Sentinel-2 for environmental ressources in Tunisia first results with L2A data

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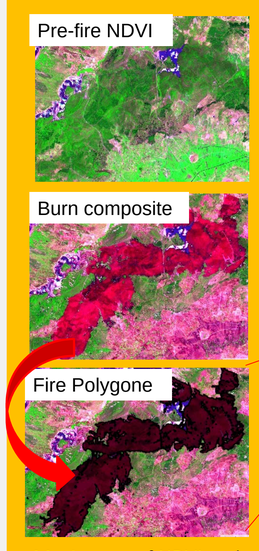
Abstract: Tunisia was selected in the framework of the THEIA-CNES project in 2015 for production of Sentinel2 L2A images. This project gathered seven proposals in Tunisia with partnerships between tunisian and french teams. All Tunisia is covered except desert. We propose to present an overview and the first or preliminary results obtained by the different partners. The thematics involved are: agriculture, water resources, soils and forests. Most of these first using of S2 data are focused on research objectives according to the proposal. The main results concern: land cover mapping, crop practices, biophysical parameters inversion, in mediterranean sub humid climate in the north (cereals, forests, humid areas) to semi arid conditions (irrigated and rainfed crops) in central Tunisia and arid conditions in the south (oasis, olive trees). First results with combination of Sentinel-2 and Sentinel-1 are presented. The multitemporal capacities of S2 data are not always valorized because some thematic don't justified frequent images (forest mapping, oasis). Other reasons are the difficulties to download data with low level internet connections and difficulties to use a large flux of satellite data with suitable tools. Applications at national level are now considered.

Detection of burned forests (northen Tunisia)

Pre-fire NDVI

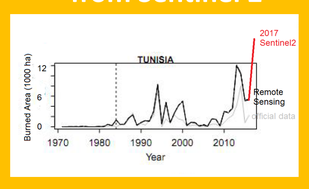
Burn composite

Fire Polygone



Maximums of NDVI and "fire indices"*
S2 temporal data:
1/5/2017 to 31/10/2017

The 2017 exceptionnal fire season in Tunisia from Sentinel 2

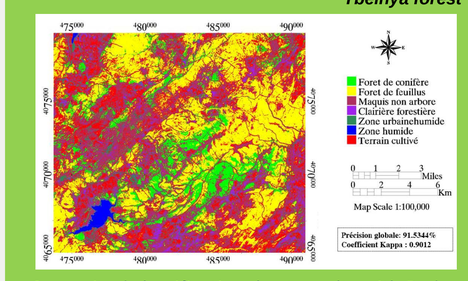


* Burn composite of 3 indices:
NBR2= LSWIR-SSWIR/ LSWIR+SSWIR
NBR=LSWIR-NIR/LSWIR+NIR
MIRBI=10*LSWIR/10000-9.8*SSWIR/10000+2

F. Mouillot , C. Belhadj Khedher

Forest mapping

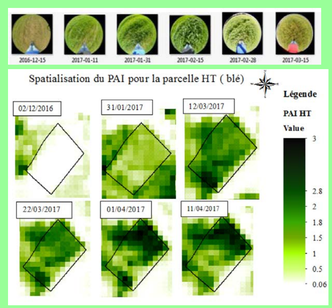
Tbeïnya forest

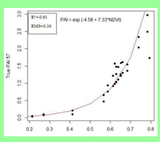


Supervised classification, best results with Red edge spectral indices (S2 image, 24/04/2017)

H. Chakroune, N. Touihri, N. Chehata & al.
Projet INFOTEL3, CNCT, MESRS

Biophysical parameters of annual crops (Cap Bon)





PAI of a wheat field with Sentinel-2, validated with hemispherical pictures.

H. Chakroune, M. Boukari, R. Zitouna

Soil practices and infiltrability (Cap-Bon)

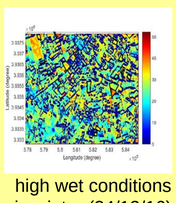
Sentinel-2 and Sentinel-1 are used to derive soil surface properties in relationships with infiltration.

C. Gomez et al, TOSCA A-MUSE, on-going work.

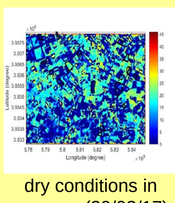
Soil moisture mapping (Merguellil)

Satellite data	Soil parameters	Vegetation parameters
Radar data: Sentinel-1 (20 m.)	Soil moisture	LAI
Optical data: Sentinel-2(20 m.)	Soil Roughness parameters	NDVI derived from optical data

An inverted equation from the WMC model calibrated with ground date, was used to map soil moisture using SAR and optical images over the study area.



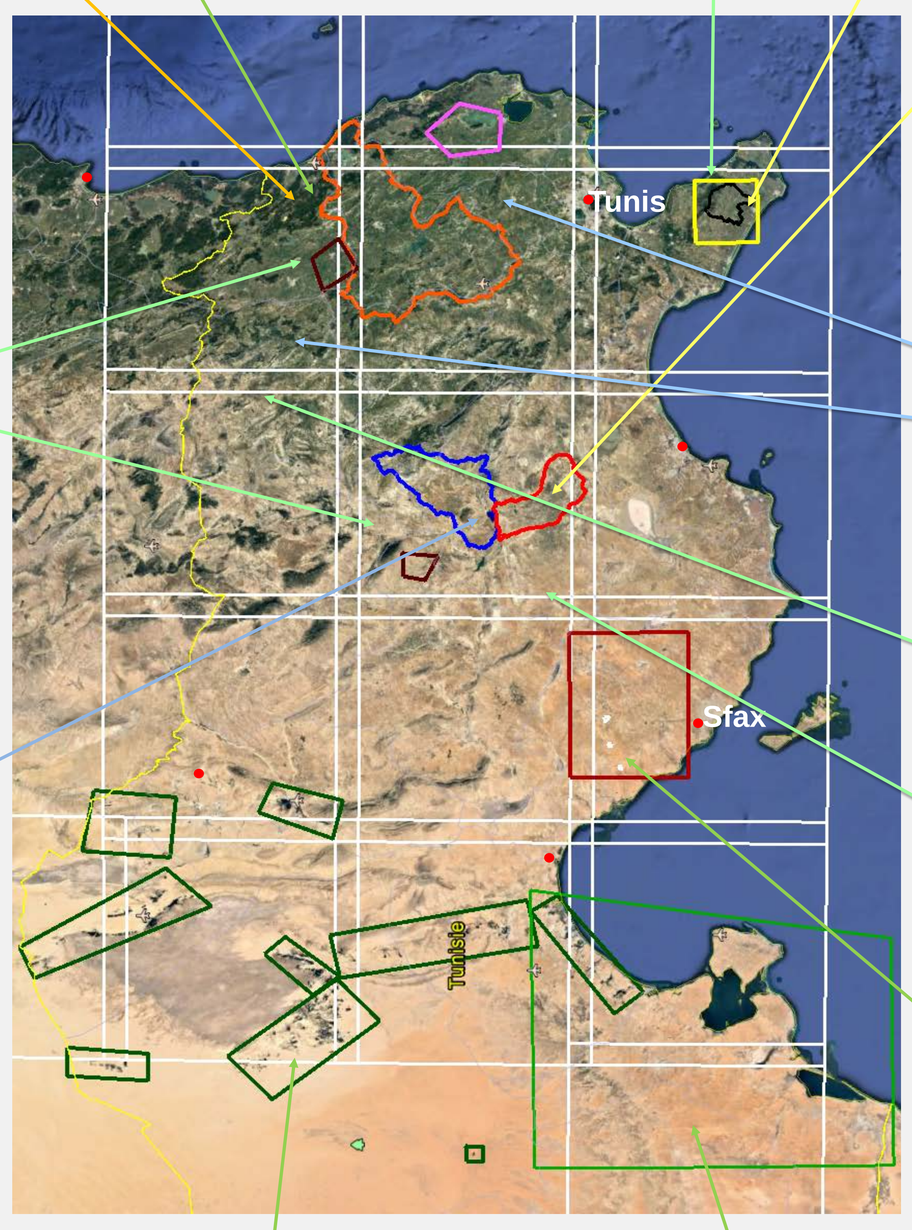
high wet conditions in winter (24/12/16)



dry conditions in summer (29/03/17)

The maps show the spatialization of soil moisture derived from the inversion approach.

M. Zribi, S. Bousbih & al.



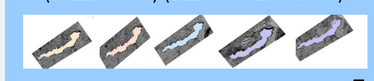
Mapping of irrigated/rainfed crops in Bou Salem and Sidi Bouzid areas

Cereals, yield, R. Abdelfattah & al.
work in progress

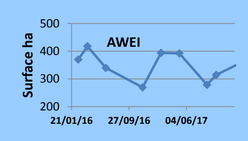
Seasonal filling of Joumine and Sidi Salem dams

Normalized Difference Water Index (**NDWI**)
(GREEN-SWIR)/(GREEN+SWIR)

Automated Water Extraction Index (**AWEI**)
4*(GREEN-SWIR)-(0.25*NIR+2.75*SWIR)

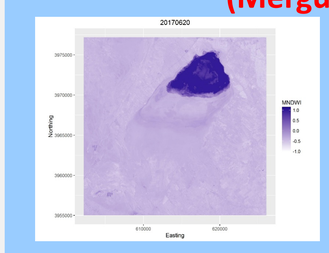


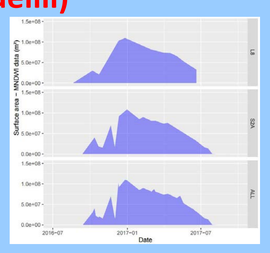
Joumine dam



Z. Kassouk, Z. Lili Chabaane & al.

Quick changes of water surfaces and volumes : small dams, sebkha, (Merguellil)





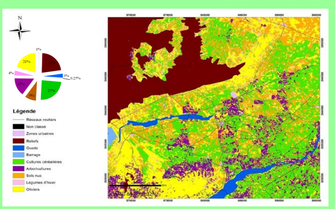
First results for Kelbia sebkha: Improvements with Sentinel-2 A&B data vs Landsat 5-8 images.

Pan-sharpening 10 m. of SWIR bands applied to MNDWI .

A. Ogilvie, A. Sebaï, S. Massuel & al.

Land use/land cover and early detection of agricultural crops (Merguellil, Jendouba)

(1) Annual and seasonal agricultural crop mapping



Winter land cover map nov 2016-mai 2017, Merguellil plain), classification by decision-tree

(2) Early detection of winter cereals and summer crops: plowing intensity, sowing detection (2018)

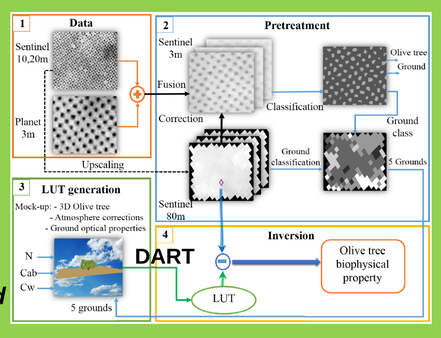
Z. Lili Chabaane, Z. Kassouk, B. Mougenot & al.

Anthropic landscape and oasis

A. Ghram Messidi & al (=> 2018)

Olive trees properties with Sentinel-2 (production and detection of diseases, Sfax)

(1) Tree biophysical property retrieval: S2 and Planet satellite data fusion, inversion with DART model.



***(2) Inversion with LiDAR IceSat-2 and Sentinel-2 data** (in 2018)*

A. Kallel & al.

Southern sites

(1) Oasis systems studies (oral session)

(2) Mapping and monitoring of Olive trees

on-going work **E. Delaitre, D. Ouerchani & al.**

Comments

The ready to-use Sentinel2 L2A products and high spatial resolution are first appreciated by thematic users for various applications. New modes as remote access to extract and produce data are expected to increase the use of Sentinel-2 time series and training courses are to be planned for researchers, and endusers at national and regional levels.

This poster reflects first results of the initial THEIA L2A proposal for Tunisia, other studies using the S2 L2A products are not mentioned here.

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…

Publications (to be completed)
H. Abdelmoula, A. Kallel, J.L. Roujean, S. Chaabouni, K. Gargouri, M. Ghrab, J.P. Gastellu-Etchegorry and N. Lauret. Olive biophysical property estimation based on Sentine-2 image inversion, IGARSS'2018.
S. Bousbih et al. Monitoring of surface soil moisture based on optical and radar data over agricultural fields. 4th International Conference on Advanced Technologies for Signal and Image Processing (ATSIP), March 21-24, 2018, Sousse, Tunisia
Z. Kassouk et al. Irrigated agriculture: Natural Resources Management for the sustainability of the terrestrial ecosystem maintaining productivity. EGU2018-13677, European Geosciences Union General Assembly 2018,Vienna, Austria, 8–13 April 2018.
Mastere
Mariem Boukari, 2017. Modélisation des variables biophysiques du blé et de la fève par SENTINEL2. Stage de Mastère M2 (Modélisation en Hydraulique et Environnement, ENIT).
Nouha Touihri, 2017. Classification d'une image SENTINEL2 en milieu forestier pour fin d'inventaire en Tunisie. Stage de Mastère M2 (Géomatique Faculté de la Manouba).
Raja Mabrouki, 2017. Occupation du sol saisonnière dans la plaine du Merguellil. Stage de mastère M2 (télédétection, INAT/Université de Carthage).