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Early warning Demonstration of pan -European RAinfall-induced impacts

Roadmap for the integration of the EDERA products in EFAS

Milestone 09

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1 Identifying the Final Product Configuration and the Roadmap to Integration within EFAS

During the first phase of the EDERA project a web viewer platform has been established to showcase flash flood forecast products, including new products developed during EDERA and existing prototype products originally developed in the TAMIR project. At the end of the EDERA project, it is envisaged for a sub-set of the test products to be integrated into the EFAS web viewer and be produced in realtime in pre-operational mode, under agreement with the JRC, managing entity of the CEMS. This milestone report firstly outlines the products that were available on the EDERA web viewer during the stakeholder training workshops in November 2023. Next, feedback from the stakeholders during the workshops is presented and used to define the final product configuration in the EDERA web viewer. Finally, a subset of EDERA products is identified as candidates to be integrated into EFAS, with the associated roadmap for integration.

1.1 Identifying Final Product Configuration in EDERA Web Viewer

At the start of the EDERA project, the web viewer platform was established with 37 different summary, forecast, animation and static products which provided information about flash flood risk at the pan-European scale. However, this large number of different products could be confusing to users of the web viewer as it may be unclear which layers they should interrogate to determine the flash flood risk in their area of interest. Therefore, feedback from stakeholders was sought at two local stakeholder training workshops held in November 2023, which would identify which products were most useful. This would allow for the identification of the final configuration of products on the web viewer, as products which were not identified as being useful by stakeholders could be removed.

Table 1 below lists the products which were available on the EDERA web viewer at the time of the November 2023 training workshops:

Table 1 List of the products available on the EDERA web viewer

Product Group	Product Name
Flash flood forecast summary (0-120 h)	Official warnings
	Seamless precipitation accumulation
	Flash flood impact over sub-catchment
Storm Impact	Radar reflectivity OPERA
	Hourly precipitation – radar nowcasting
	Storm hazard
	Hail hazard

	Wind hazard
	Precipitation hazard
	Lightning hazard
	Storm impact
	Pluvial flash flood hazard in urban areas
Animated flash flood nowcasting	Official warnings
	Hourly precipitation – 80 th percentile
	Hourly precipitation – radar nowcasting (duplicates layer shown in Storm Impacts group)
	Flash flood impact over the river network
	Pluvial flood hazard in urban areas
	Flooded areas
	Flash flood impact over sub-catchment
	ERIC points
	ERIC Affected area
	Flood probability <48 h
	Rapid impact assessment
Flash flood past 24 h summary	Official warnings
	Precipitation accumulation (24 h)
	AEMET+SYNOP Raingauge accum. (24 h)
	Flash flood impact over the river network (24 h)
	Flooded area
	Flash flood impact over sub-catchment
	ERIC points

	ERIC affected area
	Flood probability <48 h
	Rapid impact assessment
Static layers	Exposure
	Flooded area (T1000)
	Flooded area (T050)
	Flooded area (T010)

During each workshop, the stakeholders were introduced to each of the products, firstly through a series of presentations which explained their purpose and potential uses. Next, the stakeholders were guided through hands-on exercises where they accessed the products through the web viewer and used them to analyse a series of case studies of past flood events which affected their areas of interest. After the hands-on exercises, stakeholders were asked to provide feedback about each of the products by attaching coloured post-it notes, whose colours represented: useful (green), moderately useful (yellow), not useful (orange) and not used (pink) to posters representing each product. Stakeholders were also encouraged to explain on the post-it notes why they had found a particular product useful/not useful etc.

The results from the feedback were digitised into online Miro boards, with one board for the [Finland workshop](#) and another for the [Portugal workshop](#) (Figure 1). Results showed that very few products were rated as not being useful. The majority of products which stakeholders had used were rated as useful, however, some of the products within the 'past 24 h summary' and 'static layers' were not used by the stakeholders. Upon further inquiry, stakeholders mentioned that they did not have sufficient time during the exercises to use these layers. However, they did not agree that these products should be removed from the web viewer, mentioning that these products could be useful for providing broader context to a flash flood event, such as the antecedent rainfall conditions.

Stakeholders fed back that the number of products on the web viewer was not necessarily a problem, so long as clear guidance was made available on how to use each of the products. This could be achieved firstly by producing a series of short instructional videos to be made on the web viewer. Suggested topics include how to load different products in the web viewer and how to interpret the information, e.g. based on one river flash flood case study and one pluvial flash flood case study. A second suggestion was to include a simple set of text instructions on the web viewer which explains to a user which products would be useful to interrogate. For example, the instructions could state that firstly a user should look at the products in the summary products tab, before looking in more detail at either the animated flash flood nowcasting or the storm impact products.

Based on the stakeholder feedback provided during the two workshops, not change are to be made on the existing product configuration on the EDERA web viewer platform. However, training and instructions materials will be added to the web viewer to assist the product usability. Finally,

stakeholder feedback provided during the demonstration phase will be used to further refine the products.

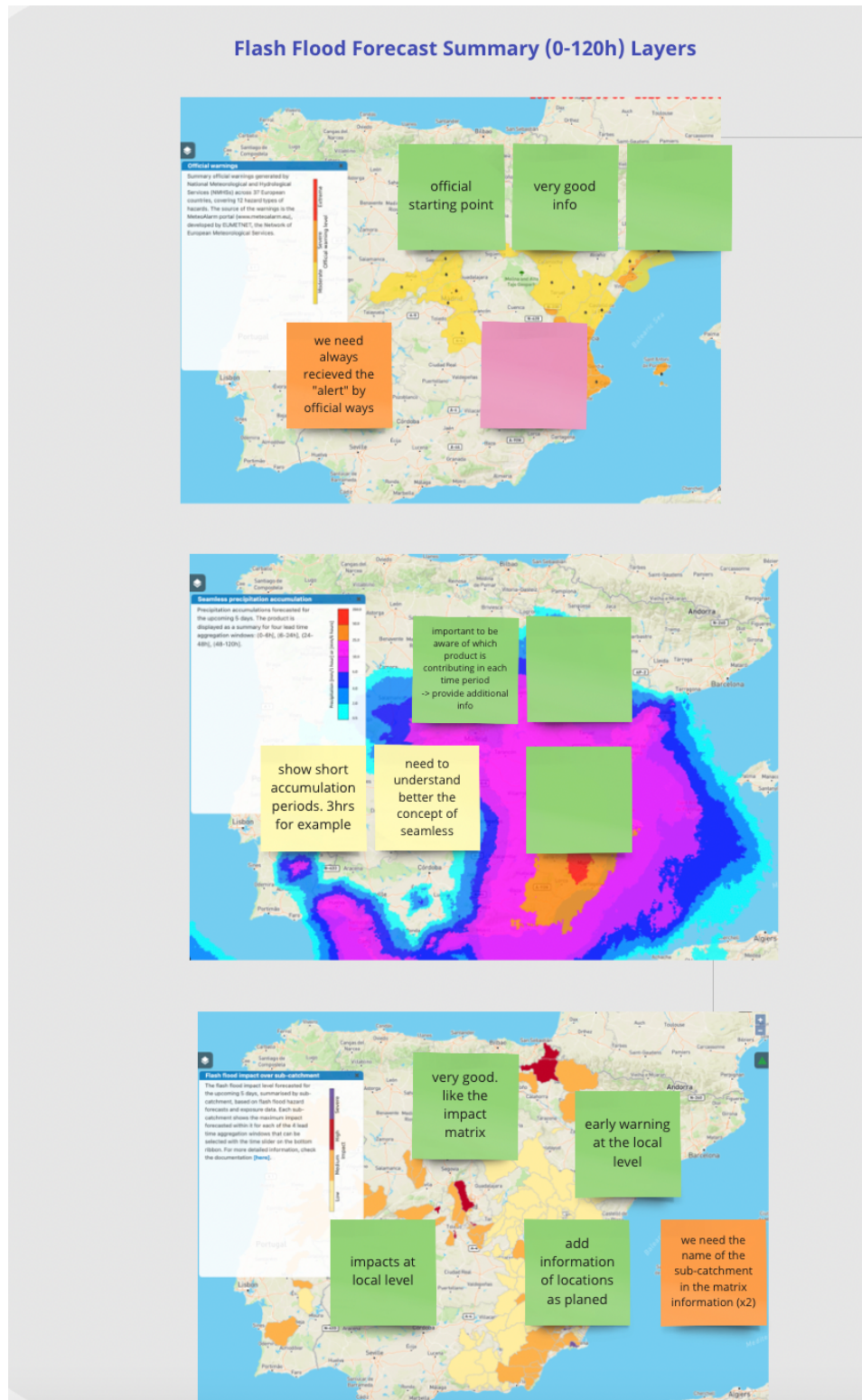


Figure 1 Example of the feedback received from stakeholders at the Portugal workshop of the summary products. Green = useful, yellow = moderately useful, orange = not useful, pink = not used. Note that the orange entries were used by a stakeholder to suggest improvements, upon further conversation they said they found the products useful.

1.2 Roadmap for Integration of EDERA Products into EFAS

Whilst it is feasible for all 37 products listed in Table 1 to be displayed in the EDERA web viewer, it is not aim appropriate to display all of these in the EFAS web viewer as this would overwhelm the existing products. Therefore, only a subset of EDERA products are planned to be integrated into EFAS, acknowledging eight of the products listed in Table 1 are already displayed in the EFAS web viewer in Nov 2023 (Table 2):

Table 2 EDERA products which are already displayed in the EFAS web viewer (Nov 2023)

Product Group(s)	Product Name
Flash flood forecast summary (0-120 h)	Flash flood impact over sub-catchment
Animated flash flood nowcasting	Hourly precipitation – 80 th percentile
	Flash flood impact over the river network
	ERIC points
	ERIC affected area
	Flood probability <48 h
	Rapid impact assessment
Flash flood past 24 h summary	Precipitation accumulation (24 h)

As by November 2023 the EFAS web viewer does not display any products from the Storm Impacts product group, nor does it display either the 'Pluvial flash flood hazard in urban areas' or the 'Flooded areas' products. These products were developed to highlight the risk of urban flooding, currently absent from any of the EFAS layers. As these products were popular with stakeholders during the hands-on exercises, it is considered that some of EDERA products within the 'Storm Impact products' category would be excellent candidates for integration within the EFAS as experimental products. Suggested candidates are listed in Table 3.

Table 3 EDERA products candidate for integration into EFAS map viewer.

Product Name
Hourly precipitation – radar nowcasting
Precipitation Hazard

Pluvial flash flood hazard in urban areas
Flooded areas
Exposure

Note that the Storm Impacts products which forecast the risk from wind, hail and lightning hazards were not selected for integration into EFAS as they do not relate to flooding, which is the focus of EFAS. Similarly, the storm hazard product combines all the hazard types and hence is not appropriate for EFAS. Finally, the storm impact layer was considered as not providing sufficient additional information to the precipitation hazard layer and hence not selected. In contrast, the exposure product (static layer) was found useful in helping identify the exposure within each ellipse highlighted in the Precipitation Hazard product.

As in November 2023, the products listed in Table 3 are produced in the EDERA project by the FMI and UPC partners, whilst the realtime EFAS forecasts are produced by ECMWF. Therefore, the integration of these products into EFAS requires relevant product generation software to be transferred from FMI and UPC to ECMWF. There are four main steps in transferring the product generation software to ECMWF, described here. Note that agreement by the JRC on which EDRA product could be published on the EFAS platform as experimental new products will need to be sought before any transfer can start.

1. FMI and UPC to transfer the product generation software to ECMWF

The first step involves FMI and UPC transferring the product generation software to ECMWF. This could be achieved by granting ECMWF access to the software repositories at each institute and enabling them to checkout a stable version of the software. During this activity, it will be necessary to identify the dependencies which are required to run the product generation software. This will identify whether ECMWF need to install additional software packages on their High Performance Computing Facility (HPCF). If it is not possible to install a particular dependency, an alternative software package will be sought.

2. Product generation software to be integrated into a real-time workflow manager

Realtime forecasts are generated at ECMWF by integrating the product generation software into a workflow manager called ecFlow. This manager allows scheduling, execution and monitoring of the different tasks within a workflow considering its inter-dependencies, time constraints and execution environment. A set of tasks, scheduling constraints and execution configuration is defined as a suite. As an example, some tasks may deal with retrieving input data, others with generating the forecast products and other with disseminating the results. The workflow manager will make sure the product generation task only starts when the retrieval task has successfully completed. The Storm Impact products proposed Table 3 to be integrated into EFAS (Table 3) are generated every 15 minutes per day at 15-minute timesteps. This differs with the general schedule used in the current suite which ECMWF uses to generate the Animated flash flood nowcasting products every hour at hourly timesteps. Instead, ECMWF currently runs a realtime forecast suite every 15 minutes to generate radar nowcast data at 15-minute timestep resolution. This suite was

originally created to generate the forecast products for the UCPM (Union Civil Protection Mechanism) funded ERICHA project., A visual representation of the suite within ecFlow is given in Figure 2. In this ERICHA suite, the main product generation tasks are done within four different worker families ($worker_1$, $worker_2 \dots worker_n$), each family is set to run at different 15-minute intervals, for example $worker_1$ generates the forecast data at 00 at the start of each hour, $worker_2$ generates the forecast data at 15 minutes past each hour. The plan to integrate the EDERA Storm Impact products, is to create new sub-tasks within the compute task of each worker family. Currently the compute tasks produce 15-minute radar-based nowcasts, therefore the new EDERA product generation sub-tasks will have a dependency to wait for the completion of the compute tasks. The setup task at the top of the suite will also need to be modified to include the setup of the execution environment required by the EDERA Storm Impact product generation.



Figure 2. The ERICHA forecast product generation suite which is currently running at ECMWF. This structure will be adapted to integrate the tasks to generate the additional EDERA storm impact products.

3. Integrate the products into the EFAS web viewer

Once the additional EDERA Storm Impact products have been generated by the suite, they need to be pushed to the webserver which serves the products to the EFAS web viewer through a Web Mapping Service (WMS). This is currently done in the ERICHA suite in the publish task (Figure 2), which will therefore require adapting to push the additional EDERA products.

4. Add new EDERA Storm Impact products to archive

The final adaptation of the ERICHA suite concerns the lag task (Figure 2) which archives forecast data which was produced 24 hours previously into the ECMWF ECFS (ECmwf File System) archive and removes the files from the operational disk. This step is necessary due to the limited space available on the operational disk. Not all the data produced by the suite needs to be stored in the archive, therefore the essential data to be stored will be identified and the corresponding task modified accordingly.

2 Conclusions

This milestone has briefly summarised the products which are currently available on the EDERA web viewer. Feedback from EDERA stakeholders during the November 2023 workshop identified that all of these products should continue to be displayed on the EDERA web viewer, with five EDERA products candidate for integration as experimental products into the EFAS platform, complementing eight of the products on the EDERA web viewer already displayed within EFAS. The additional products relate to the Storm Impact products which represent urban flood risk, something which is not currently covered by the existing products in EFAS. A roadmap for integrating these additional products has been briefly outlined, it involves ECMWF obtaining the relevant software codes and dependencies from FMI and UPC and integrating them within the existing ecFlow suite used to generate the realtime ERICHA flash flood products following agreement from the JRC for a change in the EFAS platform.