DanubeSediment project
Introduction

Barbara Kéri
Budapest University of Technology and Economics

Main objectives

• To propose a pragmatic transnational quantitative sediment monitoring network
• To establish for the first time the sediment budget for the Danube River considering the input of the most important tributaries as well,
• To identify reaches with surplus and deficit, river bed aggradation and degradation, sediment-related problems in flood risk management, hydropower generation, navigation, ecology
• To gain knowledge and better understanding of sediment transport and morphodynamic processes in the Danube River
• To develop a Danube Sediment Management Guidance (DSMG) and a related Sediment Manual for Stakeholders (SMS)
Based on the sediment continuity related issues revealed in WP4, engineering measures will be worked out.

Sediment database set up within WP3 will be thoroughly analyzed in WP4.

Comprehensive information on sediment balance.

Catalogue of best practices of measures.

WP3 - Sediment data collection

WP4 - Danube Sediment Balance

WP5 - Impacts and measures

WP6 - Synthesis: Danube Sediment Management Guidance
Sediment data analysis

- Amount of available suspended sediment data?
- Monitoring methods?
- Longitudinal variation of SS transport?
- Temporal variation of SS transport?
- Influence of floods?
- Influence of hydropower plants?
Suspended sediment monitoring stations along the Danube and at the most important tributaries (closest to the confluence)

Map 1

65 SS monitoring stations (19 on tributaries)

Legend

- Suspended sediment monitoring stations
  - Danube
  - Tributary

- Danube River Basin

- Cities
  - 100,000 - 250,000 inhabitants
  - 250,000 - 1,000,000 inhabitants
  - > 1,000,000 inhabitants

National Borders

1:6 000 000

0 50 100 200 km

http://www.interreg-danube.eu/approved-projects/danubesediment

This map was produced in the frame of the EU funded project DanubeSediment, and is based on national information provided by Contracting Parties (AT, BG, DE, HR, HU, RO, RS, SK).

Budapest, April 2018
Suspended sediment monitoring stations along the Danube and at the most important tributaries (closest to the confluence)

SUSPENDED SEDIMENT SAMPLING FREQUENCY

Legend
- Suspended sediment sampling frequency
  - 4 times per hour
  - 1 times per day
  - cca. 2 times per week
  - 1 times per month
  - 5 times per month
  - 36 times per year
  - 9 times per year
  - 5 times per year
- Danube
- Tributaries
- Danube River Basin

National Borders

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Temporal variation of annual SS load at selected monitoring stations

- Linz, Austria (1930-2015)
- Influence of HPPs on Inn River
Temporal variation of annual SS load at selected monitoring stations

- Wallsee-Mitterkirchen, Austria
- Bad Deutsch-Altenburg
- 1955-2016
- No significant differences between the two locations
Temporal variation of annual SS load at selected monitoring stations

- Bratislava, Slovakia (upstream of Gabcikovo HPP)
- Nagymaros, Hungary (downstream of Gabcikovo HPP)
- 1960-2016
- Clear decrease of SS transport downstream of the HPP
Temporal variation of annual SS load at selected monitoring stations

- Vadu Oii, Romania (downstream of Iron Gate HPPs)
- 1960-2009
- Clear decrease of SS transport after the construction of HPPs
Longitudinal variation of mean annual SS load (1986-2016) vs. preHPP

~70% decrease!
What we see from the results (SS)

• SS transport in the Upper-Danube has not been influenced significantly by HPPs on long term
• SS trapping effect of SK HPPs is apparent
• Influence of floods? Let’s see on the next slide…

Continuous decrease of SS transport via time along the Lower-Danube, why?

• Iron Gate I, II
• Tributaries
• Both

No historical data available to assess…
Influence of floods on SS transport

- 20M tons mobilized in AT (mean annual around 5M)
Influence of floods on SS transport

- Morphological changes at Aschach:

  So there are short-term effects!

source: H. Habersack
Morphological changes

- See e.g. Hungary

- Significant bed erosion took place (~3 cm/year)

- Changes in bedload transport?

![Longitudinal profile of the riverbed](image)

Mean change: -1.8 m
What we see from the results (BL)

- Very few (and uncertain) data
- Trapping effect of SK HPPs is apparent (and also at Iron Gate, but strongly different conditions due to clear sand bed in the lower Danube)
- Contribution to total sediment load max. ~10%
Unsampled fractions

Longitudinal variation of characteristic grain sizes of suspended sediment and bedload
Future improvements – in practice

• Harmonization of SS monitoring network along Danube
• Proposed methodology: combination of indirect and direct measurement methods:
  • Optical or acoustic based point measurements in a point (to capture temporal variation)
  • Multipoint cross-sectional calibration with isokinetic sampling (to capture cross-sectional variability)
• Need for better assessment of the influence of HPPs and important tributaries
• This requires improvement of existing stations and set up of new ones

• New bedload monitoring stations, especially in free flowing sections in the Upper and Middle sections (AT, HU)
Thank you for your attention!

• Barbara Kéri
• keri.barbara@epito.bme.hu
• +36 30 275 2655