
European Flood Awareness System

EFAS *Bulletin*

June – July 2023

Issue 2023(4)



NEWS

New features

EFAS v4.8 launched

A minor release of the Copernicus Emergency Management Service (CEMS) European Flood Awareness System (EFAS), version 4.8, was launched operationally on Tuesday **27 June 2023**.

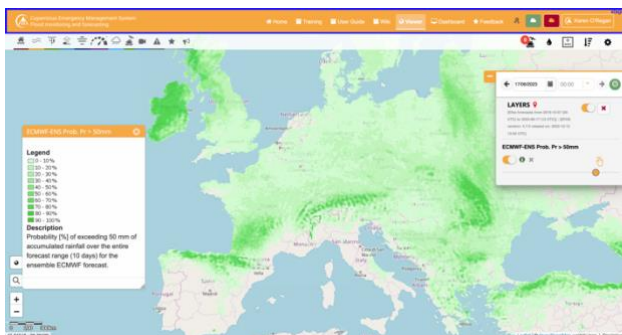


Figure 1: EFAS version 4.8 introduces changes associated with the 48r1 Numerical Weather Prediction (NWP) model configuration (resolution and extended range) that may potentially impact the results of EFAS.

CEMS EFAS v4.8 integrates changes in its Numerical Weather Prediction Forcing, with the use of ECMWF ensemble forecasting system version 48R1. The 48R1 ENS has a spatial resolution of 9km compared with 18km for previous ENS versions. The configuration of the NWP input to CEMS EFAS remains unchanged. More details on the changes can be found in the [Implementation of IFS Cycle 48r1](#).

For more information about the release of CEMS EFAS which includes also other minor changes, we refer to the [dedicated wiki pages](#). Questions and feedback can be addressed to the EFAS team via the [EFAS Contact form](#).

RESULTS

Summary of EFAS Flood and Flash Flood Notifications

The 17 formal and 21 informal EFAS flood notifications issued in June – July 2023 are summarised in Table 1. The locations of all notifications are shown in Figure 32 and Figure 34 in the appendix.

396 flash flood notifications were issued in June – July 2023. They are summarised in Table 2. The locations of all notifications are shown in Figure 33 and Figure 35 in the appendix.

Meteorological situation

As of June 2022, reporting of the meteorological situation by the Meteorological Data Collection Centre (MDCC) will no longer be published in the EFAS bulletin. Instead, the state of recent meteorology will be conducted by the Copernicus Climate Change Service (C3S) and published as monthly [Climate Bulletins](#).

Hydrological situation

by EFAS Hydrological Data Collection Centre

June

During the month of June, there were 121 stations with exceedances, which is half than the previous month. The majority of stations are in Italy (25) and Serbia (21), mainly related to water level. In Spain there are 16 stations, and in Bosnia and Herzegovina and Croatia there are 12 stations with exceedances.

In addition, there are five stations in Ukraine and Hungary, four stations with exceedance in Iceland, Austria, Slovakia, and Romania and three stations in Norway. Several countries have recorded one station with exceedances this month: Switzerland, Germany, Sweden, Belgium, Slovenia, and Kosovo*.

As for the river basins, the main river basin with values above the threshold is again the Danube, with 63 stations in ten different countries, with Serbia, Croatia, and Bosnia and Herzegovina standing out with 21 the first and 11 exceedances the latter. The Po River in Italy is the next river basin with the highest number of stations (20), followed by the Llobregat River with five stations with exceedances. A total of 58 different river basins have exceedances in June.

In terms of the stations that recorded values of mean discharge above the 90% quantile, 98 exceeded this threshold this month. In June, Spain (28) was the country with the most stations in this situation. Serbia (26), and Slovenia (10), are the countries with the next highest number of stations. The Spanish stations are distributed in 11 different basins, highlighting the Ebro River, with seven stations in this situation. In Serbia, only the Danube basin is affected while in Slovenia we find three basins, highlighting the Danube again. In

Croatia, six stations show values above this quantile. In Bulgaria and England, five stations exceed this cliff. Other stations exceed the 90% quantile value in up to 16 countries.

By river basin, it is the Danube River that stands out with 51 stations above the 90% quantile. The aforementioned Ebro river basin is the second with the highest number of stations over this cliff, showing seven stations in this situation and followed by the Minho and Guadiana river basins with 5. A total of 27 different river basins have exceedances over the 90% quantile in June.

Finally, and according to the number of stations recording mean values below the 10% quantile, in June there were 136 stations with average values below this cliff, across 15 different countries.

This month, Germany is the country with the most stations (41), followed by Spain (19). Switzerland has 17 stations with values below this threshold. With 16 stations we find France, and Poland with 11. Another ten countries show less than ten station each in this situation.

In terms of river basin, this month the Rhine is the river with the highest number of cases, with 37 stations with an average discharge below the 10% quantile. The Danube River has 17 stations, and Elba river has 10 stations in the same situation. In total, as many as 38 different basins have values below this limit in Europe.

*This designation is without prejudice to positions on status and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

July

During the month of July, there were 54 stations with exceedances, 45% of the previous month. Most of them are located in Italy (18 stations) and Slovenia (15 stations). They are mainly related to water level in Italy and both types of variables exceed in Slovenia. In Austria there are 7 stations and in Spain there are 4 stations with exceedances.

In addition, there are two stations in Norway and Serbia and several countries have recorded a station with exceedances this month: Poland, Bosnia and Herzegovina, Belgium, Romania, Hungary and Ireland.

As for the river basins, the main river basin with values above the threshold is again the Danube, with 26 stations in six different countries, with Slovenia standing out with 14 exceedances. The Po River in Italy is the next river basin with the highest number of stations (15), followed by the Tiber River in Italy and the Ebro River in Spain with two stations each with exceedances. A total of 13 different river basins have exceedances in July.

In terms of stations that recorded values of mean discharge above the 90% quantile, 122 exceeded this threshold this month. In July, Slovenia was the country with the most stations in this situation: 57. Ireland, with 18 stations in this situation, and Spain with 13, are the countries with the next highest number of stations in this situation. The Slovenian stations are distributed in four different basins, highlighting the Danube River, with 48 stations exceeding this quantile. In Ireland there are ten basins affected while in Spain we find six basins, highlighting the Guadiana River. In Serbia and Norway, eight stations have values above this quantile. In England, six stations exceed this cliff. Other stations exceed the 90% quantile value in up to 14 countries.

By river basin, the Danube River stands out with 60 stations above the 90% quantile. The Soca-Isonzo river basin (Slovenia) is the second with the highest number of stations over this cliff, showing seven stations in this situation and followed by the Guadiana river basin (Spain) with six. A total of 37 different river basins have exceedances over the 90% quantile in July.

Finally, and according to the number of stations recording mean values below the 10% quantile, in July there were 150 stations with average values below this cliff at nineteen different countries.

This month, Germany is again the country with most of the stations (38), followed by Spain with 31 stations. Poland has 18 stations with values below this threshold. With thirteen stations we find France and Switzerland with twelve. Another fourteen countries show less than ten station each in this situation.

In terms of river basin, this month the Rhine is again the river with the highest number of cases, with 33 stations with an average discharge below the 10% quantile. The Danube River has 24 stations, and Oder River has seventeen stations in the same situation. In

total, as many as twenty-nine different basins have values below this limit in Europe.

Verification

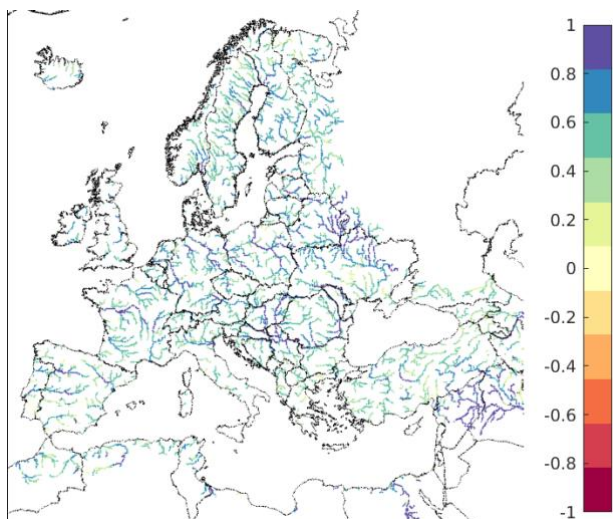


Figure 2: EFAS CRPSS at lead-time 1 day for June – July, for catchments >2000km². The reference score is persistence of using previous day’s forecast.

Error! Reference source not found. and **Error! Reference source not found.** shows the EFAS headline score, the continuous ranked probability skill score (CRPSS) for lead times 1 and 5 days for June - July across the EFAS domain for catchments larger than 2000km². A CRPSS of 1 indicates perfect skill, 0 indicates that the performance is equal to that of the reference, and any value <0 (shown in orange-red on the maps) indicates the skill is worse than the reference. The reference score is using yesterday’s forecast as today’s forecast, which is slightly different than we used previously and very difficult to beat.

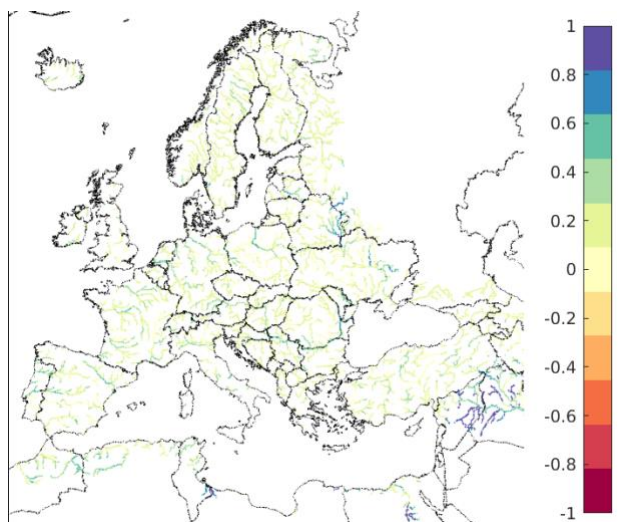


Figure 3: EFAS CRPSS at lead-time 5 days for June-July for catchments >2000km². The reference score is persistence of using previous day’s forecast.

These maps indicate that across much of Europe for forecasts are more skilful than persistence at both lead times. Regions shown in blue are those where EFAS forecasts are more skilful than persistence, with darker shading indicating better performance.

The skill of the forecast was quite good over the period, and similar to the same period last year (**Error! Reference source not found.**). An inter-annual variability of the scores is to be expected. The long-term trend is neutral over the first two years since the domain was extended, but there is an indication of increase in skill with EFAS 4.0, especially for the areas with generally lower skill.

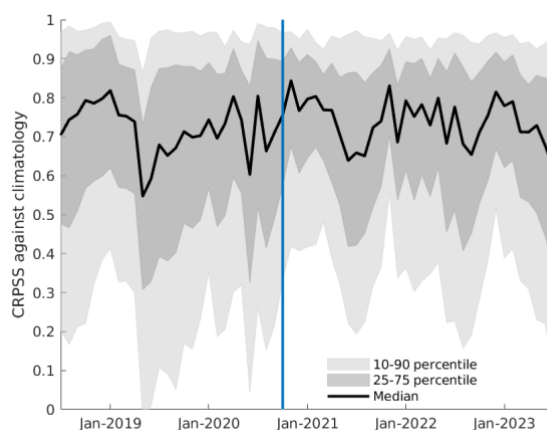


Figure 4: Monthly means of CRPSS the for lead-time 5 days for all the major river points in Europe with ECMWF ENS as forcing. Reference forecast was climatology. The skill is largest during the winter months, when there is less variation in the flow in

large parts of Europe. The blue line indicates the release of EFAS version 4.0.

ARTICLES

Floods in Serbia, Kosovo, and Romania – June 2023

by Richard Davies, [floodlist](#)

Severe flooding impacted multiple areas of Serbia, Kosovo and Romania during June 2023. At least 3 people died in flash floods in Kosovo and Romania. In Serbia dozens of municipalities declared an emergency situation due to the impact of flooding following two weeks of heavy rain.



Figure 5: Floods in Arad County Romania 25 June 2023. Photo: Arad County Government

Serbia

Several local streams and rivers broke their banks after heavy rain between 04 to 06 June 2023, flooding fields and roads. According to the Red Cross, the municipalities of Loznica, Šabac, Babušnica, Aleksinac, Grocka, Aleksandrovac, Kuršumlija, Čačak, Brus, and Vrnjačka Banja.

Further heavy rain fell across the country from 10 to 18 June 2023. The Ministry of Internal Affairs Emergency Situations Sector in Serbia reported dozens of people were evacuated or rescued during this time. By 17 June, over 50 municipalities and cities had declared an emergency situation, including the capital, Belgrade.

According to the Red Cross, as of 16 June, more than 15,432 people from 5,144 households were affected by floods in Serbia.

Among the hardest hit were communities in Pomoravlje district (2,276 households affected), Zaječar district (531 households), Pirot district (270 households), Mačva district (258 households), and Rasina district (250 households).

The Red Cross said the affected households faced substantial damage to residential properties, the essential infrastructure required for daily activities, and the livelihoods of the local population. As many as 1,700 homes suffered damage.

Kosovo

Flooding also affected parts of neighbouring Kosovo* during this period. Some homes and a bridge were damaged in the municipality of Lipjan on 02 June. Minor flooding impacted areas of Podujeva District on 14 June.

Severe flooding occurred in the municipality of Peja after a short burst of torrential rain on 24 June. The Hydrometeorological Institute of Kosovo (Instituti Hidrometeorologjik i Kosovës) reported 54.6 mm of rain fell in just over 1 hour during the evening of 24 June. This amount of rainfall in such a short period inevitably caused flooding, in particular in urban areas, the Institute said.

Flood waters swept through the streets of Peja, where two people died and two were seriously injured. In a statement on the situation, the President of the Republic of Kosovo, Vjosa Osmani, expressed her shock at the events and offered her condolences.

Romania

Similar destructive flooding occurred in Arad County in Romania on 25 June 2023. Vehicles were swept away and homes flooded. Roads were left strewn with downed trees, mud and flood debris. Residents of flooded homes moved to higher floors for safety.



Figure 6: Floods in Arad County Romania 25 June 2023. Photo: Arad County Government

The Department for Emergency Situations said the body of a man reported missing after he was his home was flooded was found approximately 5 km from the house.

Iustin Cionca, President of the Arad County Council, said “A catastrophe of this magnitude has never been recorded here before.” He said that communities in Buceava-Șoimuș, Gurahonț, Brazii and Mădrigești have all been severely impacted.

More than 60 houses and 3 km of road have been damaged or destroyed. At least 8 people had to be rescued. Several dozen families will have to be evacuated, according to the president.

The Department for Emergency Situations also reported significant flooding Hunedoara County at this time.



Figure 7: Floods in Arad County Romania 25 June 2023. Photo: Arad County Government

**This designation is without prejudice to positions on status and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.*

Flooding in Aragón region, Spain - July 2023

by Richard Davies, [floodlist](#)

A short period of torrential rain caused dramatic flash floods in the Aragón Region of Spain on 06 July 2023. The State Meteorological Agency (AEMET) said the region was hit by a series of storms in a short period during the afternoon and evening of 06 July 2023. According to AEMET figures, the town of Alcañiz in Teruel Province recorded 46 mm of rain in a few hours, with 27.6 mm falling in just 10 minutes. Meanwhile, in

the regional capital Zaragoza, the weather station at Valdespartera in the city recorded 54 mm during the storm, with 19.6 mm falling in a 10-minute period.

The [government of Aragón said](#) numerous roads were cut and homes were flooded in areas of Teruel and Zaragoza Provinces. Residents of a flooded house in Alcañiz were evacuated and relocated to a hostel. Heavy hail destroyed fruit crops in Bajo Aragón, Calatayud, and Cariñena.

The most dramatic flooding occurred in Zaragoza. Videos shared on Social Media showed raging flood waters sweeping through central parts of the city, in particular along the Z-30 road in the Parque Venecia neighbourhood. Firefighters had to rescue people who were trapped on the roof of their vehicles or left clinging to trees.

In total there were 15 high water rescues, 140 evacuations, and more than 400 interventions from firefighters, police, and other municipal services, the government of Zaragoza said. Six of those rescued were taken to hospital for assessments or minor injuries. No fatalities were reported.

Elsewhere in the city, a school building and a shopping center were damaged and several other roads were flooded. Rail and tram transport in the area were also negatively impacted. Roads and homes were also flooded in the towns of Cuarte de Huerva and Cadrete just outside the city. The roof of a building was destroyed by heavy rain in El Burgo de Ebro, to the southeast of Zaragoza. Two residents were evacuated, unharmed.



Figure 8: The Mayor of Zaragoza visited areas of Zaragoza soon after the floods on 06 July 2023. Photo credit: Government of Zaragoza

Natalia Chueca, the Mayor of Zaragoza, [visited affected areas soon after the event](#). The mayor said the material damage was considerable but the quick and effective interventions of firefighters and police prevented further personal injuries.

A team of over 200 personnel were deployed to carry out clean-up operations immediately after the event.

EFAS Partner Survey 2022

by EFAS Analytics and Dissemination Centre

The 2022 EFAS partner survey was sent to all partners in January 2023. This survey was intended to assess the general satisfaction with the EFAS service, products and performance during the year 2022. The 2022 survey was anonymous, and a total of 42 responses were received, which was similar to the number of responses received during the 2017-2021 surveys (Figure 1).

Results from the survey showed that...

- the interest in EFAS has steadily increased since the first survey was conducted in 2017
- the overall satisfaction with EFAS was very positive
- the EFAS performance and forecast skill is rated as high or very high by the majority of respondents
- EFAS provides good quality online documentation and resources
- there is a high level of engagement with the EFAS partners
- the EFAS map viewer interface has adequate content and functionalities, but it should be improved
- the ability to access and download EFAS hydrological data should be better highlighted.

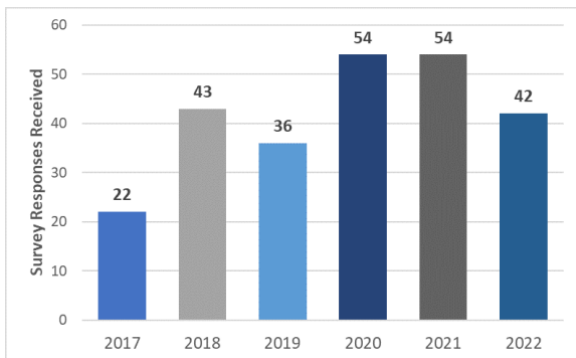


Figure 9: Number of survey responses received by year.

The survey responses are summarized according to the following categories:

- Demographics
- Overall Satisfaction
- Skill, Model Performance, and Trust
- EFAS Services
- EFAS Products and Added Value
- Feedback and Collaboration
- Future Developments

Demographics

The distribution of country origin for the survey respondents was similar in 2020-2022, but the percentage of respondents from the "others" category was highest in 2021.

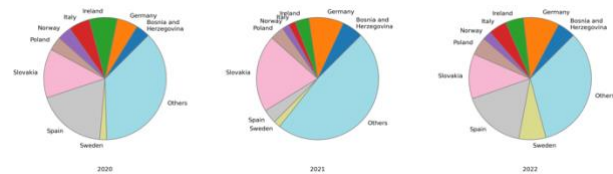


Figure 10: Pie-chart showing the country origin of the EFAS partners that answered the survey.

As in 2021, most of the participants in the 2022 survey were either an EFAS partner or both a data provider and an EFAS partner. However, there were fewer EFAS third party partners and more data providers who responded to the 2022 survey compared to the 2021 survey.

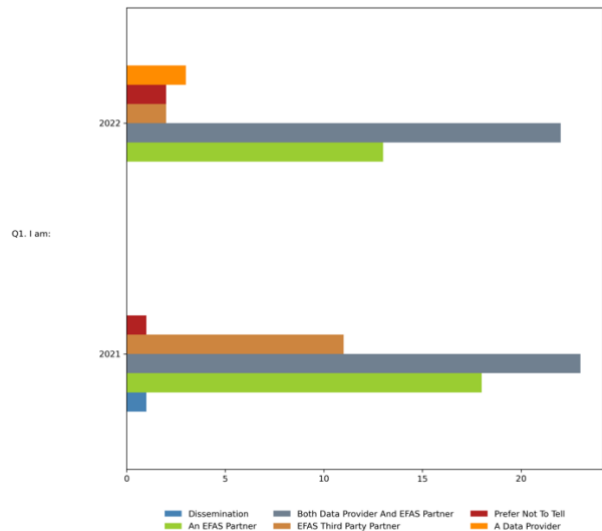


Figure 11: Roles of survey respondents. Note that the "Dissemination" option was removed for the 2022 survey.

Overall Satisfaction

No major changes in the overall satisfaction were reported in comparison to the previous five years. As with the previous surveys, the responses in 2022 were very positive for overall interest, satisfaction, and performance. A noteworthy trend in the survey responses is that there has been increasing interest in EFAS since 2017.

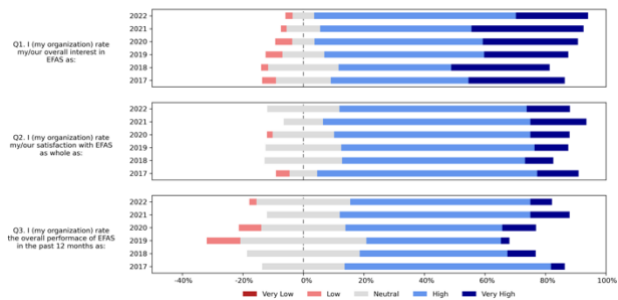


Figure 12: Average user response on overall satisfaction with the EFAS.

Skill, Model Performance and Trust

In 2022, the majority of the survey participants rated the EFAS model performance and forecast skill as high (55% of responses) or very high (7% of responses). However, 38% of respondents gave a neutral rating compared to 17% of respondents in 2021.

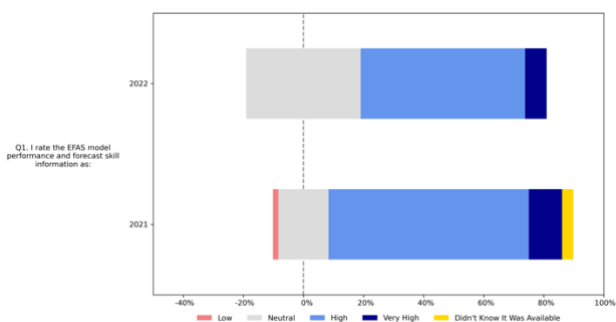


Figure 13: User response about the model performance and forecast skill.

EFAS Services

In 2022, the EFAS Wiki, User Guide, News and Events, and Resources were the most-read informative resources with 81-88% of participants reading them at least sometimes. In contrast, the three reports were the least read resources with only 52-69% of participants reading them at least sometimes. Overall, there was a decrease in the proportion of participants who read the reports in 2022 compared to 2021; for the 2022 survey, 48% and 45% of the participants responded that they never read the report or did not know that it existed for the annual meteorological report and the detailed assessment report, respectively.

However, when the survey was sent to the participants, the 2021 annual hydrological and 2021 meteorological report had just been published and the 2021 Detailed Assessment Report had not yet been published. Thus, it is very reasonable that the survey uncovered somewhat lower interest for these reports as only the 2020 reports were available in 2022 (it is here to note that the delayed publication of the hydrological, meteorological, and detailed assessment report for the reference year was caused by exceptional circumstances; the reports for the reference year 2022 will be published in mid-2023, according to the regular schedule). Note that "Always" option was removed for the 2022 survey.

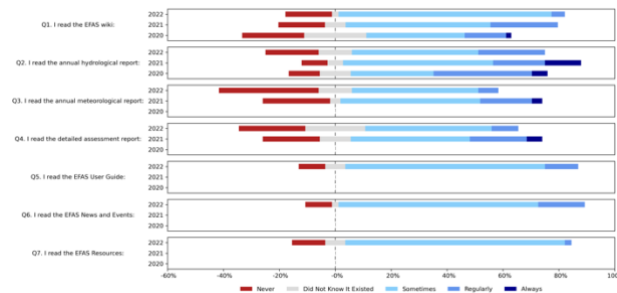


Figure 14: Average user response to EFAS informative resources.

Survey participants provided similar responses in 2022 as in previous years when asked to identify their main benefits of being an EFAS partner. Like in 2020 and 2021, the most selected options in 2022 were notifications, forecasts, and learning practices during annual meetings. Respondents have also consistently indicated that observed and forecasted precipitation and partnership are important benefits of being an EFAS partner. It is here noted that the option "Training by DISS" was not provided after 2020.

New options introduced starting from the 2021 survey were: (1) Europe-wide overview on ongoing and forecasted events, and (2) To be able to see/monitor the situation/forecast of neighbouring basins. Although these two options were highly ranked in the 2021 survey, these options were not as highly ranked by the participants in the 2022 survey. One new option, pre-tasking of satellite images in case of severe events, was included in the 2022 survey, and 29% of the respondents indicated that this was among the main benefits of their EFAS partnership. For the 2022 survey, two participants also selected the option to specify other benefits and wrote that their benefits included (1) learning practices based on using EFAS IS and (2) additional products like social media, seasonal outlooks, satellite flood monitoring products.

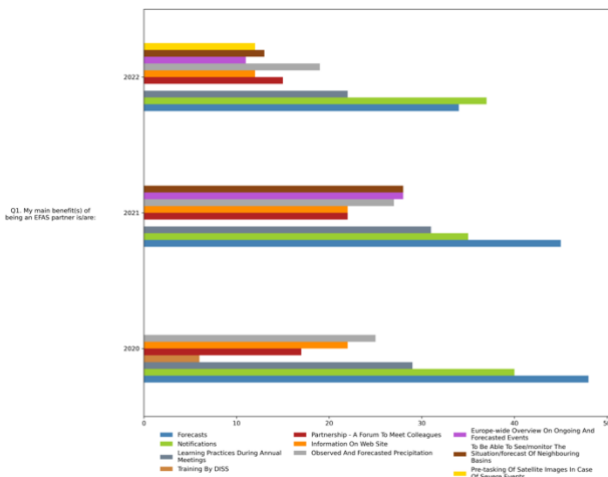


Figure 15: User responses on the main benefits of being an EFAS partner.

EFAS provides complementary flood forecast information to relevant stakeholders to support flood risk management at the national, regional and global level. From 2021 to 2022, there was an increase in the percentage of respondents/organizations who compare EFAS forecasts with those from other providers; in 2022, 67% of participants responded "yes" compared to 44% in 2021.

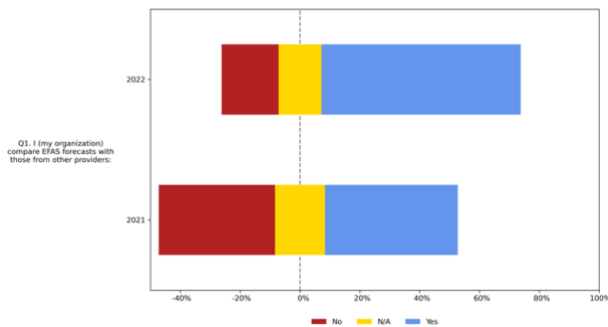


Figure 16: User responses on if they compare EFAS forecasts with those from other providers.

Participants who answered "Yes" in the 2022 survey were then asked to specify which systems they use and how those systems compare with EFAS. A summary of these systems is provided below:

- National System (8 participants)
 - EFAS resolution at present is too coarse to forecast well for rivers in England and Wales.
- Local System (5 participants)
- Own System (8 participants)
 - We check EFAS against our own more highly resolved and locally adjusted system with station updates including

water regulations in some places. We rate our own system higher compared to EFAS, but always double-check if EFAS is sending notifications.

- We use our own forecasting modelling system (rainfall-runoff and hydrodynamic model). Our results are much better (timing, values, resolution, forecasted event description, performance).
- AEMET (2 participants)
- ALADIN
- AROME
- BSMEFFG (2 participants)
- Flood Early Warning System (FEWS)
- FFGS
- HARMONIE-AROME
- HypeWEB
 - EFAS is far more precise.
- ICON ECMWF
- LHW Elbe WAVOS /SOBEK forecasts
 - In the moment we just compare the results of normal or lower flow conditions and there the results compare well
- Numerical Models
- Pantha Rhei Model
- Spanish SAIH
- W-FLOW
- WMO SEEFFGS

Partners were asked to rank their preference on different forms of training with a rank of 1 indicating their first choice and a rank of 4 indicating their last choice. Overall, the partners in 2022 preferred to receive training in the form of:

- *short online tutorials* (average rank = 2.19; first choice of 14 partners) followed by
- *regular webinars* (average rank = 2.31, first choice of 10 partners), whereas
- *workshops during the annual meeting* (first choice of 11 partners) and
- *online documentation* (first choice of 7 partner

were the least preferred with average ranks of 2.68 and 2.76, respectively. Overall, however, these responses were similar to those received during the 2020 and 2021 surveys.

The survey results indicate that the participants were quite divided on whether or not they preferred

receiving training in the form of workshops during the annual meeting. In total, 11 participants selected workshops as their first choice compared to 10 who chose regular webinars. However, there were 16 partners who ranked the workshops as their least preferred method (rank = 4) and this caused the average rank of the workshops to be worse than that of the webinars.

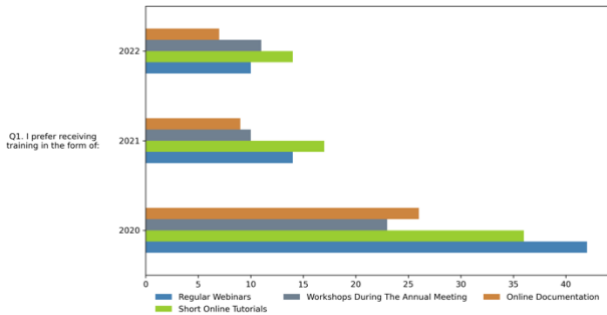


Figure 17: User responses about the preferences for receiving training. For 2020 survey, the participants were asked to check all that apply, and the bars represent the number of responses for each option. For the following surveys, the participants were asked to rank the options, and the bars indicate the number of participants who selected the option as their most preferred option.

The participants were then asked in which topic(s) they would like to receive training. Overall, flash-flood forecasts were the most popular option with 76% of participants indicating that they would like training on the topic. Approximately half of the participants were also interested in receiving training on the riverine forecasts (55%), impact-based forecasts (52%), and probabilistic forecasts (48%). One participant selected the “Other” option and wrote that they would like to receive training on LISFLOOD.

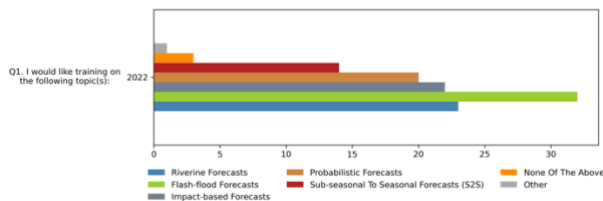


Figure 18: User responses about the preferred training topics.

EFAS Products and Added Value

The ratings of the added value of the different EFAS notifications in 2022 were generally similar to those of the previous survey years. For 2021, survey participants rated the added value of the notifications very highly; in 2022, there was a slight decrease in the ratings of the added value. In general, however, most survey participants rate the added value of the

different notifications as either high or very high, and there have not been major changes in the responses between survey years.

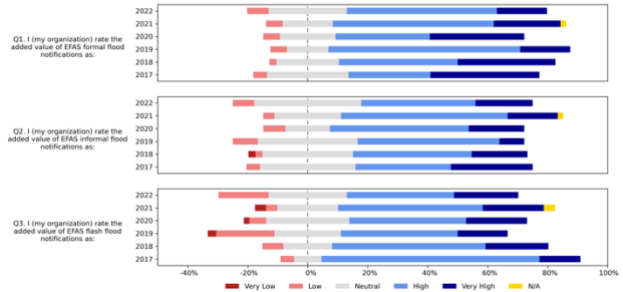


Figure 19: Average user response to the added value of notifications.

Satisfaction with each of the EFAS centres in 2022 was predominantly positive and similar to that of previous years. Note that the "Don't Know What They Do" option was introduced in the 2022 survey.

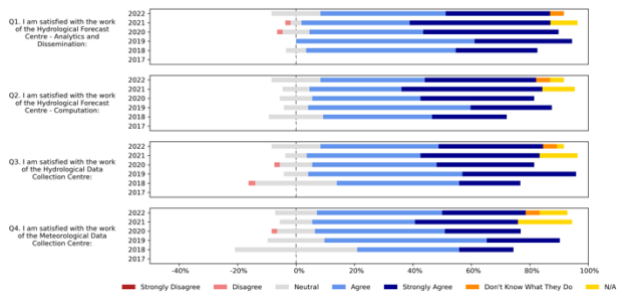


Figure 20: Average user response about the satisfaction of the work of the different EFAS centres.

Ratings for the usability or added value of the EFAS products in 2022 were generally similar to those in 2021 and higher than those in 2020. Participants were especially positive about the added value of the MapViewer in EFAS-IS and the added value of the flash flood forecast layer. The added value of the sub-seasonal and seasonal forecast and the new social media activity layers were ranked lowest.

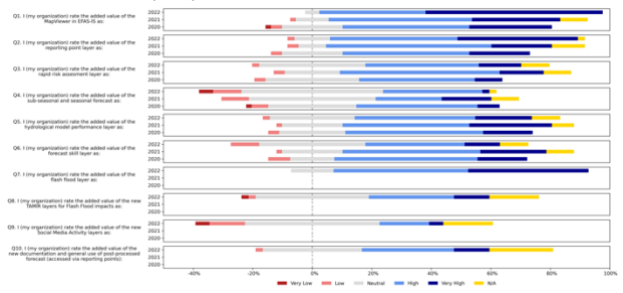


Figure 21: Average user response to the functionality/added value for some of the EFAS products/features.

Overall, awareness of the different EFAS products and features in 2022 was similar to that of the previous surveys. From 2020-2022, the highest awareness was about the training material on the EFAS-IS. From 2021 to 2022, there was a large increase in awareness that the LISFLOOD hydrological model used in EFAS is now open source. Awareness was also generally high for: (1) pre-tasking of satellite imagery for monitoring in case of a flood event, and (2) the possibility to request training from the EFAS Dissemination Centre. In contrast, awareness was lowest about the possibility to download EFAS hydrological data from the Climate Data Store and the ability to access EFAS hydrological data through FTP.

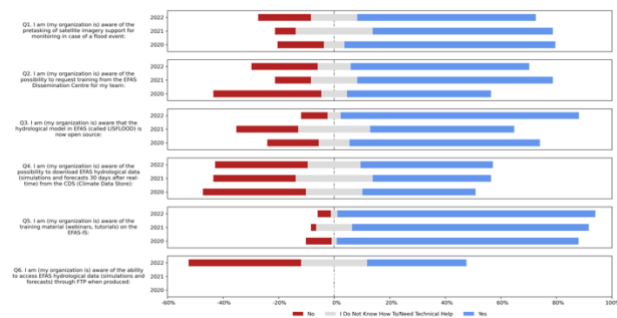


Figure 22: Average user response to awareness about some EFAS products/features.

Feedback and Collaboration

Survey participants were asked if they generally provide feedback to notifications. In total, 62% of the participants responded "yes" and 36% responded "no".

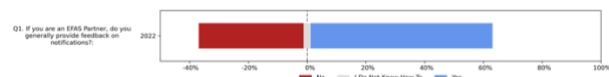


Figure 23: Average user response about providing feedback to notifications.

The survey participants who responded that they do not generally provide feedback to notifications were then asked to clarify why, and their responses are summarized below:

- No/few relevant notifications/events in their area few notifications/events (6 participants)
- Not implemented in their working procedure (2 participants)
- Lack of time/busy during flood events (2 participants)
- Not a partner
- Because we are the national civil protection authority and in most cases we are not

feedback of the events, as well as being a third party partner

- How can we estimate that a notification is a hit or a miss when the information is a probability (calculated on a different hydrograph than the post-processed one) or an areal percentage?
- I don't have habit to send feedback, because the notifications are too general and very uncertain
- I'm an EFAS OoD; so not on the receiving end of these directly
-

Some of the participants expressed their willingness to write short articles about EFAS, to conduct short verification analyses, or to evaluate new versions of EFAS before the operational phase. Note that the "Not Sure" and "N/A" options were removed for the 2022 survey.

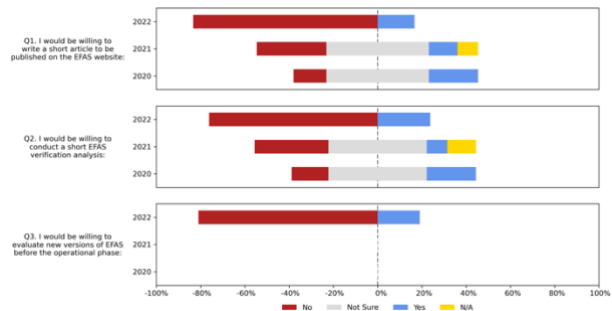
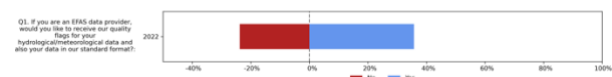


Figure 24: Average user response about the willingness to collaborate with EFAS.

Future Developments

As in 2020 and 2021, survey participants were asked in 2022 if they would like to receive quality flags for their hydrological/meteorological data and their data in a standard format (meaning harmonised time step and unit, quality controlled). For the 2022 survey, these questions were merged into one question with only options for "Yes" and "No". In total, 25 of the 42 survey participants in 2022 were EFAS data providers, and 60% responded "Yes" to the question. Note that the figure only shows the results for the 25 data providers, and this is why the red + blue areas is less than 100%.



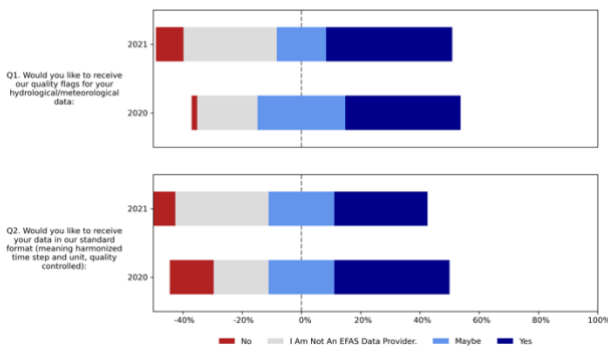


Figure 25: Average user response about obtaining specific EFAS product/data.

Lastly, partners were also asked if there was anything else they would like to communicate to the EFAS team. These responses are summarized below:

- *"Please reconsider the color scale because people who have color blindness have problem in EFAS map viewer reading."*
- *"I am strongly interested in knowing advances related to the implementation of reservoir performance in the hydrological model."*
- *"I am pleased to be a part of EFAS service. Thank you."*
- *"We would be interested in a training course in forecast/ensemble post-processing techniques."*
- *"As a Civil Protection organization, I think EFAS is very useful in meteorological and hydrological forecast and impact study, but the results are fewer in flash floods events. I hope it would be changes with TAMIR."*
- *"It would be desirable that the documentation is not only available in English but also in other languages."*
- *"We used to send mean daily discharge data, but it appears to be not very appropriate to make a good forecast (simulated discharges were far from reality, though the post-processed hydrograms that take real-time measurements into account were better). So, we discussed a lot with MDCC and hydroDCC, and finally we sent historical hourly discharge and rainfall data + real time hourly data, instead of daily data. It would be great to have a recalibration of our EFAS stations now, as detailed data is available. I hope it will drastically enhance the quality of the forecasts. I must say that is has been a pleasure to work with MDCC and HydroDCC,*

we had a lot of pleasant exchanges. HydroDCC told me that the integration of hourly discharge data should be finished by January (2023). MDCC already finished the integration in 2022."

- *"The whole process that the team does is exceptional. Thank you for that!"*
- *"The planned upgrade - EFASNext - will make EFAS products much more relevant/useful to use operationally because LISFLOOD resolution will be high enough to forecast for rivers in England and Wales."*
- *"After the intense development of products in EFAS, one strong focus should now be on organizing better the information in the EFAS viewer, which is currently organized according to the projects that have been supporting EFAS and not according to the products. That is, from a user perspective it is not easy to navigate the viewer in a rapid way (there is always a need to consult the help sections, even accessing the viewer with some frequency. In other words the learning curve for using EFAS viewer is very slow."*
- *"I think it is important to continue to improve the EFAS/CEMS flood service through regular discussions with downstream users of the system/tool. It is very unclear how EFAS forecasts are uptaken into national flood warning services. In some countries, I don't think these are highly valued, as the national models are more reliable. But hopefully this will change in the near future, with improved EU-level products!"*
- *"We were a little bit confused about some of the questions in this survey."*

Acknowledgements

The following partner institutes and contributors are gratefully acknowledged for their contribution:

- DG DEFIS - Copernicus and DG ECHO for funding the EFAS Project
- All data providers including meteorological data providers, hydrological services & weather forecasting centres
- The EFAS Operational Centres
- Richard Davies, Floodlist.com

Cover image: Flash floods caused severe material damage in Zaragoza, Spain, following a short period of torrential rain on 06 July 2023. Photo credit: Government of Zaragoza

Appendix – figures

Reporting of the meteorological situation by the Meteorological Data Collection Centre (MDCC) is **no longer** published in the EFAS bulletin. Instead, the state of recent meteorology will be conducted by the Copernicus Climate Change Service (C3S) and published as monthly [Climate Bulletins](#).

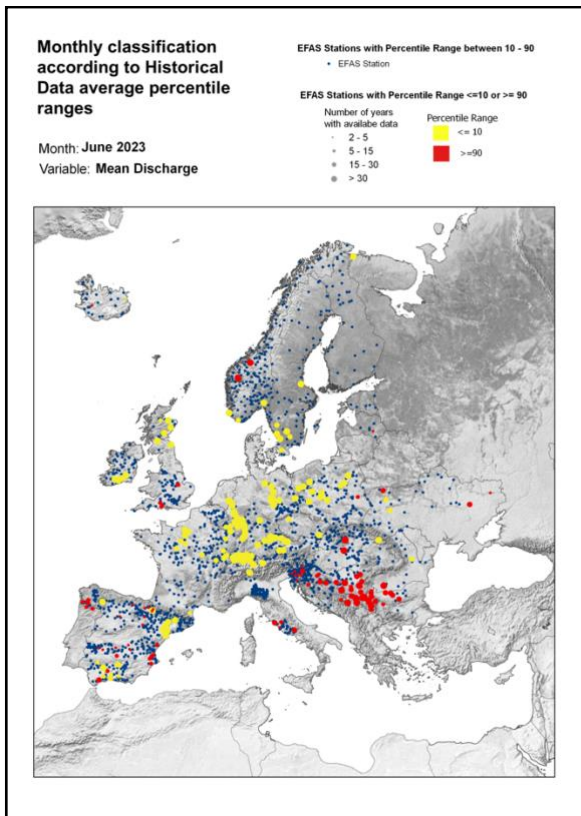


Figure 26: Monthly discharge anomalies June 2023.

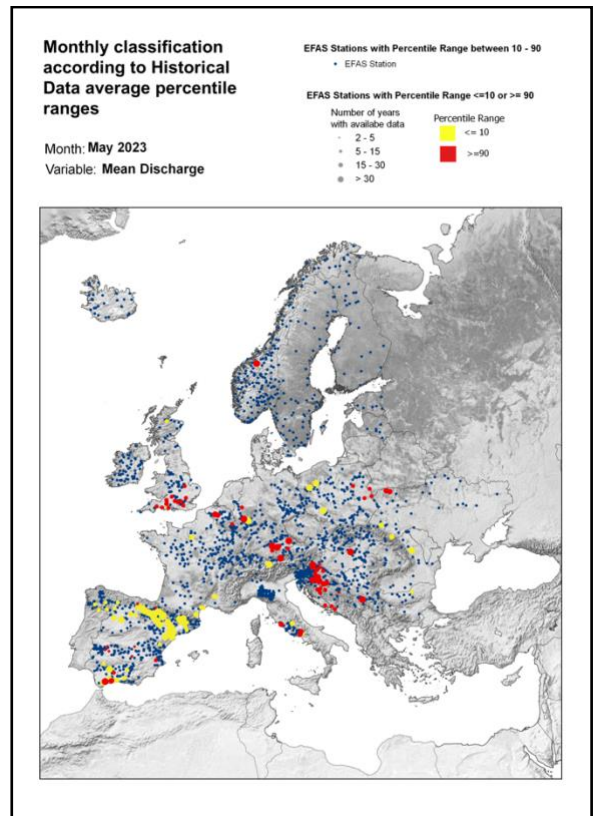


Figure 28: Monthly discharge anomalies July 2023.

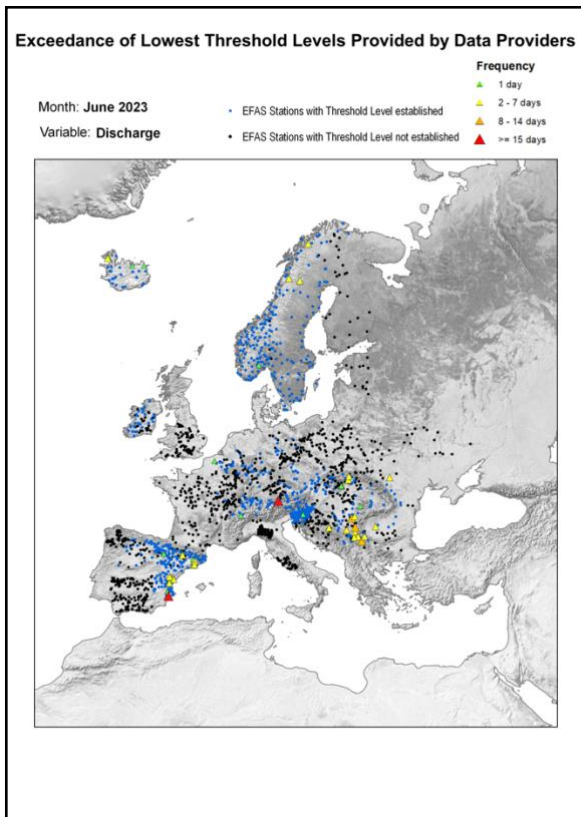


Figure 27: Lowest alert level exceedance for June 2023.

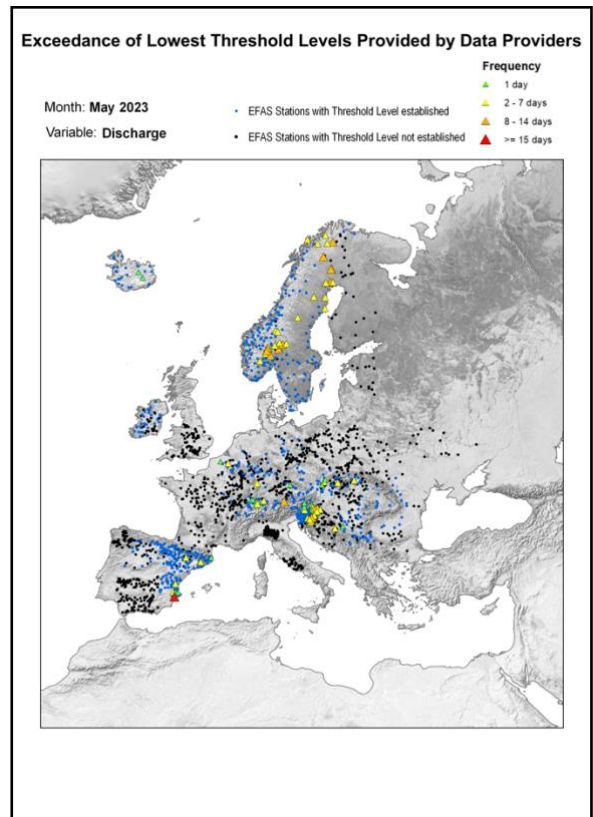


Figure 29: Lowest alert level exceedance for July 2023.

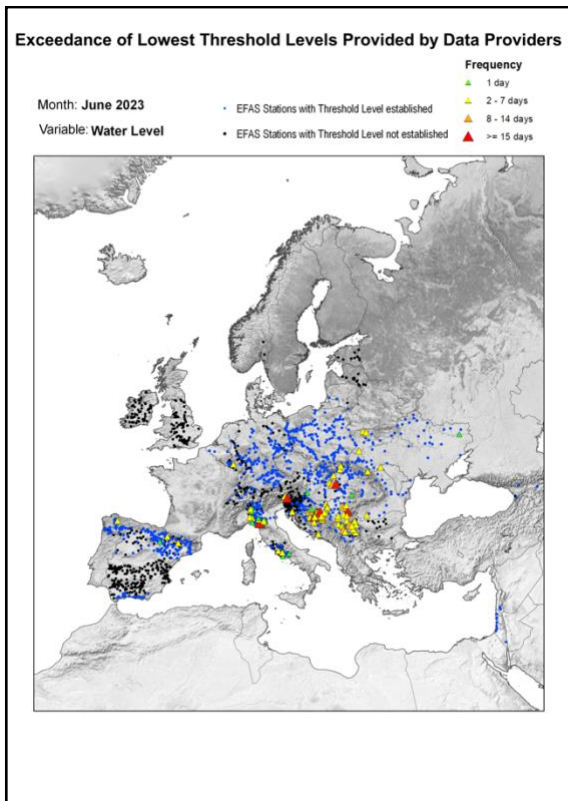


Figure 30: Lowest threshold exceedance for June 2023.

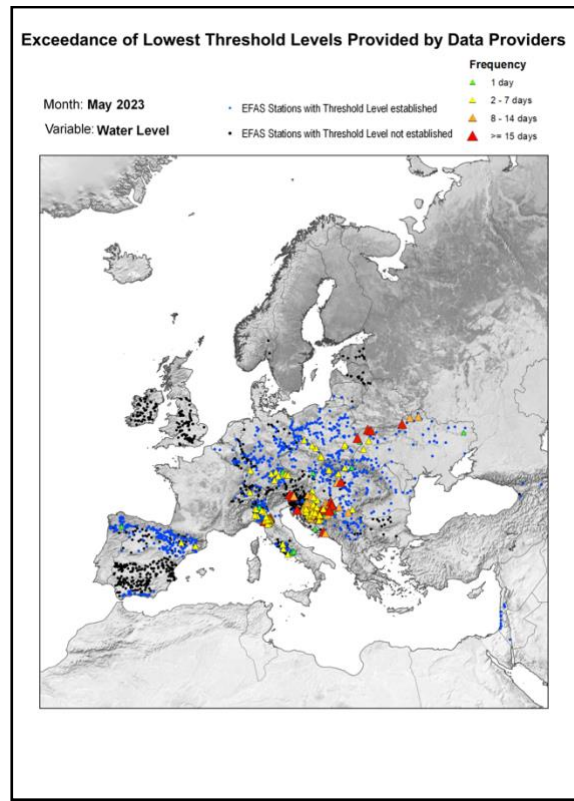


Figure 31: Lowest threshold exceedance for July 2023.

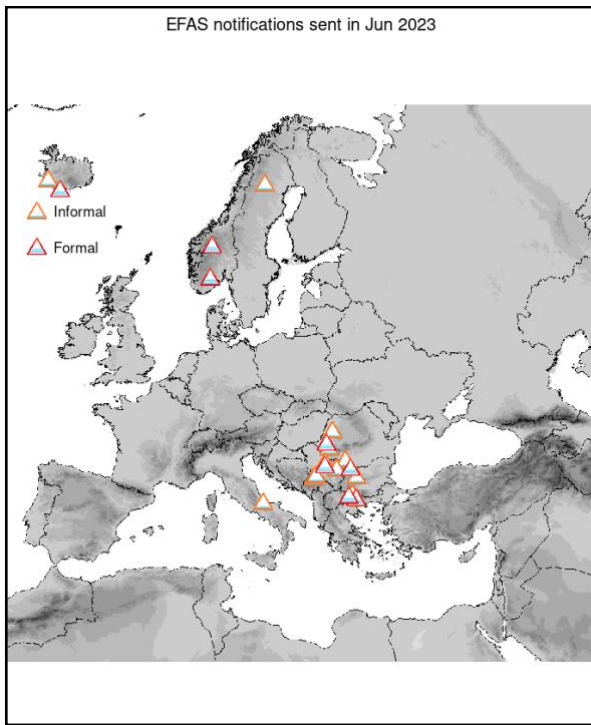


Figure 32: EFAS flood notifications sent for June 2023

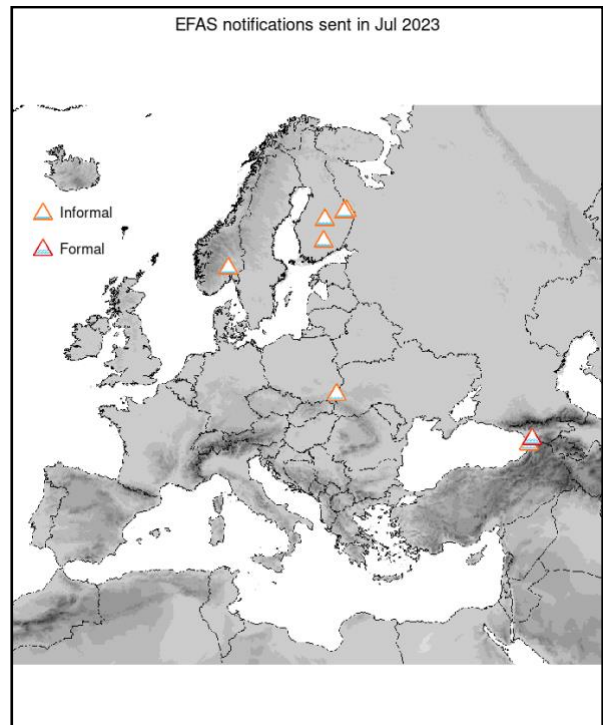


Figure 34: EFAS flood notifications sent for July 2023.

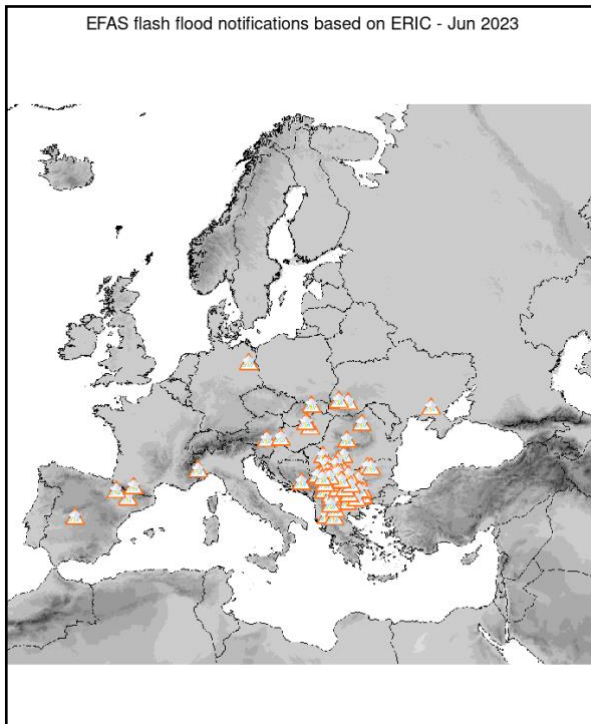


Figure 33: Flash notifications sent for June 2023

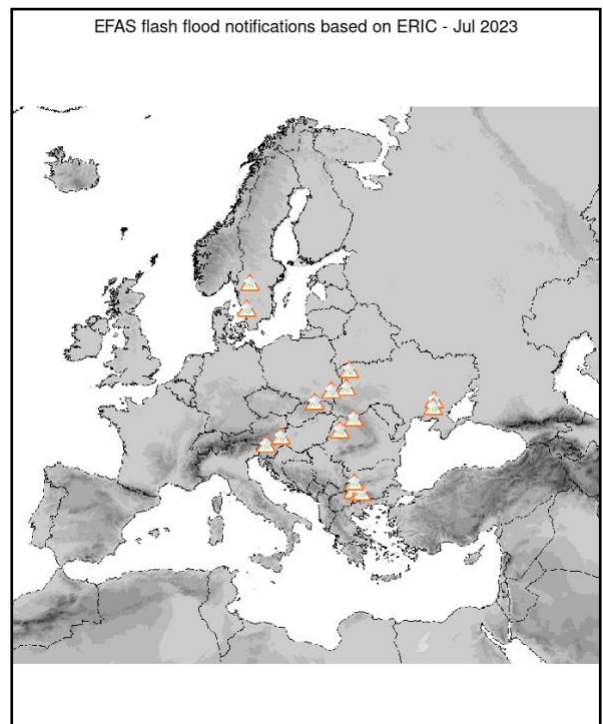


Figure 35: Flash notifications sent for July 2023.

Appendix - tables

Table 1: EFAS flood notifications sent in June – July 2023

Type	Forecast Date	Issue Date	Lead Time	River	Country
Formal	24/06/2023 00 UTC	24/06/2023	66	Moel	Norway
Informal	22/06/2023 00 UTC	22/06/2023	36	PiteV&slven	Sweden
Formal	20/06/2023 12 UTC	21/06/2023	60	Leira	Iceland
Informal	16/06/2023 12 UTC	17/06/2023	6	Vit	Bulgaria
Informal	16/06/2023 00 UTC	16/06/2023	18	Timis	Romania
Formal	15/06/2023 00 UTC	15/06/2023	60	Mures	
Formal	14/06/2023 12 UTC	15/06/2023	60	Jiu	Romania
Informal	14/06/2023 00 UTC	14/06/2023	60	Jiu	Romania
Informal	13/06/2023 00 UTC	13/06/2023	90	Sebes Koros	Romania
Informal	13/06/2023 00 UTC	13/06/2023	60	Lim	Serbia
Informal	13/06/2023 00 UTC	13/06/2023	72	Zapadna Morava	Serbia
Formal	13/06/2023 00 UTC	13/06/2023	126	Velika Morava	Serbia
Informal	13/06/2023 00 UTC	13/06/2023	72	Mlava	Serbia
Formal	13/06/2023 00 UTC	13/06/2023	114	Moel	Norway
Formal	11/06/2023 12 UTC	12/06/2023	156	Glomma	Norway
Informal	11/06/2023 00 UTC	11/06/2023	36	Veliki Timok	Serbia
Formal	11/06/2023 00 UTC	11/06/2023	48	MESTA (NESTOS)	Bulgaria
Formal	11/06/2023 00 UTC	11/06/2023	54	Strimonas	Bulgaria
Formal	10/06/2023 12 UTC	11/06/2023	150	Moel	Norway
Informal	09/06/2023 00 UTC	09/06/2023	36	Sangro	Italy
Informal	09/06/2023 00 UTC	09/06/2023	48	MESTA (NESTOS)	Bulgaria
Informal	08/06/2023 00 UTC	08/06/2023	18	OELFUSA	Iceland
Informal	02/06/2023 00 UTC	02/06/2023	36	Mesta	Bulgaria
Informal	29/07/2023 00 UTC	29/07/2023	12	Kymijoki	Finland
Informal	28/07/2023 00 UTC	28/07/2023	12	Kymijoki sub-catchment	Finland
Informal	27/07/2023 12 UTC	28/07/2023	36	Vuoksi	Finland
Informal	24/07/2023 00 UTC	24/07/2023	12	Lieksanjoki	Finland
Informal	23/07/2023 12 UTC	24/07/2023	48	Adalselva	Norway
Informal	12/07/2023 12 UTC	13/07/2023	24	San	Poland
Informal	08/07/2023 00 UTC	08/07/2023	24	NATANEBI	Georgia
Formal	07/07/2023 00 UTC	07/07/2023	66	Rioni	Georgia

* Lead time [days] to the first forecasted exceedance of the 5-year simulated discharge threshold.

Table 2: EFAS Flash notifications sent in June – July 2023

Type	Forecast Date	Issue Date	Lead Time	Region	Country
Flash Flood	29/06/2023 00 UTC	29/06/2023	24	Ebro	Spain
Flash Flood	27/06/2023 00 UTC	27/06/2023	48	Danube	Bulgaria
Flash Flood	25/06/2023 00 UTC	25/06/2023	30	Danube	Romania
Flash Flood	24/06/2023 12 UTC	25/06/2023	42		

Flash Flood	24/06/2023 00 UTC	24/06/2023	48	Danube	Bulgaria
Flash Flood	24/06/2023 00 UTC	24/06/2023	42	Strimonas(GR)/Struma(BG)	Bulgaria
Flash Flood	24/06/2023 00 UTC	24/06/2023	42	Danube	Romania
Flash Flood	22/06/2023 12 UTC	23/06/2023	18	Elbe	Germany
Flash Flood	20/06/2023 00 UTC	20/06/2023	48	Ebro	Spain
Flash Flood	18/06/2023 00 UTC	18/06/2023	30	Danube	Romania
Flash Flood	16/06/2023 12 UTC	17/06/2023	24	Seman	Albania
Flash Flood	16/06/2023 12 UTC	17/06/2023	24	Greece (North)	Greece
Flash Flood	16/06/2023 12 UTC	17/06/2023	24		
Flash Flood	16/06/2023 00 UTC	16/06/2023	18		
Flash Flood	16/06/2023 00 UTC	16/06/2023	24	Danube	Bulgaria
Flash Flood	16/06/2023 00 UTC	16/06/2023	42		
Flash Flood	15/06/2023 12 UTC	16/06/2023	42	Strimonas(GR)/Struma(BG)	Bulgaria
Flash Flood	15/06/2023 12 UTC	16/06/2023	36	Albania/Greece (Adriatic Coast)	North Macedonia
Flash Flood	15/06/2023 12 UTC	16/06/2023	24	Strimonas(GR)/Struma(BG)	North Macedonia
Flash Flood	15/06/2023 12 UTC	16/06/2023	24	Danube	Kosovo
Flash Flood	15/06/2023 12 UTC	16/06/2023	24		
Flash Flood	15/06/2023 12 UTC	16/06/2023	24	Danube	Romania
Flash Flood	15/06/2023 12 UTC	16/06/2023	36		
Flash Flood	15/06/2023 00 UTC	15/06/2023	48		
Flash Flood	15/06/2023 00 UTC	15/06/2023	48	Danube	Bulgaria
Flash Flood	15/06/2023 00 UTC	15/06/2023	48	Danube	Bulgaria
Flash Flood	15/06/2023 00 UTC	15/06/2023	36	Crni Drim / Drin	
Flash Flood	15/06/2023 00 UTC	15/06/2023	42	Danube	Serbia
Flash Flood	15/06/2023 00 UTC	15/06/2023	48		
Flash Flood	15/06/2023 00 UTC	15/06/2023	48	Dnister / Nistru	Ukraine
Flash Flood	14/06/2023 12 UTC	15/06/2023	48	Strimonas(GR)/Struma(BG)	Bulgaria
Flash Flood	14/06/2023 12 UTC	15/06/2023	48	Vardar(YG)/Axios(GR)	North Macedonia
Flash Flood	14/06/2023 12 UTC	15/06/2023	42	Adriatic Coast	Bosnia and Herzegovina
Flash Flood	14/06/2023 12 UTC	15/06/2023	48	Danube	Serbia
Flash Flood	14/06/2023 12 UTC	15/06/2023	48		
Flash Flood	14/06/2023 12 UTC	15/06/2023	48	Danube	Serbia
Flash Flood	14/06/2023 12 UTC	15/06/2023	48	Danube	Serbia
Flash Flood	14/06/2023 00 UTC	14/06/2023	48	Danube	Kosovo
Flash Flood	14/06/2023 00 UTC	14/06/2023	48		
Flash Flood	14/06/2023 00 UTC	14/06/2023	48	Danube	Serbia
Flash Flood	13/06/2023 12 UTC	14/06/2023	48	Danube	Serbia
Flash Flood	13/06/2023 12 UTC	14/06/2023	48		
Flash Flood	12/06/2023 12 UTC	13/06/2023	24		
Flash Flood	12/06/2023 12 UTC	13/06/2023	24		
Flash Flood	12/06/2023 00 UTC	12/06/2023	42	Mesta(BG)/Nestos(GR)	Bulgaria
Flash Flood	12/06/2023 00 UTC	12/06/2023	30		
Flash Flood	12/06/2023 00 UTC	12/06/2023	42		
Flash Flood	11/06/2023 12 UTC	12/06/2023	48		
Flash Flood	11/06/2023 12 UTC	12/06/2023	42		
Flash Flood	11/06/2023 12 UTC	12/06/2023	42		
Flash Flood	11/06/2023 00 UTC	11/06/2023	42	Strimonas(GR)/Struma(BG)	Bulgaria

Flash Flood	11/06/2023 00 UTC	11/06/2023	42		
Flash Flood	11/06/2023 00 UTC	11/06/2023	48	Strimonas(GR)/Struma(BG)	Bulgaria
Flash Flood	11/06/2023 00 UTC	11/06/2023	48	Danube	Bulgaria
Flash Flood	11/06/2023 00 UTC	11/06/2023	48	Danube	Bulgaria
Flash Flood	11/06/2023 00 UTC	11/06/2023	48		
Flash Flood	11/06/2023 00 UTC	11/06/2023	48	Danube	Serbia
Flash Flood	11/06/2023 00 UTC	11/06/2023	48	Danube	Serbia
Flash Flood	11/06/2023 00 UTC	11/06/2023	48		
Flash Flood	11/06/2023 00 UTC	11/06/2023	48	Danube	Serbia
Flash Flood	10/06/2023 12 UTC	11/06/2023	48		
Flash Flood	10/06/2023 12 UTC	11/06/2023	48	Danube	Serbia
Flash Flood	10/06/2023 12 UTC	11/06/2023	48		
Flash Flood	10/06/2023 12 UTC	11/06/2023	48		
Flash Flood	10/06/2023 12 UTC	11/06/2023	48		
Flash Flood	10/06/2023 12 UTC	11/06/2023	48	Danube	Kosovo
Flash Flood	10/06/2023 12 UTC	11/06/2023	48		
Flash Flood	10/06/2023 12 UTC	11/06/2023	24	Dnepr	Ukraine
Flash Flood	10/06/2023 12 UTC	11/06/2023	24		
Flash Flood	10/06/2023 00 UTC	10/06/2023	36	Dnister / Nistru	Ukraine
Flash Flood	10/06/2023 00 UTC	10/06/2023	30	Danube	Hungary
Flash Flood	09/06/2023 12 UTC	10/06/2023	42	Wisla	Slovakia
Flash Flood	09/06/2023 12 UTC	10/06/2023	24	Danube	Hungary
Flash Flood	07/06/2023 12 UTC	08/06/2023	36	Tajo	Spain
Flash Flood	06/06/2023 12 UTC	07/06/2023	30	Strimonas(GR)/Struma(BG)	Bulgaria
Flash Flood	06/06/2023 12 UTC	07/06/2023	24	Danube	Hungary
Flash Flood	05/06/2023 12 UTC	06/06/2023	30	Danube	Austria
Flash Flood	05/06/2023 00 UTC	05/06/2023	42		
Flash Flood	04/06/2023 00 UTC	04/06/2023	18		
Flash Flood	02/06/2023 12 UTC	03/06/2023	48		
Flash Flood	02/06/2023 12 UTC	03/06/2023	48	Mesta(BG)/Nestos(GR)	Bulgaria
Flash Flood	02/06/2023 12 UTC	03/06/2023	48	Strimonas(GR)/Struma(BG)	Bulgaria
Flash Flood	02/06/2023 12 UTC	03/06/2023	48	Strimonas(GR)/Struma(BG)	Bulgaria
Flash Flood	02/06/2023 12 UTC	03/06/2023	48	Danube	Bulgaria
Flash Flood	02/06/2023 12 UTC	03/06/2023	48	Danube	Serbia
Flash Flood	02/06/2023 12 UTC	03/06/2023	42	Danube	Serbia
Flash Flood	01/06/2023 12 UTC	02/06/2023	42	Danube	Serbia
Flash Flood	01/06/2023 00 UTC	01/06/2023	42	Danube	Serbia
Flash Flood	28/07/2023 00 UTC	28/07/2023	18	Dnepr	Ukraine
Flash Flood	26/07/2023 12 UTC	27/07/2023	48	Dnepr	Ukraine
Flash Flood	26/07/2023 00 UTC	26/07/2023	42		
Flash Flood	24/07/2023 00 UTC	24/07/2023	36		
Flash Flood	23/07/2023 12 UTC	24/07/2023	48	Danube	Austria
Flash Flood	13/07/2023 00 UTC	13/07/2023	36	Danube	Romania
Flash Flood	12/07/2023 12 UTC	13/07/2023	36		
Flash Flood	12/07/2023 12 UTC	13/07/2023	30	Wisla	Poland
Flash Flood	12/07/2023 12 UTC	13/07/2023	30	Wisla	Slovakia
Flash Flood	12/07/2023 00 UTC	12/07/2023	18	Common to Norway- Sweden	Sweden
Flash Flood	11/07/2023 12 UTC	12/07/2023	24	Sweden	Sweden
Flash Flood	06/07/2023 00 UTC	06/07/2023	42	Danube	Romania
Flash Flood	04/07/2023 12 UTC	05/07/2023	30	Strimonas(GR)/Struma(BG)	Bulgaria

Flash Flood	01/07/2023 12 UTC	02/07/2023	30	Mesta(BG)/Nestos(GR)	Bulgaria
Flash Flood	01/07/2023 00 UTC	01/07/2023	42		
Flash Flood	01/07/2023 00 UTC	01/07/2023	48	Danube	Bulgaria

* Lead time [hours] to the forecasted peak of the event

The European Flood Awareness System (EFAS) produces European overviews of ongoing and forecasted floods up to 10 days in advance and contributes to better protection of the European citizens, the environment, properties and cultural heritage. It has been developed at the European Commission's in-house science service, the Joint Research Centre (JRC), in close collaboration with national hydrological and meteorological services and policy DG's of the European Commission.

EFAS has been transferred to operations under the European Commission's COPERNICUS Emergency Management Service led by DG GROW in direct support to the EU's Emergency Response Coordination Centre (ERCC) of DG ECHO and the hydrological services in the Member States.

ECMWF has been awarded the contract for the EFAS Computational centre. It is responsible for providing daily operational EFAS forecasts and 24/7 support to the technical system.

A consortium of Swedish Meteorological and Hydrological Institute (SMHI), Rijkswaterstaat (RWS) and Slovak Hydro-Meteorological Institute (SHMU) has been awarded the contract for the EFAS Dissemination centre. They are responsible for analysing EFAS output and disseminating information to the partners and the ERCC.

A Spanish contractor, Ghenova Digital (formerly Soologic), has been awarded the contract for the EFAS Hydrological data collection centre. They are responsible for collecting discharge and water level data across Europe.

A German consortium (KISTERS and DWD) has been awarded the contract for the EFAS Meteorological data collection centre. They are responsible for collecting the meteorological data needed to run EFAS over Europe.

Finally, the JRC is responsible for the overall project management related to EFAS and further development of the system.

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