European Flood Awareness System

EFAS *Bulletin*

April – May 2013

Issue 2013(3)

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: Group picture - EFAS Annual Meeting 2013, Bratislava, Slovakia.

EFAS news

8th EFAS Annual Meeting

The 8th EFAS Annual meeting was held in Bratislava, on the 24th-25th April 2013. This year's event was organized by the Slovak Hydro-Meteorological Institute (SHMU). 44 participants from 25 institutions attended the meeting, including a number of EFAS Partners, the 4 EFAS Operational Centres and a representative of Copernicus.
The meeting program included an overview of the current status of EFAS from the Operational Centres, a presentation of Copernicus Emergency Service, a summary of the latest and forthcoming system developments, discussion on the conditions of access for EFAS Partners, presentations on the status of flood forecasting given by two partners who recently joined the EFAS network (Flood Forecasting Centre, UK, and Office of Public Works, Ireland), feedback on the floods of the past year from the EFAS Partners, and training on the new features of the EFAS web interface.

Inauguration of the Emergency Response Centre of the European Commission

The European Commission's central platform for disaster response, the Emergency Response Centre (ERC), was inaugurated on the 15th May in Brussels by President Barroso and Commissioner Georgieva, responsible for International Cooperation, Humanitarian Aid and Crisis Response.
The new Emergency Response Centre succeeds the Monitoring and Information Centre (MIC), as with a growing number of emergency operations the MIC had outgrown its facilities. The ERC will be operational on a 24/7 basis and will receive and analyse appeals for assistance from affected countries and serve as a hub to support coordination at various levels: Commission, Member States, the affected country, humanitarian partners and civil protection teams deployed on the field. With regards to flood forecasting and monitoring the ERC relies extensively on the flood predictions of EFAS. During the inauguration, Jutta Thielen and Peter Salamon, from the JRC, demonstrated the functionalities of the EFAS system to interested visitors.

New partners

The River Basin Management Authority Miño-Sil, from Spain (http://chminosil.es), has become an EFAS partner on May 17th 2013. Since then, EFAS Flood Alerts/Watches and Flash Flood Watches will be issued in case significant risk of flooding is detected in their basin area, in northwest Spain.

EFAS results

Meteorological situation for April - May 2013

In April 2013, the largest monthly accumulations of precipitation were recorded in NW Italy and Southern Switzerland, with maxima around 470 mm (see Figure 5). In the same areas are located the highest monthly anomalies, together with SE Spain, part of France and Scotland (Figure 6). On the other hand, negative precipitation anomalies had an overall larger extent, covering large areas in Portugal, S Italy, Greece, UK and countries facing the North Sea, Sweden and various patches in Central/Eastern Europe[1].

Significantly wetter conditions were recorded in May 2013, with monthly accumulations of precipitation larger than 150 mm in vast areas of Central Europe and Norway, and maxima in SW France, Switzerland, Germany, Austria, N Italy, Slovenia and Croatia (Figure 7). Positive monthly anomalies interested the whole central Europe, spreading west to east from France to Romania and south to north from Albania to the Southern Norway (Figure 8).
Severe precipitation had persisted over Central Europe in the first days of June, leading to widespread flooding mostly within the Danube, Rhine, Elbe and Oder river basins.

Summary of EFAS flood alerts for April - May 2013

EFAS Flood Alerts and Flood Watches sent in April - May 2013 are summarized in Table 1 and Table 2 and shown in Figure 9 and Figure 10.

[1] Spatial interpolations of precipitation and anomalies for Iceland are not meaningful as they are based on a range of 1÷5 point measurements received per day.

Table 1: EFAS flood alerts of April 2013

Type	Forecast date	Issue date	Lead time*	River	Country
Alert	01/04/2013 12 UTC	02/04/2013	6	Danube, section Timok - Jiu	Romania
Watch	02/04/2013 00 UTC	02/04/2013	1	Zala-Balaton-Sio	Hungary
Watch	02/04/2013 12 UTC	03/04/2013	2	Sava, below Drina	Serbia
Alert	07/04/2013 12 UTC	08/04/2013	6	Dnester, above Reut	Moldova
Watch	07/04/2013 12 UTC	08/04/2013	2	Tisza, section Mures - Tamis	Romania
Alert	09/04/2013 00 UTC	09/04/2013	7	Bug, above Mukhavyets	Belarus
Alert	08/04/2013 12 UTC	09/04/2013	7	Wieprz	Poland
Alert	09/04/2013 12 UTC	10/04/2013	6	Bug, above Mukhavyets	Belarus
Alert	09/04/2013 12 UTC	10/04/2013	7	Nevezis	Lithuania
Alert	10/04/2013 12 UTC	11/04/2013	6	Merkys	Lithuania
Watch	20/04/2013 12 UTC	21/04/2013	1	Po, section Adda - Oglio	Italy
Alert	25/04/2013 12 UTC	26/04/2013	0	Po, section Adda - Oglio	Italy

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

Table 2: EFAS flood alerts of May 2013

Type	Forecast date	Issue date	Lead time*	River	Country
Alert	12/05/2013 12 UTC	13/05/2013	0	Po, section Adda - Oglio	Italy
Alert	16/05/2013 12 UTC	17/05/2013	4	Vorma	Norway
Alert	16/05/2013 12 UTC	17/05/2013	5	Lainioalven	Sweden
Watch	20/05/2013 12 UTC	21/05/2013	0	Adda	Italy
Alert	27/05/2013 12 UTC	28/05/2013	0	Unstrut	Germany
Watch	28/05/2013 12 UTC	29/05/2013	2	Sebes Koros, Crisul Repede	Hungary
Alert	30/05/2013 00 UTC	30/05/2013	3	Saale, below Elster	Germany
Alert	30/05/2013 00 UTC	30/05/2013	1	Neckar	Germany
Alert	29/05/2013 12 UTC	30/05/2013	4	Rhine	Germany
Alert	29/05/2013 12 UTC	30/05/2013	2	Barycz	Poland
Alert	29/05/2013 12 UTC	30/05/2013	2	Saale, below Elster	Germany
Alert	31/05/2013 00 UTC	31/05/2013	2	Inn	Germany
Alert	31/05/2013 00 UTC	31/05/2013	2	Danube	Austria
Alert	30/05/2013 12 UTC	31/05/2013	0	Glomma	Norway
Alert	30/05/2013 12 UTC	31/05/2013	0	Vorma	Norway
Alert	30/05/2013 12 UTC	31/05/2013	2	Main, below Regnitz	Germany
Alert	30/05/2013 12 UTC	31/05/2013	3	Danube, section Isar - Inn	Germany
Watch	31/05/2013 00 UTC	31/05/2013	1	Elster	Germany

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

Summary of flash flood watches for April - May 2013

In April 2013, 2 flash flood reporting points were detected by EPIC (Figure 11), having probability higher than 60% of exceeding the high threshold (5-year return period). The forecast lead time of the predicted storm peaks is of 12 hours. Catchment size of flash flood alerts is in the range 109 - 414 km^2, with average size of 262 km^2.

In May 2013, 10 flash flood reporting points were detected by EPIC (Figure 12), having probability higher than 60% of exceeding the high threshold (5-year return period). The forecast lead time of the predicted storm peaks is in the range 6 - 54 hours, with average lead time of 29 hours. Catchment size of flash flood alerts is in the range 67 - 4376 km^2, with average size of 1069 km^2.

Based on these points EFAS Flash Flood watches have been sent to the corresponding EFAS partners for various locations in NW Italy (16th May), Adriatic coast of Central Italy (23rd May) and Eastern Hessen, Germany (26th May).

Forecast verification

The Root Mean Squared Error (RMSE) has long been used to assess the magnitude of the error of deterministic forecasts. It has the advantage that it retains the units of the forecast variable and it includes the effect of both bias and variance of estimation. In addition, the RMSE depends on a quadratic function of the estimation residuals. This lead to some peculiarities, among which: 1) it is highly affected by few large errors and 2) it is often used as error function to be minimized in a wide range of calibration and optimization processes. On the other hand it is difficult to compare RMSE values among different river stations, as their climatological discharge values may be substantially different. One option to compare the RMSE at different locations is to rescale it by the average discharge, so that resulting values become dimensionless. The resulting score is commonly referred to as coefficient of variation (CV) of the RMSE and, as for the RMSE, values close to zero are preferable. Also, CV values close to 1 means that the RMSE of estimation is of the same order of the average discharge, thus it can be associated to an inverse of the signal-to-noise ratio. By definition the CV penalizes river reaches with low average discharge compared to its variability, therefore higher CV values are expected in small or flash-flood prone river basins, as those along the Mediterranean coast.
Maps in Figure 1 and 2 show the coefficient of variation (CV) of the RMSE of the streamflow prediction, which is the RMSE of estimation divided by the average discharge at each cell. Figures refer to the ensemble mean of the hydrological simulations driven by the ECMWF 51-member ensemble forecasts, and are shown for lead times (LT) of 3 and 7 days, from 1/10/2012 onwards.

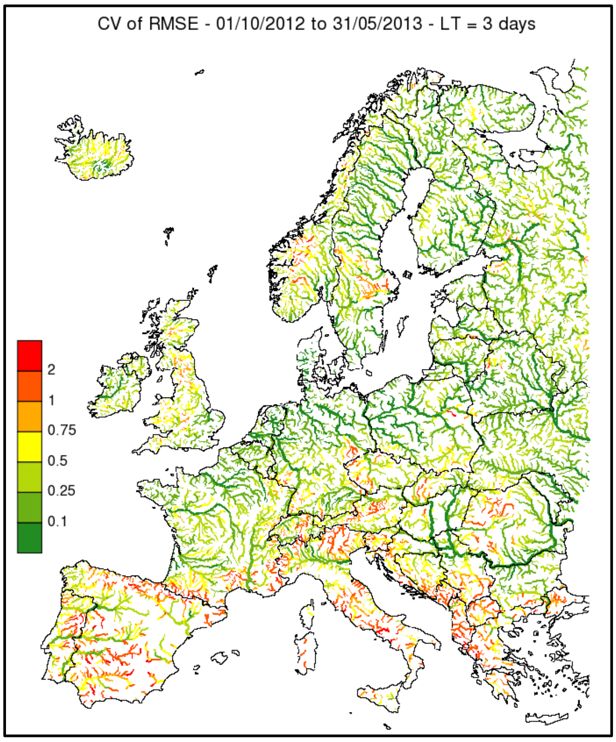

Figure 1: Coefficient of variation of the RMSE of ECMWF discharge ensemble mean from October 2012 onwards, 3-day lead time.

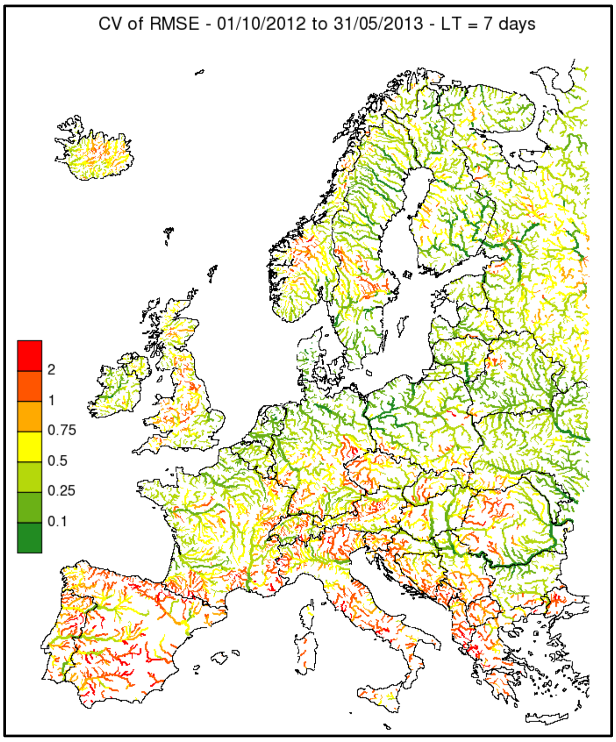

Figure 2: Coefficient of variation of the RMSE of ECMWF discharge ensemble mean from October 2012 onwards, 7-day lead time.

Case study - 22/5/2013 - Flood in the Vorma River (NO)

Heavy rainfall on Wednesday 22nd May resulted in huge floods in southern Norway. The situation was worsened by a sudden rise of temperature and consequent snow melt in the higher regions. The result was far more water than rivers and drainage systems could handle. Norway's "News in English" Reported: "Major flood warnings were posted in Oppland, Buskerud, Telemark and Hedmark counties, with flooding occurring in Akershus as well. The area around Svingen station at Fetsund in Akershus was also under water Wednesday morning."

Authorities have reported that at least 300 people have been evacuated from their homes. There has been disruption of transport with rail and road both affected.

An EFAS flood alert was sent on the 17th May to the Norwegian Water Resources and Energy Directorate, for possible flooding from Wednesday 22nd of May onwards. According to EFAS forecasts of 2013-05-16 12 UTC, up to 90% of ECMWF ensemble forecasts exceeded the high threshold (> 5 year simulated return period) and up to 6% the severe threshold (>20 year simulated return period). Deterministic models from ECMWF and DWD provided similar results, though with lower discharge peak, while COSMO-LEPS is not available for this part of Europe. Figures below show a comparison between EFAS forecasts at Losna on the Vorma River (Figure 3) on 2013-05-16 12 UTC and corresponding observed discharge (Figure 4, from www.nve.no). The timing of the EFAS alert, sent with 5 days of lead time on the flood onset, was correct. Observed peak discharge in Losna corresponds to a 50-year recurrence event.

Authorities reported that the village of Kvam, upstream Losna, was particualrly badly affected. On Thursday 23rd, 250 people had to be evacuated from their homes.

(Sources: www.newsinenglish.no, theforeigner.no, efas.eu)

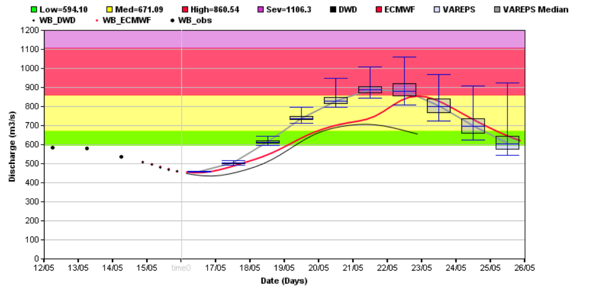

Figure 3: EFAS forecasts at Losna on the Vorma River on 2013-05-16 12 UTC.

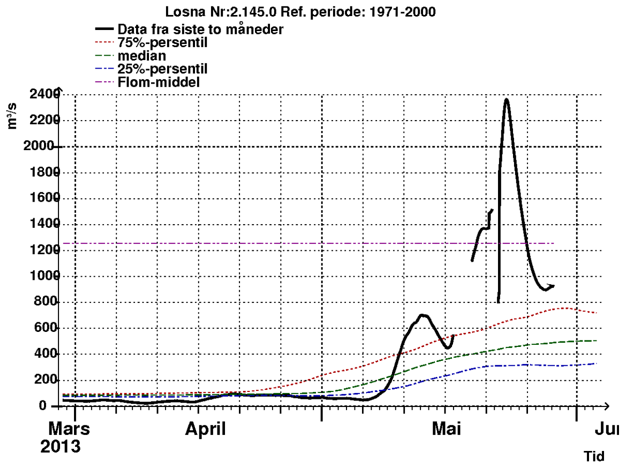

Figure 4: Observed discharge at Losna on the Vorma River (from www.nve.no, © Norwegian Water Resources and Energy Directorate).

Recent team publications

Pappenberger, F., Stephens, L., van Andel, S.J., Verkade, J., Ramos, M.H., Alfieri, L., Brown, J.D., Zappa, M., Ricciardi, G. "Operational HEPS systems around the globe" HEPEX, May 13, 2013, http://hepex.irstea.fr/operational-heps-systems-around-the-globe

Trinh, B.N., Thielen-del Pozo, J., Thirel, G., 2013. The reduction continuous rank probability score for evaluating discharge forecasts from hydrological ensemble prediction systems. Atmospheric Science Letters 14, 61–65.

Meet the EFAS team

EFAS Hydrological Data Collection Centre (HDCC)

Mercedes García-Padilla - Project Manager of the EFAS HDCC.

Mercedes is senior hydrologist and expert in water information systems at the Environmental Information Network of Andalusia (REDIAM). She holds a degree in Hydro-Geology / Environmental Geology. She is responsible for the data production and compilation section of REDIAM, where she also leads the design of the Andalusian Flood Alert System. She is member of the European Topic Centre on Spatial Information and Analysis, leading the activities for the development of ECRINS.

Rafael García-Sánchez - IT Responsible for the EFAS HDCC.

Rafael is Executive Director at ELIMCO SISTEMAS S.L. In the HDCC, he has the role of senior IT expert as well as reference contact point for IT related matters. He graduated as Industrial Engineer at the University of Seville, Spain, and then carried on his work in development, analysis, design and project management.

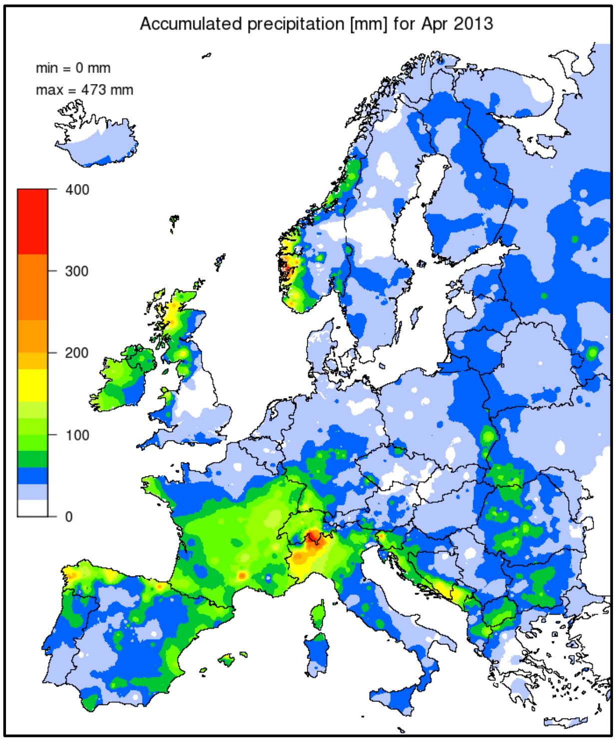

Figure 5: Accumulated precipitation [mm] for April 2013.

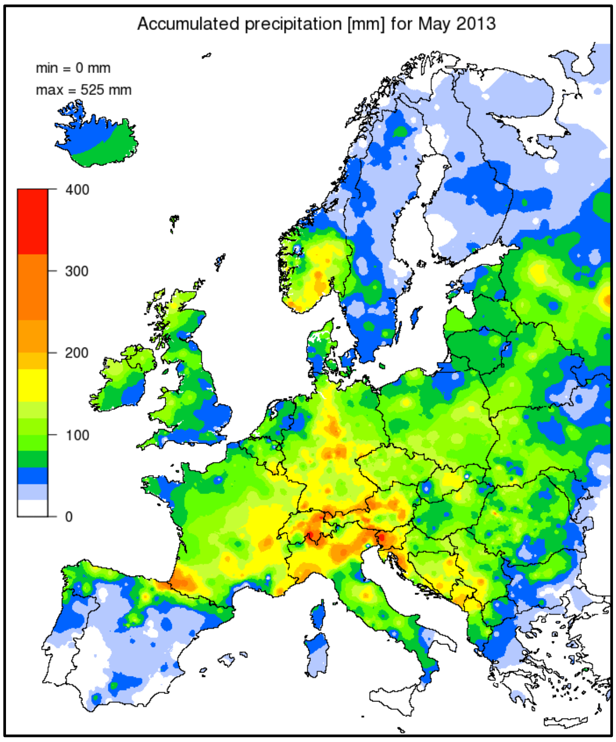

Figure 7: Accumulated precipitation [mm] for May 2013.

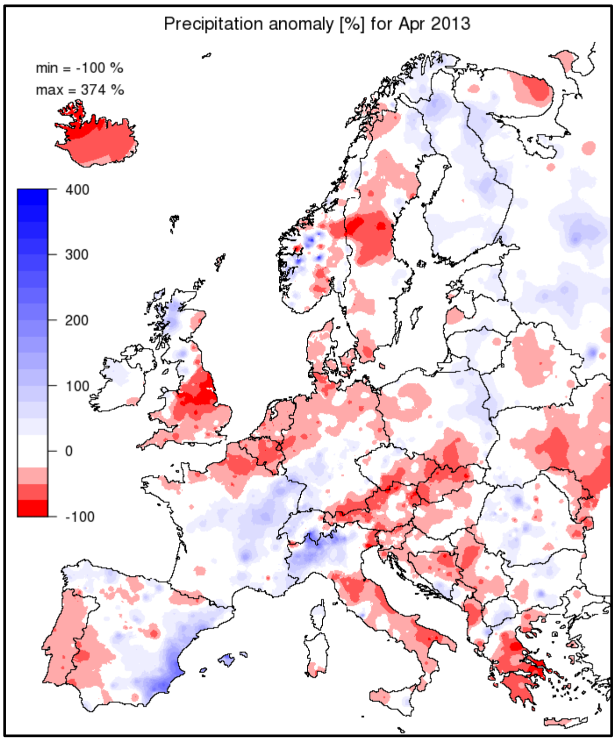

Figure 6: Precipitation anomaly [%] for April 2013, relatively to a long term average (1990-2011).

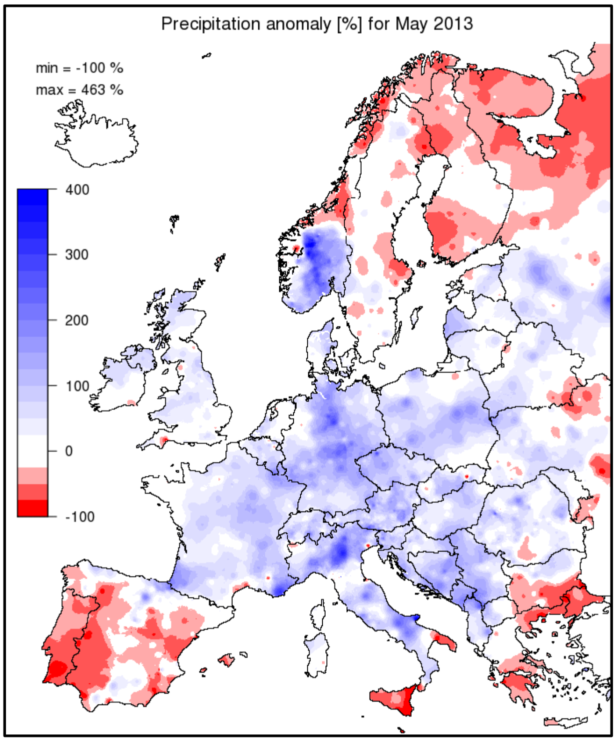

Figure 8: Precipitation anomaly [%] for May 2013, relatively to a long term average (1990-2011).

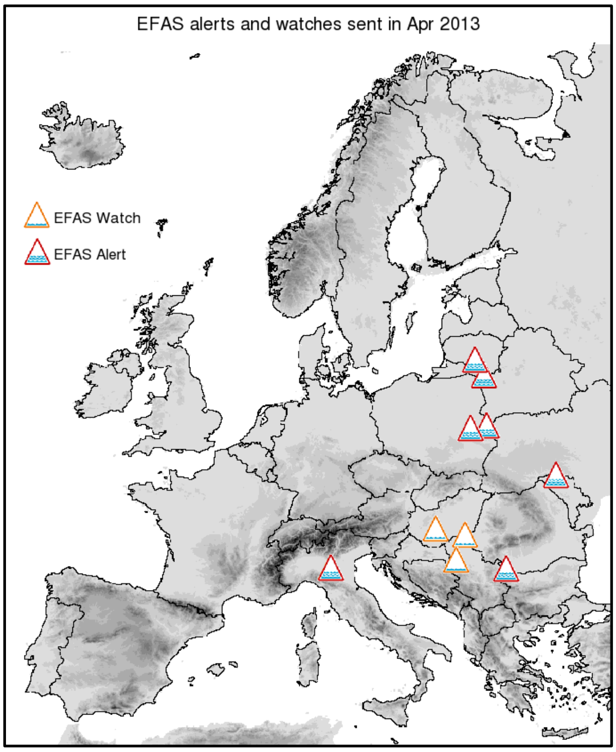

Figure 9: EFAS flood alerts and watches for April 2013.

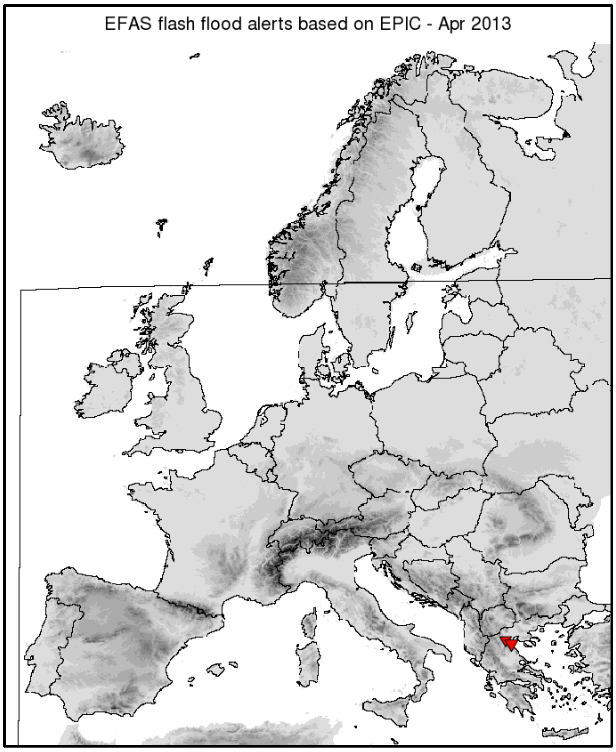

Figure 11: Flash flood reporting points for April 2013.

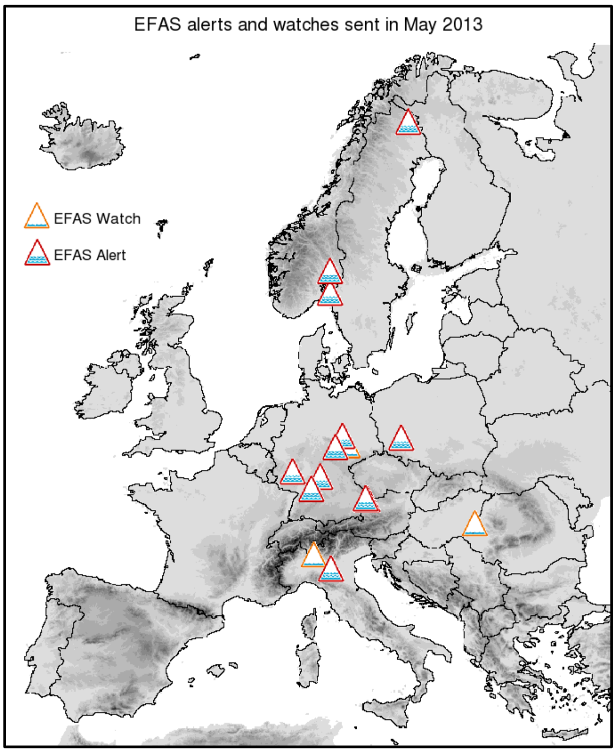

Figure 10: EFAS flood alerts and watches for May 2013.

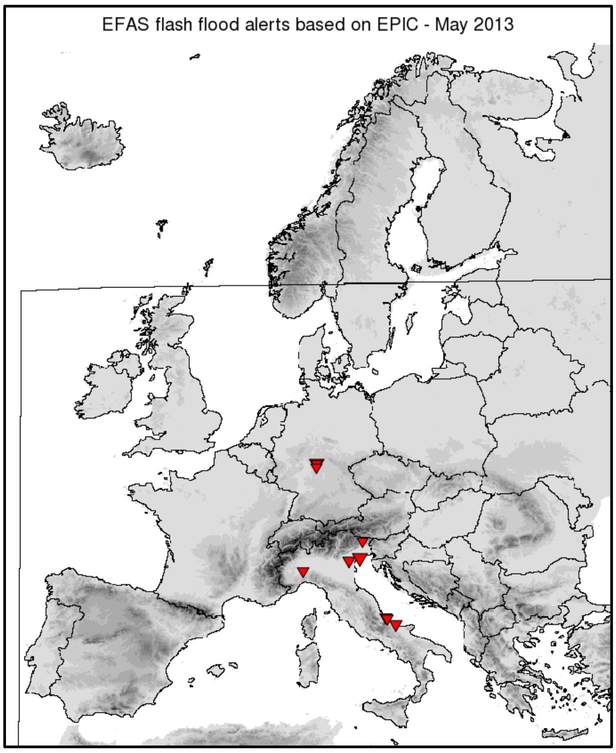

Figure 12: Flash flood reporting points for May 2013.

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- DG Enterprise - Copernicus and DG ECHO for funding the EFAS Project.
- The Norwegian Water Resources and Energy Directorate for feedback on recent flood events.
- All data providers, including meteorological data providers, hydrological services and weather forecasting centres.
- The EFAS Operational Centres.
- The Hydrological Ensemble Prediction Experiment (HEPEX) community for providing inspiration and scientific support.