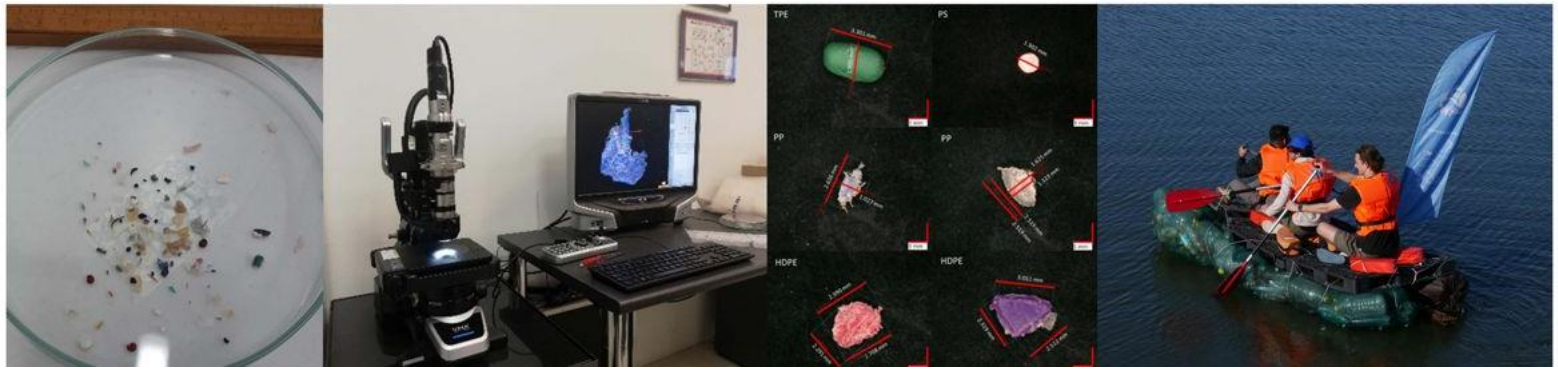
October 29-31, 2025 // BME // Plastic cup // Budapest



BUDAPEST UNIVERSITY
OF TECHNOLOGY AND ECONOMICS

M⁴ Plastics — Measuring, Monitoring, Modeling and Managing of Plastics in Flowing Waters

Sándor Baranya

Budapest University of Technology and Economics
Hydraulic and Water Resources Engineering

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Agenda

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Day 1: 29/10/2025

At Budapest BME K Building

13:30 – 14:00 – Registration

14:00 – 14:20 – Welcome by the organizers

14:20 – 14:40 – Word to our sponsor: Introduction of the Danube Region strategy, its activities and importance of plastic pollution, *Viktor Oroszi*, Head of Division of the EU Strategy for the Danube Region at Ministry of Foreign Affairs and Trade

14:40 – 15:10 Opening by the host: thematic overview of the program. *Sándor Baranya*, associate professor, Budapest University of Technology and Economics

15:10 – 15:30 – Coffee break

Agenda

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Day 1: 29/10/2025 **LECTURE DAY**

15:30 – 17:30 – Lectures on understanding the movement of plastic pollution in rivers.

- **Modelling** the movement of macroplastic pollution on rivers. *Gábor Fleit*, research fellow, Budapest University of Technology and Economics
- **Modelling** the transport of microplastic within sediment in a riverine environment. *Mirco Mancini*, research fellow, University of Florence, Italy.
- **Modelling** microplastics transport, the beginning and new challenges. *Arianna Varrani*, Assistant Professor, Institute of Geophysics Polish Academy of Sciences, Warsaw, Poland
- **Monitoring** plastic pollution of rivers by application of a lightweight image recognition system. *Gergely Tikász*, PhD student, Budapest University of Technology and Economics
- **Measuring** and sampling microplastic from rivers. *Flóra Pomázi*, research fellow, Budapest University of Technology and Economics

17:30 – 18:30 – Poster session and icebreaker

18:30 – Dinner

Agenda

Day 2: 30/10/2025 **FIELD DAY**

07:30 – Meeting in front of the K building of the Budapest University of Technology and Economics, bus transfer to Kisköre

10:00 – 16:00 Kisköre Riversaver Centre and Floating Exhibition by *Attila Dávid Molnár*, Plastic Cup Society

16:00 – departure of the bus to Budapest, estimated arrival to the 'K' building around 18:00-18:30

Agenda

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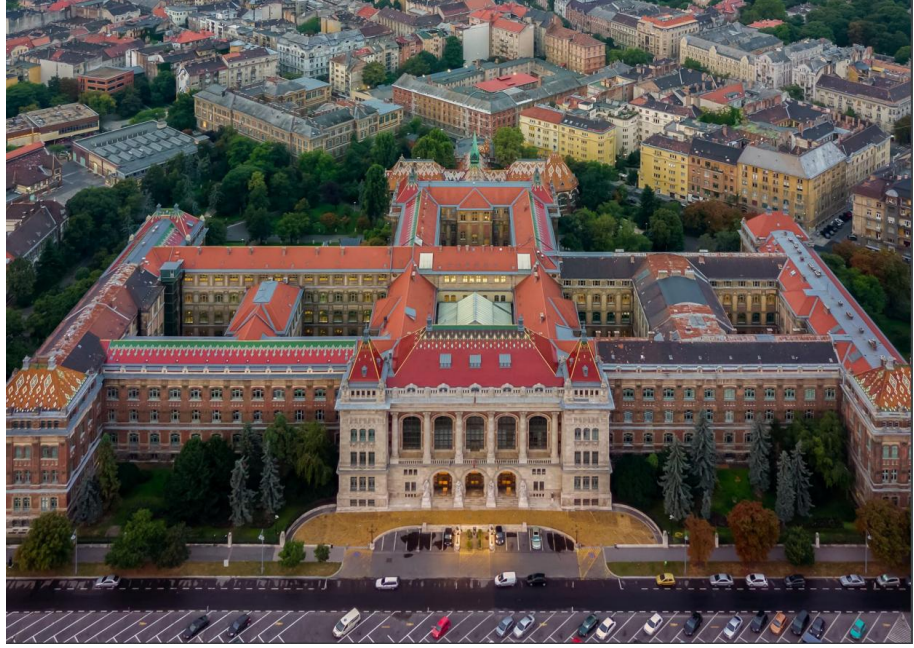
Day 3: 31/10/2025 **LAB DAY**

9:00-11:00 Lab visit of the Department of Polymer Engineering in groups

11:30 – 12:00 The Riversaver platform and network: the knowledge sharing and community platform of Plastic Cup. *Miklós Gyalai-Korpos*, head of innovation and technology, Plastic Cup Society.

BME – Budapest University of Technology and Economics

- Founded in 1782
- 21.836 students
- 2.300 international students
- 8 faculties
- 39 MSc programmes
- 26 BSc programmes
- 13 doctoral schools



Civil Engineering

Mechanical Engineering

Architecture

Chemical and Biotechnology

Electrical Engineering and Informatics

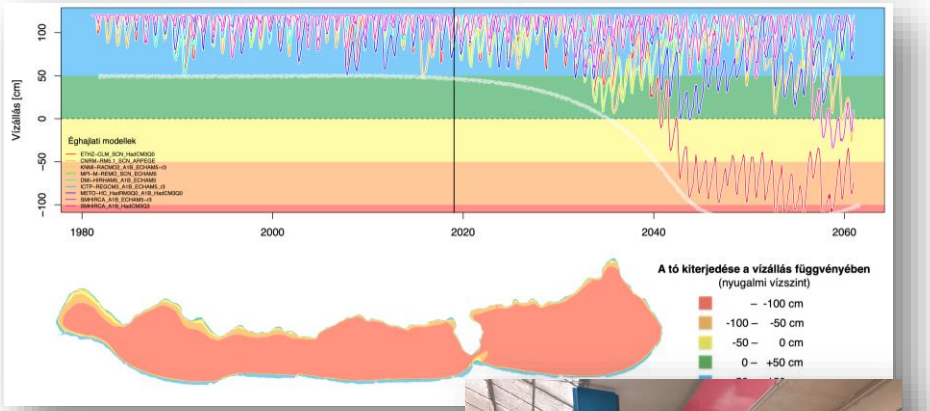
Transportation and Vehicle Engineering

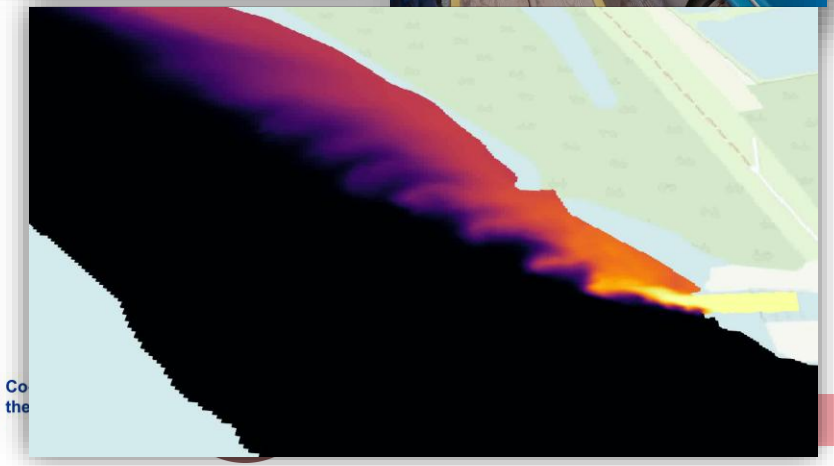
Natural Sciences

Economic and Social Sciences

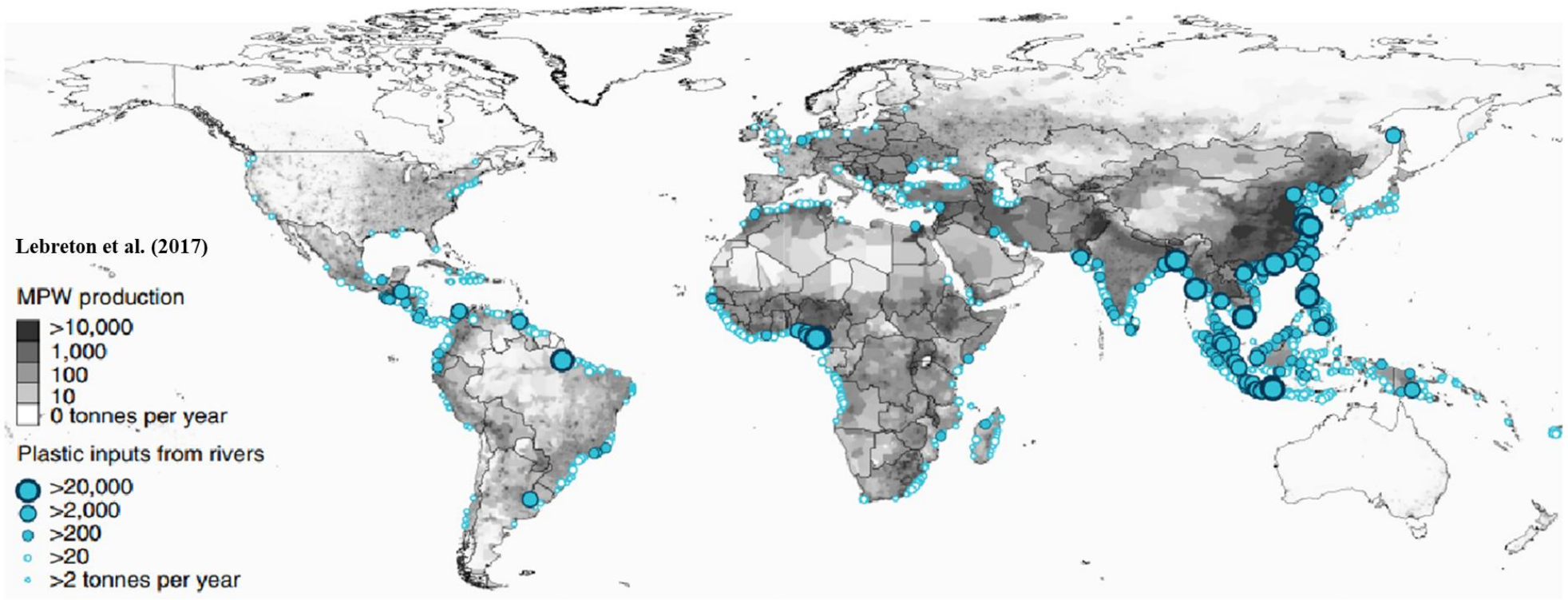
BME – Faculty of Civil Engineering

- Geodesy and Surveying
- Construction Materials and Technologies
- Photogrammetry and Geoinformatics
- Geotechnics and Engineering Geology
- Structural Engineering
- Structural Mechanics
- Highway and Railway Engineering
- **Hydraulic and Water Resources Engineering**
- Sanitary and Environmental Engineering





Global plastic issues



Laundry	Car Tiers	Urban Pollution	Road Paint	Shipe Paint	Cosmetics	Factory Pellets
textiles washing detergent						
35%	**28%**	**24%**	**7%**	**3.7%**	**2%**	**0.3%**

Global Plastic Production
In 2024: ~460-480 Mt
In 2025: surpass 500 Mt

80% of plastic pollution is transferred from river networks

[2,3,4,5,8,9]

Plastic issues in Hungary

https://www.youtube.com/watch?v=vVdMWO0CC7M

https://papirszivoszalak.hu/2019/07/19/osszefogas-a-hulladekmentes-tiszaert/

Integrated plastic pollution analysis system

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- Improved theoretical knowledge on plastic transport phenomena
- Expeditionary measurements
- Monitoring
- Modelling
- Citizen Science
- Waste collection/management
- Reuse

Integrated plastic pollution analysis system

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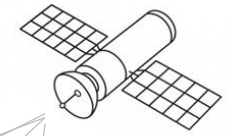


Remote sensing

Awareness raising

Citizen actions

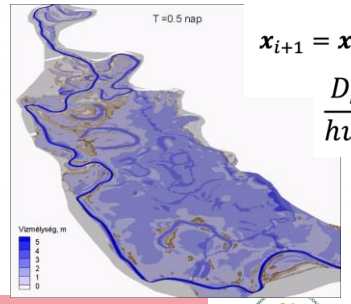
Reuse

GPS

Image-based monitoring

Laboratory analysis

Computational modelling



$$x_{i+1} = x_i + u\Delta t + R\sqrt{2D_h\Delta t} + \frac{\partial D_h}{\partial x}\Delta t$$

$$\frac{D_h}{hu_*} = 0.6\ (\pm 50\%)$$

Physical sampling

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SUSTAINABLE TECHNOLOGIES SUB-PROGRAMME

DANUBE REGION strategy Water Quality

Interreg Programme Danube Region

Co-funded by the European Union

iNNOSED iNNOvative SEDiment management in the Danube River Basin

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Integrated plastic pollution analysis system
Expeditionary campaigns

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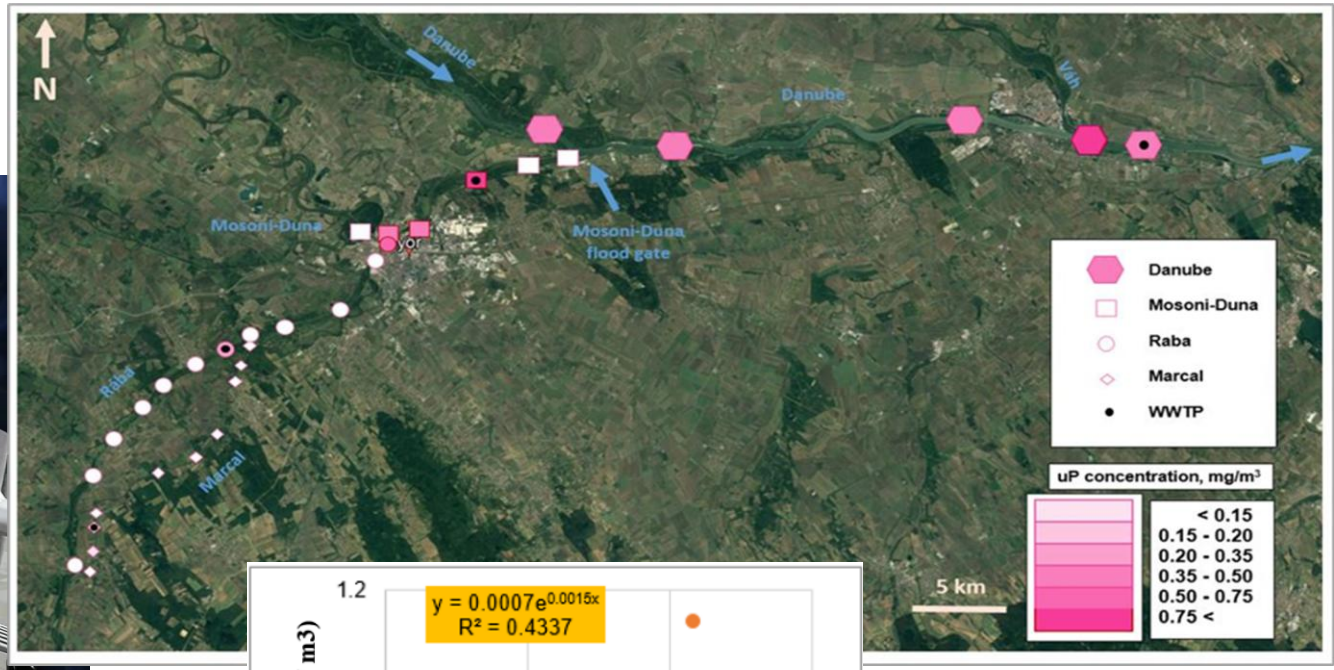

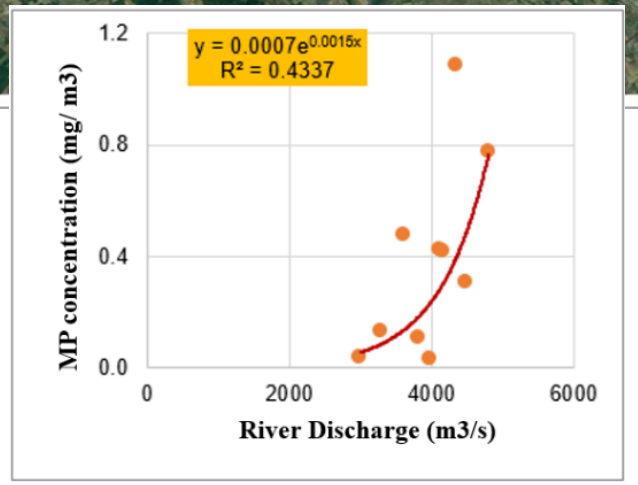

Integrated plastic pollution analysis system
Image-based techniques

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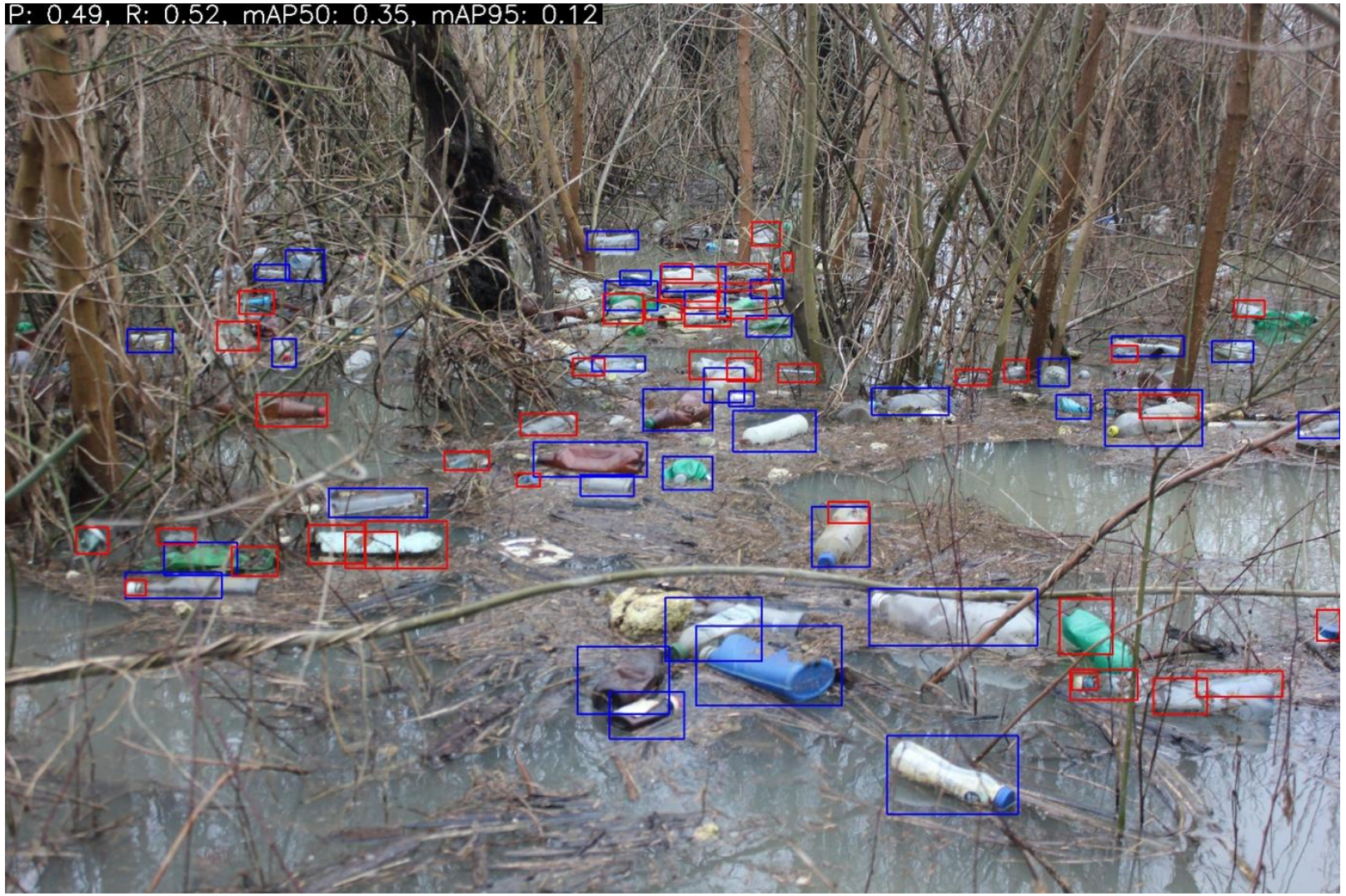

SUSTAINABLE DEVELOPMENT AND TECHNOLOGIES NATIONAL PROGRAMME OF MTA
SUSTAINABLE TECHNOLOGIES SUB-PROGRAMME

Integrated plastic pollution analysis system
GPS-based bottle tracking

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SUSTAINABLE TECHNOLOGIES SUB-PROGRAMME

Integrated plastic pollution analysis system
Remote sensing

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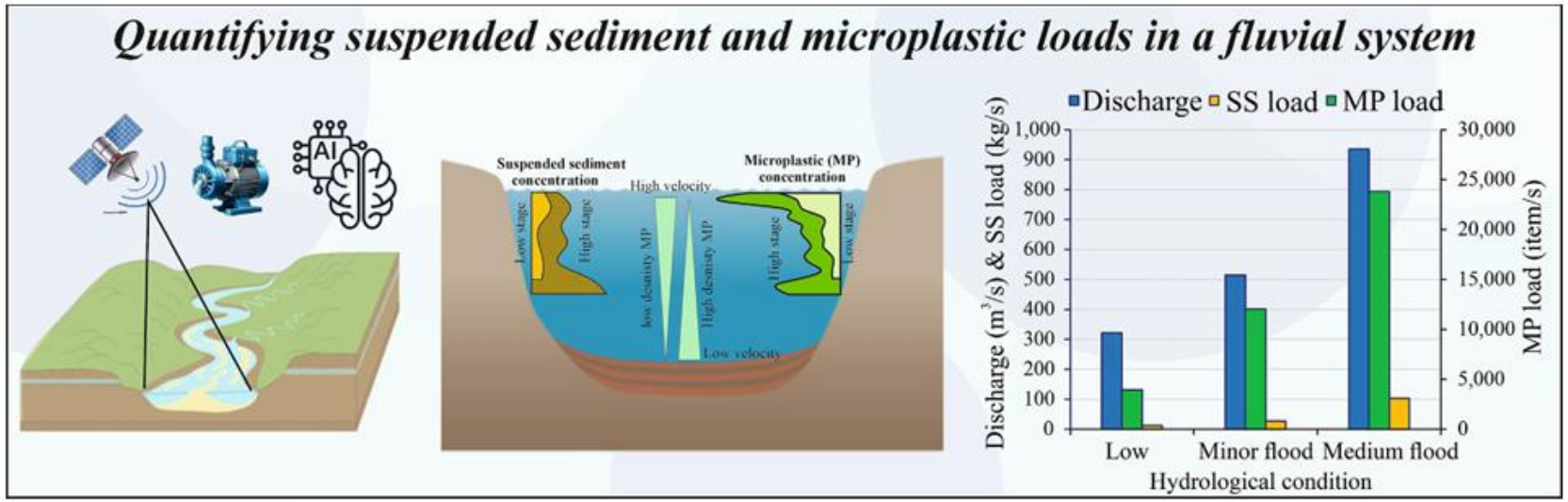

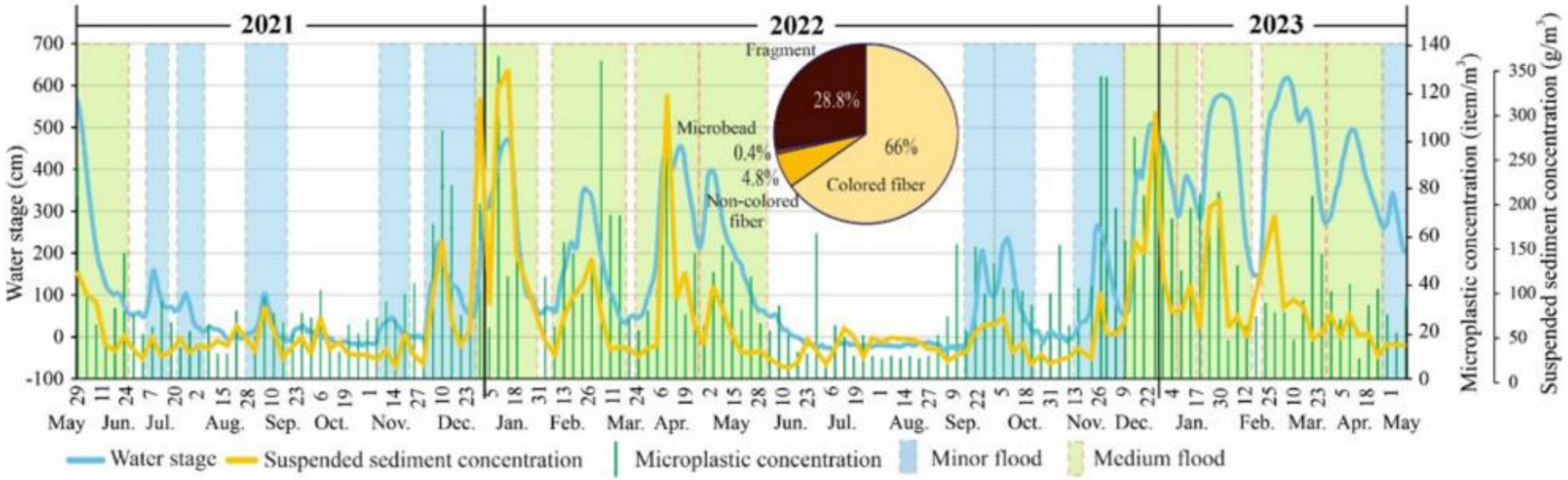

Integrated plastic pollution analysis system
Numerical modelling

- MP transport modeling
- Particle-based (Lagrangian) model
- Based on the 2D HD results (AdH)
- Virtual particles (zero volume, zero mass)
- Particle tracking tool (plasTrack)
  - Surface transport
  - Turbulent dispersion (random walk)
  - Trapping in vegetation (stochastic model)
  - Stranding and flushing (birth/death process)

$$\boldsymbol{x}_{i+1} = x_i + \boldsymbol{u}_i \Delta t + R\sqrt{2D_h \Delta t} + \frac{\partial D_h}{\partial \boldsymbol{x}_i} \Delta t$$

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Integrated plastic pollution analysis system
Numerical modelling

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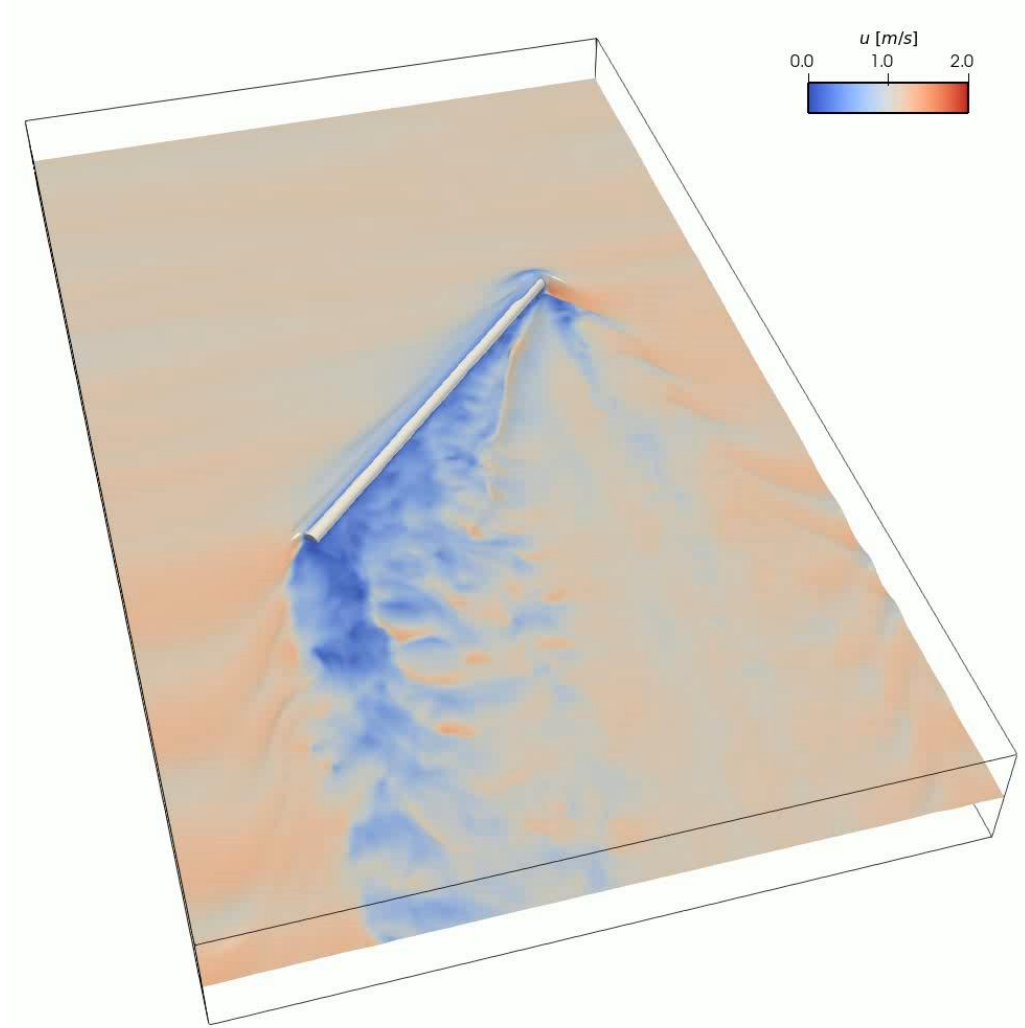
- Fine scale CFD simulations



Integrated plastic pollution analysis system
Laboratory analysis

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Integrated plastic pollution analysis system
Laboratory analysis

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Integrated plastic pollution analysis system
Laboratory analysis

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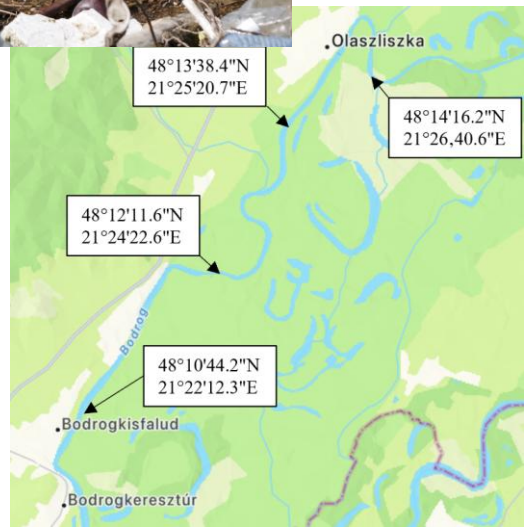
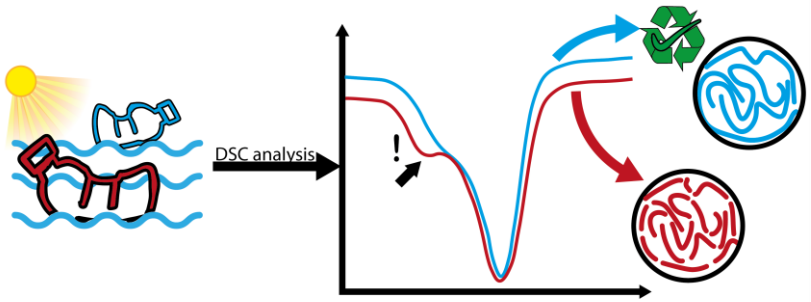
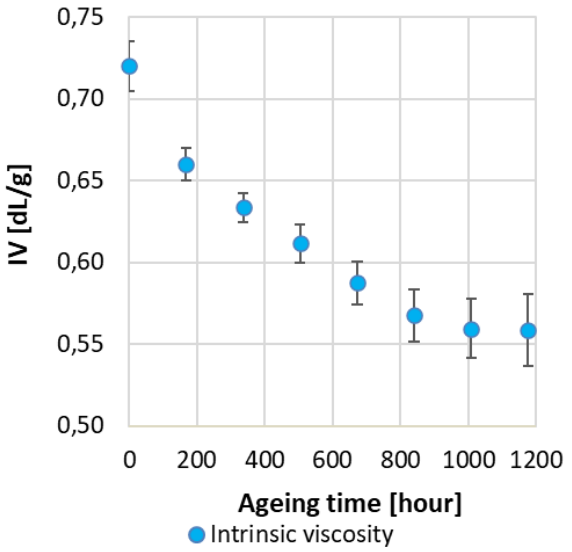
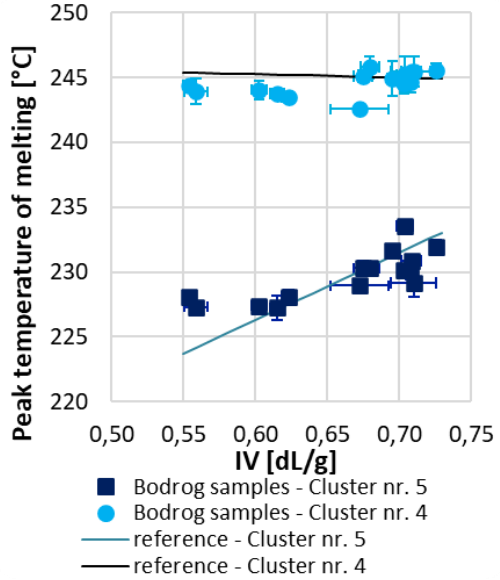
Estimating the age of river plastic waste









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Integrated plastic pollution analysis system
Laboratory analysis

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Recycling of riverine and marine plastic waste

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Enjoy the workshop ☺

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