III International Conference on Emerging Technologies in Computational Science for Industry, Sustainability and Innovation, M2P 2027
25-28 May, 2027, Terrasini (Palermo), Italy

FROM EARTH TO SPACE: MODELLING, DATA AND TECHNOLOGIES FOR SUSTAINABLE GREEN SYSTEMS

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ABSTRACT

Land-use change, intensive agriculture, climate variability, biodiversity loss and increasing pressure on natural resources are strongly interconnected challenges for sustainable development. Addressing them requires the integration of mathematical modelling, computational methods, data analysis and enabling technologies to understand complex systems, exploit heterogeneous data, explore future scenarios and support sustainable decision making.
These challenges arise naturally in terrestrial systems, where quantitative tools can support sustainable farming, ecosystem management, environmental monitoring and resource optimisation. They become even more demanding in controlled and space environments, where water, energy, nutrients and human intervention are severely constrained, and where autonomy, robustness and closed-loop operation are essential.

The session aims to explore current advances and frontier challenges across terrestrial and space-based green systems, highlighting common needs, complementary approaches and opportunities for cross-disciplinary exchange.

Topics of interest include, but are not limited to:

- data-driven modelling and dynamical systems;
- multiphysics and multiscale methods;
- optimisation and optimal control;
- uncertainty quantification, stochastic methods, inverse problems and parameter estimation;
- remote sensing, data assimilation, sensing and monitoring;
- statistical learning and scientific machine learning;
- reduced order and surrogate modelling;
- digital twins and model-based decision support;
- sustainable and precision agriculture;
- greenhouse and vertical farming;

- ecosystem and land management;
- resource-efficient systems;
- controlled environments and space farming.

In the spirit of M2P, the session is intended to foster interaction among mathematicians, engineers, computational and data scientists, agronomists, environmental scientists, technology developers, industry and other stakeholders, encouraging the transfer of methods and ideas from research to real-world applications.