

ENHANCING REGIONAL COOPERATION IN THE DANUBE BASIN: STRONGER
TOGETHER

3 April 2025, Mostar, Bosnia and Herzegovina

Flood Forecasting and Warning in the Sava River Basin

Dragan Zeljko, Executive Secretary



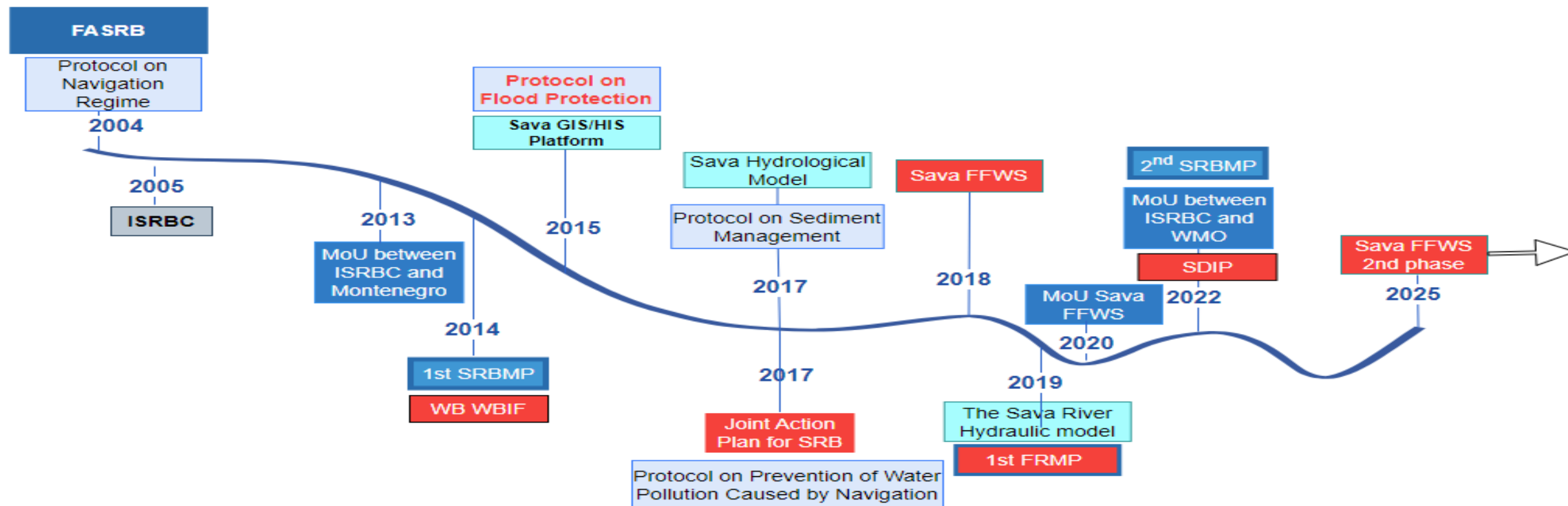
Legal basis and milestones in cooperation

Framework Agreement on the Sava River Basin (FASRB) (2004)

- *International regime of navigation*
- *Sustainable water management*
- *Measures to prevent or limit hazards and reduce adverse consequences (floods, droughts, accidents, etc.)*

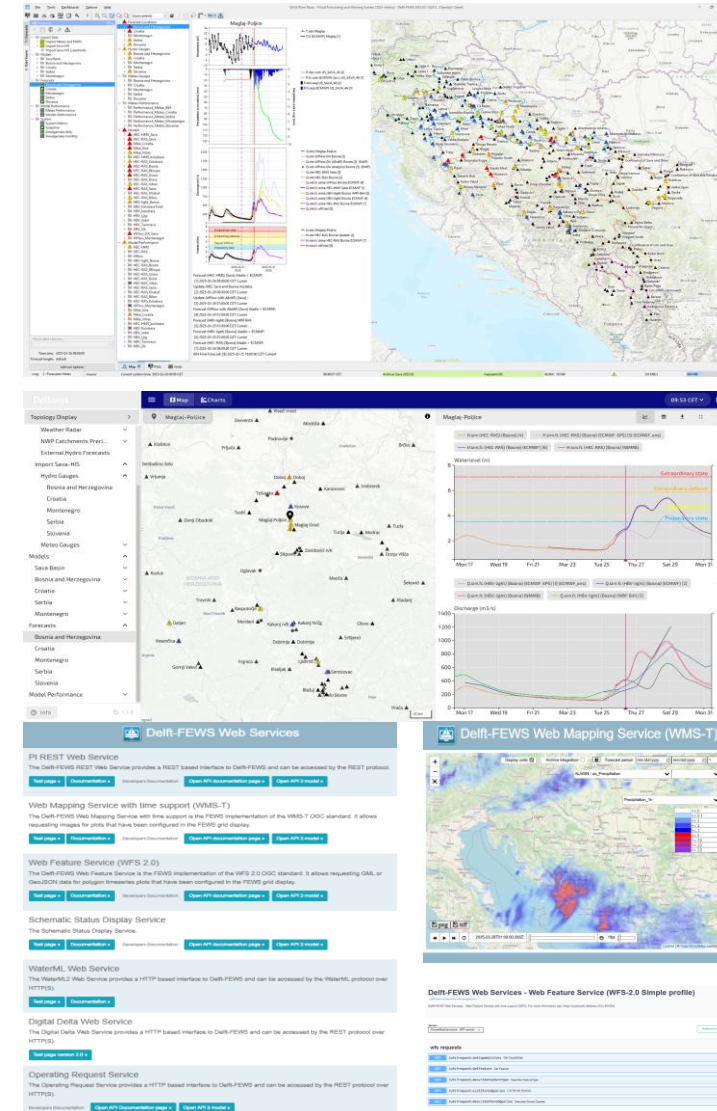
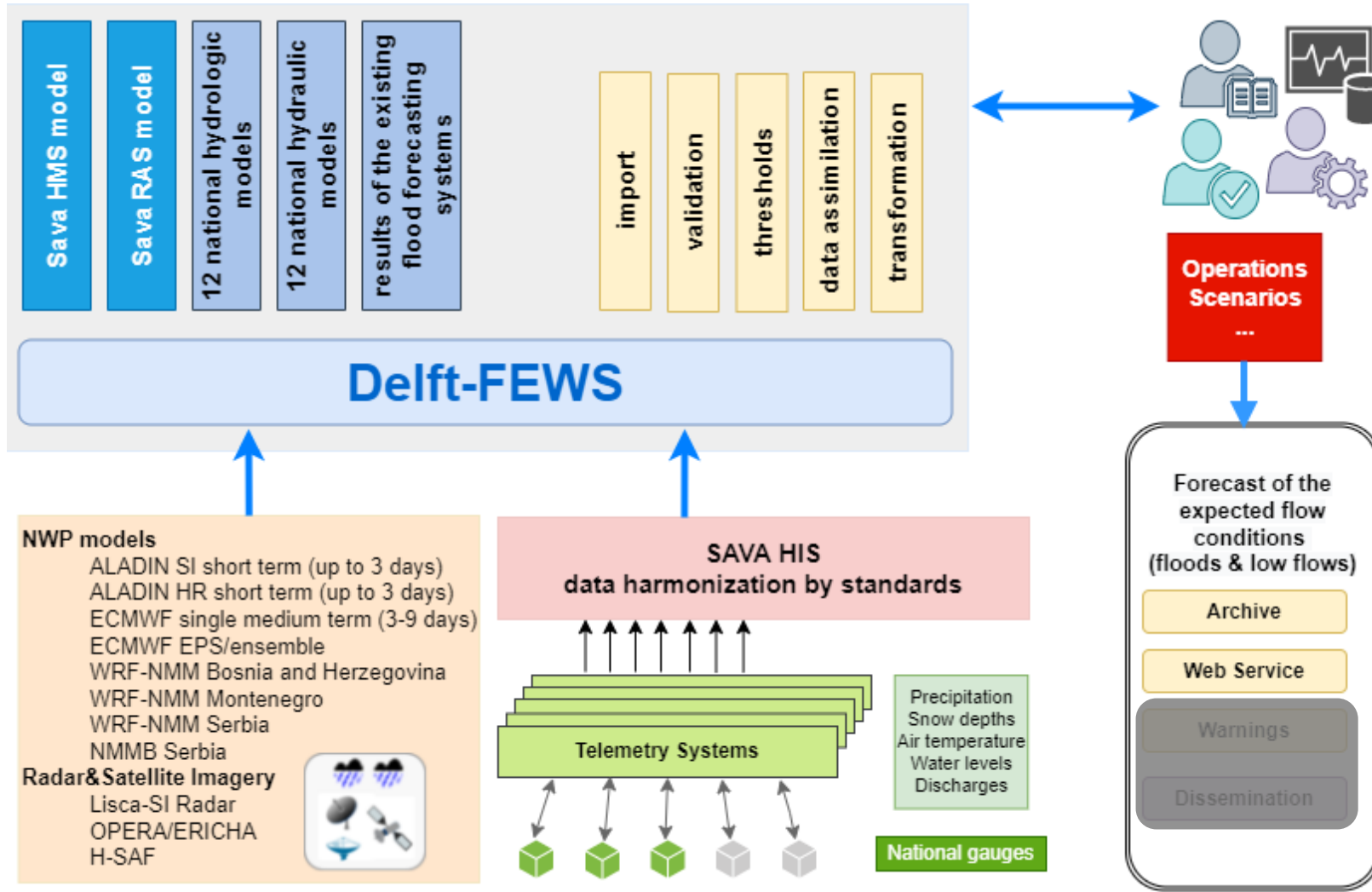
Protocol on Flood Protection to the FASRB (2015)

- *Flood Risk Management Plan*
- *Flood Forecasting, Warning and Alarm System*
- *Measures in emergencies and mutual assistance*



Sava Flood Forecasting and Warning System

Sava FFWS



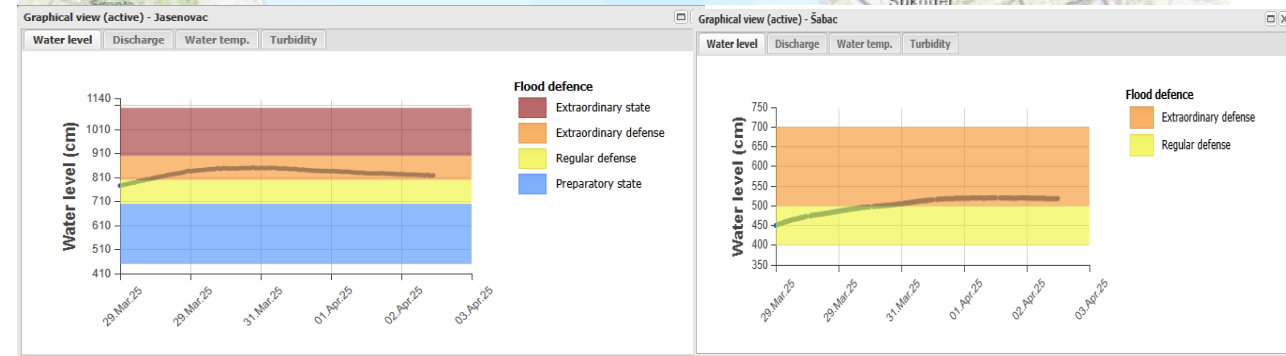
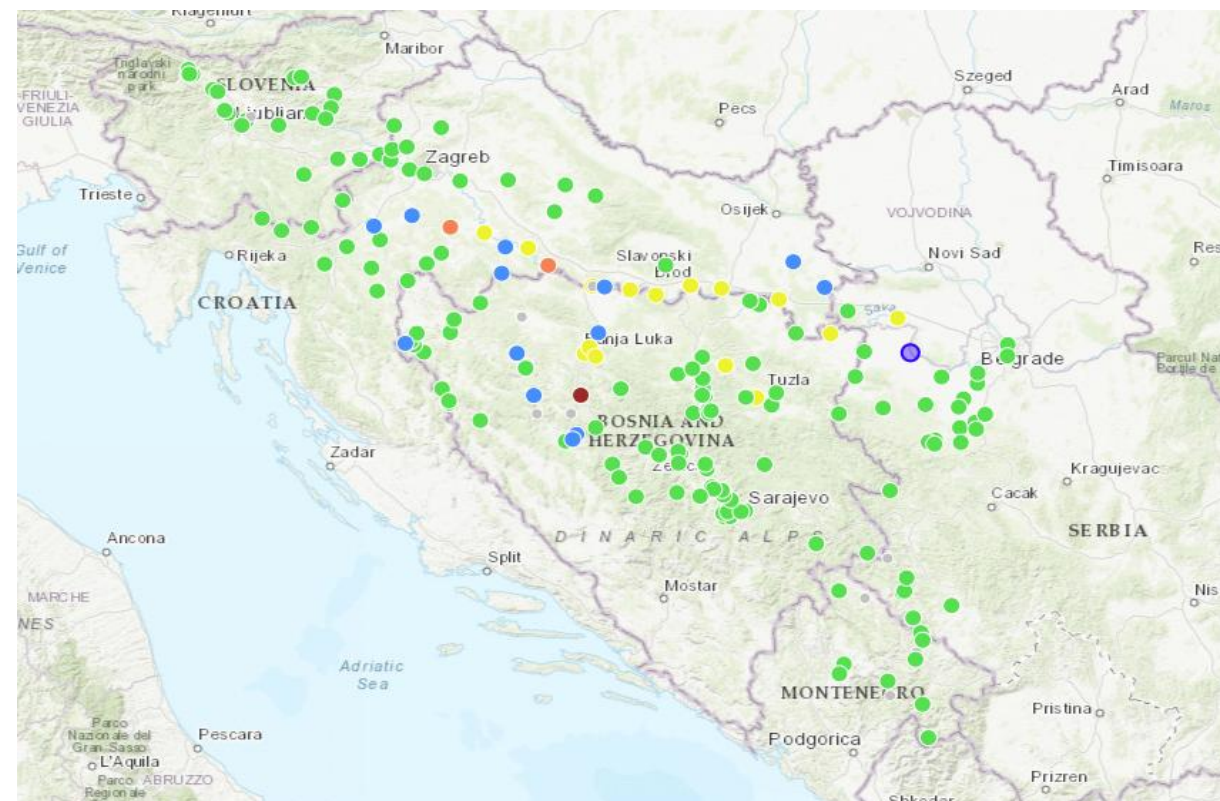
Sava Hydrologic Information System

Sava HIS

www.savahis.org

- ❖ Continuous data exchange on an hourly and daily basis in line with the Data Policy
 - 7 data providers from 5 countries
 - 310 hydrological and 220 meteorological stations
 - Water ML 2.0 standard and web services in use
 - WMO Resolution 25 (Cg-XIII) and 40 (Cg-XII) in implementation

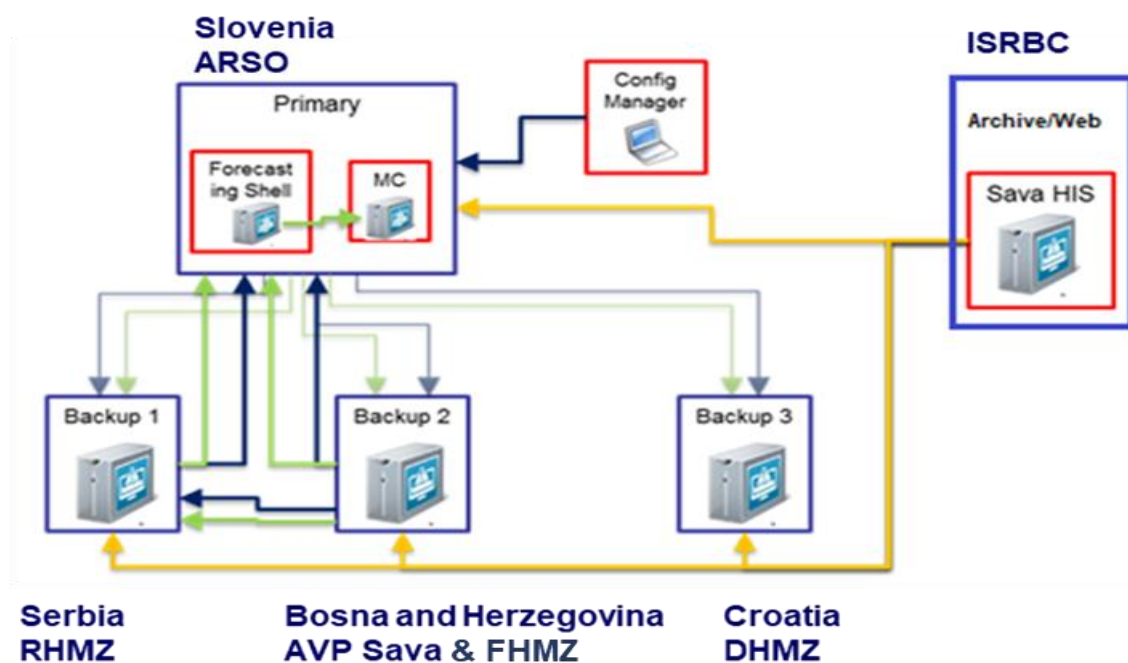
- ❖ Implemented in WMO WHOS



Sustainability of the Sava FFWS

➤ Sava FFWS MoU (2020) defines:

- Structure, rights and obligations of the **user** and **hosting** organizations
- Evaluation and assessment of the work performed (technical and decision-making bodies established)
- Joint financing (by contribution of the countries)
- Regular training of the engaged personnel
- Further development



TECHNICAL GROUP

International Forecasting Team (9 members)

International Support Team (9 members)

International Development Team (10 members)

STEERING GROUP

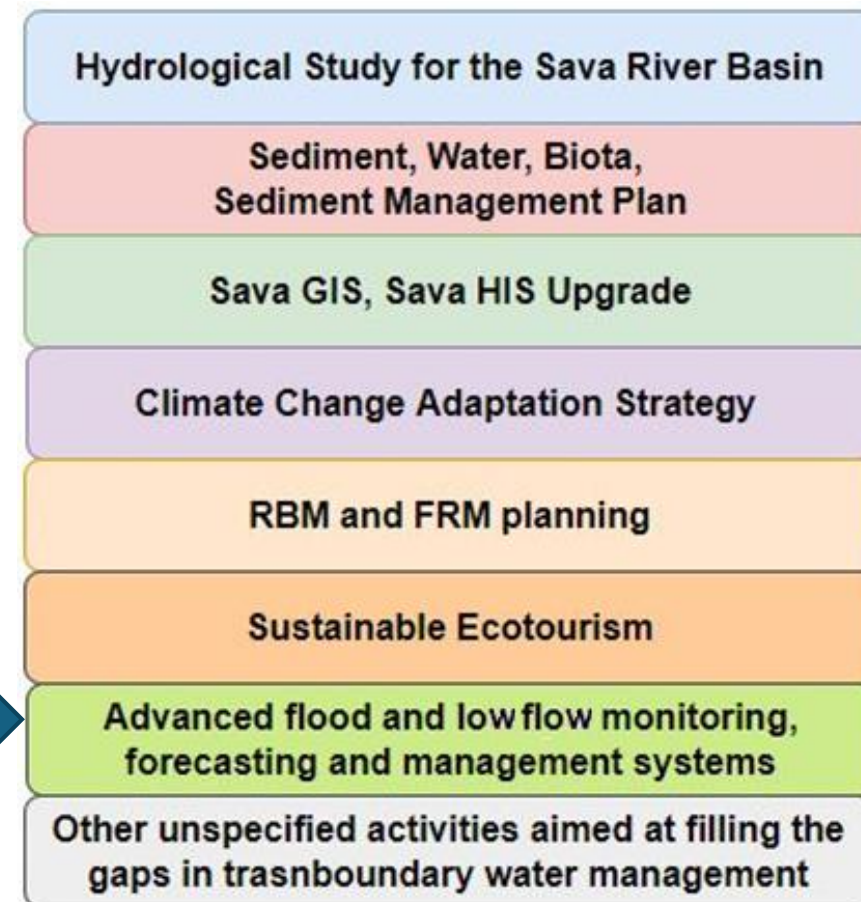
Assess, evaluate and approve all activities performed

ISRBC
8 members

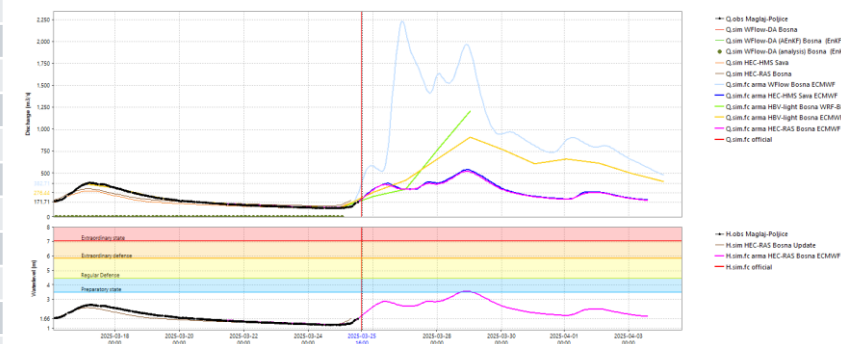
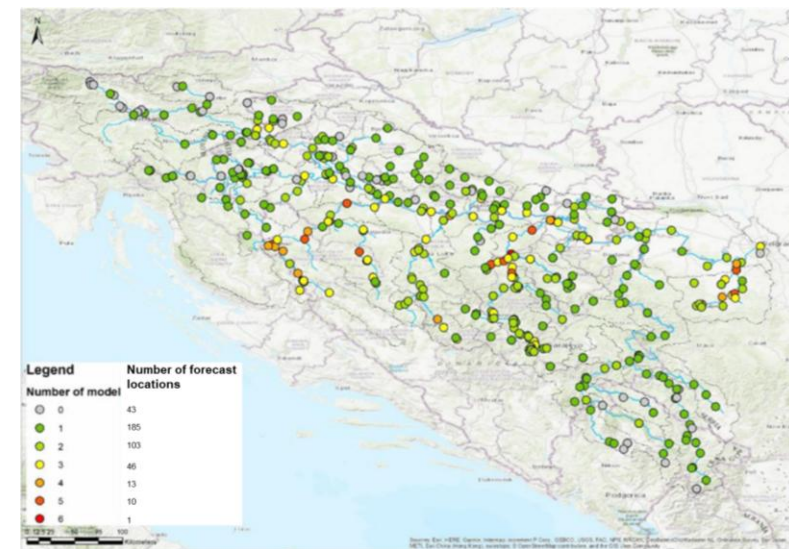
Decision making, final approval

Sava and Drina River Corridors Integrated Development Program

- ❖ Supported by Global Environmental Facility and World Bank
- ❖ Based on the Joint Plan of Actions for the Sava River Basin (2017)
- ❖ 2 phases ~ 10 years
 - ❑ phase 1: 2022-2026 in implementation
 - ❑ phase 2: 2026-2030 in preparation
- ❖ National and regional (basin-wide) component
- ❖ ISRBC - regional component substantially contributed to the implementation of the FASRB
 - ❑ supporting policy dialogue and consultations and facilitation and implementation
 - ❑ joint planning and sustainable management and development of water resources
 - ❑ building resilience to climate shocks

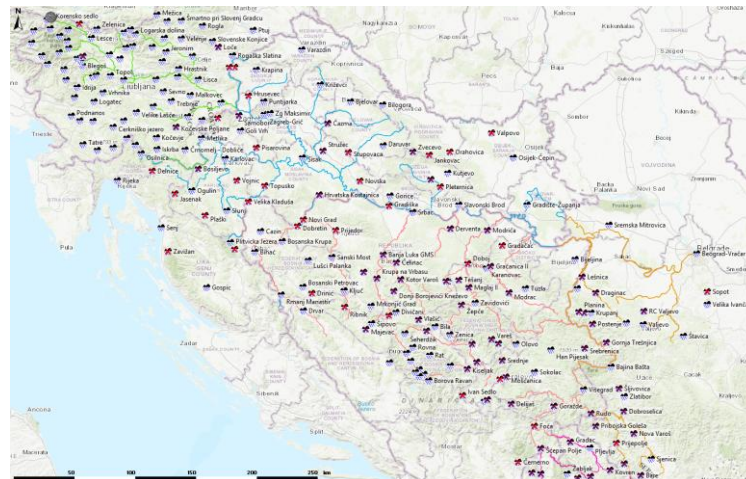
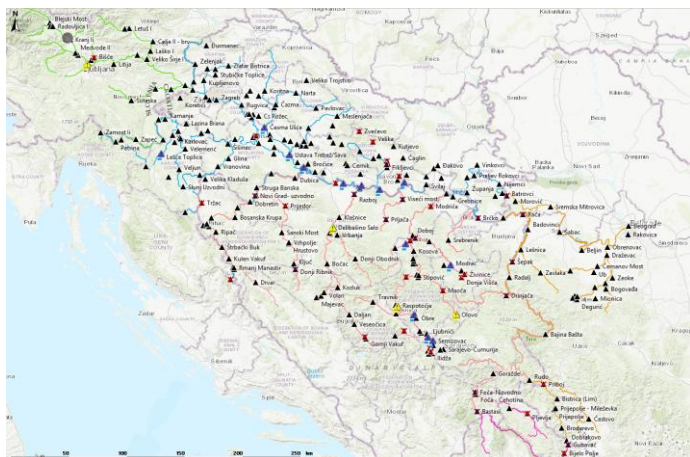


Simulation models		Numerical Weather Prediction (NWP) models							
		Basin						Local	
Hydrological	Hydraulic	Aladin SI + ECMWF	Aladin HR + ECMWF	ECMWF eps	WRF-ME 3km	WRF RS	NMMB RS	WRF BA	WRF ME 1km
HEC-HMS Sava	HEC-RAS Sava	x		x	x	x	x		
	HEC-RAS Una (1)	x		x	x	x	x		
	HEC-RAS Una (2)	x		x	x	x	x		
	HEC-RAS Una (3)	x		x	x	x	x		
	HEC-RAS Sana	x		x	x	x	x		
	HEC-RAS Vrbas	x		x	x	x	x		
	HEC-RAS Bosna	x		x	x	x	x		
	HEC-RAS Usora	x		x	x	x	x		
	HEC-RAS Drina	x		x	x	x	x		
WFlow Sava	/	x		x		x	x		
Mike-NAM Sava (Croatia)	Mike11 Sava (Croatia)		x						
Mike-NAM Una	Mike11 Una		x						
Mike-NAM Vrbas	Mike11 Vrbas	x		x	x	x	x	x	
HBVlight Bosna	/	x		x	x	x	x	x	
WFlow Drina	/	x		x	x	x	x		x
HEC-HMS Kolubara	HEC-RAS Kolubara	x		x	x	x	x		
HBV Kolubara Total	/	x		x	x	x	x		
HBV Kolubara	/	x		x	x	x	x		
HBV Jadar	/	x		x	x	x	x		
HBV Tamnava	/	x		x	x	x	x		
HBV Ub	/	x		x	x	x	x		
HBV Ljig	/	x		x	x	x	x		

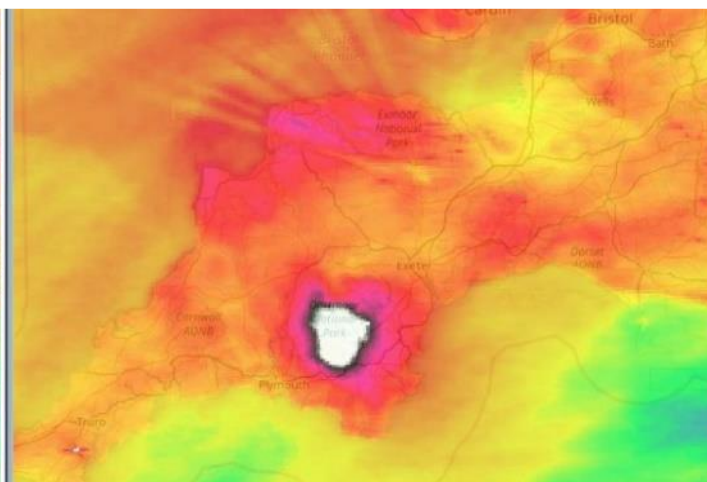
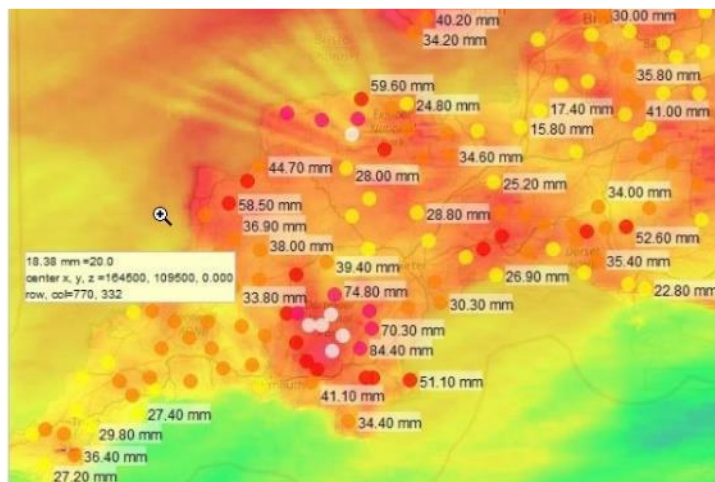


Sava FFWS 2nd phase - goals

➤ Improvement of the meteorological and hydrological real-time data



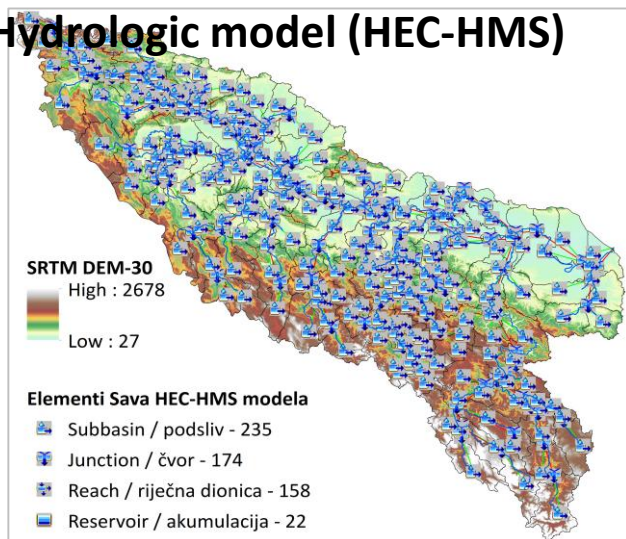
➤ Development of high-resolution NWP models, satellite, and radar composite images



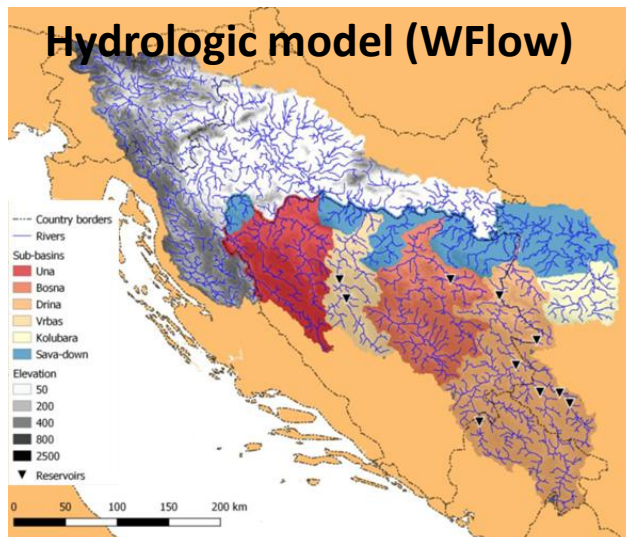
Sava FFWS 2nd phase - goals

➤ Improvement of the existing basin-wide models

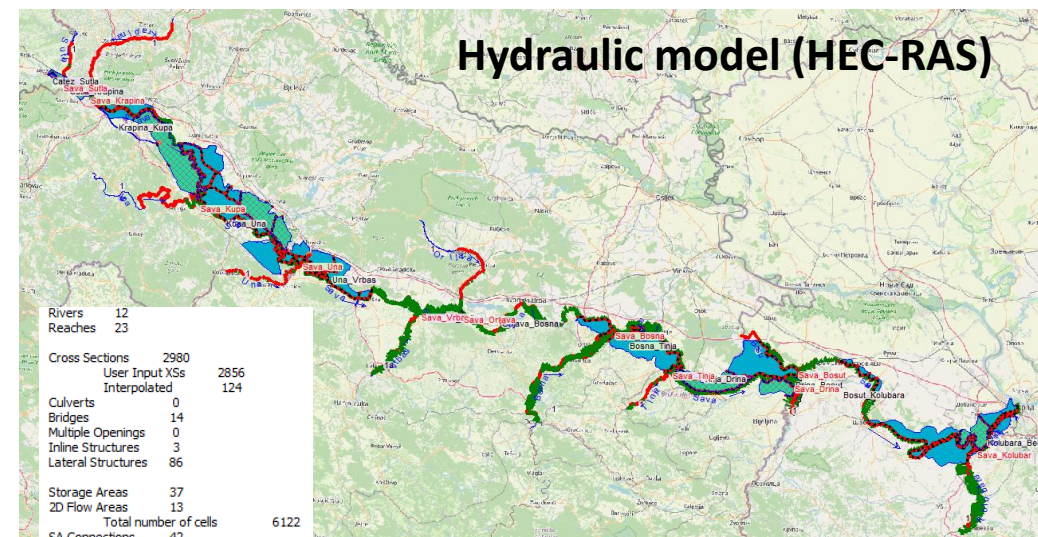
Hydrologic model (HEC-HMS)



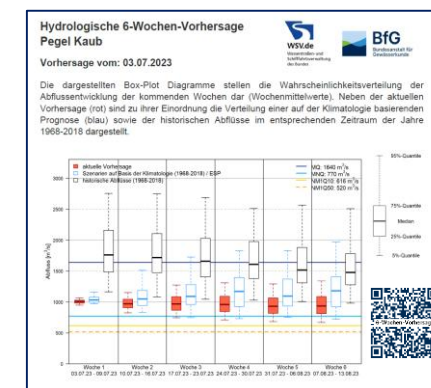
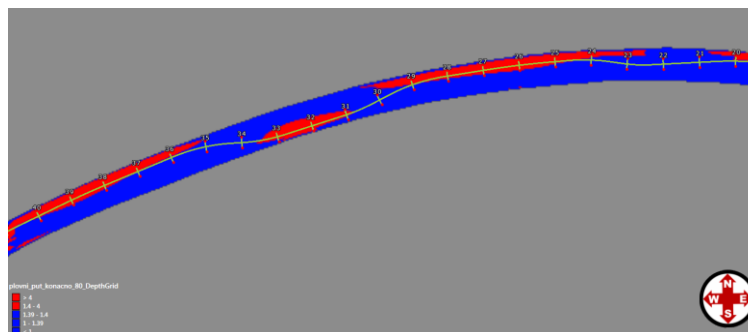
Hydrologic model (WFlow)



Hydraulic model (HEC-RAS)

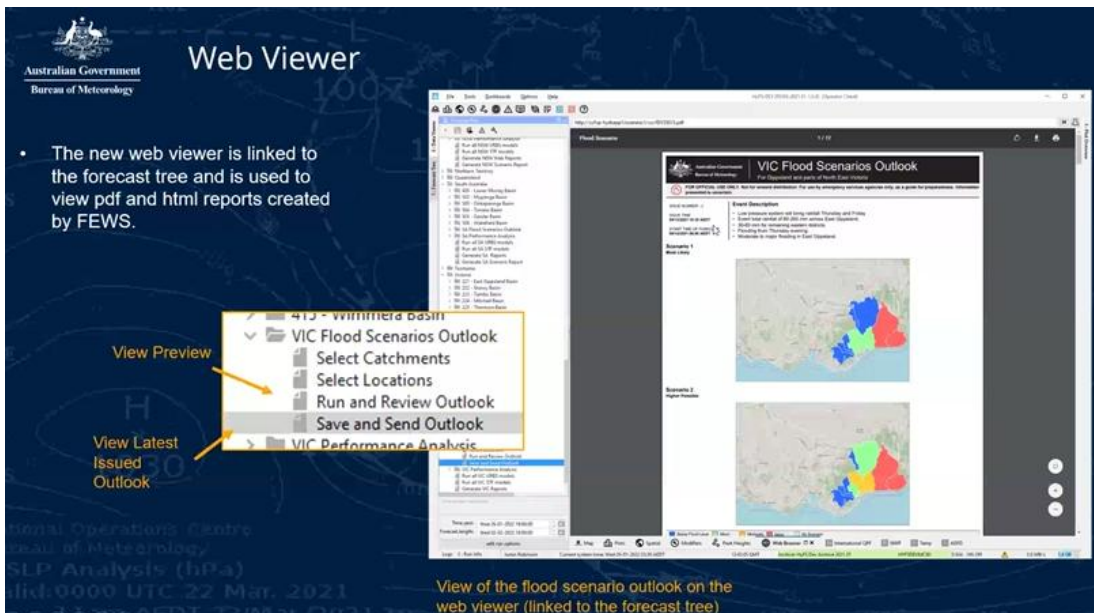


➤ Implementation of the low flow forecasting into the existing platform



Sava FFWS 2nd phase - goals

- Development of efficient flood and low flow forecasting and warning procedures and establishment of an internal web dissemination platform



Web Viewer

- The new web viewer is linked to the forecast tree and is used to view pdf and html reports created by FEWS.

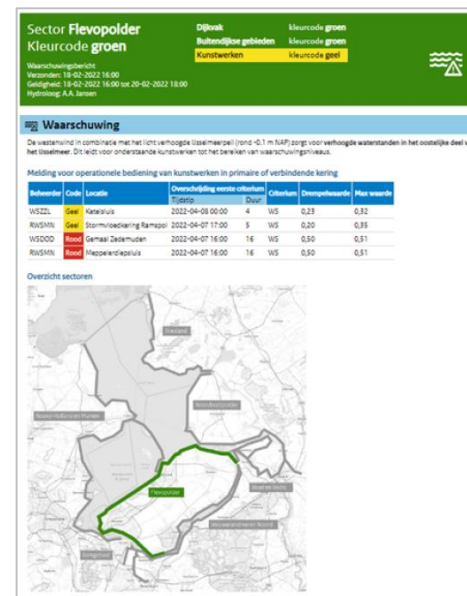
View Preview

View Latest Issued Outlook

413 - Wimmera Basin

- VIC Flood Scenarios Outlook
 - Select Catchments
 - Select Locations
 - Run and Review Outlook
 - Save and Send Outlook
- VIC Performance Analysis

View of the flood scenario outlook on the web viewer (linked to the forecast tree)



Sector Flevovolder Kleurcode groen

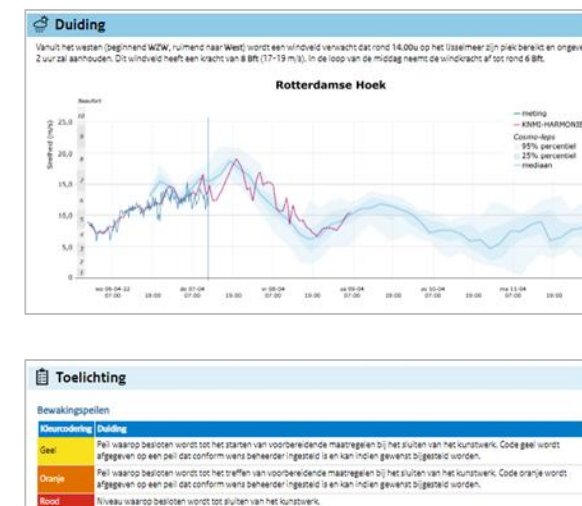
Waarschuwing

De waterstand in combinatie met het licht verhoogde (aanmerkelijk) rond 0.1 m SLP zorgt voor verhoogde waterstanden in het oostelijke deel van het toestel. Dit web voor onderstaande kunstwerken tot het bereiken van waarschuwingniveau.

Melding voor operationele besteding van kunstwerken in primaire of verbindende kering

Relevanter Code	Locatie	Overstijging water omlaag	Critisch	Overstijgingsniveau	Max waarde	
WSZL	Kanals	2022-04-08 00:00	4	WS	0.25	0.32
WSZL	Kanals	2022-04-07 17:00	5	WS	0.20	0.35
WSZL	Gemaal Deemuden	2022-04-07 16:00	16	WS	0.50	0.51
WSZL	Heppendekapels	2022-04-07 16:00	16	WS	0.50	0.51

Overzicht sectoren



- System Interoperability

Sava FFWS must be in line with the long-term activities carried out by the WMO specifically, the "Early Warnings for All" and Hydro SOS

THANK YOU FOR YOUR ATTENTION