# Outlook of the potential features of a future common data exchange or joint forecasting system

# WP4 Deliverable 4.2.3

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# 1 Introduction

The outlook of potential features of a future common data exchange or joint forecasting system is strongly related to Output 3.2 *Common vision of cooperation* in general, and the Deliverable 3.2.2 *Evaluation of the possibilities of the international forecasting system's result exchange platform* as well as the identified future Scenarios described in Deliverable 3.2.5 *Economic Impact Analysis*.

These scenarios which have been mainly developed by PP7 National Institute of Hydrology and Water Management Romania and discussed with the other PP are:

**Scenario 0 – Implementation of a common Danube River Basis *observed* data exchange platform**
This scenario is based on the direct outcome of the DAREFFORT project. A common Danube River Basin data exchange platform is implemented within the project (WP4). Subsequently the exchange platform will be operated by ICPDR. The implementation phase started in June 2018 with the start of DAREFFORT and will be finished at the end of 2021, with the implementation of Danube HIS by ICPDR.

**Scenario 1 – Implementation of a common Danube River Basin Forecasting Systems result exchange platform**
The software exchange platform HyMeDES Environet developed in DAREFFORT has an open architecture, so that later in the process additional modules can be implemented. In Scenario 1 it is foreseen to exchange forecasting data as a time series. The implementation phase could begin right after the implementation of Scenario 0 is completed and could be ready at the beginning of 2025.

**Scenario 2 – Close integration between the National Flood Forecasting and Warning Systems and the existing Regional Flood Forecasting and Warning Systems: EFAS – Copernicus service, SEE-MHEWS-A, SEE-FFG, and SAVA FFWS**
There are already several important supra-regional flood forecasting systems like EFAS (European Flood Awareness System), SEE-FFG (South-East Europe Flash Flood Guidance), and SAVA FFWS (Sava Flood Forecasting and Warning System) implemented within the Danube River Basin area. Another important one is currently under implementation: SEE-MHEWS-A (South-East European Multi-Hazard Early Warning Advisory System).

Due to the close relation between the implementation of this scenario and the development and implementation status of different regional systems, this scenario could have two phases:

- Phase I – integration with EFAS (Scenario 2a);
- Phase II – integration with SEE-MHEWS-A, Sava FFWS, and SEE-FFG (Scenario 2b).

Not all Danube river basin countries are represented in SEE-MHEWS-A, SEE-FFG and Sava FFWS. This is only the case for EFAS.

**Scenario 3 – implementation of a common Danube River Basin Forecasting Platform**
This scenario describes the implementation of a common Danube River Basin Forecasting Platform similar to the common Sava FFWS, which has been implemented recently. This is the most complex and uncertain Scenario.

Since exchange of measured hydrological and meteorological data is already scope of project DAREFFORT and the data exchange platform HyMeDES Environet developed in the project, future developments for data exchange relate either to forecasted data (Scenario 1), closer integration to other data exchange platforms (Scenario 2), and optionally the development of a joint forecasting system (Scenario 3).

On December, 3rd 2020 an online workshop has been carried out by PP STASA together with flood forecasting experts from other project partners and associated partners in the DAREFFORT consortium to discuss potential features and developments regarding the described Scenarios. In addition to the results of the aforementioned project outputs and deliverables, the results of this workshop have been taken into consideration in this document.

# 2 Intended user groups for a future system

It is very important to exactly define who are the potential users of a future common data exchange or joint forecasting system and the requirements they have.

Since the defined future scenarios are related to professional services of data exchange aimed to flood forecasting experts, users should be mainly the forecasting organizations, and not other organizations like civil protection authorities. Each forecasting organization informs the civil protection authorities itself with the country's own procedures.

Exposure of forecast data to general public is problematic, as scientific data needs to be interpreted correctly and there is a huge potential of misunderstanding the data.

Forecasting organizations are very sensitive to dissemination of the forecasted data. This is also common practice in existing platforms which exchange forecasted data, e.g., in Sava FFWS only the nine hydrometeorological forecasting organizations of five countries have access to the data. There is no access granted to the public.

According to the recommendations of flood forecasting experts, the user groups for future systems described in the scenarios 1 to 3 should be professional experts in the field of flood forecasting, depending on the sensitivity of forecasted data which will be exchanged.

Data policy should make national forecast organizations comfortable, as they are very sensitive on disseminating forecast results. Forecasted data should not made publicly available, as it needs to be interpreted and may lead to misunderstandings when disseminated to public.

# 3 Scope of future systems

According to the participants of the flood forecasting expert workshop on the outlook of the potential features, in the future there should be the possibility to view the forecasted hydrological data of all other forecasting services in the Danube basin, as described to Scenario 1. In this context, the regions near the borders in upstream direction for each respective country are of special importance. Having access to forecasted data of upstream near-border gauging stations, as it is partly already common practice, would be useful to be able to include the data into forecast models for additional runs of the models.

Regarding meteorological forecasted data a great benefit would arise from a common weather forecast for the whole basin, which could be used to make alternative runs of hydrological forecast with it. A common weather forecast would be very important, because this would avoid that an event could occur twice in data if different local meteorological forecasts are used. A common meteorological model would lead to more consistent and comparable forecasts. However, a hi-res forecast of the whole region is computationally expensive and is up to now done for most of the area but not the whole.

From the perspective of the flood forecasting experts participating in the workshop, a joint hydrological forecasting system with a harmonized forecasting model similar to Scenario 3 is currently not needed. EFAS already covers whole Danube basin with its forecasting products.

So, with respect to Scenario 3, future developments should focus on a joint meteorological forecast rather than on a joint hydrological forecast.

# 4 Potential features of a common Danube River Basin Forecasting Systems result exchange platform (Scenario 1)

The results of Deliverable 3.2.2 *Evaluation of the possibilities of the international forecasting system's result exchange platform* show that the benefits different countries may have from this platform are very heterogenous. In summary, the **bilateral exchange of hydrological and also meteorological forecasts** between countries is already common practice between neighbouring countries. Therefore, to justify the development of a **Danube wide forecasting result exchange platform**, benefits in addition to the bilateral exchange of forecasting results have to derivable from such solution. According to Deliverable 3.2.2, particularly forecasting experts from downstream countries Croatia, Romania, and Bulgaria see an additional benefit of a Danube wide forecasting result exchange platform for improving short term and medium-term hydrological forecasts and warnings. Forecasting experts from downstream countries see additional benefits in extending the lead time. Resulting from Deliverable 3.2.2, the exchange of ensemble forecasts between countries is seen as useful. A further benefit could be the improvement and standardization of data interfaces functionalities of the national systems, according to deliverable 3.2.5 *Economic impact analysis*.

Main potential features of a forecasting system's result exchange platform therefore could be:

**Feature: Standardization of exchange of forecasted data**
A forecasting system's result exchange platform would require an international standardization of exchange of forecasted data. Yet, there is no such standard to exchange ensemble forecasts, grid data and to harmonize lead times and update intervals, different spatial and temporal resolutions. The development of this platform could catalyse the efforts to develop appropriate standards for exchanging forecasted data which could also improve bilateral data exchange.

Not only the formats would have to be harmonized, but also the exchange intervals for forecasting results, because the exchange has to be adapted to the many different forecasting models which are currently in use in the Danube catchment.

**Feature: Exchange of forecasted data as time series**
Timeseries of observed data and forecasts are fundamentally different because forecasted time series have two timestamps: The timestamp at which the forecast was calculated (result time) and the timestamp of the data forecasted (phenomenon time).

**Feature: Exchange of ensemble forecasts**
Resulting from Deliverable 3.2.2, the exchange of ensemble forecasts between countries is seen as useful. But the prerequisites and boundary conditions of ensemble forecasts are very different in each country. An exchange of ensemble forecasts therefore requires a high degree of coordination and harmonization. The forecasts, but especially the boundary conditions and scenarios, must be standardised in order to use ensemble forecasts across countries.

The HyMeDES Environet platform developed in the DAREFFORT project could serve as a technical basis for the development of Danube wide forecasting result exchange platform. However, enhancements in the data model have to be made to cope for the special characteristics of forecasted data. Also, the output format WaterML 2.0 is not suitable for exchanging forecasted data, particularly regarding ensemble forecasts and grid data. The goal is to integrate the features in an open and modularized architecture in order to being able to implement additional modules in the future.

Regarding data policy, precise guidelines would be very important in order to make an exchange of forecasts across the whole Danube basement possible. Especially the liability for the results is an issue which hinders the exchange of the results. Therefore, this has to be addressed in a data policy agreement, e.g., by stating that the forecasting institutes are not liable for the forecasting results or the products that result from further processing and adding a statement that the forecast results have the character of unproved raw data. In addition, also the exchange of forecasting results free of charge is an issue for some of the countries.

# 5 Potential features for an integration with existing systems (Scenario 2)

There are already existing supra-regional flood forecasting systems, like the European Flood Awareness System (EFAS), the Sava Flood Forecasting and Warning System (Sava FFWS), South-East European Multi-Hazard Early Warning Advisory System (SEE-MHEWS-A).

According to the workshop on the outlook on future developments the existing systems should be linked together, but not replaced by a new system. The goal should be to make best use of existing systems.

Scenario 2 therefore describes a close integration between the National Flood Forecasting and Warning Systems and these existing Regional Flood Forecasting and Warning Systems.

**Feature: Transmission of measured data from the HyMeDES Environet platform into EFAS**

The aim of the European Flood Awareness System (EFAS) is to support preparatory measures before major flood events strike, particularly in the large trans-national river basins and throughout Europe in general. EFAS is the first operational European system monitoring and forecasting floods across Europe and is in full operation since 2021 as part of the Copernicus EMS (https://www.efas.eu).

The platform provides complementary, added-value information (e.g., probabilistic, medium range flood forecasts, flash flood indicators or impact forecasts) to the relevant national and regional authorities. Furthermore, EFAS keeps the Emergency Response Coordination Centre (ERCC) informed about ongoing and possibly upcoming flood events across Europe.

Almost all countries in the Danube catchment actively participate in providing data to EFAS (except Moldova), and in using the products of the EFAS platform.

Therefore, a useful feature in Scenario 2 for a closer integration with EFAS would be the transmission of observed data from the HyMeDES Environet platform to EFAS, as up to now every data provider is delivering observed data to EFAS individually. Also, according to the outcome of the workshop on potential features and developments this kind of use of the HyMeDES Environet platform should be foreseen in the future.

Currently, EFAS uses more gauging stations than available on HyMeDES Environet platform. Regional Report of EFAS delivered within WP3 EFAS get data from 478 hydrological stations in Danube catchment whereas the HyMeDES Environet platform currently comprises 329 hydrological stations. This is linked to the fact that Environet data is potentially publicly available, while EFAS data is not. However, the data model implemented in the HyMeDES Environet platform is capable to handle all in-situ parameters which are delivered to EFAS by the individual countries.

According to Regional Report of EFAS delivered within WP3 in-situ hydrological data are delivered to EFAS with following characteristics:

- Variables:
    - water level and/or discharge
    - highest historical values registered
    - lowest historical values registered
- real-time data
- historical data: minimum 3 year-long historical time series
- metadata: coordinates (WGS84), elevation, threshold levels, river name (local and in English), catchment name (local and in English) and surface area (km2), timezone and rating curves
- temporal resolution: aggregated values (start, middle and end of the interval), instantaneous values

The Meteorological Data Collection Centre is operated by KISTERS AG and the Global Precipitation Climatology Centre (GPCC) of the German Weather Service (DWD). KISTERS AG hosts the data base, quality control procedures and gridding schemes, and GPCC oversees and improves the quality control procedures and acts as focal point for meteorological data providers.

As provided in the Regional Report of EFAS delivered within WP3, in-situ meteorological data collected by EFAS have the following specifications:

- real-time data
- historic data: from January 1970 onwards
- metadata: latitude, longitude, elevation, instrument specifications
- temporal resolution: highest available (minimum daily)
- variables:
    - Precipitation
    - 2m air temperature
    - Daily minimum 2m air temperature
    - Daily maximum 2m air temperature
    - Dew point temperature
    - 10m Wind speed
    - 10m Wind direction
    - Cloud cover
    - Water vapor pressure
    - Solar radiation
    - Sunshine duration
    - Relative air humidity
    - Evaporation

The stations from which EFAS currently collects data and which are not already available on the HyMeDES Environet platform, could be added to the platform. Since the HyMeDES Environet platform has a very flexible access rights management, stations, parameters and data particularly foreseen to be used by EFAS only can be restricted for access from the regular purpose of future Danube HIS.

However, this scenario requires a consent between ICPDR as the host of Danube HIS, EFAS, and the data providers.

**Feature: Transmission of hydrological forecasts from EFAS to the HyMeDES Environet platform**

Currently it is possible to include national forecasts into the EFAS system using a Web Map Service (WMS) interface. It is quite rudimental, more tight forecasts, for example the 5-day-forecast of a gauging station are a problem, because no standards exist. There is a Country Report with additional information on the capabilities of EFAS. EFAS also offers a Sensor Observation Service (SOS), where the WaterML 2.0 standard was modified to be able to integrate forecast time series because there are no commonly agreed standards on forecasted data.

An additional feature could be that EFAS provides their hydrological forecasts, at least for border areas, to the HyMeDES Environet platform. This feature could be an alternative to the forecasting systems result exchange platform describes in Scenario 1, which could avoid the requirements of standardization of data formats for forecasting results.

**Feature: Integration with SEE-MHEWS-A**

WMO is currently implementing the project 'South-East European Multi-Hazard Early Warning Advisory System (SEE-MHEWS-A)'. Detailed Implementation Plan for SEE-MHEWS-A is available under

https://ane4bf-datap1.s3-eu-west-1.amazonaws.com/wmocms/s3fs-public/ckeditor/files/SEE-MHEWS-A_Implementation_Plan_2018-01-05_FINAL_1.pdf?Dm2eQRxFswt6QAC3tOxvtaXD8Jwibcub

which provides guidelines for development of the technical part of the system and for all activities necessary to establish advisory system operations. From the Danube basin countries, the National Meteorological and Hydrological Services of Croatia, Hungary, Moldova, Romania, Slovenia, Ukraine and Bulgaria (Serbia is considering) are partners to the SEE-MHEWS-A project. These countries have agreed to exchange meteorological and hydrological data, information, forecasts and advisories under the SEE-MHEWS-A.

The SEE-MHEWS-A has furthermore set up 4 limited area numerical weather prediction models running quasi-operationally at ECMWF, covering the whole SEE region, with forecasts to be available for all the project partners of SEE-MHEWS-A.

Hydrological models will be implemented during the current SEE-MHEWS-A project phase for a pilot river catchment in Bosnia and Herzegovina and North Macedonia, but this is planned to be expanded to cover other river catchments from the region during further phases of the project. Both meteorological and hydrological forecasts will be available to the project partners via SEE-MHEWS-A Common Information Platform, which is under development.

There is already an existing cooperation between EFAS and SEE-MHEWS-A, also between Sava FFWS and EFAS.

Based on the goals of the SEE-MHEWS-A project, and the participating countries an integration of the results of the weather prediction models from SEE-MHEWS-A into a future Danube River Basin Forecasting Systems result exchange platform (see chapter 4) based on the HyMeDES Environet platform could be useful.

In addition, as proposed for the integration with EFAS, data providers in the Danube catchment could send their data via the common data exchange platform HyMeDES Environet (future Danube HIS).

**Feature: Integration with Sava FFWS**

The establishment of a joint Flood Forecasting and Warning System in the Sava River Basin (Sava FFWS) is a component of the project "Improvement of Joint Actions in Flood Management in the Sava River Basin". The project was funded by the Western Balkans Investment Framework (WBIF) and implemented by the World Bank between 2016 and 2018. For more information about Sava FFWS and their activities please refer to https://www.savacommission.org/project_detail/24/1

The Sava FFWS provides an integrated forecasting system, covering the complete Sava River Basin. The beneficiary countries are Bosnia and Herzegovina, Croatia, Montenegro, Serbia and Slovenia, while the entire process is coordinated by ISRBC in accordance with the Protocol on Flood Protection to the Framework Agreement to the Sava River Basin.

All countries in the Danube catchment which are also in the Sava river basin use Sava FFWS to send data to the platform, and also have access to the provided data of Sava FFWS.

It is planned to integrate hydrological and meteorological observed data using the API of Sava HIS from Bosnia and Herzegovina, and Montenegro which are not directly participating in the DAREFFORT project to the HyMeDES Environet platform. This could be a first step towards an exchange of data with Sava HIS. In addition, a closer integration of the results of Sava FFWS to a future Danube River Basin Forecasting Systems result exchange platform (see chapter 4) could be useful to avoid parallel developments.

# 6 Possibilities of the implementation of a common Danube River Basin Forecasting System (Scenario 3)

According to chapter 3 future developments related to the implementation of a common Danube River Basin Forecasting Platform should focus foremost on a joint meteorological forecast. Therefore, a potential purpose and feature of common Danube River Basin forecasting system could be the provision of a common weather forecast serving as input for hydrological forecasts.

As mentioned in chapter 3 a substantial benefit would arise from a common weather forecast for the whole basin, because this would avoid that an event could occur twice in data if different local meteorological forecasts are used. In addition, a common meteorological model would lead to more consistent and comparable forecasts. A forecast with high-resolution inputs would be needed. However, a hi-res forecast of the whole region is computationally expensive and is up to now done for most of the area but not the whole.

Regarding a potential joint hydrological forecasting system, the development of a Danube specific system with a harmonized forecasting model is currently not required, from the perspective of the flood forecasting experts participating in the workshop on the outlook on future developments. EFAS already covers the whole Danube basin with its forecasting products. According to EFAS with recent and future planned upgrades of EFAS there will be also an increase in forecast accuracy on the short term due to better capturing the uncertainty by using more forecasts and improving the spatial resolution of the hydrological model. So instead of establishing an additional forecasting platform, it could be more useful to enhance the integration between future Danube HIS with EFAS as described in chapter 5.

However, in the future scenarios elaborated for Deliverable 3.2.5 *Economic impact analysis* the implementation of a common Danube River Basin Forecasting Platform similar to Sava FFWS has been proposed. Also, in Deliverable D3.2.3 *Recommendations for improvement of the flood and ice forecasting systems* (chapter 3) it is recommend to develop hydrological forecasting systems for various catchments within the Danube River Basin (micro, meso and macro scale) taking into account already existing systems at different scales, particularly the only Danube wide forecasting system EFAS and the Sava forecasting system from the ISRBC. Since several countries in the Danube river basin are also part of the Sava river basin a potential option could be to develop a joint forecasting platform similar to Sava FFWS, if national forecasting centres could see benefits on top of using existing platforms or their national forecasts on the long term. Like Sava FFWS, this platform could be developed as an open platform for managing the data handling and forecasting process, allowing a wide range of external data and models to be integrated. Similar to Sava countries the countries in the Danube catchement are using very different forecasting systems. However, the Danube catchment is much larger, and more countries and diverse systems are involved. Therefore, implementation effort will be much higher than for Sava FFWS. Depending on the plans of ICPDR, future Danube HIS could be used as the data plattform to access realtime hydrological and meteorological data for such a platform. Also Danube GIS could be integrated providing spatial layers for the patform. A local platform for the Danube river basin could enhance the collaboration between the forecasting centers and also improve the harmonization of national forecasts and help to improve the cross national knowledge exchange between the flood forecasting experts.

# 7 Project management and coordination

It is very important to decide who is coordinating / managing the process of the future developments to avoid parallel developments. This could be ICPDR in future. First there should be the preparation of a Memorandum of Understanding, which should be signed and in effect. There should be discussion groups of experts which meet regularly and also participate in other projects like EFAS. Experts of existing international platforms should be involved (EFAS, SAVA FFWS, SEE-MHEWS-A). Sava FFWS started in 2013 with a commitment and expert groups started discussions. Useful platforms were explored in Workshops.

# 8 Feasibility of the described potential features

In the following the feasibility of the Scenario specific features described above is summarized.

## 8.1 Feasibility of a Danube River Basin Forecasting Systems result exchange platform (Scenario 1)

**Feasibility of the standardization of exchange of forecasted data**
Today there are no international standards to exchange ensemble forecasts, grid data and to harmonize lead times and update intervals, different spatial and temporal resolutions. Therefore, it will be a big challenge to harmonize all of these topics within the Danube river basin. As already summarized in deliverable D3.2.2 *Evaluation of the possibilities of establishment of the international forecasting system's result exchange platform* the technical requirements for an exchange of forecasting results vary widely between the involved countries. The results show that exchanging forecasting results requires at least as much effort in coordination and harmonization as the exchange of measured data implemented in the DAREFFORT project, because of a large variety of data formats for forecasted data and forecasting models, as well as prerequisites for using them.

Not only the formats would have to be harmonized, but also the exchange intervals for forecasting results, because the exchange has to be adapted to the many different forecasting models which are currently in use in the Danube river basin.

**Feasibility of the exchange of forecasted data as time series**

The exchange of forecasted data as time series as a subset of the exchange of forecasted data is more feasible than the exchange of forecasted data in general including grid data and ensemble forecasts.

However, as mentioned in chapter 4 timeseries of observed data and forecasts are fundamentally different because forecasted time series have a timestamp at which the forecast was calculated (result time) and a timestamp of the data forecasted (phenomenon time). This can be solved technically, but WaterML 2.0 as used as a standard for observed data could not be used for providing forecasted data without tweaking this data format.

Additionally, an exchange platform for forecasted time series might be also made capable of storing multiple forecasted time series for the same point on the river, with different result time stamps, if there is no well-defined rule how to replace forecasted timeseries having an older result time stamps with new ones.

From a technical point of view, it is very reasonable that the described challenges can be solved. Forecasted time series could be exchanged via the HyMeDES Environet platform developed in the Dareffort project by enhancing the data model for the second timestamp in forecasted timeseries and using an enhanced WaterML-format of another data format for providing the data to forecasting centres or other expert users. Also, some kind of uncertainty intervals for forecasted data points in the time series could be implemented in the data model.

**Feasibility of the exchange of ensemble forecasts**

The exchange of ensemble forecasts would add an additional dimension to the exchange of forecasted timeseries: In addition to each result time stamp an array of timeseries with the different ensembles exists. Also, the ensemble configuration must be stored in the data model, otherwise the data of the ensembles are not interpretable.

Exchanging ensemble forecasts also would require harmonizing the ensemble configurations between countries, at least between neighbouring countries, otherwise forecasting centres cannot make use the ensemble forecasts from upstream countries.

Whereas the implementation of ensemble forecasts in the data model of a forecasting results exchange platform technically is feasible, but complex, the harmonization of the ensemble configurations between the countries is very difficult and would require the forecasting centres to cooperate very closely, and change their own ensemble configurations or at least calculate the harmonized ones in addition. This would also require that all forecasting centres create ensemble forecasts for the potential harmonized configurations.

## 8.2 Feasibility of potential features for an integration with existing systems (Scenario 2)

**Feasibility of the transmission of measured data from the HyMeDES Environet platform into EFAS**

From a technical point of view the parameters currently collected by EFAS from each country in the Danube catchment separately could be transmitted via HyMeDES Environet platform if the data providers enhance their data transfer to the HyMeDES Environet platform by the parameters and stations specified by EFAS. As mentioned above, the HyMeDES Environet platform has a very flexible access rights management, therefore, stations, parameters and data particularly foreseen to be used by EFAS only can be restricted for access from the regular purpose of future Danube HIS. The data model of the HyMeDES Environet platform is capable to handle the in-situ data collected by EFAS, described in chapter 5.

**Feasibility of the transmission of hydrological forecasts from EFAS to the HyMeDES Environet platform**

Transmission of hydrological forecasts from EFAS to the HyMeDES Environet platform could be technically feasible but would require technical coordination with EFAS on the data format and protocol to use, e.g., one that EFAS already uses (Web Map Service WMS or SOS service). Accordingly, adjustments to the data model of the HyMeDES Environet platform would be necessary and also the implementation of an appropriate transfer protocol.

**Feasibility of an integration with SEE-MHEWS-A**

The WMO would be open to discuss cooperation with SEE-MHEWS-A-countries. Discussion is also required with the SEE-MHEWS-A Steering Committee, consisting of the Directors of NMHSs from the region.

Regarding an integration of the results of the weather prediction models from SEE-MHEWS-A into a future Danube River Basin Forecasting Systems result exchange platform would require agreement with the SEE-MHEWS-A Steering Committee and definition and coordination of the data format and protocol to exchange the forecasted weather data as well as its implementation.

The transmission of the data to SEE-MHEWS-A via the HyMeDES Environet platform would likely be technically possible, similar the transmission of the data to EFAS.

**Feasibility of an integration with Sava FFWS**

From a technical point of view a close integration of the results of Sava FFWS with a future Danube River Basin Forecasting Systems result exchange platform is feasible, but would require the definition and coordination of the data format and protocol to exchange, as for the integration with EFAS or SEE-MHEWS-A.

## 8.3 Feasibility of an implementation of a common Danube River Basin Forecasting System (Scenario 3)

This is the most complex and uncertain Scenario, and without defining the concrete purposes and special coverage to be achieved with such a platform it is not possible to estimate the feasibility of an implementation. However, based on the fact that there are more countries involved than for example in Sava FFWS the complexity of an implementation would be much higher, also regarding implementation time and costs. Extensive duplication of efforts for similar activities and results with the regional systems, could not be avoided. The complexity of operation, maintenance und updates is also a big challenge.

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