

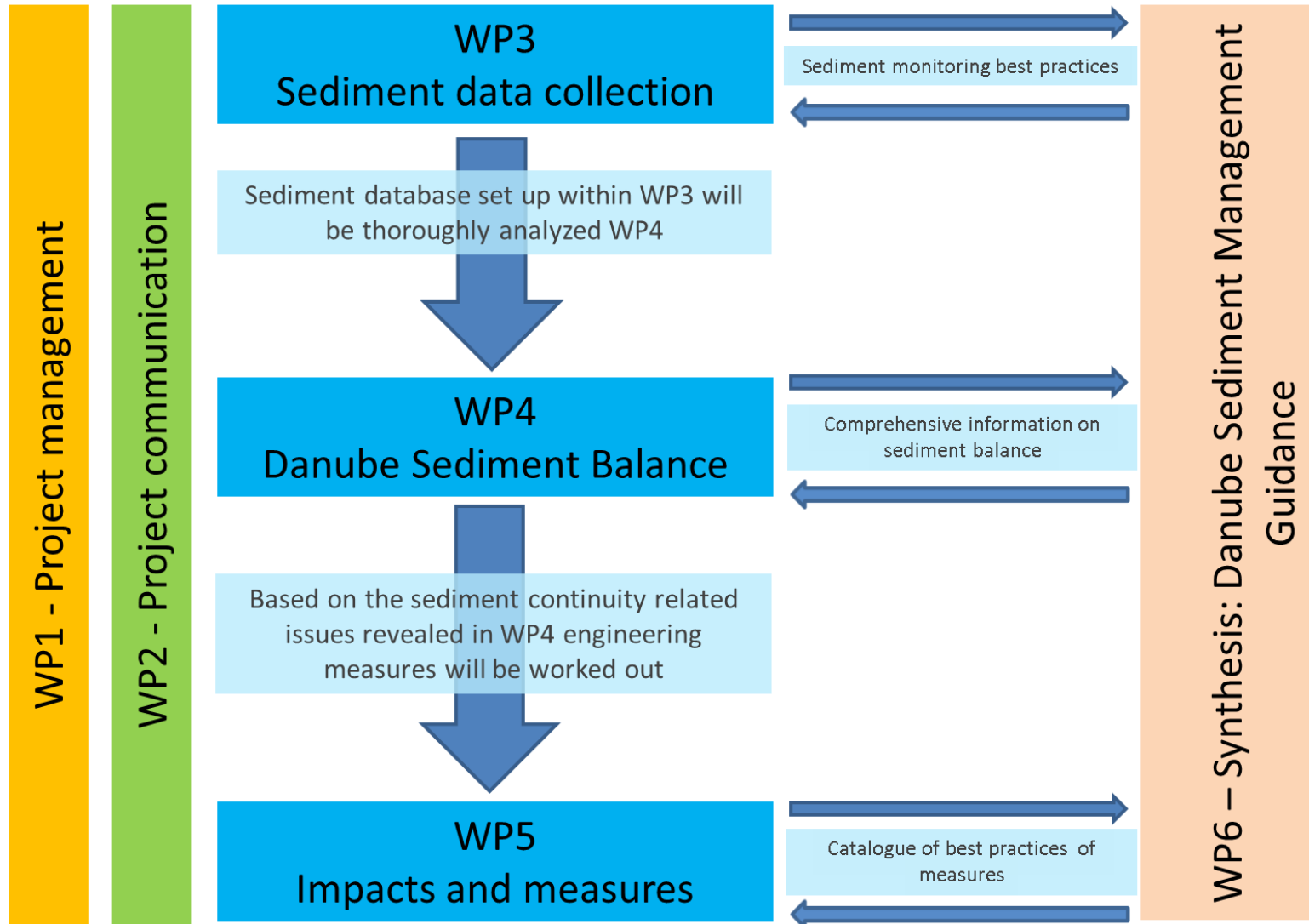
Sediment Monitoring Workshop DanubeSediment project

Introduction of applied sediment monitoring methods
along the Danube

Sándor Baranya, BME

Budapest, 18.04.2018.

Project methodology



Objectives

- Reveal all available sediment data for the Danube and the major selected tributaries at the confluence
- Permanent interaction with the data owner stakeholders (water directorates, private companies, Project Partners)
- Limited sediment transport monitoring at short reaches with significant data gaps
- Comparative analysis and intercalibration of different sediment monitoring techniques
- Recommendations for the good practices of sediment monitoring techniques
- Training of sediment experts on an international workshop

Sediment monitoring system along the Danube and at the most important tributaries

Activity 3.1 – Collection of metadata

- Web based questionnaire

DanubeSediment: Sediment monitoring spreadsheet

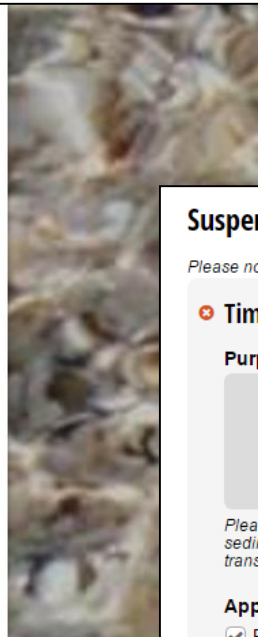
This spreadsheet provides relevant information about the sediment monitoring methods applied by the Danube countries in the Danube River and at the most significant tributaries (at the stations closest to the confluence). One questionnaire is to be filled in for each monitoring station.

Name of user:

Organization:

email address:

1. Basic information of the monitoring station



Suspended sediment monitoring

Please note that the time periods indicated here are not necessarily the same as indicated in the previous points

⊕ Time period 1

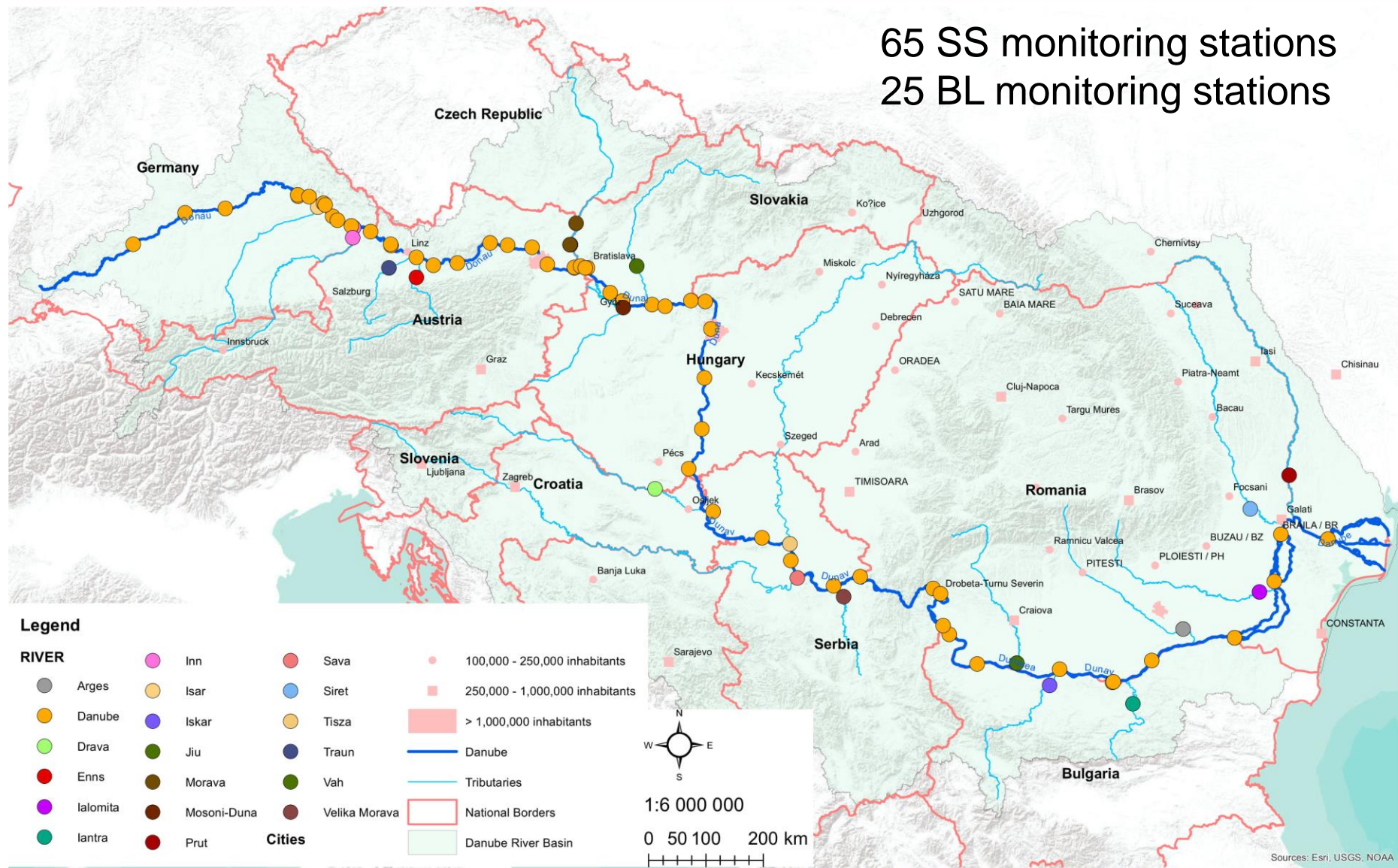
Purpose of suspended sediment monitoring

Please add a short comment on the purpose of the suspended sediment monitoring, e.g. to determine PSD, SSC (mg/l), SS transport (kg/s), SS load (t/y), SS yield (t/km²y)

Applied method:

- ☒ Physical sampling (bottle)
- ☐ Isokinetic sampling (point-integrating)
- ☐ Isokinetic sampling (depth-integrating)
- ☐ Pump sampling
- ☐ Automatized bottle sampling
- ☐ Optical backscatter point sensor
- ☐ Optical Laser diffraction point sensor
- ☐ Acoustic devices
- ☐ Other

65 SS monitoring stations
25 BL monitoring stations



<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



<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 frequency along the Danube and at the most important tributaries (closest to the confluence)

Map 4



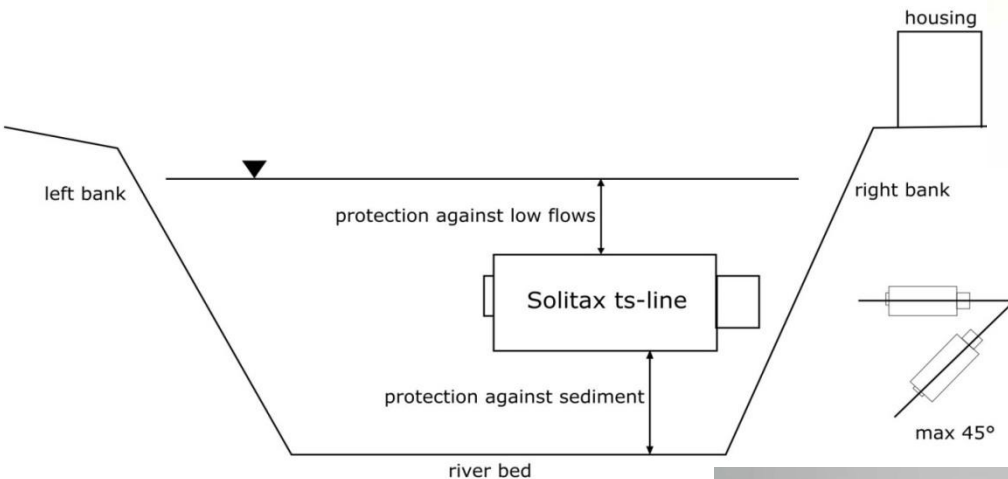
<http://www.interreg-danube.eu/approved-projects/danubesediment>

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 in Germany

- Responsible institute: Bavarian Environment Agency (LfU), Bavarian Hydrological Service (GKD), Federal Waterways and Shipping Administration (WSV)
- Automatized monitoring using Optical Backscatter Sensors (OBS), physical sampling (bottle)
- Sampling frequency: 15 min
- Nr. of stations: 9 (2 trib.)



Solitax ts-line

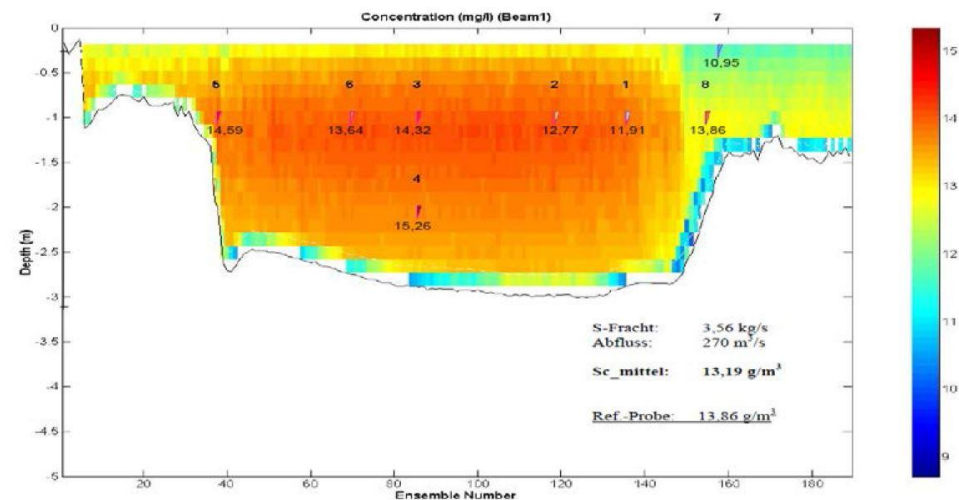


Suspended sediment monitoring in Germany

- Calibration of OBS – point sampling at the sensor



- Multipoint sampling and
- Acoustic profiling:
 - StreamPro ADCP + ViSea
- SSC analysis method: filtering



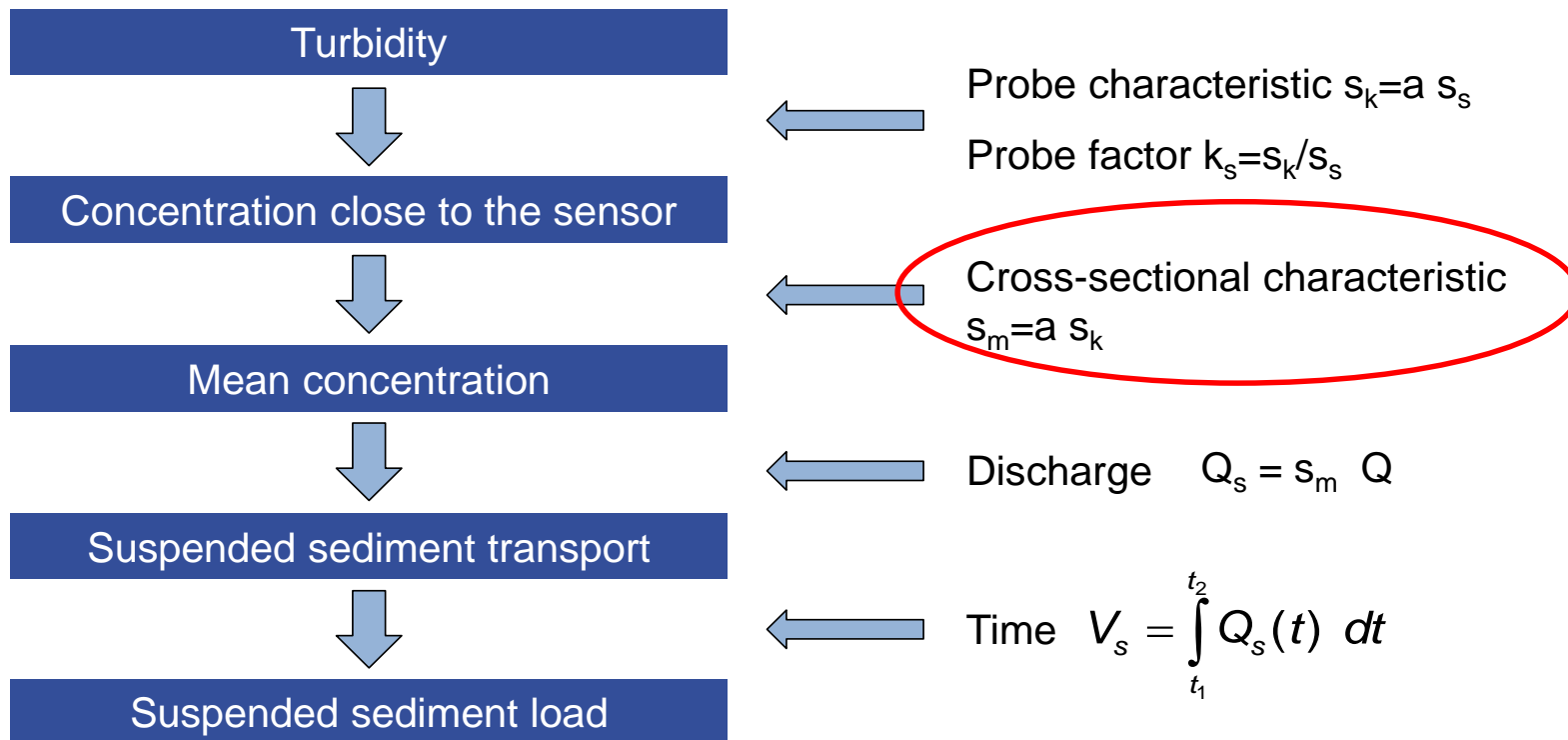
Suspended sediment monitoring in Austria

- Responsible institute: ViaDonau, Verbund Hydro Power
- Automatized monitoring using Optical Backscatter Sensors (OBS), pump sampling, automatized bottle sampling
- Sampling frequency: 15 min
- Nr. of stations: 11 (4 trib.)



Suspended sediment monitoring in Austria

- Estimation of sediment load (Habersack et al., 2013):



Suspended sediment monitoring in Austria

- Cross-sectional calibration – multipoint sampling



Suspended sediment monitoring in Austria

- Laboratory analysis of water samples
- SSC → vacuum filtration (0.45 μm filter), drying (2 hours on 105° C), weighing
- PSD → sieving instrument and sedimentation instrument



Suspended sediment monitoring in Slovakia

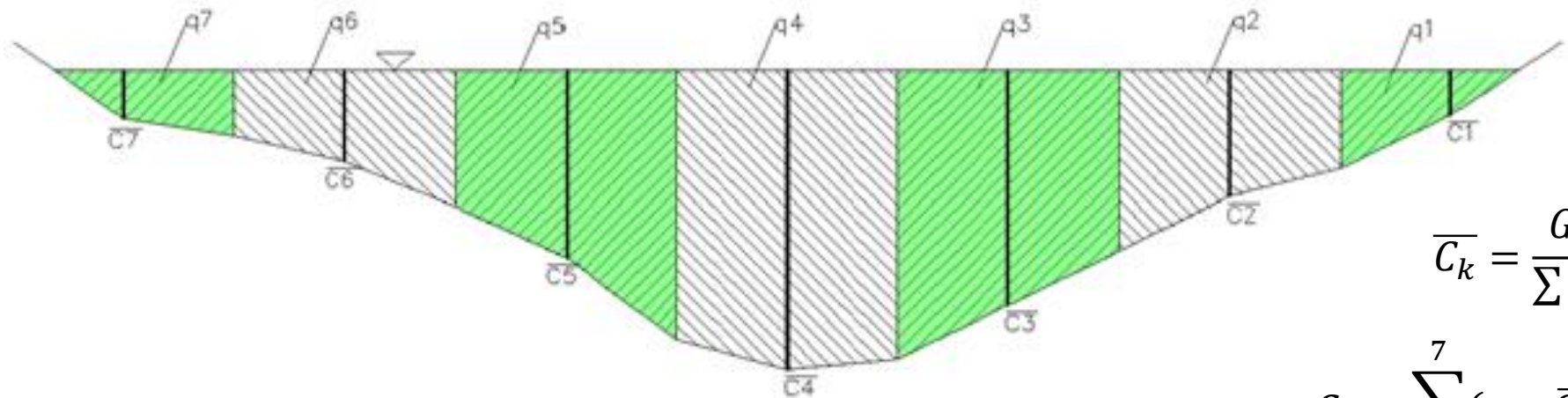
- Responsible institute: SHMU, VUVH
- Typical frequency: 3 to 20 times/week
- Depth-integrated sampling at representative verticals
- Nr. of stations: 5 (1 trib.)



- SSC → filtration of 0.2 l (0.45 µm filter), drying (24 hours on 105° C), weighing

Suspended sediment monitoring in Hungary

- Expeditionary multipoint measurements
- Typical frequency: 5 times/year
- 7 verticals, 10 points/vertical, 1 liter/point using pump
- 10x1 liter samples are integrated → sedimentation → extraction of 9 liters → remaining 1 liter is analysed → drying, weighing
- PSD → sedimentation instrument
- Nr. of stations: 7 (1 trib.)



$$\bar{C}_k = \frac{G_s}{\sum q_i}$$

$$G_s = \sum_{i=1}^7 (q_i \cdot \bar{C}_i)$$

Suspended sediment monitoring in Hungary

- Pump sampler



- Estimation of SSL using sediment rating curves and actual discharge

Suspended sediment monitoring in Croatia

- Daily physical sampling in one point at the water surface using bucket sampler → filtration (0.45 μm filter) → filters to laboratory, drying (on 105° C), weighing
- Multipoint measurements 6 times/year with pump
- Nr. of stations: 1 trib.

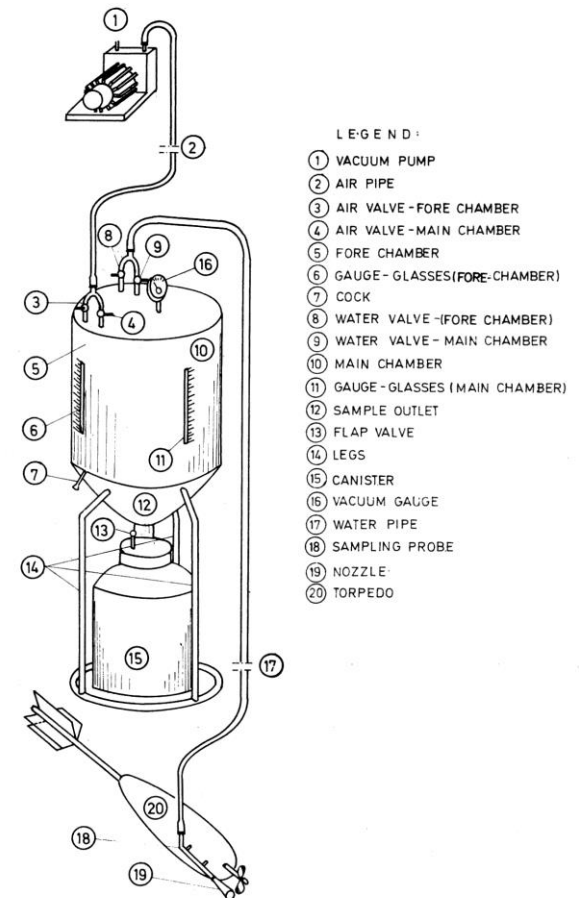


Suspended sediment monitoring in Serbia

-
- Daily physical sampling in one point at the water surface using bucket sampler (10 liters) → filtration (0.45 μm filter) → filters to laboratory, drying (on 105° C), weighing
 - Multipoint measurements 1-3 times/year with vacuum bathometer in 7-10 verticals, 5 points/vertical, ~40 liter sample/point
 - Estimation of SSL → Correlation between surface concentration and mean concentration along the cross-section
 - Sedimentation of samples for days → 1-1.5 liter of concentrated sample is extracted → repeated settling for a day → 0.1 liter of concentrated sample is extracted → drying, weighing
 - Nr. of stations: 7 (3 trib.)

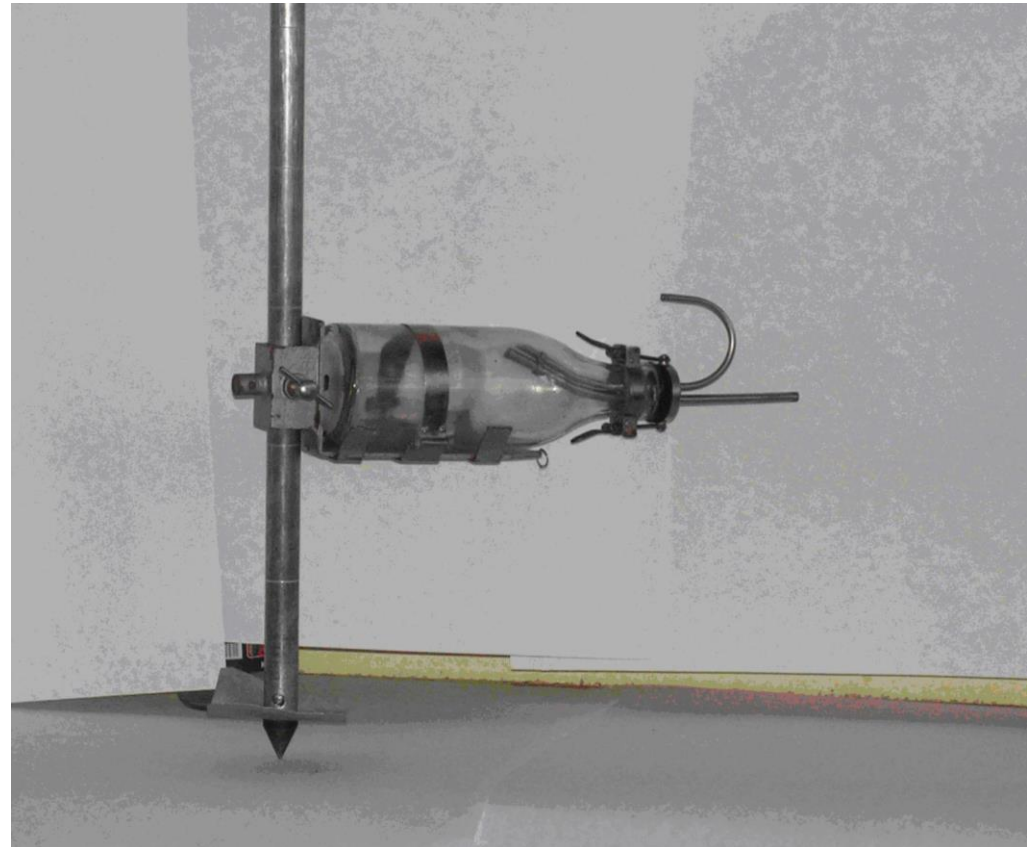
Suspended sediment monitoring in Serbia

- Daily physical sampling
- Multipoint measurements 4-6 times/year with bathometer in 5-9 verticals
- Correction of point samples with cross-section calibration
→ daily sediment discharge



Suspended sediment monitoring in Bulgaria

- Daily physical sampling with bottle sampler at the river bank
- Mean concentration in the cross-section is assumed to be the measured one at the river bank
→ daily sediment discharge
- Nr. of stations: 6 (2 trib.)



Suspended sediment monitoring in Romania

- Daily physical sampling with bottle sampler at the river bank
- Multipoint measurements 4-6 times/year with bathometer in 5-9 verticals
- SSC is determined using a portable turbidity sensor
- Nr. of stations: 19 (5 trib.)



Bedload monitoring

- Germany: expeditionary monitoring campaigns at 9 sites
 - BfG sampler
 - Sampling from ship
 - Rating curves
- Austria (1 station):
 - BfG sampler (monitoring at Bad-Deutsch Altenburg)
 - Mesh size: 1 mm
 - Sampling from bridge or from ship
 - 8-15 verticals, 3x5 minute long samplings
 - 3 times/year
 - Drying, sieving



Bedload monitoring

- Slovakia (2+1 stations):
 - intensive measurement campaigns in 1997-1998 and 2002-2003
 - Swiss-type sampler, 5-6 verticals
 - 2-5 min long samplings
 - Drying, sieving of the samples
 - Rating curves have been set up



Bedload monitoring

- Hungary (1 station):
 - continuous monitoring since 1998 at Vámosszabadi (Medvedov)
 - 4-6 times/year using the modified Károlyi-sampler at 7 verticals
 - 15 min long samplings
 - Drying, sieving of samples



Bedload monitoring

- Romania (11 stations):
 - 4-6 times/year at 11 monitoring stations, 5-9 verticals
 - ~10 min long samplings
 - Drying, sieving (0.063-50 mm)



→ **Main results of data collection and analysis**