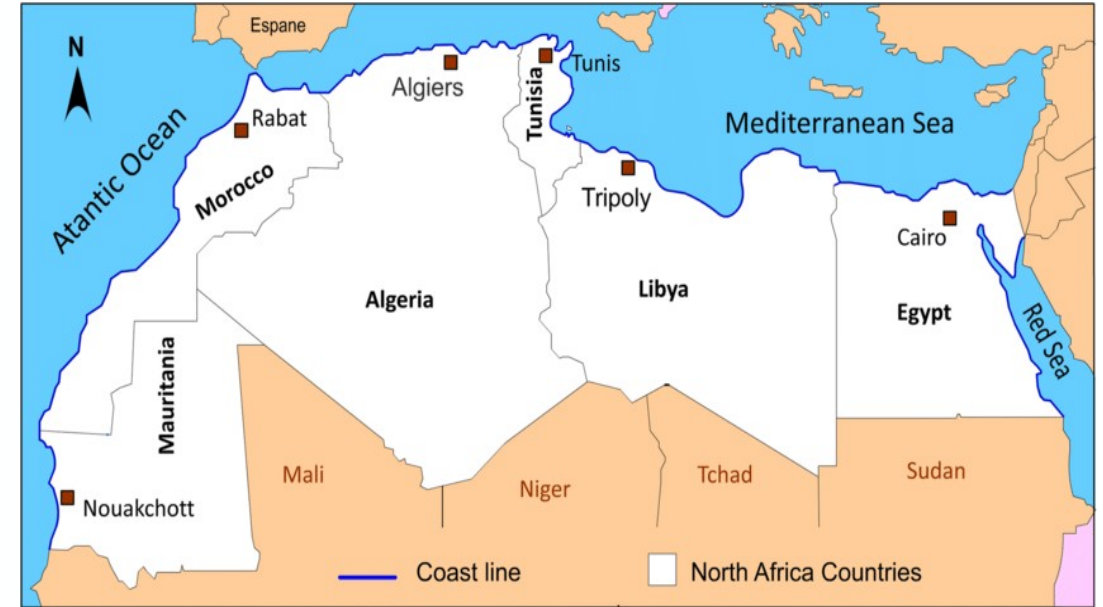




Members: Rania Ezzeldeen¹, Rokaya Hassan¹, Fatma Ismail¹, Marwa Mohamed¹, Antonios Mekhiel¹, Amal El-Sehwagy¹, Rogert Sorí², Albenis Pérez-Alarcon², Luis Gimeno², Raquel Nieto², Marta Vázquez², Luis Gimeno Sotelo²

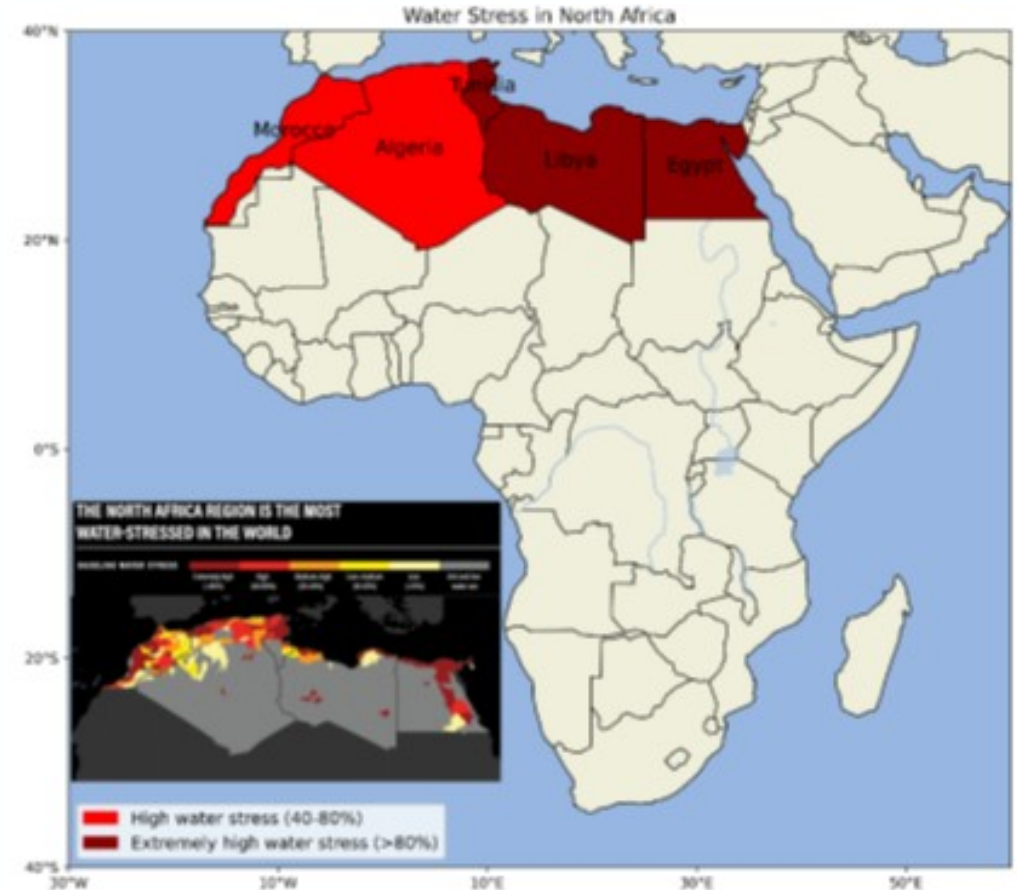
¹Egyptian Meteorological Authority; ²University of Vigo, Spain

- ☐ Introduction
- ☐ Summary of MARINA Project
- ☐ Current status
- ☐ Events (workshops and training)
- ☐ Papers in progress
- ☐ Short Visits



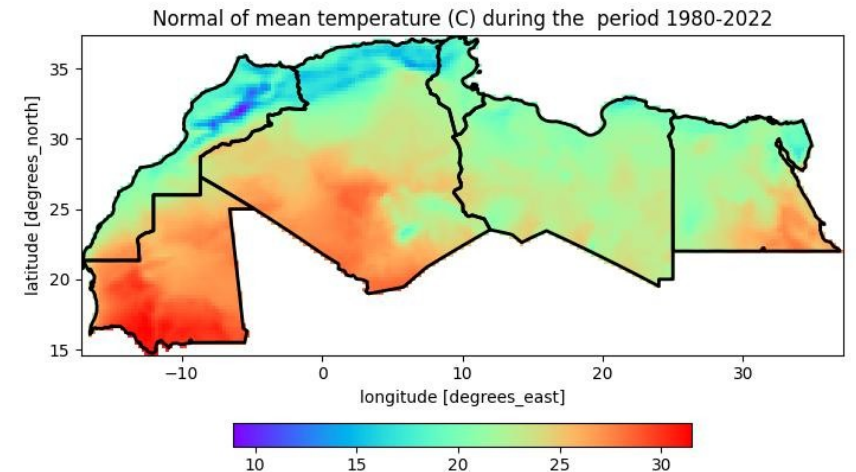
Drought in North Africa: A Critical Challenge

- North Africa is severely water scarce, with **less than 1,000 m³** of renewable fresh water available per person per year (World Bank, 2018)
- Northern Africa's population is approximately 272 million (2024), rising to **~276** million by mid-2025.
- North African countries are **highly vulnerable** due to reliance on **rain-fed agriculture**.
- Key impacts:** crop failure, water shortages, food insecurity, and displacement.
- Climate trends** point to **less rainfall** and **higher temperatures**, worsening the crisis.

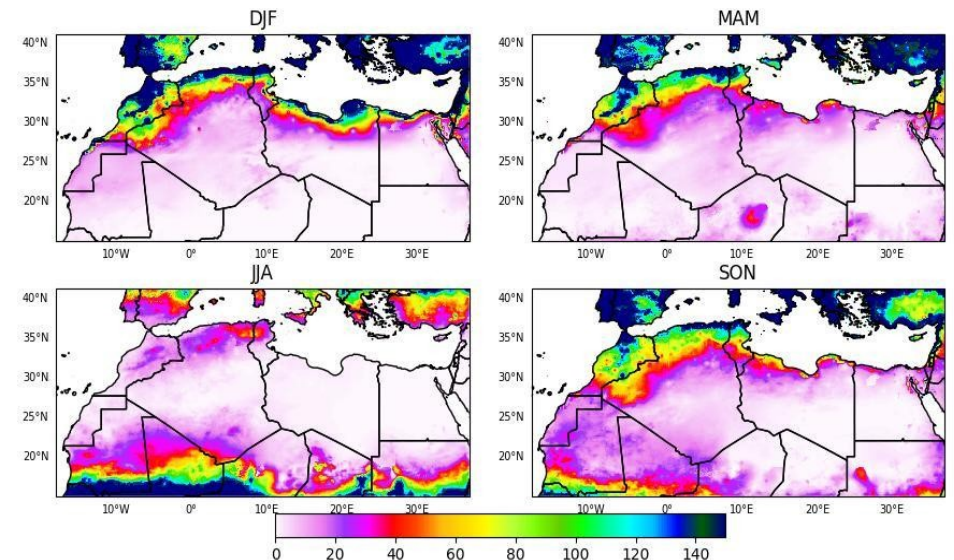


Air Temperature & Precipitation in North Africa

- Annual mean temperature in North Africa (1980–2022) ranges from 9°C to 32°C, and most of its rainfall occurs during Winter, Autumn, and Spring, respectively.
- Northwest Africa (Morocco, Algeria, Tunisia) has the lowest annual mean temperatures due to high mountain altitudes, and get rain from September to May, especially in winter (DJF).
- The southwestern parts have the highest temperatures, around 30°C, and receive less rainfall than the coast.



Mean of seasonal precipitation accumulation - CHIRIPS(1981-2022)



Objectives:

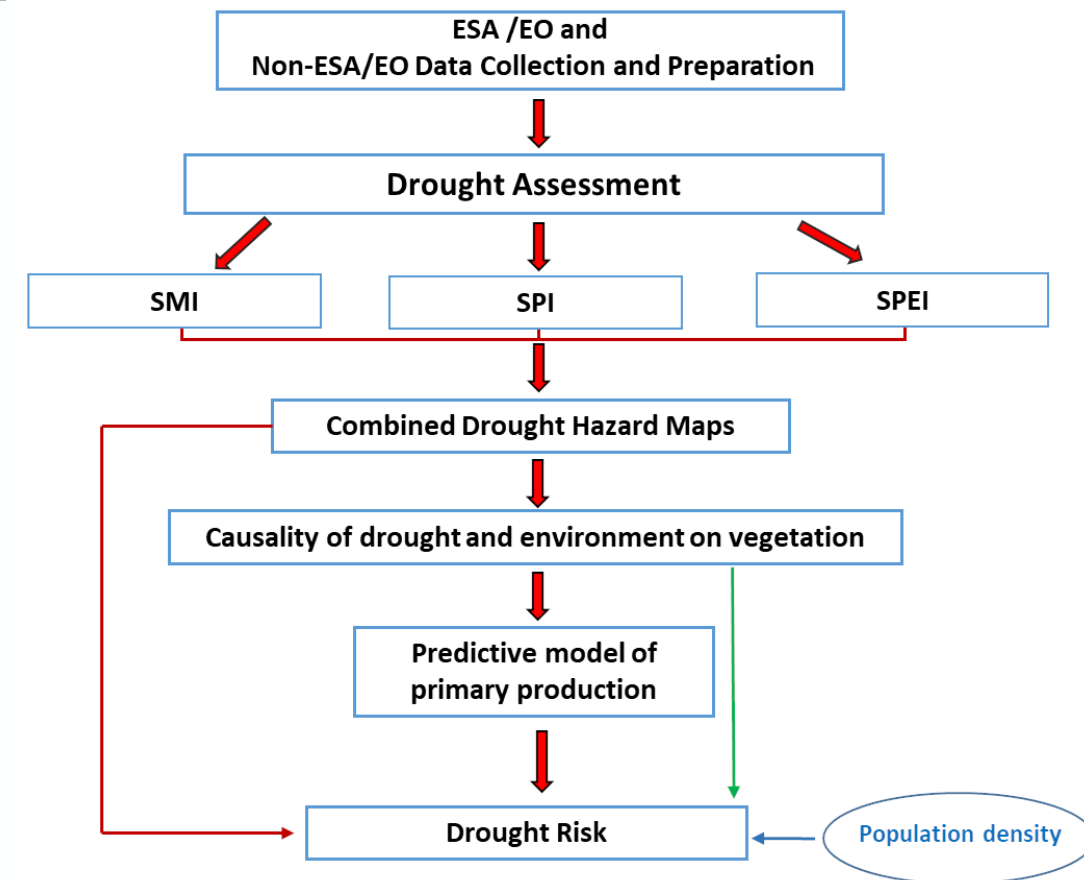
Map drought risk in North Africa by integrating drought hazards, vegetation susceptibility, and population exposure using remote sensing and reanalysis data.

Data Collection & Preparation

- **Sources:** ESA/non-ESA EO data (soil moisture, vegetation, climate) + Non-EO (population density)
- **Preprocessing:** Cleaning and standardization.

Drought Assessment

- **Indices Used:**
 - **SPI** – Standardized Precipitation Index
 - **SPEI** – Standardized Precipitation Evapotranspiration Index
 - **SMI** – Soil moisture Index
- **Output:** Combined drought hazard maps



Vegetation & Production Analysis :

- Time-series analysis of vegetation indices.
- Convergent Cross Mapping (CCM) Analysis to identify key drivers (e.g., temperature, wind, soil moisture)

Predictive Modeling

- **Method:** Random Forest
- **Goal:** Predict primary production under drought/climate scenarios

Risk Mapping

- Combine hazard, vegetation, and population data
- Produce spatial risk maps to guide adaptation strategies.

Deliverables

- Interactive dashboard for map visualization
- Technical reports and documentation

Tasks already done: Data Collection, preparation, and assessment; Studying the role of atmospheric mechanisms on precipitation variability, temperature, and drought occurrence in NA; Drought assessment.

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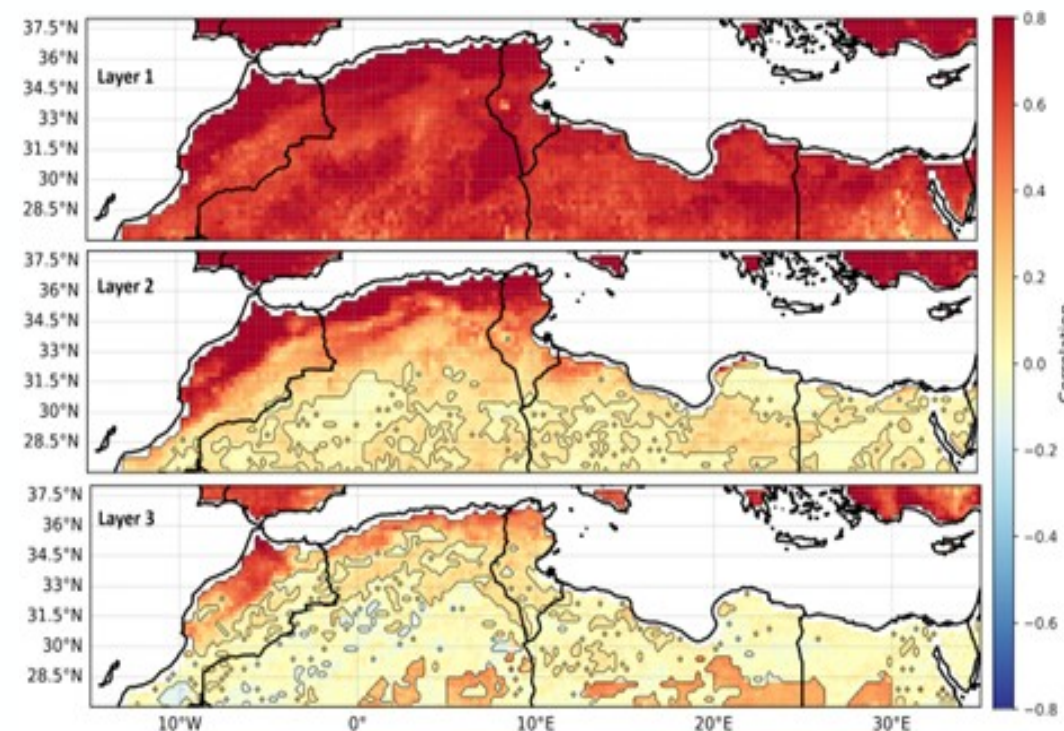
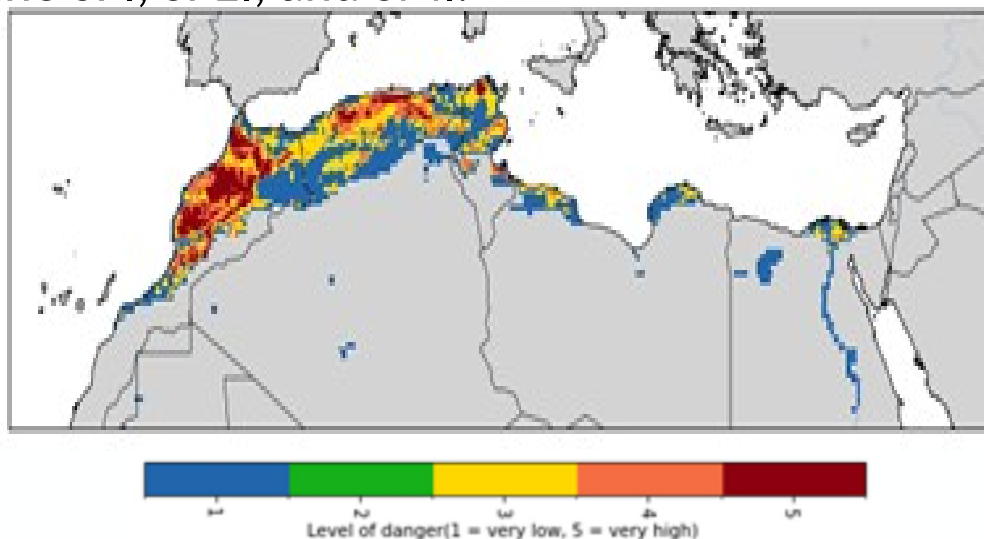
Correlation between ESA and ERA5 Soil moisture:

The correlation was done for volumetric soil moisture at three layers (1st from 0 to 7 cm; 2nd from 7 to 28 cm; and 28 to 100 cm).

The results show that the best and high positive relationship in the first layer of the soil.

Drought hazard map:

The map is based on the probability of compound severe and extreme dry conditions, according to the 3-month time scale of the SPI, SPEI, and SMI.



Correlation between ESA combined soil moisture and ERA5

■ Face-to-Face Course – EO AFRICA R&D Facility, 10-14 March in Abidjan, Côte d'Ivoire

Two members of the Egyptian team actively participated in the course.

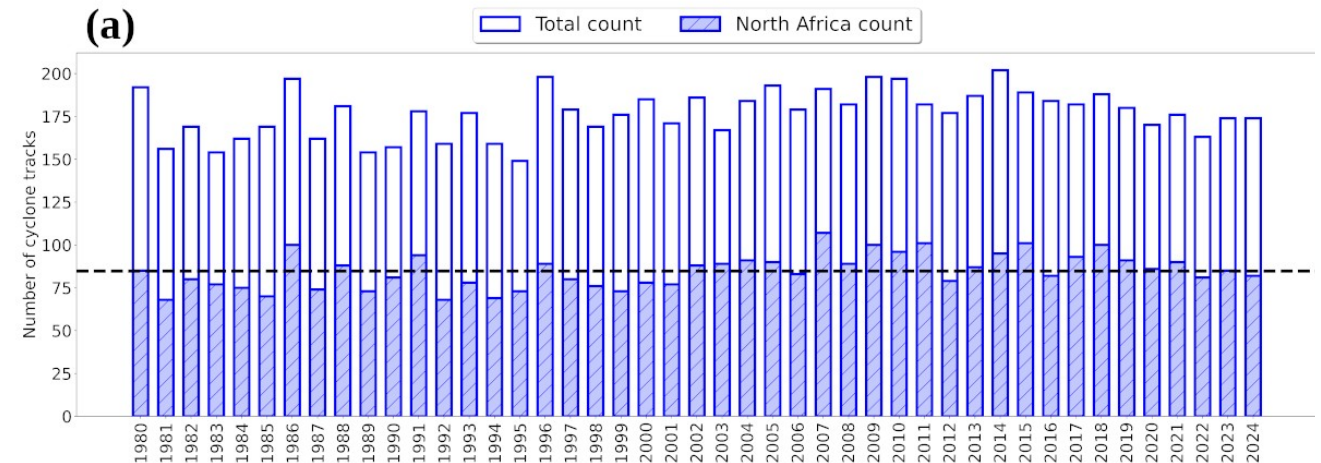
The objectives of this course:

- Define cloud computing and explain benefits of using cloud computing for EO analysis.
- Compare different cloud computing platform.
- Work with Innovation lab.
- Implement processing procedure as interactive Jupyter Notebook on Innovation Lab.
- Load and process EO data using python library.



- Three oral presentations were presented at the session entitled “Land Degradation and Desertification” by three members of the Spanish team.

- Currently there are two manuscripts in preparation,
- one has already been submitted to the Journal Earth Systems and Environment: Pérez-Alarcón, A., Sorí, R., Stojanovic, M., Salah, Z., El-Sehwagy, A., Trigo, R., Nieto, R., & Gimeno, L. (May 2025). **Quantifying the contribution of Mediterranean cyclones to precipitation totals in the North Africa region.**



Annual distribution of Mediterranean cyclones (MCs). The dashed black line in represents the mean number of MCs that contributed to the North Africa (NA) precipitation

- We held a meeting about the project progress.



Thank you for your
attention