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ESA Digital Twin Earth Precursor: Food Systems

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Part of ESA's Digital Twin Earth Precursor projects, our project focuses on supporting ESA in the definition of the concept of a Digital Twin Earth, and establishing a solid scientific and technical basis to realise this. The project, run by CGI and in close collaboration with Oxford University Innovation, Trillium & IIASA, has a focus on developing a Food Systems Digital Twin, taking on board interdisciplinary systems through the biosphere, atmosphere, and hydrosphere systems. These in turn would allow for new interdisciplinary insights for policies dealing with climate, food production and sustainability. The project is looking at a use case with the prominent use of AI processing, challenges of model integration, ingestion of socio-economic as well as physical measurements, end-to-end chain providing decision support outputs, all with innovation at each stage, and working closely with a series of stakeholders.

The purpose of our use case is to demonstrate the value of the Digital Twin Earth concept to the scientific community, by integrating the outputs of novel algorithms. We will be using selected machine learning extreme precipitation models feeding Global Gridded Crop Models, and after a regional downscaling exercise, the integration into cropland land use and pricing. By taking these steps, the benefits include improvement in routine monitoring with regular seasonal progress, short term policy development including responses to crop shortages due to extremes, and aiding in long term policy development to apply appropriate incentives. The purpose of the architecture and integration within the preparation of the demonstration is to support the use case and draw conclusions for the roadmap. These developments will be based on stakeholder consultations and the drawing together of differing model elements.

This Digital Twin Earth is an exciting project bringing together EO experts, Earth System Scientists, industry, AI experts, modellers, ICT experts and user community. It aims to establish the initial building blocks of an ambitious initiative, and, based on the prototyping activities, to develop a scientific and technology roadmap for the future, addressing current limitations. It ties in closely to both the European Space Agency's and European Commission's plan to create a series of interdisciplinary Digital Twin Earths with associated boundary conditions, in order to offer services to public sector users for developing, monitoring and assessing the impact of proposed policy and

legislative measures concerning the environment and climate.