ECMWF – DESTINATION EARTH

Machine Learning and the DestinE Digital Twins

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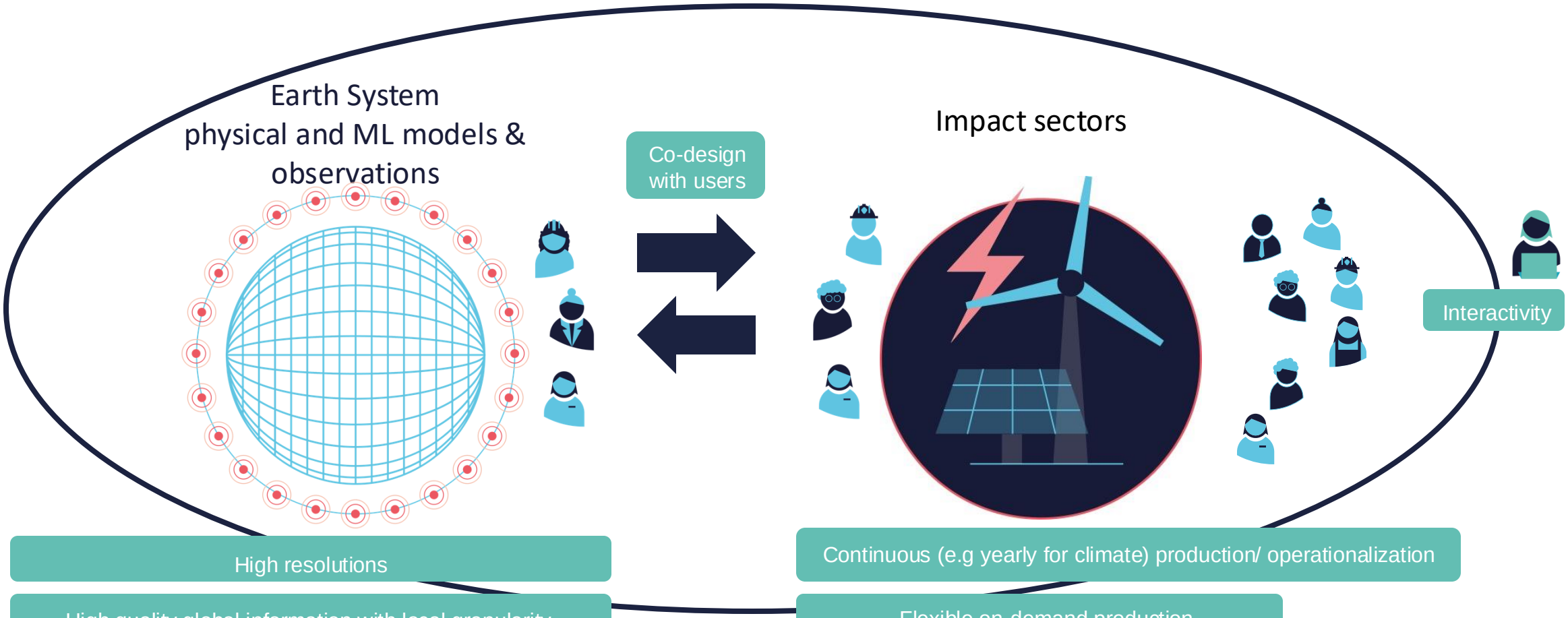
Funded by the European Union

Destination Earth implemented by ECMWF esa EUMETSAT

DestinE



High resolutions

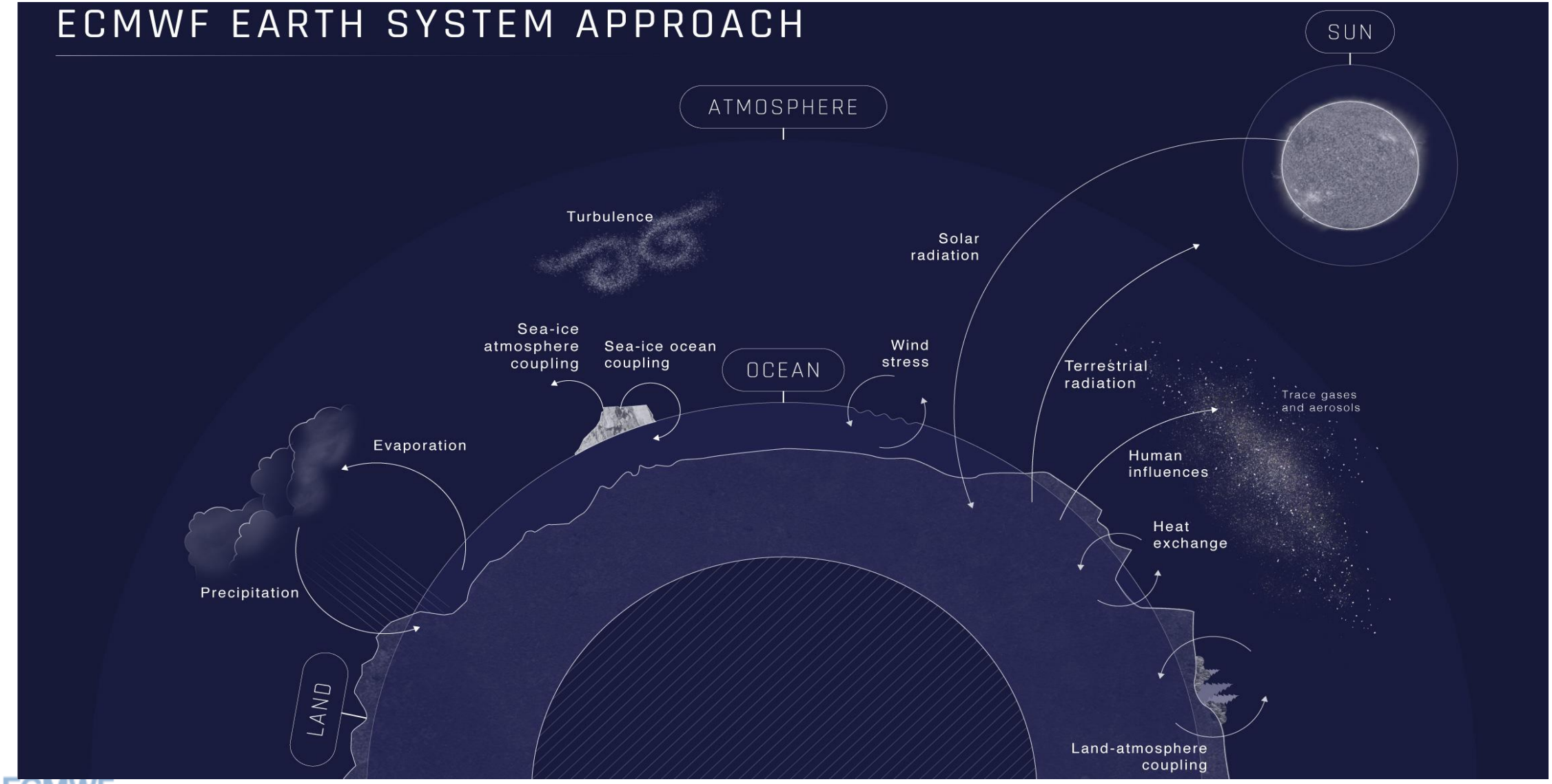
High quality global information with local granularity

Bringing impact sector models WITHIN the same workflow

Continuous (e.g yearly for climate) production/ operationalization

Flexible on-demand production

Data streaming and tailored data access

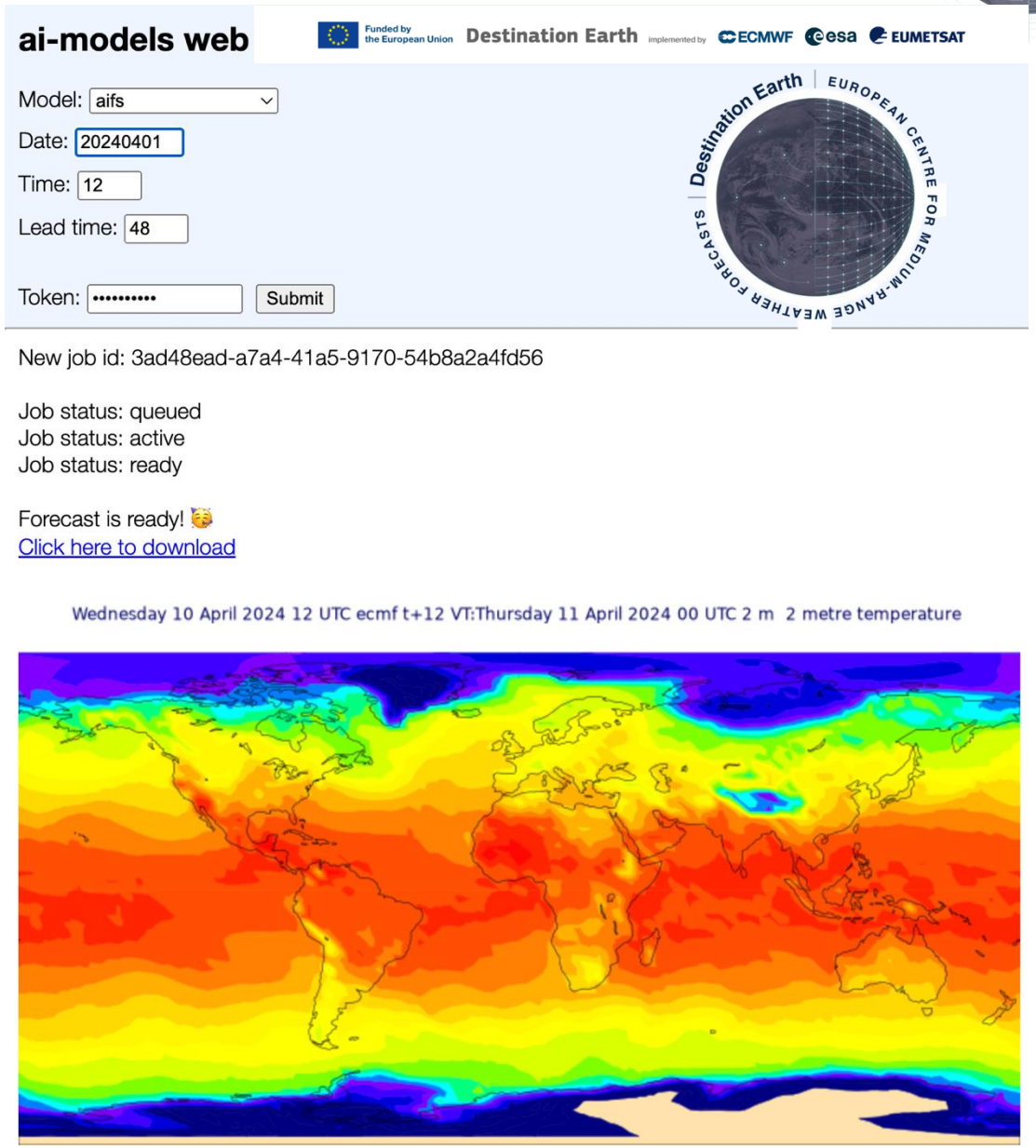

ECMWF EARTH SYSTEM APPROACH
SUN
ATMOSPHERE
Turbulence
Solar radiation
Sea-ice atmosphere coupling
Sea-ice ocean coupling
OCEAN
Wind stress
Terrestrial radiation
Trace gases and aerosols
Evaporation
Human influences
Heat exchange
Precipitation
LAND
Land-atmosphere coupling

Forecast-in-a-box

Providing a packaged system with data-retrieval, forecasting & postprocessing.

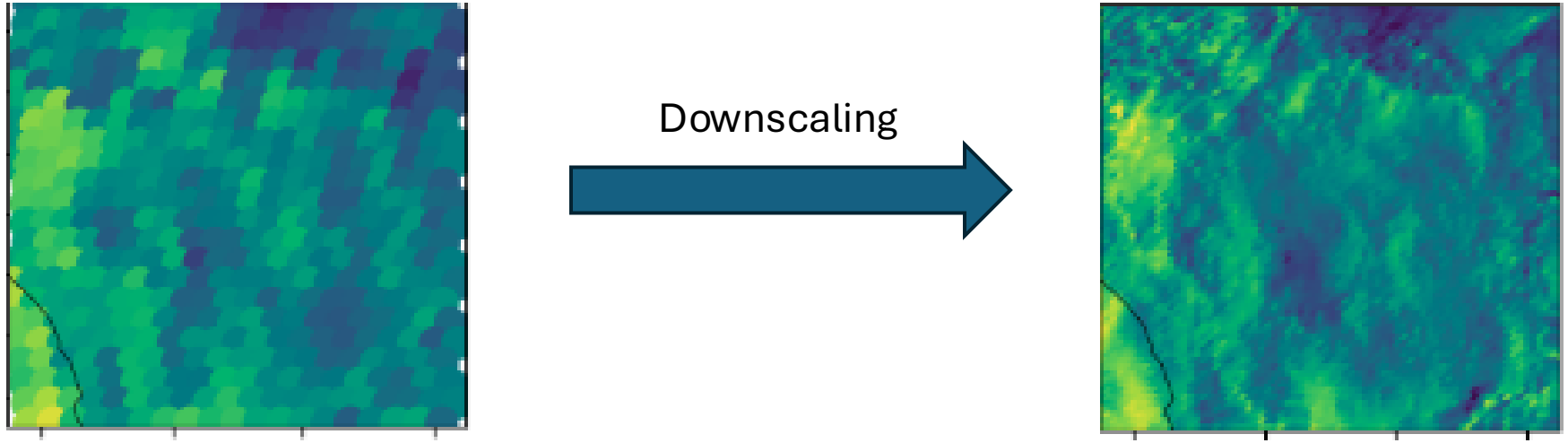
This system runs on local hardware or cloud and is delivered in a matter of minutes

It is configurable for Earth-System components and user-defined outputs.



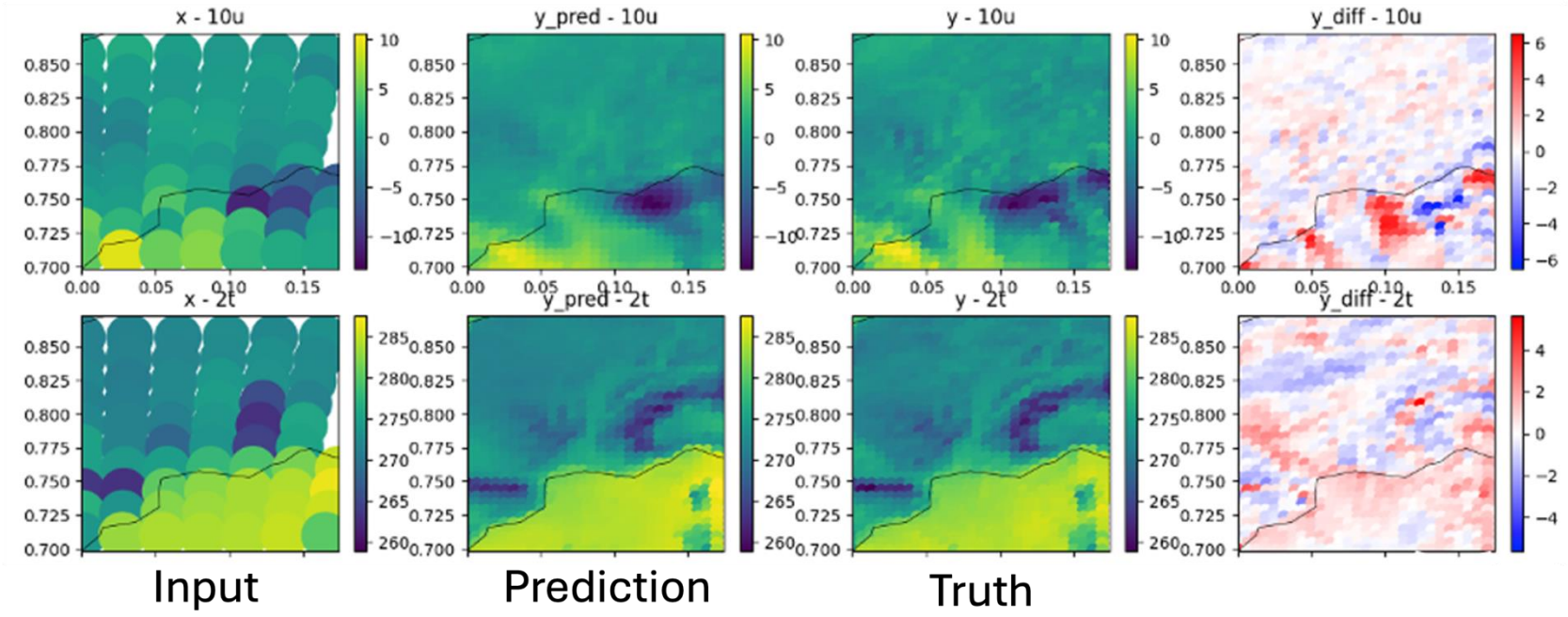
Downscaling ensemble members to km-scale resolutions (ongoing work)

- Generating km-scale large (>>10 members) global ensemble forecasts is crucial to quantify extremes
- Apply deep learning to produce high-resolution ensembles
  -> several orders of magnitude cheaper in computation time than classic approaches



Leverage uncertainty

- Of coarser ECMWF ensemble forecast products (such as the medium range ensemble)
- Given by the data distribution learned by the probabilistic approach



Summary of AI activities

Towards an earth-system machine learning model leveraging DestinE data

Developing end-to-end workflows for ML model components like land, ocean, sea-ice, hydrology

Enhance Digital Twin Engine with ML pipelines from training to post-processing

Using data-driven methods for uncertainty quantification of Extremes and Climate Digital Twin

Climate emulator to rapidly explore ‘what-if’ scenarios

Enhanced interactivity

Developing a forecast-in-a-box concept.

Building ML demonstrators for impact-sectors (e.g., health, agriculture, urban)

Develop of a weather and climate chatbot