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EGU26 GENERAL ASSEMBLY

Outstanding Student & PhD candidate Presentation contest

Evaluating a Pan-European Flood Impact Forecasting System:
A Multi-Criteria Framework Integrating Hydrological Skill and End-User Perspectives

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INLINE Integrated pan-European rainfall and floods impact forecasts for cooperation in emergency management

Introduction

Driven by climate change and urbanization, flash floods are causing immense global economic and human losses. To mitigate this, forecasting is evolving from predicting hydrological variables to estimating potential impacts.

Flood impact forecasts achieve this by combining hazard models with high resolution exposure data. Incorporating variables like population density and critical infrastructure ensures robust decision-support before and during extreme events.



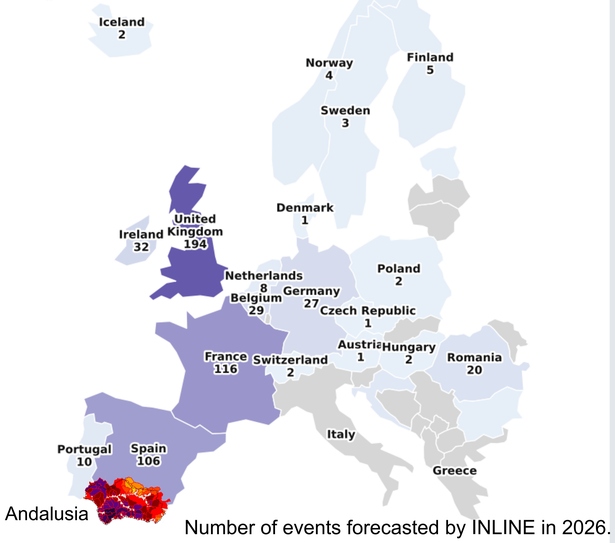
INLINE PROJECT

The system uses precipitation forecasts generated by seamless blending of probabilistic radar-based nowcasts and the precipitation simulations of the ECMWF EPS (maximum lead time: 120 hours).

INLINE objectives

- Integrating forecasts of the impacts due to storms and heavy rainfall into the operational Early Warning Systems (EWS) of national, regional and local CPAs.

- Demonstrate and assess the added value of impact forecasts through a robust evaluation with end-users.



Number of events forecasted by INLINE in 2026.

INLINE COI

The INLINE COI (Community of Interest) is a broad network established to engage participating organisations in evaluating the project's outcomes. To date, the ILNINE COI haves grown to include **44 unique institutions** spanning **21 different countries** across Europe.

Objectives

Design a multi-criteria evaluation framework applied to assess the performance of the system during the demonstration period.

(i) **Hydrometeorological skill**: Comparing the blended forecast product against radar and gauge observations to evaluate accuracy, reliability and timeliness.

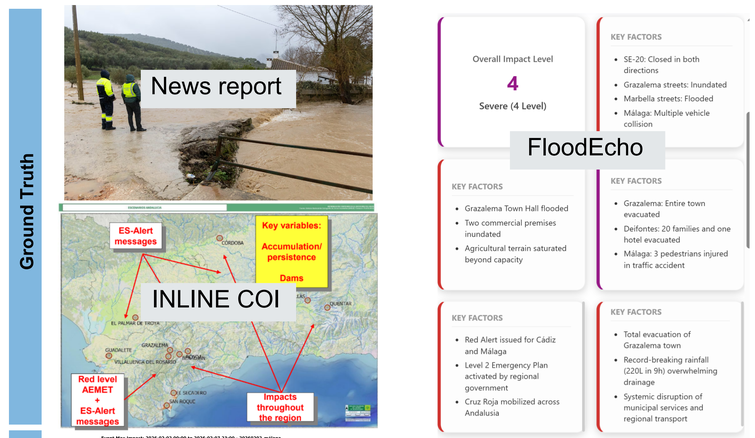
(ii) **Impact-based verification**: Evaluating the forecasted impact levels against real-world impact database.

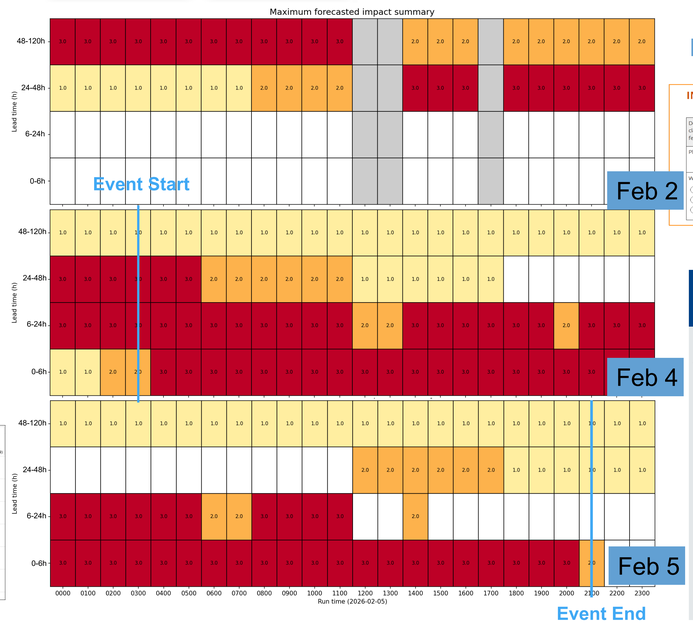
(iii) **User-centric operational value**: Quantifying the system's usefulness, clarity and operational relevance

(iv) **Added value**: Comparing the complementary of the project developments with the current operational tools used by stakeholders to quantify the improvement for emergency management.

Multi-Criteria Evaluation Framework and Results

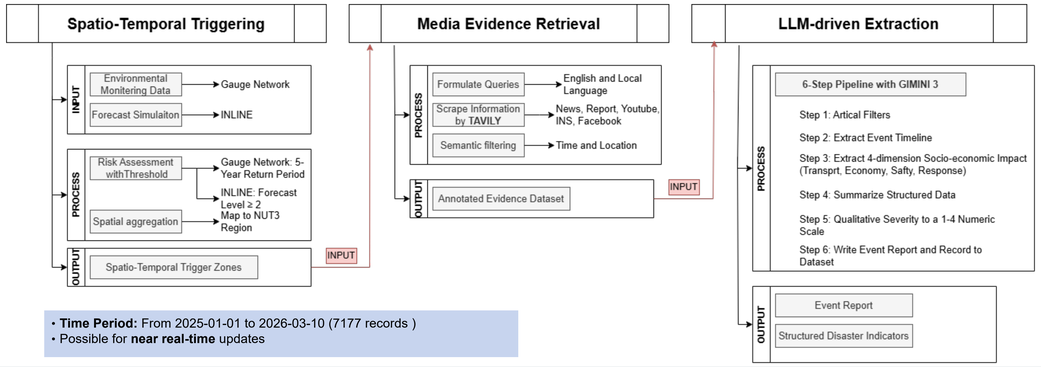
Andalusia Event 2026-02-02 to 2026-02-07





FloodEcho

FloodEcho utilizes LLMs to transform media coverage into a high-resolution dataset of multi-dimensional flood impacts. Its physics-triggered architecture bridges the gap between numerical predictions and real-world media reports, capturing "human sensor" insights regarding infrastructure, economy, and emergency response. By aggregating events to remove duplicates, the framework overcomes data sparsity to deliver a robust ground truth for validating flood forecasts.



- **Time Period:** From 2025-01-01 to 2026-03-10 (7177 records)
- Possible for **near real-time** updates

Demonstration Period 2025-09 to 2026-11

TP / FP / FN / TN — Inline Forecast vs Actual Impact Level
Threshold ≥ L2 (Medium+) | rows = inline_lv, cols = actual level

Inline \ Actual	L0 None	L1 Low	L2 Medium	L3 High	L4 Severe
LV1	TN	TN	FN	FN	FN
LV2	FP	FP	TP	TP	TP
LV3	FP	FP	TP	TP	TP
LV4	FP	FP	TP	TP	TP

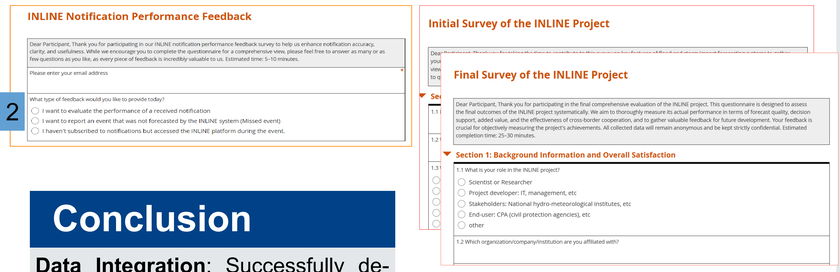
All Searched Events — Inline Forecast Level vs Actual Impact Level
searched=1 (all sources) | None = no inline forecast | n=536

Inline \ Actual	L0 None	L1 Low	L2 Medium	L3 High	L4 Severe
None	4	2	17	66	38
LV2	6	—	9	36	4
LV3	6	1	59	187	30
LV4	—	1	15	45	10

TP	395
FP	14
FN	121
TN	6
CSI	0.745
POD	0.766
FAR	0.034

Events forecasted by INLINE in 2026.

Surveys to assess the End-user's feedback



Conclusion

Data Integration: Successfully developed and applied a media-derived, multi-dimensional flood database.

System Evaluation: Assessed system performance using a multi-criteria framework that bridges hydrological accuracy and end-user value.

Operational Skill: The forecasting system showed reliable event tracking, maintaining high predictive skill and sufficient lead times.

Future Work: Final evaluations will integrate the hydrometeorological skill of INLINE products with the operational added value derived from end-user feedback.