



Digital Augmentation for Accelerated Climate Smartness of Dryland Agriculture

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FSD7
Morocco



A Systemic Crisis in Global Drylands

Urbanization

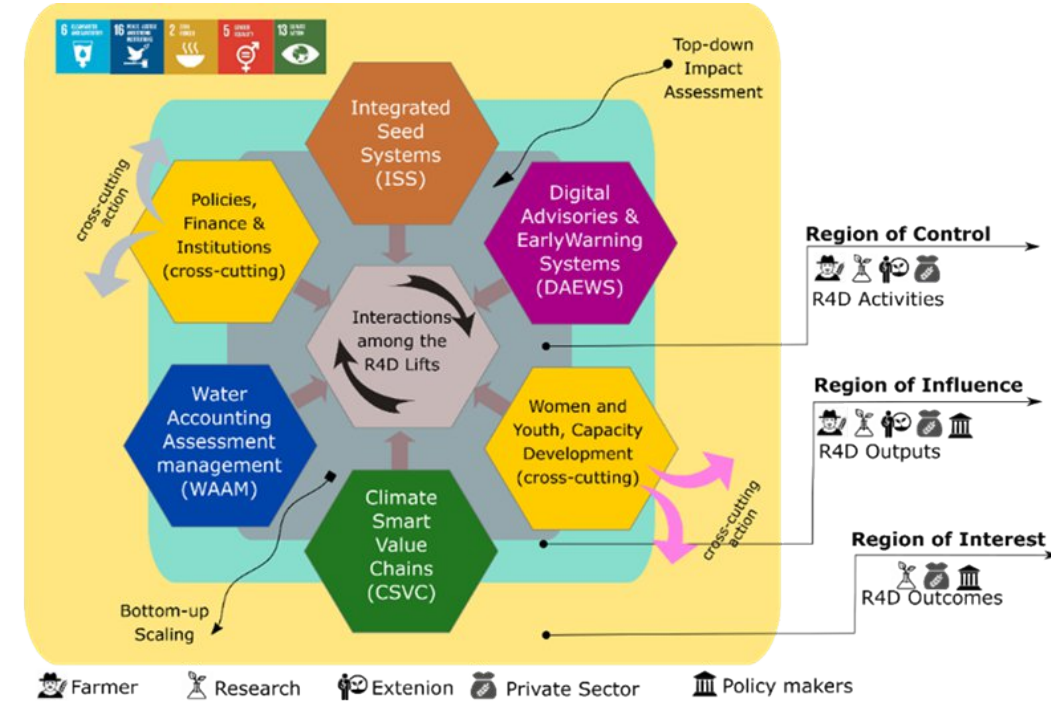
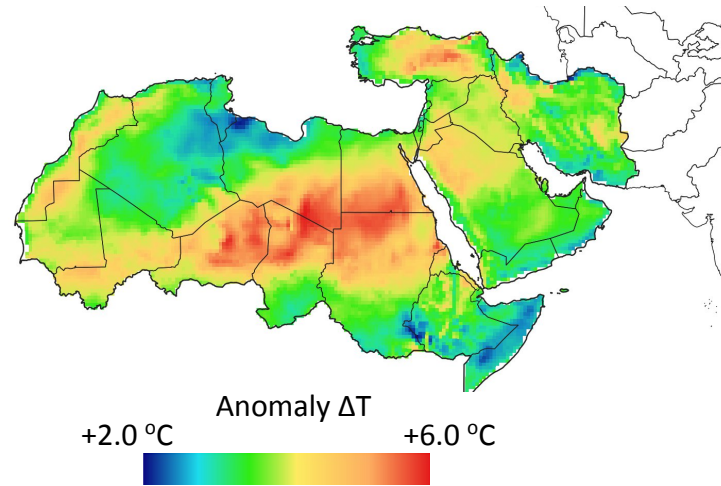
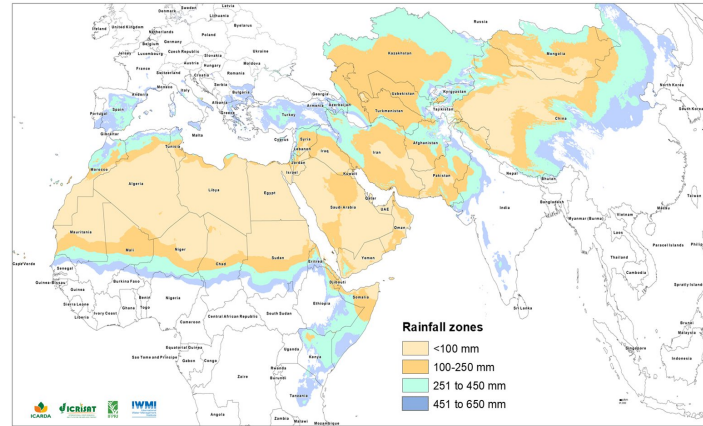
Climate Change

Land Degradation

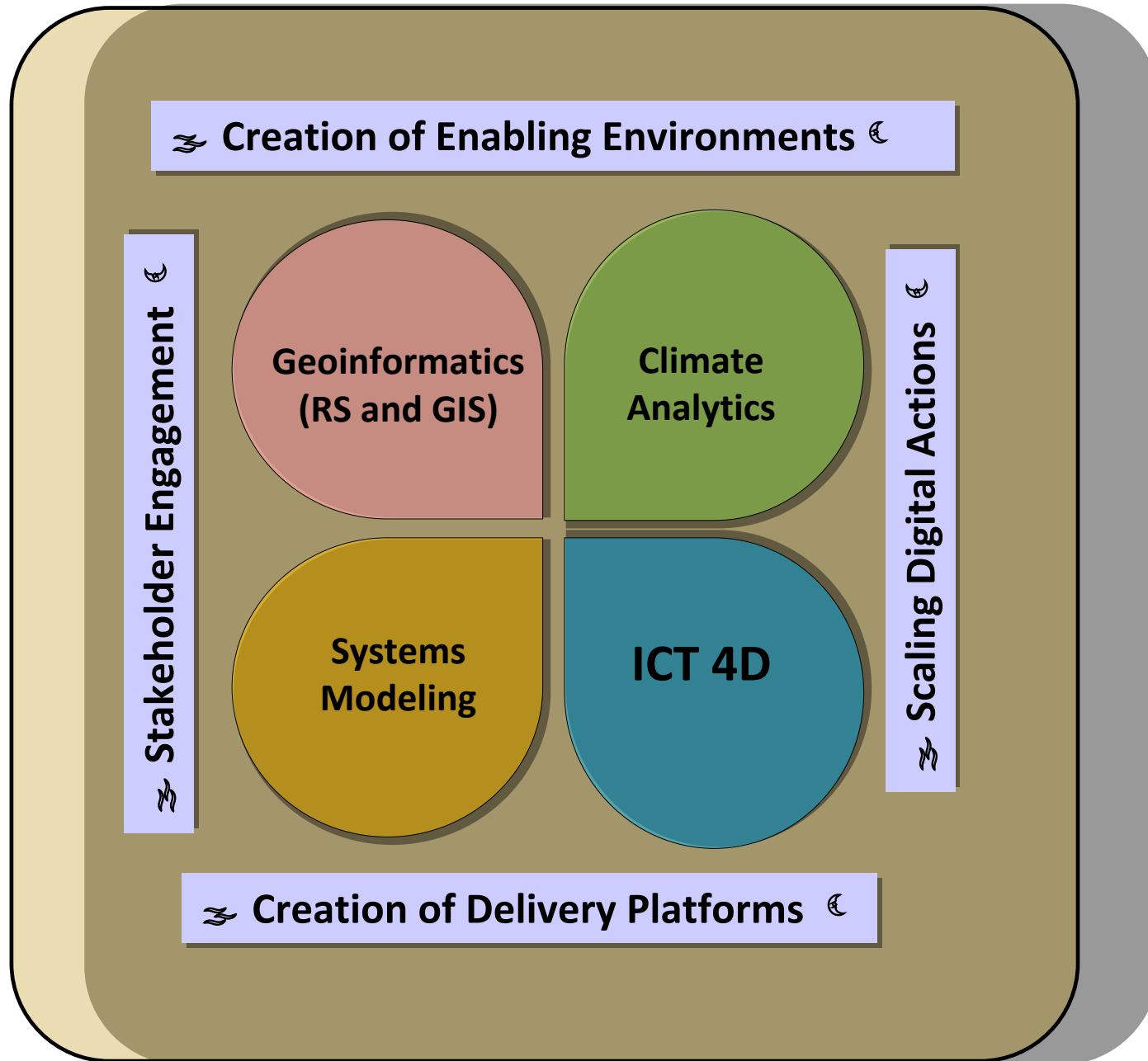
Conflicts

Climate Hazards

icarda.org



The Main Forms of Digital Actions at ICARDA



Examples of CGIAR Initiatives and Projects on Digital Actions in MENA	Countries
Excellence in Agronomy	Egypt Morocco
CWANA-Regional Initiative (WP5)	Egypt Morocco
ClimBER: Building Systemic Resilience against Climate Variabilities and Extremes	Morocco Senegal
Regional Water harvesting Potential Mapping	Entire MENA
NENA-ET Net: Regional ET Network	Entire MENA
AFESD: Plant Breeding Centre of Excellence	Morocco Sudan
Iraq Climate Smart Agriculture Investment Plan : WorldBank	Iraq

Geoinformatics-based Digital Actions

CGIAR EXCELLENCE IN AGRONOMY



Yield and Yield gap distribution in the Irrigated Systems of Egypt

Select the harvesting Year

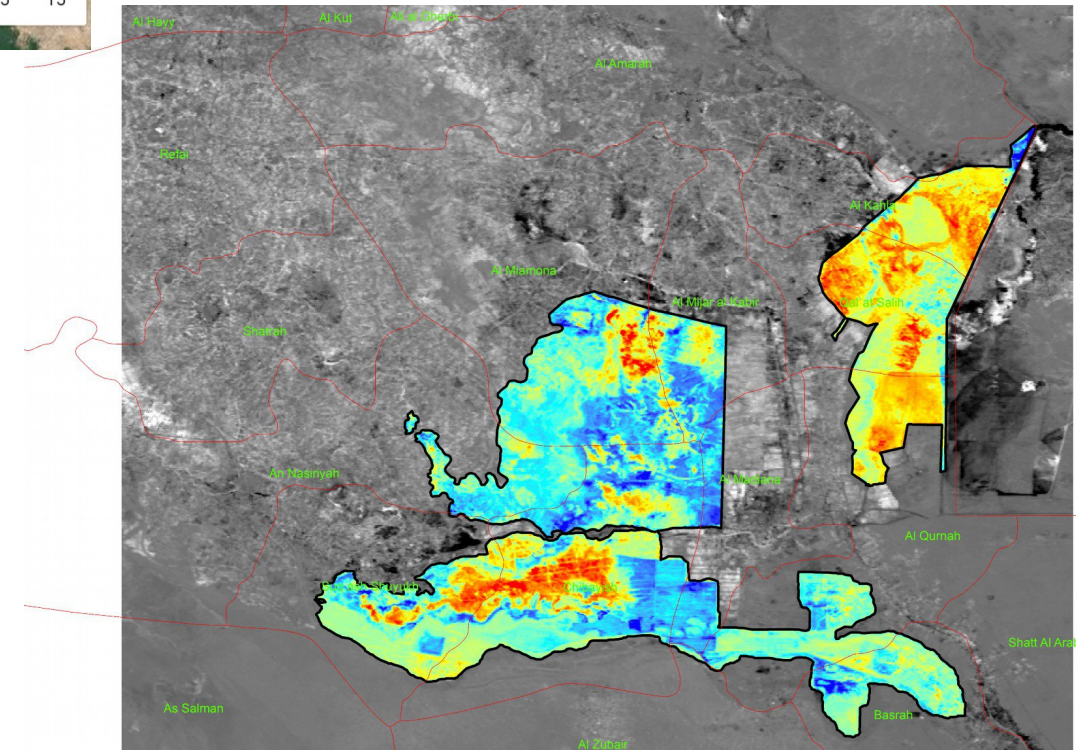
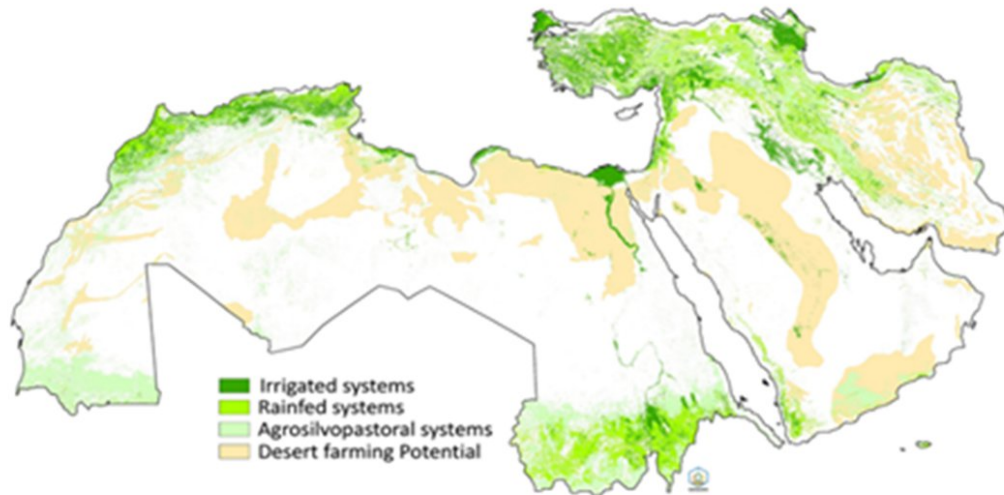
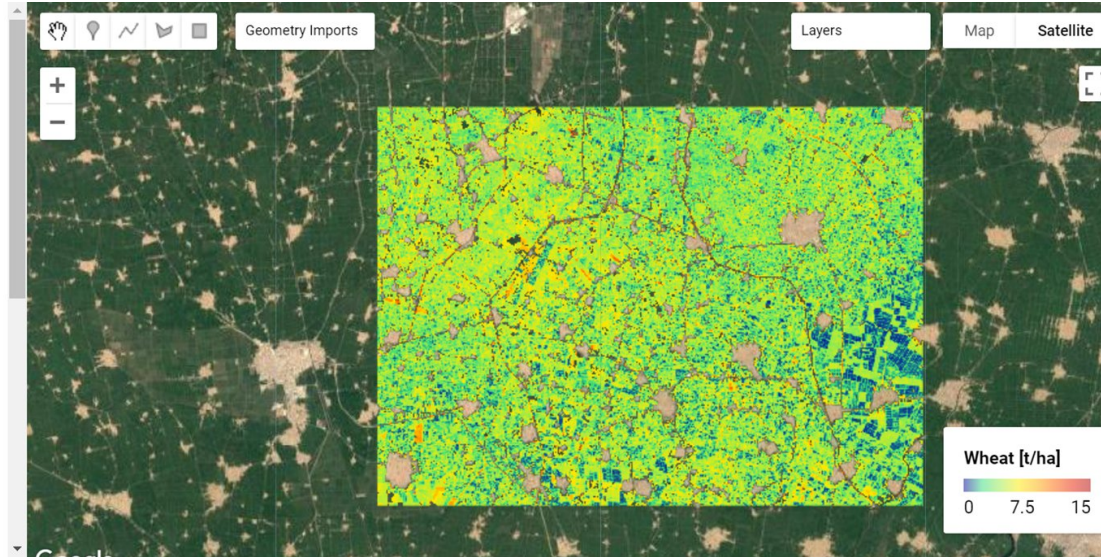
2018

Select the Crop & Create an AOI

Wheat

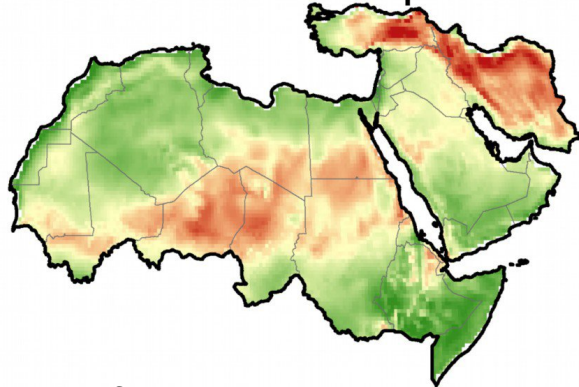
Polygon

Rectangle

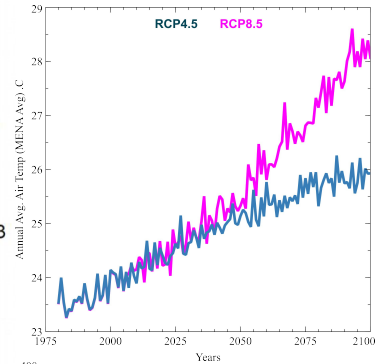


Climate Analytics as a Digital Action

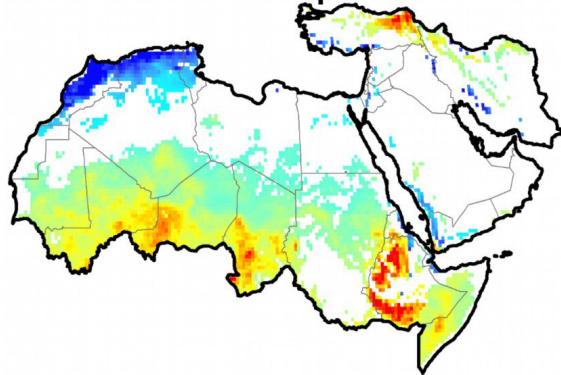
Trend of Mean Annual Temperature



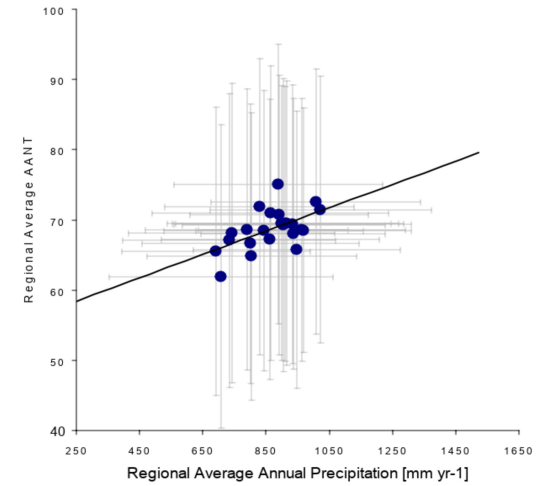
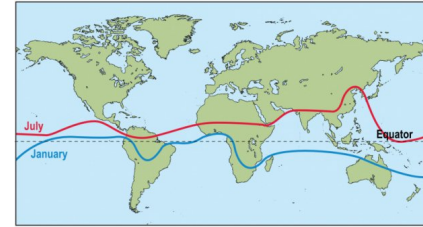
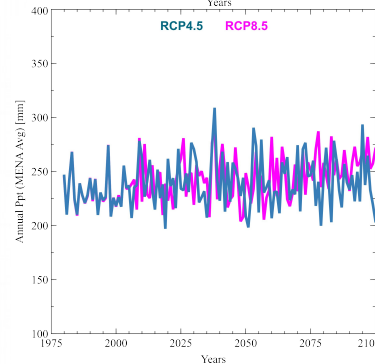
High : 0.04
Low : 0.013



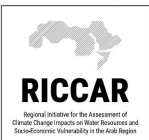
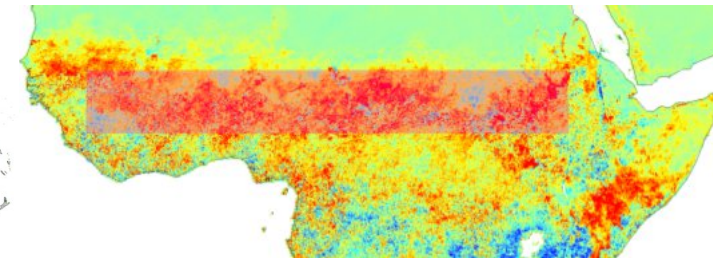
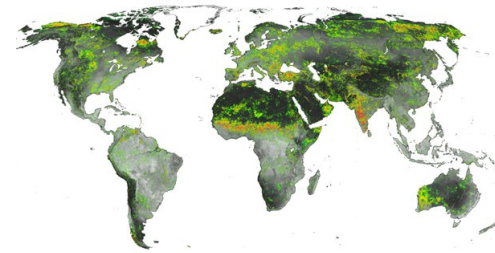
Trend of Annual Precipitation



High : 3.4
Low : -3.1

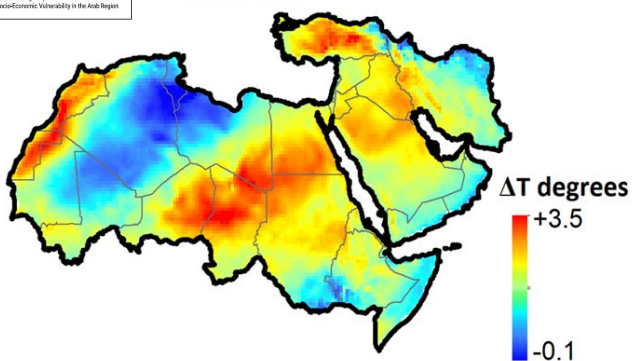


Trend of Vegetation Dynamics

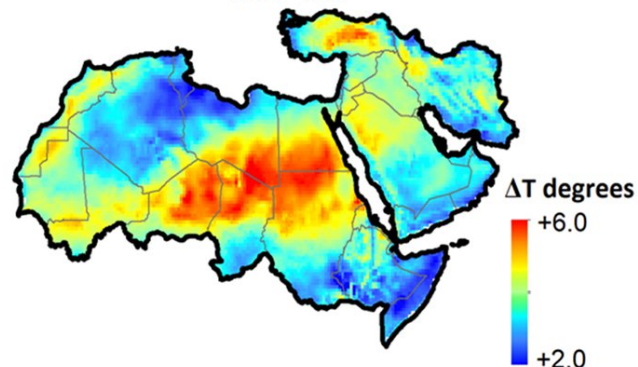


MAT change (2100-2000)

RCP4.5



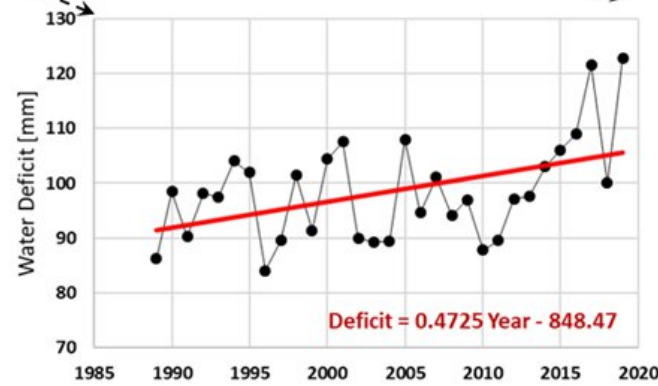
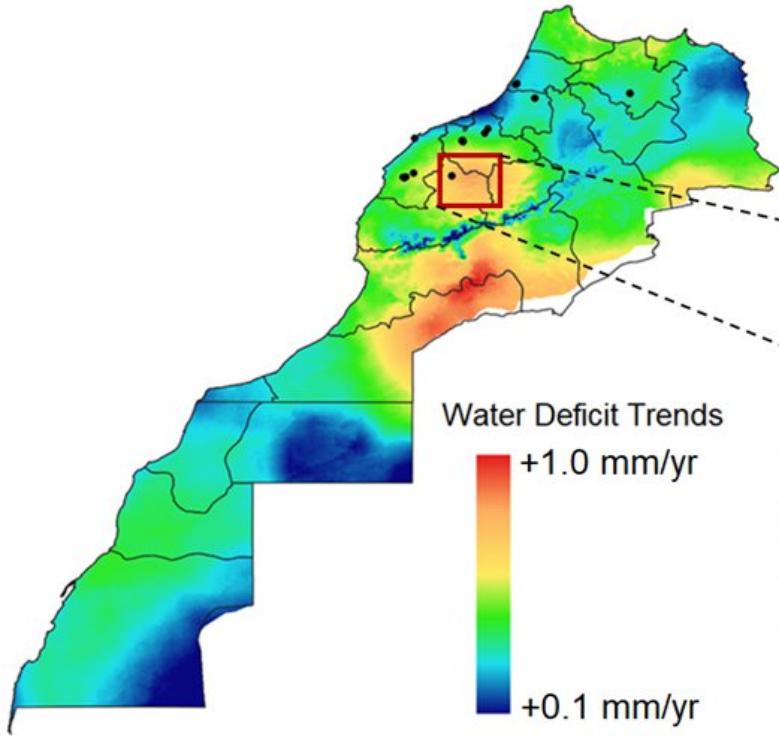
RCP8.5



- Temperature is more dynamic than Precipitation under Climate Change.
- Hot Spots of Temperature Increase: Turkish and Iranian highlands, Niger, Chad, South Egypt
- Hot Spots of Ppt Decline: Highlands of Maghreb region (NW Africa)..Morocco, Algeria, Tunisia

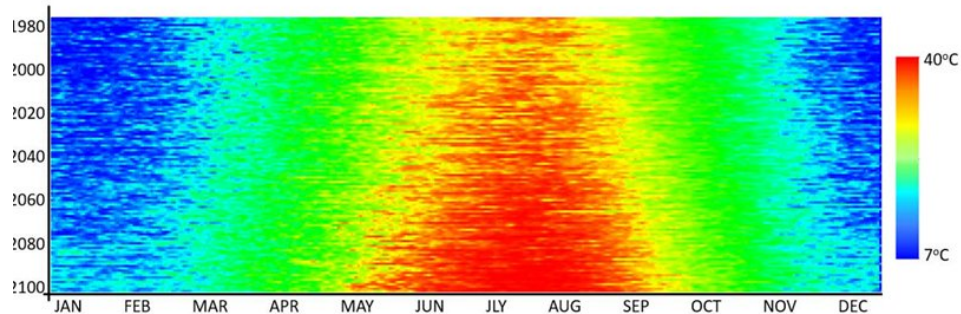
Climate Analytics as a Digital Action

Case in Morocco (a highly vulnerable site)

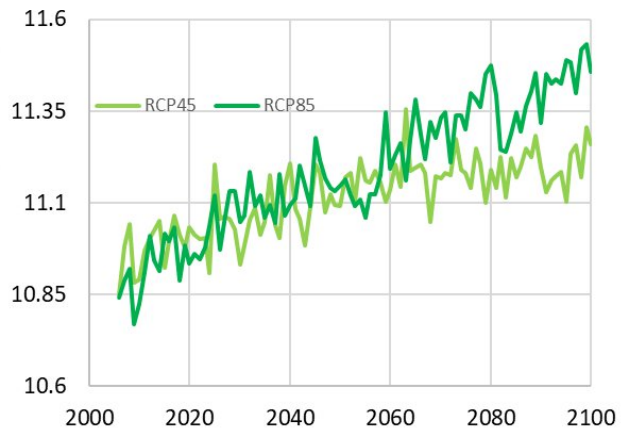


NASA-NEX-GDDP (21 GCMs)

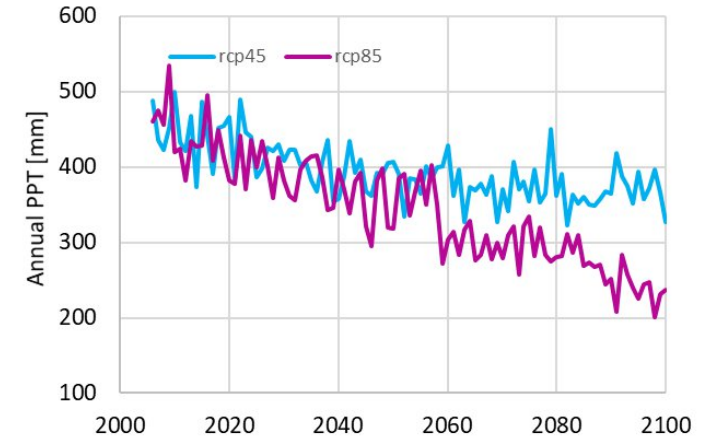
Change of Seasons with CC



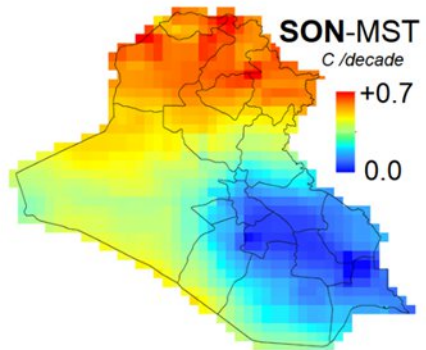
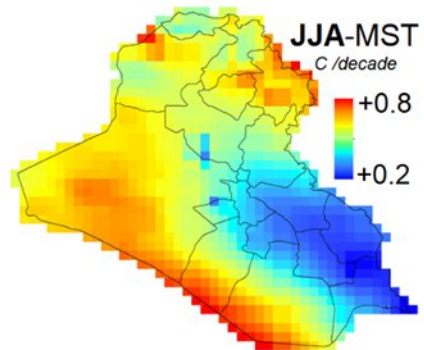
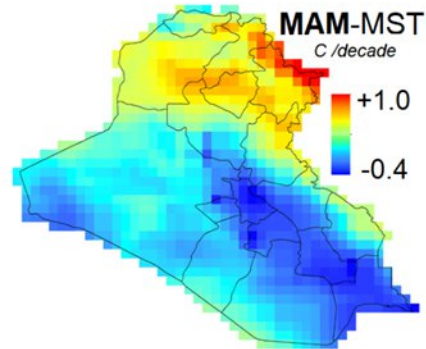
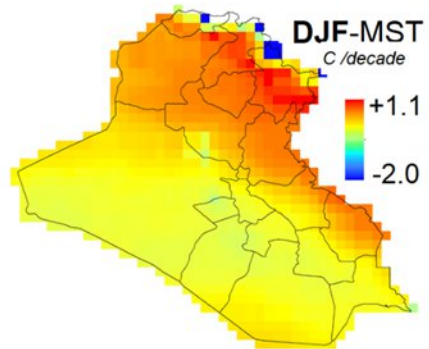
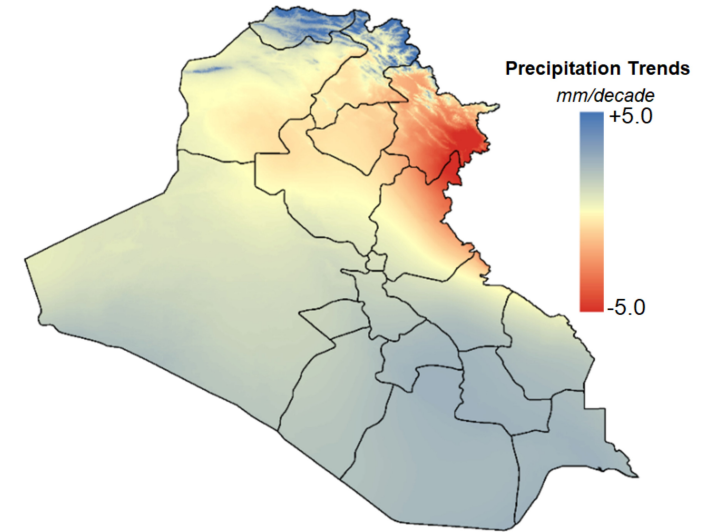
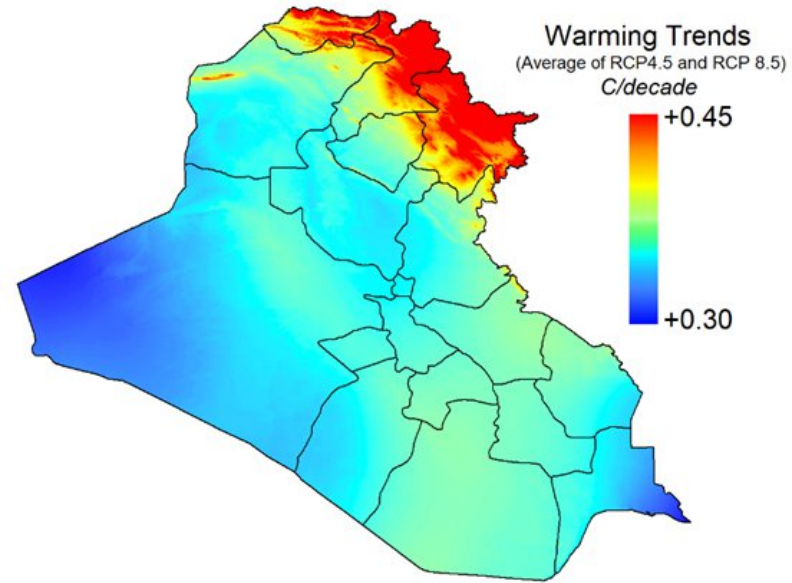
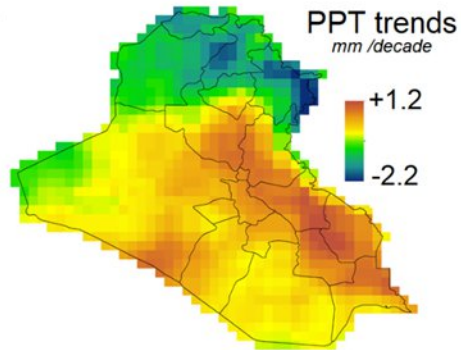
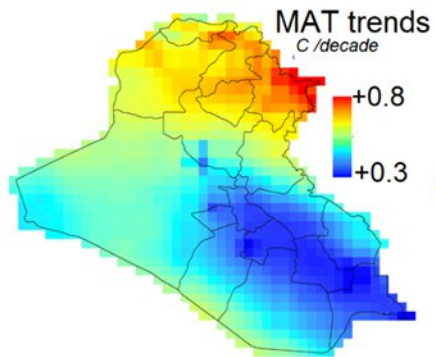
$\Delta T = T_{\text{max}} - T_{\text{min}}$



Annual Precipitation

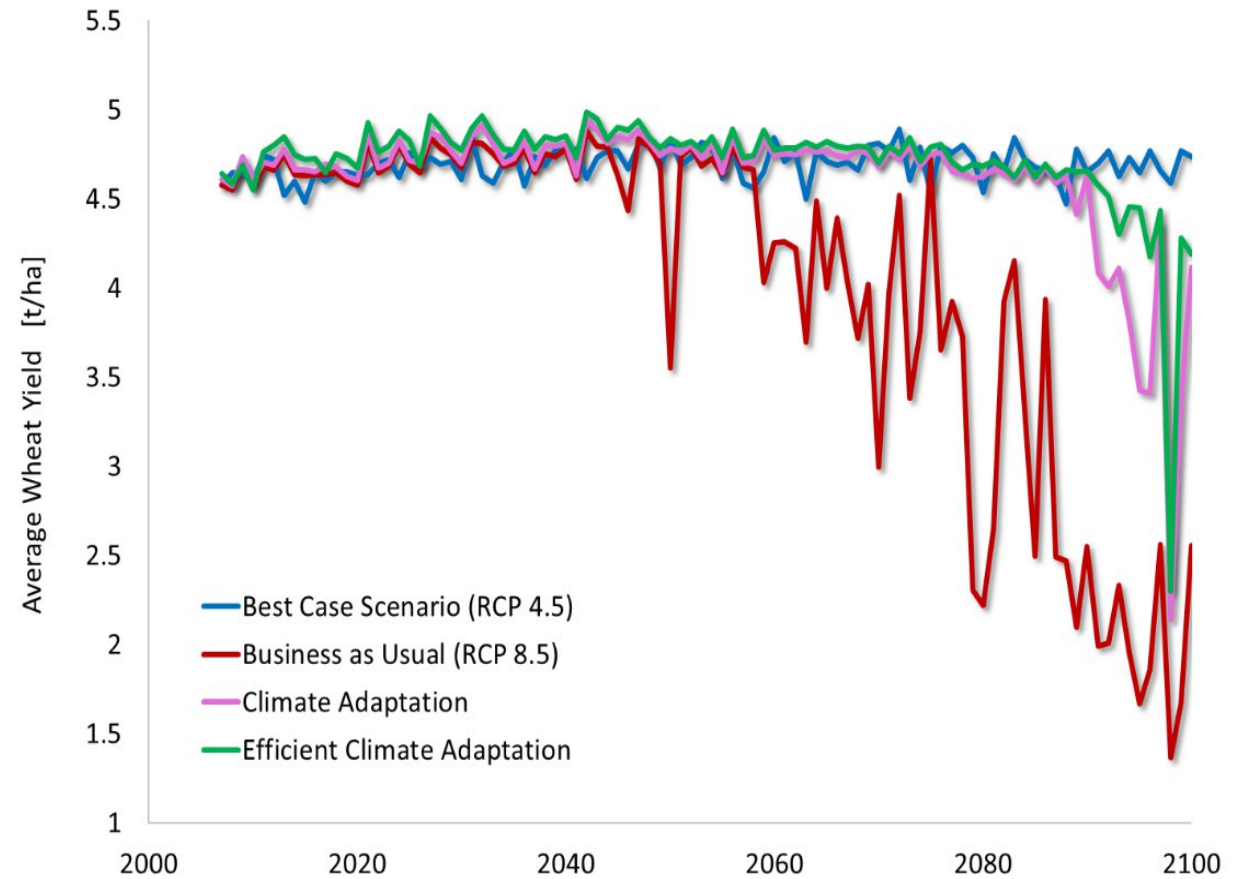
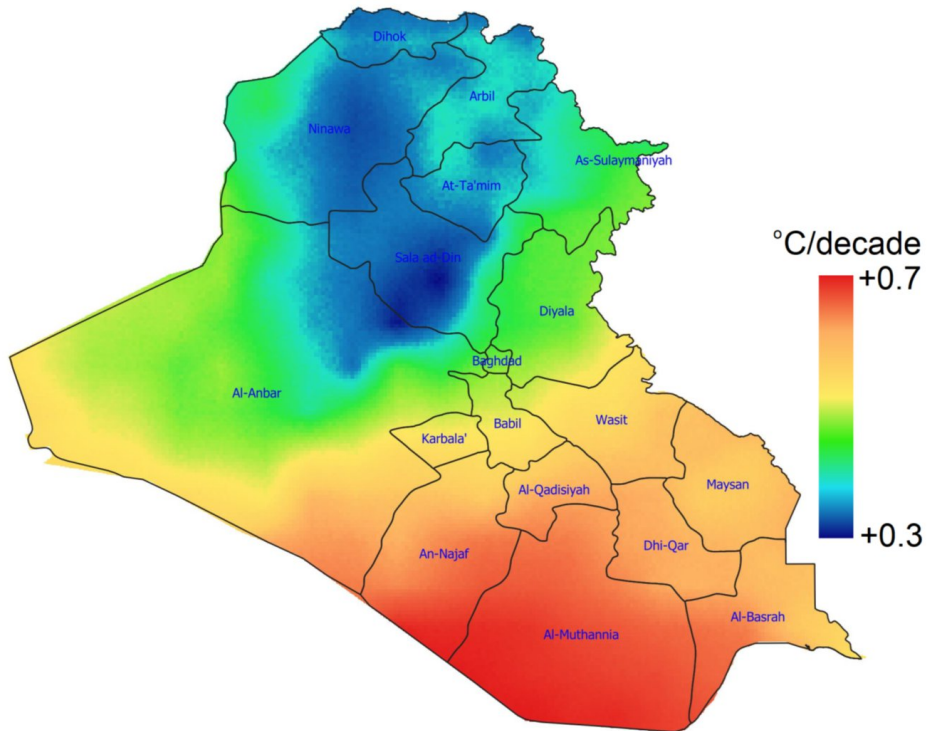


Climate Analytics as a Digital Action

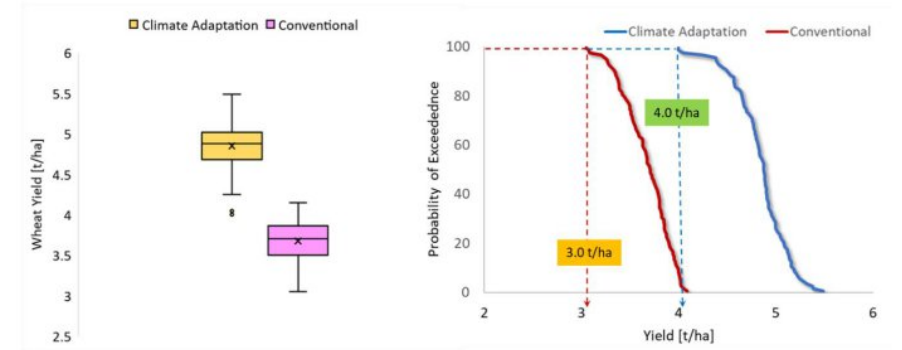
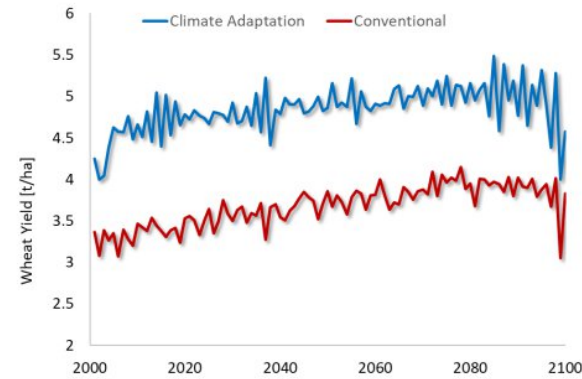
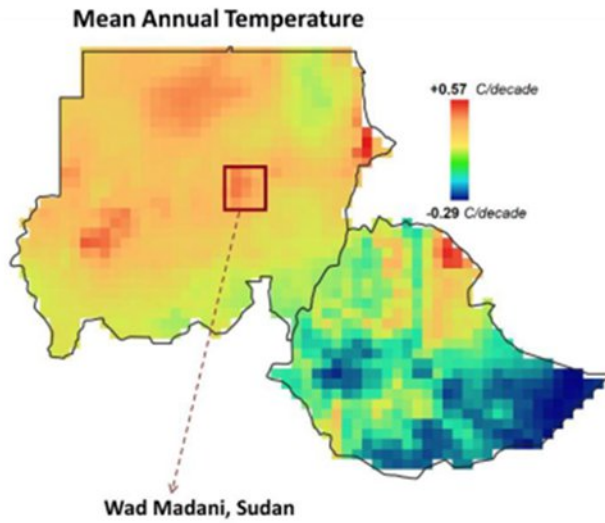


Systems Modeling as a Digital Action

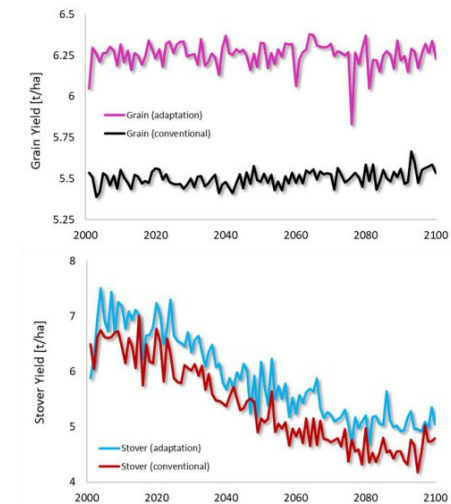
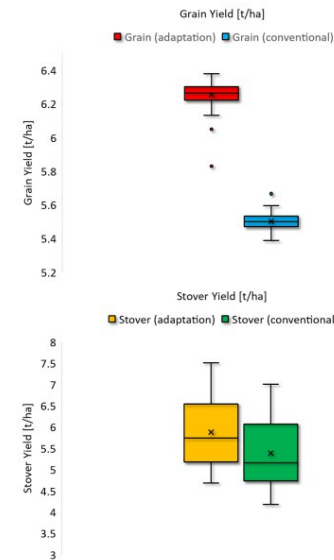
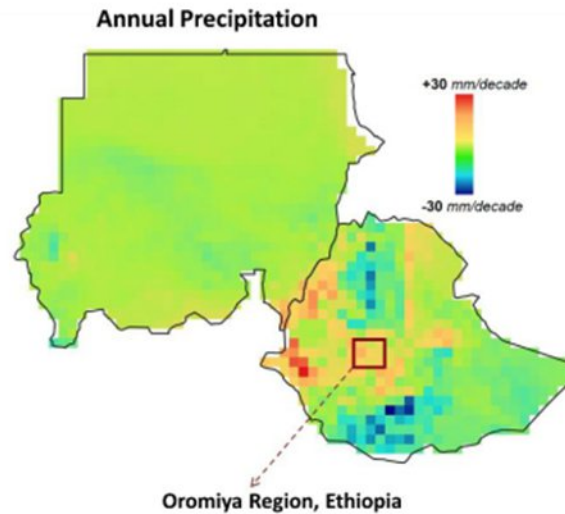
Enhancing Water Productivity as a Climate Adaptation in the Mesopotamian Plains (Irrigated Context)



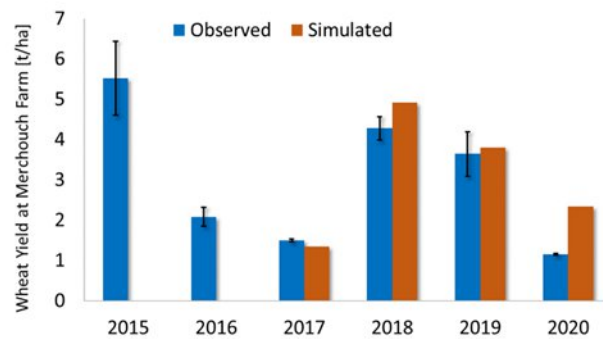
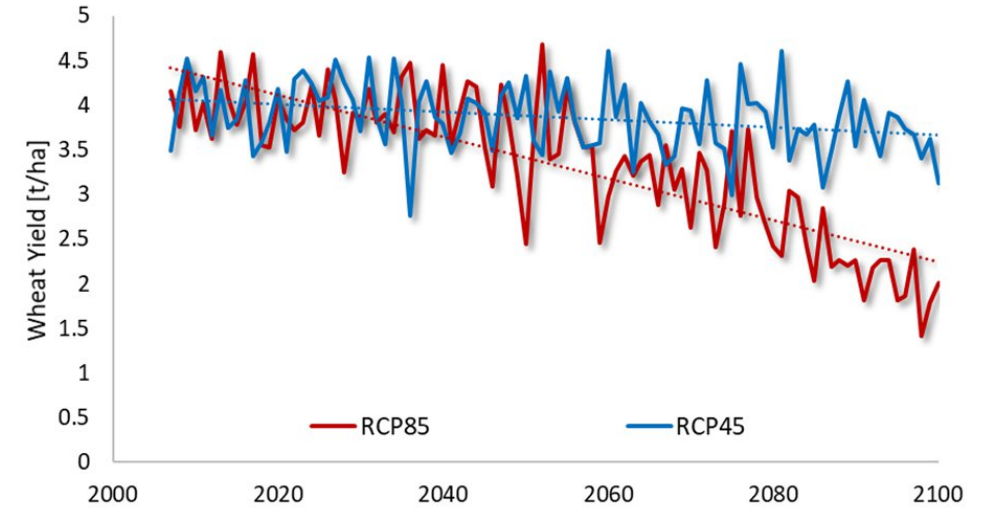
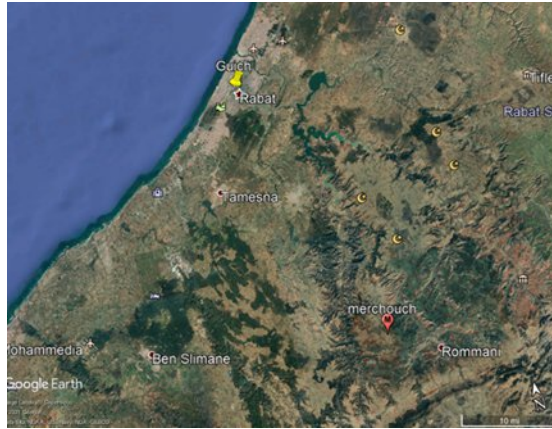
Enhancing Wheat Water Productivity in Sudan



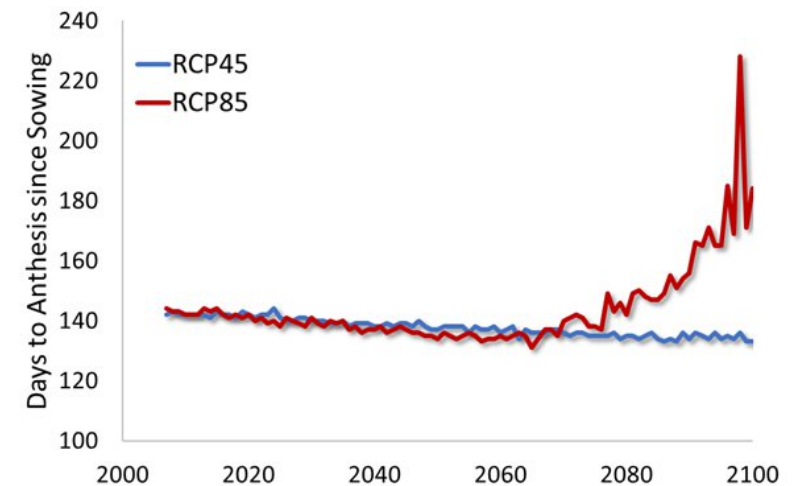
Improving Maize Agronomy in Ethiopia



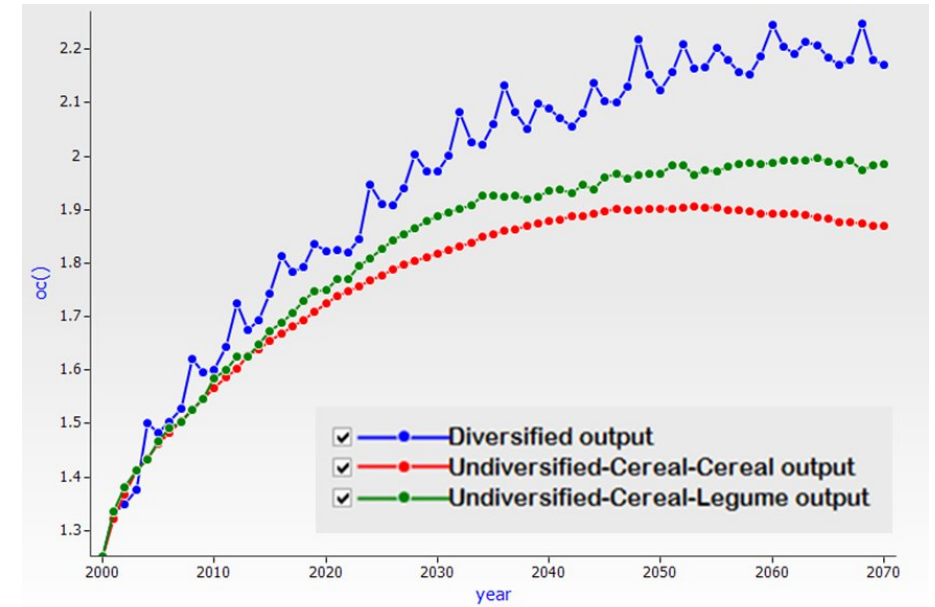
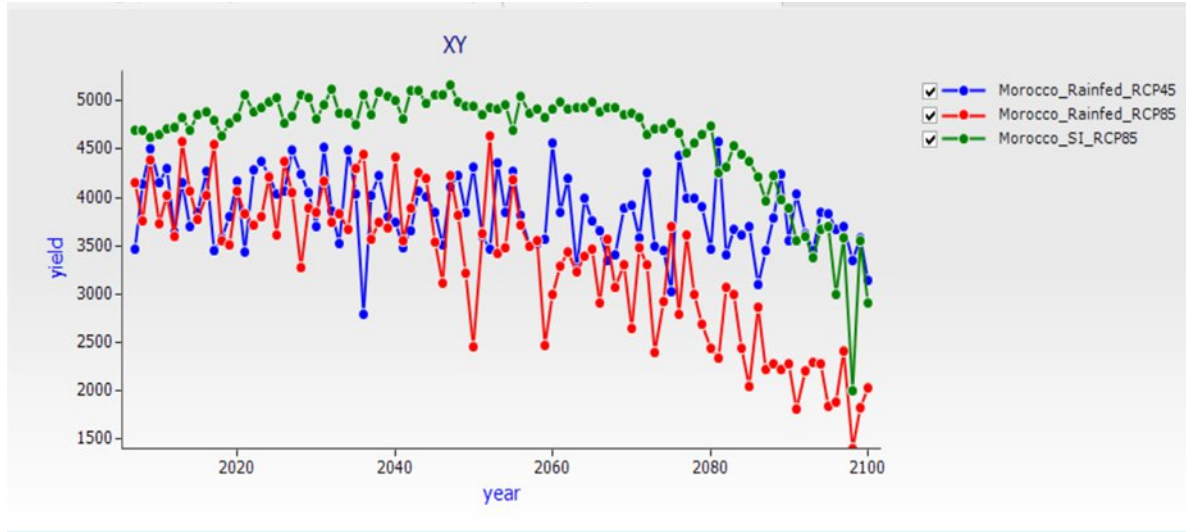
Foresight Yield Gap Analysis under Climate Change (Using Currently Promising Varieties)



Years	Observed Yields for Std. Cultivars [t/ha] (Advanced Yield Trials)			
	Miki3	Omrabi5	Waha	Mean
2014-15	6.75	5.26	4.544	5.51
2015-16	2.32	1.82	2.07	2.07
2016-17	1.50	1.49	1.49	1.49
2017-18	4.56	4.37	3.88	4.27
2018-19	4.13	3.98	2.84	3.64
2019-20	1.13	1.12	1.17	1.14



Modeling Based Identification of Climate Adaptation



Crop Diversification with a crop rotation pattern that repeats only every 4 years from 2000-2100

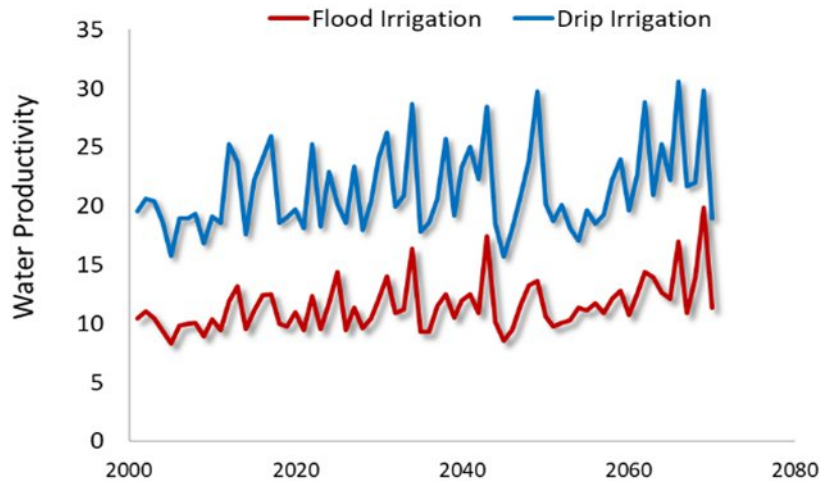
Year-1		Year-2		Year-3		Year-4	
Wheat	Soybean	Chickpea	Maize	Faba bean	Maize	Barley	Soybean

Simple- Cereal-Cereal sequence done continuously from 2000-2100

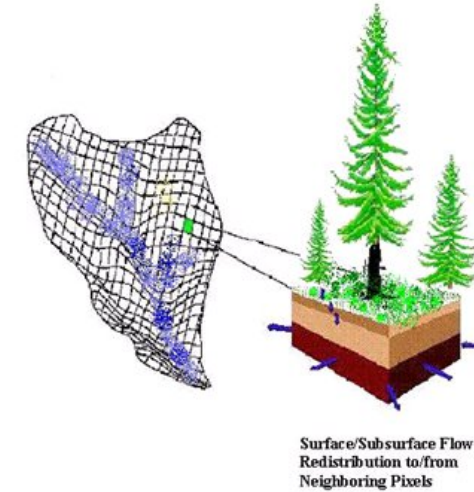
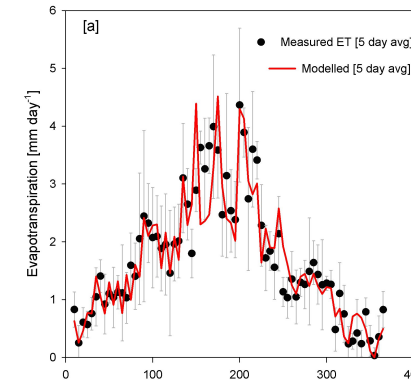
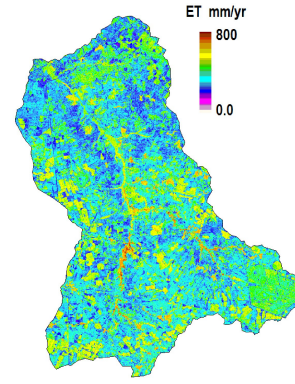
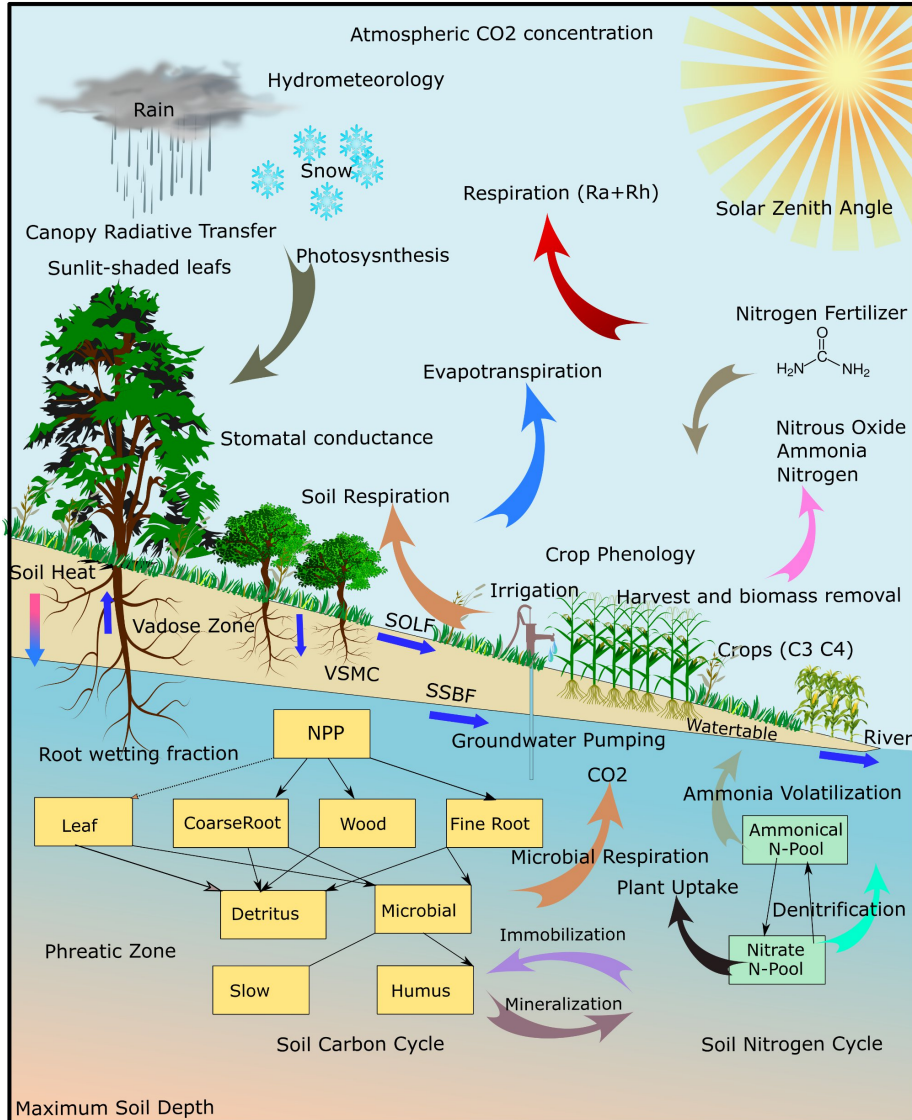
Year-1		Year-2		Year-3		Year-4	
Wheat	Maize	Wheat	Maize	Wheat	Maize	Wheat	Maize

Simple Cereal-Legume Sequence done continuously from 2000-2100

Year-1		Year-2		Year-3		Year-4	
Wheat	Soybean	Wheat	Soybean	Wheat	Soybean	Wheat	Soybean



Spatially Distributed SVAT Modeling



STEPS

Simulator of **T**errestrial **E**cohydrological **P**rocesses and **S**ystems

- Spatially- Explicit
- Spatial resolution is flexible
- Daily model
- Process-based
- Feed-back mechanisms addressed
- BGCs (C,W,N cycles) are tightly coupled
- Agroecosystems (C3 and C4 plants)
- Fate of N Fertilizer transformations
- Forest / Agroecosystem Management



Egypt

Digital Augmentation for Smallholder Farmers In Egypt



Egypt Use Case

Problem

One of the main reasons for Egypt's lower wheat production is poor agronomic practices by the farmers who do not have access to information about the best context-specific agronomic practices. The agricultural extension system is also not fully developed.

EiA Solution

EiA will develop and validate digital advisory tools that will offer farmers crucial agronomic information. This digital augmentation will also serve the extension system and will also increasingly engage women and youth

Engagement With The Government of Egypt

- Series of interaction with demand partners
- Providing active support in technical guidance
- Assisting in field data collection
- Extension support



With Heads of Extension, Economic reforms, and ICT Advisor to Ministry of Agriculture and Land Reclamation



The MVP for Egypt- GeoAgro Web App

CGIAR EXCELLENCE IN AGRONOMY



EGYPT USE CASE

Yield and Yield gap distribution in the Irrigated Systems of Egypt

Select the harvesting Year

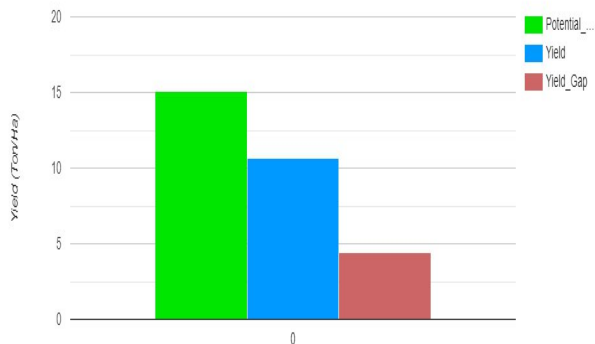
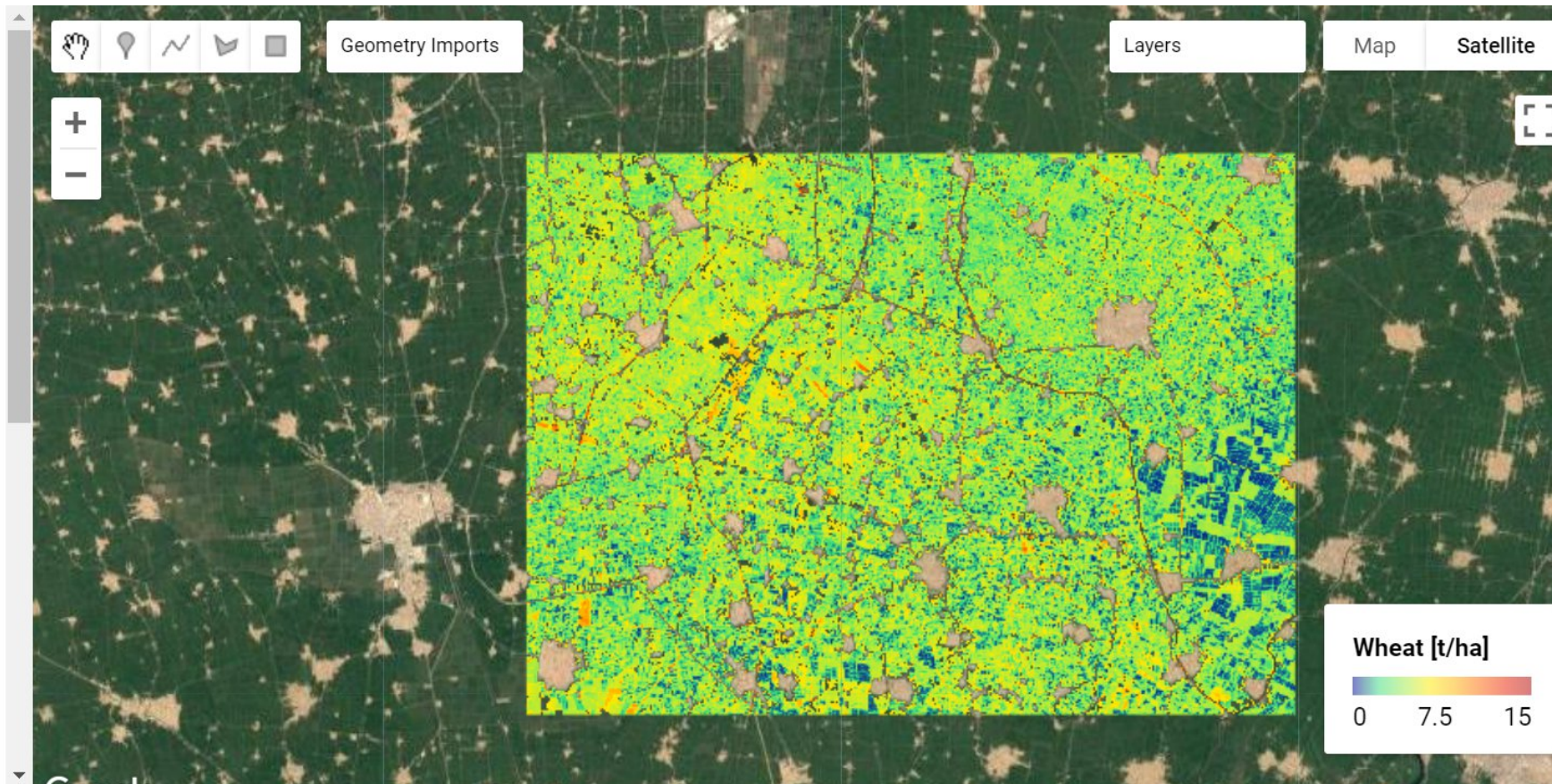
2018

Select the Crop & Create an AOI

Wheat

Polygon

Rectangle



The MVP for Egypt- GeoAgro-MiSR Smartphone App

GeoAgro Pro

Choose your Mode

CROP ADVISE | GEOTAGGING | AGROMET
LIVESTOCK | ASK EXPERT | TIPS
DISCUSS | CLOUD | IDEAS
FINANCE | MARKET | VALUE CHAIN

Crop Advisory Mode

Choose your Crop

WHEAT | FABABEAN | FORAGE
MAIZE | SUGARBEET | SUNFLOWER
ONION | ORANGES | BARLEY
SUGARCANE | AGROFOR | VEGETABLES

Crop Advisory Mode/Wheat

Continue to select Soil Type

HOME | ADVISORY

Irrigation

Choose Soil Moisture Status

High | Low

Irrigation based on plant age as following:

- 500 m3/fed at planting
- 300 m3/fed upto 4 weeks from planting
- 300 m3/fed from 4 to 14 weeks from planting
- 300 m3/fed from 15 to 16 weeks from planting

SAVE for Report

HOME | ADVISORY | PoP MENU

Fertilizer Application

Choose Residual NPK Status

N	P	K
Low ▼	High ▼	Low ▼

NITROGEN

- 15 kg/fed before 1st irrigation
- 30 kg/fed at 2nd irrigation
- 30 kg/fed at 3rd irrigation
- Or inject ammonia gas once 4 days before planting

PHOSPHOROUS

- Acceptable

POTASSIUM

- Add 24 kg/fed after 1 month from planting

SAVE for Report

HOME | ADVISORY | PoP MENU

Choose Salinity and pH levels

Salinity	pH
Medium ▼	High ▼

SALINITY MANAGEMENT

- Add 4 ton/fed gypsum with deep tillage & apply 30% extra irrigation water of salinity < 2,000 ppm

SODICITY MANAGEMENT

- Add 100 kg/fed elemental sulfur

HOME | ADVISORY | PoP MENU

Crop Advisory Mode/Wheat

Select your farm Soil

SAND | CLAY

Continue to PoP

PoP Menu

Scenario:

General Recommendations

Apt Varieties:

Sowing Time:

Cultivation Methods:

Seeding Rate:

SAVE for Report

HOME | ADVISORY | PoP MENU

Weedicide Application

Choose WeedType and Weedicide

Dicots	Monocots
Togob 20% ▼	Antlob15% ▼

SALINITY MANAGEMENT

- Add 4 ton/fed gypsum with deep tillage & apply 30% extra irrigation water of salinity < 2,000 ppm

SODICITY MANAGEMENT

- Add 100 kg/fed elemental sulfur

SAVE for Report

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Disease Identification

Disease: Stem Rust ▼

DISEASE SYMPTOM

Dark reddish brown on both sides of the leaves, on the stems, and on the spikes. With light infections the pustules are usually separate and scattered, but with heavy infections they may coalesce. Prior to pustule formation, flecks may appear. Before the spore masses break through the epidermis, the infection sites feel rough to the touch, as the spore masses break through, the surface tissues take on a ragged and torn appearance.

HOME | ADVISORY | PoP MENU

Fungicide Application

Disease Type and Fungicide

Opera 18.3% ▼ | Monbro 90% ▼ | Teit 25% ▼

LEAF RUST TREATMENT

- Add 4 ton/fed gypsum with deep tillage & apply 30% extra irrigation water of salinity < 2,000 ppm

STRIPE RUST TREATMENT

- Add 100 kg/fed elemental sulfur

HOME | ADVISORY | PoP MENU



2020-2022
Incubation Phase

- The demand was validated
- Major partnerships were identified
- The MVP was developed
- Baseline field data was accumulated
- Preliminary field testing done



2022-2024
EiA Active Phase

- The MVP will be perfected and enhanced
- Partnerships will be diversified
- The MVP will be scaled
- Field data will be collected and monitored
- Activities towards impact at scale



2024-2025
EiA Impact Phase

- The MVP will be scaled up
- Partnerships will be diversified and strengthened
- Solid impact achieved
- Contribute to Egypt's digital policy
- PPP strengthened
- Agronomy will be transformed



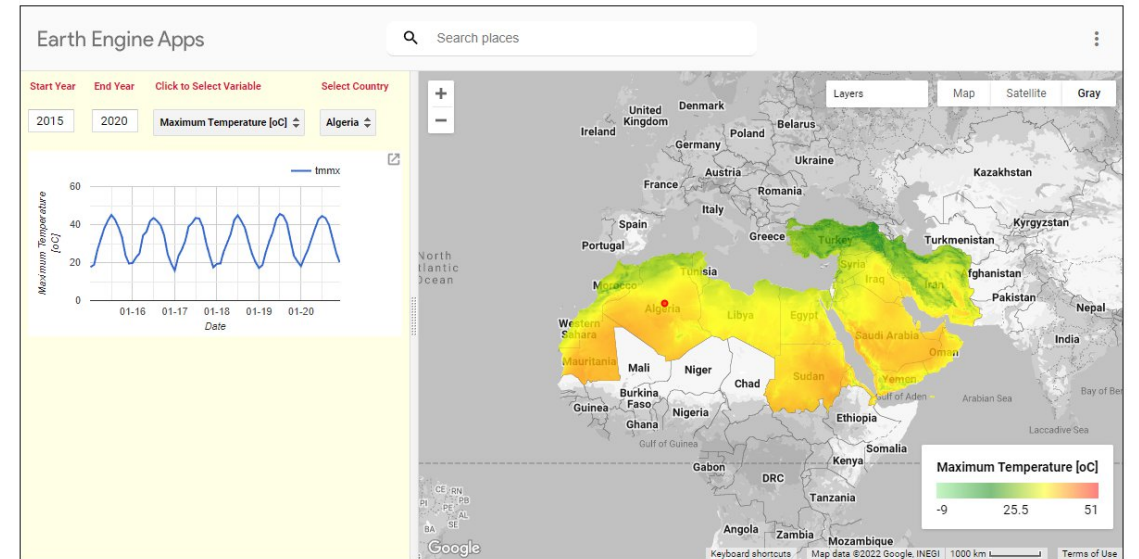
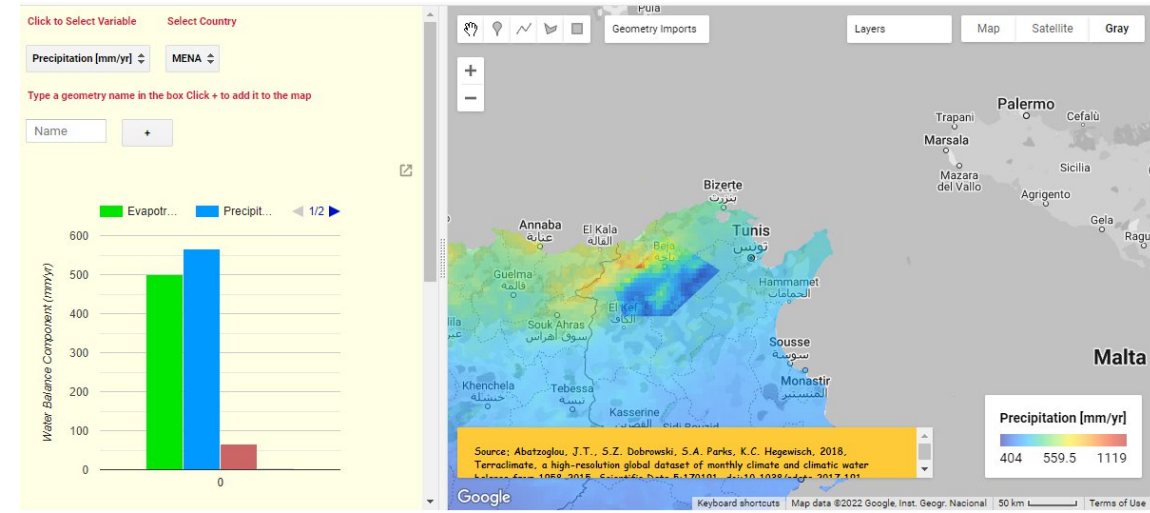
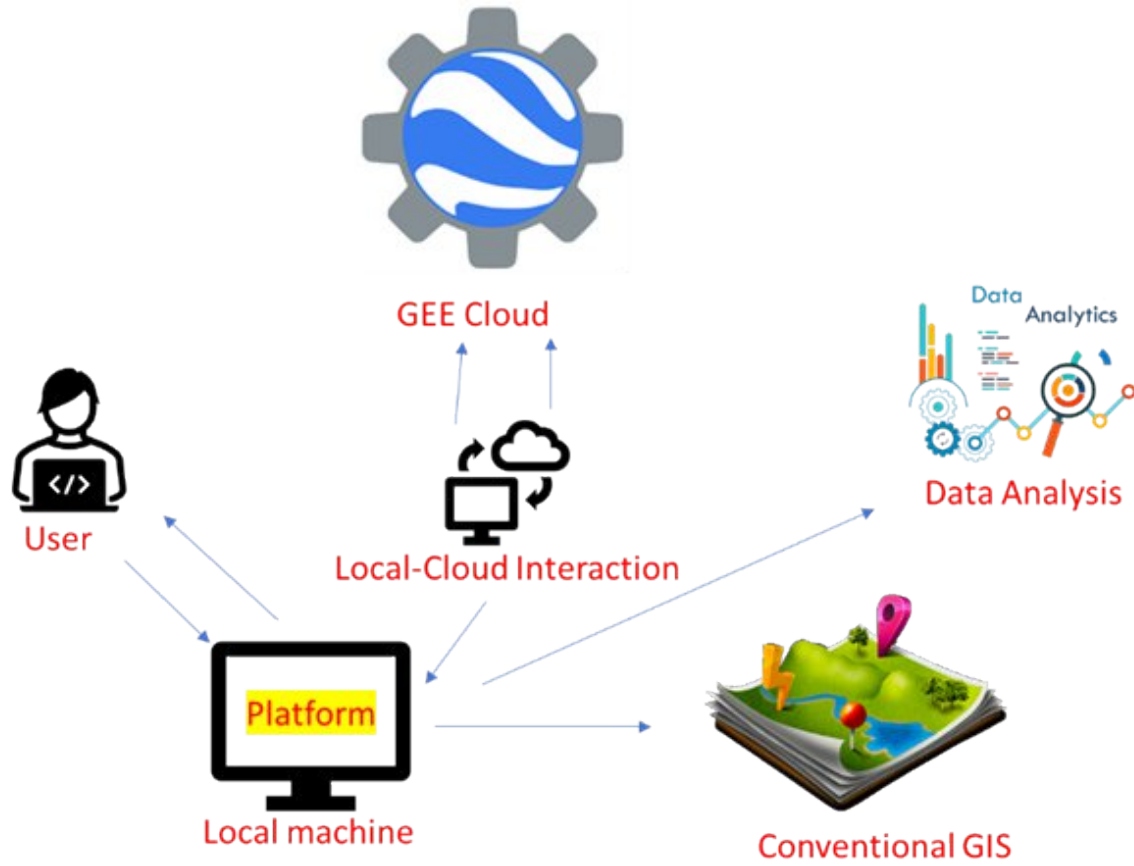
Egypt Use Case

The Web-based Platform for RWH Potential Mapping



The screenshot shows a web browser window with the address bar containing the URL <http://mena-rainwater.org>, which is circled in red. The website header features logos for ICARDA (Science for resilient livelihoods in dry areas), CGIAR, and FAO (FAO Paris). The navigation menu includes: HOME, HYDROCLIMATOLOGY, BIOPHYSICAL FACTORS, WATER BALANCE, RWH POTENTIAL ZONATION, REGIONAL STATISTICS, and SLM IN PRIORITY COUNTRIES. The main content area displays a large image of a dry, mountainous landscape with the text "Regional Water Harvesting Potential Mapping Project" overlaid in white. A blue button labeled "READ MORE" is positioned at the bottom center of the image.

Cloud Computing Enabled Dynamic Platform



Concluding Statements.....

1. Climate Adaptation in MENA's agricultural sector should have Water as the fulcrum.
2. Digital augmentation is probably the only solution to accelerate and scale climate adaptation. This can be used to supplement extension activities, capacity development activities, and policy framing, all transforming the agrifood system rapidly.
3. Digital augmentation should have broad thematic diversities, different delivery platforms and different modes of action. It can range from smartphone advisory apps, web-based platforms, ex ante assessments and geomatics based estimates. Bundling of services based approaches are better.
4. It is important to think about scaling the digital augmentation with the right enabling environments, policies and incubation and acceleration of developers with a PPP spirit for sustainable digital augmentation.
5. Engagement with stakeholders is critical (it can be in the form of stakeholder consultations, or context-specific surveys to understand the challenges and prospects).

Thanks!
مبارك

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Email: a.govind@cgiar.org