





# An assessment of the EFAS notification criteria

**18<sup>th</sup> EFAS Annual Meeting 2023**Jesús Casado Rodríguez





#### **EFAS FORMAL FLOOD NOTIFICATION**

An EFAS Formal Flood Notification is issued when the probability of exceeding critical flood thresholds are forecasted more than 2 days ahead in a river basin with a minimum upstream area of 2000 km² where there is an EFAS partner. The forecast also must be persistent (see below under criteria) and at least one deterministic forecast must exceed the EFAS 5-year return period. Formal flood notifications are automatically added to the ERCC overview (restricted information) and disseminated to the respective EFAS partner(s), the ERCC and the Civil Protection.



How to combine the 4 models?

#### Criteria:

- Catchment part of CoA (Condition of Access)
- Catchment area ≥ 2000 km<sup>2</sup>
- Event ≥ 48 h ahead
- 3 consecutive forecasts with ≥ 30% exceeding EFAS 5 year return period according to ECMWF ENS or to COSMO-LEPS forecasts
- At least one of the deterministic ECMWF or DWD forecasts exceeds EFAS the 5 year return period.









Motivation Data Methods Results Conclusions

## Geographical extent

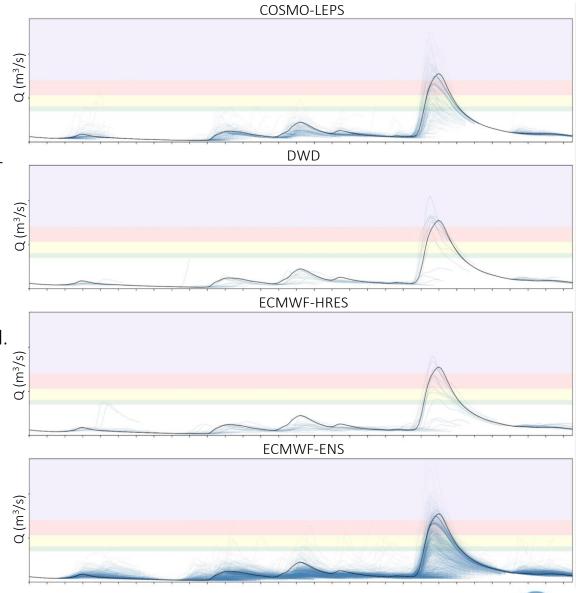
Fixed reporting points with a contributing area larger than 500 km<sup>2</sup> and a KGE larger or equal than 0.5.

#### Discharge data

- «Observed»: EFAS v4.0 reanalaysis.
- Predicted: EFAS v4.0 reforecast.
- Discharge asociated with the 5-year return period.

# Temporal extent

From October 2020 to June 2023







#### Area

 $A \ge 500 \text{ km}^2$ 

#### Lead time

 $0 \text{ h} \le \text{lt} \le 240 \text{ h}$ 

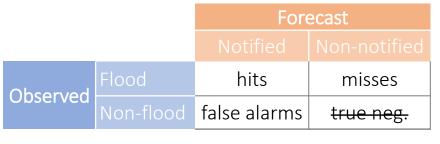
## Probability

- $P \ge 0.050$
- $P \ge 0.075$
- •
- $P \ge 0.950$

#### Persistence

- 1/1
- 2/2
- ...
- 3/3

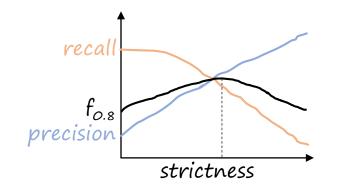
Model/combination



$$f_{0.8} = (1 + 0.8^2) \frac{precision \cdot recall}{0.8^2 \cdot precision + recall}$$

$$recall = \frac{hits}{observed}$$

$$precision = \frac{hits}{predicted}$$



Skill vs area

Skill vs lead time

 $A \ge 2,000 \text{ km}^2$  $48 \text{ h} \le \text{lt} \le 132 \text{ h}$ 

# Optimal criteria

- Probability
- Persistence
- Model/combination





# Experiment 1: individual meteorological models

Compare the individual NWP models against the current approach and set a baseline.

Area

Lead time

Probability

Persistence

#### Model

- COSMO-LEPS
- DWL
- ECMWF-HRES
- FCMWF-FNS

#### Experiment 2: combinations of models

Find the best combination of NWP models and whether it adds value over the baseline.

Area

Lead time

Probability

Persistence

#### Combination

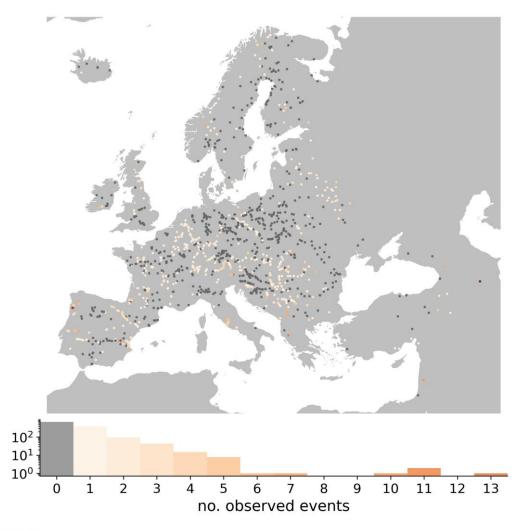
- 1D+1P
- Model mear
- Member weighted
- Skill weighted







Events NWP Combinations



- 1239 reporting points were selected for the optimization.
- 562 reporting points (45%) have at least one "observed" flood event.
- They account for 874 "observed" flood events.
- Duration of the events:
  - 72% are shorter than 2 days.
  - 11 % last for only 6 hours.



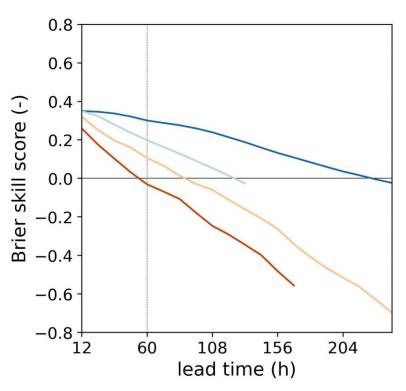


Events

NWP

Combination

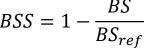
# Probabilistic skill



**EUE** COS **EUD** DWD

$$BS = \frac{1}{n} \sum_{i=1}^{n} (P_{obs} - P_{pred})^{2}$$

$$BSS = 1 - \frac{BS}{BS_{ref}}$$





Probabil. determin.

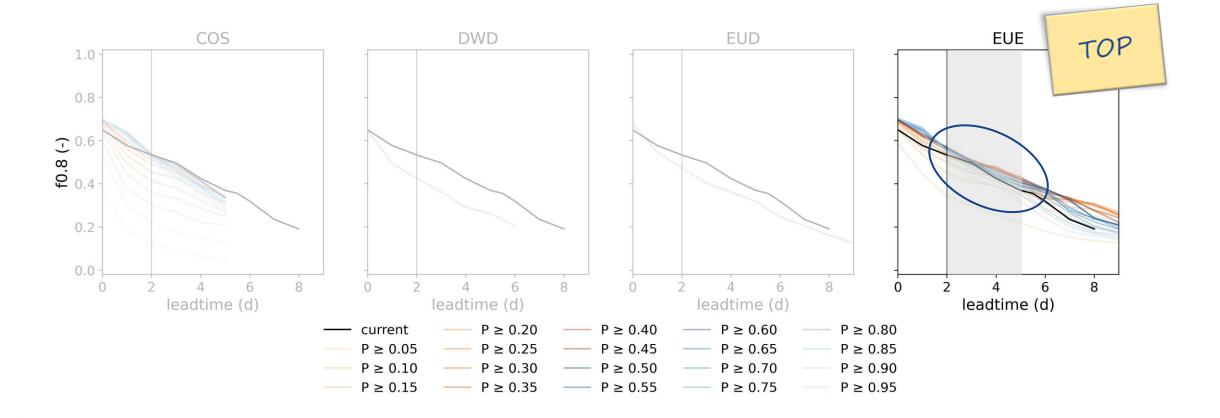






Events NWP Combination

# Notification skill vs lead time





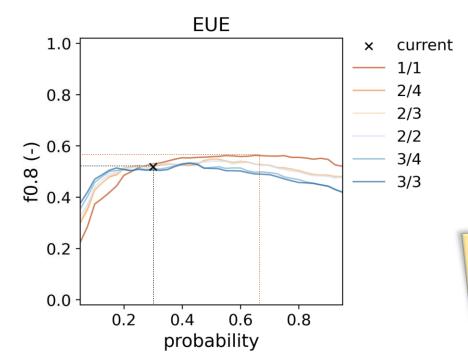




Introduction Developments Methods Results Conclusions

Events NWP Combination

# Optimal criteria



Model	Probability		recall		f <sub>0.8</sub>
1D+1P	0.300	3/3	0.413	0.618	0.518
EUE	0.650	_	0.416	0.725	0.562

NO persistence Uncertain probab.

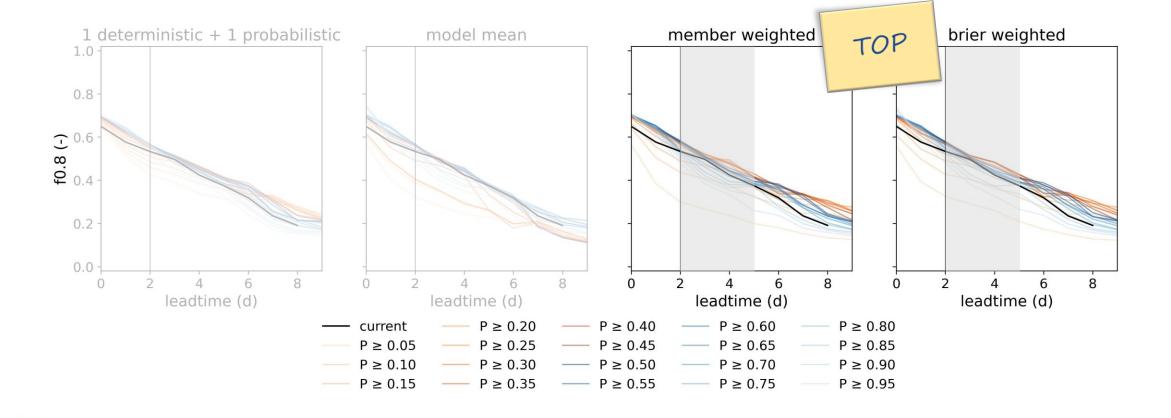
recall ≈ prec. 11%↑





Events NWP Combination

#### Notification skill vs lead time



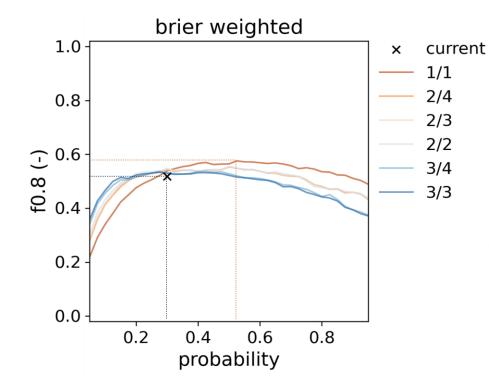




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# Optimal criteria



model					f <sub>0.8</sub>
EUE	0.650	-	0.416	0.725	0.562
BW	0.525	_	0.451	0.700	0.576

NO persistence

P ≈ 0.50

recall 4%↑
prec. 2%↓

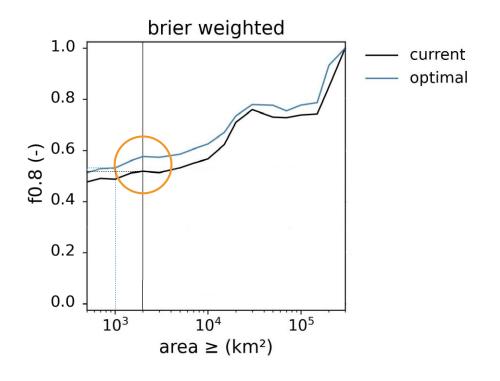




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# Notification skill vs area





Skill optimal 1000 km² ≈ skill current





#### **EFAS FORMAL FLOOD NOTIFICATION**

#### Criteria:



- Catchment part of CoA (Condition of Access)
- Catchment area  $\geq \frac{2000 \text{ km}^2}{1,000 \text{ km}^2}$
- Event ≥ 48 h ahead

- 50%
  3 consecutive forecasts with ≥ 30% exceeding EFAS 5 year return period according to ECMWF ENS or to COSMO-LEPS forecasts
- At least one of the deterministic ECMWF or DWD forecasts exceeds EFAS the 5 year return period. The total probability is computed as a skill weighted mean of the 4 meteorological models





Motivation Data Methods Results Conclusions

#### **EFAS FORMAL FLOOD NOTIFICATION**

*Proposal for new criteria:* 

- Catchment part of CoA (Condition of Access)
- Catchment area ≥ 1,000 km2
- Event ≥ 48 h ahead
- The total probability\* of exceeding the EFAS 5 year return period ≥ 50%

# Further steps:

- To be implemented in the following months.
   Join the test group!
- Visit the poster!
- To be repeated with EFASv5







<sup>\*</sup> The total probability is computed as a skill weighted mean of the 4 meteorological models.

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Events NWP Combination

