جامعة عبد المالك السعدي
Université Abdelmalek Essaadi

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

ANNOUNCEMENT OF DOCTORAL THESIS DEFENSE

Ms. RHZIEL Fatima Zahrae

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

Doctoral program: Mathematics, Physics and New Technologies
Discipline: New Technologies
Specialty: Remote Sensing and Geoinformatics

On 16/05/2026 at 15H00 at the Marrakech Thesis Defense Hall at the Faculty of Sciences of Tetouan, UAE
Under the Theme

Toward Improved Land Surface Temperature Retrieval from Next-Generation NOAA VIIRS Satellites: Proposal, Development, and Validation of a SW-LST Algorithm

Front of the jury composed of :

First Name & Last Name	Establishment	Designation
Pr. RAISSOUNI Naoufal	ENSA of Tetouan, UAE	President
Pr. AZYAT Abdelilah	ENSA of Tangier, UAE	Reviewer
Pr. BEN ACHHAB Nizar	ENSA of Tangier, UAE	Reviewer
Pr. TABYAOUI Hassan	FP of Taza, USMBA	Reviewer
Pr. BOLAJRAF Mohamed	ENSA of Tetouan, UAE	Examiner
Pr. EL ADIB Samir	ENSA of Tetouan, UAE	Examiner
Pr. LAHRAOUA Mohammed	FSJES of Tangier, UAE	Supervisor

Host Research Structure: Télédétection, Systèmes et Télécommunications (23/009 UAE/ENSATe

Abstract

Land Surface Temperature (LST) is a crucial parameter for assessing the exchange of energy between the Earth's surface and the atmosphere. It influences outgoing longwave radiation and drives turbulent heat flus within the surface-atmosphere system, making it a vital indicator of surface warming trends and climate change. Despite its importance, accurate LST retrieval from thermal infrared (TIR) satellite observations remains challenging due to atmospheric effects and surface emissivity variability.

This thesis addresses these challenges by developing and validating an optimized Split-Window Algorithm (SWA) for retrieving LST from the Visible Infrared Imaging Radiometer Suite (VIIRS) sensor onboard the NOAA-20 satellite. To enhance LST retrieval, atmospheric correction was performed using the Thermodynamic Initial Guess Retrieval version 2 (TIGR-2) atmospheric profile database in conjunction with MODTRAN 4.0, while surface emissivity was estimated using the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) spectral library. SWA coefficients were derived from 180900 radiative transfer spanning a broad range of atmospheric conditions, emissivity values, and view zenith angles. Sensitivity analysis indicated that the total LST uncertainty remains below 1.3 K when water vapor content (WVC) error is within 0.5 $g\cdot cm^{-2}$ and emissivity error is within ±0.005.

The algorithm was evaluated, using simulated GAPRI atmospheric profiles, achieving a bias of 0.16 K and an RMSE of 1.58 K, outperforming the operational Enterprise Algorithm (EA), which showed a bias of 0.13 K and RMSE of 1.65 K. Validation against ground-based SURFRAD measurements demonstrated a bias of 0.20 K and RMSE of 2.08 K, compared to EA’s 0.37 K and 2.71 K. Cross-validation with MODIS LST products over diverse regions further confirmed the robustness of the developed SWA.

Overall, the results demonstrate that the developed SWA provides accurate and reliable LST retrieval from VIIRS onboard NOAA-20, with improved precision over existing algorithms. The methodology established–combining radiative transfer simulations, sensitivity analysis, ground validation, and cross-validation–provides a framework for future LST retrieval from next-generation satellite missions, supporting climate-quality monitoring and environmental studies.

Keywords: Land Surface Temperature (LST), Split-Window Algorithm (SWA), VIIRS, NOAA-20, MODTRAN, SURFRAD, MODIS.