



Centre Royal de Télédétection  
Spatiale



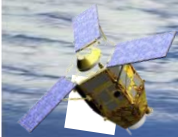
المركز الملكي للاستشعار البعدي  
الفضائي

**Royal Center for Remote Sensing**  
***Strategic tools for decision making***

## ***EARTH OBSERVATION FOR NATIONAL DEVELOPMENT STRATEGIES***

**United Nations/United Arab Emirates High Level Forum**  
**“Space as a driver for socio-economic sustainable development”**

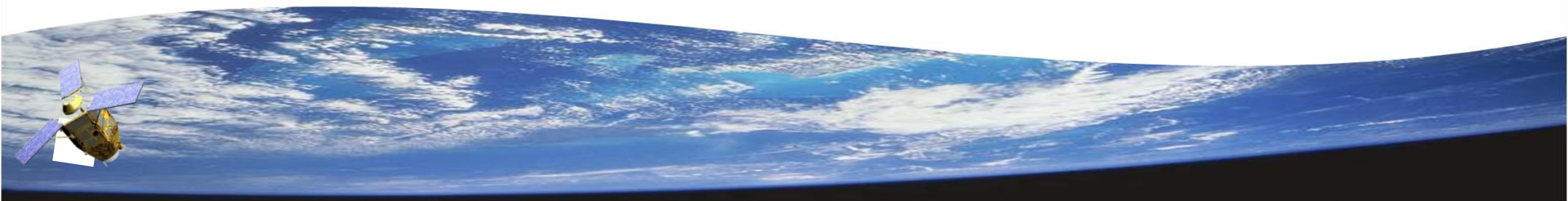
*20 – 24 November 2016*  
*Dubai, United Arab Emirates*





*Morocco must address environmental challenges, with limited and fragile natural resources.*

- *Conservation and management of water resources*  
Morocco's average water availability is well below the internationally accepted minimum standard and is subject to extreme seasonal and spatial fluctuations.
- *Renewable energies and energy efficiency*  
Morocco currently relies on fossil energy imports for 95 per cent of its fuel supply, and yet it has outstanding potential for renewable energy use
- *Environment and climate change*  
Morocco's development depends to a large extent on whether it can reduce environmental damage and conserve its natural resources so that they are available for use on a sustainable basis
- *Food security*  
**Agriculture is** the backbone of the economy, with over half the active labor force working in farming. However, Morocco faces some significant challenges, particularly with **drought** and soil **degradation**.





# MOROCCO'S SECTORAL DEVELOPMENT STRATEGY

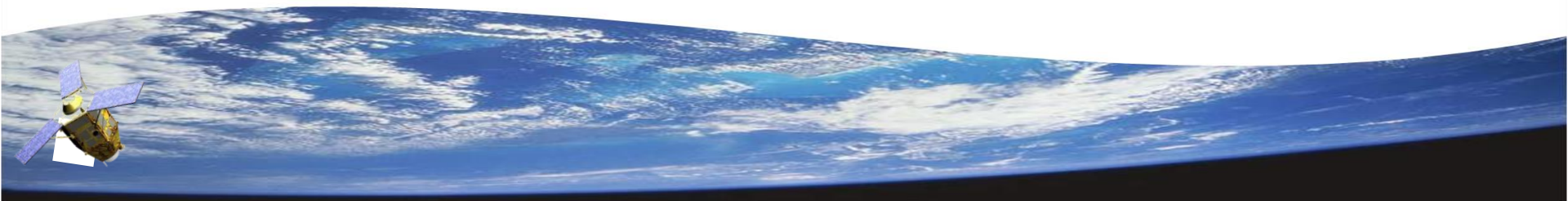






## SATELLITE IMAGES : OBSERVATIONS TO UNDERSTAND, KNOWLEDGE TO ACT ...

- These Strategies and Plans **require comprehensive and integrated data and information** to:
  - Know
  - Locate
  - Quantify
  - Assess developments
  - Detect changes
  - Control Uses
  - Evaluate Impacts

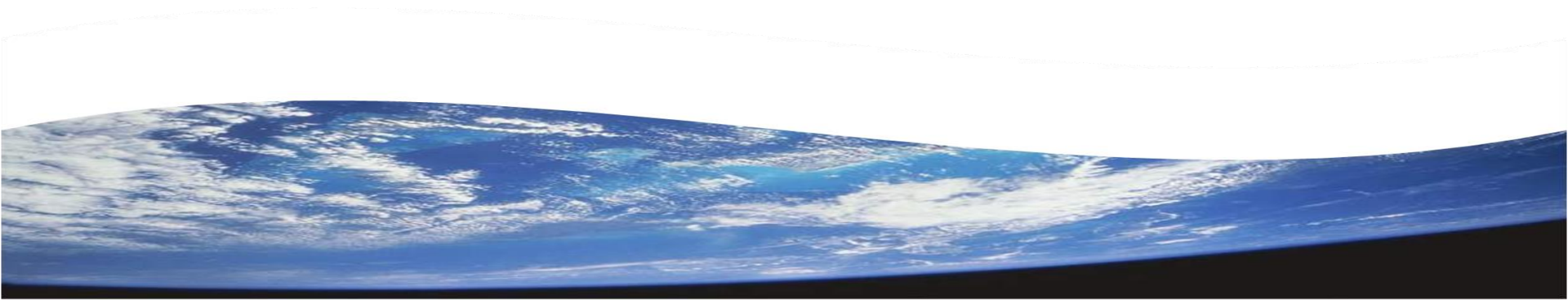






## The Vision

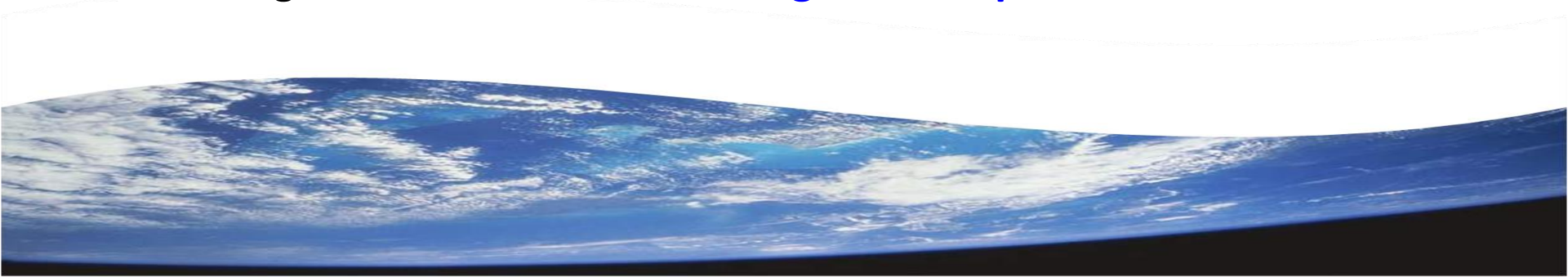
- Translating space technologies into operational tools
- Integrating geospatial information in the sustainable development Value Chain.
- Space Sciences : Astronomy
- Space Technology : Small Sat / ground infrastructures / Gallelio consortium
- Space Applications





## The CRTS Strategic Missions

- Develop and facilitate **operational uses of Earth Observation technologies** to meet users needs and and to support decision makers involved projects addressing social and economic development.
- Ensure an easy, permanent, optimal and cost-effective **access to satellite data** to all users.
- **Capacity Building** and Human Capital development to maximize the use of space technologies in the country through : **training and education** activities and **R&D programs** as well as **public awareness** initiatives.
- Strengthen **international and regional cooperation**.



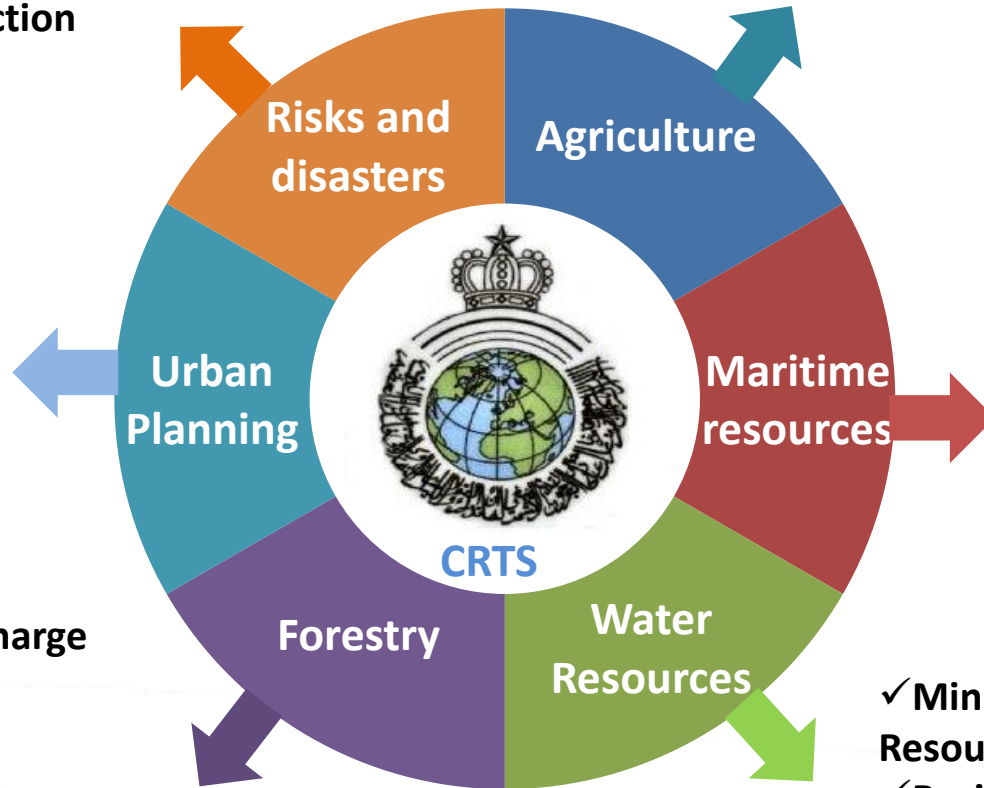


## Value Added Services to Support The User Community

- ✓ Ministry of Interior
- ✓ Royal Police
- ✓ Regional Governorates
- ✓ Civil Protection Department

- ✓ Ministry of Agriculture
- ✓ Irrigation Agencies

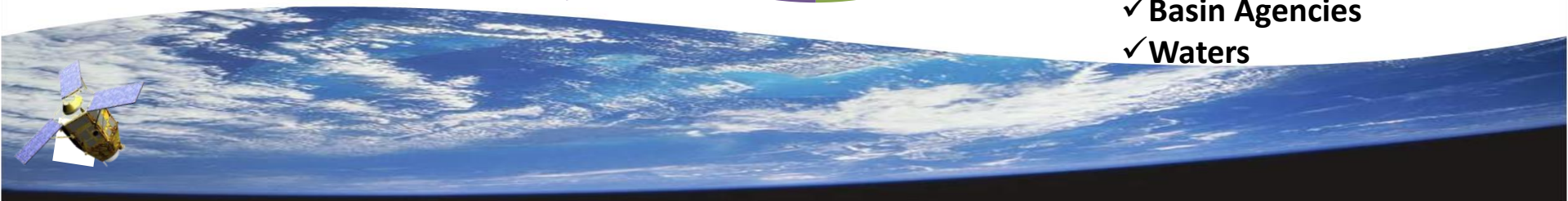
- ✓ Ministry of land Management
- ✓ Urban Planning Agencies
- ✓ Local Authorities
- ✓ Private companies



- ✓ Ministry in charge of fisheries
- ✓ National Agency of Aquaculture
- ✓ National Agency of Harbors
- ✓ Fisheries National Office

- ✓ High Authority in charge of Forest resources
- ✓ Regional Direction

- ✓ Ministry of Water Resources
- ✓ Basin Agencies
- ✓ Waters







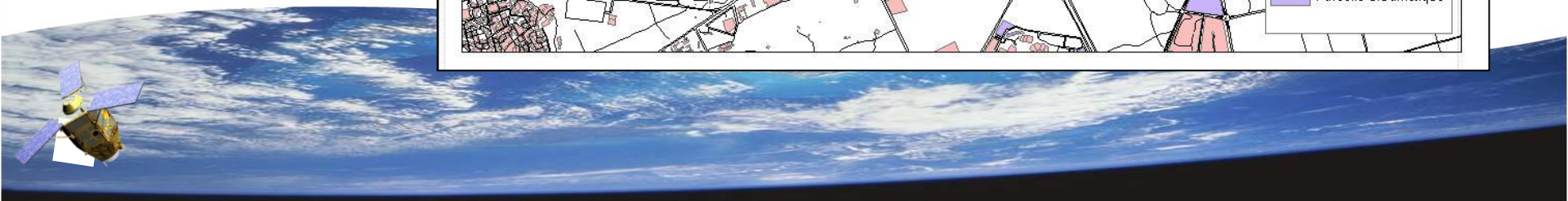
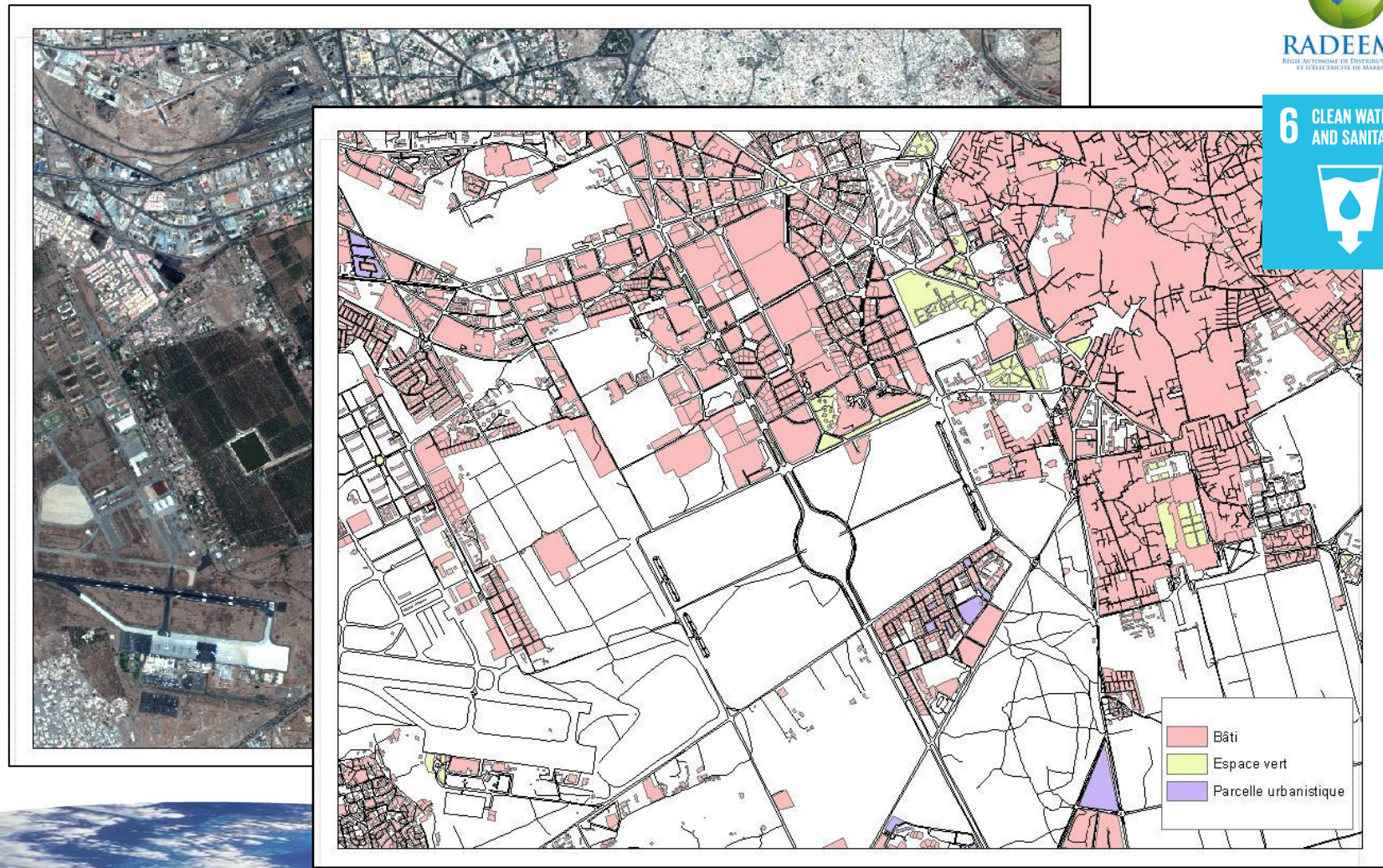
# Water and Sanitation Planning

End user



**RADEEMA**  
REGIE AUTONOME DE DISTRIBUTION D'EAU  
ET D'ÉLECTRICITÉ DE MARRAKECH

**6** CLEAN WATER AND SANITATION

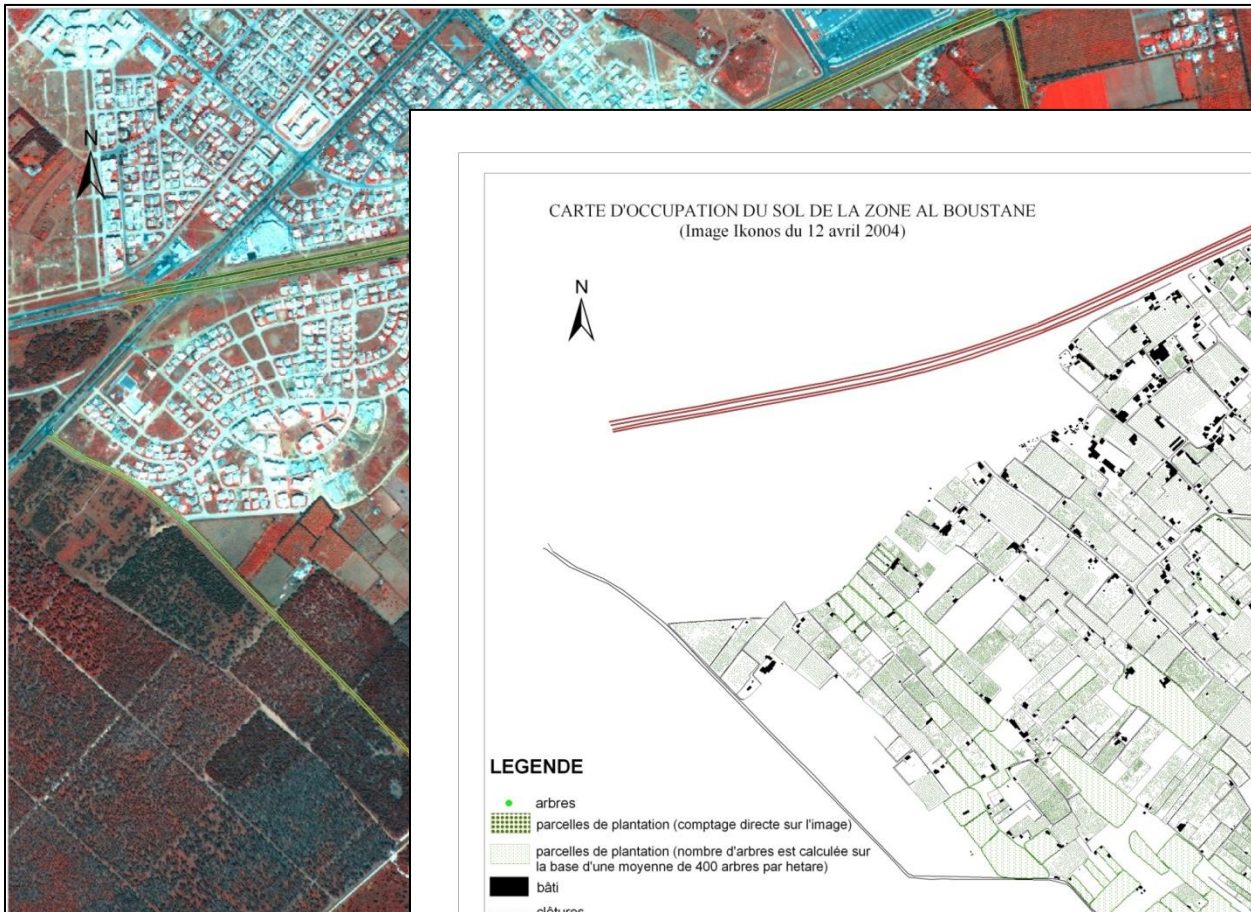




# Urban development management

End user : Société  
d'Aménagement Ryad

11 SUSTAINABLE CITIES  
AND COMMUNITIES



Rabat City

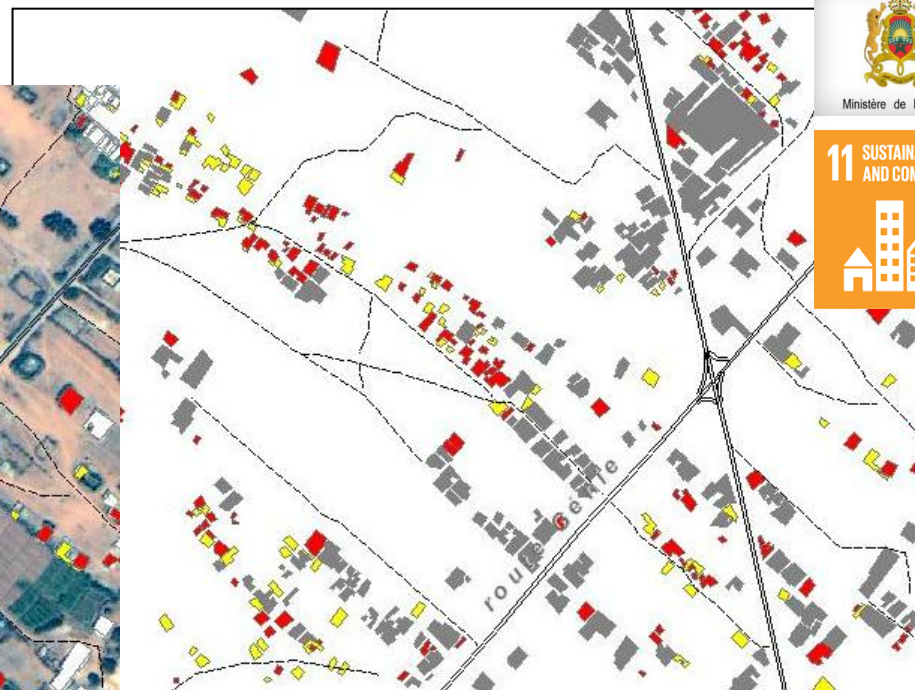
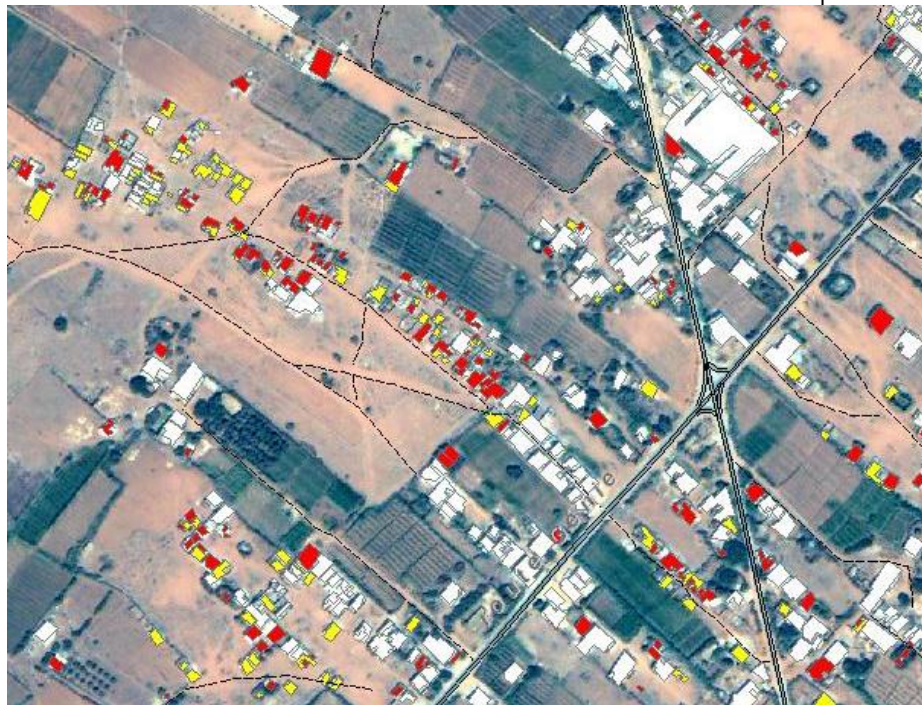




# Urban development management

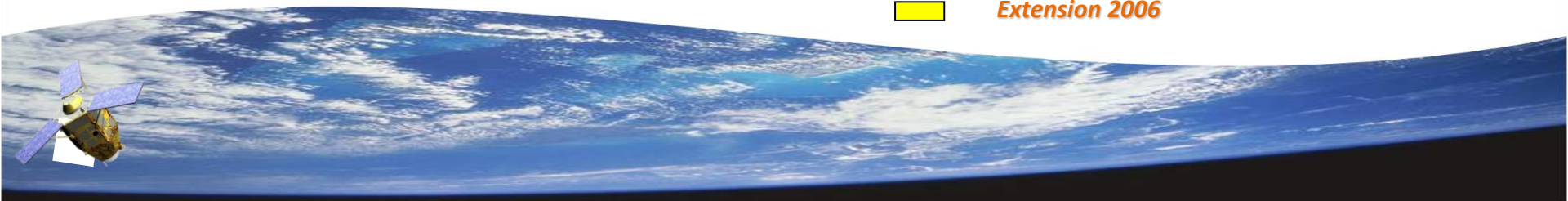
## Urban extension control to assist local authorities

End user



### Extension (cas du douar Brahma)

-  Situation 2001
-  Extension 2005
-  Extension 2006



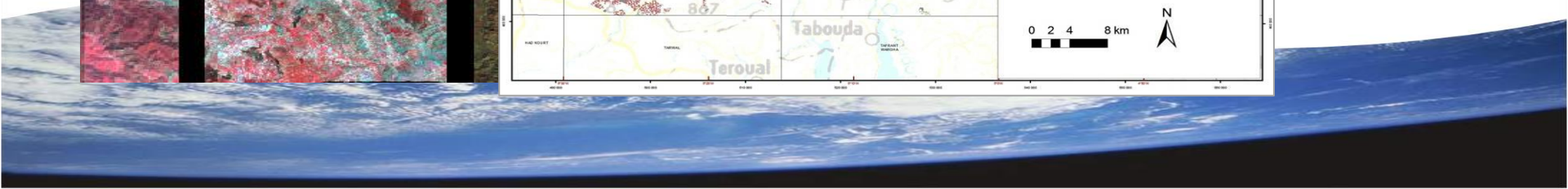
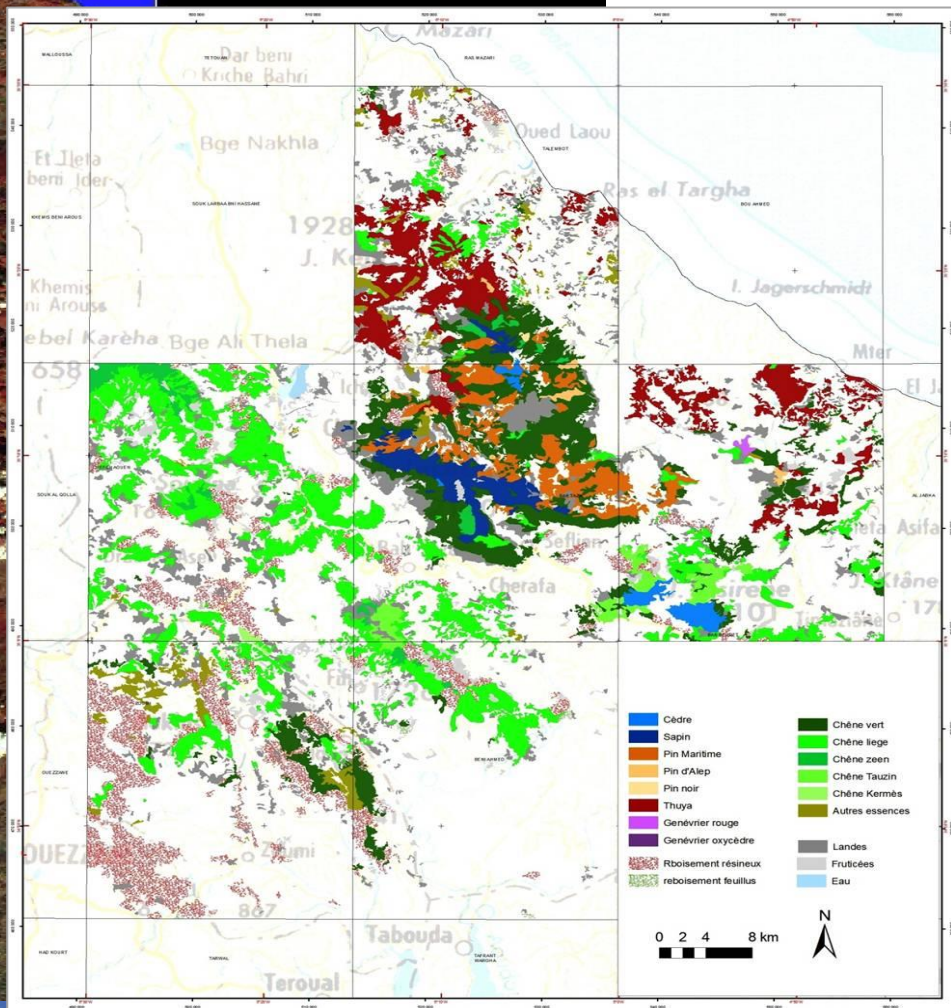
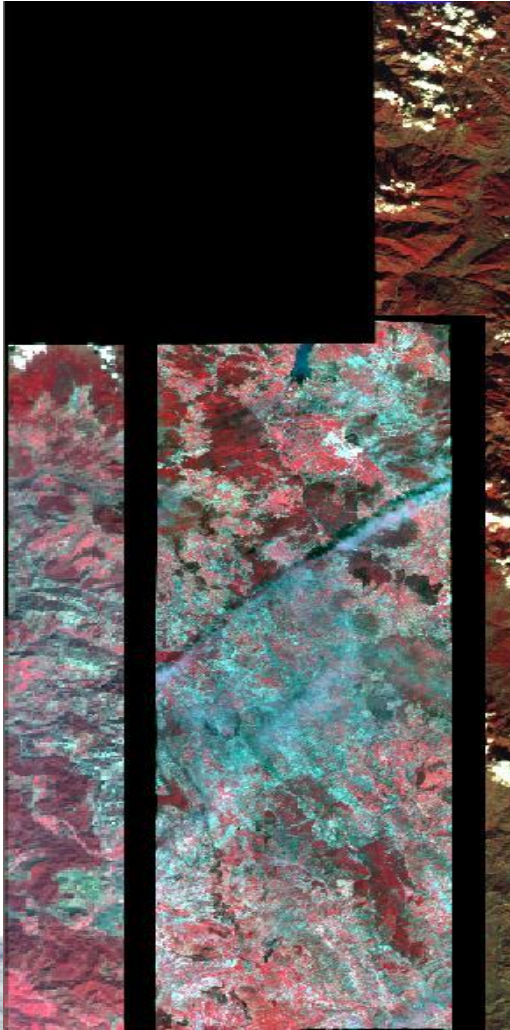




# Forest resources management

## Forest resources inventory

End user



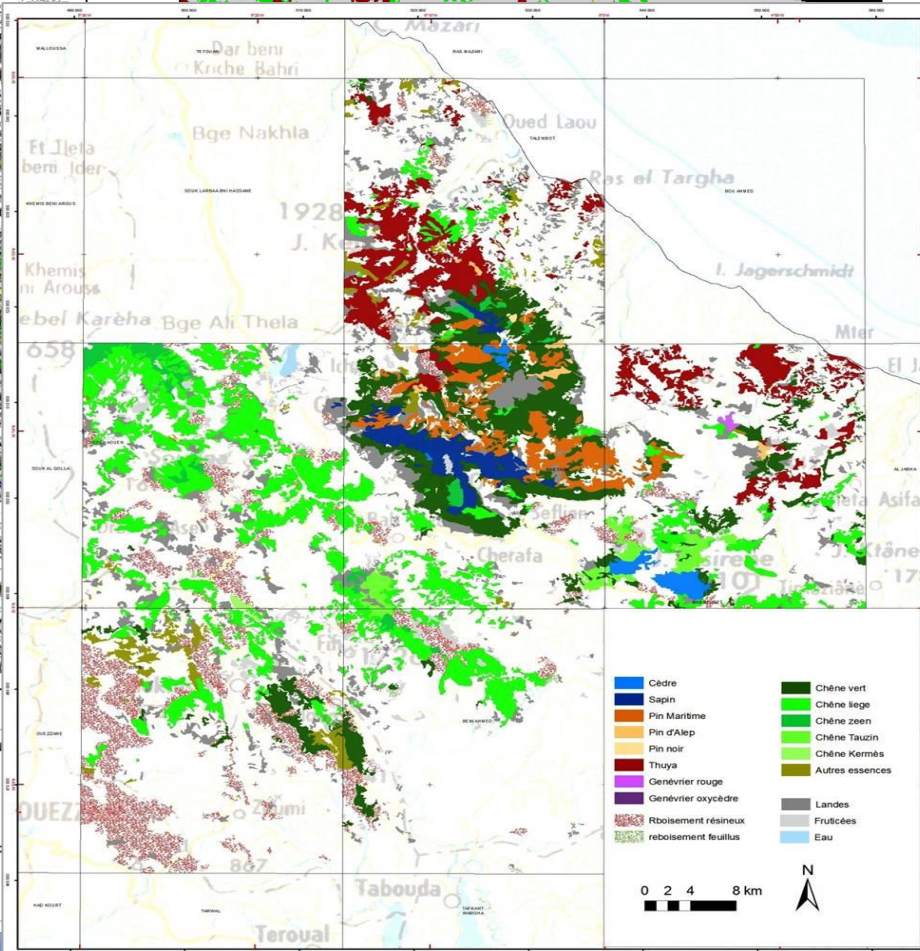
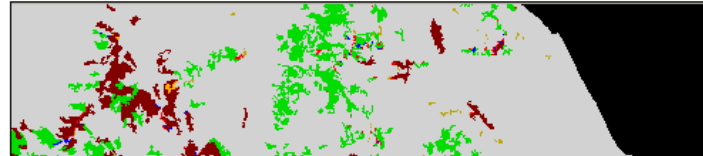
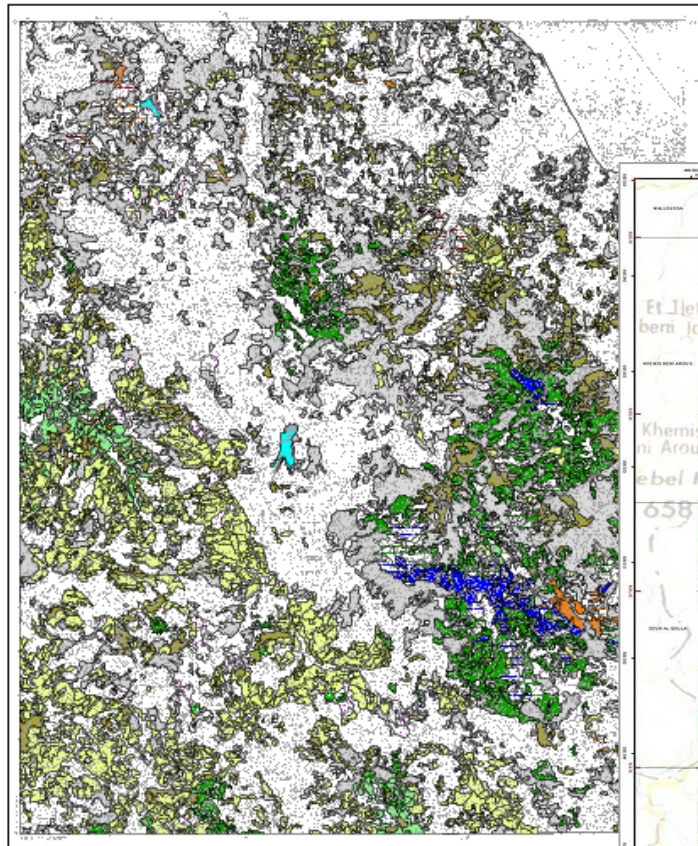




# Forest resources management

## Forest Cover Change Mapping

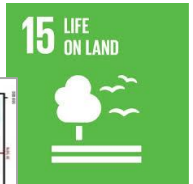
End user



**LEGENDE**

Résineux purs	Feuillus purs	Mélanges à dominance résineuse	Mélanges
Cèdre	Chêne-liège	Cèdre	FOF
Pin	Chêne vert	Pin	FOF
Genévrier	Chêne zéen	Genévrier	FOF
Thuya	Angarier	Thuya	FOF
Şapin	Autres feuillus	Sapin	FOF
Autres résineux		Autres résineux	FOF
		Matorral	FOF

Cèdre	Chêne vert
Sapin	Chêne liège
Pin Maritime	Chêne zéen
Pin d'Alep	Chêne Tauzin
Pin noir	Chêne Kermès
Thuya	Autres essences
Genévrier rouge	
Genévrier oxycèdre	
Rboisement résineux	Landes
Rboisement feuillus	Fruitières
	Eau







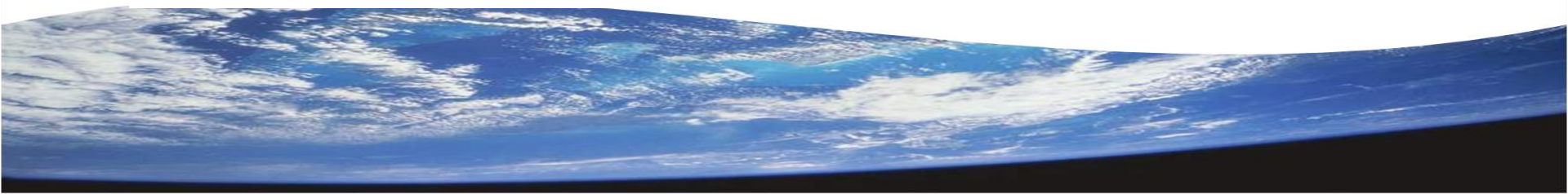
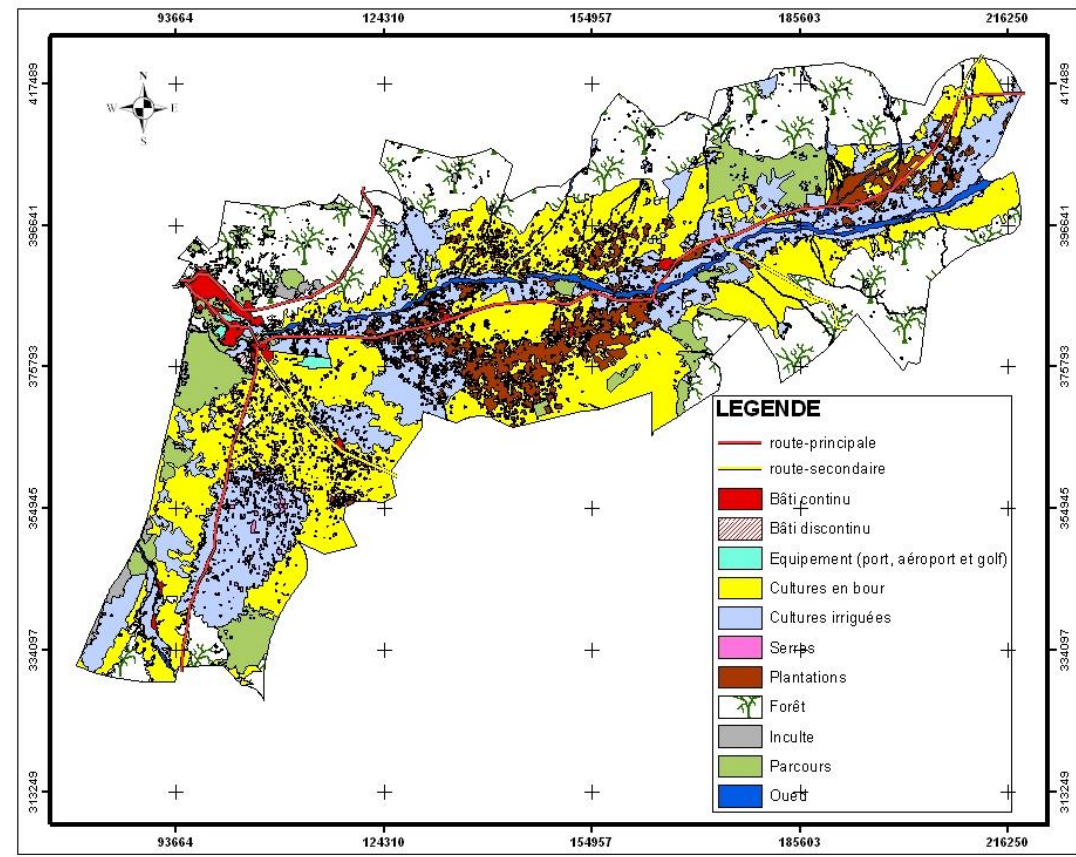
# Agriculture resources management

## Urban growth impact on arable lands

End user



Ministère de l'agriculture  
et de la pêche maritime

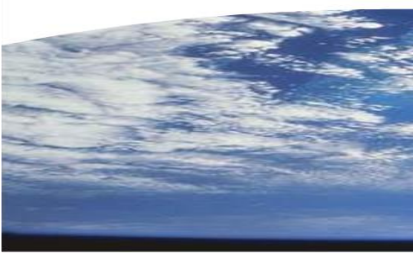
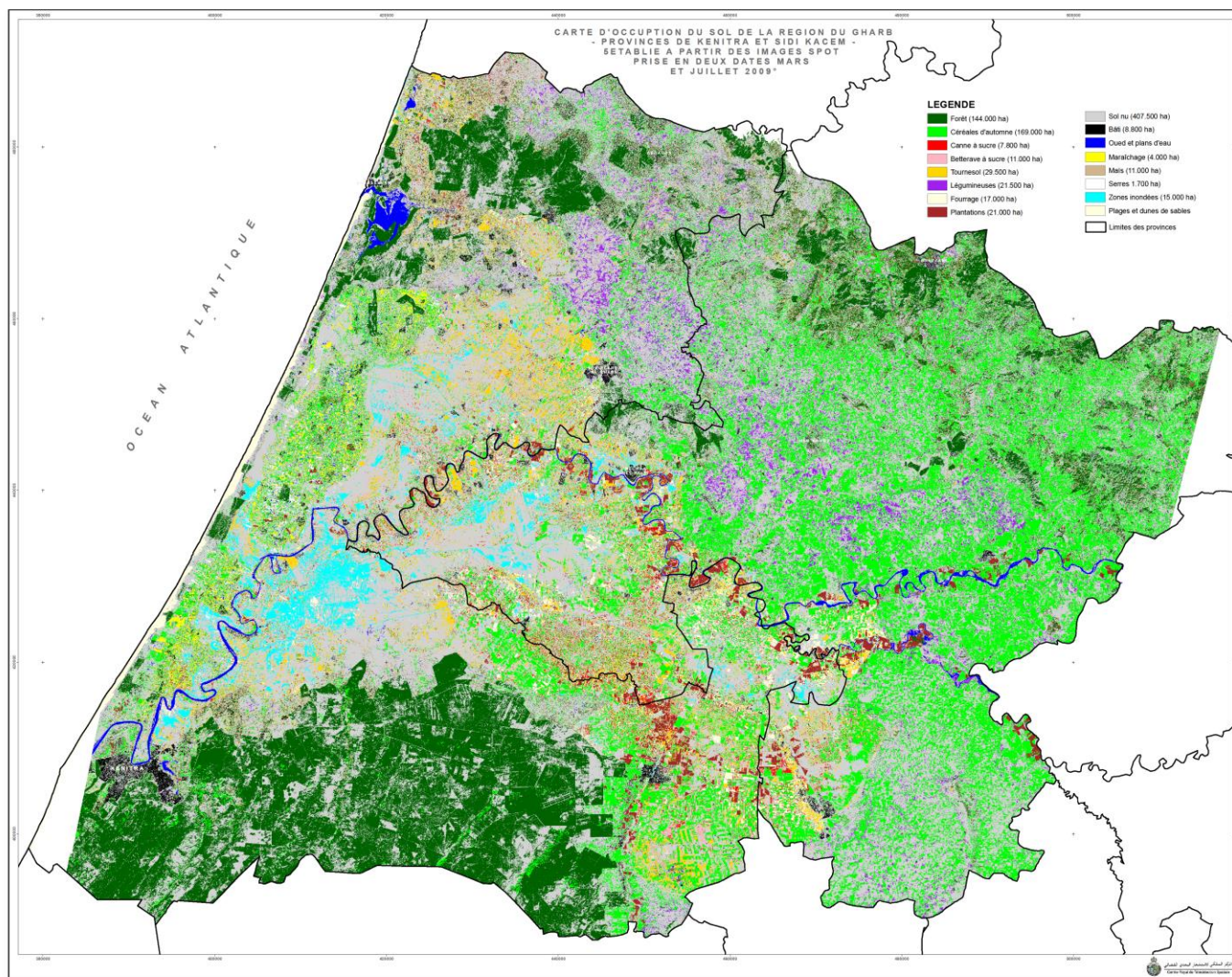






# Agriculture resources management land use Regional maps

End user



# Agriculture resources management

Monthly EO based Bulletin for crop monitoring and provides early insights on anomalies in crop condition aiding food supply and forecasts cereal production

Targeted users :

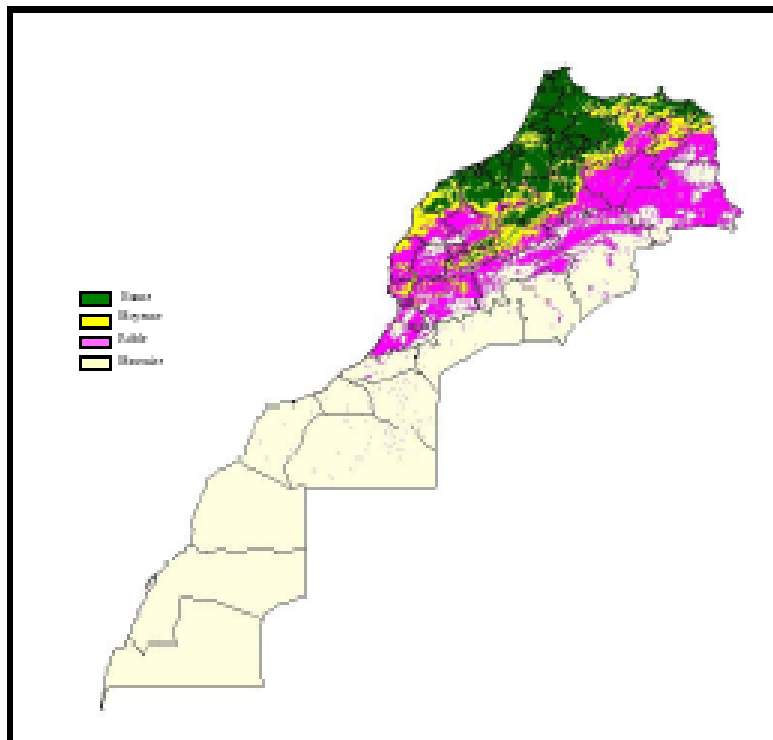
- Ministry of Agriculture
- Ministry of Interior
- Agriculture Development Agency
- Central Bank
- Insurance
- Research Community





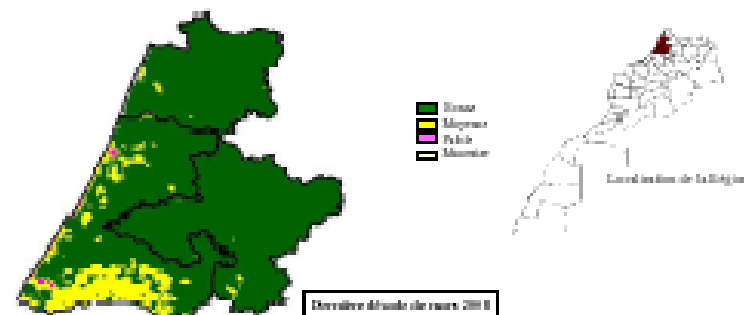
# Agriculture resources management

Situation à la troisième décade de mars 2008



A la troisième décade de mars 2008, l'état de la végétation est resté globalement stable et en bonne situation, par rapport au mois précédent sur les régions du nord, de la façade atlantique situées au nord de Casablanca, du Saïs et des côtes méditerranéennes de l'Oriental. On note une dégradation par rapport à la fin du mois de février dans les régions se situant au sud de la Chouia.

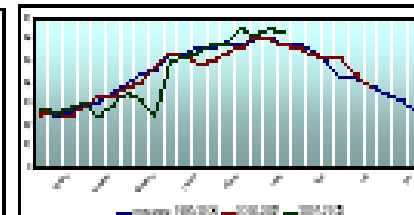
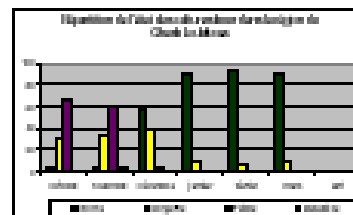
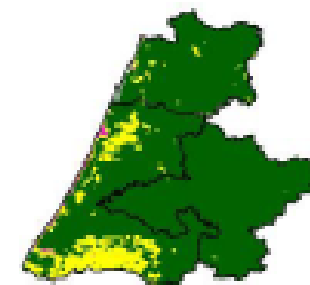
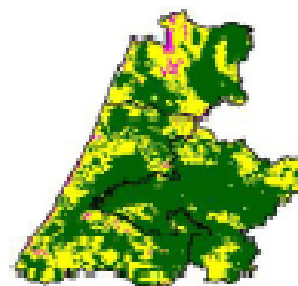
## EVOLUTION DES INDICES DE VEGETATION REGION DU GHARB LOUKKOUS



L'état de la végétation de la région de Gharb se trouve dans la même situation qu'à la fin de mois de février. Les cultures bovr se trouvent en bonne situation végétative représentant à la fin du mois de mars 2008 près de 99 % de leur superficie.

Décennie d'ensemble janvier 2008

Décennie d'ensemble de février 2008



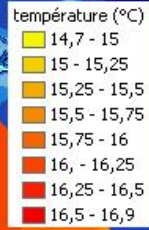
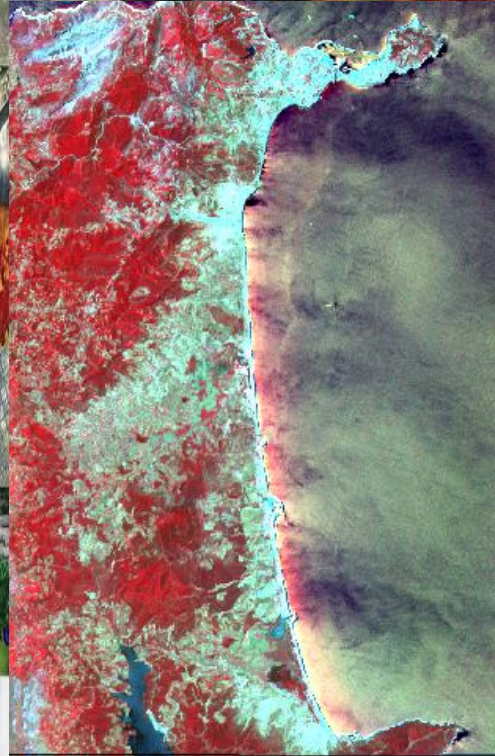
Profil d'indices de végétation moyens des cultures bovr de la région de Gharb



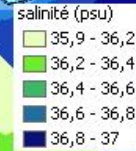
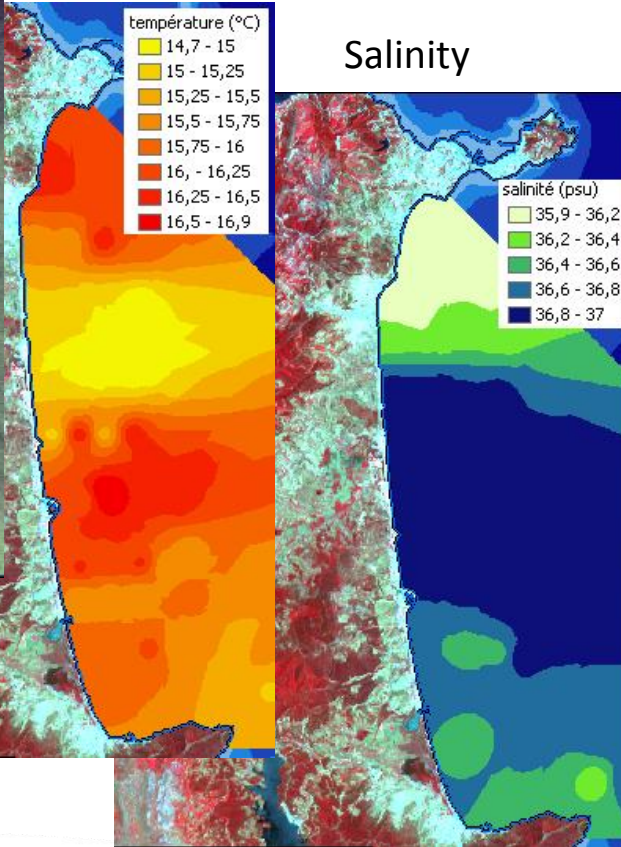
# Fisheries Management Planning

## Aquaculture Zones Identification

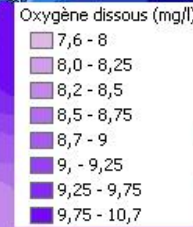
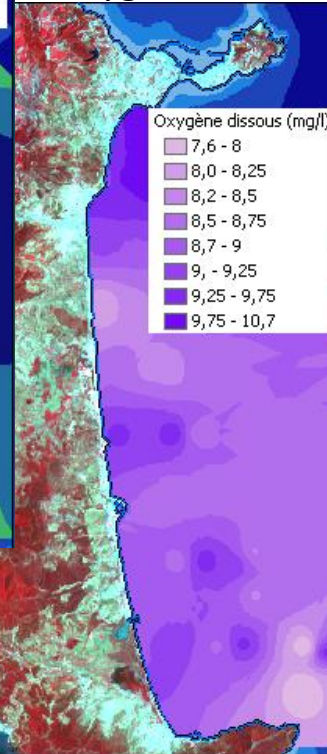
Temperature



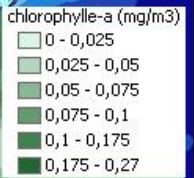
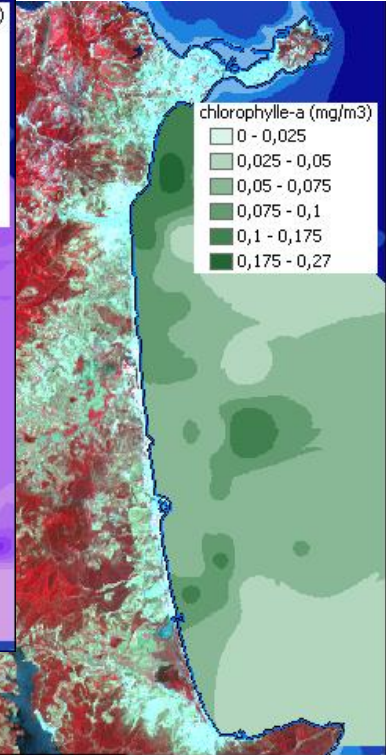
Salinity



Oxygen



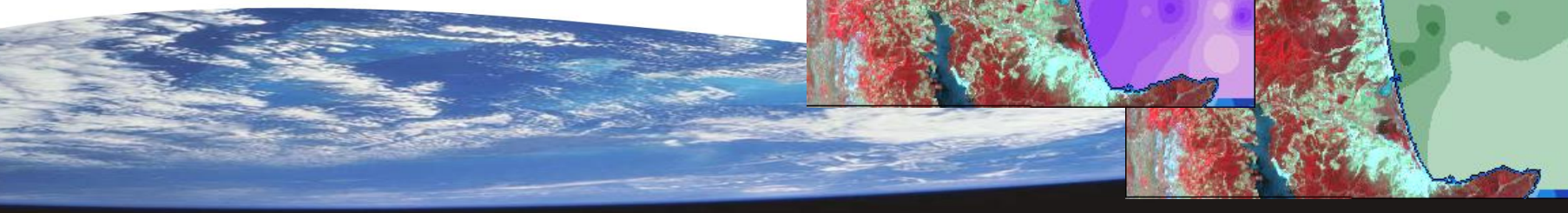
Chlorophyll a



14 LIFE BELOW WATER

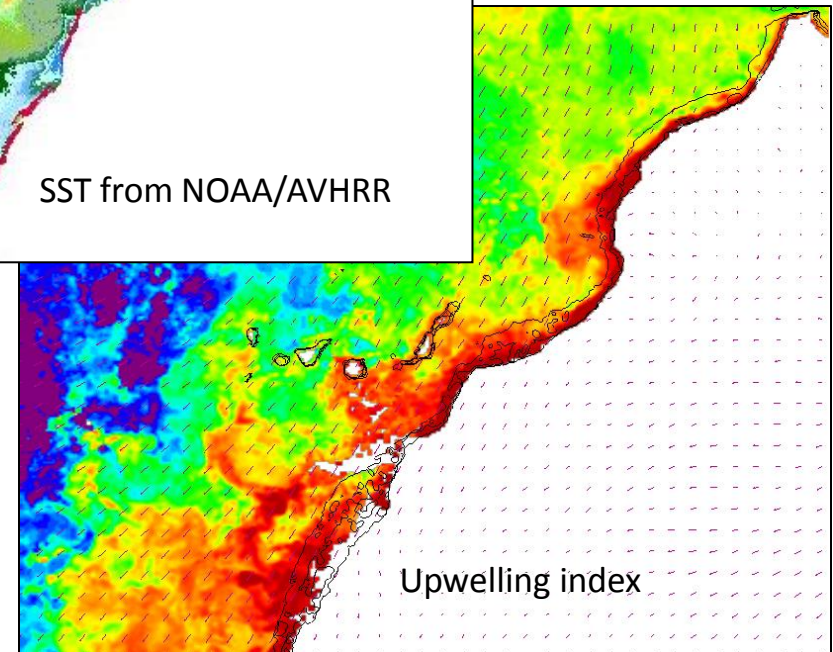
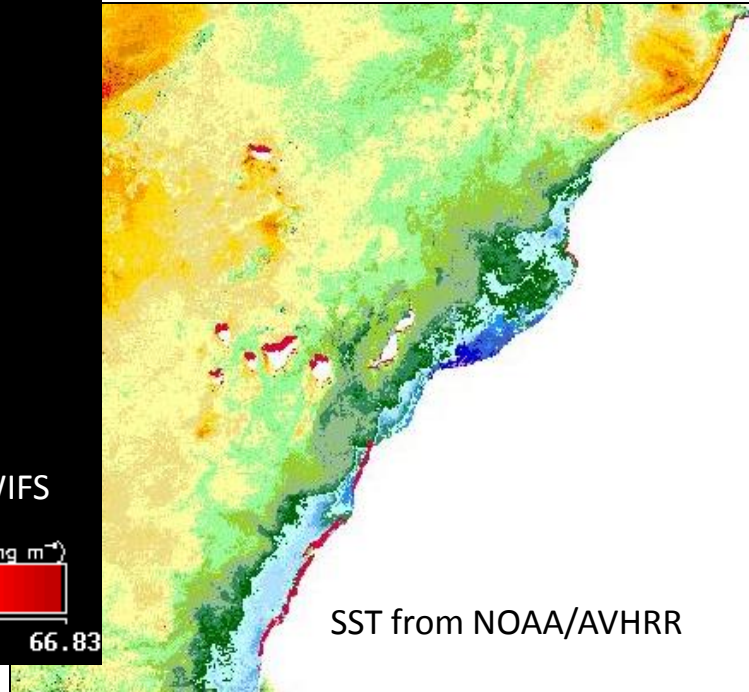
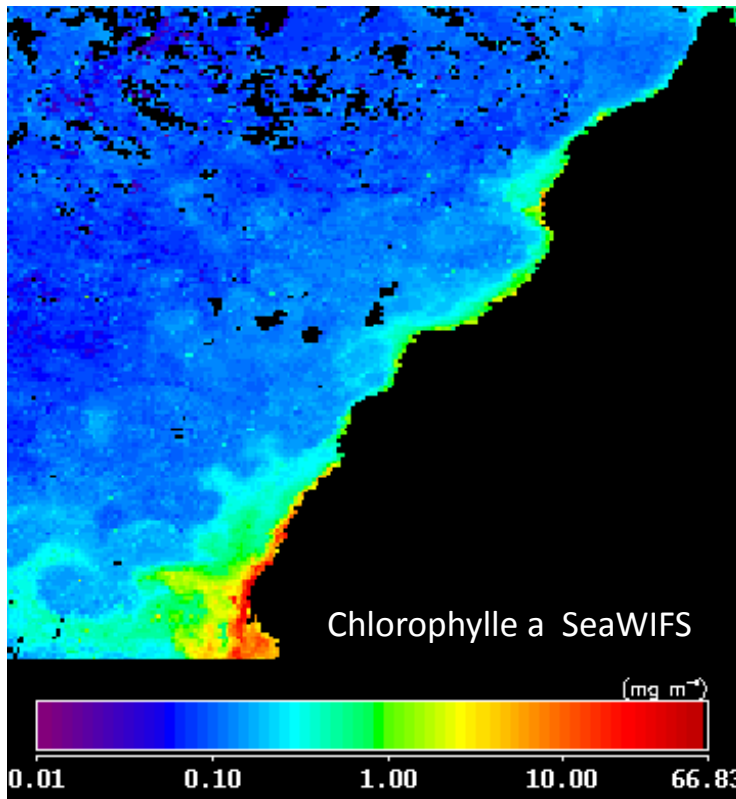


2 ZERO HUNGER





# Fisheries : location and evolution of Upwelling areas



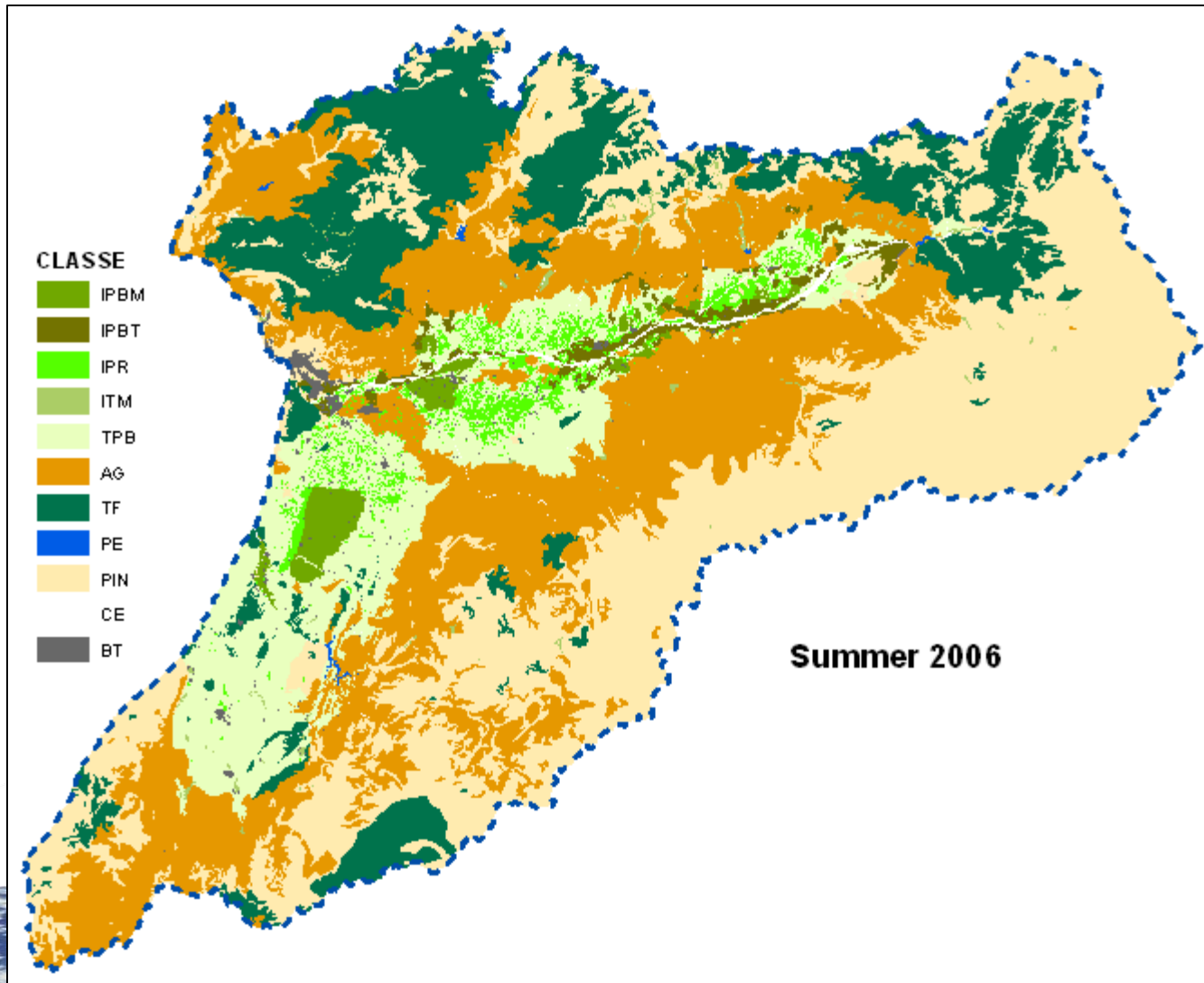
## Characterization of the Upwelling phenomenon along the Moroccan coasts

- Operational processing capacities based on several sources of satellite data (NOAA, SeaWiFS, Modis, ...)
- Production of periodic Upwelling indexes taking into consideration regional specifications



## Monitoring of Irrigated Zones Extension

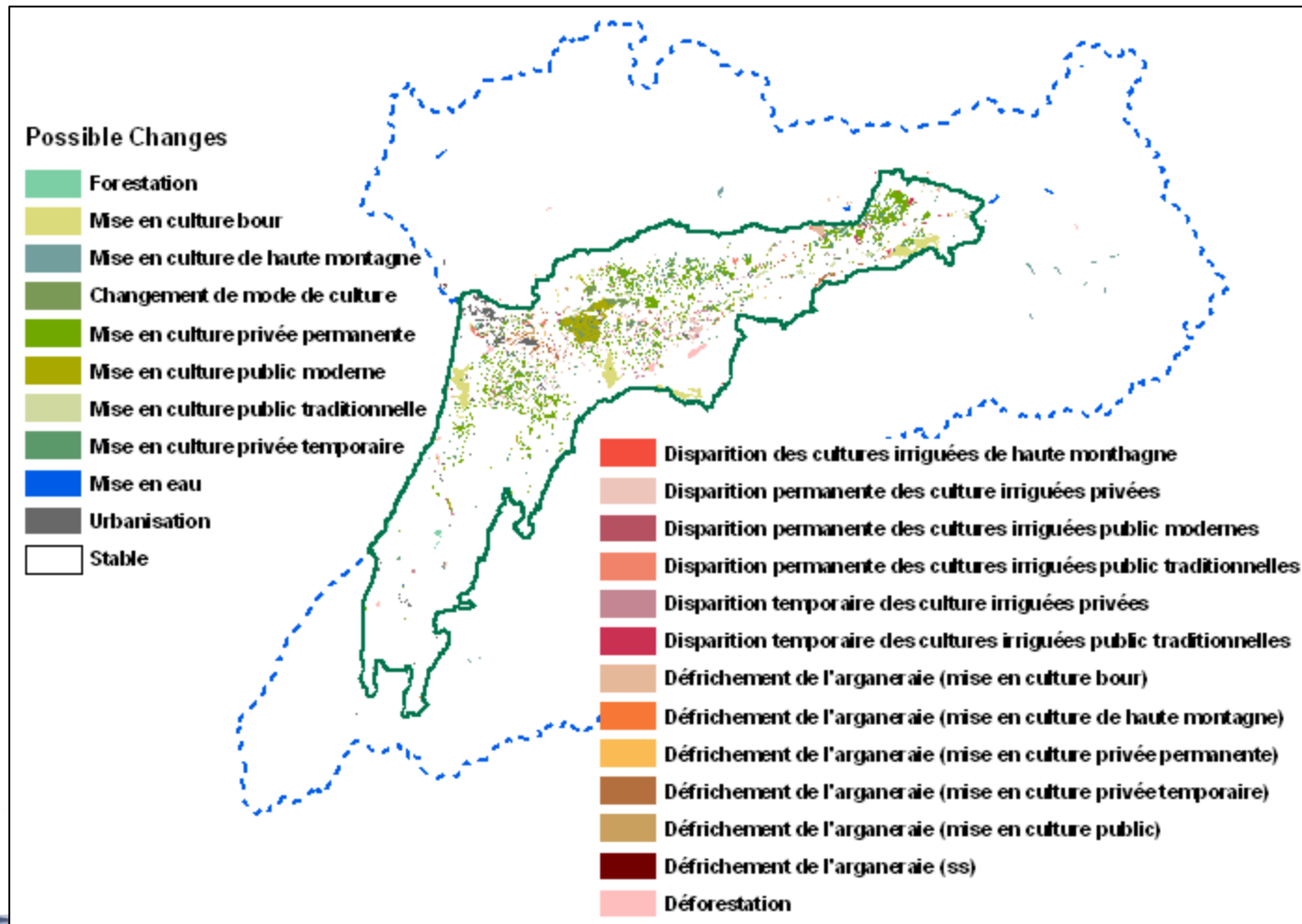
Land cover / Land use map



End user

## Monitoring of Irrigated Zones Extension

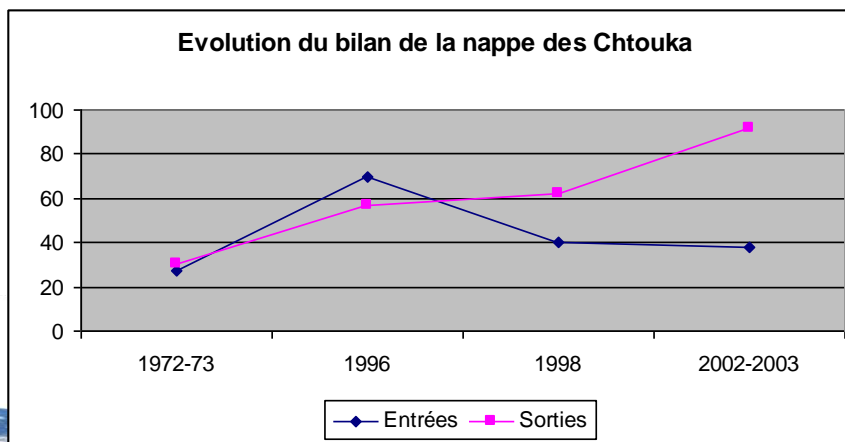
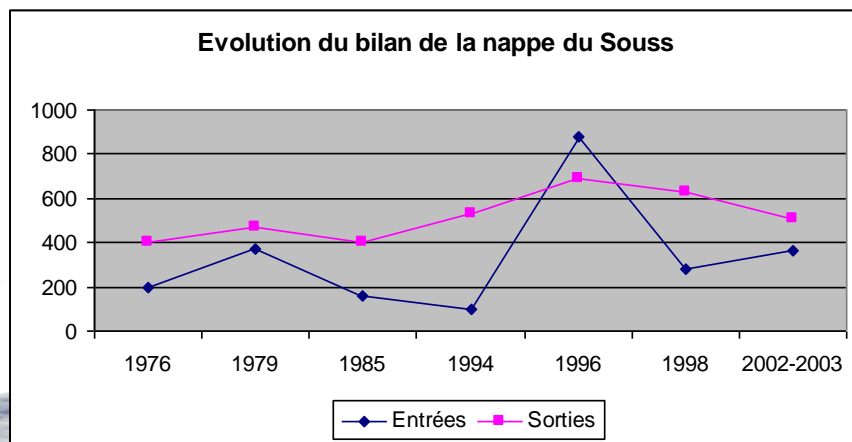
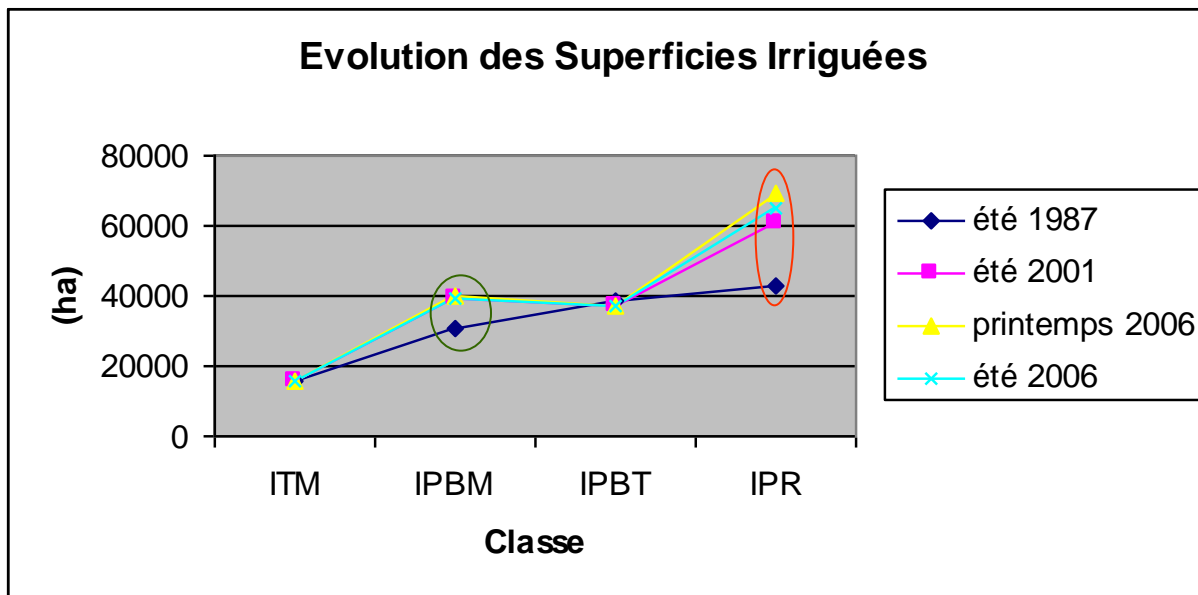
Change analysis

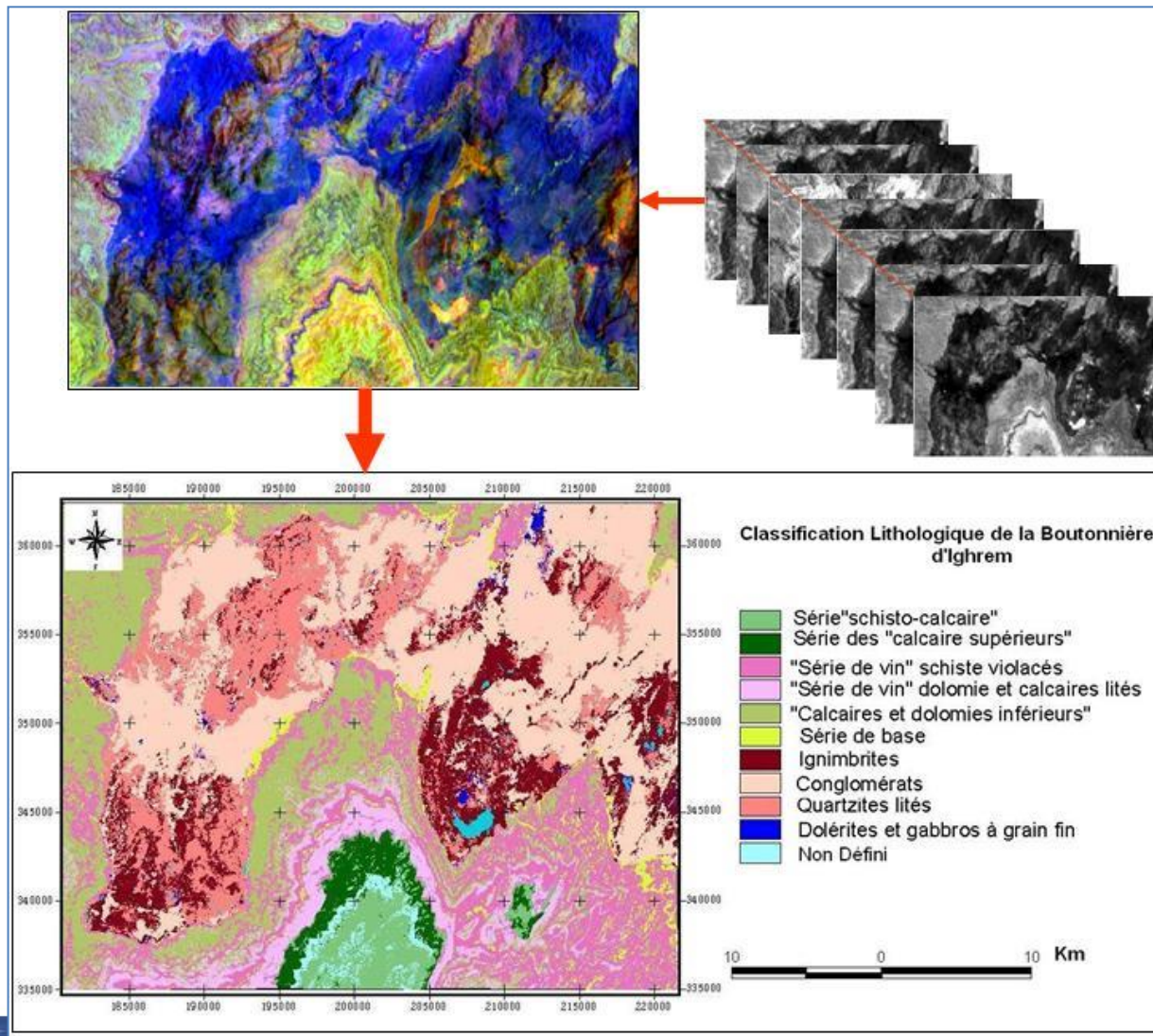




## Monitoring of Irrigated Zones Extension

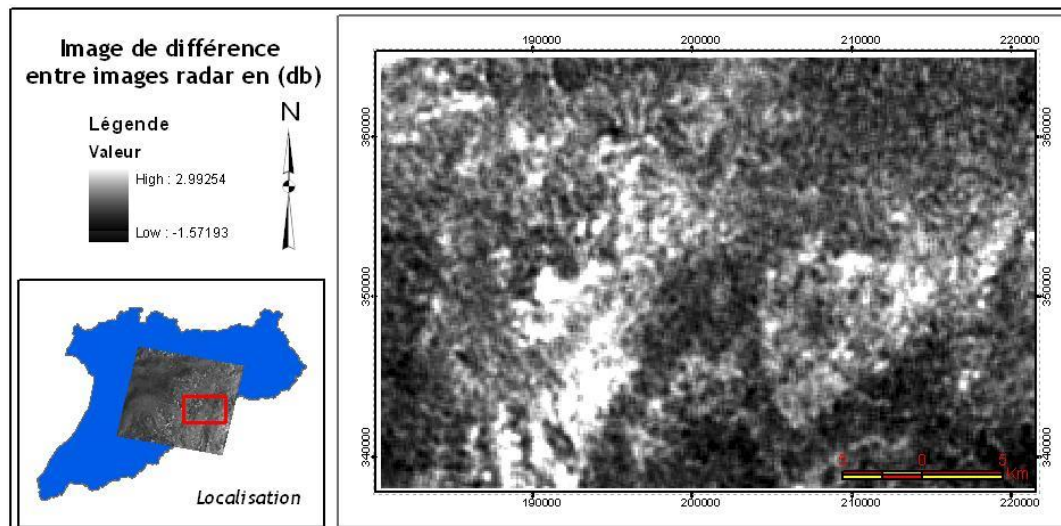
### Change analysis



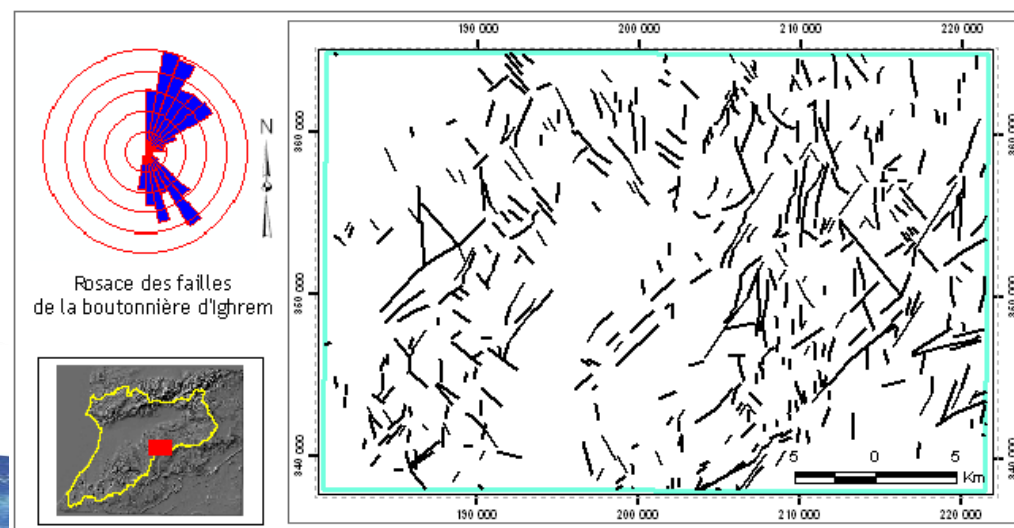


- **Information géologiques** : Résultat de la classification lithologique de la boutonnière d'Ighrem

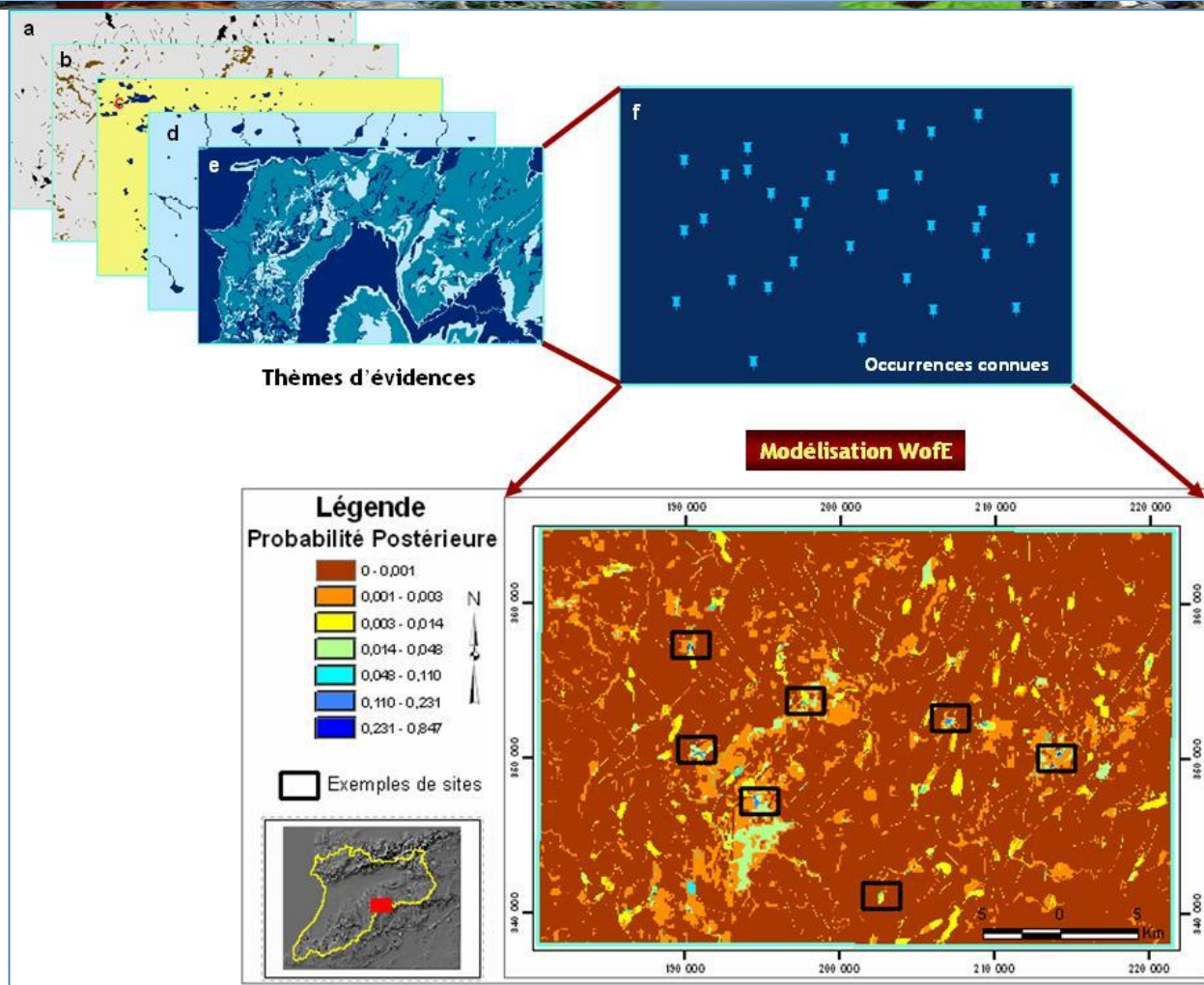




*Image de différence entre images radar*



*Carte des failles et leur diagramme de rosace directionnelle*



**Résultat de la modélisation : Identification de sites potentiels**  
( combinaison des thèmes d'évidences, a : les failles, b : la géomorphologie, c : l'humidité, d : l'hydrologie, e : la perméabilité ; et f : les occurrences connues)





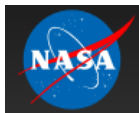
CRTS



## The Regional Coordination Project to improve Water Resources' Management and Capacity Building



LDAS-MOROCCO  
Integrating Remote Sensing Data in  
Water Resources and Agriculture Management



World Bank



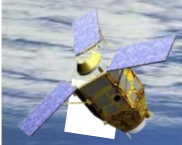


# LDAS-Maroc project partners

- Institutional Partners

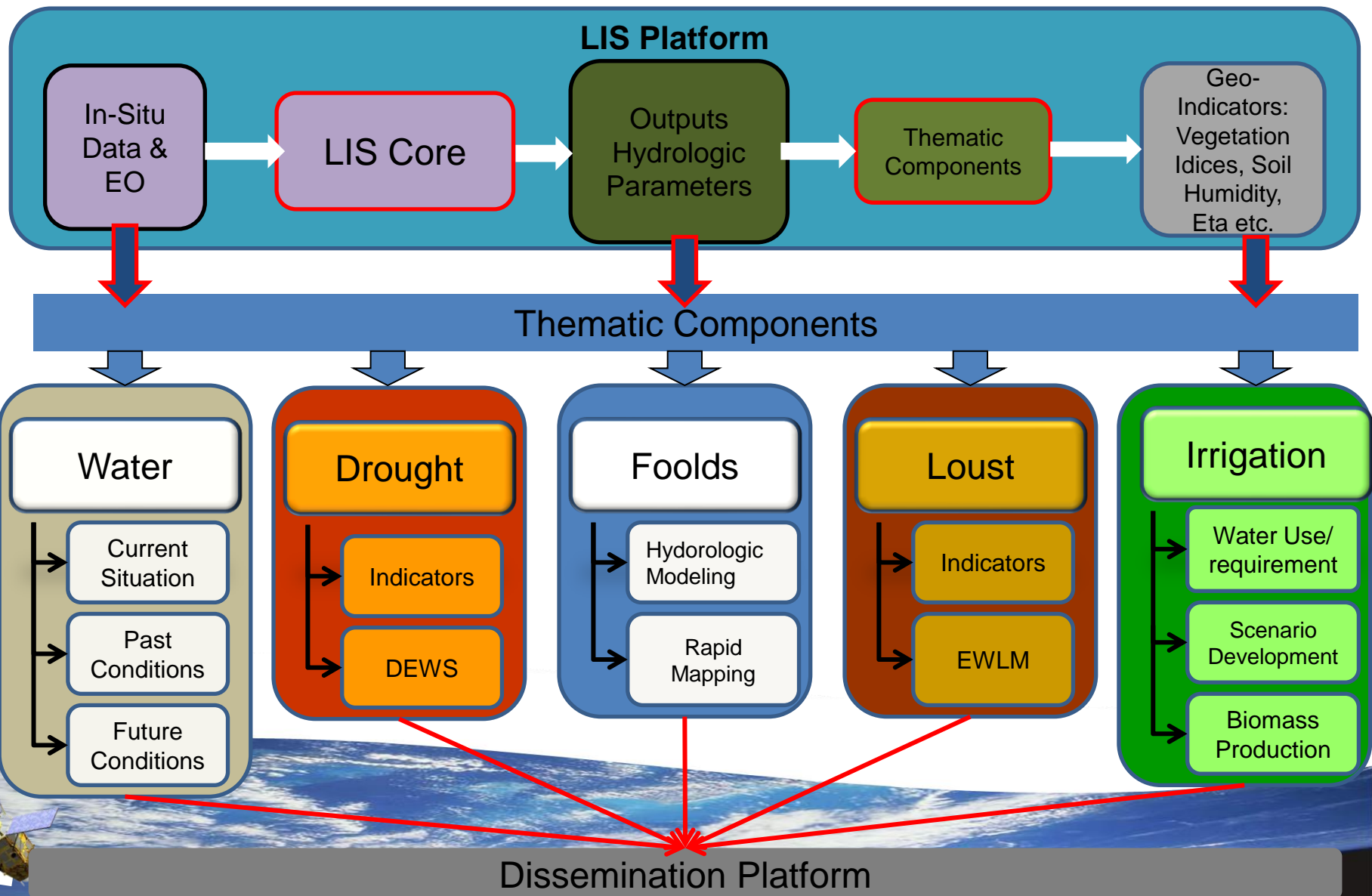


- International/ National expertise



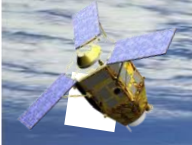
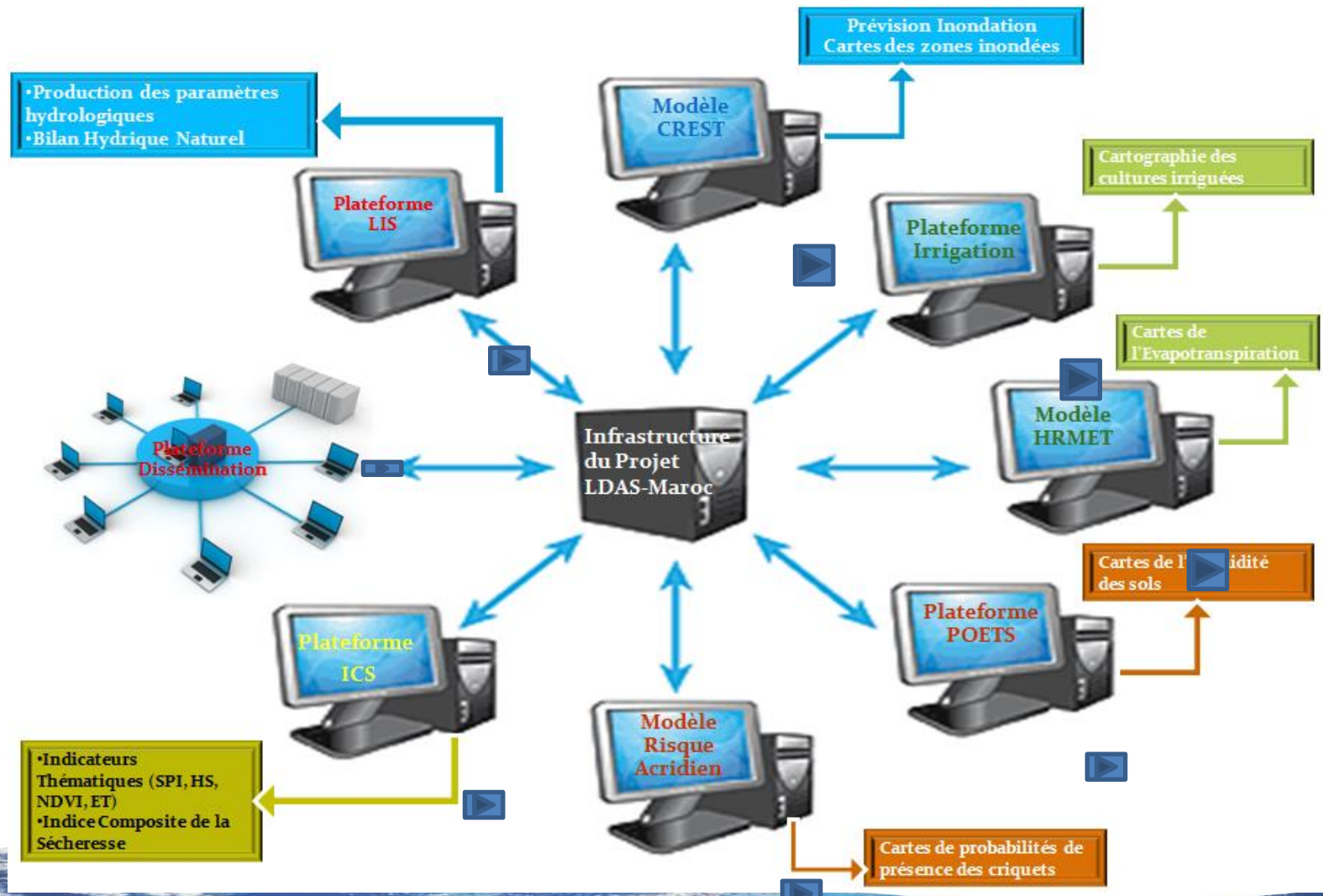


# LDAS-Marec Components





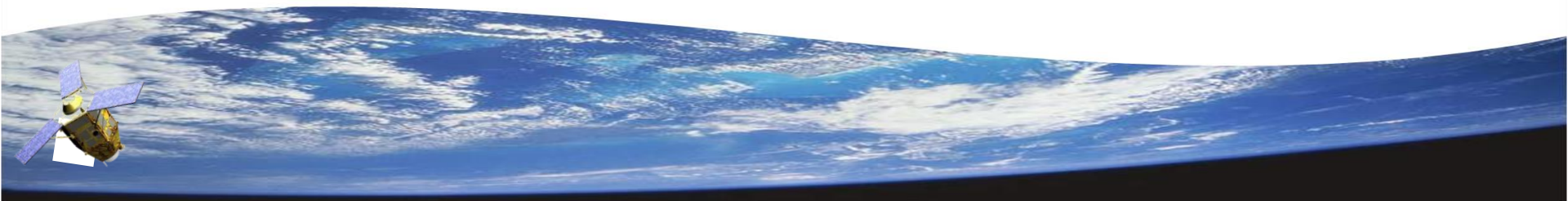
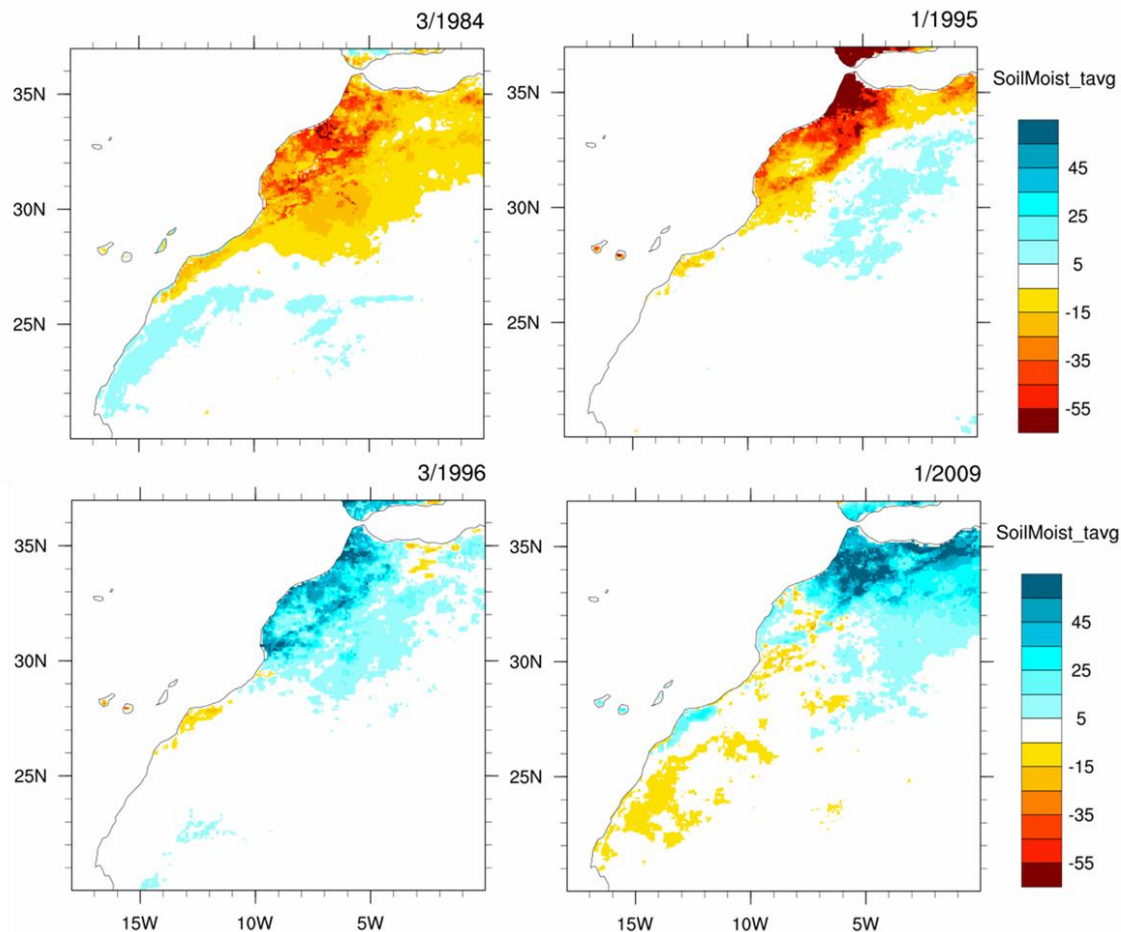
# LDAS - Projets et Outils







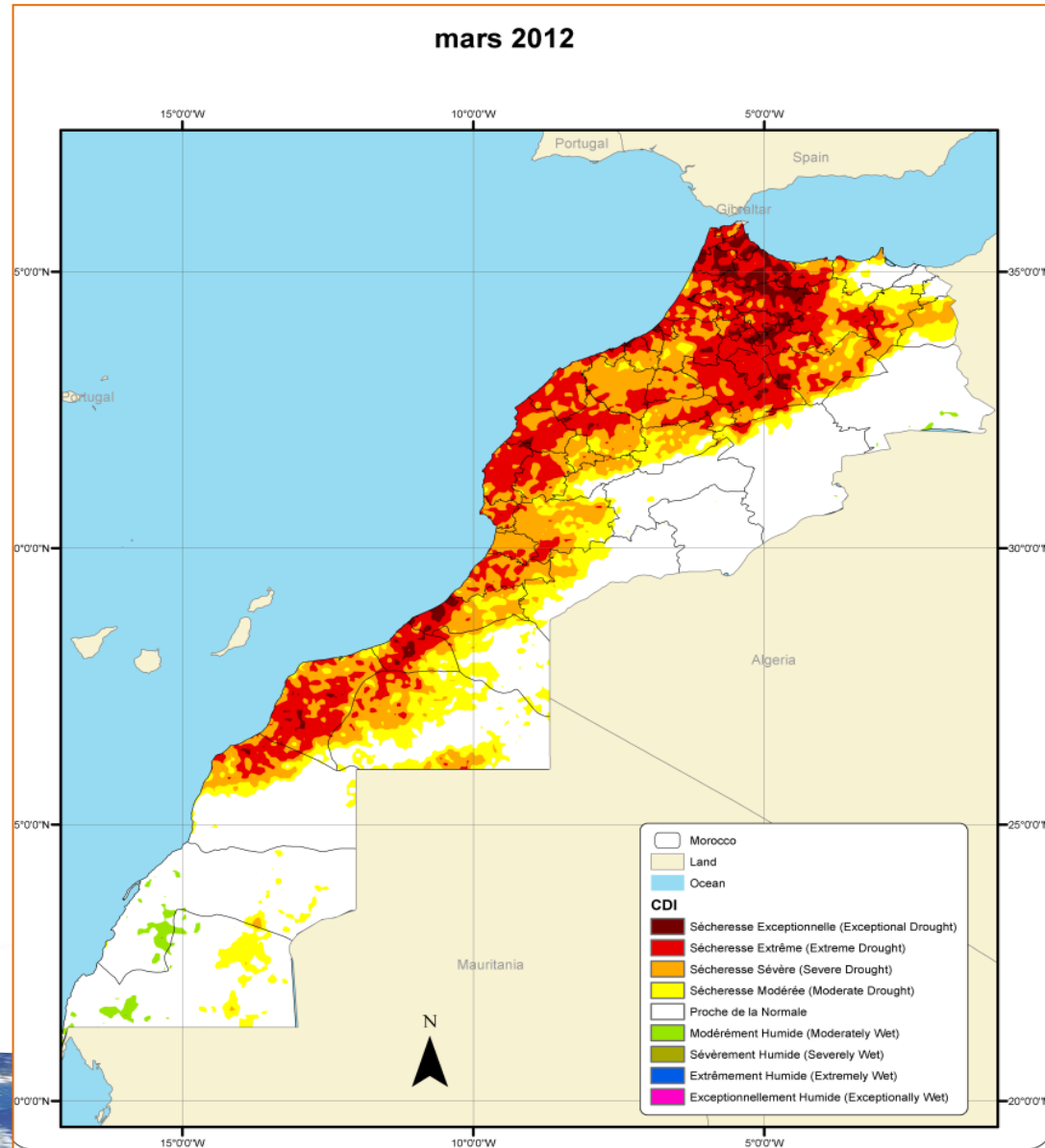
*Soil moisture anomalies in root's layer from LIS/NOAH model for dray and humid periods over Morocco (climate anomalies over 030 years).*





### mars 2012

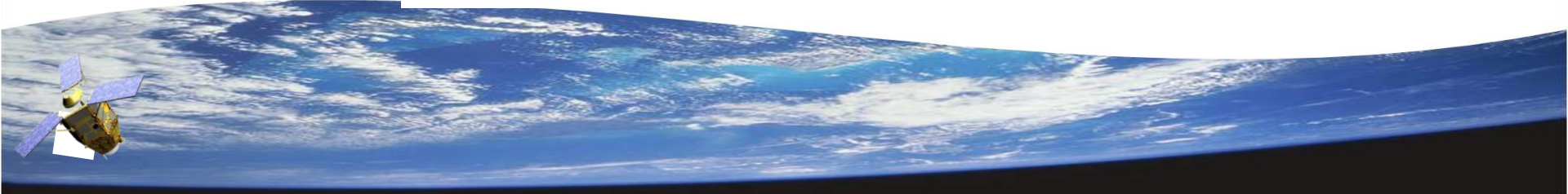
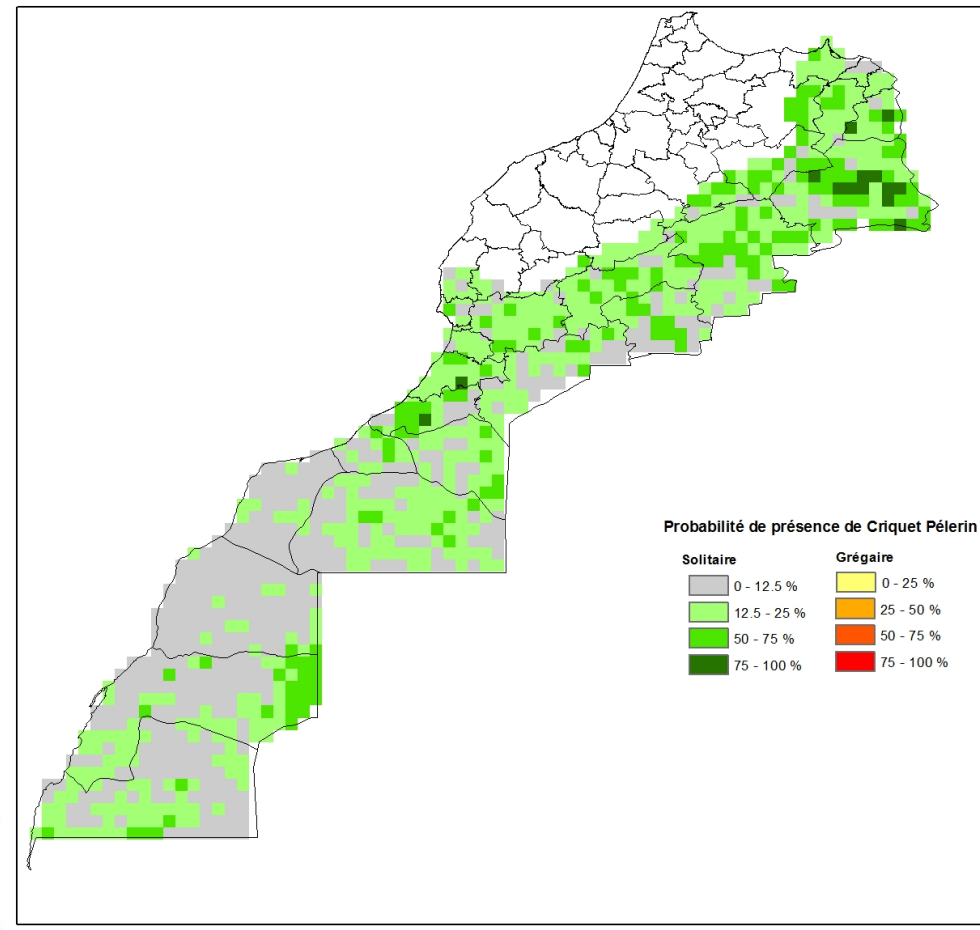
*Composite Drought Index map for a dray year (Agricultural season 2011-2012)*







# Maps of probability of presence of locust (solitary and gregarious) for a 40 days period starting from 16 January 2015





# IRRISAT Maroc Earth Observation Based system to monitor Irrigation

## Crop water productivity Supervision on water saving



**The project Provides support to**

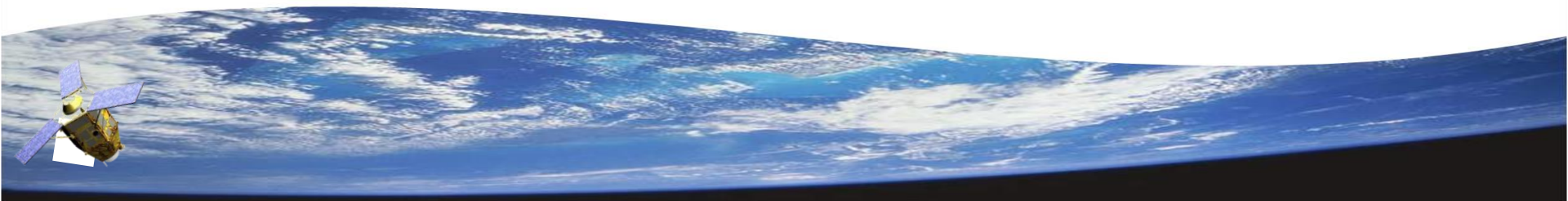
users	Covered areas
Farmers	Parcelle
Agriculture development offices	Sector / irrigated perimeters
Basin Agencies	Basin /Sub-Basin
Ministries (Water and Agriculture)	National scale



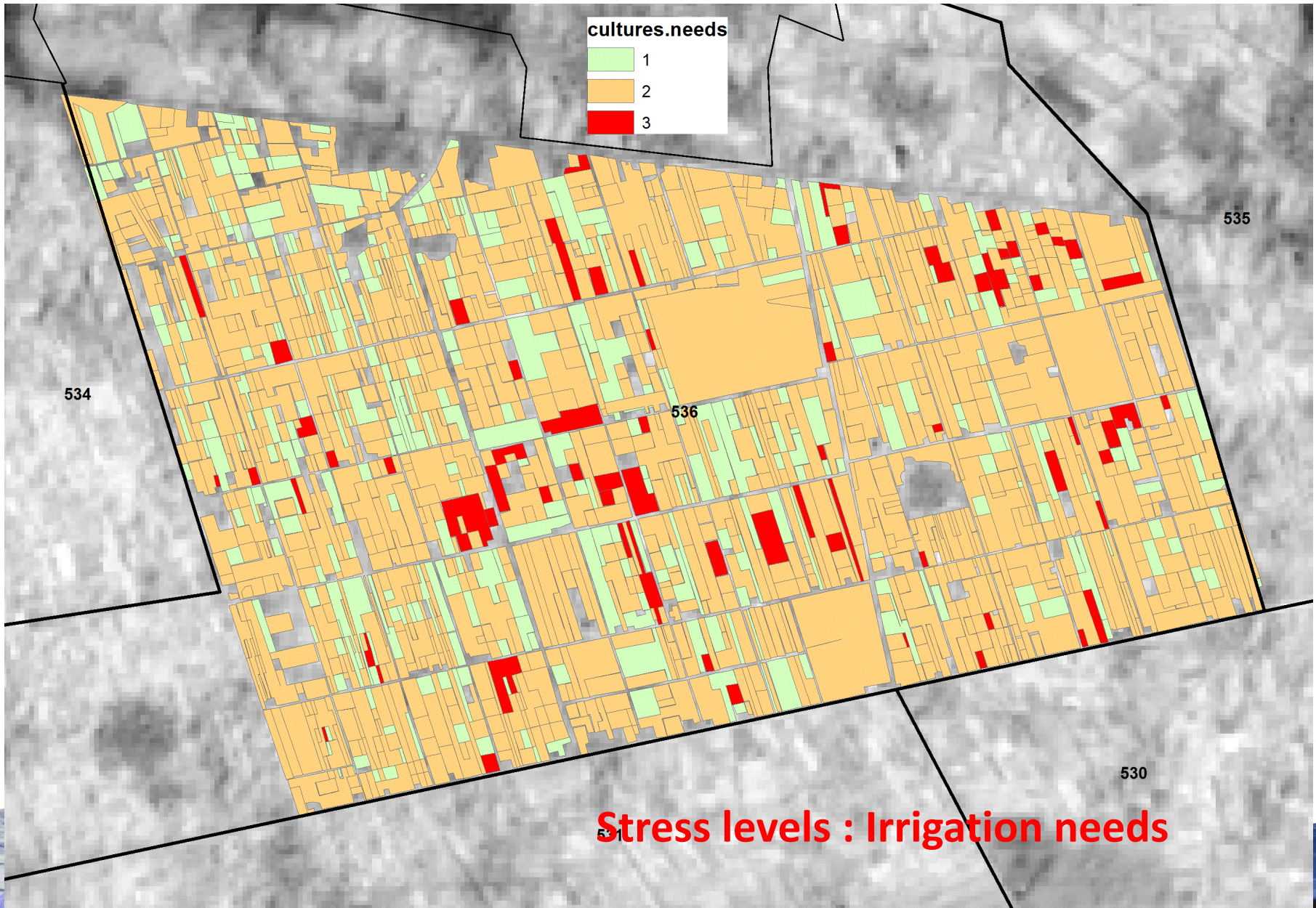
CRTS



Ministère de l'Agriculture et de la Pêche Maritime



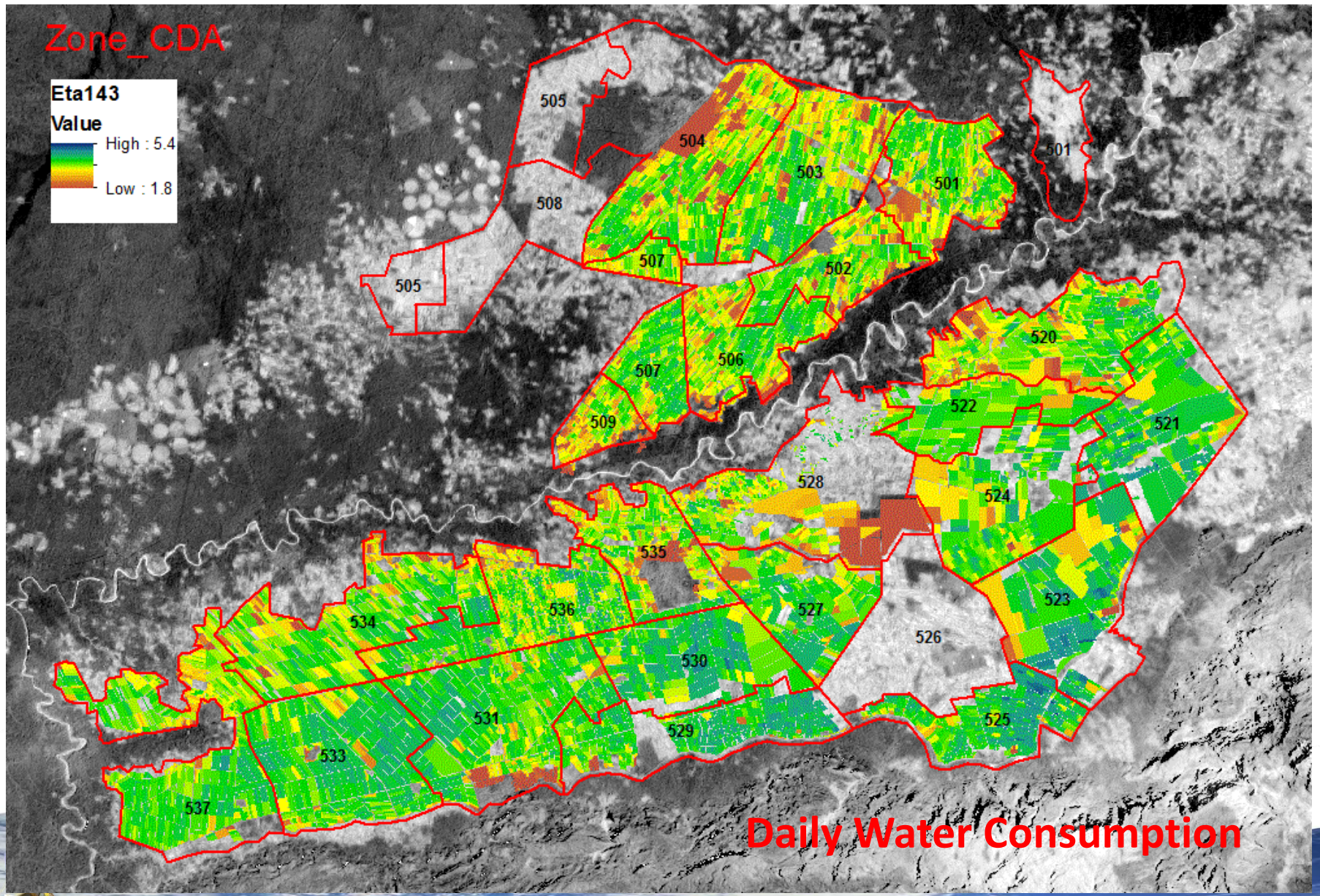
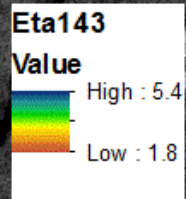




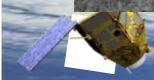




## Zone\_CDA



Daily Water Consumption





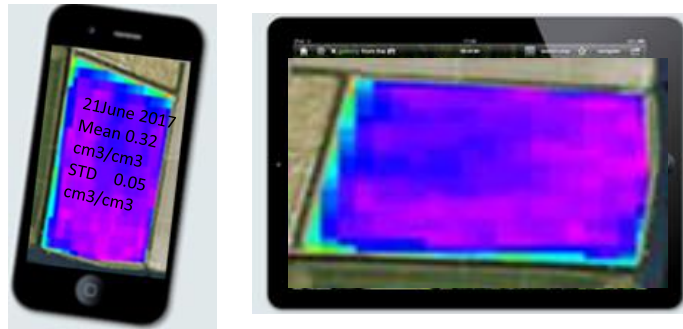
# Dissemination to users

## SMS



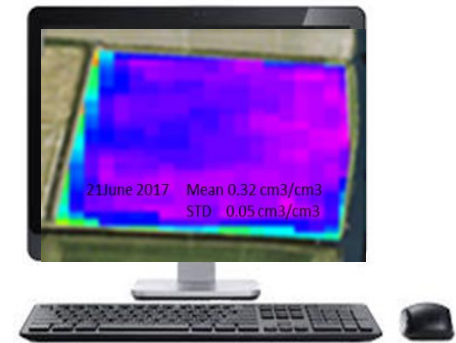
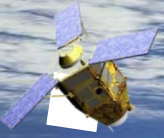
- Daily moisture root zone
- Daily irrigation amount
- Daily consumptive use
- Daily crop water stress
- Daily biomass production
- Daily production gap
- Daily Leaf Nitrogen fraction
- Daily Water Productivity Score

## Smartphone # Tablet



Daily moisture root zone		
Daily irrigation amount		
Daily consumptive use		
Daily crop water stress		
Daily biomass production		
Daily production gap		
Daily Leaf Nitrogen fraction		
Daily Water Productivity Score		

## Web

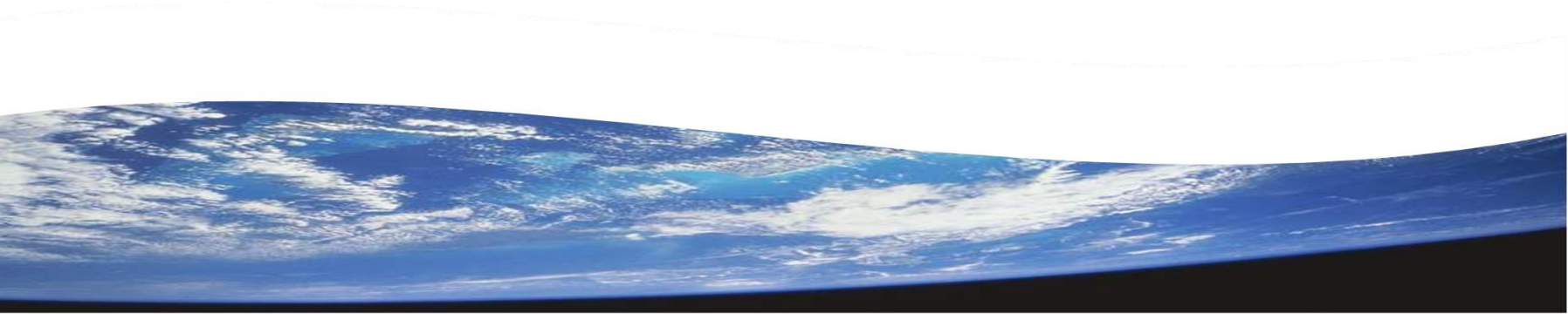


## Disaster Management

- Disaster management activities

- are implemented to support the national authorities in charge of Security and relevant agencies in the management of major disasters in the country.

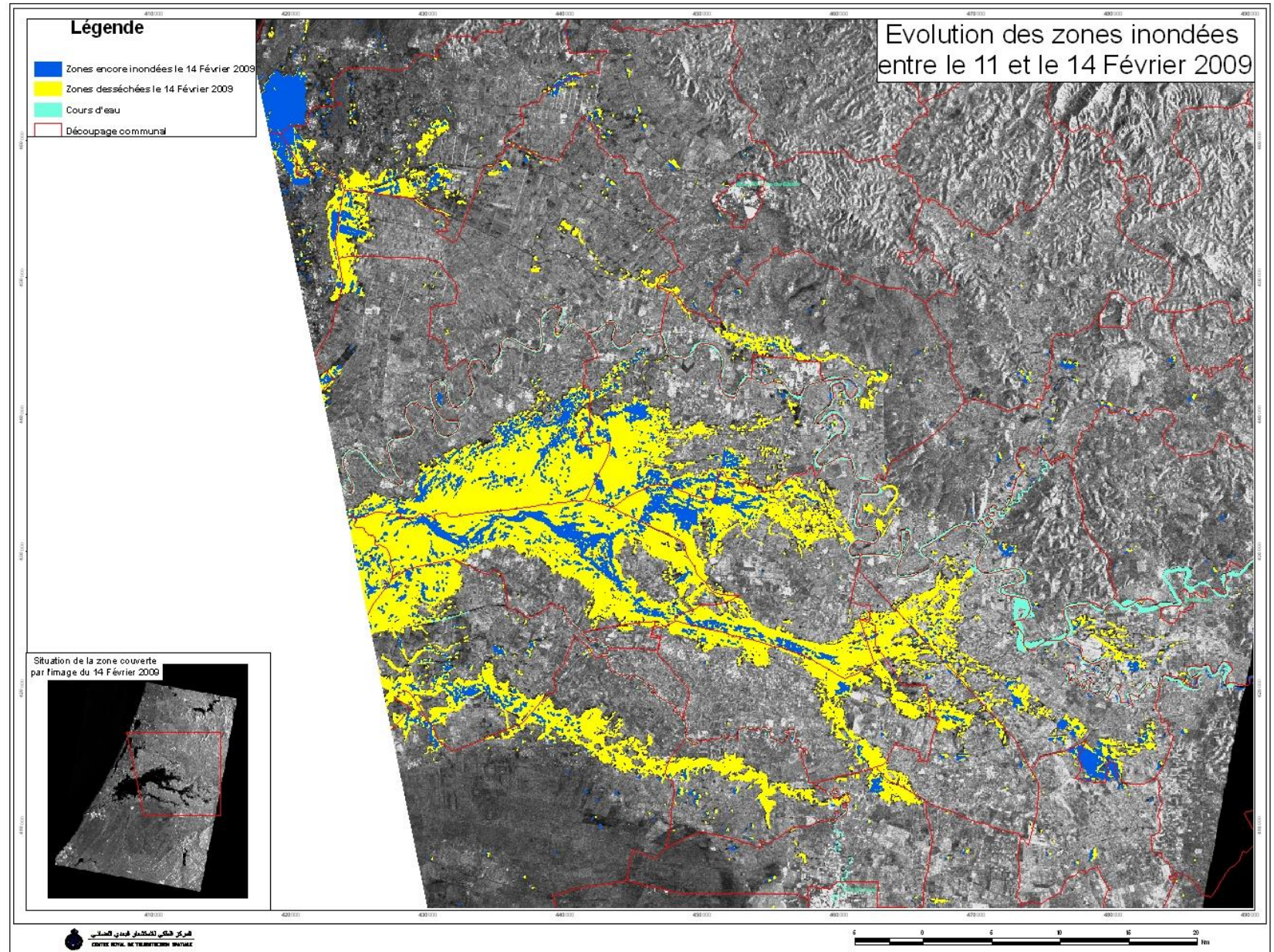
- include processing and analyzing of satellite images, and disseminating value-added data and related information .





# Flooded areas : cartography and follow up

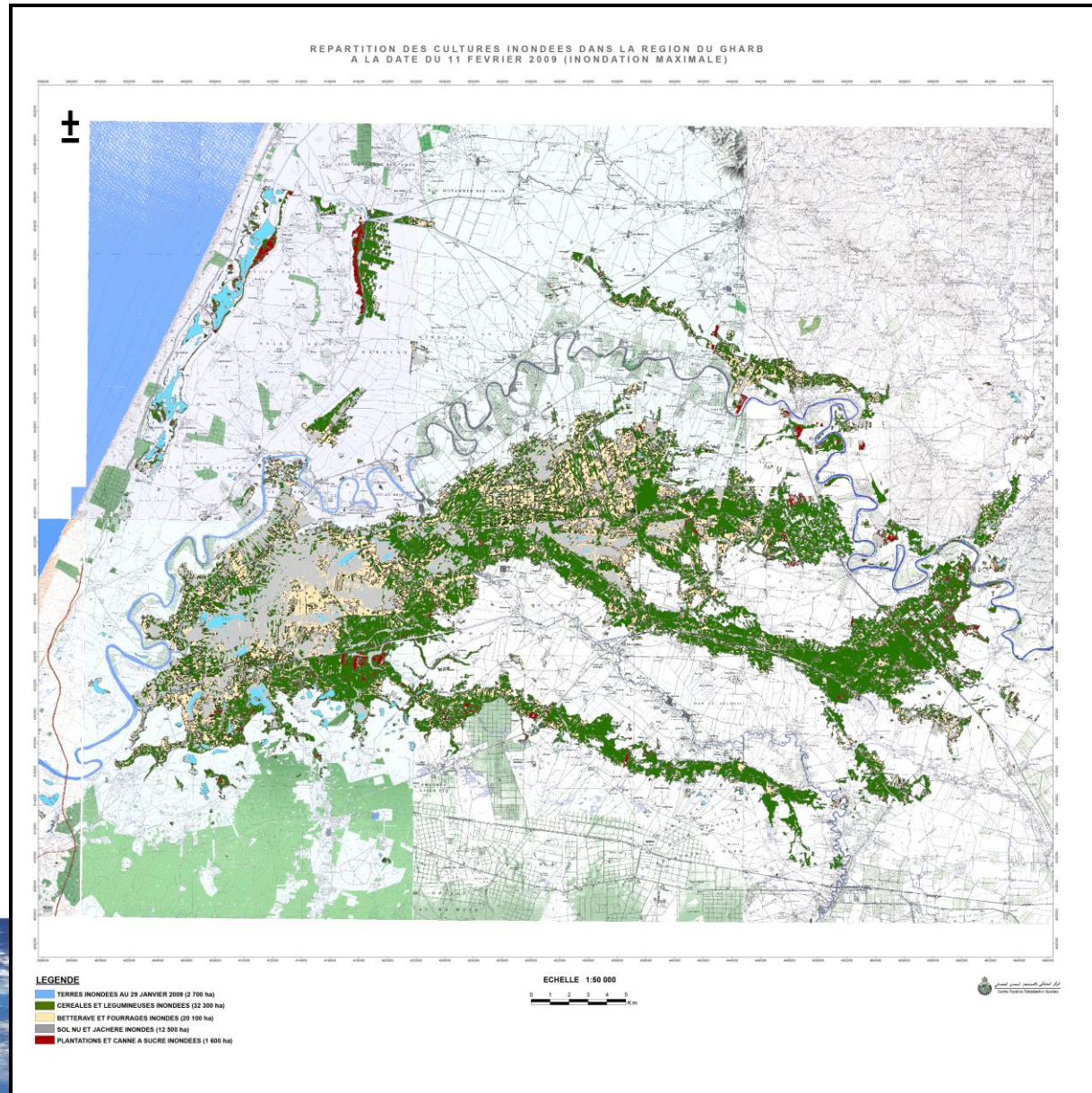
## Gharb region, Feb 2009





# Flooded areas : Damages assessment

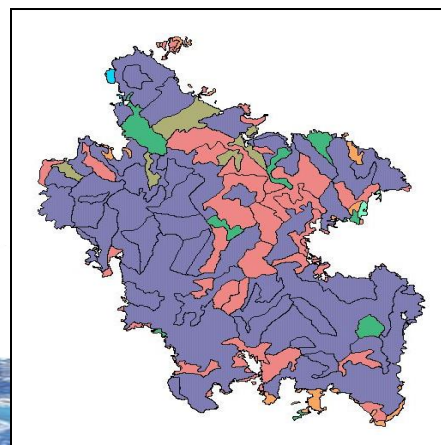
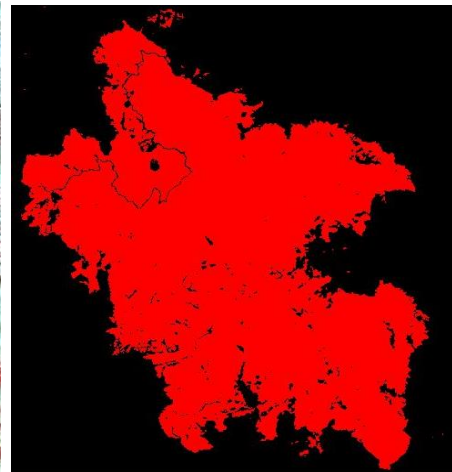
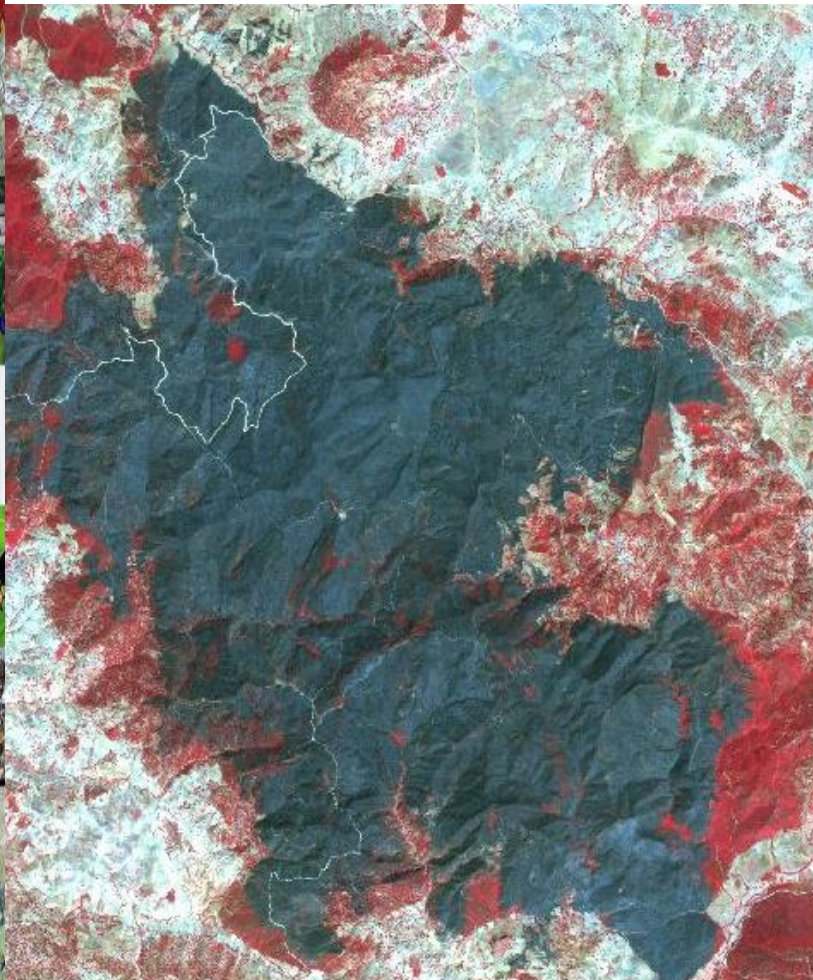
Gharb region, Feb 2009





# Forest fires : cartography of burned zones and damages evaluation

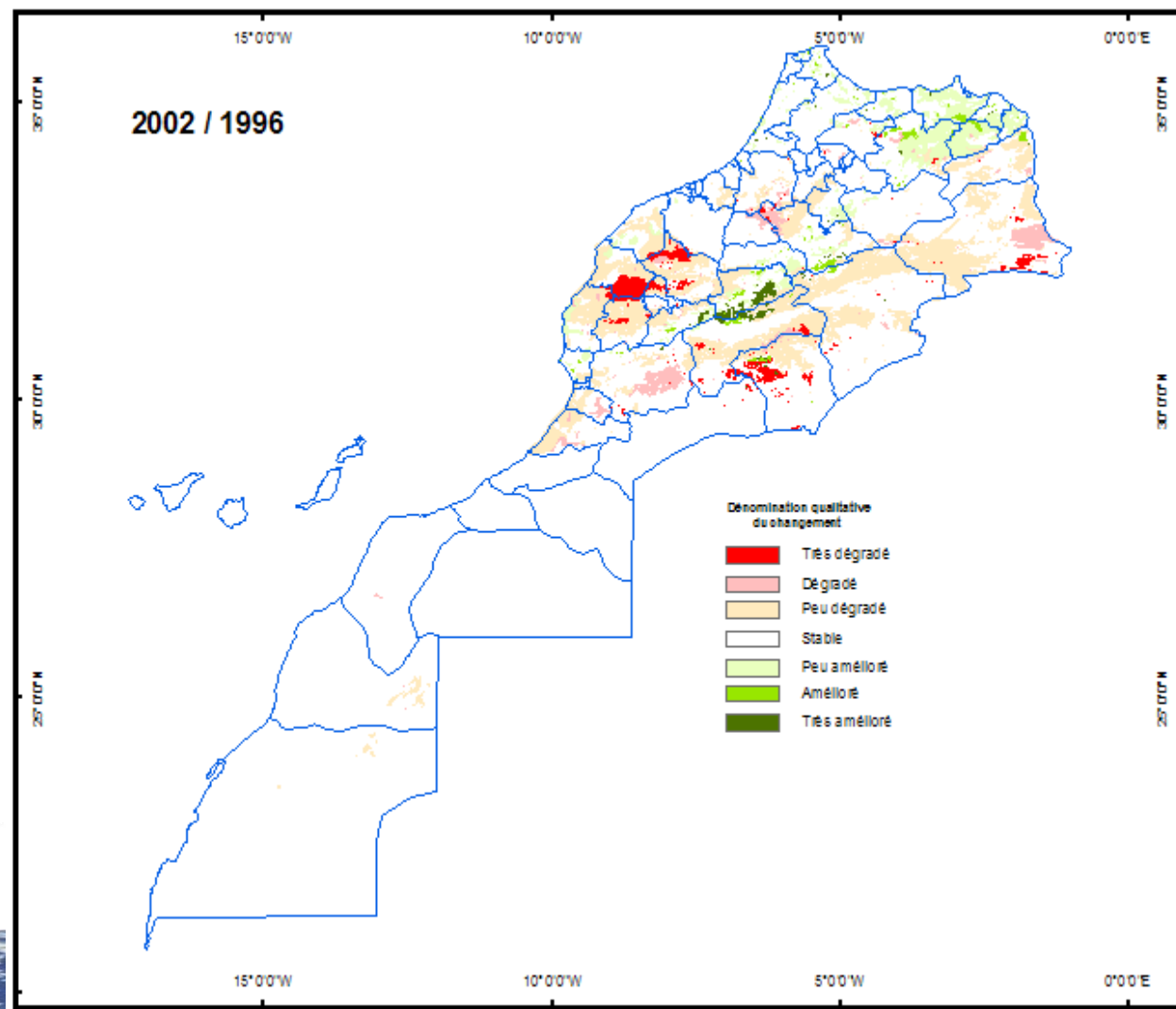
Ouazzan region, August, 2004



Forest Species	Area (ha)
Chêne liège	761,404
Chêne Vert	6,624
Feuillés	118,869
Matorral	142,127
Reboisement feuillé	6,999
Reboisement Résineux	2717,074
Terrains non Boisés	67,36
<b>Total</b>	<b>3820,457</b>

Commune	Area (ha)
Zoumi	2733
Beni Qoulla	1087
<b>Total</b>	<b>3820</b>

# Vegetation changes / Desertification







# Building damages modeling TSUNAMI Hazards

Rabat-Salé Region

*SCHEMA project (n° 030963)*

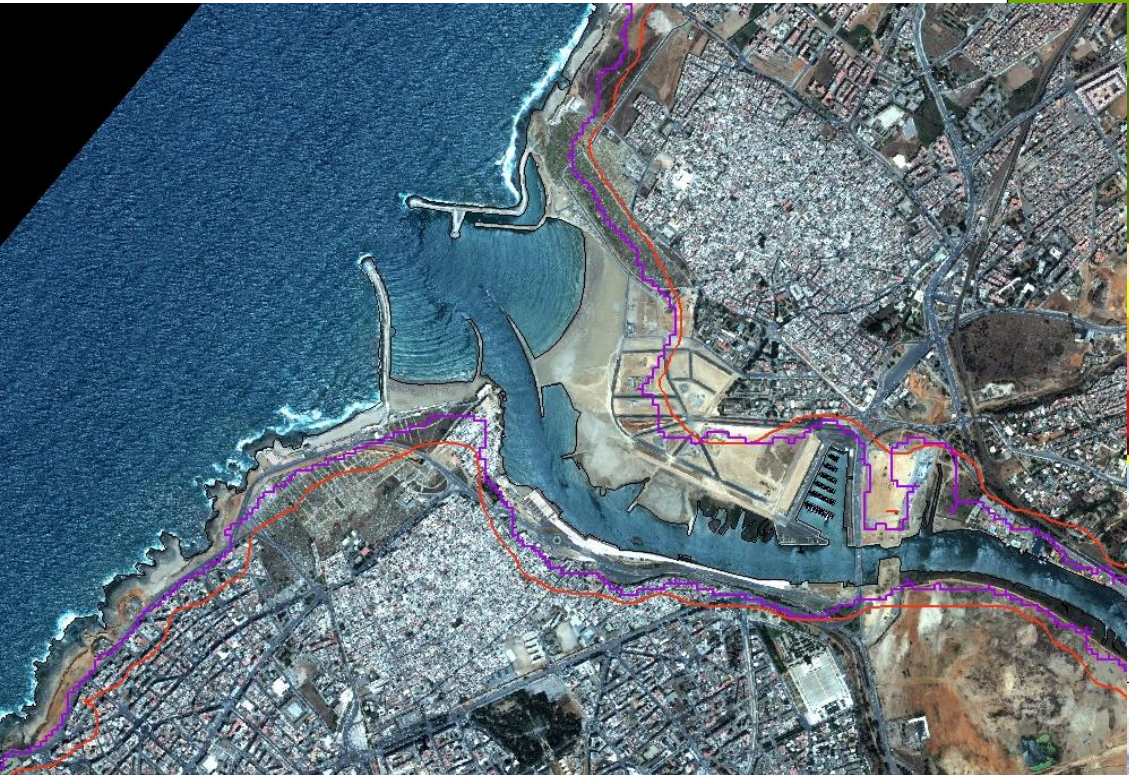
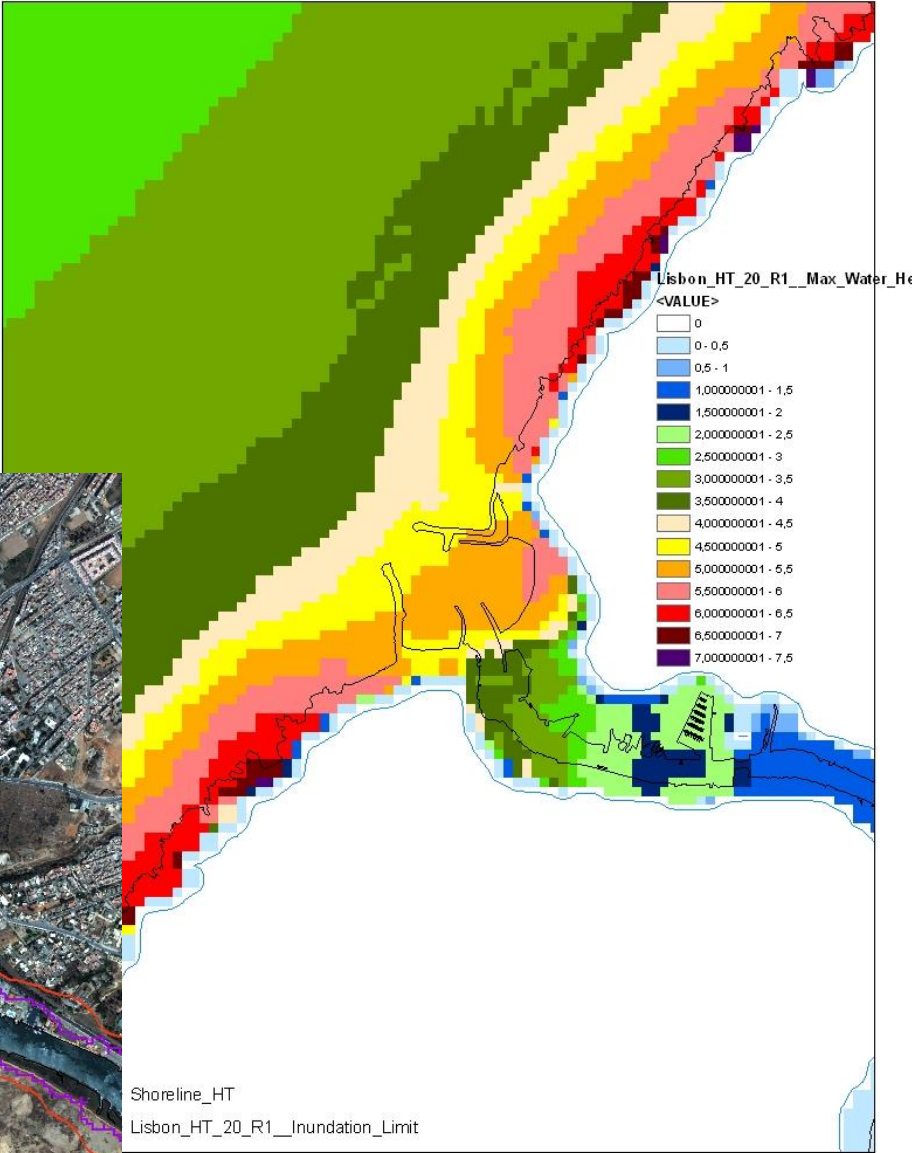
*Scenarios for Hazards-induced Emergencies Management*



المركز الملكي للإستشعار البعدي الفضائي

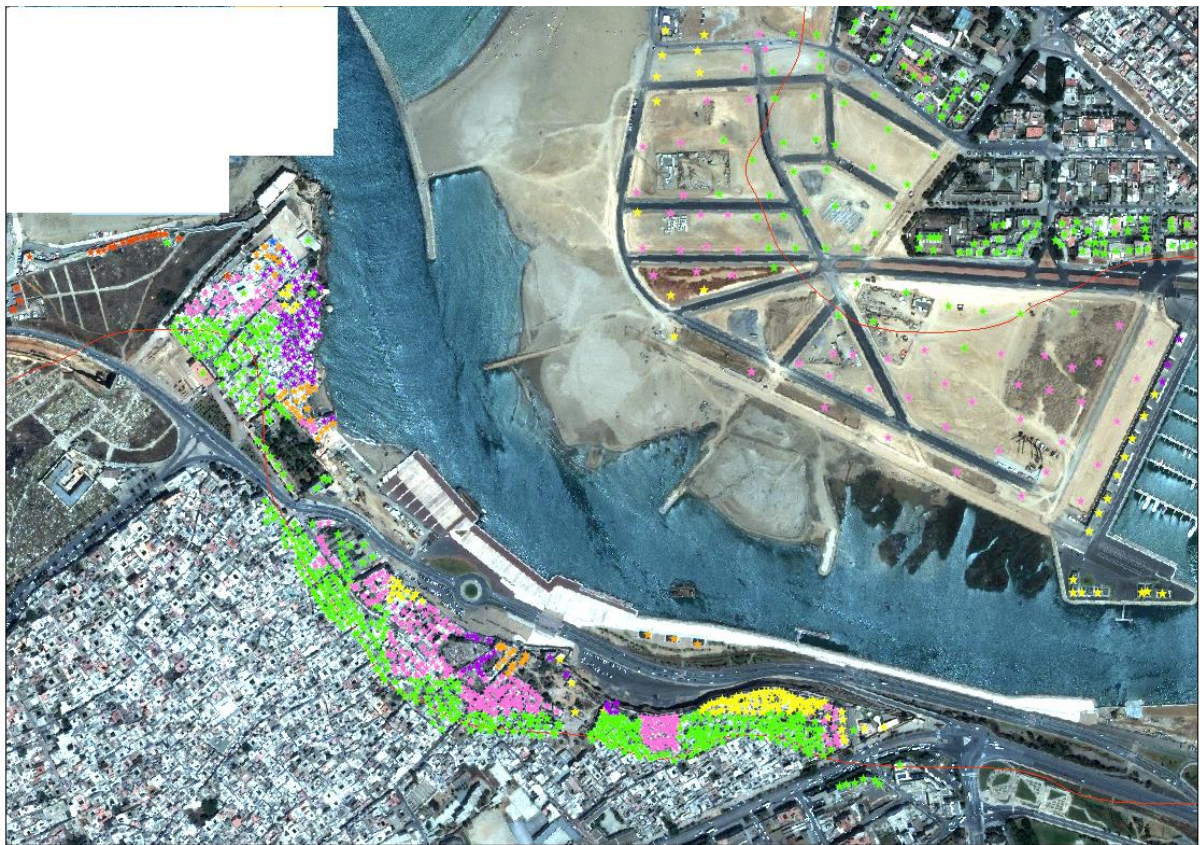
Centre Royal de Télédétection Spatiale

# Tsunami floods modeling

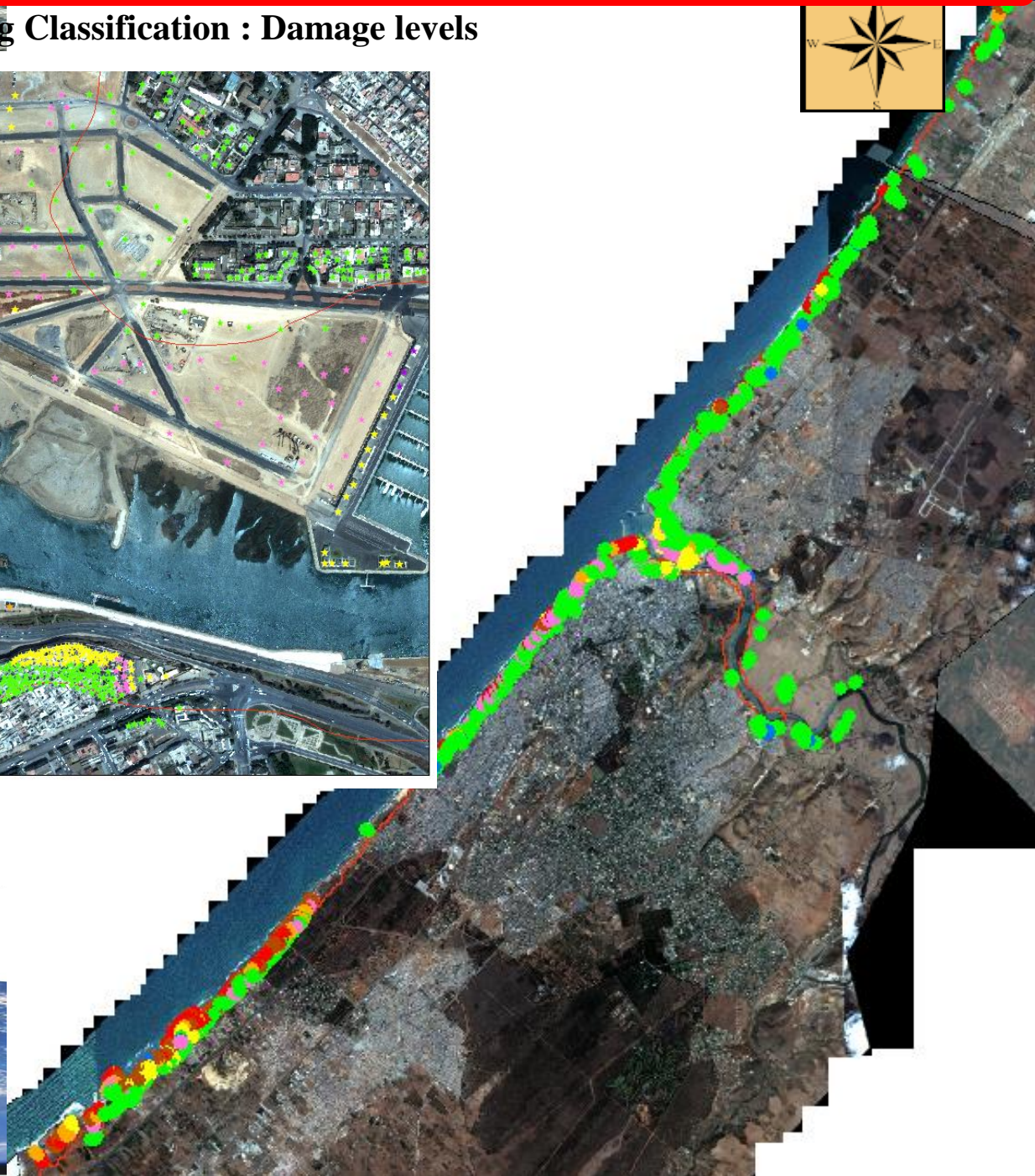




# Building Classification : Damage levels



- ★ Hors zone risque
- ★ Bâti non classé
- ★ D1
- ★ D2
- ★ D3
- ★ D4
- ★ D5







## Capacity Building : Training, R&D, Outreach



Centre Royal de  
Télédétection Spatiale



المركز الملكي للاستشعار البعدي الفضائي  
CENTRE ROYAL DE TELEDETECTION SPATIALE



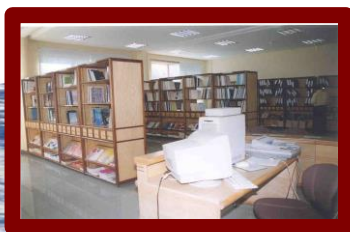


# Training and R&D activities

**Objectives : Enlarge users community and enhance national capacities**



- ✓ **Dedicated infrastructures**
- ✓ **Annual program : Up to 10 training sessions / Year**
- ✓ **Beneficiaries : National and from the region**
- ✓ **Cooperation with international organizations (ESA, FAO, COSPAR, ECSL, UNESCO/IOC, OADA, CRAFT-LF...)**
- ✓ **More than 2,000 people benefited from this training programs**





# International Coopération



Bilatérale  
CNES, ESA, NASA,  
Chine...

Contribuer au  
traitement des  
problématiques  
régionales /  
Globales

Renforcement  
des compétences  
/ Capacités  
Nationales

Développement  
de Nouveaux  
services

Promouvoir  
l'espace auprès  
des utilisateurs

Promouvoir la  
coopération SUD-  
SUD

Organisations  
internationales :  
UNOOSA, FAO,  
PNUD, GEO  
COSPAR, IAF,  
EURISY,

GALILEO –  
accord entre l'UE  
et le Maroc

Programmes  
Européens : FP7,  
H2020

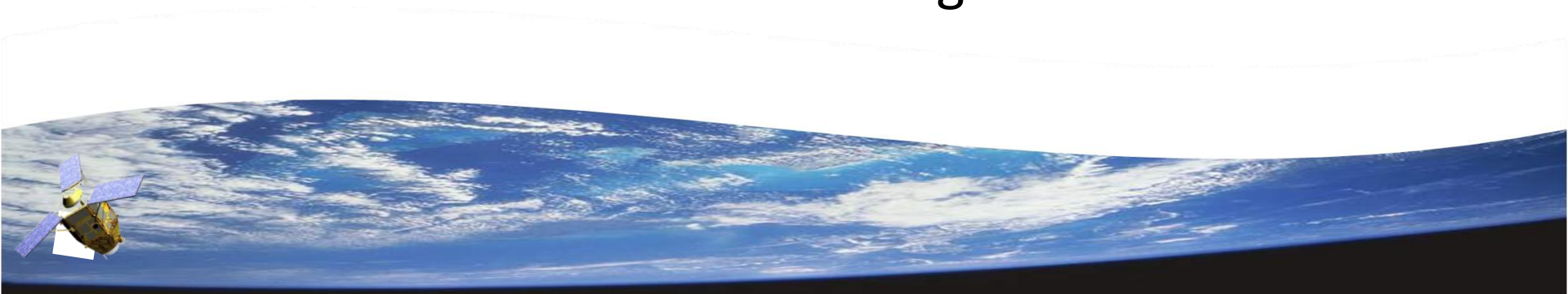






# COP22 : Marrakech

- Heads of Space Agencies meeting in Marrakesh during COP22 on « ***Space technologies helping to implement COP agreements*** »
- Declaration of Marrakesh : « **Heads of Space Agencies Support Actions at COP22 for Water Management** »
- **Africa Action Summit**: to Build African Continent that is Resilient to Climate Change





спасибо

GRACIAS

谢谢

THANK YOU

ありがとうございました MERCI

DANKE धन्यवाद

شُكراً

OBRIGADO

