

VIRAL Workshop - "The role and importance of ICT in Agriculture future development"

Earth Observation and geoinformation related projects for environment and agriculture applications

Cristian MOISE
**University of Agronomic Sciences and Veterinary
Medicine of Bucharest**



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TSAR - Campaign Support for Sentinel-1 Companion Satellite (CS) – System Studies - CampaignS1_T-SAR

CAPA - Approach in support of precision agriculture and environmental management through satellite technologies and classical methods of investigation

GEOMAG - Capacity building in Geomatics applied to agriculture and environment in Tunisia

3S - National participation strategy in the new European context of research coordination in the fields of security and space industry



TSAR - Campaign Support for Sentinel-1 Companion Satellite (CS) – System Studies - CampaignS1_T-SAR

Financed by: European Space Agency (ESA)



Contractor: Terrasigna SRL (RO)



Sub-contractor: University of Agronomic Sciences and Veterinary Medicine of Bucharest (RO)



Period: 2018 - 2021

Main objective: development of a ground-based pilot system for radar measurements performed on agricultural crops, in order to verify the feasibility of applying satellite radar techniques in this field.





Tomographic system for monitoring agricultural crops

The radar installation at Moara Domnească Didactic Farm reproduces, on the ground, the space measurement technique and geometry that the European Space Agency is considering for the launch of a future satellite mission

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The system

- is using radar technology (microwaves)
- is providing 3D radar imagery (holography)
- is providing information about:
 - crop phenology
 - growth stage
 - relative water content of plants
 - relative soil moisture

System characteristics

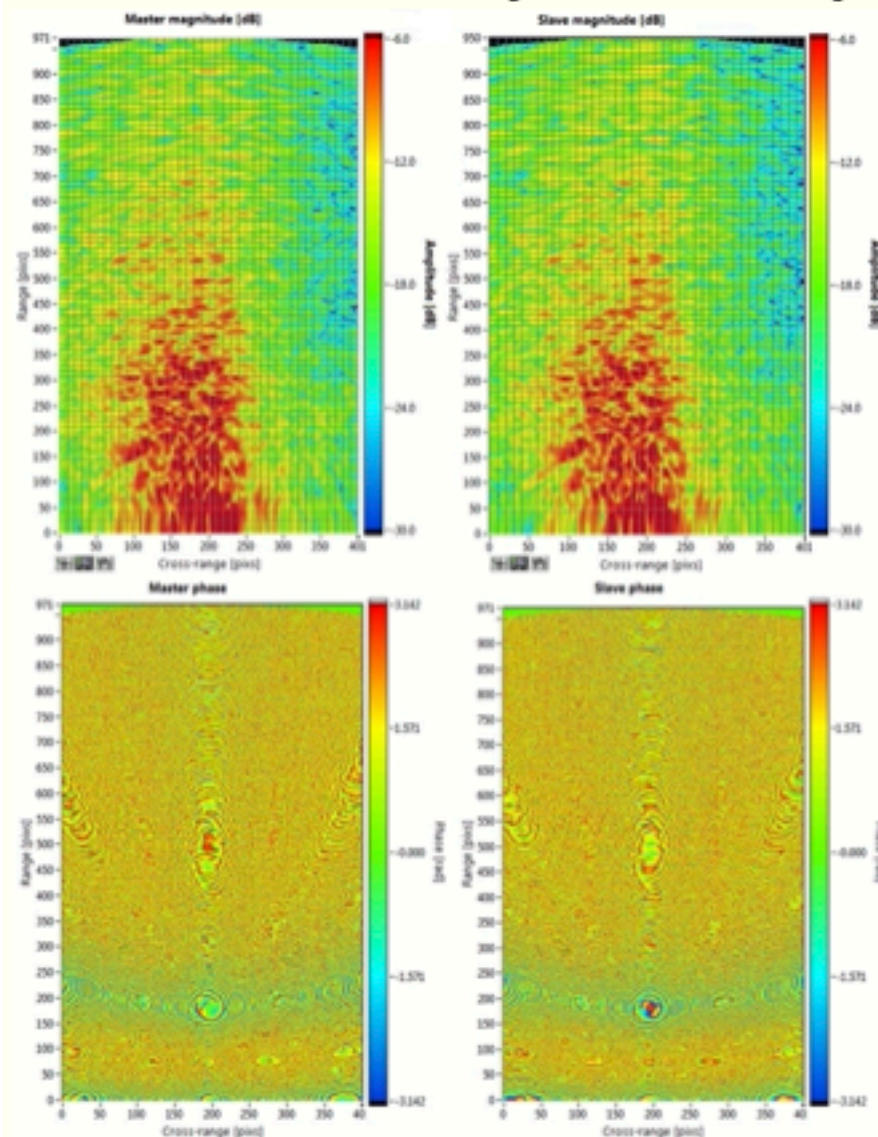
- Automatic scanning (programmable)
- Internet connection
- Video recordings
- Correlation of radar information with:
 - meteorological data / conditions
 - chromatic analysis
 - ground measurements (local sensors)
 - complementary data regarding crop parameters



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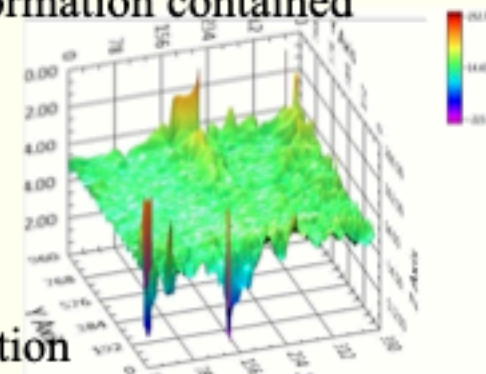
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Advanced radar signal processing

- Stacks of radar images of the monitored crop
- Extraction of the information contained in each image:
 - signal amplitude
 - signal phases
- Construction of the 3D image (hologram)
 - imagery co-registration
 - calculating the differences between two successive images
 - reconstruction of the volumetric image based on the differences between the image sequences
 - calculation of the dielectric properties of the crop for all pixels of the volumetric image



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1. Sequences of 2D radar images

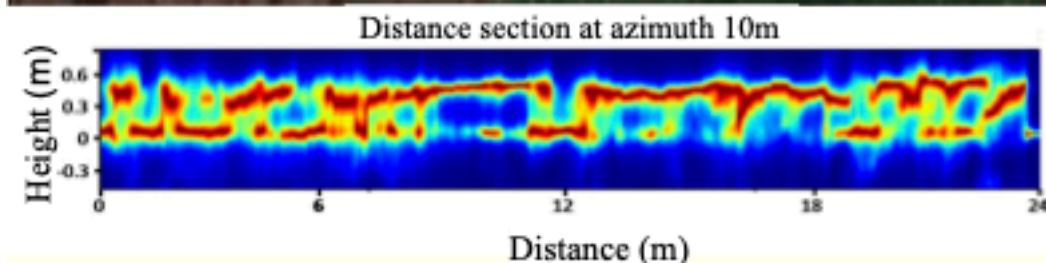
2. Longitudinal and transversal tomographic sections

First line of trees. Ground range: 81.3m

- Qualitative measurements of:
 - Plants height
 - Crop density (productivity)
 - Relative water content of leaves/stems
 - Relative soil moisture

The specificity of radar tomography

- Non-invasive investigation technique / remote sensing
- Complementary to other in-situ monitoring methods:
 - Reference direction. Azimuth: 0 degrees
 - direct measurements in the field and/or in laboratory
 - optical information
- Provides information regarding:
 - the state of development / health of the investigated crop
 - plant biophysical parameters (e.g., leaves water content)
 - correlation of tomographic information with crop vegetation status



29°54.40'N 26°15'12.68'E

technologies

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CAPA - Approach in support of precision agriculture and environmental management through satellite technologies and classical methods of investigation

Financed by: state budget through the National Plan for Research, Development and Innovation III 2014 - 2020, experimental-demonstrative project

Coordinator: National Institute of Research & Development for Optoelectronics - INOE 2000 (RO)

Partners: University of Agronomic Sciences and Veterinary Medicine of Bucharest (RO), National Institute of Research & Development in Chemistry and Petrochemistry - ICECHIM (RO)

Period: 2020 - 2022

Main objective: development and implementation of an alert system for smart agriculture and environmental management related to identification of air pollution and extreme weather events

This work was supported by a grant of the Romanian Ministry of Education and Research, CCCDI - UEFISCDI, project number PN-III-P2-2.1-PED-2019-3495, within PNCDI III

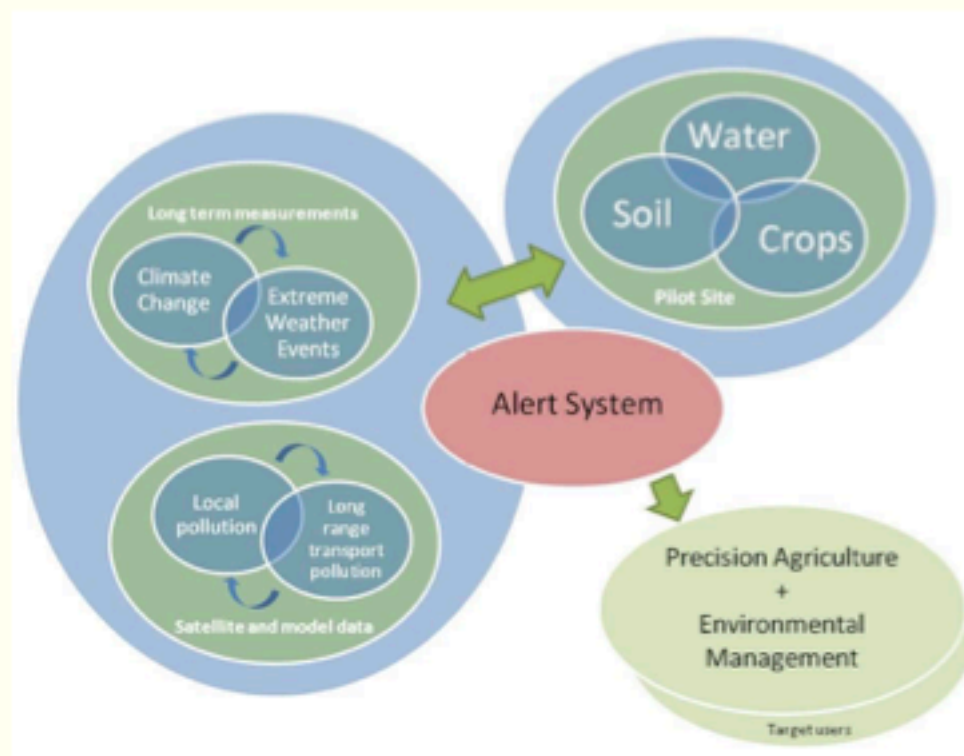


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The project is focusing on:

- the multi-annual evolution of the physical and chemical characteristics of the crops in correlation with air and climatic variables in the area of a pilot site
- the estimation of the occurrence of extreme weather phenomena
- pollution events during annual crop growth cycles with the identification of the long range transport air masses influence



The link between the components of the project,
the final product and the target users

This work was supported by a grant of the Romanian Ministry of Education and Research, CCCDI - UEFISCDI, project number PN-III-P2-2.1-PED-2019-3495, within PNCDI III



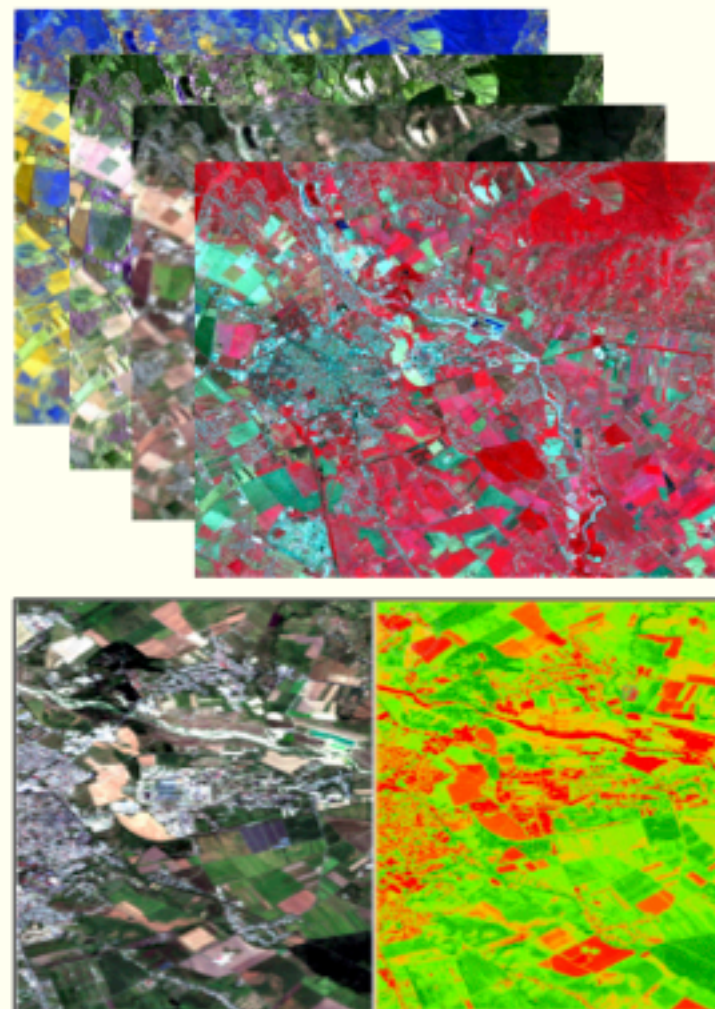
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Approach:

- **Earth Observation (EO)** - EU Copernicus Programme and ground based remote sensing
 - **Sentinel-2** - vegetation indices and other indicators from satellite imagery (like NDVI, LAI, NDWI, fCover, fAPAR and others) in order to monitor vegetation (multi-annual crop phenological development) and to derive crop growth models
 - **Sentinel 5p** - CAMS-based aerosol data - evolution of air pollutants as SO₂, NO₂, CO, CO₂
 - **in-situ measurements mobile laboratory** for characterization of the atmosphere: punctual monitoring for O₃, SO₂, NO_x and HC, differential optical absorption spectroscopy system for pollutant gas monitoring, scanning UV LiDAR - provides vertical profiles of aerosols optical properties up to 5 Km, meteorological station for temperature, pressure, relative humidity, wind speed and wind direction



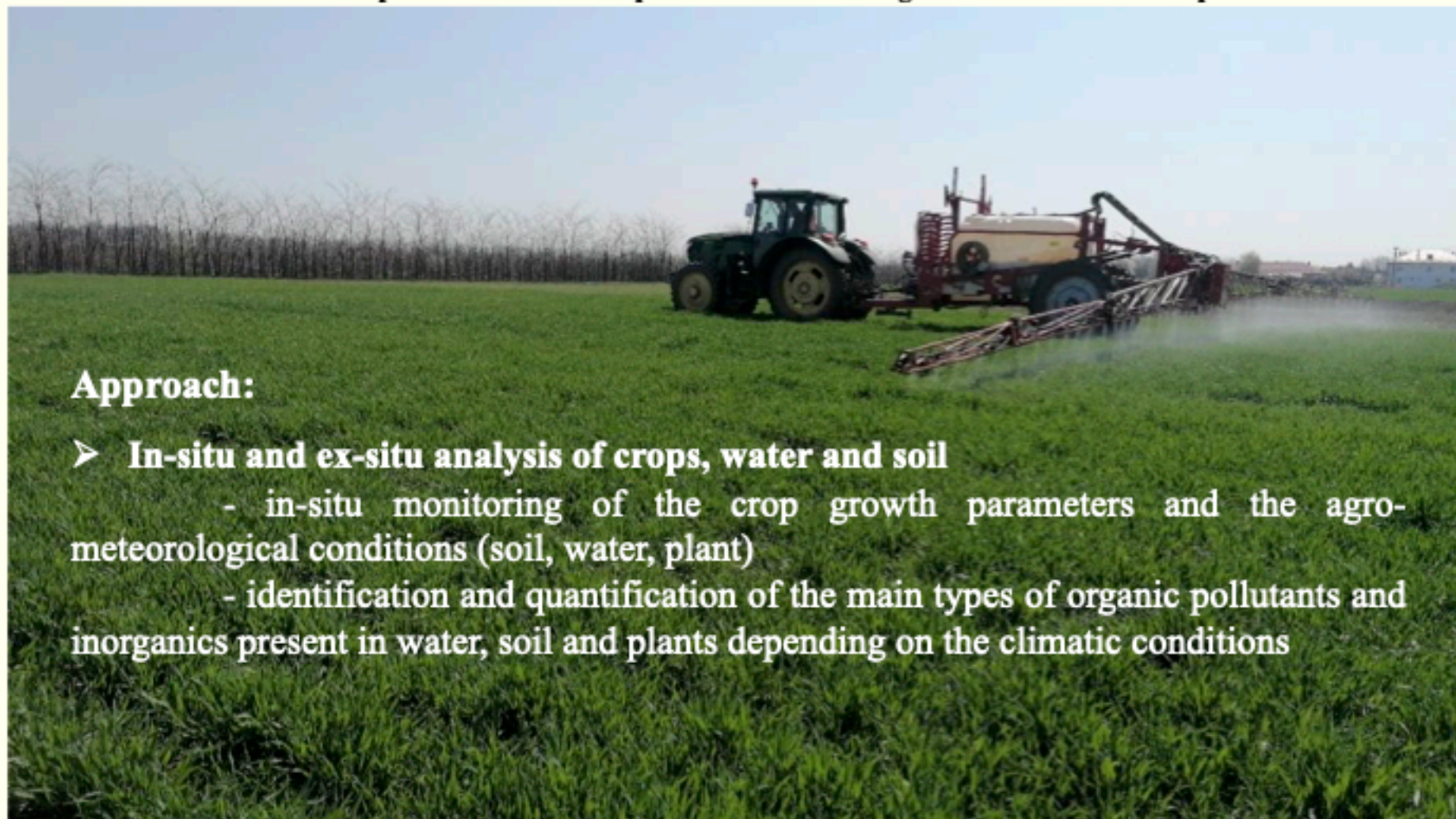
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Approach:

- **In-situ and ex-situ analysis of crops, water and soil**
 - in-situ monitoring of the crop growth parameters and the agro-meteorological conditions (soil, water, plant)
 - identification and quantification of the main types of organic pollutants and inorganics present in water, soil and plants depending on the climatic conditions

This work was supported by a grant of the Romanian Ministry of Education and Research, CCCDI - UEFISCDI, project number PN-III-P2-2.1-PED-2019-3495, within PNCDI III



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Intensive experimental campaigns to quantify climate conditions, air quality and agro-system characteristics of the pilot site during the crop growth cycles

- during each stage of the crops growth
- prognosis models outputs, satellite data and in-situ measurements will be used to create large datasets to be further analysed in connection with the data from the water, soil and plants in order to determine the correlations of all factors and to quantify the relationship between atmospheric pollutants and crop characteristics
- development of the near real time online platform for the alert system



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GEOMAG - Capacity building in Geomatics applied to agriculture and environment in Tunisia

Financed by: EU Erasmus+ Programme, Key Action 2 - Cooperation for innovation and the exchange of good practices, action type - Capacity building in the field of higher education

Coordinator: University of Carthage (TN)

Partners: 16 partners from TN, FR, RO & ES

Period: 2019 - 2022



Main objective: to contribute to a more efficient management of the agricultural sector, land and environment in Tunisia through better use of Geomatics



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AIMS OF PROJECT

At the professional level, it aims to raise awareness and mobilize managers in the agriculture and environment sectors with regard to the:

- standard and good governance issues of geographical data
- underpinning competitiveness and efficiency in the management of resources
- raise awareness and provide the professionals involved with an appropriate vocational training
- create a pool of expertise and experience sharing



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AIMS OF PROJECT

Through educational academic engineering, this project aims to design modules in Geomatics adapted to the management of agriculture, particularly for agriculture and environment at the level of:

- initial training for students at different levels: BSc, MSc, Engineer and PhD
- Continuing professional education as it is intended for practicing professionals

It also aims to build **e-learning resources** to broaden the scope of cost-controlled modules.



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PRIORITIES OF PROJECT

The project is addressing 5 priorities:

- Environment
- Engineering
- ICT
- Agriculture
- Forestry and Fisheries



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s **ADDED VALUE IN TUNISIA**

This project will contribute on:

- the **objective diagnosis of existing resources** with regard to the use of remote sensing and GIS
- the **dissemination of information** by socio-economic **partners related to the agronomic sector and environment (including disaster management)**
- the **quality of training** programmes
- the **quality of university research**
- the **quality of continuing education**



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GEOMAG’s PROPOSED SOLUTIONS FOR TUNISIA

The project, through pedagogical engineering and the development of specific modules in initial training and in-service training, will notably raise awareness about aspects related to the:

- **quality and standardization of geographical data**
- **dissemination of geographical information**

especially in the fields of agriculture and environment in Tunisia



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UASVM Bucharest present involvement:

- participation in the elaboration of the conceptual pedagogical content for several modules:
 - **Geomatics applied to resources management (coordination)**
 - **Spatial analysis and modelling**
 - **Big data**
 - **Cloud computing**



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GEOMAG's COLLABORATIVE PLATFORM

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Username Password

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GEOMAG Travail collaboratif Modules de Formation Activités & Actualités English (en)

Course categories: Travail collaboratif

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University of Carthage

GEOMAG

Renforcement des capacités en géomatique appliquée à l'agriculture et à l'environnement en Tunisie / GEOMAG

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GEOMAG



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3S - National participation strategy in the new European context of research coordination in the fields of security and space industry

Financed by: state budget through the National Plan for Research, Development and Innovation III, Solution type project

Coordinator: Romanian Space Agency (ROSA)

Partners: University of Agronomic Sciences and Veterinary Medicine of Bucharest (RO) & other 8 entities

Period: 2020 - 2021

Main target: elaboration of the National RDI Strategy in the fields of security and space industry for the strategic planning cycle 2021-2027 related to the new European context of research coordination

This work was supported by a grant of the Ministry of Education and Research, UEFISCDI, project number PN-III-P2-2.1-SOL-2020-3-0415, within PNCDI III



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The general objectives of the project are:

- identify the national research priorities and competences in the fields of security and space industry, in correlation with European research policies in these fields (DG Defense Industry and Space; European Space Agency; DG Research and Innovation; DG Communications Networks, Content and Technology; European Defense Agency etc.)
- development of the national strategy for the new strategic planning cycle (2021-2027)
- defining, promoting and supporting the implementation (identification of funding sources / instruments, expertise, etc.) of research topics of national interest
- integration of national policies and activities in the evolving international context

Expected results:

Research strategy and **Priority research topics** in the fields of security and space industry

This work was supported by a grant of the Ministry of Education and Research,
UEFISCDI, project number PN-III-P2-2.1-SOL-2020-3-0415, within PNCDI III



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UASVM Bucharest technical responsibilities:

- specific activities to substantiate the RDI strategy elements for the space and security industry:
 - **Earth Observation**
 - **precision agriculture through space techniques and applications**
 - disaster management
 - **food safety and security**
- elaboration of specific RDI strategy elements
- defining research topics specific to the space domain
- identifying the financing sources and instruments, ensuring the necessary expertise in order to endorse the identified research topics of national interest

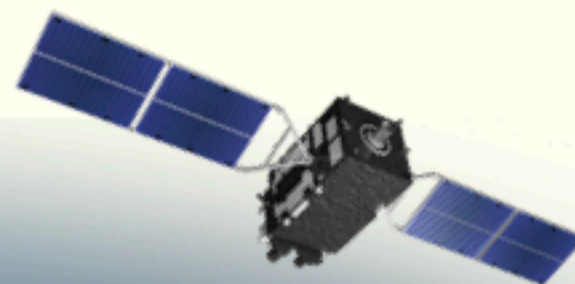
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