European Flood Awareness System

EFAS *Bulletin*

February – March 2019

Issue 2019(2)

NEWS

New features

Report on EFAS extended domain

The report on the EFAS extended domain upgrade has now been published on the EFAS website. It describes all the relevant changes performed for the latest major upgrade of the operational European Flood Awareness System (EFAS) that was launched in 16 May 2018. https://www.efas.eu/report/report-efas-upgrade-extended-model-domain

EFAS in the European State of Climate 2018

The European State of the Climate 2018 compiled by the Copernicus Climate Change Service was released 9 April 2019. It gives a general overview of the weather and climate in Europe over the last year, including headline climate indicators, events and spotlight on different activities. EFAS contributed to the report with a description of the river discharge in Europe, focusing on the low-flow during summer and early autumn. https://climate.copernicus.eu/ESOTC

Access to EFAS archive

The EFAS archive is now accessible to all users interested in historical EFAS hydrological simulations and forecasts. Time series older than 30 days are available through the ECMWF MARS archive. Registered EFAS partners can also access real-time forecasts so through a dedicated ftp server. For more information on how to access the data, please the data download page.

Documentation and tutorials on how to access the data is also available on the EFAS wiki pages. Here we will also describe what is new in each release of the EFAS system. In the coming weeks EFAS archive will also be made available through the Copernicus Climate Data Store.
https://confluence.ecmwf.int/display/COPSRV/CEMS-Floods/

Meetings

The DAREFFORT project has had its 1st Periodic Meeting from 4-6 February in Vienna, Austria. The DAREFFORT project (Development of the DAnube RivEr basin Flood FORecasTing – funded through the Interreg Danube Transnational Programme) is an initiative to implement a mutually adopted flood risk mitigation measures in a joint and sustainable way on the Danube catchment level. During the three-year implementation period the purpose is to establish a standardized international hydro-meteorological data exchange platform which can improve the quality and efficiency of national forecast services. This will feed in a public near real time system – DanubeHIS by the International Commission for the Protection of the Danube River (ICPDR) – that provides data for flood risk management or for any water related scientific activities.

The DAREFFORT consortium consist of 11 partners, many of which are also EFAS partners. The European Commission Joint Research Centre (JRC), together with the ICPDR, the International Sava River Basin Commission and the World Meteorological Organization are associated strategic partner (ASP) to the project. The JRCs main role as ASP is to ensure that the developments in DAREFFORT are linked with the relevant European initiatives and especially the Copernicus EFAS and to share the experience in hydro-meteorological data collection and exchange at a European level.

During the 1st periodic partner meeting and the 1st Biennial Danube Forecasting Forum a review of existing flood forecasting systems of the Danube river basins was performed, including the only Danube-wide forecasting system EFAS. Furthermore, discussions were held on the minimum and maximum data availability as well as additional needs and requirements. The shared experience from EFAS in setting up a similar data collection system which includes a large number of data providers was highly appreciated. Furthermore, EFAS could be used as a test candidate for the data exchange platform which will be developed in DAREFFORT. http://www.interreg-danube.eu/approved-projects/dareffort

RESULTS

Summary of EFAS Flood and Flash Flood Notifications

The 8 formal and 1 informal EFAS flood notifications issued in February-March 2019 are summarised in Table 1. The locations of all notifications are shown in Figure 21 and Figure 23 in the appendix.

185 flash flood notification were issued in February - March 2019. They are summarised in Table 2. The locations of all notifications are shown in Figure 22 and Figure 24 in the appendix.

Meteorological situation

by EFAS Meteorological Data Collection Centre

February

The meteorological situation in February 2019 was characterized by an intense activity of low-pressure systems in the beginning of the month and in the northern parts of the domain as well as blocking "high-pressure" systems in Central Europe in the second half of the month. In the beginning of the month, two low-pressure systems moved from the Atlantic Ocean eastwards, the first one on a southerly track over the Mediterranean Region causing high daily precipitation totals, e.g. in Slovenia, Bosnia and Herzegovina or Greece, whereas the second one took a northerly track over the North Sea and Baltic Sea and caused high wind speeds over Great Britain and Ireland, southern Scandinavia and central Europe.

By the middle of February, a high-pressure system moved from northern Africa to central Europe and stayed there till the end of the month. This high-pressure system forced low-pressure systems from the Atlantic Ocean on a northern track bringing high wind speeds to northern Scandinavia and Russia and allowed a southward track of the low-pressure systems east of the high-pressure. This large-scale synoptic situation forced an intense flow of warm air from the Iberian Peninsula to the Britain and Ireland, Scandinavia and Central Europe causing new temperature records for February at some stations with more than 20°C in the United Kingdom of Great Britain and Northern Ireland, the Netherlands, Belgium and Germany (at least for Germany the absolute national record was observed at another station with 23.1°C in 1900 and not broken).

Cold air moved at the eastern edge of the high-pressure system southward into the central and eastern Mediterranean region forcing the development of small low-pressure systems and convective precipitation. High daily precipitation totals, partly above 100 mm, were reported from Libya, Greece, Cyprus and Crete as well as snowfall from some islands in the Aegean Sea. Intense precipitation was also reported in Israel and Jordan on the last days of February.

Precipitation amounts were up to 520 mm in February 2019 (Figure 7). The highest precipitation totals were observed at the border between Italy and Slovenia, the northern part of the Apennine Mountains, Crete, the eastern coast of the Mediterranean Sea in Jordan, Lebanon and Israel, the Libyan coast as well as in Scotland and Norway. However, in some of these regions the precipitation totals in February are below the long term mean like in Scotland and southern Norway (Figure 8). Most parts of the EFAS domain received less than normal precipitation amounts, some regions in Spain, Greece and northern Africa no or almost no precipitation.

The monthly mean temperature ranges from -25°C to 21°C with the highest temperatures in the southeastern and the lowest temperatures in the northeastern parts of the EFAS domain (Figure 11). Temperature anomalies range from -5°C to 9°C, where most regions had above normal temperatures (Figure 12). Below normal temperatures were found in northern Scandinavia, Iceland, southern Portugal, Sicily, large parts of northern Africa, Crete, eastern Turkey and eastern Russia.

March 2019

The meteorological situation in March 2019 was characterized by an intense activity of low-pressure systems in the beginning and high-pressure systems in the second half of the month. Precipitation totals were above in the northern parts and mostly below the long term means in the southern parts of the EFAS domain. The monthly mean air temperature was in most parts of the EFAS domain above the long-term mean.

In the first half of March, low-pressure systems moved over most parts of the EFAS domain and brought most of the monthly precipitation total, whereas the Iberian Peninsula and northern Africa were more frequently

influenced by high-pressure systems. Continuous rainfall in Great Britain caused floods in Wales and England.

By the middle of March, high-pressure systems started to influence the weather conditions in most parts of the EFAS domain. A high-pressure system enlarged from the Atlantic Ocean to central Europe leading to a cut-off upper level low-pressure system trapped over northern Africa. This system brought intense rain, and snow in the mountains, of Algeria and Tunisia. Another cut-off occurred over the western Alps causing a low-pressure system moving from the central to the eastern Mediterranean region by the end of March. These high-pressure systems over central and southern Europe forced low-pressure systems to pass over northern Scandinavia and northern Russia.

Monthly precipitation amounts were up to 613 mm in March 2019. The highest precipitation totals were observed at Great Britain and Ireland, the western coast of Scandinavia and at the border between Turkey and Iraq (Figure 9). Nearly no precipitation was observed in southeast Spain, the Mediterranean coast of France and the bordering region of Italy as well as in North Macedonia. The northern part of Europe received more and the southern part less than usual precipitation amounts relative to long term means (Figure 10). Precipitation totals in Iceland were below the long term means and at the southern and eastern coast of the Mediterranean Sea above the long term means.
The monthly mean air temperatures ranged from -16°C to 32°C with the highest temperatures in the southern part and lowest temperatures in the northern and mountainous parts of the EFAS domain (Figure 13). Temperature anomalies ranged from -5°C to 9°C, where most regions had above normal temperatures (Figure 14). Abnormally cold temperatures were found in Iceland, parts of Scandinavia, some regions in Portugal and Spain as well as from northern Africa to the Caucasus Mountains.

Hydrological situation

by EFAS Hydrological Data Collection Centre

February
For the month of February, most of the stations that surpassed the lowest discharge and/or stage threshold level are concentrated along the southern Danube river basin in Slovenia, Croatia and Serbia, Po river basin in Italy, Minho-Sil and Mediterranean river basins in Spain and basins across southern Sweden. A more dispersed distribution of stations with exceedances of the first threshold level occurred throughout the Dnieper river basin in Ukraine and Belarus, Rhine river basin in Germany and Switzerland, Elbe river basin in Germany and the Czech Republic, Oder and Vistula river basins in Poland, Neman and Vistula river basins in Belarus Neretva river basin in Bosnia and Herzegovina, Danube river basin in Romania and Slovakia, Glomma and Stjordal basins in Norway and Lakhish river basins in Israel.

Most of stations that registered discharge values above the 90% quantile are located across Norway, Finland and Sweden, and the western Danube river basin in Austria, Germany and Slovenia. This occurred less frequently for stations located along the eastern Danube river basin in Romania and Serbia, Dniester and Dnieper river basins in Ukraine, Llobregat, Ebro and Minho-Sil river basins in Spain and Rhine river basin in southern Germany

Stations with values registered below the 10% quantile for discharge are mainly located across the Rhine and Elbe river basins in Germany and Ebro river basin in Spain. This occurred less frequently in stations across Scandinavian countries and for one station in Dnieper river basin in Ukraine.

March
For March, the highest concentration of stations that surpassed the lowest discharge and/or stage threshold level was in southern Germany, along the Rhine and Danube river basins, and Belarus, along the Dnieper, Neman and Vistula river basins. A more dispersed distribution of stations with exceedances of the lowest threshold level occurred throughout the Danube river basins, the Po river basin in Italy, the Don river basin in the Ukraine, the Elbe river basin in the Czech Republic and Germany, the Jordan river basin in Israel, the Glomma river basin in Norway and the Minho river basin in north-western Spain.

Stations that registered discharge values above the 90% quantile are mostly located across Norway, Finland and Sweden, the western Danube river basin in Austria and Germany and as well as for several stations located throughout Ireland. This occurred less frequently for stations located along the Rhine river basin in Germany and Switzerland, the Dnieper river basin in the Ukraine, the Llobregat river basin in north-eastern

Spain, the Vistula river basin in Belarus and the Danube river basin in Hungary and Slovakia.

Stations registering values below the 10% quantile for discharge are mainly located across the Danube river basin, in western Ukraine along the Dnieper, Dniester and southern Bug as well as in Spain along the Ebro, the Guadalquivir and the Llobregat river basins. This occurred less frequently in stations across Germany (the Elbe and Rhine river basins) and the Oder river basin in Poland.

Publications

Berghuijs, W. R., Allen, S. T., Harrigan, S., & Kirchner, J. W. (2019). Growing spatial scales of synchronous river flooding in Europe. Geophysical Research Letters, 46, 1423–1428, doi.org/10.1029/2018GL081883

Verification

Figure 1 and Figure 2 shows the EFAS headline score, the Continuous Ranked Probability Skill Score (CRPSS) for lead times 1 and 5 days for the February to March period across the EFAS domain for catchments larger than 2000km^2. 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.

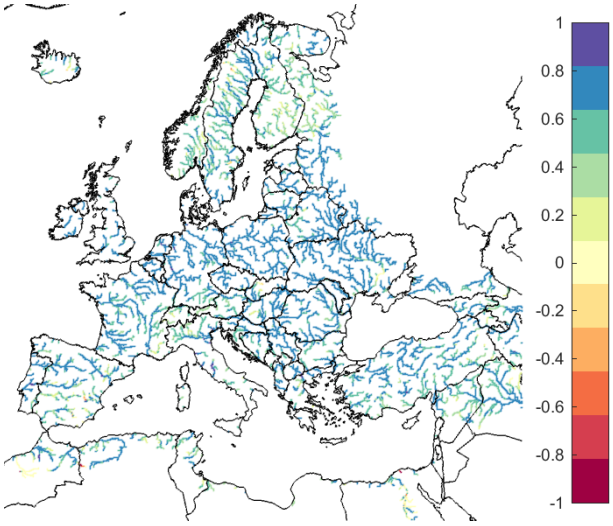

Figure 1. EFAS CRPSS at lead-time 1 days for the February-March 2019 period, for catchments >2000km2. The reference score is persistence of using previous day's forecast.

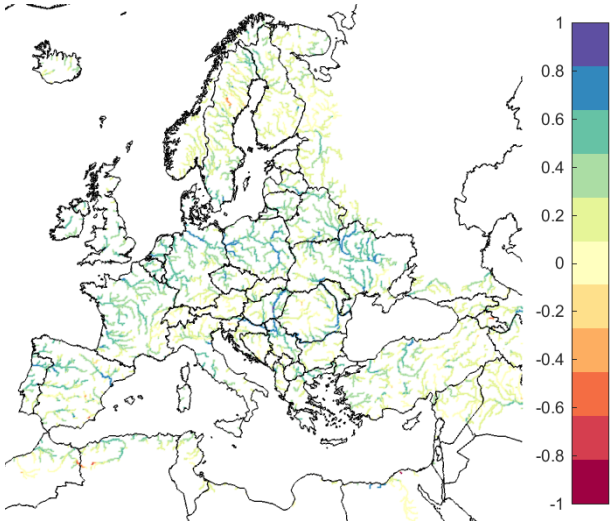

Figure 2. EFAS CRPSS at lead-time 5 days for the February-March 2019 period, for catchments >2000km2. The reference score is persistence of using previous day's forecast.

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 over the period were better in the central parts of Europe over the period than in the northern and southern parts of Europe.

FEATURES

Summary of EFAS Notifications in 2018

by EFAS Dissemination Centre

Figure 3. shows the number of formal, informal and flash flood notifications issued each month throughout 2018. With a total number of 563 EFAS notifications 2018 was the busiest of the past five years for the EFAS consortium. Compared to 2017 the Dissemination Center issued 130% more formal, 59% more informal and 53% more flash flood notifications. March was the most active month with 127 notifications, which is about 22% of the total number of notifications of 2018. April saw the most formal notifications issued, while the period from June till September was very quiet in terms of flood notifications. In total 148 formal, 97 informal and 318 flash flood notifications were issued in 2018.

Remarkable periods in 2018 were the first 3 weeks of March, with large spread floods over the Iberian Peninsula, the Baltic states and the Balkan as well as the first half of April with numerous flood signals in Spain and Russia.

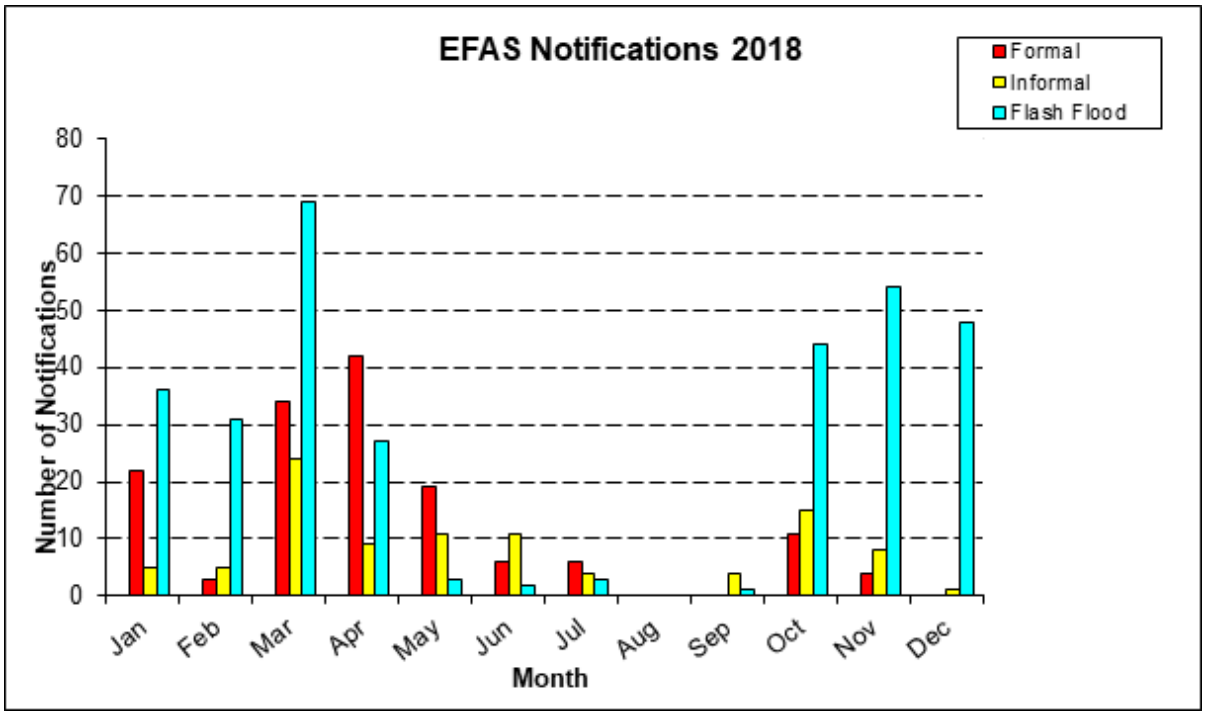

Figure 3. Number of EFAS formal (red), informal (orange) and flash flood (blue) notifications issued in 2018

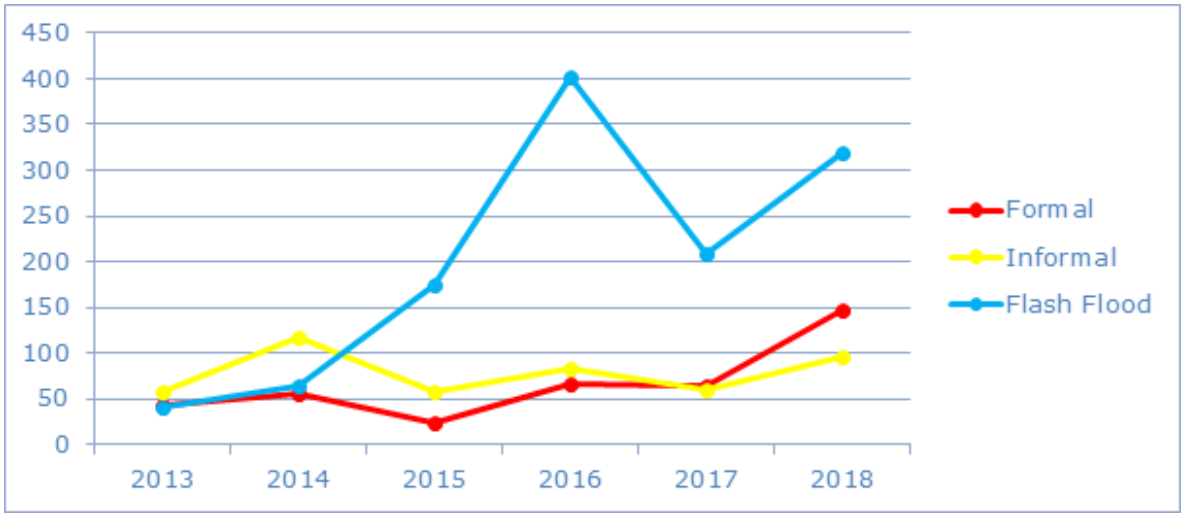

Figure 4. Total number of EFAS formal (red), informal (orange) and flash flood (blue) notifications issued per year from 2013-2018

For comparison, **Figure 4**. indicates the total number of EFAS notifications issued per year for the past 6 years. 2018 was a very wet year for all three types of notifications. The number of flash flood notifications was almost the same as in the year 2016.

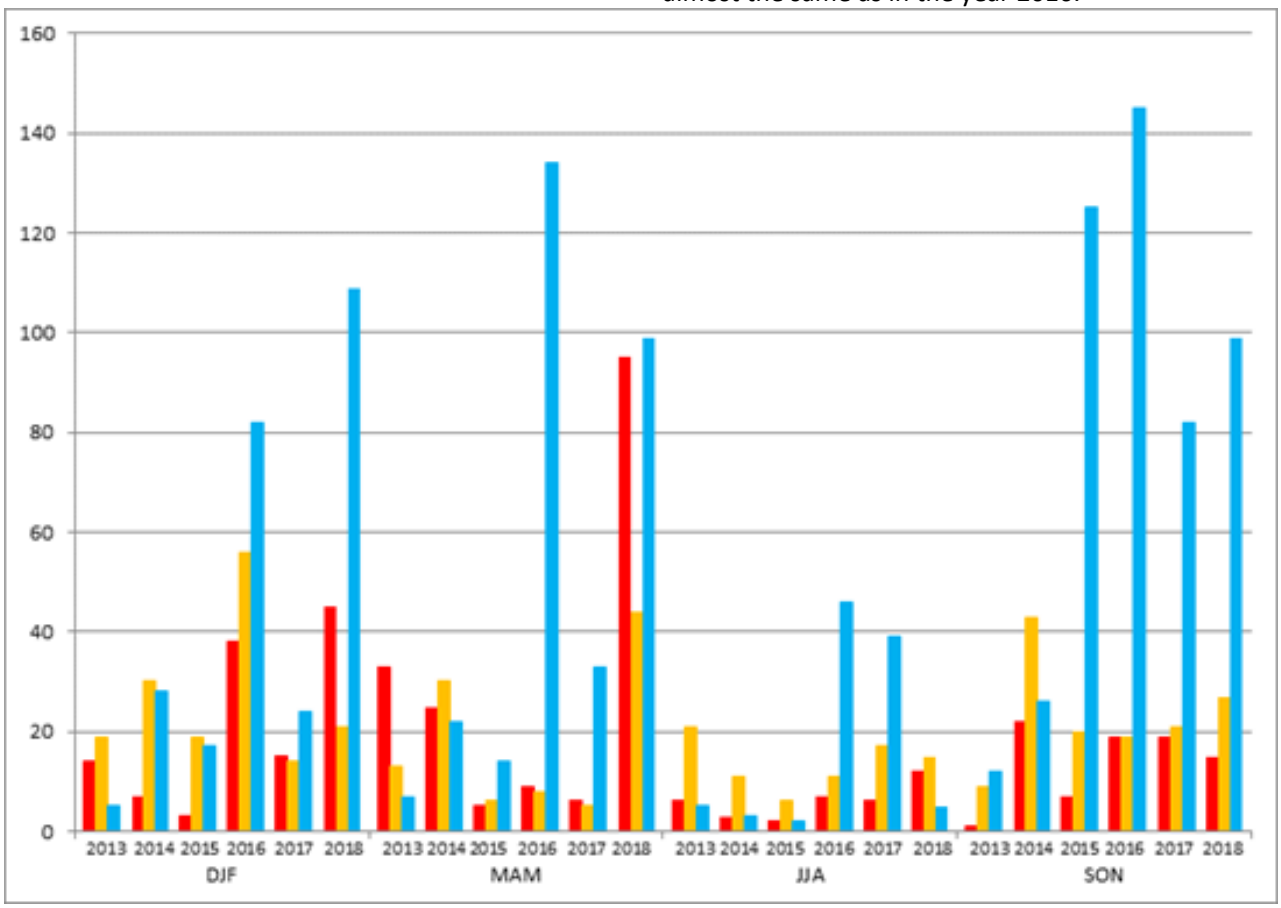

Figure 5. Number of EFAS (red), informal (orange) and flash flood (blue) notifications issued per season over the past 5 years (2017)

Figure 5 breaks down the number of notifications over the past 6 years into seasons (December-January-February [DJF], March-April-May [MAM], June-July-August [JJA] and September-October-November [SON]).

The most active seasons in terms of river flooding over the past 6 years are the winter (DJF) of 2016, the spring (MAM) of 2018 and the autumn (SON) of 2016.
Based on the number of notifications issued from 2013-2018, the most formal flood notifications are issued in spring (29 per year on average), informal notifications in winter (27 per year on average) and flash flood notifications in autumn (82 per year on average). The season with the fewest formal notifications is the summer (about 6 per year on average).

In 2018 in total 31 countries received 562 notifications (147 formal, 97 informal and 318 flash flood notifications). Just like the year before, Spain received the highest number of notifications (21 formal, 33 informal and 88 flash flood notifications). The most formal notifications were sent to Russia (24), followed by France and Spain (21), the most informal notifications to Spain (33) and the most flash flood notifications to Spain (88), followed by France (58) and the UK (30).

Report on the flooding in Crete, Greece in February 2019

by Richard Davies (FloodList).

The month of February saw two severe flood events on the Greek island of Crete, causing 5 fatalities as well as damage to buildings, agriculture, roads and other infrastructure. Local media reported that 4 people were missing on 16 February after their vehicle was swept away by the flood waters from an overflowing river. A search operation, including members of the fire service and a helicopter, was launched. Four bodies were later found in the Messara area in the southern part of the island.

Hellenic National Meteorological Service (HNMS) said that between 12 and 17 February, 180 mm of rain fell in Kastelli, including 74.5 mm in 24 hours to 17 February. A few days later, a weather system referred to by local media as "Storm Oceanis", brought further heavy rain to parts of Crete from 23 February, causing flooding and landslides.

HNMS figures showed that Souda recorded 116 mm of rain on 25 February, which is more than the average monthly rainfall for February. Local reports said that emergency teams rescued others from flood water and from vehicles trapped in landslides. Schools and roads were closed.

Figure 6. Flooding in Crete, late February 2019. Credit: Civil Protection Greece

Up to four times the average monthly rainfall

Artemis Papapetrou, Head of the Hydrology Section of HNMS, published a valuable review of the severe weather events for February, revealing that some areas of Crete saw 3 or 4 times the average monthly rainfall. According to HNMS, between 1 and 26 February, the weather station at Kastelli recorded 269 mm of rain, which is 270% of the average February monthly rainfall. The total rainfall amount for both January and February 2019 (497 mm) was 72% of the average annual rainfall.

During the same period, Heraklion recorded 193 mm, which is 300% of the average monthly rainfall for February. The total amount for both January and February 2019 (356 mm) was 74 % of the average annual rainfall. Likewise, the weather station at Souda recorded 406 mm between 1 and 26 February, which is four times the monthly average and the second highest monthly total on record.

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 in Chania, Crete, late February 2019. Credit: Civil Protection Greece

Appendix - figures

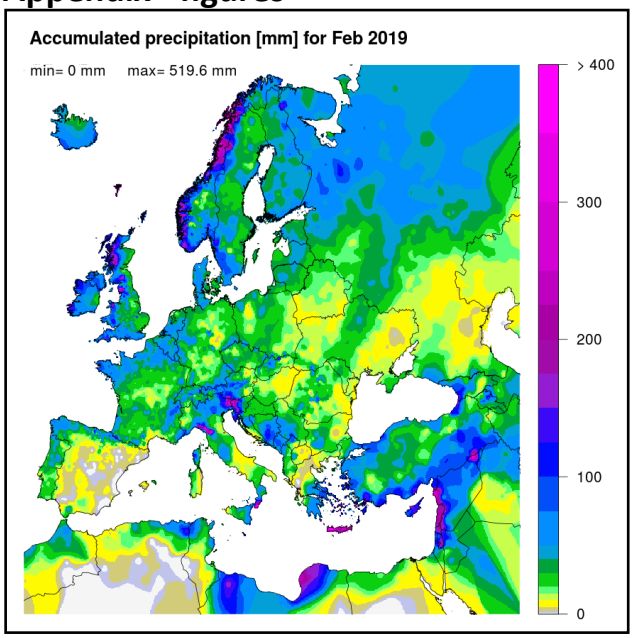

Figure 7. Accumulated precipitation [mm] for February 2019.

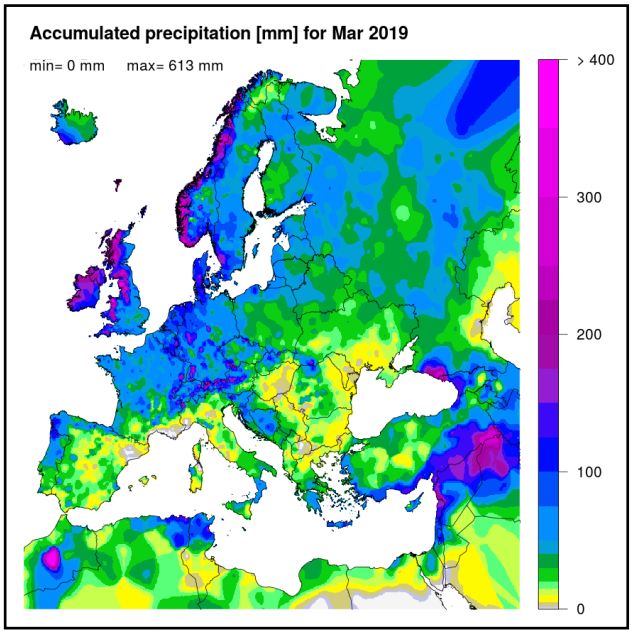

Figure 9. Accumulated precipitation [mm] for March 2019.

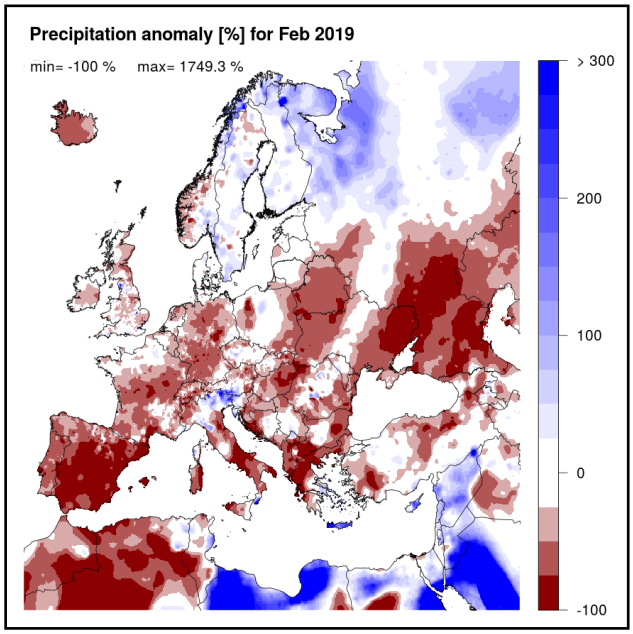

Figure 8. Precipitation anomaly [%] for February 2019, relative to a long-term average (1990-2013). Blue (red) denotes wetter (drier) conditions than normal.

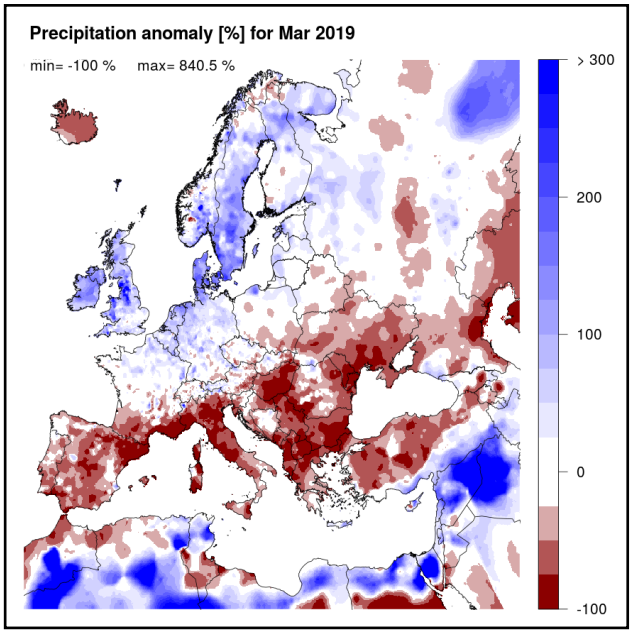

Figure 10. Precipitation anomaly [%] for March 2019, relative to a long-term average (1990-2013). Blue (red) denotes wetter (drier) conditions than normal.

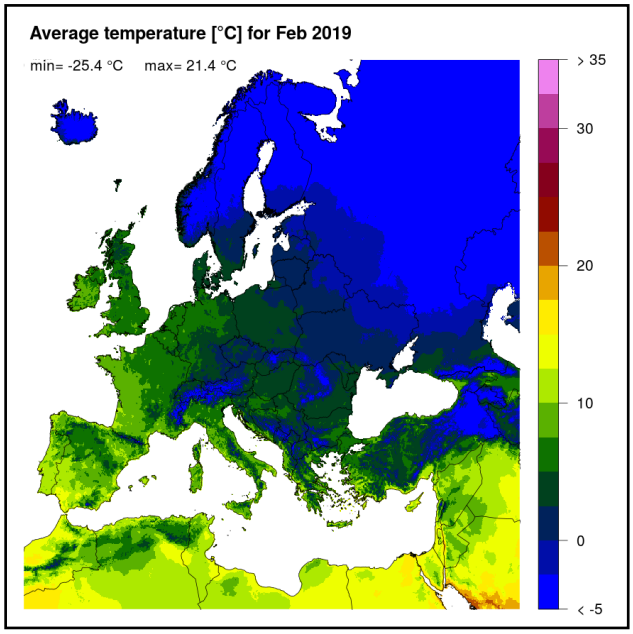

Figure 11. Mean temperature [°C] for February 2019.

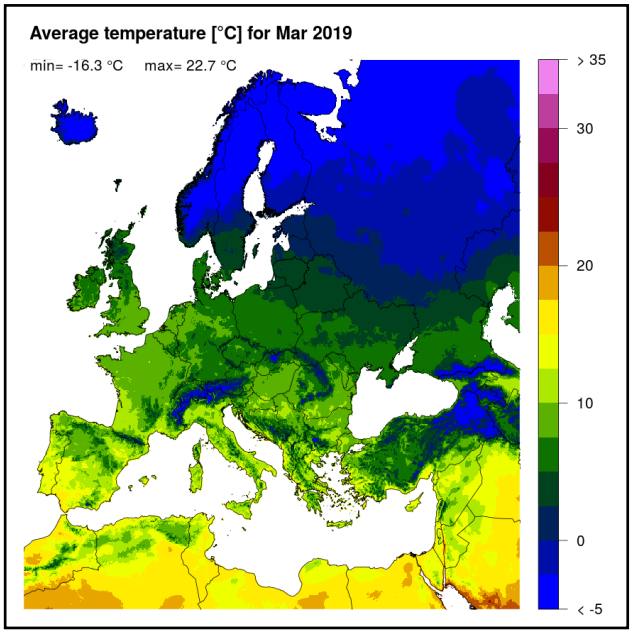

Figure 13. Mean temperature [°C] for March 2019.

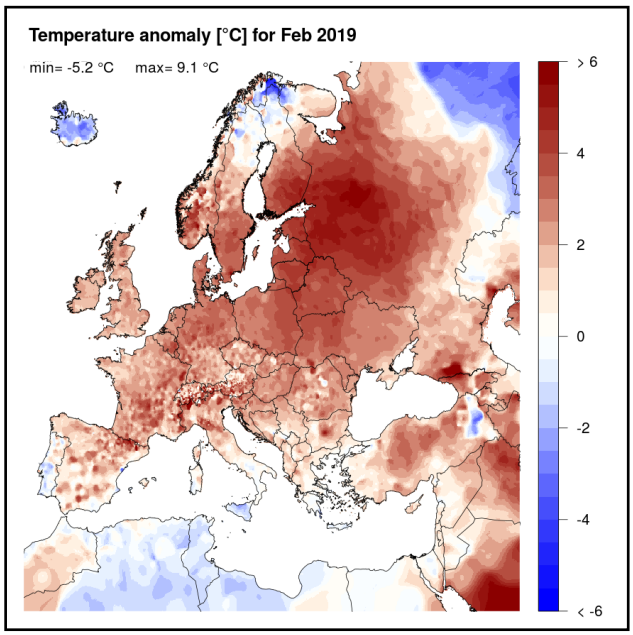

Figure 12. Temperature anomaly [°C] for February 2019, relative to a long-term average (1990-2013). Blue (red) denotes colder (warmer) temperatures than normal.

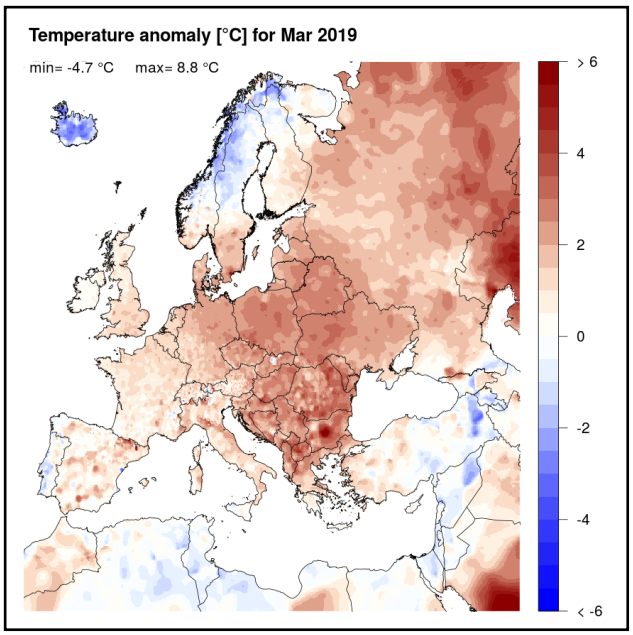

Figure 14. Temperature anomaly [°C] for March 2019, relative to a long-term average (1990-2013). Blue (red) denotes colder (warmer) temperatures than normal.

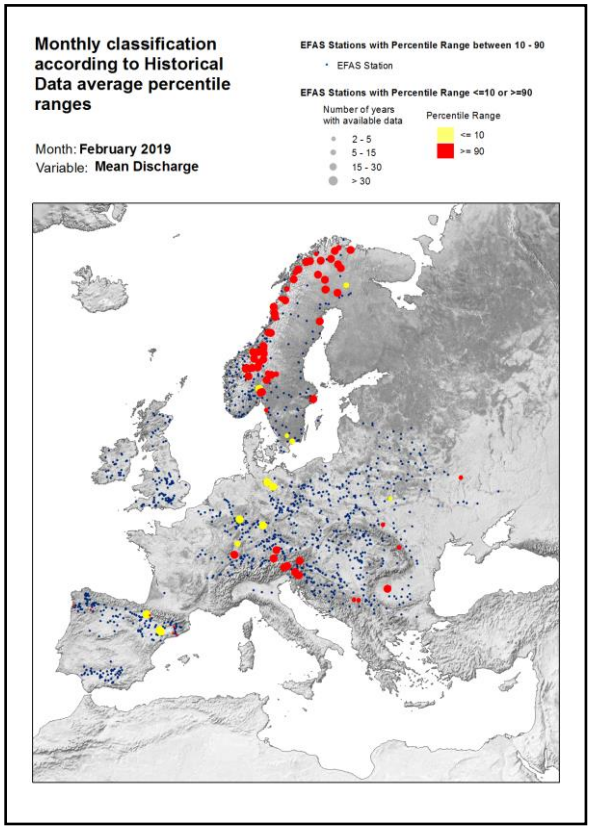

Figure 15. Monthly discharge anomalies February 2019.

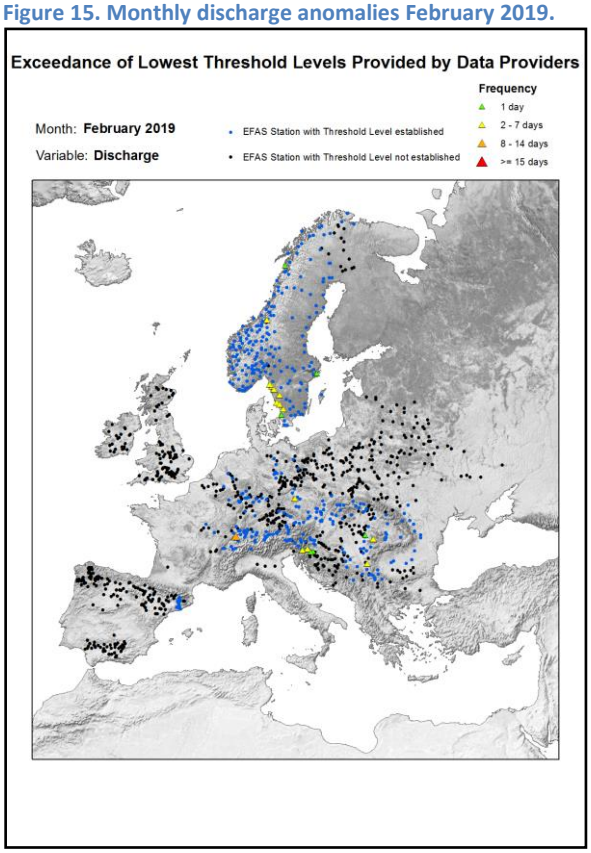

Figure 16. Lowest alert level exceedance for February 2019.

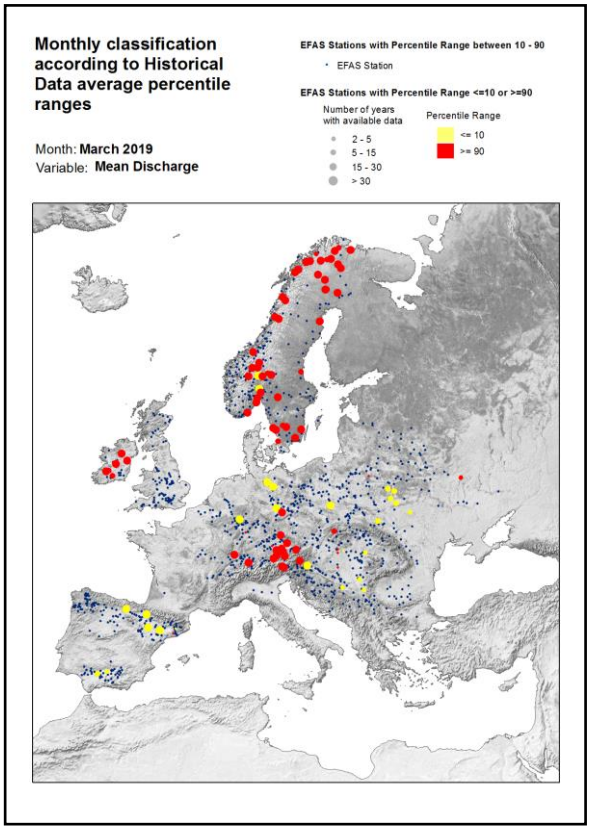

Figure 17. Monthly discharge anomalies March 2019.

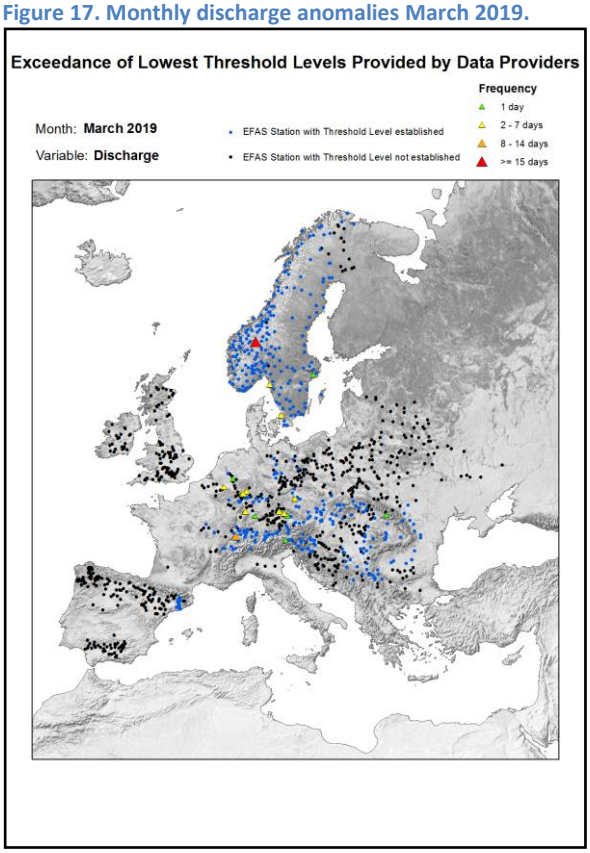

Figure 18. Lowest alert level exceedance for March 2019.

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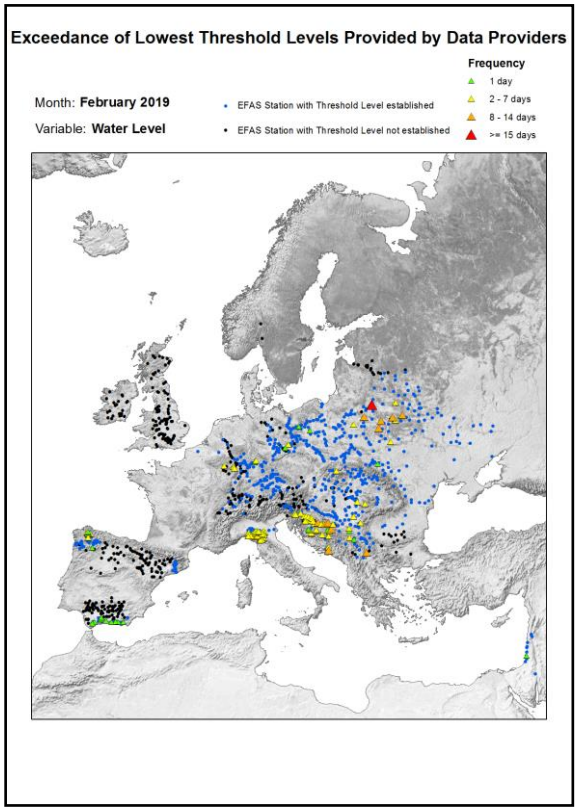

Figure 19. Lowest threshold exceedance for February 2019.

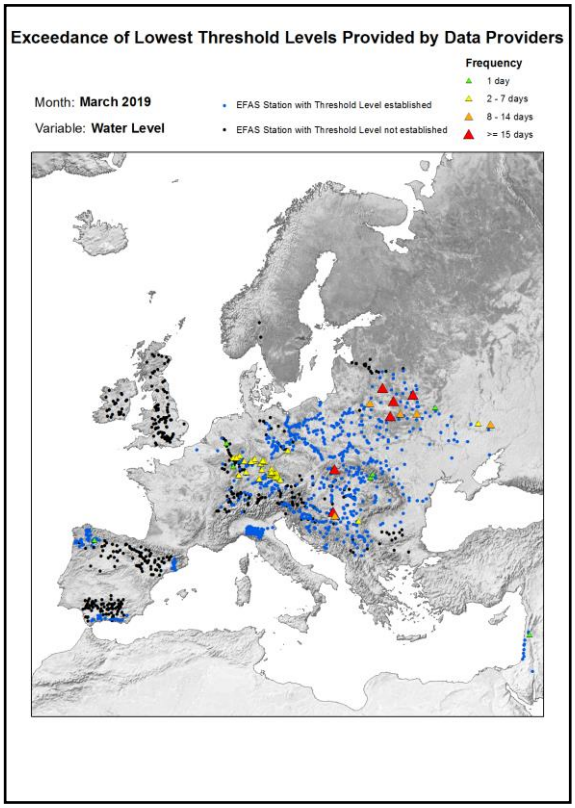

Figure 20. Lowest threshold exceedance for March 2019.

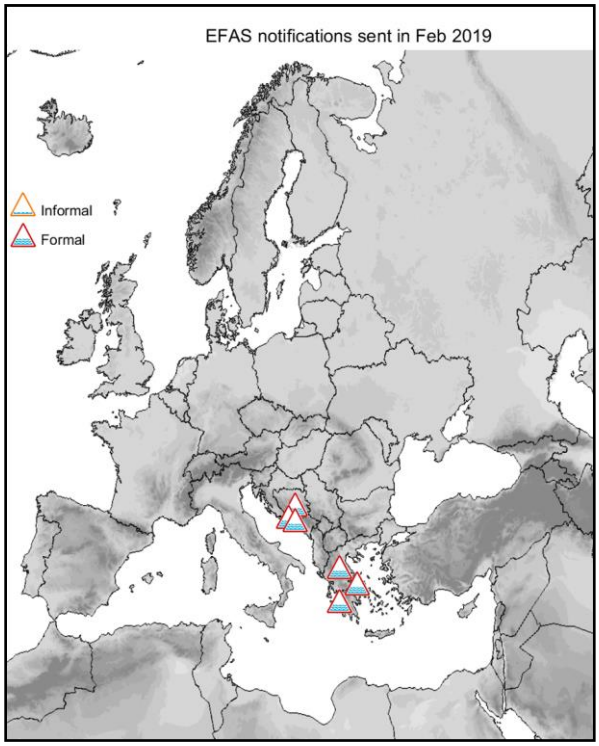

Figure 21. EFAS flood notifications sent for February 2019.

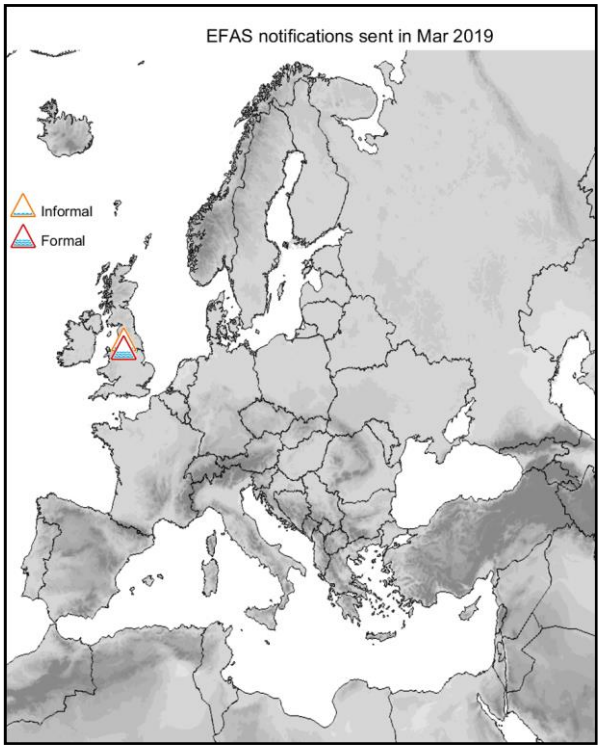

Figure 23. EFAS flood notifications sent for March 2019.

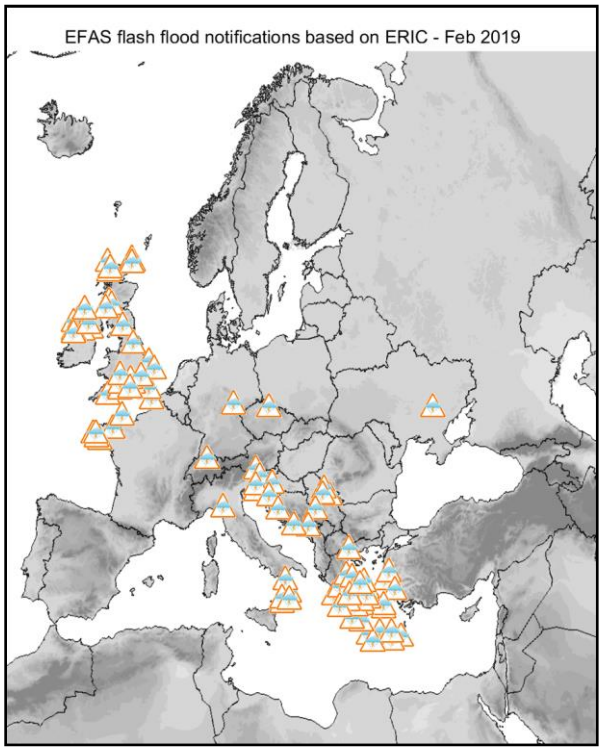

Figure 22. Flash flood notifications sent for February 2019.

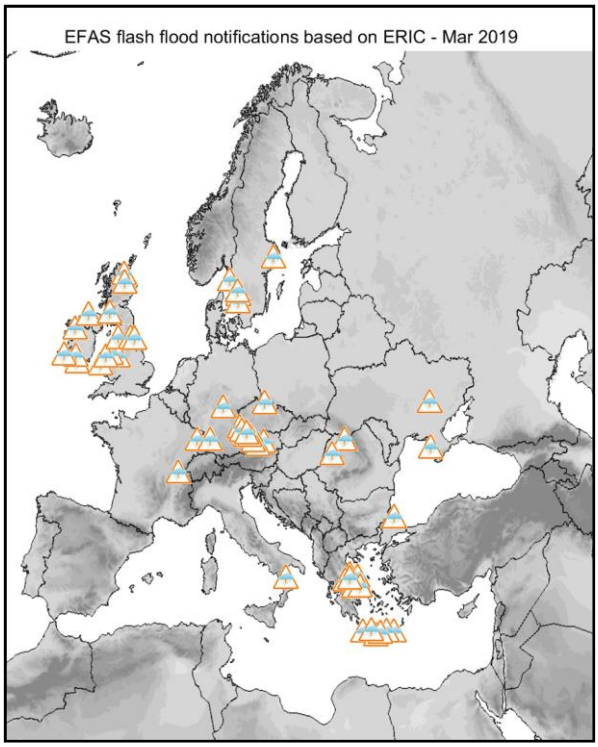

Figure 24. Flash flood notifications sent for March 2019.

Appendix - tables

Table 1. EFAS flood notifications sent in February - March 2019

Type	Forecast date	Issue date	Lead time	River	Country
Formal	31/01/2019 12UTC	01/02/2019	0	Alfeios	Greece
Formal	31/01/2019 12UTC	01/02/2019	3	Bosna	B. Herzegovina
Formal	31/01/2019 12UTC	01/02/2019	4	Neretva	B. Herzegovina
Formal	31/01/2019 12UTC	01/02/2019	3	Neretva	B. Herzegovina
Formal	01/02/2019 00UTC	01/02/2019	5	Kifisos	Greece
Formal	01/02/2019 12UTC	02/02/2019	0	Alfeios	Greece
Formal	02/02/2019 12UTC	03/02/2019	4	Pineios	Greece
Formal	10/03/2019 12UTC	11/03/2019	3	Mersey	United Kingdom
Informal	14/03/2019 12UTC	15/03/2019	0	Ribble	United Kingdom

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

Table 2. EFAS flash flood notifications sent in February - March 2019

Type	Forecast date	Issue date	Lead time	Region	Country
Flash Flood	31/01/2019 12UTC	01/02/2019	42	Parma	Italy
Flash Flood	31/01/2019 12UTC	01/02/2019	48	Primorsko-Goranska	Croatia
Flash Flood	31/01/2019 12UTC	01/02/2019	66	Sibensko-Kninska Zupanija	Croatia
Flash Flood	31/01/2019 12UTC	01/02/2019	60	Licko-Senjska Zupanija	Croatia
Flash Flood	01/02/2019 00UTC	01/02/2019	48	Jugovzhodna Slovenija	Croatia,Slovenia
Flash Flood	01/02/2019 00UTC	01/02/2019	48	Karlovacka Zupanija	Croatia
Flash Flood	01/02/2019 12UTC	02/02/2019	24	Osrednjeslovenska	Slovenia
Flash Flood	01/02/2019 12UTC	02/02/2019	48	Kralovehradecky kraj	Czech Republic
Flash Flood	01/02/2019 12UTC	02/02/2019	24	Gorenjska	Slovenia
Flash Flood	02/02/2019 00UTC	02/02/2019	54	Crna Gora	Montenegro
Flash Flood	02/02/2019 00UTC	02/02/2019	24	Primorsko-notranjska	Slovenia
Flash Flood	02/02/2019 00UTC	02/02/2019	48	Repuplika Srpska	B. Herzegovina
Flash Flood	02/02/2019 12UTC	03/02/2019	48	Zlatiborski	Serbia
Flash Flood	02/02/2019 12UTC	03/02/2019	78	Peloponnese, Western	Greece
Flash Flood	02/02/2019 12UTC	03/02/2019	78	Argolida, Arkadia	Greece
Flash Flood	02/02/2019 12UTC	03/02/2019	78	Korinthia	Greece
Flash Flood	02/02/2019 12UTC	03/02/2019	84	Axaia	Greece
Flash Flood	02/02/2019 12UTC	03/02/2019	78	Lakonia, Messinia	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	72	Eiritania	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	72	Thessaly and Central	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	72	Magnisia	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	72	Ileia	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	72	Ditiki Attiki	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	72	Attica	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	72	Anatoliki Attiki	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	72	Boiotia	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	72	Fthiotida	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	72	Fokida	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	36	Bretagne	France
Flash Flood	03/02/2019 00UTC	03/02/2019	36	Finistere	France
Flash Flood	03/02/2019 00UTC	03/02/2019	72	Aitoloakarnania	Greece

Flash Flood	03/02/2019 00UTC	03/02/2019	72	Karditsa, Trikala	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	84	Larisa	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	72	Eiboia	Greece
Flash Flood	03/02/2019 00UTC	03/02/2019	78	Kilkis	Greece
Flash Flood	04/02/2019 00UTC	04/02/2019	42	Lasithi	Greece
Flash Flood	04/02/2019 00UTC	04/02/2019	42	Irakleio	Greece
Flash Flood	05/02/2019 00UTC	05/02/2019	90	West	Ireland
Flash Flood	05/02/2019 00UTC	05/02/2019	42	Bretagne	France
Flash Flood	05/02/2019 00UTC	05/02/2019	90	West	Ireland
Flash Flood	05/02/2019 00UTC	05/02/2019	48	Finistere	France
Flash Flood	05/02/2019 00UTC	05/02/2019	48	Bretagne	France
Flash Flood	05/02/2019 12UTC	06/02/2019	84	North Yorkshire CC	United Kingdom
Flash Flood	05/02/2019 12UTC	06/02/2019	78	Border	Ireland
Flash Flood	05/02/2019 12UTC	06/02/2019	78	Border	Ireland
Flash Flood	05/02/2019 12UTC	06/02/2019	96	Orkney Islands	United Kingdom
Flash Flood	05/02/2019 12UTC	06/02/2019	78	Mayo	Ireland
Flash Flood	06/02/2019 00UTC	06/02/2019	72	Scotland	United Kingdom
Flash Flood	06/02/2019 00UTC	06/02/2019	66	Border	Ireland
Flash Flood	06/02/2019 00UTC	06/02/2019	66	West	Ireland
Flash Flood	06/02/2019 00UTC	06/02/2019	66	Border	Ireland
Flash Flood	06/02/2019 00UTC	06/02/2019	66	Border	Ireland,United
Flash Flood	06/02/2019 00UTC	06/02/2019	72	None	United Kingdom
Flash Flood	06/02/2019 00UTC	06/02/2019	72	Eilean Siar (Western Isles)	United Kingdom
Flash Flood	06/02/2019 00UTC	06/02/2019	72	None	United Kingdom
Flash Flood	06/02/2019 00UTC	06/02/2019	72	Lochaber, Skye & Lochalsh,	United Kingdom
Flash Flood	06/02/2019 12UTC	07/02/2019	96	Oxfordshire	United Kingdom
Flash Flood	06/02/2019 12UTC	07/02/2019	54	Border	Ireland
Flash Flood	06/02/2019 12UTC	07/02/2019	54	Border	Ireland
Flash Flood	06/02/2019 12UTC	07/02/2019	54	West and South of North-	United Kingdom
Flash Flood	06/02/2019 12UTC	07/02/2019	60	East Cumbria	United Kingdom
Flash Flood	06/02/2019 12UTC	07/02/2019	102	North & West Norfolk	United Kingdom
Flash Flood	06/02/2019 12UTC	07/02/2019	102	Norwich & East Norfolk	United Kingdom
Flash Flood	06/02/2019 12UTC	07/02/2019	102	Bedford	United Kingdom
Flash Flood	06/02/2019 12UTC	07/02/2019	102	East Kent	United Kingdom
Flash Flood	06/02/2019 12UTC	07/02/2019	96	Somerset	United Kingdom
Flash Flood	06/02/2019 12UTC	07/02/2019	96	Dorset CC	United Kingdom
Flash Flood	06/02/2019 12UTC	07/02/2019	96	England	United Kingdom
Flash Flood	06/02/2019 12UTC	07/02/2019	96	Berkshire	United Kingdom
Flash Flood	06/02/2019 12UTC	07/02/2019	90	Gloucestershire	United Kingdom
Flash Flood	08/02/2019 00UTC	08/02/2019	66	Pas-de-Calais	France
Flash Flood	08/02/2019 00UTC	08/02/2019	66	Pas-de-Calais	France
Flash Flood	08/02/2019 12UTC	09/02/2019	66	Saalfeld-Rudolstadt	Germany
Flash Flood	08/02/2019 12UTC	09/02/2019	42	Cotes-d'Armor	France
Flash Flood	08/02/2019 12UTC	09/02/2019	42	Manche	France
Flash Flood	10/02/2019 12UTC	11/02/2019	108	Rethimni	Greece
Flash Flood	10/02/2019 12UTC	11/02/2019	114	Irakleio	Greece
Flash Flood	10/02/2019 12UTC	11/02/2019	114	Lasithi	Greece
Flash Flood	10/02/2019 12UTC	11/02/2019	30	Branicevski	Serbia
Flash Flood	10/02/2019 12UTC	11/02/2019	48	Lesbos, Limnos	Greece
Flash Flood	10/02/2019 12UTC	11/02/2019	102	Xania	Greece
Flash Flood	10/02/2019 12UTC	11/02/2019	108	Crete	Greece

Flash Flood	11/02/2019 00UTC	11/02/2019	24	Podunavski	Serbia
Flash Flood	11/02/2019 00UTC	11/02/2019	84	Eiboia	Greece
Flash Flood	11/02/2019 00UTC	11/02/2019	48	Dnipropetrovs'k	Ukraine
Flash Flood	11/02/2019 00UTC	11/02/2019	78	Fthiotida	Greece
Flash Flood	11/02/2019 00UTC	11/02/2019	84	Boiotia	Greece
Flash Flood	11/02/2019 00UTC	11/02/2019	24	Juzno-Banatski	Serbia
Flash Flood	11/02/2019 12UTC	12/02/2019	72	Attica	Greece
Flash Flood	11/02/2019 12UTC	12/02/2019	72	Lakonia, Messinia	Greece
Flash Flood	11/02/2019 12UTC	12/02/2019	72	Anatoliki Attiki	Greece
Flash Flood	11/02/2019 12UTC	12/02/2019	72	Ditiki Attiki	Greece
Flash Flood	11/02/2019 12UTC	12/02/2019	72	Argolida, Arkadia	Greece
Flash Flood	12/02/2019 00UTC	12/02/2019	42	Aegean	Greece
Flash Flood	12/02/2019 12UTC	13/02/2019	42	None	Greece
Flash Flood	13/02/2019 00UTC	13/02/2019	18	Lesbos, Limnos	Greece
Flash Flood	14/02/2019 12UTC	15/02/2019	66	Rethimni	Greece
Flash Flood	14/02/2019 12UTC	15/02/2019	66	Irakleio	Greece
Flash Flood	14/02/2019 12UTC	15/02/2019	12	Lasithi	Greece
Flash Flood	14/02/2019 12UTC	15/02/2019	60	Xania	Greece
Flash Flood	15/02/2019 00UTC	15/02/2019	42	Orkney Islands	United Kingdom
Flash Flood	17/02/2019 12UTC	18/02/2019	78	Orkney Islands	United Kingdom
Flash Flood	20/02/2019 12UTC	21/02/2019	114	None	Greece
Flash Flood	20/02/2019 12UTC	21/02/2019	90	Aegean	Greece
Flash Flood	20/02/2019 12UTC	21/02/2019	96	Anatoliki Attiki	Greece
Flash Flood	20/02/2019 12UTC	21/02/2019	96	Boiotia	Greece
Flash Flood	20/02/2019 12UTC	21/02/2019	96	Eiboia	Greece
Flash Flood	20/02/2019 12UTC	21/02/2019	84	Lesbos, Limnos	Greece
Flash Flood	21/02/2019 00UTC	21/02/2019	78	Irakleio	Greece
Flash Flood	21/02/2019 00UTC	21/02/2019	78	Fthiotida	Greece
Flash Flood	21/02/2019 00UTC	21/02/2019	84	Cosenza	Italy
Flash Flood	21/02/2019 12UTC	22/02/2019	72	Ditikos Tomeas Athinon	Greece
Flash Flood	21/02/2019 12UTC	22/02/2019	72	Boreios Tomeas Athinon	Greece
Flash Flood	21/02/2019 12UTC	22/02/2019	78	Catanzaro	Italy
Flash Flood	21/02/2019 12UTC	22/02/2019	66	Attica	Greece
Flash Flood	21/02/2019 12UTC	22/02/2019	78	Vibo Valentia	Italy
Flash Flood	21/02/2019 12UTC	22/02/2019	108	Xania	Greece
Flash Flood	22/02/2019 00UTC	22/02/2019	60	Reggio di Calabria	Italy
Flash Flood	22/02/2019 00UTC	22/02/2019	90	Crete	Greece
Flash Flood	22/02/2019 00UTC	22/02/2019	96	Rethimni	Greece
Flash Flood	22/02/2019 12UTC	23/02/2019	72	Andros, Thira, Kea, Milos,	Greece
Flash Flood	22/02/2019 12UTC	23/02/2019	84	Lasithi	Greece
Flash Flood	22/02/2019 12UTC	23/02/2019	84	Irakleio	Greece
Flash Flood	23/02/2019 12UTC	24/02/2019	54	None	Greece
Flash Flood	02/03/2019 12UTC	03/03/2019	42	South-East (IE)	Ireland
Flash Flood	04/03/2019 00UTC	04/03/2019	60	South-West (IE)	Ireland
Flash Flood	04/03/2019 00UTC	04/03/2019	60	South-West (IE)	Ireland
Flash Flood	04/03/2019 12UTC	05/03/2019	36	South West Wales	United Kingdom
Flash Flood	05/03/2019 00UTC	05/03/2019	30	North Yorkshire CC	United Kingdom
Flash Flood	05/03/2019 00UTC	05/03/2019	60	None	United Kingdom
Flash Flood	05/03/2019 00UTC	05/03/2019	60	Hallands lan	Sweden
Flash Flood	05/03/2019 00UTC	05/03/2019	30	East Cumbria	United Kingdom
Flash Flood	05/03/2019 12UTC	06/03/2019	36	Border	Ireland

Flash Flood	06/03/2019 12UTC	07/03/2019	36	Vastra Gotaland	Sweden
Flash Flood	06/03/2019 12UTC	07/03/2019	24	Inverness & Nairn and	United Kingdom
Flash Flood	08/03/2019 00UTC	08/03/2019	66	Muhlviertel	Austria
Flash Flood	08/03/2019 00UTC	08/03/2019	66	Linz-Wels	Austria
Flash Flood	08/03/2019 00UTC	08/03/2019	66	Passau, Landkreis	Austria,Germany
Flash Flood	09/03/2019 12UTC	10/03/2019	42	South Ayrshire	United Kingdom
Flash Flood	10/03/2019 00UTC	10/03/2019	72	Crimea	Ukraine
Flash Flood	10/03/2019 00UTC	10/03/2019	84	None	Greece
Flash Flood	10/03/2019 12UTC	11/03/2019	42	East Cumbria	United Kingdom
Flash Flood	11/03/2019 00UTC	11/03/2019	48	Fthiotida	Greece
Flash Flood	11/03/2019 00UTC	11/03/2019	54	Fokida	Greece
Flash Flood	11/03/2019 00UTC	11/03/2019	48	Burgas	Bulgaria
Flash Flood	11/03/2019 00UTC	11/03/2019	54	Larisa	Greece
Flash Flood	11/03/2019 12UTC	12/03/2019	42	Magnisia	Greece
Flash Flood	11/03/2019 12UTC	12/03/2019	48	Vastra Gotaland	Sweden
Flash Flood	11/03/2019 12UTC	12/03/2019	54	Irakleio	Greece
Flash Flood	11/03/2019 12UTC	12/03/2019	48	Hallands lan	Sweden
Flash Flood	11/03/2019 12UTC	12/03/2019	42	Thessaly and Central	Greece
Flash Flood	12/03/2019 00UTC	12/03/2019	24	Boiotia	Greece
Flash Flood	13/03/2019 00UTC	13/03/2019	54	Jura	France
Flash Flood	13/03/2019 12UTC	14/03/2019	72	Muhlviertel	Austria
Flash Flood	13/03/2019 12UTC	14/03/2019	48	Haut-Rhin	France
Flash Flood	13/03/2019 12UTC	14/03/2019	66	Freudenstadt	Germany
Flash Flood	13/03/2019 12UTC	14/03/2019	66	Rhon-Grabfeld	Germany
Flash Flood	13/03/2019 12UTC	14/03/2019	72	Passau, Kreisfreie Stadt	Germany
Flash Flood	13/03/2019 12UTC	14/03/2019	72	Cham	Germany
Flash Flood	14/03/2019 00UTC	14/03/2019	42	Kralovehradecky kraj	Ireland
Flash Flood	14/03/2019 00UTC	15/03/2019	66	West	Czech Republic
Flash Flood	14/03/2019 12UTC	15/03/2019	48	Bihor	Romania
Flash Flood	14/03/2019 12UTC	15/03/2019	54	North Yorkshire CC	United Kingdom
Flash Flood	14/03/2019 12UTC	15/03/2019	60	Gwynedd	United Kingdom
Flash Flood	14/03/2019 12UTC	15/03/2019	48	Maramures	Romania
Flash Flood	15/03/2019 00UTC	15/03/2019	42	Powys	United Kingdom
Flash Flood	15/03/2019 00UTC	15/03/2019	36	Mostviertel-Eisenwurzen	Austria
Flash Flood	15/03/2019 00UTC	15/03/2019	36	South-West (IE)	Ireland
Flash Flood	15/03/2019 00UTC	15/03/2019	42	Conwy and Denbighshire	United Kingdom
Flash Flood	15/03/2019 00UTC	15/03/2019	36	East Cumbria	United Kingdom
Flash Flood	15/03/2019 00UTC	15/03/2019	42	South West Wales	United Kingdom
Flash Flood	15/03/2019 12UTC	16/03/2019	24	Innviertel	Austria
Flash Flood	15/03/2019 12UTC	16/03/2019	24	Deggendorf	Germany
Flash Flood	15/03/2019 12UTC	16/03/2019	24	Regen	Germany
Flash Flood	15/03/2019 12UTC	16/03/2019	24	Linz-Wels	Austria
Flash Flood	15/03/2019 12UTC	16/03/2019	24	Passau, Landkreis	Germany
Flash Flood	15/03/2019 12UTC	16/03/2019	24	Cham	Germany
Flash Flood	16/03/2019 00UTC	16/03/2019	42	Stockholms lan	Sweden
Flash Flood	24/03/2019 00UTC	24/03/2019	78	Dnipropetrovs'k	Ukraine
Flash Flood	25/03/2019 12UTC	26/03/2019	72	Fthiotida	Greece
Flash Flood	26/03/2019 12UTC	27/03/2019	48	Cosenza	Italy
Flash Flood	27/03/2019 00UTC	27/03/2019	72	Irakleio	Greece
Flash Flood	27/03/2019 12UTC	28/03/2019	66	Lasithi	Greece
Flash Flood	27/03/2019 12UTC	28/03/2019	60	Rethimni	Greece

Flash Flood	28/03/2019 00UTC	28/03/2019	36	Xania	Greece

* 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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