

Royal Jordanian Geographic Centre



**Water Resources Management Using Geospatial Information and
Remote Sensing Techniques
(Case Study- AL Azraq Area)**

**4th International Conference on the Use of Space Technology for Water
Management
ISLAMABAD- PAKISTAN.**

26 FEBRUARY - 2 MARCH 2018

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Project Overview

- Fresh water scarcity in the MENA region, an increasingly acute problem, especially with population growth, rapid urbanization and pressure to divert water from agriculture (which consumes more than 84 percent of water in the Mediterranean countries) continue to increase domestic and industrial use. The objective of the project is to improve water resources management, agricultural management and planning within MENA countries, Lebanon, Jordan, Egypt, Tunisia and Morocco, based on decision-making tools based on quantity and area using modern technology.

Project Components

- Improved Local Water Resources and Agricultural Management
- **(3.6 M USD)**
- Capacity Building and Project Management
- **(1.3 M USD)**
- Regional Integration and Cooperation
- **(394,595 USD)**

Project Aim

- - Measure the values of Evapotranspiration of the different plants and link that values to the quantity of irrigated water of the different plants and compare them with the quantity of pumped water (m³) according to the ministry of water and irrigation, to know if there is any illegal use of water from the farmers.

Partners

- NASA
- WORLD BANK
- Global Environment Facility
- ARAB WATER COUNCIL



PARTICIPANT COUNTRIES

- Jordan
- Egypt
- Lebanon
- Tunisia
- Morocco

STACKHOLDER

- ROYAL JORDANIAN GEOGRAPHIC CENTER.
- MINISTRY OF WATER AND IRRIGATION .

Hashemite Kingdom of Jordan



MINISTRY OF
WATER AND IRRIGATION



Project Components

- ❑ **Evapotranspiration. Yes**
- ❑ **Drought Monitoring**
- ❑ **Floods Detection and Modeling**
- ❑ **Climate Change Impact. Yes**
- ❑ **Crop Mapping & Irrigation. Yes**
- ❑ **Crop Yield Predictions**
- ❑ **Hydrological Modeling and Analysis**
- ❑ **Locust Monitoring**
- ❑ **Forest Fires Forecasting**



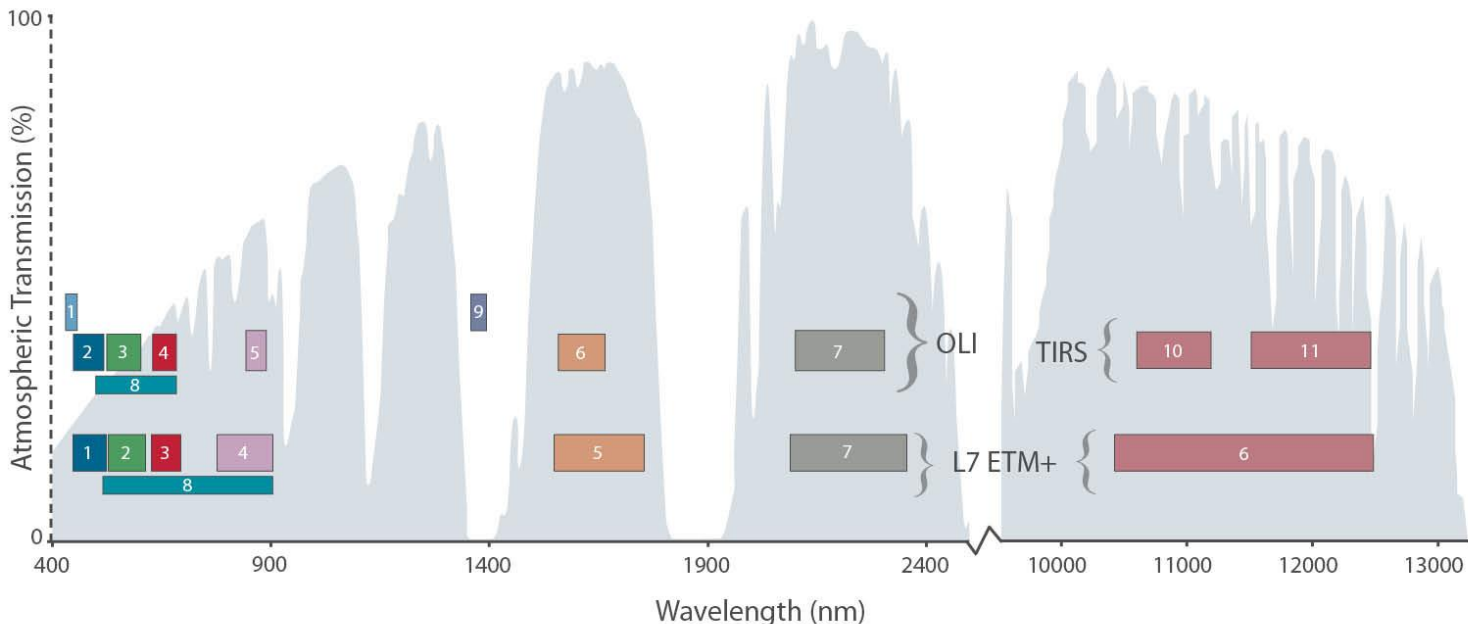
Data Used for the project

LANDSAT8 (open source)



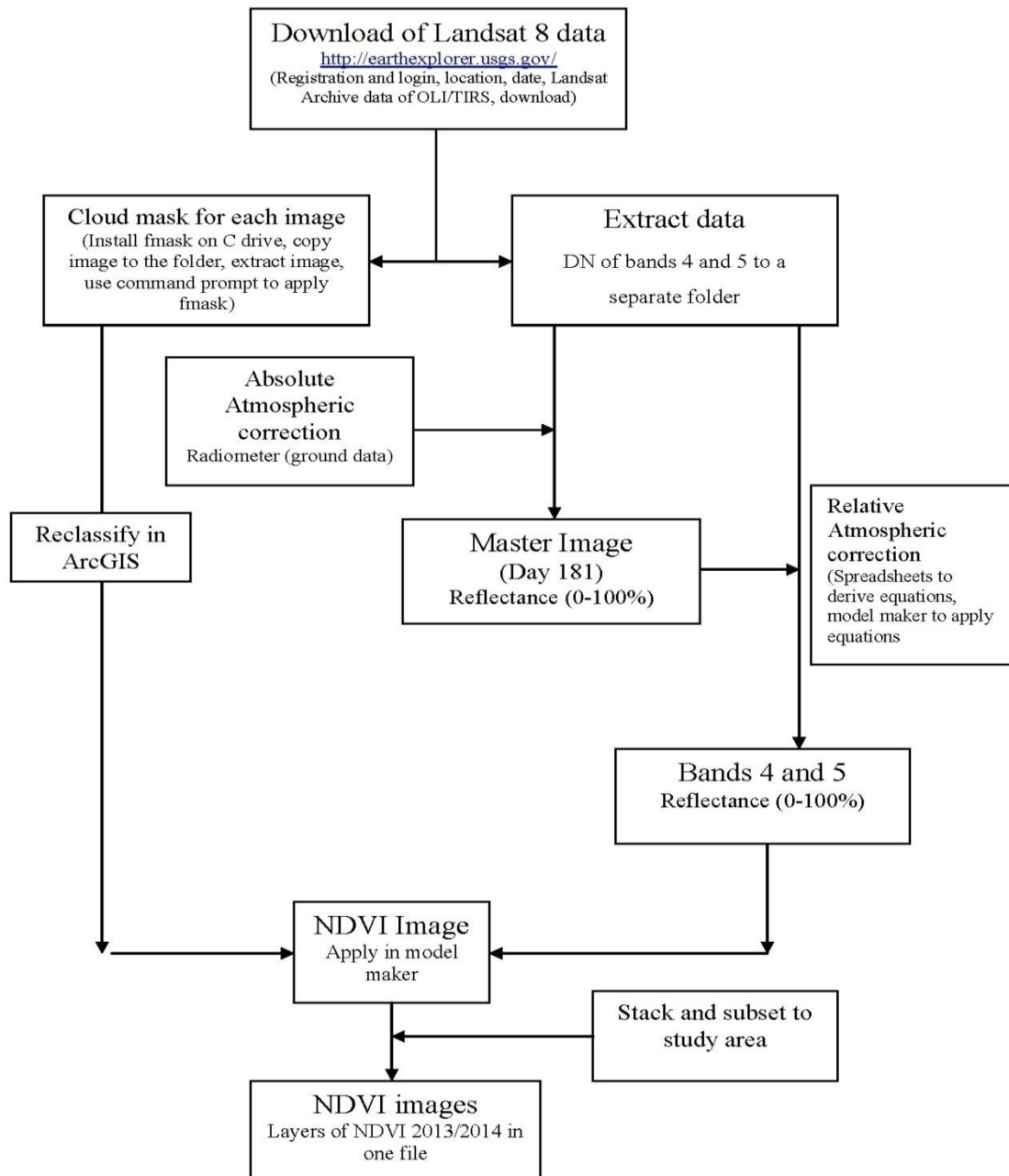
In collaboration between NASA and the United States Geological Survey (USGS)

Operates in the visible, near-infrared, short wave infrared, and thermal infrared spectrums- 15 m resolution.





Produce CROP MAPPING



Downloading Landsat 8 data

<http://earthexplorer.usgs.gov>

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Search Criteria **Data Sets** Additional Criteria Results

2. Select Your Data Set(s)

Check the boxes for the data set(s) you want to search. When done selecting data set(s), click the *Additional Criteria* or *Results* buttons below. Click the plus sign next to the category name to show a list of data sets.

Use Data Set Prefilter [\(What's This?\)](#)

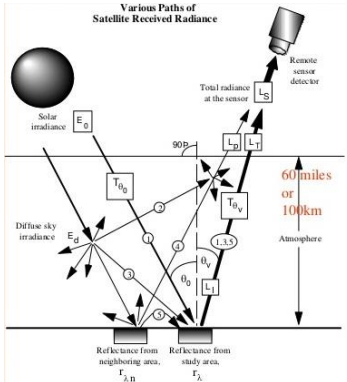
Data Set Search:

- Global Fiducials
- Global Land Survey
- HCMM
- ISERM
- Land Cover
- Landsat Archive
- Collection 1 Level-1
 - Pre-Collection
 - L8 OLITIRS
 - L8 OLITIRS Pre-WRS-2
 - Landsat Surface Reflectance - L8 OLITIRS
 - L7 ETM+ SLC-off (2003-present)
 - L7 ETM+ SLC-on (1999-2003)
 - Landsat Surface Reflectance - L7 ETM+
 - L4-5 TM
 - Landsat Surface Reflectance - L4-5 TM
 - L1-5 MSS
- Landsat Legacy
- Landsat MRLC
- NASA LPDAAC Collections
- Radar

Search Criteria Summary (Show) Clear Criteria

Map Satellite (32° 33' 21" N, 031° 27' 14" E) Options Overlays

Atmospheric Correction



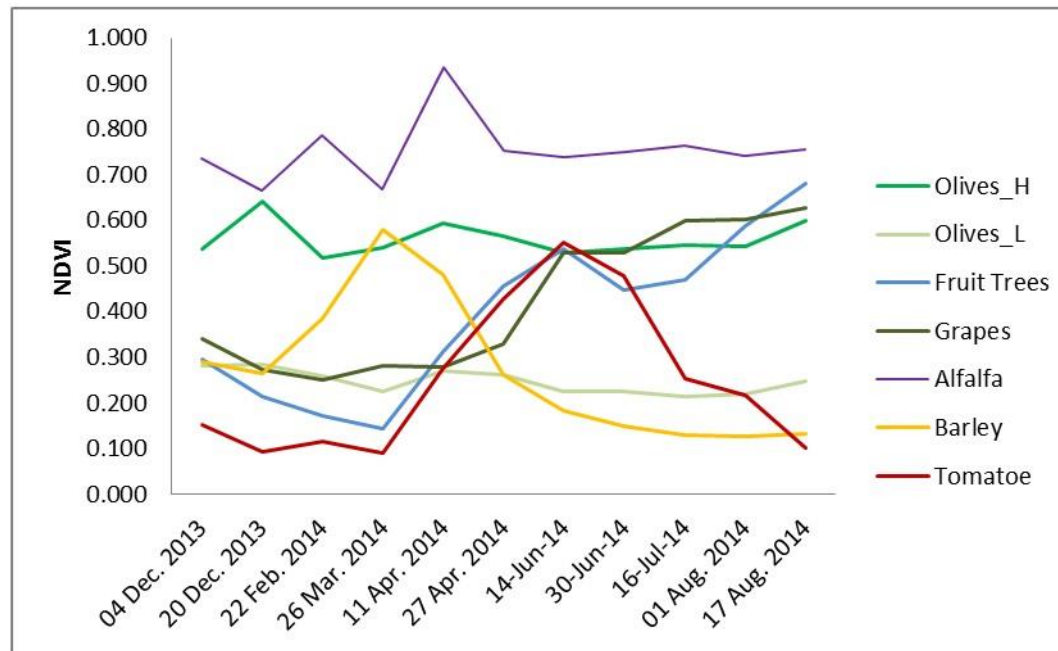
Atmospheric Correction

- Field visit.
- Using hand Held instrument.
- Calculating Radiation Value for Asphalt and non Asphalt areas .
- Compare the radiation values with Satellite radiation values.
- Atmospheric Correction for all images.

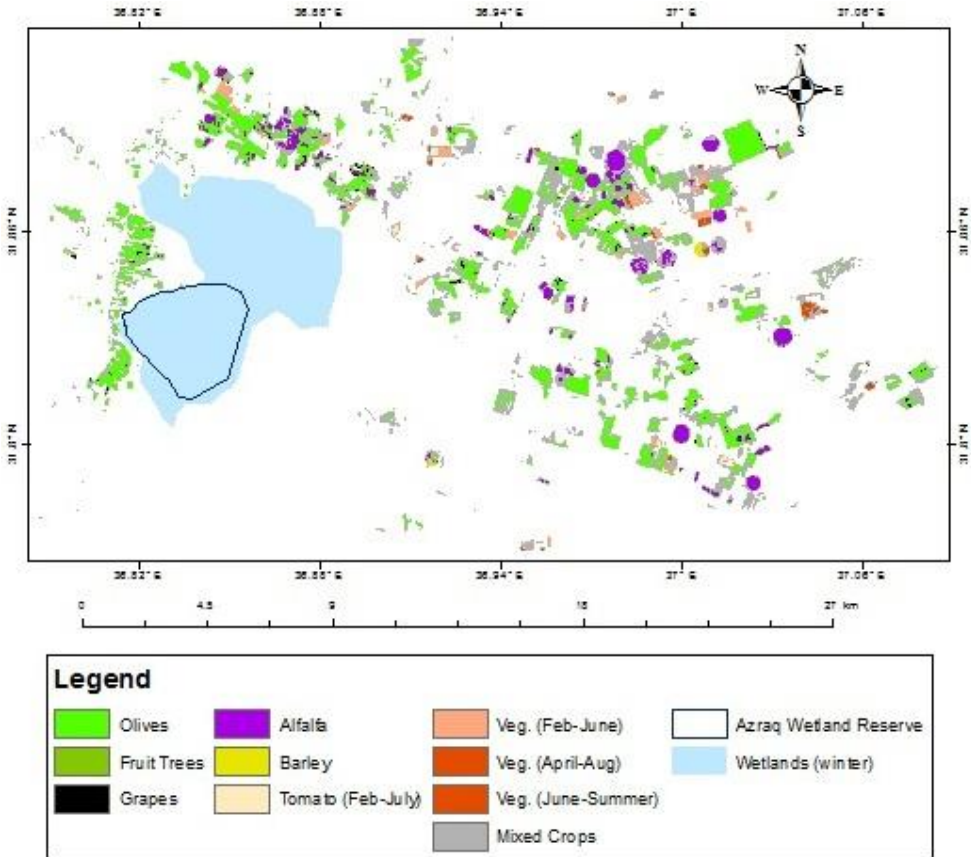
The Normalized Difference Vegetation Index (NDVI)

- $NDVI = (NIR_{ref} - R_{ref}) / (NIR_{ref} + R_{ref})$
- Stacking NDVI images in one file (data every 14days).
- Extracting NDVI profiles for crops (from agricultural specialst)
- Classifying NDVI image using results from NDVI profiles

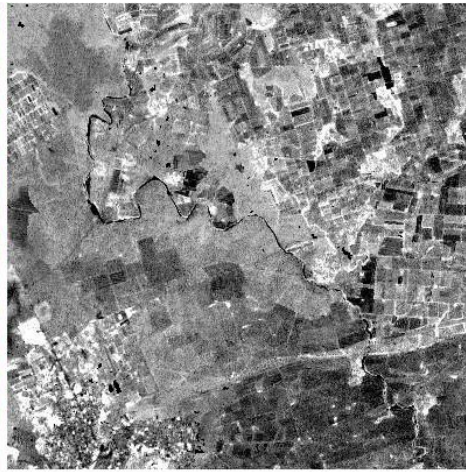
NDVI profiles for crops



Clipping the area of Azraq oasis.



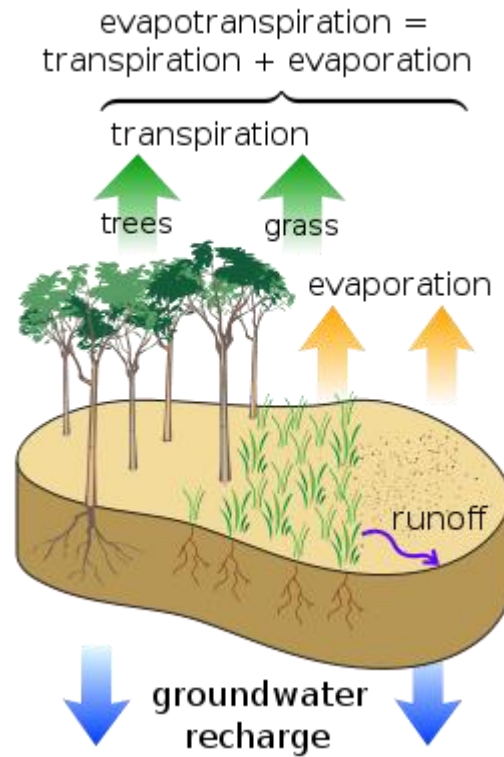
Example of image statistics extracted from Landsat data



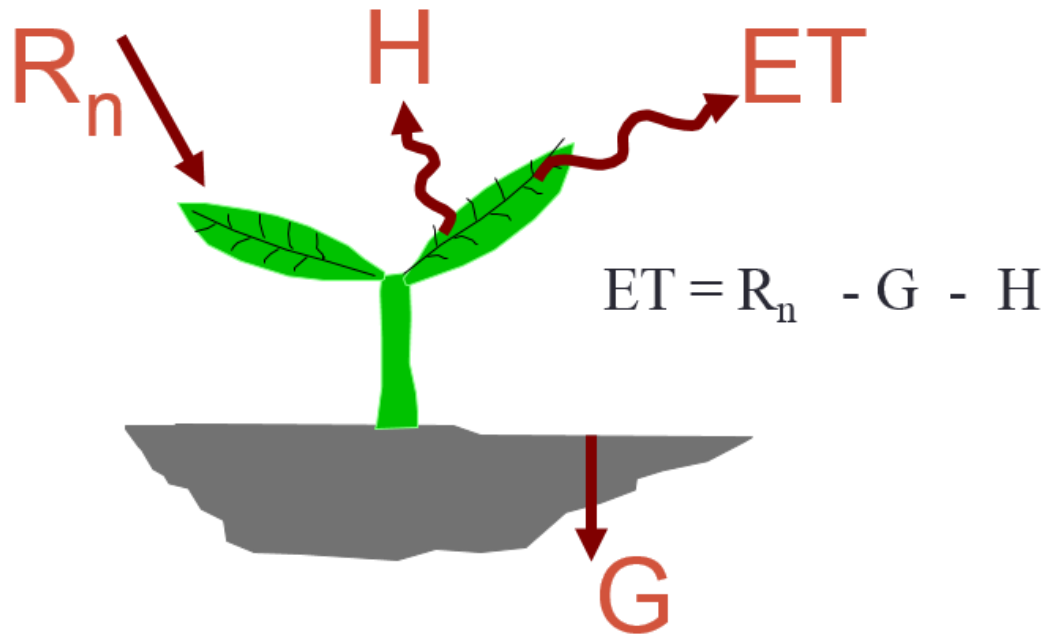


EVAPOTRANSPIRATION

Water cycle



Energy Balance



Algorithm solve the energy balance at the earth's surface using satellite imagery

- SEBAL : The Surface Energy Balance Algorithm for Land
- METRIC: (Mapping Evapotranspiration at high Resolution with Internalized Calibration)

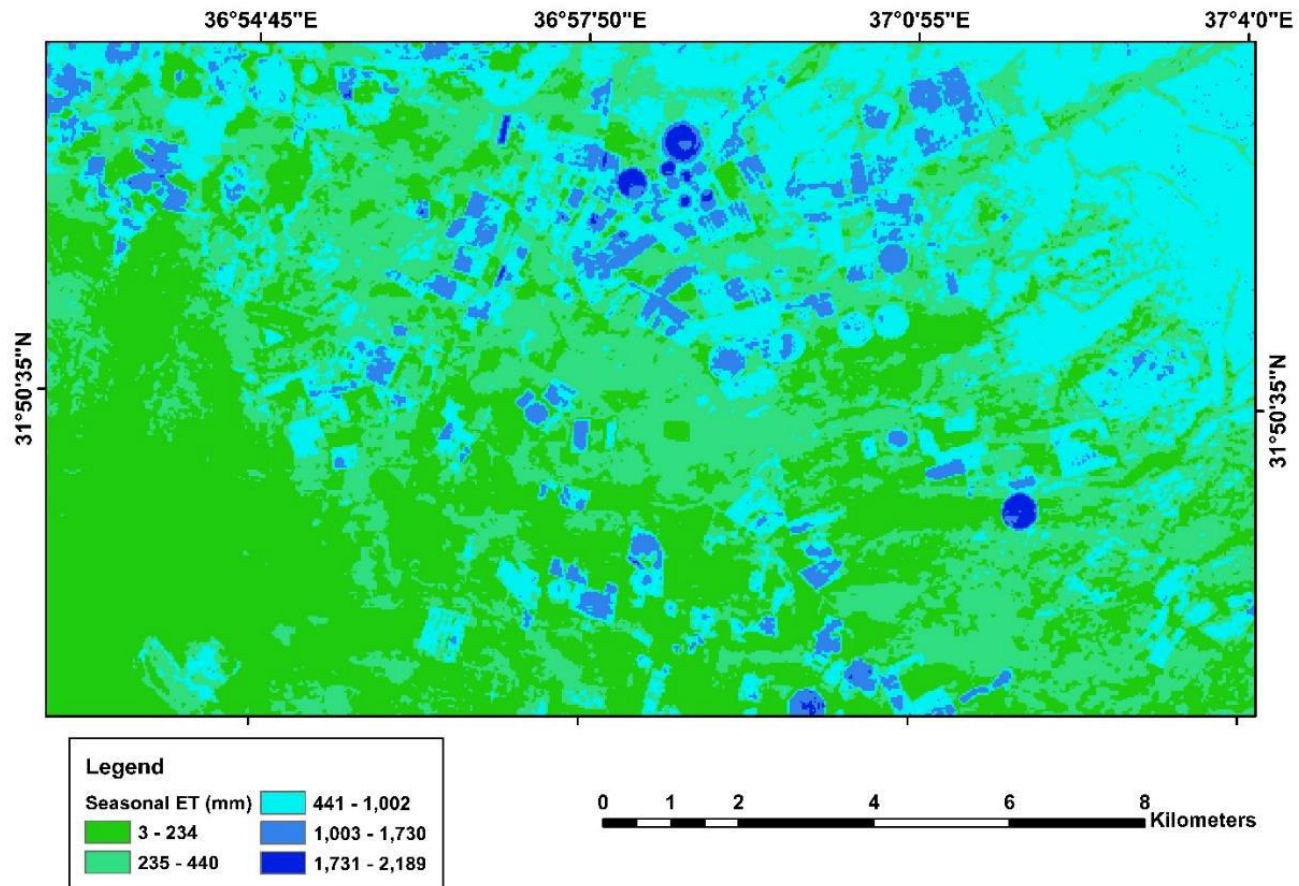
SEBAL Input

- surface albedo.
- leaf area index.
- vegetation index.
- surface temperature are derived from satellite imagery (Thermal band).
- meteorological data, such as wind speed, humidity, solar radiation and air temperature

METRIC Input

- short-wave and long-wave thermal images from a satellite e.g., Landsat and MODIS
- digital elevation model,
- ground-based weather data measured within or near the area of interest

Evapotranspiration map Al- Azraq Area



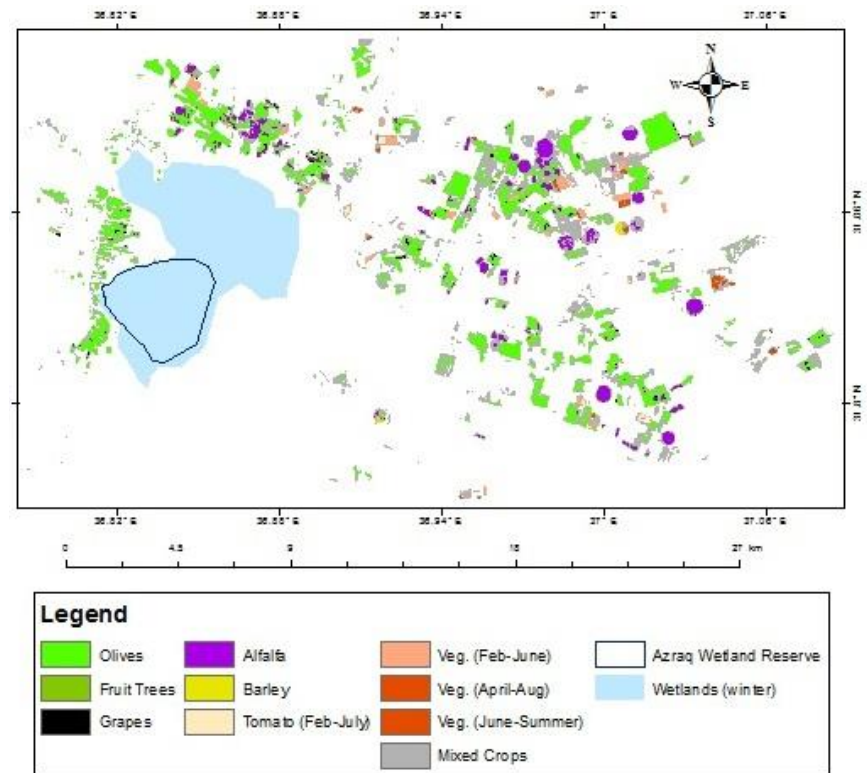
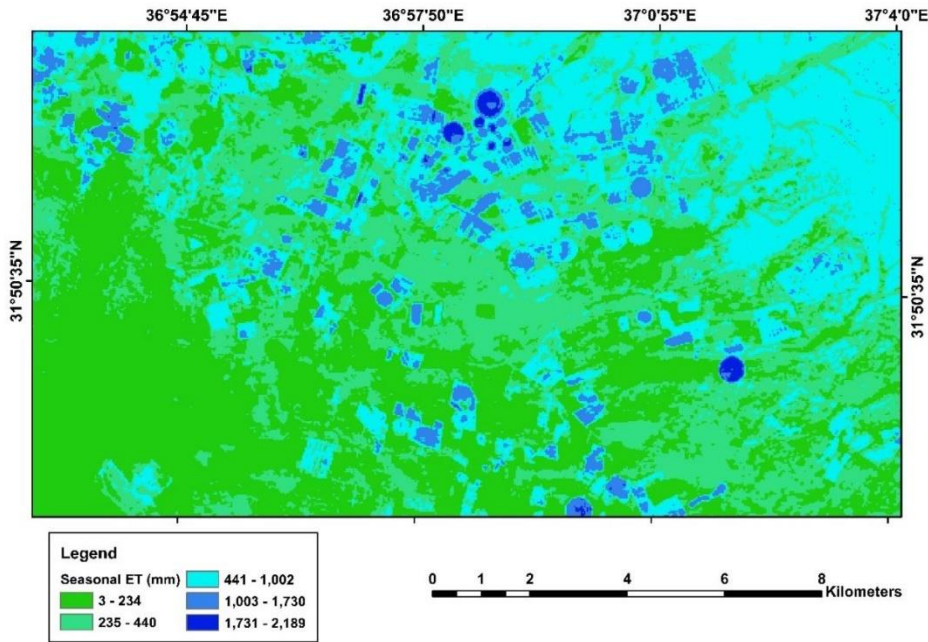
Amount of Evapotranspiration

Results

No.	Crop	Seasonal ET (mm)	Area (ha)	Total ET (MCM)	%
1	Alfalfa	1436	394.3	5.97	13.9
2	Barley	801	20.6	0.17	0.4
3	Fruits	1295	33.6	0.43	1
4	Grapes	1030	58.7	0.6	1.4
5	mixed irrigated	637	2175.8	15.58	36.3
6	Olives	1011	1723	17.42	40.6
5	Tomato (Feb - July)	871	35.3	0.37	0.9
6	Vegetables (April - August)	915	52.5	0.48	1.1
7	Vegetables (Feb. - June)	901	158	1.56	3.6
8	Vegetables (June, Summer)	853	31.4	0.37	0.9
	Total		4683.1	42.95	100

Amount of Evapotranspiration in m³ each season

Crop type map VS Evapotranspiration map





Project CAPACITY BUILDING

- **WORKSHOPS**

Workshop Title	Date	Place	No of attendees
First National Workshop- Kick off workshop	12+13/11/2013	Kempinski Hotel	40
Use of Remote Sensing in Water Management	30/12/2013-14/1/2014	Royal Jordanian Geographic Centre	15
ERDAS Imagine Software Training	10/11/2014-21/11/2014	GCE company	15
Arc GIS software Training	2014	Info Graph Company	5
Regional training on crop mapping-Mutlu Ozdogan	15/6/2014 to 21/6/2014	GCE company	20
Climate Downscaling workshop	14/12/2014 – 16/12/2014	Crop Executive Hotel	30
Crop Mapping and Evapotranspiration	18-19/3/2015	Crop Executive Hotel	50
Training on SEBAL software- Wim	19/4/2015 to 23/4/2015	GCE company	20
Closing Workshop	6+7/5/2015	Movenpick Hotel-Dead Sea	45
Dissemination Workshop for farmers	28/5/2015	Crop Executive Hotel	80

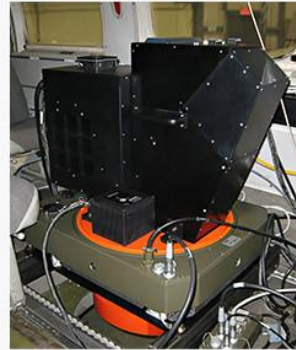
- Capacity Building- Airborne Hyperspectral



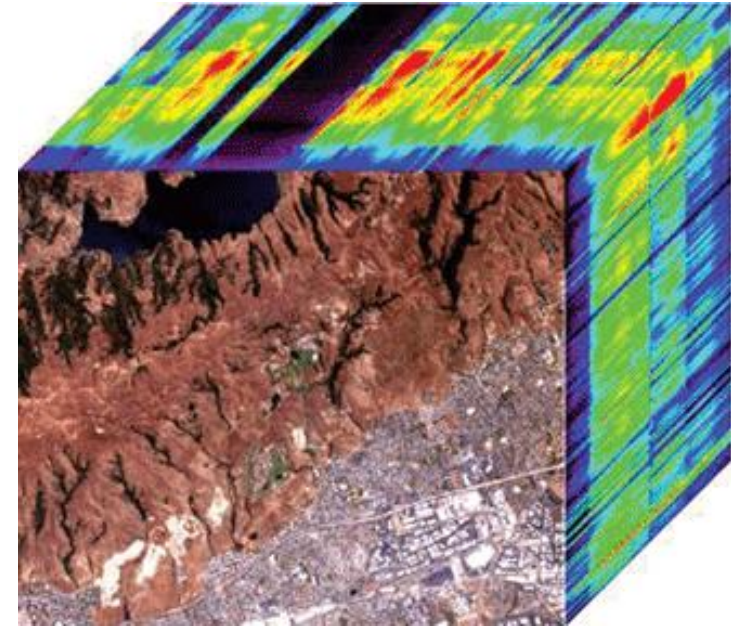
SASI-600 Sensor Head
85 H x 20 W 50 D.(cm)
40kg



CASI-1500 Sensor Head
47 H x 47 W 54 D.(cm)
25kg



CASI-1500 (L) & SASI-600 (R)
sensor heads installed in PAV30
gyro-stabilized mount



PROJECT IN THE PRESS

THE JORDAN TIMES

Friday, May 15, 2015

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Satellite remote sensing uncovers violations on underground water resources

by Hana Namrouqa | Nov 16, 2014 | 22:43  

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AMMAN — Satellite remote sensing of aquifers in Mafraq Governorate's Ramtha District has uncovered "startling" results on the magnitude of violations on underground water resources, according to government officials.

Lands planted with irrigated crops in Ramtha District, around 80km northeast of Amman, are more than double the estimated area, while the water pumped from wells is more than triple the allowed amounts, according to results of the project, which was supported by the World Bank and implemented by the Water Ministry in cooperation with the US National Aeronautics and Space Administration between December 2013 and August 2014.

The ministry's surveys indicate that there are 21,000 dunums of lands planted with irrigated crops in Ramtha,
 increased wells in the area is 43 million cubic meters (cmm) Water

الناصر: تقنية الأقمار الصناعية رصدت اعتداءات مفزعة على المياه



الثلاثاء 11 تشرين الثاني / نوفمبر 2014. 01:50 مساءً



وزير المياه والري الدكتور حازم الناصر- (أرشيفية- تصوير: أسامة الرفاعي)

1

ذات صلة <

الأقمار الصناعية تكشف

عمان-الغد- فيما بدأت وزارة المياه والري باستخدام تقنية الاستشعار عن بعد، بواسطة الأقمار الصناعية لتقدير المساحات المروية والمزروعة، وحجم الاعتداءات على مصادر المياه، بالتعاون مع وكالة الفضاء الأميركية "ناسا"، تندد وزير المياه حازم الناصر ان دراسة عبر هذه التقنية



Conclusions:

We can estimate and monitor the quantity of the consumed water in each season by using Remote Sensing techniques by using open source data and evaluate the illegal use of water from the farmers.



Thanks for your kind attention
E-mail: Nivin1000@yahoo.com