Geospatial Tools for Climate Risks in Jordan: Progress and Actions Needed

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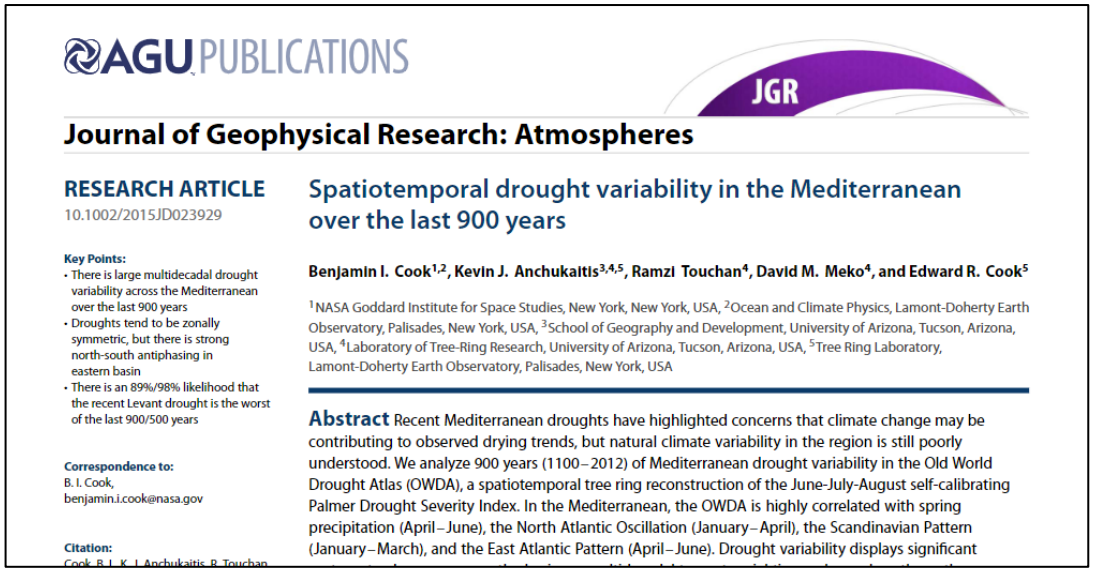
1. Introduction: Climate Risks in Jordan.
2. Need for geospatial data
3. Examples on dashboards for drought, water and soils.
4. Actions needed.

1. Introduction

1. Climate Risks in Jordan are high. Increased air temperature, decrease in rainfall, increase in heat waves and drought.

2. Reflections: water and food insecurity accelerated by degraded soil health



AGU PUBLICATIONS

JGR

Journal of Geophysical Research: Atmospheres

RESEARCH ARTICLE

10.1002/2015JD023929

Key Points:
- There is large multidecadal drought variability across the Mediterranean over the last 900 years
- Droughts tend to be zonally symmetric, but there is strong north-south antiphasing in eastern basin
- There is an 89%/98% likelihood that the recent Levant drought is the worst of the last 900/500 years

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Citation:

Spatiotemporal drought variability in the Mediterranean over the last 900 years

Benjamin I. Cook[1,2], Kevin J. Anchukaitis[3,4,5], Ramzi Touchan[4], David M. Meko[4], and Edward R. Cook[5]

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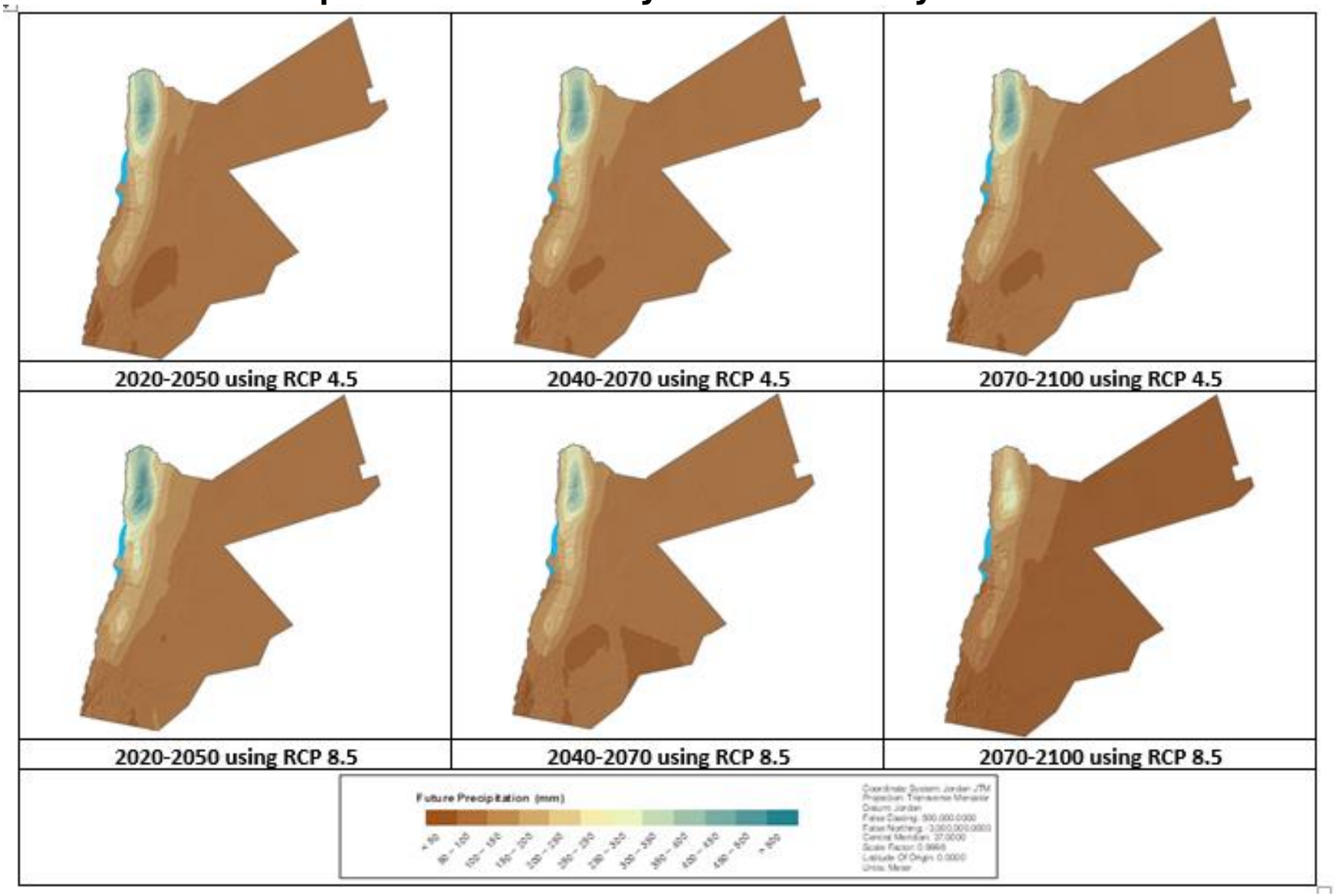
Abstract Recent Mediterranean droughts have highlighted concerns that climate change may be contributing to observed drying trends, but natural climate variability in the region is still poorly understood. We analyze 900 years (1100–2012) of Mediterranean drought variability in the Old World Drought Atlas (OWDA), a spatiotemporal tree ring reconstruction of the June-July-August self-calibrating Palmer Drought Severity Index. In the Mediterranean, the OWDA is highly correlated with spring precipitation (April–June), the North Atlantic Oscillation (January–April), the Scandinavian Pattern (January–March), and the East Atlantic Pattern (April–June). Drought variability displays significant

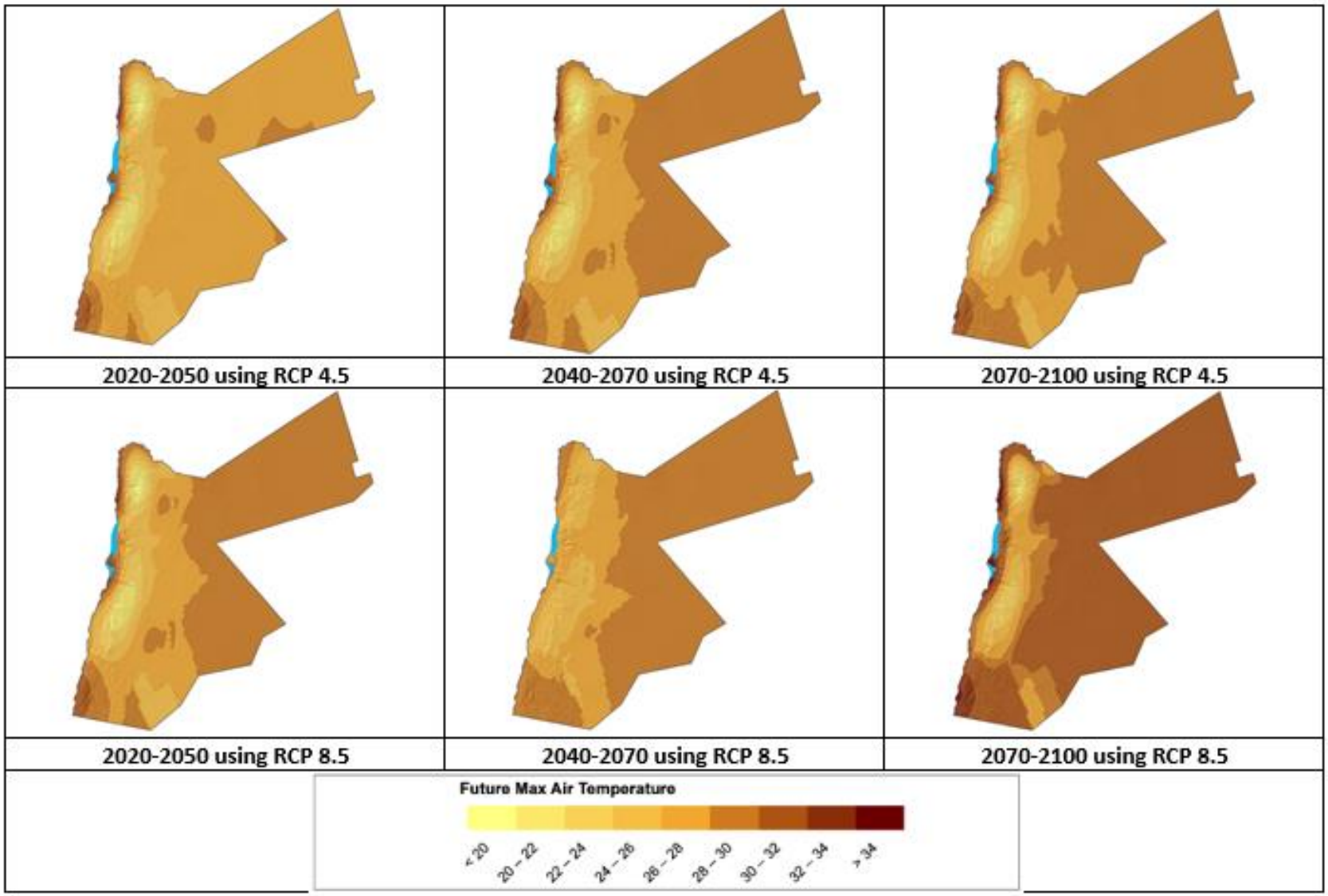
1998-2012 is the driest period during the last 900 years

Climate Projections: Precipitation

Precipitation decrease by 15.8 to 47.0% by 2100

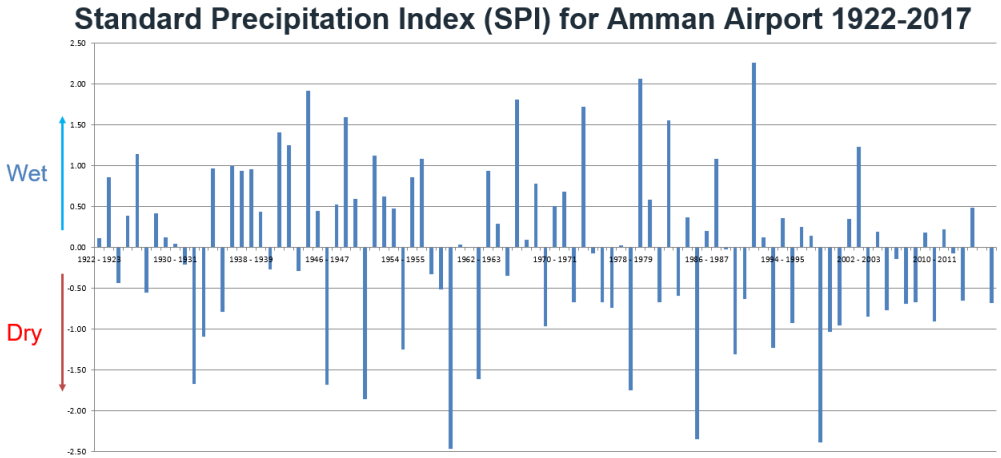


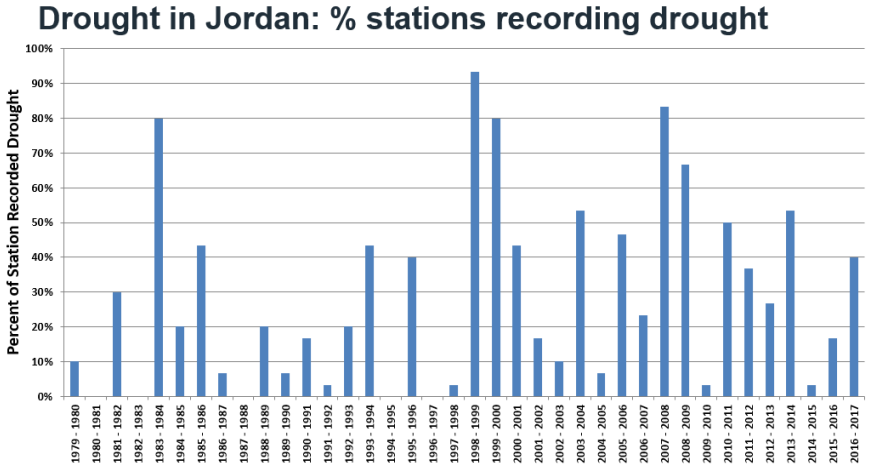
Climate Projections: Air Temp.



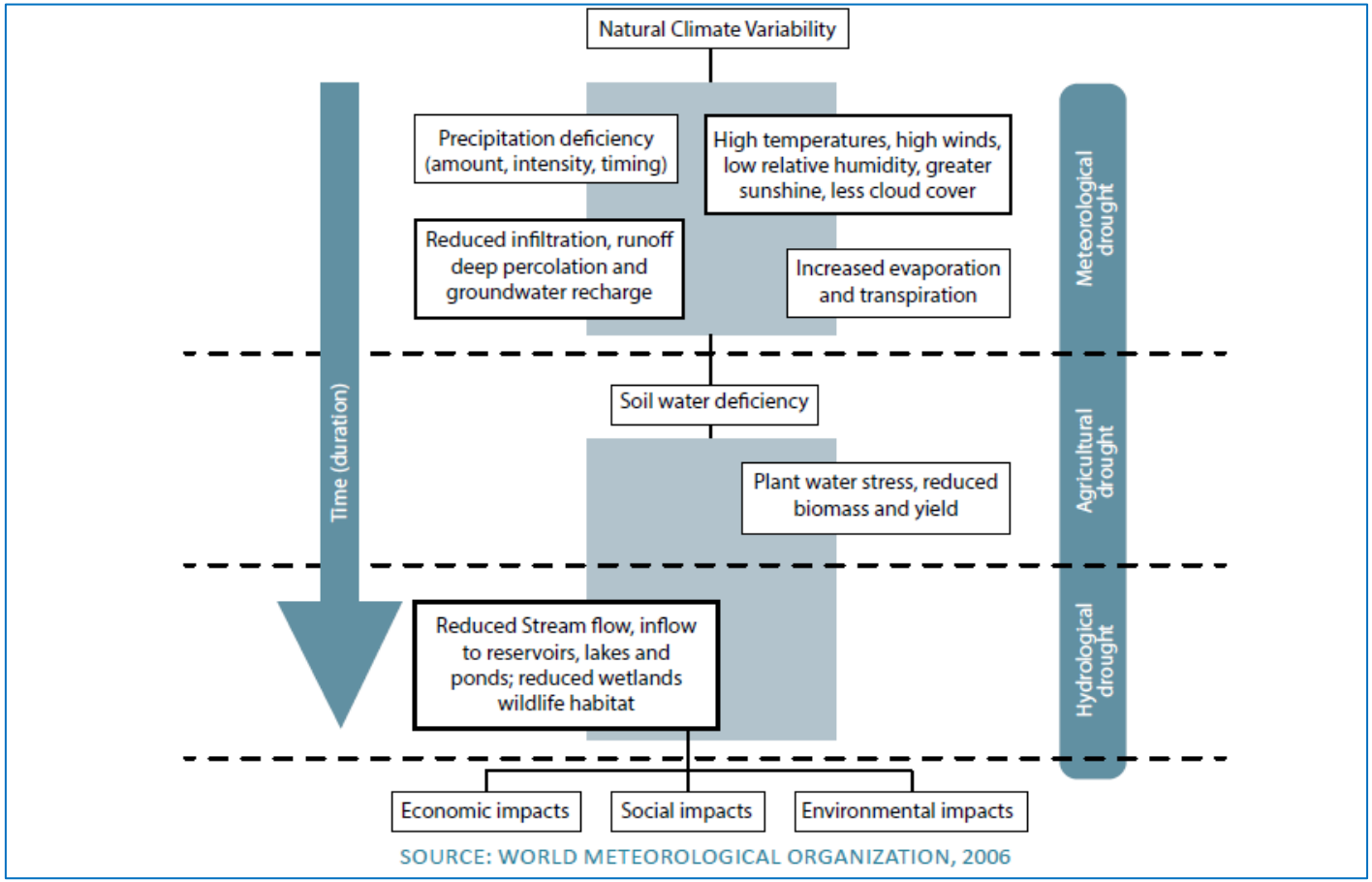
Tmin increase by +1.2 to 2.7 °C by 2070.
Tmax increase by +1.1 to 3.1 °C by 2070

How does it look in Jordan





Risks arising from drought



Need for geospatial data

- Access to the latest data and information on climate hazards and vulnerable people is important for actions and response.

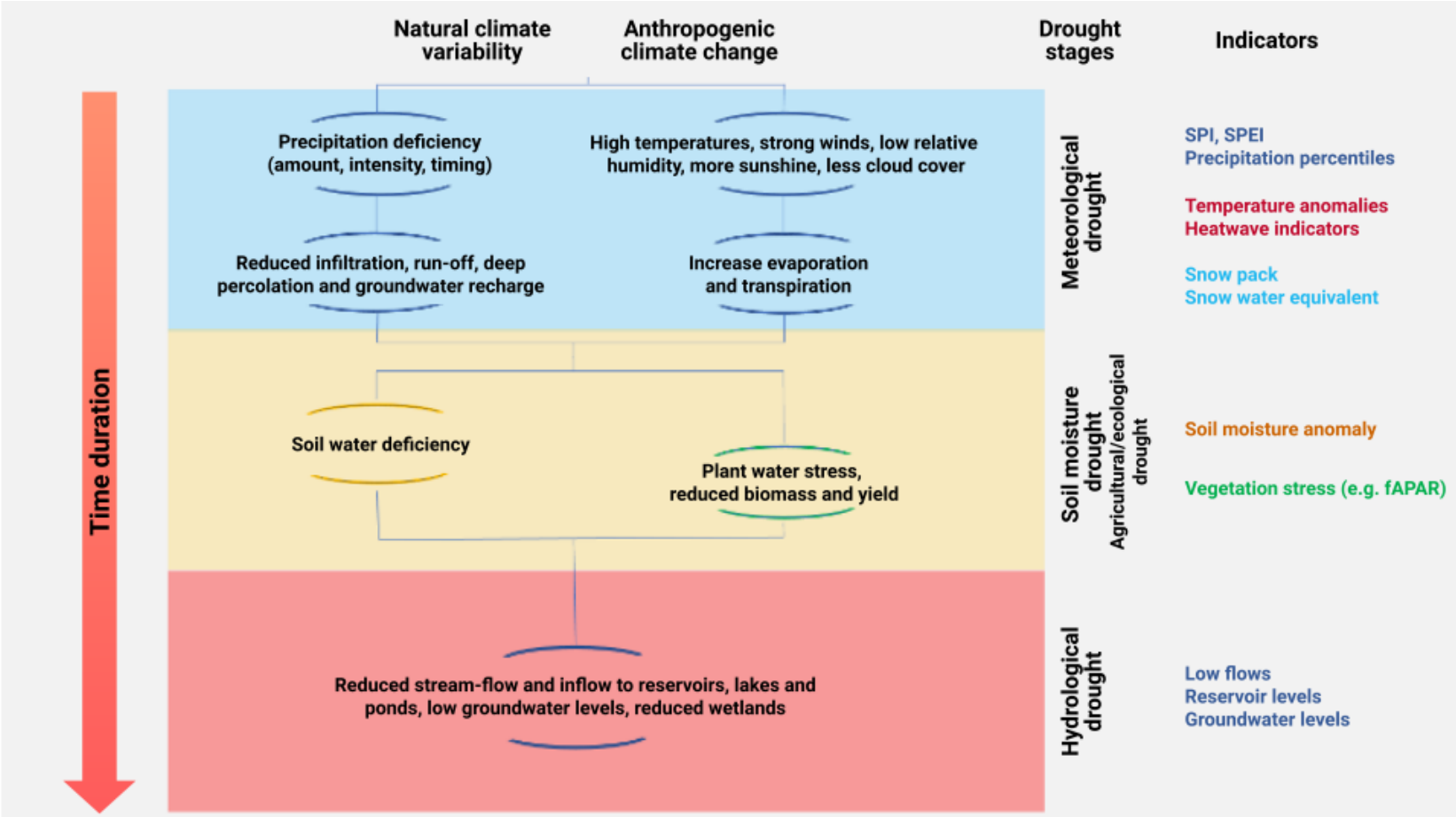
Barriers

- Poor access to ground data with good spatial distribution.
- Time and cost needed for data processing.

Solutions:

- Open-source data (EOS), platforms with functional dashboard.
- (Examples presented: PRISM, WaPOR and SIS)

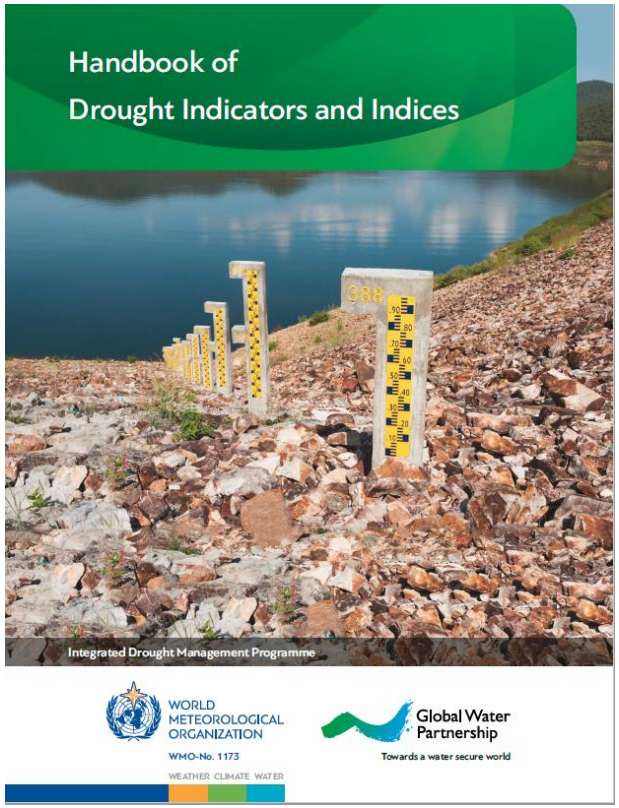
Remember: different risks and different sectors means different indicators



Source:
UNDRR, 2021. Special Report on Drought 2021, Global Assessment Report on Disaster Risk Reduction.

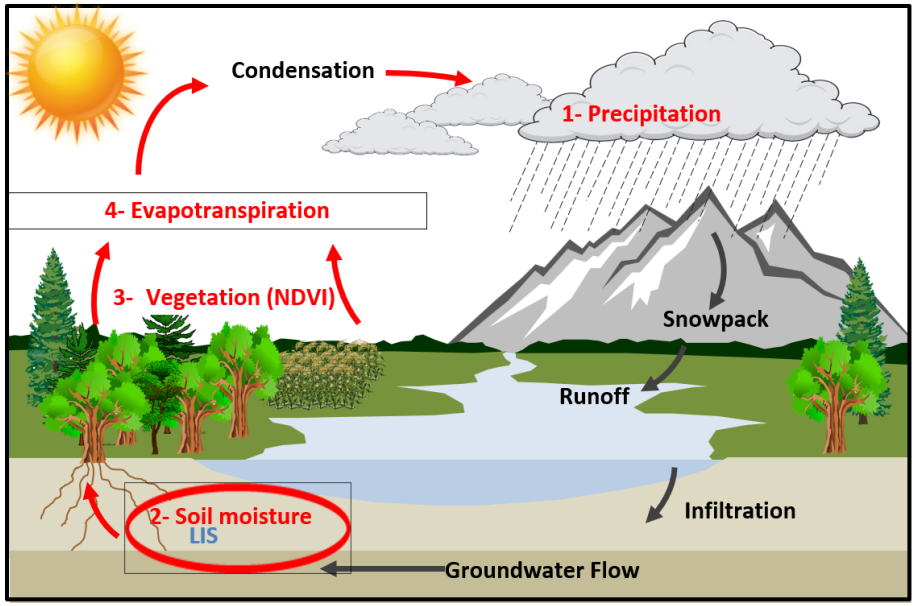
3. Examples on dashboards for drought, water and soils.

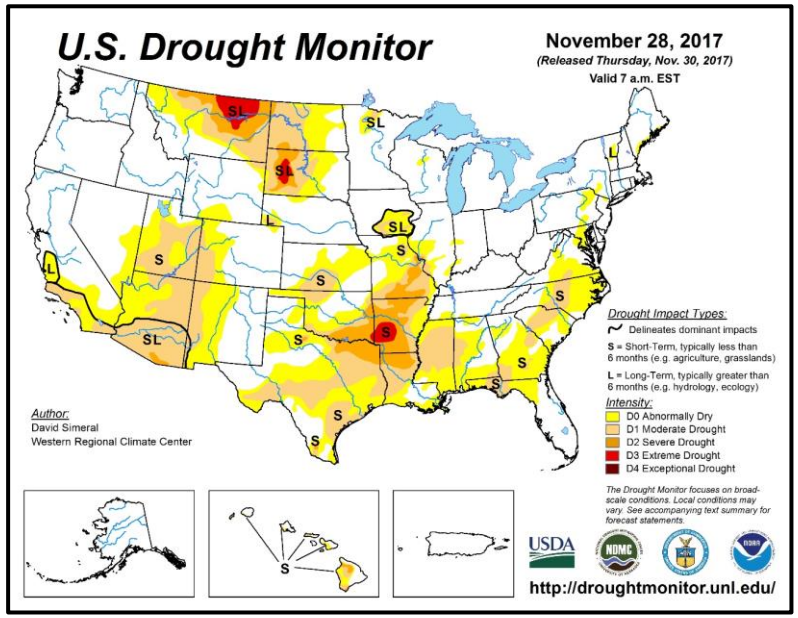
3.1. Drought



- Availability of Data, historical, present and future
- Real-Time, or even forecasted
- Scale, temporal and spatial scales
- Representation for different types of droughts
- Accuracy, for regional and local scales
- Cost, no software requirement, minimum user effort

Combined Drought Index (CDI)





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Development of a composite drought indicator for operational drought monitoring in the MENA region

Karim Bergaoui, Makram Belhaj Fraj, Stephen Fragaszy, Ali Ghanim, Omar Hamadin, Emad Al-Karablieh, Jawad Al-Bakri, Mona Fakih, Abbas Fayad, Fadi Comair, Mohamed Yessef, Hayat Ben Mansour, Haythem Belgrissi, Kristi Arsenault, Christa Peters-Lidard, Sujay Kumar, Abheera Hazra, Wanshu Nie, Michael Hayes, Mark Svoboda & Rachael McDonnell

Scientific Reports **14**, Article number: 5414 (2024) | Cite this article

Risk analysis efforts

PRISM-Platform for Realtime Impact and Situation Monitoring

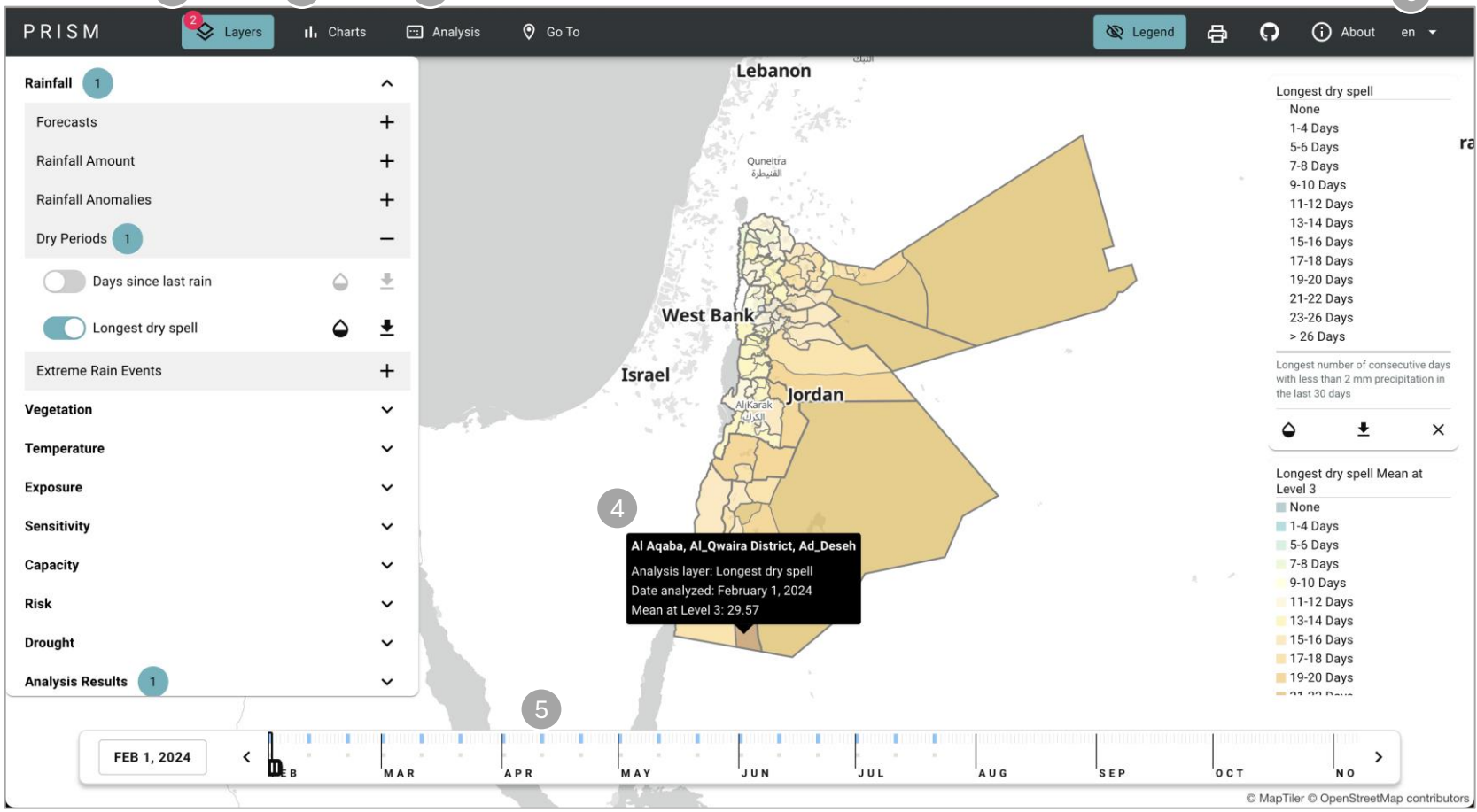
OBJECTIVES

- Reduce barriers to access information on climate hazards
- Facilitate rapid risk and impact analysis by combining hazard, vulnerability and exposure information in a single system
- Augment satellite data with information from the field from ground sensors and mobile devices
- Enable national and local ownership through easy to configure technology

PRISM Interface

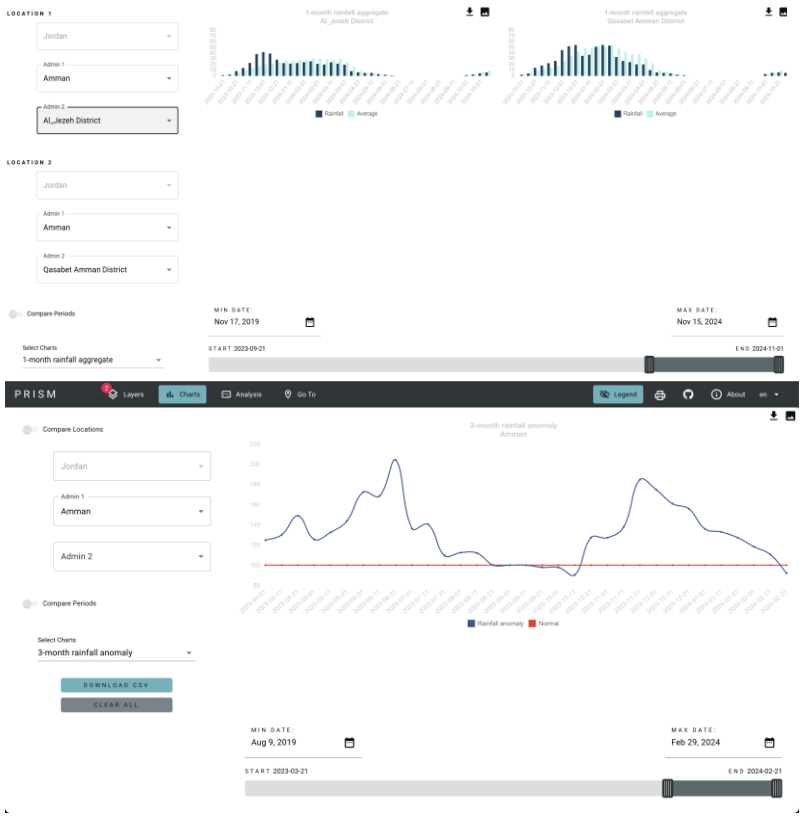
Key Features

1. Data layers are configured with government and key stakeholders
2. Charting feature shows trends of selected indicators over time
3. Users can perform spatial analysis that combines hazards, vulnerability, and exposure
4. Detailed data at the administrative level is available for each hazard, vulnerability and exposure layer
5. A timeline-based navigation allows users to view climate hazards over time
6. The user-interface can be translated into local languages



Comparison between locations and times

Trend Analysis



RAINFALL AMOUNT

- 10-day rainfall estimate (mm)
- 1-month rainfall aggregate
- 3-month rainfall aggregate (mm)
- 6-month rainfall aggregate (mm)
- 9-month rainfall aggregate (mm)
- 1-year rainfall aggregate (mm)

RAINFALL ANOMALIES

- 10-day rainfall anomaly
- Monthly rainfall anomaly
- 3-month rainfall anomaly
- 6-month rainfall anomaly
- 9-month rainfall anomaly
- 1-year rainfall anomaly
- SPI - 1-month
- SPI - 3-month
- SPI - 6-month
- SPI - 9-month
- SPI - 1-year

EXTREME RAIN EVENTS

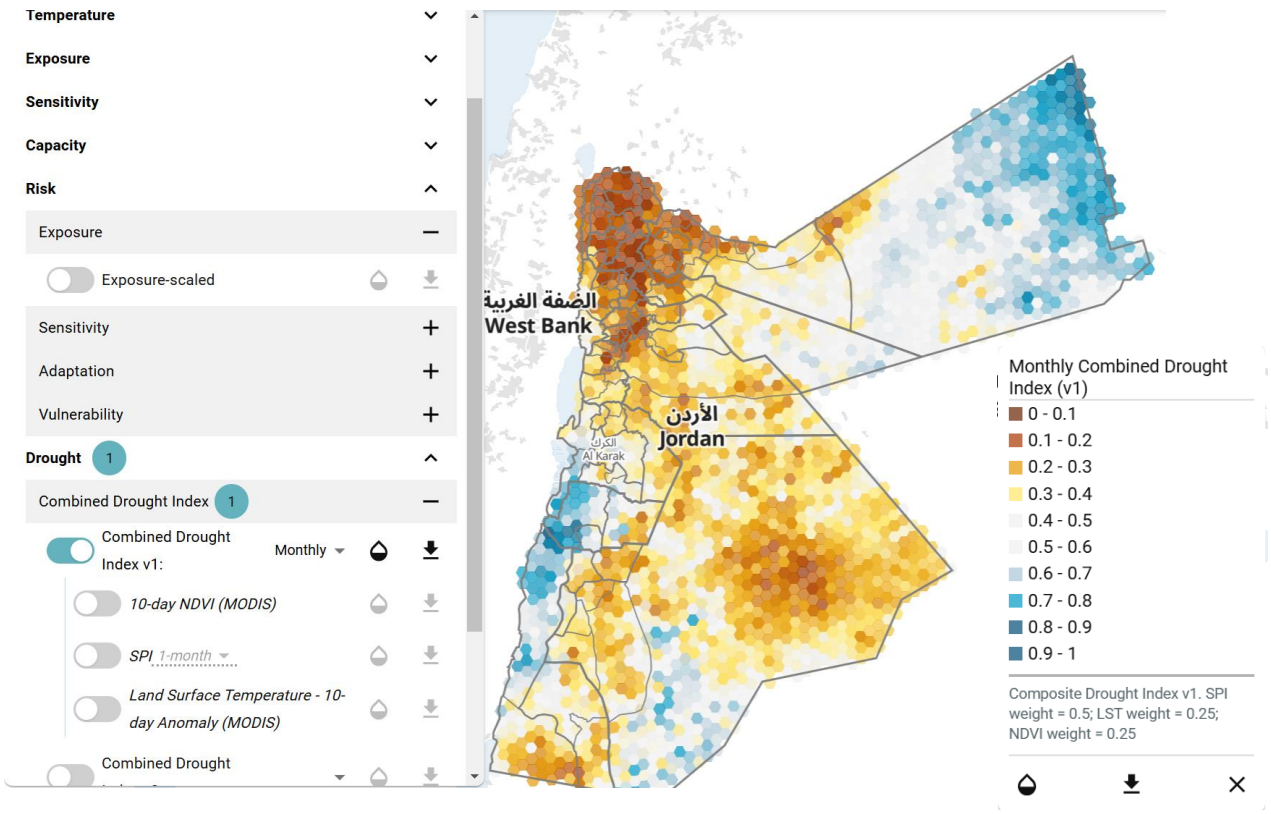
- Number of days with heavy rainfall in the last 30 days
- Number of days with intense rainfall in the last 30 days
- Number of days with extreme rainfall in the last 30 days
- Longest consecutive heavy rainfall days
- Longest consecutive intense rainfall days
- Longest consecutive extreme rainfall days

VEGETATION CONDITIONS

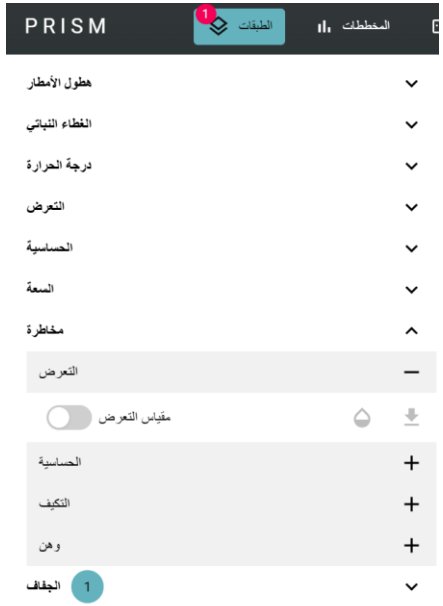
- 10-day NDVI (MODIS)
- 10-day NDVI anomaly (MODIS)

LAND SURFACE TEMPERATURE

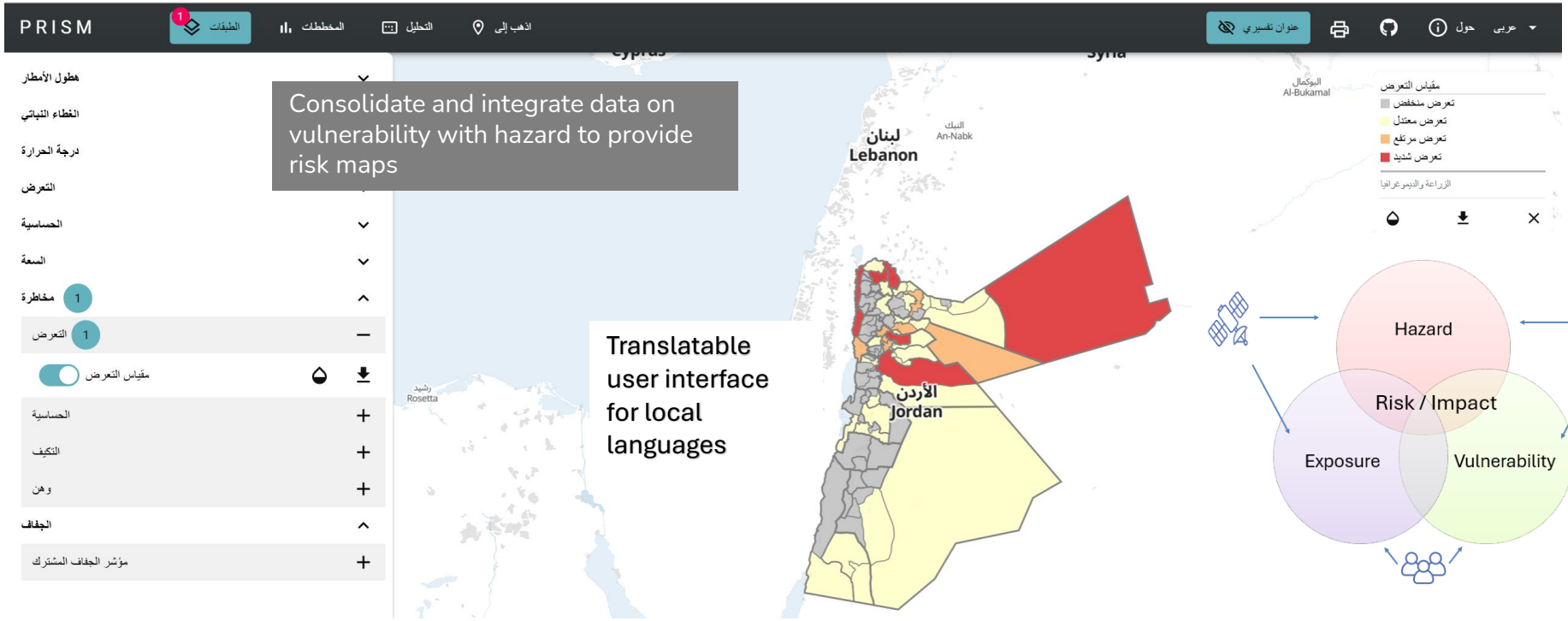
- Daytime Land Surface Temperature - 10-day (MODIS)
- Nighttime Land Surface Temperature - 10-day (MODIS)
- Land Surface Temperature - 10-day Anomaly (MODIS)
- Land Surface Temperature - 10-day Amplitude (MODIS)



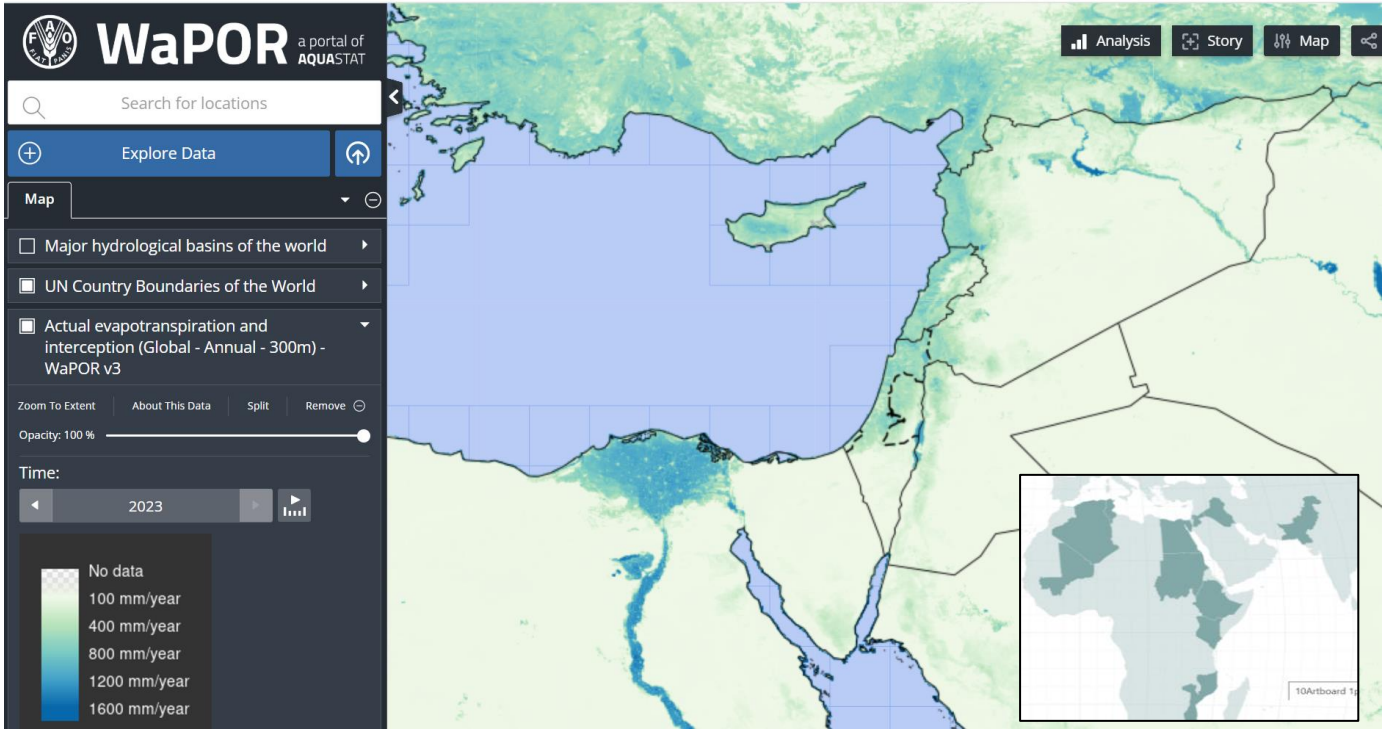
Supports different languages



PRISM: Dashboard for climate risk and impact analysis



Example 2- WAter Productivity through Open-access of Remotely sensed derived data



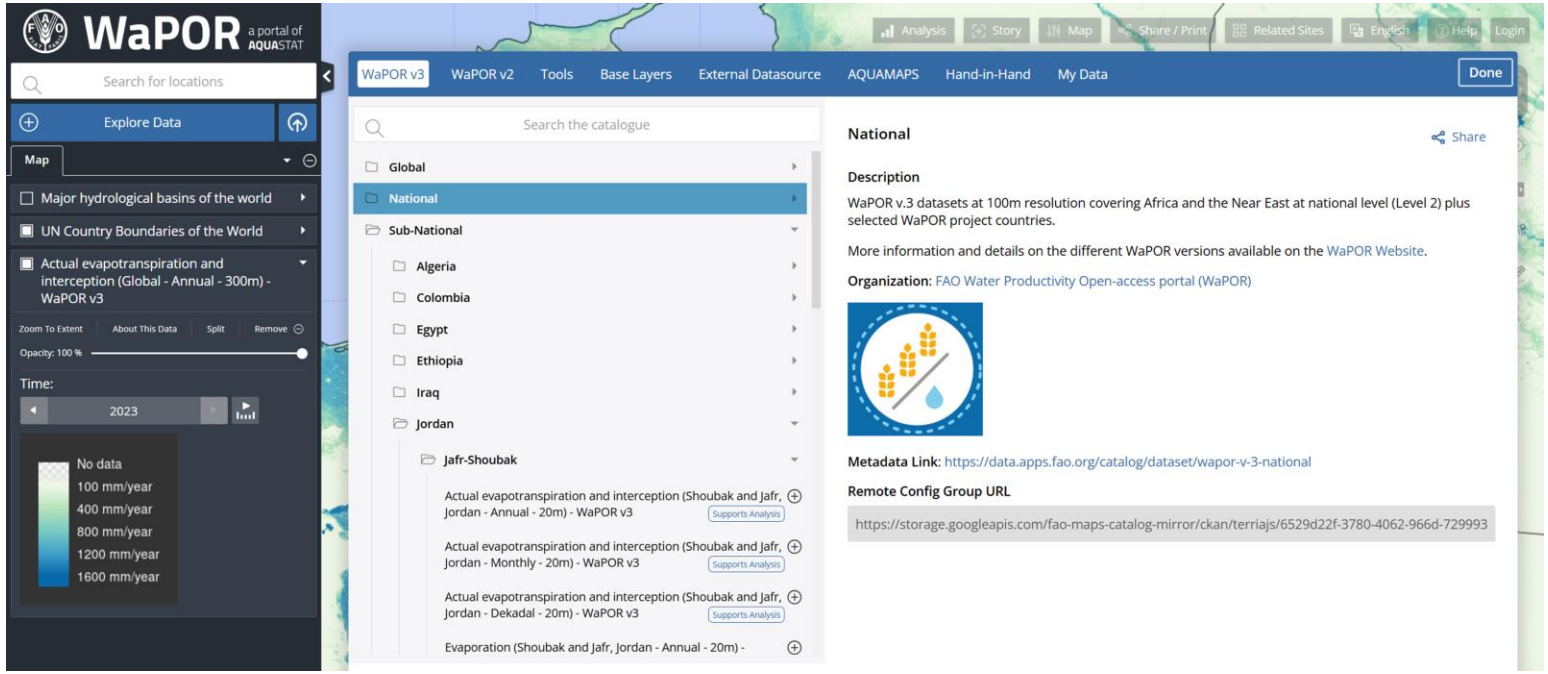
WaPOR OBJECTIVES

- Monitoring water productivity,
- Identifying gaps and propose solutions,
- Contributing to a sustainable increase of agricultural production and food security.

https://data.apps.fao.org/

Data

- Rainfall
- ET
- Biomass
- Water Productivity
- Soil Moisture
- Spatial:
- 250, 100 and 30 m
- Temporal:
- 10 days, monthly, annual
- Access:
- FAO
- Google Earth Map
- QGIS



The PRIMA programme is supported under Horizon 2020, the European Union's Framework Programme for Research and Innovation.

PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

Example 3: Soil and land information platform in the MR

- Most of the MR countries have old soil maps and surveys
- Using different classification systems and nomenclature that is not easy to understand for a non-specialist
- Different analysis methods
- Scales and details vary

Advice and Outreach Committee

JRC (Joint Research Center) of the European Commission

FAO-GSP – Global Soil Partnership

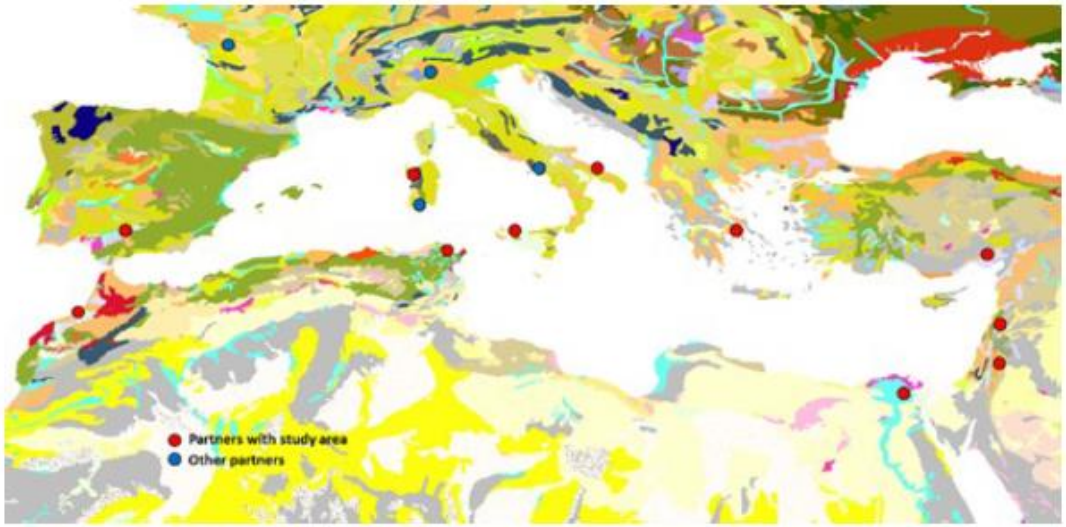
ISRIC – World Soil Information

Conscious Planet – Save Soil

Contacts

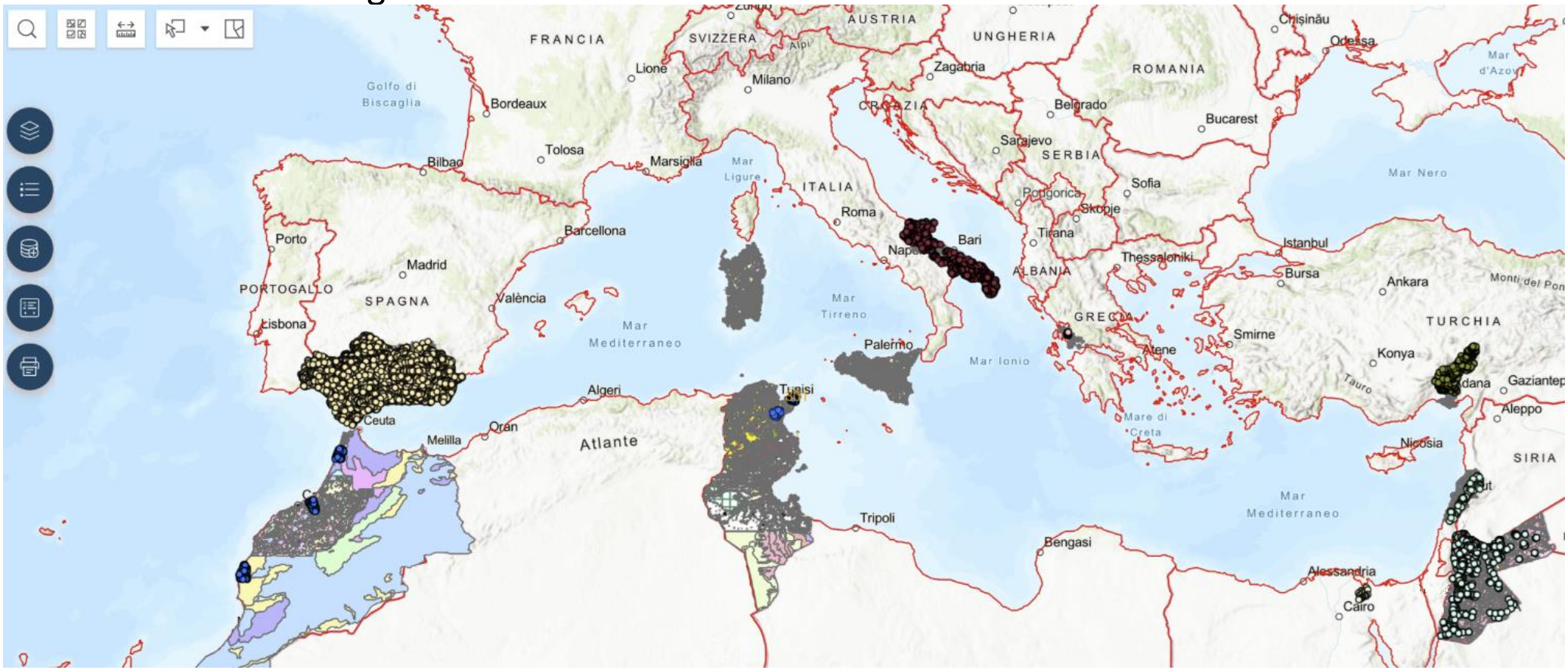
SOILS4MED Project at UNISS:
smsl@uniss.it, clzucca@uniss.it

Viale Italia 39, 07100 Sassari, Italy



Objectives and activities

- Collect soil data and maps and standardize classification systems.
- Updating soil data and developing soil health indicators (SHI).
- Create an updated SIS database and Living Labs (LL) to disseminate data and knowledge



Next steps

- An enhanced version of the PRISM platform.
- Launch of the Mediterranean Soils Platform (2026)
- Activate and improve water management platforms
- Establishing a climate change platform within the executive program of the economic modernization vision.

Actions and opportunities (What is next)

Research and Academia (MENA and MR)

- Assessment of data and impacts (Accuracy, integration…etc.)
- Regional networking at Mediterranean level for exchange of ground data, results, methods, development of dashboards...
- Improvement of data and EOS data processing (AI, ML, PY scripts..etc.)
- Integration of climate risks in educational curricula (Climate change, green skills, disaster risk reduction, water accounting, WEFE nexus…etc.)
- ??

Examples on research

Earth Systems and Environment (2021) 5:561–573
https://doi.org/10.1007/s41748-021-00245-2

ORIGINAL ARTICLE

Evaluation of Remotely Sensed Precipitation Estimates from the NASA POWER Project for Drought Detection Over Jordan

Muhammad Rasool Al-Kilani[1] · Michel Rahbeh[1] · Jawad Al-Bakri[1] · Tsegaye Tadesse[2] · Cody Knutson[2]

Received: 22 February 2021 / Revised: 1 July 2021 / Accepted: 2 July 2021 / Published online: 12 July 2021

Earth Systems and Environment (2021) 5:751–766
https://doi.org/10.1007/s41748-021-00238-1

ORIGINAL ARTICLE

Assessment of Climate Changes and Their Impact on Barley Yield in Mediterranean Environment Using NEX-GDDP Downscaled GCMs and DSSAT

Jawad Al-Bakri[1] · Ibrahim Farhan[2] · Mohammed Al-Qinna[3] · Emad Al-Karablieh[1] · Karim Bergouli[4] · Rachael McDonnell[5]

Environ Monit Assess (2024) 196:879
https://doi.org/10.1007/s10661-024-13061-8

RESEARCH

Assessment of meteorological drought impacts on rainfed agriculture using remote sensing–derived biomass productivity

Muhammad Rasool Al-Kilani · Jawad Al-Bakri · Michel Rahbeh · Qasem Abdelal · Seleshi Yalew · Marloes Mul

ELSEVIER

Science of The Total Environment
Volume 952, 20 November 2024, 176010

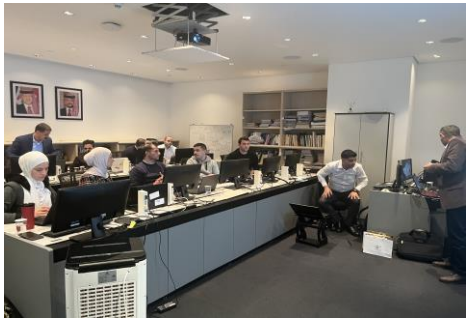
The heat-mortality association in Jordan: Effect modification by greenness, population density and urbanization level

L. Luque-García [a b c], S. Bataineh [d], J. Al-Bakri [e], F.A. Abdulla [d], W.K. Al-Delaimy [f]

Actions (What is next)

Institutional and decision making

- Mainstreaming of risks in planning of affected sectors
- Capacity building in MENA countries
- Guidelines for assessment of impacts (post disaster)
- Plans for recovery and adaptation at sectoral levels (Water, agriculture, environment, health)



Thank you for listening