# USE OF AIRBORNE LASER SCANNING DATA FOR THE DETECTION OF CHANNEL DYNAMICS IN SLOVAKIA

*Miloš Rusnák, Lukáš Michaleje*

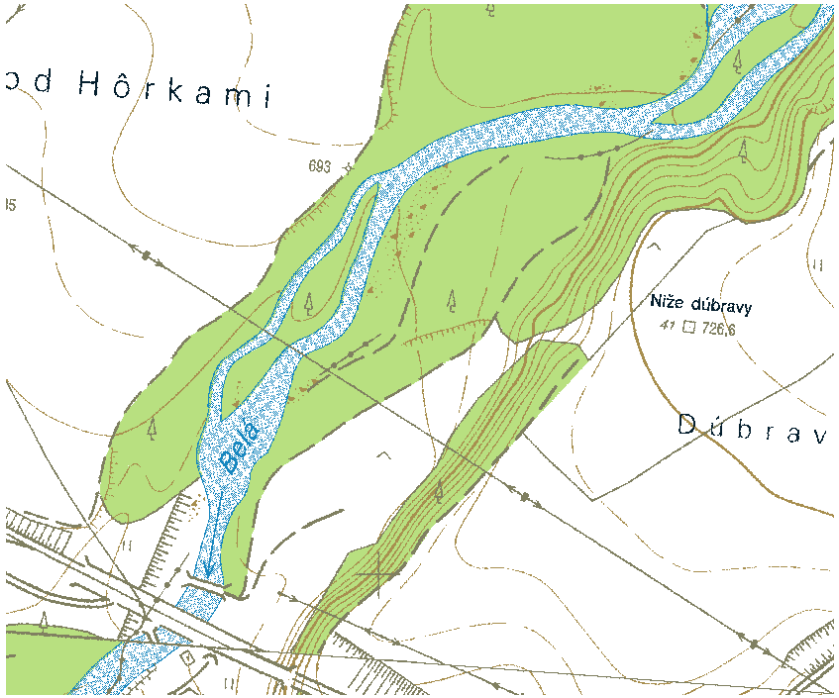
GEOGRAFICKÝ ÚSTAV SAV

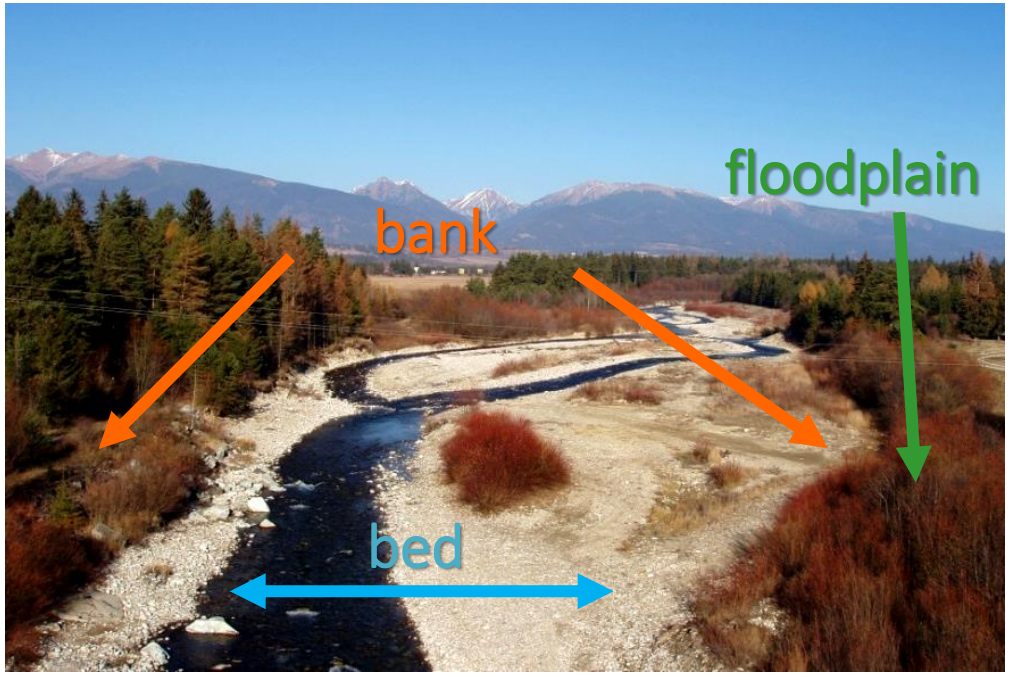
Slovak Rivers LAB

H$_2$O'Lyon Université de Lyon

esa European Space Agency

# Rivers – line element?

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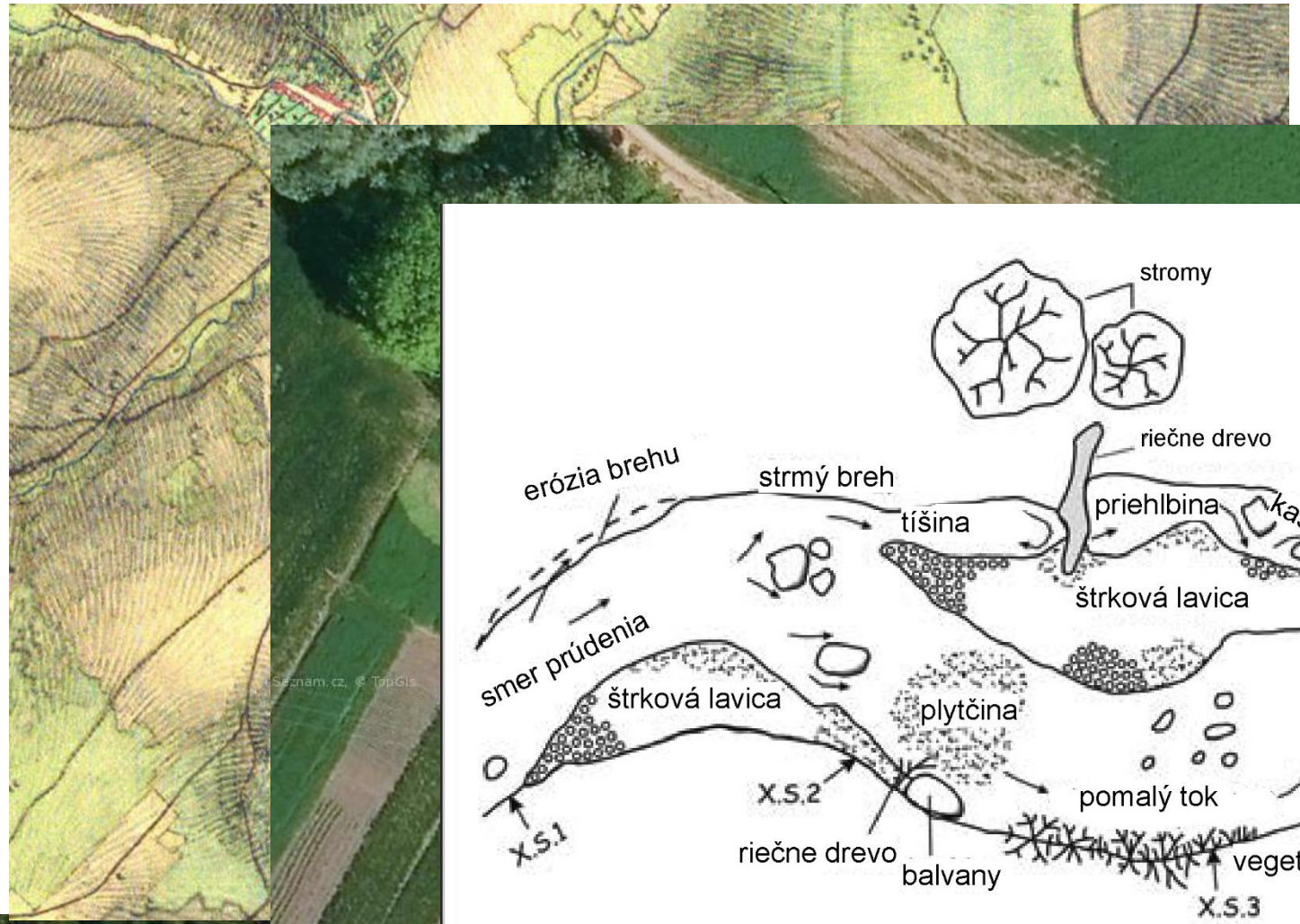




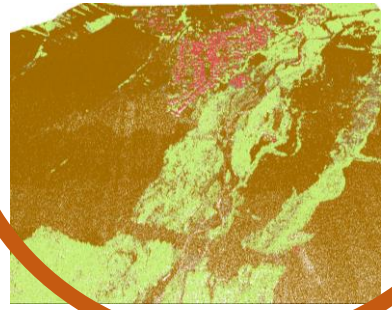



# Rivers morphology

*- object detection*
*- multi-scale approach*

Satellite + aerial images

LiDAR



scale

TLS

UAV

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# Airborne Laser Scanning

Geoportál

Geodetic control | Cadastre | ZBGIS | Archive | Applications | Services | INSPIRE | FAQ

Home > ZBGIS > Airborne Laser Scanning - DTM

**ZBGIS**

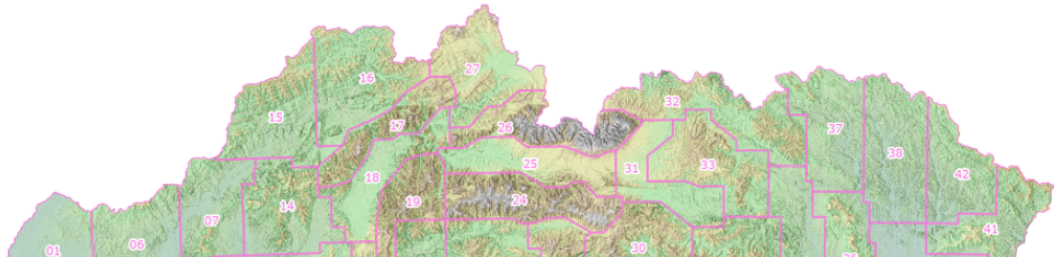
- ZBGIS
- Digital Cartography
- Orthophotomosaic
- Airborne Laser Scanning - DTM
  - 1st project cycle (2017 – 2023) and creation of DTM 5.0
  - 2nd project cycle (2022 – 2026) and creation of DTM 6.0

## Airborne Laser Scanning - DTM

### 1st project cycle (2017 – 2023) and creation of DTM 5.0

Since **2017**, the Geodesy, Cartography and Cadastre Authority of the Slovak Republic (ÚGKK SR) was preparing (in a contractor manner) a new Digital Terrain Model (DTM 5.0) of the entire territory of the Slovak Republic created from Airborne laser scanning (ALS) data. **In May 2023**, the 1st cycle of the ALS project was completed by making the seamless DTM 5.0 of the entire territory of Slovakia available to the public.

In the 1st cycle of the project, the territory of Slovakia was divided into 42 sites (lots). The scanning was carried out in the vegetation-free winter period gradually from the west to the east of Slovakia.




# USING LIDAR FOR DETECTION OF CHANNEL DYNAMICS

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# River incison

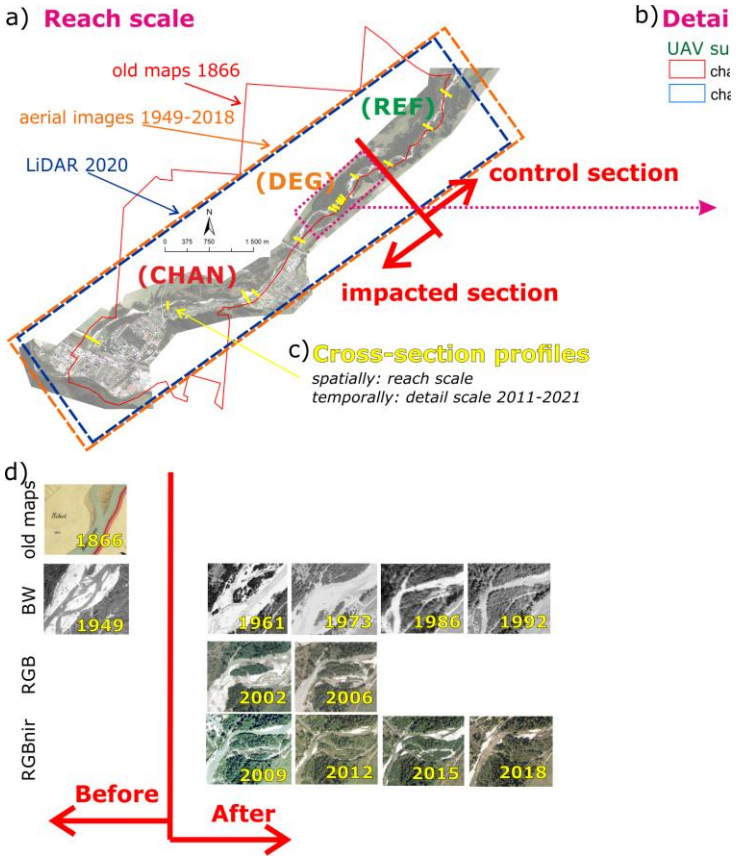
Received: 18 October 2023 | Revised: 21 March 2024 | Accepted: 24 March 2024
DOI: 10.1002/esp.5840

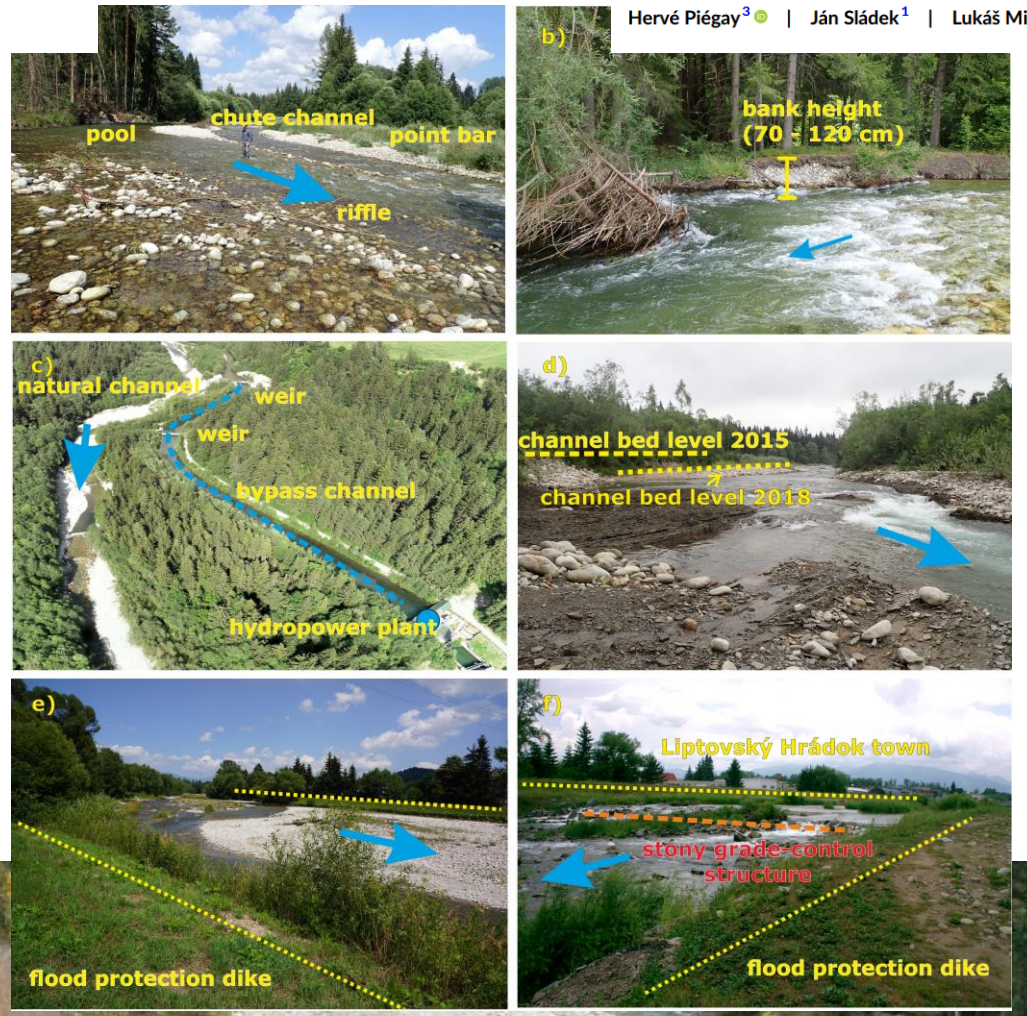
RESEARCH ARTICLE

ESPL WILEY

## Inferring channel incision in gravel-bed rivers: Integrating LiDAR data, historical aerial photographs and drone-based SfM topo-bathymetry

Miloš Rusnák[1] | Ján Kaňuk[2] | Anna Kidová[1] | Milan Lehotský[1] | Hervé Piégay[3] | Ján Sládek[1] | Lukáš Michaleje[1]

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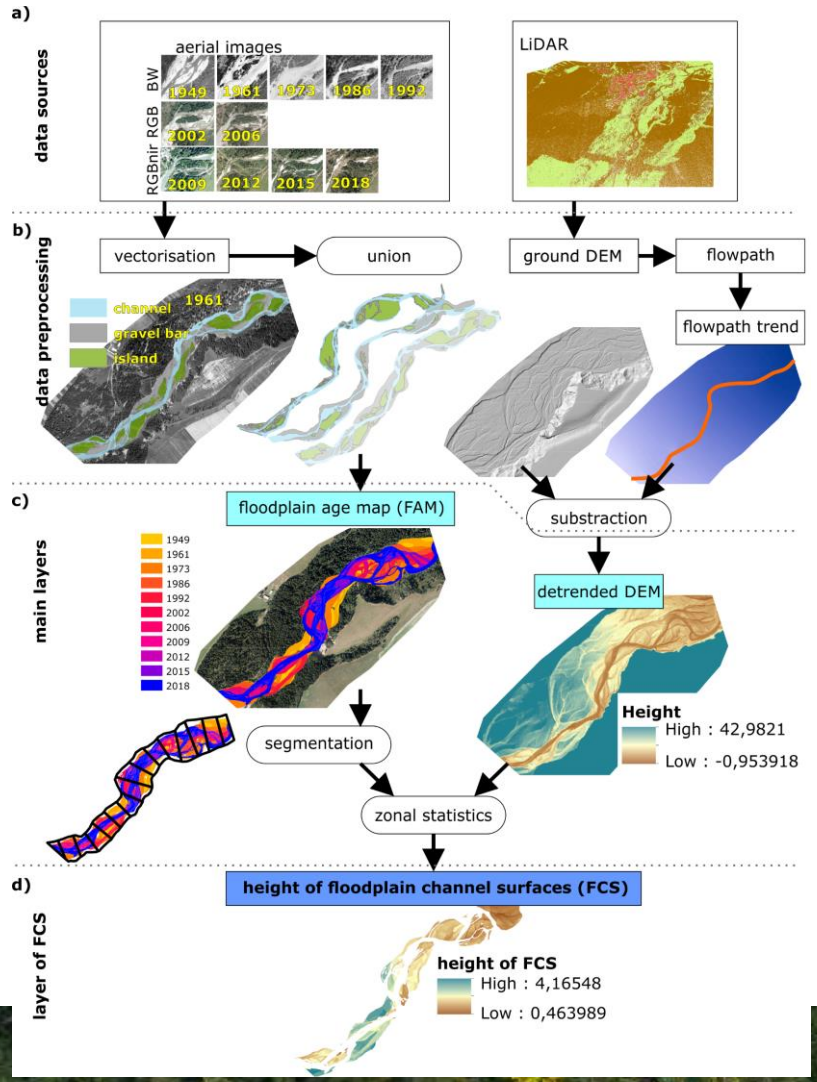


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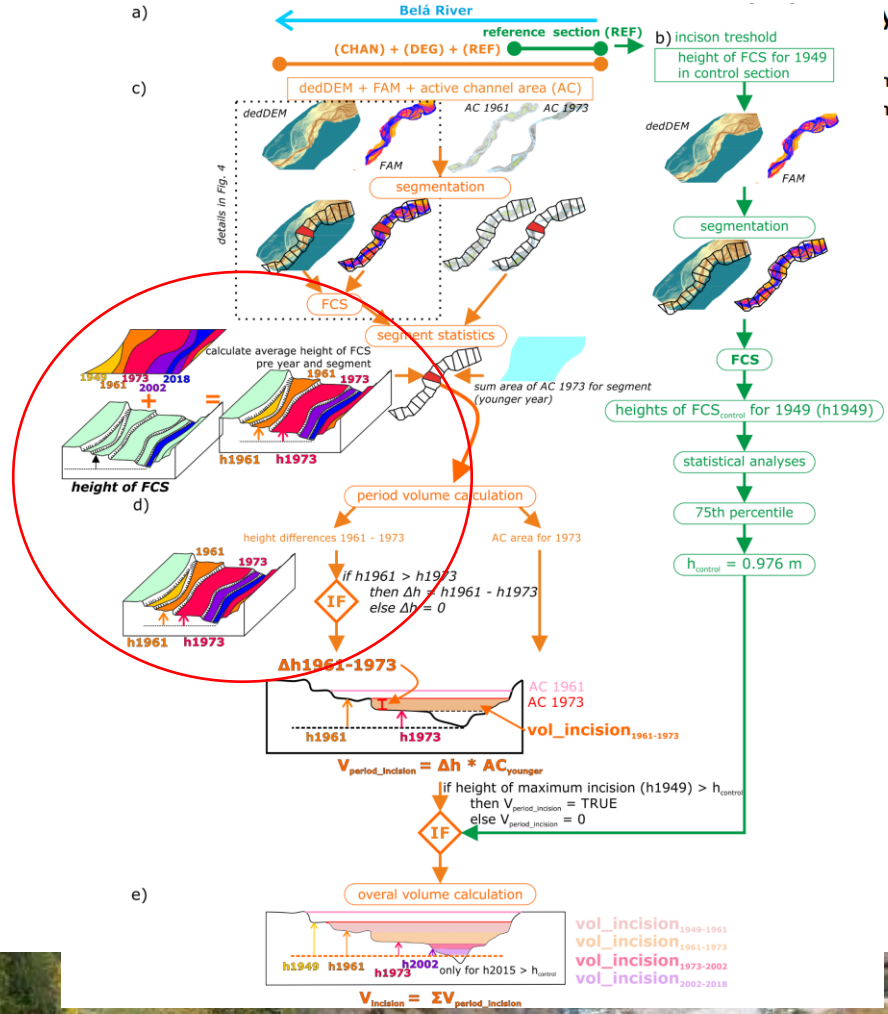


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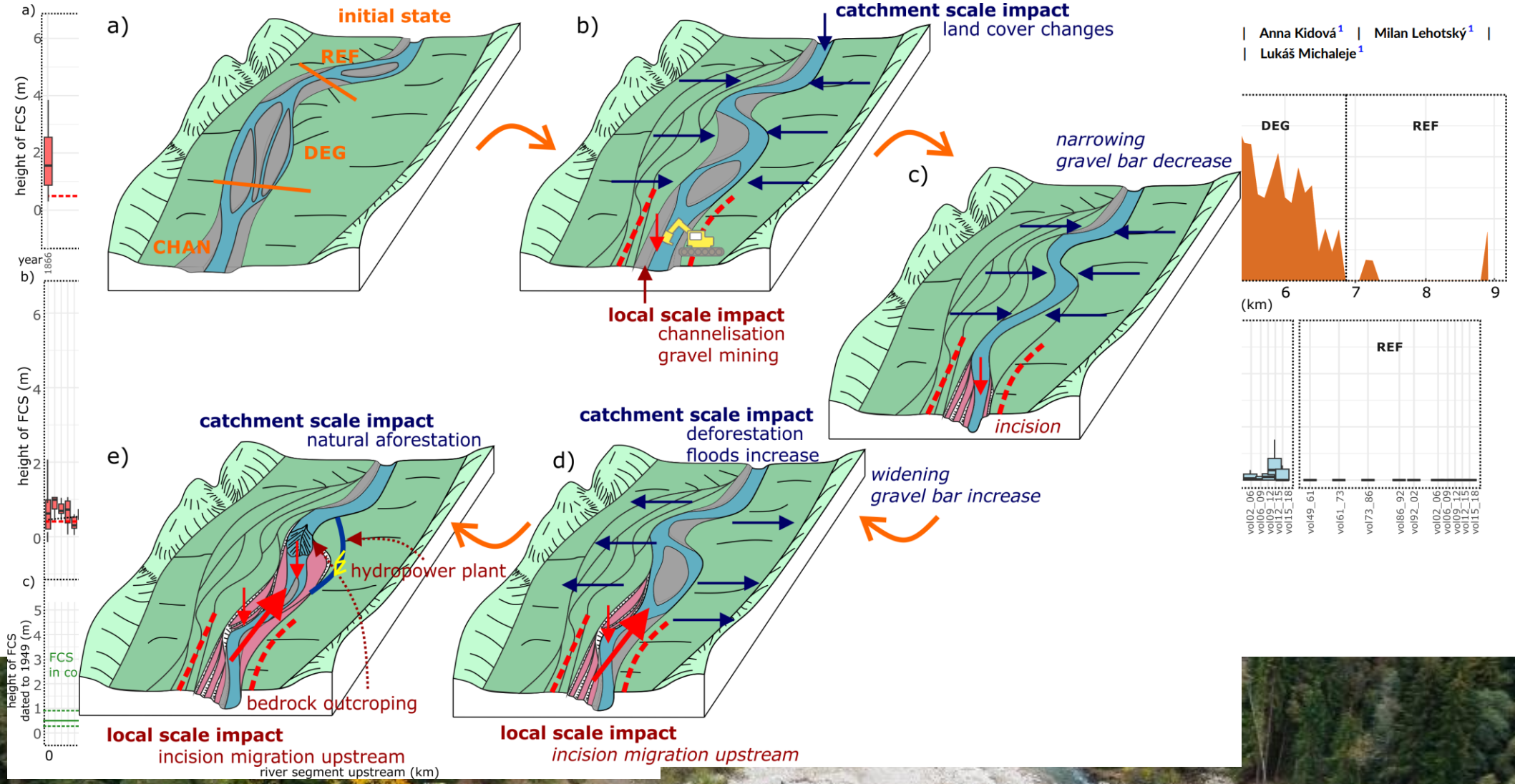

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# Sediment deposition

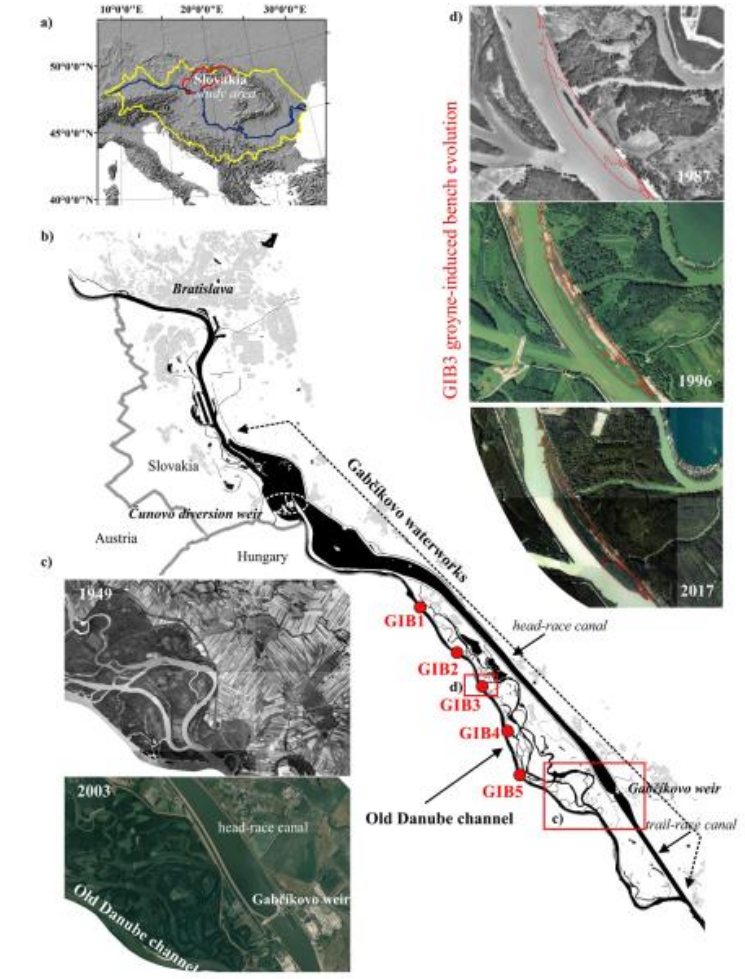
Pure Appl. Geophys.

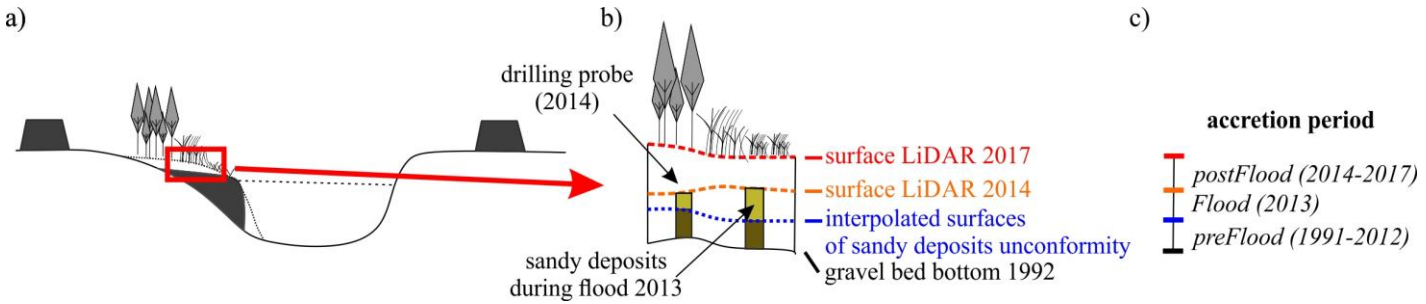
https://doi.org/10.1007/s00024-024-03433-z

Pure and Applied Geophysics

Morphologic Adjustment of a River Reach with Groynes to Channel Bypassing

Milan Lehotský,[1] Šárka Horáčková,[1] Miloš Rusnák,[1] Tomáš Štefanička,[2] and Jaroslav Kleň[3]

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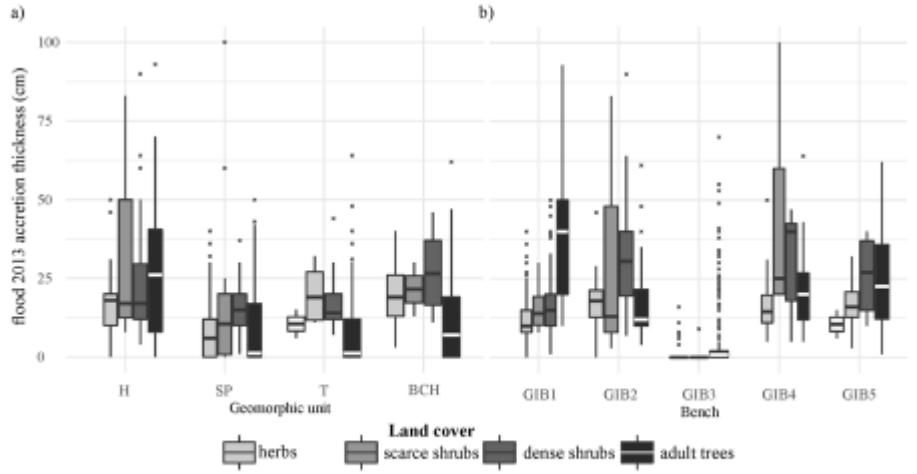
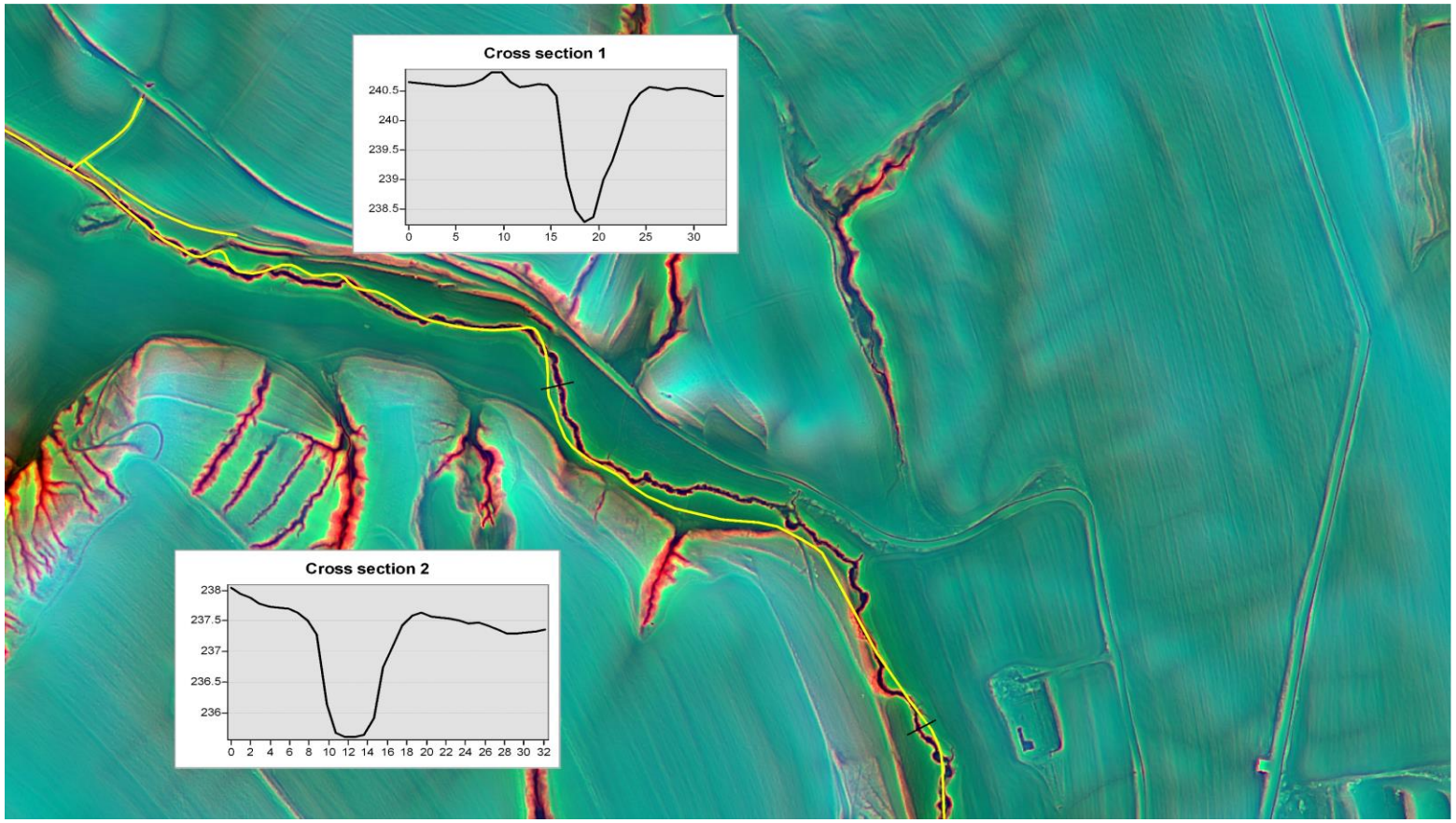



Figure 8
Effect of vegetation cover on the vertical accretion caused by the 100-year flood event in 2013 within groyne-induced benches 1–5 and different geomorphic units (H – top, SP – supra-platform, T – tail, BCH – backchannel)

- bypassed channel developed after water diversion in 1992
- accretion 1992 – 2017: total **1,146,589 m$^3$**
- flood event in 2013: **209,752 m$^3$**
- post flood period 2014- 2017: **267,700 m$^3$**
- accretion rate span from 3.8 cm.year$^{-1}$ to 5.3 cm.year$^{-1}$.

# Channel detection

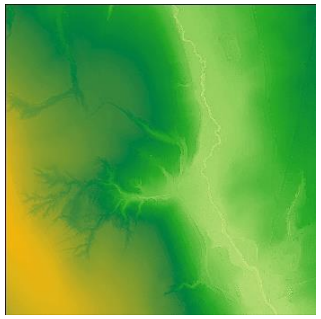



## Main goal

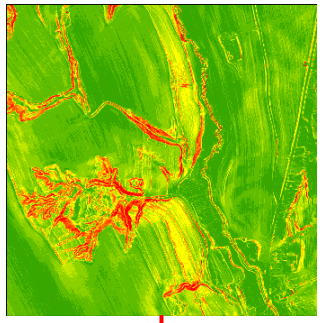
Short-term goal: semiautomatic detection of watercourse channel with machine learning

Medium-term goal: flood risk preliminary assessment of channel of watercourses

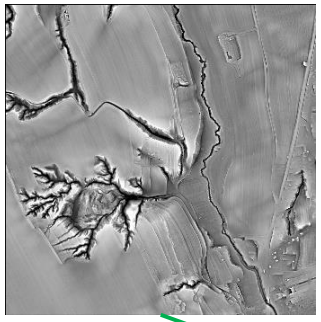
# Channel detection



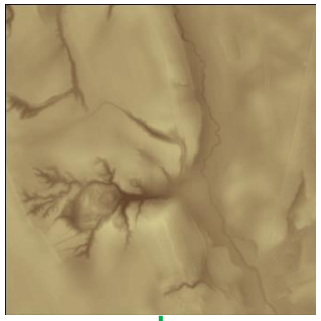
DEM



Slope

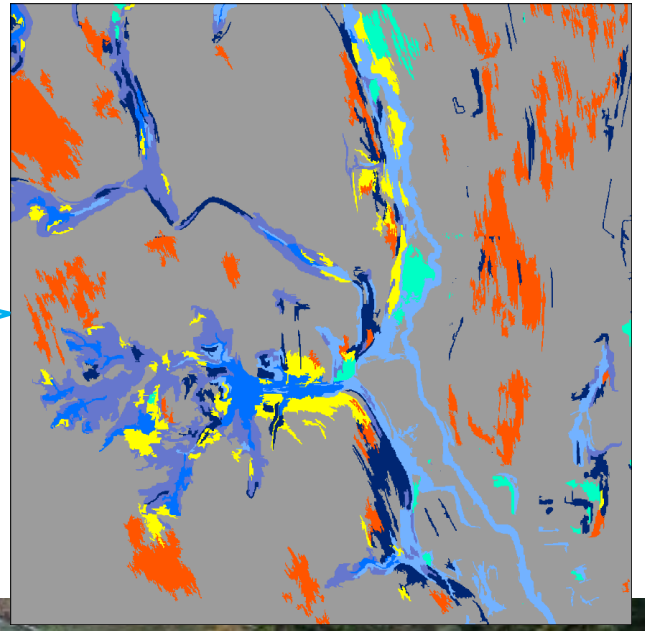


TO

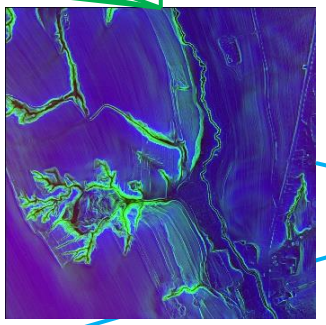


TPI

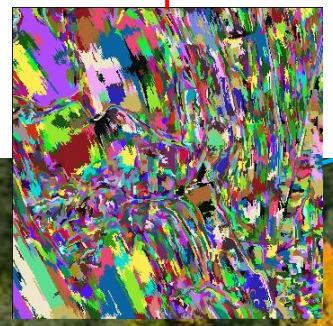
Classification

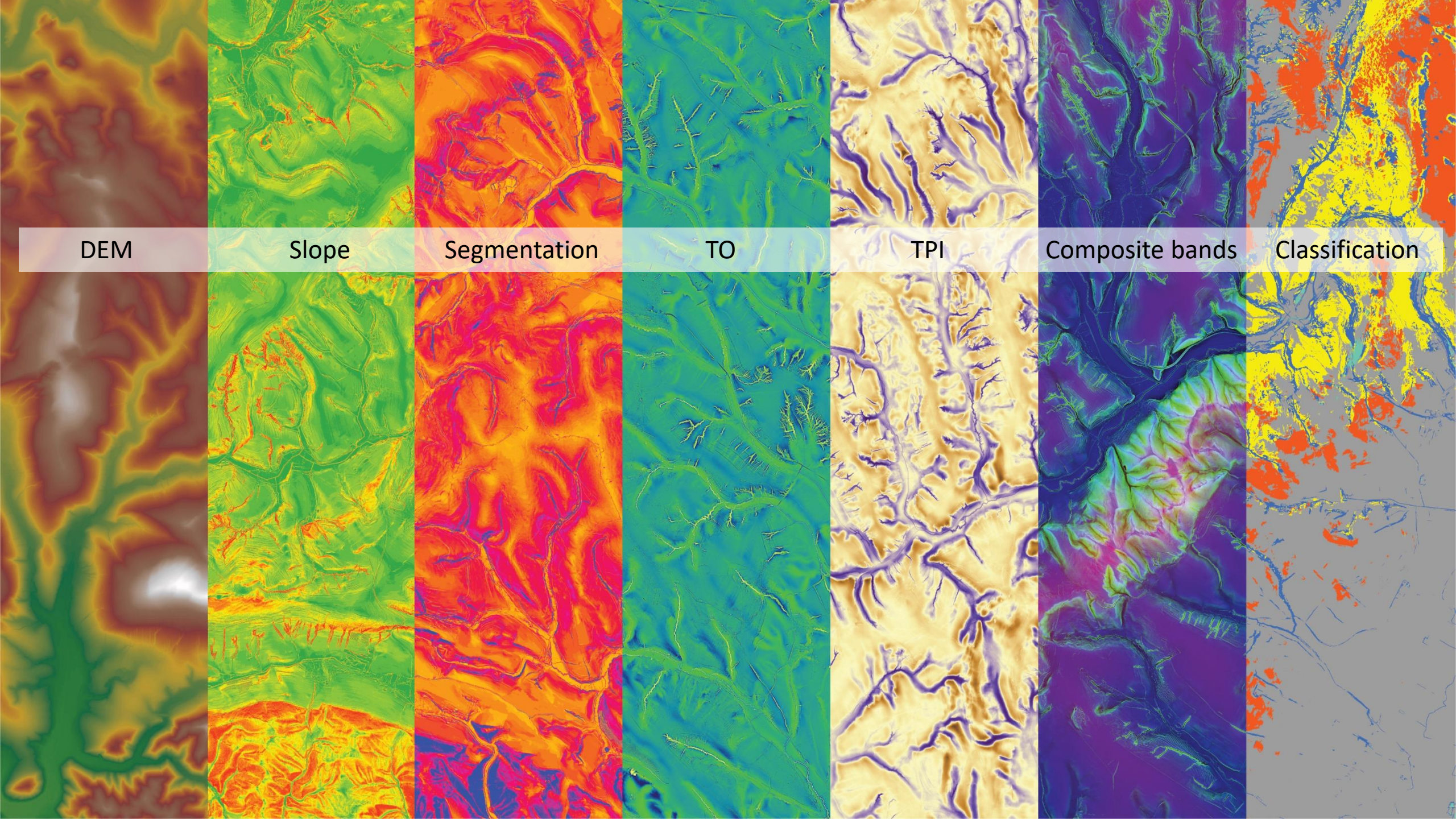


Composite bands



Segmentation




DEM
Slope
Segmentation
TO
TPI
Composite bands
Classification

# Channel detection

**Four classes of channel**

Natural channel on lower part of watercourse - NCHLP

Natural channel on upper part of watercourse - NCHUP

Watercourse difficult to detect - WDD

Modified watercourse – MW

**Additional classes**

slope, slope near watercourse, water bodies, other

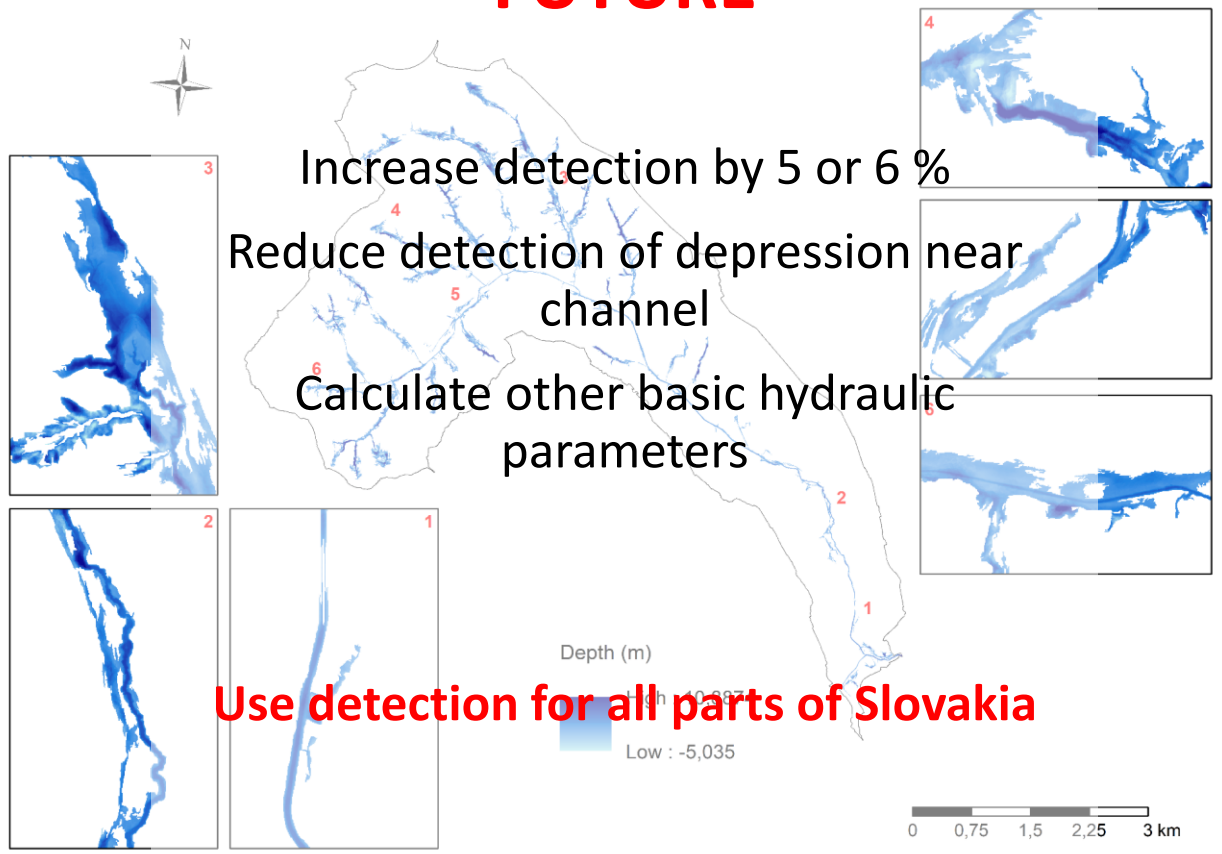
**Accuracy of machine learning detection– 90,59%**

## FUTURE

Increase detection by 5 or 6 %

Reduce detection of depression near channel

Calculate other basic hydraulic parameters




**Use detection for all parts of Slovakia**

# THANKS

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