

1st DestinE User eXchange 2023

15th February 2023 | ESA-ESRIN | Frascati (Rm), Italy

Use cases from DT Climate

Sami Niemelä¹, Heikki Tuomenvirta¹, Christian Steger², Stephan Thober³, Roberto Chavez⁴, Aleks Lacima⁴, Miguel Castrillo⁴, Katherine Grayson⁴, Aparna Chandrasekar³, Barbara Früh², Marta Terrado⁴, Gerrit Versteeg⁴, Francisco Doblas-Reyes⁴, Timea Biro⁵, Jenni Kontkanen⁵

*FMI*¹, *DWD*², *UFZ*³, *BSC*⁴, *CSC*⁵



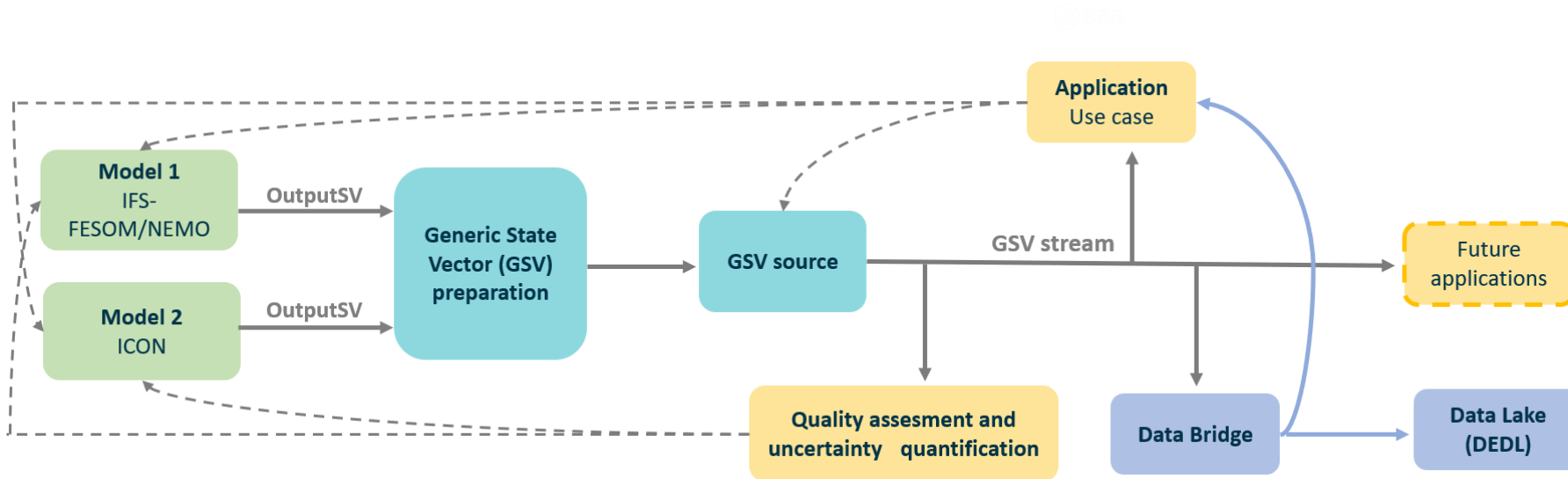
USE CASES AS A PART OF CLIMATE-DT (DE340)

- The long-term vision is to provide new tools for climate adaptation policy making and expand the user community, i.e., to allow the climate DT to scale across applications.
- Five different use cases are chosen to demonstrate the fidelity of the information provided by the ESMs within climate DT and to ensure that climate DT addresses the needs of different impact sectors.
 - **Wildfires** (e.g. impact of land use policies on wildfire risk)
 - **HydroRiver** (e.g. climate impact on key hydrological processes)
 - **HydroMet** (e.g. Hydro-meteorological extremes and their change)
 - **Energy** (e.g. future changes in wind energy resource.)
 - **Urban** (e.g. variability of heat waves in urban environments)

VISION OF HOW USERS WILL WORK WITH CLIMATE-DT

The digital twin aims to renew the way climate information has been provided and used, for instance in the context of CMIP or CORDEX. Time-scales from the order of years to months/weeks.

WHAT IS NEW?



VISION OF HOW USERS WILL WORK WITH CLIMATE-DT

The digital twin aims to renew the way climate information has been provided and used, for instance in the context of CMIP or CORDEX. Time-scales from the order of years to months/weeks.

WHAT IS NEW?

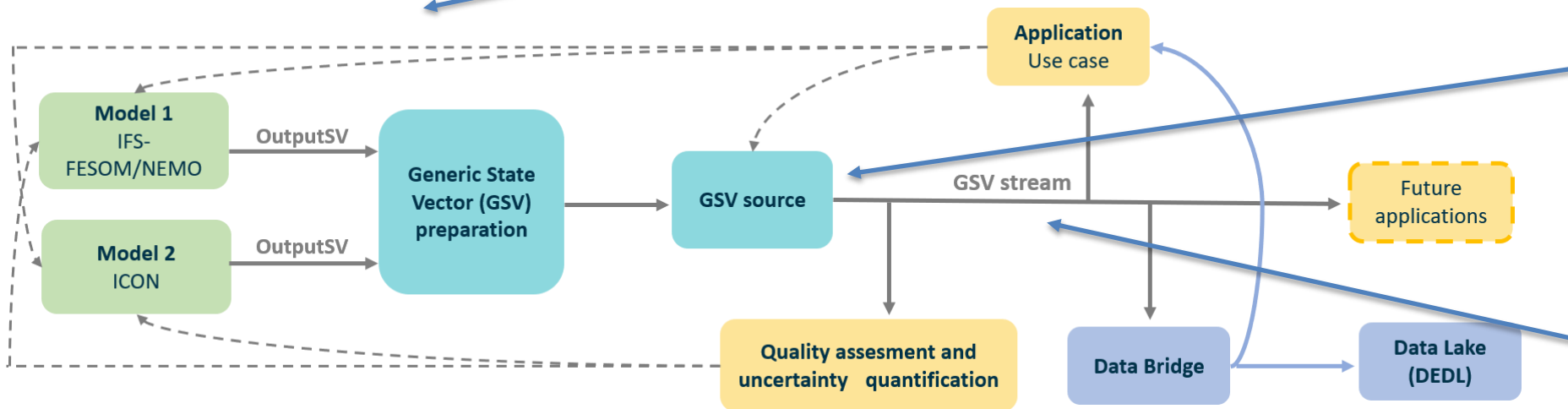
Interaction: iteratively contribute to the design of the experimental setup of climate models and request additional variables and indicators

Continuously streamed climate model data:

- high frequency
- native resolution
- common grid
- data available during runtime

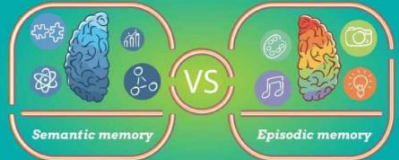
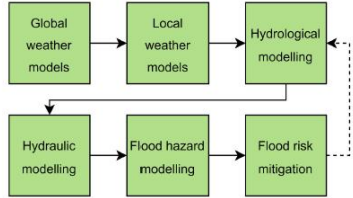
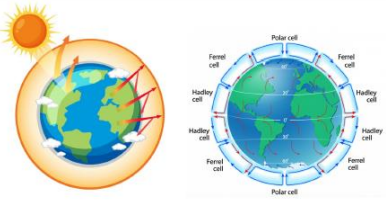
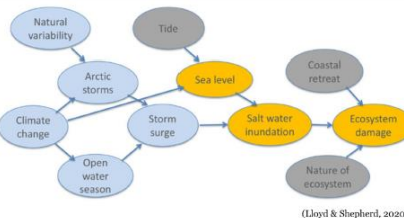
One pass algorithms:

- data reduction tasks
- updated summary statistics
- on-the-fly bias correction



THE GOALS OF THE USE CASES IN CLIMATE-DT DURING PHASE 1

- To demonstrate the novelty, potential and advantages the DT offers.
- To provide technical recipes for users to access the data and to link application or impact models to digital twin.
- To provide the results of the use cases in the form storylines that are physically self-consistent unfoldings of historic extreme events in plausible future climates

<p>Risk awareness</p> <p>Communication without stories is practically impossible</p> <p>People are more likely to respond to stories than to factual information</p>	 <p><i>(The Human Memory, 2019)</i></p>	<p>Decision-making</p> <p>Storylines can stress-test the vulnerability and exposure context of users to extreme (compound) events</p> <p>A modelling chain can link hazards to impacts</p>	 <p><i>(Sillmann et al., 2021, based on NFRF, 2016)</i></p>
<p>Separating uncertainty</p> <p>Dynamic drivers of the hazard are partly restricted, causing the changes in hazards to be dominated by thermodynamics</p> <p>It gives higher signal to noise ratio, useful for subsequent impact analysis</p>	 <p><i>(grfurf, 2022 & Internet Geography, 2022)</i></p>	<p>Exploring plausibility</p> <p>There's a strong need to understand the physical processes underlying climate change (extremes) as it triggers society to respond</p>	 <p><i>(Lloyd & Shepherd, 2020)</i></p>

Four characteristics of why a storyline approach has potential



STATUS AND PLANS OF USE CASE IMPLEMENTATION IN DE340 DURING PHASE 1

