



XLII

International School of Hydraulics

20 - 23 May 2025

• Radocza

• Poland

The influence of vegetation on the spatial distribution of water velocity in a regulated lowland river – preliminary results

Andrzej Strużyński, Maciej Wyrębek, Leszek Książek

University of Agriculture in Kraków



UNIwersytet Rolniczy
im. Hugona Kollątaja w Krakowie



XLII – International School of Hydraulics



Life4Delta
2019 – 2024 (25)



The aim of the work is to compare water flow parameters and measurement problems in sections with and without vegetation.



XLII – International School of Hydraulics



Study object:

Nida River

Length - 153 km

Catchment area exceeds 3.8 thousand km².

The Nida is a lowland river with sandy bottom.

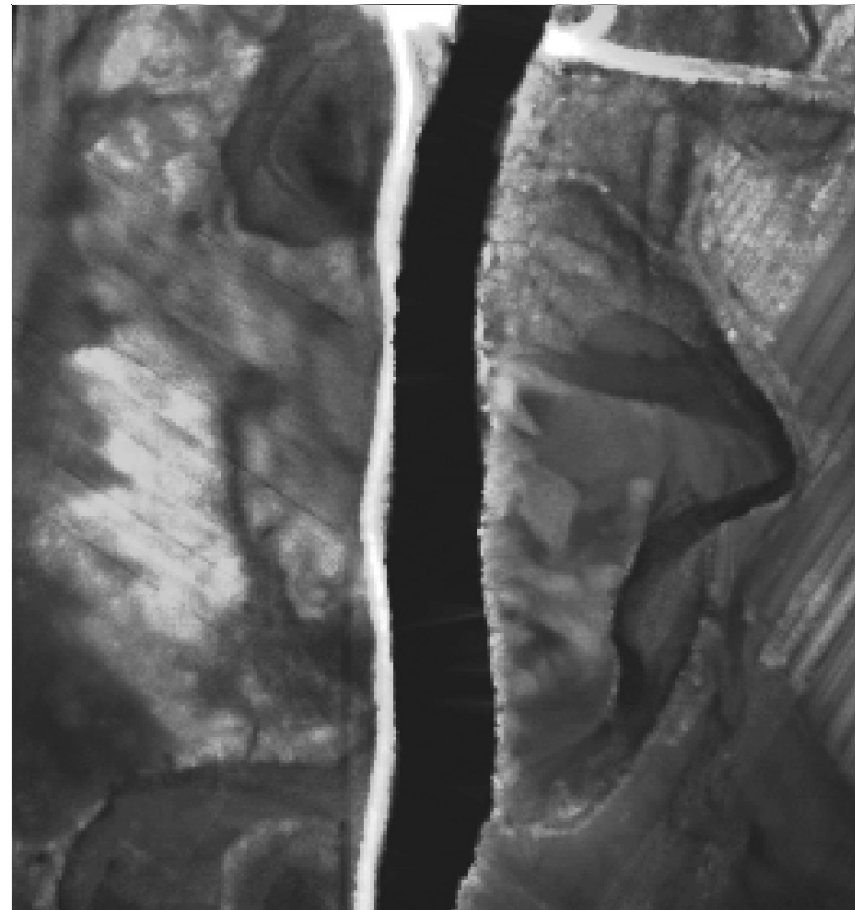
Presented data:

2020-03-31 – $Q = 8.35 \text{ [m}^3/\text{s]}$, $I = 0.00030 \text{ [-]}$

2020-09-21 – $Q = 3.72 \text{ [m}^3/\text{s]}$, $I = 0.00035 \text{ [-]}$

2021-05-31 – $Q = 9.15 \text{ [m}^3/\text{s]}$, $I = 0.00033 \text{ [-]}$

2022-10-22 – $Q = 8.71 \text{ [m}^3/\text{s]}$, $I = 0.00031 \text{ [-]}$



DTM – geoportal.gov.pl

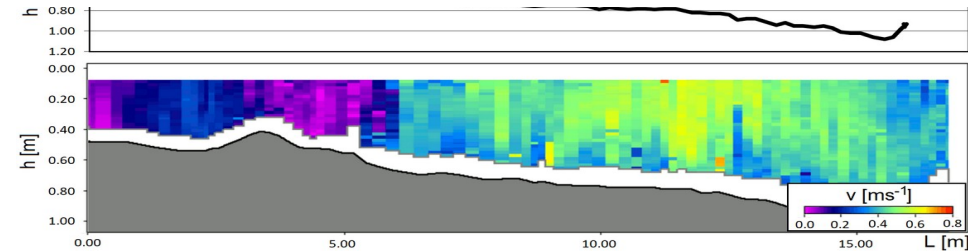
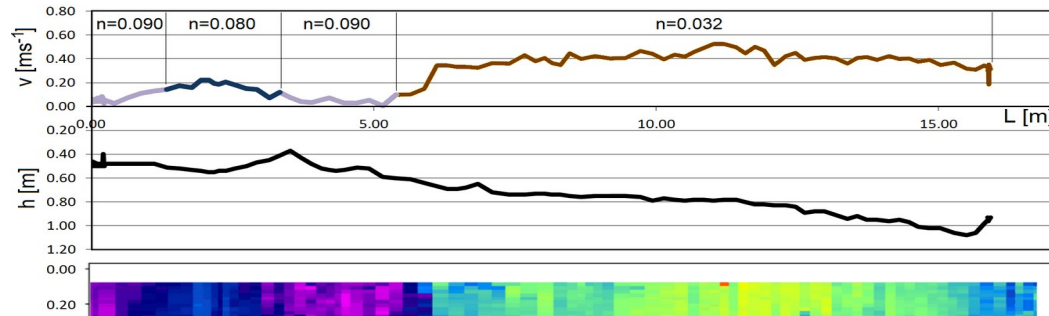
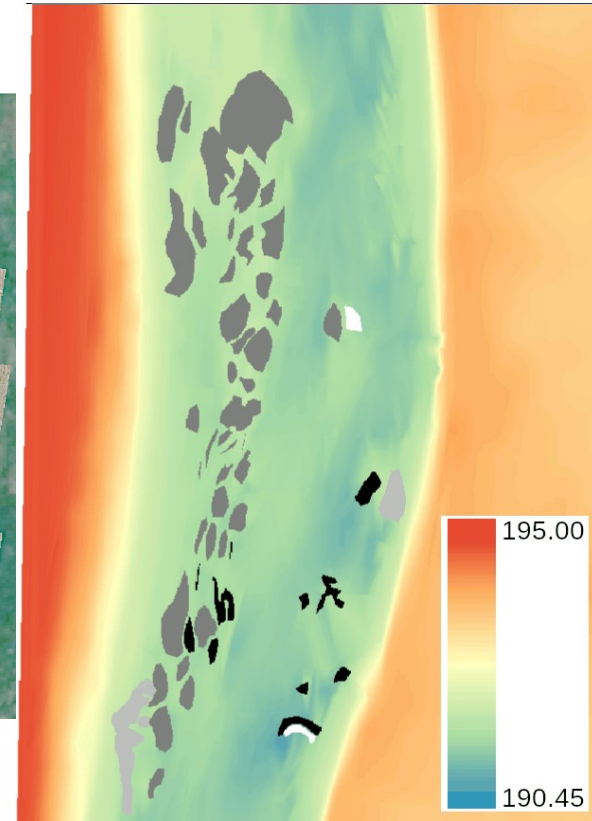
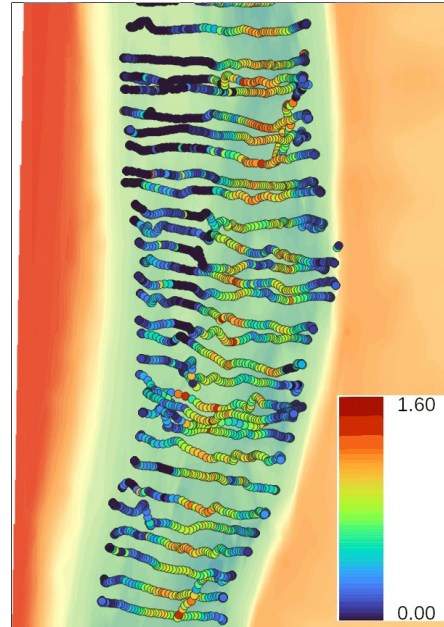


XLII – International School of Hydraulics

Methodology:

ADCP
GPS, RTK
Low altitude photogrammetry

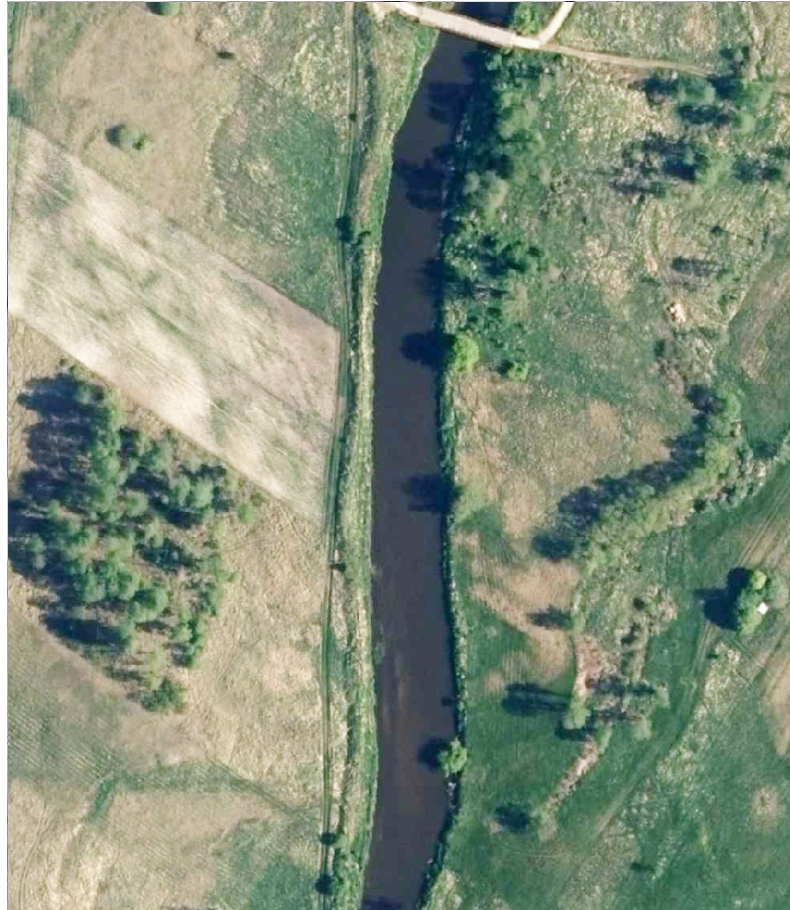
GIS – data processing
Velocity fields interpolation
Plant zones - roughness





XLII – International School of Hydraulics

Vegetation
in progress



national service

2020-03-31 – $Q = 8.35 \text{ [m}^3\text{/s]}$, $I = 0.00030 \text{ [-]}$

google service



aerial view – 2020-07-15

different colors
in vegetation zone

Photo:
P. Adamski





XLII – International School of Hydraulics

settlement areas
observed
-
low discharge



2020-09-21 – $Q = 3.72 \text{ [m}^3\text{/s]}$, $I = 0.00035 \text{ [-]}$



XLII – International School of Hydraulics



no settlement areas

2021-05-31 – $Q = 9.15 \text{ [m}^3\text{/s]}$, $I = 0.00033 \text{ [-]}$



XLII – International School of Hydraulics



light penetrates to the bottom



2021-05-31 – $Q = 9.15 \text{ [m}^3\text{/s]}$, $I = 0.00033 \text{ [-]}$



XLII – International School of Hydraulics



strong vegetation on banks



2022-10-22 – $Q = 8.71 \text{ [m}^3\text{/s]}$, $I = 0.00031 \text{ [-]}$



XLII – International School of Hydraulics



settlement areas observed

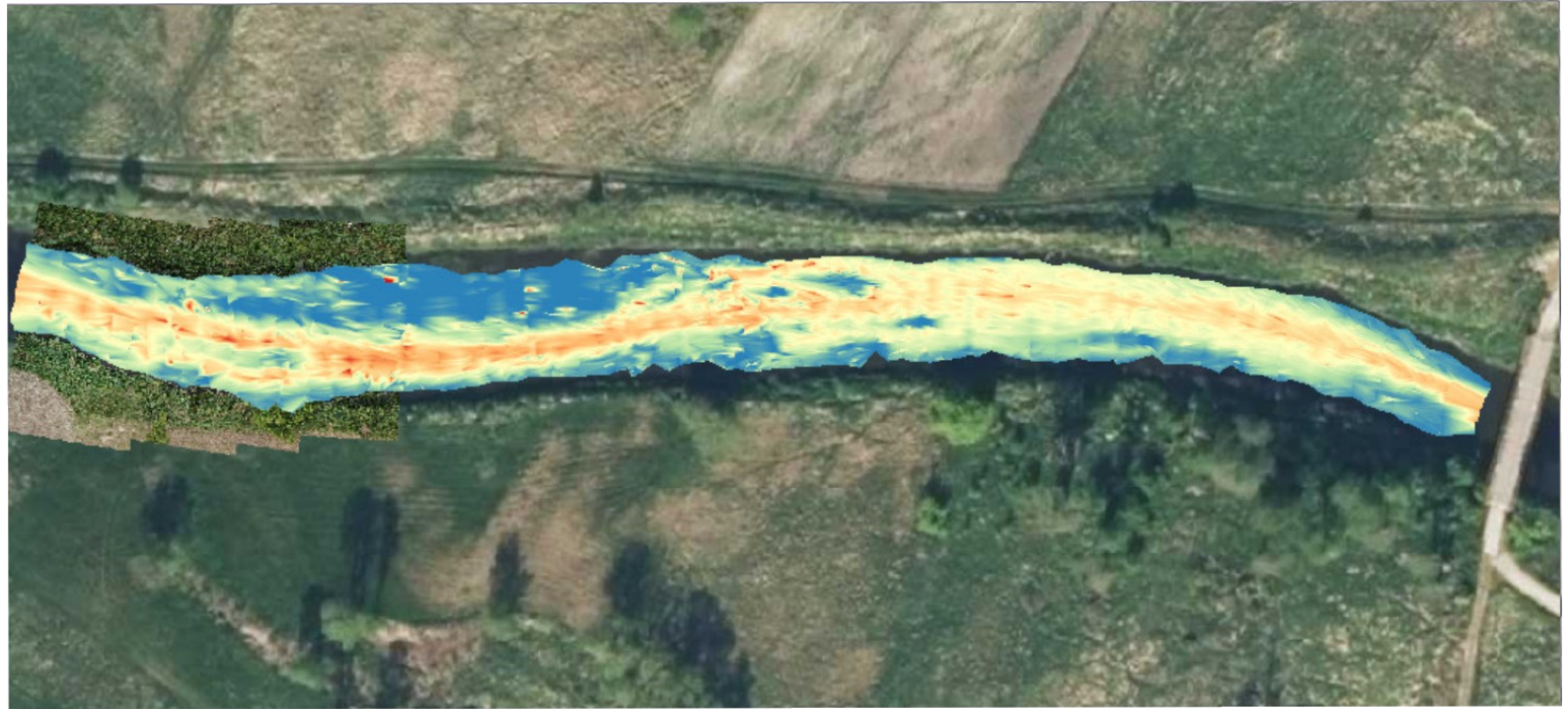
2022-10-22 – $Q = 8.71 \text{ [m}^3\text{/s]}$, $I = 0.00031 \text{ [-]}$



2020-03-31 – $Q = 8.35 \text{ [m}^3\text{/s]}$, $I = 0.00030 \text{ [-]}$



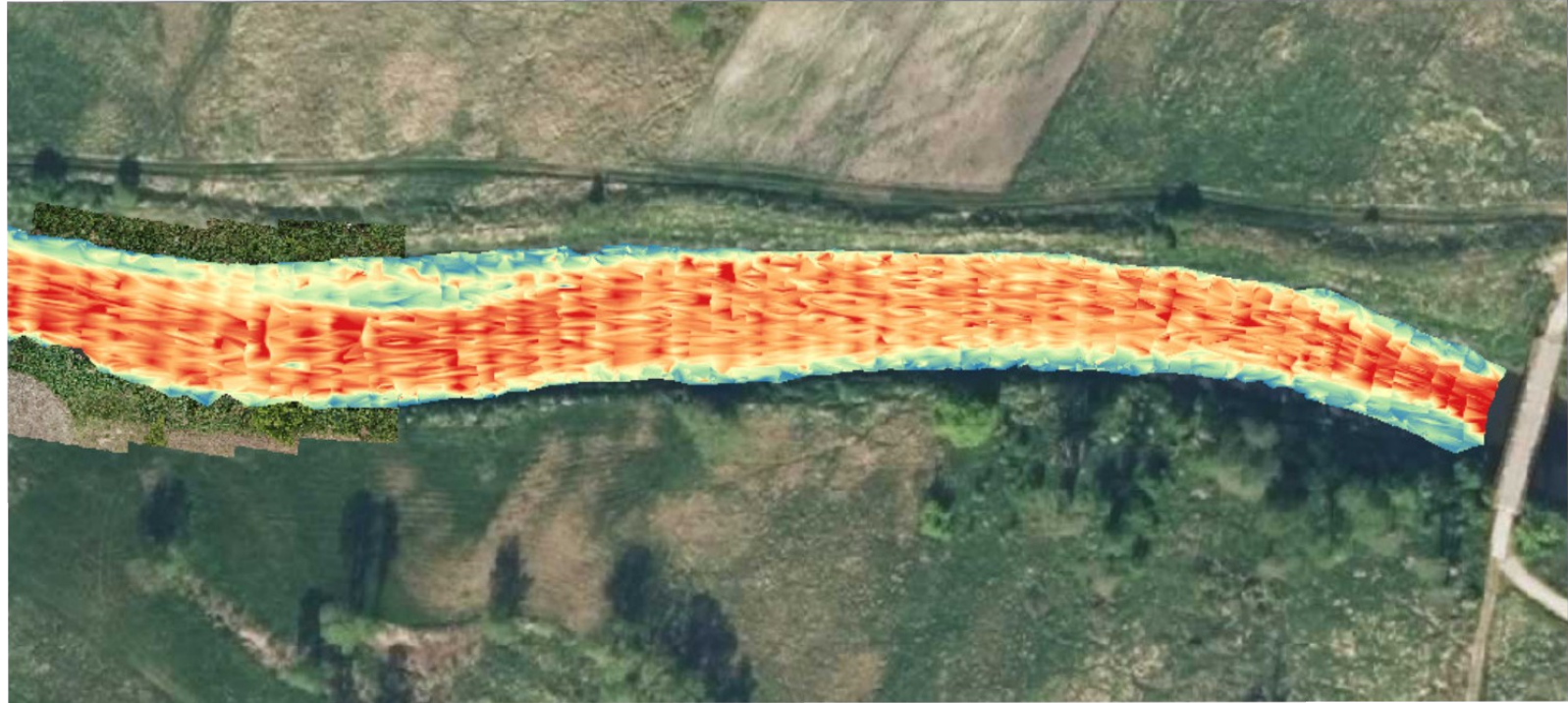
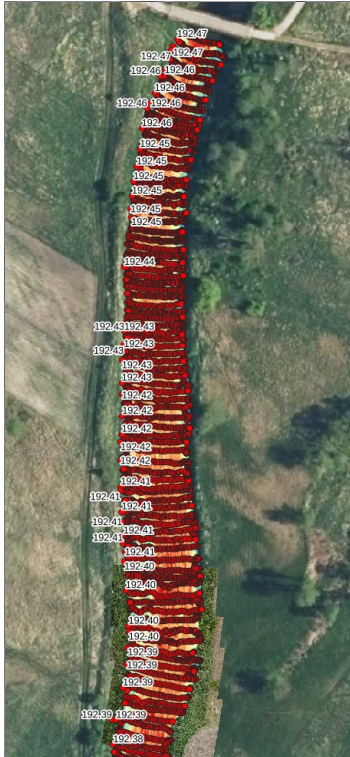
XLII – International School of Hydraulics



2020-09-21 – $Q = 3.72 \text{ [m}^3\text{/s]}$, $I = 0.00035 \text{ [-]}$



XLII – International School of Hydraulics



2021-05-31 – $Q = 9.15 \text{ [m}^3\text{/s]}$, $I = 0.00033 \text{ [-]}$



XLII – International School of Hydraulics



2022-10-22 – $Q = 8.71 \text{ [m}^3\text{/s]}$, $I = 0.00031 \text{ [-]}$



2022-10-22 – $Q = 8.71 \text{ [m}^3\text{/s]}$, $I = 0.00031 \text{ [-]}$

session length - 690m



XLII – International School of Hydraulics

Measurements
Velocity [m/s]



2020-03-31 – $Q = 8.35 \text{ [m}^3\text{/s]}$

2020-09-21 – $Q = 3.72 \text{ [m}^3\text{/s]}$

2021-05-31 – $Q = 9.15 \text{ [m}^3\text{/s]}$

2022-10-22 – $Q = 8.71 \text{ [m}^3\text{/s]}$



XLII – International School of Hydraulics

model $Q = 4 \text{ m}^3/\text{s}$

Models
Velocity [m/s]



DTM 2020-03-31



DTM 2020-09-21



DTM 2021-05-31

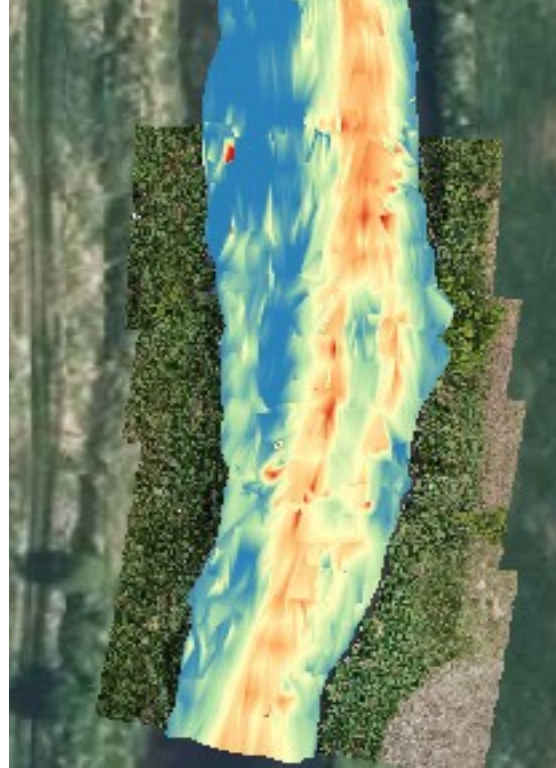


smooth V fields
good agreement

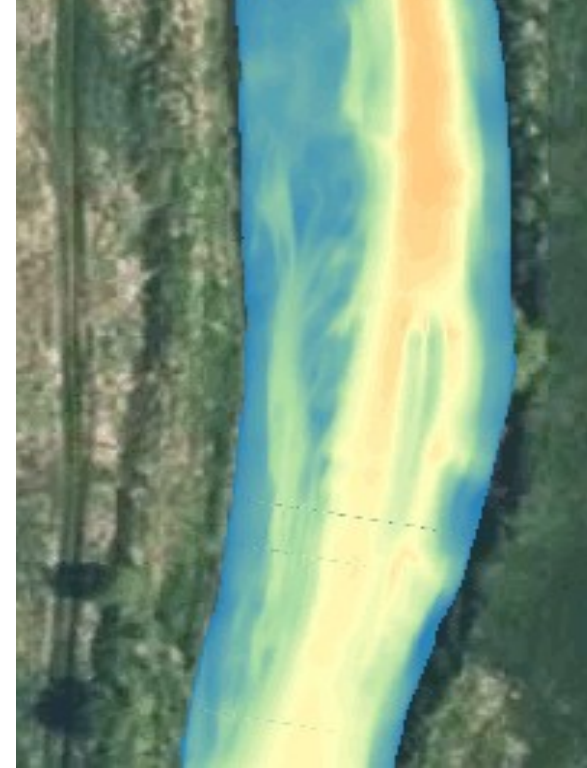
Velocity [m/s]



aerial photo



measurement – 3.72



model – 4.00

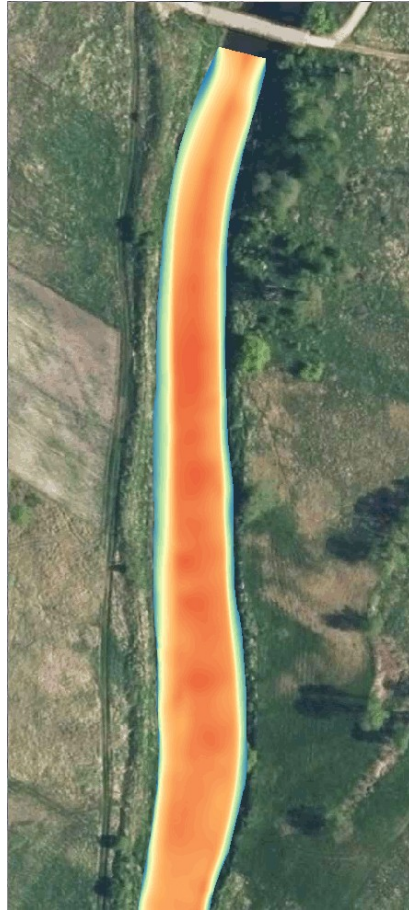
Q [m³/s]



XLII – International School of Hydraulics

model $Q = 9.15 \text{ m}^3/\text{s}$

Velocity [m/s]



DTM 2020-03-31



DTM 2020-09-21
bad agreement ?



DTM 2021-05-31



Conclusions

1. On September 2020 vegetation was weak in the river channel and every next time it was bigger
2. There is seasonal change in vegetation dynamics
 - fresh vegetation on spring,
 - dense vegetation on autumn,
 - settlement areas on autumn
3. Vegetation can lead to stream concentration
4. When light penetrates to the bottom, vegetation can overgrow the cross-section
5. ADCP measurements results with the map of temporary velocity, interpolation give many artifacts
6. Problem with reflecting vegetation effect (roughness) for different discharges (in calibration process)



XLII – International School of Hydraulics

Thank you

