# DESTINATION EARTH & ESA DTE DEUX INITIATIVES EUROPÉENNES SUR LES JUMEAUX NUMÉRIQUES DE LA TERRE?

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## **Destination Earth**

A Highly Accurate Digital Model of the Earth

To monitor, simulate and predict natural phenomena and the impact of human activity on Earth

To assist in designing accurate adaptation strategies and climate change related mitigation measures

> To accelerate the EU's green and digital transition

To leverage existing and new data sources and EU's advanced digital and computing infrastructure





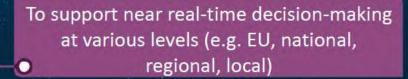








To create and test "what if" scenarios and to integrate impact sector applications for more sustainable development



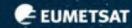


To go beyond the current complex systems designed mainly for expert use



To scale up existing models and fuse simulation with observation





## DestinE Initiative Objectives



#### Contribution to policy-makers

- monitor and simulate the Earth's system and the impact of human interventions,
- evaluate socio-economic consequences of environmental disasters,
- enable the assessment of scenarios for sustainable development.

#### Contribution to researchers and scientists

- provide access to a wide set of Earth-related data such as Earth observation data, output data from high-resolution Digital Twins, socio-economic data, etc.,
- create a science development ecosystem with up-to-date tools and software, especially AI, for stakeholders to develop, share, and optimize Earth-related models.

#### Contribution to the general public

 facilitate the access, exploitation, and visualization of Earth system related information to raise awareness and involve the global population in the topics of sustainability and environmental crisis.



## **Destination Earth - Implementation**





- > The Commission (DG CNECT) leads in coordination with Member States and Associated Countries
- Strategic partnerships with:
  - European Space Agency (ESA)
  - European Centre for Medium-Range Weather Forecasts (ECMWF)
  - European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)
- Funding under the Digital Europe Programme
- Significant Involvement of the EU industry
- Important R&I activities under Horizon Europe to support evolution of Destination Earth
- > Synergies with other EU programmes, like Copernicus and the EuroHPC Joint Undertaking

#### 2021-2024

- Operational cloud-based platform
- · First two digital twins

#### 2024-2027

Platform integrates the next operational digital twins and offers services to public sector users

#### 2027-2030

Towards a full "digital twin of the Earth" through a convergence of multiple digital twins on the platform

#### **Quelques éléments budgétaires**



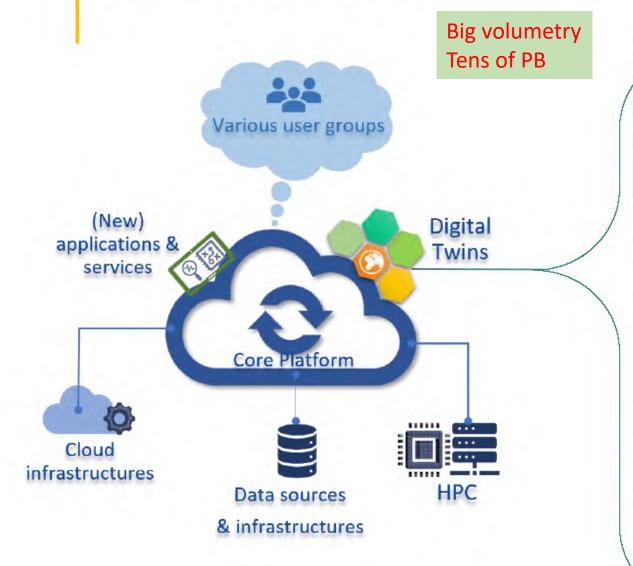
- Les contrats signés avec DG CONNECT pour la phase I sont :
  - 55 M€ pour l'ESA : système et core platform
  - 35 M€ pour Eumetsat : datalake et entrepôt
  - 60 M€ pour ECMWF : les deux premiers jumeaux

#### En plus de ces budgets

- I'ESA (EOP) a déjà lancé, pour plusieurs M€, depuis 2019 des études techniques de haut niveau pour soutenir le processus de définition des jumeaux numériques et en particulier Destination Earth : les précurseurs de jumeaux Food System, Forest & carbon, Climate explorer, Ocean, Antartica, Hydrology, Urban, ... A noter : une forte représentation des UK.
- Par ailleurs, la Commission européenne a lancé plusieurs R&T H2020 ou Horizon Europe sur les digital twins. Ceci représente une programmation > 200 M€.
- La Commission et l'ESA compte également utiliser des ressources informatiques gratuites, mises à disposition via EuroHPC (machines pre-exascales) et les centre HPC nationaux.
- En outre, l'ESA va démarrer un nouveau programme DTE Digital Twin Earth (budget 50 M€ sur 4 ans) en parallèle du projet DestinE contribution France 6 M€.

## DestinE baseline architecture & DTs

Continuous & On-demand



#### **Digital Twins**



#### 1. Weather-induced and Geophysical Extremes

Environmental extremes at very high spatial resolution and close to real-time decision-making support (e.g. floods, wild fires, hurricanes, earthquakes, volcano eruptions)



#### 2. Climate Change Adaptation

Climate change adaptation policies and mitigation scenario testing at decadal timescales aiming at a real breakthrough at the level of reliability at regional and national levels, for understanding the causes and explaining the feedback mechanisms of change, predicting possible evolution trajectories and identifying irreversible tipping points



Oceans DT



Al-powered Urban DTs



**Biodiversity DT** 





More DTs... (e.g. migration)





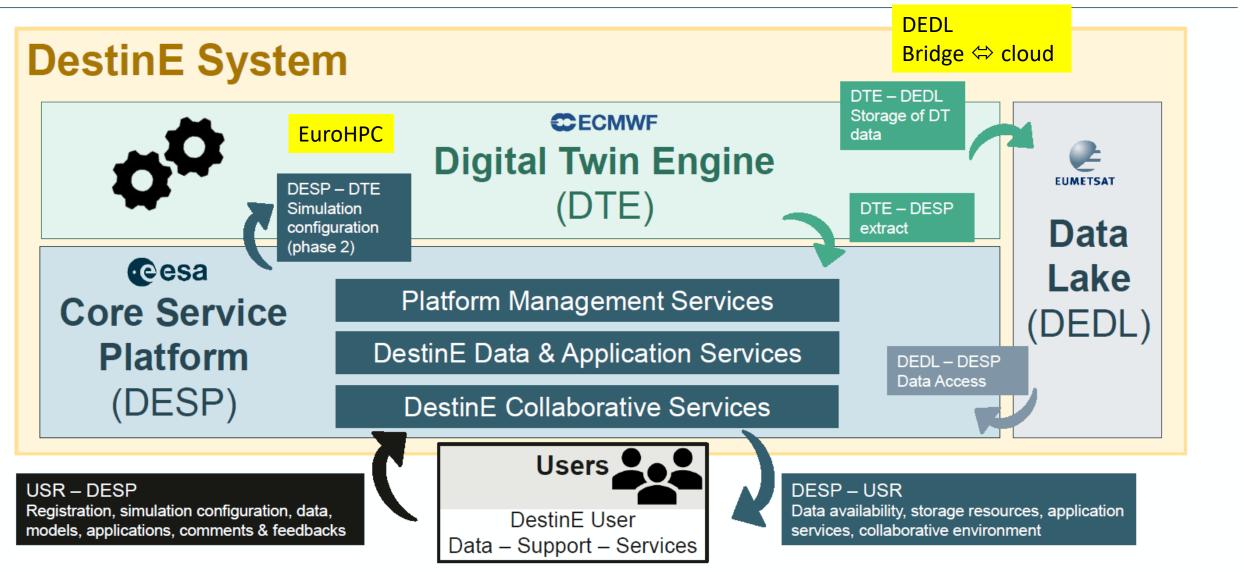
Horizon Europe calls to support research related to Destination Earth (modelling, DTs...)

Strategic Union initiative for EuroHPC



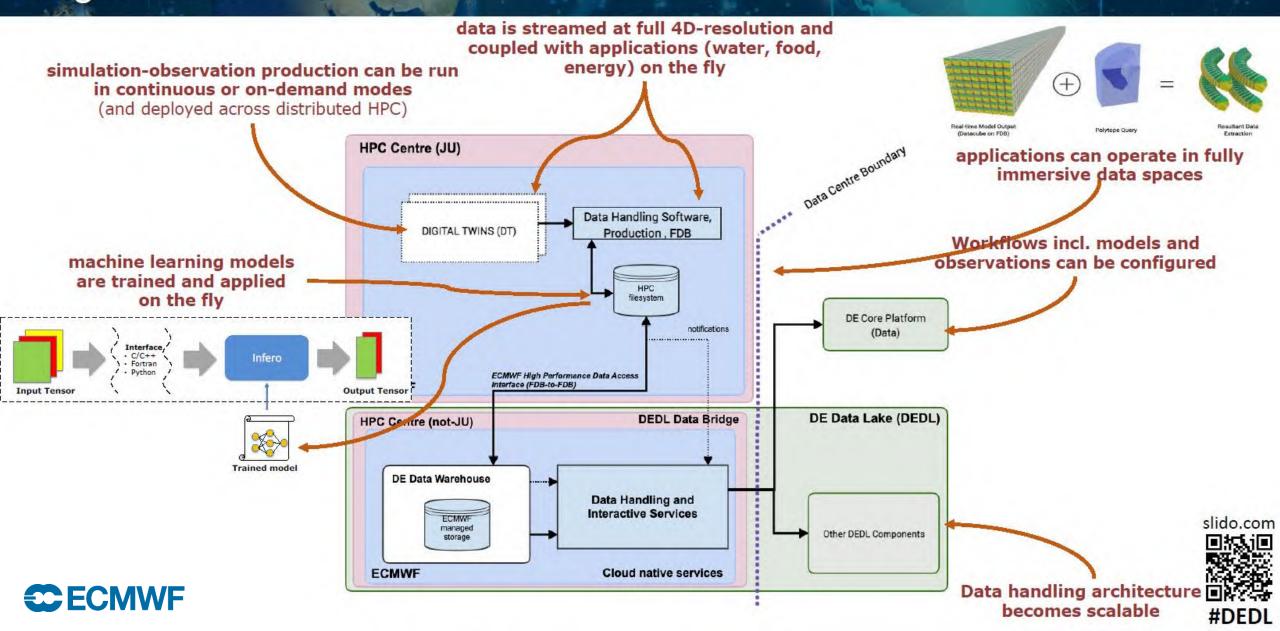
## **Destine System Overview and Main Dataflows**





## Destination Earth Digital Twin Engine / DTs





## Scope of the joint Partnership Plan









- Describes the joint approach towards partnerships in DestinE
- Summarizes current and planned partnership agreements.
- Defines approach to selecting use cases/partnerships.
- Defines specific objectives, roles and commitments of all partners in selected partnerships. Version 1: September 2022

#### Partnership plan

Version 2: September 2023 Partnership is defined through the setting up of common objectives, roles and commitments between the different potential partners. ESA, ECMWF and EUMETSAT are responsible to develop together with the European Commission the establishment of the corresponding partnership plan with the potential partners. The <u>partnership plan is</u> further <u>used to monitor</u> progress on both sides of the partnership and measure the success of the activity. It is noted that such plan should be established by default in Phase I + Phase II duration. Usage of resources shall be documented in the partnership plan and made available according to the corresponding phase agreement. Partnerships contribution is considered by default as an inkind contribution from both sides. Procurements by the DestinE Entrusted Entities of general

#### **Objet du ESA DTE – Digital Twin Earth**



- Développer des EO DTC (Digital Twin Components)
  - pour valoriser tous les atouts EO en Europe (données, infrastructures et science)
  - construire sur un foisonnement d'initiatives en Europe sur les jumeaux numériques à base de données EO.
    - données EO 
       Copernicus et les Earth Explorer et un peu les données des Etats-Membres.
  - jusqu'à un niveau pré-opérationnel
    - => éléments pré-opérationnels où de nouvelles capacités d'OT peuvent jouer un rôle majeur dans différents domaines thématiques et domaines d'application spécifiques.
    - Amenés à compléter les jumeaux mis en œuvre par ECMWF