

On-demand
mapping



Rapid
Mapping



Risk and Recovery
Mapping

Early warning
and monitoring



Floods



Fires



Droughts

Exposure
Mapping



Population



Built-up
areas



Copernicus Emergency Management Service

What is EFAS post-processing?

EFAS Annual Meeting 2022

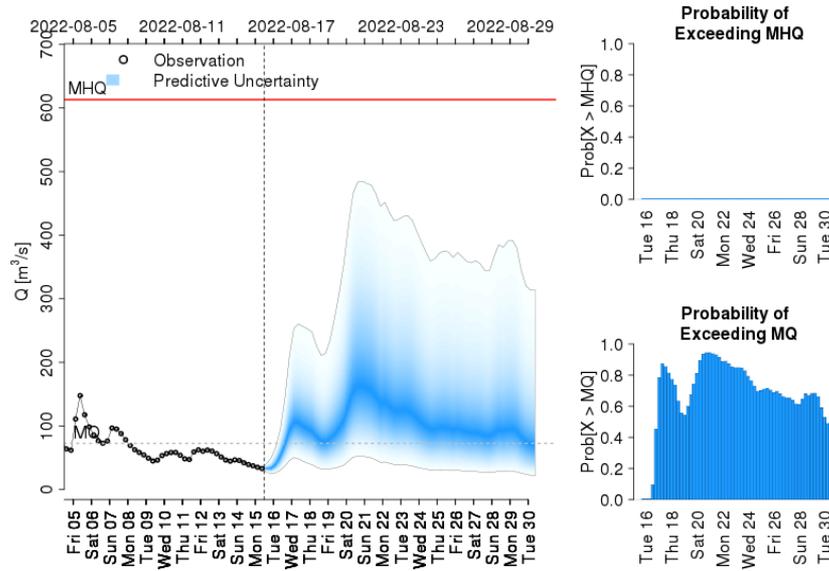
Presented by Gwyneth Matthews

27 09 2022





Aim: To reduce errors and uncertainty in the forecast so that it more accurately predicts the observed discharge.



- Post-processed forecast product
- Bias-corrected forecast
- Real-time hydrograph
- PP (post-processing)



Agenda



Presentation: 'What is EFAS post-processing?'



Demonstration: How to use the EFAS Sensor Observation service (SOS)



Activity: Group mind-mapping



Discussion: Future of EFAS post-processing



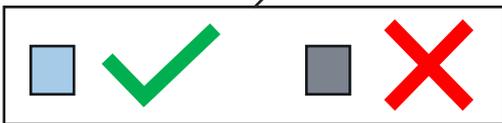
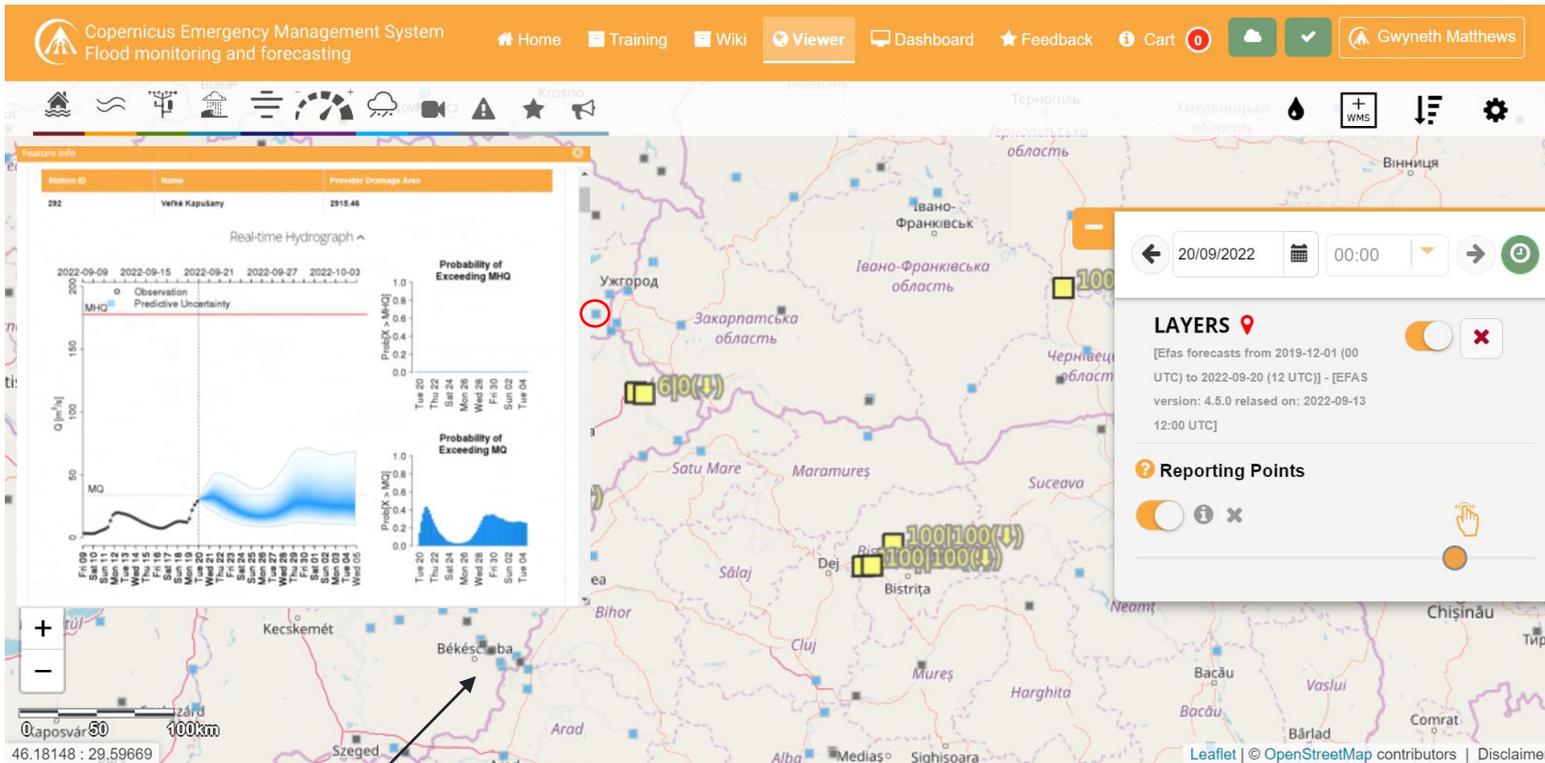
What is the EFAS post-processed forecast product?





Post-processed forecast product

Emergency Management

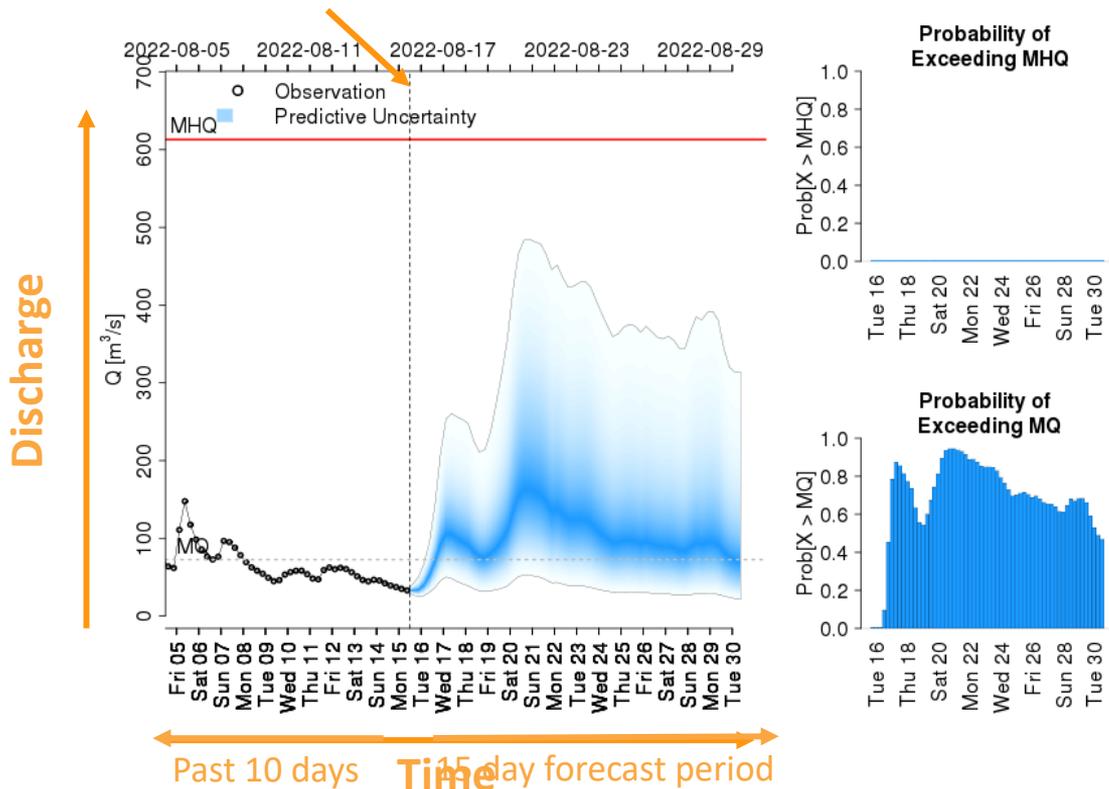




Emergency
Management

Post-processed forecast product

Forecast date





Emergency Management

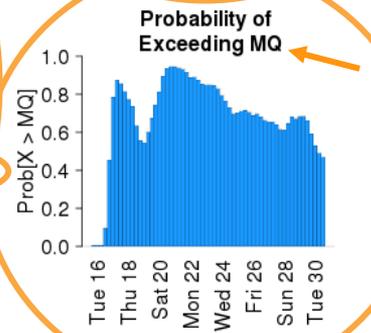
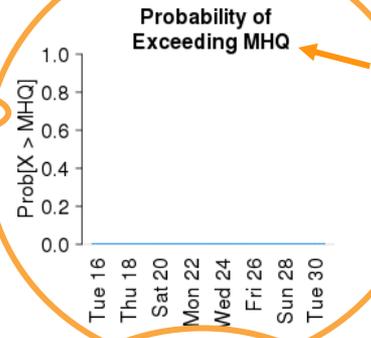
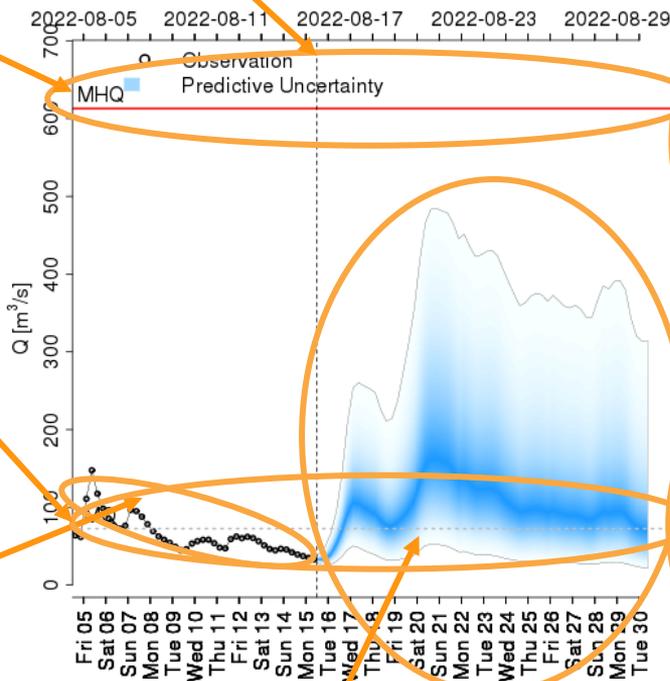
Post-processed forecast product

MHQ threshold:
mean annual
maximum
observed flow

MQ threshold:
Average observed
flow

Recent discharge
observations

Forecast date



Past 10 days

15 day forecast period

Probabilistic
forecast



No equations!



How is the EFAS post-processed forecast made?





Two parts to the process:

Offline calibration

Performed twice a year:

- Incorporating newer observations
- New stations can be added during this step.



Toolbox



Online forecast update

Performed twice a day (00 and 12):

- Bias-corrects the forecast based on real-time observations

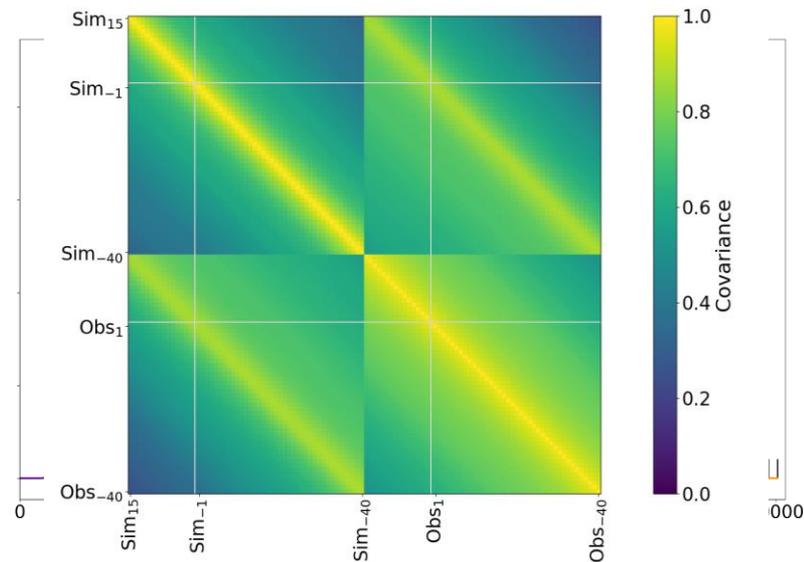
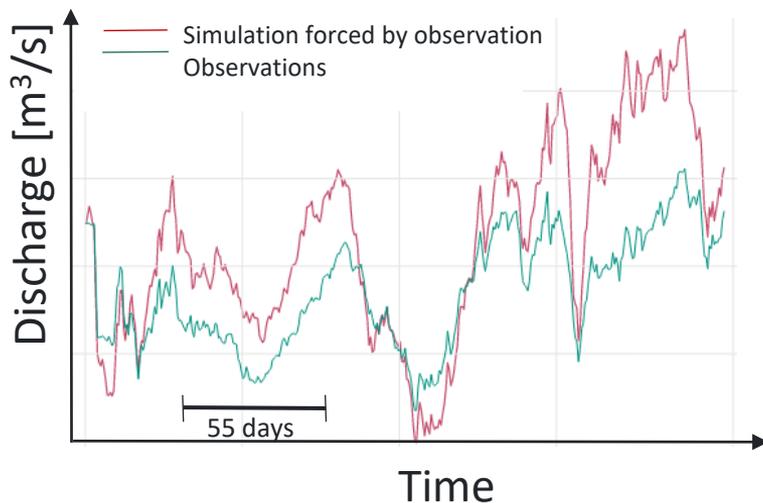


Method – Offline calibration

Input data

- Past discharge observations
- EFAS simulation forced by meteorological observations

Toolbox



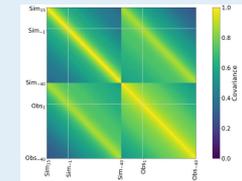
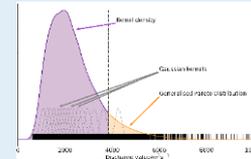


Method – Online forecast update

Input data: From the past 40 days

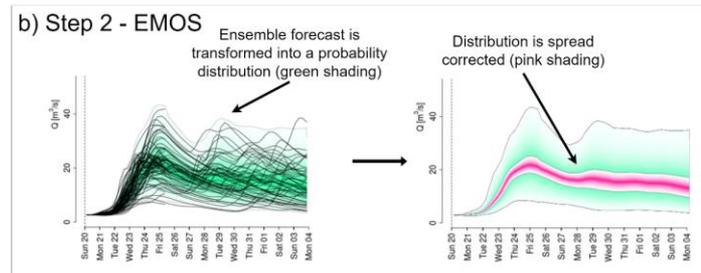
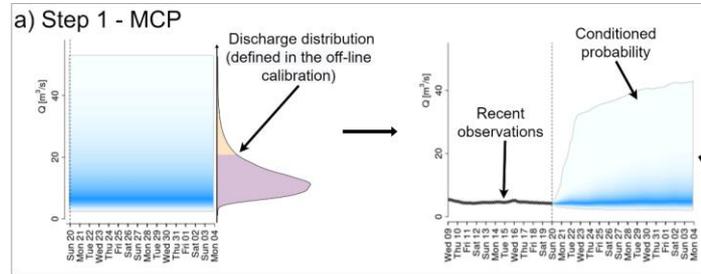
- Past discharge observations
- Simulation forced by observations
- EFAS ensemble forecasts

Toolbox



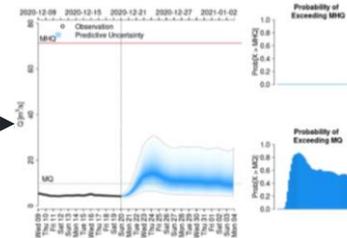
- Initial conditions
- Hydrological model

- Meteorological forcings



Step 3 - Kalman Filter

Step 4 – Real-time Hydrograph





- This information is all available on the EFAS Wiki!

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Pages / ... / EFAS medium-range forecasting Edit Save for later Watching Share

EFAS Post-processing

Created by Karen O'Regan, last modified by Gayneth Matthews on Sep 18, 2022

The aim of the EFAS post-processing methodology is to adjust the EFAS medium-range ensemble forecasts at specific locations, so they become predictors of future observed river discharge values. The EFAS post-processing methodology is based on a combination of two post-processing techniques: the Model Conditional Processor (MCP; Todini, 2008) and the Ensemble Model Output Statistics (EMOS; Gneiting et al., 2005) method. The post-processed forecast is represented by a probability distribution that is dependent on recent observations, simulation forced by observations (also known as the EFAS reanalysis), and forecasts. The output of this process is the 'Real-time Hydrograph' which is available in the pop-out windows of the Reporting Point layer for static reporting points where near real-time and past river discharge observations are available. Since EFAS version 4.5, the post-processing has been performed at 6-hourly timesteps where possible.

In EFAS, the post-processing is composed of two parts; the calibration (offline), and the forecast update (online):

Calibration (offline)

The offline calibration of the post-processing is performed twice a year to include the most recent observations.

Data: The off-line calibration requires at least 2 years of river discharge observations and the simulation forced by observations for the same time period. Where possible 6-hourly observations and simulations are used (as this allows the forecasts to be post-processed at a 6-hourly timestep in the forecast update part); daily observations are used otherwise and the simulation is aggregated to a daily timestep. For each station, the simulation comes from the most recent LISFLOOD historical run (available <https://cds.climate.copernicus.eu/cdsapp#/dataset/efas-historical?tab=overview>).

The off-line procedure has two main objectives:

- **Estimation of separate river discharge distributions for the observed and simulated river discharge values.** This estimation is performed by fitting a Generalised Pareto distribution to the extreme river discharge values and applying a kernel density estimation procedure for the remainder of the distribution (see Figure 1).



<https://confluence.ecmwf.int/x/AwLMDw>



How good are the EFAS post-processed forecasts?

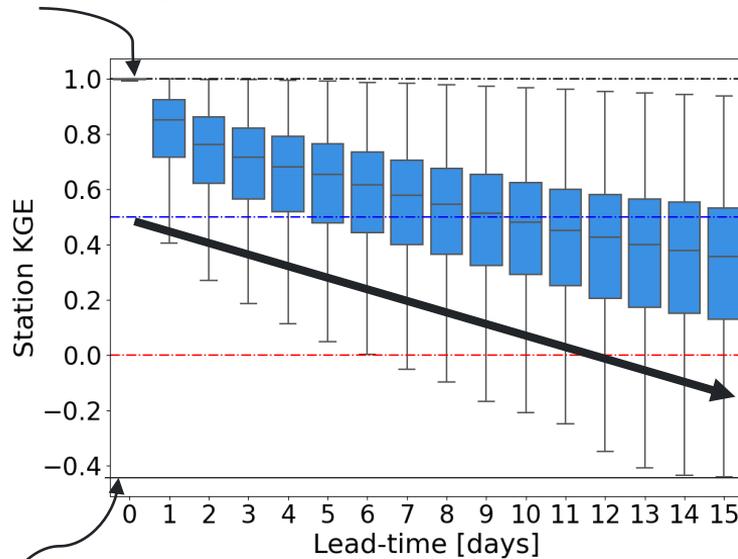




Evaluation – Forecast median

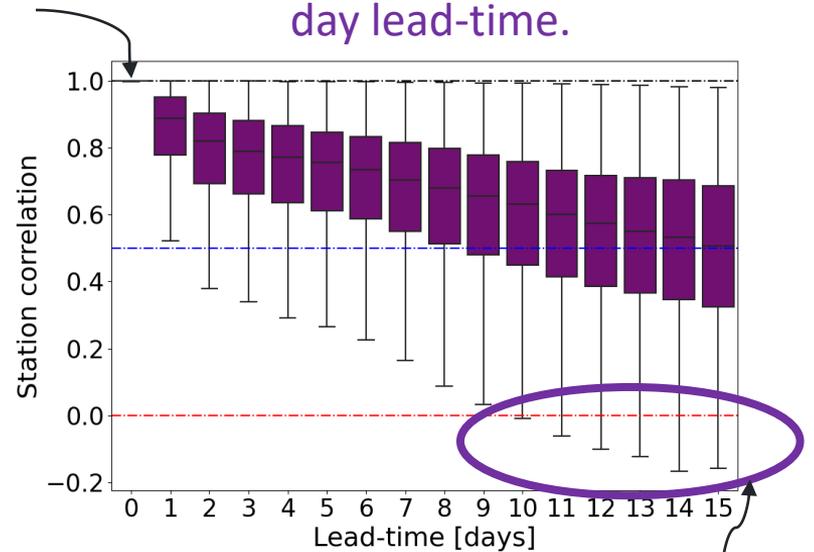
- KGE is a combination of time, bias, and variability errors

Initial conditions



Skill of the mean observations

Initial conditions



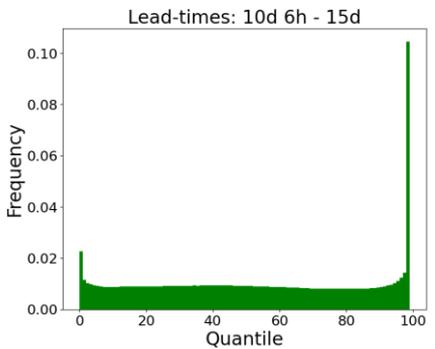
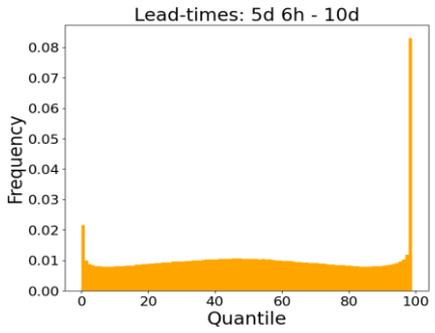
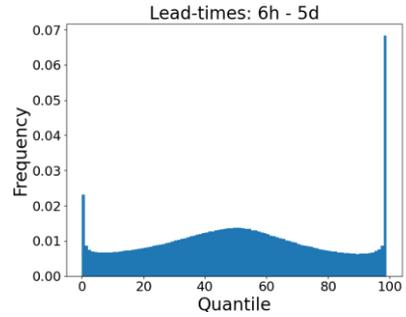
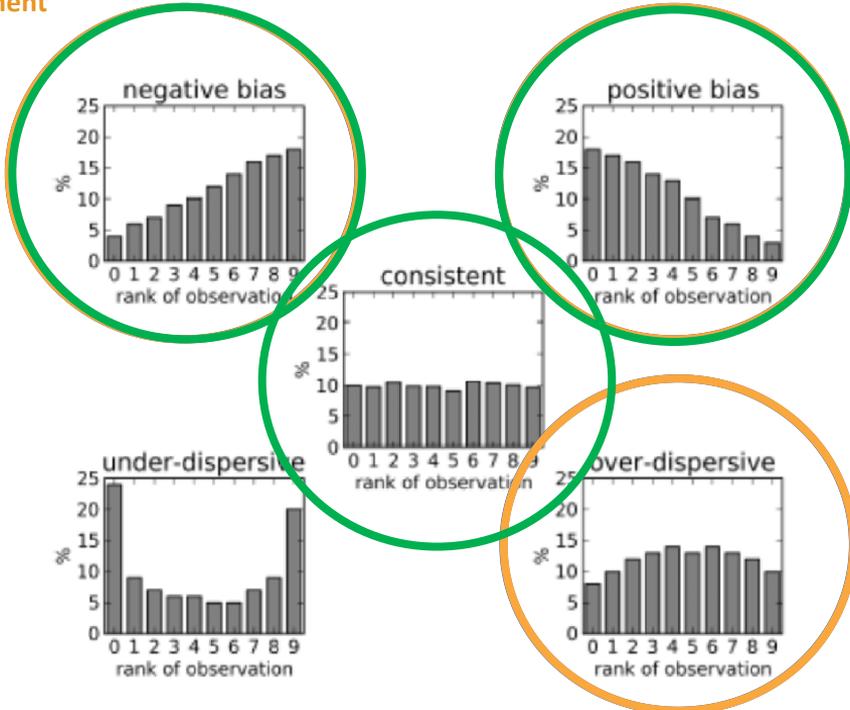
> 50% of stations have a correlation of +0.5 at a 15-day lead-time.

Some negative correlations



Evaluation – Forecast distribution

Emergency Management

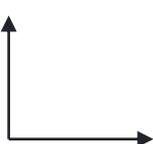




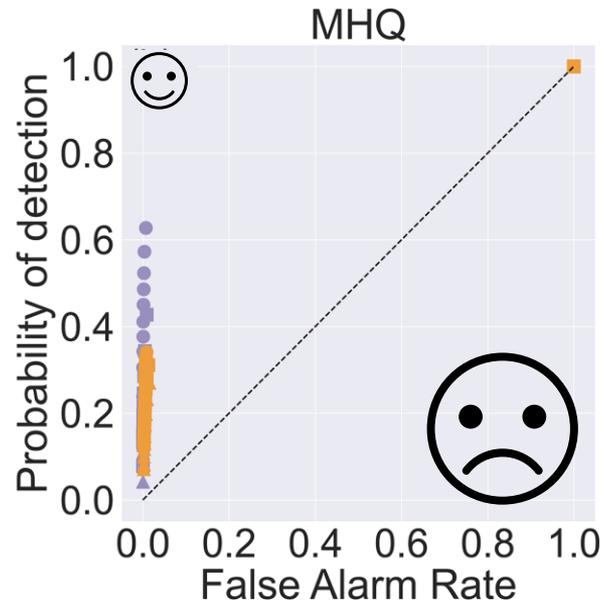
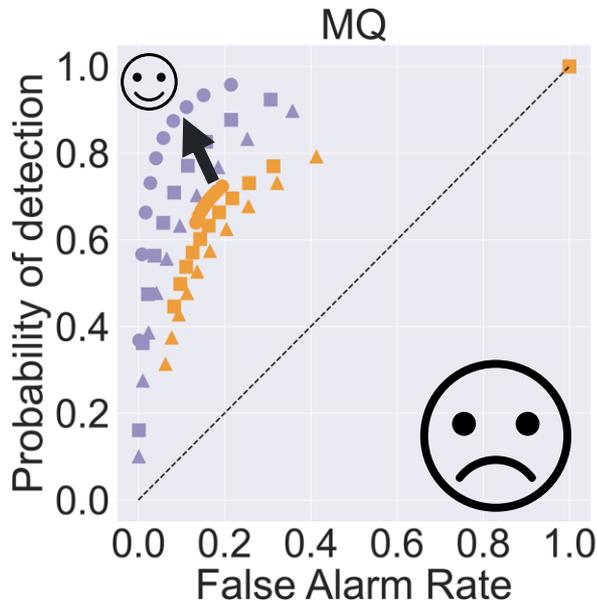
Benefits of post-processing

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Hits compared to misses



False alarms compared to true negative



raw post-processed

Lead-times

● 1-5 d

■ 6-10 d

▲ 11-15 d

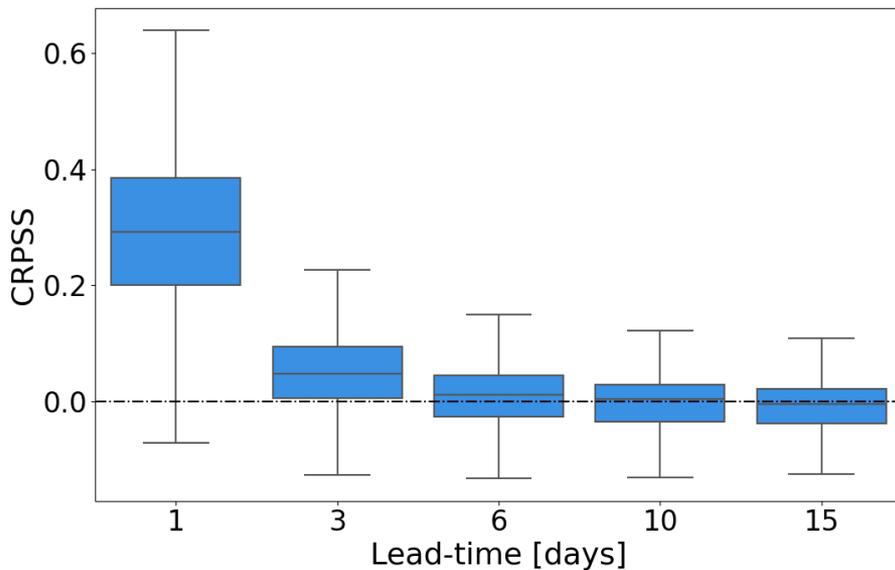
Post-processed forecast is more reliable at predicting the **OBSERVED** discharge value!



6 - hourly post - processing

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Management

6-hourly is
better



Daily is
better

- Short lead-times are improved by using 6-hourly observations.
- Longer lead-times are not impacted.



Access points – EFAS-IS

Emergency Management

Copernicus Emergency Management System
Flood monitoring and forecasting

Home Training Wiki Viewer Dashboard Feedback Cart 0 WMS

Gwyneth Matthews

Feature Info

| Station ID | Name | Provider | Drainage Area |
|------------|----------------|----------|---------------|
| 292 | Veľké Kapušany | | 2915.46 |

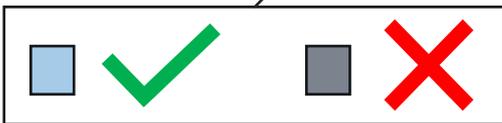
Real-time Hydrograph

Map showing stations with status indicators: 6|0|1, 100|100|1, 100|100|1.

Layers: [Efas forecasts from 2019-12-01 (00 UTC) to 2022-09-20 (12 UTC)] - [EFAS version: 4.5.0 released on: 2022-09-13 12:00 UTC]

Reporting Points

Leaflet | © OpenStreetMap contributors | Disclaimer





CEMS-Flood Sensor Observation

https://confluence.ecmwf.int/pages/viewpage.action?pagelId=247897101

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Pages / ... / Web Services

CEMS-Flood Sensor Observation Service (SOS)

Created by Karen O'Regan, last modified by Dimitar Tasev on Jun 17, 2022

The Sensor Observation Service (SOS) is a web-based API that allows access to the EFAS post-processes forecasts via web-based query. This allows users to download real-time data from stations on the EFAS River Network.

EFAS SOS can be accessed by EFAS Partners using the credentials available on the <https://www.efas.eu/en/efas-web-services> page.

Currently, SOS is **not** available for GloFAS.

EFAS SOS Example Requests

Get Capabilities Request: <https://efas-sos.efas.eu/sos/kvp?service=SOS&request=GetCapabilities>

Get all featureOfInterest/stations :
<https://efas-sos.efas.eu/sos/?service=SOS&version=2.0.0&request=GetFeatureOfInterest>

Get a specific station (a feature of interest):
https://efas-sos.efas.eu/sos/?service=SOS&version=2.0.0&request=GetFeatureOfInterest&featureOfInterest=ID_1

Get observations for a specific station (ID_1), model/ensemble member(eud_lisflood) and execution time (2020-08-10T12:00:00Z):
https://efas-sos.efas.eu/sos/?service=SOS&version=2.0.0&request=GetObservation&featureOfInterest=ID_1&procedure=eud_lisflood&temporalFilter=om:resultTime,2020-08-10T00:00:00Z

Get observations for a specific station (ID_1), model/ensemble member (eue_lisflood_3) and execution time (2020-08-10T12:00:00Z):
https://efas-sos.efas.eu/sos/?service=SOS&version=2.0.0&request=GetObservation&featureOfInterest=ID_1&procedure=eue_lisflood_3&temporalFilter=om:resultTime,2020-08-10T00:00:00Z

- placemoider - GloFAS User Guide
- CEMS-Flood Data User Guide
 - CEMS-Flood Terminology
 - Data Catalogue
 - Data Structure and Formats
- Data Access
 - CDS
 - MARS
 - FTP
- Web Services
 - CEMS-Flood Sensor Observation**
 - CEMS-Flood Web Map Service
 - Accessing CEMS-Flood Data
 - Using QGIS for CEMS-Flood Data
 - Using ESRI ArcMap for CEMS-Flood Data
- Working with CEMS-Flood Data
- FAQs
- CEMS-Flood Data Support
- CEMS-Flood Development and Deployment
- UTCI

Space tools



Activity





Discussion





What would be the one thing that you want changed?



Emergency
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Discussion

Do you like the name 'Real-time
Hydrograph'?

Please complete the post-workshop questionnaire!



<https://tinyurl.com/yx3hyf65>



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Thank you!

Please send question to
Gwyneth.g.matthews@ecmwf.int



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