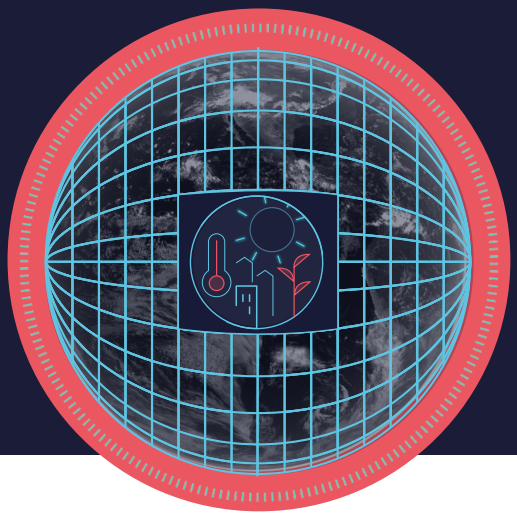
ECMWF - DestinE factsheets

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

TECHNICAL DATA

Models	ICON, IFS-FESOM, IFS-NEMO
Resolution	**Atmosphere:** 5 or 10 km **Ocean:** 5 km (ICON, FESOM), 1/12° (NEMO)
Climate simulations following a modified HighResMIP protocol	Historical 1990–2020 (CMIP6) Scenarios for 2020–2050 (ScenarioMIP) 1950 control (HighResMIP)
Storylines of extreme events in past, present and future worlds	Recent extreme events and their unfolding for a climate representative of the 1950s, 2020s, 2050s (produced by nudging the large-scale circulation to ERA5 for 2017–2023)
HPCs	Euro HPC systems, LUMI in phase 1, also MareNostrum5 and Leonardo in Phase 2
Output grid	HEALPix high-resolution (close to model native grid) and standard-resolution (~50 km)
Output parameters	DestinE data portfolio (variables at surface and on pressure and ocean levels)
Output frequency	**Atmosphere:** 1 h **Ocean:** daily means (selected surface fields 1h)

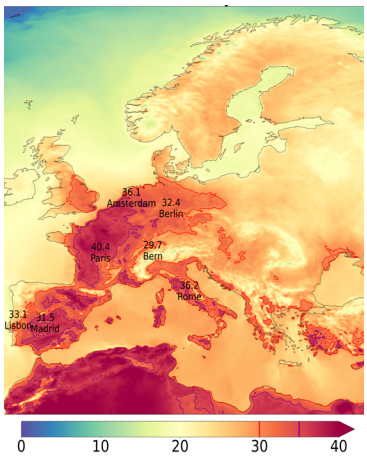
Explore the currently available simulations: https://destine.ecmwf.int/climate-dt-simulations

CLIMATE SIMULATIONS

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

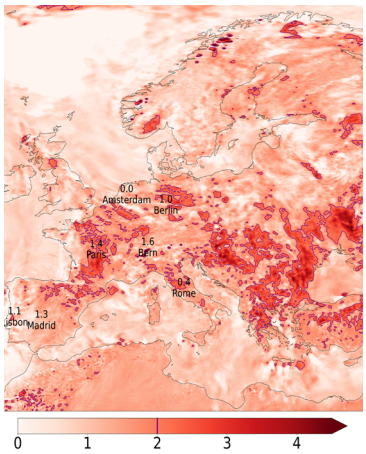
The European heatwave of 25th July 2019 (left panel) along with the additional warming in a +2°C world compare to present-day conditions (right panel). The results are based on novel kilometre-scale storyline simulations with IFS-FESOM on LUMI.

25TH JULY 2019



2m-temperature max (°C)

WARMING IN A +2°C WOLRD



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

CLIMATE ADAPTATION DIGITAL TWIN CONSORTIUM

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

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