UNIVERSITY OF AGRICULTURE IN KRAKOW
Faculty of Environmental Engineering and Land Surveying

Department of Hydraulic Engineering and Geotechnics

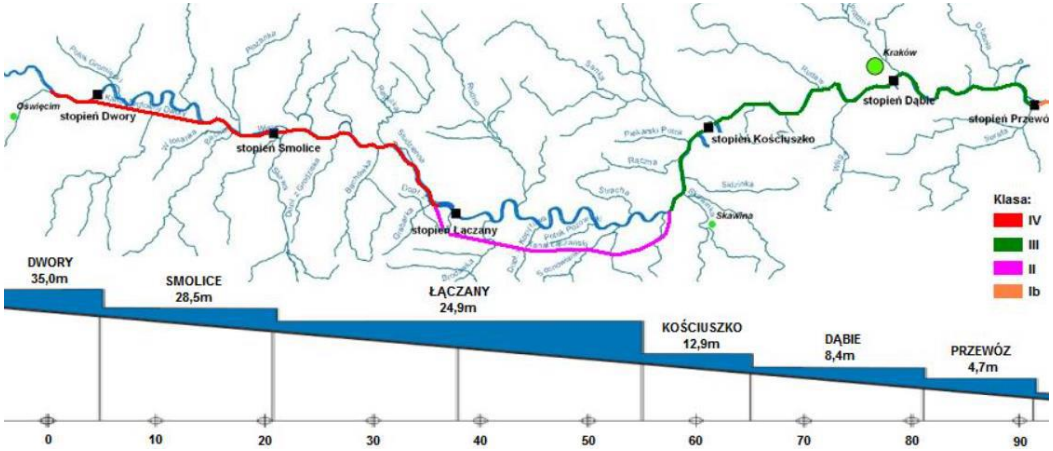
The negative phenomenon of anthropogenically induced hydropeaking – process and damage

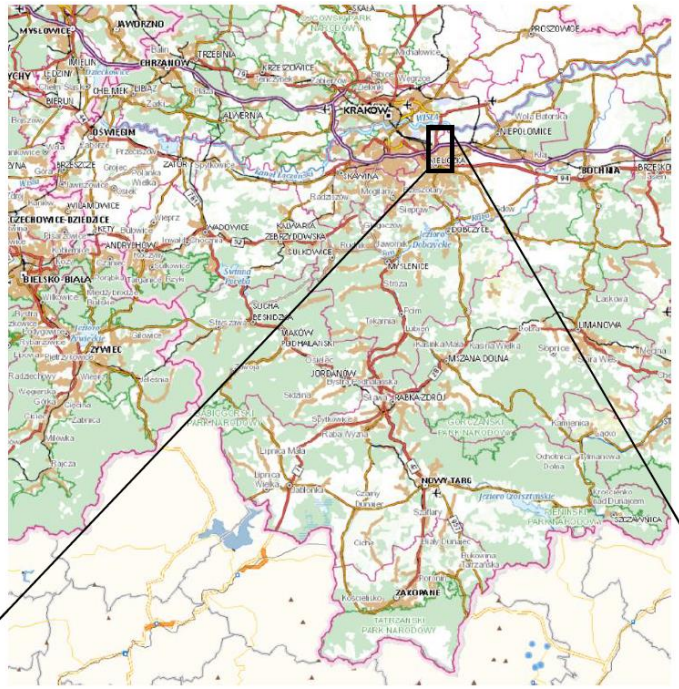
XLII International School of Hydraulics
Radocza, Poland
20–23 May 2025

Leszek Książek
Jacek Florek
Maciej Wyrębek
Andrzej Strużyński

Localization

Map and longitudinal profile of the Upper Vistula Cascade

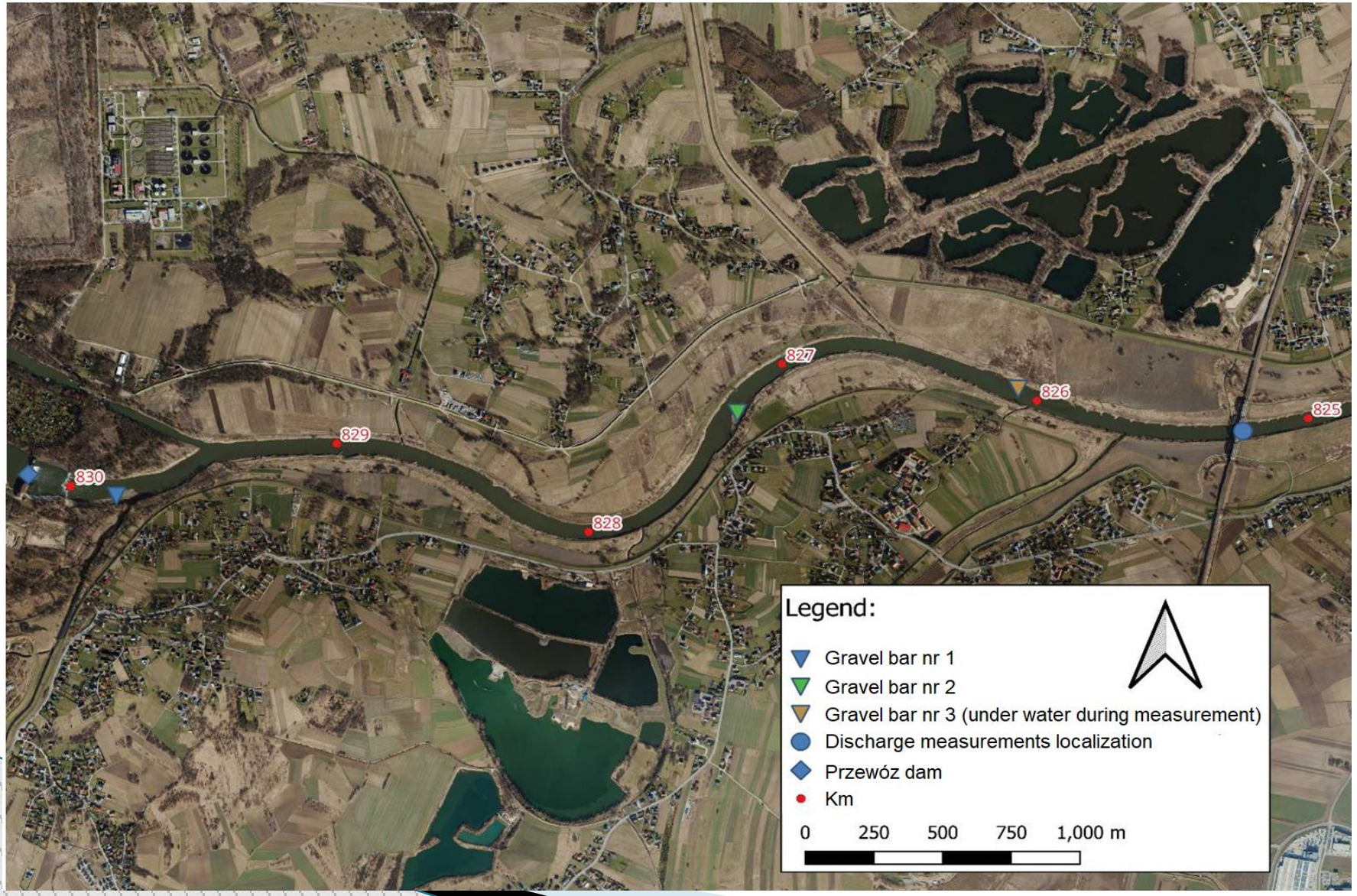




Przewóz Dam, Vistula River view from the downstream, February 18, 2024 [Fot.LeK]

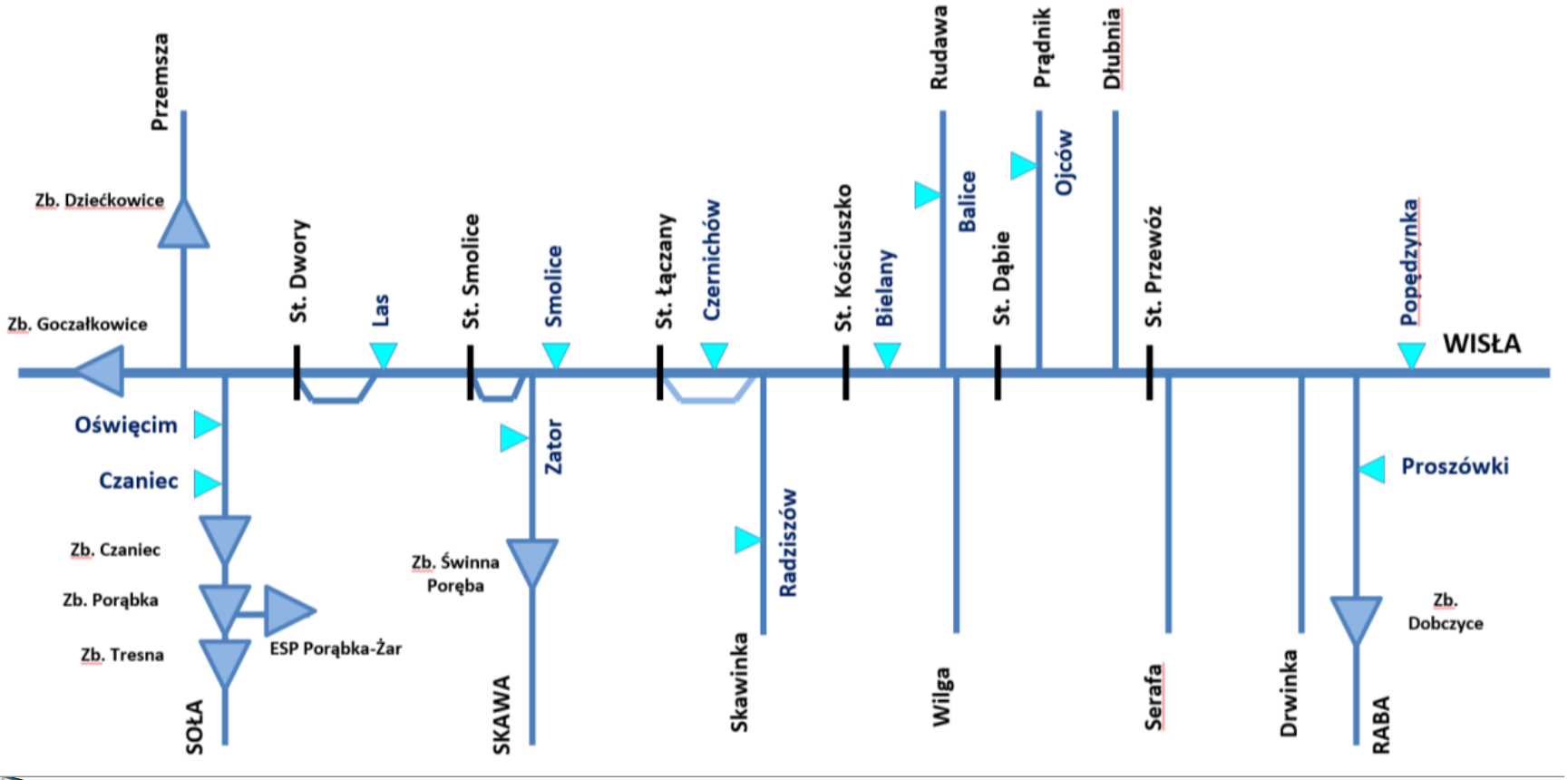
Localization

The section of the Vistula River with the location of the gravel bars below the Przewóz Dam



Hydrology

Diagram of the hydrological system, Vistula from the Goczałkowice reservoir to the Popędzynka water gauge



Hydrology

Diagram of the hydrological system, Vistula from the Goczałkowice reservoir to the Popędzynka water gauge

Dziećkowice 52.8 Skawa Soła

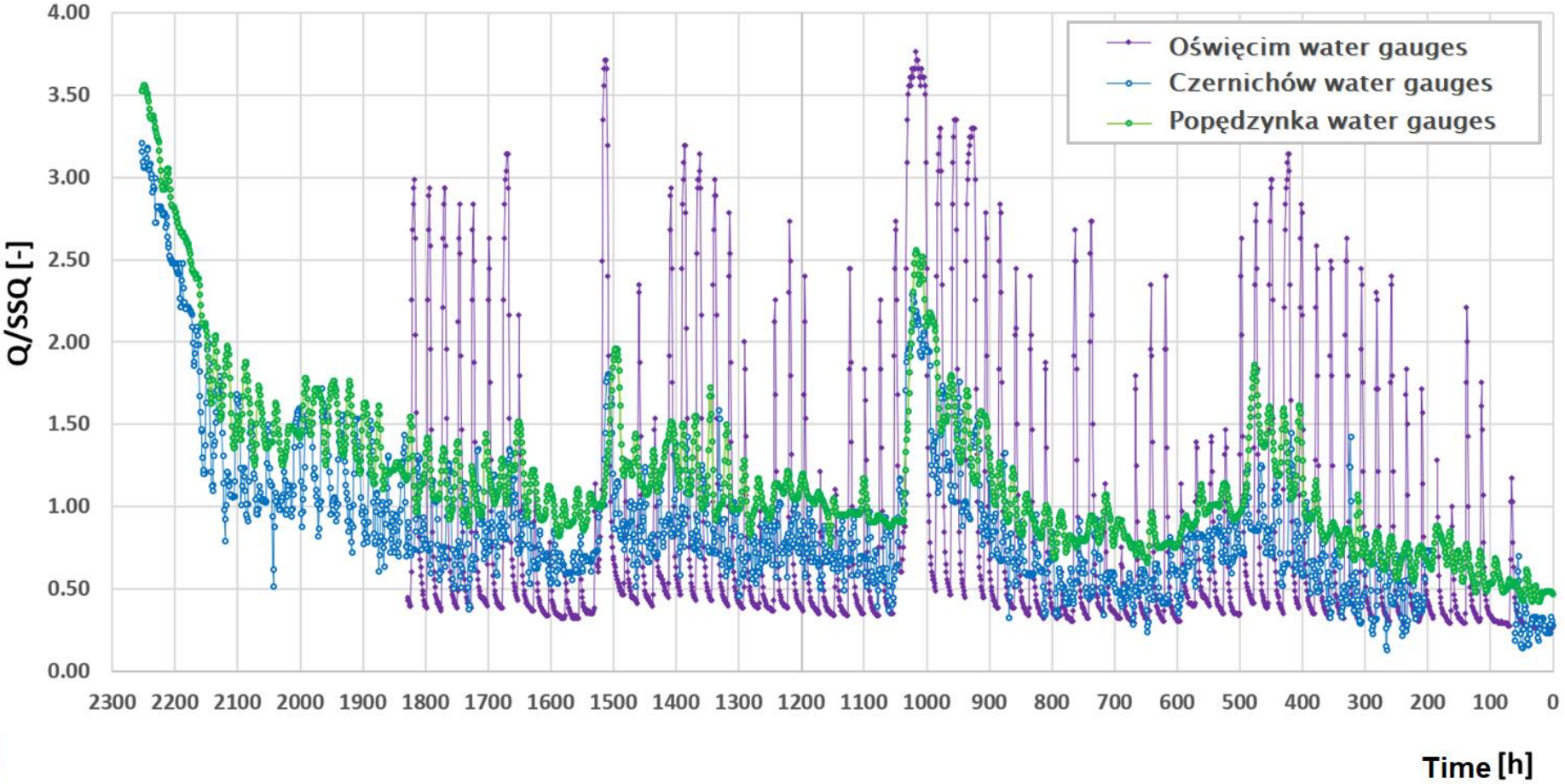
Czaniec 1,3 Soła
Porąbka 26,6 Soła
Tresna 94 Soła

Świnna Poręba 161 Skawa

Dobczyce 127 Raba

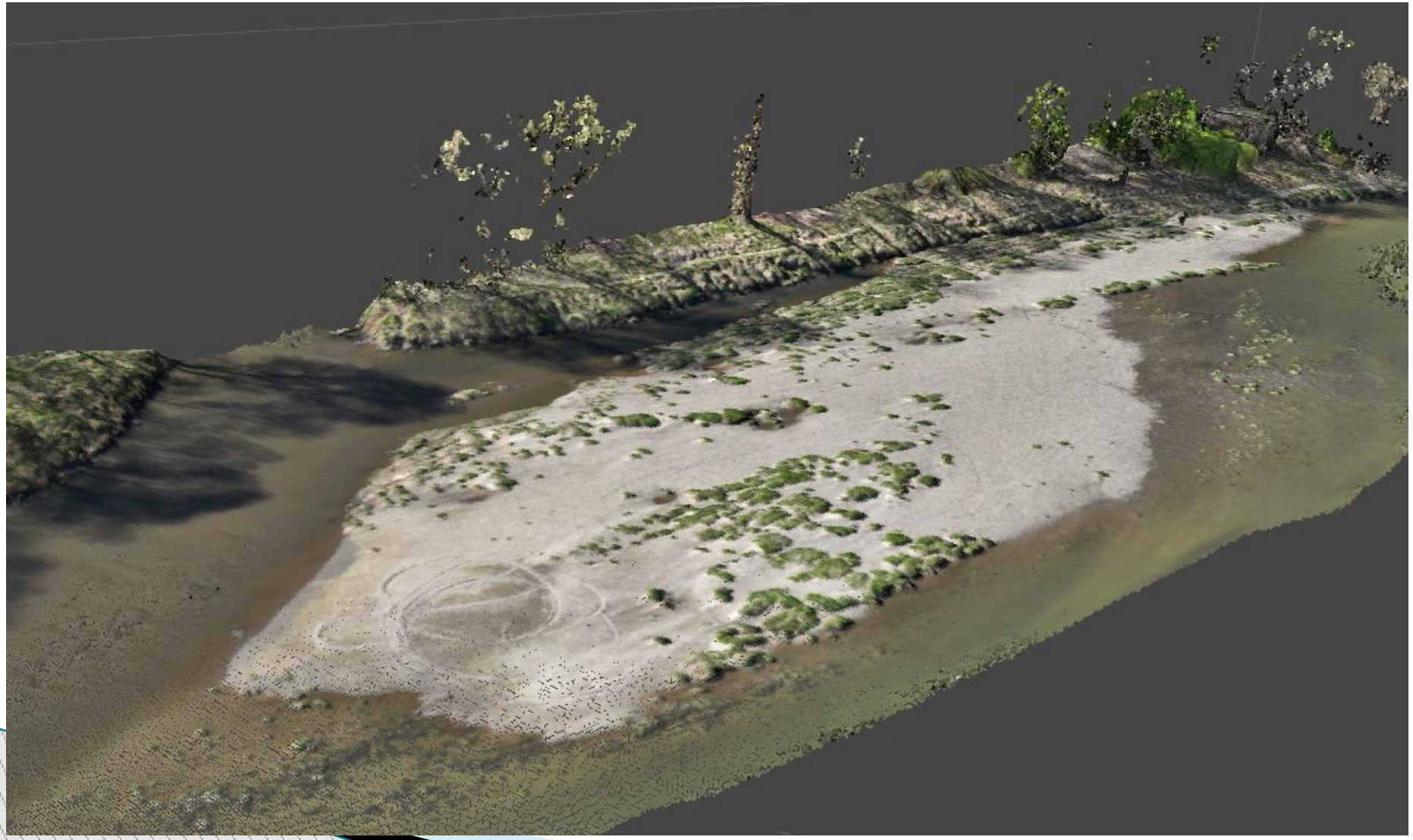
Hydrology

Flow in relation to the SSQ flow value at the Oświęcim, Czernichów and Popędzynka water gauges



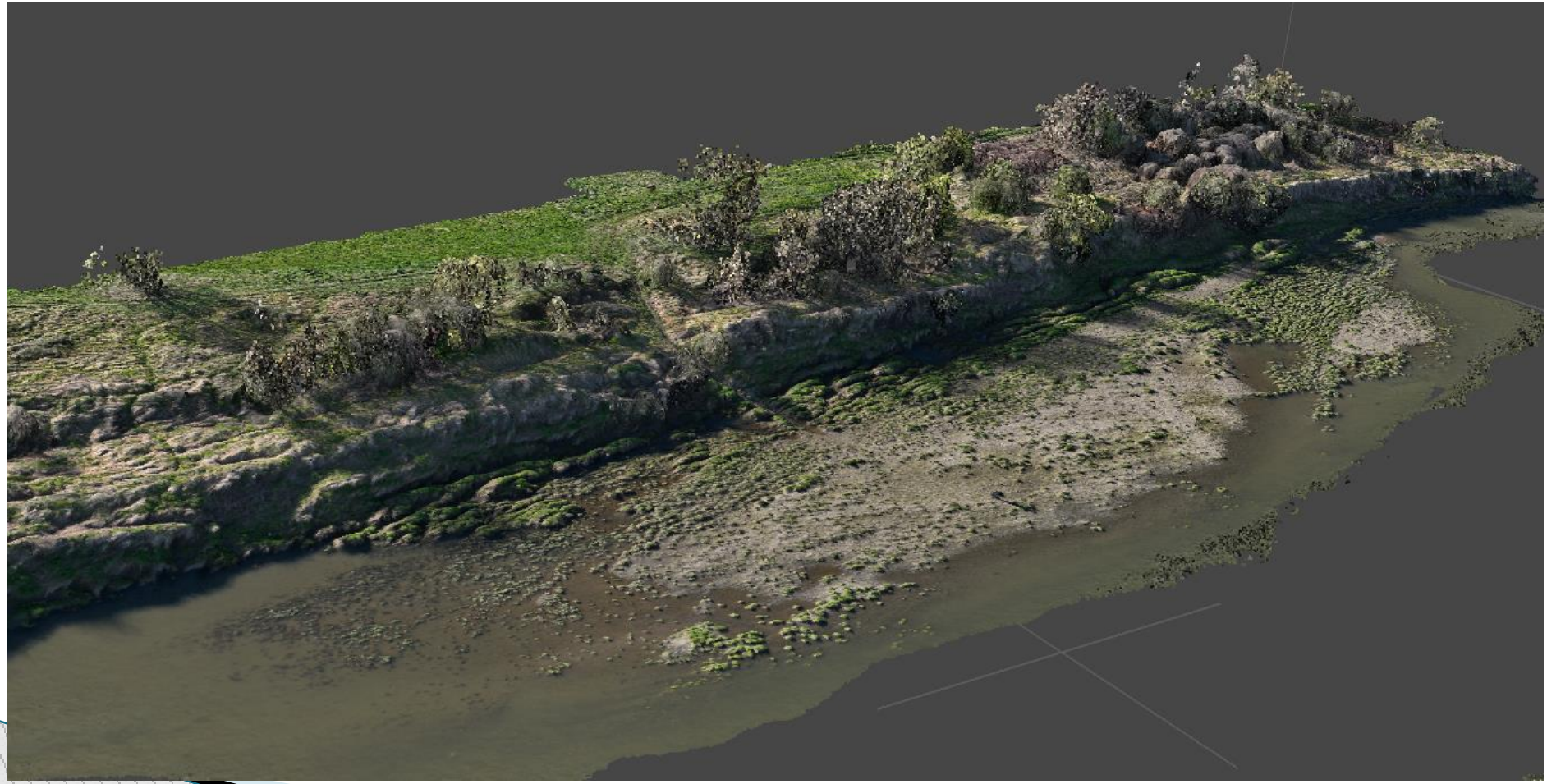
Gravel bar 1

3D model of bar 1, Wisła, discharge 90 m^3s^{-1}



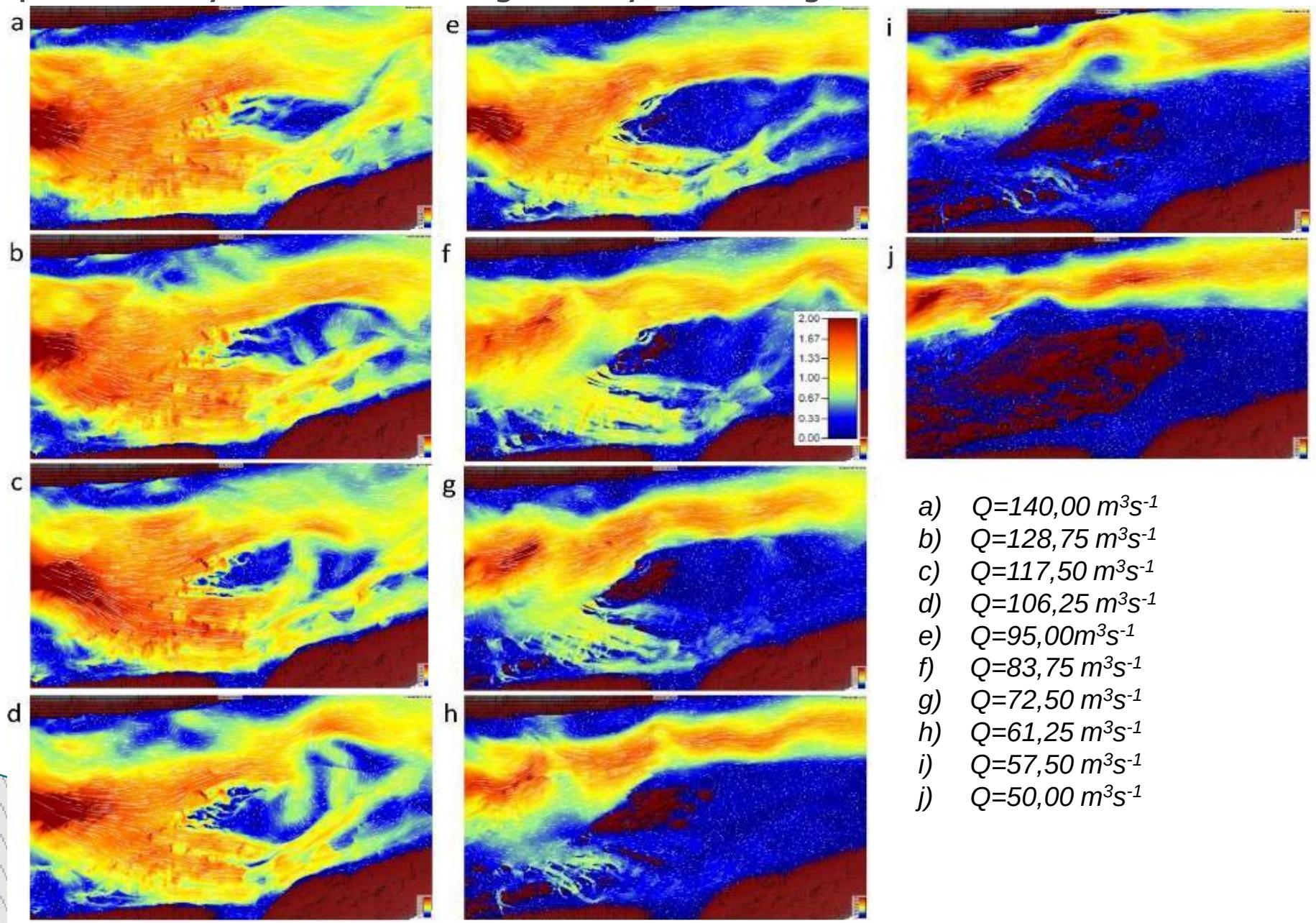
Gravel bar 2

3D model of bar 2, Wisła, discharge 90 m^3s^{-1}



Results

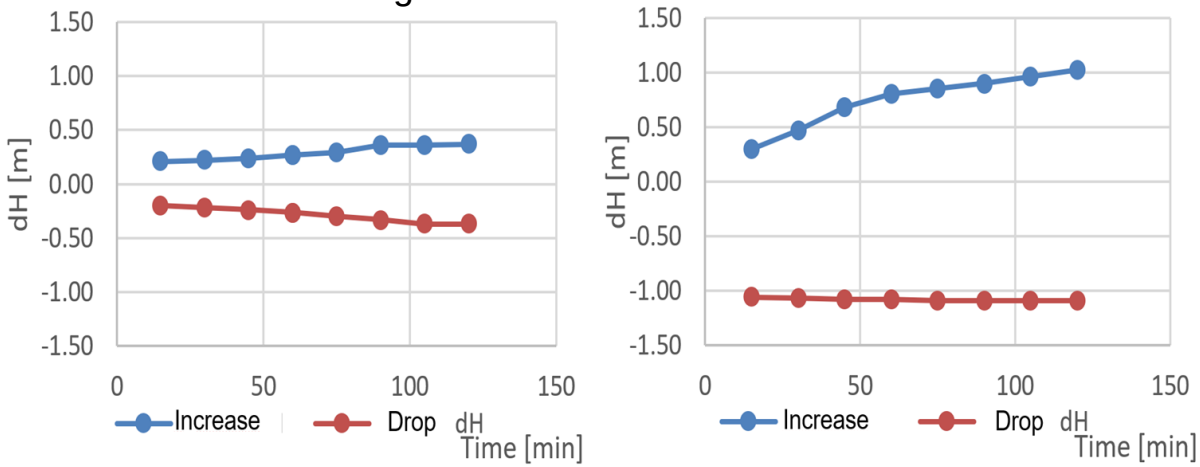
Spatial velocity distribution during a slowly descending wave



a) $Q=140{,}00\ m^3s^{-1}$
b) $Q=128{,}75\ m^3s^{-1}$
c) $Q=117{,}50\ m^3s^{-1}$
d) $Q=106{,}25\ m^3s^{-1}$
e) $Q=95{,}00 m^3s^{-1}$
f) $Q=83{,}75\ m^3s^{-1}$
g) $Q=72{,}50\ m^3s^{-1}$
h) $Q=61{,}25\ m^3s^{-1}$
i) $Q=57{,}50\ m^3s^{-1}$
j) $Q=50{,}00\ m^3s^{-1}$

Results

Highest recorded fluctuation of water surface level in the period August-November 2023 from 15 to 120 minutes, The Vistula River, upstream (left) and downstream (right) of The Przewóz Barrage

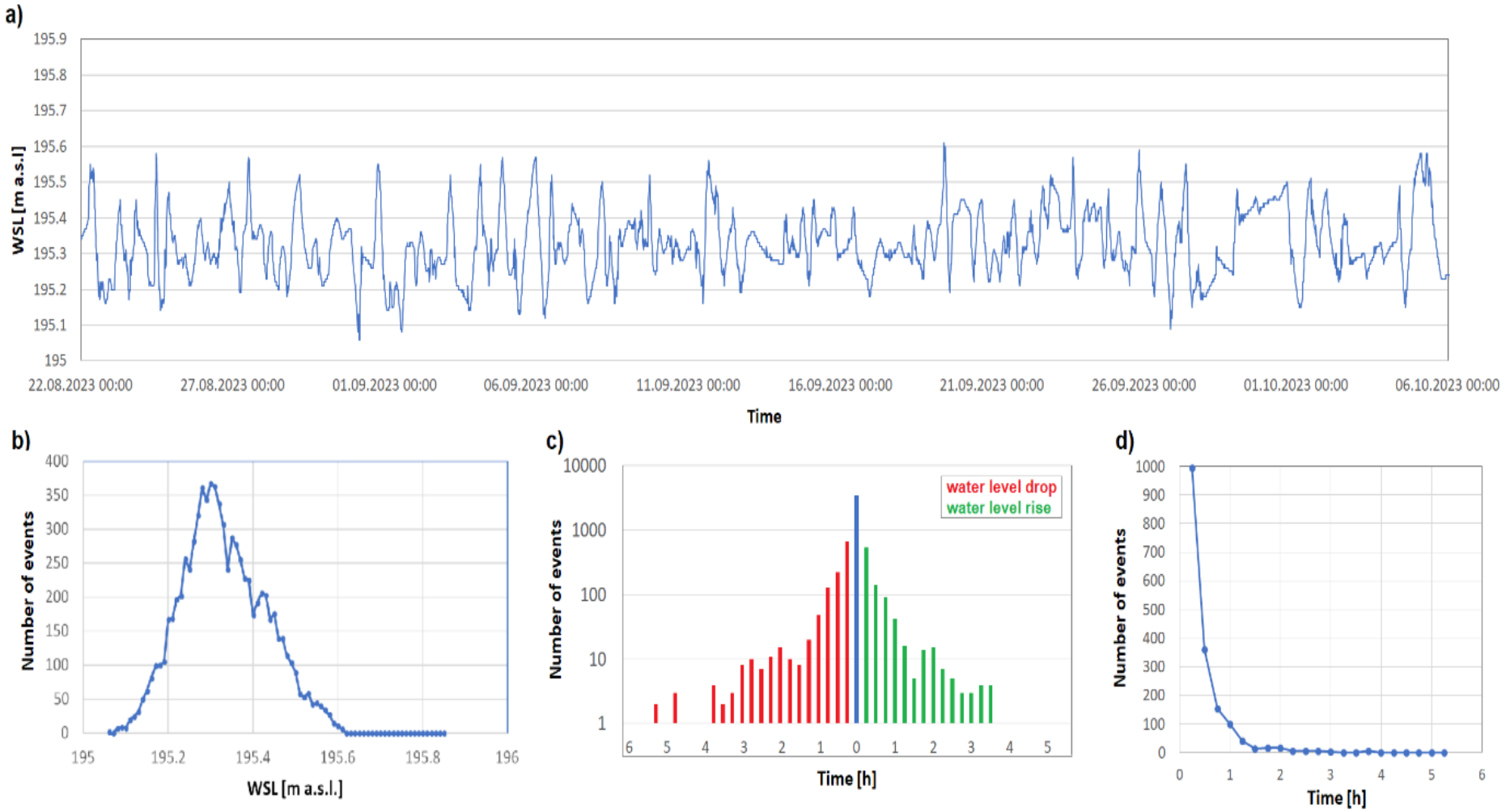


Model parameters, water level drop Δh [cm/min]

Time [min]	Discharge [m^3s^{-1}]	WSL [m a.s.l.]	ΔH [cm]	Δt [min]	Δh [cm/min]
0	140.0	189.54	-	-	-
30	117.5	189.49	5	30	0.17
60	95.0	189.26	23	30	0.77
90	72.5	189.07	19	30	0.63
110	57.5	188.82	25	20	1.25
120	50.0	188.58	24	10	2.40

Results

Przewóz Barrage, upstream, (The Vistula River); a) water surface level, b) number of events for the water surface level, c) distribution of water level changes duration, drop; increase, d) distribution of constant water level durations

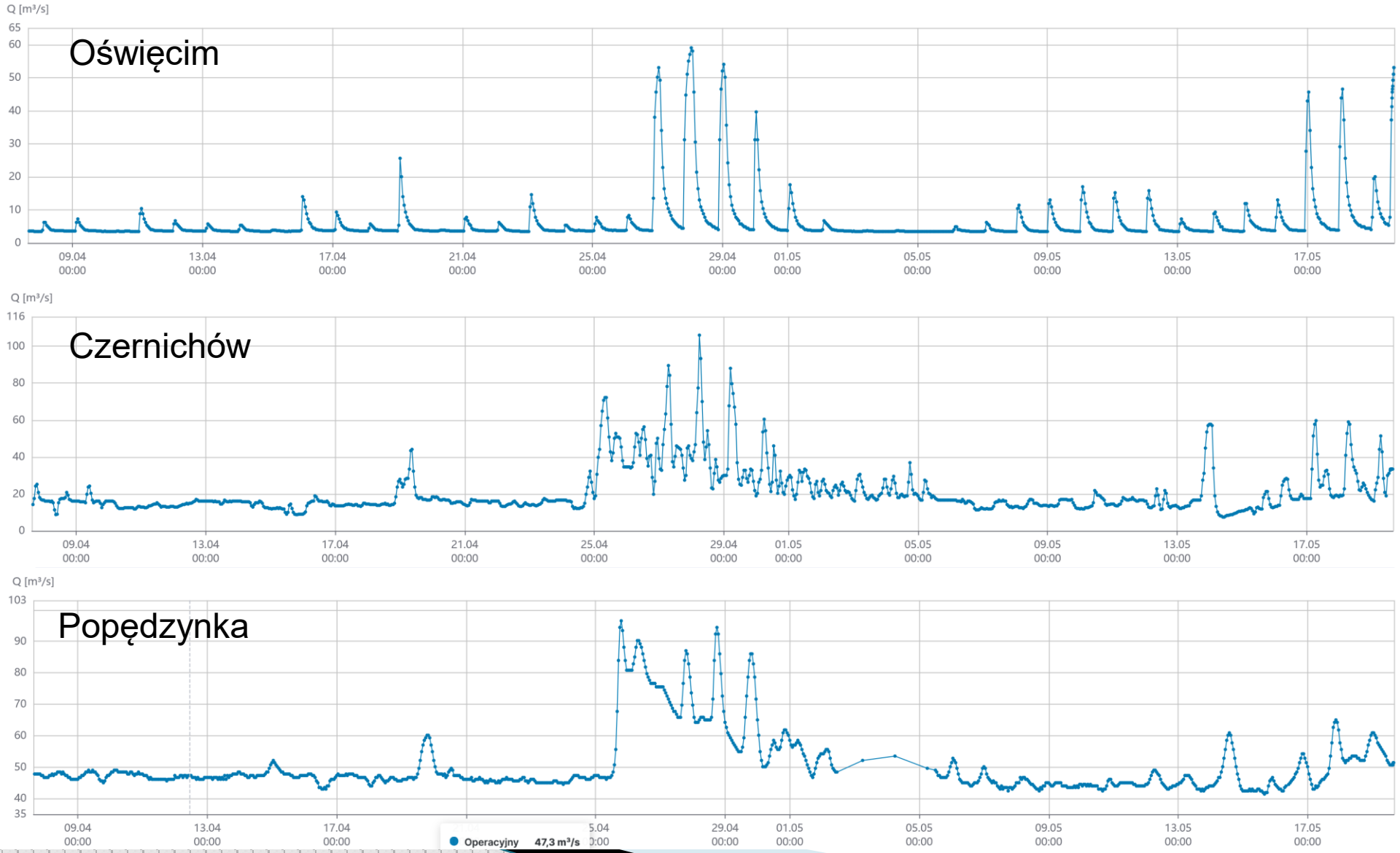


Conclusion

- large discharge and short time changes; from reservoirs – problem of procedures, energy grid players, rules,
- small retention capacity of Vistula infrastructure under existing procedures,
- a new timetable based on ecosystem limitations should be introduced,
- remote controll system developed in years 2023/25 – changes,

Conclusion

- One time case or … ?



UNIVERSITY OF AGRICULTURE IN KRAKOW
Faculty of Environmental Engineering and Land Surveying

Department of Hydraulic Engineering and Geotechnics

The negative phenomenon of anthropogenically induced hydropeaking – process and damage

XLII International School of Hydraulics
Radocza, Poland
20–23 May 2025

Leszek Książek
Jacek Florek
Maciej Wyrębek
Andrzej Strużyński