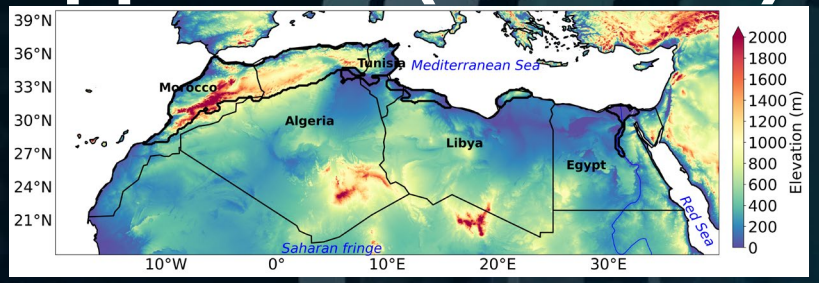
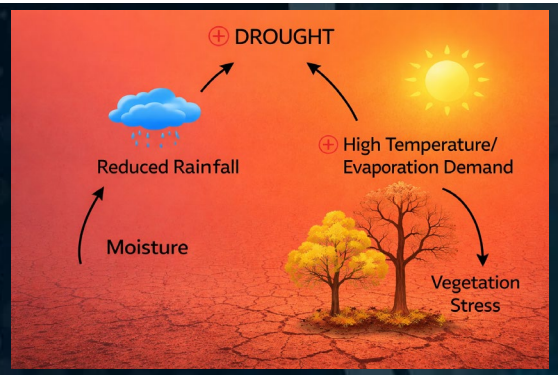
Mapping Drought Risks in Water-Stressed Regions of North Africa: An Integrated Approach (MARINA)





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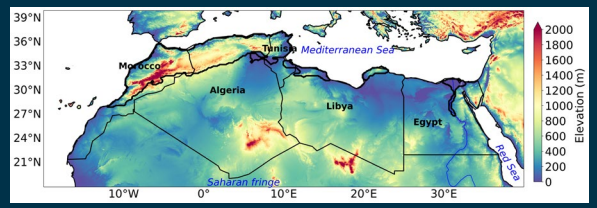
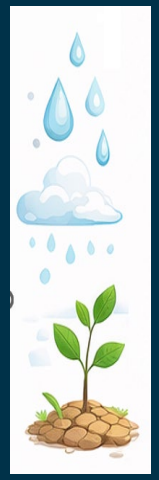
Scientific Background and Objectives



MOTIVATION



- ✓ **Study region: North Africa (Morocco, Algeria, Tunisia, Libya, Egypt)** is one of the **most water-stressed regions** worldwide, where **more than 83 %** of the population experiences **extremely high-water stress**.
- ✓ Increasing **drought frequency** and severity, together with **climate change** and **rain-fed agriculture**, threaten **water availability, ecosystems and food security**.
- ✓ Understanding **hydroclimatic drivers** and **atmospheric mechanisms** controlling drought variability is essential for improving drought **monitor** and **risk assessment**.

OBJECTIVES

- ✓ Investigate the role of atmospheric mechanisms controlling precipitation variability and drought occurrence.
- ✓ Assess drought occurrence and evolution using multiple drought indices (SPI, SPEI, SMI).
- ✓ Analyze causal relationships between atmospheric drivers and vegetation dynamics.
- ✓ Develop drought hazard and risk maps integrating climate, and vegetation exposure

DATA

- ✓ Soil Moisture CCI (Combined product)
- ✓ Vegetation indices (Proba-V, Sentinel)
- ✓ Precipitation datasets (MSWEP, ERA5)
- ✓ Potential evapotranspiration (ERA5 Land)

Research Outline

Input data
ESA/EO and Non-ESA/EO

Assessment of atmospheric drivers

Drought indices calculation

Drought event detection

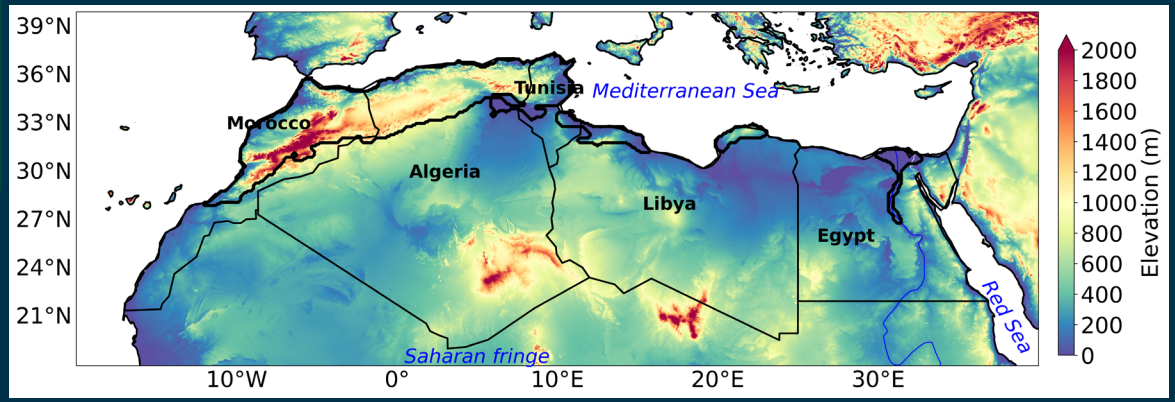
Drought typology

Drought risk

Article:
Pérez-Alarcón, A., et al. (2025).
Unveiling the Role of Mediterranean Cyclones in North Africa's Precipitation.
Earth Systems and Environment.
DOI: 10.1007/s41748-025-00905-7

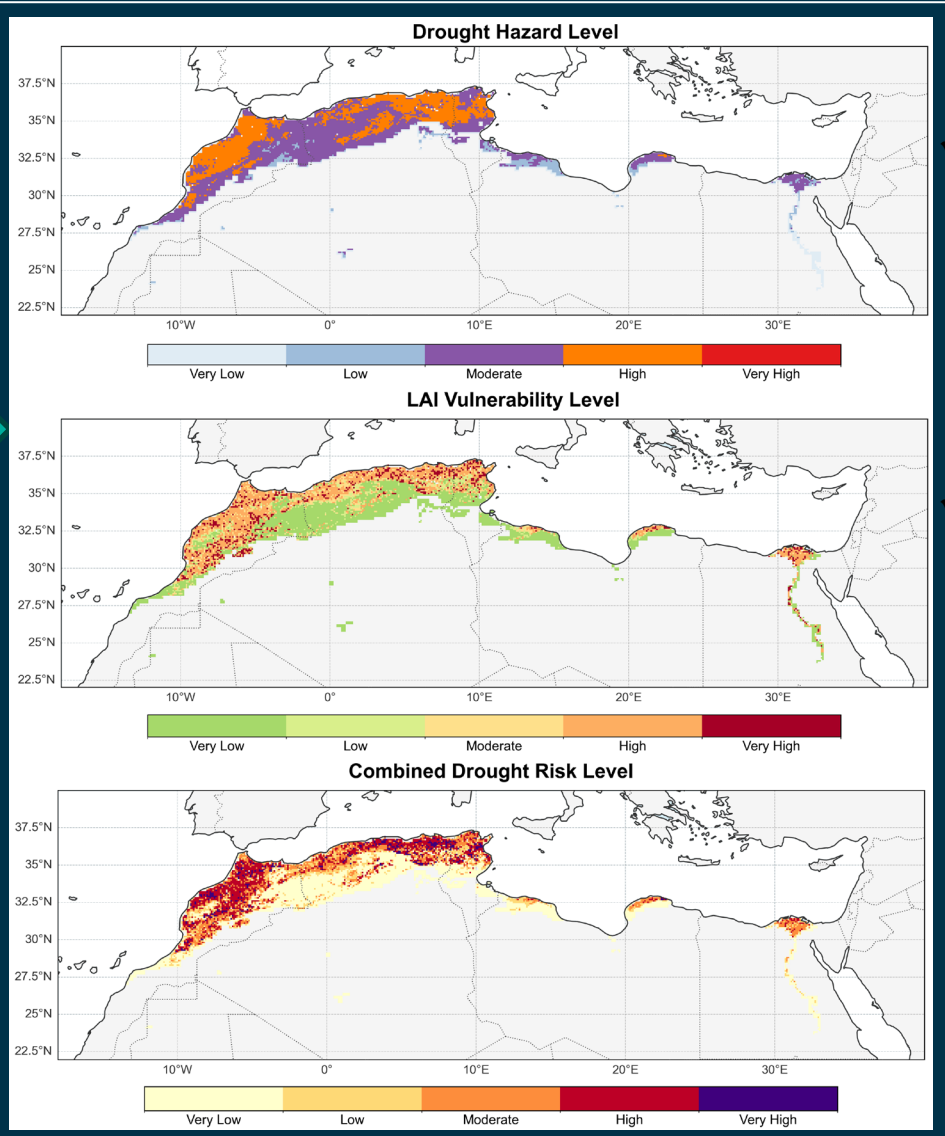
Article Draft:
Stojanovic, M., et al. (2026).
Drought dynamics in North-West Africa: atmosphere–soil coupling and temporal evolution

Study Area



Results

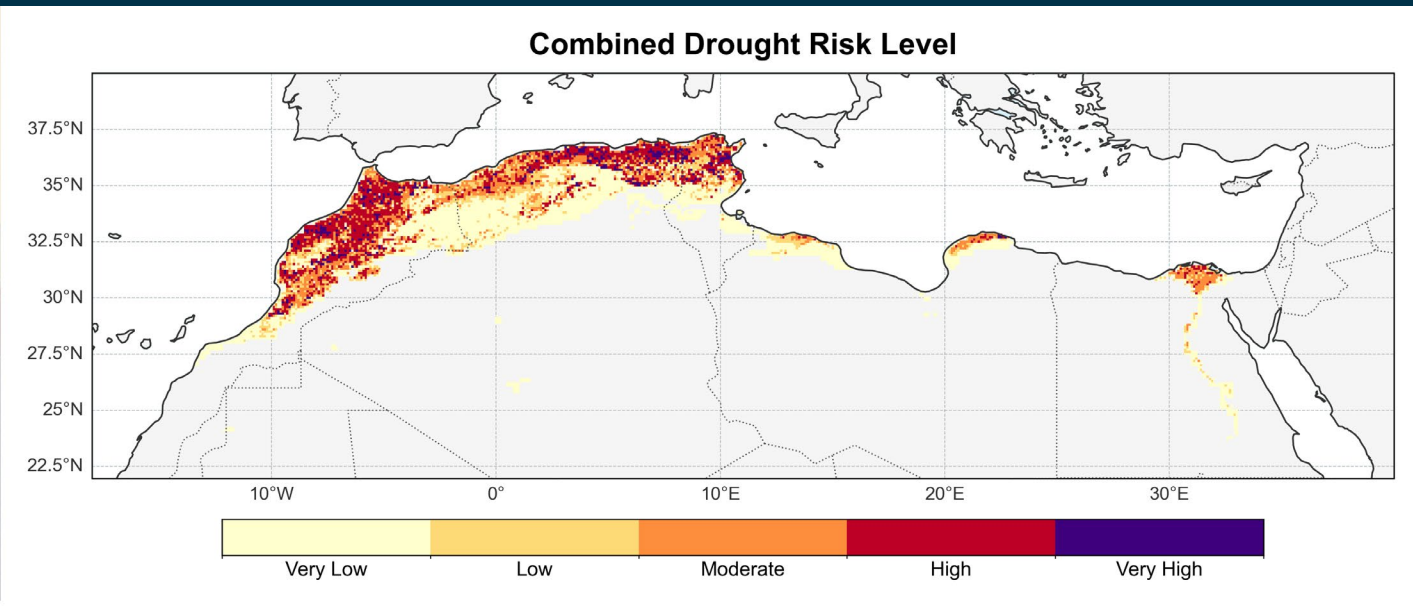
- ✓ Annually, combined drought risk is governed by orography and vegetation dynamics.
- ✓ Severe meteorological hazards and vegetation vulnerability strictly align along the mountain ranges. This demonstrates how topographic barriers simultaneously constrain Mediterranean precipitation regimes and dictate the spatial footprint of highly susceptible rainfed agricultural systems.
- ✓ The widespread high vulnerability of vegetation, reflects ecosystems operating at their absolute physiological limits.



Further work

- ✓ Linking drought risk with mortality to better understand the societal impacts of climate extremes in North Africa.
- ✓ In addition, expanding collaboration with the research groups and institutions engaged during the project through future joint initiatives.

Layout for social media posts



Post for BS and X:
Proud to share the results from our ESA funded MARINA project: The results reveal drought hotspots and supports better climate-risk assessment across the region. #ESA #Drought #NorthAfrica #UniversityOfVigo #EPhysLab

Post in LinkedIn:
As part of the ESA-funded MARINA project (Mapping Drought Risk in North Africa), we developed spatial assessments of combined agricultural drought risk across the water stressed northern Africa. The figure highlights the risk pattern derived from the integration of multiple indicators, supporting a better understanding of where compound drought conditions may have the greatest impact on vegetation. This work contributes to improve climate-risk assessments, regional monitoring and more informed adaptation planning. #ESA #NorthAfrica #Drought #ClimateRisk #UniversityOfVigo #EPhysLab