

# DEODE

## The On-Demand Extremes DT project in Destination-Earth

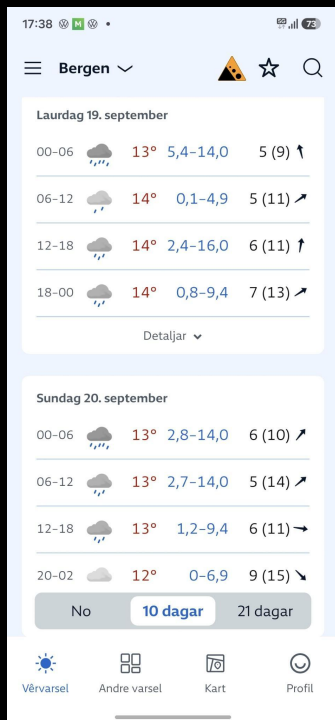
Ulf Andrae, SMHI

Metodkonferensen 23-24 september 2026

Vad gjorde ni i helgen?



# Vädret i Bergen den gångna helgen



11:53 📶 📶 📶

Bergen

**Pågår: Jord- og flomskredfare**  
(Vestland og deler av Rogaland)  
Gult nivå

**Skildring**  
Pågående nedbør gir fare for jord- og flomskred.

**Tiltrådingar**

- Hold deg unna bratte skråninger, samt bekker og elveløp med stor vannføring
- Hold stikkrenner, kummer og andre vannveier fri for grus, søppel, kvist og løv
- Tette vannveier med oppdemmet vann kan forårsake skred
- Hold deg oppdatert om utviklingen av været, skred- og flomsituasjonen, og følg med på værradaren
- Beredskapsmyndigheter skal vurdere fortløpende behov for beredskap og forebyggende tiltak

**Konsekvensar**

- Skredhendelser kan forekomme
- Utsatte bane- og vegstrekninger kan bli stengt

**Område**  
Gjeld for Vestland og deler av Rogaland  
[\[varsom.no\]](#)

**Tidsperiode**

12° Tips oss

Bergens Tidende



32,9 millimeter regn var lørdagsfasit: – Våtere i dag

12° Tips oss

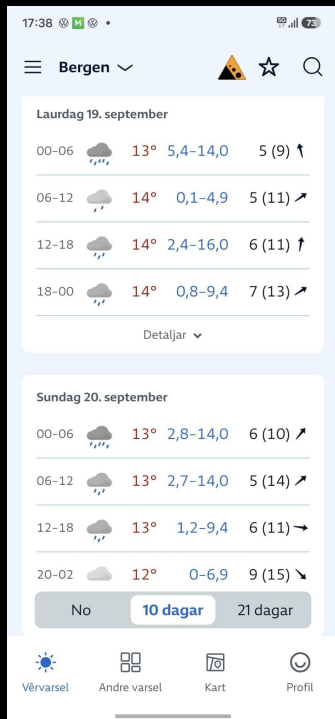
● Trafikken nå

E39 dirigeres etter jordras: – Ti meter bredt og en meter høyt

<https://www.bt.no>

<https://www.yr.no>

# Vädret i Bergen den gångna helgen



11:53

Bergen

**Pågår: Jord- og flomskredfare**  
(Vestland og deler av Rogaland)  
Gult nivå

**Skildring**  
Pågående nedbør gir fare for jord- og flomskred.

**Tilrådingar**

- Hold deg unna bratte skråninger, samt bekker og elveløp med stor vannføring
- Hold stikkrenner, kummer og andre vannveier fri for grus, søppel, kvist og løv
- Tette vannveier med oppdemmet vann kan forårsake skred
- Hold deg oppdatert om utviklingen av været, skred- og flomsituasjonen, og følg med på værradaren
- Beredskapsmyndigheter skal vurdere fortløpende behov for beredskap og forebyggende tiltak

**Konsekvensar**

- Skredhendelser kan forekomme
- Utsatte bane- og vegstreknings kan bli stengt

**Område**  
Gjeld for Vestland og deler av Rogaland  
[\[varsom.no\]](https://varsom.no)

**Tidsperiode**



Jølster:

● **Måtte stenge E39**

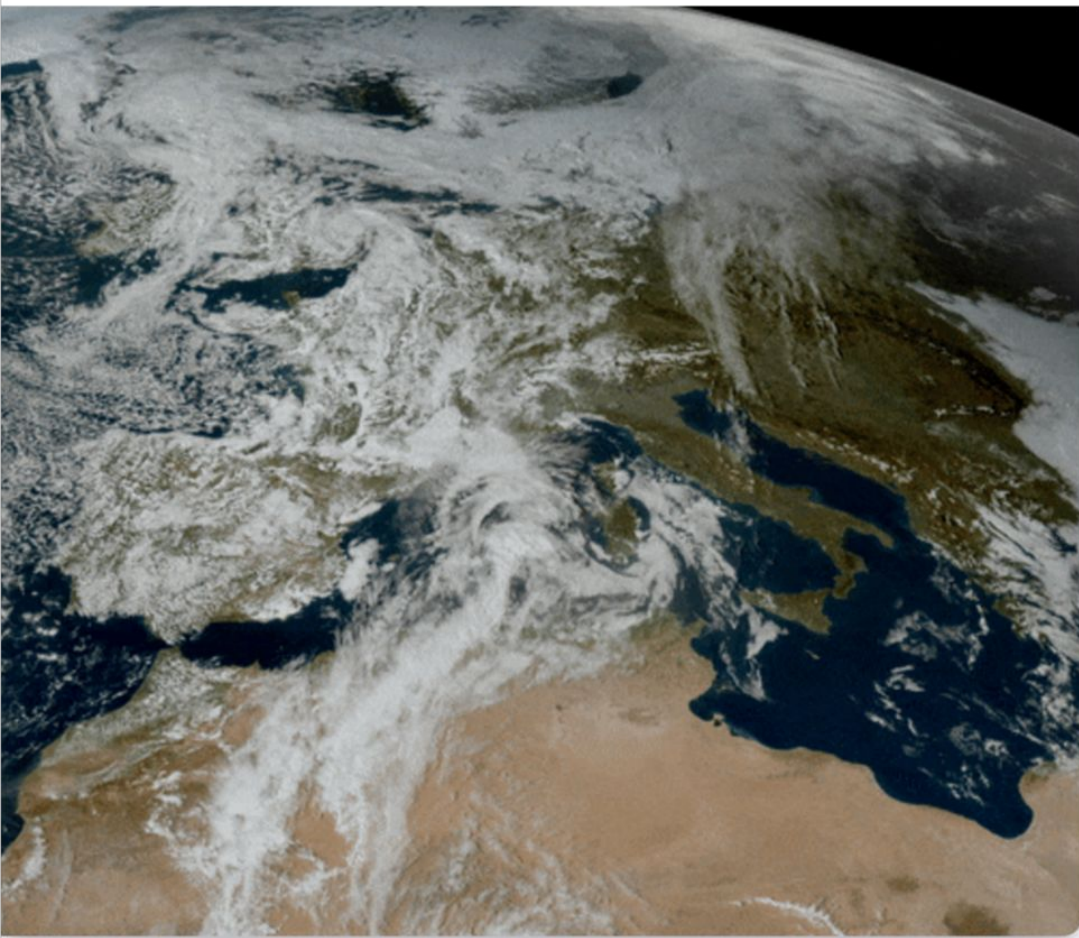
<https://www.firda.no/>

<https://www.yr.no>

# Syftet med DEODE:

Prognoser för extrema  
väderrelaterade händelser

- där det händer
- när det händer



# Destination Earth

Destination Earth is a flagship initiative of the European Commission to develop a highly-accurate digital model of the Earth (a digital twin of the Earth) to model, monitor and simulate natural phenomena, hazards and the related human activities. These groundbreaking features assist users in designing accurate and actionable adaptation strategies and mitigation measures.

DestinE unlocks the potential of digital modelling of the Earth system at a level that represents a real breakthrough in terms of accuracy, local detail, access-to-information speed and interactivity.

By pushing the limits of computing and climate sciences, DestinE is an essential pillar of the European Commission's efforts towards the [Green Deal](#) and [Digital Strategy](#).

## How DestinE will be used

DestinE will support tackling complex environmental challenges to:

- monitor and simulate the Earth's system developments (land



<https://destination-earth.eu/>

# Destination Earth System

<https://destination-earth.eu/>

DestinE enables users to access thematic information, services, models, scenarios, simulations, forecasts and visualisations.

The main components of the DestinE system are:



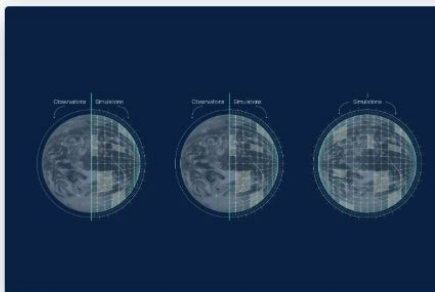
## DestinE Platform

The platform provides evidence-based decision-making tools, applications and services, based on an open, flexible and secure cloud-based computing infrastructure. The platform is implemented by [ESA](#).



## Data Lake

The data lake brings together data from [ESA](#) and [EUMETSAT](#), as well as from Copernicus, and many other diverse sources, with new data from the Digital Twins. It allows discovery and data access as well as big data processing in the cloud. The Data Lake is implemented by [EUMETSAT](#).



## Digital Twins and Digital Twin Engine

DestinE is creating several digital replicas covering different aspects of the Earth system and based on state-of-the-art simulations and observations. [ECMWF](#) is implementing the Digital Twin Engine, the complex software and data services needed for Earth System digital replicas, as well as the first two digital twins; Climate Change Adaptation, which provide multidecadal simulations, and the Weather-induced Extremes twin, with both high-resolution forecasts and on-demand simulations.

## ECMWF DestinE digital twins

### Weather-Induced Extremes DT



4.4km global upplösning  
Dagliga prognoser upp till 4  
dygn

### Climate Change Adaptation DT

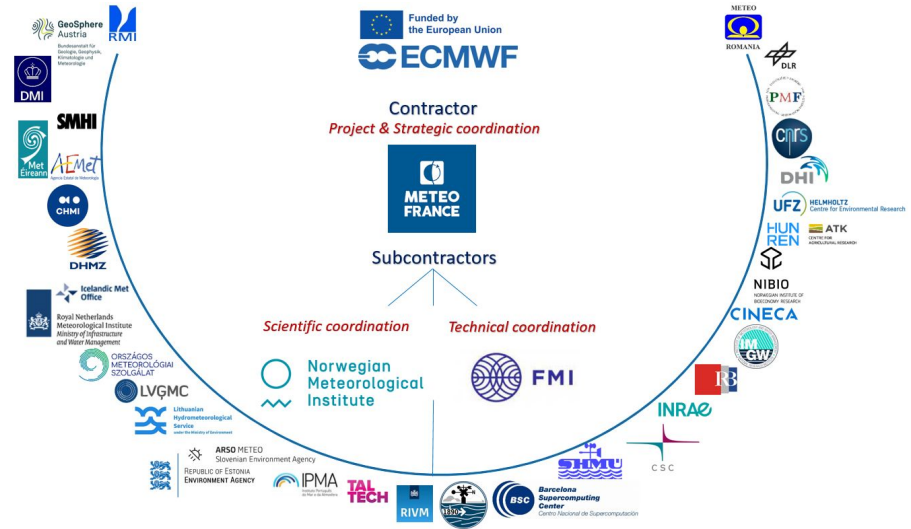


5-10km global upplösning

<https://destine.ecmwf.int/destine-factsheets/>

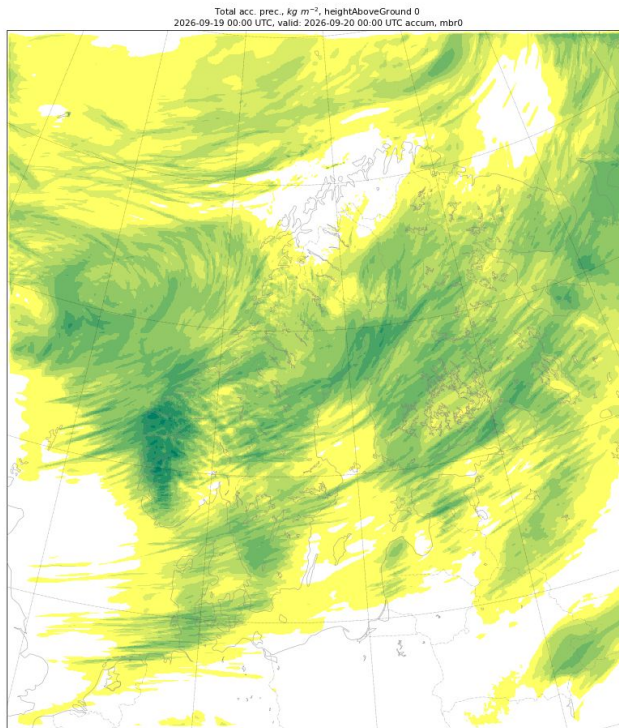
## DE330 (DEODE) är ett delprojekt inom DestinE

- Göra prognoser för extrema väderrelaterade händelser, där det händer, när det händer
- Hög upplösning globalt (4.4km) och på den lokala skalan (500m) för hög detaljrikedom. 750m för EPS.
- Nära kopplat med hydrologi, luftmiljö energisektorn och andra applikationer
- Startade hösten 2022. Inne i tredje fasen som slutar april 2028.

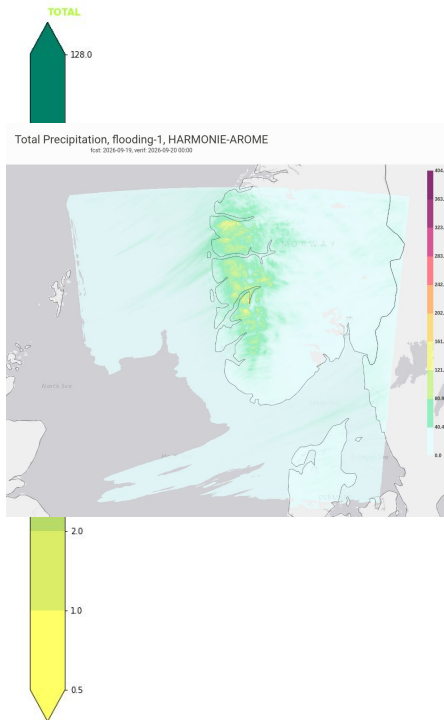


## Men vad är skillnaden mot SMHIs operationella prognoser?

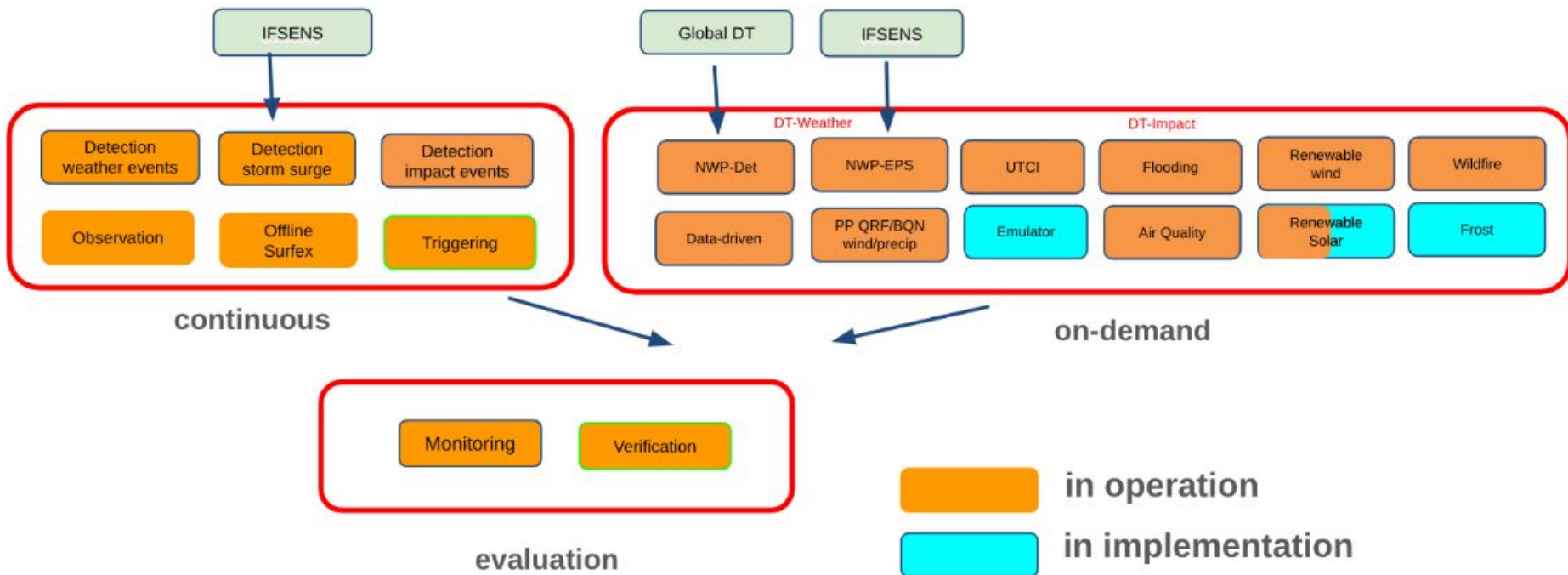
- 500/750m horisontell upplösning mot 2500m operationellt
- En ny domän varje körning (där det behövs). Gör i nuläget att det körs utan data assimilation
- Modellanpassningar för den högre upplösningen
- Endast en körning per dygn i nuläget, 8 ggr operationellt.
- Stort fokus för att tillrättalägga output för nedströms applikationer. Har [t.ex.](#) 5 minuters output för sol/vindkrafts applikationer



Max RAIN: 104.74 Max SNOW: 40.01 Max GRAUPEL: 48.78



## Samtliga komponenter i DEODE, mer än bara väderprognoser

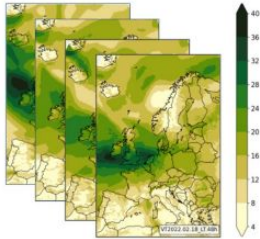


# Detektering av extrema händelser baserat på IFSENS

## Input data

Forecast data (e.g. from ECMWF ensemble prediction system or operational data from other regional or global NWP models)

a) Daily maximum wind gust (m/s) from ensemble of forecasts

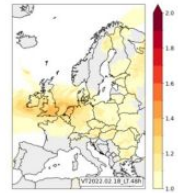


OPTI-THRED triggering applied on Storm Eunice (18 February 2022)

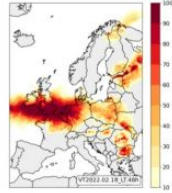
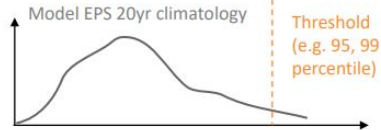
## Detection method

Threshold based methods calculated from climatological information

b) Measure of intensity (fraction over threshold)



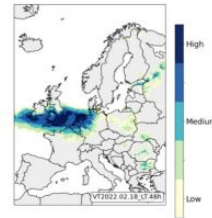
c) Measure of probability (%)



## Output information

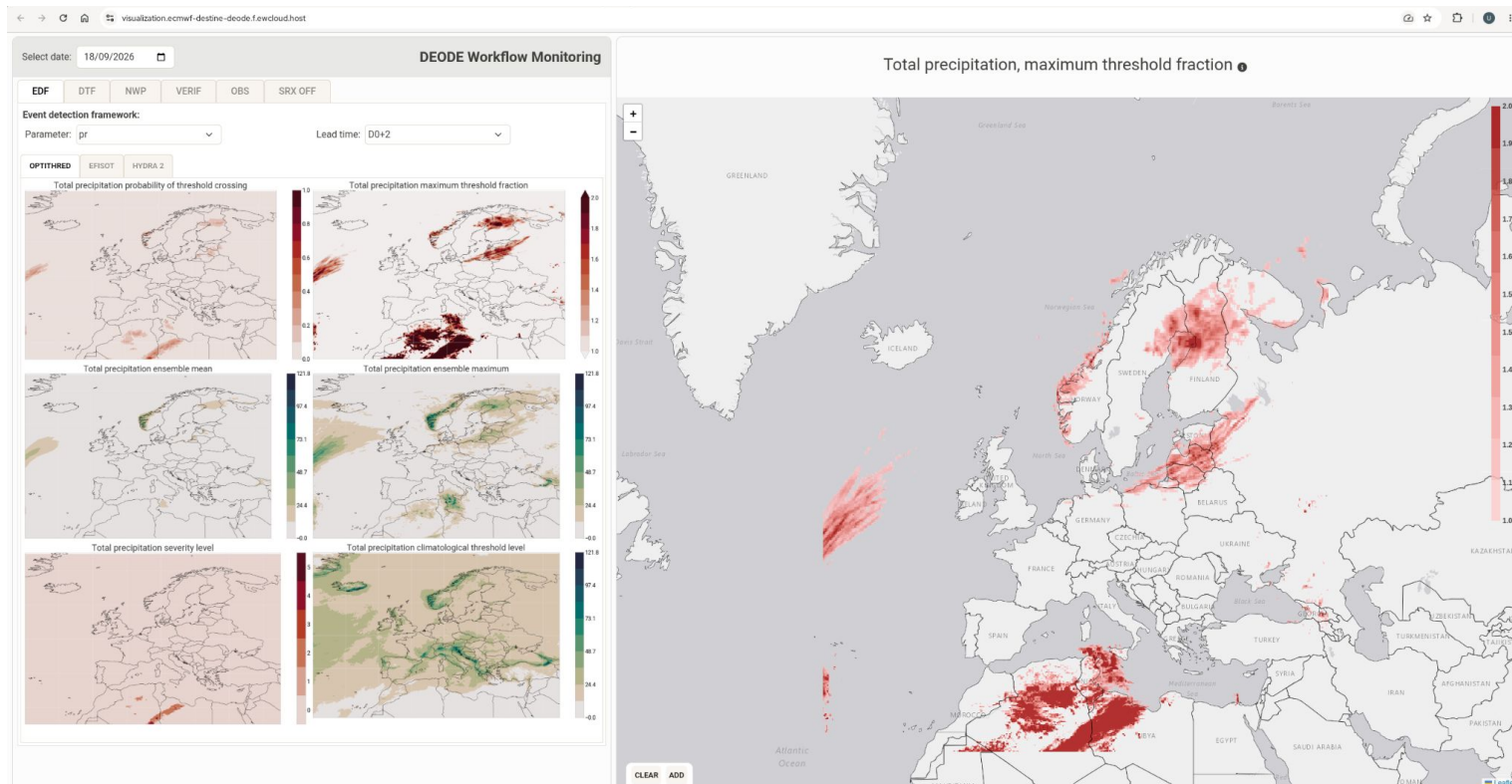
Output information categorized in 1 to 5 triggering priorities based on EPS agreement and intensity

d) Triggering information (priority)



- Vind/Byvind
- Nederbörd
- Min/Max Temp
- UTCI (värme index)
- Frostrisk

# Detekterade hög risk för kraftig nederbörd för helgen som var



# Från automatisk detektering till automatisk triggerering

## Automatisk triggade domäner i lila

Select date: 19/09/2026

### DEODE Workflow Monitoring

EDF **DTF** NWP VERIF OBS SRX OFF

**Deode triggering framework:**

Event: flooding  Lead time: D0+1

Pre-Mask: eventtype  Post-Mask: no mask

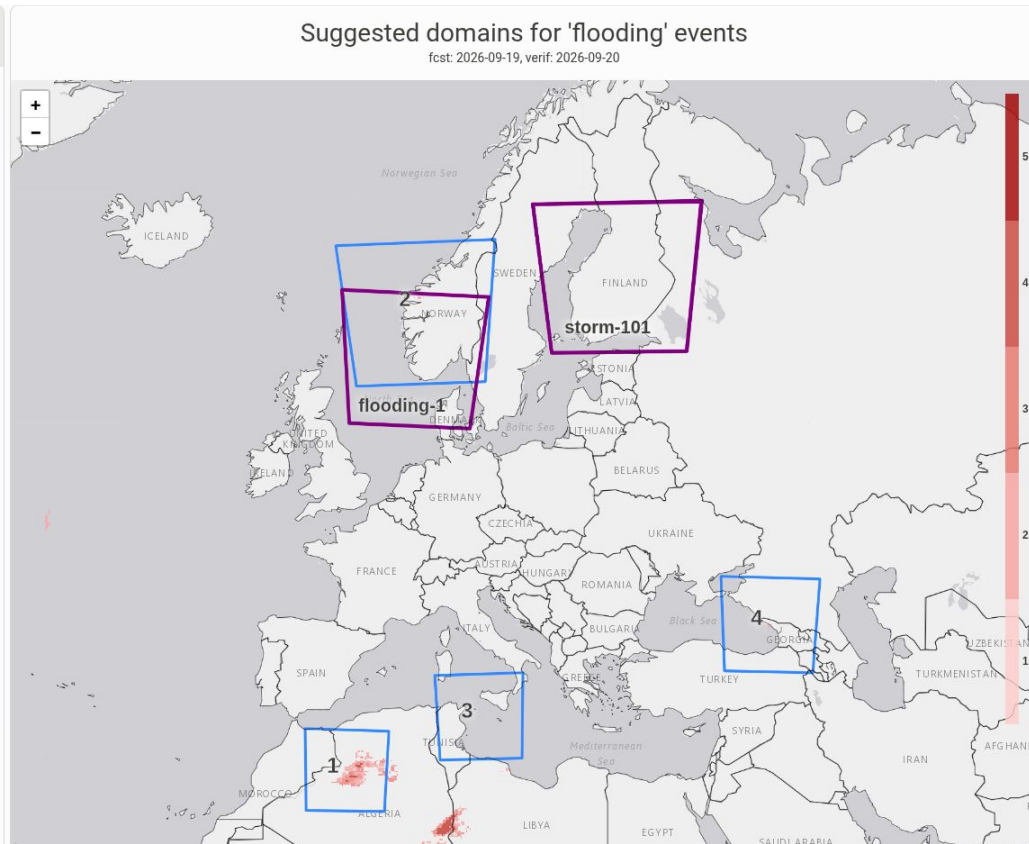
**DOMAIN 1** DOMAIN 2 DOMAIN 3 DOMAIN 4

[general]  
event\_type = "flooding"

[domain]  
xlncen = -0.5630318949343125  
xlatcen = 31.839122629316183  
number = 1

[general.times]  
start = "2026-09-19T00:00:00Z"  
forecast\_range = "P2D"

flooding



## För den intresserade så går det att prenumerera på information

A new DEODE DT run is available for your area of interest on FDB (ECMWF ATOS) for retrieval:

|                 |                       |
|-----------------|-----------------------|
| Event type:     | flooding              |
| Country code:   | NOR                   |
| Domain center:  | lat: 59.11, lon: 5.91 |
| Init date:      | 2026-09-19 00         |
| Forecast range: | +48h                  |
| Resolution:     | 500m                  |
| CSC/model:      | HARMONIE_AROME        |
| Run type:       | deterministic         |



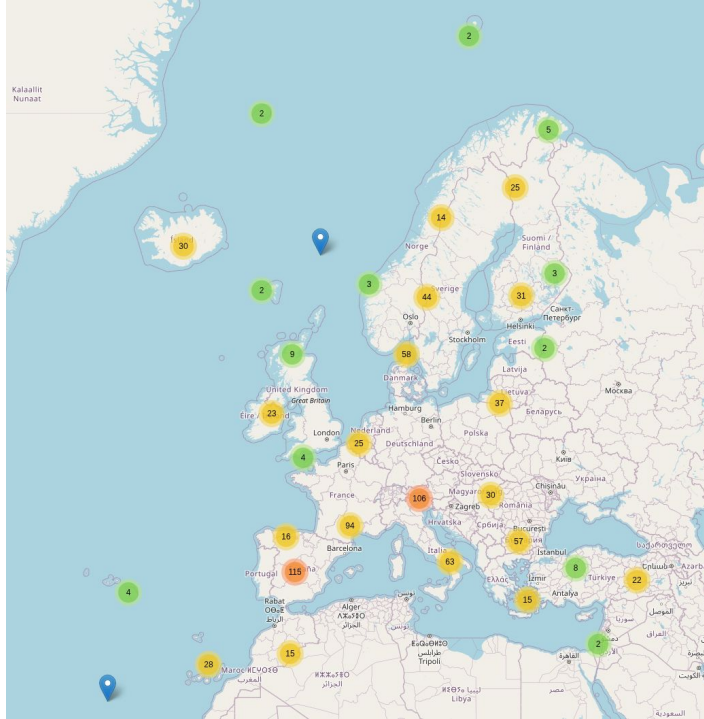
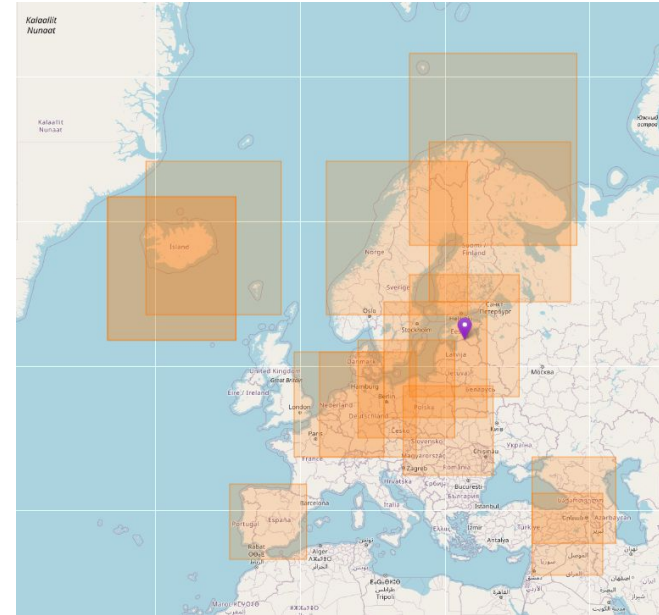
\*see fdb request syntax in the Appendix of the mail\*

In case of questions, you can reach the DEODE operational team under: [deode-oper-team\(at\)groups.ecmwf.int](mailto:deode-oper-team(at)groups.ecmwf.int)

The DEODE operational team

**Skicka mail till: [deode-oper-team@groups.ecmwf.int](mailto:deode-oper-team@groups.ecmwf.int)**

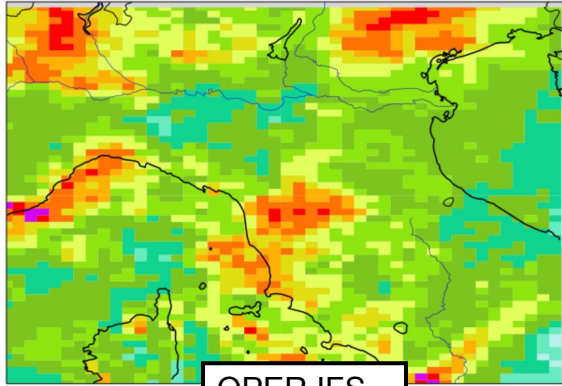
## Nära 900 körningar för extrema fall sedan 1a Sep 2024



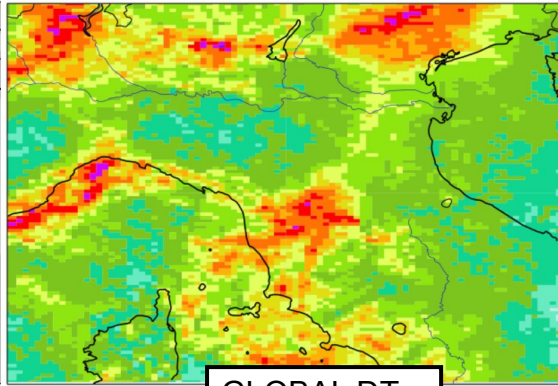
Körningar sedan 1a september 2026

<https://object-store.os-api.cci1.ecmwf.int/deode-dcmdb/stac-catalog/dcmdb-stac-catalog/index.html>

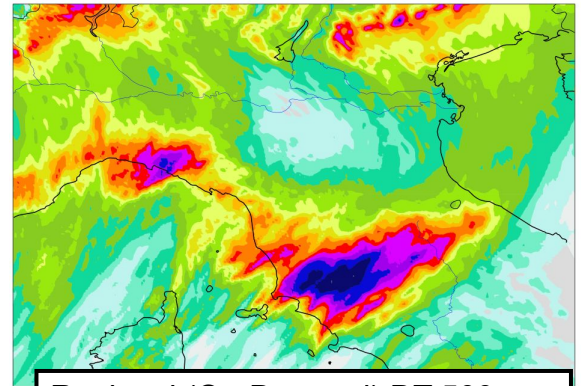
## Nederbördsexempel över Italien



OPER IFS

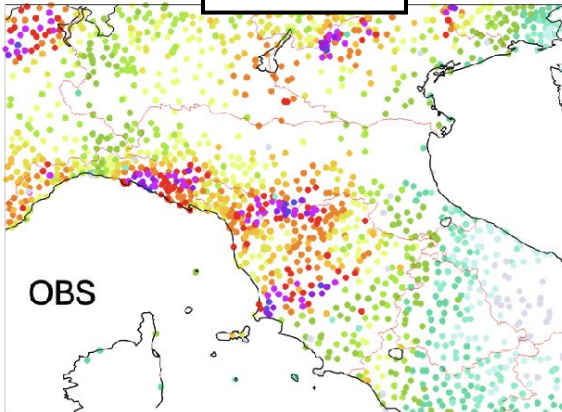


GLOBAL DT



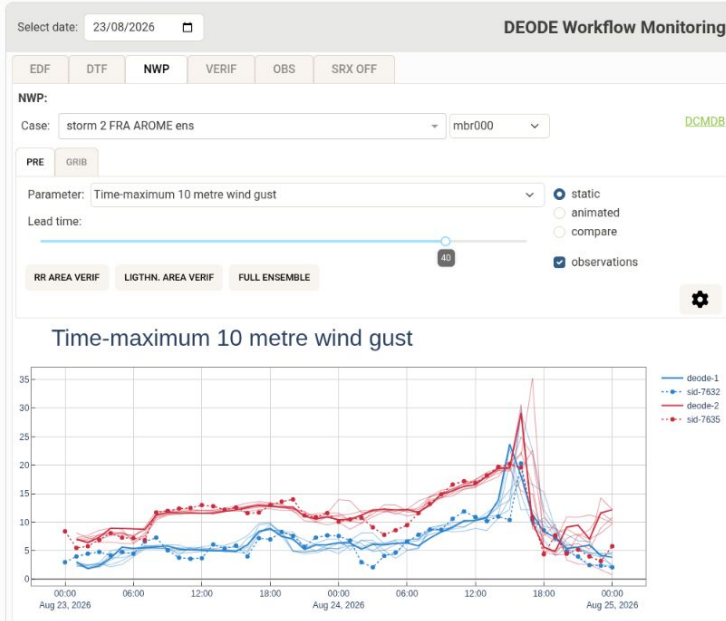
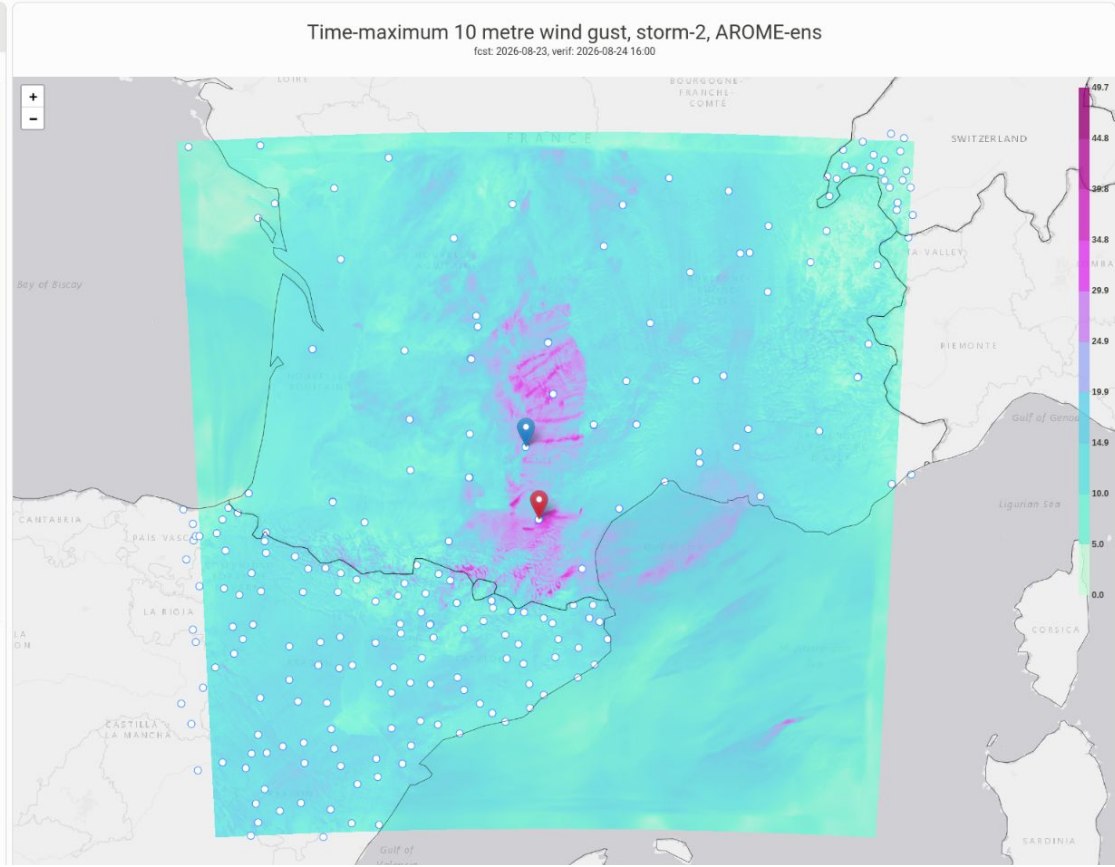
Regional (On-Demand) DT 500m

Forecast 17/10/2024 00 UTC **T+34h**

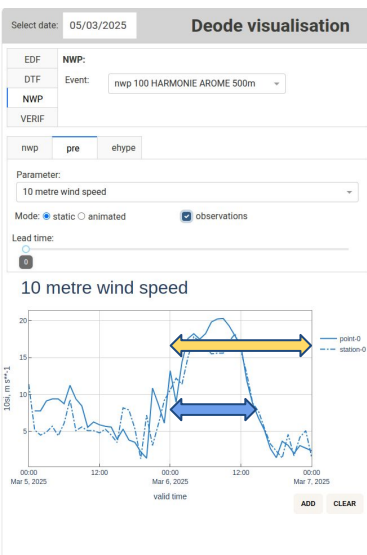
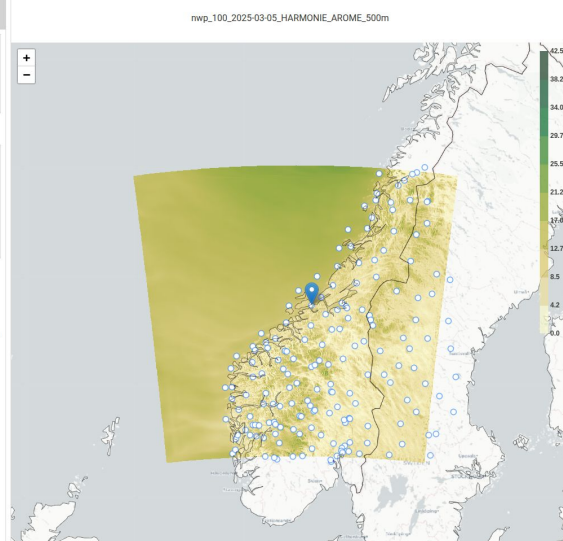
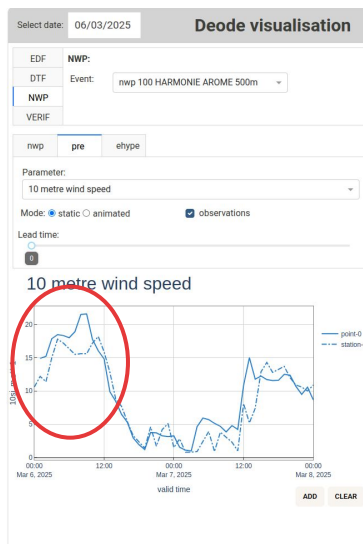
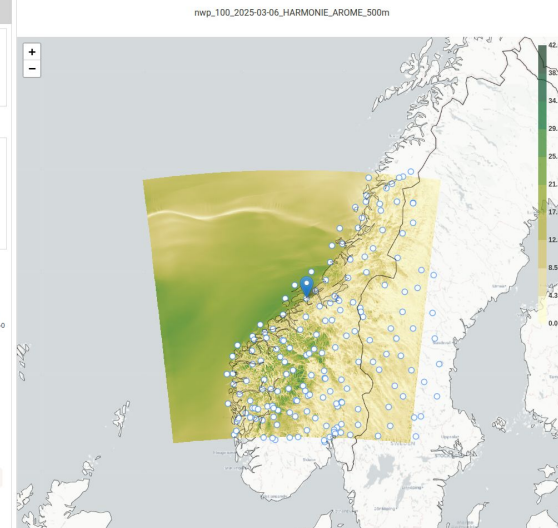


OBS

# Tornado i Frankrike, 24 augusti 2026

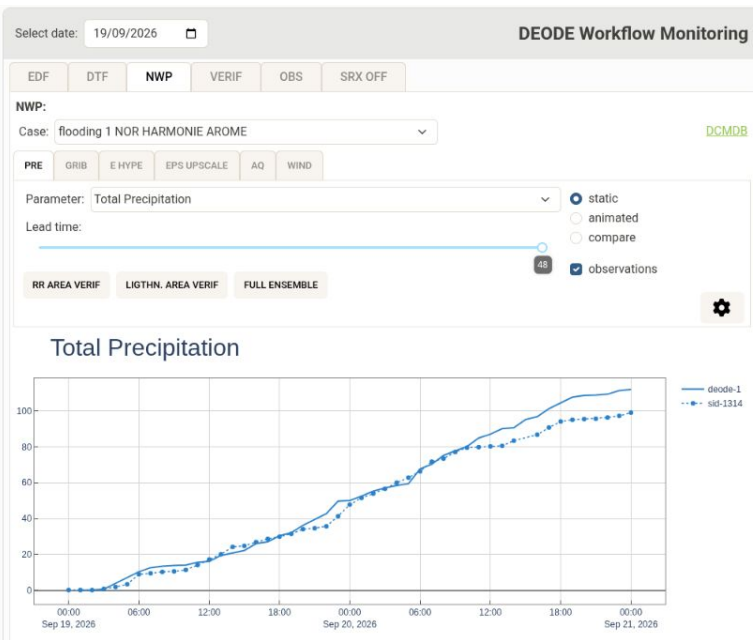
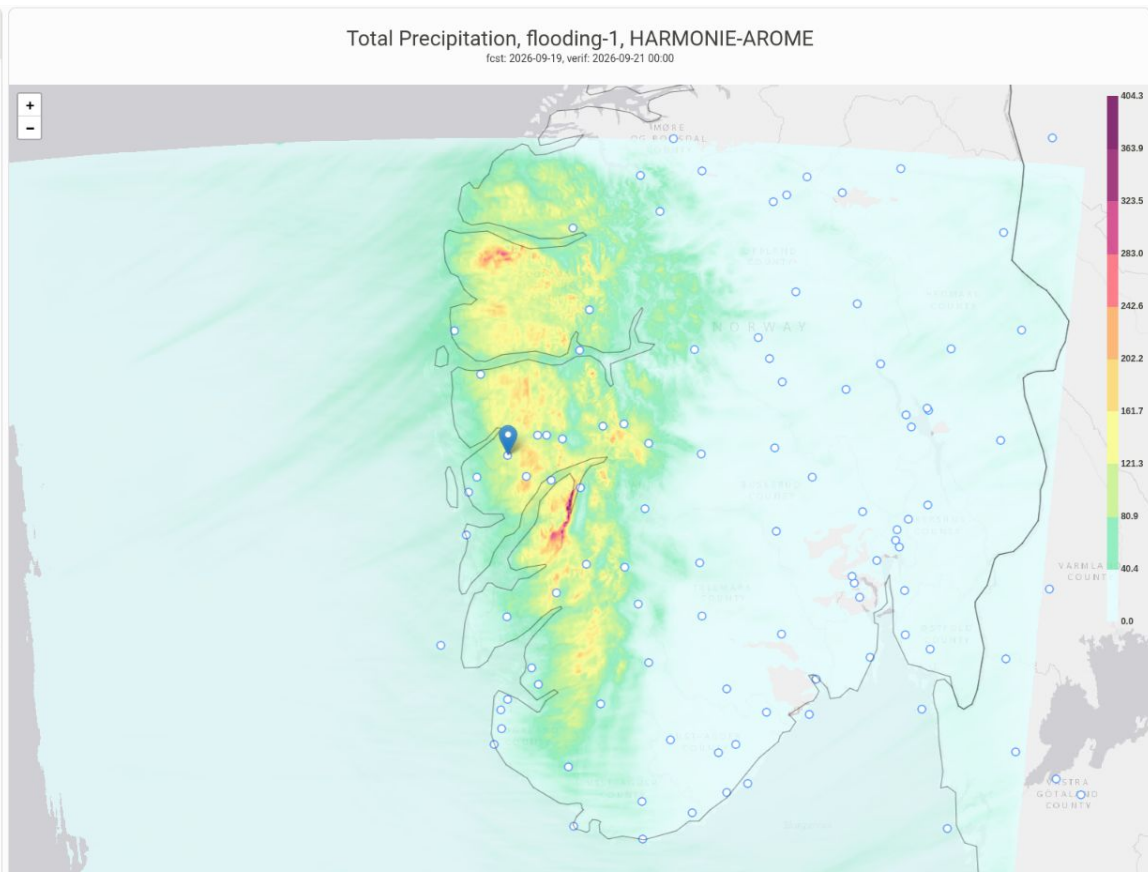


# Support för FIS Nordic World Ski Championships - 26e februari - 9e Mars 2025

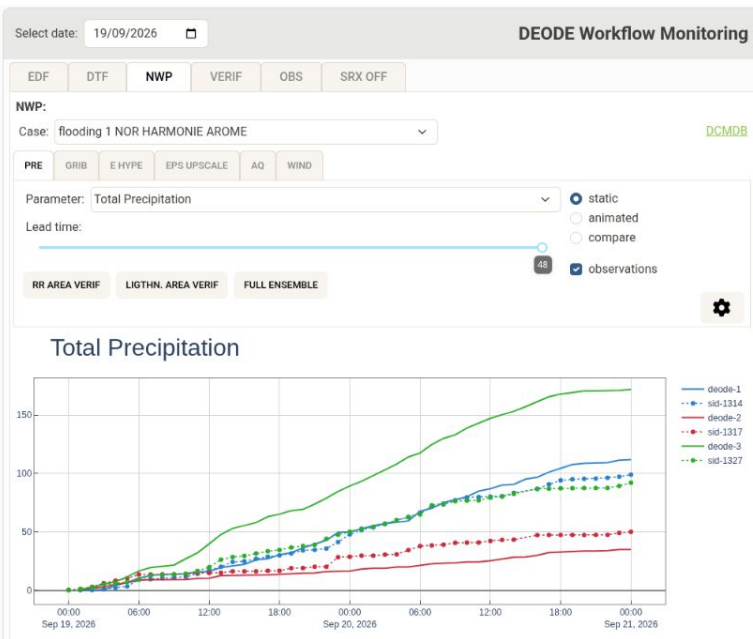


- Forecast of wind speed produced the 5th with the useful forecast in day-2 (6th March – light yellow arrow (a)).
- Few events were postponed during the 6th March until 12:30 (light blue arrow (a))
- **The forecast from 5th (strong drop of wind intensity, (a)) could help the local forecasters in taking the good decision. Due to different reasons, this forecast was not used in the decision making, but as general comment, the resolution of the wind was very good and helped them to make different decisions.**
- Red circle (b) shows that the forecast was good confirming the decision.
- Note: solid lines are forecasts, dashed lines are observations and the white dots are observations stations.

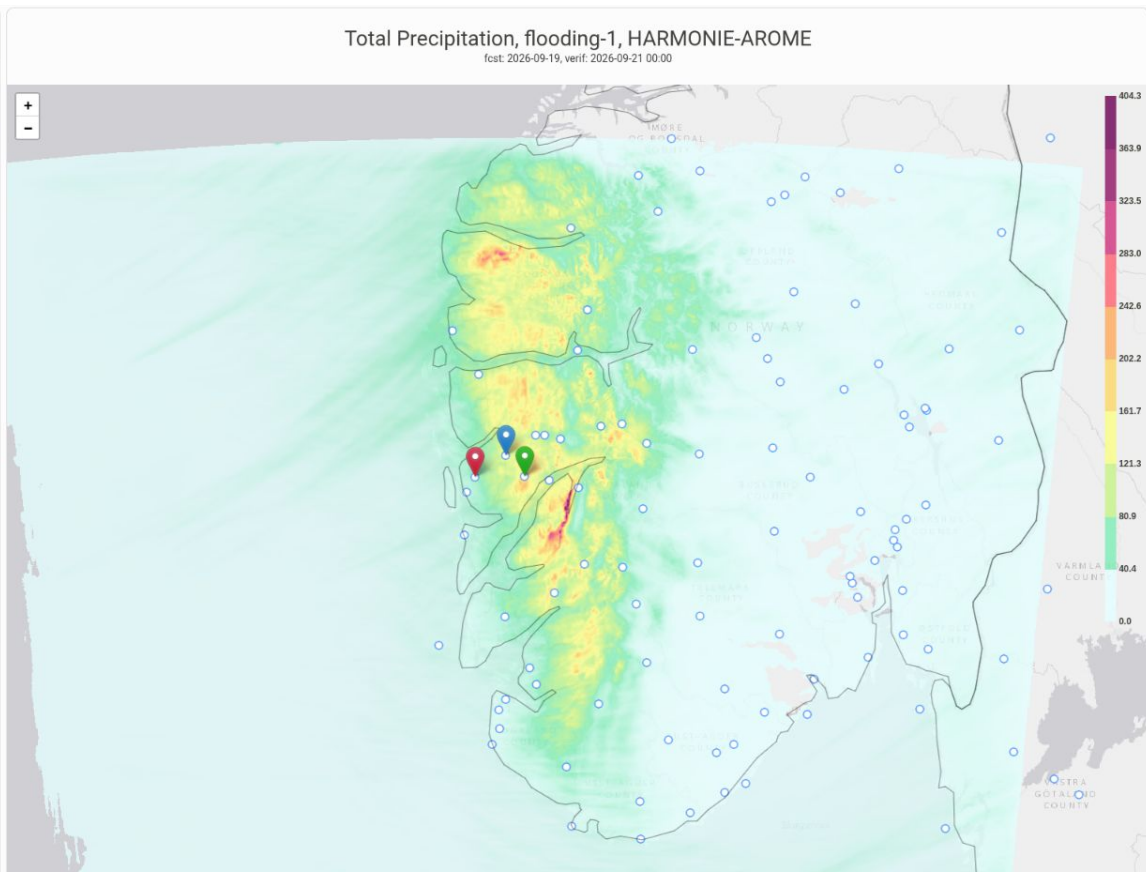
# Hur bra var egentligen prognosen över Bergen?



# Hur bra var egentligen prognosen över Bergen?

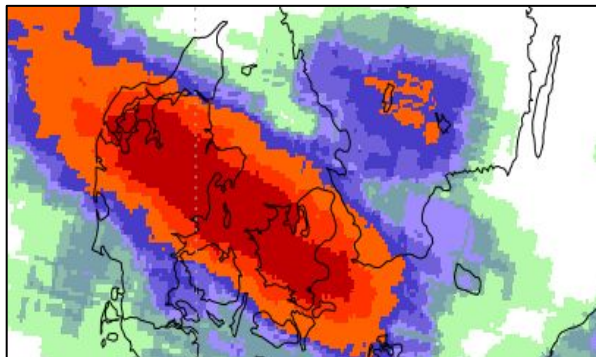


Behov av ensembleprognoser!

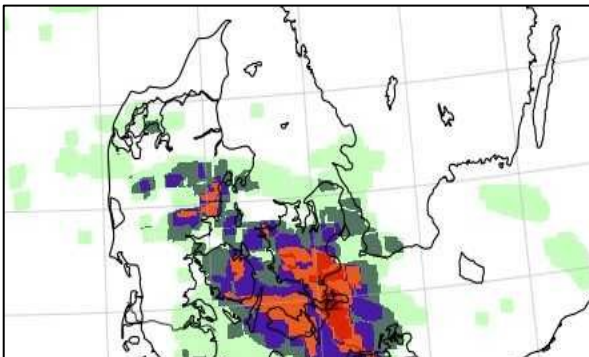


# Exempel på DEODE ensemble prognos jämfört med operationell upplösning

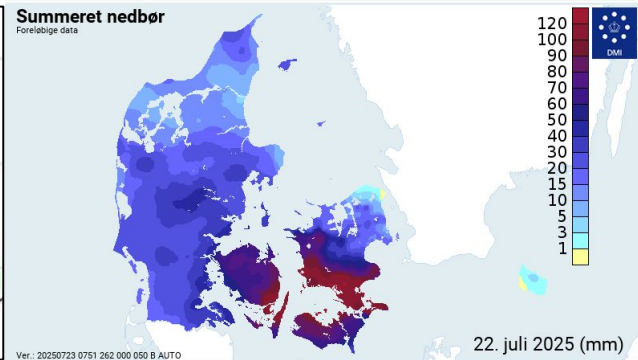
Sannolikhet för nederbörd > 50 mm på 24h , 22 juli 2025



Operationell (DMI) 2 km



DEODE 750m



Observationer

# Hur jämför sig 1h nederbörd med ECMWF?

Visar på olika karakteristik, men vi ska inte dra långtgående slutsatser från ett fall.

DEODE :: Verification of case studies



Select Verification Directory

Model combination

GDT\_ekm + IFS + HARMONIE\_AROME\_500m

Dates

0000 19 Sep 2026 - 0000 19 Sep 2026

Parameter

AccPcp1h

Load

station\_group

All

Time axis

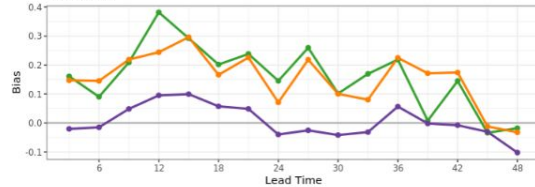
Lead Time



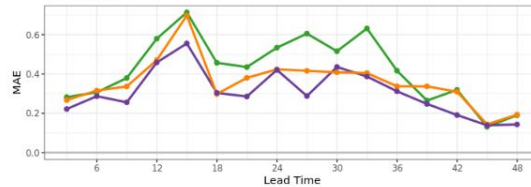
Dashboard

Interactive

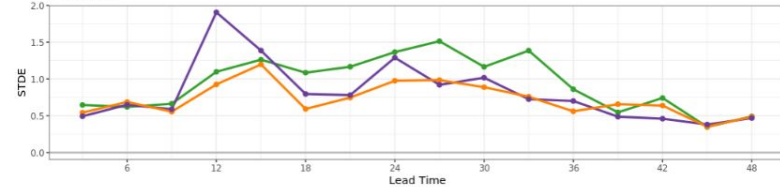
Mean Bias  
112 stations



MAE  
112 stations



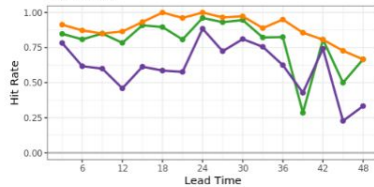
Std Dev of Error  
112 stations



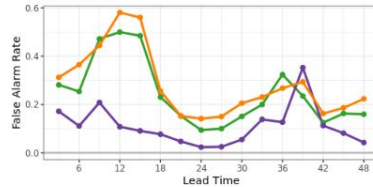
Threshold

>= 0.1

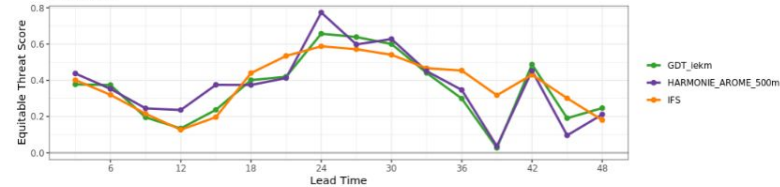
Hit Rate  
112 stations



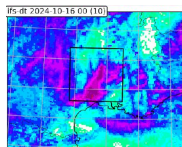
False Alarm Rate  
112 stations



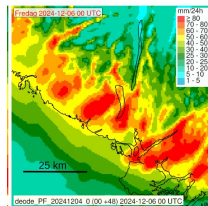
ETS  
112 stations



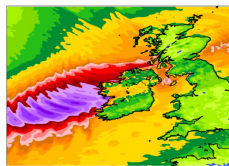
# Extrema väderhändelser utvärderade 2024/2025



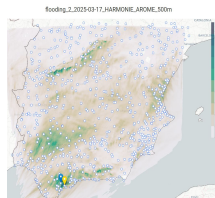
Mediterranean event  
(17/10) France



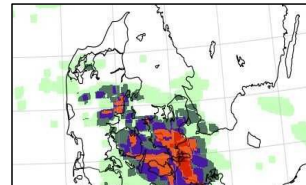
Extreme precipitation  
(06/12) Norway



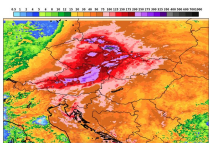
Windstorm Éowyn  
(24/01) Ireland



Extreme precipitation  
(17/03) Spain

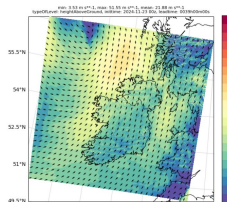


Extreme precipitation  
(22/06) Denmark



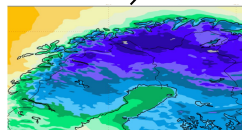
Storm Boris  
(26/06-07)

Austria, Czech Republic

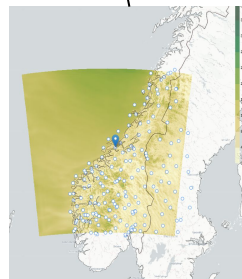


Storm Bert  
(22-23/11)  
Ireland

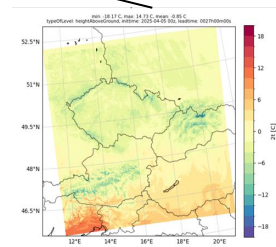
202  
5



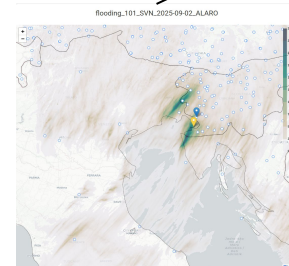
Cold spell  
(04/02)  
Finland



Ski World Championship  
Norway



Frost  
(05/04) Czech Republic



Flood Trieste  
(02/09)  
Italy

Evaluated in both in Global DT and On-Demand DT

## DEODE 500m vs globala 4km Digital Twin

|                                                    | DT Global (4.4 km) added value vs OPER (9 km) |           | Regional (On-Demand) added value vs DT Global |           |
|----------------------------------------------------|-----------------------------------------------|-----------|-----------------------------------------------|-----------|
|                                                    | Flat areas                                    | Mountains | Flat areas                                    | Mountains |
| Extreme precipitation (convective and large-scale) | ↓/→                                           | ↑         | ↑                                             | ↑         |
| Extreme wind/wind gusts                            | ↑                                             | ↑         | ↑                                             | ↑         |
| Extreme low temperatures                           | →                                             | ↑         | →/↑                                           | →/↑       |
| Extreme warm temperatures                          | →                                             | ↑         | →/↑                                           | →/↑       |
| Medicanes/<br>rapid development cyclones           | ↑                                             | ↑         | ?/↑                                           | ?/↑       |
| Squall lines                                       | ↑                                             | ↑         | ?                                             | ?         |

 Improvement  
 Similar Performance  
 Degradation

## Till slut

- DEODE är ett komplement till de operationella prognoserna fokuserat på att fånga extrema väderhändelser
- Körs i realtid och nuvarande fokus på bättre leveranstider för prognoser.
- För vidare information och information om access till data kontakta **deode-oper-team@groups.ecmwf.int**

**Tack för uppmärksamheten!**