



**Regional Coordination on Improved Water Resources Management  
and Capacity Building Technical Assistance Project  
- GEF funded project -**

**LDAS – MAROC  
For improving water resources  
management and climate change  
adaptation**

<b>Grant Implementing Agency:</b>	<b>Royal Centre for Remote Sensing (CRTS)</b>
<b>Partner for Project execution:</b>	<b>Ministry of Energy, Mines, Water and Environment (<u>Ministry in charge of Water</u>)</b>
<b>Grant Implementation Period:</b>	<b>~3 years (2012 – 2015)</b>
<b>Word Bank (GEF Grant):</b>	<b>1.050.000 \$</b>



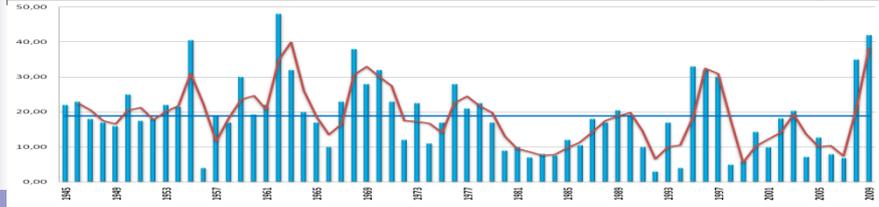
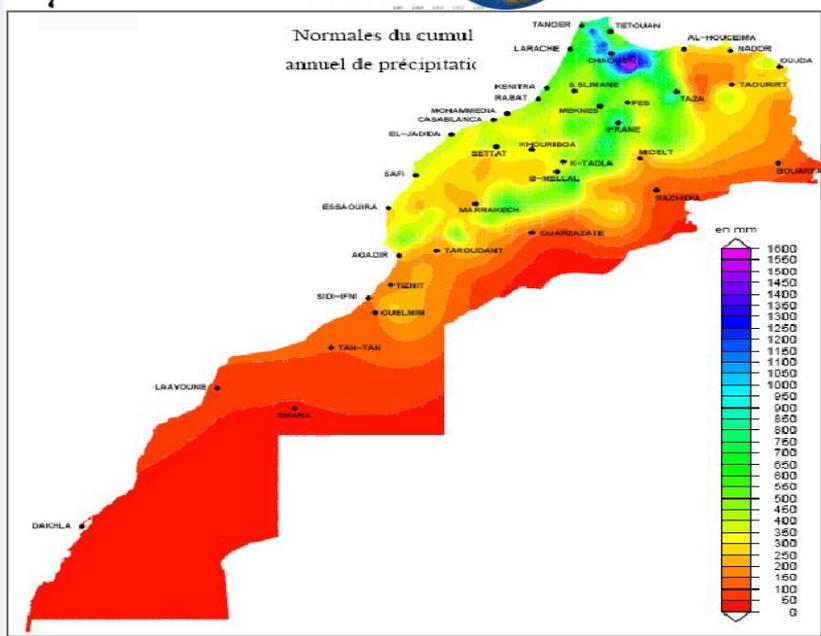
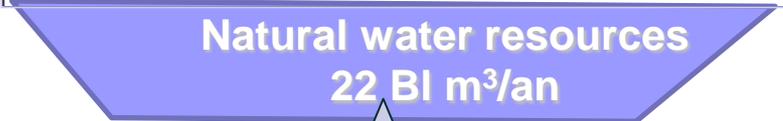
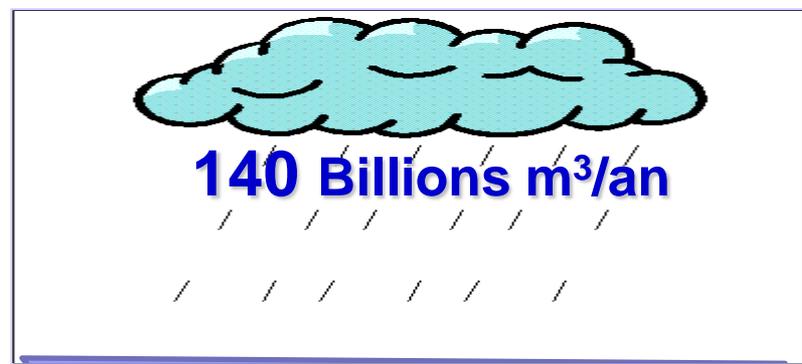
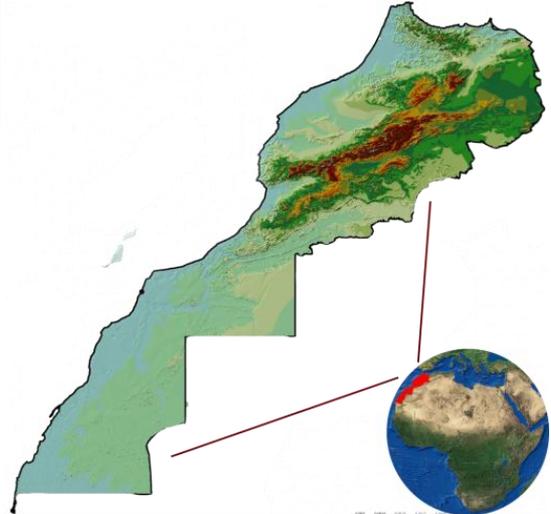
# CONTENT

- **General Introduction**
- **Project general scope**
- **Modules definition (concept, needs etc.)**
- **Major steps and current situation**



# 1. Introduction : Water context

## Limited water resources potentialities



Slide Credit: Benabdelfadel



# 1. Introduction : Water context

...cont

- **Growing water demand**: domestic, industrial and in particular water for irrigation
- **Water quality deterioration** : pollution (domestic, industry and irrigation)
- **Groundwater overexploitation**, mainly in plain areas where some times it's a no renewable water.
- **Water losses** related to agricultural practices, and to the ocean during wet seasons
- **Lack of new information technologies** use as source of information and tools of analysis.



## 2. LDAS-Maroc Overview

### Project Objectives:

- **Strengthen the national capacities** for an operational use of the combination of land surface models and the land data assimilation system (**LDAS**) developed and widely used by NASA and its partners.
- Contribute to a **more accurate characterization of the national hydraulic potentialities** to be used by **decision makers** for improving actual water resources management and long-term planning
- Improve capacities **to better assess past, actual and future climate change impacts** on the local and national **water conditions**, including surface and groundwater storage, and related irrigated agricultural activities
- **Apprehend the climate change impacts on the environment** by consolidating the actual knowledge and strengthening the adaptation measures to face the extreme phenomena such as **floods, drought** and **locust** migration.



## 2. LDAS-Maroc Overview

### Project Partners

Different sectors: water sector, agriculture, forestry, disaster management, R&D etc.

→ **Partners** : For project realization

- Royal Centre for Remote Sensing (**CRTS**)
- Ministry of Energy, Mines, Water and Environment (**Water Department**)

→ **Beneficiary Partners** :

Will be involved in system validation and exploitation :

- Ministère de l'Agriculture et de la Pêche Maritime (**MAPM**)
- Haut Commissariat aux Eaux et Forêts et à la Lutte Contre la Désertification (**HCEFLCD**)
- Centre National de Lutte Anti Acridienne (**CNLAA**)

→ **Sub-contractors** :

- Moroccan Universities
- National and International Expertise



## 2. LDAS-Maroc Overview

### Partnership:

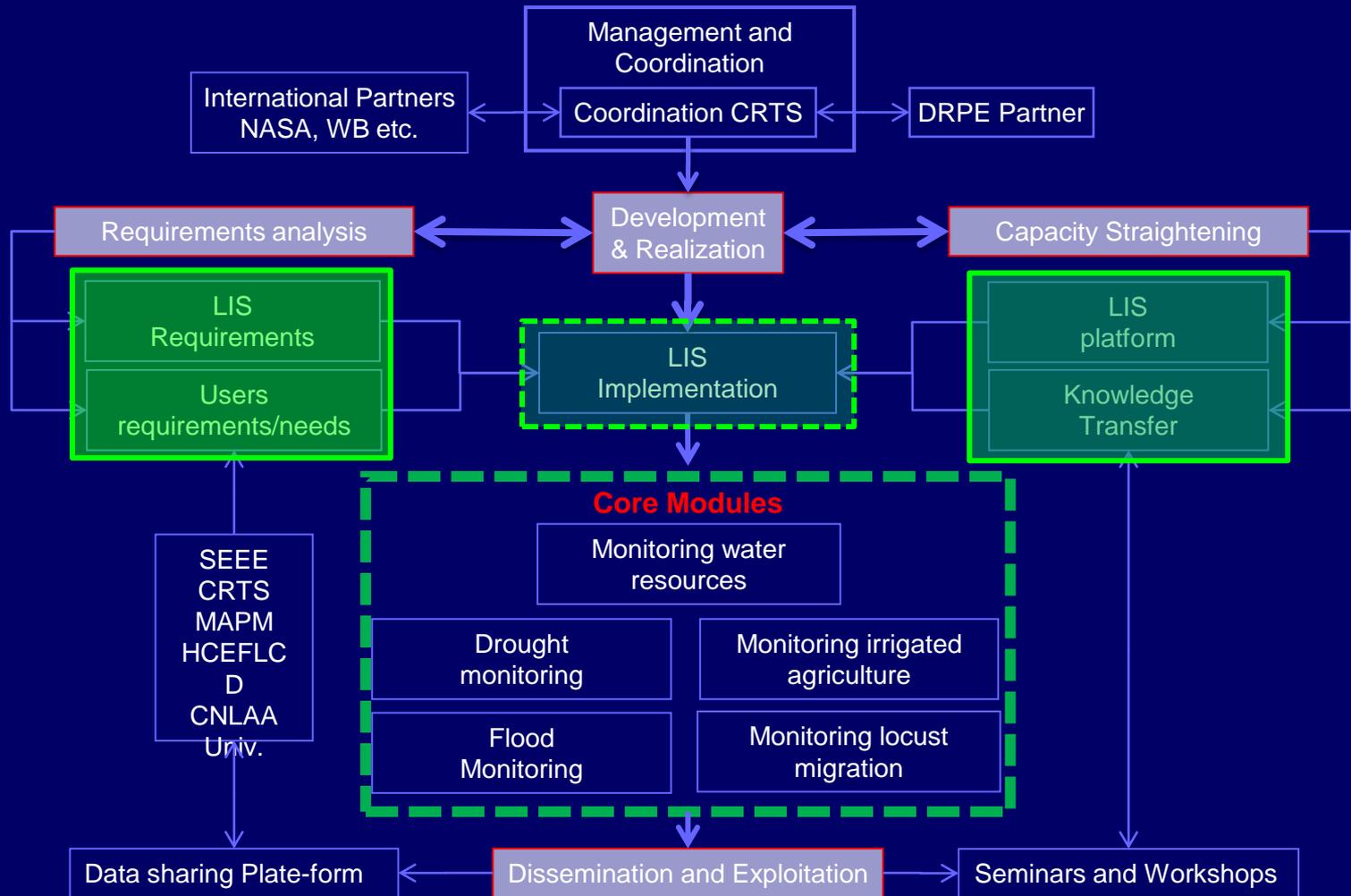
The partnership in this project aims at converging the efforts of both parties for module **implementation and ensuring long-term operation**:

- Contribute to the **modules establishment** : needed inputs and validation
- Ensure **modules long-term operation**: data access continuity (inputs and products)
- **Strengthen capacities through training**
- Support and conduct **joined R&D activities** for advanced scientific and technical system's development (Univ., labs, etc)



# 3. LDAS-Maroc Implementation

## Conceptual Framework



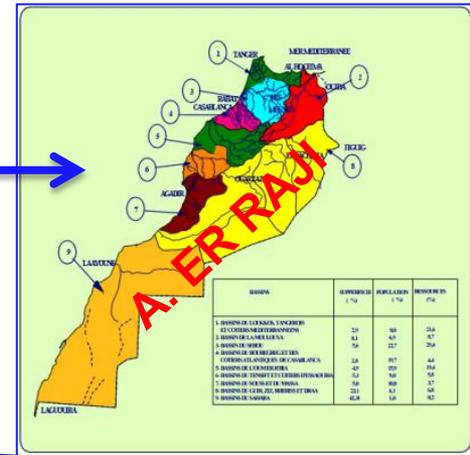


# 4. LDAS-Maroc Technical Components

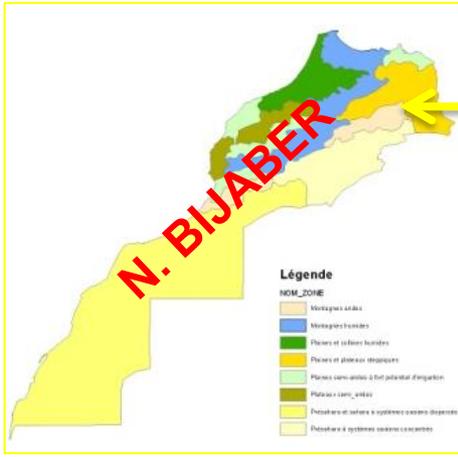
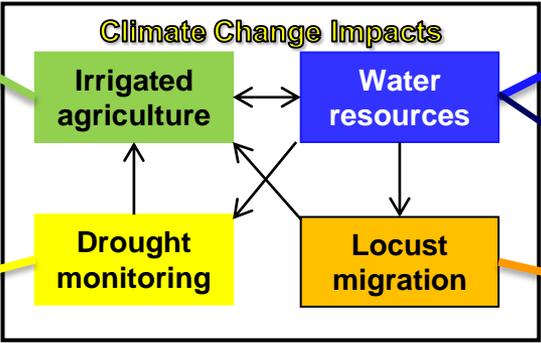


- Assess past climate change impacts
- Characterize current water situation
- Scenarios development (future)

- Irrigated areas water requirements/use
- Agriculture biomass productivity
- Scenarios development (future)



- Hydrologic Modeling (national)
- Rapid Mapping (High resolution)



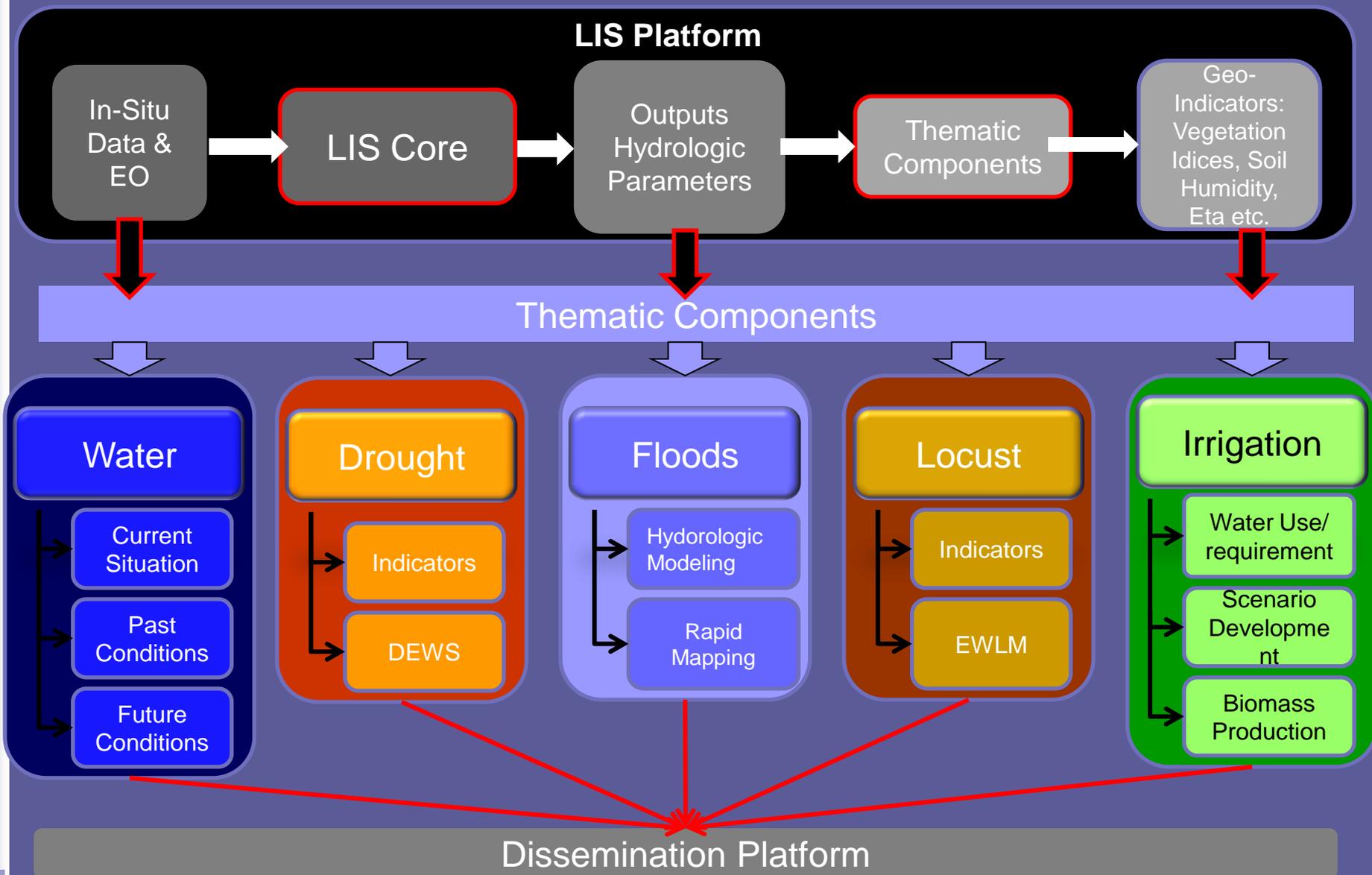
- Environmental indicators
- Drought early warning system
- Drought monitoring bulletin

- Specific environmental indicators
- Locust early warning system





# 5. Thematic Components: global architecture





# Module-1 : Assessment of climate change impact on water conditions

## Outcomes:

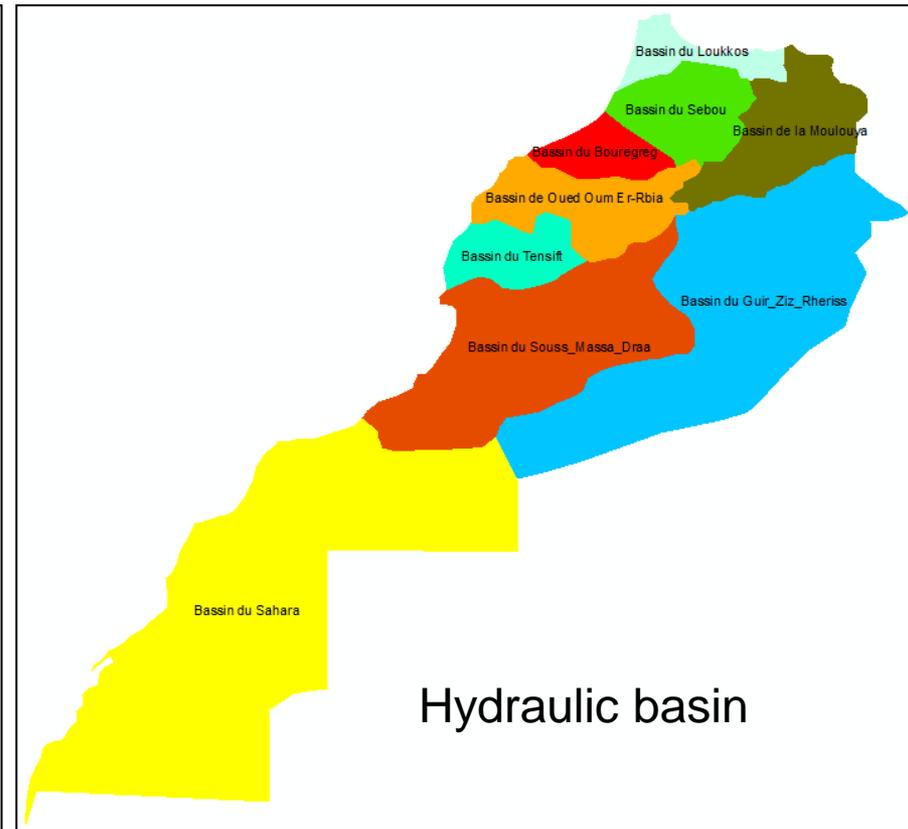
1. **Historical hydrologic parameters** (based on historical forcing data)
2. **Current hydrologic parameters** (for water balance estimation locally and nationally)
3. **Future hydrologic parameters** (based on scenarios development from global models)



# Module-1 : Assessment of climate change impact on water conditions

## Module-1 : Expected product

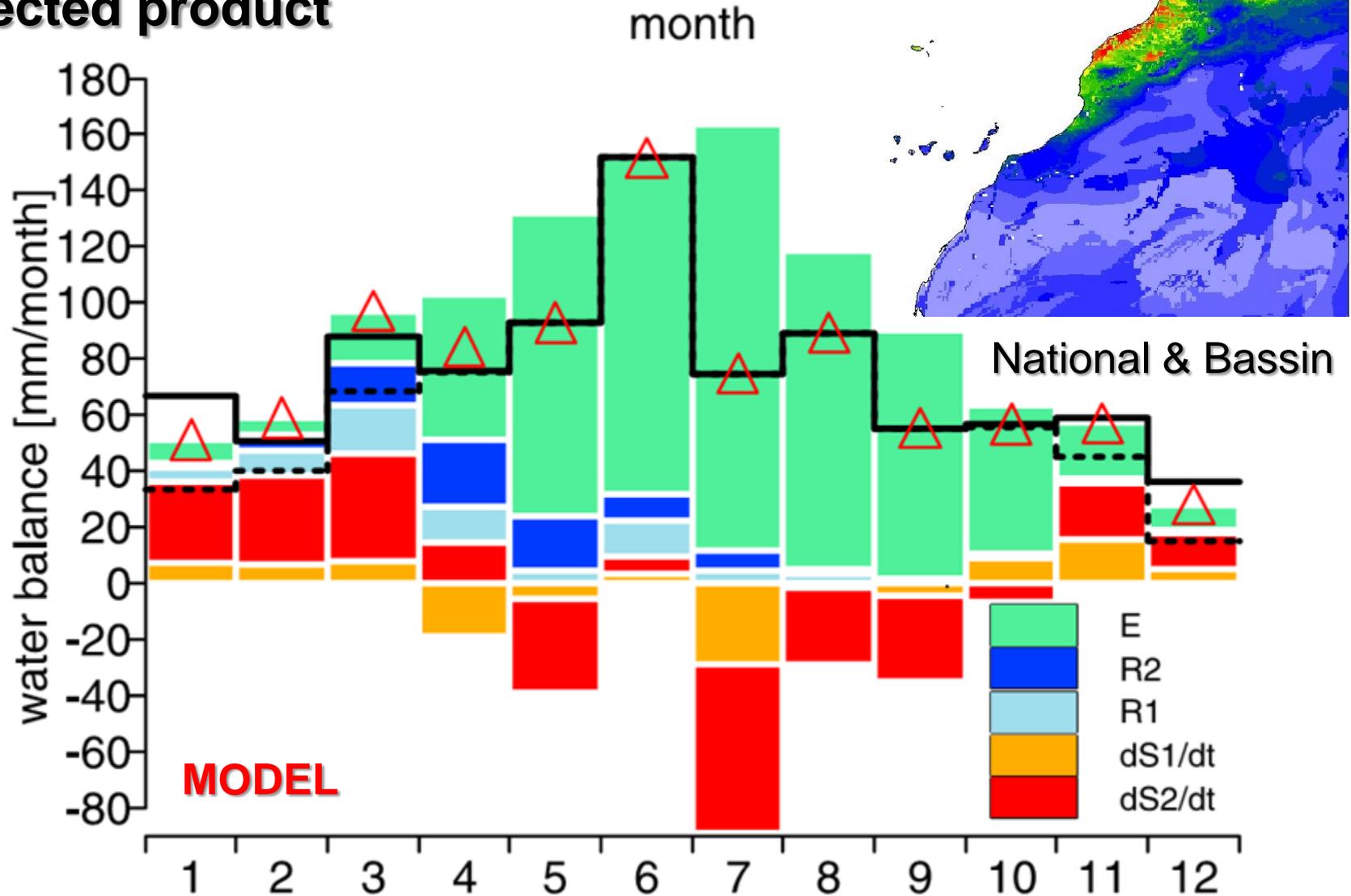
At different levels: national and basin





# Module-1 : Assessment of climate change impact on water conditions

## Expected product



Mitchell & al. 2004





# Module-1: Current Situation

- **LIS agreements signed: codes downloaded (rp6.1 and rp6.2)**
- **LIS standard version installation (CRTS & ICBA: June 2013)**
- **Geo Database for Static and hydro-meteo parameters (ongoing with end-users, 2 MoU signed)**
- **Hardware acquisition (ongoing)**
- **ToR for training session on LIS models and DA (Invitation published)**
- **ToR for LIS platform implementation (Invitation published)**



# Module-1 : Assessment of climate change impact on water conditions

## Terms of Reference n°1

# Implementing a water resources Platform (LIS)

**Activity 1:** training on how to effectively use Land Information System (LIS)

**Activity 2:** Adapting LIS to the Moroccan context

**Activity 3:** Derive Hydrological parameters on Morocco from LIS

**Activity 4:** Calibration and validation of the generated parameters.



Activity	Deliverable
▪ <b>Activity 1 : Training on how to effectively use the LIS (Land Information System)</b>	<ul style="list-style-type: none"><li>- <b>Training</b> of the team in charge of this task via short-term stage and supervision</li><li>- Produce of a <b>user's manual</b> for the customized LIS exploitation</li><li>- Provide the required <b>documentation</b> related to LIS and related topics</li></ul>
▪ <b>Activity 2 : Customizing LIS to the Moroccan context</b>	<ul style="list-style-type: none"><li>- <b>Adapt LIS</b> to the Moroccan context</li><li>- Methodological <b>report</b> on input preparation</li><li>- Scripts that allow the conversion and <b>data integration</b> to the customized LIS</li></ul>
▪ <b>Activity 3 : Genesis of Hydrologic parameters on Morocco</b>	<ul style="list-style-type: none"><li>- Methodological <b>note</b> to validate LIS output (ToR local)</li><li>- Hydrologic <b>parameters</b> on Morocco on 5 km and 1 km</li></ul>
▪ <b>Activity 4 : Calibration and validation of the generated parameters</b>	<ul style="list-style-type: none"><li>- <b>Calibration</b> and validation of the customized LIS</li><li>- <b>Synthetic Report</b></li></ul>



# **Module-1 : Assessment of climate change impact on water conditions**

## **Terms of Reference n°2**

# **Training on Land Surface Modeling & Data Assimilation Techniques**

- 1. State of the Art of Modeling Global Processes**
- 2. Use of Multi-scale and Multi-source Satellite Data in modeling Land Processes**
- 3. Use of Satellite Data and Data assimilation Techniques in Water Resources sector**
- 4. Application and Case Studies (Morocco)**



# Module-2 : Flood Monitoring

## Outcomes:

### User needs

- Floods forecast in the small watersheds
- Flood monitoring at high temporal and spatial resolution

### Products

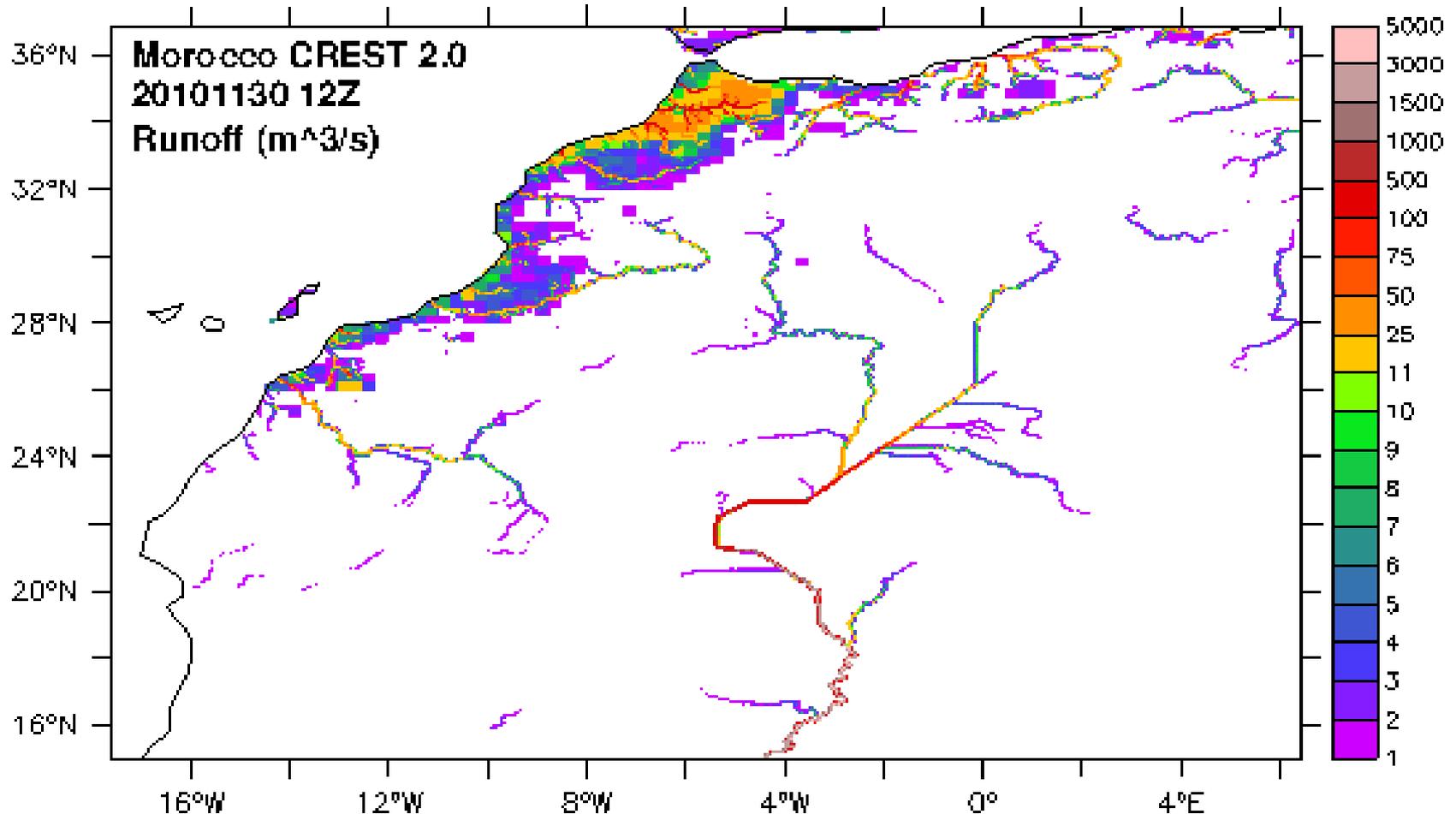
- Hydrologic modeling at national scale
- Hydrological modeling in key rivers (for flood forecast )
- High resolution flood maps at near-real-time (rapid mapping)
- Flood risk maps



# Module-2 : Flood Monitoring

## CREST Products # LIS

*Runoff ( $m^3/s$ ) Morocco Flood, 30<sup>th</sup> Nov. 2010  
CREST 2.0 Model Simulation*



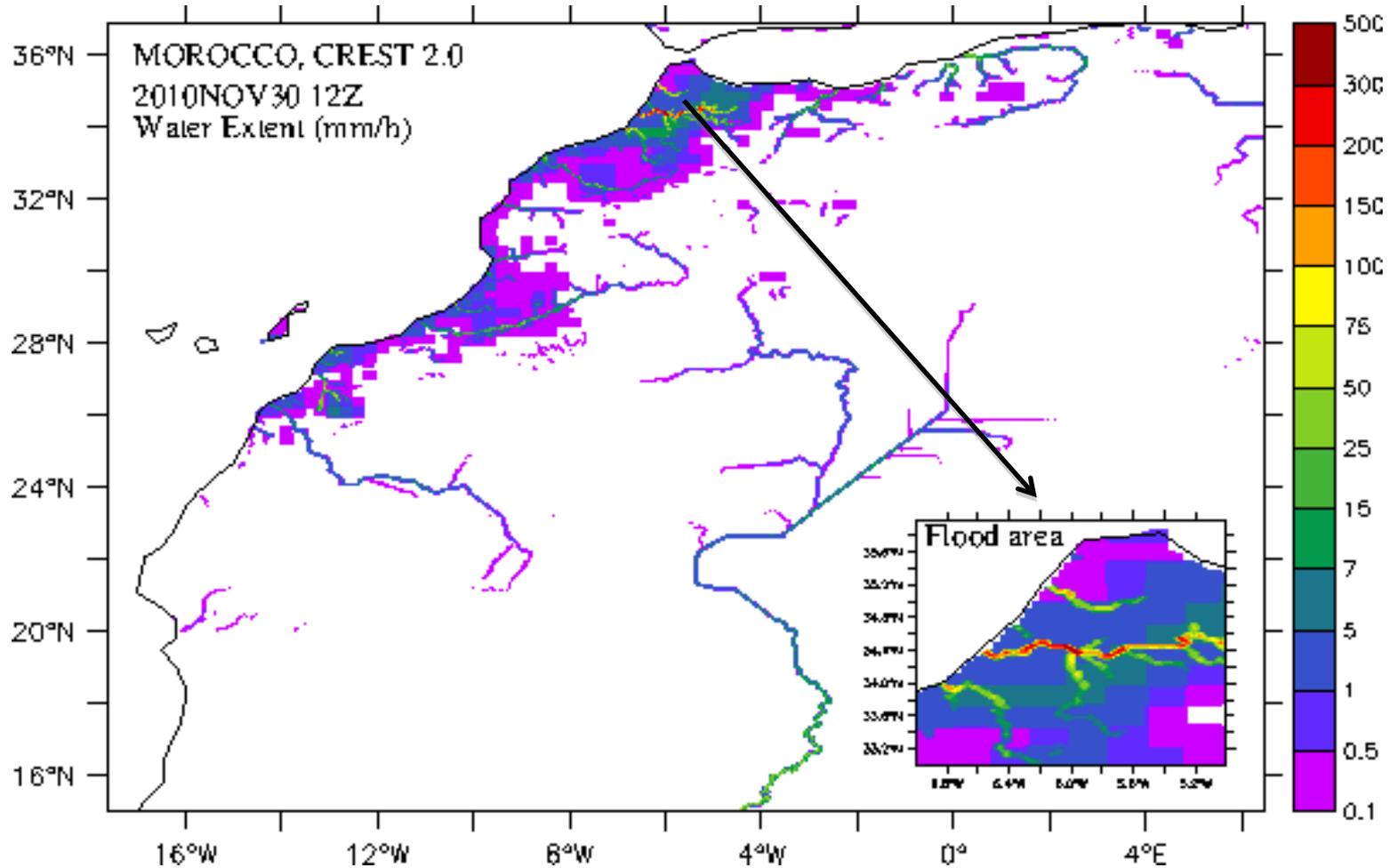
Polliceli, 2012



# Module-2 : Flood Monitoring

## CREST Products # LIS

*Water Extent (mm) Morocco Flood, 30<sup>th</sup> Nov. 2010*  
*CREST 2.0 Model Simulation*



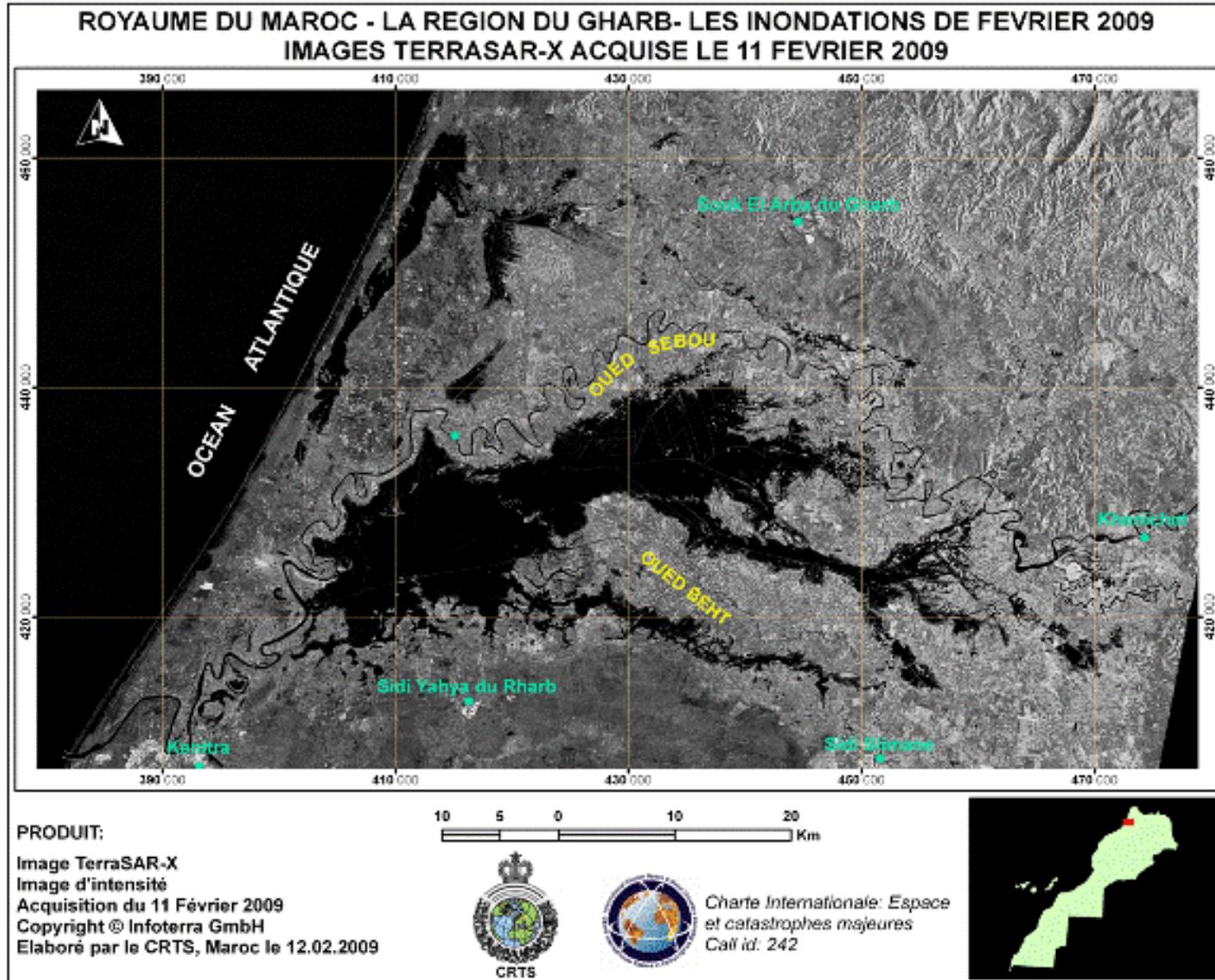
Polliceli, 2012

December 2013 / GSFC / Washington



# Module-2 : Flood Monitoring

## Rapid Mapping





## Module-2: Current Situation

- **CREST first products (GSFC)**
- **CREST installation and training**
- **In-situ** data requested for calibration
- **CREST product comparison VS LIS component**
- **Rapid Mapping Tools** (exist)
- **End-User** interested by **flood forecast** (small watershed)



## Module-3 : Irrigation Optimization and Monitoring

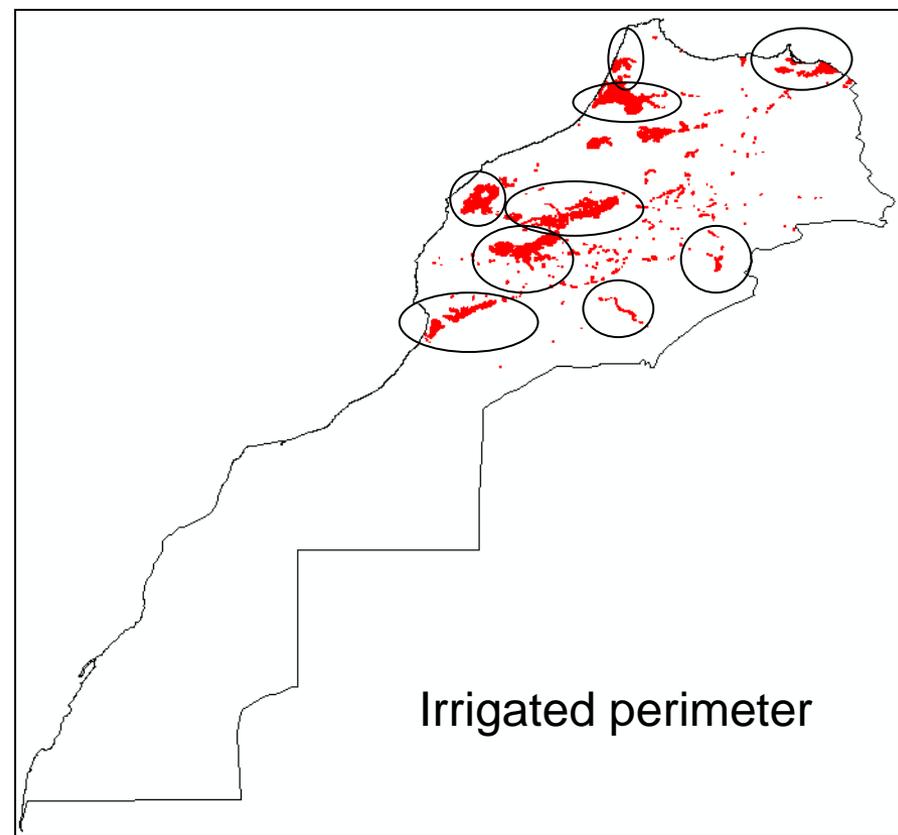
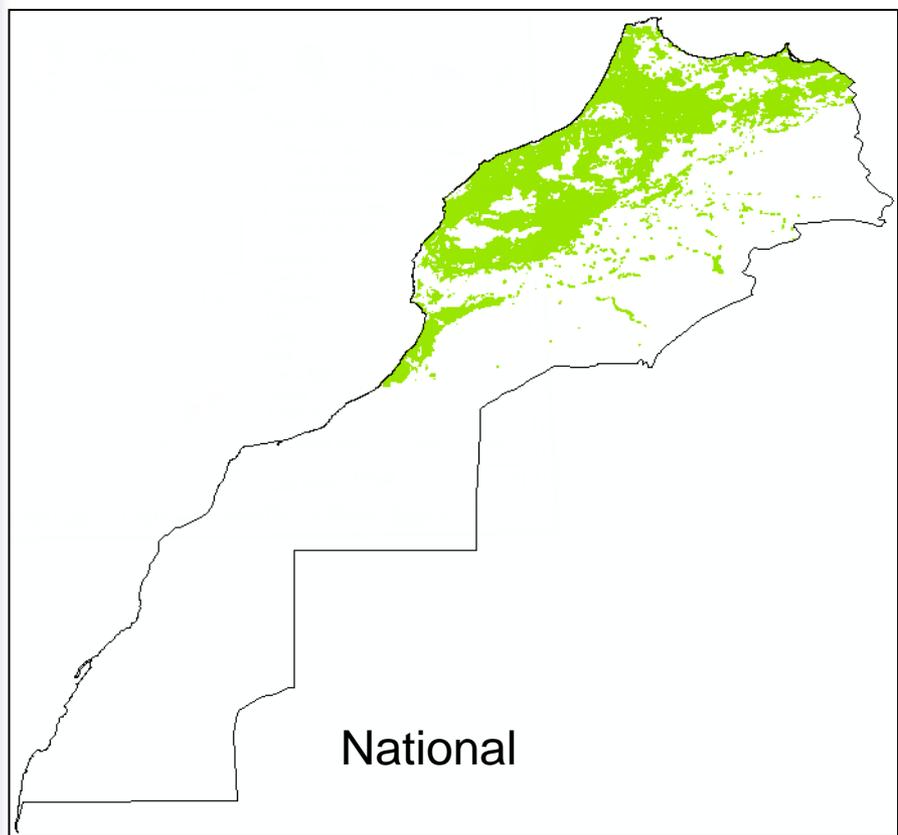
### Outcomes:

- Produce irrigated areas maps (national and local level)
- Produce water use/requirements maps to better manage irrigated areas
- Estimate the agricultural biomass production including rain-fed areas



# Module-3 : Irrigation Optimization and Monitoring

Mapping: At different levels: national and irrigated perimeter



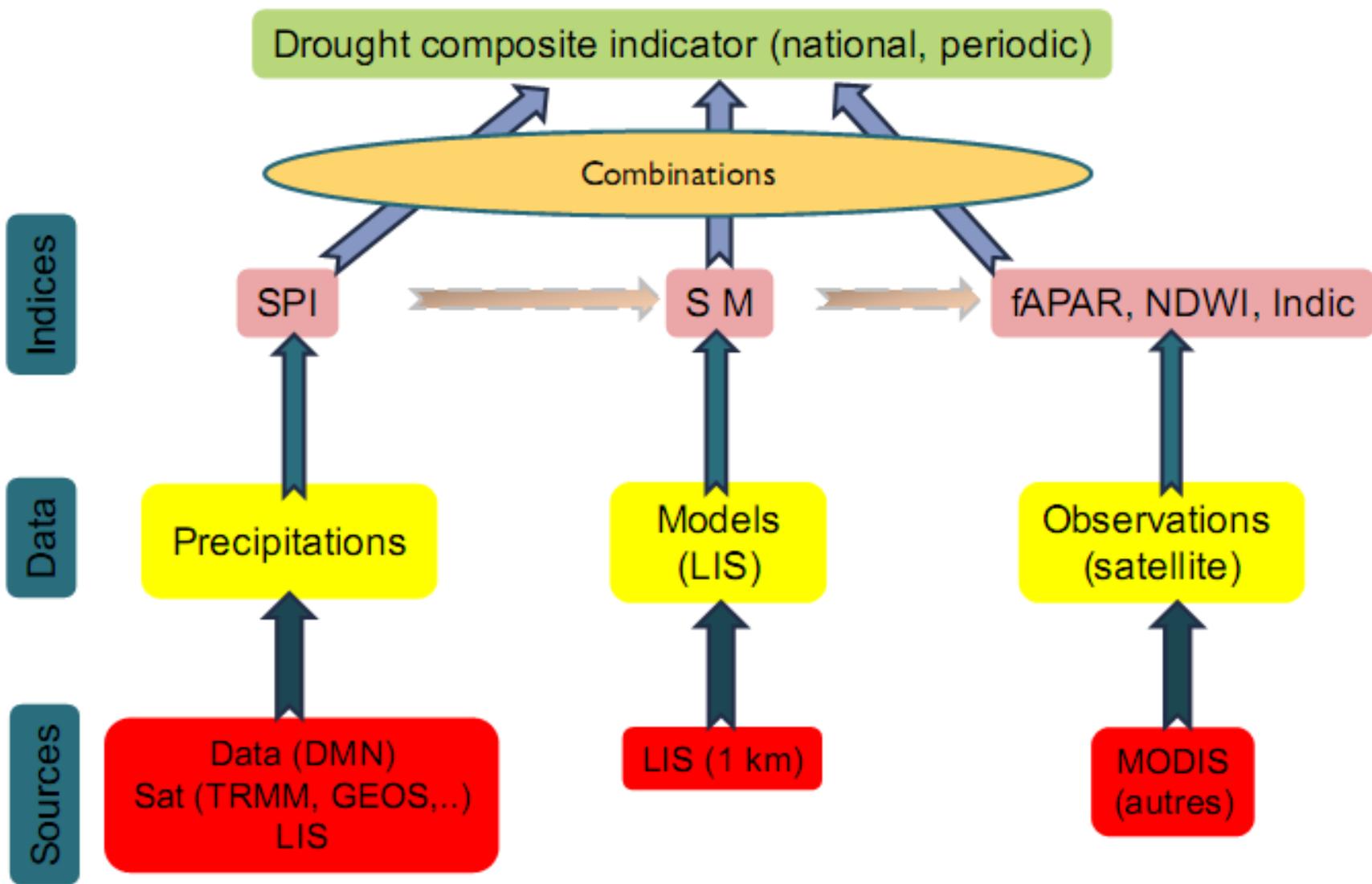


# Module-3: Current Situation

- **International expert selected : contract under negotiations**
- **Training session on the approach (Last 2 weeks in Wisc. Univ)**
- **Geo Database for Land Use / Land Cover maps (ongoing)**
- **End-User involved (MoU ongoing)**
- **First expert intervention expected in early January 2013**



# Module-4 : Drought Monitoring





# Module-4: Current Situation

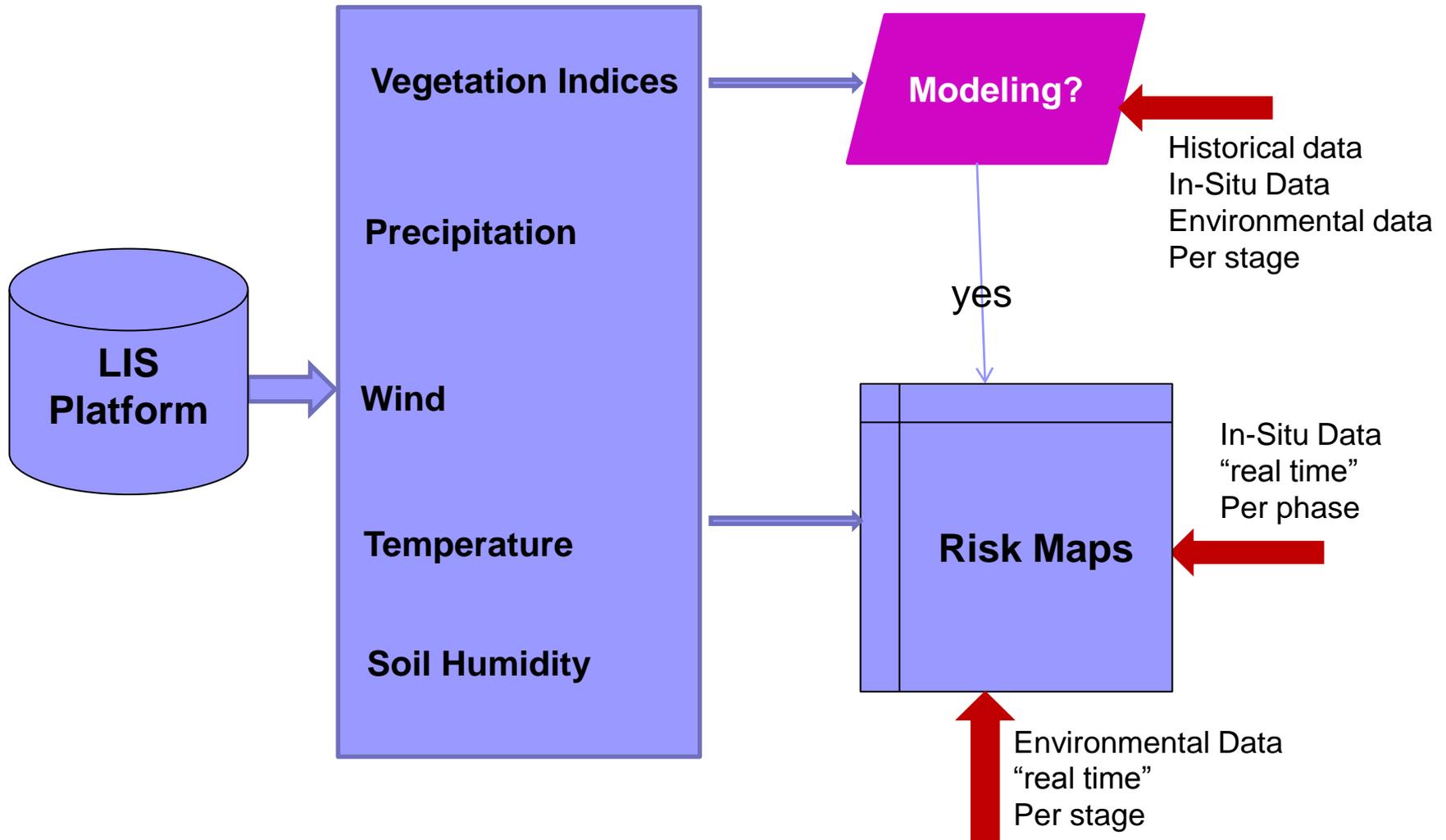
- **International expert selected : contract under negotiations**
- **Geo Database form previous projects (ongoing)**
- **End-User involved (HCEFLCD, Water Department, MAPM)**
- **First expert intervention expected in early January 2013**



# Module-5 : Locust Monitoring

## Action I : Environmental Indicators

## Action II : Locust Risk Maps





## **Module-5: Current Situation**

- **First expert recruited (report elaborated)**
- **Geo Database for environmental parameters (ongoing)**
- **End-User involved (MoU signed)**
- **Post-Doc engaged**
- **ToR-2 locust risk modeling (submitted)**
- **ToR-3 soil moisture production (submitted)**



# Project Global Current Situation

## 1<sup>st</sup> Project Partners Workshop



Royal Centre for  
Remote Sensing

المملكة المغربية  
ROYAUME DU MAROC



Ministère de l'Énergie, des Mines, de l'Eau et de  
l'Environnement  
Département de l'Eau



The World Bank



## Regional Coordination on Improved Water Resources Management and Capacity Building Program

### The First National Workshop Rabat- January 17, 2013

**LDAS-Morocco Project:**

**Integrating Remote Sensing Data in Water  
Resource Management and Agriculture**



# Project Global Current Situation

## 1<sup>st</sup> Project Partners Workshop

Programme Final  
Premier Atelier National  
CRTS, 17 Janvier 2012

8h30 - 9h Accueil/inscription

9 h -10h30 Présentations Générales :

- **Allocutions d'ouverture**
  - Centre Royale de Télédétection Spatiale
  - Banque Mondiale
  - Conseil Arabe de l'Eau
- **Présentations Générales**
  - CRTS (missions, mandats, projets)
  - DRPE (Stratégie Nationale 2030)
  - CAE (Coopération régionale)

10h30-10h45 Pause Café

10h45-12-45 : Les composantes thématiques du projet LDAS-Maroc

- Le projet LDAS-Maroc : concept, objectifs, plan d'implémentation et résultats attendus (A. Er Raji)
- Evaluation de l'impact des changements climatiques sur les ressources en eau (A. Er Raji)
- Optimisation de la gestion d'irrigation (M. Merdas/ A. Er Raji)

Pause Déjeuner

14h30-16-00 : Les composantes thématiques du projet LDAS-Maroc (suite)

- Sécheresse et alerte précoce (N. Bijaber)
- Suivi des inondations (A. Er Raji)
- Suivi du criquet (M.F. Smiej)

16h - 16h15 Pause Café

16h15 - 18h table Ronde

- Table ronde sous le thème : Synergie entre les partenaires et utilisateurs du projet pour une exploitation durable des résultats du projet.
  - D. Ouazar, de l'École Mohammadia des Ingénieurs
  - A. Ben Abdelfadel, Direction de la Recherche et de la Planification de l'Eau
  - X. Chauvat, Banque Mondiale
  - A. Er Raji, Centre Royal de Télédétection Spatiale



Projet de Coordination Régionale pour l'Amélioration de la Gestion des Ressources en Eau et de Renforcement des Capacités

**LDAS-MAROC**

Intégration dans le projet

**LIVRABLES**

- Evaluation de l'impact des changements climatiques sur les conditions hydrologiques passées (données historiques)
- Production de paramètres hydrologiques clés pour l'évaluation du potentiel hydrique actuel (plan hydrique national et par bassin)
- Développement de scénarios sur les conditions hydrologiques futures

**OBJECTIFS**

- Développer des données satellite et d'indicateurs dans les domaines de la :

**BENEFICIAIRES**

- Agences des Bassins Hydrologiques
- Citoyens de l'axe en Valeur Agricole

**PARTENAIRES**

- Ministère de l'Énergie, des Mines, de l'Eau et de l'Environnement; Département de l'Eau, Direction de la Recherche et de la Planification de l'Eau

**AMéliORATION DE LA GESTION DES RESSOURCES EN EAU ET ADAPTATION AUX CHANGEMENTS CLIMATIQUES**

Les Données de Télédétection pour la Gestion des Inondations

**LIVRABLES**

- Paramètres hydrologiques au niveau national
- Cartes des inondations au niveau local

**BENEFICIAIRES**

- Agences des Bassins Hydrologiques
- Protection civile
- Autorités locales

**PARTENAIRES**

- Ministère de l'Énergie, des Mines, de l'Eau et de l'Environnement; Département de l'Eau, Direction de la Recherche et de la Planification de l'Eau

**OBJECTIFS DE LA COMPOSANTE**

L'objectif principal vise à contribuer à une meilleure connaissance de l'hydrologie des grands bassins et l'organisation des interventions sur le terrain pour la production rapide d'informations sur les événements inondables et la mise à disposition de ces informations aux intervenants au moment opportun.

Les objectifs spécifiques sont :

- Contribuer à une meilleure connaissance de l'hydrologie des grands bassins hydrographiques à travers la production de paramètres hydrologiques au niveau national
- Production d'informations rapides à partir des images à très haute résolution spatiale pour la gestion des événements inondables

En raison du grand intérêt que représentent ces régions pour le pays, les actions de développement futur doivent tenir compte de la réduction et l'atténuation de l'impact dévastateur des inondations. Ceci passe inévitablement à travers la maîtrise de plusieurs niveaux du risque d'inondation dans la région. Les actions les plus urgentes doivent donner plus d'importance à la réduction de la vulnérabilité et à la gestion de la période de crise.





# Project Global Current Situation

## Project Monitoring Tables (DRAFT)

Fund Sources	Total Budget (2011-2015)	% of	Annual Budget (2013)	Completed					
				Allocated	% of				
7	8	9	10	11	12	Cumulative Completed to DATE		% of Cumulatively Completed to PAD	
						Quantity	Amount	Quantity	Amount
<b>Component 1: Improved Local Water Resources and Agricultural Management</b>									
103	<b>Sub-total for component 1</b>						61 000,00		3,38
<b>Component 2: Capacity Building and Project Management level</b>									
<b>2-A-1: Capacity building by participation in workshops</b>									
107	2-A-1-1: Organizations of 1st national workshop with partners and endusers.					1,00	6 000,00	100,00	100,00
108	2-A-1-2: Organizations of annual workshops in Morocco to share information and results with partners and endusers.					0,00	0,00	0,00	0,00
<b>2-A-2: Capacity building by Consultants</b>									
110	2-A-2-1: Training on LIS models and Land Data Assimilation Techniques					0,00	0,00	0,00	0,00
111	2-A-2-2: Training on the use of EO for drought monitoring					0,00	0,00	0,00	0,00
112	2-A-2-3 Training on applied RS to environmental monitorin for CRTS and end-users								
<b>sensing</b>									
114	2-B-1-1: Participation to international conferences and seminars					0,00	40 000,00	0,00	285,71
115	2-B-1-2: Participation to regional workshops					0,00	0,00	0,00	0,00
116	2-B-1-2: participation to short stage					0,00	0,00	0,00	0,00
117	2-B-1-2: participation to individual training session					0,00	0,00	0,00	0,00
<b>2-C: Funding graduate fellowships</b>									
119	2-C-1-1: Short stage on specific project needs					0,00	0,00		0,00
<b>institutions</b>									
<b>2-D-1: Dissemination Plate form implementation</b>									
122	2-D-1-1: Plate form specification (ToR)					0,00		0,00	
123	2-D-1-2: Plate form acquisition (hardware)					0,00			
124	2-D-2: Plate form implementation (software)						0,00		0,00
<b>2-E: Project management of the Grant</b>									
<b>2-E-1: PMU assistance</b>									
127	2-E-1-1: Recrutement of procurement specialist					15,00	35 000,00	100,00	100,00
128	2-E-1-2: Recrutement of technical expert					0,00	0,00	0,00	0,00
129	2-E-1-3: Documents traduction to english					0,00	0,00	0,00	0,00
130	<b>Sub-total for component 2</b>						81 000,00		21,60
131	<b>Contingency</b>						0,00		0,00
132	<b>Project Total</b>						142 000,00		13,52



# Project Global Current Situation

- **Negotiations : 16-18 March 2011**
- **Effectiveness : 27 January 2012**
- **NASA visit 25, 26 et 27 January 2012: Meetings with end-users**
- **Thematic components technical description (partners, data, outputs etc.)**
- **Product description (resolution, frequency, etc )**
- **Project Implementation Plan (CRTS/NASA)**
- **Detailed action plan per component**
- **Recruitment of a Procurement specialist**
- **Internal workshop in CRTS 23-24 October 2012**
- **1st national workshop 17 January 2013**
- **Regional Component (Report to AWC: April and November 2013)**
- **Semi-annual reports n°1, n°2 and n°3**
- **IGF 1<sup>st</sup> audit (November 2013)**
- **Review of Project Procurement Plan (Sept 2013)**
- **Establishment of physical and financial tables (2<sup>st</sup> version, Nov 2013)**
- **LIS installation (CRTS and ICBA)**
- **ToR/Contracts for thematic components (done and ongoing)**
- **MoU signed with end-users (3/4)**

**Time is for RESULTS**