European Flood Awareness System

EFAS *Bulletin*

August – September 2017

Issue 2017(5)

NEWS

Official release of the operational GloFAS
The official release of the operational GloFAS (Global Flood Awareness System, www.globalfloods.eu) is set to 10 November 2017. This will also be the release of the GloFAS seasonal forecasts. GloFAS has been running in a pre-operational mode since 2011 but will from now on have full operational service level.

First announcement of the next EFAS annual meeting
The 13th EFAS annual meeting will take place in Norrköping (Sweden) 13-14 March 2018. The focus will be partner networking and sharing experiences. Workshops and trainings addressing different interests will be offered. For more information, follow announcements on www.efas.eu/home.

Meetings

4th ANYWHERE Project Meeting and 2nd ANYWHERE workshop, 19-21 September 2017, Helsinki, Finland.
The meeting was hosted by the Finnish Meteorological Institute in Helsinki. The ANYWHERE project aims at developing tools to support decision makers in real-time coordination of the emergency management operations to face the challenge of extreme weather and climate events. The meeting aimed at presenting and discussing the current state of the project. The JRC contributes to the project with tools such as EFAS, EFFIS (European Forest Fire Information System), EDO (European Drought Observatory) and the coastal storm surge activities. The linking of these specific tools to the multi-hazard platform developed under ANYWHERE were discussed in detail.

EFAS training at the Summer School on "Floods and Flood Risk Management", 18-21 September, Lesbos, Greece
The Jade University of Applied Sciences and the University of the Aegean organized a summer school on *floods and flood risk management* at the Department of Marine Sciences, in Mytilene, Greece. Aim of this DAAD funded program was to exchange experiences and state-of-the-art practises regarding floods and flood risk management among experts in that field (from local and national authorities as well as universities) and students (Master, PhD and postdocs) from various backgrounds with strong interest in that subject. The JRC contributed to this program with lectures on probabilistic flood forecasting, including an introduction and hands-on session on EFAS, which was very well received.

RESULTS

Summary of EFAS Flood and Flash Flood Notifications

The 6 formal and 15 informal EFAS flood notifications issued in August-September 2017 are summarised in Table 1. The locations of all notifications are shown in Figure 22 and Figure 24 in the appendix.

30 Flash flood notifications, summarised in Table 2, were issued from August to September 2017. The locations are shown in Figure 23 and Figure 25 in the appendix.

Meteorological Situation

by EFAS Meteorological Data Collection Centre

Meteorological situation for August 2017
In the beginning of August low-pressure systems dominated the weather conditions in northern Europe and parts of southern Europe. This led to flash floods and landslides in the mountainous areas in northern Italy between 4 and 5 August. The heaviest rainfall (102.4 mm in 24h) was recorded at the Misurina weather station and resulted in one fatality. Urban flash floods occurred after summer storms with heavy precipitation amounts in eastern and southern England on 8-10 August, which damaged many buildings. In the eastern Yorkshire towns of Leconfield and Bridlington, 57 and 56 mm of rain were respectively measured within 24 h on 8-9 August. Next day´s highest precipitation totals were recorded in South London with 44.6 mm in 24 hours. In other European areas, some weaker high-pressure systems occurred.

In the middle of the month a high pressure system stretching from North Atlantic to parts of eastern Europe grew in strength and moved towards Scandinavia. In this region the low pressure systems weakened, but on 22 August a strong local low pressure system led to high precipitation sums and flash flooding in northern Ireland, especially the counties of Londonderry and Tyrone were worst affected. Two bridges were also destroyed by the flooding in this area - several buildings, cars as well as roads were damaged. During this day, the county of Donegal received over 70 mm rainfall in 24 hours. This system moved across northern England causing localized flooding on 23 August, particularly in North and West Yorkshire measuring 40 mm in just one hour. Up the end of August, Scandinavia and some eastern European countries were influenced by high-pressure systems. In the rest of Europe, low-pressure systems dominated.

Overall precipitation anomalies displayed drier conditions, except in large parts of Spain, Austria and northeastern European countries (Figure 11). The highest accumulated precipitation was measured in the Alps with a maximum of 498.4 mm (Figure 10). In the Mediterranean region, especially in Italy, high temperatures and low precipitation sums led to severe droughts. Precipitation sums below the average in the spring and summer months together with the extreme heat wave in the beginning of August were responsible for a water shortage in Italy. Because of this water crisis, the Italian government declared a State of Emergency in Latium and Umbria. This situation changed after cooler air masses moved from the North towards Italy causing storms with hail and tornados.

The average temperature for August ranged from -1.3°C up to 30.0°C (Figure 14). In southern and eastern Europe as well as in the Balkan States it was much warmer than normal (Figure 15). The influence of low-pressure systems explains the cooler temperatures especially in northern Europe and Scandinavia.

Meteorological situation for September 2017

Low-pressure systems dominated the weather conditions in most parts of Europe in the beginning of September. On 3 September, one of them was located over England, which once again hit parts of southwestern England with surface flooding after a period of heightened precipitation. The highest rainfall levels were recorded in St Breward, Cornwall, with 55.4 mm in 24 hours. After this event, a high-pressure system localized over Scandinavia, expanded and moved towards Central Europe. During the next few days, low-pressure systems were again evolving and strengthening throughout Europe.

After an extreme period of drought with wildfires, violent storms caused floods in the Italian Tuscany region in Livorno. More than 250 mm of rain were measured within two hours on the 10 September resulting in widespread flooding, landslides, six fatalities and enormous damage to infrastructure. Furthermore, torrential rainfall of almost 280 mm in 24 hours led to flash floods and 127 damaged buildings in Zadar, Croatia on 12 September. In general, the average precipitation sum for this month is 105 mm. Other regions of the Balkans were also affected by flooding on 11-12 September, e.g. Tirana in Albania measured 72 mm in 24 hours.

Afterwards some regions of southern Europe were influenced by weakening high-pressure systems, but in total low-pressure systems determined the weather in this month. Consequently, more than 80 mm of rain fell within 24 hours in the city of Elblag in northern Poland between the 18 and 19 of September and led to the overflowing of the Kumiela River damaging around 50 buildings. The low-pressure areas over Europe moved slowly easterly and caused floods in Greece on 25-26 September, more precisely on the northern Aegean Sea island of Samothraki with a precipitation sum of 273.4 mm within three hours. Because of this, power and drinking water supply have been cut and schools were closed. Several rivers have overflowed in parts of southeastern and eastern Iceland after a period of heavy rain started on 26 September.

At the end of September this situation changed, because high-pressure systems occurred. An especially strong one having been located over Scandinavia with a spatial extension up to Central Europe. The precipitation anomalies displayed wetter conditions corresponding to the regions affected with flooding during this month, with the exception of southern Norway (Figure 12 Figure 13). In the other parts of Europe, especially in Spain and Iceland, it was drier than normal.

The average recorded temperatures ranged from -4.8°C in mountainous areas to 26.8°C in the Mediterranean region (Figure 16). In Iceland, Scandinavia, Eastern Europe, the Pyrenees and parts of Spain temperatures above the average were measured (Figure 17). Otherwise, the temperature anomaly was negative which refer to the influence of strong low-pressure systems in September.

Hydrological situation

By EFAS Hydrological Data Collection Centre

The overall situation for the past bimonthly period is that September has accounted for a higher rate of exceedance events than August (Figure 19 and Figure 21). The minimum warning level for a number of stations has been reached, of which the most noticeable are the ones found in the Po river, in Northern Italy, as well as for some in the Danube basin throughout Slovenia and Croatia, more specifically along the Sava and Mur rivers and the Danube itself bordering between Croatia and Serbia.

A fewer number exceedance levels was surpassed for stations belonging to Norway and Germany, in the higher Danube, Rhine and Elbe basins. Some exceedance levels were also reached in Austria, Romania, in the southern basin area of the Rhine in northern Switzerland, in the southern basin area of the Vistula in northern Slovakia as well as in the north eastern area of Spain in the LLobregat river basin.

Concerning the average water level and discharge values registered throughout this period, the 90% quantile has been surpassed by stations in the Po river basin, Scandinavian countries, mainly Norway, and in Austria (Figure 18 and Figure 20). This has occurred with less frequency in stations belonging to river basins in northern and southern Spain, as well as for stations found halfway in the Rhine river basin in Germany, in the Elbe river basin, in the Danube river basin across Romania, Serbia, Bulgaria and in the Thames river basin in the UK as well as in the Daugava river basin in Latvia.

Regarding the average water level and discharge values that have remained below the 10% quantile, during the bimonthly period this has occurred for stations that belong to river basins in southern and northern Spain, for the Danube river basin in Serbia and others in the Po river basin. This has occurred for a small number of stations belonging to the southernmost river basins in the UK, in the Meuse river basin in Belgium, in the Danube river basin in Austria, Slovakia, Serbia, Ukraine, Romania and Bulgaria. Other stations with a similar behaviour have been found in the Daugava river basin in Latvia, in the river basins of the Dniester and Dnieper rivers in Ukraine as well as the Rhone river basin in France.

Verification

Figure 1 shows the EFAS headline score, the Continuous Ranked Probability Skill Score (CRPSS) for one lead-time, for the August to September period across the EFAS domain for catchments larger than 2000km^2. The reference score is the persistence forecast. 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 red on the maps) indicates the skill is worse than persistence.

The map shown in Figure 2 displays the CRPSS at 3 days lead-time. The corresponding maps for 5 and 10 days lead-time are shown Figure 3 and Figure 4. These maps indicate that across much of Europe for forecasts are more skilful than persistence at all lead times. Regions shown in blue are those where EFAS forecasts are more skilful than persistence, with darker shading indicating better performance.

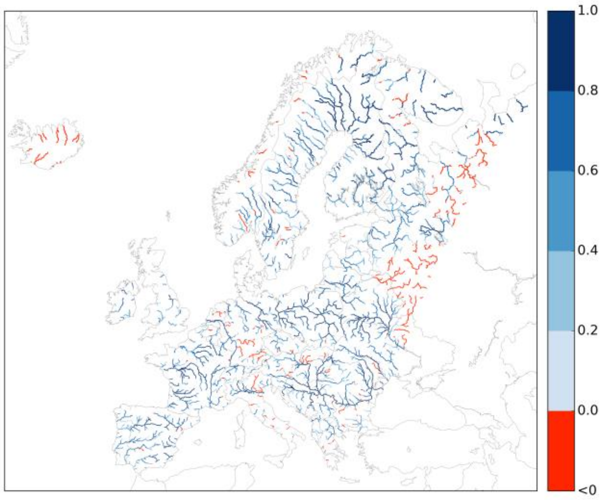

Figure 1. EFAS CRPSS at lead-time 1 day for the August-September 2017 period, for catchments >2000km2. The reference score is persistence.

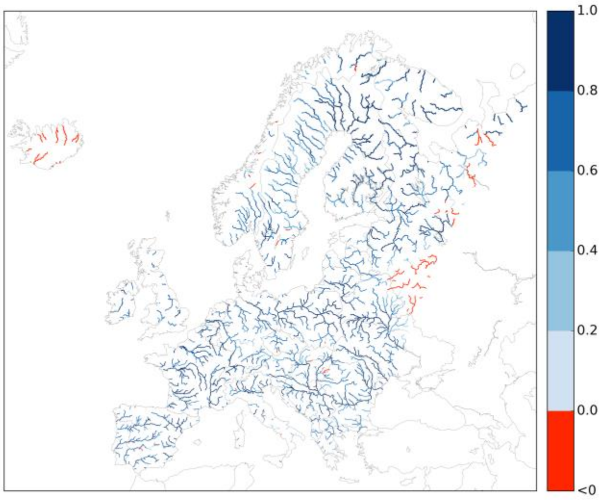

Figure 2. EFAS CRPSS at lead-time 3 days the August-September 2017 period, for catchments >2000km2. The reference score is persistence.

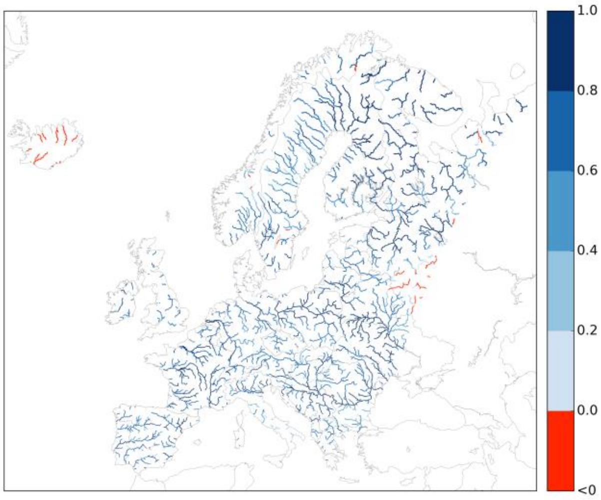

Figure 3. EFAS CRPSS at lead-time 5 days the August-September 2017 period, for catchments >2000km2. The reference score is persistence.

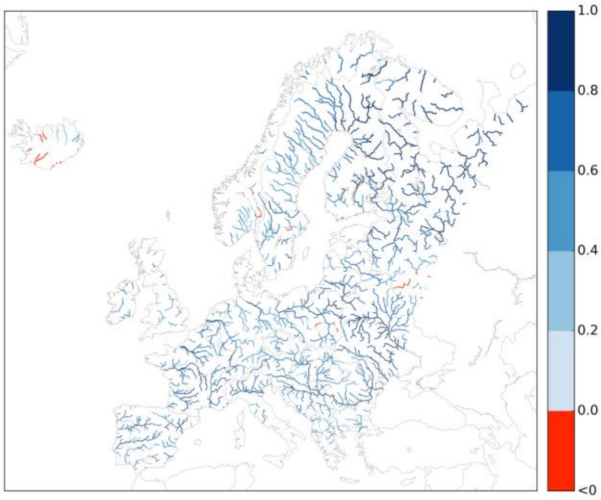

Figure 4. EFAS CRPSS at lead-time 10 days the August-September 2017 period, for catchments >2000km2. The reference score is persistence.

Publications

Coughlan de Perez, E., Stephens, E., Bischiniotis, K., van Aalst, M., van den Hurk, B., Mason, S., Nissan, H., and Pappenberger, F., 2017, Should seasonal rainfall forecasts be used for flood preparedness?, Hydrol. Earth Syst. Sci., 21, 4517-4524, https://doi.org/10.5194/hess-21-4517-2017, 2017.

Lavers, D.A., E. Zsoter, D.S. Richardson, and F. Pappenberger, 2017, An Assessment of the ECMWF Extreme Forecast Index for Water Vapor Transport during Boreal Winter. Weather Forecasting, 32, 1667–1674, https://doi.org/10.1175/WAF-D-17-0073.1

FEATURES

The flood event of May-June 2016 in the Seine and Loire basins (France)

by EFAS Dissemination Centre and IRSTEA

Introduction

From 28 to 31 May 2016, a heavy rainfall event reached the northern part of France. The episode was persistent and was followed by additional rainfall that lasted until 3 June. The high amount of rainfall led to severe flooding in northern France, mainly over the Upper and Middle Seine river basin and in several tributaries of the Middle Loire river basin.

Figure 5. The six main hydrographic districts in France (source: Agences de l'Eau); In the box: the most impacted zone

On request of the EFAS Dissemination Centre, the French research institute IRSTEA compiled an overview of the 2016 flood event. The full report can be downloaded from the EFAS website.

What caused the floods?

The low-pressure systems of the late May-early June period were fed by warm, moist air from the Mediterranean Sea, bringing heavy rainfalls over the northern part of France. Mesoscale convective systems were embedded in these rainy systems, causing localized, intense rainfalls and flooding in several tributaries and river reaches of the Seine and the Loire river basins. May 2016 was the rainiest month of May over the period 1959-2016 in the Centre, Île de France, Picardie and Bourgogne regions, with totals 1.5 to 3 times above the climatological mean. The cyclonic circulation observed on 28-31 May brought heavy rainfalls over the country, mainly in its northern part. May 30 was the rainiest day of this period, with 24-hour totals equivalent of 1-month precipitation at several locations. Record 24-hour rainfall totals were observed on 29 May: 85.1 mm in Palluau (Vendée), 99 mm in Saint-Même-le-Tenu (Loire-Atlantique), and 30 May: 76.2 mm in Ailly-sur-Noye (Somme), 77 mm in Cheverny (Loir-et-Cher) and 100 mm in Loury (Loiret). In some areas, the 28-31 May totals represented over three months of precipitation.

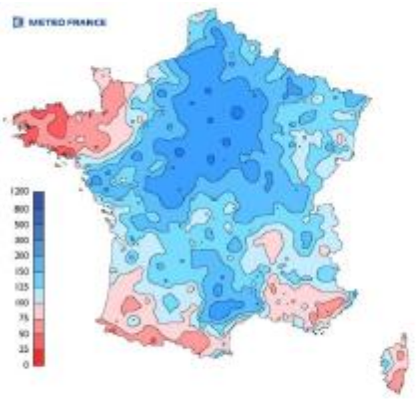

Figure 6 Deviation from average values for the period 1981-2010 of total precipitation of May 2016 in France (in %) (source: Bulletins climatiques de Météo-France)

Effects of the flood event

The flood event had a large number of consequences, ranging from economic, social, industrial, environmental, etc. About 1150 municipalities were declared in a "natural disaster" status a few days after the event and many others (up to more than 1500 cities) were declared in a disaster status in the following months.

In France, four people died and another 24 were wounded in incidents linked with this event. More than 20,000 people had to be evacuated and were temporarily rehoused outside inundated areas. This was the case in Longjumeau for example where the city centre was fully flooded. More than 20,000 houses suffered from electricity cuts, especially in the departments of Seine-et-Marne, Essonne, Loiret and Loir-et-Cher. The flood had also impact on industrial activities. The authorities had to warn several critical industrial sites along the Loing River. In Île-de-France, almost 800 companies were directly impacted.

Many agricultural activities were impacted by the floods: crops, market gardening, livestock farming, arboriculture, especially along the Mauldre, Yvette and Seine rivers and on the Loiret and Loire-et-Cher departments. Large sectors of wheat, barley and oats crops were flooded with dramatic consequences on harvest. Damages to the agricultural sector were estimated to 200 million euros.

In Paris, some museums (Orsay, Louvre, Grand Palais) were closed for a few days to prevent losses of art works. In the Louvre, where some collections are stored underground in flood safe zones, 150 000 art works were evacuated.

Forecasts and warnings

Weather forecasts of 28 May had already announced an important rain event for the 29-30 May, although its location and total rain remained very uncertain. It must be noted that flood forecasting centres receive quantitative weather forecasts as min/max intervals of daily accumulations over pre-established weather watch areas for days D, D+1 and D+2.

At the national scale, flood watches are provided to the public through a "vigilance map" which is available at https://www.vigicrues.gouv.fr/. Each river included in the map is divided into sections. Each section is given a colour: green, yellow, orange or red according to the flood watch level needed to meet flood dangers liable to arise within the next 24 hours. Currently, only the real-time situation (water levels or discharges) can be displayed. Hydrological forecasts are not available yet.

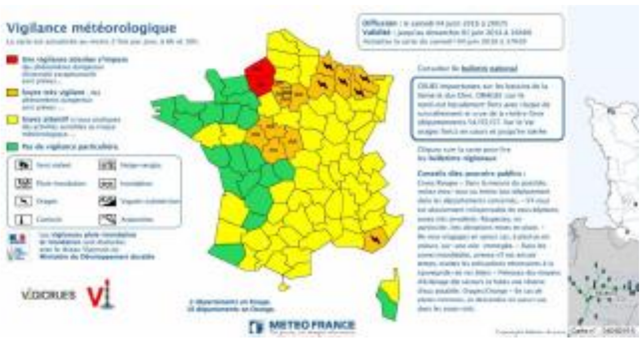

Figure 7. Weather warning map (left) and flood watch map (right) issued in France on the evening of 4 June 2016 showing the propagation of the flood event downstream the Seine river basin to Normandy (source: Météo-France and Vigicrues websites at the time of the event)

Before and during the event, 10 EFAS notifications were sent to the national flood forecasting organization SCHAPI. On May 27, significant events were forecasted on the Cher, Seine and Yonne basins, with peaks expected between 1 and 3 June. There was about a 60% probability of exceeding the 5-year return period and more than 30% of exceeding 20-year return period. On 28 and 29 May, notifications were sent for expected flood on several departments (Essonne, Indre, Loiret) in the coming days. On 30 May, warnings were sent for the downstream part of the Loire, with expected peak on June 5. Ten-day-ahead forecasts for the Paris / Seine gauge on 26, 28 and 30 of May show that part of the probabilistic scenarios quite well anticipated the peak for Friday 3rd and that an important flood event was coming, though the amplitude of the peak was variable between forecasts .

The EFAS flood notification received on 27 May by SCHAPI was sent to the regional SMYL and LCI forecasting services. At that time, it indicated that a significant event could happen, though it was very unusual at that season of the year. Retrospectively, SCHAPI judges that the event had been well anticipated by EFAS, especially on the Loing basin. This indicates that this product could have had an interesting added value in the case of this event to improve preparedness. When getting closer to the event, the subsequent notifications and forecasts quite well supported other information available at SCHAPI.

Currently, the French forecasters do not routinely use the EFAS information. There are several reasons that explain this situation:

- French forecasters are not used to interpret probabilistic forecasts;
- The amount of real time measurements sent by SCHAPI to EFAS for data assimilation is very limited. Consequently, the actual magnitude and timing of floods is difficult to interpret due to biases compared to actual observations.
- The mandatory objective for flood watches in France is 24 h forecast time. Though longer lead times are expected by civil security, the efforts are currently focusing on improving the quality of the 24 h forecast.

Case study: Floods in Tuscany, Italy, September 2017

by Richard Davies, FloodList

Flash floods caused severe damage in the provinces of Livorno and Pisa in Tuscany on 10 September 2017. The Mayor of the city of Livorno, Filippo Nogarin, said that as much as 250 mm of rain fell in just two hours between 02:00 and 04:00 (10 September). Elsewhere, 152 mm of rain fell in 24 hours at Pisa International Airport, according to WMO figures. Italy's civil protection authority (Dipartimento dei Vigili del Fuoco, del Soccorso Pubblico e della Difesa Civile - VVF) said that two rivers in the area - the Ardenza and Maggiore - both overflowed.

Eight fatalities

Eight people died in the floods, including four of the victims were members of the same family who were trapped by floodwaters in their basement. (link: http://www.ansa.it/english/news/general_news/2017/09/12/livorno-flood-death-toll-up-to-eight-2_39aff665-c740-4bb5-8b19-912b3b8fbe75.html)

Figure 8. Floods destroyed a bridge over the Ardenza river. Taken on 12 September, 2017. Photo credit: Regione Toscana, Under Creative Commons CC BY-NC-ND 2.0

Infrastructure damaged

The municipalities of Livorno, Collesalvetti and Rosignano Marittimo were the worst affected. Several people had to evacuate their homes, including 25 people in Rosignano Marittimo. Roads were inundated and images on social media showed cars strewn around streets and piled on top of each other, such was the force of the floodwater. Train services were interrupted, including the Pisa to Livorno railway line. Flooding caused damage to gas and water supplies, as well as two bridges across the Ardenza and Maggiore.

Rescue operations

Fire department teams were called to over 700 interventions in 36 hours in the provinces of Pisa and Livorno. In order to manage and carry out rescue operations, a special flood response plan - MOCRA (Modulo Operativo Contrasto Rischio Acquatico) – was put into place by local authorities. (link: http://www.vigilfuoco.it/aspx/notizia.aspx?codnews=43505)

Oil refinery flooded

Flooding also affected the ENI oil refinery in Livorno. ARPAT (Agenzia regionale per la protezione ambientale della Toscana) the Tuscany region's environmental agency, reported that leakages from the oil refinery had spilled into nearby water bodies. (http://www.arpat.toscana.it/notizie/comunicati-stampa/2017/il-punto-sulla-situazione-a-livorno)

EFAS Training for Bosnia and Herzegovina

by Simon Eriksson & Raduška Cupać

A delegation from Bosnia and Herzegovina (BiH) participated in the World Water Week taking place in Stockholm, Sweden. On 29 August the group took the opportunity to visit SMHI (the Swedish Meteorological & Hydrological Institute), one of EFAS' Dissemination Centres, to participate in an EFAS training.

Bosnia and Herzegovina recently became an EFAS member and has two partners representing each of the country's entities: the Federal Hydrometeorological Institute of BiH and the Republic Hydrometeorological Service of the Republic of Srpska. Additionally, the Watershed Agencies for the Adriatic Sea and Sava river basins and the Public Institution Vode Srpske have joined the network as EFAS third parties. Bosnia's apparent interest in flood forecasting was obvious throughout the training session with plenty of questions and vibrant discussions.

An operational hydrological warning service is currently under development in BiH, but there is a necessity of more forecasting tools. This is where EFAS comes into play. The country suffered severe casualties during the mid-May floods 2014 and was affected by the Balkan floods in November 2016. Prior to the flood 2014 the country was not notified by the extreme precipitation that eventually hit ground which in turn led to considerable losses both in terms of human lives and in terms of economic damage. These two events were examined using past EFAS forecasts and the notification archive. We could establish that both events were captured by models and officers on duty, respectively. The hope is to forecast future flood events and to reduce flood related losses; EFAS has potentially a role to play here.

Mr. Boško Kenjić, Head of Water Resources department at the Ministry of Foreign Trade and Economic Relations, BiH stated that after extreme floods experienced in past several years, Bosnia and Herzegovina had decided to significantly develop its flood forecasting capacities. "Reliable forecasting capacities cannot be developed overnight thus cooperation with EFAS is of extreme importance. Moreover, EFAS is giving us possibility to connect with network of European forecasters and its valuable knowledge and experiences." added Mr. Kenjić.

We also went through EFAS related information like the JIRA communication system, EFAS-IS, the hydrological and meteorological models used within the system and the use of probabilistic forecasting. Future development of EFAS and related projects were also covered. Due to the country's karst and mountainous characteristics and liability to orographic rainfall causing flash floods special focus was given to this EFAS feature; ERIC calculations were depicted, the system's pros and cons were discussed and more general information on flash flood notifications was presented. Other related problems in BiH are recurring hailstorms, which significantly harm crop yields and the more or less countrywide susceptibility to landslides. Therefore, the landslide susceptibility map is a welcome feature. Additional landslide tools would be considered an asset.

The statistical calculations to derive thresholds were also described and the process where the partner is obliged to send historical time series (3 year minimum) to the Hydrological Data Collection Centre in order for the Centre to derive the return periods.

It was also identified that there is no best practice on what to do after a notification has been received by a partner. This is due to the variability in partners' institutional capacity. The whole team agreed that it would be nice if the notifications could be further developed in order to give some added value. Consequence based information from flood risk maps is one option. Another improvement would be to include detailed regulation routines in LISFLOOD in order to improve model quality in heavily regulated areas.
The training rounded off with a tour (and group photo) at the national forecast and warning service at SMHI.

Figure 9. The group attending the training. From left to right: Raduška Cupać (UNDP BiH), Simon Eriksson (SMHI), Ingela Oleskog (SMHI), Suad Skejović (Federal Ministry of Agriculture, Water Management and Forestry), Alisa Grabus (UNDP BiH), Nenad Đukić (Republic of Srpska Ministry of Agriculture, Forestry and Water Management), Amer Husremović (Federal Ministry of Agriculture, Water Management and Forestry), Elinor Andersson (SMHI) and Boško Kenjić (Ministry of Foreign Trade and Economic Relations).

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: ENI oil refinery after the floods. Taken on 11 September 2017. Photo credit: Regione Toscana, Under Creative Commons CC BY-NC-ND 2.0.

Appendix - figures

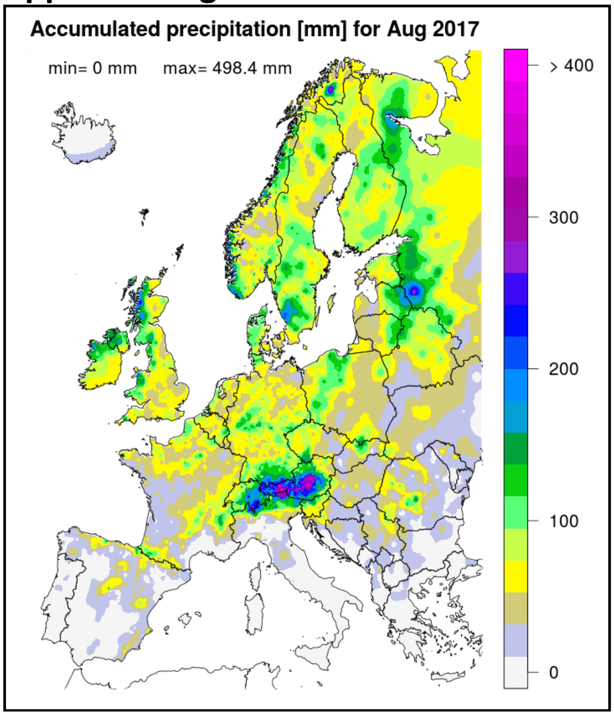

Figure 10. Accumulated precipitation [mm] for August 2017.

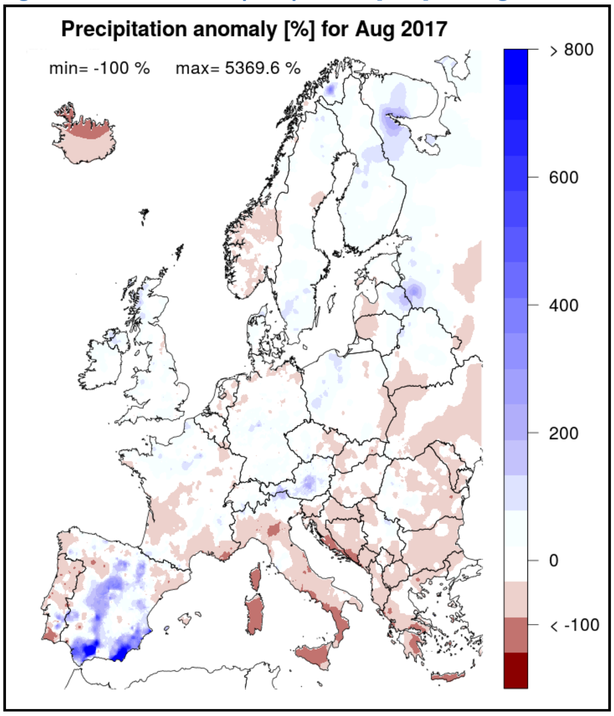

Figure 11. Precipitation anomaly [%] for August 2017, relative to a long-term average (1990-2013). Blue (red) denotes wetter (drier) conditions than normal.

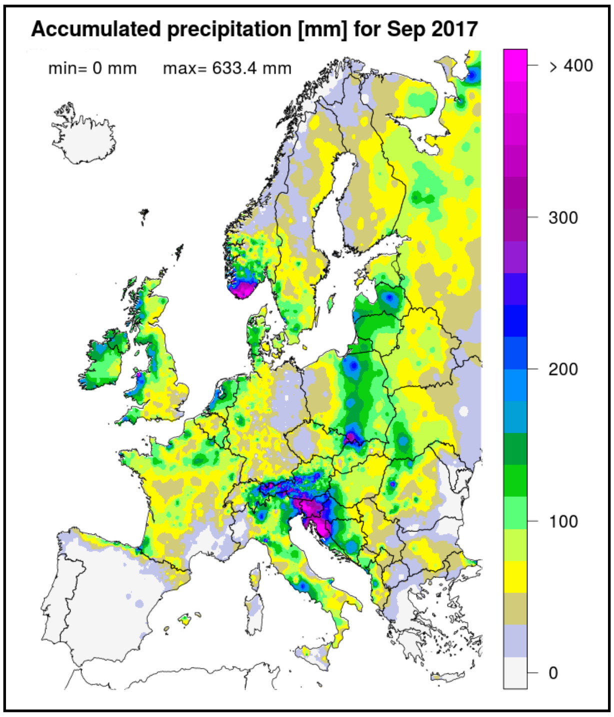

Figure 12. Accumulated precipitation [mm] for September 2017.

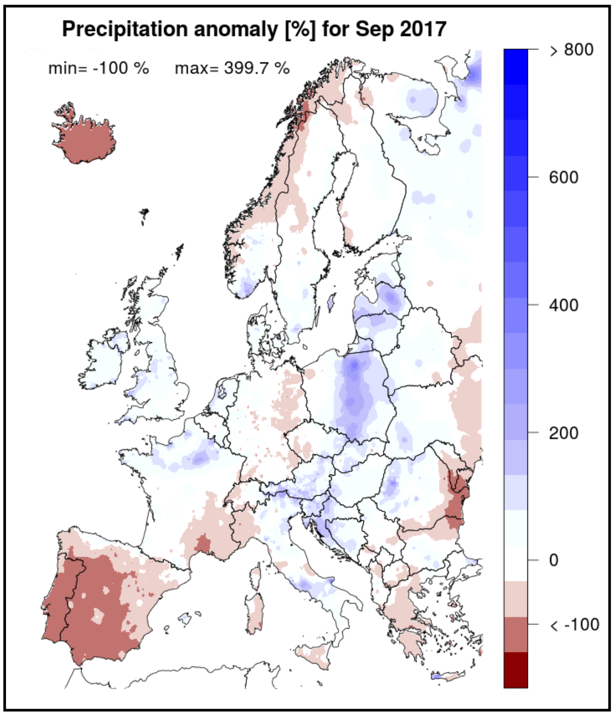

Figure 13. Precipitation anomaly [%] for September 2017, relative to a long-term average (1990-2013). Blue (red) denotes wetter (drier) conditions than normal.

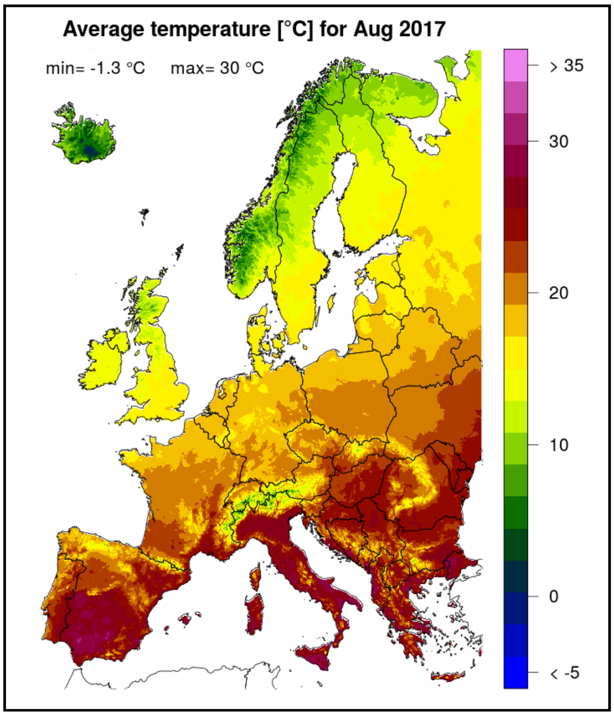

Figure 14. Mean temperature [°C] for August 2017.

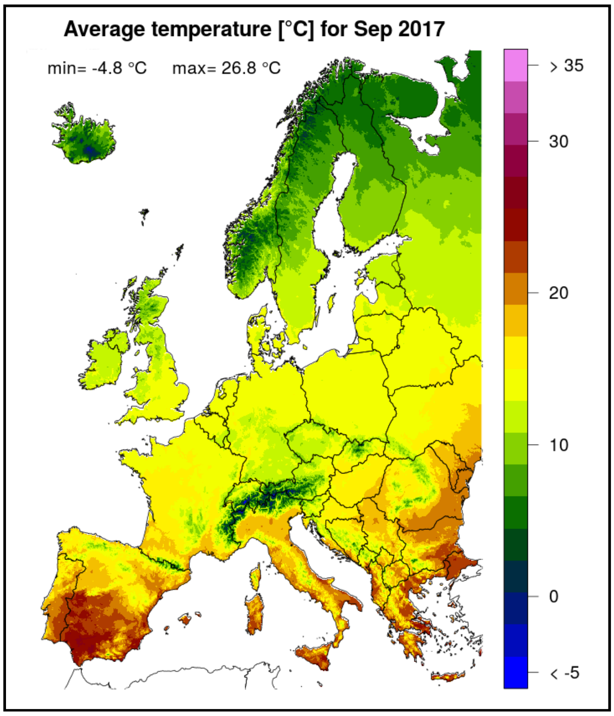

Figure 16. Mean temperature [°C] for September 2017.

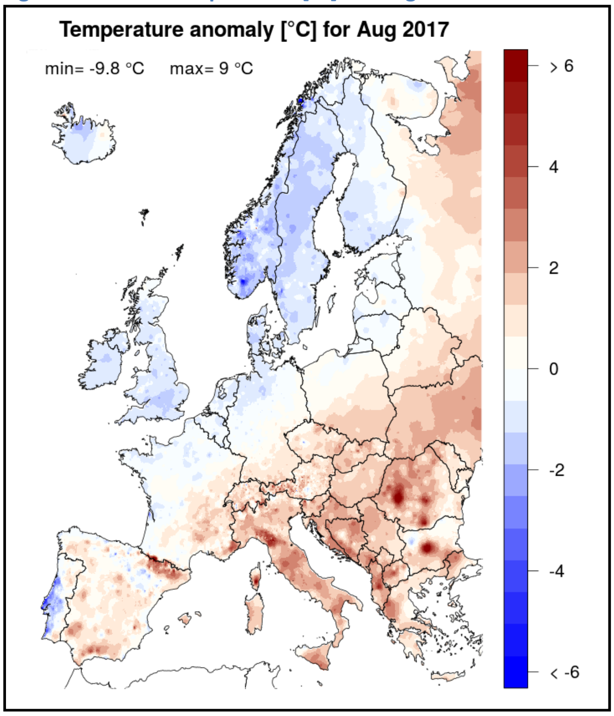

Figure 15. Temperature anomaly [°C] for August 2017, relative to a long-term average (1990-2013). Blue (red) denotes colder (warmer) temperatures than normal.

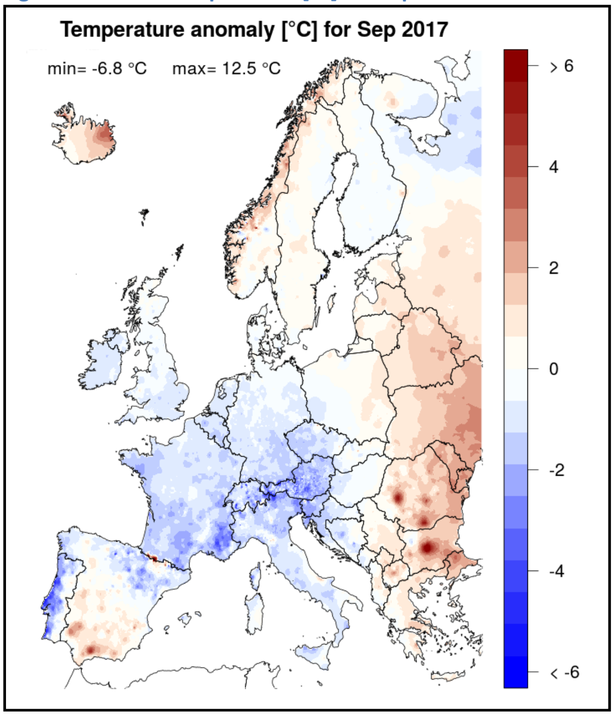

Figure 17. Temperature anomaly [°C] for September 2017, relative to a long-term average (1990-2013). Blue (red) denotes colder (warmer) temperatures than normal.

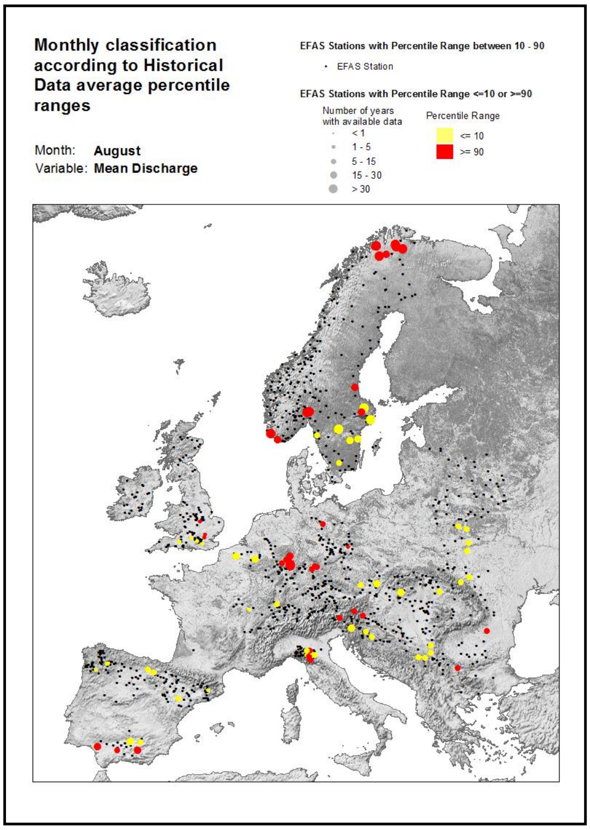

Figure 18. Monthly discharge anomalies August 2017.

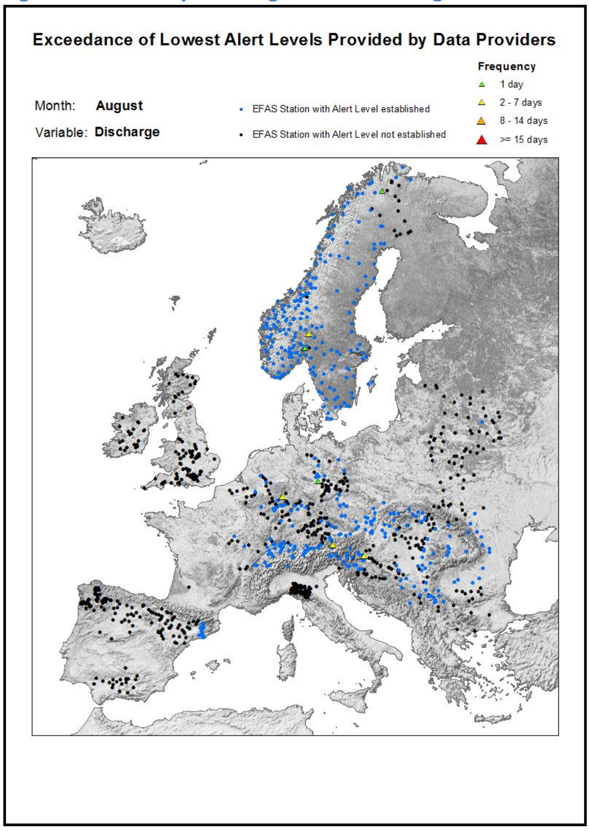

Figure 19. Alert level exceedance for August 2017.

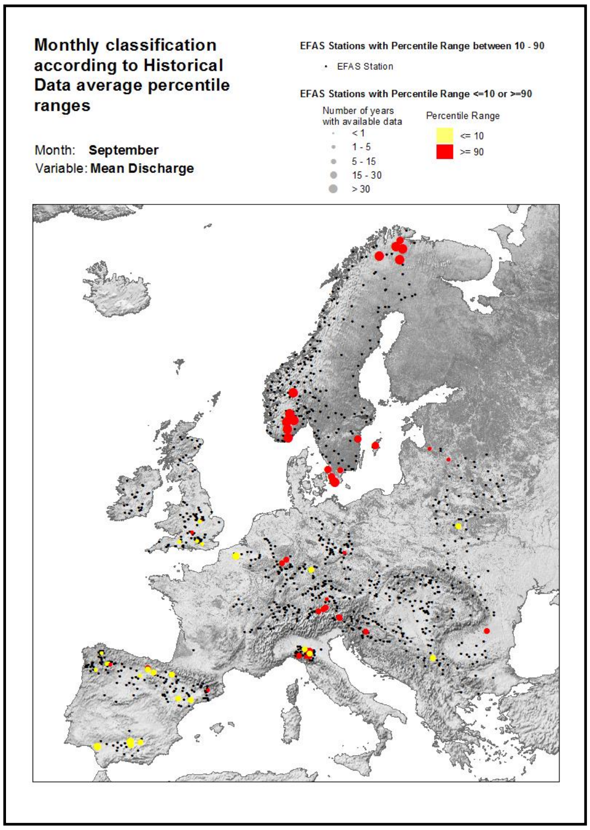

Figure 20. Monthly discharge anomalies September 2017.

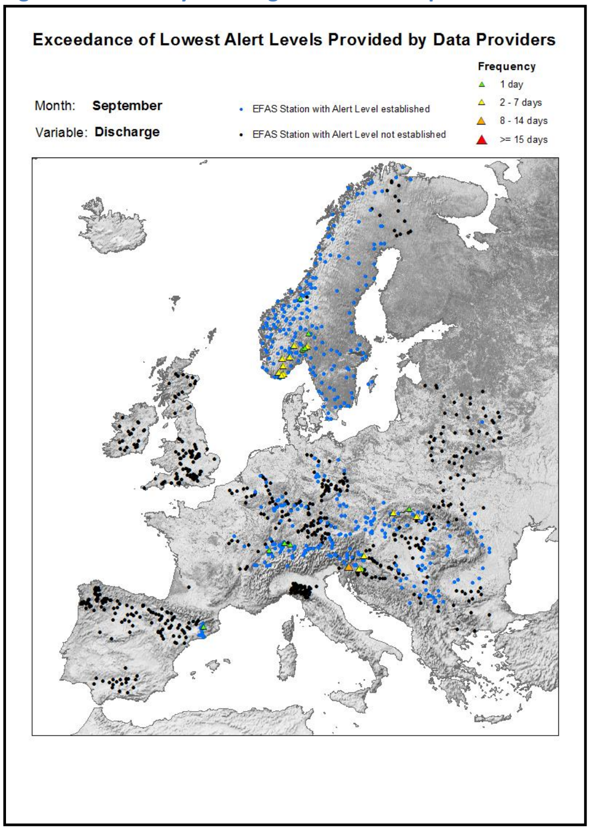

Figure 21. Alert level exceedance for September 2017.

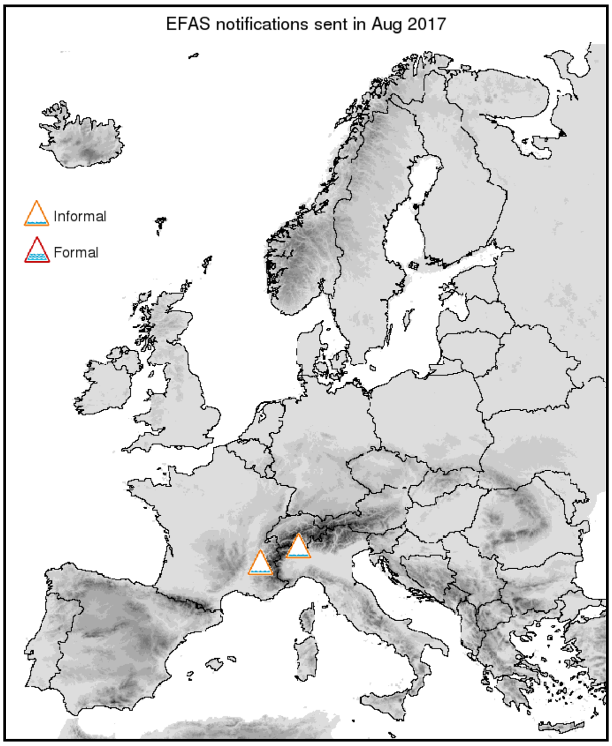

Figure 22. EFAS flood notifications sent for August 2017.

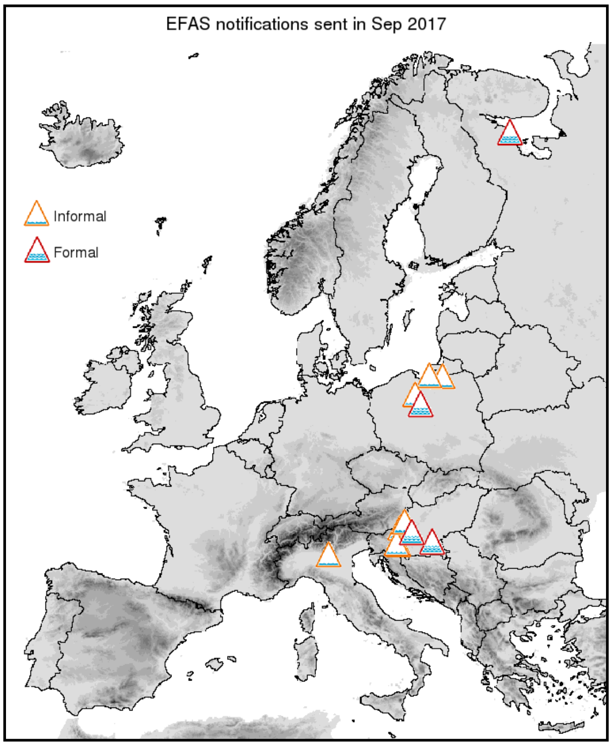

Figure 24. EFAS flood notifications sent for September 2017.

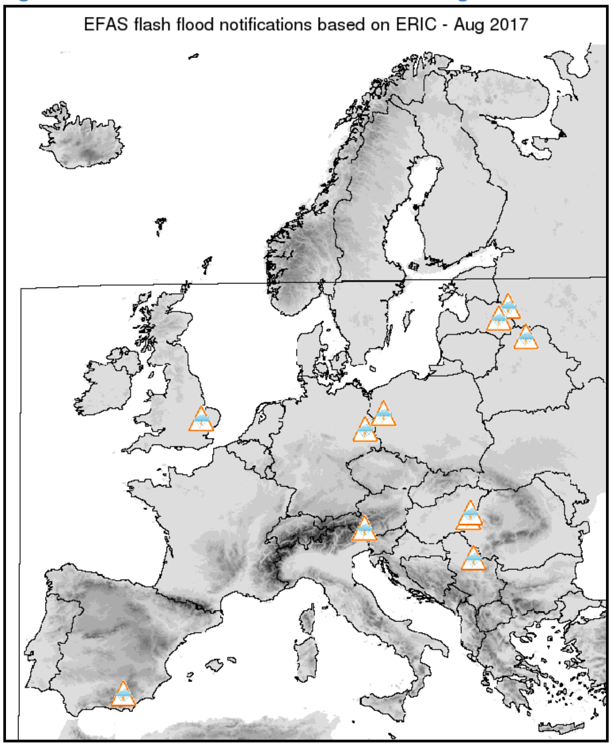

Figure 23. Flash flood notifications sent for August 2017.

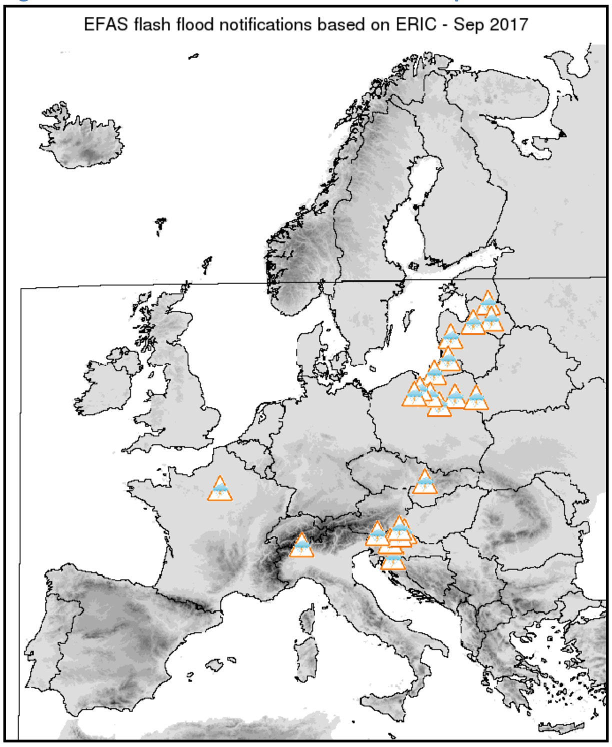

Figure 25. Flash flood notifications sent for September 2017.

Appendix - tables

Table 1. EFAS flood notifications sent in August - September 2017.

Type	Forecast date	Issue date	Lead time*	River	Country
Informal	29/08/2017 12 UTC	30/08/2017	2	Ticino	Italy
Informal	30/08/2017 00 UTC	30/08/2017	1	Isere	France
Informal	07/09/2017 12 UTC	08/09/2017	1	Wista, below Brda	Poland
Informal	07/09/2017 12 UTC	08/09/2017	2	Po, below Oglio	Italy
Formal	11/09/2017 12 UTC	12/09/2017	2	Russia - coastal zone	Russia
Formal	15/09/2017 12 UTC	16/09/2017	3	Wista, section Bzura - Drweca	Poland
Informal	16/09/2017 12 UTC	17/09/2017	2	Pasneka	Poland
Informal	17/09/2017 00 UTC	17/09/2017	1	Pasneka	Poland
Informal	17/09/2017 12 UTC	18/09/2017	1	Sava, above Kupa	Croatia
Informal	17/09/2017 12 UTC	18/09/2017	1	Sava, above Kupa	Slovenia
Informal	17/09/2017 12 UTC	18/09/2017	2	Raab, Raba	Hungary
Formal	18/09/2017 00 UTC	18/09/2017	3	Mura	Hungary
Formal	18/09/2017 12 UTC	19/09/2017	4	Drava	Croatia
Informal	18/09/2017 12 UTC	19/09/2017	2	Mura	Austria
Informal	20/09/2017 12 UTC	21/09/2017	0	Lyna	Poland

* 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 2017.

Type	Forecast date	Issue date	Lead time*	Region	Country
Flash flood	08/08/2017 00 UTC	08/08/2017	54	East of England	United Kingdom
Flash flood	10/08/2017 00 UTC	10/08/2017	30	Lubuskie	Poland
Flash flood	10/08/2017 00 UTC	10/08/2017	30	Brandenburg	Germany
Flash flood	10/08/2017 00 UTC	10/08/2017	36	Karnten	Austria
Flash flood	12/08/2017 00 UTC	12/08/2017	24	Vojvodina	Serbia
Flash flood	12/08/2017 00 UTC	12/08/2017	30	Del-Alfold	Hungary
Flash flood	12/08/2017 00 UTC	12/08/2017	30	Eszak-Alfold	Hungary
Flash flood	22/08/2017 12 UTC	23/08/2017	54	Vitsyebskaya voblasts'	Belarus
Flash flood	23/08/2017 00 UTC	23/08/2017	36	Latgale	Latvia
Flash flood	23/08/2017 12 UTC	24/08/2017	30	Pskovskaya oblast'	Russia
Flash flood	29/08/2017 00 UTC	29/08/2017	42	Granada	Spain
Flash flood	06/09/2017 12 UTC	07/09/2017	24	Warminsko-Mazurskie	Poland
Flash flood	06/09/2017 12 UTC	07/09/2017	24	Kujawsko-Pomorskie	Poland
Flash flood	06/09/2017 12 UTC	07/09/2017	18	Kujawsko-Pomorskie	Poland
Flash flood	08/09/2017 00 UTC	08/09/2017	48	Piemonte	Italy
Flash flood	09/09/2017 12 UTC	10/09/2017	72	Trenciansky kraj	Slovakia
Flash flood	12/09/2017 00 UTC	12/09/2017	48	Paris	France
Flash flood	15/09/2017 00 UTC	15/09/2017	84	Podlaskie	Poland
Flash flood	15/09/2017 12 UTC	16/09/2017	60	Trenciansky kraj	Slovakia
Flash flood	16/09/2017 00 UTC	16/09/2017	66	Warminsko-Mazurskie	Poland
Flash flood	16/09/2017 00 UTC	16/09/2017	54	Kujawsko-Pomorskie	Poland
Flash flood	16/09/2017 12 UTC	17/09/2017	54	Mazowieckie	Poland
Flash flood	16/09/2017 12 UTC	17/09/2017	60	Kaliningradskaya oblast'	Russia
Flash flood	17/09/2017 00 UTC	17/09/2017	36	Pieriga	Latvia
Flash flood	17/09/2017 00 UTC	17/09/2017	42	Taurages apskritis	Lithuania
Flash flood	17/09/2017 00 UTC	17/09/2017	36	Vidzeme	Latvia

Flash flood	17/09/2017 12 UTC	18/09/2017	30	Podlaskie	Poland
Flash flood	18/09/2017 00 UTC	18/09/2017	12	Telsiu apskritis	Lithuania
Flash flood	18/09/2017 00 UTC	18/09/2017	12	Iouna-Eesti	Estonia
Flash flood	18/09/2017 00 UTC	18/09/2017	48	Pomurska	Slovenia
Flash flood	18/09/2017 00 UTC	18/09/2017	42	Podravska	Slovenia
Flash flood	18/09/2017 00 UTC	18/09/2017	42	Savinjska	Slovenia
Flash flood	18/09/2017 00 UTC	18/09/2017	42	Spodnjeposavska	Slovenia
Flash flood	18/09/2017 00 UTC	18/09/2017	48	Steiermark	Austria
Flash flood	18/09/2017 00 UTC	18/09/2017	42	Karnten	Austria
Flash flood	19/09/2017 00 UTC	19/09/2017	18	Karlovacka zupanija	Croatia

* 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 ENTR 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 ELIMCO) 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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