Extreme flooding in the Vesdre valley in July 2021

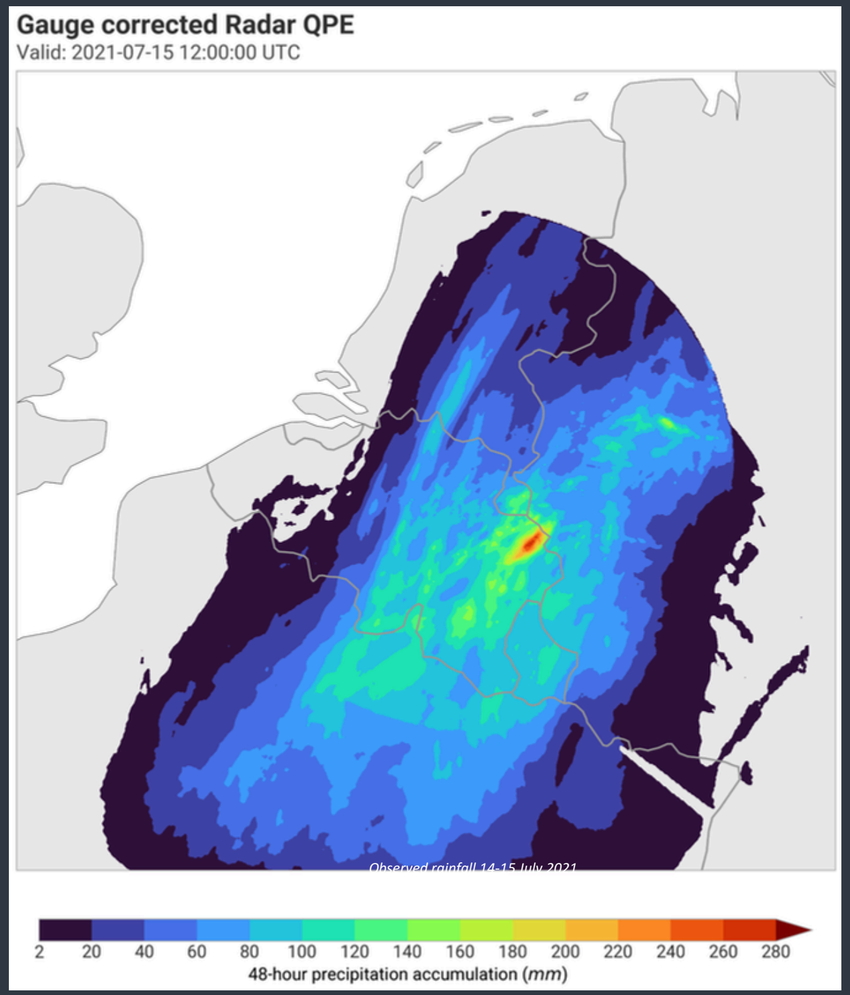
Support to disaster risk management in Belgium by the Extremes Digital Twin

A natural disaster that resulted in a human tragedy

39 lives lost

billions in damages

>3 years of recovery effort



RMI issued a red alert for heavy rainfall

"During this crisis, the Royal Meteorological Institute issued a red alert. This warning was grounded in the best science and technology available at the time, drawing on numerical forecasts from ECMWF combined with high-resolution limited-area models developed in collaboration with national meteorological services across Europe. "

Prof. dr. David Dehenauw,
Head of Forecasting, RMI

Funded by the European Union Destination Earth implemented by ECMWF esa EUMETSAT

RMI

Extreme flooding in the Vesdre valley in July 2021

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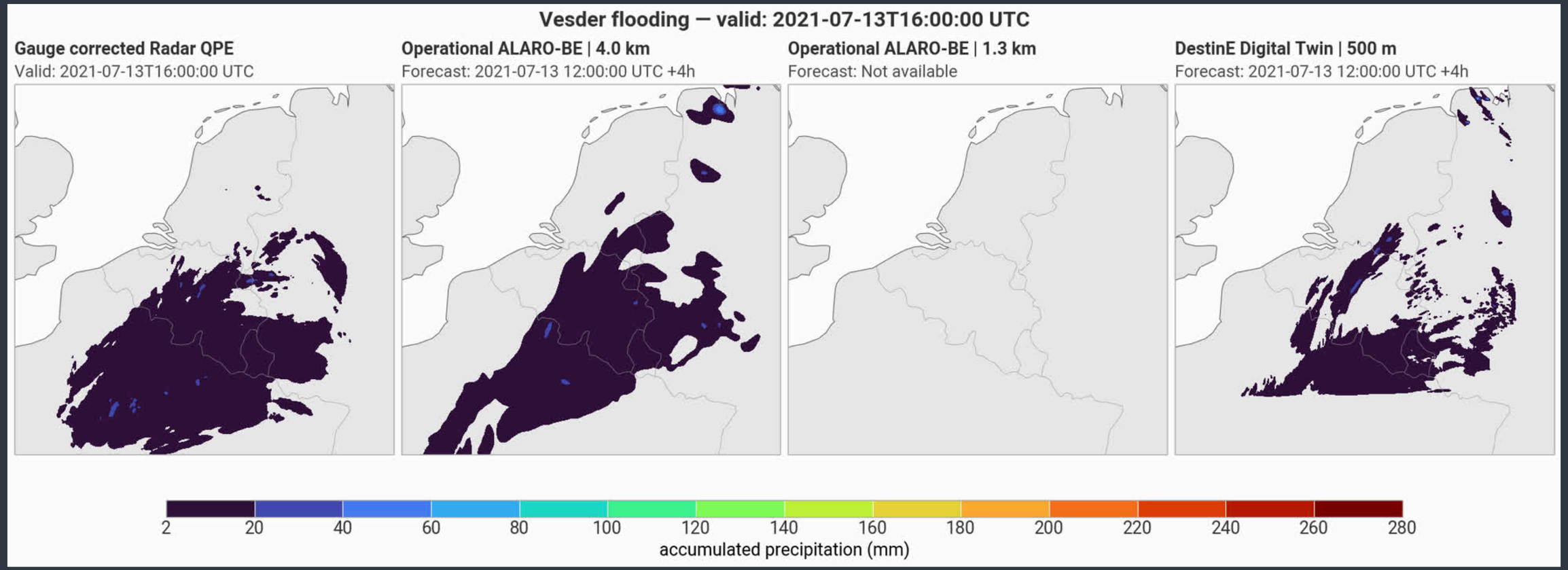

Destination Earth Extremes Digital Twin: the power of higher resolution

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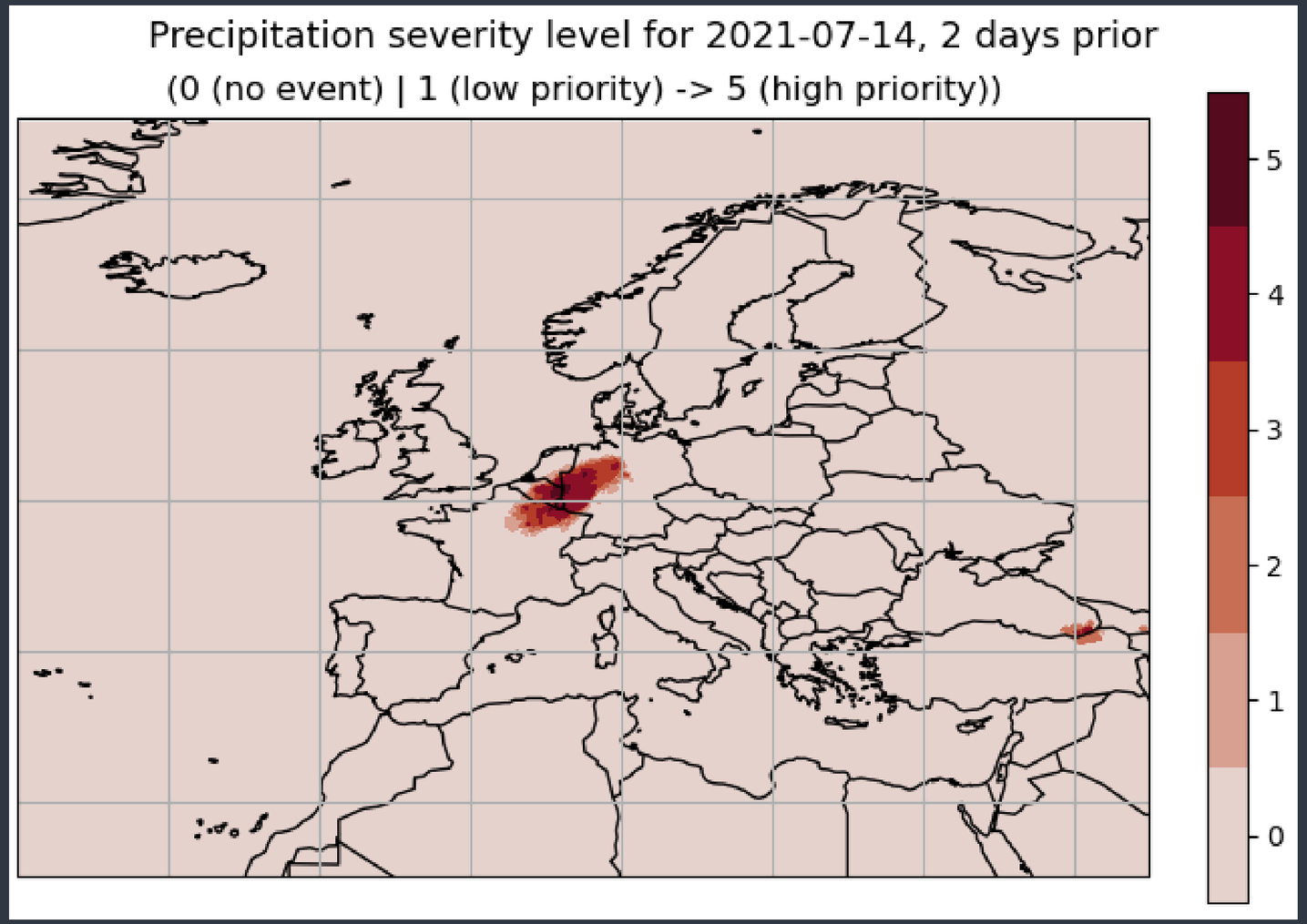
RMI

Exploiting novel Destination Earth technologies at the RMI

DE_330: Detection of extreme weather events

The **Extreme Detection Framework** (EDF) produces **severity levels** by comparing forecasts with climatology made from reforecasts.

During the **extreme rainfall event** of 14 July 2021, the EDF would have indicated its **highest severity level two days prior to the event**, ahead of the red warning issued by the RMI based on conventional forecasting approaches.



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RMI

Exploiting novel Destination Earth technologies at the RMI

DE_330: exploiting EURO-HPC

EUROHPC Joint Untaking provides enormous **computing power** needed for **forecasting at high resolution**. Belgium is a partner in the LUMI consortium.

The ALARO LAM numerical weather mode used by RMI was adapted to efficiently use its GPU-based computing power.

The LUMI and LEONARDO supercomputers of EuroHPC, resp. #9 and #10 on the TOP500 supercomputer list.

Exploiting novel Destination Earth technologies at the RMI

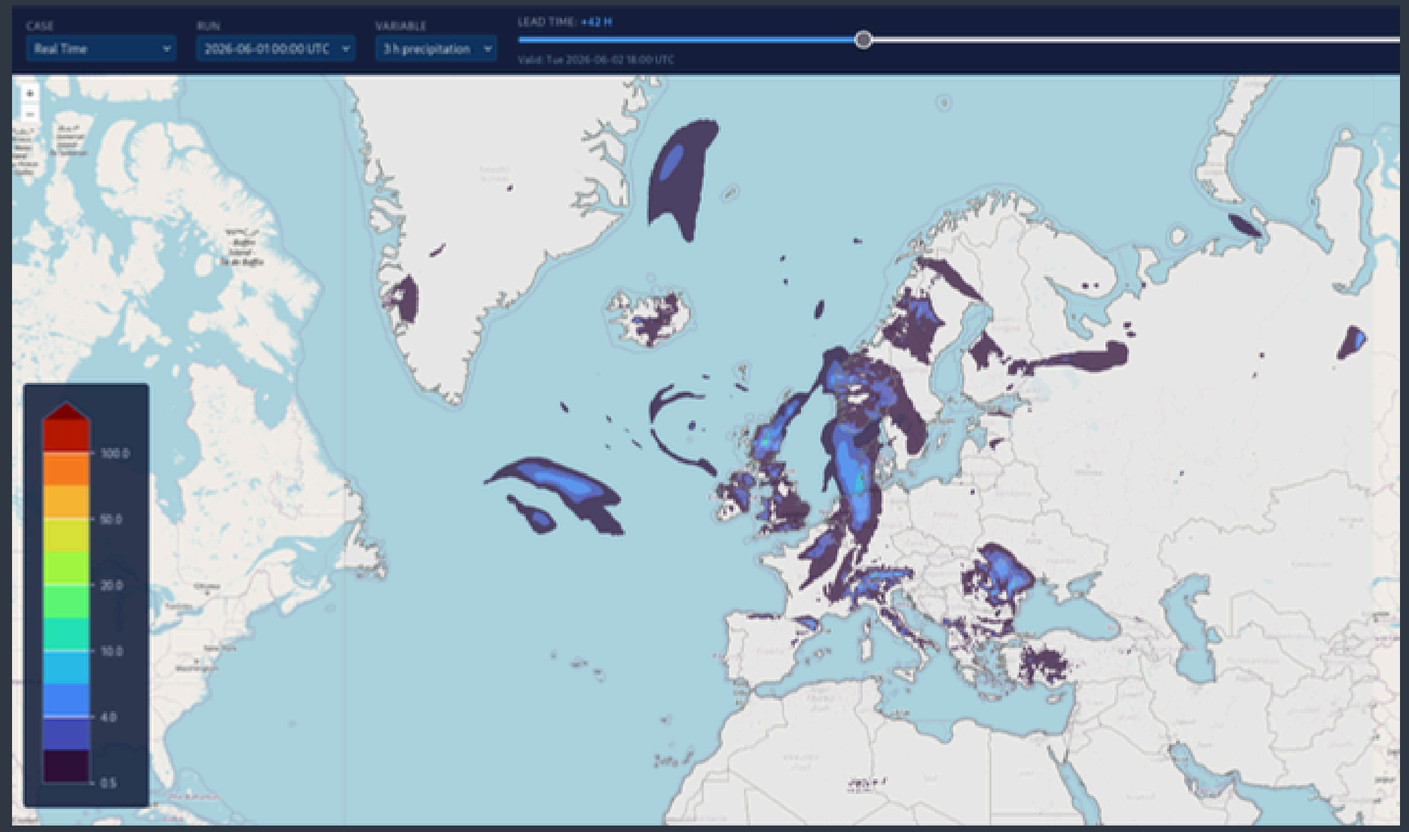
Development of a regional version of the AIFS within the ML Pilot Project

Co-development of anemoi-LAM configuration

- 30+ training experiments
- 100+ training runs leading to a **CERRA-based LAM model**

Data-Driven Limited Area Model

- Developments within the MLPP framework
- First model pre-operational



Upgrade is currently being made using GPU.hours on LUMI through the Belgian LUMI consortium membership.

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RMI

Destination Earth use cases by the RMI and partners

DE_374a: High Resolution forecasts for Next Generation Dynamic Line Rating computation

Static Line Rating

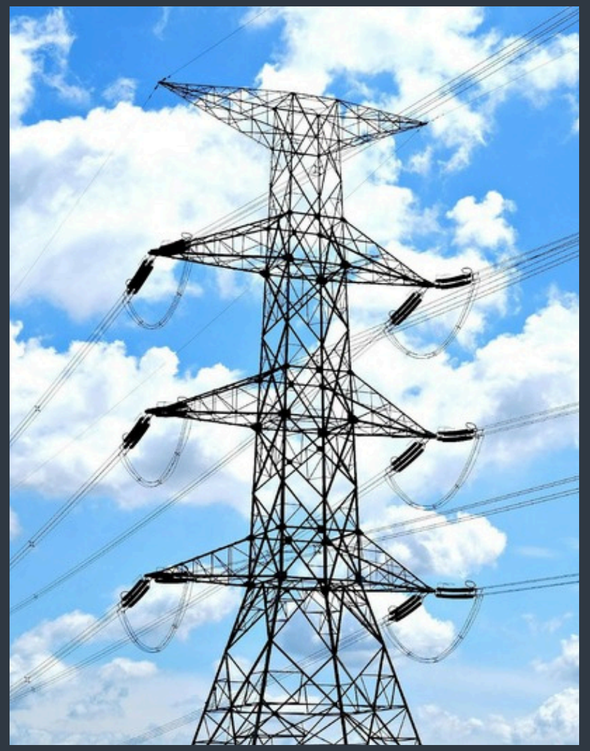
Conservative assumptions

Worst-case weather:

- Low wind speed
- High ambient temperature
- Clear sky radiation

→ Limits renewable integration

→ Underutilization of capacity



Dynamic line Rating

Weather dependent capacity

- Real-time conditions → Real-time capacity
- +40% to +170% capacity increase

→ Critical for renewable integration

→ Unlock extra transmission capacity

More electricity can be transported by taking advantage of favourable weather (cool and windy conditions)!

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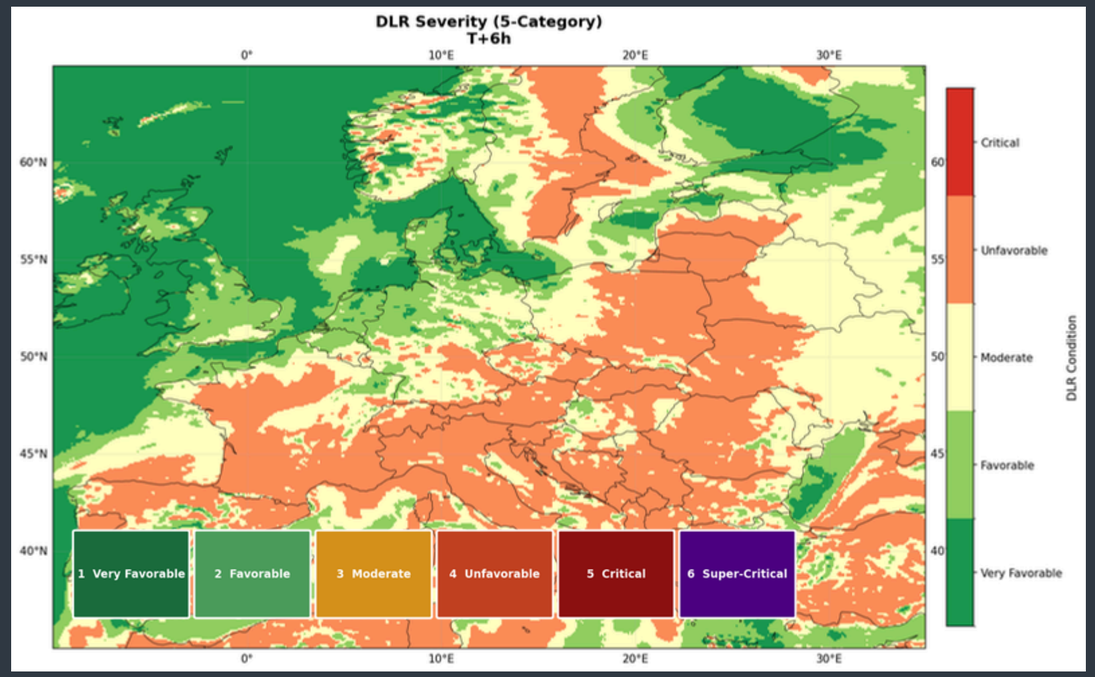
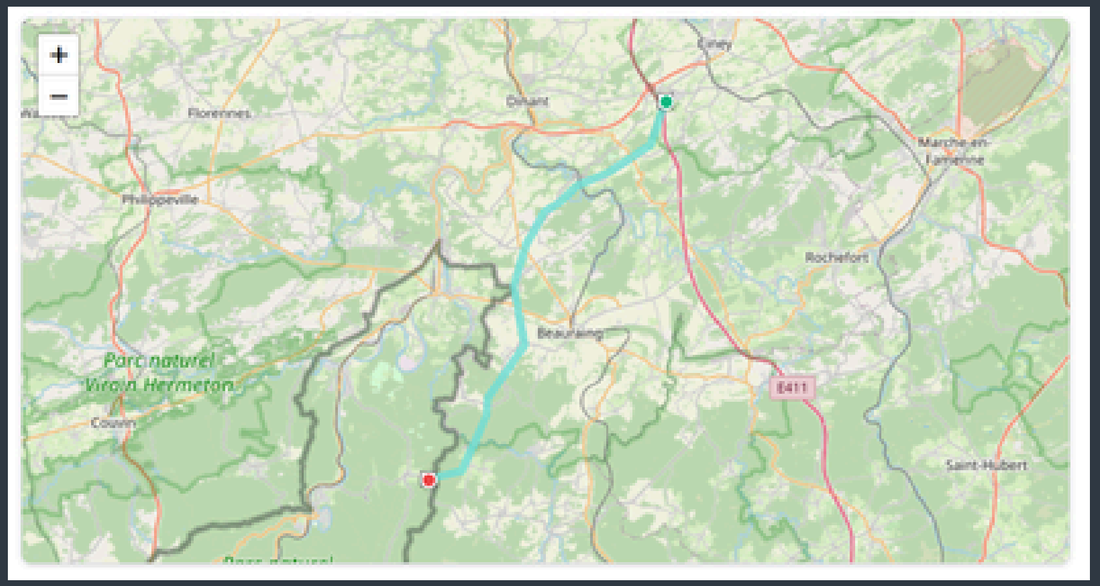
RMI

Destination Earth use cases by the RMI and partners

DE_374a: High Res. forecasts for Next Generation Dynamic Line Rating computation





DLR Severity Maps

- Compound-event severity scale, ensemble-based probability
- Operators receive actionable conditions, not raw meteorological fields

Multi-scale: continental to corridor

- From European-wide screening to identifying the single critical span 48 hours ahead
- DestinE Extremes Digital Twin (~750 m) + CIGRE / IEEE thermal model
- → spatially resolved ampacity per line segment - bottleneck identification at pylon level

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RMI

Destination Earth use cases by the RMI and partners

TALES project: Elaborating Tales of Future Weather to increase preparedness for extremes

Using **Tales of Future Weather** to increase preparedness for future extreme climate events. Crucial to have solid science basis and close collaboration with stakeholders!

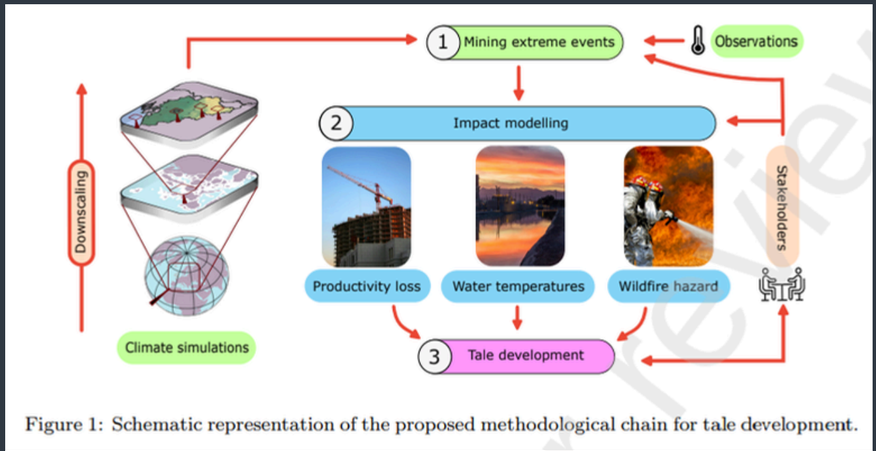

Figure 1: Schematic representation of the proposed methodological chain for tale development.

Successful Belgian **pilot on extreme heat Tale**. What would the impact of a 1976-heatwave in a GWL2 world?

sdsqd

Hittegolf zet gezondheidsinfrastructuur in Antwerpen onder druk

A tale of future weather presented in human language in the format of a news article. The tale is based on numerical climate model output.

Tale used for tabletop exercise organized by city of Mechelen for extreme heat crisis

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