DAREFFORT

Output 5.1. Expert workshops on knowledge exchange

Deliverable 5.1.1. Minutes of knowledge exchange workshops (9 countries)

Deliverable 5.1.2 Evaluation report of questionnaire

Table of Contents:

The project is funded by the European Union

WP5 National Knowledge Exchange Workshop

PP1 Hungary

The project is funded by the European Union

MINUTES

WP5 National Knowledge Exchange Workshop Hungary

Danube River Basin Enhanced Flood Forecasting Cooperation – DAREFFORT
Project code: DTP2-064-2.1

22 of October 2019, Budapest

Venue: Conference Room OVF, Márvány Street 1/D, 1012 Budapest

Total number of registrations: 17
Total number of participants: 14
(See the scanned attendance list)

Péter Juhász welcomes the participants to the DAREFFORT National Knowledge Exchange Workshop for Hungary. He gave a general overview of the project and the purposes of the workshop.

Dr. László Balatonyi presented by the Ministry of Foreign Affairs and Trade (MFAT), summarized the goals of the Danube Region Strategy (DRS). The DRS addresses a wide range of issues; these are divided among 4 pillars and 12 priority areas. Each priority area is managed by two countries as Priority Area Coordinators (PACs).

The Environmental Risks Priority Area (PA5) – coordinated by Hungary and Romania – has three major objectives to follow during its work. First, PA5 addresses the challenges of water scarcity and droughts based on the 2013 update of the Danube Basin Analysis and the ongoing work in the field of climate adaptation. Second, to implement Danube wide flood risk management plans – under the Floods Directive – with the aim to reduce flood risks significantly by 2021, taking into account the potential impacts of climate change as well. Third, to update the accidental risk spots inventory at the Danube River Basin level.

The PA5 Priority Area's most significant activity in the field of environmental risks is to facilitate the flood protection of the Region and to enhance the flood safety of the whole Danube Basin involving the 14 stakeholder countries.

MFAT facilitated the DAREFFORT project from the beginning supporting partner search and project development, or communicating its importance for decision making bodies and on international events.

After this presentation, Amarilla Mátrai gave detailed overview of DAREFFORT project (duration, start of the project, estimated full budget, potential partners, areal coverage). She presented the scope of the project, the content and the goals of each Work Package as well as the previous and next steps in the project. She introduced the outputs of the work packages and the ICPDR Danube Hydrological Information System.

After this presentation, the standardized questionnaire was handed out and filled in by the participants.

The last presenter was András Csík. He gave some historical overview about the Hungarian Hydrological Forecasting Service. He present the hydro-meteorological station network, which station data are used for hydrological forecasts. Furthermore he descried the users of the hydrological forecast and the products of the HHFS. The products of HHFS are available on official webpages: www.hydroinfo.hu or www.hydroinfo.hu/en . The main products: water level forecast, ice forecast, water regime map, shallow section information, snow information, publishing hydrological and meteorological information in table and map format.

After the presentation the participants had opportunity to ask questions and comment on the topics.

The participants noted that stations, which shared in the Danube HIS database, do not provide adequate coverage of the Danube River Basin. It would be ideal if the participating countries shared data from several stations.

Further opinions and suggestions were also included in the questionnaires

After this the meeting was finished.

WP5 National Knowledge Exchange Workshop

PP2 Germany

The project is funded by the European Union

MINUTES

Knowledge Exchange Workshop Germany
Danube River Basin Enhanced Flood Forecasting Cooperation – DAREFFORT
Project code: DTP2-064-2.1

26th September 2019, Munich

Venue: *Room K4, Bavarian State Ministry of the Environment and Consumer Protection, Rosenkavalierplatz 2, 81925 Munich, Germany*

Participants: *Dr. Klaus Arzet, Bavarian State Ministry of the Environment and Consumer Protection*
Falko Bader, Steinbeis Applied Systems Analysis GmbH
Christine Hangen-Brodersen, Bavarian Environment Agency
Mag. Franz Hauer, Office of the Federal Government of Lower Austria
Dipl. Ing. Peter Kickinger, Office of the Federal Government of Upper Austria
Dr. Philipp Liedl, Steinbeis Applied Systems Analysis GmbH
Dr. Monika Rauthe, German Meteorological Service
Werner Schulz, State Office of Environment
Kim Schwarz, Steinbeis Applied Systems Analysis GmbH
Dr. Natalie Stahl-van Rooijen, Bavarian State Ministry of the Environment and Consumer Protection
Dr. Alfons Vogelbacher, Bavarian Environment Agency

26th of September 2019 (10:00 – 16:15)

ITEM 1
DISCUSSION

10:00-14:00 Part 1: Knowledge Exchange workshop – general part
Dr. Arzet welcomed all participants and talked about the origins and the background of DAREFFORT project. A greeting by Dr. Liedl followed. The agenda and the objectives of the workshop were presented, followed by a round of introductions of all participants.

Topic 1 Overview DAREFFORT-Project
Dr. Liedl presented the key data and objectives of the project and the data exchange platform. In addition, this section briefly summarized which data should be exchanged and what the architecture of the exchange platform and the output data format will look like. Finally, the goals of the

This project is supported by the Danube Transnational Programme funded under the European Regional Development Fund and European Neighbourhood Instrument, co-funded by Hungary and other Danubian States.

knowledge exchange workshop were presented. The presentation was followed by a discussion, initiated by Mr. Hauer about the differences between the data of the planned database of the DARREFORT project and the data sent to EFAS. In case of EFAS the focus is more on meteorological data and the station density can also differ, whereas the focus of the DAREFFORT project is on the Danube catchment area.
Then the question was raised why not just collecting data from public websites. Dr. Liedl stated that for professional data exchange it is not suitable to just read out data from public websites, because formats can change too quickly and data is coded in graphical information rather than values very often. Therefore, from a professional point of view, it is essential to establish an agreed standardized protocol to exchange data.

Topic 2 Forecasting Models and Services in Austria/State of Upper Austria

Mr. Kickinger presented the forecasting models and forecasting service of Upper and Lower Austria. The main input variables are measurement data like water level, discharge and precipitation and meteorological forecasts. A distinction is made between internal and external forecasts. External forecasts are used for catchment areas bordering Austria. For example, the forecasts of the LfU (Germany) are used for the Danube up to Passau. Passau is the transfer point. From then on the Upper Austrian model is used for further calculations, i.e. the internal forecast. This is also passed on to neighbouring countries/areas (for example, the forecasts for the Inn are passed on to Bavaria). From the Danube catchment area only 14% of the run-off from internal calculations is used. However, internal forecasts are also calculated for the border areas, to check the plausibility of the values received and as a backup if a system fails. Shipping has an independent forecast. This is designed to predict low water periods at an early stage. One conclusion that can be drawn from this presentation is that it is advisable for the neighbouring areas to take over the forecasts of the flood forecasting centres there, as they have better knowledge of the catchment area.
Mr. Kickinger also participated at the DAREFFORT Knowledge Exchange Workshop in Austria. He reported that the representatives of the flood forecast centres of the States and a representative of the port of Vienna had presented the different forecasting systems and had discussed benefits and suggestions for the project.

Topic 3 Forecasting Models and Services in Bavaria

Afterwards Dr. Vogelbacher presented the basics of flood forecasting in Bavaria: measuring network, structure of the database and the models that are used. The model is improved and supplemented constantly in cooperation with Rhineland-Palatinate, Baden-Wurttemberg, Saxonia and Hesse. This model is embedded in a water balance model and a

This project is supported by the Danube Transnational Programme funded under the European Regional Development Fund and European Neighbourhood Instrument, co-funded by Hungary and other Danubian States.

hydrographic model. In addition, the legal basis for the bilateral data exchange between Bavaria and Austria was presented as an example. In such contracts, the prediction period, the calculation frequency and the transfer points must be defined as well as the way in which the data is provided. Bavaria receives data from the Baden-Wurttemberg flood forecast centre and the hydrographic services in Tyrol and Salzburg. They submit data to the hydrographic service in Upper Austria and Lower Austria. In Germany the shipping sector has own forecasts, too. In normal situations these forecasts are used, only in flood situations shipping uses the forecasts of LfU.

Topic 4 The offer of weather data for flood forecasting

In her presentation Dr. Rauthe gave an overview of the offers and products of the German Meteorological Service. The DWD offers various data categories such as real-time data and model data. The real-time data consists of a ground monitoring network (approx. 1.300 synoptic stations and 1.800 precipitation stations) and a radar monitoring network. These two data sets are combined with the RADOLAN method. Then there is the now casting product RADVOR with a precipitation tracking, quantified precipitation forecast, a forecast of the aggregate state and the predicted new snow rate. In forecasting, the DWD distinguishes between global (ICON) and regional (COSMO) forecasts. The SNOW 4 model describes the development of snow cover. Other DWD products include three-level warnings and personal consultations. The data can be retrieved in various ways. On the one hand free of charge and freely accessible via https://opendata.dwd.de. At https://maps.dwd.de, various data sets can be accessed as OGC-compliant (Open Geospatial Consortium) services. On the other hand there is a secure supply where individual requirements are also possible. For flood protection there is a special offer called WaWis (water management information system).

ITEM 2

14:15-16:30 Flood forecasting expert discussions on future requirements and improvements in transnational forecasting systems and services

Dr. Liedl thanked for the presentations and introduced the following discussion about the benefits of the DAREFFORT project and about ideas and expectations for further development.

Mr. Hauer started the discussion, stating that data exchange is not a technical problem. The problem is more about legal issues and the political will for data exchange. At the moment there are a lot of differences in data provision within and between the countries. For example within Austria, forecasts are not given to private institutions

This project is supported by the Danube Transnational Programme funded under the European Regional Development Fund and European Neighbourhood Instrument, co-funded by Hungary and other Danubian States.

(except the products on official websites), whereas in Germany this can be done. Referring to international data exchange it would be useful to find common solutions for whole Europe, especially with respect to liability.

Based on the experience of Dr. Vogelbacher an exchange of forecasting results rather than only the underlying data should be preferred, because the national forecasting centres know their regional situations best, e.g. with respect to water level control by powerplants. In general national forecasting centres have more background information for the section of Danube for which they are responsible than other countries.

Dr. Stahl-van Rooijen mentioned that raw data can be faulty because there can be measurement mistakes. If data is verified concerning obvious mistakes and outliers and then provided for a DAREFFORT database, this could be a benefit of the project. Different persons replied that this is difficult because there is not a regular process of verifying data by the forecast offices. Verifying is done during the process of forecasting. There is also processed (historical) data, but processing usually might take one year or longer. Nevertheless sometimes it happens that verification is done faster, e.g. in case of flood scenarios. In this case real time data of the near past, e.g. 48 hours data is corrected (verified). Therefore, it could be useful to have verified data as a third category of data, besides real time and processed (historical) data. This data can be overwritten e.g. by the past 48 hours by not only acquiring the latest real time data, but also acquiring real time data referring to the previous 48 hours. If there are different kinds of data it must be marked as either raw, verified or processed. However, it is important to note that the quality control of data is not the task of the data provider. Quality control has to be done by the user because only the user (e.g. a forecasting centre) knows how the data is used, and therefore can define a required quality level for the data, depending e.g. on the forecasting models used. If a subsequent correction of the data for the database is scheduled, the original value should also be retained in the database. In this discussion it was also stated that it makes sense to include a comment field where special characteristics can be noted.

Mr. Hauer asked if an exchange of meteorological grid data/radar data is also possible. It would be a benefit for the project to exchange grid data, too.

The participants discussed how the exchange of forecasts can be improved. As aforementioned it is useful to receive both measurement data and forecasts from an upstream country. Exchange could be improved if also ensemble forecasts are exchanged. An ensemble consists

This project is supported by the Danube Transnational Programme funded under the European Regional Development Fund and European Neighbourhood Instrument, co-funded by Hungary and other Danubian States.

of a certain number of well-defined members. A requirement for exchanging ensemble data therefore is, that the definitions of the members must match exactly and there must be an agreement about the ensemble data that are exchanged.

Mr. Schulz stated that it could be useful to have more regular meetings of the flood forecasting representatives of the countries, e.g. once a year. This is helpful for a continuous exchange of knowledge and experience and it is also important if there is not a certain occasion for a meeting. For neighbouring countries it is useful to meet more often, to improve a close cooperation.

Dr. Stahl-van Rooijen said that beside the regular project meetings it would be good if the employees of the forecast offices from the countries visit each other to improve transnational knowledge exchange between forecasting experts. This would be helpful to see and learn how forecasting is carried out in other countries.

Dr. Vogelbacher stated that for any forecast purpose it is necessary to have a dense network of (automatic) measuring stations. There must be a measuring network that is dense in time and space. This is the base for any forecasting model in every country. From his experience this topic is crucial for improving the reliability of forecast and also for transnational collaboration towards joint forecasting activities.

In summary the discussions and knowledge exchange with the participants based on their experiences result in the following main proposals for future developments to improve hydrological forecasting products on a transnational level:

- common data exchange policy for Danube river basin, also covering the topic of liability is necessary especially if also forecasting results are exchanged
- in addition to real time data (raw data) and processed (historical) data, short term corrected (verified) real time data could be stored in the DAREFFORT database marked as verified data accordingly. This would help to prevent double adjustments of false data.
- exchange of meteorological grid data (radar data) could improve transnational forecasts, nevertheless currently only a few countries provide grid data
- establishing a dense network of automatic measuring stations in every country is essential for improving accuracy of hydrological forecasting. It could be an aim in the Danube catchment to reach a

This project is supported by the Danube Transnational Programme funded under the European Regional Development Fund and European Neighbourhood Instrument, co-funded by Hungary and other Danubian States.

comparable level in measuring standards.

- it could be advisable for the neighbouring countries to take over the forecasts of the national flood forecasting centres, as they have better knowledge of their regional catchment area
- if ensemble forecasts should be shared between countries it is necessary to find a routine how to define and name the members in order to use the ensembles from upstream countries for the forecasting in downstream countries. The definition and naming of the members would have to be unified.
- increasing the number of regular meetings of representatives of forecasting centres in the different countries, e.g. on a yearly basis could be useful for a continuous exchange of knowledge and experience, especially between neighbouring countries
- with respect to knowledge exchange it could be very helpful for the employees of the forecast offices especially from downstream countries if they could visit forecasting centres in upstream countries, to see best practices in hydrological forecasting on a transnational level.

This project is supported by the Danube Transnational Programme funded under the European Regional Development Fund and European Neighbourhood Instrument, co-funded by Hungary and other Danubian States.

WP5 National Knowledge Exchange Workshop

PP3 Austria

The project is funded by the European Union

MINUTES

WP5 National Knowledge Exchange Workshop Austria

Danube River Basin Enhanced Flood Forecasting Cooperation – DAREFFORT
Project code: DTP2-064-2.1

24 of April 2019, Vienna

Venue: Conference Room Economica, Liniengasse 50–52, 1060 Vienna

Total number of registrations: 15

Total number of participants: 11

(See the scanned attendance list)

Georg Graser welcomes everyone to the DAREFFORT National Knowledge Exchange Workshop for Austria. The meeting begins with the attending people giving a short introduction about themselves. These attending people are:

Georg Graser, Oscar Weinzettl, and Baris Ertugrul from Economica, DI Franz Higer from the Hydrology Department of the State of Lower Austria, DI Reinhold Godina from the Austrian Ministry of Sustainability and Tourism, DI Ulrich Haberl from Verbund Trading GmbH, DI Peter Kickinger from the Upper Austrian state Department of Hydrology, Mag. Friedrich Wölfelmaier and Julia Band from the Zentralanstalt für Meteorologie und Geodynamik (ZAMG), DI Hans Wiesenegger responsible for flood forecasts for the State of Salzburg and Ing. Wolfgang Löhr who is the Department Head for Technology & Purchasing of the Hafen Wien company.

After this Georg Graser gave a detailed overview of DAREFFORT and its goals. He presented the content and goals of each Work Package as well as the previous and next steps in the project.

After this, Hans Wiesenegger began his presentation on flood forecasting in the State of Salzburg. He started by giving a short overview over flood characteristics and historical records of floods that are specific to the Salzburg region. He also explained how Salzburg used to use cannons to warn the population of an incoming flood. Afterwards he explained the model Salzburg uses called HYDRIS (**Hydr**ologisches **I**nformationsSystem zur Hochwasservorhersage) to forecast floods. It was developed at the University of Natural Resources and Life Sciences in Vienna. Due to good contacts to various companies such as Salzburg AG and Verbund, the State is able to include more data in their model to strengthen its prediction capabilities. He mentions how they have improved

communications due to mistakes in the past such as during the year 2013 where they thought they had communicated that a flood was coming, but used convoluted and confusing terms. Afterwards they held a meeting and were able to specify the language used to improve communications. Due to the Regensburger treaty, there is a transnational cooperation between the State of Bavaria and Austria, which includes yearly meetings and data exchange.

After this presentation, Franz Higer presented the system used in the State of Lower Austria and Upper Austria. He started with some historical details, such as that horse riders from Salzburg would ride to Linz and then to Vienna to warn the city of an incoming flood and there would still be enough time to print this news in the newspapers.

The abilities of the forecasters to give correct predictions is directly correlated with the accuracy and amount of data they receive. After the catastrophic flood of 2002, Lower Austria included precipitation data to improve their capabilities. He then introduced the system used in Lower Austria called the ZAMG: INCA-opt System and then explained the procedures of how flood forecasting is done and then how and where the relevant information is given out to the public.

Lower Austria has 8 plus 1 forecast stations along the Danube, this allows forecasting for around the next 48 hours. These forecasts are recalculated on an hourly basis and published four times daily. Franz Higer also discussed the accuracy of these forecast and problems they face. As an example: their system is specialized for flooding, not for baseflow. They also focus on rate of wave rise and the apex of waves. He also explained in detail where issues with forecasting can come from, for example from incomplete or wrongly measured data or when the information arrives too late. Franz Higer also highlighted how Lower Austria communicates when there is a flood. During normal times there are daily controls of the system and the data transfer. There is also a permanent on-call service line. During flooding the information center is permanently occupied by at least two people. Anyone is able to call this center if in need of information.

In the following discussion, the various representatives of the hydrology departments talked about an exercise that was undertaken between Vienna, Lower and Upper Austria to train for the case of floods at the End of 2018. Over 1.000 people took part in this exercise. Overall the statements were very positive about the outcome. Communication and cooperation have been improved, especially when compared to the flood year of 2002.

Wolfgang Löhr from the Hafen Wien company said they don't really need any further hydrological related data. Ice does not affect them as they have an icebreaker to keep the ports operational in the winter and they have all necessary data and access to data in case of flooding to be able to close and secure the ports in case of a forecasted flood.

After a lunch break Reinhold Godina from the Ministry of Sustainability and Tourism held a presentation about eHYD, the internet platform in Austria for hydrological services. eHYD is a website that collects hydrographical data and analyses. Access to the platform is free for certain historical parameters (precipitation, water level, water temperature, drain, groundwater level, delivery of a spring and more). Reinhold Godina mentions that some of the most accessed and/or used variables on the platform are downpour, information on surface water and ground water. If certain values for certain key variables are exceeded, then eHYD will issue a warning. Information will be summarized to be distributed via links to the website of the hydrographical services of the various states. Special analyses such as design depth of precipitation, average annual rainfall etc. but also maps of certain information are available on the eHYD platform. For the future, there are plans to make the eHYD platform available also for mobile devices such as tables, smartphones and so on.

After this presentation, Friedrich Wölfelmaier from the Zentralanstalt für Meterologie und Geodynamik (ZAMG) presented the project EFFORS (Enhanced Flood Forecasting System for Critical Infrastructure Protection in Medium Size Alpine Catchments). EFFORS is a tool to specialize on flood forecasting on small scale and local regions. The calculation and forecasting happen in real-time and on 2D projections. The tool is capable of hourly forecasting and client specific wishes and needs. The tool is also able to calculate and forecast floods in feeder rivers. The system has a high level of reliability, achieved with the integration of satellite and terrestrial data transfer.

The Last presentation was held by Ulrich Haberl from Verbund Trading GmbH. Verbund is the largest energy provider in Austria and 90% of its power is created via hydropower. The company uses its own tool for flood forecasting called EPV-ProVis (Energiewirtschaftliche Planung Verbund Prognose Visualisierung). Verbund has 127 hydropower plants along various rivers in Bavaria and Austria, which created 28.864 GWh in 2018. Water inflow forecast is one of the most important parts for water management for the company. Since the water level (be it high or low) determines how much power can be created, Verbund has its own forecast system to be independent and able to specialize on their own needs. It also is one of the leading indicators used in extreme situations such as dispatching. At certain thresholds (such as 4000m^3/s water at the powerplant in Greifenstein along the Danube) emergency protocols are activated, that are highly regulated. At that point the forecasting isn't as relevant anymore. However, an issue is that it is often required to know on Thursday if this threshold will be met or surpassed on the weekend, which isn't an easy task. Ulrich Haberl also highlights what some of the key operative challenges are that Verbund faces. These are unsurprisingly similar to the ones already raised by the previous

presenters: measurement errors, monitoring density, switching off of radar, forecast errors, physical illustration important processes etc. Also, model uncertainty is an issue. A 1x1 km gird is too rough to make depict hydrological processes. Verbund AG requires much more precise information.

That concluded the presentations, after this the standardized questionnaire was handed out and filled in by the participants. After this the meeting was finished.

WP5 National Knowledge Exchange Workshop

PP4, PP5 Slovakia

The project is funded by the European Union

Minutes - Knowledge exchange workshops on flood and ice forecasting

Bratislava, Slovakia 11.9.2019

On 11 September 2019, a knowledge exchange workshop on flood and ice forecasting took place in Bratislava with 60 participants. The participants were coming to registration between 8:30 to 9:30 a.m.

1. Opening

The workshop was open by Lucia Cizmaziova who introduced the general director of Slovak Hydrometeorological Institute (SHMU) **Martin Benko** and other representatives of the project. Next, Benko held a short speech where he emphasized how important are the high quality data in hydrological modelling and thus the potential of DAREFFORT project for participating countries.

2. DAREFFORT and flood and ice forecasting

First block of presentations was open by **Valeria Wendlova** who presented the main targets and ideas of the DAREFFORT project. She explained its possible use in different fields of hydrological praxis, commented the main expected outputs from all work packages and showed its promotional video in slovak language.

No questions followed.

3. Hydrological forecasting service

Next, **Danica Leskova**, the head of Hydrological Forecasts and Warnings department in SHMU gave a presentation on the main concepts, developments and current stage of Hydrological forecasting service in Slovakia. She reminded the most important legislative regulations that the service must respect and fulfil. For an easier orientation and a better overview of all available information that the service provided, she showed the participants the hydrological section of SHMU´s website. Leskova next commented and explained all different warnings. Special cases of floods are ice floods. Leskova described the methods of SHMU to monitor winter hydrological phenomena such as snow cover, snow water equivalent or ice phenomena on streams and showed a video of a catastrophic ice flood on Bystrica River in 2012.

No questions followed.

4. Hydrological forecasts and uncertainties

Last, **Michaela Mikulickova**, a forecaster at the Hydrological Forecasts and Warnings department in SHMU gave a presentation about hydrological modelling and its uncertainties. She started by showing the website of SHMU and the current stage of publishing forecasts in deterministic form for 48 hours. The forecasts were run automatically four times a day by two hydrological models HBV and HEC-HMS that she shortly described. Next, Mikulickova showed an example of forecasts for an event whereby she emphasized the uncertainty of meteorological input data. Consequently, she explained how showing known uncertainties can be beneficial for issuing more precise and correct forecasts – probabilistic forecasting. Finally, she stated that the Slovak hydrological forecasting service planned to publish ensemble forecasts in short time.

No questions followed.

5. DAREnet

After a short coffee break, **Martin Kostolny** from the International Security and Emergency Management Institute (ISEMI) gave a presentation on the Horizon 2020 project DAREnet. He started by reasoning why this project was submitted as well as what are challenges of the project. The main goal of the project is to identify innovative initiatives from practitioners in water management and creating a common interinstitutional and international network of experts in this field. Another benefit of the project is to help drafted projects to finish them and eventually submit to the European Commission. He encouraged practitioners to join the DAREnet Community to share knowledge and experience on different problems they might encounter. Finally, he explained that the project runs in yearly cycles that repeat four times. At the end, he showed the website of the project as well as a platform cmt for communication, event planning and uploading of initiatives that everyone can join.

6. Workshop and discussion

After lunch followed an active part of the workshop, where the participants shared their experience and opinions on products of SHMU´s Hydrological Forecasts and Warnings department. First, **Eva Kopacikova** resumed 40 answers from the previously distributed questionnaire. The main outcomes were:

- Experts are generally satisfied with the quality of hydrological information and think that the services improved over past 3-4 years.
- Experts have main interest in warnings for fluvial and flash floods.
- Up to 50% of experts stated that they only need 30 min to 1 hour forecast lead-time. Another 35% need 3 to 6 hours.
- About 46% of responders would appreciate a training.
- Several participants of the workshop stated they have experience with e-learning tools.

Next, the participants were split into four groups to participate in an active workshop. Representatives of hydrological forecasting service prepared questions and redistributed them into 4 topics: New products, Warnings I., Warnings II. and Website with following feedback:

6.1. Stand 1 – New products

Everyone would appreciate hydrological forecasts joint with flood risk maps and a portal at SHMU´s website focusing on emergency events related to floods, droughts, forest fires, warnings etc. It should comprise several layers on maps. A joint system where SHMU, Civil protection and other interested parties could add information would be welcome by all. Unfortunately, information from the Ministry of Interior are protected with high level of security and thus could never enter such a system. Moreover, experts suggested a mobile application, map services as WMS, WFS, WCS, trainings etc.

6.2. Stand 2 – Warnings I

All participants understand the warnings well, read the text inside them and can differentiate meteorological and hydrological forecasts. However, roughly, 40% would like to receive them joint, the rest would like to leave them separate or only unite their format. In addition, the experts would like a new type of warnings for urban floods and more detailed geolocation of expected events.

6.3. Stand 3 – Warnings II

Concerning reliability of warnings, about 50% of participants found them *reliable*, and 12,5% for each of *sufficient*, *too frequent*, *imprecise* or *do not know* options. The participants would also more prefer

false warnings rather then missed events. Lead-time and need for spatial resolution depends on organisation where participants work and size of stream that is supposed to be hit. Nonstop working services prefer a shorter lead-time with a more precise information, others the opposite. The participants would also appreciate probabilistic information included in forecasts and warnings.

6.4. Stand 4 – Website

Experts are generally satisfied with the SHMU´s website and state that they can find there everything they need. Especially, they appreciate the possibility of watching forecasts in the graphical form instead of only a numerical forecasted value for a specific time. The majority of them also reads the daily updated texts of expected developments for whole basins. The most frequently suggested improvements include enhancement of maps (better zooming, additional layers, geolocation), publishing pictures from webcams on streams and adding links for a quicker orientation in emergency management.

7. Conclusion

At the end, Danica Lešková closed the workshop. Based on statements of the participants of the meeting it is possible to say that the professional public is interested in hydrological data, forecasts and warnings. Participants use them directly in their practice and would welcome such meetings even after the end of the project.

WP5 National Knowledge Exchange Workshop

PP6 Croatia

The project is funded by the European Union

Interreg
Danube Transnational Programme
DAREFFORT

DAREFFORT

WORKPACKAGE 2 AND 5, ACTIVITY 2. AND 5.

WP2. DISSEMINATION EVENT AND WP5. – KNOWLEDGE EXCHANGE WORKSHOP

30.10.2019, ZAGREB, CROATIA
ERDF PP6 / CW

«DANUBE RIVER BASIN ENHANCED FLOOD FORECASTING COOPERATION»

October 2019

Institution	**Croatian Waters**
Contributor/s	**Daria Čupić, Danko Biondić, Darko Barbalić, Mariela Sijekavica Klepo, Nataša Strelec Mahović, Ivana Čagalj**
Lead Author	**Daria Čupić**
Date last release	**05.10.2019.**

Contributors, name and surname	Institution
Daria Čupić, MSc	Croatian Water
Danko Biondić, Ph.D.	Croatian Water
Nataša Strelec Mahović, Ph.D.	Croatian Meteorological and Hydrological Service
Mariela Sijekavica Klepo, Ph.D.	Croatian Water
Darko Barbalić, Ph.D.	Croatian Water
Ivana Čagalj, MA	Croatian Water

Table of content

1. Introduction

The first national knowledge exchange workshop and project dissemination was organized by the Croatian Waters, Department of Water Management Institute, 30th, October, 2019 in Croatian Water, Croatia within the thematic WP2 and WP5: DISSEMINATION EVENT DAREFFORT AND WP5. KNOWLEDGE EXCHANGE WORKSHOP. Invitations were sent to over 388 stakeholders and employees of Croatian Waters via e-mail, as well as through individual telephone calls and it was open to public. 29 stakeholders attended the workshop. Total number of event participants was 85.

The main goals of the event were:

- Presentation of project DAREFFORT to public and distribution of promotion materials
- Introduction of workshop's goals and themes
- Questionnaire – the significance to the project and instructions on how to fill
- Presentation of the **"VEPAR Project - Improvement of Non-Structural Flood Risk Management in Croatia - Water and Environmental Monitoring, Analysis and Solutions (VEPAR)"** and reference to common goals
- Presentation of the **"METMONIC Project - Modernization of te National Weather Observation Network"** and reference to common goals
- Presentation of the **Preliminary Flood Risk Assessment 2018** and relevance of current flood protection work to project implementation by Croatian Waters
- Questionnaire output (5.)- presentation: share of experiences and good practices in the field of Educational issues for hydrological monitoring and forecasting, especially related to e-learning approach, experience in using e-learning material, for supporting training activities in the field of hydrological monitoring and forecasting, example, experience, recommendations, proposals for focus, subject and thematic of the e-learning course, using e-learning tools for training peoples involved in operational flood forecasting and warnings activitie.
- Open discussion on DAREFFORT project influence on flood risk assessment and its' implementation

The translated workshop invitation and agenda are attached below.

Dear Madam/Sir,

It gives us pleasure to invite you to the public event and national workshop of the "**DAREFFORT Project - Danube River Basin Enhanced Flood Forecasting Cooperation"**. The public event and workshop will be held **on Wednesday, 30 October 2019** on the premises of Hrvatske vode, on the ground floor in Josip Juraj Strossmayer Hall, Ulica grada Vukovara 220, 10000 Zagreb, starting at **11:00** a.m., with the following programme:

1. Introduction
2. Presentation of the **"DAREFFORT Project - Danube River Basin Enhanced Flood Forecasting Cooperation"** (http://www.interreg-danube.eu/approved-projects/dareffort) and instructions on how to fill in the questionnaire, Daria Čupić
3. Presentation of the **"VEPAR Project - Improvement of Non-Structural Flood Risk Management in Croatia – Water and Environmental Monitoring, Analysis and Solutions (VEPAR)"** (https://www.voda.hr/hr/novosti/hrvatske-vode-obiljezile-143-godinu-organiziranog-upravljanja-vodama-u-hrvatskoj-dan), Mariela Sijekavica Klepo
4. Presentation of the **"METMONIC Project - Modernization of te National Weather Observation Network" (**http://meteo.hr/istrazivanje.php?section=projekti&param=projekti_u_tijeku&el=metmonic), Nataša Strelec Mahović
5. Presentation of the **Preliminary Flood Risk Assessment 2018** (https://www.voda.hr/hr/prethodna-procjena-rizika-od-poplava-2018), Darko Barbalić
6. Discussion

The presentation will last 30 minutes each. The workshop is expected to finish around 1:30 pm.

Yours sincerely,

Hrvatske vode

Head of Department of Development

Danko Biondić

Figure 1. Event invitation

DAREFFORT

DANUBE RIVER BASIN ENHANCED FLOOD FORECASTING COOPERATION

Zagreb, 30.10.2019.

FIRST NATIONAL WORKSHOP AND DISSEMINATION EVENT

Venue:

Premises of Hrvatske vode

Josip Juraj Strossmayer Hall

Ulica grada Vukovara 220

10000 Zagreb

Croatia

TIME	TOPIC
10:30-11:00	REGISTRATION
11:00-11:10	WELCOME
	Danko Biondić (Hrvatske vode) Welcome address
11:10-11:30	DAREFFORT
	Daria Čupić (Hrvatske vode) Dareffort Project – Danube River Basin Enhanced Flood Forecasting Cooperation
11:30 – 11:35	INSTRUCTIONS ON HOW TO FILL IN THE QUESTIONNAIRE
11:35-12:00	PRESENTATION OF INTERNATIONAL PROJECT "Improvement of Non-Structural Flood Risk Management in Croatia – Water and Environmental Monitoring, Analysis and Solutions" (VEPAR)
	Mariela Sijekavica (Hrvatske vode)
12:00-12:30	PRESENTATION OF PROJECT "MODERNIZATION OF THE NATIONAL WEATHER OBSERVATION NETWORK IN CROATIA" (METMONIC)
	Nataša Strelec Mahović (DHMZ)
12:30- 13:00	PRELIMINARY FLOOD RISK ASSESSMENT 2018
	Darko Barbalić (Hrvatske vode)
13:00-13:30	FINAL DISCUSSION

Figure 2. Event agenda

2. Minutes

The workshop was opened by introductory words from the Head of Department of Development of Croatian Waters dr.sc. Danko Biondić. He welcomed all ateendees and wished for a successful workshop.

The invited lecturers are all renowned experts in their field of research with relevant work experience. Daria Čupić from Croatian Water is a hydrogeology expert and the project partner leader who presented the project goals, thematic packages, meaning of the project Dareffort results to the field of flood protection in general, the status quo of flood and ice forecasting in Croatia, the effort Croatian Waters generally make in flood defence as the national agency and flood risk assessment done by Croatian Waters in River Basin Management Plans.

Mariela Sjekavica Klepo, civil engineer expert from Croatian Waters, presented international project “Improvement of Non-Structural Flood Risk Management in Croatia – Water and Environmental Monitoring, Analysis and Solutions” (VEPAR). She stressed out the aim of the VEPAR project. This project has to improve the non-construction flood risk management measures under the responsibility of project beneficiaries, Croatian Waters and Croatian Meteorological and Hydrological Service, which will achieve the targeted result of flood risk reduction in the Republic of Croatia, with other positive results related to improvements in monitoring, analysis and finding optimal solutions for the integral and sustainable management of water, the aquatic environment and flood risks in the Republic of Croatia. Considering the comprehensiveness of the project, significant impacts are expected in all aspects of flood risk management and achieving a targeted result in terms of reducing flood risk across the entire Republic of Croatia. In addition to directly influencing the increase in the effectiveness of the implementation of non-construction measures such as the establishment of flood forecasting systems and early warning or direct flood protection, the project will also significantly improve the systematic planning of the implementation of construction flood risk management measures, all through improved techno-economic analysis and optimizing potential measures. Considering that the same will be implemented on the basis of improved databases and improved study documentation, significant socio-economic benefits are expected. These benefits will be realized through optimization of individual measures and optimization of the order of their construction, while encouraging the implementation of green infrastructure measures, which will maximize the socio-economic benefits (reduction of flood risk) from the implementation of the overall program of measures required to achieve the strategic goals set out in the Management Strategy Water (SUV) and Flood Risk Management Plan (PURP).

Nataša Strelec Mahović from Croatian Meteorological and Hydrological Service as leader of the international project METOMONIC and expert in forecasting presented the project. The purpose of the strategic project "Modernisation of the National Weather Observation Network in Croatia - METMONIC is the establishment of a modern and high quality system of automatic surface meteorological stations, meteorological-oceanographic buoys and remote measurement systems,

including meteorological radars. In total, 450 modern automatic meteorological systems will provide traceable, reliable, high quality and timely information on the state of the atmosphere and the sea throughout the territory of the Republic of Croatia. This will allow continuous monitoring of weather, climate and climate change and will improve early-warning of hazardous weather in order to support adaptation systems to climate change and natural disasters, thus providing direct support to sustainable development, increasing security and preserving human lives and goods. Analysis of the current meteorological observation network and its supporting technical, informational and organizational systems confirms that there is a great need to increase the availability of measured climate variables as well as the analyses of climate conditions for the needs of different economic branches and public activities. The need to carry out the METMONIC project is justified and supported through several national documents.

The key components of the project are:

- Modernization and improvement of surface meteorological measurements
- Modernization and improvement of upper-air meteorological measurements
- Modernization and improvement of the meteorological radar network
- Establishment of a measurement system of meteorological-oceanographic buoys
- Enhancement and modernization of the system for receiving, processing, controlling and storing data and ensuring data availability
- Improvement of the meteorological calibration laboratory
- Improvements in monitoring of trace elements in the ecosystem.

Modernization of the observation network in all segments of the observation system will ensure full and homogeneous coverage of the land and the territorial sea with meteorological, oceanographic and radar measurements, enable the availability of all measured data for public, as well as the modern and comprehensive ability to calibrate observation sensors.

The project will significantly contribute to:

- Improvement of early-warnings to severe weather and natural disasters
- Development of human, technical and scientific capacities
- International exchange of information
- Developing products tailored to the needs of users in order to achieve sustainable development
- Modernization of all components of the DHMZ observation system, easier access to its archives and databases and accompanying infrastructure.

Current and archived data will be publicly available on the DHMZ website and will serve research institutions, non-governmental organizations and interested users, especially in the research related to climate change and its impact on vulnerable sectors.

Darko Barbalić as the hydrology expert with a lot of experience in flood risk assessment for River Basin Management Plan presented Preliminary flood risk assessment 2018 in Croatia - the recognized gaps and issues, as well as the integrated approach to flood protection and risk

assessment. His presentation stressed the importance of non-structural measures and climate change effects which must be taken into account during any flood risk planning.

3. Event outcomes and conclusions

Danube River Basin basic hydrological and meteorological data in the closes possible real time standard format and validated long time data for flood risk management in the project DAREFFORT pilot area will be systematized by Croatian partners in Danube HIS.

29 Questionnaires filled by stakeholders for the purpose of the output 5.- share of experiences and good practices in the field of Educational issues for hydrological monitoring and forecasting, especially related to e-learning approach, experience in using e-learning material, for supporting training activities in the field of hydrological monitoring and forecasting, example, experience, recommendations, proposals for focus, subject and thematic of the e-learning course, using e-learning tools for training peoples involved in operational flood forecasting and warnings activities.

Promotional materials in the form brochures, textile based bags and umbrellas with project DAREFFORT and Croatian Waters logo were distributed for dissemination purposes:

***Figure 3**. Promotional materials and logos*

4. Moderated discussion

A moderated discussion led by Danko Biondić ensued after the presentations. The discussion was a two-way, productive interaction between CW experts and stakeholders.

Some of the highlighted topics were:

- Significance of fast sharing of the hydrological and meteorological data in the closes possible real time standard format
- The importance of continuous and living cooperation with Croatian Meteorological and Hydrological Service as Croatian Waters are responsible for flood defence on the national level and Croatian Meteorological and Hydrological Service are the national meteorological service and national service responsible for dangerous weather phenomena forecasting
- Improvements of monitoring of weather, climate and climate change to support climate change adaptation systems and response to natural disasters are highly important
- The analysis of the current situation has shown that there is a great need to increase the availability of measured data on climate variables and the analysis of climate opportunities for the needs of the national economic and public activities.
- Establishment of a modern system of automatic ground-based meteorological stations, meteorological-oceanographic buoys and remote atmospheric measurement systems, including a system of meteorological radars to provide traceable, representative, high-quality, reliable and timely information on the state of the atmosphere and the sea throughout the Republic of Croatia is needed.

Dragica Kvesić, expert from private company Proning d.o.o. (Ltd), asked why Bosnia and Hercegovina (BIH) is not involved in DAREFFORT project activities taken in consideration it is also a Danube country. Daria Čupić and Danko Biondić as experts from Croatian Waters replied that every country was able apply, but BIH did not. However, as BIH is member of ICPDR, very soon they will have contribute in Danube HIS trough ICPDR.

Zoran Hebar, architect from Association of architects (NGO), emphasized the importance of flood risk planning calculations while developing urban plans and especially for cultural heritage urbanistic planning. Darko Barbalić, flood risk planning expert from Croatian Waters, explained how Flood Risk Plan are calculated and how urban planning is starting to be a part of it.

Neven Kuspilić, ex dean and full-time professor of hydro engineering from the Faculty of Civil Engineering in Zagreb and a specialist in river and maritime constructions, asked about establishment of meteorological-oceanographic measurement system.

Branka Ivančan Picek, head of Croatian Meteorological and Hydrological Service, replied that through project METMONIC establishment of meteorological – oceanographic measurement

system is currently in development, including five monitoring points: Kvarner, Blitvenica, Viški Kanal, Palagruža and Molunat.

5. Photos

The pictures were taken by Ivana Čagalj, the projects Finance and Communication manager from CW.

***Figure 4**. Public presentation part of the event*

***Figure 5**. PhD Danko Biondić during public presentation of the project*

***Figure 6**. Daria Čupić, MSc during public presentation of the project*

***Figure 7**. PhD Mariela Sijekavica Klepo during her presentation*

***Figure 8**. PhD Nataša Strelec Mahović during her presentation*

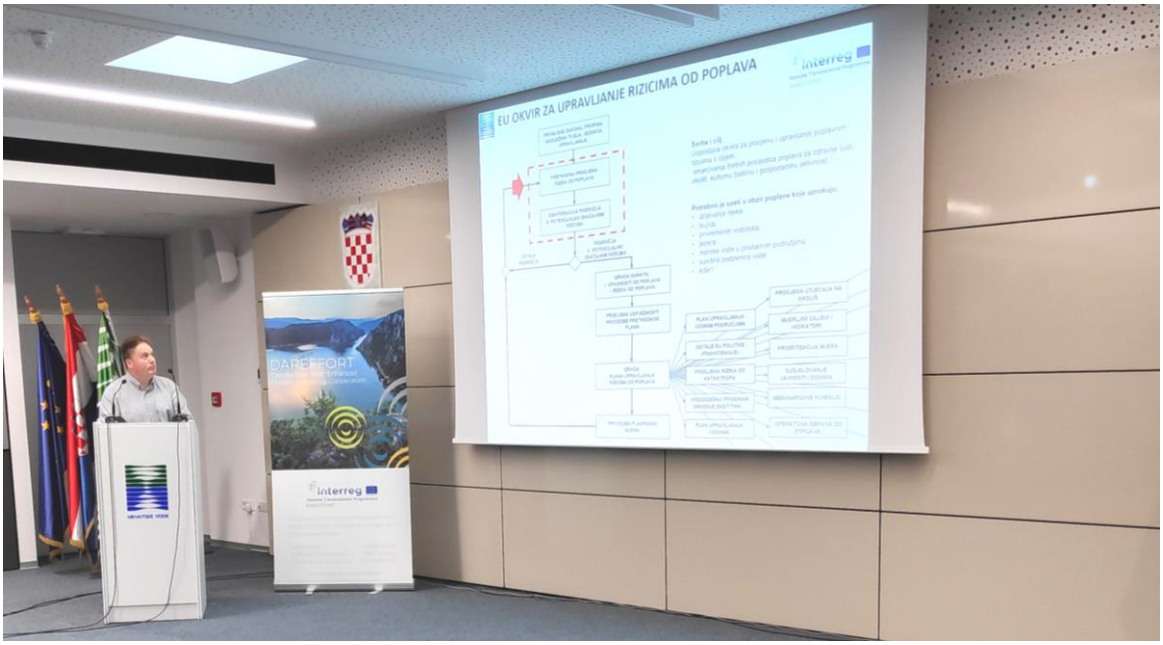

***Figure 9**. PhD Darko Barbalić during his presentation*

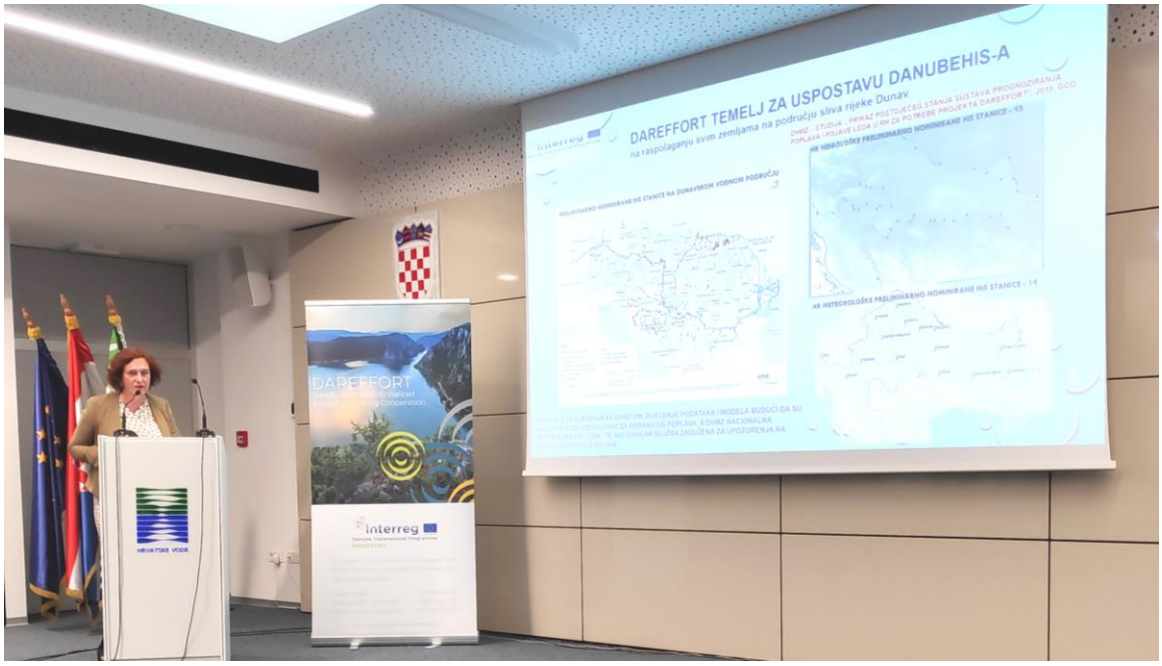

***Figure 10**. Daria Čupić, MSc during the workshop part of the event*

***Figure 11**. Moderated discussion*

Figure 12. Moderated discussion

6. Questionnaires output

29 Questionnaires were filled by stakeholders and analysed for the purpose of project DAREFFORT output (5.), 27 Croatian Waters employees also filled the questionnaires but as their results were not usable for project purposes, data was collected for Croatian Waters internal database.

1. Stakeholder general information

1.1. Country: Croatia = 29 (all)

1.2. Organisations: Croatian Meteorological and Hydrological Service, Rittmeyer d.o.o. (Ltd), Faculty of civil engineering in Zagreb, Faculty of civil engineering and architecture in Osijek, Croatian Electricity Company HEP (PLC), Proning DHI d.o.o. (Ltd), Water Supply and Drainage d.o.o. (Ltd), Croatian Bureau of Statistics, Zagreb University of applied sciences, Institute for electricity and energy (IE Zagreb) d.o.o. (Ltd); Slap (NGO), Vita projekt d.o.o. (Ltd), Ministry of Environment and Energy of the Republic of Croatia

2. Hydrological information and forecasts – channels of delivery:

2.1. Do you normally receive hydrological information and forecasts?

(a) Yes = 24
(b) No = 8

2.2. If yes, how do you usually get this information?

(a) Directly from hydrological service = 11
(b) Hydrological service website = 11
(c) Other websites = 8
(d) Television = 12
(e) Radio = 9
(f) Newspaper = 4
(g) Mobile telephones = 11
(h) Other sources (please specify): = 1 “scientific publications”

2.3. How easy is it for you to understand the hydrological information and forecasts products?

(a) Easy = 20
(b) Neutral = 9
(c) Difficult = 0

3. Use of the hydrological information and forecasts:

3.1. Do you normally use hydrological information and forecasts in your current activities?

(a) Yes = 22

(b) No = 7

3.2. How often do you use hydrological information and forecasts in your current activities?

(a) Daily = 14
(b) Weekly = 3
(c) Once a month = 6
(d) Rarely = 6

3.3. How useful do you consider the hydrological forecasts and warnings products you receive?

(a) Very useful = 10
(b) Useful = 19
(c) Not useful = 0

3.4. Based on your experience, please comment on the following aspects regarding hydrological information and forecasts products:

	Very good	Good	Bad	Very bad
Accuracy	6	23		
Timeliness	7	21	1	
Access	13	16		

3.5. Compared to 3 – 4 years ago, hydrological forecasts and warnings are:

(a) More useful = 11
(b) About the same = 12
(c) Less useful = 0
(d) Don't know / No comment = 5

3.6. Compared to 3 – 4 years ago, how do you rate the current availability of hydrological information and forecasts:

(a) Significantly improved = 8
(b) Slightly improved = 15
(c) About the same = 5
(d) Less available = 0
(e) Don't know / No comment = 2

3.7. Which elements would be of most interest to you in hydrological forecasts:

	Very interested	Interested	Somewhat interested	Not interested
Hydrological warnings – fluvial floods on medium and large scale	13	19	7	
Hydrological warnings – flash floods	16	18	6	
Water level	19	15	7	
Discharge	21	14	8	
River ice phenomena	8	15	13	6
Deterministic forecasts	8	14	15	2
Ensemble / probabilistic forecasts	10	8	18	2

3.8. How much warning lead time do you need to properly take actions / make decisions?

(a) 30 minutes = 3
(b) 1 hour = 3
(c) 3 – 6 hours = 3
(d) 12 – 24 hours = 11
(e) 2 – 3 days = 4
(f) More than 3 days = 1
(g) Other (please specify): = 3 (no specified answer)

4. Proposals and recommendations:

4.1. Do you need assistance / training in the interpretation / understanding of the hydrological information and forecasts?

(a) Yes = 5
(b) No = 23

4.2. Kindly provide your suggestions to improve the effective dissemination of the hydrological information and forecasts?

Greater presence on TV, involving as many participants as possible from different profession domains. Increased availability on social networks. Direct delivery or web service to interested parties, customizing product users. Hydrological information along the Danube basin should be better visible on the media and websites. By creating web portals with customization of different categories of users, accessibility of web pages. Education of citizens, schools, their relationship with the local community. Establishment of a web service, development of an application for access to hydrological data and forecasts for improvement of flood alerts in meteorological alarm, improvement of hydro meteorological instrumentation and communication information system.

4.3. Kindly provide your suggestions for development of new hydrological information and forecast products?

Improvement of existing AVS and system functions; Development of evaluation module, determination of efficiency measures of hydrological prognostic models; Educational info centers; Development of mobile applications for frequent monitoring hydrological and meteoro forecasts, 3-hour, from multiple models connection of meteorological and hydrological forecasts (Precipitation-flow); Data exchange experiences for torrential floods can be used in other areas; Spatial coverage of floods in real time

We would like to keep in contact with you as we value your feedback very much. What methods would you like in order for us to maintain contact?

(a) Telephone calls = 1
(b) E-mail = 28
(c) Attending other user workshops = 9
(d) Web based feedback forms = 1
(e) Other (please specify): = 0

Figure 10. *Questionnaires results (marked red) summary*

5.Participation list

Interreg
Danube Transnational Programme
DAREFFORT

PARTICIPANTS

30th October 2019, Hrvatske vode, Zagreb, Croatia

Ime / Name	Institucija / Institution	Zanimanje / Position	e-mail	Potpis / Signature
SANJA OSTOJIĆ	GRAĐEVINSKI FAKULTET	STUDENTICA	sanja.ost55@gmail.com	[signature]
BORNA JURIŠKOVIĆ	GF	STUDENT	bornajuriskovic@gmail.com	[signature]
VESNA PAVIŠIĆ FILIPIĆ	HEP		VESNA.PAVISIC@HEP.HR	[signature]
GORDANA BUŠELIĆ	DHMZ	VODITELJICA SEKTORA	buselic@cirus.dhz.hr	[signature]
TOMISLAV DEANIĆ	HRVATSKE VODE	SAMOST. INŽENJER	tomislav.deanic@voda.hr	[signature]
BORIS MIĆETIĆ	HRVATSKE VODE	INŽ	boris.micetic@gmail.com	[signature]
TOMISLAV PROKO	MZOIE	STRUČNI SURADNIK	tproko@yahoo.com	[signature]
RENATA VIDAKOVIĆ ŠUTIĆ	IEE	VODITELJ ODJELA	renata.sutic@ie-zagreb.hr	[signature]
MARIJO KOSTANJIĆ	VODOOPSKRBA I ODVODNJA ZAGREB	ŠEF TEHNIČKOG ODJELA	marijo.kostanjic@[illegible]	[signature]
MARINA ŽUBOVIĆ	HRVATSKE VODE	SAMOSTALNI INŽENJER	marina.zubovic@voda.hr	[signature]
MLADEN PETRIČEC	TVZ	prof. v. šk.	m.petricec@tvz.hr	[signature]
ZRINKA MOLAK MILIĆ	HRVATSKE VODE	SAMOSTALNI INŽENJER	zrinka.molak@voda.hr	[signature]
ALMA TUDIĆ	HV	SAMOSTALNI INŽ.	alma.tudic@voda.hr	[signature]
IVANA ČAGALJ	Hrvatske vode	EKONOMIST	ivana.cagalj@voda.hr	[signature]

Interreg
Danube Transnational Programme
DAREFFORT

PARTICIPANTS

30th October 2019, Hrvatske vode, Zagreb, Croatia

Ime / Name	Institucija / Institution	Zanimanje / Position	e-mail	Potpis / Signature
HANNA MILIČEVIĆ	GF	STUDENT	hanna.mo@hotmail.com	
IVAN PAVKOVIĆ	HRVATSKE VODE	SAMOSTALNI INŽENJER	ivan.pavkovic@voda.hr	
IVAN TOT	HRVATSKE VODE	SAMOSTALNI INŽENJER	itot@voda.hr	
ŽELJKA KLEMAR	DHMZ	VODITELJ SLUŽBE	klemar@cirus.dhz.hr	
MARIJANA ORŠOLIĆ	HRVATSKE VODE	GLAVNI INŽENJER	morsolic@voda.hr	
IGOR KOKOLJAN	HRVATSKE VODE	INŽENJER	igor.kokoljan@voda.hr	
DRAŽEN ŠEGON	— " —	VODITELJ ODJELA	dsegon@voda.hr	
NEVEN KUSPILIĆ	GRAĐEVINSKI FAK.	SVEUČILIŠNI PROFESOR	kuspa@grad.hr	
VESNA TUBIĆ	HRVATSKE VODE	VIŠI STRUČNI SURADNIK	vtubic@voda.hr	
TOMISLAV DOMAC	Zagreb Rittmeyer d.o.o.	Direktor	tomislav.domac@rittmeyer.com	
MARIO BAGARIĆ	HRVATSKE VODE	SAMOSTALNI INŽENJER	mario.bagaric@voda.hr	
Davor Nedić	Hrvatske vode	viši savjetnik	dnedic@wdc.hr	
Mario Sikora	— " —	glavni inženjer	msikora@voda.hr	
MARIJA ŠKRLEC	— " —	SAMOSTALNI INŽENJER	marija.skrlec@voda.hr	

PARTICIPANTS

30th October 2019, Hrvatske vode, Zagreb, Croatia

Ime / Name	Institucija / Institution	Zanimanje / Position	e-mail	Potpis / Signature
Sinisa Marčić	GRAFOS	predvrač	smarcic@gfos.hr	
NATALIJA PAVLIĆ	ZELENI SERVIS	Pr. oec, mag. vodstvo	...e marketing. pavlic@zeleni-servis...	
DARKO BARBALIĆ	HV	DIPL. ING. GRAD	DARKOB@VODA.HR	
Vlatko Jurković	HV	dipl. ing.	vlatko.jurkovic@voda.hr	
Jerko Bosić	HV	struč. spec. ing. grad.	jerko.bosic@voda.hr	
ZORAN KREBS	ODR URS	ARHITEKT	zoran.krebs@... com	
ZLATKO ŠUMANAC	HV	DIPL. ING. GRAD.	zlatko.sumanac@voda.hr	
ANDREJ PAVLOVIĆ	HV - VGI OPUZEN	dipl. ing. grad.	andrej.pavlovic@voda.hr	
JOSIP BAGARIĆ	ViO	mag. ing. grad	josip.bagaric@zgh.hr	
DIJANA KLARIĆ	DHMZ	meteorolog	dijana@cirus.dhz.hr	
NATAŠA STRELEC MAHOVIĆ	DHMZ	meteorolog	strelec@cirus.dhz.hr	
Gordana Lepčević	DZS	dip. ing. agr.	lepcevicg@dzs.hr	
KREŠIMIR LOŽNJAK	HV	dip. ing. grad	kresimir.loznjak@voda.hr	
MARIO STAVIĆ	GF	bacc. ing. aedif.	mstava511996@gmail.com	

Interreg
Danube Transnational Programme
DAREFFORT

Ime / Name	Institucija / Institution	Zanimanje / Position	e-mail	Potpis / Signature
ROBERT FLISZAR	GF ZAGREB	STUDENT	robert.fliszar@student.grad.hr	
IVAN CRNČEC	GF ZAGREB	STUDENT	ivan.crncec8@gmail.com	
DAMIR TOMAS	FN	samostalni kotizant	damir.tomas@voda.hr	
DUBRAVKA BRADIĆ	VODOOPSKRBA I ODVODNJA	prof. fizike i kemije	dubravka.bradic@zgh.hr	
ALENA VLAŠIĆ	HV	koord.	avlasic@voda.hr	
[illegible]	HV	voditelj [illegible]	[illegible]@voda.hr	
GORAN PETROVIĆ	HV	viši sav. inž.	goran.petrovic@voda.hr	
TOMISLAV DJANDARA	GF ZAGREB	STUDENT	djandaratomislav@gmail.com	
NATAŠA GECAN	HRVATSKE VODE	VIŠI SAV. INŽENJER	natasa.gecan@voda.hr	
ANA IVANIŠEVIĆ	HR. VODE	VIŠI SAV. INŽ.	ana.ivanisevic@voda.hr	
MATE VUJEVIĆ	HV	HIDROLOG [illegible]	mvujevic@voda.hr	
TOMISLAV MATIJEVIĆ	ViO	PROJEKTANT ODVODNJE	tomislav.matijevic@zgh.hr	
Vesna Aparlinović	ViO	Pom. direktora	vesna.aparlinovic@zgh.hr	
DRAŽEN KURECIĆ	HV	DIPL. ING. AGR.	dkurecic@voda.hr	
TIJANA ROSANDIĆ	HV	dipl. ing. računarstva	tijana.rosandic@voda.hr	
SANDRA STUBLAN POPOVIĆ	HV	dipl. ing. geot.		
IVANA ŠARIĆ	VITA PROJEKT d.o.o.	VODITELJICA PROJEKTA	ivana.saric@vitaprojekt.hr	

Interreg
Danube Transnational Programme
DAREFFORT

PARTICIPANTS

30th October 2019, Hrvatske vode, Zagreb, Croatia

Ime / Name	Institucija / Institution	Zanimanje / Position	e-mail	Potpis / Signature
MARIO SPAJIĆ	HRVATSKE VODE	dipl. ing. grad.	mspajic@voda.hr	[signature]
VLASTA TUTIŠ	DHMZ	načelnica Sektora	tutis@cirus.dhz.hr	Vlasta Tutiš
IGOR TOŠIĆ	HRVATSKE VODE	mag.ing.geoing.	itosic@voda.hr	[signature]
BRANKO PEREC	-II-	voditelj VGI „Plit-Bedja"	bperec@voda.hr	[signature]
KATARINA MARKOČ	-II-	samostalni inženjer	katarina.markoc@voda.hr	[signature]
TIHOMIR GALIĆ	-II-	DIPL. ING. GRAĐ	tgalic@voda.hr	[signature]
MIRJANA ŠVONJA	-II-	MR. SC.	SMIRJANA@VODA.HR	Mirjana Švonja
MARINA BARBALIĆ	-II-	MR. SC.	marina.barbalic@voda.hr	Marina Barbalić
DARKO JUKIĆ	DZS	VODITELJ SLUŽBE	jukicd@dzs.hr	[signature]
ANDRIJA RUBINIĆ	HRVATSKE VODE	DIPL. ING. GRAĐ	andrija.rubinic@voda.hr	[signature]
LUKA VUKMANIĆ	HRVATSKE VODE	SAMOSTALNI INŽENJER	LUKA.VUKMANIC@VODA.HR	[signature]
KARLO SUČIĆ	GF ZAGREB	STUDENT	KSUCIC@HOTMAIL.COM	[signature]
LOVRE DIJAN	GF ZAGREB	STUDENT	lovre.dijan@gmail.com	L Dijan
Domagoj Perković	GF ZAGREB	STUDENT	dp.domagoj.perkovic@gmail.com	Domagoj Perković

Interreg

Danube Transnational Programme

DAREFFORT

Ime / Name	Institucija / Institution	Zanimanje / Position	e-mail	Potpis / Signature
MIRJANA VARAT	HV	dipl. ing. agr.	mvarat@voda.hr	[illegible]
SLAVEN JETAMA	HV			[illegible]
GORAN SALOPEK	HV	dipl. ing. grad.	gsalopek@voda.hr	[illegible]
TOMISLAV SLOBODA	HV - VGO VŽ	dipl. ing. geoteh.	tsloboda@voda.hr	[illegible]
DRAŽENKA KVESIĆ	PRONING DHI	dip. ing. grad.	drazenka@PRONING-DHI.HR	[illegible]
DRAGAN MAJIĆ	HV	dipl. ing. geod.	dragan.majic@voda.hr	[illegible]
STJEPAN LAMBĚ	HV	mag. ing. aedif.	slambe@voda.hr	[illegible]
MARIJA VIZNER	HV	dipl. ing. agr.	marija.vizner@voda.hr	[illegible]
MARIELA SJEKAVICA KLEPO	HV	dr. sc.	mariela.sjekavica@voda.hr	[illegible]
DANKO BIONDIĆ	HRVATSKE VODE	VODITELJ SEKTORA	danko.biondic@voda.hr	[illegible]
DARIA ČUPIĆ	Hrvatske vode	SAM. INŽENJER	dcupic@voda.hr	[illegible]
BORNA IVAN BALAŽ	HV	INŽENJER	borna-ivan.balaz@voda.hr	[illegible]

WP5 National Knowledge Exchange Workshop

PP7 Romania

The project is funded by the European Union

MINUTES

WP5 National Knowledge Exchange Workshop, Romania

Danube River Basin Enhanced Flood Forecasting Cooperation – DAREFFORT
Project code: DTP2-064-2.1

19 of September 2019, Bucharest

Venue: Conference Room "Academy", Ramada Majestic Hotel, Calea Victoriei Street 38-40, Bucharest

Total number of participants: 18
(See the scanned participants list)

Project Partner Organizer: National Institute of Hydrology and Water Management (NIHWM)

The DAREFFORT National Knowledge Exchange Workshop for Romania, was organized as a back-to-back meeting together with the national dissemination event.

Representatives from the following Stakeholders participated to the event: Ministry of Water and Forests, "Romanian Waters" National Administration, General Inspectorate for Emergency Situation, Hydropower Company "HIDROELECTRICA", Lower Danube Navigation Administration, Navigable Channels Administration, National Company for Road Infrastructure Administration.

The workshop was open by Marius Matreata, director of National Hydrological Forecasts Centre – National Institute of Hydrology and Water Management (NIHWM), presenting the purposes of the two events, introducing the participants and the invited institutions.

The first part of the National Knowledge Exchange Workshop was common with the National Dissemination Event. In this part, Marius Matreata presented the main objectives, activities, expected results and output of the DAREFFORT project.

He gave also a general presentation of the technical work packages (WP3 - "EVALUATION OF FORECASTING", WP4 – "HARMONIZED DATA EXCHANGE", WP5 – "KNOWLEDGE TRANSFER"), with emphasis on the NIHWM contribution within the project.

The second part of the workshop, was dedicated to the knowledge exchange with stakeholders, but the participants from other institutions, who participated in the dissemination event, were also invited to join the meeting.

The workshop started with a brief introduction to the discussions with the participants about their experiences related to the use of hydrological forecasts and warning products in their activities.

Marius Matreata gave a detailed presentation of the questionnaire dedicated to the stakeholders, with the mention that it should be completed and sent by email along with the recommendations and related questions.

After that, Marius Matreata introduced the proposed topics for discussions, gave a short presentation of the components and capabilities of the current National Flood Forecasting System, which is use by the National Hydrological Forecast Centre, and review the main hydrological forecasts and warning products that are available on the NIHWM web page.

A discussion was conducted on the role and benefits of international cooperation, between National Hydrological Forecasts Centres, in other regional projects coordinated by WMO, respectively the South East Europe Flash Flood Guidance System (SEEFFG) which is already operational, and the South East Europe Multi Hazard Early Warning Advisory System which is just started, and it is planned to be implemented in the next 5 years.

Marius Matreata initiated a discussion on flash flood forecasts and warnings, he mentioned the particularities of these dangerous hydrological phenomena, the associated very high uncertainties both at the level of input data (QPE and QPF) but also at the level of hydrological models taking into account that flash flood events are occurring mainly in ungauged small river basins, uncertainty which represent a great challenge for the forecasters. He also mentioned that one of the clearest impacts of the climate change in the next years is the increase of frequency of occurrence and severity of flash floods events, and that further development of the flash floods forecasting and warnings methodologies and models represent a major priority for NIHWM for the next period.

Pompiliu Mita had an intervention, regarding the particularities and related issues for increasing the lead time of floods forecasting and warning for very small basins, where the time of rise is very short (under 30 minutes).

Marius Matreata presented the ongoing cooperation with the Emergency Management Inspectorate in order to include the dissemination of flash floods or other immediate hydrological dangerous phenomena warning messages in the new RO ALERT System.

He also emphasized a potential solution for improving the flash floods forecasting system and increasing the flash floods warning lead time by adopting probabilistic forecasts and warnings, but that will imply also the need to prepare and train the institutions who will

use these new kind of forecasting and warnings to be able to adapt their intervention procedures and decision making process to these new products.

Catalin Popescu, from the HIDROELECTRICA Hydropower Company, ask for clarification and more information on ensemble and probabilistic hydrological forecasts.

An explanatory discussion on probabilistic and ensemble forecasts was conducted by Marius Matreata, with an emphasis on the generation mechanism, type of products, their added value in connection with the forecasts associated uncertainty, as support for better hydrological forecasting products.

He indicated that the National System does not have now this capability, but it is planned to be added in the new national modernization project WATMAN II, in the next 3 – 4 years. He also presented the NIHWM cooperation as partner within European Operational EFAS System, which main objective is to produced ensemble and probabilistic hydrological forecasts products up to 10 days lead time, products that due to the high associeated uncertainty are dedicated to be used only by the National Hydrological Forecast Centres as supplemental support information in their activity, for increasing the flood warnings lead time.

Pompiliu Mita, the President of Honour of the Romanian Association of Hydrological Sciences presented a brief history of the monitoring and forecasting methodologies for dangerous ice phenomena on the rivers in Romania, especially concerning the Romanian sector of the Danube. He indicated that in some cases, the historical maximum recorded water level was generated by very severe ice on river phenomena.

Also, the issue of implementing the e-learning tool was proposed for discussion for the last part of the event.

Gabriela Morosanu, from the Institute of Geography opened the discussion about the gap between academic training and the activity of research institutes and proposed ideas for collaboration on specialized training on new products. She also presented some e-learning platforms used in her work. The limitations, difficulties and advantages of these e-learning platforms were discussed.

The needs for continuous training, specialization of personnel, was discussed after that, especially taking into consideration the personnel frequent change, difficulty in assuring the personnel stability, which raise the needs for acceleration of the training process, one solution, in particular for the operational activities, could be to use in the training process “Flood Forecasting System” simulator tools.

George Ionas, representative of the Ministry of Environment presented the experience of a partnership for a pilot course in a master's degree at Lucian Blaga University in Sibiu.

Radu Drobot, representative of Technical University of Construction of Bucharest (UTCB) presented the experience of participating in a complex e-learning course within an international collaboration.

Marius Matreata presented the summary and main conclusions of the workshop, and reminded the participants to send by e-mail the completed questionnaires and related recommendations.

Most of the participants indicated that they are very interested in the hydrological data, forecasts and warnings products, and they would welcome such meetings towards the end of the project, or even after the end of the project, to see the final projects results.

After this the meeting was finished.

WP5 National Knowledge Exchange Workshop

PP8 Bulgaria

The project is funded by the European Union

MINUTES

Expert workshop on knowledge exchange WP5
Deliverable - D 5.1.1 (PP8)
Danube River Basin Enhanced Flood Forecasting Cooperation – DAREFFORT
Project code: DTP2-064-2.1

25th September 2019, Pleven, Bulgaria

Venue: *hotel Balkan, Pleven, bul. „Rouse“ 85, 5800 Pleven*

Total number of participants: 21

Participants:

PP8 team - Snezhanka Balabanova, Georgy Koshinchanov, Valeriya Yordanova, Silviya Stoyanova, Nikolay Nedkov, Mariana Asenova

Pavel Vaptsarov (director National Institute of Meteorology and Hydrology Branch Pleven)
Ivan Borisov Kalamerov (Chief Expert in Danube River Basin Directorate-Pleven /DRBD/ at The Ministry of Environment and Water)
Vesela Komarevska (Danube River Basin Directorate-Pleven /DRBD/ at The Ministry of Environment and Water)
Teodora Georgieva (Regional Directorate "Fire Safety and Population Protection" , Pleven)
Ivan Atanasov (head expert Hydraulic engineering in Kozloduy NPP)
Desislava Bratoeva (Irrigation systems branch of the lower Danube)
Boyan Mihaylov (Irrigation systems branch of Vidin)
Further participants: representatives of regional Irrigation systems, Water Supply and Sewerage Ltd. and NGO

Danube Transnational Programme
DAREFFORT

Minutes of expert workshop on knowledge exchange Bulgaria, Pleven *25th* September 2019

25th of September 2019 (11:00 – 14:00)

11:00 Registration

11:20 – 11:30 Opening of the event (Assoc. Prof. eng. Snezhanka Balabanova)

Snezhanka Balabanova welcomed the participants and guests

11:30 – 12:20 TOPIC 1: Presentation

1. *HYDROLOGICAL FORECASTINGS, FORECASTING SYSTEMS, EARLY WARNING SYSTEMS - eng. Valeriya Yordanova*

Valeria Yordanova presented the capacity of hydrological forecasts in NIMH (available hydrological forecasts and warning products and experience in Flash Flood forecasting) and its importance for the stakeholders.

2. *DANUBE RIVER BASIN ENHANCED FLOOD FORECASTING COOPERATION - DAREFFORT - eng. Silviya Stoyanova*

Silviya Stoyanova presented the project, main objectives of the project, work packages, project outputs, NIMH activities in the project, the completed tasks up to now.

Georgy Koshinchanov presented summary of the project activities up to now and future plans of our team.

12:20 – 12:40 Coffee break

12:40 – 14:00 TOPIC 2: discussion

Silviya Stoyanova presented summary of the questionnaire. According to the results - most of the stakeholders are receiving directly from our institute hydrological information. Most of the institutions prefer graphical view of the Hydrological forecasts. Most of the stakeholders has stated that they use everyday hydrological information and forecasts. Most of stakeholders has stated that for them 12-24 hours is enough warning lead time for taking actions (make decisions). The second preferred answer was 2-3 days warning lead time. Recommendations from the stakeholders: to give access to the NRT data, to emphasize on the mobile applications and social media in the future development of our work.

The experts on the meeting were kindly asked to fill in the additional questionnaire about the e-learning module.

Vaptsarov (NIMH - branch Pleven): I'm surprised by the small number of stakeholders that has checked ensemble forecasts. So in the e-learning it could be included.

Mihaylov (Irrigation Systems) - In those e-learning materials should be included and explained the ensemble and deterministic forecasts.

Balabanova (NIMH): Also the difference between deterministic and ensemble forecasts should be definitely one of the topics in those e-learning materials, because when we give you those forecasts the stakeholders should be aware what are they receiving.

Vaptsarov (NIMH - branch Pleven): Sometimes the quality of the data is not the desired one. We could not always measure correctly the elements, so in the models sometimes there are gaps or wrong data. So the ensemble forecasts are manly for that purpose - to play different scenarios.

Balabanova (NIMH): Another issue is that this year (up to now) there was no significant river flood but there were many pluvial floods. All the meteorological scenarios show no big change in the precipitation amount over Bulgaria as yearly sum, but big difference in the distribution within the year. This means more intensive precipitations will happen in the future. Most problems with those intensive rainfalls arise in the settlements - where the coverage is asphalt and the capacity of the sewerage systems is limited due to the fact that they were designed many years ago and can't take the water from the intensive rainfalls which we see nowadays.

Kalamerov (DRBD): According to the information from the preliminary assessment of the flood risk for the Danube river Basin show that more than 65 % of the floods are caused by intensive rainfalls (these are data from 2011). In the recent years this percentage has even increased. So the forecasting products for the intensive rainfalls are of great importance for us.

Balabanova (NIMH): We have one model for flash flood forecasting but with this project we want to see the experience of the other countries in the Danube river basin - they have more conventional and automatic stations but what is more - they have radar data. Intensive rainfalls usually fall on a very small area and very often not where the gauge is situated. So without this radar data we cannot say what really caused a given event.

Komarevska (DRBD): I'm responsible for dissemination the information when the operational bureau at MOEW is activated. As a result from this project could be the municipalities to be included in the dissemination of the information - the people are interested from the information coming from you. When there is danger from floods we are always publishing the information coming from you. One example - last year when there was danger of floods in Smolyan region a person by occasion saw this warning and cancelled family vacation in that endangered region. So to summarize this information is of great importance for the people. We have to improve our work the municipalities and the local authorities.

Balabanova (NIMH): What is your opinion - where should this information be published? Because we are publishing it in our website but not everyone and everywhere could it be opened and read it. This information is more or less specialized. So how do you see this dissemination?

Komarevska (DRBD): There are different channels for dissemination of this information: we are using emails; there is integrated electronic system for exchange of information in the administration. There are some municipalities which are still not integrated in it. The vision is by the end of this year all municipalities to be integrated in this system. Each telephone has VIBER or Messenger and mainly in private sector the information is disseminated through these applications. When talking for the accessibility we are publishing plain text in order each telephone each computer to be able to open it and people to read it. But we are always making reference to the MOEW website or NIMH website.

Stoyanova (NIMH) presented the website of the section Hydrological Forecasts. Below is given the part of the page with short description of the DAREFFORT project and is regularly updated with upcoming events and news from the project.

Minutes of expert workshop on knowledge exchange Bulgaria, Pleven *25th* September 2019

Interreg
Danube Transnational Programme
DAREFFORT

НИМХ

Национален институт по метеорология и хидрология
Хидрологична информация и прогнози

Времето

BG / EN

- Начало
- Обща информация

Новини

Наводнения
- Стара Загора 03.06.2018 г.
- Роман 29.06.2018 г.

Данни
- Месечен бюлетин
- Реки
  - Ежедневни-графики
  - Ежедневни-таблица
  - Месечен отток
- Подземни води
  - Ниво и дебити
- Наноси
  - Мътност
- Валежи
- Снежна покривка

Индекси на засушаване
- Месечни
  - SRI
  - SMI
  - SPI

Годишни оценки на:
- реките 2018
- подземните води 2018

Проекти и публикации
- DAREFFORT
- DanubeSediment
- ArdaForecast
- Maritsa/Tundzha

ПОДОБРЯВАНЕ СЪТРУДНИЧЕСТВОТО В ОБЛАСТТА НА ПРОГНОЗИРАНЕТО НА НАВОДНЕНИЯ В БАСЕЙНА НА РЕКА ДУНАВ — ПРОЕКТ НА ЕС

Interreg
Danube Transnational Programme

DANUBE RIVER BASIN ENHANCED FLOOD FORECASTING COOPERATION (DAREFFORT) – DANUBE TRANSNATIONAL PROGRAMME

Период на проекта: 06.2018 – 05.2021

Проектът се съ-финансира от фондове на Европейския съюз (ERDF и ENI)

Актуална информация може да бъде намерена на сайта www.interreg-danube.eu/dareffort

Дунавският басейн е най-интернационалният речен водосбор, в който 14 държави имат големи и значими притоци по дължината на река Дунав. Наводненията в басейна стават все по-чести явления (2002, 2005, 2006, 2009, 2010, 2013 и 2014), което налага по-ефективно и по-добре хармонизирано регионално и трансгранично сътрудничество в областта на прогнозирането на наводнения. Наводненията не признават политически и административни граници и подтикват към международно сътрудничество на ниво речен басейн за намаляване на риска от тях. Необходимостта от по-добро сътрудничество в областта на защитата от наводнения е официално призната в редица международни и междурегионални политически документи, като плановете за действие EUSDR PA5 и PA4, Европейската Директива за наводнения (EU FD 2007/60/EC), Първия план за управление на риска от наводнения за Дунавския Регион (FRMP).

Основните цели на проекта са:
- Оценка и анализ на съществуващите системи за прогнозиране на наводнения и ледови явления на страните в Дунавския регион. Определяне на нуждите на отделните страни по отношение на изискванията за хидрометеорологични данни.
- Класифициране и популяризиране на най-съвременните техники за прогнозиране на наводнения и ледови явления.
- Подобряване на сътрудничеството за по-добро прогнозиране на целия басейн на река Дунав.
- Международен обмен на хармонизирани хидрометеорологични данни в басейна на река Дунав. Създаване на база данни на Дунавската хидрологична информационна система (ICPDR DanubeHIS) и Европейската Система за Прогнозиране на Наводнения (EFAS), с което ще се осигури дългосрочна устойчивост на резултатите на проекта за Дунавските страни.

Целеви групи, към които е насочен проектът:
- Международни организации
- Национални публични органи свързани с управлението на водите
- Регионални публични органи свързани с управлението на водите
- Доставчици на инфраструктурни и публични услуги
- Висше образование и наука

Резултати от проекта:
- Изготвяне на доклад за оценка на прогнозите за наводнения и ледови явления
- Изготвяне на обща концепция за сътрудничество
- Определяне на политика и препоръки за обмен на данни
- Разработване на софтуер за обмен на данни
- Организиране на експертни семинари за обмен на знания
- Определяне на насоки за управление на данните
- Електронно обучение за прогнозиране на наводнения и ледови явления. Изготвяне на материал, който да бъде използван от експертите от националните и регионалните органи, отговорни за мониторинга и прогнозирането на наводнения и ледови явления, като същевременно ще бъде полезен и в курсовете за университетско обучение.

НИМХ е партньор в проекта и ще участва във всички дейности по работните пакети. С участието си в този проект, НИМХ ще подобри и разшири сътрудничеството си с други партньори в басейна на река Дунав в областта на прогнозирането на наводнения и системите за ранно предупреждение при наводнения. Обменът на знания и добри практики в рамките на проекта ще допринесе за развитие на моделирането и прогнозирането на наводнения, които са едни от основните задачи на НИМХ. Обменът на опит ще разшири нашите знания и възможности в прогнозирането на ледови явления.

Новини и събития

Откриваща среща 13-14.09.2018 г., Будапеща

Първа среща, 4-6.02.2019 г., Виена

Втора среща, 28-29.05.2019 г., Букурещ

Представяне на проекта, 31.10.2018 г., София

Семинар – представяне на проекта DAREFFORT

Експертен семинар по проекта DAREFFORT

14:00 – Closing the meeting

WP5 National Knowledge Exchange Workshop

PP9 Slovenia

The project is funded by the European Union

MINUTES

National Dissemination Event and Workshop in Slovenia:
Flood Forecasting, Warning, and Collaboration to Improve the Emergency Response

Danube River Basin Enhanced Flood Forecasting Cooperation – DAREFFORT
Project code: DTP2-064-2.1

Date: Tuesday, 10 September 2019

Venue: Slovenian Environment Agency (ARSO – Agencija Republike Slovenije za okolje), Vojkova 1b, Ljubljana. Slovenia, Great Conference Room

Total number of registrations: 43

Part 1: National Dissemination Event
Number of attendees in the Dissemination Event: 41
For details see the scanned attendance sheets.
All presentations are available at: http://ksh.fgg.uni-lj.si/ksh/razisk_dej/Dareffort_delavnica.html

Dr. Mira Kobold, from the Slovenian Environment Agency as the project's Associated Partner, welcomed everyone to the Dareffort dissemination event for Slovenia. She gave a brief overview of the agenda and introduced the speakers.

The first speaker was Dr. Mojca Šraj, project leader for PP9 University of Ljubljana, who gave a detailed presentation of DAREFFORT, including an overview of the project's goals, funding, and project partners. She underlined the significance of reliable and comprehensive meteorological and hydrological data for timely flood forecasting and focused on floods in the Danube river basin and the impact of climate change. Finally, she introduced the Dareffort video, which was then shown to the audience. The Dareffort brochure translated into Slovenian was handed out to the participants during the registration.

The next speakers were hydrologist Janez Polajnar and meteorologist Jurij Jerman (both from Slovenian Environment Agency), who presented Slovenian hydrological and meteorological forecasting services, respectively. Janez Polajnar discussed cases of recent and historical major floods in Slovenia, hydrological extremes, as well as the impact of climate change based on assessment of return periods over recent decades, specifically after 1990. The focus was also on warning lead-time and the problem of reliability in hydrological forecasting, particularly in flash flood events (versus karst floods), which constitute a significant hazard, while there is typically little lead-time for an actual warning. He also discussed the uncertainty of hydrological modelling, the early-warning system, and the colour scheme of warnings according to the severity (i.e. orange and red warning). He underlined that flood warnings are dynamic rather than absolute, and highlighted the problem of uncertainty and reliability of hydrological forecasting, which is lower in case of flash flood events. He invited the participants to give suggestions for improving the communication channels when hydrological warnings are issued.

Jurij Jerman first discussed the co-dependence of hydrological and meteorological services, as most extreme hydrological events depend on the weather (e.g. precipitation, temperature), while the reliability of hydrological forecasting highly depends on meteorological forecasts. He underlined the importance of good cooperation between the two services, which have been historically "under the same roof" in Slovenia – this is an exception rather than the rule, offering Slovenia advantage over neighbouring countries. Then he presented numerical meteorological models, spatial and temporal dimensions of weather processes, the theoretical limit of weather prediction, and gave an example of an ensemble weather forecast. He concluded that the quality of meteorological forecasts is improving, but meteorological forecasts can never be fully exact in Slovenia due to complex orography and convective processes that cause flash floods.

The final speaker in the dissemination event was Mag. Florjana Ulaga (Slovenian Environment Agency), whose presentation focused on public awareness raising about floods. She showed an example of a board with a high-water mark, which are used in Slovenia to show maximum water-levels recorded on streams and karst poljes (e.g. Planina 2014, Grad Snežnik, 1851). This is part of a public awareness-raising campaign that started in 2014, as a reminder of the fact that water needs, more or less frequently,

additional room. Various institutions, e.g. Slovenian Environment Agency, ICPDR, Ministry of the Environment and Spatial Planning, local communities, museums, landscape parks, schools, and other stakeholders have been involved in the campaign.

This was followed by a Questions and Discussion session. The first question from a representative from the University of Ljubljana, Faculty of Civil and Geodetic Engineering, was regarding the placement of high-water marks and how the information is checked. The answer was that proof of a certain high water-level is always required and that all information is checked before the installation of a high-water mark.

A representative from the City of Ljubljana expressed his belief that information does not reach the end users, he felt that the communication is too hierarchical, and that nowadays this could easily be improved. He suggested the setting-up of a SMS flood alerting system, which could be accessed via online registration. Any subsequent changes in the risk level should also be sent via text messages. In these cases, very concrete information and instructions are necessary, but are now lacking (e.g. clean the storm drains, don't drive through flood water, check the anti-flood valves). Information was provided that two crowdsourcing projects are already underway, i.e. projects where the general public is involved and where modest resources are needed to achieve a lot.

A representative from the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief (URSZR – Uprava Republike Slovenije za zaščito in reševanje) raised the problem that on the Drava River, from Markovci downstream, the flood alerts come too late. He suggested the installation of cameras at the water stations. They all agreed that the water levels, particularly in that section, are not recorded well enough, in fact this situation was better in the past when the information was diligently recorded in the SPIN application.

Another representative from URSZR commented on the lack of connectivity among institutions in general, despite the smallness of Slovenia. She also mentioned that amendments to the Natural Disaster Recovery Act are being drawn up.

A representative from another municipality felt that more effort should be put into awareness-raising and prevention measures, as remediation works are delayed, but this is however not within the jurisdiction of ARSO.

ARSO underlined that there is always a hydrologist available on-call to provide the latest information.

Another representative from a municipality commented on the lack of local emergency response services (specifically for the Savinja River); they however set up a local system of alerting the fire service and they have their own camera surveillance system in place, as they believe that video monitoring provides the most credible information for decision-makers. Representatives from ARSO agreed that the visual information is highly credible. In fact, a national video surveillance system has already been set up, but is not yet online.

Part 2: Workshop

Number of attendees in the Workshop: 40
For details see the scanned attendance sheets.
All presentations from the workshop are available at: http://ksh.fgg.uni-lj.si/ksh/razisk_dej/Dareffort_delavnica.html

After the break Dr. Mira Kobold gave some opening remarks about the workshop and provided an overview of the programme.

The first presentation was given by Dr. Sašo Petan (Slovenian Environment Agency) on the hydrological forecasting system at the Slovenian Environment Agency. He started off by presenting hydrological modelling as a support to hydrological forecasting in general and underlined the significance of implementing early-warning systems and the benefits of investments in preparedness, as they reduce the potential flood damage in the Danube river basin countries by between 30 and 40%. The impact of floods has exponentially grown since the late 1980s and rather than implementing major construction works a more integrated approach to addressing floods has been increasingly recognised since. Hydrological models are one of the key components within these integrated systems; however, the most important parts of a flood-warning

system are proper communication, dissemination, and response. This was followed by a more detailed presentation of real-time meteorological and hydrological observations, the positive and negative effects of simulations, FRISCO1 and CROSSRISK projects, and the web application *hfsvis*. The presentation focused on ARSO's hydrological forecasting system, whose results must always be critically and professionally reviewed. The system was set up in 2011 but is being continuously developed and upgraded.

The next speaker was Mag. Andrej Vidmar (University of Ljubljana, Faculty of Civil and Geodetic Engineering) who provided a practical illustration of KRPAN application for estimating the expected annual flood damage due to Q10, Q100, and Q500 flood events. For the estimation of values, both data from census and market values were used. This application will be useful in preparing investment projects, as it allows for a simple cost-benefit calculation. All built-in GIS tools that are necessary for the operation of KRPAN are freely available.

During the Questions and Discussion session a representative from the City of Ljubljana recognised the value and potential benefit of KRPAN for statistical purposes as well as in the planning process.

In the final part, the participants visited the premises of both services. The visit to the National Meteorological Service was kindly hosted by Brane Gregorčič. He presented the meteorological models used by the service and elsewhere and invited the participants to join in the discussion about the reliability of forecasts and data exchange.
The visit to the Hydrological Service was hosted by Janez Polajnar who explained the colour-coded warning system and gave some other very informative and unique insight into the day-to-day work of the hydrological service.

Then Dr. Mira Kobold thanked everyone for attending and invited them to fill out the online questionnaire, had they not done so previously, as the questionnaire had been sent out to the participants prior to the meeting. Finally, the participants continued their discussions over a catered meal.

Minutes recorded by:
Mojca Vilfan

Project Partner (PP9 UL) leader:
izr. prof. dr. Mojca Šraj

Interreg
Danube Transnational Programme
DAREFFORT

WP5 National Knowledge Exchange Workshop

ENI UA PP1 Ukraine

The project is funded by the European Union

Minutes of the Workshop

Ukrainian Hydromet Center, Kyiv, Ukraine, 6b-Zolotovoriska Str.Room604

September 1,2019

Subject- Prospect for the DAREFFORT project implementation in Ukraine

The workshop was held in the premises of the Hydromet Center of Ukraine. It was opened by the UHMC Director Dr.M.Kulbida who made a short presentation of the Center`s activities with the special impetus on the hydro- and meteorological forecasting and the Centers achievement in improving the forecasts accuracy. He also mentioned about the Center`s international projects and very good international cooperation both on the by-lateral and regional level.

DAREFFORT coordinator O.Skoropad informed the participants of the project development and its role and importance for the Danube region, and in particular for the Ukrainian delta and Zakarpatie regions. The participants were also informed of the progress achieved on the way towards the DAREFFORT implementation and on the nearest plans to be introduced.

The head of hydro-forecasting department Dr.V.Boyko presented the methodology of forecasting used in UHMC in the Danube river basin

Senior UHMC forecaster V.Korniienko introduced to the participants some preliminary ideas on the DAREFFORT implementation toolbox and software products.

The participants had an exchange of views on the cooperation between UHMC and the customers and partners, discussed the methodology used by the UHMC in its forecasting work and express their proposals as how to improve collaboration. Special attention was given to the accuracy of forecasting and possibilities to have more direct access to information. The participants agreed that the DAREFFORT project when implemented

may bring more benefits for the regions in terms of increasing the efficiency of hydrological forecasting.

The participants of the workshop express their interest in getting more information on project development.

2/Agenda-Annex 1

3/List of participants - as in Annex 2

Annex 1

Ukrainian Hydromet Center, Kyiv, Ukraine, 6b-Zolotovoriska Str.Room604

September 1,2019…… Workshop

Subject- Prospect for the DAREFFORT project implementation in Ukraine

AGENDA

1/ Welcoming by UHMC, by Dr.M.Kulbida, Director

2/ Introduction of DAREFFORT project by O.Skoropad,project coordinator

3/Hydrological forecasting methodologies for the Danube basin river

By V.Bojko and V.Korniienko

4/Discussions, exchange of views.

Annex 2

List of the participants

nn	name	agency	email	signature
1	M.Kulbida	**UHMC, Director**	kulbida@ meteo.gov.ua	
2	V.Bojko	**UHMC,head of Dpt**	Vic_bojko@ Meteo.gov.ua	
3	O.Skoropad	Project coord.	**omtm@ukr.net**	
4	O.Galushchenko	**Min.ecology d-r center**	**a.galushchenko@ gmail.com**	
5	V.Malyarenko	**NGO on water problems**	vmalyarenko@ gmail.com	
5	**V.Manukalo**	**UkrNIGMI**	**Vmanukalo@ Ukr.net**	
6.	S.Madiura	**Min.region Chief exp.**	**madiura@ minregion.gov**	
7	**O.Kosovets**	**Geophisical Observatory,D-r**	**aupcgo@ meteo.gov.ua**	
8.	V.Korniienko	**Snr.researcher**	**Viktoria.22.kor@ Ukr.net**	
9.	**O.Voitsehovych**	**Ecomonitor Center**	**0.voitsekhovych@ Gmail.com**	
10.	V.Manivchuk	Zak.region HM Center	**vasco@gmc. uzhgorod.ua**	
11	Morozov V.	**Danube Obzerva-Tori, D-r**	morozov@meteo. Gov.ua	
12	**Prokopenko V.**	**Danube Delta Org.**	**morozov@ meto.gov.ua**	

Evaluation report of questionnaire

WP5 Deliverable 5.1.2

October, 31 st 2019

National Institute of Hydrology and Water Management - NIHWM, Bucharest, Romania

Marius Mătreaţă, Simona Mătreaţă, Cătălina Petre, Andreea Ghinescu, Elena Ghiţă

Introduction

The technical information summarized in this document is derived from the outputs of the 9 national knowledge exchange expert workshops, on flood and ice forecasting, that were organized by dedicated partner within the activity 5.1. in each of the 9 partner countries (ECONOMICA in Austria, NIMH BAS in Bulgaria, CW in Croatia, STASA in Germany, OVF in Hungary, NIHWM in Romania, SHMU in Slovakia, UL in Slovenia, UHMC in Ukraine).

This evaluation report summarizes mainly the results of the questionnaires prepared in WP5 of the DAREFFORT project, supporting information gathering from stakeholders, but also summarizes some of the conclusions and recommendations from the knowledge exchange expert workshops.

The number of questionnaires received from stakeholders participating organisations are summarised in Table 1.

Table 1 The number of received questionnaires

No.	Country	Number of received questionnaires
1	Austria	8
2	Bulgaria	19
3	Croatia	29
4	Germany	6
5	Hungary	9
6	Romania	20
7	Slovakia	64
8	Slovenia	24
9	Ukraine	8

The following tables, presented in this document, reflect the information on hydrological data and forecasts synthesized by countries. The resulting conclusions are intended to contribute to the improvement of future hydrological forecast and warning products, in order to better serve and support the needs of different stakeholders, in their activities.

1 Channels of delivery

This section aimed at investigating how respondents get access to hydrological data and forecasts products.
It was found that most of the respondents receive information regarding hydrological forecasts and warning products directly from hydrological service, and / or from hydrological service websites.

Table 2 shows a summary of the primary / easiest ways of access for the different stakeholders.

Table 2 Percent of persons using hydrological information and / or hydrological forecasts received on different communication channels.

No	Country	Channels of delivery (% of respondents)							
		Directly from hydrological service	Hydrological service website	Other websites	Television	Radio	Newspaper	Mobile phones	Other sources
1	Austria	62.5	100.0	25.0	0.0	0.0	0.0	12.5	0.0
2	Bulgaria	31.6	47.4	26.3	15.8	5.3	5.3	0.0	15.8
3	Croatia	37.9	37.9	27.6	41.4	31.0	13.8	37.9	3.4
4	Germany	100.0	66.7	50.0	33.3	33.3	16.7	16.7	0.0
5	Hungary	22.2	77.8	55.6	0.0	0.0	0.0	22.2	0.0
6	Romania	90.0	35.0	10.0	0.0	0.0	0.0	5.0	0.0
7	Slovakia	51.6	56.3	10.9	17.2	17.2	4.7	37.5	18.8
8	Slovenia	16.7	70.8	20.8	29.2	29.2	12.5	12.5	29.2
9	Ukraine	100.0	100.0	87.5	0.0	0.0	0.0	0.0	0.0

2 Usage, understanding and usefulness of hydrological information and forecasts

2.1 Understanding of hydrological information and forecasts

Table **Hiba! A hivatkozási forrás nem található.**number 3 reflects the ease of understanding of the hydrological information and forecasts for the respondents, grouped by country. Most of them find it easy to understand the information, although in Croatia and Slovenia the level of understanding is neutral for 30% of the respondents, and in Hungary 22.2 % consider difficult to understand hydrological information and forecasts products.

Table 3 The ease of understanding of the hydrological information and forecasts by country

No	Country	The degree of understanding (% of respondents)		
		Easy	Neutral	Difficult
1	Austria	75.0	25.0	0.0
2	Bulgaria	78.9	21.1	0.0
3	Croatia	69.0	31.0	0.0
4	Germany	100.0	0.0	0.0
5	Hungary	77.8	0.0	22.2
6	Romania	95.0	5.0	0.0
7	Slovakia	95.3	4.7	0.0
8	Slovenia	66.7	33.3	0.0
9	Ukraine	100.0	0.0	0.0

2.2 Usage of hydrological information and forecasts

The frequency of use of hydrological information and forecasts, by different stakeholders in their activities, is described in table number 4. Most of the respondents use the information on a daily basis and a large percent use it weekly.
The whole sample of respondents from Germany and 90% of the sample from Romania use the information daily.

Table 4 The frequency of use of hydrological information and forecasts

No	Country	The frequency of use (% of respondents)			
		Daily	Weekly	Once a month	Rarely
1	Austria	75.0	50.0	0.0	0.0
2	Bulgaria	63.2	15.8	26.3	15.8
3	Croatia	48.3	10.3	20.7	20.7
4	Germany	100.0	0.0	0.0	0.0
5	Hungary	44.4	11.1	22.2	22.2
6	Romania	90.0	10.0	0.0	0.0
7	Slovakia	65.6	12.5	9.4	12.5
8	Slovenia	33.3	50.0	4.2	12.5
9	Ukraine	62.5	75.0	12.5	0.0

2.3 Usefulness of hydrological information and forecasts

Table number 5 reflects the perception of the respondents on the usefulness of hydrological information and forecasts. Most of the respondents consider it very useful, especially the respondents from Germany (100%)., while 65% from the respondents in Croatia find it only useful.
Some of the stakeholders from Slovakia and Slovenia indicated that for them the hydrological information and forecasts products are not useful, it will be good to further investigate if this is due to the fact that they don't need to use such information in their activities, or current available products does not provide the specific information they need.

Table 5 The usefulness of hydrological information and forecats

No	Country	The degree of usefulness (% of respondents)		
		Very useful	Useful	Not useful
1	Austria	75.0	25.0	0.0
2	Bulgaria	42.1	52.6	0.0
3	Croatia	34.5	65.5	0.0
4	Germany	100.0	0.0	0.0
5	Hungary	77.8	22.2	0.0
6	Romania	75.0	25.0	0.0
7	Slovakia	73.4	25.0	1.6
8	Slovenia	45.8	50.0	4.2
9	Ukraine	62.5	37.5	0.0

Compared to the situation from 3-4 years ago, most of the respondents consider the current hydrological information and forecast products to be more useful, or about the same, as shown in table number 6.

Table 6 The usefulness of hydrological information and forecats compared to previous period

No	Country	The current usefulness of hydrological information and forecasts (% of respondents)			
		More useful	About the same	Less useful	Don't know / No comment
1	Austria	37.5	50.0	0.0	12.5
2	Bulgaria	63.2	15.8	0.0	15.8
3	Croatia	37.9	41.4	0.0	17.2
4	Germany	50.0	50.0	0.0	0.0
5	Hungary	44.4	11.1	0.0	44.4
6	Romania	50.0	45.0	5.0	0.0
7	Slovakia	45.3	45.3	1.6	7.8
8	Slovenia	66.7	12.5	4.2	16.7
9	Ukraine	75.0	25.0	0.0	0.0

3 The availability and quality of the hydrological information and forecast

3.1 The current availability of hydrological information and forecasts

Compared to 3-4 years ago, most of the respondents consider the current availability of hydrological information to be slightly improved, as shown in table number 7.

Table 7 The availability of hydrological information and forecats compared to previous period

No	Country	The current availability of hydrological information and forecasts (% of respondents)				
		Significantly improved	Slightly improved	About the same	Less available	Don't know / No comment
1	Austria	12.5	75.0	0.0	0.0	12.5
2	Bulgaria	42.1	36.8	0.0	0.0	15.8
3	Croatia	27.6	51.7	17.2	0.0	6.9
4	Germany	16.7	66.7	16.7	0.0	0.0
5	Hungary	33.3	11.1	22.2	0.0	33.3
6	Romania	45.0	30.0	20.0	0.0	5.0
7	Slovakia	31.3	39.1	21.9	0.0	7.8
8	Slovenia	41.7	29.2	16.7	0.0	12.5
9	Ukraine	100.0	0.0	0.0	0.0	0.0

3.2 The quality of hydrological information and forecasts

The quality of hydrological information and forecast products, in terms of accuracy, timeliness and access, perceived by the respondents from the participating countries is summarized in table number 8.

The accuracy and timeliness of the current information is considered good by the vast majority of the respondents in each country (100% in Germany and Ukraine, 79% in Slovenia, 75% in Romania, Slovakia and Austria).
However, in some countries the accuracy is considered not satisfactory by an important percent of the respondents (44,8 % in Croatia, 12,5 % in Austria and 10% in Romania). A significant percentage of the sample from Hungary consider the accuracy of information very good (44,4%).

Table 8 The perception on quality of hydrological data and forecat products

Country	Quality of hydrological information and forecasts (% of respondents)				
		Very good	Good	Bad	Very bad
Austria	Accuracy	12.5	75.0	12.5	0.0
	Timeliness	37.5	62.5	0.0	0.0
	Access	25.0	75.0	0.0	0.0
Bulgaria	Accuracy	26.3	68.4	0.0	0.0
	Timeliness	36.8	47.4	5.3	0.0
	Access	47.4	42.1	0.0	0.0
Croatia	Accuracy	20.7	24.1	44.8	0.0
	Timeliness	24.1	72.4	3.4	0.0
	Access	44.8	55.2	0.0	0.0
Germany	Accuracy	0.0	100.0	0.0	0.0
	Timeliness	16.7	83.3	0.0	0.0
	Access	33.3	66.7	0.0	0.0
Hungary	Accuracy	44.4	55.6	0.0	0.0
	Timeliness	33.3	66.7	0.0	0.0
	Access	22.2	55.6	22.2	0.0
Romania	Accuracy	20.0	75.0	10.0	0.0
	Timeliness	35.0	65.0	5.0	0.0
	Access	45.0	55.0	0.0	0.0
Slovakia	Accuracy	23.4	75.0	0.0	1.6
	Timeliness	35.9	56.3	6.3	1.6
	Access	59.4	40.6	0.0	0.0
Slovenia	Accuracy	16.7	79.2	0.0	4.2
	Timeliness	33.3	58.3	4.2	4.2
	Access	45.8	50.0	0.0	4.2
Ukraine	Accuracy	0.0	100.0	0.0	0.0
	Timeliness	0.0	100.0	0.0	0.0
	Access	0.0	100.0	0.0	0.0

In terms of timeliness, the hydrological information and forecasts are generally considered good (100% Ukraine, 83% Germany, 72% Croatia).

The access of hydrological information and forecasts is rated as good by most of the respondends and very good by most of the respondents from Bulgaria and Slovakia.

4 The minimum warning lead time required

In order to properly make decisions and take actions in the case of a forecasted hydrological events, or to satisfy the needs for their decision support process specific to different activities, most of the stakeholders need a minimum warning lead time of 12 - 24 h, as shown in table number 9.

This category is followed by the one that needs 3-6 h as minimum warning lead time.

62,5 % of the respondents in Ukraine needs more than 3 days of warning lead time, in order to make decisions and take action, while 20% of the stakeholders from Slovakia and Slovenia can adapt and benefit even from hydrological warnings with a lead time of 30 minutes.

Table 9 The minimum required warning lead time

No	Country	Warning lead time (% of respondents)						
		30 min	1 hour	3-6 hours	12-24 hours	2-3 days	More than 3 days	Other
1	Austria	0.0	12.5	25.0	62.5	25.0	0.0	0.0
2	Bulgaria	0.0	0.0	5.3	52.6	36.8	10.5	5.3
3	Croatia	10.3	10.3	10.3	37.9	13.8	3.4	10.3
4	Germany	16.7	16.7	16.7	33.3	33.3	16.7	16.7
5	Hungary	0.0	11.1	33.3	33.3	11.1	0.0	11.1
6	Romania	5.0	5.0	30.0	45.0	20.0	15.0	0.0
7	Slovakia	20.3	21.9	31.3	18.8	0.0	3.1	4.7
8	Slovenia	20.8	29.2	12.5	12.5	4.2	0.0	16.7
9	Ukraine	0.0	12.5	12.5	50.0	0.0	62.5	0.0

5 Stakeholder assistance requirements

In general we could consider that for the standard hydrological information products, and for the clasic deterministic hydrological forecasts products, in general there is no needs for a special assistance for understanding and use such kind of products.
However, in some particular situations, for some special products it is recommended to provide for the stakeholders some assistance, training and guidance on the interpretation and use of these products, especially for the new generation of ensemble and probabilistic type of hydrological forecasting products.

Most respondents indicated that they do not require assistance and / or training for the interpretation, understanding and properly use of the hydrological information and forecasts, except for those in Hungary (55,6%).

Table 10 Stakeholder assistance requirements

No	Country	Assistance requirements (% of respondents)	
		Yes	No
1	Austria	0.0	100.0
2	Bulgaria	36.8	63.2
3	Croatia	17.2	79.3
4	Germany	0.0	100.0
5	Hungary	55.6	44.4
6	Romania	20.0	80.0
7	Slovakia	28.1	71.9
8	Slovenia	33.3	66.7
9	Ukraine	0.0	100.0

6 Suggestions for implementing e-learning tools

Some of the stakeholders have previous experience in using e-learning tools in general and a few for supporting training activities in the field of hydrological monitoring and forecasting (Hungary, Slovenia, Germany, Romania).

These previous experiences include: using electronic materials, training for conducting risk assessments, e-courses on flash-floods , EFAS webminars (Slovenia).

Based on their previous experience, the respondents made some reccommendations for the subject and thematic of e-learning courses:

- explain accuracy of forecasts; limitations of forecast accuracy due to input data;
- the uncertainty of predictions and how to deal with it;
- Interpretation of hydrological forecasts;
- use of ensemble forecasts;
- forecasting methodologies and hydrological forecasting models;
- flood forecasting system simulator tools.
- hydrological monitoring networks implementation;
- selection criteria of monitoring stations;
- databases and query options; recommendations for data exchange;
- reliability of hydrological data;
- automatic data quality control and quality assurance;
- statistical methods for analysing hydrological data.

They also mentioned some available online platforms suitable and accessible for implementing e-learning tools: Moodle, Mooc, Web platforms edX, Quora, Coursera.

Antoher specific recommendation, highlighted during the discussions based on previous experiences, in order to have good results in using E-learning type approach, is needed to organize and provide online technical support for the users of the E-learning tools.

7 Suggestions to improve the effective dissemination of the hydrological information and forecasts

In order to improve the effective dissemination of the hydrological information and forecasts, most of the respondent stakeholders suggest the use of dedicated mobile application tools and web-services capable to provide real-time updates of the warnings (Slovenia, Croatia, Romania, Slovakia, Bulgaria). Romania, Austria, Slovenia and Slovakia mentioned also the electronic distribution of the information via SMS and e-mail.

For a wider audience of users, the respondents from Bulgaria, Croatia and Romania proposed also social media as an appropriate distribution tool.

Respondents from Slovakia, Croatia and Slovenia suggested the direct delivery to interested parties, to the district and municipal administrations at risk. Respondents from Slovakia also suggest to provide hydrological information and forecasts as open data and the unification of format of hydrological and other types of warnings issued by SHMU system, that enables rapid modelling and issuing warnings more precise for specific location.

Improving the effective dissemination of the hydrological information and forecatsts by a greater presence on TV, involving as many participants as possible from different professions, creating web portals with customization of different categories of users is suggested by the respondents from Croatia.

Some respondents from Romania mention that in order to warn the population in the shortest time in case of an emergency situation generated by dangerous hydrological phenomena, it is necessary to interconnect the hydrological warnings and threshold exceedance information from the monitoring systems data (hydrometrical stations, reservoirs) with the real time warning system for the population (RO-ALERT).

8 Suggestions for development of new hydrological information and forecast products

Among the most suggested recommendations for new hydrological information and forecast products or product enhancements, we could mention the following:

- Improved radar products for hydrological applications.
- Improved quantitative preciptations forecasting products, especially for high intensity rainfall events.
- Archives with historical data.
- Hydrological forecasts joint with flood risk maps products, and a portal at hydrological service website focusing on emergency events related to floods, droughts, forest fires, warnings.
- Ensemble forecasts shared between countries, propose a unified definition and naming of the ensemble members in order to use the ensembles from upstream countries for forecasting in downstream countries.
- Improved hydrological diagnosis and forecasting ice on rivers phenomena products.
- Improved products for inflows into water reservoirs and better accuracy of forecasts for small river basins.
- Development of mobile applications for dissemination of monitoring and forecasting data.

- Creation of working groups on online platforms, for improving the cooperation between forecasting services and main skateholers.

9 Conclusions

In most of the participating countries, interested stakeholders use the hydrological information and forecasts received directly from hydrological service or from dedicated web-sites on a daily or weekly basis, they find it easy to understand and they find it useful or very useful. The current availability of hydrological information and forecasts is improved compared to the past.

The quality of hydrological information and forecast products, in terms of accuracy, timeliness and access, perceived by the respondents from the participating countries is considered good by most of the respondent stakeholders.

According to the warning lead time mentioned by the most of the stakeholders In order to properly make decisions and take actions in the case of a forecasted hydrological event (12 - 24 h, or 3 - 6 h). It is necessary to further improve the flash floods forecasting and warning methodologies in order to increase the warning lead time for flash floods, but without increasing too much the flase alarm rate.

Although most respondents do not require additional assistance and / or training for the interpretation, understanding and use of the hydrological information and forecasts products, in countries like Hungary, Bulgaria, Slovenia, Slovakia, there is a significant percentage of the interested stakeholders that need additional assistance.

For the implementation of E-learning tools some popular and easy to use online platforms are suggested and the main subjects proposed are related to the accuracy of forecasts and use of ensemble forecasts, and in general description of hydrological forecasting methodology.

The use of dedicated mobile applications and web services capable to provide real time updates of the warnings are among the most popular suggestions for the improvement of the dissemination of the hydrological information.

New radar products and quantitative precipitation forecasts products are needed in order to improve in the future the hydrological forecast performance.