Centre of Environmental Research

Waste Management, Circular Economy and Environmental Security

CEVOOH

cenia

MUNI ECON

ÚSTAV CHEMICKÝCH PROCESŮ AV ČR
INSTITUTE OF CHEMICAL PROCESS FUNDAMENTALS OF THE ASCR

VŠB TECHNICKÁ UNIVERZITA OSTRAVA

VYSOKÁ ŠKOLA CHEMICKO-TECHNOLOGICKÁ V PRAZE

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

VÚV TGM

WP 1.A4 The application of remote sensing methods for the determination of pollutants in building envelopes

Environment - Environment for Life
12. – 14. 9. 2022

T A
C R

Project SS02030008 Centre of Environmental Research: Waste Management, Circular Economy and Environmental Security is co-financed with the state support of the Technology Agency of the Czech Republic as part of the Environment for Life Program.

www.tacr.cz

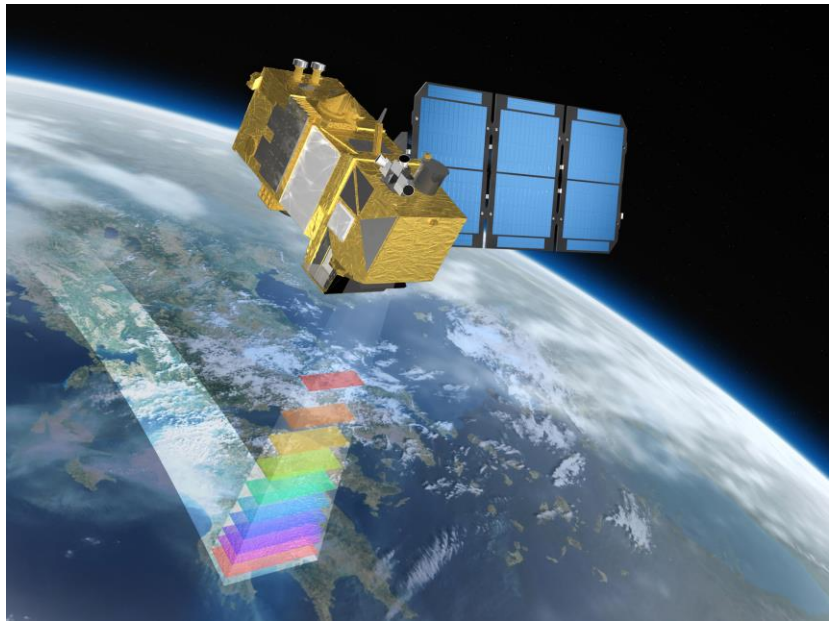
The application of remote sensing methods for the determination of pollutants in building envelopes

Bc. Mojmír Polák

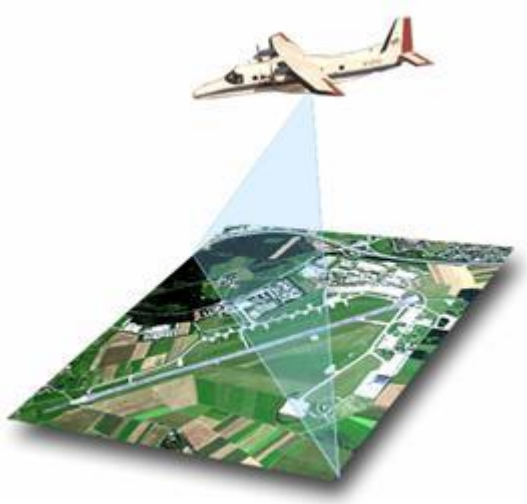
Czech Environmental Information Agency

Remote sensing

- Remote sensing is the process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance (typically from satellite, aircraft or UAV)



ESA (2012)



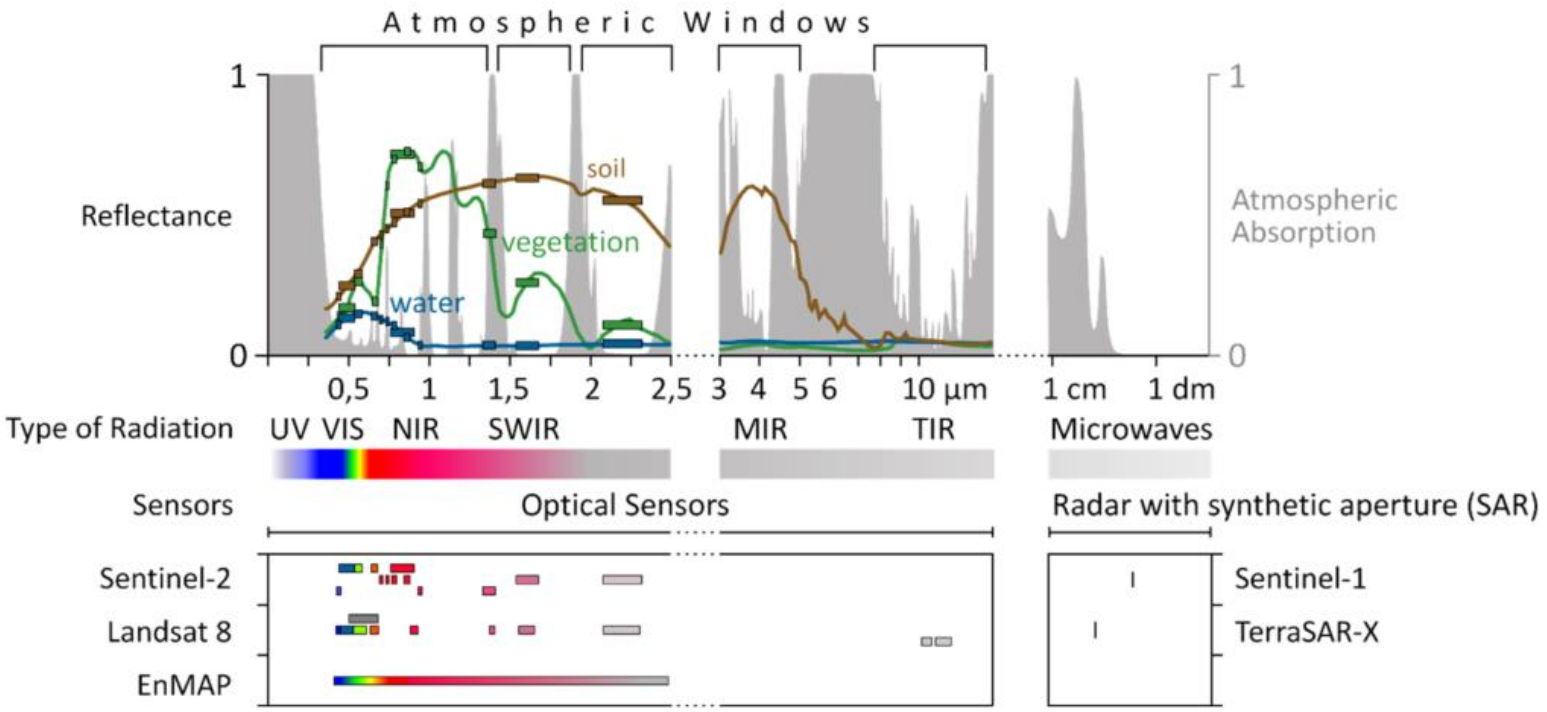
DLR (2022)

Resonon (2022)

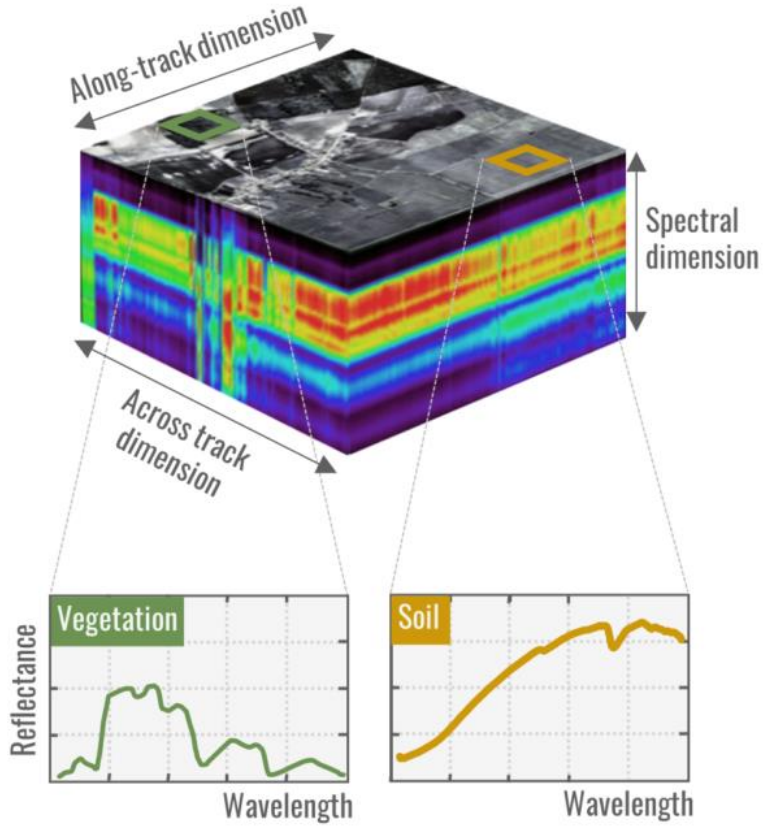
Aims of study

- **Detection of asbestos-containing or eternit materials in the outer envelope buildings**
  - **2021**
    - Literature research on the topic detection of asbestos-containing materials using panchromatic, multispectral and hyperspectral data
    - Validation of selected data processing methods at test sited – eventually, design of own detection method (or processing process)
  - **2022**
    - Application of selected remote sensing data analysis to the detection of asbestos-containing materials within a larger area (e.g. municipality)
    - Creation of a specialised map of asbestos roofs (coverings) in a selected area (input classes municipality)

Hyperspectral data



EO College (2022)



EO College (2022)

1st area of interest: Šošůvka

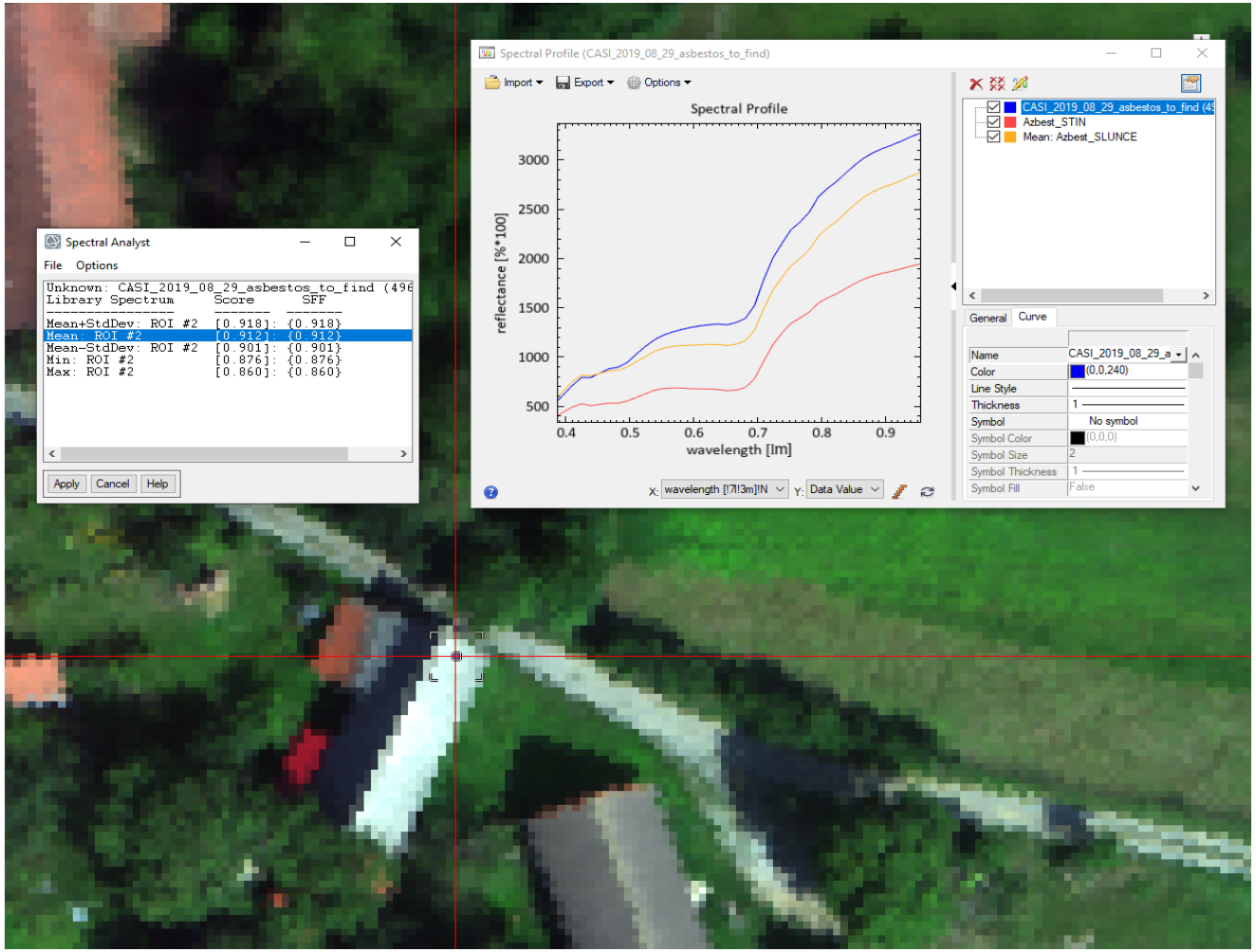
2nd area of interest: Vysoké Popovice

Data and methods

- Cooperation with CzechGlobe - Institute of Global Change Research, The Czech Academy of Sciences (CAS)
- Aerial hyperspectral data
  - CASI (400-1000 nm)
  - SASI (1000-2500 nm)

- Spectral Analyst
- Minimum Noise Fraction (MNF) Transform
- Classification of hyperspectral data using SAM algorithm

Spectral Analyst



Blue curve: unknown material

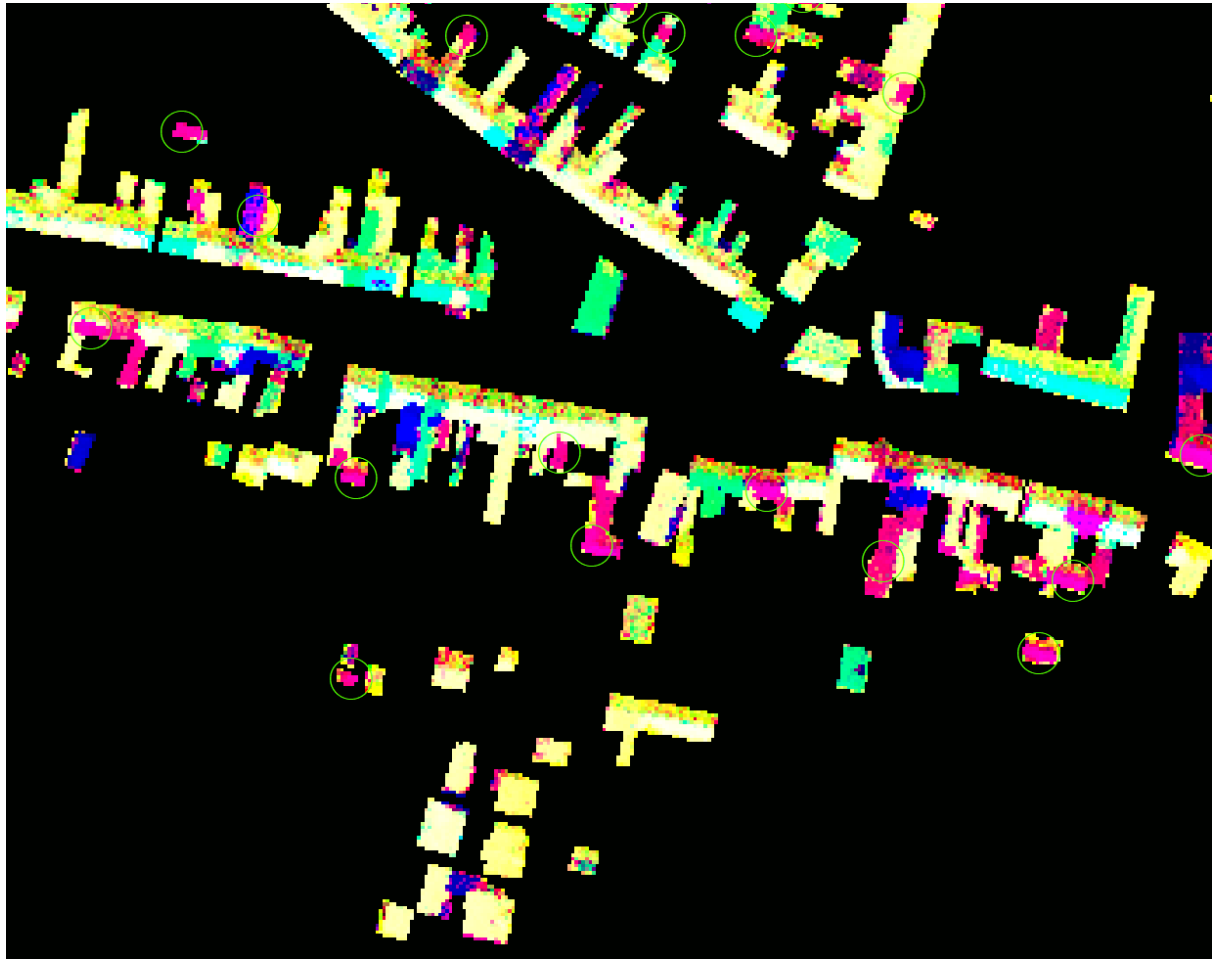
Orange curve: Average curve of the AZBEST roof from 1000 pixels on the sunlit side

Red curve: Average curve of the AZBEST roof from 1000 pixels on the shadow side

- 91% asbestos in the tested pixel in Šošůvka

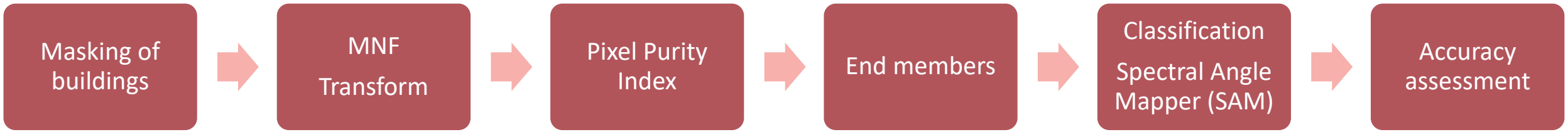
Minimum Noise Fraction Transform

- Vysoké Popovice
- Roofs with potential asbestos content can be visually interpreted after transformation



Classification of hyperspectral data

- More complex process than for multispectral data (Landsat , Sentinel-2)
- Results affected by the quality of the training sample (shadows, mixing of materials)
- Input classes:
  - Asbestos medium roofing
  - Ceramic roofing (red, black)
  - Roof made of asphalt strips
  - Sheet metal roofing
- The accuracy of asbestos-cement roofs identification in Popovice was 68 %



Sources

- DLR (2022): DLR - Earth Observation Center - Team: Sensor Operations, https://www.dlr.de/eoc/en/desktopdefault.aspx/tabid-6579/10800_read-24372/ (4. 9. 2022).
- EO COLLEGE (2022): Beyond the Visible – Introduction to Hyperspectral Remote Sensing – EO College, https://eo-college.org/courses/beyond-the-visible/ (31. 8. 2022).
- ESA (2012): ESA - Sentinel-2, https://www.esa.int/ESA_Multimedia/Images/2012/02/Sentinel-2 (4. 9. 2022).
- RESONON (2022): Hyperspectral Sensors & Airborne Remote Systems | Resonon, https://resonon.com/hyperspectral-airborne-remote-sensing-system (4. 9. 2022).
- USGS (2022): What is remote sensing and what is it used for? | U.S. Geological Survey, https://www.usgs.gov/faqs/what-remote-sensing-and-what-it-used (31. 8. 2022).

Thank you for your attention!