



Science for action

The (draft) science plan of the DestinE advisory board

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on behalf of the DestinE SAB

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Disclaimer:

The Strategic Advisory Group (SAB) on the Destination Earth initiative provides the European Commission with technical and scientific advice for the implementation and further development of the initiative. Statements and views in the science plan were developed by the SAB in full autonomy. They do not reflect the views of the European Commission and may not be construed to constitute a commitment on the part of the European Commission.



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Starting point: A vision for digital twins of the Earth system

From the DestinE web site:

Building a highly accurate
~~digital model~~ of the Earth
twin



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Document structure:

1. Introduction and background
2. Challenges
3. Generic aspects of a prospective work programme
4. Specific elements of a prospective work programme
5. Concluding remarks
6. Glossary
7. References



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Key points from the introduction:

SAB only had two full in-person meetings thus far

- Difficult to start working together and find/digest all available information
- Science plan necessarily incomplete



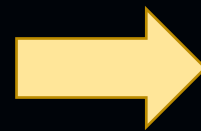


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A lot of variability at the local scale: :



- Different people
- Different environmental issues
- Different priorities
- Different values



Different decision-making
Different information needs

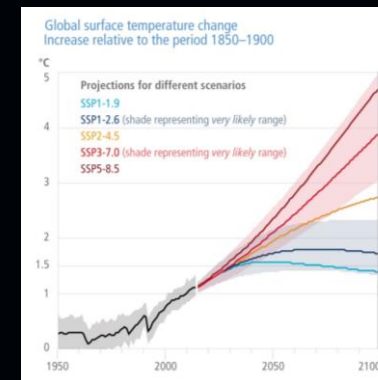
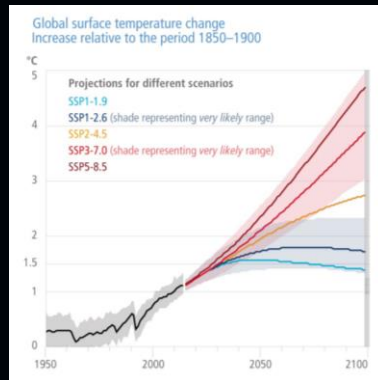


Use-case driven development
Co-design



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Full coupling from global to local scale (and back!):





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DestinE must react to a changing world:

Resilience

Digitalisation

Sovereignty

AI

Leadership

Cyber security



Energy efficiency and sustainability



Challenges:

2.1 Paradigm change of model development to DT development

Key feature of DTs is the twinning of a physical entity and one or more virtual entities allowing bidirectional interactions

What information in the physical world is required from the virtual entity for a given purpose?

What is the twinning rate, e.g. the rate at which the model is updated using physical data and human inputs?

2.2 Interactivity and decentralized approaches

The Destination Earth ecosystem aims to support in near-real time the needs of a large and diverse community of users

This requires the DestinE system to be highly interactive

Need insight into how globally aggregated information from models and data translates to a local context with differing legal, ethical, institutional and social implications

Requires new operational models for HPC and de-centralized user management without giving up security



Challenges:

2.3 Openness and (local) stakeholder co-design

Infrastructure for scientists and non-scientists to implement global, national, regional and local climate strategies

Openness and stakeholder co-design is key for success

Trustworthiness must be established

People must have control over their “modeled habitat”

2.4 Integration with other DTs and other environmental information and modeling systems

Interoperability poses semantic, technical and scientific challenges

Need for GIS interfaces

Relates to governance aspects: how much detail and which feedbacks are needed for which application?



Challenges:

2.5 Social and human dimension and values

Adaptation and mitigation measures require decisions by humans that are taken at the local level

Scenario development along socio-economic pathways will include human decisions and they are influencing mitigation and adaptation options

Interaction of people with the DestinE system is embedded in their local context, such as culture and location, and they are shaped by their norms and values

The wider sociological, ethical and political context and consequences of actions based on DestinE information needs to be ensured

Needs a framework that promotes just and fair actions, equitable access for users, openness and transparency of data, software and information, and well-being and sustainability



Challenges:

2.6 Ensuring the intended societal impact

Development is needed to improve information quality on impacts of hazards and climate extremes at the local scale

How to abstract such local knowledge and lessons learned so that predictions and support can be improved in other regions and contexts?

Monitoring measures for adaptation success need to be developed and tailored to DTs

Need to research DestinE system resilience given the heterogeneous HPC landscape in Europe

2.7 Reconciling the increasing demand for high resolution models, compute and large data with energy efficiency and sustainability

Local scales necessitate the application of very high-resolution model systems

Need to optimize the usage of large-scale data centres, e.g. through careful planning of experiments



Generic aspects of a prospective work program:

- Needs to be aligned with planned procurements and ongoing tenders/projects
- Emphasize cross-disciplinary aspects
- Strong support of use-case driven approach beyond traditional Earth science areas
- Advocate sustainable and reusable developments
- Needs to be associated with a open governance structure



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Generic aspects of a prospective work program:

Complex funding landscape

Core system tenders

Other tenders

HORIZON Europe Calls

National Calls

Core Service Platform
The platform will provide evidence-based decision-making tools, applications and services, based on an open, flexible, and secure cloud-based computing infrastructure.

Data Lake
The data lake will bring together data from ESA, EUMETSAT, ECMWF as well as from Copernicus, and many other diverse sources, with new data from the Digital Twins. It will allow discovery and data access as well as big data processing in the cloud.

Digital Twins and Digital Twin Engine
DestinE is creating several digital replicas covering different aspects of the Earth system and based on state-of-the-art simulators and observations. ECMWF is implementing the Digital Twin Engine, the complete software and data services needed for Earth System digital replicas, as well as the first two digital twins, Climate Change Adaptation, which will provide multiscalar simulations, and the Weather-related Extremes twin, with both high-resolution forecasts and/or operational simulations.

DLR Space Agency: Integration of Copernicus Data and services into Digital Twins
Presented by: [DLR Space Agency](#)

ESA EO DATA SPACE HIGHWAY
In the frame of the ESA Digital Twin Earth, the subject of this procurement is the ESA EO High Performance Earth Observation Digital Twin (Copernicus Sentinel Data) reference to an "Missions", which will allow Earth System data access and services for research together with Digital Twins and for application by Digital users within the Sentinel user-Sentinel Platform.
Presented by: [ESA](#)

HORIZON-INFRA-2024-TECH-01-04: New digital twins for Destination Earth
Support of the development of Destination Earth (Destination Earth) and its digital twins. The aim is to develop new digital twin infrastructures that support the development of new digital twins, covering new areas, into the Destination Earth digital twin framework. The aim is to develop new digital twin infrastructures that support the development of new digital twins, covering new areas, into the Destination Earth digital twin framework. The aim is to develop new digital twin infrastructures that support the development of new digital twins, covering new areas, into the Destination Earth digital twin framework.
Presented by: [ESA](#)

HORIZON-INFRA-2024-TECH-01-05: AI/ML-powered digital twins for modelling complex phenomena in new AI application areas
The aim of this procurement is to deliver digital twin solutions which address the state-of-art of European AI and show transformative potential in AI applications. The solutions should cover new or emerging AI/ML applications in the field of Earth System digital twins.
Presented by: [ESA](#)

Search funding & tenders

Search by keyword...

102 item(s) found

Programme: Horizon Europe (HORIZON)

Match whole words only

Type

- Grants (102)
- Tenders

Submission status

- Open for submission (58)
- Forthcoming (44)
- Closed

Programming period

Programme / Programme group

Horizon Europe (HORIZON)

ATM application-oriented research for air-ground integration and autonomy
HORIZON-SESAR-2023-DES-ER2-WA2-2 Call for proposal
Horizon Europe (HORIZON)

ATM application-oriented research for the aviation Green Deal
HORIZON-SESAR-2023-DES-ER2-WA2-3 Call for proposal
Horizon Europe (HORIZON)

ATM application-oriented research for Artificial Intelligence (AI) for aviation
HORIZON-SESAR-2023-DES-ER2-WA2-4 Call for proposal
Horizon Europe (HORIZON)

ATM Excellent science and outreach for virtualisation and cybersecure data-sharing
HORIZON-SESAR-2023-DES-ER2-WA1-5 Call for proposal
Horizon Europe (HORIZON)

ATM Excellent science and outreach for civil-military interoperability and coordination

National DestinE-related Activities

Discover the multiple National DestinE-related activities across Europe in the interactive map below.



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Specific elements of a prospective work program:

This part is still under discussion by the SAB!





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Specific elements of a prospective work program:

4.1 Modelling and data core system (currently 2 topics)

Subtitle: model complexity, higher resolution, new processes and feedbacks

4.2 Development of a DestinE AI strategy (2 topics)

4.3 Expanding the human dimension for a successful DestinE uptake (3 topics)

4.4 System integration and ensuring impact (7 topics)

4.5 Interactivity and interfaces (6 topics)

4.6 Infrastructure and security (5 topics)

4.6 Towards DestinE as open decentralized system (2 topics)



Specific elements of a prospective work program:

Comments:

- Technological research topics are presently more fine-grained and detailed compared to natural and social science topics → **better balance required**
- Wide range of topics from very basic, fundamental research to developing solutions at TRL 7 and beyond
- Some topics may overlap with planning of tenders in phase 2
→ **alignment is needed (task of the commission)**

Disclaimer 2: The SAB sees itself in the role of proposing R&D topics that might be selected for future work programs, without us writing future work programs.



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Next steps and timeline:

- V8 of science plan was sent to full SAB and EU commission last Friday; feedback requested until Friday, Nov 17th
- Presentation about science plan at DCG meeting on Friday, Nov 24th
- Finalisation of document by writing team on and after Wednesday, Nov 30th
- Delivery of final science plan document by Friday, Dec 8th