



Pole for Doctoral Studies  
Center for Doctoral Studies  
Sciences, Technologies, and Medical Sciences

## ANNOUNCEMENT OF DOCTORAL THESIS DEFENSE



**Ms. BELHAJ Fatima**

**Will present here research work with the aim of earning a  
Doctorate**

**Doctoral program: Biology, Chemistry and Geology**

**Discipline: Geology**

**Specialty: Hydrology, Soil Water erosion, Climate Change  
and Geomatics**

**On 12/07/2025 at 10H00 at the Thesis Defense Hall of the Faculty  
of Sciences of Tetouan, UAE  
Under the Theme**

**Monitoring and Forecasting Water Erosion in Response to Climate Change  
Effects Using the Integration of the Global RUSLE/SDR Model and  
Predictive Models: A Case Study of the Loukkos Watershed in Morocco**

**Front of the jury composed of :**

First Name & Last Name	Establishment	Designation
Pr. AMRI Isma	Faculty of Sciences of Tetouan, UAE	President
Pr. CHAKIRI Said	Faculty of Sciences of Kenitra, UIT	Reviewer
Pr. MIHRAJ Abdelilah	Faculty of Sciences of El Jadida, UCD	Reviewer
Pr. MORARECH Moad	Faculty of Sciences of Tetouan, UAE	Reviewer
Pr. AASSOUMI Habiba	Faculty of Sciences of Tetouan, UAE	Examiner
Pr. SADKAOUI Driss	Faculty of Sciences of Tetouan, UAE	Examiner
Pr. MAATE Ali	Faculty of Sciences of Tetouan, UAE	Expert
Pr. HLILA Rachid	Faculty of Sciences of Tetouan, UAE	Supervisor

**Research Laboratory: Environmental Geology and Natural Ressources (GERN)**

## Abstract



Water-induced soil erosion represents a major environmental concern in Morocco, particularly in the Loukkos watershed located in the northwestern region of the country. The combination of clayey slopes, low-permeability soils, and increasing anthropogenic pressure exacerbates soil loss and reservoir siltation. This research aims to assess the spatio-temporal dynamics of erosion in the basin in relation to climate change, and to project its evolution through 2040 by identifying high-risk areas, estimating sediment yield (SY), and proposing recommendations for sustainable land management.

The methodological approach integrates multiple tools: the empirical RUSLE model coupled with the Sediment Delivery Ratio (SDR), the Analytic Hierarchy Process (AHP), the Linear Mixed-Effects (LME) model, and the CA-Markov spatio-temporal simulation model. These tools, informed by geospatial, rainfall, and remote sensing (NDVI) data, allow for the modeling of both current and future erosion patterns by accounting for R and C factors in the RUSLE framework.

The results indicate an average annual soil loss of 111.51 t/ha/year, with a sediment yield estimated at 6.81 million m<sup>3</sup>, consistent with field observations at the El Makhazin dam. Projections reveal a 11.4% decrease in annual rainfall between 1999 and 2040, accompanied by a nearly 13% reduction in healthy vegetation cover. Erosive dynamics fluctuate, peaking in 2009 (138.27 t/ha/year), declining to 103.50 t/ha/year in 2029, and slightly rising again to 104.16 t/ha/year by 2040. These variations are strongly correlated with rainfall erosivity ( $R^2 = 0.99$ ), confirming it as the principal driver of soil loss in the Loukkos watershed.

This study proposes a robust, transferable methodological framework and provides scientifically grounded insights to support the implementation of integrated land management strategies that respond to the challenges of climate change and water security.

**Keywords:** Climate change, water erosion, spatial modeling, RUSLE/SDR, remote sensing, GIS, Loukkos watershed.