Forecasting Discharge with EO4AI Along the Danube River

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Abstract: Being able to predict river discharge across multiple hydrometric points along a river provides substantial benefits for agencies in charge of river monitoring, preservation and maintenance. It is also instrumental in the context of climate change, as mitigation and adaptation measures can be designed based on the input of forecasted data. We present an AI method using earth observation data and in-situ measurements to build prediction models, and show their precision on 8 points along the Danube. We discuss the importance of forecasting in the process of daily operations of rivers and in the process of planning future activities. One key point in this narrative is the availability of open access data and the role of Organizations like ICPDR that take care of these data.

Keywords: AI, Danube, Forecasting discharge

'River discharge' is the volume of water flowing through a river channel; measured at any given point in cubic metres per second. High river discharge can lead to flooding; while low river discharge can have impacts for species relying on the ecosystem and, in extreme cases, result in drought and itself be a result of drought[1]. Recent years show that river discharge is lower than average for two thirds of the year across Europe, and was most severe in central Europe. In November and December in the other hand, the discharge was high in Western Europe and caused 158 flood notifications[2]. This has important impact on the climate conditions in the entire continent. That is why it is important to investigate the fluctuations of discharge historically, currently, but also with foresight of the trends for future quantities. Further, proper river management, maintenance and preservation requires constant monitoring and in depth analysis of the hydrological and hydrodynamic processes along the entire river basin and catchment in order to plan for adequate measures to protect the river environment and to secure good condition of the flow, the quality of the water, the shape of the river banks, critical areas and flood plains. One important element of this surveillance is the monitoring of the discharge levels.

We present a method to predict discharge in different hydrometric points along the river by using earth observation data, in-situ measurements and deep learning – AI, and demonstrate how it can be applied to monitoring and management of the Danube river – the longest river in Europe, crossing several countries.

[1] https://climate.copernicus.eu/ESOTC/2019/river-discharge
[2] https://climate.copernicus.eu/ESOTC/2019/river-discharge

Examples of the forecasting performance of discharge on several points of the Danube are shown on Figure 1 below.

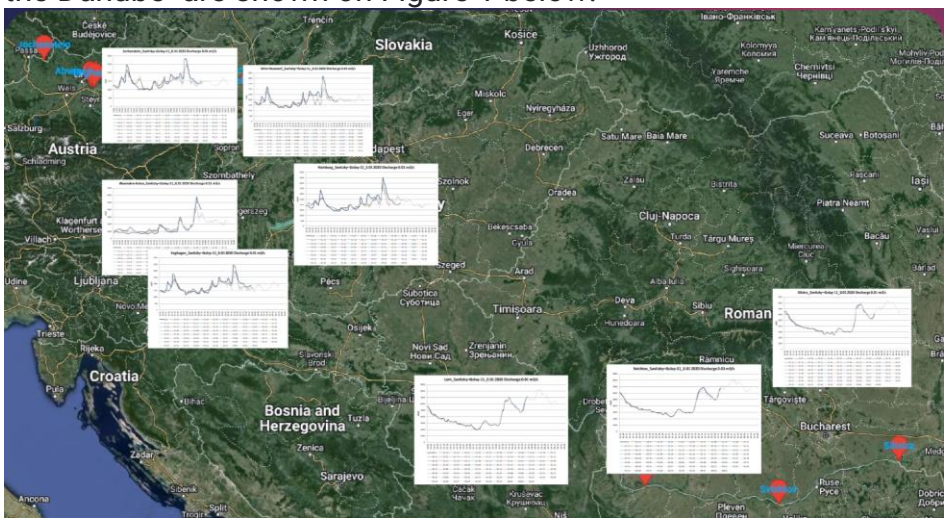

Figure 1. Forecast results of discharge over 8 points of hydrometric stations.

We emphasize the value of open access data with in-situ measurements provided by ICPDR[3] through their online platform to enable experiments and solutions built on top of or by means of the available data collections.

We discuss the relevance of the ability to provide with forecasts about the discharge along the entire river to ensure better ground for identifying critical aspects, river areas and seasonal behaviour that will help build an overall view of the river and climate change processes. This will in turn provide the basis for better informed decision making for river maintenance and protection over time.

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[3] https://www.icpdr.org/

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