# Detection of extremes and triggering of the On-Demand DT

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# Detection and triggering in the Extreme On-Demand Workflow

## Role of the Detection:

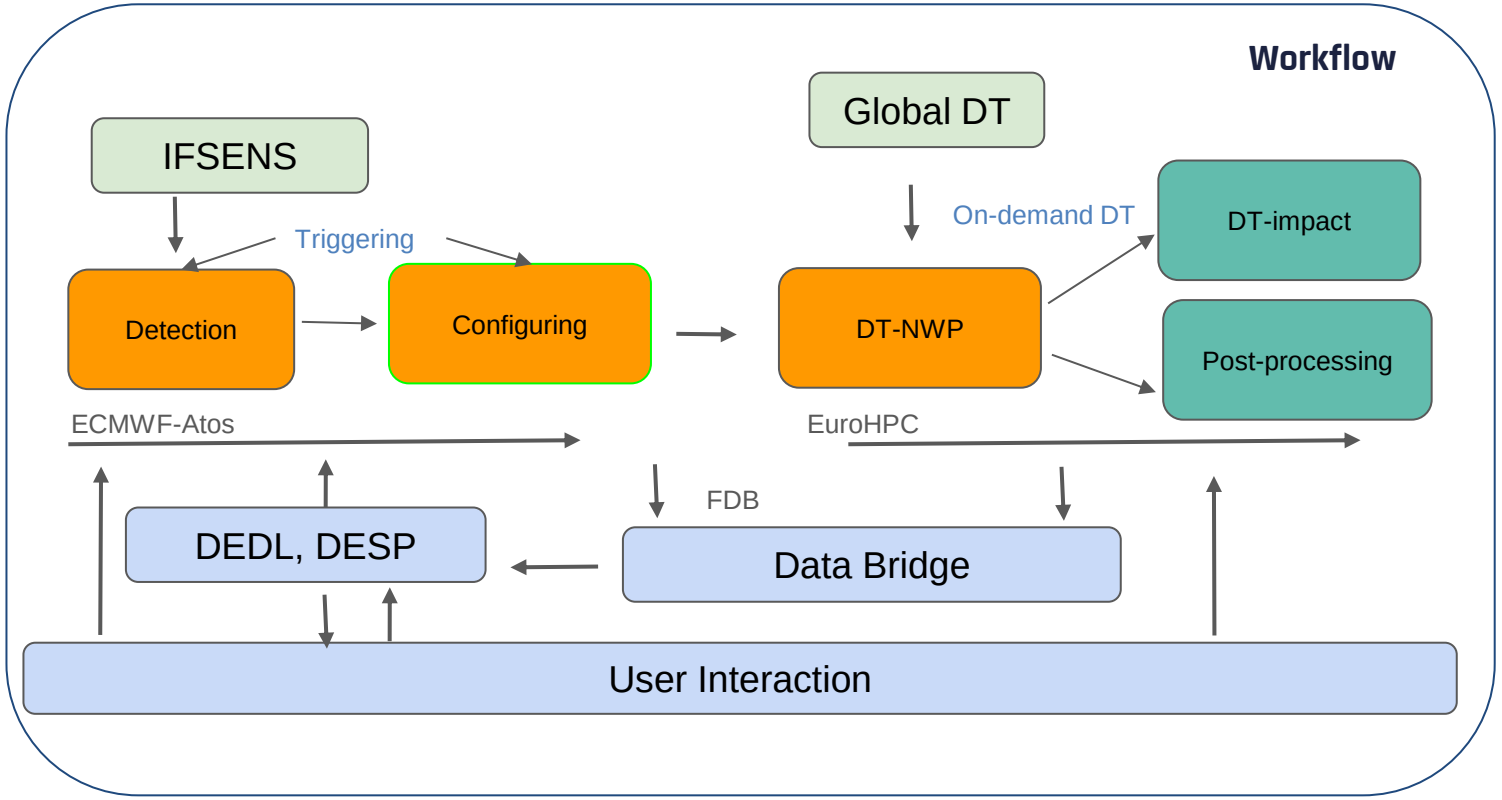
- Provide awareness for the immediate future extreme events happening over Europe:
  - Probability maps
  - Triggering priority maps
- Advanced analytics to substantiate decisions to start forecast runs

## Role of the Configuration:

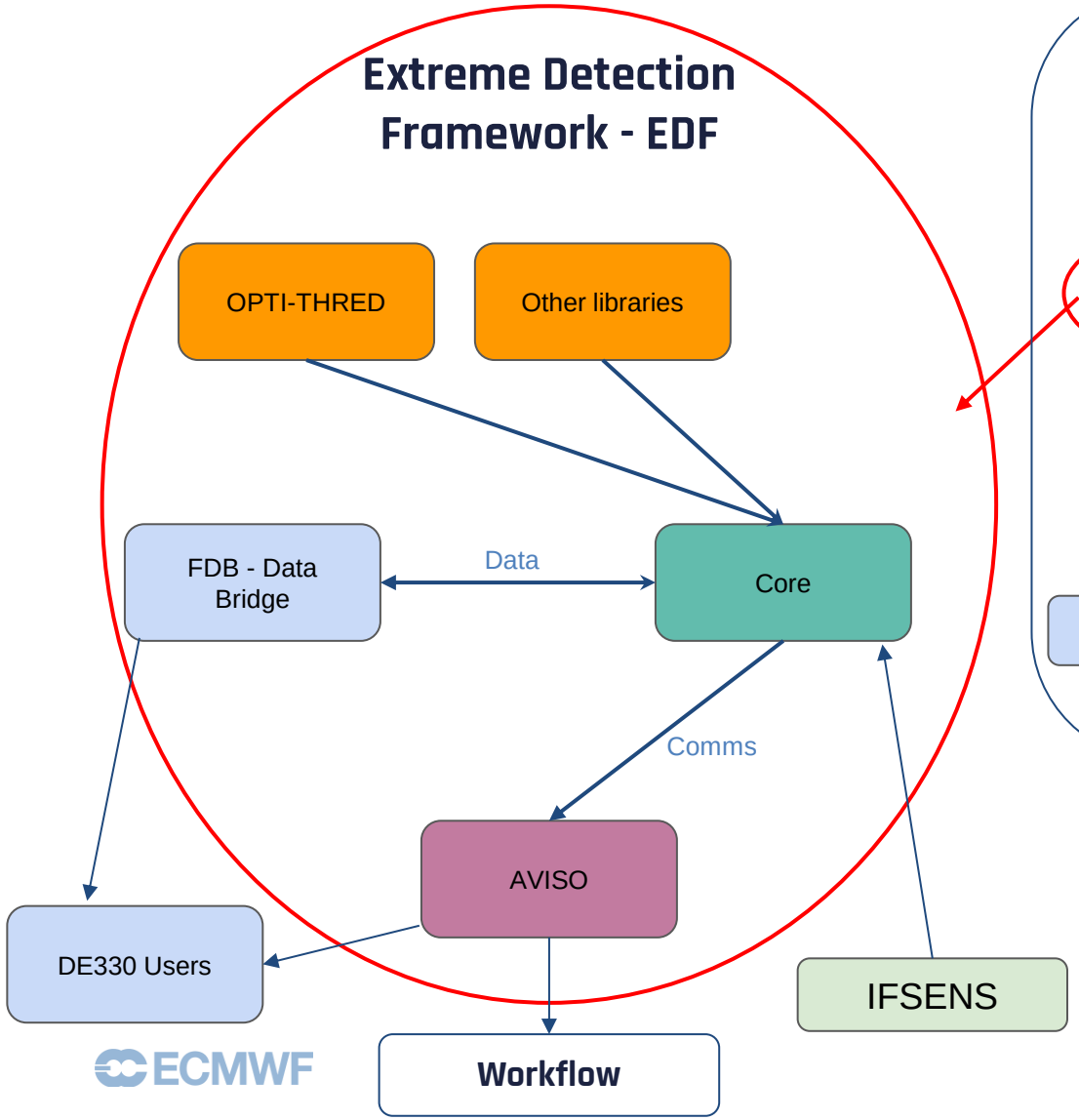
- Estimate geographical extent of the extremes
- Provide related configuration for the forecast models

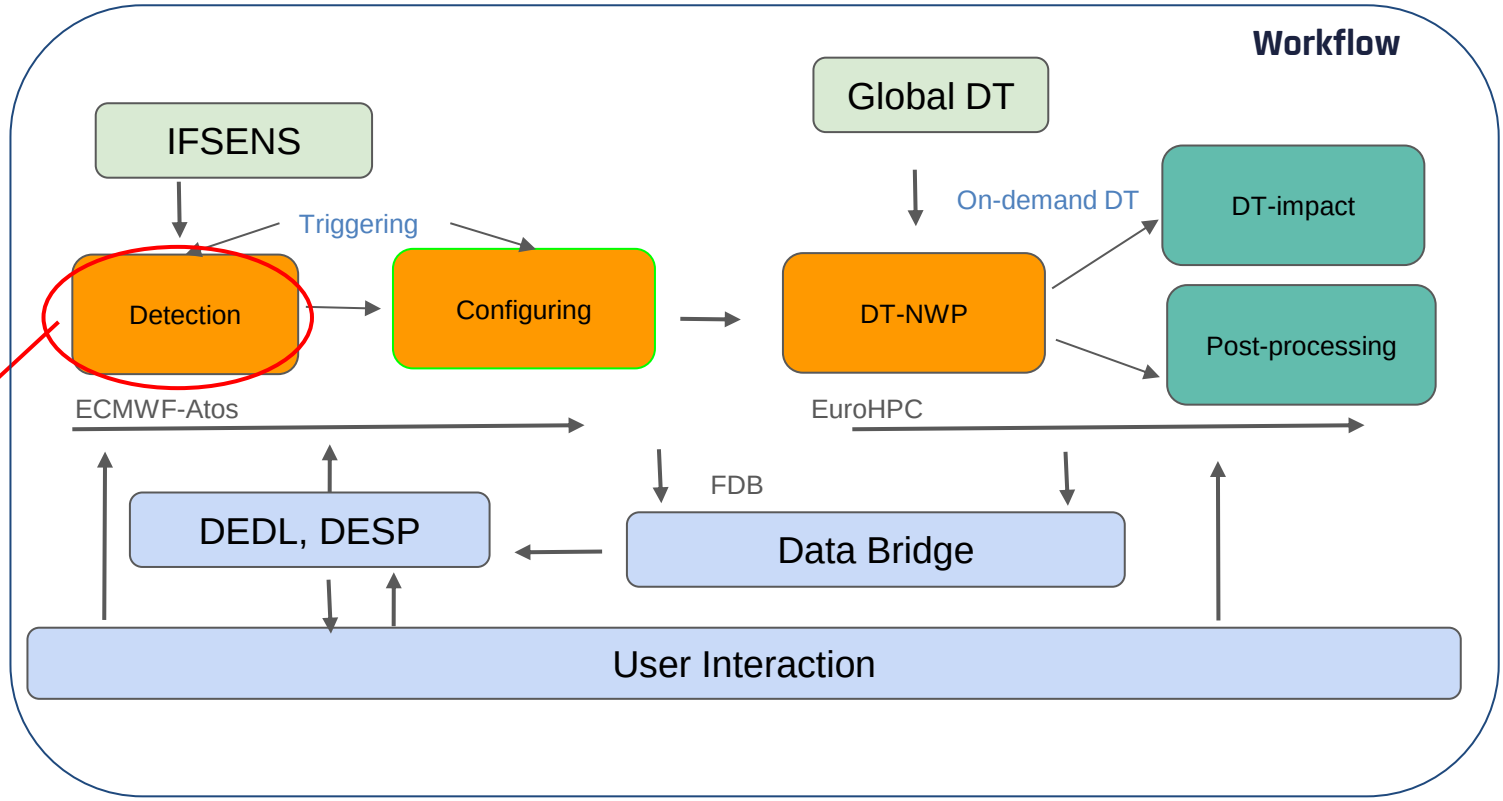
## Decision to trigger:

- Human-driven (DE330 forecasters in the loop, see Xiaohua Yang monitoring presentation)
- Automated (not yet implemented in phase 2)



# Detection in the Extreme On-Demand Workflow



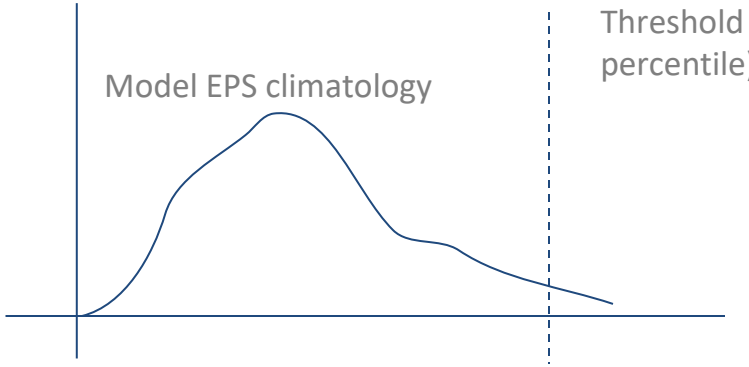



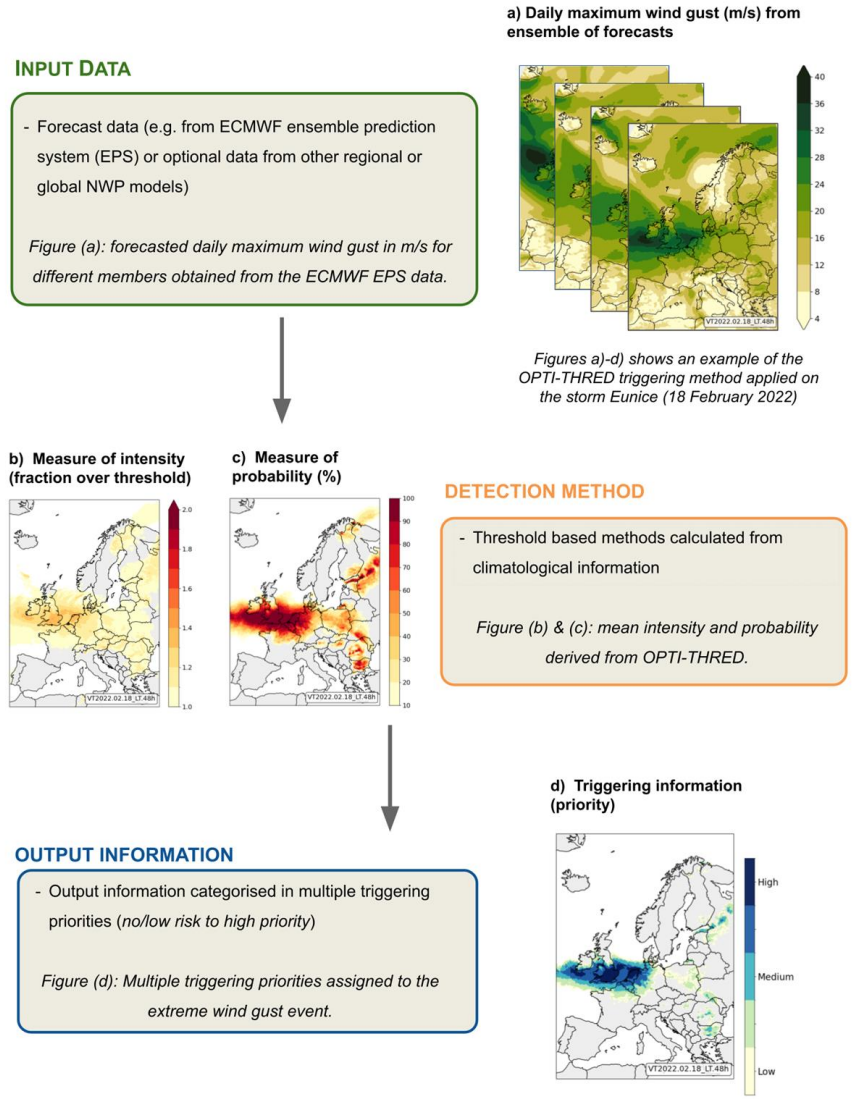

## Extreme Detection Framework duties:

- Estimate probability and assess the triggering priority of extremes up to 5 days ahead
- Various use cases (pres. flooding, heatwave, convection, storm, more to come)
- Store analysis data and diagnostics
- Communicate to DE330 users and workflow

# OPTI-THRED (OPTImized THReshold-based Event Detection)

- Threshold-based method to detect anomalously high/low values for various meteorological variables.
- So far tested on single variables, daily statistics (avg/max/min):
  Precipitation (total and convective), CAPE (cape, capes), 2m temperature, 10m wind (mean wind speed and gust).
- **Input data:**
  ECMWF ensemble forecasts (50 members)
  Thresholds computed from ECMWF ensemble (EPS) reforecasts climatology (~20 years)
- **Output data:**
  Map with detection results - levels of "triggering priorities" (1 -> 5) based on EPS agreement and intensity.

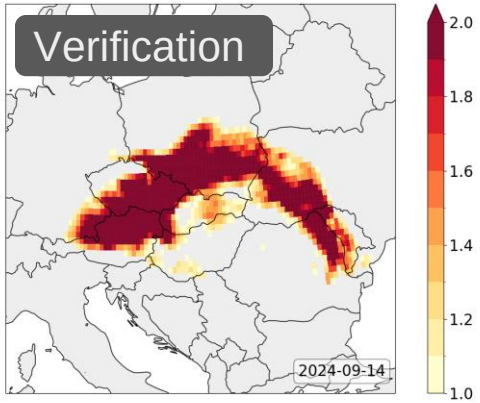


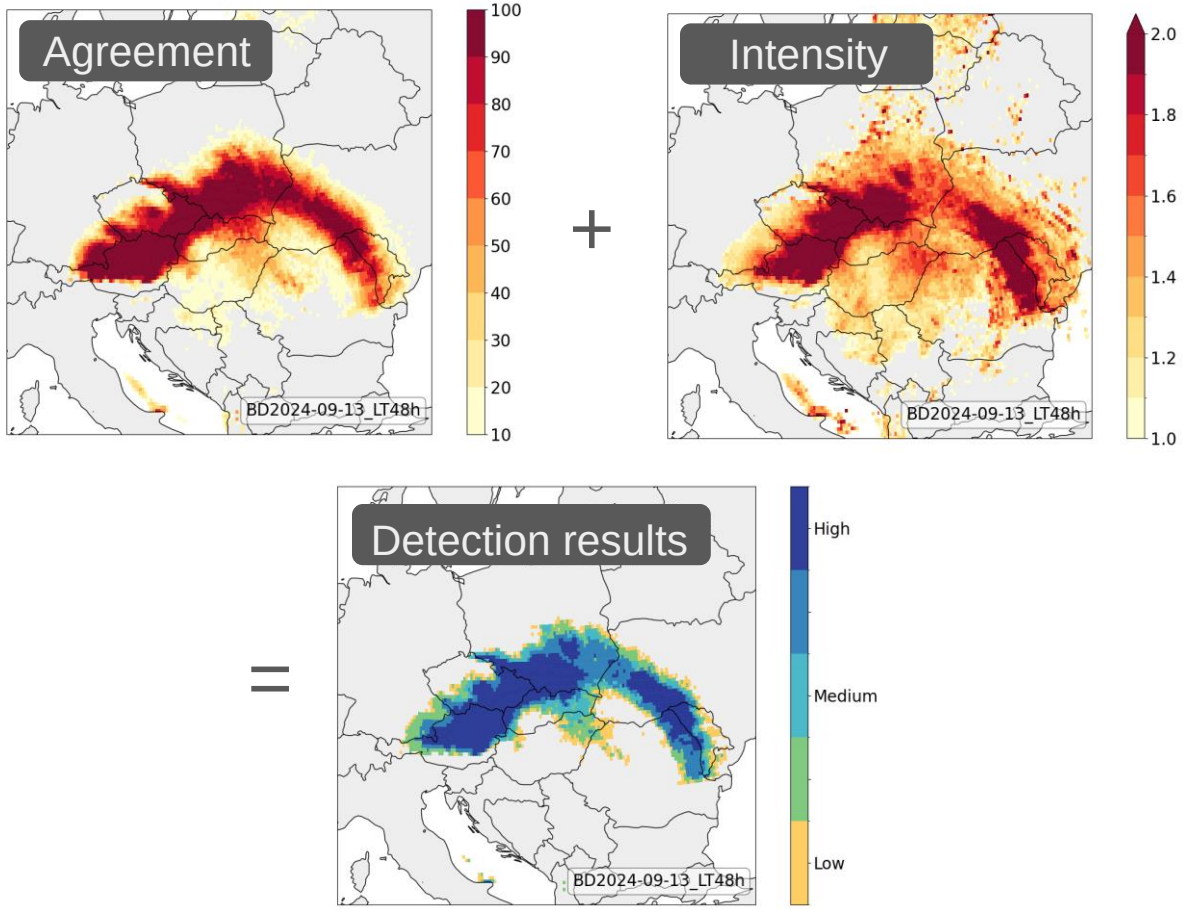
# OPTI-THRED Use case example: Boris (September 2024)

- Extreme precipitation over central-east Europe
- Large human, societal and economical damages and costs

ERA5 Pr intensity (fraction > p99)

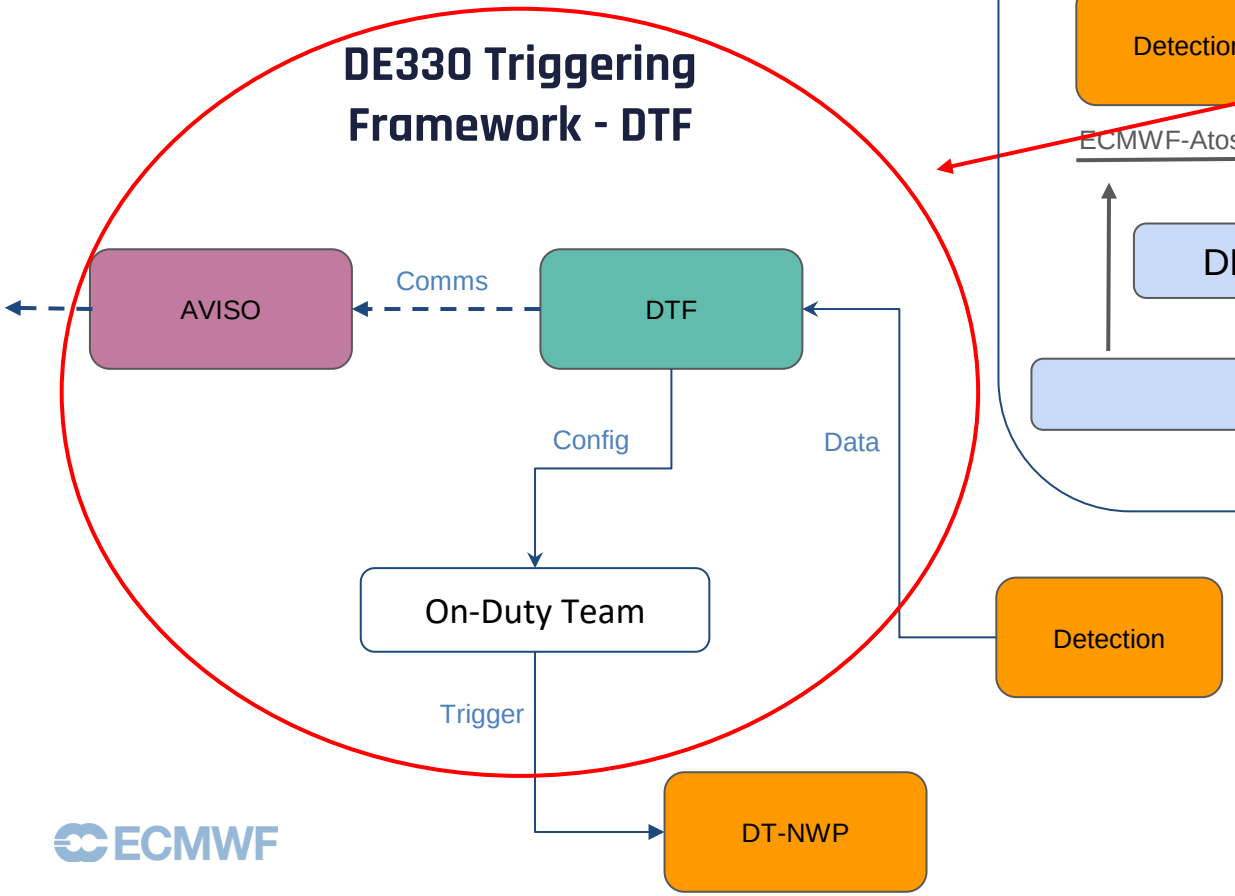


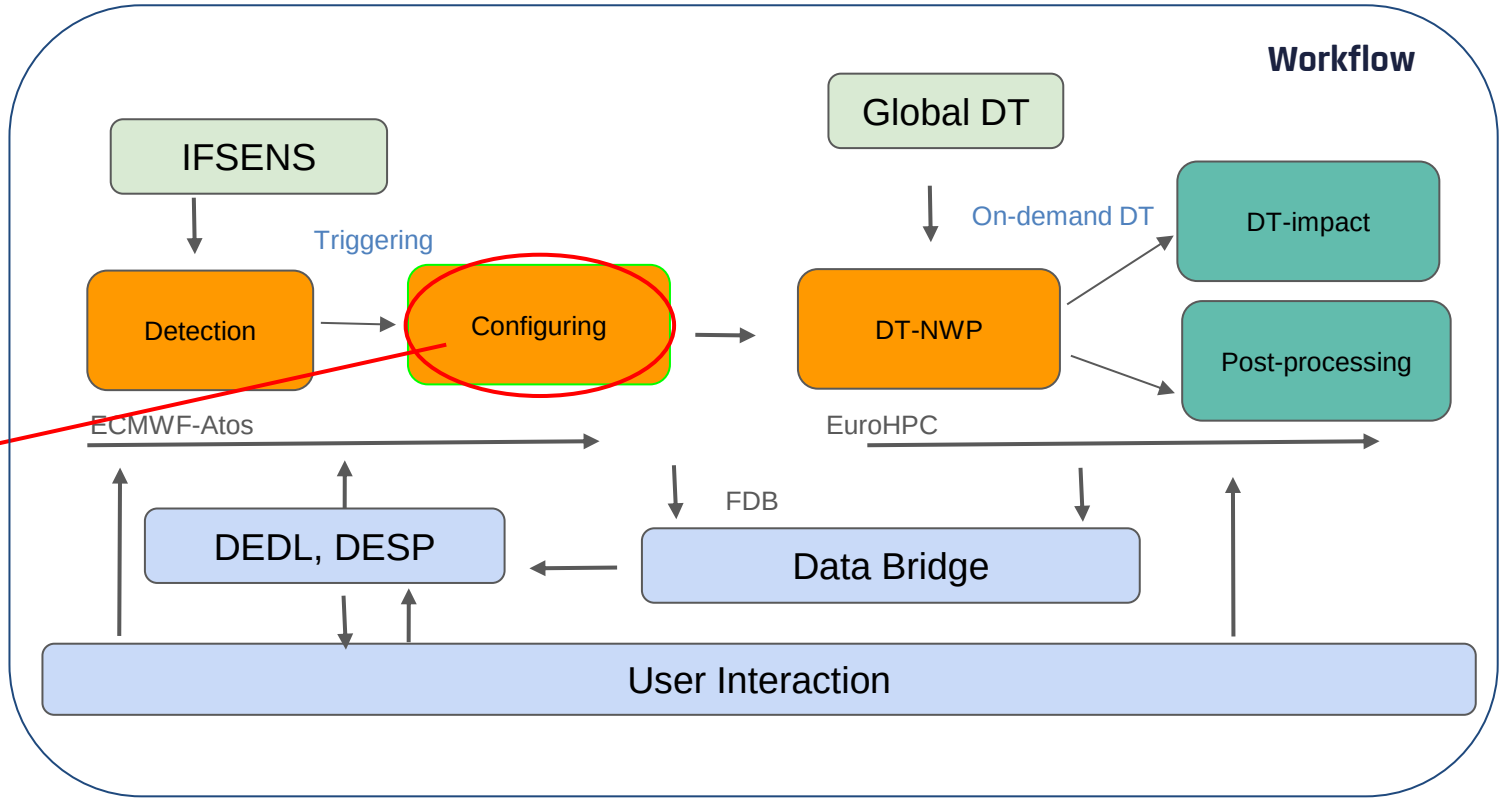

OPTI-THRED:



# Configuration in the Extreme On-Demand Workflow

- For phase 2, triggering will be done by the DE330 consortium members (On-duty team)
- Currently, no prioritization policy

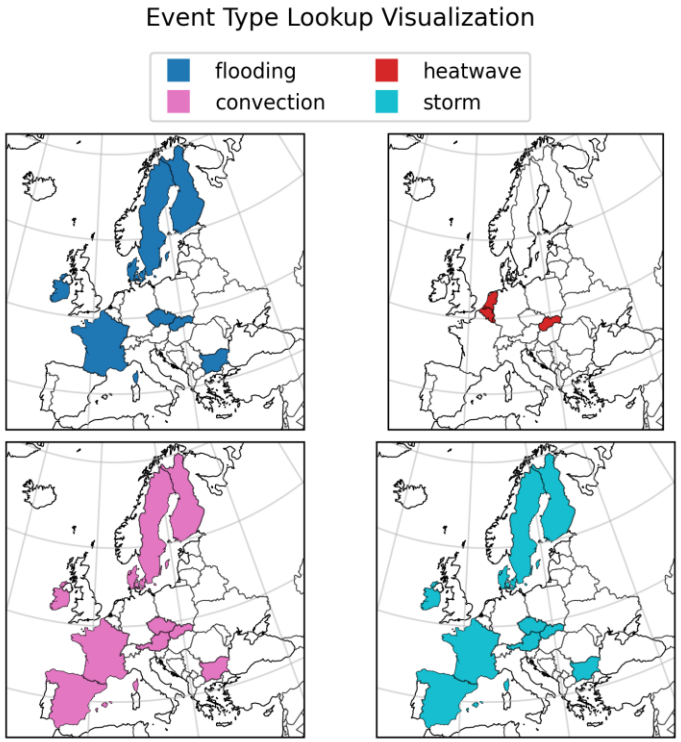



## DE330 Triggering Framework duties:

- Compute model domain for each detected extreme
- Provide model configuration files to the workflow
- Currently, used to trigger manually NWP (forecasters from NMHS in the loop)
- In the future, automated triggering (in addition to user triggers)

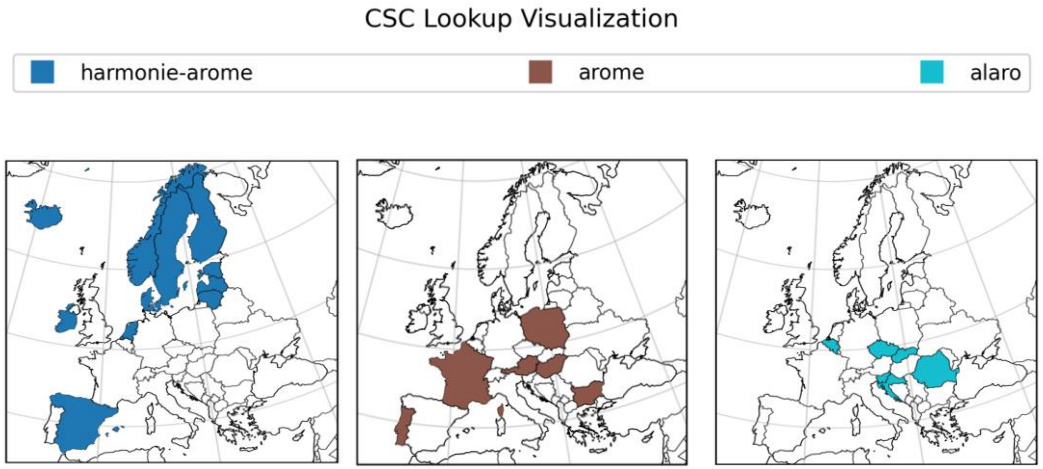
# Tailoring model runs to user needs using the Triggering Framework




```
[CZE]
  csc = ["alaro"]
  events = ["flooding", "convection", "storm"]

[DNK]
  csc = ["harmonie-arome"]
  events = ["flooding", "convection",
            "storm", "storm_surge", "solar_energy"]

[ESP]
  csc = ["harmonie-arome"]
  events = ["storm", "convection", "fire"]

[EST]
  csc = ["harmonie-arome"]
  events = ["storm_surge"]
```

"pilot regions for different events and applications"

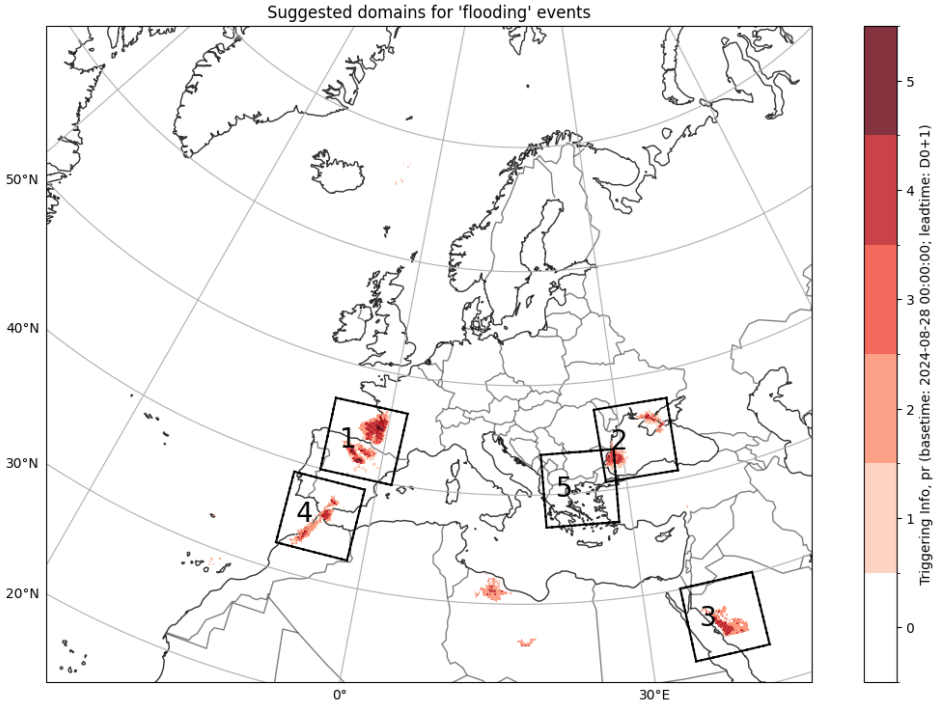
## Model selection



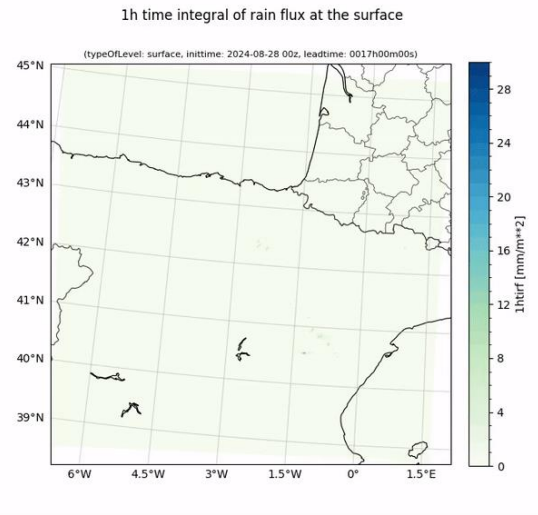

```
[domain]
  name = "CUBIC_1500x1500_500m"
  nimax = 1489
  njmax = 1489
  xdx = 500
  xdy = 500
  xloncen = -3.516191369605984
  xlatcen = 42.522448161525034
  lmrt = false
  tstep = 20
  gridtype = "cubic"
  order = 1
  csc = "harmonie-arome"
```

# Example: 29th August 2024 Intense Precipitation over Spain

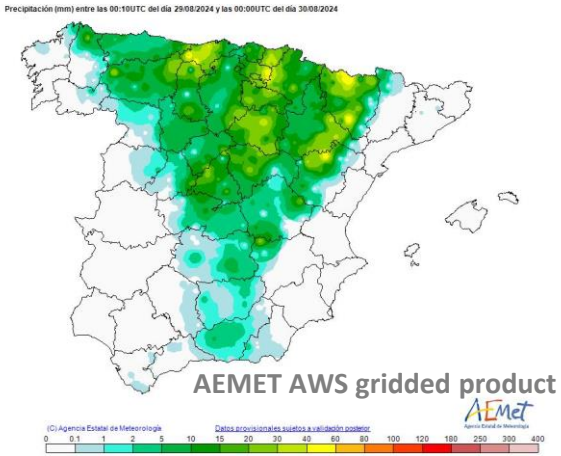
## Detection (EDF - OPTITHRED) & Triggering (DTF)

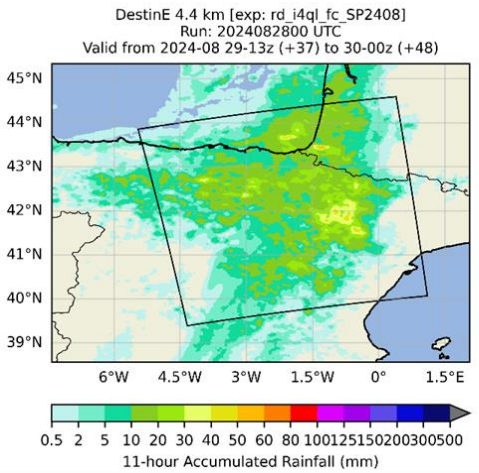


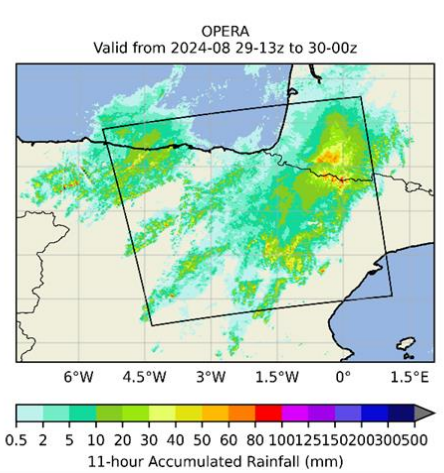

## NWP - Precip 1h acc.

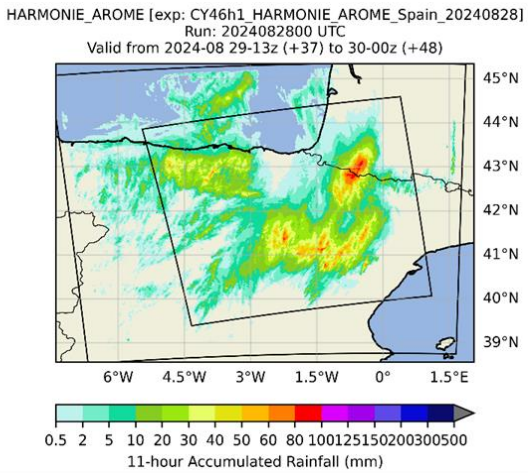



## Verification



# Outlooks/Usage

- More event types detected at the end of phase 2
- Seamless AVISO communications across the workflow and toward users
- Triggering done by consortium members (forecasters) for phase 2:
  - Automation for the end of the phase
  - General open access to triggering not planned
- Detection/triggering data access to be discussed (ECMWF, DE330, EC, Member States / NMHS)