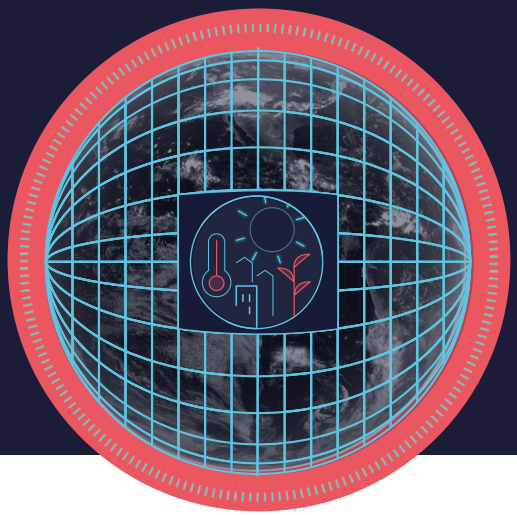
ECMWF - DestinE factsheets

DIGITAL TWIN FOR CLIMATE CHANGE ADAPTATION



Delivering global high-quality climate information at scales that matter to society

KEY FEATURES

Km-scale Earth system models

Uses km-scale Earth system models, at 5 to 10 km resolution, to better represent critical processes like storms and ocean eddies.

Global multi-decadal projections with local granularity

Produces global multi-decadal climate projections with local granularity, up to 2050, by exploiting the EuroHPC pre-exascale supercomputers.

Tailored climate information

Tailors the climate information to match the needs of users from relevant impact sectors, through co-design and innovative data streaming and data handling techniques.

Routine and on-demand operational production of climate simulations

Establishes an operational infrastructure to produce climate simulations in support of adaptation activities, both routinely (yearly or less) and on-demand.

The DestinE Digital Twin for Climate Change Adaptation (Climate DT) supports adaptation activities through the provision of innovative climate information. **It represents the first ever attempt to operationalise the production of global multi-decadal climate projections at resolutions of a few kilometres at which many of the impacts of climate change are observed. It also enables bespoke simulations to address "what-if" questions regarding the impacts of new scenarios or of extreme events in a rapidly warming world.**

INNOVATIVE DEVELOPMENTS

- ☑ Exploiting Earth system models at km-scale resolutions in an operational infrastructure.
- ☑ Novel workflows for operationalising multi-decadal climate simulations (1990–2050), that are ready to ingest user requirements.
- ☑ A reliable and flexible standardised climate data portfolio.
- ☑ AI-enabled interactivity and access to information.

Harnessing the developments in:

Earth System Sciences
Building on decades of European investments in Earth system modelling and climate sciences.

Supercomputing
Harnessing the EuroHPC pre-exascale supercomputers and efforts to adapt Earth system models to their novel architectures.

Artificial Intelligence
Exploiting recent breakthrough developments in AI in weather and climate sciences.

Climate Impact Assessment
Building upon the rich European ecosystem of user engagement and impact assessment for climate-vulnerable sectors.

Funded by the European Union Destination Earth implemented by ECMWF esa EUMETSAT

CONCEPTS INFO-BOX

Model Resolution

The resolution of a model refers to the size of each grid box. When increasing the resolution, the grid boxes become smaller, allowing for more detailed calculations and the model output to be more relevant to users.

Storm-Resolving and Eddy-Rich Earth System Models

Numerical models simulating the Earth system, which by using a high resolution of a few kilometres explicitly represent important phenomena like storms in the atmosphere, and eddies in the ocean.

Supercomputers

The Climate Digital Twin high-resolution simulations are only possible thanks to the new generation of supercomputers (pre-exascale) in Europe. An agreement with the EuroHPC JU provides DestinE access to some of the most advanced supercomputers in the world.

Climate Projections

A virtual representation of the climate system's response to the drivers of climate change, such as changes in greenhouse gases, aerosols and land-use over a specific time.

Global Data with Local Granularity

In DestinE, the high-resolution (5 - 10 km) models produce consistent high-quality climate information at the scales where many of the impacts of climate change and extreme events are observed (local granularity), on a global scale.

Climate Information for Impact Sectors

A set of models and indicators are integrated in the Climate DT workflow to derive specific climate essential variables into user-relevant indicators for key sectors such as renewable energies, water management, or agriculture. The flexible workflow allows addition of models for different sectors.

Data Streaming

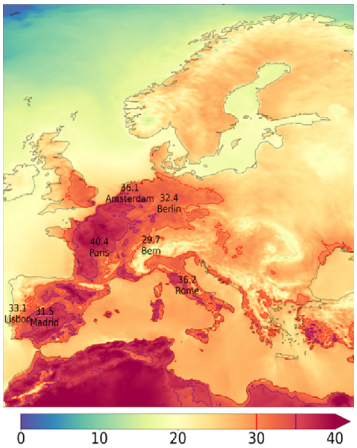
The streaming of the model output gives users immediate access to the complete set of climate data generated by the models in a standardised format across different models and model components.

ADDRESSING "WHAT-IF?" QUESTIONS

Example of a simulation answering the question:
"What would the 2019 European heatwave look like in a +2˚C world"?

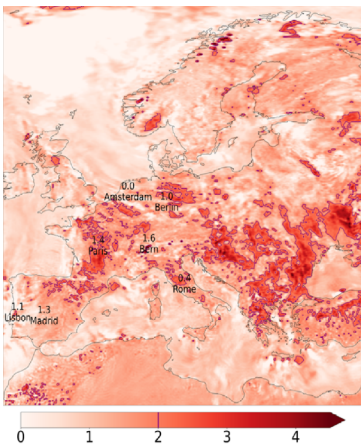
The European heatwave of 25th July 2019 (left panel) along with the additional warming in a +2˚C world compare to present-day conditions (right panel). The results are based on novel kilometre-scale storyline simulations with IFS-FESOM on LUMI.

25TH JULY 2019



2m-temperature max (˚C)

WARMING IN A +2˚C WORLD



△ 2m-temperature max rel. to present day (˚C)

CLIMATE ADAPTATION DIGITAL TWIN CONSORTIUM

Procured by ECMWF, implemented by a wide partnership led by CSC.

CSC · Ilmatieteen laitos Meteorologiska institutet Finnish Meteorological Institute · Barcelona Supercomputing Center Centro Nacional de Supercomputación · Hewlett Packard Enterprise · UCLouvain · University of Helsinki · DWD · AWI Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung · DKRZ Deutsches Klimarechenzentrum · Politecnico di Torino · Max-Planck-Institut für Meteorologie · UFZ Helmholtz Centre for Environmental Research

Funded by the European Union · Destination Earth · implemented by ECMWF · esa · EUMETSAT