

Extremes in a Changing Climate

Roar Skålin, DestinE User eXchange, 15.10.2024

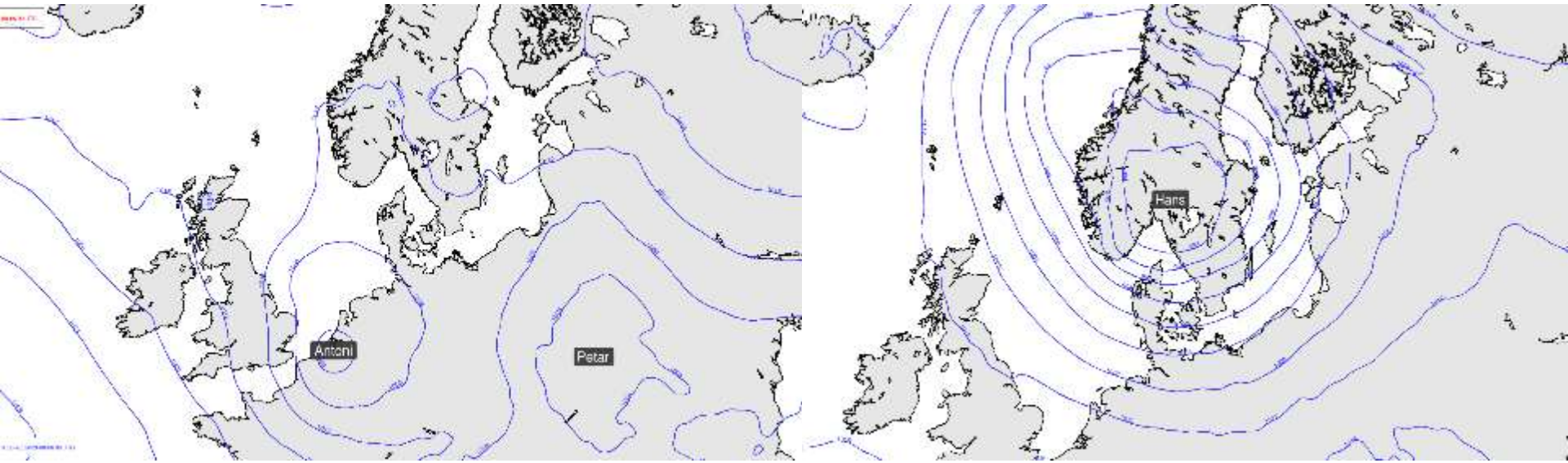


Norway August 2023: Hans



Video:
NRK

The synoptic situation leading up to Hans



“The severity of the event exceeded our expectations”

Why is this a common statement after extreme weather events?

- People base their interpretation of the forecast on how they were affected by previous events
- The formal definition of “extreme events” is based on thresholds (relative to “normal”) - the interpretation of what is “extreme” is individual and based on context
- The weather and flood forecast is not accurate enough
- The consequences of the event is not sufficiently explained and/or understood

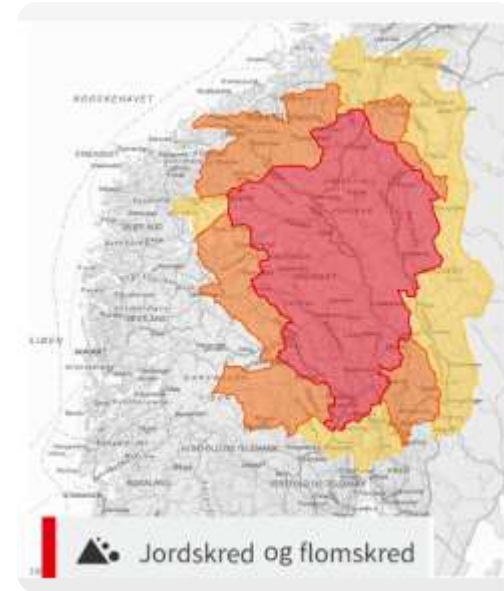


“Hans”: Lillehammer 8 August 2023.
Photo: Shutterstock

Adapt, Prepare and Handle

How to minimise the consequences if extreme weather events?

- **Mitigate:** We are running late but every tenth of a degree counts
- **Adapt:** What measures should we take the next 5-10 years?
- **Prepare:** What actions should we take when we receive the forecast, hours to days ahead of the event?
- **Handle:** What actions should we take the first hours and days following the event?



Adaptation is not for free

The cost to secure

- Norwegian buildings against floods and landslides: 8 Bn Euro
- 20 vulnerable roads in Norway: 1.2 Bn Euro

How do we know what the best and most cost efficient measures are?

How high cost are the public and the politicians willing to accept?



Foto: Odd-Arne Mikkelsen/NVE



Foto: Rakkar / Firda Tidend

Cost-efficient Adaptation using the Digital Twins

- DT Climate discovers events we can expect in a changing climate - based on scenarios (“what if”)
- DT Extremes simulate local effects of likely, but not yet observed, events (“what kind of weather events can I expect in my home town in a changing climate”)
- The DestinE ecosystem offers resources to simulate events and analyze their downstream effects (agriculture, infrastructure, urban life etc)
- The result is a solution for investigating adaptation measures that will provide the high societal value over the next 5–10 years.

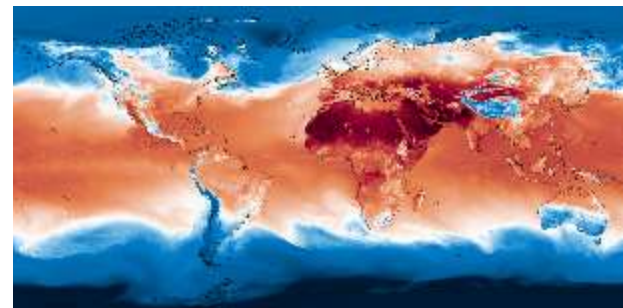


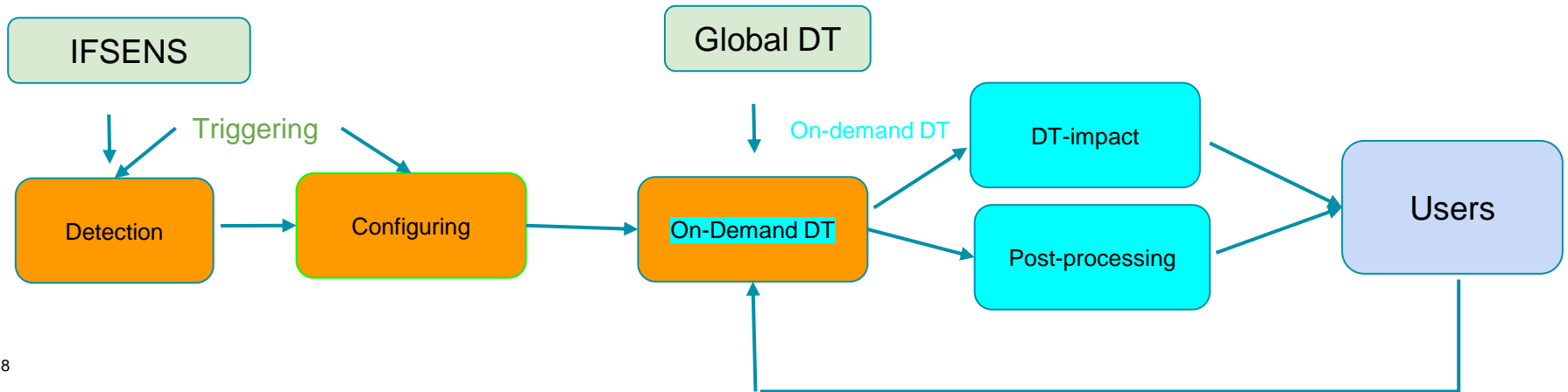
Illustration by ECMWF

Local impact-based forecasting

- The On-Demand Extremes DT is triggered for extreme events occurring over Europe
- Based on the ACCORD models and boundary conditions from the global Extremes DT
- Provides forecasts for a couple of days and offers insights into downstream effects

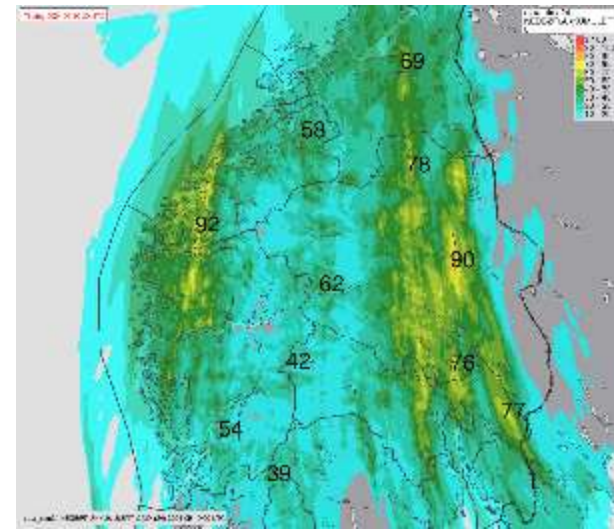
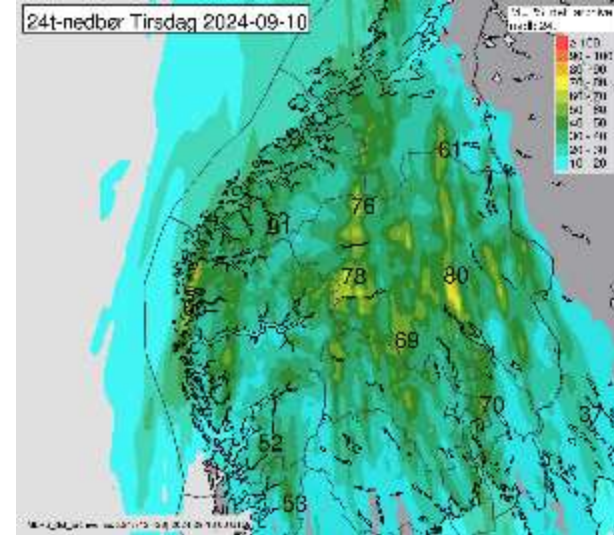
Operational use requires

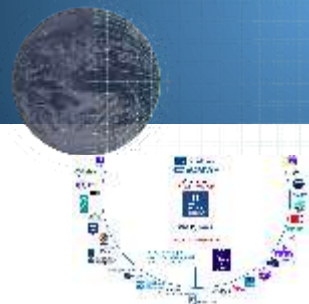
- Regular testing on real events
- Close collaboration between the responsible agencies



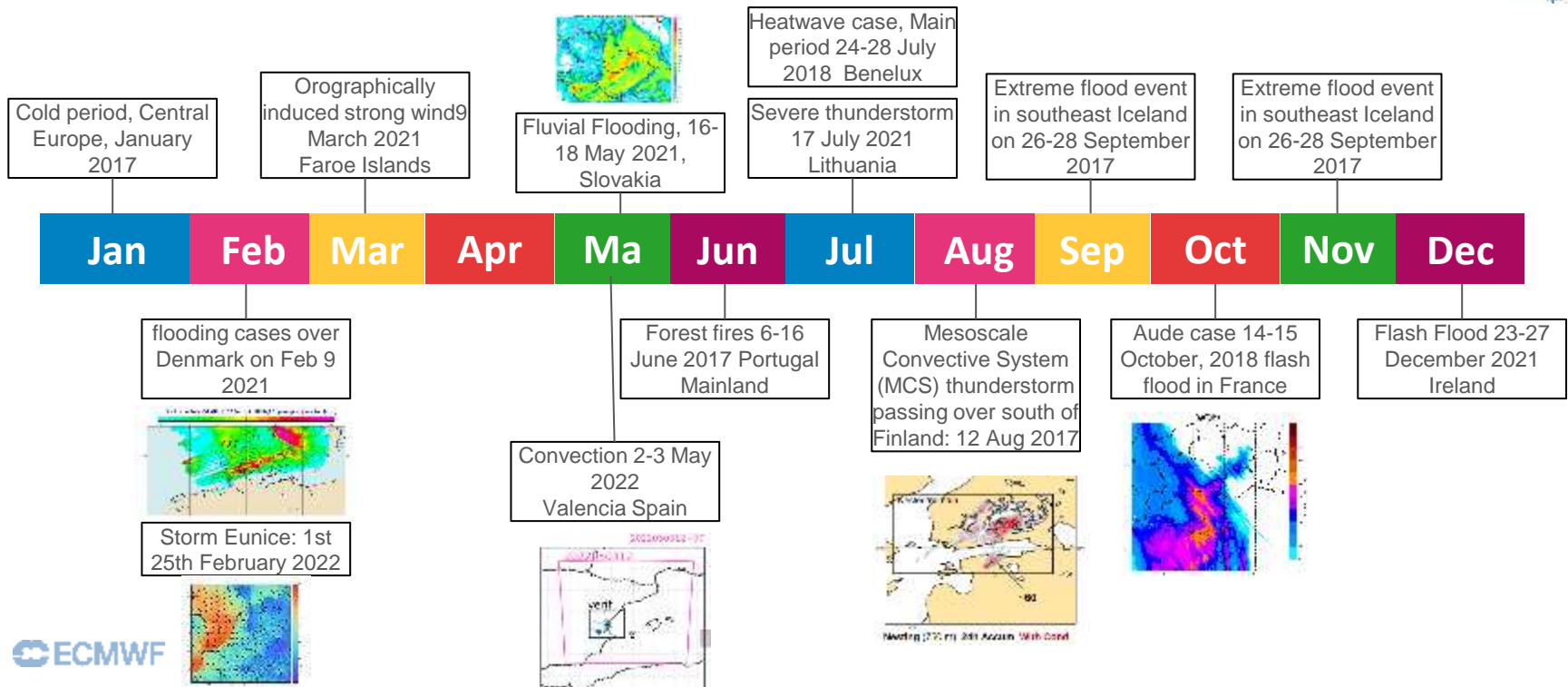
Establishing trust in DT Extremes

- Testing the model on cases that has proven difficult to forecast with existing models
- Situations where we issue Yellow and Orange warnings are often difficult to forecast accurately but may have huge consequences
- Case from 10 September 2024 - up to 90 mm precipitation and floods. Operational model (top) and DT Extremes (bottom). DT Extremes had better representation of the precipitation





Value demonstration: Many events analysed using the DEODE prototype



Handling the extreme event

Downstream effects may last for days or even weeks

- precipitation events leading to floods in major rivers
- heatwaves or precipitation with long term consequences for agriculture

The Digital Twins should be used for simulating the weather extremes and the downstream effects also once the event has passed.



“Hans”: Gol in Hallingdal 10 August 2023.
Photo: Shutterstock

Human behaviour in Digital Twins

Photos: NRK

The damaging effect of the Hans was substantially reduced by regulating the level in the water reservoirs

The value of the Digital Twins will be enhanced by the ability to model human the effect actions that could reduce the damage (or, if done inappropriately, increase the damage)



Handling the extreme event

Photo: TV2

“Overall, the extreme weather Hans was handled in a very good way. **Early and accurate forecasting and coordination between the various actors**, especially between the state administrators, the Norwegian Water Resources and Energy Directorate (NVE) and the Norwegian Meteorological Institute (MET), **was crucial for a good and coordinated handling.**”

Evaluation of the extreme event Hans. Report by the Norwegian Directorate for Civil Protection (DSB), September 2024
(my translation of the conclusion)





Norwegian
Meteorological
Institute

Thank you