ECMWF

European Flood Awareness System

EFAS *Bulletin*

June – July 2014

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Copernicus · European Commission · ECMWF · SMHI · SHMU · ELIMCO SISTEMAS · Rediam

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), since 2002, in close collaboration with national hydrological and meteorological services, the Monitoring and Information Centre (MIC) of the European Civil Protection Mechanism, and other research institutes.

Since 2011, EFAS is part of the initial operations of the Copernicus (formerly GMES) Emergency Management Service, (GIO EMS) and was transferred to operational service in 2012 through public tender procurement.

As a result of the procurement procedure,

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 MIC.

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.

The work related to the EFAS Meteorological data collection centre has been outsourced but onsite the JRC. Finally, the JRC is responsible for the overall project management related to EFAS and further development.

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Cover image: Destruction after the flash flood in the district of Asparuhovo, Varna, Bulgaria- Friday June 20, 2014

EFAS news

Meetings

The European Commission hosted a Donors' Conference in Brussels on 16 July to mobilise further support to Bosnia and Herzegovina and Serbia in the aftermath of the recent floods. The conference was co-organised with France and Slovenia. One of the main conclusions of this conference was that Serbia and Bosnia Herzegovina need to improve their disaster risk reduction capacities, mechanisms and infrastructures. This includes the further introduction of early warning systems at all levels. EFAS will support and contribute to this effort. Further information: http://ec.europa.eu/enlargement/news_corner/floods/index_en.htm

EFAS results

Meteorological situation for June -July 2014

The weather in June was dry or normal for the most parts of Europe, with the exception of south-east Europe, from Italy across the Balkans, which received large rain amounts in mid-June through very intense storms (Figure 5 and Figure 6). The intense storm over North-Eastern Bulgaria produced more than 100 mm of rain within a few hours, causing massive destruction to the low-lying part of Varna, where houses and cars were washed away and 16 people were killed (see meteorologists' comment below).

July 2014 saw intensification of the June pattern with hot and dry weather in northern Europe and unusually wet and cold weather in the middle and southern parts of Europe (Figure 7 and Figure 8). This extreme situation was caused by a blocking, with a high pressure over the north of Europe and a trough with a lot of convection in the south (Figure 2). For more details about the situation, see the "meteorologists' comment below. The rain outbreaks led to a number of flood warnings and alerts in the affected areas, but there were also numerous reports of flash floods in other parts of Europe, not only in the south. The unusual wet and cold weather in southern Europe was countered by the extreme hot and dry weather in Northern Europe, the most northern part of Sweden experienced the warmest July on record.

Summary of EFAS flood alerts for June - July 2014

EFAS Flood Alerts and Flood Watches sent in June - July 2013 are summarized in Table 1 and their location is shown in Figure 9 and Figure 10.

Summary of flash flood watches for June - July 2014

There were no flash floods issued in June or July 2014, though there were quite a few incidents. None of these showed a strong enough signal in COSMO-LEPS to trigger a warning. This could be due to the inability of the models to correctly predict deep convective storms. For an analysis of the situation, see meteorologists' comment further down in this bulletin.

Table 1: EFAS flood alerts sent in June-July 2014

Type	Forecast date	Issue date	Lead time*	River	Country
Watch	04/06/2014 12 UTC	05/06/2014	2	Muoniojoki	Finland
Watch	12/06/2014 12 UTC	13/06/2014	2	Po, above Dora Baltea	Italy
Watch	14/06/2014 00 UTC	14/06/2014	1	Tanaro	Italy
Watch	18/06/2014 12 UTC	19/06/2014	0	Danube, section Arges - Ialom	Romania
Alert	19/07/2014 12 UTC	20/07/2014	1	Rhone, above Saone	France
Watch	20/07/2014 00 UTC	20/07/2014	1	Doubs	France
Alert	26/07/2014 12 UTC	27/07/2014	2	Jiu	Romania
Watch	26/07/2014 12 UTC	27/07/2014	2	Olt	Romania
Watch	29/07/2014 12 UTC	30/07/2014	3	Ogosta	Bulgaria
Alert	30/07/2014 12 UTC	31/07/2014	1	Timok	Serbia
Watch	30/07/2014 12 UTC	31/07/2014	0	Morava, above Nisava	Serbia

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

Meteorologists' comment on recent weather

by Linus Magnusson, Ivan Tsonevsky and Fredrik Wetterhall

An unstable air mass triggered a lot of convection accompanied by severe thunderstorms, hail and torrential rain across Bulgaria from 15 to 19 June 2014. A strong synoptic-scale forcing also played a role. At the time of the heaviest rain over NE Bulgaria in the evening on 19 and in the morning on 20 June a rapid cyclogenesis occurred over the Black Sea just offshore the Bulgarian coast. The deep cyclone that formed moved to the north and then to the east turning the wind from E to NW over Bulgaria. ECMWF's ENS and COSMOLEPS captured the event, but underestimated the severity and placed the maximum rainfall out to sea (Figure 1).

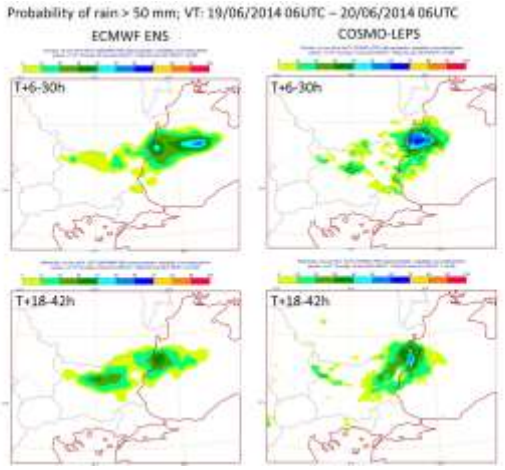

Figure 1. Probability of rain above 50 mm/24h from ECMWF ENS (~32 km, left column) and COSMO LEPS (~10 km, right column) for the lead times 6-24 hours (top) and 18-42 hours (bottom).

In July the weather over Europe was dominated by a blocking over Scandinavia with a persistent trough over southern Europe (Figure 2). The trough creates stratification in the atmosphere which favours convection. In the front zone between the warm air in east/north and the colder air in west, severe thunderstorms were triggered and caused flash floods in various places in the middle/southern Europe. The same weather regime was responsible for the warm and dry weather over Northern Europe.

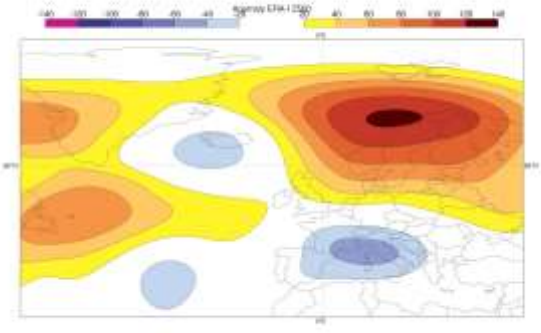

Figure 2. Anomaly of geopotential height at 500 hPa for July 2014 from ERA-Interim reanalysis.

ECMWF's global model has problem to capture the maximum precipitation in convective systems. Sometimes the horizontal scale of the most intense precipitation is smaller than the model grid scale and the precipitation peaks are therefore not represented in the grid box mean. Flash floods due to convection in mountainous areas is also challenging for weather models. Convection-permitting models are needed to really overcome this deficiency.

Verification

The verification of EFAS performance was recently published in Journal of Hydrology (see Alfieri et al, 2014 listed in new publications). Figure 3 below show the performance of EFAS driven by ECMWF ENS for lead time 5 Using CRPSS. Only catchments >4000km^2 is shown. The performance increases over time, but there are also large variations.

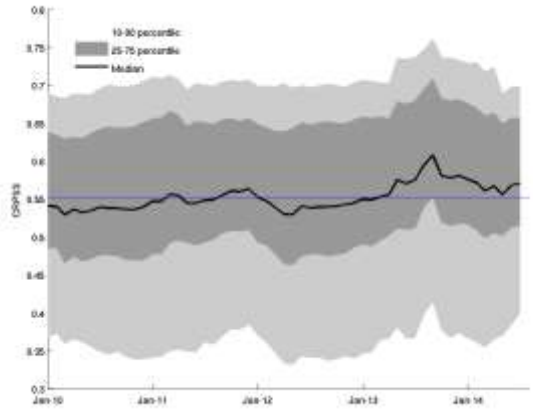

Figure 3.CRPSS for the period Jan 2010 - Jul 2014 for catchments >4000km^2 and lead time 5 days. The blue line denotes the mean over the entire period

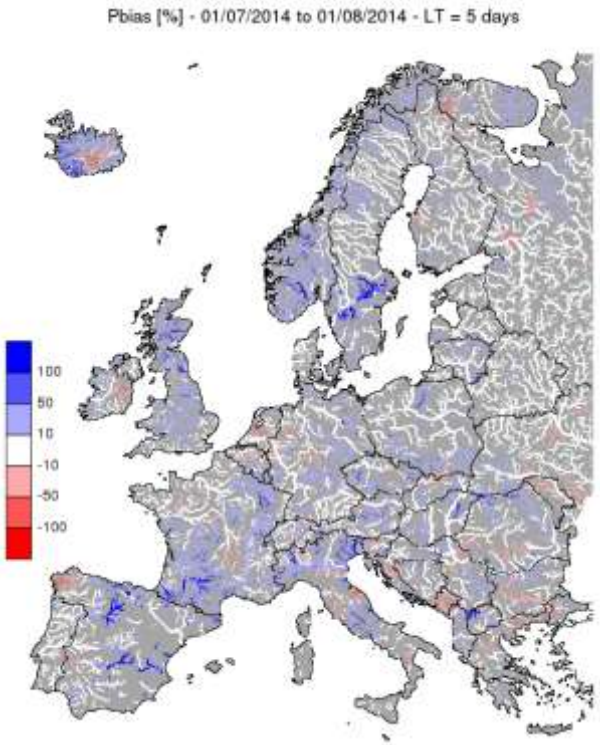

Figure 4. Percentage bias for lead time 5 days for EFAS driven by ECMWF ENS.

The verification plot above shows the percentage bias for July 2014. The plot shows a mixed picture of the bias, but the areas that received most precipitation show a dry bias (red; Figure 4). Another interesting feature is the apparent wet bias over the big lakes in central Sweden. There was no rainfall and at the same time very warm during this period. The reason for this bias could be that the lakes are too cold lakes in the ECMWF model, however this is currently under investigation. The lake model in ECMWF IFS will soon be upgraded, and the new version will be more dynamic.

Results from the EFAS Survey 2014

by Jutta Thielen and Peter Salamon

The survey was conducted at the EFAS annual meeting in Lelystad, The Netherlands and 25 answers from the participants. In case an answer was left out it was counted as "neutral".

EFAS in general

Overall, the satisfaction with the overall EFAS was rated above average with 16/25 high or very high and none with very low or low. Regarding the performance of EFAS for 2013, more than half rated their satisfaction as high or very high (14/25), about a third of the participants ticked "neutral" (8/25) and three rated their satisfaction as "low". From the survey it cannot be determined why the satisfaction was low and if it was because of EFAS performance regarding floods or flash flood events. Possibly the results are reflecting that the Elbe and Danube flooding of 2013 were captured relatively late by EFAS and not – or not much – earlier than the national services.
The value of probabilistic forecasting is rated with very high with 17/25 and only 1 participant rated the value low. The highest number of "neutral" votes (11/25) received the question of the overall interest of the organisation in EFAS, indicating that communication between EFAS and the national partners as well as within the organisations can be improved.

EFAS products

The questions that prompted more than 50% of "agree" or "strongly agree" were
- Appreciate that EFAS keeps evolving with new products (96%)
- EFAS products represent added value for the (national) organisations (64%),
- flashflood indicator is useful (56%) and
- would like to see more satellite data (52%).

The questions that prompted high percentage "strongly disagree" or "agree" were
- New products stimulate new development in my organisation (28%)
- Organisation is aware of Copernicus EMS (24%)
- landslides susceptibility information is useful (20%)
- EFAS would have more presence in our organisation if EFAS products could be loaded directly into our local systems, e.g. through web-services (20%)

It can be concluded that more communication on Copernicus EMS would be useful, in particular since a high number of participants would like to see more satellite products. Overall, the development of new products in EFAS is seen favourably and an added value for the organisations. The fact that new EFAS products do not stimulate new development could indicate that the training on EFAS products could be improved.

Skill, performance and trust

Almost all participants (96%) would like to have a measure how well the model performs in simulating past events, and most (76%) of all participants agreed that the skill of EFAS has increased over the years.

Regarding the trust in EFAS results, 72% of all participants agree or strongly agree that EFAS information is followed by action in the organisation, for example a check in the local system for more information. Only 1 participant did not agree.
Most participants (88%) agreed or strongly agreed that EFAS information is appreciated even if the probabilities are low and the events did not occur.

Service
The large majority of participants agree or strongly agree that the workshops are well organised (88%) and 96% agree or strongly agree that they would like to participate again next year. However, most of the participants also agree or strongly agree that more training should be offered through EFAS (76%). From the survey it would appear that the many of participants are not clear whether training provided in EFAS is transferred within the local organisations (44%), while 16% would disagree of strongly disagree that EFAS training is NOT transferred to the organisation. However, 40% would agree or strongly agree that EFAS training is not transferred to the local organisation.
The survey results indicate that the level of information provided in EFAS emails or alerts is adequate. Only 8% of all participants think that the EFAS information contains too much information while 64% disagree with this statement.
Regarding the system itself, 84% are satisfied with the complexity of the EFAS interface and 72% of the participants connect regularly to the interface. However, there are also 20% which do not connect regularly.
More than 60% of participants agree or strongly agree that EFAS bulletins are interesting and read in the organisation.
72% of the participants agree or strongly agree that EFAS is useful for EU Civil protection and 68% agree or strongly agree that EFAS created a strong network for operational hydrology.

Concluding remarks
The participants of EFAS are in general satisfied with EFAS, and it is clear that the development of EFAS is seen as important. Therefore it is vital that the system continues to develop. The skill of EFAS will continue to improve in a foreseeable future as the models and methodology of EFAS improves.

It is also clear that there are things that can be further improved. There is still a strong wish for more validation of the skill of EFAS. Even though forecast skills are routinely displayed within the bulletin, it does not seem to be enough, more effort and new ways to present the skill is needed. The bulletins seem to be fairly appreciated, but a new format of sharing the information in the bulletins could result in higher uptake and understanding of the skill. There is also a need for more training, and transferring this information to the local organisations.
It would appear that the survey confirms earlier statements of EFAS partners that the missed events are perceived more negative than false alarms.

Recent team publications

Alfieri, L., Pappenberger, F., Wetterhall, F., Haiden, T., Richardson, D. and Salamon, P.: Evaluation of ensemble streamflow predictions in Europe, Journal of Hydrology, 517, 913–922, doi:10.1016/j.jhydrol.2014.06.035, 2014.

Dutra, E., Wetterhall, F., Di Giuseppe, F., Naumann, G., Barbosa, P., Vogt, J., Pozzi, W. and Pappenberger, F. (2014), Global meteorological drought - Part 1: Probabilistic monitoring, Hydrology and Earth System Sciences, doi:10.5194/hess-18-2657-2014, 18, 2657-2667.

Dutra, E., Pozzi, W., Wetterhall, F., Di Giuseppe, F., Magnusson, L., Naumann, G., Barbosa, P., Vogt, J. and Pappenberger, F. (2014), Global meteorological drought - Part 2: Seasonal forecasts, Hydrology and Earth System Sciences, doi: 10.5194/hess-18-2669-2014, 18, 2669-2678.

Raynaud, D., Thielen, J., Salamon, P., Burek, P., Anquetin, S. and Alfieri, L. (2014), A dynamic runoff coefficient to improve flash flood early warning in Europe: evaluation on the 2013 central European floods in Germany. Met. Apps. doi: 10.1002/met.1469

Wanders, N., Karssenberg, D., de Roo, A., de Jong, S. M., and Bierkens, M. F. P.: The suitability of remotely sensed soil moisture for improving operational flood forecasting, Hydrol. Earth Syst. Sci., 18, 2343-2357, doi:10.5194/hess-18-2343-2014, 2014.

Appendix - figures

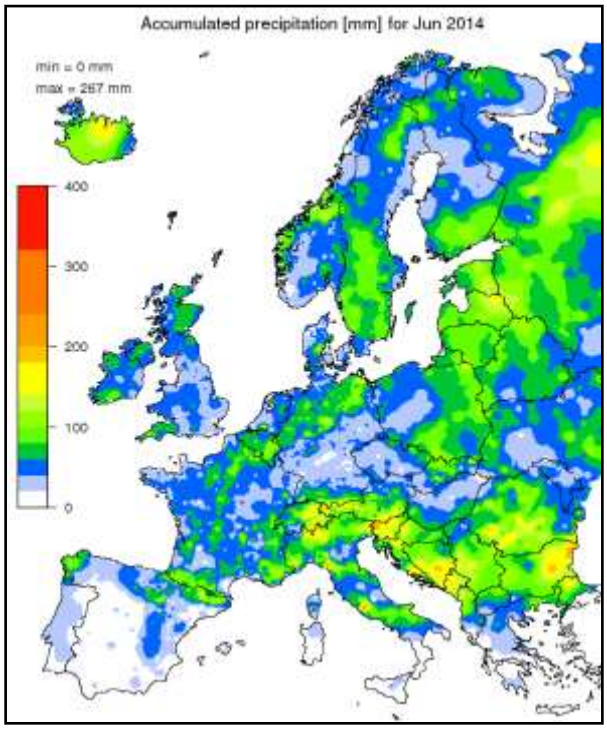

Figure 5: Accumulated precipitation [mm] for June 2014.

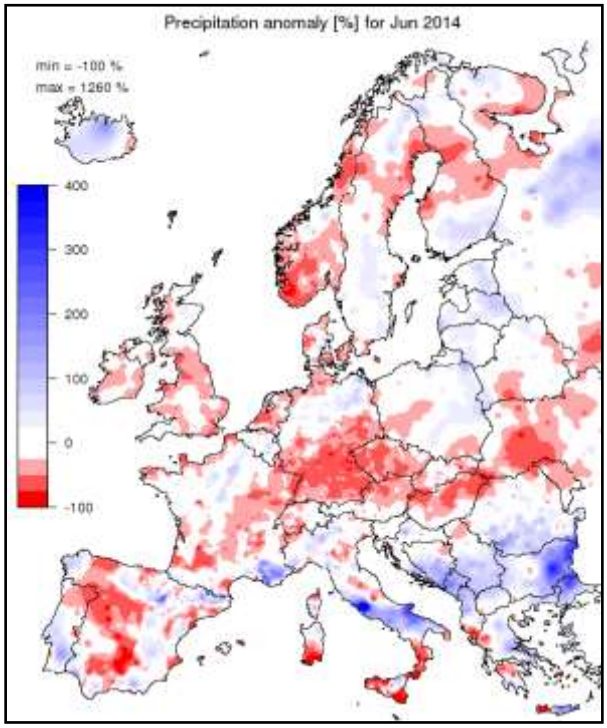

Figure 6: Precipitation anomaly [%] for June 2014, relatively to a long term average (1990-2011).

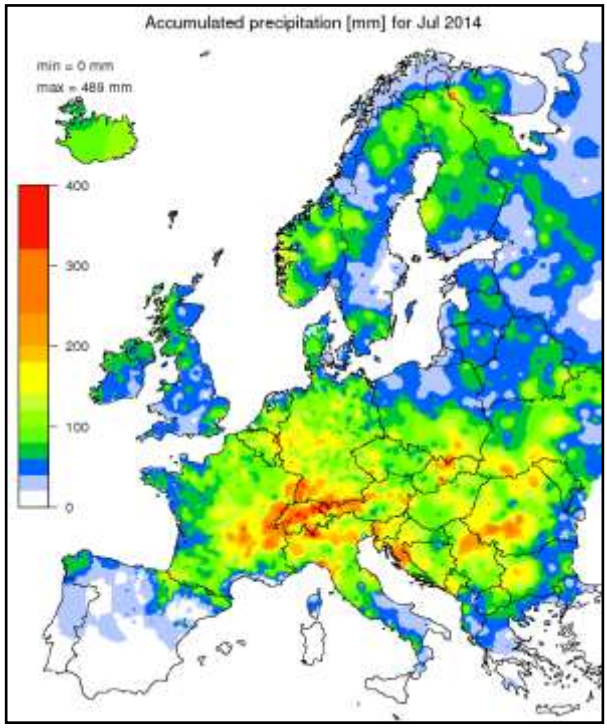

Figure 7: Accumulated precipitation [mm] for July 2014.

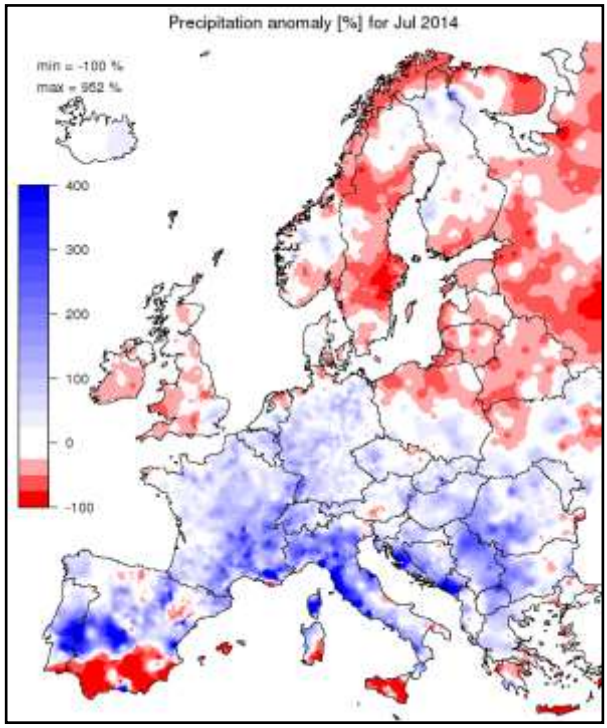

Figure 8: Precipitation anomaly [%] for July 2014, relatively to a long term average (1990-2011).

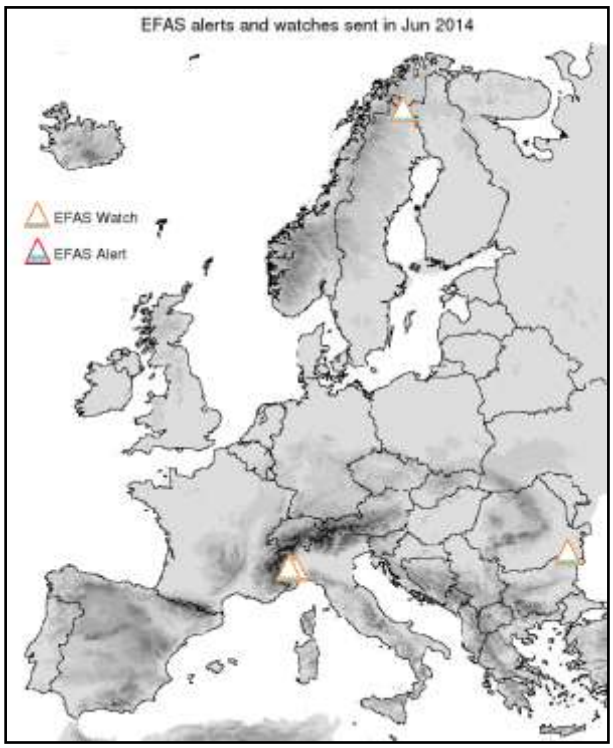

Figure 9: EFAS flood alerts and watches for June 2014.

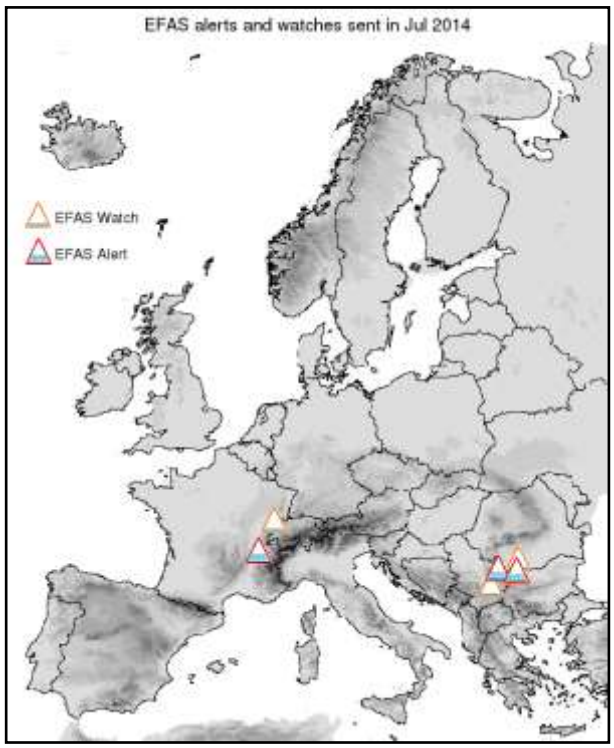

Figure 10: EFAS flood alerts and watches for July 2014.

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- All data providers, including meteorological data providers, hydrological services and weather forecasting centres.
- The EFAS Operational Centres.