DESTINATION EARTH

CLIMATE ADAPTATION DIGITAL TWIN

Theresa Kiszler & Climate DT team

CSC – IT Center for Science, Finland

Funded by the European Union

Destination Earth implemented by ECMWF esa EUMETSAT

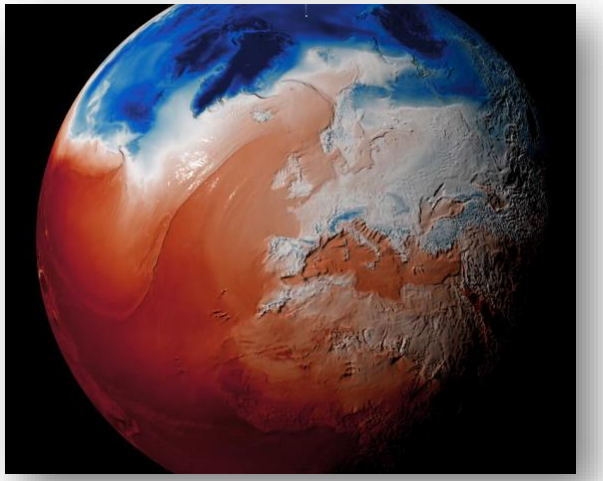
CLIMATE DT VISION

Goals:

- Production of operational climate projections
- Integration of impact sector models (use-cases)

Solutions:

- Implementation of the Climate DT system
- Automatized high-resolution climate simulations
- Direct analysis and impact sector models via data streaming
- Use of EuroHPC systems LUMI and Marenostrum 5



CLIMATE DT SETUP

High-resolution multi-decadal simulations with 3 coupled models

ICON

IFS-NEMO

IFS-FESOM

Multiple impact sector models (use-cases)

Data-related innovations introduced:

Use of HEALPix meshes and a Generic State Vector

Continuous monitoring of simulations via data quality checker

Direct analysis of simulation data to provide an uncertainty quantification and quality assessment using AQUA

CLIMATE DT WORKFLOW

Coupled Models → Climate simulations

Additional jobs → Check data

Use case applications → Impact sector analysis

AQUA → Simulation data analysis

FDB on Data bridge

Data Lake

DESP → Data access for users

Fields DataBase (FDB) on EuroHPC

CLIMATE DT SIMULATIONS

Coupled Models

⬇

Climate simulations

Operational multi-decadal simulations with 10-5km resolution

Core simulations: Projections, historical and control runs

➡ Presentation by Pablo Ortega

Special simulations: Storyline simulations

➡ Presentation by Amal John

Climate model output format is standardized using HEALPix grids and a generic state vector (GSV)

Fields DataBase (FDB) on EuroHPC

FDB on Data bridge

Data Lake

⬇

DESP

⬇

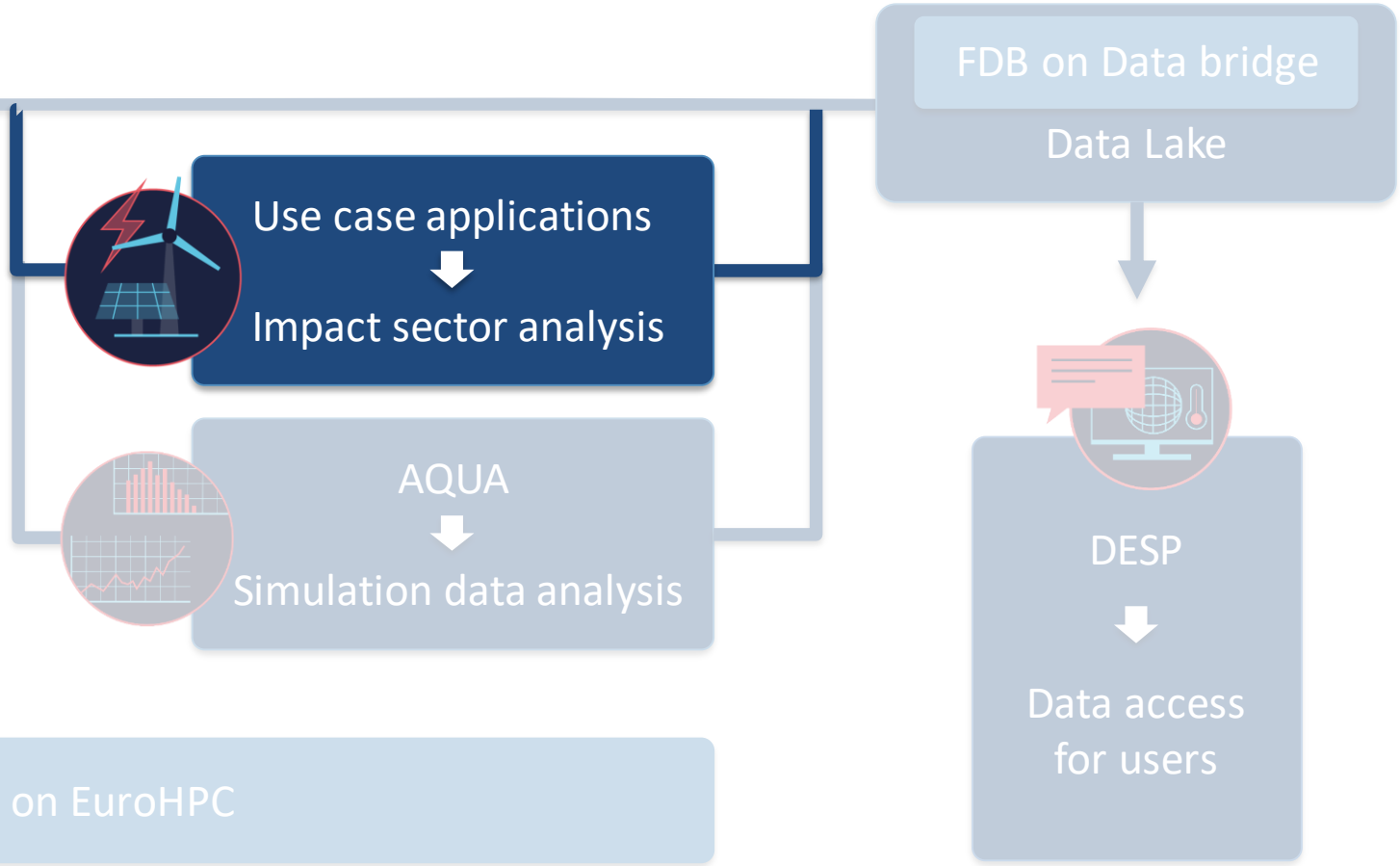
Data access for users

USE-CASES

Impact sector models run as part of the workflow

Data streaming enables applications to directly process the simulation data

Climate DT Phase 2 use cases: HydroLand, Wildfires, Energy on-shore and Energy off-shore



MODEL EVALUATION

Operationalization requires continues simulation quality monitoring

Use of AQUA software to provide automatic data analysis

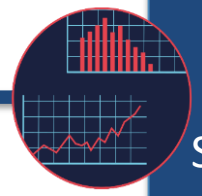
Objective diagnostics and metrics used to evaluate the model performance

➡ Presentation by Paolo Davini

Use case applications

⬇

Impact sector analysis



AQUA

⬇

Simulation data analysis

) on EuroHPC

FDB on Data bridge

Data Lake

DESP

⬇

Data access for users

OPERATIONAL PLAN

Multiple steps for the development, verification and operationilization required

Developments

- Changes in climate models and use-case applications by developers
- Initial testing with low-resolution simulations

Verification experiments

- Verification of technical functionalities and physical correctness
- Multi-year high-resolution simulations

Operational simulations

- Multi-decadal simulations
- Continuous monitoring
- Data streaming to use-case applications

OPERATIONAL PLAN

Multiple steps for the development, verification and operationilization required

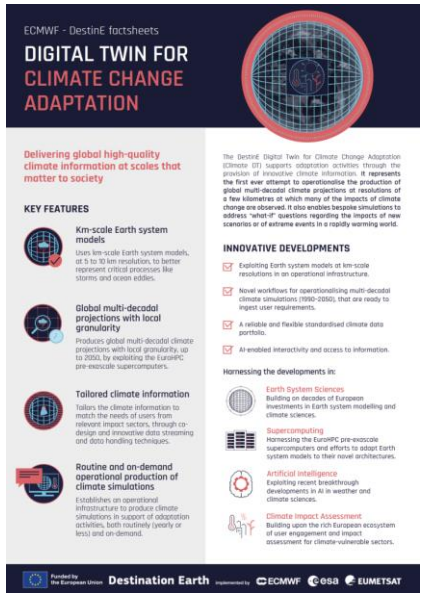
Developments	Verification experiments	Operational simulations
• Changes in climate models and use-case applications by developers • Initial testing with low-resolution simulations	• Verification of technical functionalities and physical correctness • Multi-year high-resolution simulations	• Multi-decadal simulations • Continuous monitoring • Data streaming to use-case applications

January 2025: Operational production simulations start
July 2025: First output available on the data bridge

FIND OUT MORE!

Online

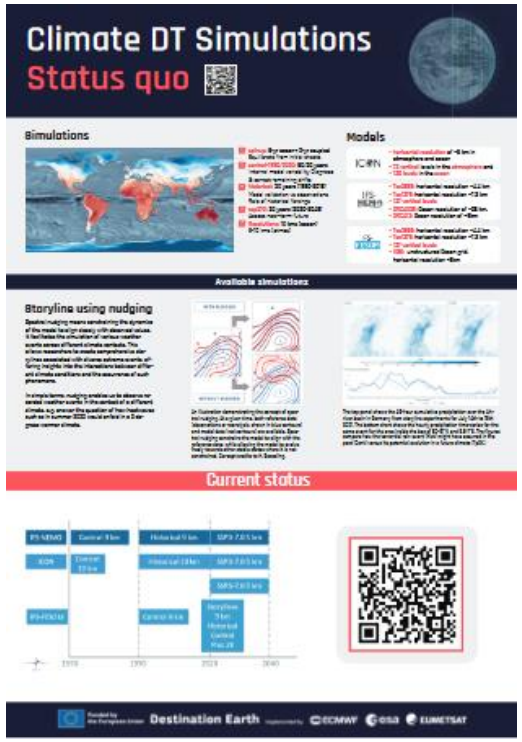
Explore the available Climate DT simulations



Factsheets

Posters

Climate DT Simulations: Status quo



Climate DT: Model Evaluation