European Flood Awareness System

EFAS *Bulletin*

August – September 2020

Issue 2020(5)

NEWS

New features

EFAS 4.0 – New version of EFAS Launched

EFAS version 4.0 was launched on 14 October 2020. It introduces a step-change with the medium-range ensemble forecasts driven by ECMWF-ENS at a 6-hourly time step.

EFAS-4 follows a complete recalibration at 6-hourly time step of EFAS hydrological model, LISFLOOD, now based on over 1100 river stations across the EFAS domain covering 60% of the full spatial domain. The newly calibrated LISFLOOD results in a marked improvement in both the magnitude and timing of the simulated flood peaks, especially in medium-size catchments (see Figure 1 for an example of improved hydrographs with EFAS-4). A detailed article regarding the EFAS v4.0 update is published in the Articles section of this bulletin.

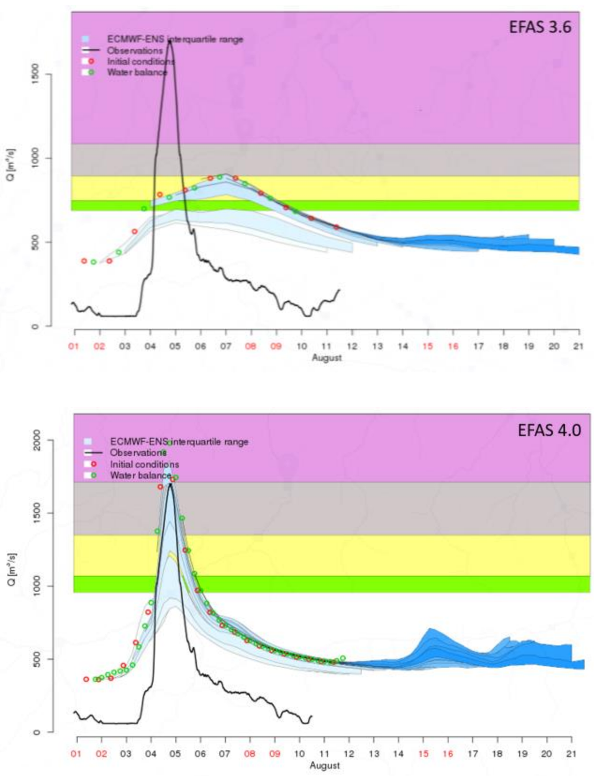

Figure 1: Hydrographs of the water balance layer provided by EFAS 3.6 (top) and EFAS-4 (bottom) for the Inn at Muehldorf, Germany (12600km2) produced on 11 August 2020 : discharge observations (black), simulations forced with observed precipitation and air temperature (green) and with forcings from the fill-up period (red), and medium-range ECMWF-ENS ensemble forecasts (blue). (Information restricted to EFAS partners only).

Events

EFAS Annual Meeting 2020 (online)

The EFAS Annual Meeting took place on 22 October 2020. This event took place online for the first time due to the COVID-19 pandemic. More than 160 participants from the EFAS Partner community and four EFAS Centres were in attendance.

Figure 2: A selection of the many participants who joined the EFAS Annual Meeting online.

The online meeting was well received, with healthy discussions and feedback throughout. Items covered in the meeting included: (1) The status of the EFAS operational service summarized from the 4 EFAS Centres including experiences, issues, challenges, (2) New developments with regard to EFAS 4.0, (3) New products and services, (4) Detailed assessment of the floods in Spain in 2019, (5) The next steps for EFAS, (6) Developments with regard to flash flooding product, and (7) Discussion on open data and new EFAS partner agreement. Content of the meeting including presentations and further information will be shared through the EFAS website at a later stage.

Copernicus Hackathon 2020

Due to the COVID-19 pandemic, the Copernicus Hackathon 2020 was hosted as a virtual event. The Hackathon was held online on 16-17-18 October 2020.

Hackathon is for developers, designers, data wranglers, data journalists, data enthusiasts, and everyone interested in exploiting potential of cutting-edge developments. Topics covered were weather forecasting, risk modelling, and earth observation to improve information and services for emergency management and the general population, with a view to protect lives. The Hackathon focused on raising awareness about the Copernicus programme and promoting the benefits it brings to crisis management and response at local, regional, national, and international levels. Participants of the Copernicus Hackathon were requested to use the provided tools and datasets in order deliver software developments supposing added value downstream services, such as:

- Develop web applications for policy-and decision-makers.
- Apps & services for specific public and commercial needs (e.g. tourism, energy, transport).
- Effective communication of risks (environmental or societal challenges) to the public (participatory approach, crowdsourcing and social media data).

The challenges that participants addressed are shown in detail on the event website. For more information, see the event homepage or visit social media: LinkedIn, Twitter, Facebook.

New Partners

New EFAS Third Parties
We gladly welcome the National Fire and Rescue Authority, Israel, and the National Authority for Emergency and Civil Protection, Portugal as new EFAS Third Party partners.

New Research Partner
We gladly welcome the "Plastic waste and the Black Sea" project, ARGANS, as a new EFAS Research partner. The project is a set of applications for the litter monitoring in the Back Sea. EFAS data will be used to implement the litter land model, as land-based plastic waste in relation with river flow contributes heavily to the volume of marine litter. EFAS data will allow to have an estimate of the volume of litter carried by rivers in near real time.

RESULTS

Summary of EFAS Flood and Flash Flood Notifications

The 37 formal and 12 informal EFAS flood notifications issued in August-September 2020 are summarised in Table 1. The locations of all notifications are shown in Figure 34 and Figure 36 in the appendix.

153 Flash flood notification were issued in August - September 2020. They are summarised in Table 2. The locations of all notifications are shown in Figure 35 and Figure 37 in the appendix.

Meteorological situation

by EFAS Meteorological Data Collection Centre

August
August 2020 was characterised by roughly normal monthly mean surface pressure in the EFAS domain, only lower than normal around Spitsbergen. Monthly precipitation totals were below the long-term means in an arc from northern Africa over the Black Sea towards Scandinavia, with an extension to the Iberian Peninsula and above normal elsewhere. Monthly mean air temperatures were below the long-term means from western Russia to Iran and Turkey as well as at the western Iberian Peninsula while positive anomalies occurred in the other parts of the EFAS domain.

At the beginning of August 2020, the Azores High was around its usual position and a low-pressure system was located near Iceland, and another one over northern Russia, which brought notable precipitation amounts in this region in the first days of August. Even as the low-pressure system near Iceland weakened at the surface, an upper-level trough extended with a cold air advance towards central Europe. This caused intense rainfall at the Alps and in the higher parts of the mountains enough snowfall for skiing. Some local floods appeared in the region. An upper-level low-pressure system was cut-off from the trough and moved along the Adriatic Sea, bringing intense rain to the western Balkans and Italy. In the same days, yet another low-pressure system moved from the Atlantic Ocean to Iceland and brought significant precipitation amounts to Great Britain and Ireland. The high-pressure system from Russia extended south-westwards, developing a new core over the Baltics, which moved to Scandinavia and later back to the Baltics. A trough developed over the eastern Atlantic Ocean towards the Iberian Peninsula and caused severe weather in Spain, the United Kingdom, and France. Another upper-level low-pressure system developed westward of Great Britain and Ireland, moved across the Gulf of Biscay and English Channel to Great Britain and Ireland, where it merged with a very strong low-pressure system coming in from the Atlantic Ocean. It brought strong winds to Great Britain and Ireland and later to western Scandinavia as it moved there. Only a few days later, another low-pressure system developed and intensified very fast over the eastern Atlantic Ocean and moved across Great Britain and Ireland, and the North Sea towards the Baltic Sea bringing very strong winds along its track. Worth mentioning is also a low-pressure system over the Kola Peninsula. Both low-pressure systems brought notable precipitation amounts. A few days later, another low-pressure system moved on a similar track from the Atlantic Ocean to the Baltic Sea. An upper-level trough developed from this low-pressure system over France and detached from it, moving slowly eastwards and causing again heavy precipitation in and around the Alps. This was a similar situation as at the beginning of August, but it brought rain also at its eastern edge and to southern France and the Balearic Islands.

In August 2020, the highest precipitation totals were observed over the Alps, Balkans and Great Britain and Ireland (Figure 20). No or almost no precipitation fell in the south of the EFAS domain, in the south of the Iberian Peninsula, and some regions to the north of the Black Sea. Monthly precipitation totals below the long-term means occurred in the Scandinavia, north and south of the Black Sea, the Baltics, in parts of south-western and central Europe, and in the south of the EFAS domain (Figure 21). Monthly totals above the long-term means were reported in the centre of the EFAS domain but also around the Caspian Sea, Great Britain and Ireland, and parts of the Iberian Peninsula.

The monthly mean air temperature ranged from -2.5°C to 38.2°C with the highest values in the southern parts of the EFAS domain. The lowest temperature values were reported in the northern and mountainous regions (Figure 24). Air temperature anomalies ranged from -5.8°C to 7.9°C (Figure 25). Monthly mean air temperatures below the long-term means occurred from western Russia southward to Iran and Turkey, in parts of Scandinavia, and the Iberian Peninsula. Positive monthly mean temperature anomalies were reported in other parts of the EFAS domain.

September

September 2020 was characterised by roughly normal monthly mean surface pressure in the EFAS domain, only lower than normal around Spitsbergen. Monthly precipitation totals were below the long-term means in many regions in the EFAS domain, especially in the southeast. Monthly mean air temperatures were below the long-term means in parts of northern and western Europe and Africa as well as in the east of the EFAS domain, while positive anomalies occurred in the other parts.

At the beginning of September 2020, the Icelandic Low and Azores High were around their usual positions while another high-pressure system was located over western Europe and Scandinavia, a low-pressure system over the North Russian Lowlands and an upper-level low-pressure system above the northern Adriatic Sea. The upper-level system moved towards central Europe causing intense precipitation at its eastern edge and disappeared, while the high-pressure system moved via Scandinavia towards Russia. The Azores High extended to central Europe with the development of a new core over western Russia. The Icelandic Low intensified, causing continuous heavy rain in Great Britain and Ireland, and around the North Sea. Later, it moved to Spitsbergen. Also at the beginning of August, intense precipitation events associated with flash floods were reported from Tunisia and Algeria. From the aforementioned low-pressure system, an upper-level trough developed over central Europe, was cut-off and moved to the western and central Mediterranean Sea, causing heavy precipitation with associated flash floods. During the same days, a low-pressure system moved from the Atlantic via Iceland to Scandinavia including the formation of secondary low-pressure systems, which brought notable precipitation amounts there and eastward of Scandinavia. A weak high-pressure ridge developed from the Azores and extended to eastern Europe. By the middle of the month, a high-pressure system developed over central and eastern Europe moving slowly eastward and an old low-pressure system intensified again over the West Siberian Plain. A low-pressure system formed over southern Scandinavia, experienced a rapid intensification and moved to western Russia, associated with strong winds and continuous heavy rain. At the same time, a high-pressure system developed over the North Sea and a low-pressure system moved from the Atlantic Ocean to the west of the Iberian Peninsula and later the Bay of Biscay with notable rain amounts in southwest Europe. In addition, the short-lived tropical storm “Alpha” developed west of Portugal and Medicane “Ianos” (also named “Cassilda”) brought strong wind and heavy precipitation including flash floods to Greece and Crete, and some coastal regions in Libya. A low-pressure system moved with strong wind via Iceland and northern

Scandinavia to the West Siberian Plain. Weak pressure gradients were found in the remaining EFAS domain, allowing several convective precipitation events in the western and central Mediterranean Region. An upper-level trough with several low-pressure cores at the surface developed over Great Britain and Ireland and extended to the central Mediterranean region, whereas one of the cores moved to Scandinavia. It was cut-off, with the centre over the Alps, weakened and moved to the eastern Carpathian Mountains by the end of the month, associated with repeated continuous heavy precipitation in central and eastern Europe, and the Balkans. Another low-pressure trough developed over Iceland and extended to Great Britain and Ireland, also associated with intense precipitation.

In September 2020, the highest precipitation totals were observed around the central Mediterranean region, northern Carpathian Mountains, and along the western Scandinavian coast (Figure 22). No or almost no precipitation fell in the south-east of the EFAS domain and north-west of the Caspian Sea. Monthly precipitation totals below the long-term means occurred in many parts of the EFAS domain, especially in the east and south-east, but also at the southern Iberian Peninsula, central Europe and the Baltic Bridge (Figure 23). Monthly totals above the long-term means were reported in parts of the Mediterranean region, eastern and northern Europe, and the northern Iberian Peninsula. Two erroneous spots with high precipitation totals are in Syria/Jordan and Morocco/Algeria due to single erroneous data points passing the automated quality control procedures as they were still below the thresholds.

The monthly mean air temperature ranged from -4.8°C to 36.7°C with the highest values in the southern parts of the EFAS domain. The lowest temperature values were reported in the northern and mountainous parts (Figure 26). Air temperature anomalies ranged from -6.3°C to 8.6°C (Figure 27). Monthly mean air temperatures below the long-term means occurred in Iceland, Great Britain, Ireland, and in some regions in Scandinavia, the Iberian Peninsula, northern Africa, and eastern Europe. Positive monthly mean temperature anomalies were reported in other parts of the EFAS domain.

Hydrological situation

by EFAS Hydrological Data Collection Centre

August

In August, the main concentration of stations that exceeded their lowest threshold level is located in central Europe: Poland and Germany (the Oder and Elbe basins respectively); the Danube basin across Austria, Hungary, Slovakia and Croatia; the Po basin in Italy; and the southern Rhine basin in Switzerland. Exceedance took place for more than twenty days in the stations located on Parma, Riglio, and Stirone Rivers (the Po basin); on the Tisza River; and on Lake Ossiach (the Danube basin). As can be seen in Norway, four stations located on the west side; the Storelvi, Breelvi, and Loelva rivers, exceeded their threshold for two days. Three stations in the Bakkahlaup basin and one in the Skjalfandafljot basin (Iceland), and three stations in Spain (the Llobregat and Minho basins) exceeded their lowest threshold level.

The stations that exceeded the quantile 90% are scattered throughout the European continent. Spain stands out with 15 stations having values higher than this quantile in the Guadalquivir, Guadalhorce, Velez, Minho, Ter, and Llobregat basins. The stations located in the Danube basin are remarkable too. These stations represent 36% of the stations that exceeded quantile 90%. The rest of stations are in France (the Loire and Seine basins), Germany (the Rhine basin), Poland (the Oder basin), Ukraine (the Dnieper basin), southern and central Ireland, southern United Kingdom, and Norway.

Finally, 63% of the stations that met the quantile value of under 10% for August are located in Poland, Germany, and Belgium. The rest of the stations are scattered throughout the United Kingdom, the Netherlands, Spain, Romania, Ukraine, Czechia, Norway, and Sweden.

September

For September, the highest concentration of stations that exceeded their lowest threshold level (almost 50 percent of the total number of stations that exceeded this month) was located in Italy, in the Po river basin. In central Europe, the Danube river basin is notable, containing stations with their threshold level exceeded in Austria, Slovenia, Germany, Hungary, and the Czech Republic. Another concentration of stations can be seen across Norway and finally, some scattered stations are found between the Oder and Vistula river basins on the west side of Poland.

With respect to stations registering values above the 90% quantile, these are located in central Europe, mainly in the Danube (Austria, Romania, Serbia, Germany, Slovakia, Ukraine, Czech Republic, Slovenia, Bulgaria, Bosnia and Herzegovina, and Croatia) and Rhine river basins. To a minor extent, values above 90% quantile can be found in stations located in basins to the north of the Danube (Dnieper, Vistula, Oder, Elbe) and west Rhine river basins (Meuse, Rhône, Seine, Loire, Vilaine, Hérault). Also, a high density of stations exceeding the 90% quantile is located in Spanish (Ebro, Douro, Guadalquivir, Minho and Ter) and Norwegian river basins, mainly in the south-central area. Values above the 90% quantile were also registered in isolated stations in basins located in Great Britain and Ireland (Don, Exe, Mersey, Thames, Yare, Barrow and Shannon basins), northern Finland basins (Naatamo, Kemijoki and Tana) and Sweden (Moälven basin).

Finally, and regarding values under quantile 10%, the greatest concentration of stations that met this condition are located in southern Sweden, in the Hungarian Danube basin, and in north-eastern France (Rhone and Seine basins). We can also find stations showing values below 10% in Germany (Rhine and Elbe basins), Poland (Vistula and Oder basins), central Norway, southern England (Thames basin) and in southern Spain. Besides those listed above, other isolated stations also showing values below the 10% quantile are located in Serbia (Danube basin), Ukraine (Dnieper river basin), and in Spain (Minho river).

Verification

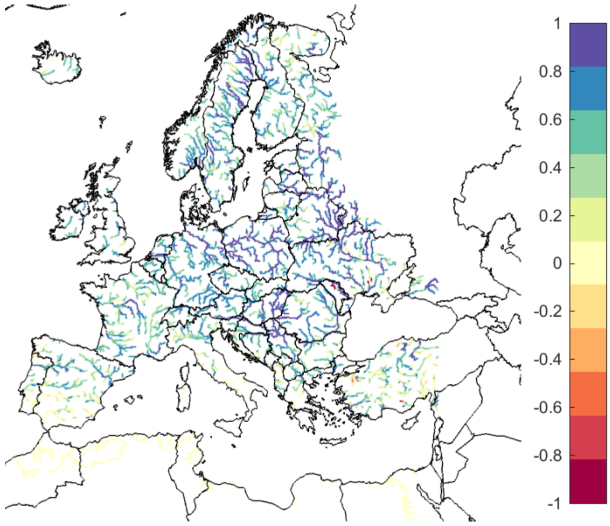

Figure 3. EFAS CRPSS at lead-time 1 day for the August-September 2020 period, for catchments >2000km2. The reference score is persistence of using previous day's forecast.

Figure 3 and Figure 4 shows the EFAS headline score, the continuous ranked probability skill score (CRPSS) for lead times 1 and 5 days for the August to September period 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.

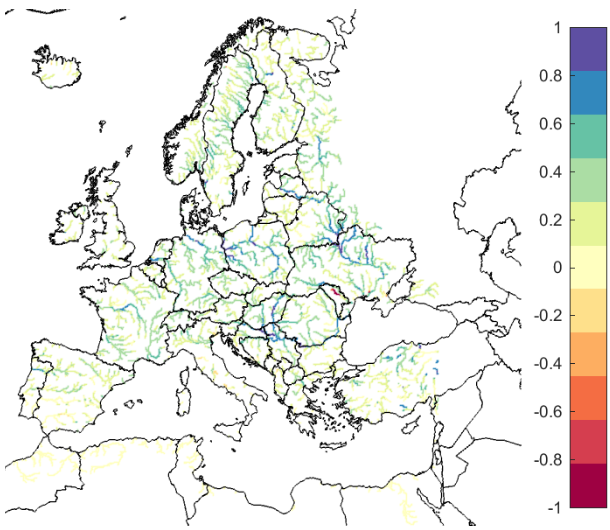

Figure 4. EFAS CRPSS at lead-time 5 days for the August-September 2020 period, for catchments >2000km2. The reference score is persistence of using previous day's forecast.

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 better compared to the same period last year (Figure 5). 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.

With the release of EFAS v4.0, skill scores are now available on EFAS-IS. We will therefore no longer show skill scores in the bimonthly bulletin.

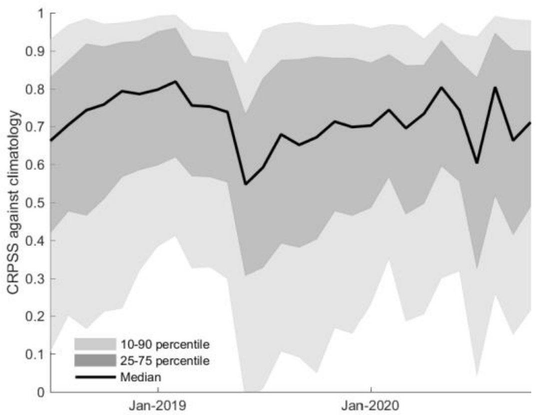

Figure 5. Monthly means of CRPSS the for lead-time 5 days for all the major river points in Europe with ECMWF ENS as forcing. Reference forecast was climatology. The skill is largest during the winter months, when there is less variation in the flow in large parts of Europe.

ARTICLES

EFAS version 4.0: the new cycle upgrade of the European Flood Awareness System

by Christel Prudhomme, Cinzia Mazzetti and the whole team of the EFAS Computational Forecast Centre.

On the 14 October 2020, the European Flood Awareness System (EFAS) launched a new cycle upgrade, EFAS version 4.0. It introduces a step-change in the way river discharge is simulated and flood warnings are calculated, with twice daily medium-range ensemble forecasts driven by ECMWF-ENS now provided at a 6-hourly time step — a 4-fold increase in the temporal resolution compared with the daily time step issued up until now — and statistical post-processed forecasts available on over 1000 stations. EFAS v4.0 follows a complete recalibration at 6hourly time step at over 1100 river stations across the EFAS domain covering 50% of the full spatial domain (Figure 6).

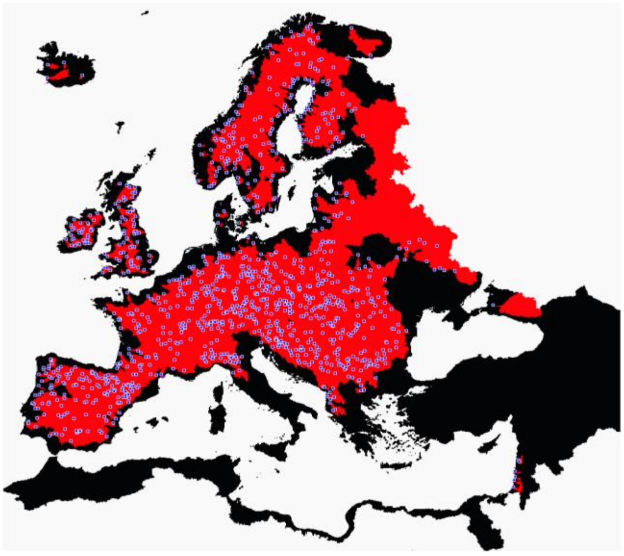

Figure 6: EFAS v4.0 - Area of EFAS Pan-European domain included in the calibration (in red) with associated calibration points (in blue).

Hydrological modelling

The hydrological model was calibrated using sub-daily and daily discharge data provided by EFAS partners up to July 2018.

However, additional river gauges shared by EFAS partners and managed by the Hydrological Data Collection Centre (HDCC) after that date have been included as fixed reporting points where partners can monitor EFAS simulations over their catchment of interest. As part of the continued evolution of the service, new fixed reporting points are added regularly by the team through the publication of new EFAS versions.

The new calibrated LISFLOOD model produces marked improvements in both the magnitude and timing of simulated flood peaks, especially in medium-size catchments (Figure 7). The Kling-Gupta Efficiency increase for 400 of the 540 common calibration points from EFAS3.6 to EFAS v4.0 (Figure 8).

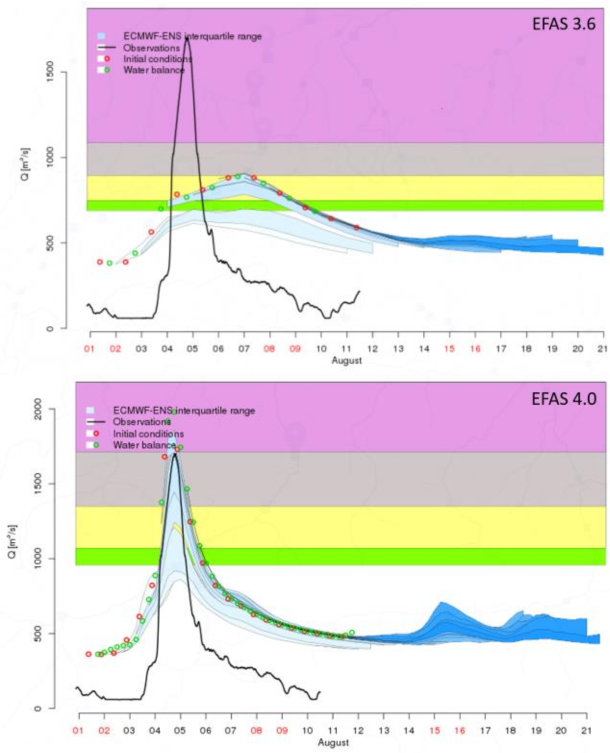

Figure 7: Hydrographs of the water balance layer provided by EFAS v3.6 (left) and EFAS v4.0 (right) for the Inn at Muehldorf, Germany (12600km2) produced on 11 August 2020 : discharge observations (black), simulations forced with observed precipitation and temperature (green) and with forcings from the fill-up period (red), and medium-range ECMWF-ENS ensemble forecasts (blue).

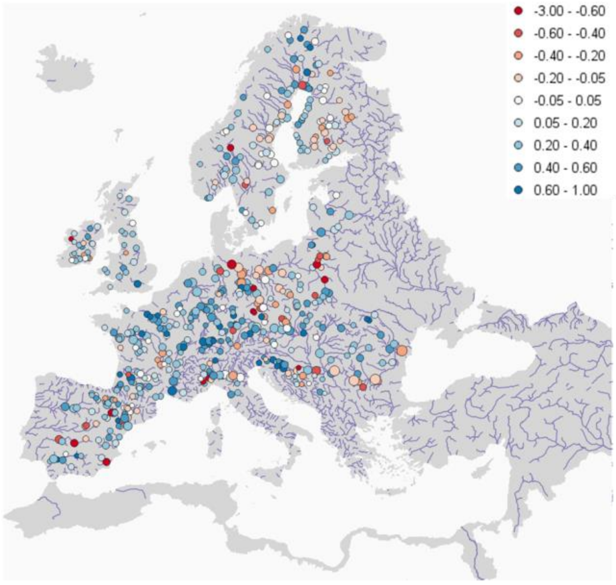

Figure 8: Spatial distribution of Kling-Gupta Efficiency skill score between EFAS v4.0 and EFAS v3 (benchmark). For each point, size of the dot represents area of the upstream catchment. Blue shows improvements from EFAS v3 at the daily time step.

Enhanced information for users

To help users interpret EFAS forecasts, we added new layers describing the way LISFLOOD represent rivers and locates reservoirs and lakes (available under the 'Static' tab in EFAS-IS map-viewer menu). We also made some changes in the way the information is displayed. For example, we introduced a new 'evaluation' tab where summary of the hydrological model performance (see Figure 9) and forecast skills are provided.

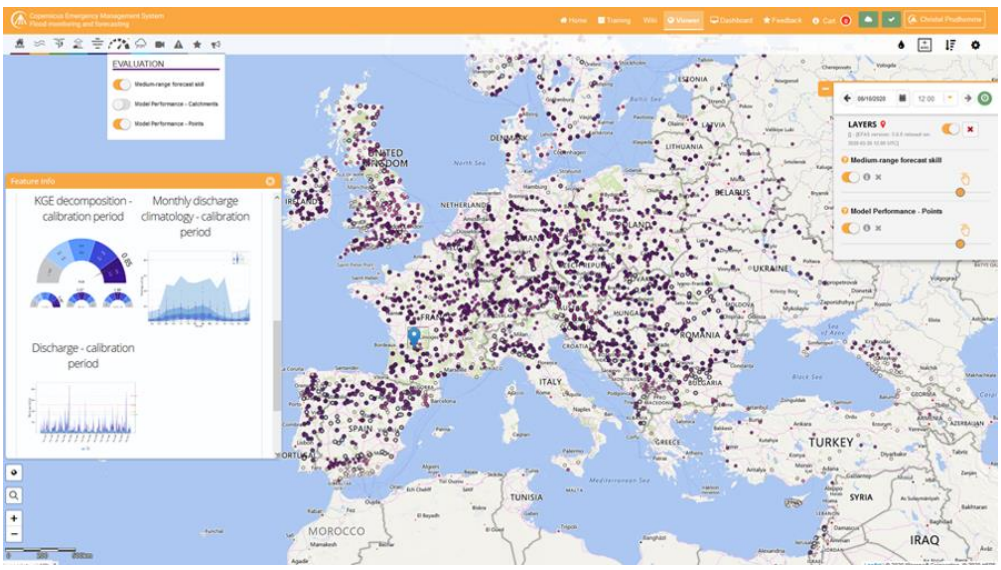

Figure 9: Evaluation layers in EFAS v4.0 including a revamped hydrological model performance (with its redesigned pop-up window, insert) and a new medium-range forecast skill layer, available for all fixed reporting points (only calibration points for the model performance layer).

The pop-up windows associated with the 'Reporting Point' layers have been redesigned, with the discharge forecasts hydrographs (Figure 10) and post-processed forecasts (for those stations with real-time river discharge data available through the HDCC) available together, so that users can easily compare the simulations and forecasts with their own observations. The persistence tables have been reconfigured for a more intuitive reading, with the latest forecasts now on top of the figure. The information is provided for all the 2651 EFAS fixed reporting points of EFAS version 4.0.

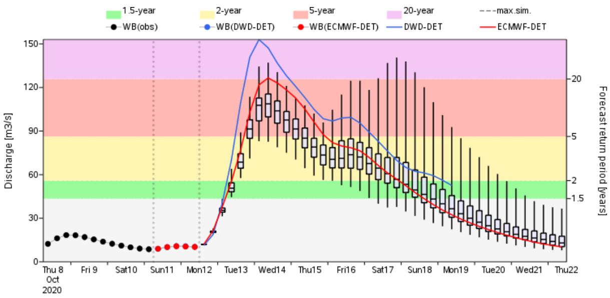

Figure 10: Six-hourly discharge hydrograph published twice daily for all medium-range forecasts from EFAS 4.0, with both discharge (left axis) and return period (right axis) shown together. Example of ECMWF-ENS forecast of 2020-10-12 12:00 UTC for the Hornad at Margecany (Slovakia).

Finally, we also are now publishing all produced EFAS datasets through the Copernicus Climate Data Store. In addition to the already available 30-days old EFAS real-time forecasts and the EFAS historic simulations since EFAS-2, now also real-time EFAS seasonal outlooks and ECMWF-based EFAS medium-range and seasonal reforecasts are part of the CDS so that users can conduct their own local evaluation and use data for downstream applications.

Additional Information

Supplementary documentation detailing the EFAS system (model, products, and service) and its upgrades are provided through dedicated Wiki pages.

A new medium- to sub-seasonal range reforecast, seasonal forecast and seasonal hindcast datasets have also been released with EFAS v4.0. Seasonal and seasonal reforecasts datasets will be available from ~10 November 2020 following the first seasonal forecast in EFAS v4.0. The reforecasts are available through the CDS: https://doi.org/10.24381/cds.c83f560f

EFAS v4.0: Forecasts of the Adige floods of 30 August 2020 (Italy)

by Cinzia Mazzetti

The Adige catchment

The Adige is the second longest river in Italy, after the Po, and the third largest Italian catchment after Po and Tiber rivers. It flows in the Northern part of Italy, collecting water from Alpine streams upstream of the cities of Bolzano and Trento, crossing the city of Verona and finally flowing to the Adriatic Sea.

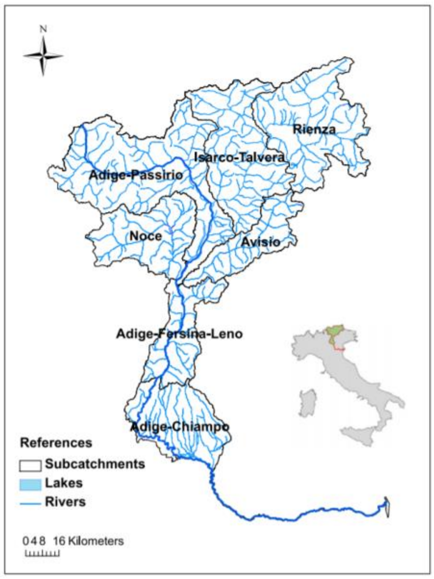

Figure 11: The Adige river catchment in Italy. From Chiogna, G. et al., 2015. A review of hydrological and chemical stressors in the Adige catchment and its ecological status. The Science of the total environment. 343. 10.1016/j.scitotenv.2015.06.149.

The flood event of the 29th- 31st August 2020

Between the 29 and 30 August 2020, northern Italy experienced heavy rainfall that lead to severe flash floods and riverine floods in many areas, with associated increased landslide risk in some places. The Adige catchment was severely hit. The river and one of its main affluents, the Isarco, burst their banks and flooded large areas. More than 600 inhabitants were evacuated from their homes in Egna, and people were told to flee to higher storeys of their buildings. The most affected area was the Adige valley between the cities of Bolzano and Trento, where water caused the temporary closure of the highway and the railroad between Italy and Austria.

Figure 12: The river Adige during the 29-30 August flood event. Credits:https://www.trentotoday.it/cronaca/maltempo-adige-piena.html

The flood peak was recorded at the gauging station of Bronzolo (Bolzano) in the afternoon of 30 August 2020 (Figure 13), marking one of the highest peaks in the last 30 years with ~1350 m3/s.

The European Flood Awareness System (EFAS) version 4.0 had already entered its testing phase when the event struck the Adige catchment and the team at EFAS Forecast Computational Centre got the chance to observe results from the new system.

The first signal of the upcoming event was captured by EFAS v4.0 as early as 7 days before the flood peak, in the forecast from the 00 UTC run on the 23 August, when a 2-year return period reporting point appeared at Bronzolo (Bolzano) river gauge. A 5-year return period reporting point appeared at the same station the day after, in EFAS v4.0 forecast from the 12 UTC run on the 24 August (Figure 14).

In EFAS v4.0 forecast from the 12 UTC run on the 28 August, 48 hours before the flood peak in Bronzolo, the flood signal was clearly indicating 30th August as the most probable day for the flood peak. The new 6-hourly forecast overview tables were also clearly showing the timing of the peak using the new sub-daily time scale (Figure 15).

Figure 13: Observed discharge recorded at Bronzolo gauging station (courtesy of Provincia Autonoma di Bolzano Alto Adige). EFAS version 4.0 forecasts

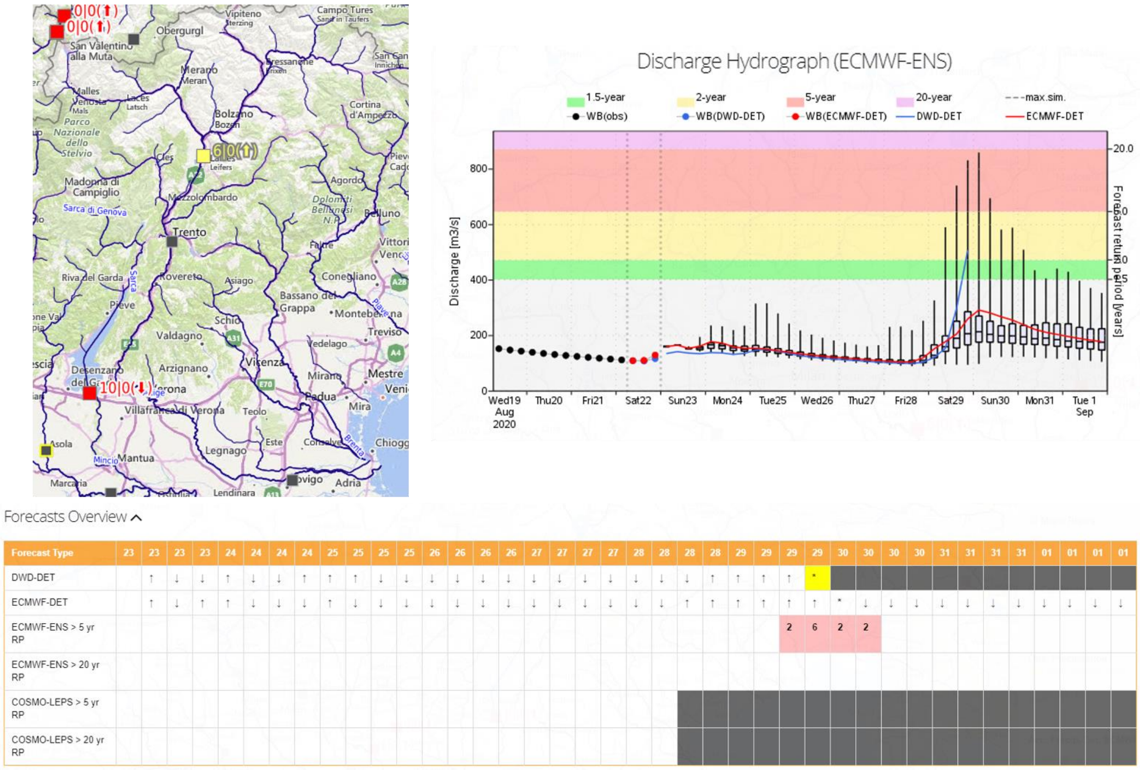

Figure 14: EFAS v4.0 forecast from the 00 UTC run on 23 August 2020. Top left is EFAS v4.0 reporting point layer, top right is EFAS v4.0 discharge forecast at Bronzolo, bottom is forecast overview at Bronzolo.

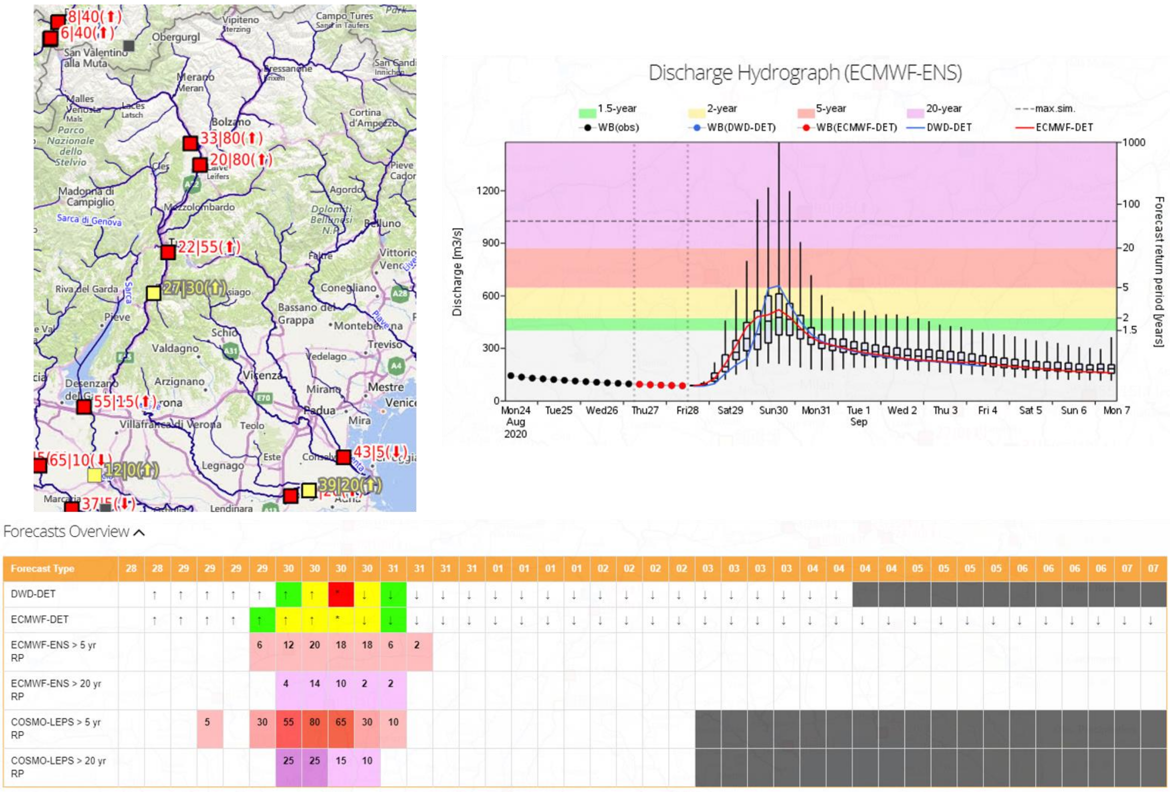

Figure 15: EFAS v4.0 forecast from the 12 UTC run on 28 August 2020. Top left is EFAS v4.0 reporting point layer, top right is EFAS v4.0 discharge forecast at Bronzolo, bottom is forecast overview at Bronzolo.

A few days later, on 1 September, when maps containing observed precipitation and air temperature were ingested in LISFLOOD, the hydrological model produced a hydrograph whose magnitude and timing were consistent with observations at Bronzolo station (Figure 16).

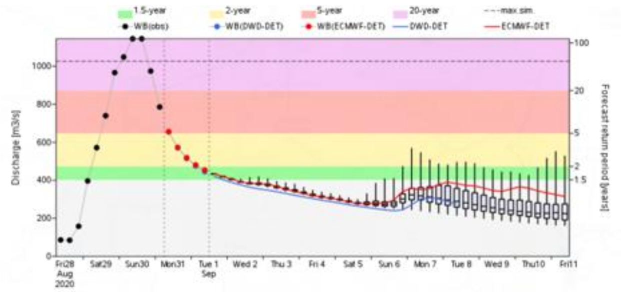

Figure 16: The left part of the graphs (black dots) shows the output of LISFLOOD model when forced with observations at the station of Bronzolo.

What's next?

EFAS version 4.0 was implemented as the operational system of EFAS the 14 October 2020. The forecasts produced for the Adige floods of the end of August 2020 are very encouraging, but of course, the team of the Computational Forecast Centre will continue to closely monitor forecasts and assess the modelling performance. EFAS partners are encouraged to also monitor EFAS forecasts in their region and to inform the EFAS centres how EFAS v4.0 performs locally.

Flooding in County Galway, Ireland, September 2020

by Richard Davies, floodlist and Karen O'Regan

Figure 17: Flooding from the Owenglin river in Clifden, 02 September 2020. Credit: Elena Vaughan, published with permission

Homes and schools were evacuated after flash floods in County Galway, western Ireland on 2 September 2020. The flooding came after heavy rainfall overnight, 1-2 September, caused rivers including the Owenglin River to break their banks. The coastal town of Clifden was particularly badly affected. Local observers said the speed at which the flooding occurred in the town was unprecedented. Fire and Rescue Service evacuated a number of people from approximately 17 properties in Clifden. Police said flooding from the Owenglin river caused temporary closure of parts of Clifden town. Galway County Council said that at least six roads in the area were closed. Most were reopened to traffic later on 2 September.

Rainfall and Warnings

The weather station at Connemara National Park Automatic, located in near Letterfrack, around 8km north east of Clifden, recorded 60mm of rain in a few hours early on 02 September.

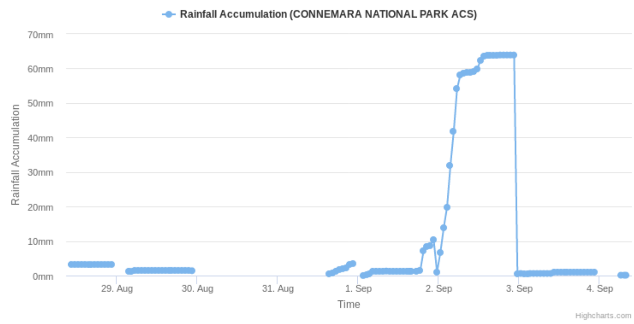

Figure 18: Rainfall in early September 2020 measured at the Connemara National Park weather station near Letterfrack, Galway. Image / data: Met Eireann

In a statement of 2 September, Galway County Council said:

"Met Éireann issued a Status Yellow Rainfall Warning for Mayo, Sligo, Leitrim and Donegal on the 1st September 2020... The warning did not extend to Galway, however the weather system pushed south into the Galway resulting in a period of high Intensity Rainfall in the Connemara area from 10pm last night to 8am this morning where up to 50mm of rainfall was recorded. This resulted in a surge in rivers causing a series of flooding events on roads in the Connemara area with the town of Clifden significantly impacted by heavy flooding from the Owenglin River."

Copernicus EMS Maps

The Copernicus Emergency Management Service was activated in Rapid Mapping mode on 02 September

(EMSR460), to provide satellite maps of the areas affected by the flooding event.

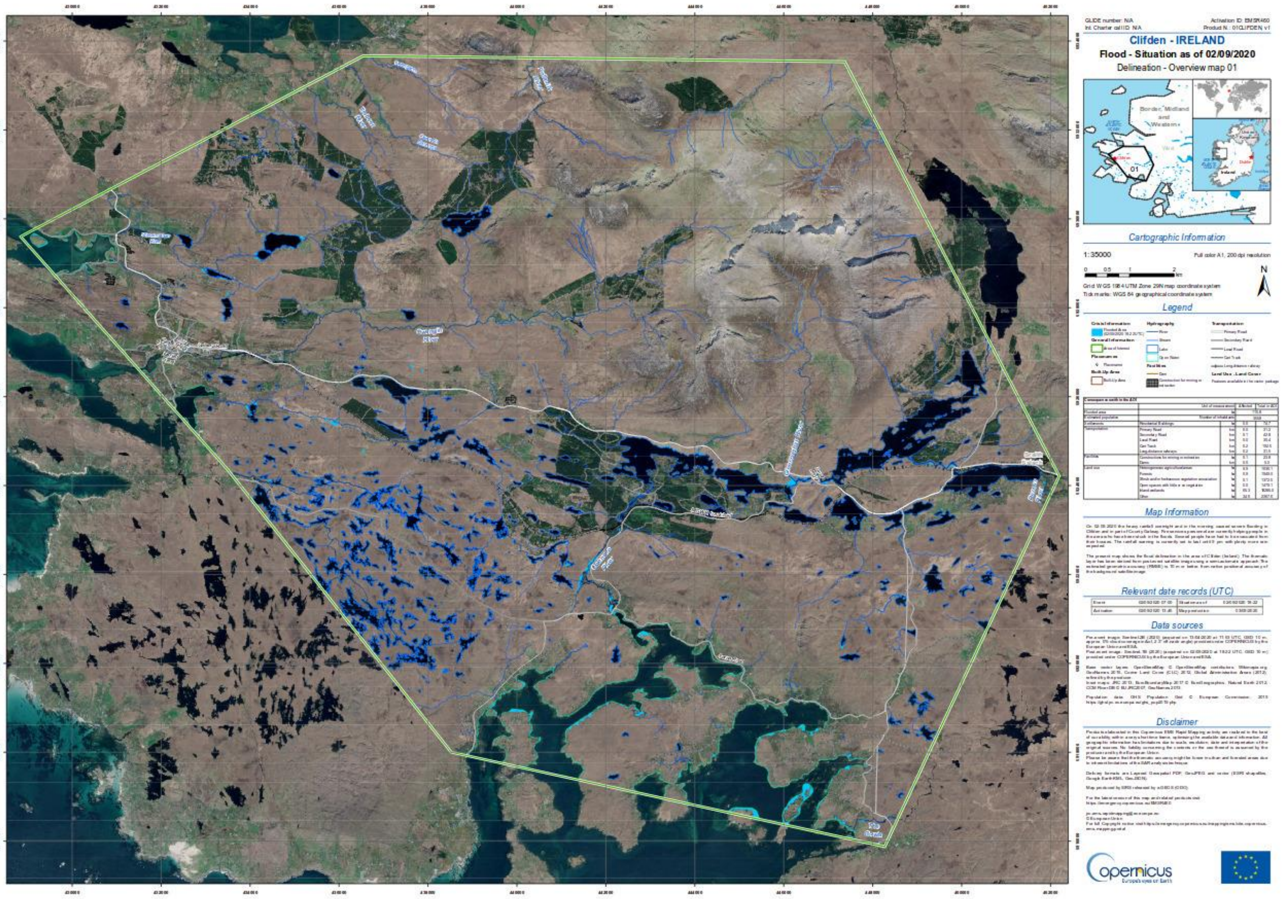

Figure 19: Copernicus EMS map of Galway floods, 2 September. Credit; Copernicus EMS

Flood Relief Scheme

The Minister of State with responsibility for the Office of Public Works, Patrick O'Donovan TD, visited flood-hit areas of Clifden on 2 and 3 September. Minister O'Donovan said:

"It is only when you see the damage that you can fully appreciate the devastation caused to this community. I wish to assure local residents of the support from government to assist in the recovery of those affected and our commitment to working with Galway County Council to progress the Flood Relief Scheme for the town... The OPW, in partnership with Local Authorities, is working to deliver a significant planned programme of flood relief schemes, and this €1 billion investment will ensure that this and future generations will no longer live with the risk, fear and impact from flooding."

The State of Flood Forecasting in Ireland

Following extensive flooding in the winter of 2015/2016, the Government of Ireland decided to establish a National Flood Forecast and Warning Service (NFFWS) to forecast for fluvial and coastal floods. The operational element of the NFFWS, a Flood Forecast Centre (FFC) is to be implemented by Met Éireann (The Irish Meteorological Service), while the Office of Public Works will provide guidance and standards.

Stage 1 will involve the development of fluvial flood forecasting models at a National and Catchment level. Ireland has 36 such hydrometric areas and catchment models will be built for each of these. A review of fluvial models and integrator systems was undertaken by Met Éireann, and the HYPE model was selected for the operational fluvial model for the FFC. It is expected that a non-operational trial of the FCC will commence in Q3 2021.

Acknowledgements

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

- DG GROW - 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: Flooding from the Owenglin river in Clifden, Galway, Ireland, 02 September 2020. Credit: Elena Vaughan, published with permission.

Appendix – figures

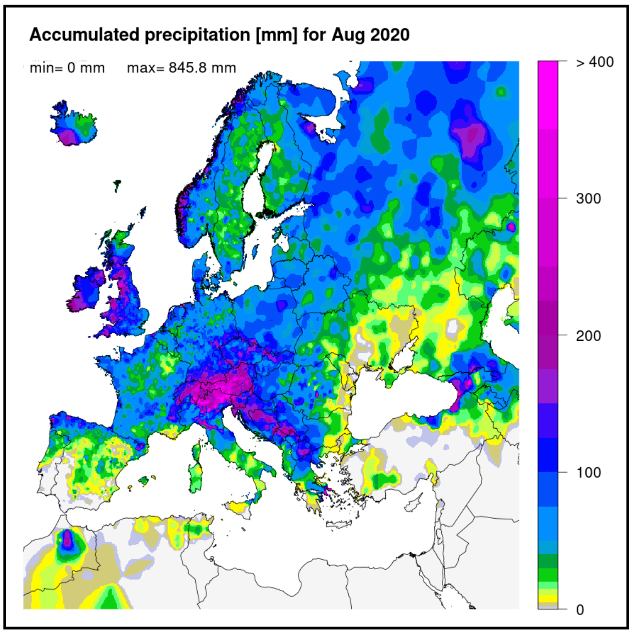

Figure 20. Accumulated precipitation [mm] for August 2020.

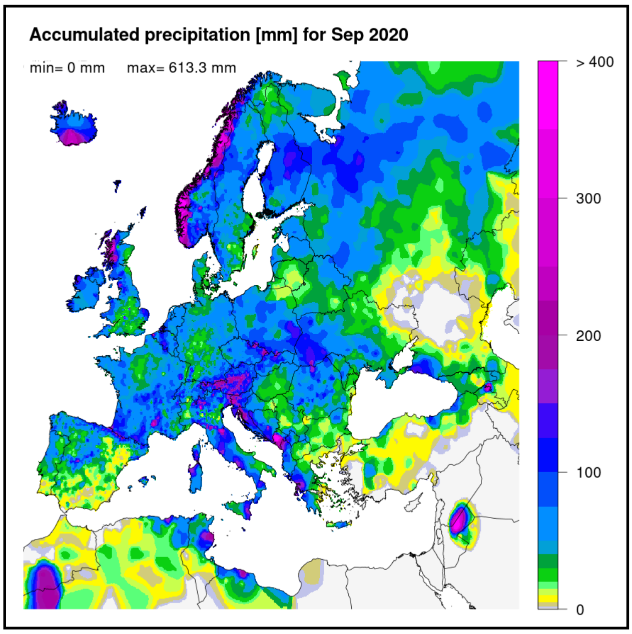

Figure 22. Accumulated precipitation [mm] for September 2020.

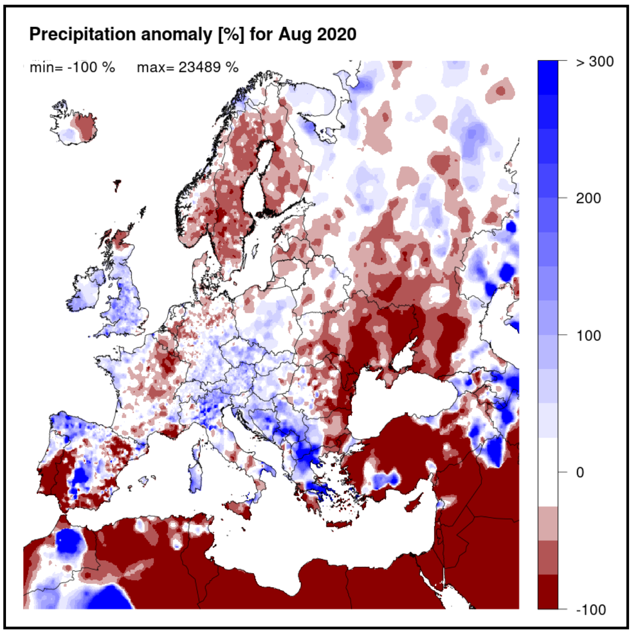

Figure 21. Precipitation anomaly [%] for August 2020, relative to a long-term average (1990-2013). Blue (red) denotes wetter (drier) conditions than normal.

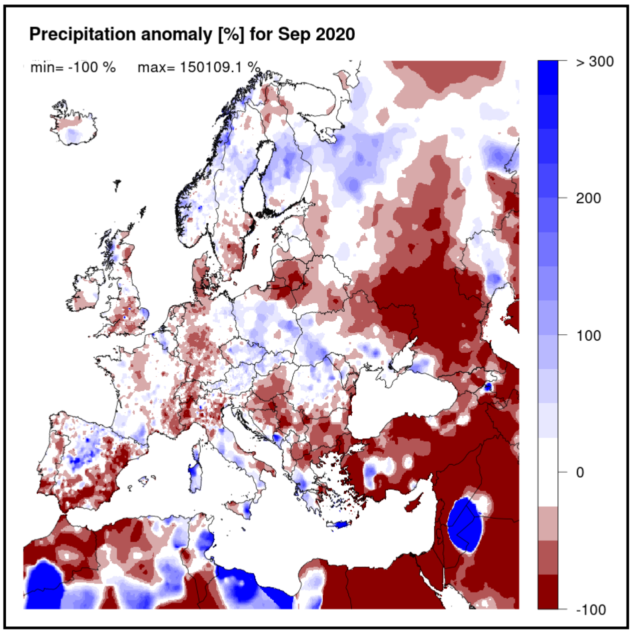

Figure 23. Precipitation anomaly [%] for September 2020, relative to a long-term average (1990-2013). Blue (red) denotes wetter (drier) conditions than normal.

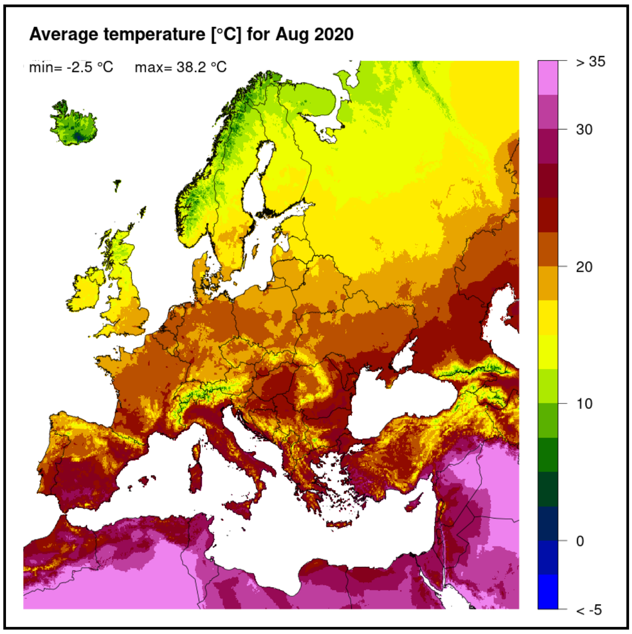

Figure 24. Mean temperature [°C] for August 2020.

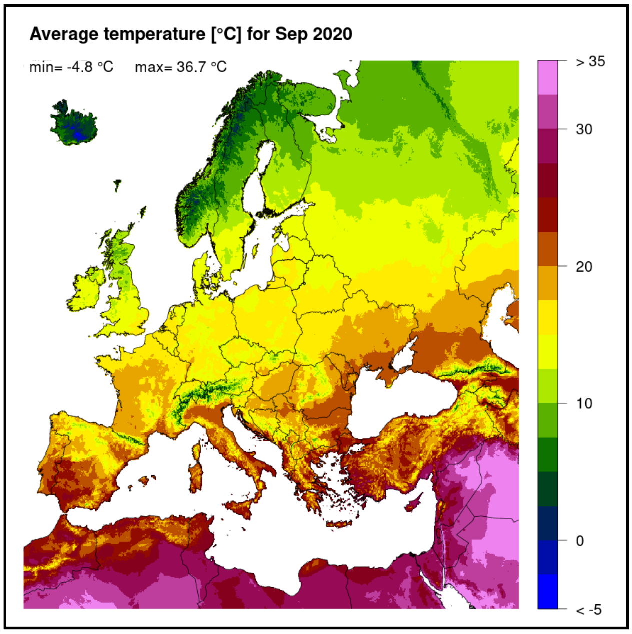

Figure 26. Mean temperature [°C] for September 2020.

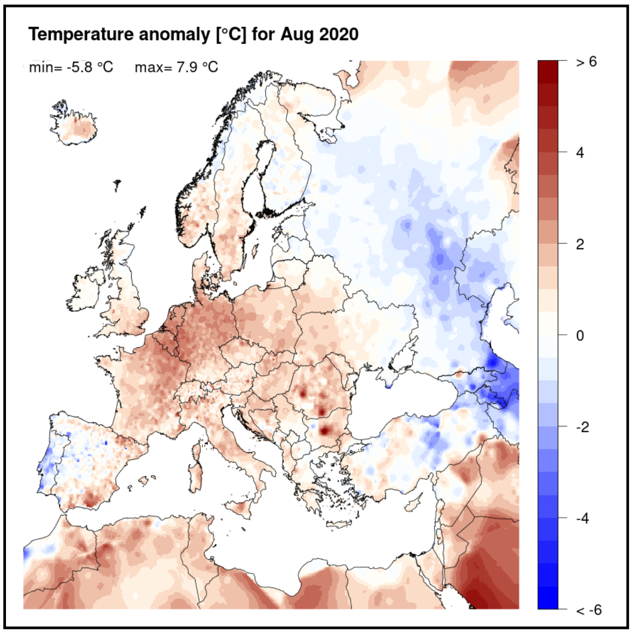

Figure 25. Temperature anomaly [°C] for August 2020, relative to a long-term average (1990-2013). Blue (red) denotes colder (warmer) temperatures than normal.

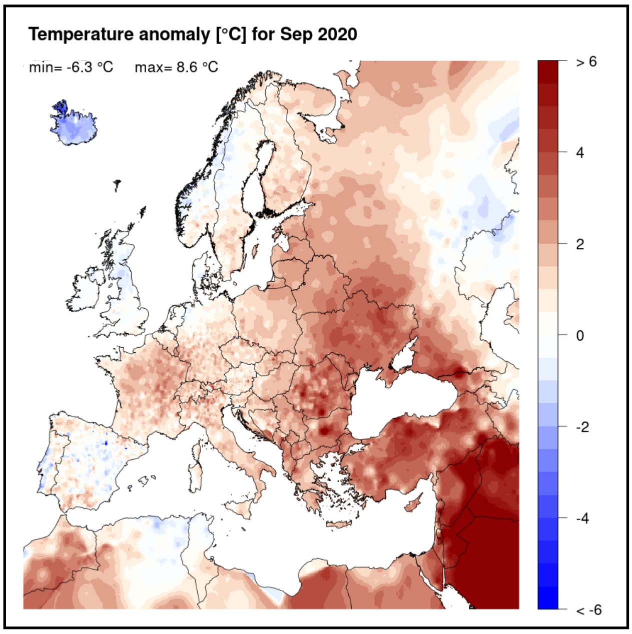

Figure 27. Temperature anomaly [°C] for September 2020, relative to a long-term average (1990-2013). Blue (red) denotes colder (warmer) temperatures than normal.

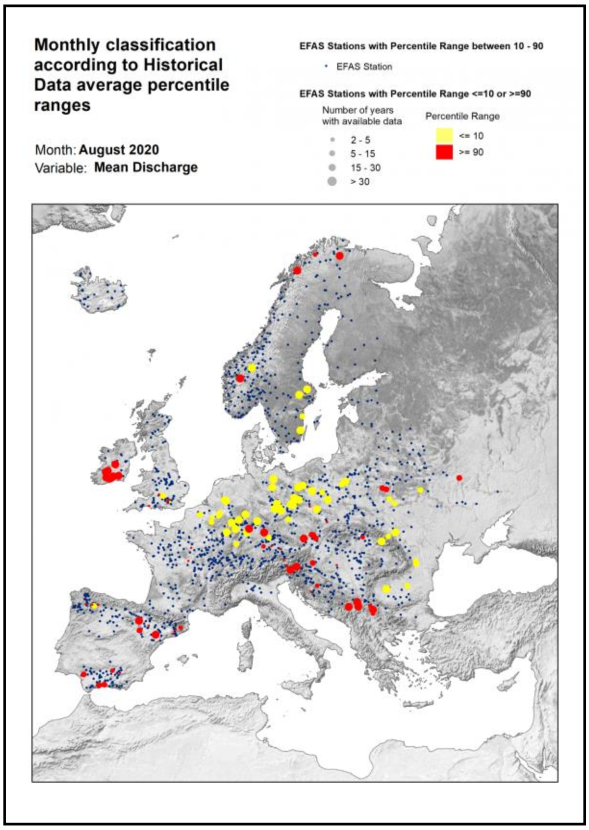

Figure 28. Monthly discharge anomalies August 2020.

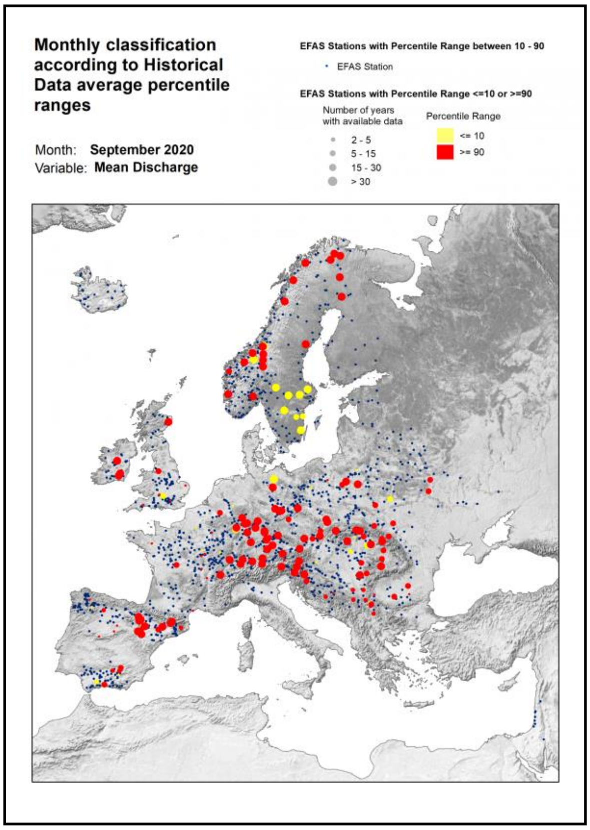

Figure 30. Monthly discharge anomalies September 2020.

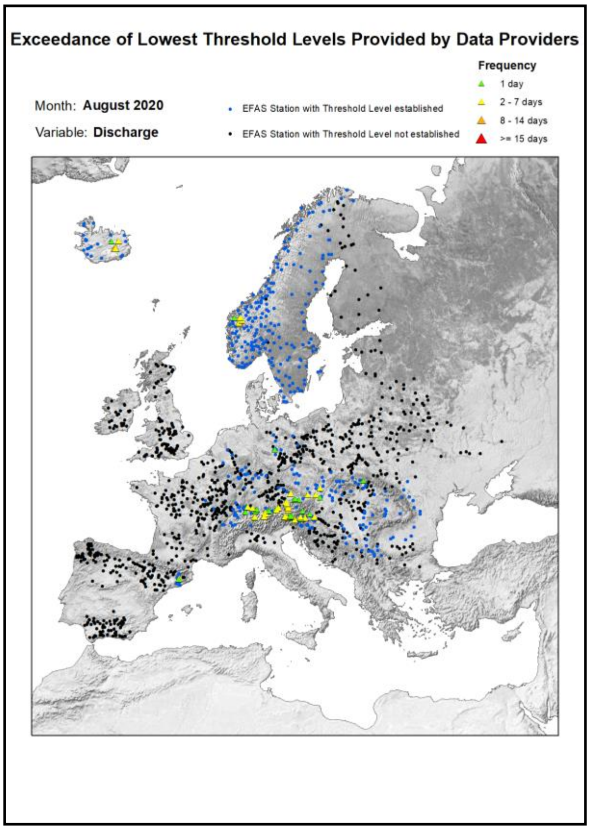

Figure 29. Lowest alert level exceedance for August 2020.

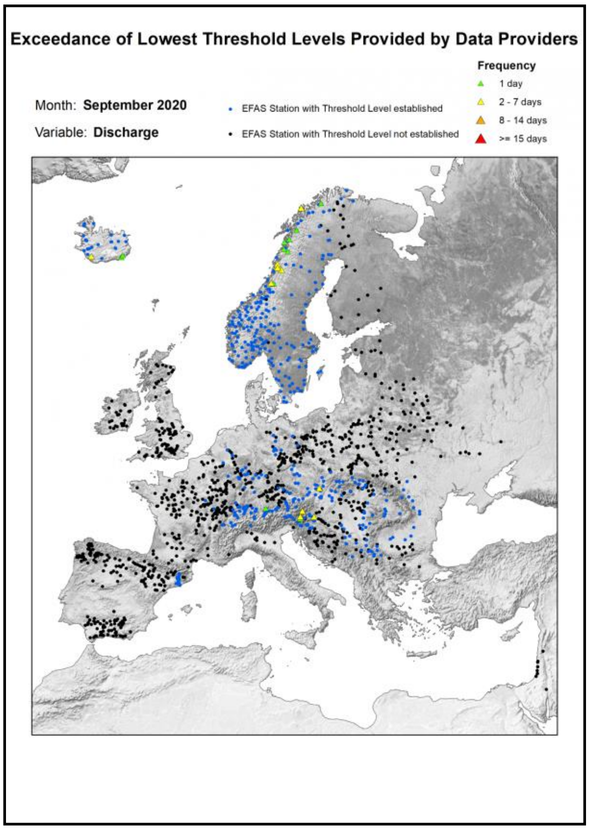

Figure 31. Lowest alert level exceedance for September 2020.

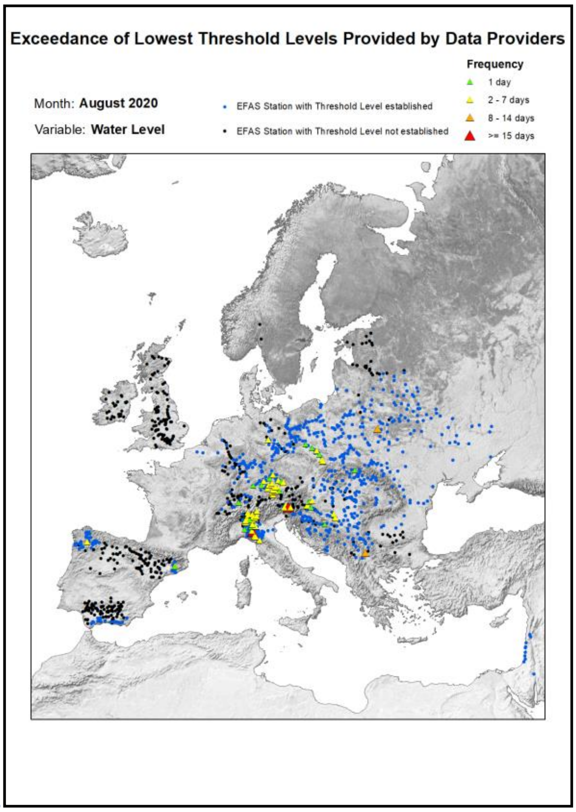

Figure 32. Lowest threshold exceedance for August 2020.

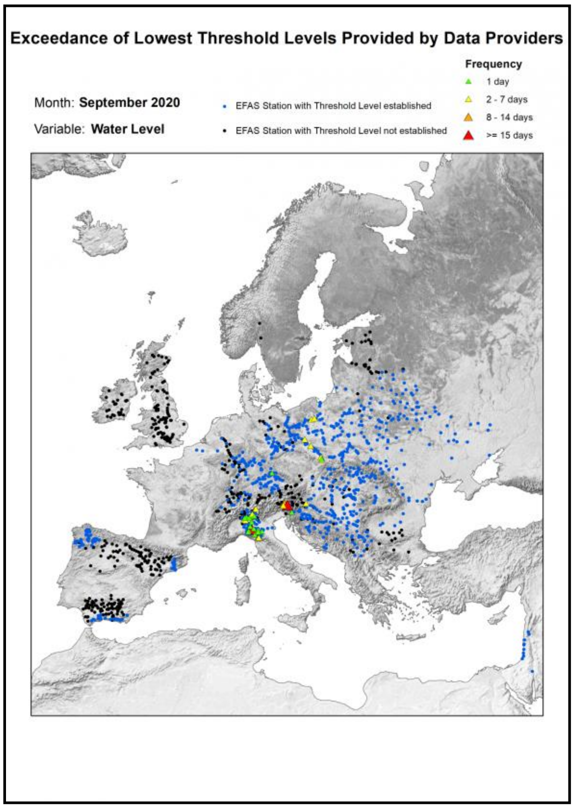

Figure 33. Lowest threshold exceedance for September 2020.

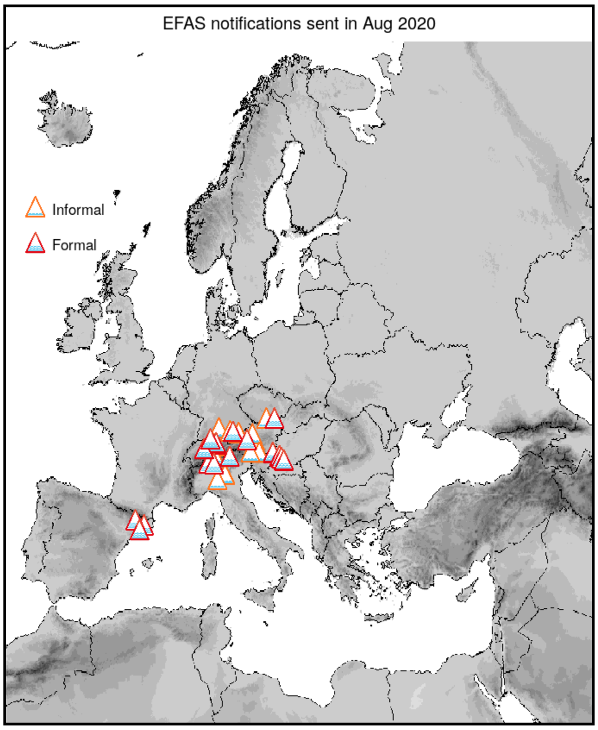

Figure 34. EFAS flood notifications sent for August 2020.

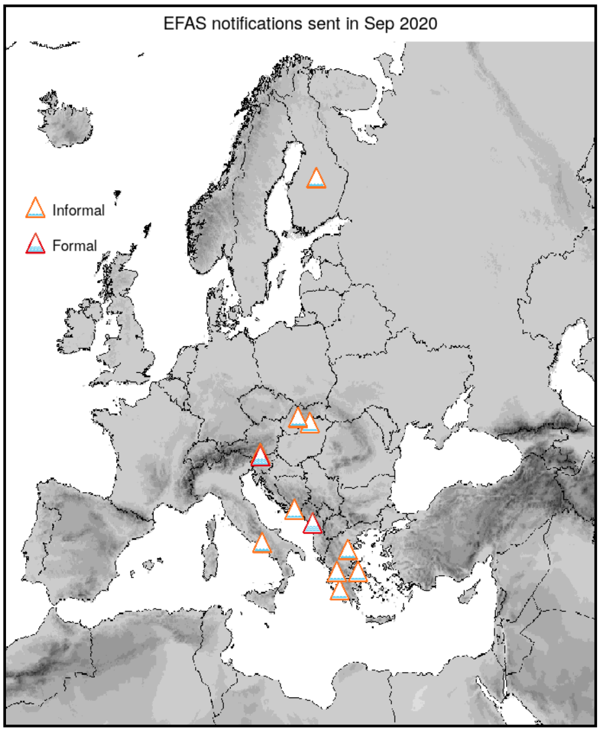

Figure 36. EFAS flood notifications sent for September 2020.

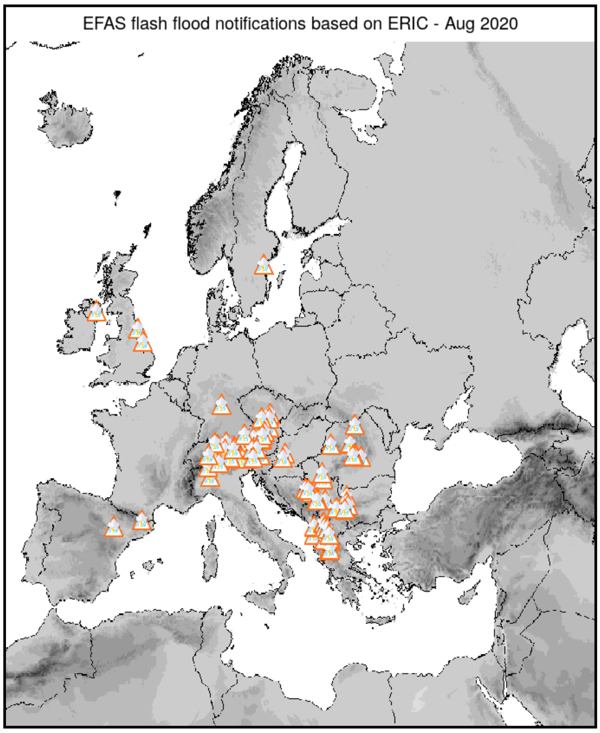

Figure 35. Flash flood notifications sent for August 2020.

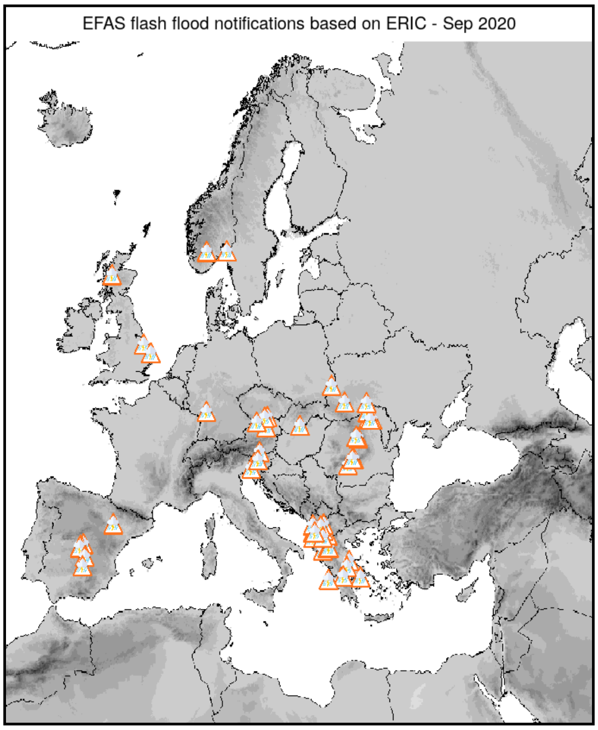

Figure 37. Flash flood notifications sent for September 2020.

Appendix - tables

Table 1: EFAS flood notifications sent in August - September 2020

Type	Forecast date	Issue date	Lead time	River	Country
Formal	31/07/2020 12UTC	01/08/2020	2	Saalach	Austria
Informal	31/07/2020 12UTC	01/08/2020	2	Enns	Austria
Informal	31/07/2020 12UTC	01/08/2020	2	Mur	Austria
Informal	01/08/2020 12UTC	02/08/2020	1	Traun	Austria
Informal	01/08/2020 12UTC	02/08/2020	2	Gurk	Austria
Informal	03/08/2020 00UTC	03/08/2020	0	Mincio	Italy
Formal	03/08/2020 00UTC	03/08/2020	3	Mur	Hungary
Formal	03/08/2020 00UTC	03/08/2020	3	Mur	Croatia
Formal	03/08/2020 00UTC	03/08/2020	1	Mur	Slovenia
Informal	03/08/2020 12UTC	04/08/2020	1	Iller	Germany
Informal	03/08/2020 12UTC	04/08/2020	0	Amper	Germany
Formal	03/08/2020 12UTC	04/08/2020	0	Isar	Germany
Informal	04/08/2020 00UTC	04/08/2020	0	Inn	Germany
Informal	04/08/2020 00UTC	04/08/2020	0	Thaya	Austria
Formal	04/08/2020 00UTC	04/08/2020	2	Drava	Hungary
Formal	04/08/2020 00UTC	04/08/2020	3	Drava	Croatia
Formal	04/08/2020 12UTC	05/08/2020	1	Thaya	Czechia
Formal	25/08/2020 12UTC	26/08/2020	3	Ter	Spain
Formal	25/08/2020 12UTC	26/08/2020	3	Adige	Italy
Informal	26/08/2020 00UTC	26/08/2020	3	Rhine	Austria
Informal	26/08/2020 00UTC	26/08/2020	3	Ill	Austria
Formal	26/08/2020 00UTC	26/08/2020	3	Rhine	Austria
Formal	26/08/2020 00UTC	26/08/2020	3	Lago Maggiore	Switzerland
Informal	26/08/2020 00UTC	26/08/2020	3	Ill	Austria
Informal	26/08/2020 00UTC	26/08/2020	3	Ticino	Switzerland
Informal	26/08/2020 00UTC	26/08/2020	3	Rhine	Switzerland
Formal	26/08/2020 00UTC	26/08/2020	3	Rhine	Switzerland
Informal	26/08/2020 12UTC	27/08/2020	3	Lieser	Austria
Formal	27/08/2020 00UTC	27/08/2020	2	Adda	Italy
Formal	27/08/2020 00UTC	27/08/2020	2	Segre	Spain
Formal	27/08/2020 00UTC	27/08/2020	2	Llobregat	Spain
Informal	27/08/2020 00UTC	27/08/2020	2	Hinterrhein	Switzerland
Informal	27/08/2020 12UTC	28/08/2020	1	Mincio	Italy
Informal	27/08/2020 12UTC	28/08/2020	2	Adda	Italy
Formal	27/08/2020 12UTC	28/08/2020	2	Reuss	Switzerland
Formal	27/08/2020 12UTC	28/08/2020	3	Untersee	Switzerland
Informal	28/08/2020 12UTC	29/08/2020	1	Thur	Switzerland
Informal	15/09/2020 00UTC	15/09/2020	2	Kymijoki sub-catchment	Finland
Informal	16/09/2020 00UTC	16/09/2020	2	Kifisos	Greece
Informal	17/09/2020 12UTC	18/09/2020	1	Alfeios	Greece
Informal	18/09/2020 00UTC	18/09/2020	0	Acheloos	Greece
Informal	18/09/2020 00UTC	18/09/2020	1	Pineios	Greece
Formal	23/09/2020 12UTC	24/09/2020	0	Drin-Buna	Albania
Informal	24/09/2020 00UTC	24/09/2020	2	Slana	Slovakia
Informal	24/09/2020 12UTC	25/09/2020	1	Hron	Slovakia

Informal	26/09/2020 12UTC	27/09/2020	1	Volturno	Italy
Informal	27/09/2020 00UTC	27/09/2020	1	Krupa	Bosnia And Her-
Informal	27/09/2020 12UTC	28/09/2020	1	Gurk	Austria
Formal	29/09/2020 00UTC	29/09/2020	6	Gurk	Austria

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

Table 2: EFAS flash flood notifications sent in August - September 2020

Type	Forecast date	Issue date	Lead time	Region	Country
Flash Flood	31/07/2020 12UTC	01/08/2020	54	Tirol	Austria
Flash Flood	31/07/2020 12UTC	01/08/2020	60	Lombardia	Italy
Flash Flood	31/07/2020 12UTC	01/08/2020	60	Steiermark	Austria
Flash Flood	31/07/2020 12UTC	01/08/2020	60	Salzburg	Austria
Flash Flood	01/08/2020 00UTC	01/08/2020	60	Provincia Autonoma di Bolzano/Bozen	Italy
Flash Flood	01/08/2020 12UTC	02/08/2020	60	Kraj Vysocina	Czech Republic
Flash Flood	01/08/2020 12UTC	02/08/2020	60	Niederosterreich	Austria
Flash Flood	01/08/2020 12UTC	02/08/2020	60	Karnten	Austria
Flash Flood	01/08/2020 12UTC	02/08/2020	36	Oberosterreich	Austria
Flash Flood	01/08/2020 12UTC	02/08/2020	60	Jihomoravsky kraj	Czech Republic
Flash Flood	02/08/2020 00UTC	02/08/2020	54	Jihocesky kraj	Czech Republic
Flash Flood	02/08/2020 12UTC	03/08/2020	48	Vorarlberg	Austria
Flash Flood	02/08/2020 12UTC	03/08/2020	36	Oberbayern	Germany
Flash Flood	03/08/2020 00UTC	03/08/2020	36	Schwaben	Germany
Flash Flood	03/08/2020 00UTC	03/08/2020	24	Provincia Autonoma di Bolzano/Bozen	Italy
Flash Flood	03/08/2020 00UTC	04/08/2020	36	Vorarlberg	Austria
Flash Flood	03/08/2020 12UTC	04/08/2020	42	Durres	Albania
Flash Flood	03/08/2020 12UTC	04/08/2020	48	Diber	Albania
Flash Flood	03/08/2020 12UTC	04/08/2020	48	Poloski	N. Macedonia
Flash Flood	03/08/2020 12UTC	04/08/2020	42	Lezhe	Albania
Flash Flood	03/08/2020 12UTC	04/08/2020	48	Jugozapaden	N. Macedonia
Flash Flood	03/08/2020 12UTC	04/08/2020	78	Korce	Albania
Flash Flood	03/08/2020 12UTC	04/08/2020	48	Pelagoniski	N. Macedonia
Flash Flood	03/08/2020 12UTC	04/08/2020	48	Ipeiros	Greece
Flash Flood	03/08/2020 12UTC	04/08/2020	48	Dytiki Makedonia	Greece
Flash Flood	04/08/2020 00UTC	04/08/2020	30	Del-Dunantul	Hungary
Flash Flood	04/08/2020 00UTC	04/08/2020	30	Nyugat-Dunantul	Hungary
Flash Flood	04/08/2020 12UTC	05/08/2020	24	Prizren	Republic Of Kosovo*
Flash Flood	04/08/2020 12UTC	05/08/2020	24	Kukes	Albania
Flash Flood	04/08/2020 12UTC	05/08/2020	42	Zlatiborska oblast	Serbia
Flash Flood	05/08/2020 00UTC	05/08/2020	24	Rasinska oblast	Serbia
Flash Flood	05/08/2020 00UTC	05/08/2020	24	Republika Srpska	Bosnia And Herzegovina
Flash Flood	07/08/2020 00UTC	07/08/2020	42	Poloski	N. Macedonia
Flash Flood	07/08/2020 00UTC	07/08/2020	42	Pelagoniski	N. Macedonia
Flash Flood	07/08/2020 00UTC	07/08/2020	30	Korce	Albania

Flash Flood	07/08/2020 00UTC	07/08/2020	36	Ipeiros	Greece
Flash Flood	08/08/2020 00UTC	08/08/2020	12	Dytiki Makedonia	Greece
Flash Flood	08/08/2020 00UTC	08/08/2020	18	Jugozapaden	N. Macedonia
Flash Flood	10/08/2020 12UTC	11/08/2020	60	Zaragoza	Spain
Flash Flood	13/08/2020 00UTC	13/08/2020	54	Oberosterreich	Austria
Flash Flood	13/08/2020 00UTC	13/08/2020	54	Steiermark	Austria
Flash Flood	13/08/2020 00UTC	13/08/2020	54	Niederosterreich	Austria
Flash Flood	13/08/2020 12UTC	14/08/2020	66	Bihor	Romania
Flash Flood	13/08/2020 12UTC	14/08/2020	42	Unterfranken	Germany
Flash Flood	15/08/2020 00UTC	15/08/2020	30	Sofia (stolitsa)	Bulgaria
Flash Flood	15/08/2020 00UTC	15/08/2020	30	Moravicka oblast	Serbia
Flash Flood	15/08/2020 00UTC	15/08/2020	30	Pcinjska oblast	Serbia
Flash Flood	15/08/2020 00UTC	15/08/2020	30	Sofia	Bulgaria
Flash Flood	15/08/2020 00UTC	15/08/2020	30	Montana	Bulgaria
Flash Flood	15/08/2020 12UTC	16/08/2020	24	Pernik	Bulgaria
Flash Flood	17/08/2020 00UTC	17/08/2020	24	Niederosterreich	Austria
Flash Flood	17/08/2020 00UTC	17/08/2020	60	Moravicka oblast	Serbia
Flash Flood	17/08/2020 12UTC	18/08/2020	42	Branicevska oblast	Serbia
Flash Flood	17/08/2020 12UTC	18/08/2020	54	Region Vojvodine	Serbia
Flash Flood	18/08/2020 00UTC	18/08/2020	60	Mures	Romania
Flash Flood	18/08/2020 00UTC	18/08/2020	36	Region Sumadije i Zapadne Srbije	Serbia
Flash Flood	18/08/2020 00UTC	18/08/2020	60	Brasov	Romania
Flash Flood	18/08/2020 00UTC	18/08/2020	42	Moravicka oblast	Serbia
Flash Flood	19/08/2020 00UTC	19/08/2020	18	Pelagoniski	N. Macedonia
Flash Flood	19/08/2020 00UTC	19/08/2020	30	Suceava	Romania
Flash Flood	24/08/2020 00UTC	24/08/2020	36	Moravicka oblast	Serbia
Flash Flood	24/08/2020 00UTC	24/08/2020	36	Northern Ireland	United Kingdom
Flash Flood	24/08/2020 12UTC	25/08/2020	30	Brasov	Romania
Flash Flood	24/08/2020 12UTC	25/08/2020	30	Sibiu	Romania
Flash Flood	27/08/2020 00UTC	27/08/2020	60	Girona	Spain
Flash Flood	27/08/2020 12UTC	28/08/2020	48	Ticino	Switzerland
Flash Flood	27/08/2020 12UTC	28/08/2020	54	Provincia Autonoma di Bolzano/Bozen	Italy
Flash Flood	27/08/2020 12UTC	28/08/2020	42	Tirol	Austria
Flash Flood	27/08/2020 12UTC	28/08/2020	60	Ostergotlands lan	Sweden
Flash Flood	27/08/2020 12UTC	28/08/2020	30	North Yorkshire	United Kingdom
Flash Flood	27/08/2020 12UTC	28/08/2020	30	Lincolnshire	United Kingdom
Flash Flood	27/08/2020 12UTC	28/08/2020	54	St. Gallen	Switzerland
Flash Flood	27/08/2020 12UTC	28/08/2020	36	Graubunden	Switzerland
Flash Flood	27/08/2020 12UTC	28/08/2020	48	Lombardia	Italy
Flash Flood	28/08/2020 00UTC	28/08/2020	48	Karnten	Austria
Flash Flood	28/08/2020 00UTC	28/08/2020	48	Steiermark	Austria
Flash Flood	28/08/2020 00UTC	28/08/2020	48	Friuli-Venezia Giulia	Italy
Flash Flood	28/08/2020 00UTC	28/08/2020	48	Veneto	Italy
Flash Flood	28/08/2020 00UTC	28/08/2020	54	Salzburg	Austria
Flash Flood	28/08/2020 12UTC	29/08/2020	24	Piemonte	Italy
Flash Flood	28/08/2020 12UTC	29/08/2020	48	Thurgau	Switzerland
Flash Flood	29/08/2020 00UTC	29/08/2020	36	Provincia Autonoma di Bolzano/Bozen	Italy
Flash Flood	29/08/2020 00UTC	29/08/2020	30	Uri	Switzerland

Flash Flood	29/08/2020 00UTC	29/08/2020	36	Tirol	Austria
Flash Flood	29/08/2020 00UTC	29/08/2020	30	Lombardia	Italy
Flash Flood	31/08/2020 12UTC	01/09/2020	24	Jihomoravsky kraj	Czech Republic
Flash Flood	02/09/2020 12UTC	03/09/2020	48	Harghita	Romania
Flash Flood	04/09/2020 12UTC	05/09/2020	60	Niederosterreich	Austria
Flash Flood	12/09/2020 00UTC	12/09/2020	30	Highlands and Islands	United Kingdom
Flash Flood	16/09/2020 00UTC	16/09/2020	66	Madrid	Spain
Flash Flood	16/09/2020 00UTC	16/09/2020	72	Zaragoza	Spain
Flash Flood	16/09/2020 00UTC	16/09/2020	66	Toledo	Spain
Flash Flood	16/09/2020 00UTC	16/09/2020	66	Toledo	Spain
Flash Flood	16/09/2020 00UTC	16/09/2020	66	Toledo	Spain
Flash Flood	16/09/2020 12UTC	17/09/2020	60	Attiki	Greece
Flash Flood	17/09/2020 00UTC	17/09/2020	42	Ciudad Real	Spain
Flash Flood	17/09/2020 00UTC	17/09/2020	36	Ciudad Real	Spain
Flash Flood	17/09/2020 12UTC	18/09/2020	36	Ionia Nisia	Greece
Flash Flood	17/09/2020 12UTC	18/09/2020	42	Dytiki Ellada	Greece
Flash Flood	17/09/2020 12UTC	18/09/2020	42	Sterea Ellada	Greece
Flash Flood	17/09/2020 12UTC	18/09/2020	42	Thessalia	Greece
Flash Flood	18/09/2020 00UTC	18/09/2020	18	Dytiki Makedonia	Greece
Flash Flood	18/09/2020 00UTC	18/09/2020	18	Ipeiros	Greece
Flash Flood	21/09/2020 12UTC	22/09/2020	48	Ipeiros	Greece
Flash Flood	22/09/2020 00UTC	22/09/2020	54	Durres	Albania
Flash Flood	22/09/2020 12UTC	23/09/2020	48	Zaragoza	Spain
Flash Flood	22/09/2020 12UTC	23/09/2020	42	Jugozapaden	N. Macedonia
Flash Flood	23/09/2020 00UTC	23/09/2020	30	Poloski	N. Macedonia
Flash Flood	23/09/2020 00UTC	23/09/2020	30	Diber	Albania
Flash Flood	23/09/2020 12UTC	24/09/2020	42	Friuli-Venezia Giulia	Italy
Flash Flood	24/09/2020 00UTC	24/09/2020	36	Karnten	Austria
Flash Flood	24/09/2020 00UTC	24/09/2020	54	Korce	Albania
Flash Flood	24/09/2020 00UTC	24/09/2020	30	Gorenjska	Slovenia
Flash Flood	24/09/2020 00UTC	24/09/2020	54	Elbasan	Albania
Flash Flood	24/09/2020 00UTC	24/09/2020	48	Lezhe	Albania
Flash Flood	24/09/2020 00UTC	24/09/2020	54	Diber	Albania
Flash Flood	24/09/2020 00UTC	24/09/2020	54	Durres	Albania
Flash Flood	24/09/2020 00UTC	24/09/2020	54	Gjirokaster	Albania
Flash Flood	24/09/2020 00UTC	24/09/2020	54	Pelagoniski	N. Macedonia
Flash Flood	24/09/2020 00UTC	24/09/2020	54	Jugozapaden	N. Macedonia
Flash Flood	24/09/2020 00UTC	24/09/2020	54	Poloski	N. Macedonia
Flash Flood	24/09/2020 00UTC	24/09/2020	54	Ipeiros	Greece
Flash Flood	24/09/2020 00UTC	24/09/2020	54	Dytiki Makedonia	Greece
Flash Flood	24/09/2020 12UTC	25/09/2020	30	Lincolnshire	United Kingdom
Flash Flood	24/09/2020 12UTC	25/09/2020	42	Banskobystricky kraj	Slovakia
Flash Flood	25/09/2020 00UTC	25/09/2020	24	Fier	Albania
Flash Flood	25/09/2020 00UTC	25/09/2020	48	Karlsruhe	Germany
Flash Flood	25/09/2020 00UTC	25/09/2020	42	Valcea	Romania
Flash Flood	25/09/2020 00UTC	25/09/2020	24	East Anglia	United Kingdom
Flash Flood	25/09/2020 12UTC	26/09/2020	30	Arges	Romania
Flash Flood	25/09/2020 12UTC	26/09/2020	24	Telemark	Norway
Flash Flood	25/09/2020 12UTC	26/09/2020	18	Ostfold	Norway
Flash Flood	25/09/2020 12UTC	26/09/2020	24	Jihocesky kraj	Czech Republic
Flash Flood	25/09/2020 12UTC	26/09/2020	24	Niederosterreich	Austria

Flash Flood	25/09/2020 12UTC	26/09/2020	36	Ivano-Frankivs'k	Ukraine
Flash Flood	26/09/2020 00UTC	26/09/2020	6	Diber	Albania
Flash Flood	26/09/2020 00UTC	26/09/2020	6	Ipeiros	Greece
Flash Flood	26/09/2020 00UTC	26/09/2020	6	Pelagoniski	N. Macedonia
Flash Flood	26/09/2020 00UTC	26/09/2020	6	Jugozapaden	N. Macedonia
Flash Flood	26/09/2020 00UTC	26/09/2020	6	Poloski	N. Macedonia
Flash Flood	26/09/2020 00UTC	26/09/2020	6	Dytiki Makedonia	Greece
Flash Flood	26/09/2020 00UTC	26/09/2020	48	Lezhe	Albania
Flash Flood	26/09/2020 00UTC	26/09/2020	6	Durres	Albania
Flash Flood	26/09/2020 00UTC	26/09/2020	48	Korce	Albania
Flash Flood	26/09/2020 12UTC	27/09/2020	24	L'viv	Ukraine
Flash Flood	27/09/2020 12UTC	28/09/2020	30	Tirane	Albania
Flash Flood	28/09/2020 00UTC	28/09/2020	42	Harghita	Romania
Flash Flood	28/09/2020 12UTC	29/09/2020	54	Arges	Romania
Flash Flood	29/09/2020 00UTC	29/09/2020	12	Falesti Glodeni Riscani Balti and Singerei	Moldova
Flash Flood	29/09/2020 00UTC	29/09/2020	12	Iasi	Romania
Flash Flood	29/09/2020 00UTC	29/09/2020	12	Botosani	Romania
Flash Flood	29/09/2020 00UTC	29/09/2020	24	Khmel'nyts'kyy	Ukraine
Flash Flood	29/09/2020 00UTC	29/09/2020	24	Edinet Briceni Donduseni and Ocnita	Moldova

a. * 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 consortium (REDIAM and 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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