



LDAS - TUNISIA

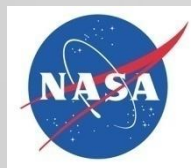
AMELIORATION DE LA GESTION DES RESSOURCES EN EAU ET ADAPTATION AU CHANGEMENT CLIMATIQUE LDAS – Tunisie

IMPROVEMENT OF WATER RESOURCES MANAGEMENT AND ADAPTATION TO CLIMATE CHANGE LDAS – Tunisia

Karem Ben Khaled

On behalf of the Project coordinator, CRTEAN

Cairo, Mai 25 2017



Project overview

The Project concerns 05 states :

Tunisia, Morocco, Egypt, Lebanon and Jordan



❑ GEF Grant managed by the World Bank



❑ Technically supported by **NASA**



❑ Managed by the **CRTEAN**



❑ **Supported by :**

▪ Arab Water Council AWC



▪ International Center for Biosaline Agriculture ICBA



▪ USAID



Partners

❖ Ministry of Agriculture

- ☐ General Directorate of Water Resources
- ☐ General Directorate of Rural Engineering and Water Exploitation
- ☐ General Directorate of Agricultural Production
- ☐ National Institute for field crops

❖ National Center of Mapping and Remote Sensing

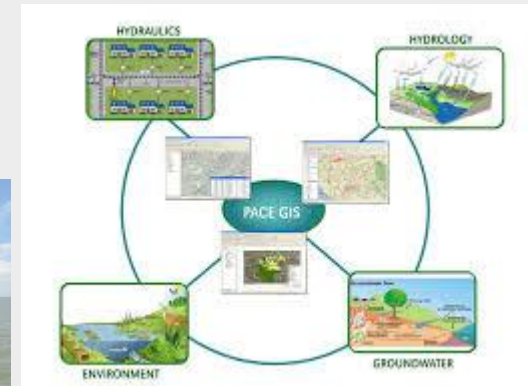
❖ National Institute of Meteorology

❖ Universities and research labs

- ☐ Arid Region Institute
- ☐ National Agronomic Institute of Tunisia
- ☐ National School of Engineer of Tunis

General Objectives

- ❖ Monitor the availability of water resources
- ❖ Monitor the agricultural activities, using evapotranspiration models
- ❖ Flood mapping, forecasting and monitoring
- ❖ Establish a mechanism for data dissemination: GISWEB
- ❖ Monitor the phenomenon of drought through the use of WISP tools



Specific Objectives

- ❖ **Integration of data from earth observation, in-situ data and models to product hydrological parameters for the characterization and optimization of the use of water resources;**
- ❖ **Improvement of management capacity of the variation of water resources availability including surface water, groundwater and changes in land use associated with them;**
- ❖ **The contribution to the estimation of the water used by irrigated crops for better planning and evaluation of productivity**
- ❖ **The contribution to the release and determination of trends in terms of climate change impacts and the consolidation of existing knowledge**
- ❖ **Capacity building for operational use of the possibilities offered by new information technologies**

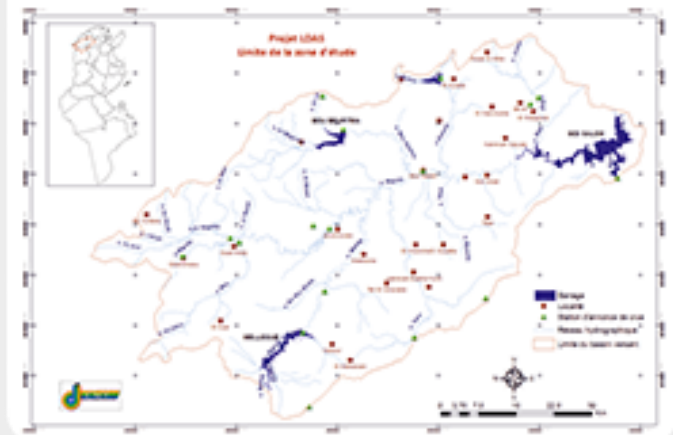
Project Area

STUDY AREA

- Grombalia aquifer
- North-Gafsa aquifer
- Sidi Bouzid aquifer
- Kairouan aquifer
- North and South Gabes aquifers
- Kebili
- Tozeur



STUDY AREA



STUDY AREAS: Public Irrigated Perimeters

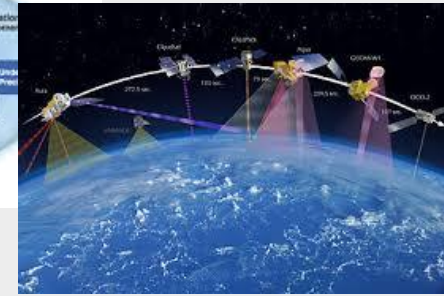
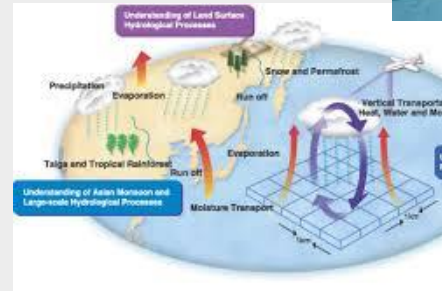
- Jendouba : El Brahmi (sector 1)
- Nabeul : Lebna
- Kairouan: Ain Bou Morra



Project deliverables

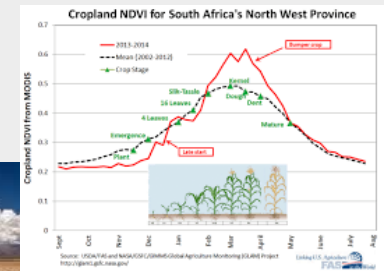
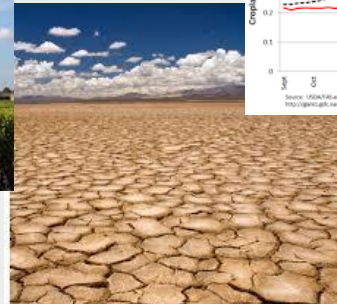
The main Project deliverables will be:

- ❖ Benefit from the contribution of coupled physical models of terrestrial and space observation for the quick estimation of hydrological parameters



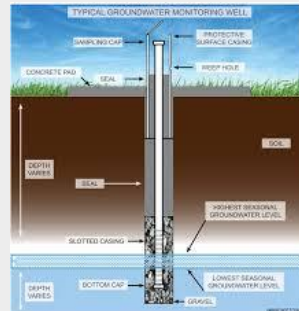
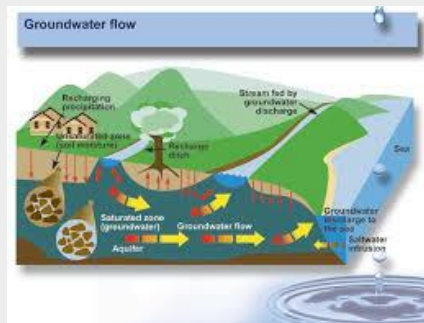
- ❖ Optimize the use of water for irrigation through the monitoring of crop water needs

- ❖ Crop monitoring, yield estimation and drought monitoring



Project deliverables

- ❖ Monitor the impacts of climate change on changes in the availability of water resources



- ❖ Improve the management and enhancement of groundwater monitoring

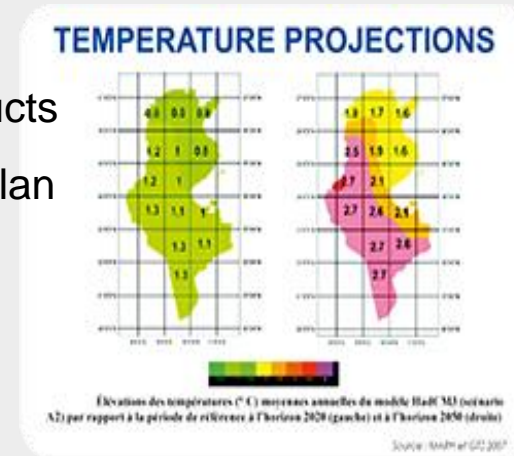
- ❖ Flood mapping; monitoring and forecasting



implementation phases

Phase 1 : Identification and analysis of users needs

- ❖ Collection and analyzing detailed needs of potential users of products
- ❖ Better understanding of the areas of activities, to develop a work plan and identify capacity building needs
- ❖ Definition of thematic applications to be considered by the project
- ❖ Analyses will include the size of the system capacity in terms of acquisition and processing of data and to assess the need to perform field measurements



Phase 2 : Capacity building

Capacity building will focus on the acquisition of NASA data in real time, their processing and participation in the development of different models on an appropriate platform based on the technical assistance of national and international experts which also accompany the local team to ensure a sustainable operation of the system.

implementation phases

Phase 3 : development and implementation

- ❖ During this phase, the scientific and methodological approaches adopted for each application will be developed, and based on needs identified during the first phase of the project.
- ❖ Ultimately, this phase should allow the implementation of the data infrastructure necessary for the operation of the Tunisian system and applications developed.
- ❖ The system will be the subject of ongoing work during the validation phase and will be operated by different users according to the initially requirements.

Phase 4 : Dessimination

- ❖ The results of this project will be disseminated through workshops and seminars.
- ❖ The project also includes the establishment of a platform for online access to the products for different users. This platform should provide and secure sharing of information necessary to operate the system.
- ❖ It will exchange in direction of the users by providing them with products and allow the transfer of in situ data to improve performance of the system.

Tasks performed (1/3)

- ❖ **Starting workshop:** Tunis, 31 January 2011
- ❖ **2nd National Workshop :** Tunis, 22-23 November 2012
 - Identification of technical teams
 - Definition of a draft of implementation plan
- ❖ **Meeting with World Bank** on 25/04/2013, Tunis.
- ❖ **Management visit to GSFC:** June 2013
- ❖ **3rd National Workshop :** Tunis, 25-27 November 2013 **(85 national participants + 02 from Libya + 02 from Soudan: guests of CRTEAN)**
 - Confirmation of end-users needs
 - Updating the implementation plan
- ❖ **Training on CREST model:** SSAI , Inc, November 2013
- ❖ **Training on Irrigated crop mapping by remote sensing:** WU, November 2013
- ❖ **Agreement signed with Ministry of Agriculture :** 04 December 2013

Project Axis

❖ Flood Mapping and Modeling

- Delimitation of the study area
- Collection and formatting historical meteorological data.
- Collection and formatting hydrological data.
- Collection and formatting topographic data (DEM, GIS data).
- Initiation of the model calibration

❖ Irrigation and Crop Mapping

- Training on Crop mapping at the University of Wisconsin from 21 to 29/10/2013.
- Meetings with partners to identify end-users needs
- Choice of study areas according to the diversity of the agriculture landscape and the issues of irrigation: 03 governorates are selected.
- Preparation of digital data set for the study areas.

❖ Drought

❖ Ground water storage

- first meeting of the Group was held at the INM in April 2013

❖ Climate change

- Preparation of digital data set for the study areas

Updating of implementation plans

Flood mapping & modeling (1/3)

Application	NASA Role	Tunisian team Role (CNCT, DGRE, INM, DGBGTH)	Comments	Tentative Schedule	
				Start Date	Completion
Training on flood regional model transfer	Training on CREST model	-Select trainees (2 participants, duration 12 days) - Procure computers	NASA to have agreement with Oklahoma university	28 October 2013	08 November 2013
CREST global flood model	NASA assist in evaluation	Implementation of the CREST model	DEM resolution of 1Km	November 2013	November 2013
	-NASA assist in validation	-To provide major dams characteristics - to provide historical precipitation and evapotranspiration data - Calibration and validation of the CREST model	DEM resolution of 1Km	December 2013	January 2014
	NASA to provide GPM precipitation data (10 km or 0.1 °resolution)	To evaluate data		1st quarter 2014	3rd quarter 2014
	- NASA assist in server specifications - The new version of CREST model??	- To acquire a server - Implementation and validation of the CREST model using DEM resolution of 30m	DEM resolution of 30m	1st quarter 2014	1st quarter 2014
NRT (250m) MODIS flood maps	To generate and provide maps for historical flood events from 2003 to 2012	-To provide digitized survey maps of streams (250 m) -To evaluate maps	http://oas.gsfc.nasa.gov/floodmap/	1st quarter 2014	1st quarter 2014
Landsat (30m) flood maps	To generate and provide maps for historical flood events from 2003 to 2012	-To provide digitized survey maps of streams (30 m) -To evaluate maps		1st quarter 2014	1st quarter 2014

Flood mapping & modeling (2/3)

Application	NASA Role	Tunisian team Role (CNCT, DGRE, INM, DGBGTH)	Comments	Tentative Schedule	
				Start Date	Completion
Regional Flood modeling	Training on flood mapping at GSFC	To select trainees (2 participants, duration 10 days)		March 2014	March 2014
	<ul style="list-style-type: none"> - To develop prototype 30m and 250m flood model for Medjerda river - To assist in evaluating: <ul style="list-style-type: none"> - CREST - Others models -To perform customization for visualization results and model development on prototype 	<ul style="list-style-type: none"> -To evaluate: <ul style="list-style-type: none"> - CREST - Others models -To evaluate customization for visualization results and model development on prototype 		April 2014	June 2014
	Training on flood mapping (use and valorization of generated products)	To select trainees (duration 15 days)	For end-users in Tunisia	November 2014	November 2014

Flood mapping & modeling (3/3)

Application	NASA Role	Tunisian team Role (CNCT, DGRE, INM, DGBGTH)	Comments	Tentative Schedule	
				Start Date	Completion
Radar flood mapping	<ul style="list-style-type: none"> - NASA to provide the algorithm - NASA to perform training on radar flood mapping 	To select trainees (3 participants, duration 10 days)		1 st half Sept September 2014	1 st half September 2014
	- To assist in approach	-To approach CSA, JAXA and ESA for radar data and evaluate.	Agreement to receive required data at the same day of the flood event	2nd quarter 2014	2nd quarter 2014
Regional Flood Forecasting CREST		- to determine what precipitation and evapotranspiration forecast data are available	<ul style="list-style-type: none"> - Spatial resolution? - Forecasting time? - Model? 	January 2014	January 2014
		- to evaluate forecast maps based on historical data		July 2014	October 2014
	- To assist in evaluation	<ul style="list-style-type: none"> - Developing forecast maps to provide early warning indication. - To evaluate forecast maps 		November 2014	March 2015

Irrigation and Crop Mapping (1/2)

Application	NASA Role	Tunisian partners Role	Where	Tentative Schedule	
				Start Date	Completion
Digital GIS data set of irrigated areas and crop types for three governorates: Nabeul, Kairouan & Jendouba	Provide training to Tunisian partners.		University of Wisconsin	21/10/2013	29/10/2013
	Transfer the capability / model / software for 2 persons during 7 days.	Establish rules to identify cropland	Tunisia	3 rd quarter 2013	On going
	Provide training to Tunisian partners on programming algorithm using scripts/languages for 2 persons during 10 days.	Identify rules for irrigated, non irrigated areas	GFSC or its contractors	March 2014	March 2014
	Validation of the rules made on crop type identification	use the rules already done on crop type identification in a programming/script language	Tunisia	May 2014	November 2014
		Acquire very high resolution image (for instance, Quickbird, world view,...) Mapping field boundary using very high resolution image in pilot sites.	Tunisia	February 2014	Mars 2014
	Training on the valorization of crop mapping results. The trainer from WU.	Provide crop mapping results and evaluation	Tunisia	December 2014	December 2014

Irrigation and Crop Mapping (2/2)

Application	NASA Role	Tunisian partners Role	Where	Tentative Schedule	
				Start Date	Completion
ET mapping		Acquire Flux station (1) for ET measurements Measurements of ET at field conditions.	Tunisia	January 2014	Mars 2014
		Acquire soil moisture sensors (20) Monitoring soil water content for crops at field conditions	Tunisia	January 2014	Mars 2014
	Plan a visit to crop monitoring services at USDA for 4 persons during 05 days	Identify the crop monitoring system by remote sensing used by USDA	USDA	March 2014	March 2014
	Provide training on actual ET mapping using Alexi DisAlexi and/or METRIC models for 2 persons during 10 days. Providing the models to Tunisian partners	Provide ET data and modeling validation.	NASA or USDA or Wisconsin University	May 2014	May 2014
	Provide training on mapping crop water requirement for 10 persons during 10 days. The trainer is from WU/USDA.	Provide information on field boundary and major crop classes.	Tunisia	November 2014	November 2014
Crop modeling	Provide training on crop modeling and yield mapping using DSSAT for 2 persons during 10 days	Provide yield and biomass data and modeling validation	Giorgia University or Wisconsin University	September 2014	September 2014

Drought Monitoring

Application/Action	NASA Role	Roles of Tunisian partners	Comments	Tentative Schedule	
				Start Date	Completion
Literature review on drought early warning systems	Reviewing	Task to be carried out by the Tunisian partners. IRA takes the lead.		4 th quarter 2013	ongoing
Alexi ET and anomaly (3km, daily, NRT) maps	NASA / USDA to generate	INM (Northern region) and IRA (central and southern regions) to validate, USDA training in Tunis and/or at USDA		2 nd quarter 2014	Ongoing
MODIS ET 1 km, daily NRT	NASA to investigate	INM (Northern region) and IRA (central and southern regions) to validate, USDA training in Tunis and/or at USDA	NASA generated product (Univ. of Montana - Steve Running algorithm)	1 st quarter 2014	
Disalexi (90m, NRT, produced at CNCT)	NASA / USDA to generate	INM (Northern region) and IRA (central and southern regions) to validate, USDA training in Tunis and/or at USDA	Additional resources required from CNCT for NASA contractor	1 st quarter 2014	1st quarter 2015
LIS ET, SM, ground water level (1 km, daily nowcast)	NASA provided hydrological model	Produced via DGRE validated and calibrated model	See hydrological modeling above	2nd quarter 2014	1st quarter 2015
Precipitation data and forecast	NASA can provide TRMM and GEOS-5 data	INM to provide data storage and management	NASA's future GPM satellite data. CNCT to provide precipitation forecast from their Meteorology Office	2nd quarter 2014	
Soil moisture satellite products	TBD	TBD	From NASA's future SMAP satellite. CNCT can contact ESA for SMOS data.	2nd quarter 2014	TBD
fAPAR (& fAPAR anomaly) calculation (1 km, 10 days)	TBD	CNCT to calculate fAPAR	Contacts with JRC will be established by CNCT to investigate eventual partnership	2nd quarter 2014	On going
MODIS NDWI* (1 km, 10 days)	TBD	CNCT to calculate and validate		2nd quarter 2014	
Calculation of Combined Drought Indicator (CDI) using SPI, soil moisture & fAPAR	TBD	INM and CNCT to calculate this indicator using the generated parameters above (SPI, SM & fAPAR)	International expertise will be engaged for the methodology development and adaptation to the Tunisian context	3rd quarter 2014	

Climate changes (2/2)

Application	NASA Role	INM Role	Comments	Tentative Schedule	
				Start Date	Completion
Statistically downscaled climate projections for TUNISIA	<ul style="list-style-type: none"> ▪ NASA / JHU to provide downscaling scripts. ▪ Transfer of downscaling code to INM. ▪ Provide documentation and initial support for implementation. Of ICBA 	<ul style="list-style-type: none"> ▪ To execute the script and customize it. ▪ Produce climate projections for TUNISIA with a resolution of about 10 km. Projections will be performed for middle and high emissions scenarios and for multiple GCM realizations. ▪ Evaluate utility of climate projection data. ▪ Formatting projection climate data needed in the other project components. 	<ul style="list-style-type: none"> ▪ Will require statistical downscaling training for two engineers at ICBA in January 2014. (10 days of training) 	1 st quarter 2014	ongoing
Dynamically downscaled climate projections for TUNISIA	<ul style="list-style-type: none"> ▪ Investigate the feasibility of providing NASA climate projections from CMIP5 climate model runs. 	<ul style="list-style-type: none"> ▪ Work with ICBA to adopt and adapt dynamic methods of downscaling. ▪ Coupling the WRF model with GCM outputs of CMIP5. ▪ Produce climate projections for TUNISIA with a resolution of about 15 km. 	<ul style="list-style-type: none"> ▪ Will require dynamical downscaling training at ICBA not later than March 2014. ▪ Will require computing capacity of ICBA or strengthening computing capacity of INM with the acquisition of a working station of 250 Gigafllops to ensure dynamic downscaling execution. Budget? 	TBD (Tributary to the dynamical downscaling training)	TBD (Tributary to the computing capacity available)

Ground water storage (1/2)

Application	NASA Role	Tunisian team Role	Comments	Tentative Schedule	
				Start Date	Completion
To develop the water balance of groundwater basins : Abstraction and recharge	Provide model	Provide hydrogeological data (historical of groundwater levels, ..)	CRTEAN, World Bank and NASA to discuss with ICBA and sign agreement.	1 st quarter 2014	2 nd quarter 2014
LIS model	Technical assistance	To evaluate	NASA non objection	1 st quarter 2014	2 nd quarter 2014
Training on storage modeling (LIS)		1. To select trainees 2. To procure computers	NASA to have agreement with ICBA	3 rd quarter 2014	3 rd quarter 2014
Ground water storage and recharge modeling	NASA/ICBA to develop prototype model for : - Grombalia aquifer, - North-Gafsa aquifer, - Sidi Bouzid aquifer, - Kairouan aquifer, - North and South Gabes aquifers. - Kebili - Tozeur NASA/ICBA to assist in evaluating	to provide piezometric data and area	Additional resources required for Tunisia for NASA contractor	-	4 th quarter 2014
		To perform customization for visualization results and model development on prototype		October 2014	Tbd
		to evaluate		Jan 2015	Ongoing

Ground water storage (2/2)

Application	NASA Role	Tunisian team Role	Comments	Tentative Schedule	
				Start Date	Completion
Ground water storage and recharge modeling	NASA to provide the algorithm and NASA to perform training on ground water storage	to approach for ground water data and evaluate. To select trainees To procure computers	Approximately 12 months required to prepare the algorithms for transfer	1 st quarter 2014	Ongoing
				2 nd quarter 2014	-
Regional Ground water storage and recharge evaluation	TBD	DGRE to determine what hydrogeologic data is available from DGRE and CRDA.	Spatial resolution? Time step of piezometric data? File format type binary? File transfer method?	TBD	

شكرا جزىلا

Thank you for your attention