جامعة عبد المالك السعدي
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Université Abdelmalek Essaadi

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

ANNOUNCEMENT OF DOCTORAL THESIS DEFENSE

M. NOUAYTI Abdelhamid

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

Doctoral program: Mathematics Sciences, Physics and New Technologies
Discipline: Physics
Specialty: Nuclear Physics

On 05/07/2025 at 15H00 at the Department of Chemistry Meeting Room, Faculty of Sciences of Tetouan
Under the Theme

Development of Open-AMA Software for Tracing Radioactive Aerosol Sources, and Artificial Neural Network-Based Prediction of Atmospheric Gross β Radioactivity

Front of the jury composed of :

First Name & Last Name	Establishment	Designation
Pr. ACHAHBAR Abdelfattah	Faculty of Sciences of Tetouan, UAE	President
Pr. EL BARDOUNI Tarek	Faculty of Sciences of Tetouan, UAE	Reviewer
Pr. BOUKHAL Hamid	Faculty of Sciences of Tetouan, UAE	Reviewer
Pr. EL MAHJOUB Chakir	Faculty of Sciences of Kenitra, UIT	Reviewer
Pr. AZOUGAGH Mohamed	National School of Arts and Crafts of Rabat, UM5	Examiners
Pr. EL HAJJAJI Otman	Faculty of Sciences of Tetouan, UAE	Examiners
Pr. AZAHRA Mustapha	Faculty of Sciences of Tetouan, UAE	Supervisor

Research Laboratory: Artificial Intelligence and Computational Physics Laboratory, Radiations and Nuclear Systems Group, FS, Abdelmalek Essaadi University, Tetouan, Morocco

Abstract

(theses abstract)

This thesis presents the development of a new open-source software "Open-AMA" developed to investigate the impact of atmospheric circulation on the level of radioactivity in the air at the surface level. This software integrates new model for source identification based on air mass trajectories and ambient air radioactivity concentration data and enhances certain existing ones. Beyond source identification, it offers a rich array of functionalities for making it automatic, quick and easy to get access many kinds data including gridded meteorological data, trajectory calculations, synoptic parameter extraction from air masses trajectories.

As a demonstration of the software's capabilities, this thesis investigates the influence of air masses on the activity concentrations of gross alpha and gross beta in aerosols at the surface level in the Santander region of Spain. The results show a strong relationship between air masses originating from the southern cluster of air masses. These air masses, characterized by slow movement and high concentrations of radioactive aerosols, originate from areas with significant amount of uranium in the ground. This finding suggests that the gross alpha and beta concentrations observed in Santander are primarily attributable to radon progeny transported from these regions.

Additionally, this thesis introduces a new methodology aimed at predicting gross β levels in the atmosphere. The methodology incorporates an innovative input data consisting of local meteorological and synoptic variables, alongside temporal lags and residence time of air masses, to predict gross β activity concentration in the atmosphere.

A high-performance Artificial Neural Network (ANN) model was constructed for this purpose. Across 8 sampling sites, strong linear relationships are evident between predicted and actual values, with correlation coefficients (R) ranging from 0.86 to 0.92. And R-squared values, ranging from 0.7320 to 0.8502, further affirm the model's ability to explain a significant proportion of the variance in gross β activity.

By combining Open-AMA development with the sensitivity analysis of the predictive models, this thesis makes a significant contribution to the understanding of atmospheric radioactivity behavior. It provides a strong framework for addressing environmental and public health challenges related to air quality and pollutant transport.

Keywords: Radioactivity, Open-AMA, ANN model, source-receptor model, gross α, gross β, Radon, air masses, Prediction, Clustering