Optimizing Climate Services for high-Demand use Cases: the Experience of the SMC with Insurance-Related Reports

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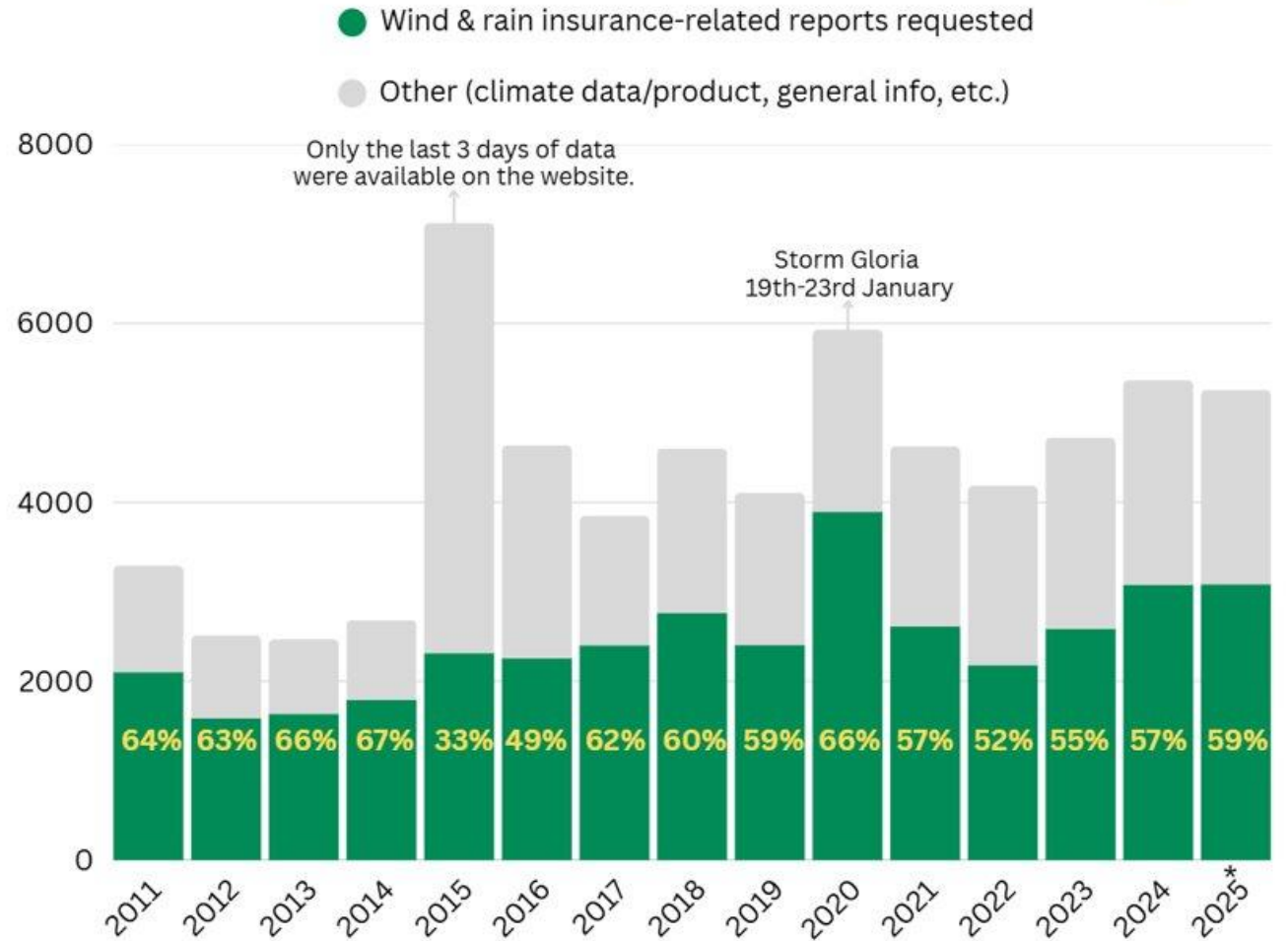Generalitat de Catalunya

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The problem

High-demand of weather & climate information

- **Over 50% of all requests** → wind & rain insurance reports

- **Severe weather in populated areas** = surge in requests.

- **Slow response times** due to manual case validation → 15-30 days

- Repetitive, **time-consuming** workflow.

- **Open data platforms** (website, API, Open Data Portal) are not enough if not user-oriented.

Annual weather & climate information requests

- ● Wind & rain insurance-related reports requested
- ● Other (climate data/product, general info, etc.)

Only the last 3 days of data were available on the website.

Storm Gloria 19th-23rd January

8000 6000 4000 2000 0

64% 63% 66% 67% 33% 49% 62% 60% 59% 66% 57% 52% 55% 57% 59%

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025*

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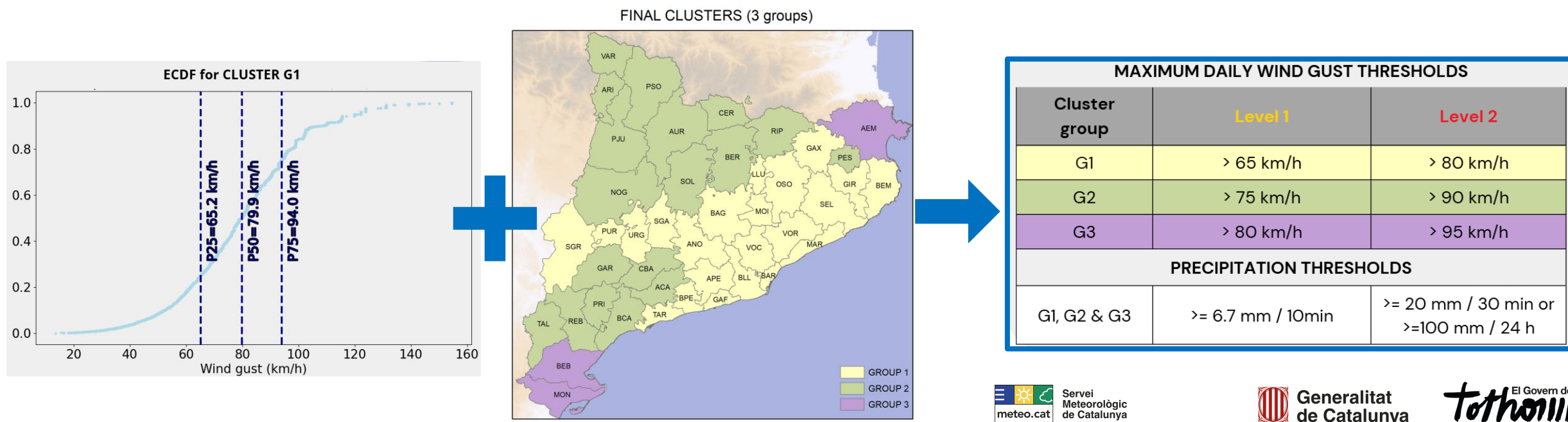
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Which rain and wind intensities triggers related-insurance requests?

Rain & wind thresholds to trigger insurance-related report requests

- ECDF-based identification of minimum **wind and rainfall values** from which the number of **report requests starts to increase**.

- **Wind**: **3 clusters** identified across Catalonia, reflecting different vulnerability levels to wind damage.

- **Rainfall**: no clustering applied — locally intense rainfall affects all regions similarly; also considered heavy but non-intense events (>100 mm / 24 h).

- Two threshold levels (Level 1 & Level 2) defined from the **25th and 50th percentiles**, representing increasing probabilities of insurance-related requests.

ECDF for CLUSTER G1

P25=65.2 km/h
P50=79.9 km/h
P75=94.0 km/h

FINAL CLUSTERS (3 groups)

GROUP 1
GROUP 2
GROUP 3

MAXIMUM DAILY WIND GUST THRESHOLDS		
Cluster group	Level 1	Level 2
G1	> 65 km/h	> 80 km/h
G2	> 75 km/h	> 90 km/h
G3	> 80 km/h	> 95 km/h
PRECIPITATION THRESHOLDS		
G1, G2 & G3	>= 6.7 mm / 10min	>= 20 mm / 30 min or >=100 mm / 24 h

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Proactivity

Proactivity

- **From reactive to proactive:** Instead of waiting for insurance-related data requests, we can now anticipate where they will come from.

- Algorithm design: Combines **population data** with the **wind and rainfall** thresholds previously identified → which municipalities are most likely to submit requests after a weather event.

- **Report generation in advance:** Prepare meteorological reports even before the majority of citizens request them → **Reduction in response time**.

- **Optimization:** Testing several population thresholds showed that **10k inhabitants** — about **125 municipalities** — offers the best balance between proactive coverage and actual demand. – Example for the squall line 22nd Januari 2021

>60
50-60
40-50
30-40
20-30
15-20
10-15
5-10
2-5
1-2

20000 inhabitants | 10000 inhabitants
5000 inhabitants | 2000 inhabitants

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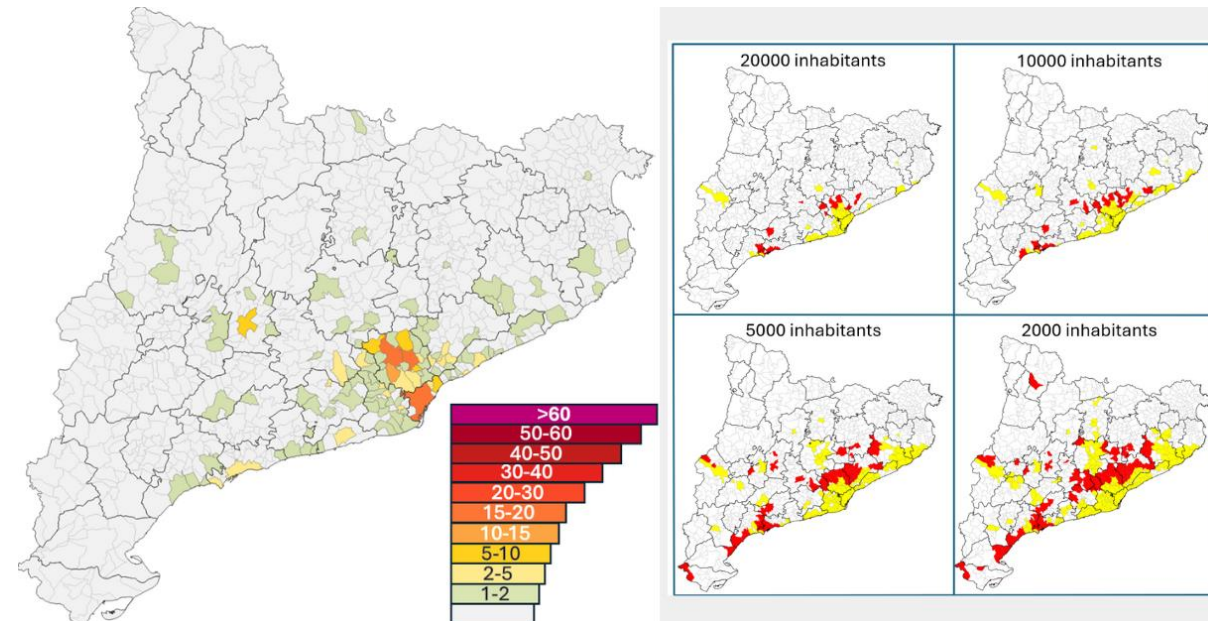
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Streamlining weather report generation

Streamlining weather report generation

- Developed a simple Python-Flask web app to:

  → easily **identify the most representative data**
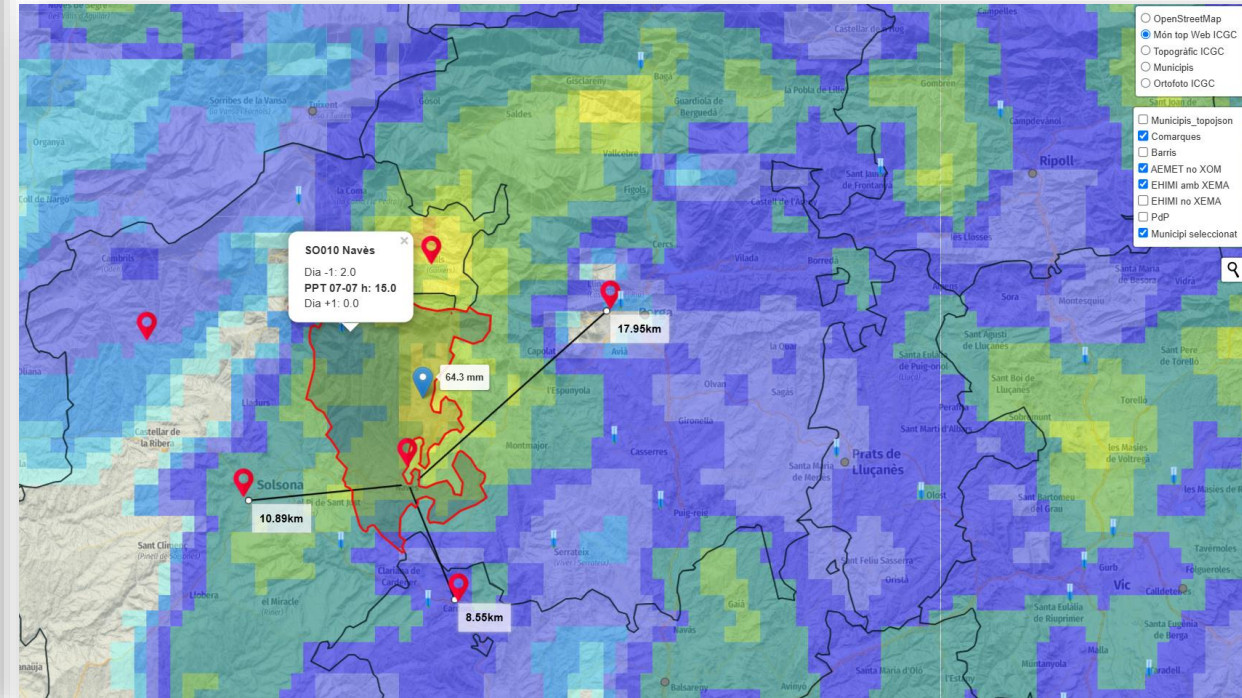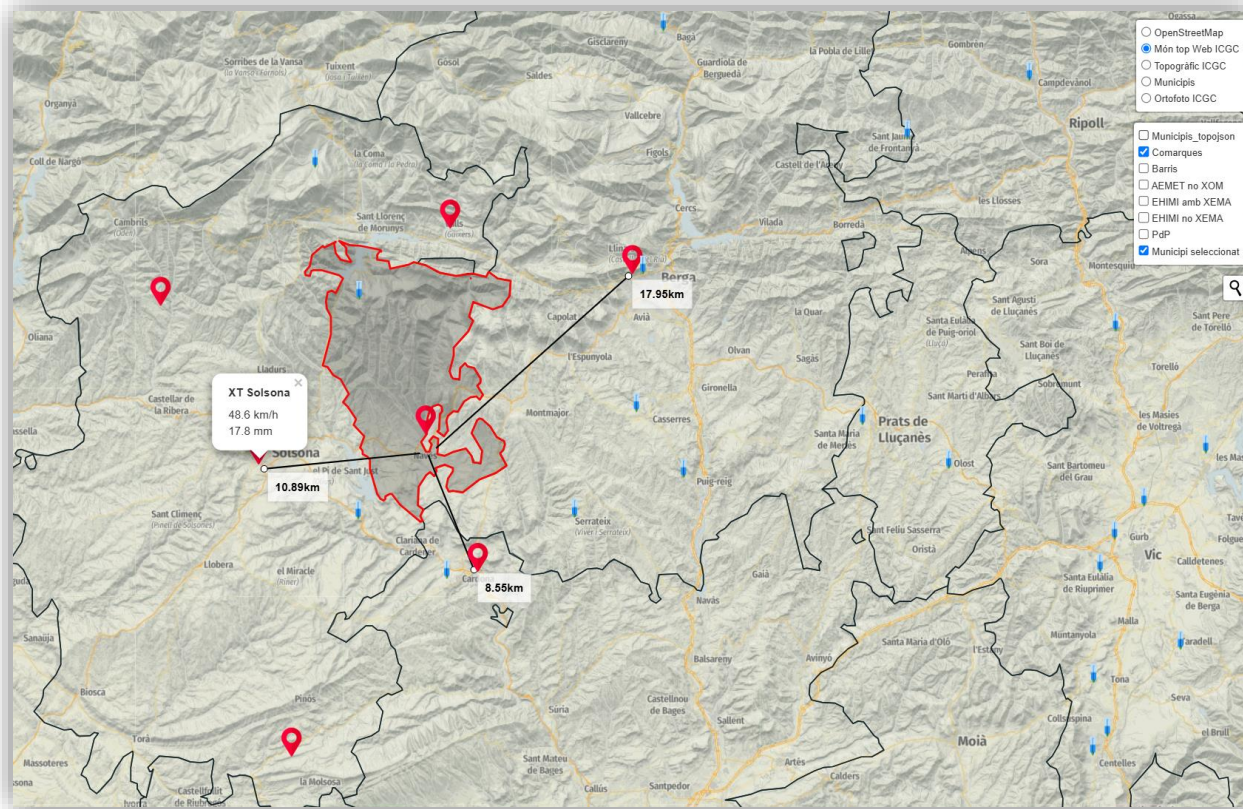
  → create a **standardized** meteorological certificate.

Streamlining weather report generation

- Map viewer to display
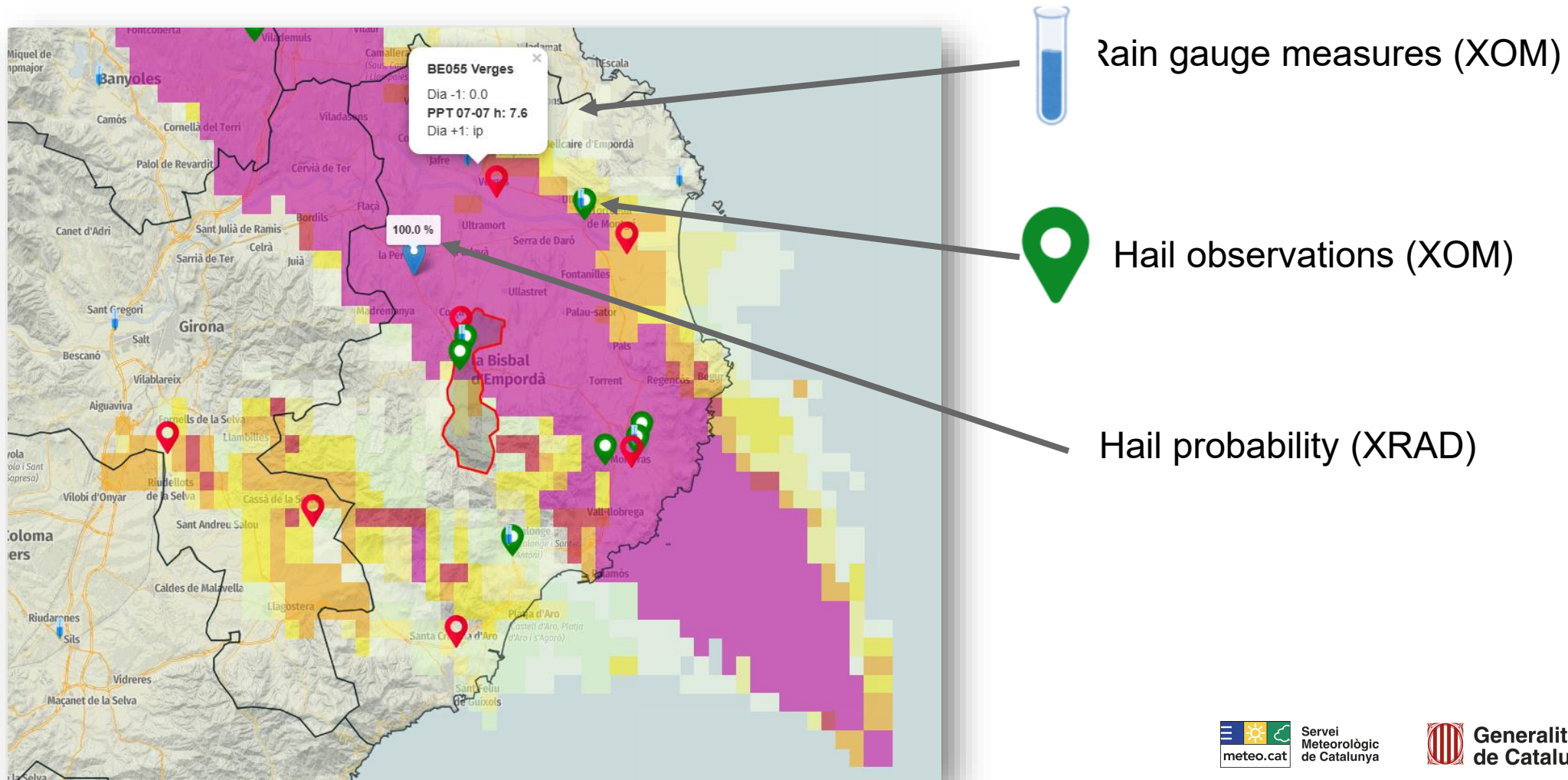
  → Data from nearby AWS (wind gust + precipitation).

  →Daily precipitation estimation derived from radar network (XRAD).

Streamlining weather report generation

→ Observations from Xarxa d'Observadors Meteorològics (XOM)

→ **Hail probability** derived from radar network (XRAD)

Rain gauge measures (XOM)

Hail observations (XOM)

Hail probability (XRAD)

Streamlining weather report generation

→ Generates a standardized certificate using the most **representative data**. **Consistency**: same format for all certificates.

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Certificates freely accessible

Certificates freely accessible

→ Certificates are **freely available** on our website **within the same week** of the weather event.

→ Didn't find your certificate? On-demand requests available — now with **faster response time**.

Scan to explore weather certificates issued in the last 2 years for any Catalan municipality

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Monitoring certificate downloads

Monitoring certificate downloads

2024

→ **2217** certificates generated from 443 municipalities

→ Mean on-demand response time: **7 days**

→ **4209** unique downloads

→ Most downloaded certificate *Terrassa* (228k inhabitants) **04/11/2024 –** red warning issued for heavy rain.

→ **City** with most downloads **Barcelona** (1,6M inhabitants) **341**

Total unique downloads per municipality 2024
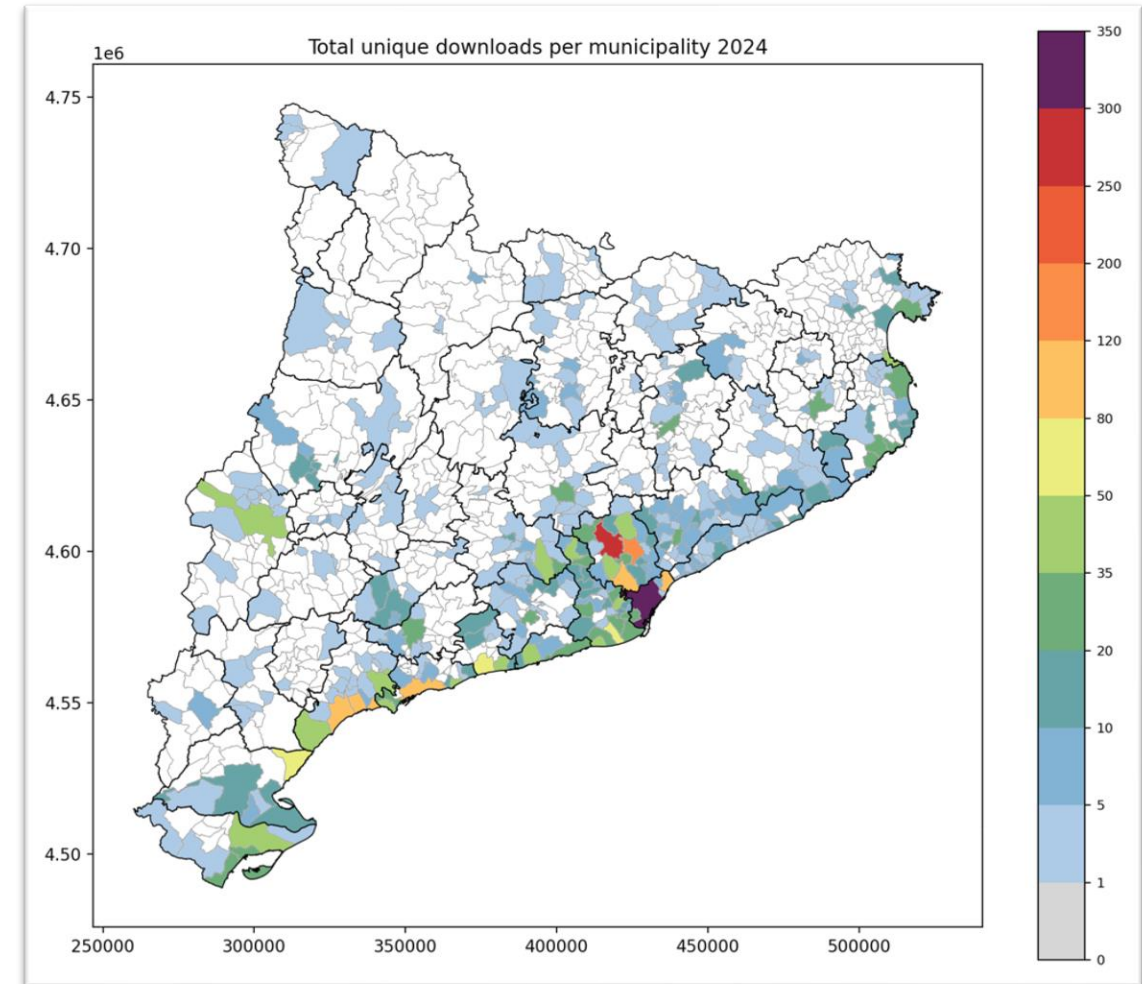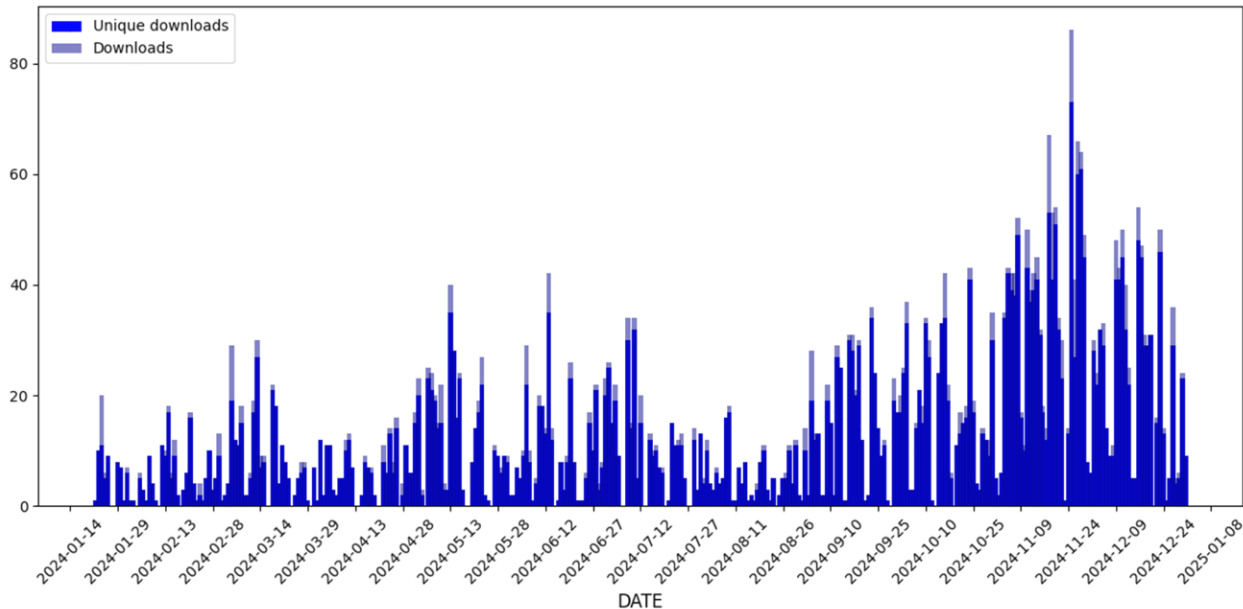
Monitoring certificate downloads

2025 (until 28th oct)

→ **1742** certificates generated from 426 municipalities

→ Mean on-demand response time: **10 days**

→ **3049** unique downloads (until 28th oct)

→ Most downloaded certificate *Vilafranca del Penedès* (41k inhabitants) **12/07/2025 –** red warning issued for heavy rain and accumulation

→ **City** with most downloads **Terrassa** (228k inhabitants) **265**

Total unique downloads per municipality 2025 (until 27th oct)
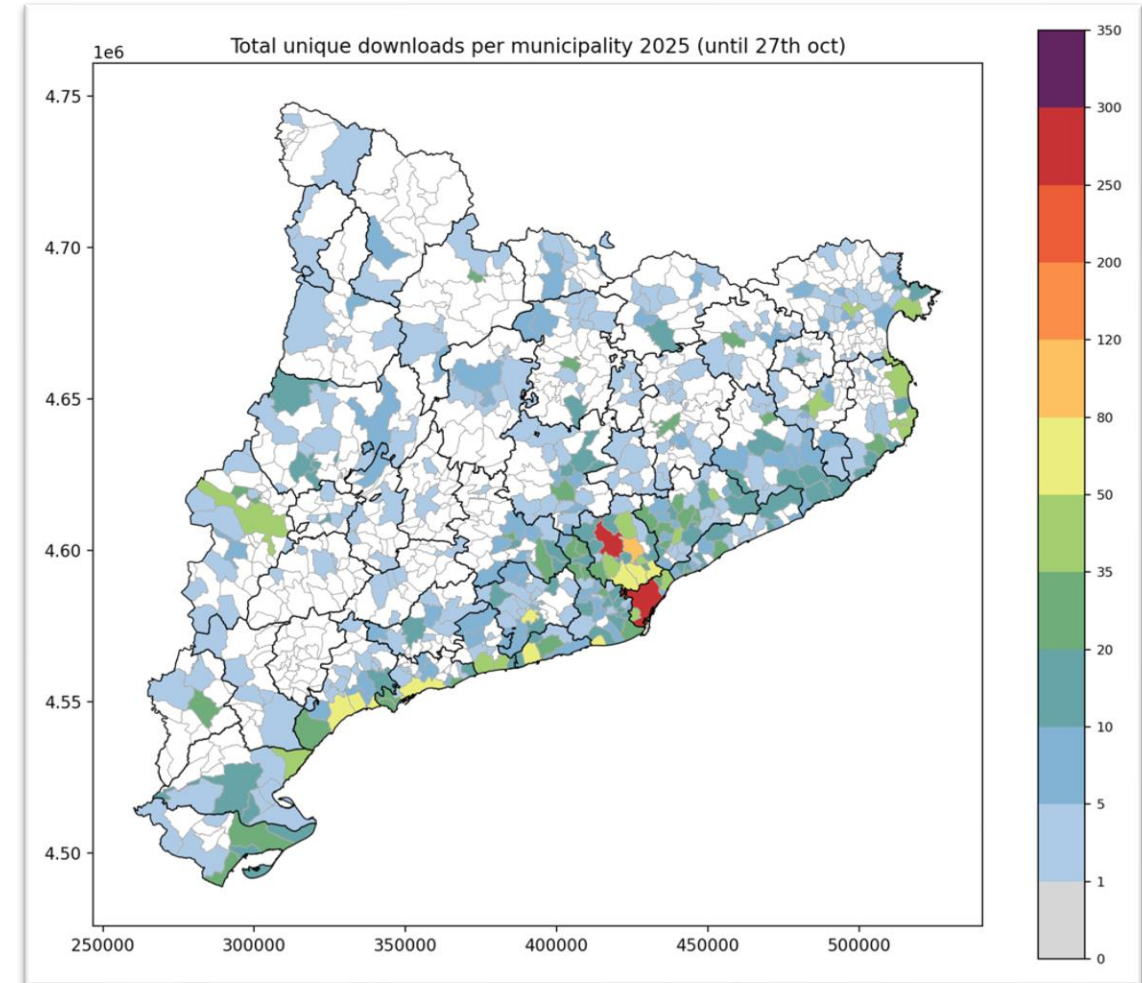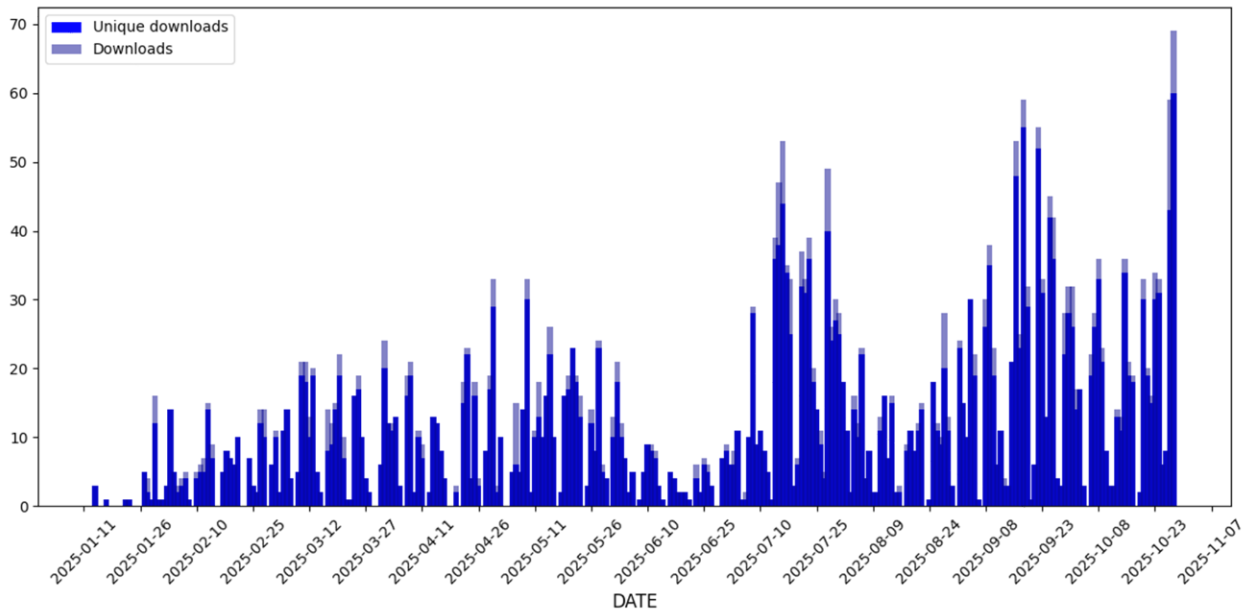
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Conclusions

Conclusions

Achieved

→ Easier **identification of the most representative** weather data for each event and location.

→ Reduction in response time (most reports generated within the same week).

→Standardized methodology ensuring **consistent data** for each municipality and day.

→**Free online access** — certificates available for download from our website.

→Over **7,200 downloads** in the first two years.

TO DO

→ **Promote the service** — many on-demand users don't know the certificate is already available.

→ For large municipalities or highly local rain events, explore **sub-municipal zoning**

→ Include **lightning strike data** within each certificate

Step 1 Proactivity

Step 2 Streamlining

Step 3 Open Sharing

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Thank you!

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