# Razvoj usklađene razmjene hidroloških i meteoroloških podataka u okviru Danube HIS-a i razmjene znanja za potrebe projekta DAREFFORT

## KONAČNO IZVJEŠĆE

**DRŽAVNI HIDROMETEOROLOŠKI ZAVOD (DHMZ)**

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**travanj 2021.**

Sadržaj

## Questionnaire for evaluating the possibilities of establishment of an international forecasting system's result exchange platform - Hydrological forecasting centres

The purpose of this questionnaire is to evaluate the possibilities, perspectives and efforts of establishment of a Danube wide exchange platform for forecasting results.

The answers will serve as input for deliverable D3.2.2 "Evaluation the possibilities of establishment of the international forecasting system's result exchange platform".

### Exchange of hydrological and meteorological forecasting results

### Exchange of hydrological forecasting results with other countries

**Do you already exchange hydrological forecasting results with neighboring countries, either receiving, delivering or both? If yes, please specify which countries, which parameters are exchanged and in which interval.**

Receiving:

Slovenia (ARSO) send results from their hydrological forecasting model for most downstream hydrological station, water level and discharge in hourly time step, every hour. Format is Mike11 (.dfs0)

Hungary (OVF) send their hydrological forecast for selected points on Mura, Drava and Danube, water levels in 6-hourly time step, once a day. Format is xml.

Sending:

To Bosnia and Herzegovina (AVP) we are sending hydrological forecast for 2 hydrological stations, hourly. We also run the Una River model, which is connected to Croatian Sava forecast model, hourly. After each run the whole model (setup and result files) is compressed and put on ftp server so they can download and process it (Mike11 file formats).

To Sava Commission we are sending our forecasted Sava model's results for the Sava-FFWS. It contains discharge and water level forecast for 141 hydrological stations and precipitation, temperature and snow water equivalent for 159 catchments. All forecasted values have hourly time step. Sending is hourly in txt format.

**What are or can be the benefits of exchanging hydrological forecasting results with neighboring countries?**

Croatian largest rivers – Danube, Drava and Sava are transboundary rivers with significant catchment area upstream of Croatia. Our neighboring upstream countries Slovenia and Hungary modeled their parts of the catchments and agreed to send us their most downstream forecast results that we use as the inputs for our forecasting models.

Bosnia and Herzegovina uses our Sava River forecast results as the downstream boundaries for their models of the Una and Vrbas Rivers that are inflows to Sava River.

The benefits are great for all of us because each country has the best forecasting results for their area which can serve as best input for models of neighboring countries.

**What could be the benefits and perspectives of exchanging hydrological forecasting results within whole Danube catchment?**

Exchange of the results is a benefit for all. Exchanging hydrological forecasting results for the whole catchment would rise awareness of hydrological conditions in Danube basin on larger scale, propagation and regime of flows from source to mouth and improve overall understanding of hydrological cycle in that region. It could also enable development of a large scale forecasting model that would cover the whole Danube catchment.

It would also be opportunity for each country to improve their forecasting results at the outlets of the country by assimilating them to measurements of downstream cross-border profiles (hydrological stations), which would be in best interest for both of them.

**Are you able (methodologically / technically) to include hydrological forecasts from other countries in the forecasts of your institution?**

We have successfully add such forecasts as input to our models during implementation phases where it was planned.

To do such modifications of our forecasting models in the future, additional consultant expertise would be needed.

**Which requirements must be fulfilled to be able to include hydrological forecasts from other countries in the forecasts of your institution?**

Forecasting result from other country should be in the same format (or converted to) of forecasting software that we use, which depends on the model.

For example it is Mike11 time series format (.dfs0) for existing Sava River basin model.

Also consultancy from someone experienced in model development is needed to be able to make adjustments to the existing models.

**Which forecasted parameters should be exchanged within whole Danube catchment and in which interval (e.g. water level, discharge)?**

Discharge and water level forecasts, preferably in hourly time step. Exchange interval can be reduced to a few daily runs.

**Would it make sense to exchange ensemble forecasts?**

Yes if they are available. We don't have ensemble hydrological forecasts yet.

## Exchange of meteorological forecasting results with other countries

**Do you already receive meteorological forecasting results from other countries? If yes, please specify which countries, which parameters are exchanged and in which interval.**

No.

**What are or can be the benefits of receiving meteorological forecasting results of other countries?**

Some countries don't have resources to access some meteorological models. In such cases, for the consistency of the hydrological forecast along the river catchment, it would be great if sharing of certain model which covers area of other country that can't provide it for itself could be an option.

Sharing of meteorological forecasting results of its own area could be beneficial in terms of noticing some weather instability before it reaches your own country, which could improve preparedness for significant hydrological events.

**Are you able (methodologically / technically) to include meteorological forecasts from other countries in your forecast?**

Probably, but it would require significant efforts and probably expert consultancy.

**Can you think of using meteorological forecasting results from an existing international platform (e.g. WMO, ECMWF, …)?**

Yes, for example ECMWF ensemble forecasts.

**Are there bottlenecks of using an existing international platform for meteorological forecasting results?**

These models have to be adjusted to suit our hydrological models (subcatchment areas etc).

**Which forecasted parameters should be exchanged within whole Danube catchment and in which interval (e.g. precipitation)?**

Precipitation, temperature, snow depth, evapotranspiration, in hourly time step.

Interval of forecast exchange depends on the frequencies of the model runs.

## Technical requirements of hydrological forecasting results exchange

**If your institution also provides measured hydrological data to DAREFFORT project: Would it be possible to provide the forecast results in the same way as the measured data?**

Yes, by uploading them to ftp server.

**If not, how would you provide forecast results?**

by FTP

**In which data format forecast results could be delivered to an exchange platform for hydrological forecasts?**

dfs0, txt, csv

**To which geographical positions are the hydrological forecasts of your institutions assigned?**

to the position of hydrological measuring stations

**Does hydrological forecast data could be delivered as time series per measuring station?**

Yes

**Which (technical) effort would be required for your institution to deliver hydrological forecasting results to an exchange platform?**

It would require slightly adjustments of similar processes which we have already established to exchange forecasting results with other partners.

**Which (technical) effort would be required for your institution to use hydrological forecasting results from other countries in the forecasting models of your institution?**

It would require to perform conceptual changes to the forecasting models, some of which aren't developed in house.

### Data Policy issues of hydrological forecasting results exchange

**Is your institution willing to provide hydrological forecasting results to an exchange platform for the countries in the Danube catchment?**

Yes if that would be decided.

**Which data policy restrictions would apply for the hydrological forecasting results of your institution/country with respect to such a results exchange platform?**

Ownership of the input data to such platform remains the property of the providers.

No unauthorized sharing of the data to third parties.

Data providers should not be responsible for the consequences of using their data in other applications and forecasting systems.

## 3.2. Izvještaj o postojećim prognostičkim uvjetima - meteorološki prognozeri

### Questionnaire for evaluating the possibilities of establishment of an international forecasting system's result exchange platform - Meteorological forecasting centres

### Provision of meteorological forecasting results on a Danube wide exchange platform

### General

**Do you already provide meteorological forecasting results to other countries? If yes, please specify which countries, which parameters are provided and in which interval.**

We are sending meteorological forecasts from Aladin and ECMWF models to Bosnia and Herzegovina in txt format with column values: Longitude, Latitude, metres above sea level, forecasted values.

ECMWF – 2 times a day:

Temperature with 3-hourly timestep

Accumulated 3-hourly precipitation

Aladin – 4 times a day:

Temperature with 1-hour timestep

Accumulated 1-hour precipitation

To SEE-FFGS (South East Europe Flash Flood Guidance System) we are sending Aladin precipitation in GRIB format, 4 times a day.

To Sava Commission we are sending Aladin accumulated precipitation and temperature in hourly time step, grib formats, 4 times a day

### Technical requirements

**If your institution also provides measured meteorological data to DAREFFORT project: Would it be possible to provide the forecast results in the same way as the measured data?**

Meteorological forecasts could be provided also by uploading them to ftp, same as measured meteorological data.

**If not, how would you provide forecast results?**

by FTP

**In which data format forecast results could be delivered to an exchange platform for meteorological forecasts?**

Same as described in question 1.1., in txt or grib format.

**To which geographical positions are the hydrological forecasts of your institutions assigned?**

To the position of hydrological measuring stations

Grid-data

### Data Policy

**Which data policy restrictions / requirements apply to deliver forecasts to an international exchange platform?**

Ownership of the input data to such platform remains the property of the providers.

No unauthorized sharing of the data to third parties.

Data providers should not be responsible for the consequences of using their data in other applications and forecasting systems.

## 3.3. Analiza ekonomskog učinka potencijalnih scenarija budućeg sustava

**Data about maintenance costs DAREFFORT/DanubeHIS**

*The DAREFFORT project will serve as the basis for a future DanubeHIS. How many people are expected to deal with the maintenance of DAREFFORT/DanubeHIS related data directly? How many people are invovled in general hydrological and meteorological tasks in your institution?*

| | |
|---|---|
| (2) Institution | Croatian Meteorological and Hydrological Service |

Example:

1 Person is in charge of the maintenance of the interface between the institution and the DanubeHIS Server.
The annual salary incl. non-wage labour costs is 40.000 Euros
6 People are involved in the daily business (meteorological and hydrological services), where 1 person only works part time
Their annual salary incl. non-wage labour costs is 200.000 Euros
A cost increase of 2% per year is expected

| **(3) Expenditures (in Euro)** | **2021** | **2022** | **2023** |
|---|---|---|---|
| **TOTAL** | 91130 | 92952,6 | 94811,65 |
| PERSONNEL COSTS (incl. non-wage labour costs) | 90130 | 91932,6 | 93771,25 |
| thereof: DAREFFORT/DanubeHIS | 37790 | 38545,8 | 39316,72 |
| thereof: general | 52340 | 53386,8 | 54454,54 |
| MATERIAL COSTS (server, needed equipment) | 1000 | 1020 | 1040,4 |

| (4) Employees | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| DAREFFORT/DanubeHIS related (per capita) | 2 | 2 | 2 | 2 | 2 |
| general (per capita) | 4 | 4 | 4 | 4 | 4 |
| DAREFFORT/DanubeHIS related (full-time equivalent) | 2 | 2 | 2 | 2 | 2 |
| general (full-time equivalent FTE) | 4 | 4 | 4 | 4 | 4 |

# REZULTATI RADNOG PAKETA 4: USKLAĐENA RAZMJENA PODATAKA

## 4.1. Preporuke o podatkovnoj politici vezano za najbolje korištenje postojećih podataka i jačanje procesa razmjene

**Questionnaire Data Policy Issues for preparation of discussions during 4th period project meeting**

Current situation regarding data policy

**Which categories of data receivers are addressed by existing data policy documents of your institution?**

| **categories of data receivers** | **covered by data policy? (yes / no)** |
|---|---|
| Hydrological Forecasting centres | Yes |
| Universities | Yes |
| Public research institutions | Yes |
| Private research institutions | Yes |
| Public authorities | yes |
| Companies (e.g. harbours, power suppliers, shipping companies) | yes |
| General public | yes |
| Others (please specify) | |

**Which restrictions apply for the different kinds of data receivers, mentioned above?**

Data is provided based on a request received with the stated purpose, without right to republish the data to third parties unless it is specifically agreed.

To public authorities, public and private research institutions and individuals for the preparation of graduate and doctoral theses and scientific and professional papers, for the needs of the protection of people and property – data is provided free of charge whereby only the material costs incurred in issuing the information are charged.

Use of information from investor stations maintained by DHMZ is governed by investor agreements. Most often, permission from third parties to use data should be sought from the investor - the data owner.

The data involved in the international exchange is divided into basic and additional data. Basic information is free of charge for users while additional are charged.

The catalog and price list of data, products and services from Croatian meteorological and hydrological service are published on the website (https://klima.hr/razno/katalog_i_cjenikDHMZ.pdf).

Continuous meteorological and hydrological data exchange between hydrological forecasting centres is arranged through separate agreements.

**Are there restrictions for data receivers in using the data for own (non-commercial / commercial) product?**

Source of used data in their product must be specified.

**Which products of your institution are free of charge within your country, and for whom?**

| **Product** | **free of charge? (yes / no)** | **for whom (e.g. public, research, forecasting centres)?** | **comments** |
|---|---|---|---|
| Hydrological measured data (near real time) | yes, partially | To all, but for different station selection. | NRT data availability depends on its use and is considered specific to each case. For example, public has access to certain station selection and power suppliers to additional. Most of NRT data is available on public website for the last 15 days, but not for some investor stations. |
| Hydrological historical data (processed data/year books) | yes/no<br>depends for whom | Free for research and government institutions. It is charged for commercial use. | |
| Hydrological forecasts | yes | Only available to forecasting centres | Only DHMZ and Croatian waters have access to forecasting results. Also a portion of model results goes to Sava FFWS platform for forecasting centres from other |

| | | | |
|---|---|---|---|
| | | | countries which have access to the platform. |
| Flood warning levels | yes | Public | They can be found in documents regarding flood defence plans published on the website of Croatian Waters. |
| Ice data | no | There is no systematic tracking of ice data on Croatian rivers. | Only some ice events are registered, some not in digital form. |
| Meterological measured data (near real time) | yes | Public | Data from automatic meteorological stations is published on DHMZ website |
| Meterological historical data (processed data / year books) | yes/no<br>depends for whom | Free for research and government institutions. It is charged for commercial use. | |
| Meterological forecasts | yes/no | Some weather forecasts are published for public, but some are made specifically for contracted parties. | Special weather forecast is made for i.e. transportation authorities. |
| Others (please specify) | | | |

**If your institution receives data, which requirements do you have on data policy?**

Frequency of data updates (e.g. hourly, daily)?

It is mostly hourly data from meteorological or hydrological stations or from hydrological model of upstream countries.

Liability topics?

Received data is used on our own responsibility and for purpose of our own model developments.

Others?

Received data is not republished.

**Which restrictions apply currently regarding data exchange with other countries?**

Is data use free of charge? Yes

Comments: Data exchange with other countries is arranged in bilateral agreements with forecasting institutions from other countries, free of charge.

Can data be redistributed by foreign institutions? No

Comments: It should be used only for their purposes.

Are there other restrictions? No

Perspectives of data policy for data exchange with other countries in Danube River Basin

Receiving data from other countries

**Could your institution use data from other countries in daily work?**

Hydrological data

Which kind of data?

Data that we are already using: water levels, discharges from nearby stations and hydrological model outlet results from upstream countries.

Ice data

Which kind of data?

Appearance of ice and ice cover type/percentage on border rivers so we can compare it to conditions at our stations.

Meteorological data

Which kind of data?

Near real time data from automatic weather stations – rainfall, temperature.

**Would you expect to receive this data for free from other countries in case of internal usage?**

yes

**redistributing this data?**

no

**Providing data to other countries**

**To which kind of institutions could data be provided in other countries?**

Hydrological Forecasting centres - Yes

Universities - No

Public research institutions - No

Private research institutions - No

Public authorities - No

Companies (e.g. harbours, power suppliers, shipping companies) - No

General public - No

Others (please specify)

**Do different restrictions apply for data receivers in other countries compared to data receivers in own country (see question 1.2)?**

No.

**Is it possible to provide this data free of charge for other countries?**

Yes if agreed in project agreement or other kind of agreement between countries, as it is already the practice.

Current situation regarding data policy

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|---|---|
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| Public authorities | yes |
| Companies (e.g. harbours, power suppliers, shipping companies) | yes |
| General public | yes |
| Others (please specify) | |

**Which restrictions apply for the different kinds of data receivers, mentioned above?**

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To public authorities, public and private research institutions and individuals for the preparation of graduate and doctoral theses and scientific and professional papers, for the needs of the protection of people and property – data is provided free of charge whereby only the material costs incurred in issuing the information are charged.

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| Others (please specify) | | | |

**If your institution receives data, which requirements do you have on data policy?**

Frequency of data updates (e.g. hourly, daily)?

It is mostly hourly data from meteorological or hydrological stations or from hydrological model of upstream countries.

Liability topics?

Received data is used on our own responsibility and for purpose of our own model developments.

Others?

Received data is not republished.

**Which restrictions apply currently regarding data exchange with other countries?**

Is data use free of charge? Yes

Comments: Data exchange with other countries is arranged in bilateral agreements with forecasting institutions from other countries, free of charge.

Can data be redistributed by foreign institutions? No

Comments: It should be used only for their purposes.

Are there other restrictions? No

Perspectives of data policy for data exchange with other countries in Danube River Basin

Receiving data from other countries

**Could your institution use data from other countries in daily work?**

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Which kind of data?

Data that we are already using: water levels, discharges from nearby stations and hydrological model outlet results from upstream countries.

Ice data

Which kind of data?

Appearance of ice and ice cover type/percentage on border rivers so we can compare it to conditions at our stations.

Meteorological data

Which kind of data?

Near real time data from automatic weather stations – rainfall, temperature.

**Would you expect to receive this data for free from other countries in case of**

internal usage?

yes

redistributing this data?

no

**Providing data to other countries**

**To which kind of institutions could data be provided in other countries?**

Hydrological Forecasting centres - Yes

Universities - No

Public research institutions - No

Private research institutions - No

Public authorities - No

Companies (e.g. harbours, power suppliers, shipping companies) - No

General public - No

Others (please specify)

**Do different restrictions apply for data receivers in other countries compared to data receivers in own country (see question 1.2)?**

No.

**Is it possible to provide this data free of charge for other countries?**

Yes if agreed in project agreement or other kind of agreement between countries, as it is already the practice.

## 4.2. Preporuke IT stručnjaka za prognoziranje poplava

### Introduction

In this deliverable of the DAREFFORT project flood forecasting- and IT-expert recommendations for supporting the establishment of a common data exchange system and policy are summarized.

The first chapter gives an overview about the existing data exchange systems of national data providers as well as country specific needs and requirements.

A summarization and recommendation for the implementation of a common data exchange platform based on the existing country specific systems and requirements is provided in chapter 2.

In chapters 3, 4, 5 and 6 the characteristics of the foreseen common data exchange format and system characteristics of the data exchange platform are defined.

The recommendations and requirements of the graphical user interface are described in chapter 7.

Chapter 8 provides the requirements for the user manual of the common data exchange system.

The results presented in this document have been derived and elaborated from the following main sources:

- output WP 3.1 Evaluation report on flood and ice forecasting systems and methodologies in the Danube countries (21/05/2019) and the related country fact sheets and questionnaire
- First Data Providers Conference in Vienna 04/02/2019
- Second Data Providers Conference in Bucharest 29/05/2019
- Software Developers Workshop in Vienna 06/02/2019
- technical discussions with representatives of International Commission for the Protection of the Danube River (ICPDR) and representatives of International Sava River Basin Commission ISRBC about the definition of system characteristics and data policy

- Technical Information Forms provided by the technical contact persons of DAREFFORT project in each country (see Annex 1 technical contact persons)
- discussions about the appropriate software architecture between VIZITERV and STASA based on the proposal of VIZITERV for the software architecture LAELAPS (28/11/2018) and the proposal for DAREFFORT Data Model and Data Exchange Service of STASA (01/02/2019)

The recommendations recognize the existing national and international data exchange methods by utilizing existing exchange APIs and data servers. Existing IT-systems and data formats of data providers in the different countries summarized in chapter 0 will be used as far as this is technically possible. The system characteristics on server side, running the data exchange service, are compliant to ICPDR IT-requirement, as ICPDR will be the operator of the future DanubeHIS in the long term.

The different data formats from data providers will be converted by light-weight conversion filters (plugins) which will run either on the side of the data providers pushing the data to the server or on the side of the data exchange service, pulling the data from the data providers. The conversion filters themselves are developed within the project and should be administrated by the data providers on the long term.

The provided solution uses standardization possibilities with respect to data formats, storage systems and software by using established IT-standards, e.g. Water ML 2.0, Apache Webserver, PHP. The solution will be open source and extendible in the future.

Also with respect to standardization topics and the broad acceptance of the solution, the data exchange policy should be in line with World Meteorological Organization (WMO) Resolution 40 for exchange of meteorological data and Resolution 25 for exchange of hydrological data which recognize the responsibility of the members for the security and well-being of the people of their countries, through mitigation of water-related hazards and sustainable management of water resources.

The common data exchange software service developed in DAREFFORT project is referred to as **Danube Hydrological and Meteorological Common Data Exchange Service (HyMeDES).**

The corresponding data model is called **Hydrological and Meteorological Common Data Exchange Data Model (HyMeDEM)**.

The naming reflects the purpose to exchange hydrological and meteorological data and tries to prevent confusions with other data services with different purposes.

## Analysis of data providers' systems

Based on the country facts (WP3) and bilateral discussions the following chapters summarizes the technical capabilities for each country to deliver the data for common data exchange.

### Croatia

#### Technical capabilities

Croatian Meteorological and Hydrological Service (DHMZ) is a state administrative and a scientific research legal entity headed by a director, appointed by the government and responsible to the government. Croatian Meteorological and Hydrological Service is the official source of hydrological and meteorological data and information.

*Hydrology*

DHMZ is the main actor tasked with all activities on the collection, processing, archiving and distribution of hydrological data in the Republic of Croatia.

All selected stations for DAREFFORT are connected online and have an hourly updating frequency. Water temperature isn't measured at every hydrological station. The data is stored in a relational data base with no time limit. No real time ice data is available. Croatian Waters has some historical reports.

*Meteorology* All stations selected for DAREFFORT are connected online. The update interval of the precipitation, air temperature and snow cover is hourly. No grid data is available.

**Metadata**

Metadata for hydrological stations is provided via https://hidro.dhz.hr/hidroweb/skripte/hidrobazahtml.py?funkc=puninfopost&kpost=XYZ. XYZ should be replaced by the code of the station. An example for station codes can be seen below.

| STATION NAME | RIVER NAME | MSHISStCode | Internal db code |
|---|---|---|---|
| CRNAC | SAVA | 3020 | 55 |
| DAVOR C.S. | SAVA | 3179 | 58 |
| JASENOVAC | SAVA | 3219 | 65 |
| MAČKOVAC USTAVA | SAVA | 3207 | 68 |
| RUGVICA | SAVA | 3096 | 71 |
| SLAVONSKI ŠAMAC | SAVA | 3101 | 73 |

Meteorological Metadata are available via https://meteo.hr/infrastruktura/popis_osnovne_mreze_meteoroloskih_postaja.xlsx

**Current data delivery method**

*Real time hydrological data* The data format of the hydrological data will be the same as for the exchange for SAVA HIS. It is a csv file with hourly data in the following columns:

```
Station name; Station code (MSCD_HISST); Timestamp (UTC+1); Water level
(relative, cm); Discharge; Temperature
```

9999.9 is the code for missing data.

Example:

```
AKUMULACIJA PAKRA;3399;2019-08-01 09:00;327;9999.9;9999.9
AKUMULACIJA PAKRA;3399;2019-08-01 10:00;327;9999.9;9999.9
AKUMULACIJA PAKRA;3399;2019-08-01 11:00;327;9999.9;9999.9
BAČICA;2514;2019-07-31 00:00;9999.9;9999.9;9999.9
BAČICA;2514;2019-07-31 01:00;9999.9;9999.9;9999.9
BAČICA;2514;2019-07-31 02:00;9999.9;9999.9;9999.9
BAČICA;2514;2019-07-31 03:00;9999.9;9999.9;9999.9
BAČICA;2514;2019-07-31 04:00;9999.9;9999.9;9999.9
BAČICA;2514;2019-07-31 05:00;9999.9;9999.9;9999.9
```

The data is provided via ftp server every hour: ftp://radar.dhz.hr/. For the project purposes of DAREFFORT a login has been provided.

After the project the same restrictions as during the project should apply for data access.

*Real time meteorological data* The data format of the meteorological data will be the same as for the exchange for SAVA HIS. It is a xml file with hourly data. An example can be seen below:


```
<?xml version="1.0" encoding="UTF-8" ?>
- <data id="Croatia_latest_weather">
    <Copyright>DHMZ - meteo.hr</Copyright>
    <Copyright_URL>meteo.hr</Copyright_URL>
  - <DateTime>
      <DateValid>2019-07-29 12:00:00</DateValid>
      <DateIssued>2019-07-29 12:37:07</DateIssued>
    </DateTime>
  - <Weather>
    - <station>
      - <station_data>
          <station_id>Bjelovar</station_id>
          <station_number>14253</station_number>
          <station_name>Bjelovar</station_name>
          <lat>45.910</lat>
          <lon>16.869</lon>
          <altitude_m>141</altitude_m>
        </station_data>
      - <meteo_data>
          <temp_air_C>25.3</temp_air_C>
```


The data is provided via ftp server every hour. ftp://radar.dhz.hr/. For the project purposes of DAREFFORT a login has been provided.

After the project the same restrictions as during the project should apply for data access.

*Processed hydrological data* Separate csv files for each station and parameter can be produced. First line denotes parameter, second station id.

Example of water level data: Vodostaj (cm)

SIFRA:;3026

2013-01-01 00:00;72

2013-01-02 00:00;32

2013-01-03 00:00;6

Processed data is not available online. The DHMZ is the official provider of hydrological data for Croatia and should be contacted for data reusability.

*Processed meteorological data* Text file can be generated for separate station and parameter. Example of precipitation data:

"." marks a day without precipitation. 0.0 marks a day with trace precipitation.

```
REPUBLIKA HRVATSKA - DRZAVNI HIDROMETEOROLOSKI ZAVOD

 KLIMATOLOSKO METEOROLOSKI SEKTOR
```

```
ZAGREB-GRIC 3


Postaja:  BJELOVAR
ddmmgggg  PREC(mm)
01012018     .
02012018   11.6
03012018    0.1
04012018    0.2
```

Processed data is not available online. The DHMZ is the official provider of hydrological data for Croatia and should be contacted for data reusability.

**Future developments**

Implementation of WISKI7 (Water information system, Kisters AG) is planned in the next few years. Development of web services for hydrological data exchange is also recognized as a necessity and shall be considered for development in the near future.

## 4.3. Evaluacijski izvještaj o upitniku

Introduction

This evaluation report summarizes the results of the questionnaire prepared in WP3 of the DAREFFORT project, regarding technical and IT topics which are important for the implementation of the common data exchange service within the project. In addition to the questionnaire, results from technical information forms provided by the technical contacts of national data providers are summarized in this document.

The tables presented in this document reflect the information for data exchange which will be used for implementing the common data exchange service based on deliverable 4.1.1 Flood forecasting and IT expert recommendations. This document also reflects the latest status of information, and therefore may differ from the status of deliverable 3.1.3 Evaluation report of questionnaire (WP3).

The technical information summarized in this document is derived from the 12 countries participating in the DAREFFORT project.

Real time hydrological data

In the following tables data delivery methods for real time hydrological data are described which are foreseen to be used in DAREFFORT project, and which will be the basis for future DanubeHIS. The information may differ from the Evaluation Report of Questionnaire of WP3, Deliverable 3.1.3, because the focus of the present document is the technical implementation of DAREFFORT data exchange platform. Especially the delivery methods and available parameters differ from information which can be retrieved from public websites and in bi-lateral data exchange, because for the DAREFFORT data exchange platform standardised solutions have to be used.

Data delivery methods for real time hydrological data

In Table 1 the data delivery method foreseen in DAREFFORT project and future DanubeHIS is described as derived from the questionnaire and technical information forms of the national data providers.

Overall there are two main types of data delivery: FTP-server or Web-API. In most countries data delivery methods which already exist can be used, these are Austria, Croatia, Germany, Hungary, Moldova, Serbia, Slovakia, and Slovenia. In case of Austria there is an existing Web-API by which water-level can be retrieved. This Web-API will be enhanced to retrieve additional hydrological and meteorological parameters. In other countries appropriate data exchange formats will be defined, these are Bulgaria (probably FTP), Czech Republic (Water ML 2.0), Romania (FTP), and Ukraine (FTP or API).

Table 1: Data delivery methods for real time hydrological data foreseen in DAREFFORT project and future DanubeHIS

| | **selected stations for Danube HIS are automatic?** | **database** | **persistence of storage** | **data delivery method for DanubeHIS** | **data delivery method same as for SAVA HIS?** | **availability of processed data** |
|---|---|---|---|---|---|---|
| Croatia | all | relational data base | indefinitely | FTP | yes | yes, csv |

Update frequencies for real time hydrological data

Table 2 shows the availability and capabilities regarding update frequencies for different hydrological parameters which can be transferred using the data exchange protocols summarised in the previous section. Because the information given in Table 2 reflect the technical capabilities of the concrete interfaces used for data exchange within the DAREFFORT project and in future DanubeHIS, the available parameters and frequencies shown in Table 2 may differ from the information of Evaluation Report of Questionnaire of WP3, Deliverable 3.1.3 about availability on public websites or bi-lateral data exchange.

Table 2: Availability and update frequencies of real time hydrological data

| | **water level** | **discharge** | **water temperature** | **turbidity** | **Water quality** | **Sediment transport** |
|---|---|---|---|---|---|---|
| Croatia | hourly | hourly | hourly (not every station) | - | - | - |

* depending on hydrological conditions / warning level exceedance, minimum is once per day

The parameters **water level, discharge** and **water temperature** can be / will be delivered using the foreseen data exchange interface in almost all countries, except in Bulgaria. Because other

parameters are only provided in few countries, it is not recommended to enhance the minimal parameter set of **water level, discharge** and **water temperature** for data exchange in DAREFFORT project. This meets the draft specifications of minimal set of hydrological data foreseen to be exchanged in future DanubeHIS, except water temperature for Bulgaria.

The minimal common overall update frequency is one hour for automatic stations and daily for manual stations.

Real time meteorological data

In this chapter data delivery methods for real time meteorological data are described which are foreseen to be used in DAREFFORT project, and which will be the basis for future DanubeHIS. As for the real time hydrological data the information may differ from the Evaluation Report of Questionnaire of WP3, Deliverable 3.1.3. Especially the delivery methods and available parameters differ from information which can be retrieved from public websites and in bi-lateral data exchange, because for the DAREFFORT data exchange platform standardised solutions have to be used.

Data delivery methods for real time meteorological data

In Table 3 the available and planned data delivery methods for DAREFFORT project and future DanubeHIS are described as derived from the questionnaire and technical information forms of the national data providers.

As for the real time hydrological data there are basically two main types of data delivery: FTP-server or Web-API. In most countries data delivery methods which already exist can be used, these are again Austria, Croatia, Germany, Hungary, Moldova, Serbia, Slovakia, and Slovenia. In case of Austria the existing Web-API for hydrological data will be enhanced to exchange meteorological parameters. In other countries appropriate data exchange formats will be defined, these are Bulgaria (probably FTP), Czech Republic (Water ML 2.0), Romania (FTP), and Ukraine (FTP or API).

Table 3: Data delivery methods for real time meteorological data foreseen in DAREFFORT project and future DanubeHIS

| | **selected stations for DanubeHIS are automatic?** | **database** | **persistence of storage** | **availability of grid data** | **data delivery method for DanubeHIS** | **data delivery method same as for SAVA HIS?** | **processed data available** |
|---|---|---|---|---|---|---|---|
| Croatia | all | | | no | FTP | yes | yes, csv |

* hydrological stations are also used in the DAREFFORT project for providing the meteorological data. This may change in the future.

Update frequencies for real time meteorological data

The availability and capabilities for DAREFFORT project regarding update frequencies of real time meteorological information is shown in Table 4.

Again, because the information given in Table 4 reflect the technical capabilities of the concrete interfaces used for data exchange within the DAREFFORT project and in future DanubeHIS, the available parameters and frequencies shown in this table may differ from the information of Evaluation Report of Questionnaire of WP3, Deliverable 3.1.3, which depicted the availability of data on public websites or bi-lateral data exchange.

Table 4: Availability and update frequencies of real time meteorological data

| | **precipi-tation** | **air Tempe-rature** | **humi-dity** | **precipi-tation type** | **snow cover** | **air qualit y** | **air pres-sure** | **wind speed** | **wind direction** |
|---|---|---|---|---|---|---|---|---|---|
| Croatia | hourly | hourly | - | - | hourly | - | - | - | - |

*22 synoptic stations

Only the parameter **precipitation** can be delivered in all countries using the foreseen data exchange interface at the moment, which meets the draft specifications of minimal set of meteorological data foreseen to be exchanged in future DanubeHIS.

Additionally, there could be a possibility to also exchange air temperature in the future because only Austria and Bulgaria do not foresee to provide this information at the moment.

The minimal common overall update frequency is one hour for automatic stations and daily for manual stations.

Grid data

Grid data is not available in all countries. Table 5 shows which countries provide grid data and the file format in which the data is available

Table 5: Availability of meteorological grid data

| | **grid data** | **file format** | **Provider** | **Coverage** | **Data base** |
|---|---|---|---|---|---|
| Croatia | no | - | - | - | - |

Ice data

In Table 6 the periods in which ice data is measured if any, the parameters which are measured and the corresponding update frequencies are listed.

Because of the nature of ice phenomena and the regional relevance, the periods, but also parameters vary between the countries.

Table 6: Measured ice data and update frequencies

| | ice data measure-ment period | ice cover | percentage of surface covered by ice | thickness of ice cover | duration of ice cover | height of snow | water equivalent |
|---|---|---|---|---|---|---|---|
| Croatia | no data (croatian water has some) | - | - | - | - | - | - |

Meta data

In Table 7 the availability of meta data of hydrological and meteorological stations is summarized.

Table 7: Availability of meta data, and access method

| | online | hydrological | meteorological | electronical |
|---|---|---|---|---|
| Croatia | yes | https://hidro.dhz.hr/hidroweb/skripte/hidrobazahtml.py?funkc=puninfopost&kpost=XYZ | https://meteo.hr/infrastruktura/popis_osnovne_mreze_meteoroloskih_postaja.xlsx | yes |

Meta data is not in all countries available online via a web-interface. All of the countries can make meta data of the stations available electronically.

Summary

One main result from the questionnaire and the technical information forms is that for data exchange of real time data in the DAREFFORT project and for future DanubeHIS there will be mainly two main types of data delivery: FTP-server or Web-API.

In most countries data delivery methods which already exist for hydrological and meteorological real time data can be used, these are Austria, Croatia, Germany, Hungary, Moldova, Serbia, Slovakia, and Slovenia. In case of Austria there is an existing Web-API by which water-level can be retrieved. This Web-API will be enhanced to retrieve additional hydrological and meteorological parameters. In other countries appropriate data exchange formats will be defined, these are Bulgaria (probably FTP), Czech Republic (Water ML 2.0), Romania (FTP), and Ukraine (FTP or API).

In all countries the hydrological parameters **water level and discharge** can be / will be delivered using the foreseen data exchange interface. Water temperature can be delivered by all countries except Bulgaria.

Only the meteorological parameter (**precipitation)** can be delivered in all countries using the foreseen data exchange interface at the moment, which meets the draft specifications of minimal set

of meteorological data foreseen to be exchanged in future DanubeHIS. Additionally, there could be a possibility to also exchange air temperature in the future because only Austria and Bulgaria do not foresee to provide this information at the moment.

Ice data is provided very heterogonous level at the moment. Also grid data is not available in each country.

Meta data is electronically available in all countries. If there is no Web-API for transferring meta data it is recommended to provide meta data of hydrological and meteorological stations via csv-files.

## 4.4. Mapiranje hidro-kodova

### Overview

The purpose of the described database is storage of hydrological and meteorological time series data. There are monitoring points at which observed properties are measured. The monitoring points and observed properties with their attributes are also covered in the data base. Additionally, there are attributes and tables which do not directly serve the purpose of storing time series data but are intended as optional extensions to complete the database. They will be useful for daily work of hydrologists and meteorologists and for possible display on a web site. The database consists of two different schemas: hydro schema and meteo schema for hydrological measurements and meteorological measurements respectively.

### HR Monitoring points selected for exchange in Danube-HIS

#### Hydrological stations and parameters

| national code | station name | EuropeanHISStCode | CountryCode | RiverName | RiverCategory | Q | Water temperature |
|---|---|---|---|---|---|---|---|
| 5170 | Batina | HR5170 | HR | Dunav | 1 | Y | Y |
| 5001 | Aljmaš | HR5001 | HR | Dunav | 1 | Y | Y |
| 5130 | Dalj | HR5130 | HR | Dunav | 1 | Y | Y |
| 5070 | Vukovar | HR5070 | HR | Dunav | 1 | Y | Y |
| 5024 | Ilok | HR5024 | HR | Dunav | 1 | Y | N |
| 5044 | Mursko Središće | HR5044 | HR | Mura | 3 | Y | N |
| 5035 | Goričan | HR5035 | HR | Mura | 3 | Y | N |
| 5008 | Botovo | HR5008 | HR | Drava | 2 | Y | N |
| 5063 | Terezino Polje | HR5063 | HR | Drava | 2 | Y | N |
| 5150 | Donji Miholjac C.S. | HR5150 | HR | Drava | 2 | Y | Y |
| 5005 | Belišće | HR5005 | HR | Drava | 2 | Y | N |
| 5053 | Osijek | HR5053 | HR | Drava | 2 | N | N |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3405 | Drenje Brdovečko | HR3405 | HR | Sava | 2 | Y | N |
| 3425 | Drenje Brdovečko (SIMK) | HR3425 | HR | Sava | 2 | Y | N |
| 3087 | Podsused žičara | HR3087 | HR | Sava | 2 | Y | N |
| 3121 | Zagreb | HR3121 | HR | Sava | 2 | Y | Y |
| 3096 | Rugvica | HR3096 | HR | Sava | 2 | N | N |
| 3020 | Crnac | HR3020 | HR | Sava | 2 | N | N |
| 3219 | Jasenovac | HR3219 | HR | Sava | 2 | Y | N |
| 3104 | Stara Gradiška | HR3104 | HR | Sava | 2 | Y | N |
| 3207 | Mačkovac ustava | HR3207 | HR | Sava | 2 | Y | N |
| 3179 | Davor C.S. | HR3179 | HR | Sava | 2 | Y | N |
| 3177 | Slavonski Kobaš | HR3177 | HR | Sava | 2 | Y | N |
| 3098 | Slavonski Brod | HR3098 | HR | Sava | 2 | Y | N |
| 3101 | Slavonski Šamac | HR3101 | HR | Sava | 2 | N | N |
| 3211 | Županja stepenica | HR3211 | HR | Sava | 2 | Y | N |
| 3416 | Gunja | HR3416 | HR | Sava | 2 | Y | N |
| 4029 | Kupari | HR4029 | HR | Kupa | 3 | Y | N |
| 4016 | Hrvatsko | HR4016 | HR | Kupa | 3 | Y | N |
| 4208 | Zapeć | HR4208 | HR | Kupa | 3 | Y | N |
| 4024 | Kamanje | HR4024 | HR | Kupa | 3 | Y | N |
| 4003 | Brodarci | HR4003 | HR | Kupa | 3 | N | N |
| 4111 | Karlovac | HR4111 | HR | Kupa | 3 | N | N |
| 4056 | Rečica 2 | HR4056 | HR | Kupa | 3 | Y | N |
| 4107 | Jamnička Kiselica | HR4107 | HR | Kupa | 3 | Y | N |
| 4065 | Šišinec | HR4065 | HR | Kupa | 3 | Y | N |
| 4010 | Farkašić | HR4010 | HR | Kupa | 3 | Y | N |
| 3215 | Donja Suvaja | HR3215 | HR | Una | 3 | Y | N |
| 3410 | Štrbački buk | HR3410 | HR | Una | 3 | Y | N |
| 3414 | Dobretin | HR3414 | HR | Una | 3 | Y | N |
| 3415 | Struga Banska | HR3415 | HR | Una | 3 | Y | N |
| 3217 | Kostajnica | HR3217 | HR | Una | 3 | Y | N |
| 3026 | Hrvatska Dubica | HR3026 | HR | Una | 3 | N | N |

**Meteorological stations and parameters**

| national code | station name | longitude | latitude | country | H (m) |
|---|---|---|---|---|---|
| 1002 | Bjelovar | 16,8694444 | 45,9097222 | Croatia | 141 |
| 1003 | Daruvar | 17,21 | 45,5913889 | Croatia | 161 |
| 1006 | Gorice | 17,2783333 | 45,2236111 | Croatia | 135 |
| 1008 | Gradište | 18,7036111 | 45,1591667 | Croatia | 97 |
| 1010 | Karlovac | 15,565 | 45,4936111 | Croatia | 110 |
| 1013 | Krapina | 15,8883333 | 46,1377778 | Croatia | 202 |

| | | | | | |
|---|---|---|---|---|---|
| 1014 | Križevci | 16,5536111 | 46,0288889 | Croatia | 155 |
| 1586 | Osijek-Čepin | 18,5613889 | 45,5025 | Croatia | 89 |
| 1030 | Sisak | 16,3666667 | 45,4997222 | Croatia | 98 |
| 1031 | Slavonski Brod | 17,9952778 | 45,1591667 | Croatia | 88 |
| 1035 | Varaždin | 16,3638889 | 46,2827778 | Croatia | 167 |
| 1477 | Zagreb-Maksimir | 16,0336111 | 45,8219444 | Croatia | 123 |

## 4.5. Pristup administratorskom sučelju Environet softvera za razmjenu podataka

Na serveru DHMZ-a, za potrebe ispunjavanja zahtjeva projekta prema Hrvatskim vodama, instaliran je se fleksibilan alat „Environet“ za konverziju i slanje podataka u sustav DanubeHIS. Taj softver prima podatke iz postojećeg izvora podataka te osigurao konverziju formata izmjerenih podataka u dogovoreni format zajedničke razmjene podataka (WML 2.0). Dijelovi koji su nacionalno specifični (pod-programi) bi imali ograničen pristup te njima može samo manipulirati DHMZ u ime RH. Sučelje i softver za konverziju održavat će DHMZ uz podršku proizvođača softvera.

**Acceptance report HR**

Summary

This software acceptance document establishes formal acceptance of the delivery for the ENVIRONET HyMeDES Software implemented in the DAREFFORT project.

The ENVIRONET HyMeDES Software meets all the acceptance criteria as defined in the requirements document and project scope statement.

Transition to Operations has been completed. The software has been installed either as a

☑ Data Node including the country specific conversion filter (Option A)

or as a

☐ Conversion Plugin including the country specific conversion filter on the Distribution Node configured for pulling the data (Option B)

The software has been tested and evaluated to verify that all deliverables meet performance, functional and quality requirements defined within the DARFFORT project.

The Software has been handed over to Operations and the transfer of knowledge from the Project Team to Operations has also been completed. The technical staff of the operation institution has received a training how to install and use the ENVIRONET HyMeDES Software either during the Workshop on Software Topics on 27th May 2020 or in individual training workshops.

Acceptance Criteria

☑ Software has been installed either as Data Node or Conversion Plugin running on the Distribution Node

☑ Country specific conversion filter has been implemented and handed over

☑ Key pairs for accessing Distribution Node have been created

☑ Data Provider has been registered as a user on the DAREFFORT Project Distribution Node running at LP VIZITERV

☑ Country specific monitoring points have been configured on the DAREFFORT Project Distribution Node running at LP VIZITERV

☑ Observable properties have been configured on the DAREFFORT Project Distribution Node running at LP VIZITERV

☑ Country specific Data Access Rights have been configured on the DAREFFORT Project Distribution Node running at LP VIZITERV

Test and Evaluation results

☑ Access to the DAREFFORT Project Distribution Node running at LP VIZITERV is tested and working

☑ Data is transferred regularly from Data Provider to DAREFFORT Project Distribution Node running at LP VIZITERV is tested and working

☑ Data transfer is tested to be correct

☑ Data update intervals are correct

### Pristup hidrološkim i meteorološkim podacima koji se šalju u razmjenu za Danube-HIS

Datoteke s odabranim hidrološkim i meteorološkim podacima stavljaju se na ftp server otvoren za potrebe projekta Dareffort kojemu se može pristupiti s idućim parametrima:

ftp adresa: 161.53.81.105

username = dareffort

password = VicpJA8z

Za održavanje procesa neprekidne dostave podataka zadužen je DHMZ.

### Pristup interaktivnoj karti s pregledom podataka poslanih u razmjenu za Danube-HIS

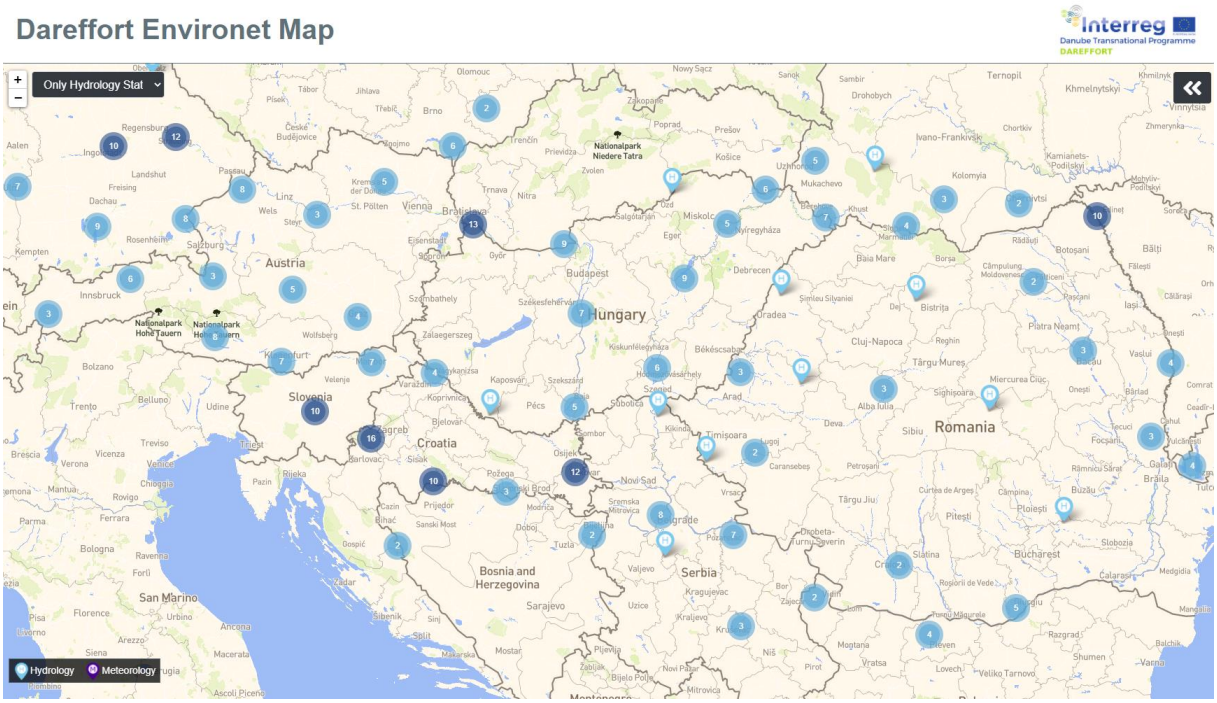
In order to demonstrate the capabilities of the common data exchange based on the HyMeDES EnviroNet Platform implemented in Activity 4.2 and the common data model described above a webtool has been implemented. As a proof of concept this webtool acquires the data stored on the HyMeDES EnviroNet Platform via the implemented API in WaterML 2.0 format and shows the information in an interactive map of the Danube catchment.

The Map can be accessed at *http://dareffort.stasaapps.de/*

The map can be accessed by project partners with:

username: dareffort

password: Dareffort2020Stasa!




**Pristup administratorskom sučelju softvera**

Hrvatskim vodama će se omogućiti pristup administratorskom sučelju softvera Environet u kojem se radi prijava ili izmjena hidroloških i meteoroloških postaja za koje se šalju podaci.
Također se pomoću administratorskog sučelja upisuju metapodaci o lokacijama i podacima.

Administratorskog sučelju pristupa se na web adresi:
https://environet.environ.hu/admin/login

Korisnički podaci za administriranje hidroloških podataka:

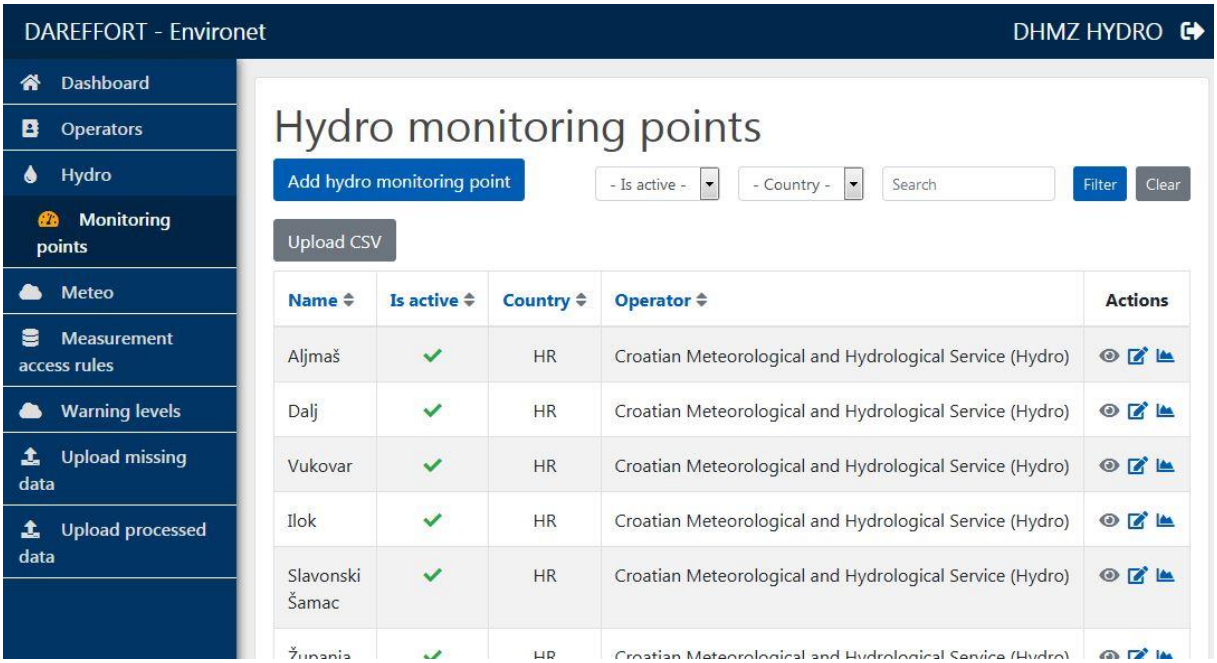
user: dhmzhydro

password: J2MtohQ70H

Korisnički podaci za administriranje meteoroloških podataka:

user: dhmzmeteo

password: J2MtohQ70H




Slika 1: Pristup administracijskom sučelju za administriranje hidroloških podataka za Danube HIS

# REZULTATI RADNOG PAKETA 5: PRIJENOS ZNANJA

## 5.1. Pregled potencijalnih razvojnih scenarija budućeg sustava

| | 0 | 1 | 2a | 2b | 3 |
|---|---|---|---|---|---|
| Status quo | Implementation of a common DRB observed data exchange platform | Implementation of a common DRB Forecasting Systems result exchange platform | Close integration between the National Flood Forecasting and Warning Systems and the existing Regional Flood Forecasting and Warning Systems | Close integration between the National Flood Forecasting and Warning Systems and the existing Regional Flood Forecasting and Warning Systems | Implementation of a common Danube River Basin Forecasting platform |

| | | | | | |
|---|---|---|---|---|---|
| bilateral data exchange, no common data exchange platform | Danube HIS: common data exchange platform (precipitation, temperature, discharge, water level) | Exchange of forecasted water level and discharge time series for selected sections | Phase I: integration with EFAS | Phase II: integration with SEE-MHEWS-A, Sava FFWS and SEE-FFG | similar like the common Sava River Basin Flood Forecasting and Warning System, which have been implemented recently in the Sava River Basin. |
| past - 2021 | 2018-2021 | 2022-2024 | 2022-2023 | 2022-2025 | 2022-2030 |
| | 2021- | 2024- | 2023- | 2025- | 2030- |
| - | ROU + BGR + SRB + UKR | all countries | all countries | all countries | all countries |
| - | improvement by: 4h-120h | ? | difference from national lead time to EFAS products lead time (7-10 days); up to 15 days in the future | | maximum possible |
| - | SVK + HUN + HR | will be improved | Potential improvements of forecasts accuracy | Significant increase of the performance of short-term hydrological warnings and forecasts products | maximum possible |
| | 1,7 mil. Euro | similar to costs of WP4 | similar to costs of WP4 | 0,5~1 * costs of Sava HIS | 3~4 * costs of Sava HIS |
| | 3,66 mil. Euro | no additional costs (same costs as senario 0) | no additional costs (same costs as senario 0) | GER + AUT + SVK + CZE like scenario I; rest is covered by SEE-MHEWS-A | ? |

## 5.2. Sadržaj modula za e-učenje

**Currently used forecast system**

Subbasin SAVA:

Croatian Meteorological and Hydrological Service (DHMZ) and Croatian Waters (HV), mutually developed hydrologic/hydraulic 1D/2D model of the Sava catchment in Croatia and Bosnia and

Herzegovina named SAVA SM from the Slovenian border until Serbia with DHI/Proning as consultants. It was done within period September 2014 - December 2016 in two phases. The model was improved through Interreg V-A FRISCO1 project during period 2018-2019. and it became operational as SAVA SM2. The model covers 43% of Croatian teritory.

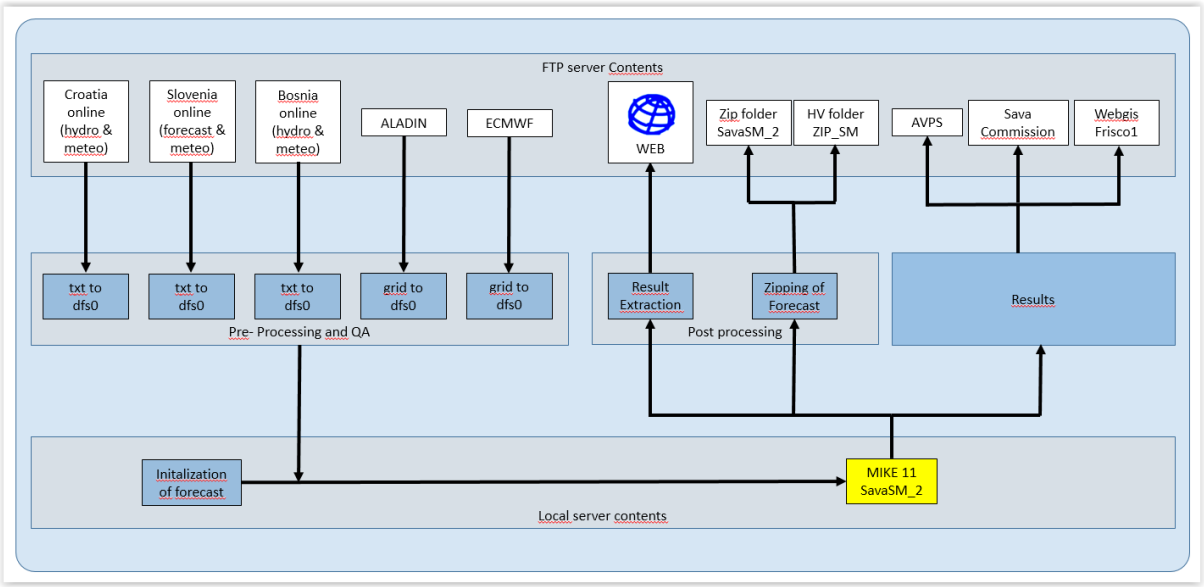
The Sava SM and Sava SM2 models were developed within MIKE11 software (DHI). It is operational, runs regularly at hourly frequency at DHMZ on a PC.

A combined hydrological-hydrodynamic MIKE11 model has been developed partly based on the existing hydrodynamic sub-models, existing upstream sub-models developed jointly with Agency for Environment (ARSO) in Slovenia and new hydrological sub-models which have not been already modelled. After development and calibration of the MIKE11 model, the model has been upgraded to a forecasting model, which is applied in the operational flood forecasting system. The final forecasting system has been installed at DHMZ and at Croatian Waters (HV). The forecast are issued automatically each hour for the next 5 days and it provides forecasts of water level and discharge on 171 river locations.The forecasting system is synchronized with a similar Slovenian flood forecasting system at ARSO including real-time exchange of inflow forecast and online data. All forecasts are disseminated to a WEB page where it is possible to monitor flood warning status for the next 5 days on a map, on charts, in tables and in reports.

After the forecast simulation is completed, the model behind the forecast simulation with all real-time data is made available in the cloud ready for further processing or analyzing.

The Hydrological operational forecasting system (HOFS) with MIKE11 is based on the real-time data received from available online hydrological and meteorological stations in Croatia, Slovenia and Bosnia and Herzegovina, relevant hydrological forecast from Slovenia and prediction from the meteorological models ALADIN and ECMWF.

Relevant partner: HR, SLO, BiH, SRB




**Transnational projects:**

| | Between two countries | Among more than two countries | Info |
|---|---|---|---|
| Meteorology | | | |
| Hydrometeoorolog | | FAIRway Danube | development of River Danube forecasting model in low water regime for the river transportation planning. |
| | | | http://www.fairwaydanube.eu/ |
| | | | https://vodniputovi.hr/en/eu-projects/fairway/ |
| Hydrometeoorolog | | Sava FFWS | https://www.savacommission.org/project_detail/24/1 |
| Hydrometeoorolog | | Frisco1 | https://frisco-project.eu/en/ |

## DAREFFORT E-learning Course on Flood and Ice Forecasting

## TEST REPORT – WP5 Deliverable 5.4.3.

Contact Information

Please provide the contact information of the person who performed the test.

| | |
|---|---|
| **Institution** | Croatian Meteorological and Hydrological Service |
| **Country** | Croatia |
| **Role in the project** | Data provider (not PP or ASP) |
| **Contact Person** | Željka Klemar |
| **Phone** | 00385 1 4565 797 |
| **E-mail** | zeljka.klemar@cirus.dhz.hr |

Framework

The purpose of this document is to report on the beta testing of the *DAREFFORT E-learning Course on Flood and Ice Forecasting Practices - Output 5.4. (*https://dflearn.environ.hu/*),* by project partners and associated strategic partners.

This is the final phase of the elaboration of this important output of the project (Output 5.4). The main goal of the e-learning course is to provide the necessary information for the potential future professional users of the EnviroNet data exchange system elaborated by the Project, as well as to support the better understanding of flood and ice forecasting in general, and to represent the Project's contribution to this field and describe the main results achieved by the DAREFFORT project.

In the earlier phases of the work flow, first, the **Structure and design (Deliverable 5.4.1.)** of the course have been defined. Based on that, the **Content of the e-learning modules (Deliverable 5.4.2)** have been elaborated and uploaded to a dedicated site, using Moodle framework. The content is available on this site since the end of period-5.

Since then, the functionality and graphic design of the e-learning site have been further developed and tested internally by LP.

The e-learning course will be finalized based on these test reports.

Test results

Please register to the site and test the functions, as well as all modules. Please click on the uploaded materials and attempt the quizzes (if there is any). In case you experience any problem please let us know where is it (*Reference column*) and what would be an appropriate correction if you can (*Test results, remarks column*). In case you find everything all right in a module, just use the term "OK".
**You can expand the tables below as necessary, the type of feedback is not further specified.**

Suggestions for improvements are also welcome, however please consider, that this testing is mostly focused on the functionality and on the modules. Certainly if you may find any significant error in the content (definitions, equations, missing explanation etc.), please let us know. Also, if you may find some major typing error (e.g. name of the project is not correct somewhere), you can also include them in this report.

Functions

| **Main functions** | **Test results, remarks** |
|---|---|
| Access to the site | OK |
| Registration | OK |
| Enrolment to modules | OK, but access to the modules should be more visible IMO, larger button on the dashboard, not just small folder icon and name Modules below the username and in hidden menu. |
| Tracking of progress | Inconsistent between modules, i.e. in module 6 there are no checkboxes to mark progress in topic overview like in module 8, only inside each topic.<br>Also, in most modules there is unnecessary checkbox next to "How to enrol this module" section (except in Module 2).<br>In modules with presentations you can mark progress in checkboxes (i.e. Module 6), in others that have lessons the progress is marked automatically within the lesson, but you cannot mark it as complete in the overview (Module 3) |
| Tracking of grades/quiz results | OK |
| **Any other remarks on the functions** | |
| *Topic names* | Inconsistent between modules, some modules have numbered Topics (Modules 6,8..), others just names of sections (Module 3) |
| *Presentations* | In some modules (8..) presentations are opened with Power Point, in some they are embedded via Google Slides (module 1). |
| *Quiz names* | They should be named the same across modules, there are "Revision questions", "Quiz", or just the name of the quiz with icon. |

Modules

*1. Introduction to Flood and ice forecasting in the Danube River Basin*

| Reference | Test results, remarks |
|---|---|
| | OK |

*2. Flood forecasting and warning systems*

| Reference | Test results, remarks |
|---|---|
| | OK |

*3. Hydrological and meteorological monitoring networks and real-time data acquisition*

| Reference | Test results, remarks |
|---|---|
| | OK |

*4. Forecasting the formation and evolution of ice phenomena on rivers*

| Reference | Test results, remarks |
|---|---|
| | OK |

*5. Flash flood forecasting and warning*

| Reference | Test results, remarks |
|---|---|
| | OK |

*6. Verification of hydrological forecasts*

| Reference | Test results, remarks |
|---|---|
| Topic 5 | Is empty |

*7. The EnviroNet data exchange system*

| Reference | Test results, remarks |
|---|---|
| | OK |

*8. Data life cycle*

| Reference | Test results, remarks |
|---|---|

| | |
|---|---|
| | OK |

*9. Representative National Flood Forecasting and Warning Systems within the Danube River Basin*

| **Reference** | **Test results, remarks** |
|---|---|
| | OK |

*10. Representative Regional Flood Forecasting and Warning Systems within the Danube River Basin*

| **Reference** | **Test results, remarks** |
|---|---|
| | OK |

## 5.3. Životni ciklus podataka u RH

In Croatia, Hydrological data on water levels are collected from several sources (DHMZ,Hrvatske Vode, Nationalparks, HEP) into the data management software Hydras 3(Ott).

Data from automatic stations aresent through a mobile network via ftp inhourly, half-hourly or 15-minute intervals (depending on thesettings at each individual station) whereas data from limnigraphs are collected from the stationsevery three months.

Control readings of water levels are performed during visits to the stations and resultsare entereddirectlyinto the Hydras 3 and serve during the subsequent data analysis.

The basic processing of water levels is conducted periodically through the Hydras, and the verified series are stored in the information system "HIS2000", which is developed by the Hydrology Department, whereas the database is developed as relational, under the InterBase RDBMS.

Meteorological data are stored in separate databases.

A relational database of type PostgreSQL serves for storing climatological data, precipitation data, sea temperatures, soil temperatures, data on evaporation and data on the stations. Some measured values are daily, some are interval ones for 07, 14, 21 hours. Data from the automatic stations are stored in the Database of the automatic meteorological stations.

## 5.4. Sudjelovanje na aktivnostima Dunavskog prognostičkog foruma (DAFF)

Događaji Dunavskog prognostičkog foruma promoviraju raspravu o međunarodnoj podatkovnoj politici dunavske regije kao podrška radu Stručnoj skupini za zaštitu od poplava ICDR-a na razvoju

sustava DanubeHIS. Dunavski prognostički forum okuplja stručnjake za prognoziranje poplava i leda radi rasprave o ograničenjima monitoringa i prognoziranja novim tehnološkim postignućima te mogućnosti zajedničkog sustava prognoziranja na razini regije ili pod-sliva.

3 stručnjaka iz DHMZ-a će sudjelovati na on-line konferenciji Dunavskog prognostičkog foruma koji će se održati 30.4.2021., a dr.sc. Tatjana Vujnović će održati prezentaciju u ime DHMZ-a pod nazivom "Present and future Croatian flood forecasting system".

# ZAKLJUČAK

Prognoziranje poplava, prikupljanje podataka i harmonizirana razmjena podataka od ključne su važnosti među zemljama dunavskog sliva. Oborine, razine vodostaja, protoci, temperature vode i pojava leda mjereni su te pohranjeni u izoliranim sistemima u svakoj pojedinoj zemlji. Do sada su se ti podaci razmjenjivali samo sa susjednim zemljama temmeljem bilateralnih sporazuma. Poštujući navedene sporazume, situacija se sada poopćava zahvaljujući projektu DAREFFORT.

Državni hidrometeorološki zavod je uz projektnog partnera Hrvatske vode temeljem sklopljenog Ugovora sudjelovao u svih radnim paketima u okviru svog djelokruga, a tu ulazi i upravljanje službenim hidrometeorološkim podacima za Republiku Hrvatsku. Stoga DHMZ ima u Projektu Dareffort status pružatelja podataka za RH.

Jedan od najopipljivijih rezultata Projekta razvoj je sustava za harmoniziranu razmjenu hidrometeoroloških podataka te njihovo slanje u zajedničku bazu podataka DanubeHIS.

Na serveru DHMZ-a, za potrebe ispunjavanja zahtjeva projekta prema Hrvatskim vodama, instaliran je fleksibilan alat za konverziju i slanje podataka u sustav DanubeHIS, naziva HyMeDES EnviroNet.

Sučelje i softver za konverziju održavat će DHMZ, a Hrvatskim vodama je omogućen pristup administratorskom sučelju softvera.

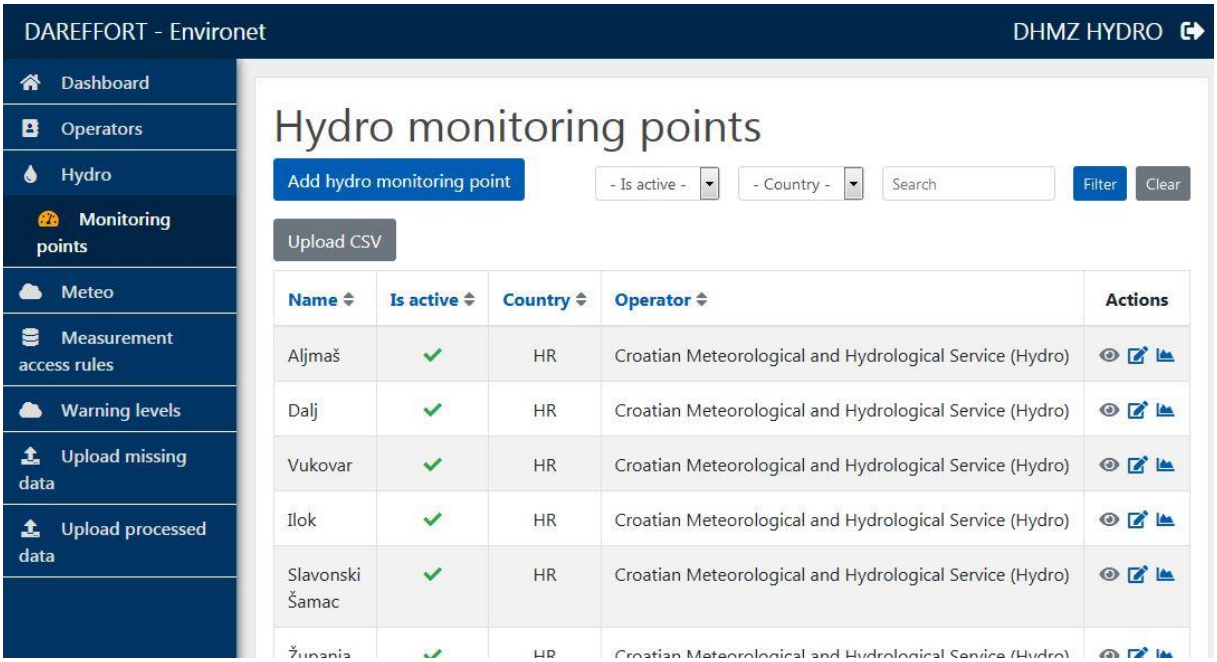
Pomoću administratorskog web sučelja registrirani korisnici mogu upravljati nacionalnim podacima koji sudjeluju u DanubeHIS razmjeni. Primjerice moguće je prijavljivati nove hidrološke ili meteorološke postaje, određivati parametre i metapodatke navedenih izvora podataka.

**Administratorskom sučelju pristupa se na web adresi:**
https://environet.environ.hu/admin/login

**Korisnički podaci za administriranje hidroloških podataka:**
user: dhmzhydro
password: J2MtohQ70

**Korisnički podaci za administriranje meteoroloških podataka:**
user: dhmzmeteo
password: J2MtohQ70H

Kao primjer, na slici ispod je prikazan dio prijavljenih hidroloških postaja iz Hrvatske.




Korisničko sučelje je podijeljeno u više sekcija kojima se pristupa pomoću bočne navigacijske trake s lijeve strane ekrana.

Opsežne korisničke upute priložene su na CD-u koji je sastavni dio ovog Izvješća.

# PRILOG

Uz Konačno izvješće prilaže se CD sa softverskim materijalima te dokumentacijom sustava za razmjenu podataka za Danube HIS instaliranog u DHMZ-u.

## Sadržaj CD-a:

1. Docker-Installer environet-docker-master
2. Source Code environet-master
3. Software User Manual
4. User manual for Environet System
5. Environet konfiguracijske datoteke – HR
6. Konačno izvješće.docx
7. Konačno izvješće.pdf