

CLEOS (Cloud Earth Observation Services) is the **digital platform** that enables **the digital transformation of e-GEOS**. CLEOS boosts the GeoInformation business in the new Space Economy framework. It makes knowledge, capabilities and sharing products, easy to build, for the best use of Earth Observation services in new business applications.

CLEOS is the new **Digital Marketplace** for accessing the whole range of EO/non-EO data, products and services marketed by e-GEOS, TPZ GI Lob and Third Party providers.

CLEOS is the new **Development Platform** enabling the development of new services and applications with a microservice approach in a scalable, elastic and secure multicloud platform.

Space data are growing exponentially as well as enabling technologies such as **Cloud, Artificial Intelligence, Big Data and 5G, accelerating the paradigm shift in Data collection and Information delivery** and defining a new concept of "Space of Things". CLEOS is the all-in-one solution to master the Digital Revolution of Geoinformation Services.



https://cleos.earth

CLEOS allows the access to manifold **satellite and non-satellite data sources** through a set of data collectors, which are adapted to the interfaces offered by individual data/contents providers (e.g. satellite mission Ground Segments). CLEOS features a multi-cloud orchestration service that enables the deployment of the CLEOS platform itself or single processing jobs in **different commercial cloud infrastructures, including all Copernicus DIAS**. This set of capabilities enables a wide range of services, in particular:

GEOINFORMATION ONE-STOP-SHOP

CLEOS is the **one-stop-shop for Satellite and Earth Observation data**. Through a unique marketplace, all users have direct online access to extensive commercial data **for feeding customisable workflows** already optimised for CLOUD scalability. The CLEOS initial Data & Service offer is organised according to the following categories:

Satellite imagery: free&open (e.g. Copernicus Sentinels) and commercial (e.g. COSMO-Sky-Med and COSMO-SkyMed Second Generation, MAXAR/DigitalGlobe) satellite missions (archive&tasking, where available).

Information Products: geoaspatial layers immediately available for downloading.

Processing Services: batch processing services for massive satellite data processing (e.g. SAR data pre-processing).

The CLEOS offer will evolve very quickly, integrating more data sources and offering new processing capabilities and services, available also **through public and secure APIs**.

PROCESSING PLATFORM, DEVELOPER PORTAL & AI FACTORY

The CLEOS **Processing Platform** is the module that is responsible for the execution of all processing tasks, from the simple retrieval and delivery of a product up to the **orchestration of complex and long batch processing jobs** involving thousands of processing nodes.

The Processing Platform can:

- manage the provision of the necessary infrastructure resources in a dynamic way with elastic scaling up & down in multiple clouds and on premise infrastructures.
- deploy the processing pipelines using a data-driven and message-based approach, where requests are queued and progressively managed, enlarging or reducing the size of the available worker nodes according to demand.
- **manage DevOps** through a CI/CD pipeline.

ARTIFICIAL INTELLIGENCE

The **AI Factory** is the platform section dedicated to the development and management of AI models and corpus, where **AI developers and users work together** to develop, test and scale new AI based applications.

The AI Factory allows:

- access to a large set of pre-defined AI models or the import of custom ones;
- the import of training corpus or the building of new ones by using a simple and intuitive interface;
- the training and retraining of models, benchmark performance metrics and the management of model versioning;
- the direct inclusion of trained AI models into processing pipelines.

RADAR PROCESSING SERVICES

MULTI-TEMPORAL COHERENCE (MTC) RADAR

Multi-temporal analysis is an RGB image derived from a pair of interferometric Radar data sets containing both SAR Detected Amplitude and SAR Coherence information. Multi-Temporal Coherence (MTC) is useful to support visual analysis of SAR products by providing an "at a glance" image of changes occurred between two SAR scenes collected with the same geometry; moreover, it represents a powerful tool for different applications as, for example: land-use/land-cover definition, feature extraction (road network, built structures and built-up areas), thematic mapping and monitoring of key sites.

RADAR GEOCODING

This simple tool converts single COSMO-Sky-Med and Sentinel-1 Single Look Complex (SLC, Level 1A) scenes into terrain-corrected, GIS-ready geocoded images **using the available Digital Elevation Model** (or available Digital Elevation Models). Radiometric calibration is applied for converting original Digital Numbers into calibrated sigma naught. No reference points are necessary to obtain very high geometric accuracy, since Radar Geocoding exploits precise orbital parameters delivered by satellite operators and a direct geocoding model.

ARTIFICIAL INTELLIGENCE AT WORK

Artificial Intelligence models (Machine Learning/Deep Learning) can automate tasks such as object detection, objection segmentation and anomaly detection on both Optical and SAR imagery, as well as fusing EO and non-EO data. Through CLEOS, customers can build, test and scale their own AI models to address manifold tasks using pre-trained AI models and available training datasets in the AI Fac**tory**. Trained AI models can be then deployed into operational pipelines and be immediately available via API to perform AI inference at scale. Data Science and Operations Teams can use CLEOS to collaborate in bringing AI into daily activities, as well as in the rapid development of Minimum Viable Products to be tested in the Market.

RADAR PRE-PROCESSING

Radar Pre-Processing provides professional tools to generate "GIS-ready" (geo-coded) Time Series of co-registered SAR Detected Amplitude and **SAR Interferometric Coherence** at scale. Radar stacks, either alone or in combination with Optical satellite data, are essential to **exploit the time-wise analysis** aimed at detecting both short-term activity and long-term changes. The advantage of Radar Time Series of Amplitude and Coherence is their reliability and density, as Radar satellites can acquire data under any lighting and weather condition.

Manila city - Targeted post-processing implemented using high satellite data knowledge

NATIONAL MONITORING

MapItaly

Since the beginning of the MapItaly acquisition programme, more than **100,000 COSMO-Sky-Med Stripmap HIMAGE** scenes have been acquired and stored in the COSMO-SkyMed central archive in the Matera Space Centre. Now all these scenes are available for immediate download through CLEOS, processed as Level 1A Single Look Complex (SCS_B) products on a pre-set framing, ready for processing in CLE-OS (to build Analysis Ready Data) or included into customers' own processing pipelines.

COSMO-SkyMed Image © ASI Processed and distributed by e-GEOS

RealVista

RealVista 1.0. consists of remote sensing images of the entire Italian territory with a resolution of **50 centimetres from aircraft**. Public entities and companies can therefore make use of this valuable database.

GLOBAL MONITORING

COSMO-SkyMed

The COSMO-SkyMed "Background Mission" provides a unique opportunity to collect thousands of genetic stacks with high temporal resolution over thousands of sites since 2011 all over the world. A new generation of CO-SMO-SkyMed radar satellites is now available. The **COSMO-SkyMed Second Generation** is at the forefront of radar technologies, ensuring improvements and guaranteeing continuity with the first generation satellites, to preserve **high quality and the highest precision features**, both required for interferometric activities.

COSMO-SkyMed Second Generation Image © ASI Processed and distributed by e-GEOS

SAOCOM

Thanks to the unique L-band SAR technology, the SAOCOM satellites can monitor the Earth day and night, regardless of weather conditions, and can penetrate the vegetation cover and the soil, collecting information for soil moisture and interferometry products and for risk mapping.

FEDERATION OF PARTNERS ACADEMY AND DEVELOPER PORTAL

e-GEOS has a large and global footprint which enables it to succeed in many countries and on all continents through its many partnerships. CLEOS will reinforce and attract national and international SMEs and larger geoinformation industries, creating new partnership opportunities based on both standard agreements and revenue sharing on new subscriptions, which will merge different data and production sources.

