

IAF EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Data Systems and Technology (4)

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DIGITAL TWIN FACTORY: A NEW LIBRARY CONNECTED TO EO PORTALS FOR EARTH
MONITORING

Abstract

The Earth System Digital Twins (DT) are now accessible through the last decade's advances in computing capacities and mathematical methods (mostly around Artificial Intelligence). The large expansion of Earth Observation data is likewise a breakthrough in this topic. The availability of data with a large spectrum of sensors, strengthens and supplements in-situ observations and numerical models. DT is a powerful tool to model the current state of the Earth (what now?), predict the future (what next?) and conduct impact analysis (what if?). They can be global as proposed in the European Destination Earth program or local and specified to address very precise topics (e.g. urban heat islands or coastal vulnerabilities). The motivation to create such numerical objects is very high, as are the expectations around it. Nonetheless, they remain very complex objects; the inclusion of Space data may also be not straightforward.

The French space agency, CNES, develops a new software library to enable the generation of Earth DTs. This library, named the Digital Twin Factory (DTF), aims at facilitating the use of space data in building local and thematic DTs. Each DT relies on common preparation and visualization stages: computing a data cube of multi-sources and exogenous data, handling of 3D models, exploration of results, benchmarks of physical models and computation of surrogate ones... The DTF will gather these generic functions with a strong issue on interoperability with other DT and EO libraries. Standards apply to data formats but to software functions too, to ease connections. The optimization of energy consumption is a key problem for DT, both for computation runs and for data storage. The DTF address this problem through code optimization and storage rationalization.

An important part of the DTs is also the access to Space data. The GEODES portal, previously named GeoDataHub in its beta version, has been developed by CNES to centralize the past, present and future

CNES EO data. It gathers the former PEPS platform, CNES mission data and more advanced products. This portal has been built with high standards of interoperability to enable collecting meta-data from other catalogues and reference them. GEODES is an important input of the DTF as the provider of a centralized data source.

The DTF and GEODES developments will be illustrated by the use case of the SCOast-DT project. This program develops a coastal Digital Twin to help adapt to climate change, in the framework of a NOAA-NASA-CNES cooperation.