





European Flood Awareness System

EFAS Bulletin

August – September 2018 Issue 2018(5)















NEWS

Announcements

EFAS Annual Meeting 2019

The 14th EFAS annual meeting will take place in Stresa (Italy) 21-22 May 2019. The official invitation with detailed information about the event, registration form, reimbursement information, accommodation and travelling will be sent later this year. The meeting will be organized under the umbrella of the Copernicus Emergency Management Services (EMS). It will start on Tuesday 21 May in the morning and end on Wednesday 22 May in the afternoon. The annual meeting will offer workshops and trainings that will address different EMS-related interests. A common meeting of all services: mapping, flood, forest fire, and drought is planned for the morning of day 1. If you have any questions please contact the technical organizer: Michaela Mikulickova: michaela.mikulickova@shmu.sk

GloFAS becomes operational

On the 14 November, the Global Flood Awareness System (GloFAS) will become fully operational. The new release will contain a new calibration of the routing, a n improved reference simulation of discharge and a better availability of the archived forecasts. For more information, please see here.

EFAS and GLOFAS tutorials

If you need to freshen up on the EFAS and GloFAS forecasts, remember that there are a number of tools to help you, including the YouTube videos available for <u>EFAS</u> and <u>GloFAS</u>.

New features

A new EFAS version (v16) was implemented on 10 October 2018. This included updated ERIC layers and the criteria for EFAS flash flood notifications. For more details, see feature article in this bulletin. Further, EFAS forecasts are now archived in ECMWF meteorological archiving system (MARS) which will allow for easier access to EFAS output to partners and the public. Note that access to archived data still follows the rule of access to EFAS data. A longer article as well as details regarding the release of the new EFAS website will be presented in the next EFAS bulletin.

New partners

We gladly welcome the Icelandic Meteorological Office as new EFAS partner.

Meetings

Kick-off of the DAREFFORT project

by Marcel Zvolenský, SHMU and Peter Salamon, JRC

None of the flood risk mitigation measures serves better the protection of human lives and the social estate than extending the preparation time to avoid catastrophes. Reliable hydrological data is the basis of sound forecasting system in any country. The most cost-effective non-structural tangible solution which highly reflects the solidarity principle is the improvement of forecasting capabilities on basin-wide scale. The DAREFFORT project (Danube River Basin Enhanced Flood Forecasting Cooperation) is a horizontal initiative to implement a flood risk mitigation measure through a common hydrological database in a joint and sustainable way on catchment level for the whole Danube region. On the 13 - 14 September 2018, the DAREFFORT project kick-off meeting took place in Budapest.

The project is led by a Hungarian state owned non-profit organization VIZITERV which will cooperate with 12 partners and the same number of associated partners from 9 EU countries, 1 accessing country (Serbia) and 2 neighbouring countries (Ukraine and Moldova), covering nearly the whole Danube region. 10 out of the 18 partners/associated partners are also EFAS partners and, in addition, the JRC is linked to the project as international associated strategic partner ensuring that the DAREFFORT project benefits from the extensive experience in EFAS on international data exchange and river basin wide flood risk management. Expected lifespan of the project is from 1 June 2018 until the end of May 2021 (total duration 36 months).

The main deliverable of the project is to establish a standardized international hydro-meteorological data exchange platform, which can improve the quality and efficiency of forecast services including EFAS. This would feed a public near real time system – DanubeHIS supported by the ICPDR – that provides data for flood risk management or for any water related scientific activities. For more information please visit the official project website: http://www.interreg-danube.eu/ap-proved-projects/dareffort.

RESULTS

Summary of EFAS Flood and Flash Flood Notifications

The 4 informal EFAS flood notifications issued in August-September 2018 are summarised in Table 1. The locations of all notifications are shown in Figure 19 in the appendix.

1 flash flood notification were issued from August to September 2018, summarised in Table 1. The location is shown in Figure 21 in the appendix.

Meteorological situation

by EFAS Meteorological Data Collection Centre

August

In the beginning of the month low-pressure systems dominated the weather in Europe and led to several flood events after heavy hail- and thunderstorms in eastern Germany, Austria, Sardinia, and Corsica. On the French island of Corsica, a flash flood in a canyon killed five canyoners near Soccia. In addition, a storm front moved across France, Germany and Turkey between 9 and 10 August. This front brought more than 100 mm of rain within 1 hour to the Rhône Valley, France, and led rivers to overflow, resulting in 1,600 evacuations and one missing person. High precipitation amounts were also recorded in northern Turkey which caused severe flooding in Ordu Province. One person died in a landslide triggered by heavy rain in Ikizce district. In some areas, more than 100 mm of rain were measured within 24 hours. After this, high-pressure systems were slowly expanding, especially over northeastern Europe and parts of Scandinavia.

Mid-month a strong low-pressure system formed over eastern Spain and led to severe floods after heavy thunderstorm in the Province of Alicante. Southern Italy was also affected by floods on 20 August. After flash-floods in the Region of Calabria, near Civita in the Province of Cosenza, at least 10 hikers died. Towards the end of August northern Europe and western parts of Scandinavia were mostly influenced by a stable low-pressure system. The rest of Europe experienced alternating high- and low-pressures, which led to a heavy thunderstorm in southern Germany on 30 August.

Overall precipitation anomalies displayed wetter conditions in countries bordering the Mediterranean Sea,

the western coastline of Norway and parts of northeastern Europe (Figure 6 and Figure 7). The area with very high precipitation amounts in eastern Georgia is a result of faulty measurement. The countries south of the Black Sea had drier than normal conditions. The drought situation in Germany which started in February is still ongoing. The accumulated precipitation sums indicated a maximum of 514.1 mm on the western coastline of Norway and the Alps. The average recorded temperatures ranged from -1.8°C to 37.5°C in southern Europe, parts of Africa and Asia (Figure 10). In Iceland, Norway, eastern Europe and northern Algeria it was colder than normal, in the rest of Europe temperatures were generally above the average (Figure 11).

September

The beginning of September, Scandinavia was mostly influenced by high-pressure systems moving eastwards. Later, a very strong low-pressure system dominated the weather conditions 11 September and onwards. In other regions of Europe, northern Africa and parts of Asia, low-pressure and high-pressure systems alternated. On 8 September, extreme rainfall caused flash floods in the small town of Cebolla, Toledo Province, in the autonomous community of Castile-La Mancha, Central Spain. A flood event caused by very strong low-pressure cells occurred in the eastern Algerian province of Tebessa on 12 September. More than 50 mm of rain were measured in Tebessa in just one hour.

The next flood event occurred in the southern Spanish town of Ronda, in the Malaga Province on 13 September. Streets in Ronda turned to rivers after a short period of high precipitation amounts with up to 50 mm in 30 minutes. On the same day, a storm caused major flash-floods in Balikesir Province, Turkey. More than 147 mm of rain were measured in the city of Bandirma. Overall, a wide area of the Marmara region, including Istanbul, was hit by hail during this storm which damaged buildings, roof tiles and windows.

Mid-month high-pressure systems were located over the whole of Europe, except Scandinavia. Flash floods caused by heavy rain due to low pressure systems over northeastern Algeria on 19 September. Three days later storm Brian, a powerful tropical-like cyclone referred to as a Mediterranean hurricane or 'Medicane', caused flash floods in northern Tunisia which resulted in five fatalities. Nabeul Governorate was the worst affected area with up to 197 mm in 24 hours.

Towards the end of September, the weather situation changed, and low-pressure systems developed gradually but were eventually replaced by another strong high-pressure system moving easterly. A new strong local low-pressure system named storm Zorba caused around 140 mm of rain in 24 hours in Greece (see report later in the bulletin). Three people were reported missing after strong winds, heavy rain and flash flooding occurred in several parts of the country. Heavy rain associated with Zorba caused flooding in parts of Libya from 26 to 27 September. In Turkey, high precipitation sums were also recorded on 30 September.

In September precipitation amounts of up to 845.8 mm were measured on the coastline of western Scotland and Norway (Figure 8). In northern Africa and Greece, the higher accumulated precipitation sums correlated with the flooding events during this month and indicated wetter conditions in these areas (Figure 9). In mostly all other countries had positive anomalies. The temperature anomaly was positive almost everywhere in Europe, parts of Asia and Africa, and reached values of up to 37.9°C (Figure 12). In Iceland, Ireland, England, Scotland and Norway the weather was colder than normal (Figure 13) conditions than the average. Some seemingly positive or negative "hotspots" in the map were caused by station sign errors. Especially the spot in northern Spain was caused by the station "San Esteban de Gormaz" which recorded too high precipitation values in the mid of September.

Hydrological situation

by EFAS Hydrological Data Collection Centre

During August and September, most of the stations that surpassed the minimum discharge and/or stage threshold levels were concentrated along the basins in eastern Norway and Po river basin in Italy (Figure 15 and Figure 17). A more dispersed distribution of stations with exceedances was seen across the Don river basin in Ukraine, Dnieper river basin in Belarus, central area of Danube river basin, Rhine river basin in Germany and Switzerland, Elbe river basin in Germany as well and stations located on Llobregat and Andarax river basin in south-eastern Spain.

Most of stations that registered discharge values above the 90% quantile were located across the south-eastern Danube river basin (Serbia, Romania and Bulgaria), Guadalquivir, Llobregat and Ebro river basins in Spain and basin rivers across Norway (Figure 14 and Figure 16). This occurred less frequently for stations located on basins in southern England, western Danube river basin, Rhine river basin in Germany, Guadalquivir and Dnieper river basin in Ukraine.

Stations that did not surpass the 10% quantile for discharge values were mainly located across Sweden and basins in Central Europe: Rhine, Oder, Elbe and western Danube river basin. This occurred less frequently in Eastern Danube river basin, for basins in England Ireland and Scotland as well as for some isolated stations along the Ebro and Mihno river basins in Spain, the Poriver basin in Switzerland, the Rhône river basin in France, the Dnieper river basin in Ukraine, the Vístula in Poland and the Scheldt and Meuse river basins in Belgium.

Verification

Figure 1 and Figure 2 shows the EFAS headline score, the Continuous Ranked Probability Skill Score (CRPSS) for lead times 3 and 7 days for the June to July 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.

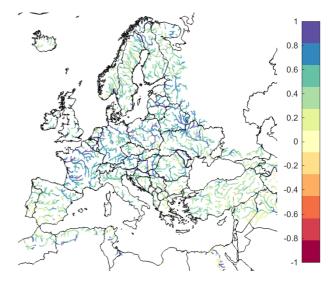


Figure 1. EFAS CRPSS at lead-time 3 days for the Aug-Sep 2018 period, for catchments >2000km2. The reference score is persistence of using previous day's forecast.

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.

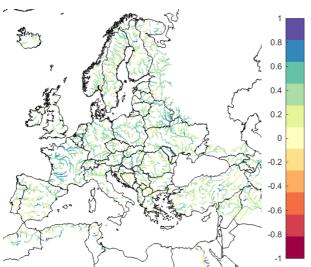


Figure 2. EFAS CRPSS at lead-time 7 days for the Aug-Sep 2018 period, for catchments >2000km2. The reference score is persistence of using previous day's forecast.

The skill is higher in central Europe than in southern and northern for this period, however the sample is still too small to draw any general conclusions. We will during the following months run more runs to create a database over past performance to create more robust verification scores and present these in the new online EFAS bulletin.

FEATURES

Update of the ERIC layers and the criteria for EFAS Flash Flood Notifications

by Calum Baugh, EFAS Computational Centre

After the release of the extended domain on 16 May 2018, which included a new version of the LISFLOOD hydrological model, it was noted that there were far fewer ERIC reporting points being displayed, which raised the concern that more flash flood events may be missed. Therefore, a new verification exercise was performed with ERIC forecasts using the extended domain. The verification was performed for each 00

and 12 UTC forecast from 2018-05-16 until 2018-07-10 for each lead time in 24 hour intervals up to 120 hours [5 days] ahead. The forecasts were compared against heavy precipitation observations from the European Severe Weather Database [ESWD: www.eswd.eu].

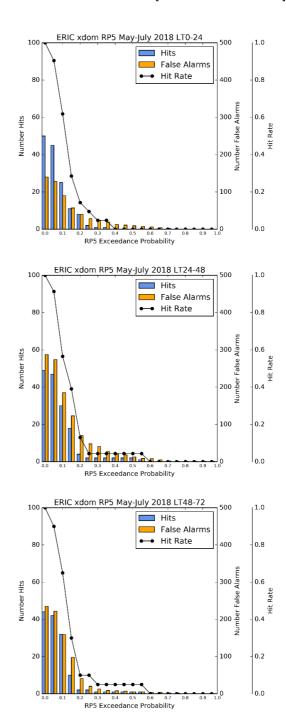


Figure 3. Verification results from the new ERIC version for different exceedance probabilities of the 5-year return period level at 1, 2 and 3 days lead time

Results of the verification are shown in the figures below. Figure 3 illustrates the hits, false alarms and hit rate for the ERIC indicator for different exceedances probabilities above the 5-year return period and different lead times (1, 2, and 3 days).

Figure 4 illustrates critical success index for the ERIC indicator for different exceedances probabilities above the 5-year return period and different lead times (1, 2, 3, 4 and 5 days).

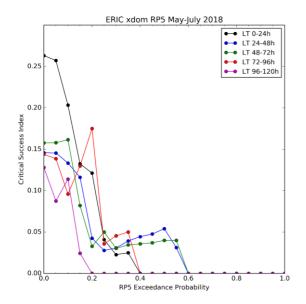


Figure 4. Critical Success Index (CSI) verification results for the new ERIC version with different exceedance probability thresholds of the 5-year return period level at different lead times (1, 2, 3, 4 and 5 days).

The results suggest that the plotting thresholds of the ERIC indicator as well as the thresholds for sending out an EFAS Flash Flood notifications should be changed to have the best balance between hits, false alarms and misses. Therefore, the following rules will be applied for plotting of the ERIC indicator reporting points and the ERIC affected area:

- Yellow ERIC triangle: Probability (RP 2yr) >=
 15% and probability (RP 5yr) < 5%
- Red ERIC (small) triangle: Probability (RP 5yr)
 5 and probability (RP 5yr) < 10%
- Red ERIC (large) triangle: Probability (RP 5yr)
 10% and probability (RP 20yr) < 10%

 Purple ERIC (large) triangle: Probability (RP 20yr) >= 10%

An example of the appearance of the updated ERIC flash flood layers in EFAS is shown in Figure 5 below.

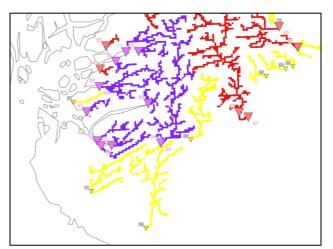


Figure 5. Appearance of the updated ERIC flash flood layers in EFAS after the addition of the yellow triangles and channel network shading

The new criteria for issuing an EFAS flash flood notifications is as follows:

Issue flash flood notifications when the exceedance probability of the 5-year return period is >= 10% and the lead time is less than 72 hours

The impact of these new criteria will be monitored closely, with the verification procedure being re-performed once more observation data become available. Further details on the verification of the ERIC indicator will be published in the upcoming EFAS bulletins.

Floods in Greece, late September 2018

by Richard Davies (FloodList).

Data for Greek weather by Artemis Papapetrou, Head of the Hydrology Section, Division of Climatology, Hellenic National Meteorological Service (HNMS) Greece

Severe weather affected parts of Greece from 28 to 30 September 2018, with heavy rain of almost 300 mm reported in some areas, as well as strong winds and high waves. Media referred to the severe weather as a Mediterranean hurricane or 'Medicane' and named it 'Storm Zorbas'. The heavy rain caused some streams

and rivers to overflow and significant flooding in several areas. The worst affected areas were in the Peloponnese, eastern parts of Central Greece (Sterea Hellas), Euboea (Evia/Evvoia) and the Sporades Islands, where flooding and landslides caused significant economic damage, including flooding residences, damaging roads and disrupting transport.

Firefighters received almost 2,000 calls for assistance to help evacuate people trapped in cars and flooded homes and to remove downed trees and other debris. Civil Protection in Greece said that flooding in Mantoudi in the municipal unit of Kireas, Euboea, had caused major problems. Media initially reported that 3 people were missing in the floods in Mantoudi. Later updates reported that one of the three had died, one was rescued and one remained missing. A state of emergency was declared for affected areas, including parts of Euboea and Phthiotis regional units of Central Greece and municipal units of Korinthos, northeastern Peloponnese.

HNMS meteorological stations showed that Oreoi (North Evvoia) recorded 295 mm of rain between 28 to 30 September, over 10 times the September average of around 26mm. During the same period Argos (Peloponnese) recorded 111 mm, Elefsina (Attica) 95 mm, Skyros Island (near Evvoia) 111 mm, Skiathos (Sporades Island) 151 mm and Tanagra (Sterea Hellas/east Central Greece) 156mm. An informal EFAS flood notification for the Kifisos river was sent on 28 September.

Parts of Turkey also saw very heavy rain and some flooding was reported on 30 September in Sakarya Province in the Marmara region, and Beykoz, a district of Istanbul. Heavy rain associated with the severe weather system had already caused flooding in parts of Libya from 26 to 27 September 2018. Some of the worst flooding was seen in the capital, Tripoli, where streets were inundated causing major traffic problems.

Characteristics of the Russian Flood Forecasting System

by Alexey V. Romanov

The operational flood forecasting system of the Russian Federation (RF) is an integral part of the national system of hydrometeorological monitoring and forecasting of all weather elements and fully operates

within the framework of the Federal Service on Hydrometeorology and Environment Monitoring of RF (Roshydromet) structural organizations. This circumstance is of principal importance for a domestic system of hydrological forecasting, since it facilitates an exchange of information flows between different types of hydrometeorological forecasts. A similar organizational structure has a fairly large number of other countries in the World Meteorological Organization system.

The current functionality of the hydrological forecasting system of RF is determined by two main documents adopted by the Government of RF in recent years:

- Direction of the Government of RF of September 3, 2010 No. 1458-r "On the strategy of activities in the field of hydrometeorology and related areas for the period until 2030 (considering aspects of climate change)"
- Decree of the Government of RF No. 350 of April 19, 2012 "On the Federal Target Program" Development of the Water Management Complex of RF in 2010-2020 ").

Based on these resolutions, Roshydromet has undergone structural changes that affected virtually all the organizations that are part of the service. The hydrological forecasting system of Roshydromet is based on an administrative principle; that is, a territory of activity of a structural subdivision of Roshydromet covers one or several subjects of RF (republics, autonomous regions, territories, regions) within their administrative boundaries. The only exception is the Specialized Hydrometeorological Observatories, which responsible for organizing hydrometeorological monitoring and forecasting of a water body (reservoir) within a water area. Organization of works based on the administrative principle has several advantages: 1) a possibility of organizing close cooperation with the administrations of the subjects of RF, organizations and territorial bodies of the Ministry of RF for Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters as well as with many other users; 2) ensuring a unity of hydrological, meteorological and agrometeorological monitoring and forecasting. At the same time, in RF there is many Departments for Hydrometeorology and Environmental Monitoring (DHEM) where a basin principle is observed. This principle is applied in the basins of the Kama, the Northern Dvina, the Pechora, the rivers of the Kola Peninsula, where territory of DHEM activities completely covers a river basin. Most of the structural organizations of Roshydromet have groups or departments (with the number of employees from 3 to 5 specialists) directly involved in an issue of hydrological forecasts. At the same time Hydrometeorological Research Centre of Russia (a leading forecasting and scientific and methodological centre of Roshydromet) is responsible for ensuring the scientific, methodological and coordination activities of entire system of hydrological forecasting. At present 25 DHEM operate on the territory of RF. At the same time, 13 of them are located on the territory of the European part of RF with an area of more than 3 500 000 km².

Modern flood forecasting systems (FFS) assume a wide use of the latest achievements in such areas as mathematical modeling of hydrological processes, open channel hydraulics, numerical modeling using MATLAB library, remote sensing methods (including using unmanned aerial vehicles), visualization of observational data, ArcGIS, programming in Fortran, Python and R languages in different operating environments. All these achievements are implemented in different level of complexity of runoff formation models used in FFS. Due to several objective and subjective reasons, a set of such models used in the organizations of Roshydromet is still extremely limited. Primarily the models of short-term forecasts of water levels are based on linear regression equations are used that do not require large computational power, complex software and large volumes of initial hydrometeorological information. Methods of long-term runoff forecasts (with a monthly and quarterly lead time) based on empirical relationships that reflect all the main components of the water balance equation are also widely used.

Correlation links (as well as the method of equivalent water levels with variable recession time) are still widely used due to their availability in the framework of FFS, but they do not seriously advance the physical understanding of the processes that take place in a channel and in a catchment area. And most importantly, these connections become powerless when a problem arises of transition to assimilation of new types of information in the conditions of substantial update of a technical base of measuring equipment used in DHEM. Only in recent years, there has been a definite progress in this area due to the complex implementation of the Hydrometcentre model for the catchment of the Kuban, as well as the implementation

of a conceptual model for formation of runoff for the rivers with heavily waterlogged territories in the Asian part of RF. Work is underway in the field of complex processing of operational hydrological information on the basis of modern GIS and web technologies, which in the near future should replace AWP-hydrologist (an automated working place of hydrologist) existing in DHEM. It should be emphasized that despite an obvious progress in updating a technical base of measuring equipment (Modernization-1 and Modernization-2 projects), the rates of technological updating of FFS methodological base remain extremely slow with a large gap to other countries. The reason for this is a low qualification level of staff associated with hydrological forecasts and an obvious under-funded financing of their work.

The works of Romanov A.V. "Development of flood forecasting system in Russia. Part 1. Background and catalysts of changes (Proceedings of the Hydrometeorological Research Centre of Russia, 2017. Issue 365. P. 182-195)" and "Part 2. Specificity of changes (Proceedings of the Hydrometeorological Research Centre of Russia, 2018. No. 1 (367), pp. 39-63)" gives a fairly detailed description of all main points associated with updating a methodological base of FFS at the RF. At the same time, great importance is attached to participation of RF in EFAS (European Flood Awareness System) project, which at present covers only three DHEM (with different levels of participation) located in the European part of RF. A positive experience of using flood warnings in these DHEM with lead time up to 10 days obtained using EFAS portal for the period from September 2017 to July 2018 indicates a need to expand the number of DHEM connected to this project. A gradual transition of DHEM (already involved in the project) to a higher level of participation including a conceptual analysis of the structure of LISFLOOD based on PCRaster with the purpose of improving a basic software appears to be natural. This is all more important that in long term, similar to COSMO (The Consortium for Small-scale Modeling), that all models and tools are based on an open-source software for all the members of the consortium.

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
- Alexey V. Romanov, Russian flood forecasting centre

Cover image: Greece Fire Service respond to floods 30 September 2018. Credit: Greece Fire Service

Appendix - figures

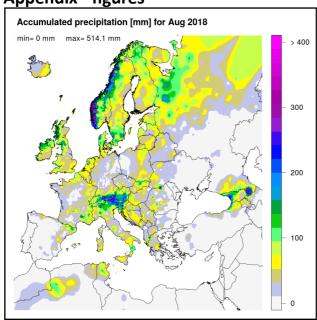


Figure 6. Accumulated precipitation [mm] for August 2018.

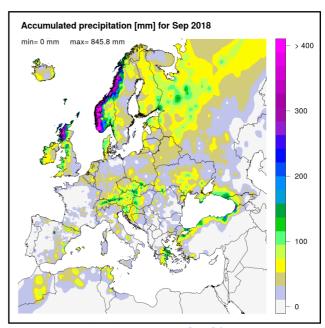


Figure 8. Accumulated precipitation [mm] for Sept. 2018.

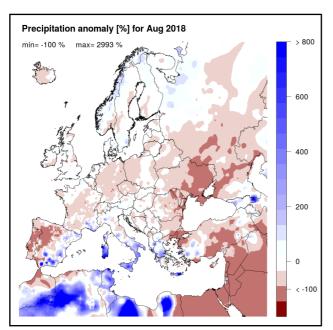


Figure 7. Precipitation anomaly [%] for August 2018, relative to a long-term average (1990-2013). Blue (red) denotes wetter (drier) conditions than normal.

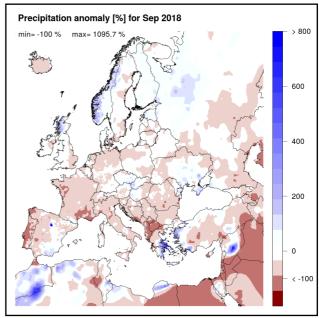


Figure 9. Precipitation anomaly [%] for September 2018, relative to a long-term average (1990-2013). Blue (red) denotes wetter (drier) conditions than normal.

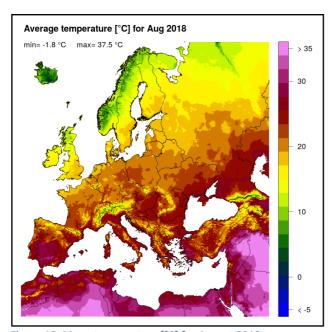


Figure 10. Mean temperature [°C] for August 2018.

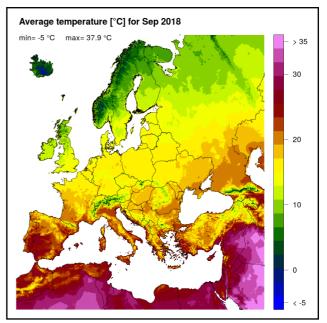


Figure 12. Mean temperature [°C] for September 2018.

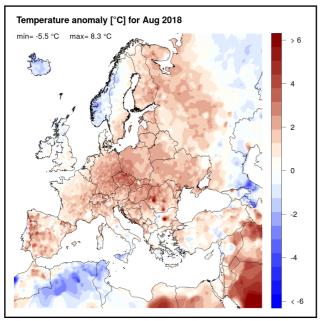


Figure 11. Temperature anomaly [°C] for August 2018, relative to a long-term average (1990-2013). Blue (red) denotes colder (warmer) temperatures than normal.

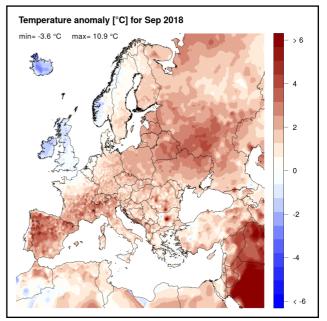


Figure 13. Temperature anomaly [°C] for September 2018, relative to a long-term average (1990-2013). Blue (red) denotes colder (warmer) temperatures than normal.

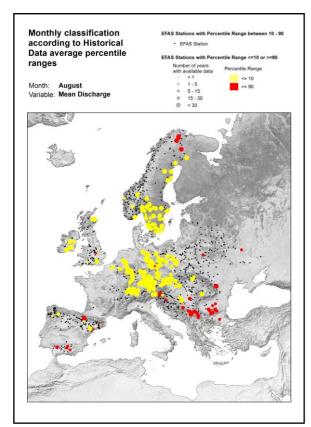


Figure 14. Monthly discharge anomalies August 2018.

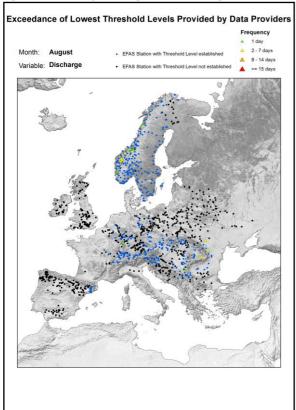


Figure 15. Lowest alert level exceedance for August 2018.

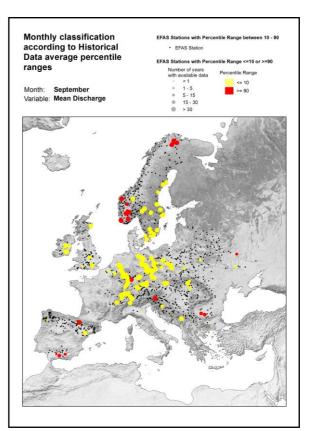


Figure 16. Monthly discharge anomalies September 2018.

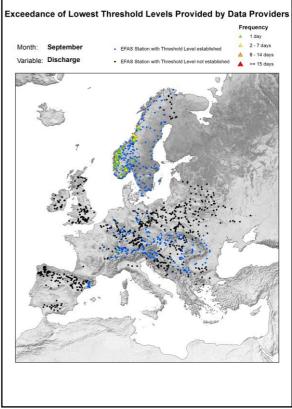


Figure 17. Lowest alert level exceedance for September 2018.

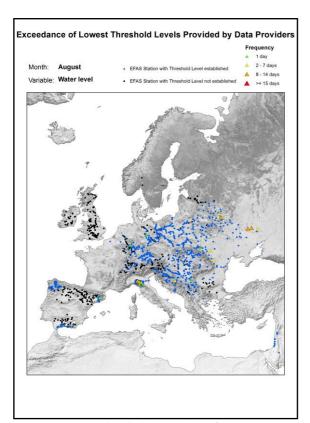


Figure 18. Lowest threshold exceedance for August 2018.

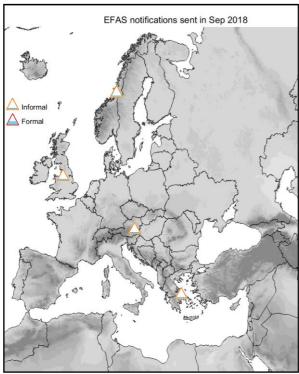


Figure 19. EFAS flood notifications sent for September 2018.

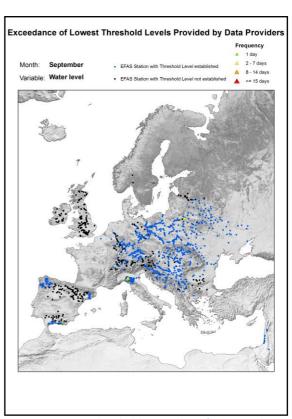


Figure 20. Lowest threshold exceedance for September 2018.

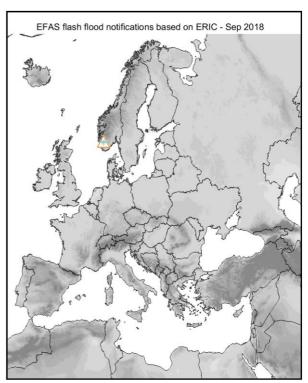


Figure 21. Flash flood notifications sent for September 2018.

Appendix - tables

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

Туре	Forecast date	Issue date	Lead time*	River/Region	Country
Informal	31/08/2018 12UTC	01/09/2018	2	Mura	Austria
Informal	19/09/2018 12UTC	20/09/2018	1	Mersey	United Kingdom
Informal	26/09/2018 00UTC	26/09/2018	0	Coastal zone	Norway
Informal	28/09/2018 00UTC	28/09/2018	2	Kifisos	Greece

^{*} 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.

Туре	Forecast date	Issue date	Lead time*	Region	Country
Flash flood	24/09/2018 12UTC	25/09/2018	48	Rogaland	Norway

^{*} 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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