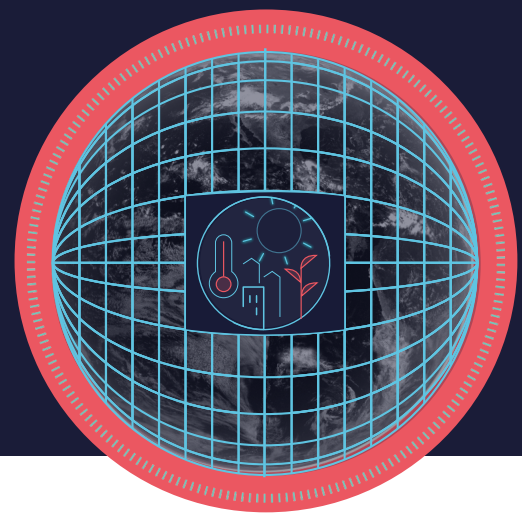


# DIGITAL TWIN FOR CLIMATE CHANGE ADAPTATION



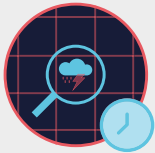
**Delivering global high-quality climate information at scales that matter to society**

## KEY FEATURES



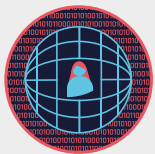
### Km-scale Earth system models

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

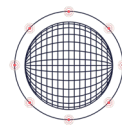
Establishes an operational infrastructure to produce climate simulations in support of adaptation activities, both routinely (yearly or less) and on-demand.

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.

## TECHNICAL DATA

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

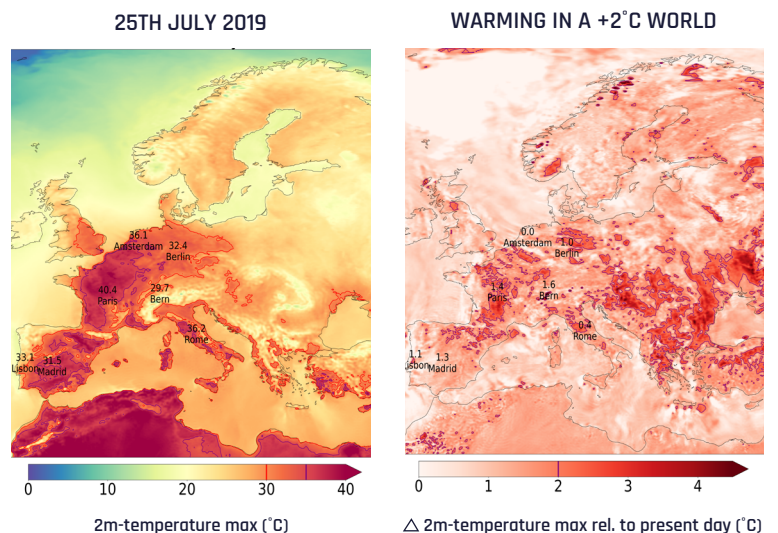


Explore the currently available simulations:  
[https://destine.ecmwf.int/climateDT\\_simulations](https://destine.ecmwf.int/climateDT_simulations)

## 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.



## CLIMATE ADAPTATION DIGITAL TWIN CONSORTIUM

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



Funded by the European Union

Destination Earth

implemented by

