



GEOSCIENCE RESEARCH GROUP

Exploring the Impact and Vision of RNM-373



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OVERVIEW

01

Introduction to Geoscience Research Group

02

Research Group Members

03

Main Research Areas

04

Research Group Achievements

05

Our Laboratory

06

Proposed Research Lines

07

Possible Future Projects

08

Seeking collaboration



Focus Area

- Innovative + traditional geoscience research



Main Objectives

- Addressing key environmental & societal challenges
- High quality research
- Dissemination and outreach

**INTRODUCTION TO
GEOSCIENCES
RESEARCH GROUP
01**



RESEARCH GROUP MEMBERS

02

Our experience and cooperation opportunities



<https://produccioncientifica.uca.es/grupos/7856/detalle>



DR. MARÍA LUJÁN MARTÍNEZ
(HEAD)



Dr. EDUARDO
MOLINA PIERNAS



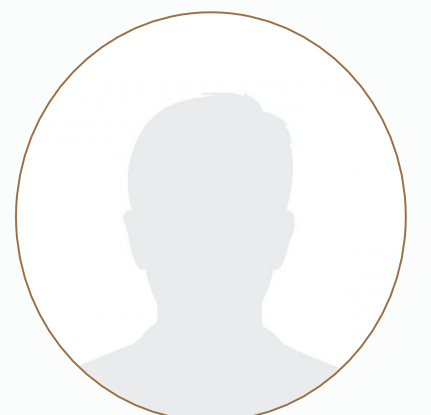
Dr. GIORGIO
ANFUSO MELFI



Dr. ROSA
MOLINA GIL



MSc. PEDRO
ZARANDONA PALACIO



Dr. LUIS
O' DOGHERTY LUY



Dr. SANTIAGO
GARCÍA LÓPEZ



Dr. VERÓNICA
RUIZ ORTIZ



Dr. ÁNGEL
SÁNCHEZ BELLÓN



Dr. MERCEDES
VÉLEZ NICOLÁS



MSc. MARÍA JESÚS
PACHECO ORELLANA

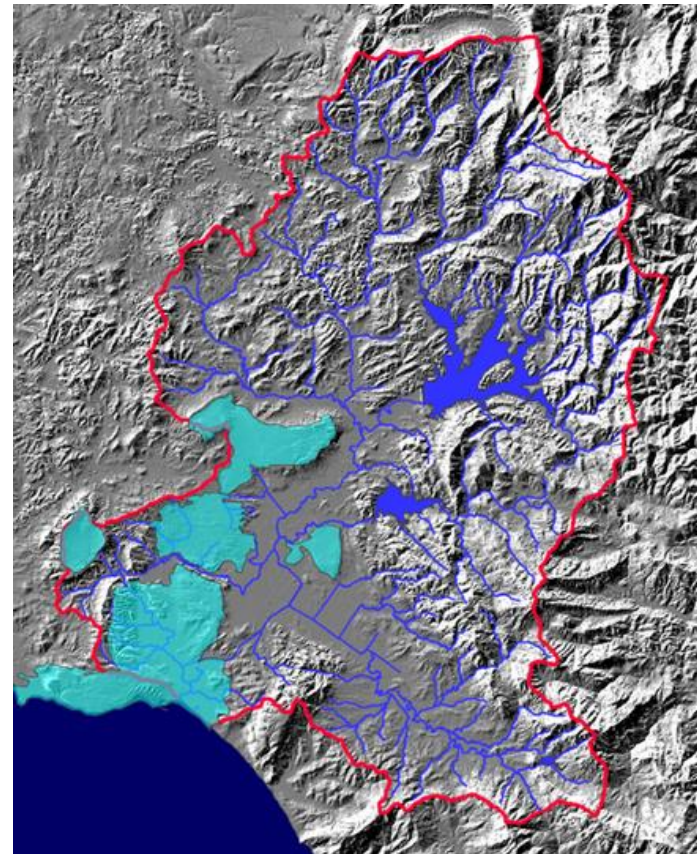


MSc. MARCIA
SALAZAR ROJAS

MAIN RESEARCH AREAS

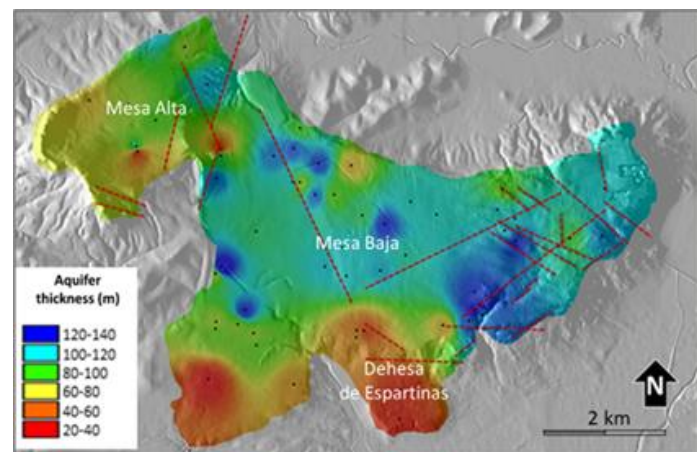
03

HIGHLIGHTING THE PRIMARY RESEARCH FOCUSES FOR THE GROUP



Natural resources management

- **Functioning** of karstic and detrital aquifers.
- Surface and groundwater hydrology: **control networks**, hydrochemistry, isotope hydrology, system modelling and **water resource assessment**.

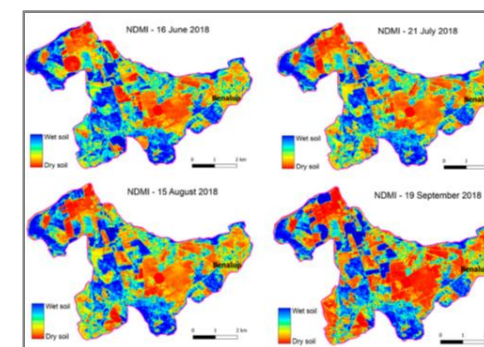


- Application of **numerical models** and **DSS tools** for joint SW-GW management.
- SW-GW interactions



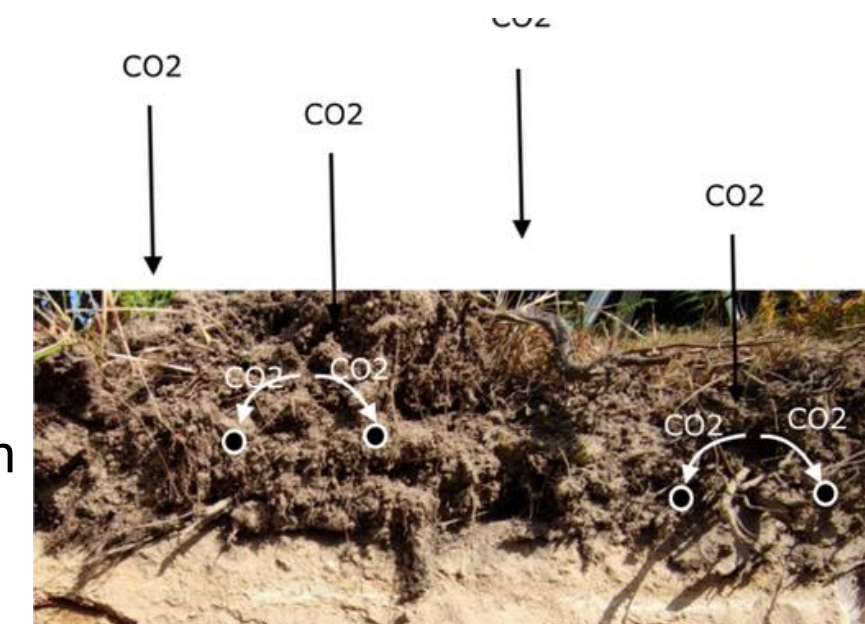
Remote Sensing Technology

- Application of **remote sensors** to hydrology and soils.
- **Coastal dynamics**, geomorphology and coastal landscape.
- **Plastic monitoring**



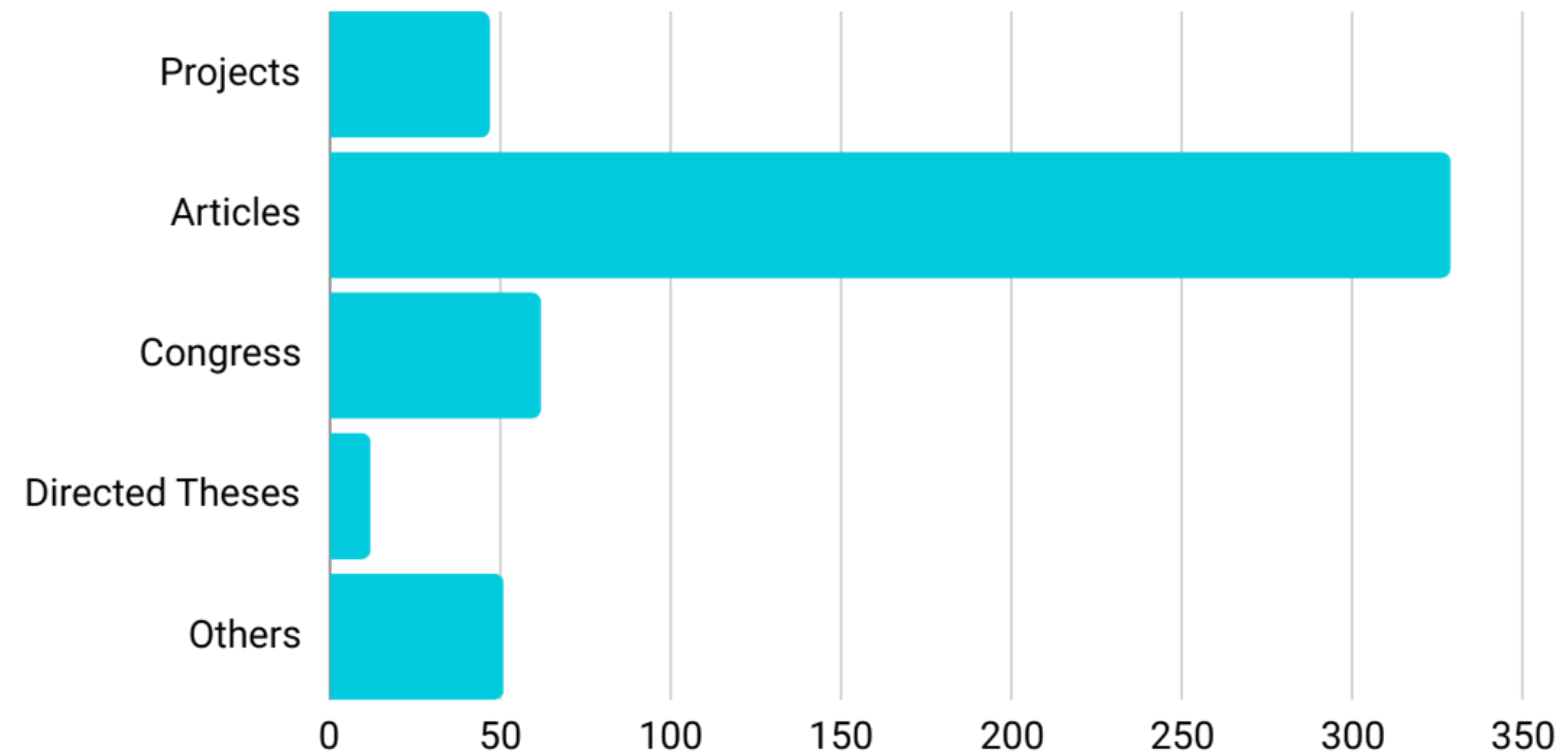
Climate change:

- Drought monitoring and assessment
- Soil management and **C sequestration**
- **Building materials** from animal by-products in the framework of Circular Economy



RESEARCH GROUP ACHIEVEMENTS 04

Highlighting Major Accomplishments of the Research Group



- 329 papers in high impact JCR journals
- Communications in 62 international and national conferences
- Direction/participation in 47 projects at different scale

Our experience and cooperation opportunities



Contents lists available at ScienceDirect
Engineering Geology
 journal homepage: www.elsevier.com/locate/enggeo

Learning from hydrological and hydrogeological problems in civil engineering. Study of reservoirs in Andalusia, Spain

Verónica Ruiz-Ortiz ^{a,*}, Santiago García-López ^b, Mercedes Vélez-Nicolás ^b, Ángel Sánchez-Bellón ^b, Antonio Contreras de Villar ^a, Francisco Contreras ^a

Contents lists available at ScienceDirect
Science of the Total Environment
 journal homepage: www.elsevier.com/locate/scitotenv

UAV-borne LiDAR revolutionizing groundwater level mapping

S. García-López ^a, M. Vélez-Nicolás ^{a,*}, P. Zarandona-Palacio ^b, A.C. Curcio ^{a,b}, V. Ruiz-Ortiz ^c, L. Barbero ^{a,b}

Advances in Geoethics and Groundwater Management: Theory and Practice for a Sustainable Development
 Proceedings of the 1st Congress on Geoethics and Groundwater Management (GEOETH&GWM'20), Porto, Portugal 2020

agriculture MDPI
 Article
Assessment of Intrinsic Vulnerability Using DRASTIC vs. Actual Nitrate Pollution: The Case of a Detrital Aquifer Impacted by Intensive Agriculture in Cádiz (Southern Spain)
 Sérgio Mateus Chiluale ^{1,2}, Mercedes Vélez-Nicolás ^{3,*}, Verónica Ruiz-Ortiz ⁴, Ángel Sánchez-Bellón ⁵ and Santiago García-López ⁵

Environ Monit Assess (2022) 194:722
<https://doi.org/10.1007/s10661-022-10312-4>
Mapping the spatial variability of rainfall from a physiographic-based multilinear regression: model development and application to the Southwestern Iberian Peninsula
 Verónica Ruiz-Ortiz ¹, Jorge M. G. P. Isidoro ², Helena Maria Fernandez ³, Fernando M. Granja-Martins ⁴ and Santiago García-López ⁵

water MDPI
 Article
Precipitation Variability and Drought Assessment Using the SPI: Application to Long-Term Series in the Strait of Gibraltar Area
 Mercedes Vélez-Nicolás ¹, Santiago García-López ^{1,*}, Verónica Ruiz-Ortiz ², Santiago Zazo ³ and José Luis Molina ³

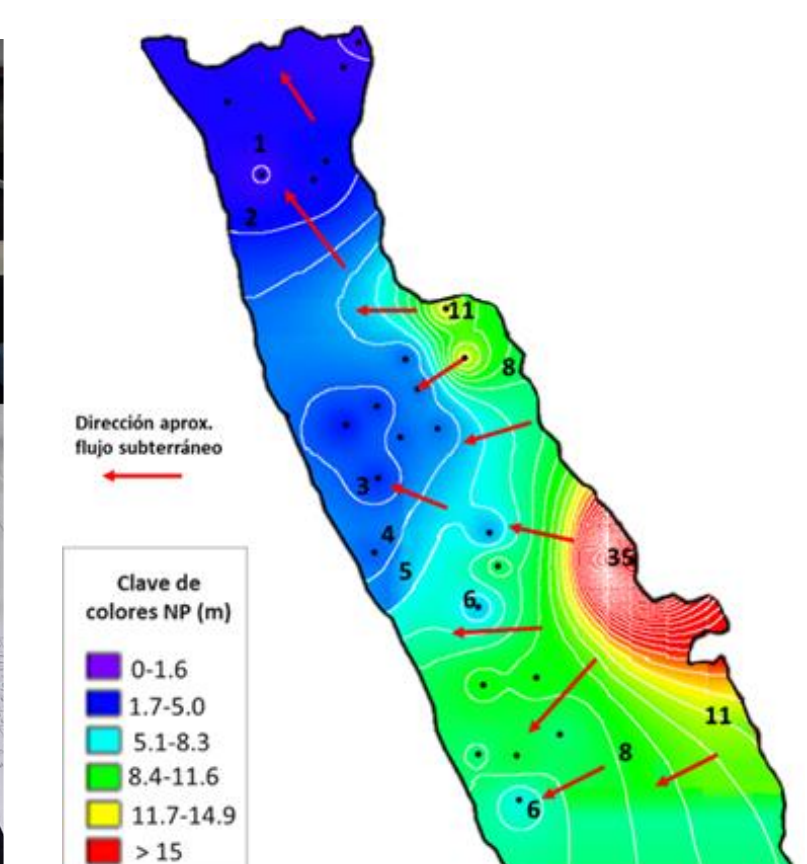
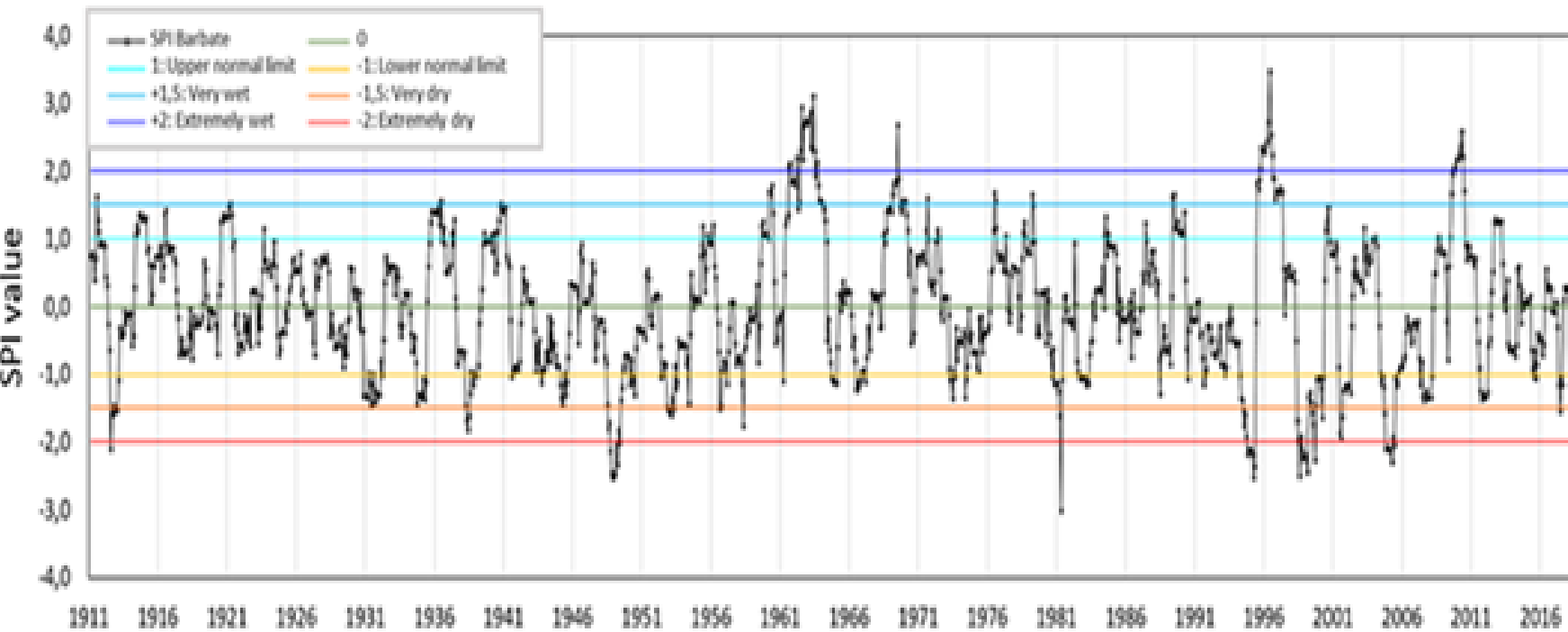
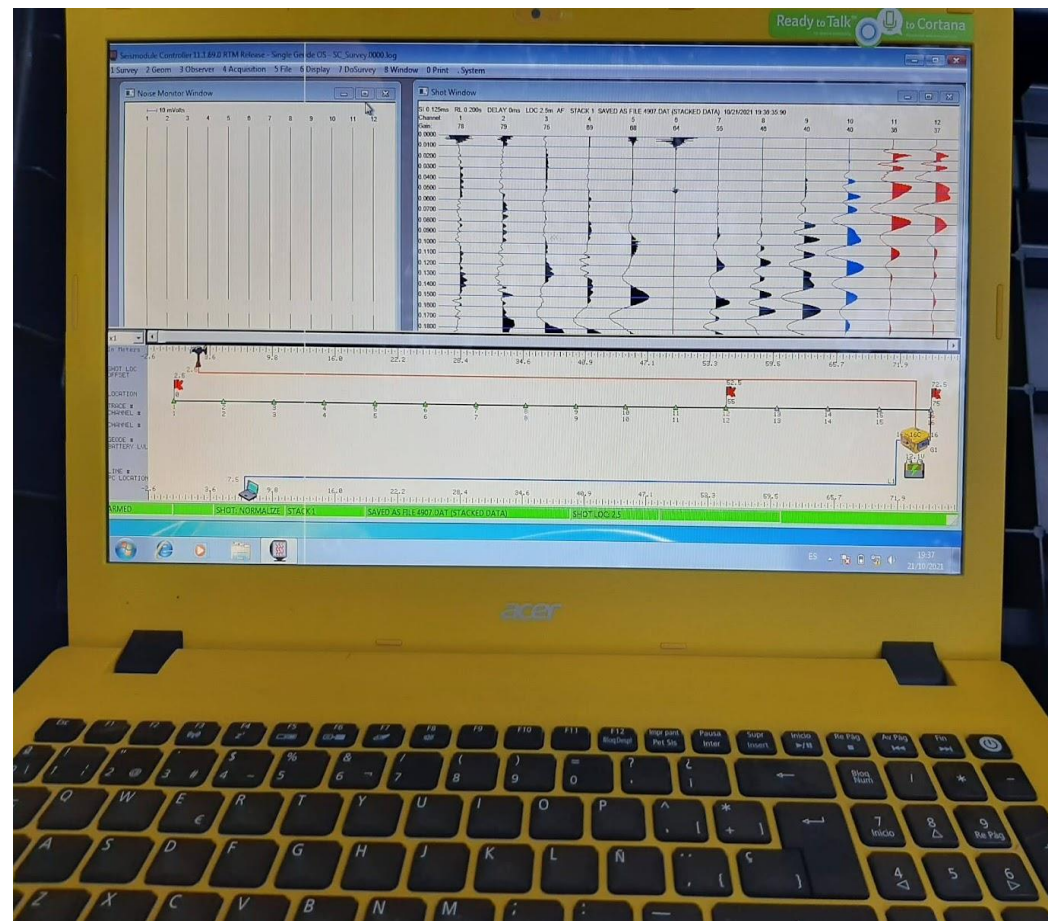




OUR LABORATORY 05

Our experience and cooperation opportunities





OUR LABORATORY 05

Our experience and cooperation opportunities





06

PROPOSED RESEARCH LINES

Outline of future efforts and vision of the research team

4.A

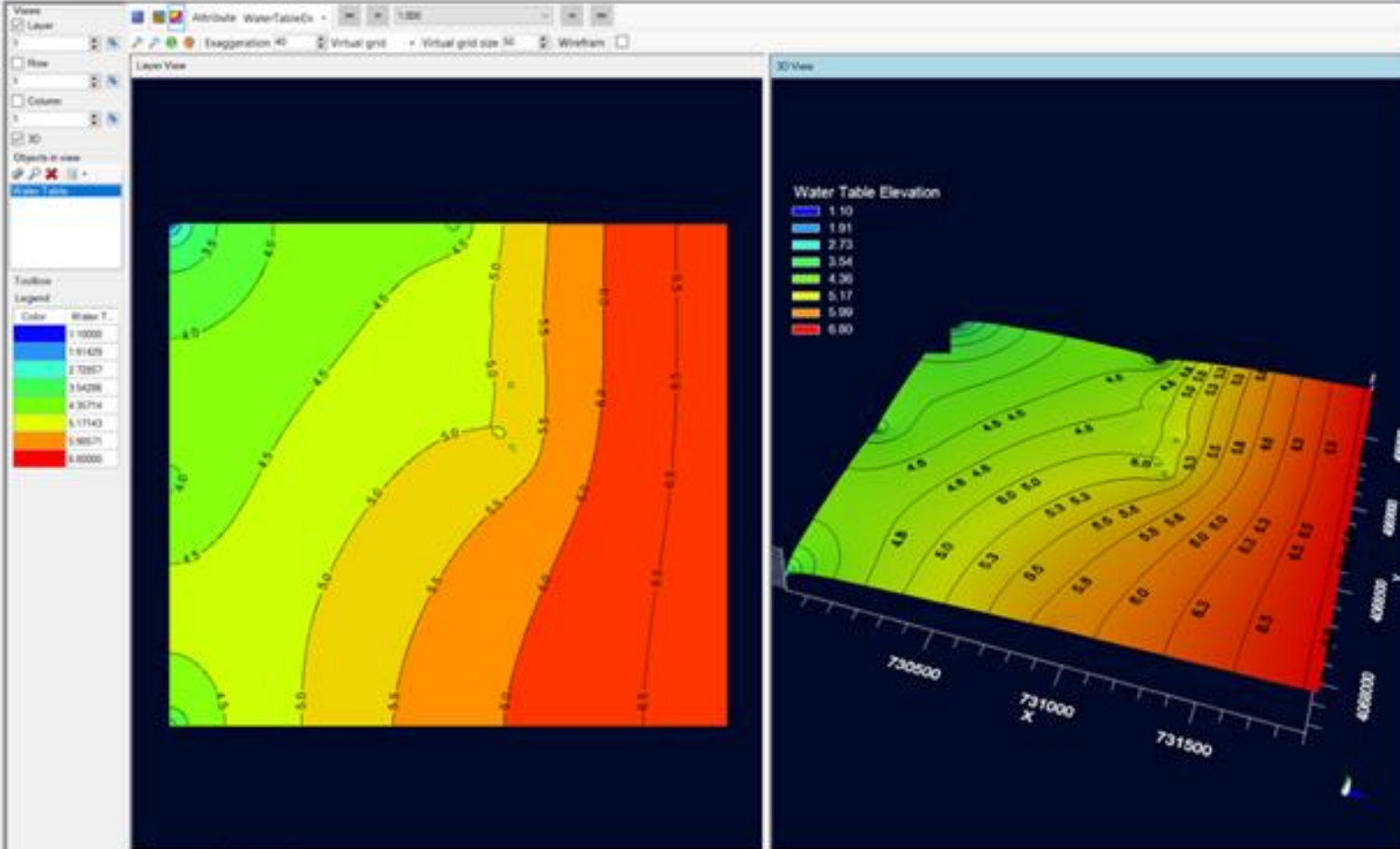
Contribution of numerical models to the analysis and conjunctive management of surface and groundwater

4.B

Definition and mapping of hydrological variables through multivariate statistics and interpolation methods

4.C

Implications of evaporative losses for water resources management



CONTRIBUTION OF NUMERICAL MODELS TO THE ANALYSIS AND CONJUNCTIVE MANAGEMENT OF SURFACE AND GROUNDWATER

4.A



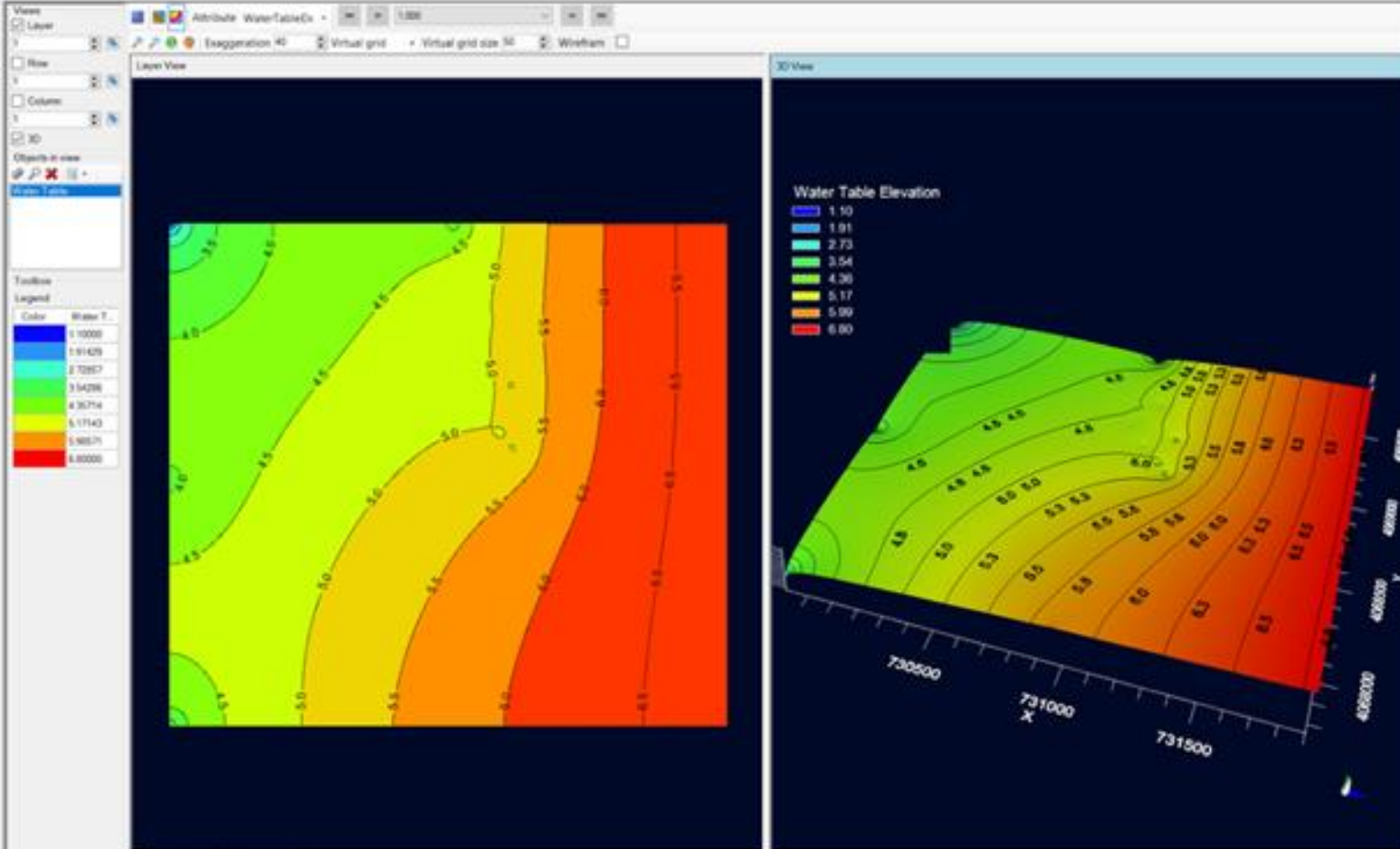
Hypothesis

- Climate change, sea level rise and changing recharge rates will have significant impact on the dynamics of groundwater systems.



Objectives

- Merge **numerical modelling, remote sensing and classic techniques** to improve knowledge on hydrogeological systems.
- Analysis of the **physical, hydro(geo)logical and socio-economic context** of the study area.
- Conceptual and numerical modelling under **different management/climatic scenarios**.
- Improve **integrated and joint management** of surface and groundwater resources.
- **Guidelines** for the optimal utilisation of water resources.

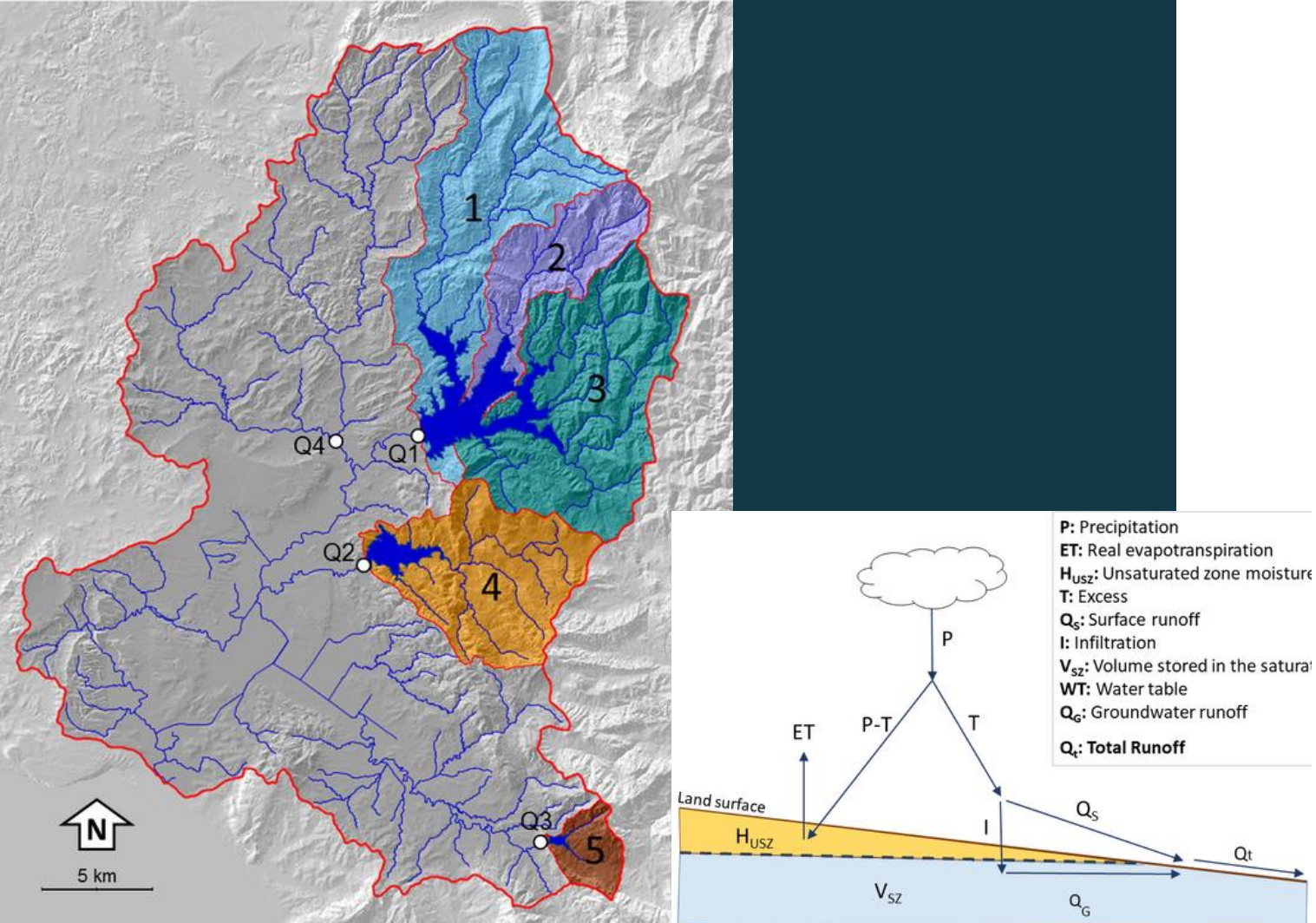


Lines of Collaboration

- Comprehensive analysis of hydrogeological systems in other study areas.
- Assessment of water resources availability and distribution.
- Applications of numerical models and ML in hydro(geo)logical studies .
- Reduce uncertainty in GW recharge and abstraction.
- GW quality and vulnerability.
- Interactions SW-GW and SGWD
- Hydro-economic modelling

**CONTRIBUTION OF
NUMERICAL MODELS TO
THE ANALYSIS AND
CONJUNCTIVE
MANAGEMENT OF
SURFACE AND
GROUNDWATER**

4.A



DEFINITION AND MAPPING OF HYDROLOGICAL VARIABLES THROUGH MULTIVARIATE STATISTICS AND INTERPOLATION METHODS

4toB



Hypotheses

- Changes in P and T patterns have a significant impact on the rainfall-runoff models (RRM).
- These RRM are key for water resources planning and management.
- Merging different techniques will reduce the uncertainty of current hydrological models.



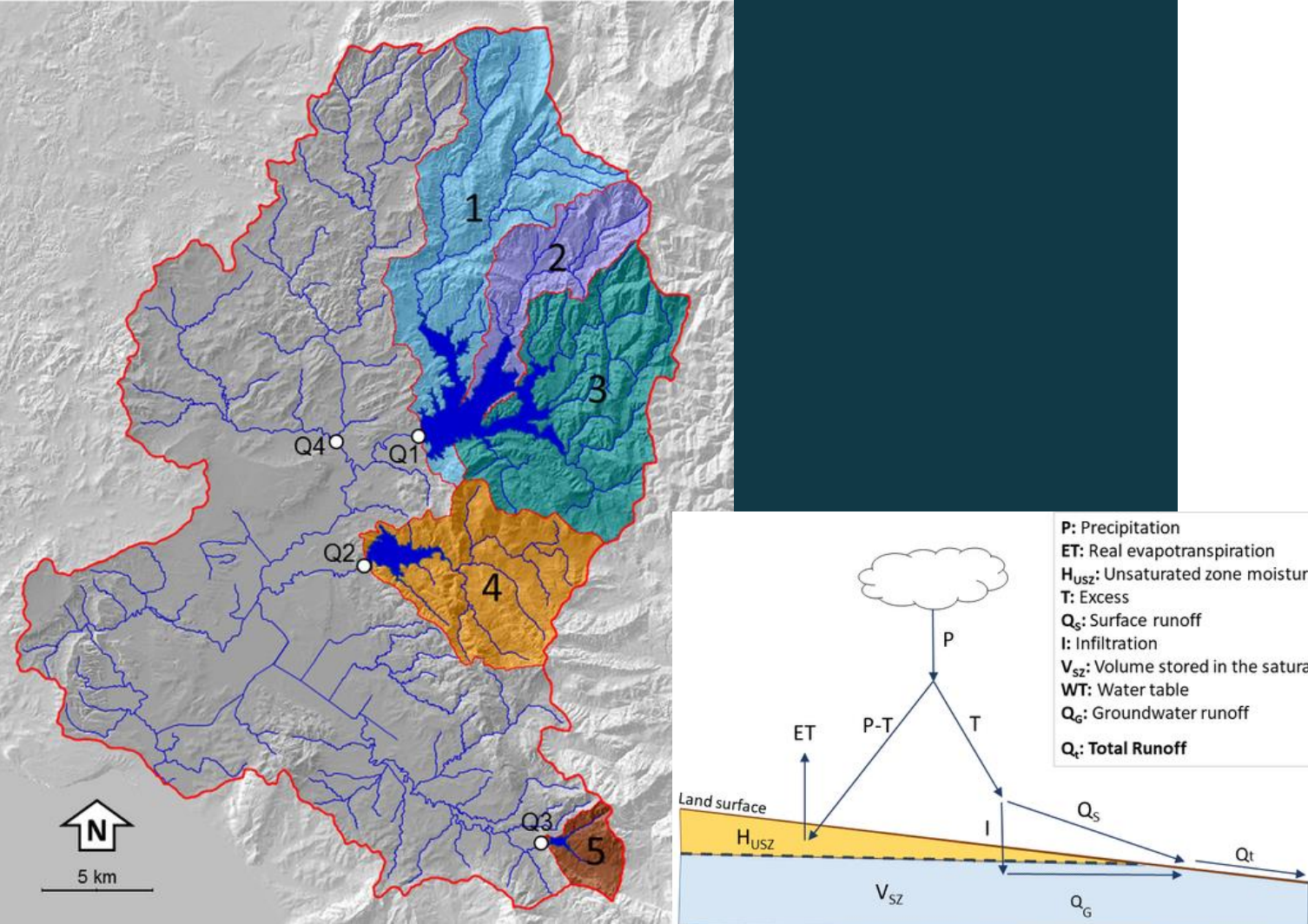
Objectives

- Definition of **RRM** from **multivariate statistics** based on physiographic and geographical variables.
- **Estimate** different **hydrological variables** (P, R, ETR) from different models, comparing their results and establishing the degree of **uncertainty** of each one of them.



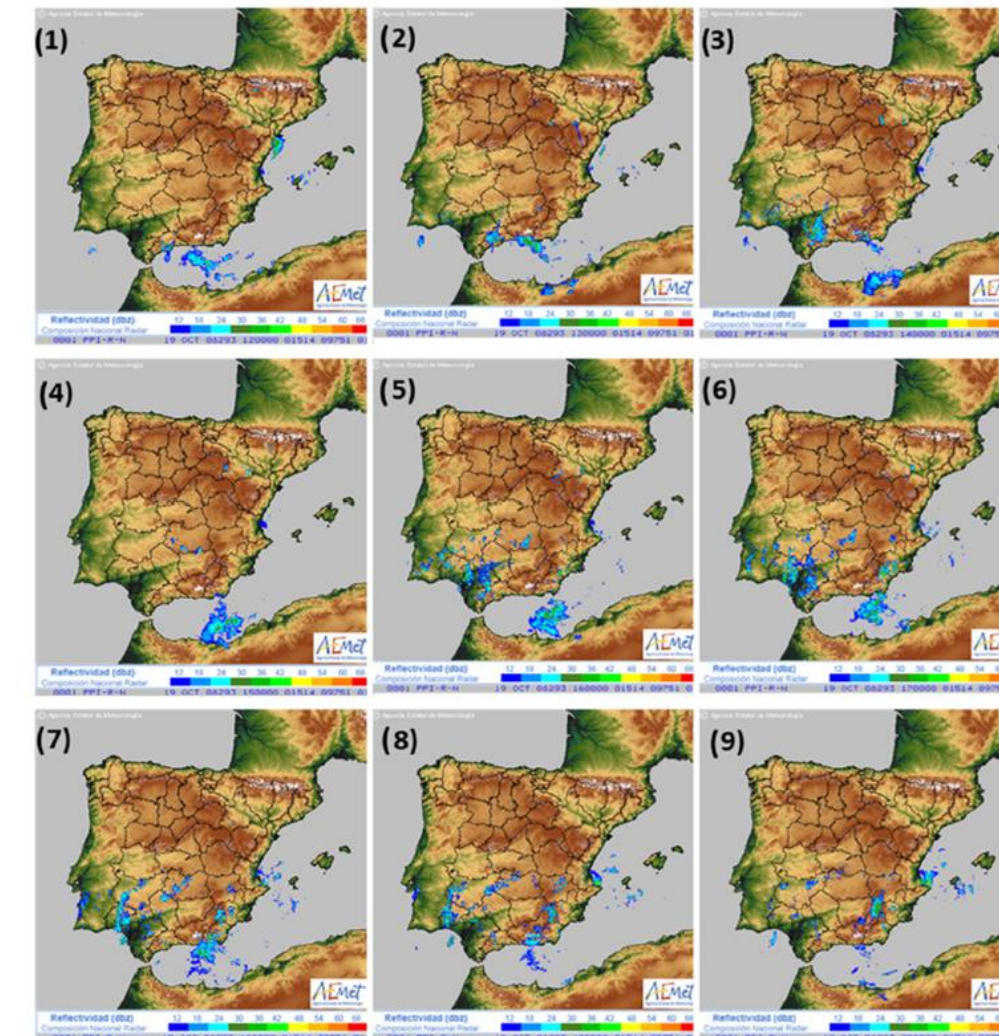
Lines of Collaboration

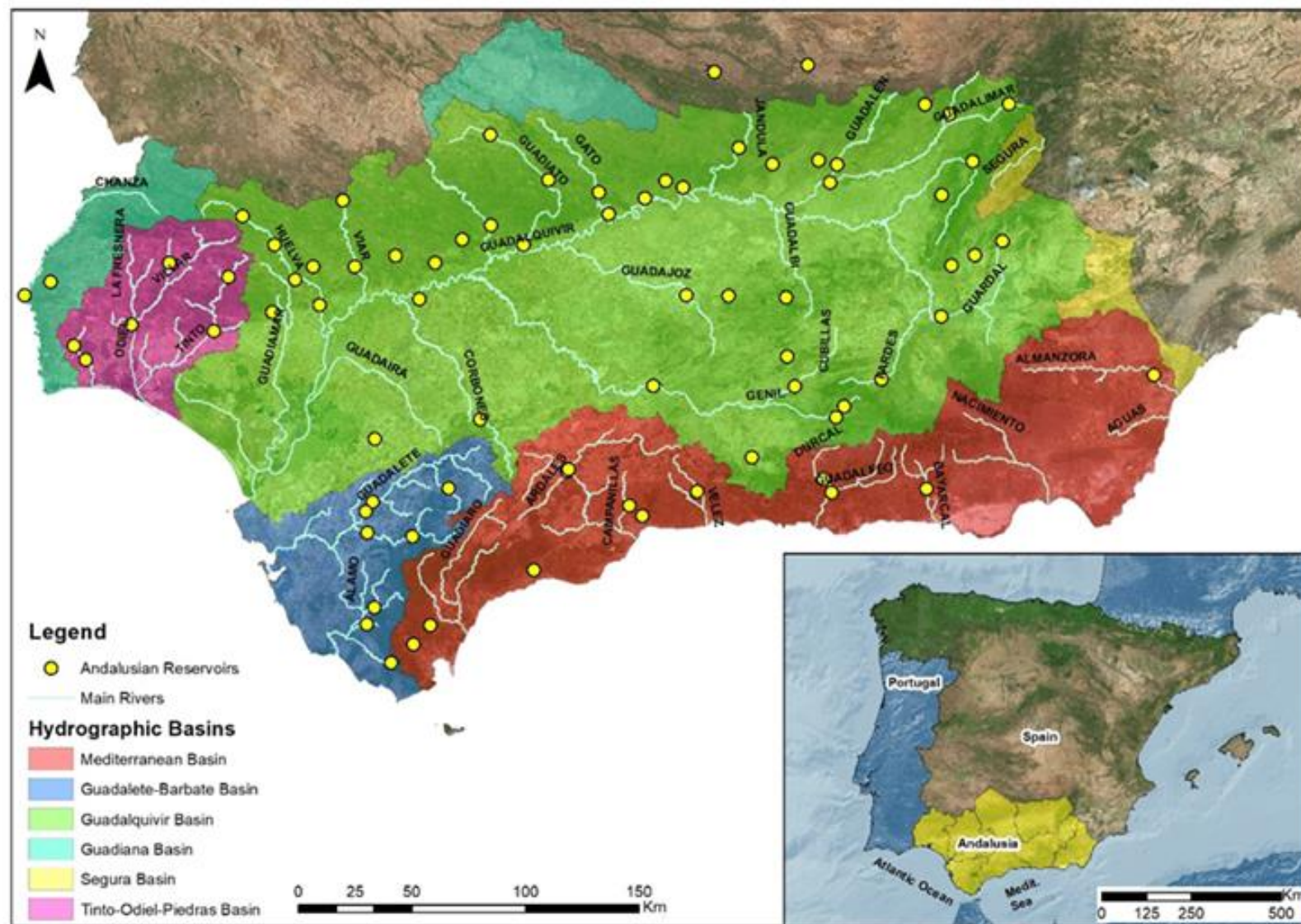
- Apply these **models** to catchments with different climatological regimes and assess their performance.
 - Temez
 - Sacramonte
 - HBV...
- Explore the use of **radar imagery** to map hydrological variables.



DEFINITION AND MAPPING
OF HYDROLOGICAL
VARIABLES THROUGH
MULTIVARIATE
STATISTICS AND
INTERPOLATION METHODS

4B





Hypotheses

- Evaporation from reservoirs lead to large water losses in Andalusia, hindering the efficient management of water resources.
- It is essential to develop methodologies to quantify evaporation from reservoirs and predict the behaviour of future infrastructures, thus contributing to decision-making.



Objectives

- **Preliminary assessment** of the annual evaporation losses in 76 large reservoirs (>5 hm³) in Andalusia (S Spain), under different climate change scenarios.
- **Reservoir classification** according to evaporation from morphometric and hydrological variables.
- Methodology for the selection of **suitable sites for large regulation infrastructure** based on evaporation losses.

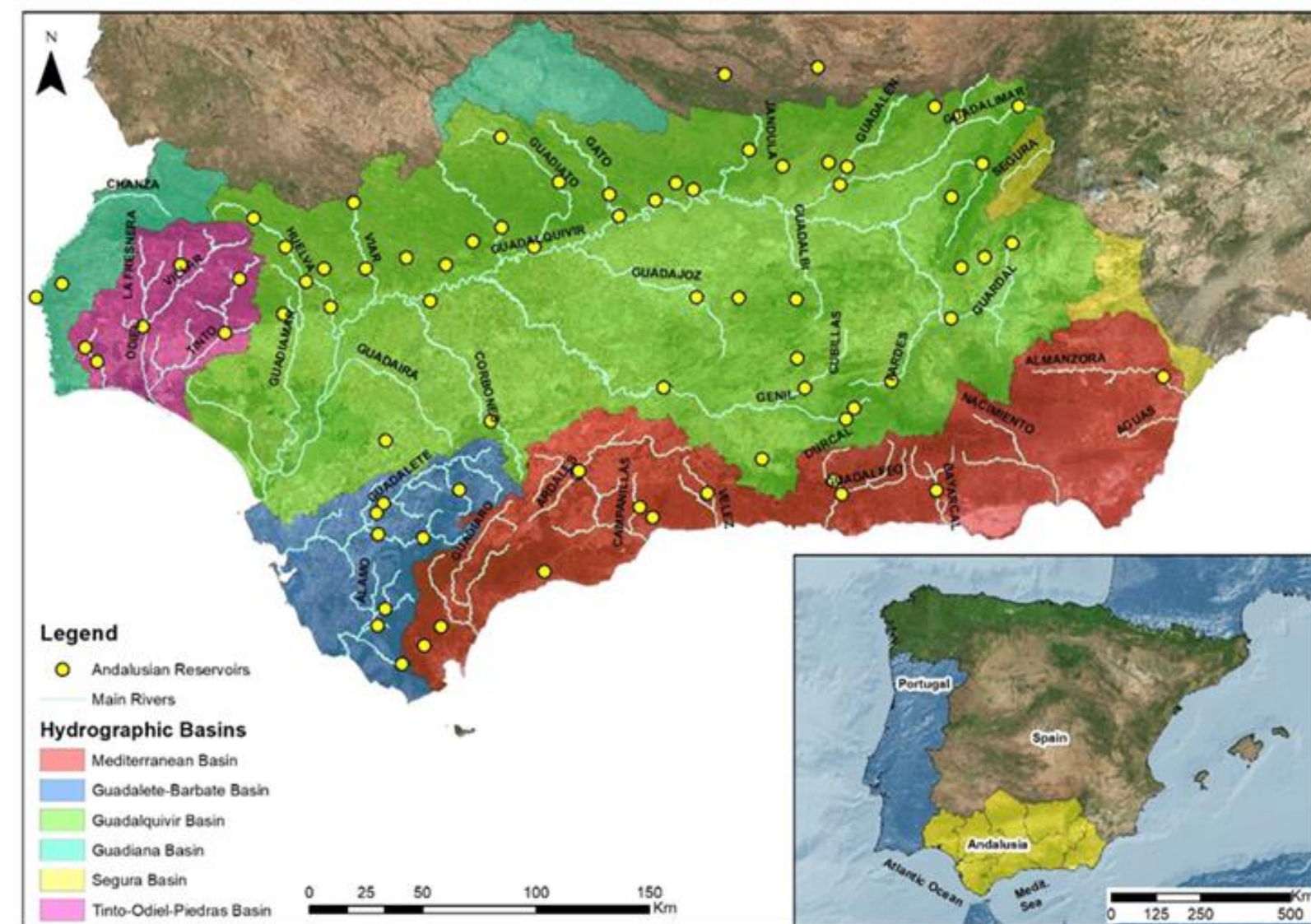
IMPLICATIONS OF EVAPORATIVE LOSSES FOR WATER RESOURCES MANAGEMENT

4.C



Lines of Collaboration

- Implement **this approach** to **other systems** with different climatic characteristics.
- Incorporate **ML techniques** to process data and extend the study to the whole Iberian Peninsula



IMPLICATIONS OF EVAPORATIVE LOSSES FOR WATER RESOURCES MANAGEMENT

4.C



07 POSSIBLE FUTURE PROJECTS

Outline of future efforts and vision of the research team



PROJECT 1

Comprehensive analysis of detrital aquifers in SW Iberian Peninsula under a context of climate change



PROJECT 2

Urban hydrology and sustainability



SEEKING COLLABORATION 08

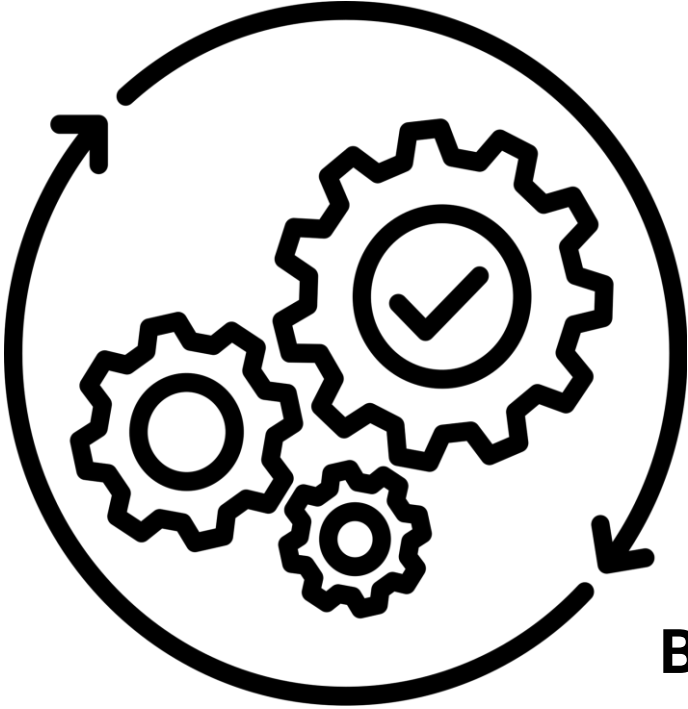
Our experience and cooperation opportunities 



Enhanced research opportunities

Establish collaborations

Increase impact and visibility



Expand Research Scope

Mutual gain of expertise

Boosted problem solving

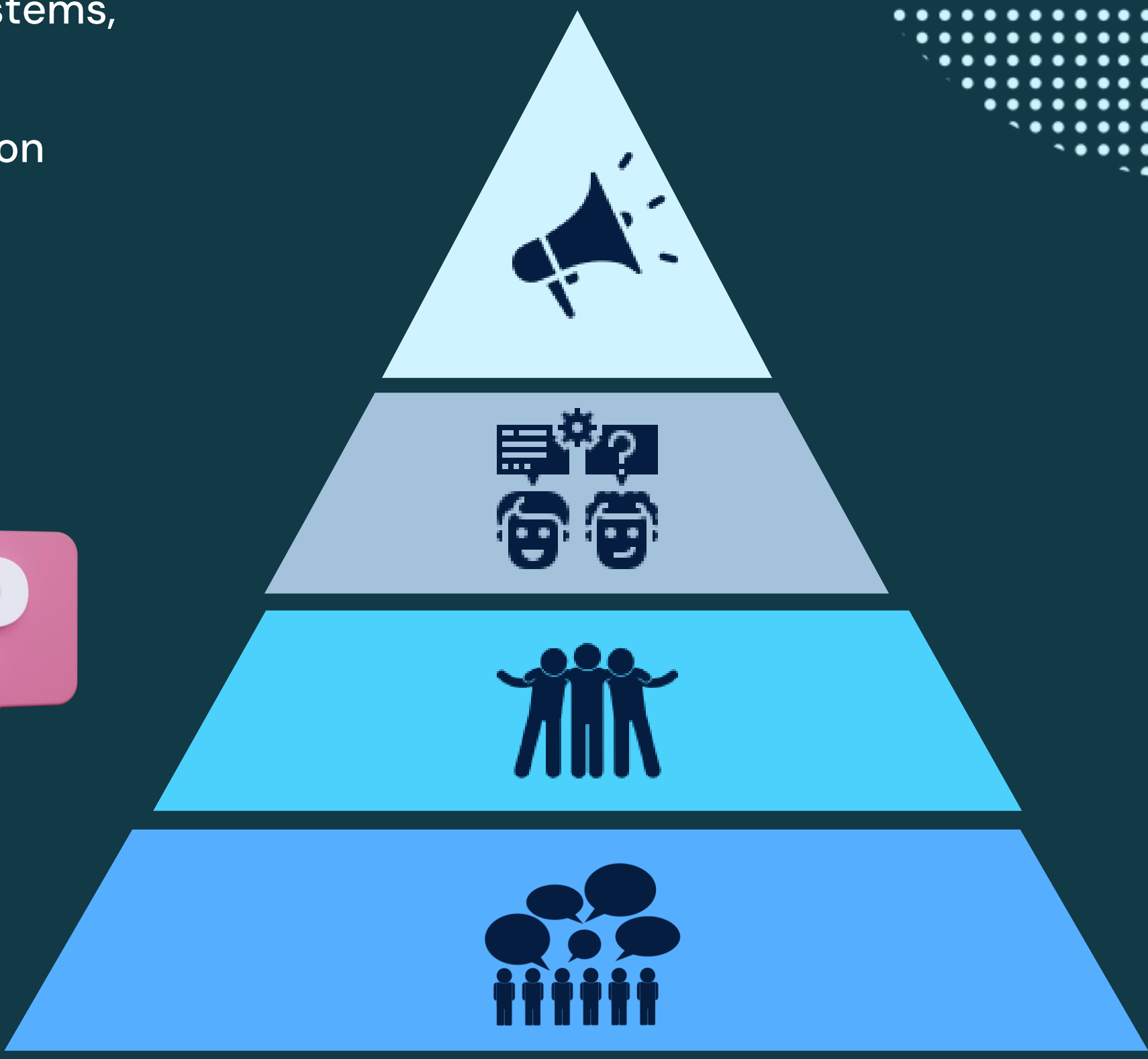




SUMMARY OF POSSIBLE COLLABORATIONS

- 01** Extend current research to other study areas: GW systems, RRM, evaporation assessment...
- 02** Incorporate ML in groundwater studies and evaporation estimations in large areas.
- 03** Use of radar imagery to map hydrological variables
- 04** Hydro-economic modelling

SHARED RESEARCH INTERESTS?



SEEKING COLLABORATION

08



THANK YOU!

GEOSCIENCE RESEARCH GROUP

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