Irrigation management based on innovative smart technologies, at different spatial scales, in Mediterranean areas

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Remote Sensing in Agriculture and Hydrology

Concept.

The IPCC report 2022 indicates that the world, in the near and long-term future, will face serious water, energy, and food challenges due to the growing demand for food in a resource degradation current scenario. Considering that agriculture uses more than 70% of the world's available freshwater, the adoption of a holistic approach to better understand and quantify the interlinkages between water, energy, and food nexus solutions is of pivotal importance.

Agriculture 4.0, as the most recent evolution in precision farming technology, puts forward four essential requirements: i) increasing crop productivity; ii) improving the sustainable use of natural resources; iii) increasing resilience to climate change and, iv) reducing food wasting.

Because of the relatively high consumption of available freshwater, the optimization of irrigation systems design and of the irrigation management plays a key role in the sustainable use of natural resources. The countries of the Mediterranean basin are generally characterized by wet and rainy winters but hot and dry summers; thus, irrigation is therefore essential for agricultural applications. In the last decades, the increase of atmospheric evaporative demand and often, the reduction of water availability for agriculture (due to climate change) have exacerbated the problems of drought in several regions. In this framework, the adoption of strategies for "sustainable" and "precise" use of water resources in agriculture is mandatory to deal with water scarcity.

Scientific approach.

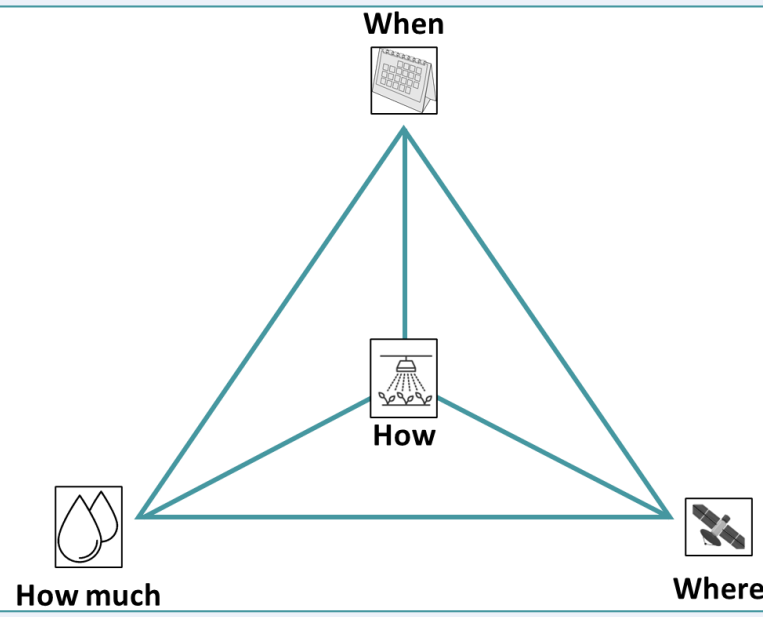
The proposed research intends to deepen the knowledge of the processes involved in the soil-plant-atmosphere (SPA) continuum. A new nexus modeling framework is proposed to combine remote sensing and geographic information systems and scenario simulations.

The proposed approach is based on a smart conceptual model to estimate actual evapotranspiration fluxes at different spatial scales. Specifically, agro-hydrological and/or energy balance models will be implemented innovatively by combining field monitoring, remote sensing data, and machine learning techniques.

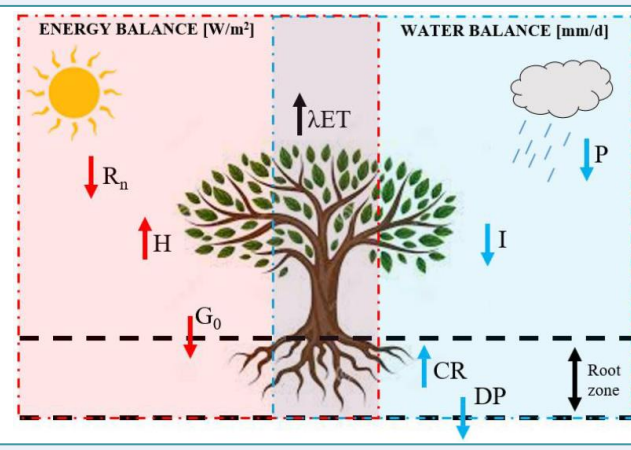
Research objectives.

The proposed research intends to contribute in promoting the digital agenda in agriculture also leading to a more sustainable water management practice. This will provide to policymakers, scientists, and farmers smart tools to analyze different SPA systems for the maximization of the food production while minimizing its water footprint.

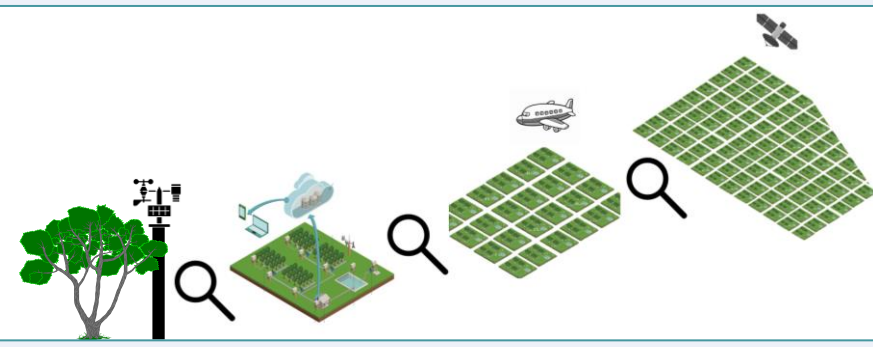
Precision Irrigation Tetrahedron



State-of-Art



Spatial Scales



Research Rational Schemes