectors cross the screen. When the operator's finger touches the screen a horizontal and vertical infrared light beam is interrupted and an appropriate action is taken. The touch screen and display menu concept makes the control and monitoring of a such complex instrument relatively simple. Menus are presented on the screen to the operator, identifying what action will occur when a designed area on the screen is touched.

The MIVIS Menu System displays on the touch screen a series of nineteen different menus organized into three levels: Level 1 Menu (Scanner Operation), Level 2 Menus (4 further menus), Level 3 Menus (12 further menus). These 3 levels differ by their significance to the system operator. Data collection and recording are done using level 1 menu. All routine operator adjustments to the system are accomplished in either level 1 or level 2 menus. Level 3 menus control less frequently needed system parameters such as special setups, diagnostic tests and other maintenance functions. The MIVIS system configures itself upon startup optimizing all adjustable parameters to meet most application needs without operator intervention.

The Digitizer, after operator selection, formats data to the MWD for a video image of one or two of the acquired channels. The unit continuously monitors the data quality for all channels, examining for high and low out of range condition, and low signal level. This information is presented to the operator on the touch screen in the form of a matrix of 102 numbers (one for each channel). The matrix indicates the Dynamic Range status of each channel. The channel number will be blank if the channel has no Over Range, Under Range, or Low Signal errors. The channel number will be illuminated when any of the above mentioned dynamic range errors occur. When one or more channels are affected by dynamic range errors, touching a selection on the touch screen, information on Data Number values and ranges relative to that channel(s) are showed, allowing the operator to adjust parameters to solve the problem. If the system determines that a channel is not present, that particular channel number will be displayed in reverse video.

The functionality of the entire system is checked upon startup through a series of Built In Tests (BIT) initiated from the Digitizer. The status of other MIVIS subsystems is monitored by Digitizer, and reported to the operator by messages on the touch screen. Some tests of the BIT sequence continuously follows key MIVIS functions and notify when the MIVIS system is ready to operate and if some critical or not critical error is occurring.This status information is also included into information recorded onto the data tape.

The Position and Attitude Sensor (PAS) is a peripheral function supervised by the Digitizer. The PAS system is composed of a gyroscope for roll and pitch sensing, a flux gate compass to sense aircraft heading, and a GPS receiver for location, track, speed, time, date, height, etc. Data from these sensors is sampled, time-correlated and recorded on the data tape, and used by ground processing system to remove distortions caused by aircraft motions and/or terrain relief. Correction of aircraft roll (±15°) is performed in real time to take advantage of the high precision of PAS. The remaining corrections are done by the data processing system after flight.

The MIVIS system records all data for post flight analysis by an image processing system. The VLDS recorder is a digital magnetic tape drive using helical scan technology and tape cassettes similar to the home VCR. It enables MIVIS to store a large quantity of data (10.2 Gbytes per cassette) at high speed. A buffered version of VLDS is used because it contains internal memory allowing data transfers at different scan speeds. Up to 240 minutes of data (dependent on scanner speed) can be stored per tape cassette, and a new cassette can be loaded into the recorder in approximately 15 seconds. Tape operations are controlled through a SCSI interface, making the recorder compatible with ground based computer systems that also use this standard.

The MIVIS system operates entirely from 28 volt DC aircraft power. The Power Distributor is the interface between this input power and the remaining MIVIS system components. The input power is converted to other voltages and distributed to other MIVIS chassis. Isolation of critical circuits from other MIVIS components as well as the aircraft power systems is the responsibility of the Power Distributor. This chassis contains circuit breakers, relays, power converters, electrical filters, and engineering data monitors. Certain high power functions such as the scan motor control and reference source control circuits are also located in this subsystem. Operation of the motor and reference control circuits as well as communication with the remaining MIVIS system components are supervised by an embedded computer.

4. MIDAS SYSTEM

The MIDAS system has been developed to efficiently preprocess, analyze and visualize MIVIS data, and is written for portability to a large number of computer platforms. It has been designed for use on a wide variety of UNIX workstations that support X-Window System and the Application Visualization System (AVS) graphical programming environment. LARA project hosted MIDAS software on a UNIX Silicon Graphics SGI 4D/420VGXT based in Pomezia in a configuration that is sintetically listed below:

- *Two 40 MHz CPUs*
- *128 Mbytes of main memory*
- *Four 1.1 Gbytes IPI high-speed disks*
- *Two 1.2 Gbytes SCSI disks*
- *VLDS helical scan cartridge tape system*
- *Two 8 mm Exabyte tape drives (5 Gbytes capacity each)*
- *One 8 mm Exabyte tape drive (10 Gbytes capacity)*
- *1/4 inch cartridge tape drive (150 Mbytes capacity)*
- *Kodak Model XL-7700 film recorder*

A MIDAS Production Processor handles data ingestion, standardized processing, reformatting, archiving and dissemination. Raw data from MIVIS are ingested with the VLDS helical scan cartridge tape system and backuped on the 10 Gbytes 8mm Exabyte tape, while preprocessing, archiving, dissemination, and alternative data ingestion is via the two 5 Gbytes 8 mm Exabyte tape drives and the 1/4 inch cartridge tape drive.

The big capacity of this particular hardware and software configuration is the use of a flexible three-dimensional data structure that allows to rapidly move information from high speed disks to memory, so that arbitrarily large data volumes may be processed or interactively visualized (30 frames/sec) without regard to memory limitations. This allows a sensitive compression of times for ingestion, reformatting, validation and preprocessing of MIVIS data before their distribution. In fact, all modules in MIDAS handle hyperspectral data in the Volume Image Management System (VIMS) format greatly improving the system performance. MIDAS organises data into volume elements (voxels), rather than rasters, and uses the voxel bricking (an extension of the planar processing pixel tiling) reducing the disk thrashing problem.

MIDAS functions to preprocess MIVIS data include radiometric calibration, filtering of eventual systematic noises introduced into MIVIS data during recording, geometric and atmospheric corrections. The radiometric calibration uses the MIVIS internal references sources and the more recent calibration data from test bench. The Internal Radiometric Calibration (IRC) computes radiance values for the reflected energy bands (1-92) by using the following equation:

$$R_i = (R_0 - REF_1) / (F*G*A)$$

where R_i represents the internally corrected radiance value (Watt/cm^2/ster/micron), R_0 the observed raw data number (DN), REF_1 the reference body DN, F the scale factor (DN/radiance), G the gain selected value (1, 10, 1000), and A is an attenuation factor (0.4-1.0). The term (F*G*A) is constant for each band for the entire flightline. For the thermal IR (channels 93-102) the IRC uses a different algorithm where the user must select a minimum temperature value (T_{min}), used as zero in the output image, and a sensitivity value (TperDout), used to scale the results. The temperature for each pixel is computed using the following expression:

$$DNO_i = C + (DN_i - REF_1)*D$$

where DNO_i represents the output DN and DN_i the input DN for pixel i, REF_1 the DN of the first internal reference black body, and C is equal to

$$C = (T_1 - T_{min}) / TperDout$$

while D is equal to

$$D = TperDref / TperDout$$

where

$$TperDref = (T_2 - T_1)/(REF_2 - REF_1)$$

letting T_2 and T_1 the temperatures (°C), and REF_2 and REF_1 the DN, for each scan line, of the two internal reference bodies.

The atmospheric effects on the sensed radiance at the detector are wavelength dependent, and due to the presence of various scattering and absorption media. These effects depend upon aircraft altitude, the sensor scan angle, the solar geometry, and the spatial distribution of the scattering and absorptive media. The atmospheric correction algorithms provided by MIDAS offer a generic correction capability and may be driven by either LOWTRAN, MODTRAN or user provided atmospheric models. The output of the IRC adjustments could be used as input of the Path Radiance Corrections (PRC) to correct the calibrated values taking into account the solar illumination conditions, the sensor geometry and the atmospheric attenuations and sky irradiance. To applied the PRC to MIVIS data MIDAS is planned to receive a VIMS file of polynomial coefficients that are used to correct data from atmospheric effects. The polynomial coefficients, function of the position of the pixels across the scan line, can be estimated by user's specific codes or by standard atmospheric models. The expression used by MIDAS to correct data from atmospheric effects is the following:

$$R_p(\lambda,c) = a_1(\lambda,c)*R_c(\lambda,c)^2 + a_2(\lambda,c)*R_c(\lambda,c) + a_3(\lambda,c)$$

where R_p represents the path radiance corrected data for each band (λ) and for every cross track pixel number (c), R_c the IRC calibrated radiance, and a1, a2, a3 are the sky brightness coefficients. The Spectral Reflectance Normalisation (SRN) correction can be applied to the PRC output as a vector normalization, dividing the PRC radiance by the estimated solar irradiance for each spectral window.

The geometric correction rectifies images to eliminate the panorama distortions due to scanner geometry and effects introduced by perturbations in position and attitude of the airborne platform. For this last operation MIDAS uses GPS and inertial references (gyro and flux gate compass) data recorded for each scan line into MIVIS data. MIDAS allows two possible choices for geometric corrections: Simplified Airborne Scanner Image Rettifications (SASIR) or Position Attitude System Image Rettifications (PASIR).

The SASIR algorithm corrects the image from distortions due to scanner geometry, and taking into account the average aircraft velocity, terrain clearance and crab angle. The algorithm assumes a rotating mirror-based scanner whose mirror axis is parallel to both the Earth's surface and the aircraft fusolage. The Earth is assumed flat and no pitch, roll and yaw variations are taken into account.

The PASIR algorithm corrects MIVIS data using inertial sensors supplied data as aircraft pitch and roll based on a gyro outputs and yaw angles based on a flux gate compass outputs, GPS info, sensor characteristics, scan rate, and average terrain altitude. The PASIR approach to generate a rectified image is to project the unrectified image in an arbitrary coordinate system, using both the platform attitude estimates and the sensor characteristics. For each scan line in the unrectified image, the position of the sensor is estimated and the intersection of the pointing vector defined by the look direction and the target plane, is calculated. Pixels are assigned in the output space on a choice within nearest neighbour, bilinear or cubic interpolation techniques. The PASIR geometric correction allows an estimate of missing pixels on the ground.

Besides MIVIS data production, MIDAS offers to users a very powerful system for hyperspectral image processing. Hyperspectral data manipulation requires an analysis system with a high level of interactivity to handle and visualize large volumes of data. MIDAS, as mentioned, handles data with a highly flexible three-dimensional voxel structure for storage, implementing data transfer for both visualization and computation independently of image size. This data structure allows to optimize computation in each spatial dimension and the spectral dimension. Furthermore, algorithms included in MIDAS provide all the standard functions of a software dedicated to image processing, but more, offer software tools to analyze data in the spectral domain and allow the possibility to develop new algorithms for particular user's analysis.

5. SICILY LARA 1994 DEPLOYMENT

During the second half of last July 1994 LARA Project in the framework of final MIVIS/MIDAS testing and tuning held a MIVIS test deployment in cooperation with national and international institutions on a variety of Sicilian sites. The deployment was successful and more than 56 Gbytes of MIVIS data were collected in almost 5 hours of VLDS recording time.

This first MIVIS deployment besides its testing purposes it was also an opportunity offered to the scientific community to obtain MIVIS data on selected test sites. The surveyed sites, the proposing institutions, and the scientific objectives are sintetically listed below.

	SITE(S)	INSTITUTION(S)	SCIENTIFIC OBJECTIVES
1)	Mt. Etna, Vulcano, Stromboli	JPL (Pasadena, CA USA), CNR/IIV (Catania), CNR/GNV (Roma), CNR/CSGDSA (Pisa), ING (Roma), OGUM (Modena), Roma University, Palermo University	Geological mapping and measurement of active volcanic phenomena.
2)	Mt. Etna slopes	CNR/IROE (Firenze)	Beech-wood canopy studies.
3)	Messina Straits	CNR/CST (Messina)	Sea currents dynamics and physical characteristics.
4)	Gela	CNR/IROE (Firenze), Catania University	Coastline pollution.

5)	Marsala Lagoon	Palermo University	Algae bloom studies.
6)	Acireale, Taormina	Catania University	Coastline pollution, waste discharges and archeological studies.
7)	Selinunte, Alesa	CNR/Comitato Nazionale Scienza e Tecnologia dei Beni Culturali, Palermo University	Archeological studies.

During MIVIS data acquisition a contemporaneous ground data acquisition campaign has been carried out for most sites. For the surveys on volcanic areas CNR/IIV offered its ground support logistics in making measurements of plume SO_2 with its portable COSPEC instruments, while JPL, CNR/CSGDSA, ING, OGUM, and the Universtiry of Palermo people launched radiosondes to measure H_2O profiles, used anemometers for wind speeds, a GER portable spectrometer to measure ground radiances, radiation thermometers and thermocouples for measurements of ground temperatures. CNR/IROE deployed by helicopter its FLIDAR instrument contemporaneously with MIVIS on Gela's coastline and on Mt. Etna's beech-woods. CNR/CST and the University of Palermo made sea truths measurements with scientific boats on the Straits of Messina and inside/outside the Lagoon of Marsala.

After the Sicily 1994 MIVIS deployment an evaluation of MIVIS inflight performances has been done for thermal channels making statistics on a portion of the ocean West of Stromboli Island (6771 pixels). In Figure 1 is reported the inflight SNR while in Figure 2 the inflight NEΔT is shown.

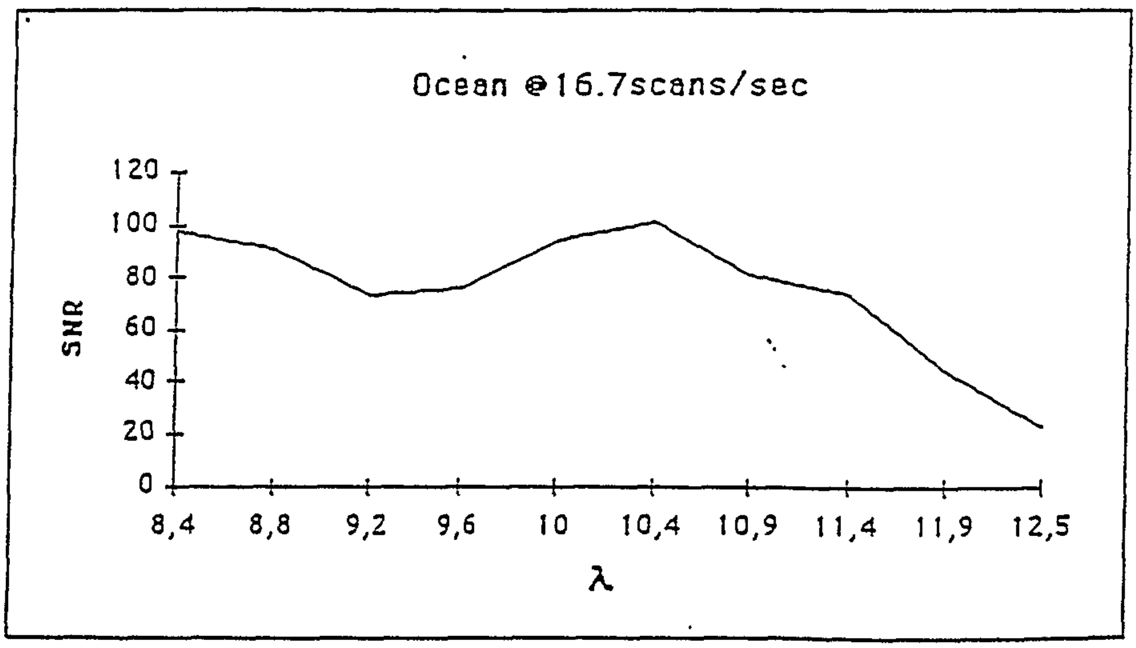

Figure 1 - Inflight SNR computed for the 10 MIVIS thermal channels on a portion of ocean target (6771 pixels), West of Stromboli Island.

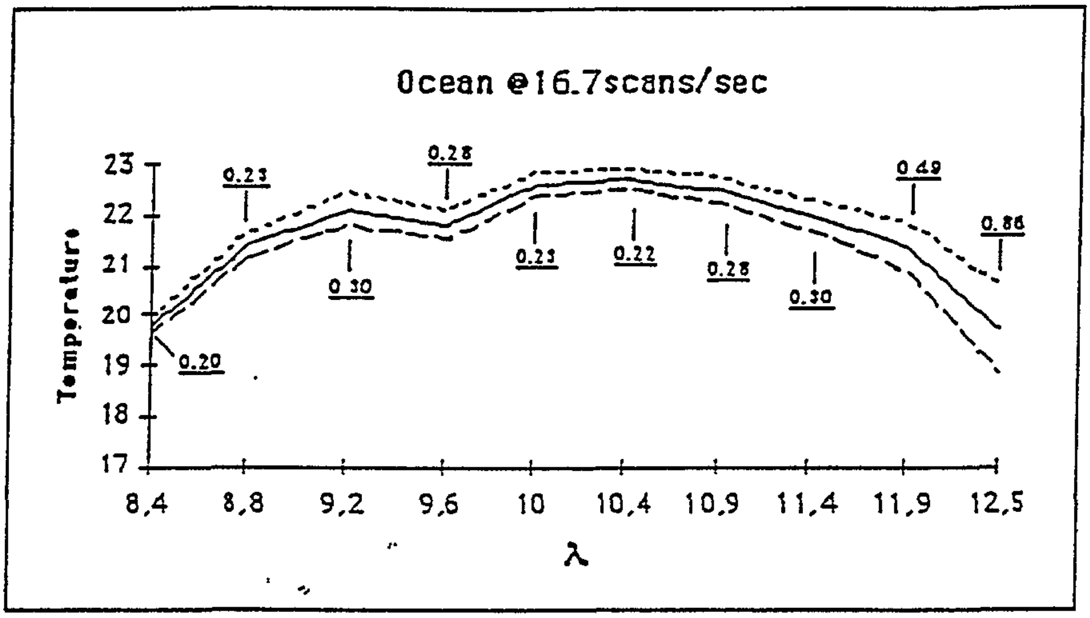

Figure 2 - Inflight NEΔT (underlined numbers on the plot) computed for the 10 MIVIS thermal channels on a portion of ocean target (6771 pixels), West of Stromboli Island.

Selected scenes of the Sicily 1994 MIVIS data will be extracted for general distribution under request starting from the end of 1994.

6. REFERENCES

1. DAEDALUS Enterprises, *AA5000 MIVIS Operator Manual*, 6 volumes., 1994.
2. TASC Company, *MIDAS Data Center User's Manual*, 2 volumes., 1993.

- Libya is located on the southern side of the Mediterranean Sea with a long coastal line that extends to about 2000 km from the Tunisian border in the west to the Egyptian border in the east.

- Libya is a relatively very vast country. Its area is about 1.7 million sq.km with a population approximately 4 million. Due to its geographical location and diversity, and due to the limited manpower and human resources, Libya find itself obliged to use remote sensing techniques for assessing, studying, monitoring, and evaluating its natural resources and its environment.

- In the late 80's two remote sensing centres were established namely :

  1. Libyan Remote Sensing Centre and Space Science
  2. Biruni Remote Sensing Centre

- These Centres are equipped with relatively modern facilities to carry out their tasks

- The Centres are actively involved in the following :

  1. Projects on land use and land cover classifications
  2. Projects of civil engineering nature such as helping to select the routes of gas and huge water pipelines, and new rail road lines
  3. Projects on deliniation of potential hydrologic reservoirs in the south of the country
  4. Studying and evaluating the illegal deforestation in cooperation with the Technical Centre of Environmental Protection
  5. Evaluating the urban expantion on the limited rich soils
  6. Studies on the search and classification of good agriculture soils
  7. etc.

- In Libya the Technical Centre for Environmental Protection (TCEP) is responsible to follow up and address all the environmental issues. TCEP is the focal point for RAC/ERS, TCEP is ready to support and cover all local expenses for any project that will be carried out in cooperation with RAC/ERS, to name few of the projects that can be carried out but not limited to the following:

  1. Sea Water Intrusion
  2. Deforestation and desertification monitoring
  3. Under ground water depleation
  4. Oil spills and ship cleaning
  5. Crop inventory and prediction
  6. Coast line management
  7. Etc.

Presentation of Libya - Exposé de la Libye

- These projects can be carried out together and it is foreseen that RAC/ERS to help in training and giving consultation on procedures and methodology that be followed in these projects.

- These procedures and methodologies should be unified within all Mediterranean countries in order to help develop common data base for all countries, this information and experience can be shared and exchanged among expertise and organizations of Mediterranean countries.

المركز الوطني للاستشعار عن بعد

CNT

CENTRE NATIONAL DE TELEDETECTION

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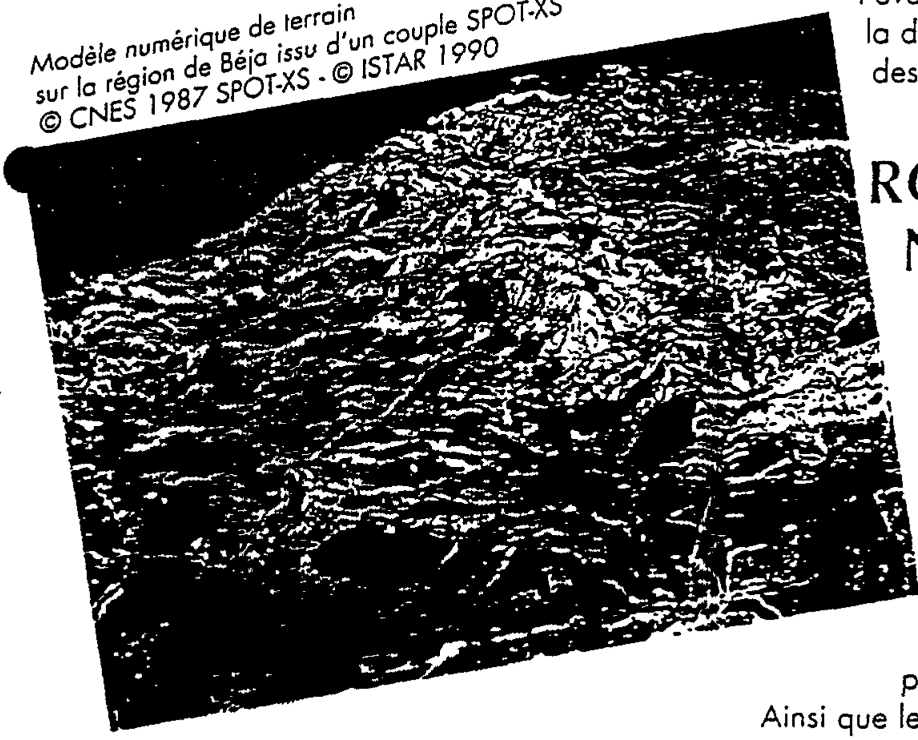
QU'EST CE QUE LA TÉLÉDÉTECTION ?

La télédétection recouvre l'ensemble des techniques mises en œuvre pour l'étude de la surface de la terre ou l'atmosphère en utilisant les propriétés des ondes électromagnétiques émises, réfléchies ou diffusées par les différents corps observés.

La télédétection spatiale consiste à exploiter les données recueillies par satellites d'observation de la terre (LANDSAT, SPOT, NOAA)... en vue d'en extraire des informations physiques, biologiques et humaines. Ces images apportent une vue d'ensemble sur de vastes territoires et permettent, grâce à leur répétitivité, de suivre l'évolution de certains phénomènes telles la désertification, la pollution, l'utilisation des terres, l'urbanisation...

Modèle numérique de terrain sur la région de Béja issu d'un couple SPOT-XS © CNES 1987 SPOT-XS - © ISTAR 1990



ROLE DU CENTRE NATIONAL DE TÉLÉDÉTECTION

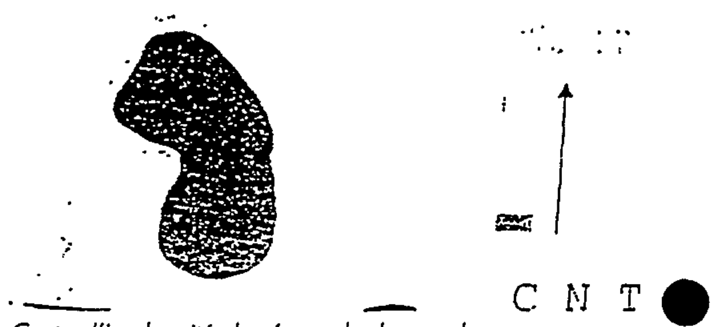
Le Centre National de Télédétection, créé en Juillet 1988, est un établissement public à caractère industriel et commercial. Il a pour mission de définir, développer, soutenir et valoriser l'utilisation de la télédétection au profit des projets d'envergure nationale.

Ainsi que le décrit la loi N° 88-83 du 11-7-1988, il doit notamment :

- *participer à l'élaboration d'une politique nationale*

en matière de télédétection de nature à préserver les intérêts économiques, sociaux, culturels et stratégiques;
- acquérir, distribuer, traiter et archiver sans monopole ni restrictions des données en matière de télédétection;
- offrir des prestations de service à la demande;
- promouvoir la formation et le perfectionnement du personnel des services administratifs concernés par la télédétection;
- apporter son concours dans la recherche ciblée sur les projets d'envergure nationale utilisant la télédétection et effectuer des expertises en cas de besoin.
Le Centre National de Télédétection est également habilité à adhérer aux organismes internationaux de télédétection.

Par la réalisation de ses missions, le CNT s'attache à répondre aux besoins d'un grand nombre de départements nationaux convaincus de l'apport de cette technique et soucieux de l'introduire parmi leurs méthodes d'investigation. Pour sa mise en place, le CNT a bénificié



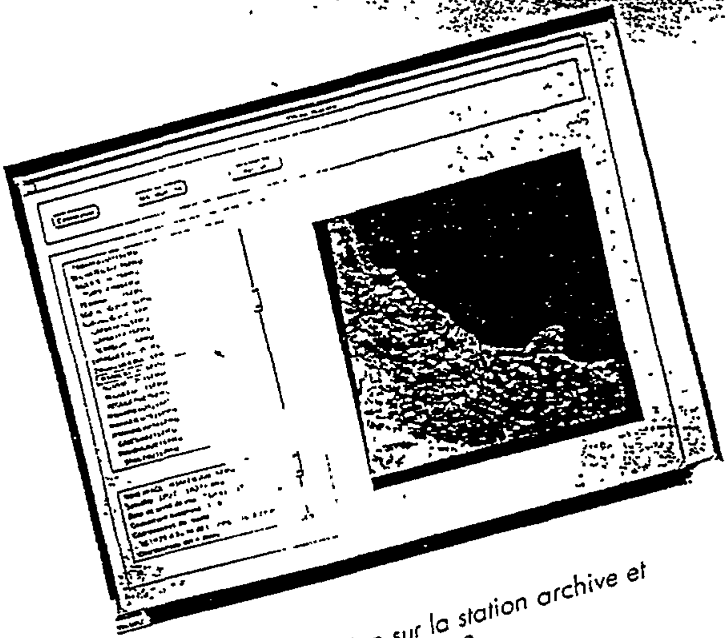
Carte d'isodensité du réseau hydrographique Région de Béja

d'important moyens humains et matériels acquis sur le budget national mais aussi d'une large contribution de la coopération scientifique et technique française, notamment en matière d'équipements, de formation et de soutien à la réalisation de projets
Par son action au sein du Centre Régional de Télédétection de l'Afrique du Nord, le CNT contribue au développement de la télédétection au niveau nord-africain dans des projets d'intérêt commun.

Salle de calcul du Centre National de Télédétection

LES MOYENS DU CNT

Le CNT dispose d'une équipe de spécialistes en traitement et interprétation des images spatiales qui s'appuient, pour leurs travaux d'études et de développement, sur des stations de traitements d'images : système informatique performant munis de processeurs images et de logiciels adaptés.



Consultation sur la station archive et distribution - STADIS -

Le choix des équipements du CNT a été basé sur une conception matérielle type ateliers spécialisés (traitement images, géométrie, cartographie, édition...) reliés par réseau local. Outre ces ateliers destinés à la réalisation des projets, le CNT dispose également :

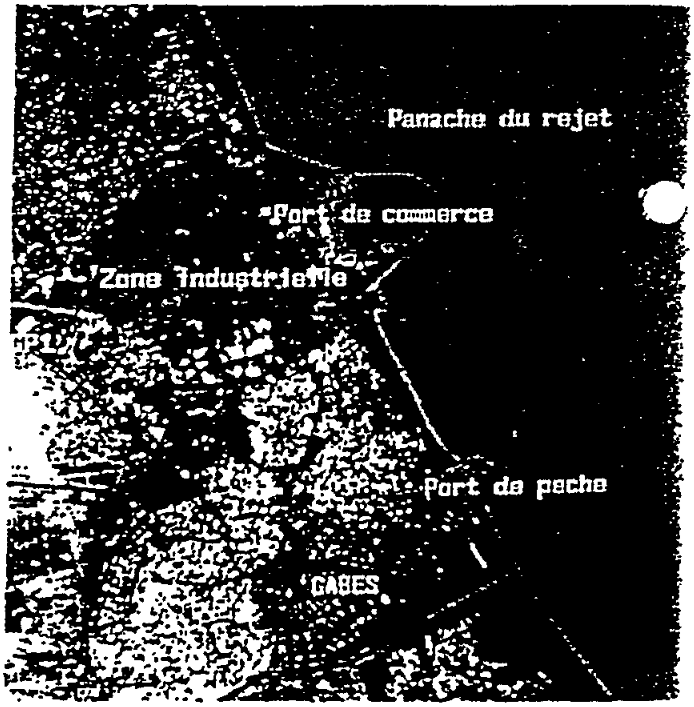
- de stations de traitement d'images destinées à la formation,

- d'une station d'archive numérique et d'une base de données images ; accessible via le réseau de télécommunication, cette dernière offre aux utilisateurs le catalogue de toutes les images disponibles au CNT.

Par ailleurs, un centre de documentation a été mis en place ; il regroupe une centaine d'ouvrages de base et une trentaine de titres de périodiques spécialisés enrichis chaque année par de nouvelles acquisitions.

Un service permet l'exploitation de ce fond documentaire de référence en la matière par tous les utilisateurs de la télédétection.

Etude de la pollution chimique dans le Golfe de Gabès
© CNES 1990 - Distribution SPOT-IMAGE -
Traitement CNT



Carte des états de surface - Région de Menzel Habib. - © CNES 1990

LES ACTIVITÉS DU CNT

Les projets en cours de réalisation au CNT ont été définis en étroite concertation avec ses partenaires nationaux ; ces projets sont relatifs à des thèmes de première priorité pour le développement du pays : environnement, gestion des eaux de surface, urbanisme...

Environnement :

.. télédétection permet la cartographie des zones difficilement accessibles tel le milieu narin. Dans le golfe de Gabès, les images SPOT et LANDSAT ont permis la cartographie de la zone côtière et la mise en évidence de la disparition de couvert végétal d'un des milieux halieutiques les plus riches du pays.
e recours aux images satellites pour l'étude de a désertification se justifie par la nécessité de disposer de données synoptiques et répétitives pour une étude dynamique des phénomènes. Ainsi, dans la région de Menzel Habib, des nages d'archive LANDSAT et des images SPOT plus récentes ont permis d'étudier l'évolution du paysage sur une période de 10 années. Cette étude dégage les effets des différents projets de mise en défens entrepris par le Ministère de l'Agriculture et permet de mieux adapter les mesures de protection dans le cadre du plan de lutte contre la désertification.

Urbanisme :

L'imagerie satellitaire est un outil privilégié pour la cartographie de l'occupation du sol en milieu urbain.
Conduite sur la région du Grand Tunis, premier pôle urbain du pays, l'étude rétrospective de l'évolution urbaine sur les dix dernières années s'inscrit dans le cadre de la révision du Plan Directeur de l'Urbanisme.

Etude de la pression urbaine sur les terres agricoles dans la région de Tunis
© CNES 1990 - Distribution SPOT-IMAGE

Gestion des eaux de surface :

Les produits dérivés des images satellitaires tels Modèle Numérique du Terrain, cartes des pentes... permettent une étude des bassins versants et conduisent à l'établissement de carte des zones vulnérables à l'érosion, première étape dans l'identification de sites potentiels pour l'implantation de retenues collinaires. Cette première étude sur la région de Béja est extensible à d'autres sites de la Tunisie et s'inscrit dans le cadre de la lutte contre la sécheresse en zone semi-aride.

Calamités naturelles :

La possibilité de programmation urgente du satellite SPOT a permis la disponibilité d'images couvrant les zones sinistrées à la suite des inondations qui ont affecté le Centre et le Sud de la Tunisie en Janvier 1990.
Une étude comparative de ces images avec celles acquises en Juin 1988 a débouché sur la cartographie exhaustive des dégâts causés par les inondations. En seconde phase, l'étude des bassins versants sur les images SPOT contribuera à la révision de la carte des zones vulnérables aux inondations.

FORMATION

De part sa mission, le CNT contribue au développement de la télédétection par l'initiation et la formation des utilisateurs en organisant :

- des séminaires, journées "porte ouverte"... destinés à la sensibilisation des décideurs aux apports de la télédétection dans leur domaine,

- des ateliers de travail ciblés sur des thèmes en rapport avec les projets initiés par le CNT. D'une durée moyenne de quinze jours, ces ateliers permettent l'initiation d'ingérieurs, techniciens, chefs de projet... aux techniques de traitement et d'interprétation des images spatiales. Ils comportent en général des exposés de cas, des travaux pratiques sur systèmes de traitements d'images et des sorties de contrôle terrain.

RECHERCHE

La contribution du CNT au développement de la recherche se traduit par l'accueil et le co-encadrement d'étudiants ou élèves ingérieurs sur des sujets définis en concertation avec les établissements d'enseignement supérieur.

Atelier de travail "Télédétection et occupation du sol"
Tunis, Décembre 1988

Thank you Mr. Chairman,

I would like to express my gratitude to the RAC/ERS for this meeting, which I believe would bring about essential contributions to the fulfillment of MAP activities, and I hope further success would be achieved at the subsequent meetings.

Environmental informations and data systems definitely make prompt and considerable scientific and technical provisions at almost every phase of decision-making, particularly at national development plans.

The Mediterranean countries, in this connection, are preliminarily in need of convenient and timely environmental information and data systems when they are making their coastal areas management plans. Thanks to the RAC/ERS for its attempts to meet this need.

I firmly believe that a cooperation of this kind will, at the same time, create close ties and maintain a friendly atmosphere full of love and peace towards the solution of environmental problems of the Mediterranean Basin.

To this end, various methods should be developed to enhance further cooperation and realize much faster exchange of information and data among the Mediterranean countries.

Additionally, larger number of courses, whose subjects would be aspects of data collection such as remote sensing techniques and evaluation systems like Geographic Information Systems, together with their applicability, could be arranged to assist a higher number of attendants. This, I am sure, will make further contributions to the desired level of success.

Presentation of Turkey - Exposé de la Turquie

Yet, political and economic decision-making has not been fully integrated with the environmental dimension in Turkey, which, however, is an issue considered to be foremost and is under scrutiny of public interest. We are expecting the seemingly independent and disconnected activities to be incorporated and integrated with the planned activities of the Ministry of Environment of Turkey.

The Ministry, under these circumstances, has been trying to re-assess the existing environmental situation and make the required plannings. Henceforward, the feasibility of "Environmental Inventory and Information System" has been set up so that system exchange could be realized and facilitated among national and international information and data systems.

Besides, a Geographic Information System to integrate and utilize the data collected from various sources is underway. The Ministry will, then, be able to give access, through this data bank, to all necessary information, to any organisation submitting request.

The Turkish Ministry of Environment evidently intends to take the principles, experience and competence of CTM as a guideline to its performance in Turkey. Our co-activities with RAC/ERS and the training sevices which we can greatly make use of will be to the benefit of Turkey in accelerating the realization of the planned activities. Thus, the "Environmental Management Plans" , which are symbols of a new concept will be prepared and founded on a more realistic and solid base.

Thank you!

ANNEX V

RECOMMENDATIONS

1. to thank Italy and CTM for the financial and technical support given to RAC/ERS during the biennium 1994-95; and to request the continuation of this vital support for the biennium 1996-97;

2. to re-affirm the important contribution that remote-sensing techniques can provide to the implementation of scientific and socio-economic activities of MAP, by adding a dynamic dimension to the observation, study, planning and control of the environmental conditions and changes in the Mediterranean basin;

3. to stress the need for a close cooperation between the MAP's RACs and RAC/ERS by introducing, as appropriate, the remote-sensing techniques in the implementation of the approved programmes (e.g. to contribute to the management of protected areas, the study of socio-economic trends, the Mediterranean Observatory, the control of oil-spills, the integrated coastal and marine areas management, etc) in order to enhance the scope and the results of such programmes;

4. to ask RAC/ERS to propose, in co-operation with the focal points, and as appropriate, help to the implementation of the practical uses of the remote sensing techniques, for the monitoring of relevant coastal and marine pollution parameters;

5. to ask RAC/ERS to participate and to contribute to regional projects of MAP and other international organizations, which contribute to the sustainable development of individual countries as well as the Mediteranean as a whole and which deal with climatic changes, biodiversity and natural hazards;

6. to ask RAC/ERS to develop methodologies, that would combine remote-sensing, Geographic Information Systems, mathematical modelling, for investigating problems typical of Mediterranean countries, especially in the preparation of Environmental Impact Assessment (EIA), particularly in relation to:
   - pre and post evaluation of impacts of proposed major projects
   - identification of land and marine management strategies
   - identification of transboundary impacts

7. to ask RAC/ERS to disseminate and exchange information with the respective Mediterranean countries on the availability of remote sensing data, developments in software, and other relevant developments in the field;

8. to ask RAC/ERS to work towards promoting a common approach and strategy for the standardization of data collection and analysis that would enable the establishment of an "information base" common to all Mediterranean countries;

9. to ask RAC/ERS to contribute to projects of the ongoing and future CAMP programmes (dealing with coastal erosion, land use, seismic risks, integrated planning, implications of climatic changes, specially protected areas, etc);

10. to ask RAC/ERS to continue to develop the study of the method named "COSMOS";

11. to ask RAC/ERS to co-operate with Blue Plan RAC in setting up and developing the Mediterranean Observatory by using the remote sensing techniques;

12. to ask RAC/ERS to continue developing the project on classification and monitoring of vegetation in all the Mediterranean region through the use of remote sensing;

13. to ask RAC/ERS to continue its work on the preparation and updating of the Directory of Remote Sensing Centre in the Mediterranean;

14. to ask RAC/ERS to organize during the biennium 1996-97, training courses on remote sensing techniques and applications that can prove of benefit towards the sustainable development of the whole Mediterranean Region;

15. to ask RAC/ERS to regularly convene Meetings of Focal Points.