Spatial Digital Twins and AI – Racing into the Future

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What if …

We create a comprehensive digital replica of Earth that …

- simulates & observes the Earth-human interaction with high accuracy …

- harnesses innovative extreme-scale computing, data handling and AI technologies …

- is continuously updated with Earth Observation data and other data …

- enables accurate Earth-system simulation and prediction capabilities …

- provides detailed views of past, current and future physical changes …

 → transforms data into information for decision & policy making.

→ **Digital Twin of the Earth**

Digital Twin Earth Components and Output

- **Cloud infrastructure**

- **HPC infrastructure**

- **Harmonised Data Lakes**

- **Earth simulation & observation centers**

- **AI & Software & Science competence centers**

- **European data networks**

Simulation and Monitoring
past, present & future

Visualisation

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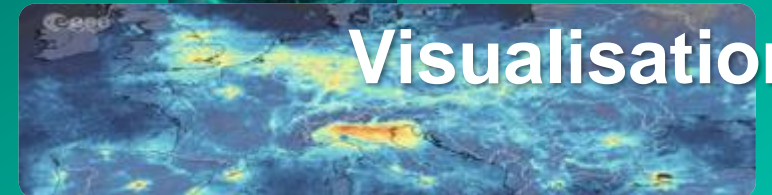
Digital Twin Earth Principles

esa

Data →

← Policies

Data Management
Fusion, Assimilation, IoT

↔

- **Cloud infrastructure**
- **HPC infrastructure**
- **Harmonised Data Lakes**
- **Earth simulation & observation centers**
- **AI & Software & Science comp. centers**
- **European data networks**

- Display results from year 1
- Large user community in 3 years
- Be open
- Be evolutionary
- Be interactive
- Be collaborative
- Generate visibility

Digital Twins
e.g.
- Extreme Events /Emergency
- Climate Change Adaptation
- Ocean

Modelling, Simulation, Reasoning
Past, Present, Future

Toward a potential ESA Digital Twin Earth

Forest
VTT (FIN)

Hydrology
CNR-IRPI (IT)

Antarctica
U. Edinburgh (UK)

Food
CGI (UK)

Ocean
IFREMER (FR)

Climate Hot Spots
Telespazio (UK)

- 6 Activities have been launched addressing different aspects of the Earth system and dedicated sectorial application domains;

- All activities aims at prototyping an "instance" of DTE that..:
  - may capitalise on the outputs from the initial DestinE DTs: e.g., dedicated additional user modules…
  - or establish the basis for potential future DTs: e.g., future DTs focused on specific aspects of the Earth system and/or application sectors.

Requirements consolidation

Development & Demonstration

Roadmap

Stakeholder engagement

An example: Digital Twin Antarctica