Potenciál letecké spektroskopie pro mapování azbesto-cementových střech

Polák, Mojmír
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POTENTIAL OF AIRBORNE SPECTROSCOPY FOR ASBESTOS-CEMENT ROOFS MAPPING

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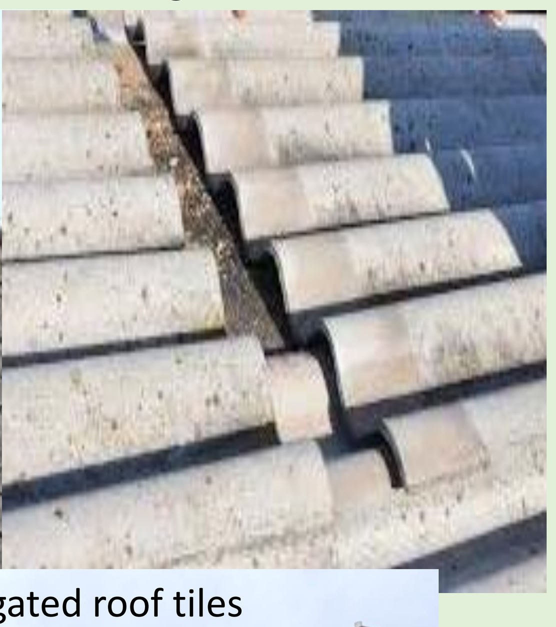
Introduction

Until the 1980s, one of the most common uses of asbestos in homes in many countries was as roofing material. Although asbestos has insulating properties which are highly useful in the construction industry, and it is outstanding in resistance to acids and alkalis and in fire resistance, asbestos fibres inhalation significantly increases the risk of developing asbestos-related diseases (Abós-Herràndiz et al. 2017, Furuya et al. 2018, Janošíková et al. 2020). The aim of the study was to identify asbestos-cement roofs using airborne hyperspectral data (400 – 2500 nm, https://olc.czechglobe.cz/) acquired for two Czech municipalities of Vysoké Popovice and Šošůvka.

Flat roof tiles

Corrugated roof tiles



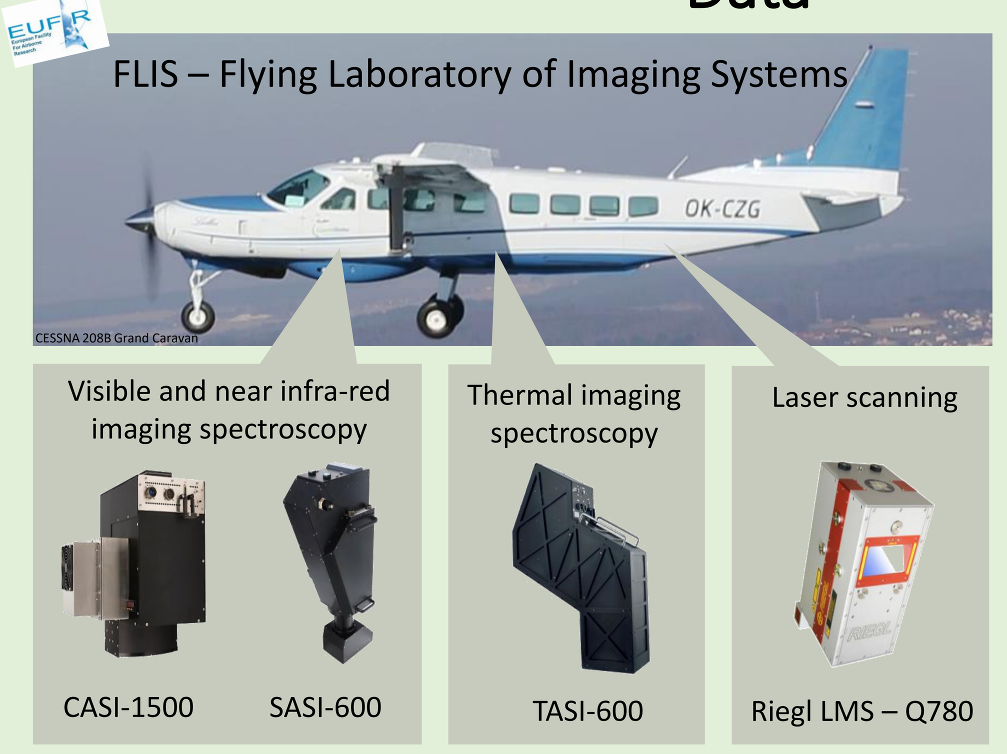
Corrugated roof tiles

Methods

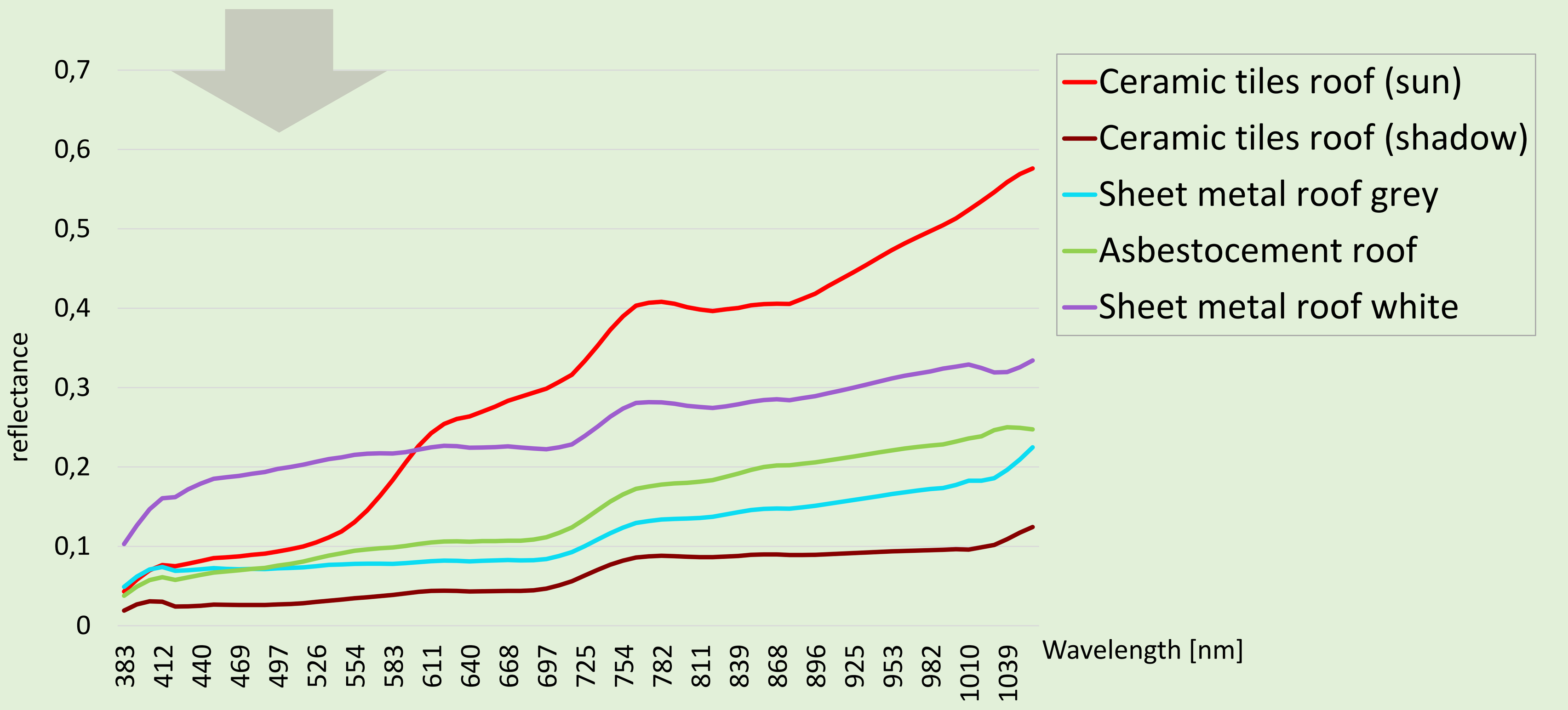
The **first approach** was the Spectral Analyst method where spectra of building roofs from airborne data were compared with laboratory spectra from a specific sample with an unknown curve. The result was a probability value of the asbestos-cement spectrum occurring in the image pixel. The asbestos-cement roofing material was identified with a **91%** probability of asbestos occurrence. The result was validated using ground truth data.

The **second approach** was a supervised classification. We used Registry of territorial identification, addresses and real estate (RUIAN) data, which was validated over the orthophoto of the State Administration of Land Surveying and Cadastre (ČÚZK) to create roofs mask. The process of airborne hyperspectral data normalization and residual noise reduction was performed using Minimum Noise Fraction (MNF) transformation. Then, the pixel spectra of pure materials were found using pixel purity index with a setting of 10,000 iterations and a threshold of 2.5 standard deviations. Next, we selected end-members as inputs to the classification with the Spectral Angle Mapper (SAM) method followed by accuracy evaluation using ground truth data. The accuracy of asbestos-cement roofs identification was **68 %.**

Data



Parameters of data acquisition	
Hyperspectral CASI sensor	Hyperspectral SASI sensor
380-1050 nm	950-2450 nm
VNIR	SWIR
3.2 nm	15 mn
FOV 40^0	
1 m	2.5 m
Acquisition date 1: 25.09.2022	
Acquisition date 2: 29.08.2019	

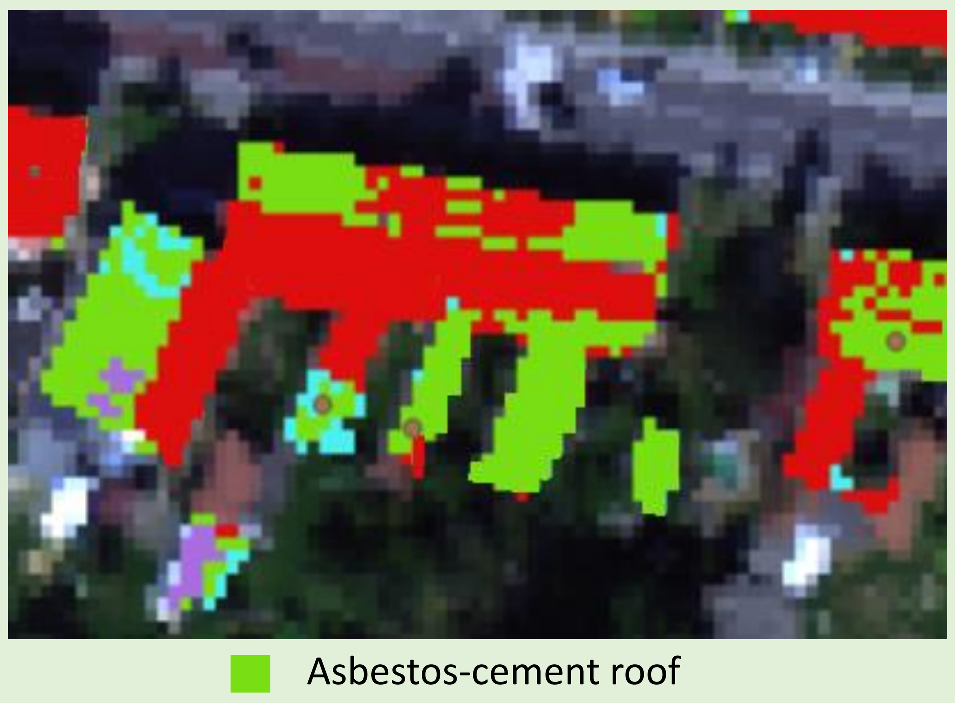


Study site Vysoké Popovice

Spectral Analyst method

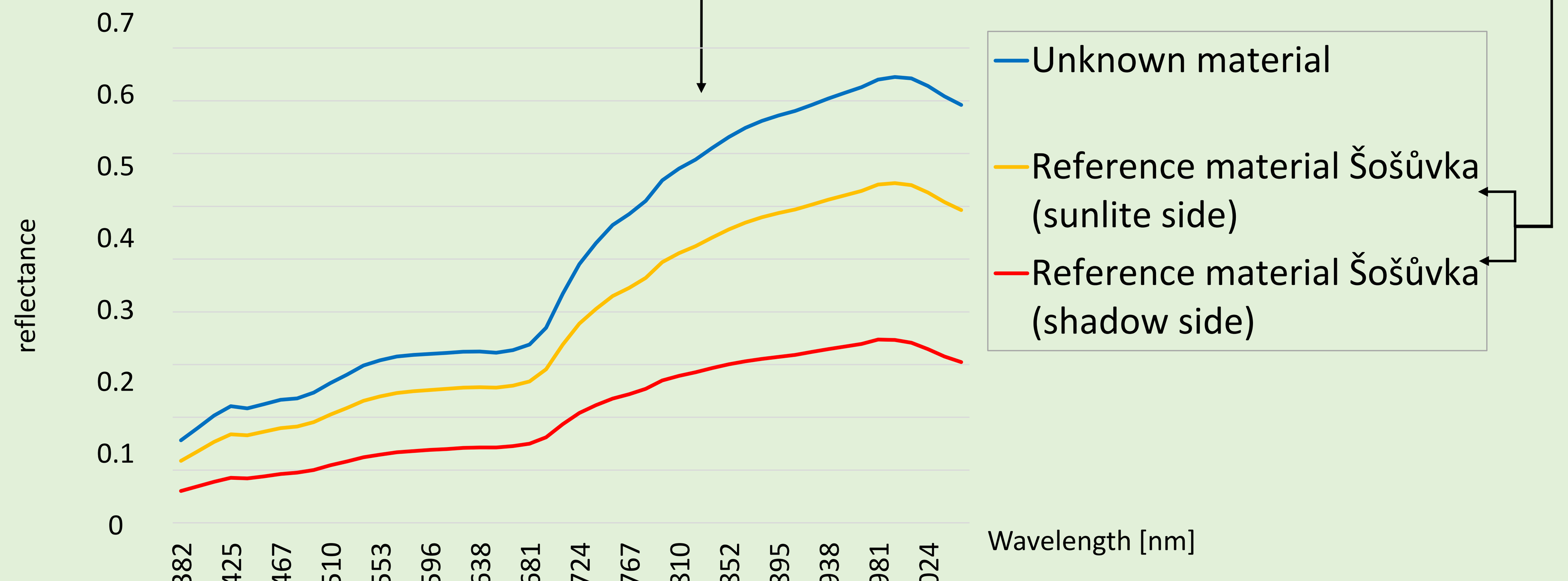
Asbestos-cement roof

Spectral Angle Mapper method



Asbestos-cement roof
Sheet metal roof white
Sheet metal roof grey
Ceramic tiles roof

Study site Šošůvka



Study results can be interesting for organizations involved in the improvement of settlements, in architectural planning and environmental protection. Potentially, results can help in planning to use modern insulation roof materials to contribute to adaptation/mitigation environmental programs.

References: Abós-Herràndiz, R. et al. Risk factors of mortality from all asbestos-related diseases: a competing risk analysis. 2017. Can Respir J.; 2017:9015914. doi: 10.1155/2017/9015914. **Furuya, S.** et al. 2018. Global asbestos disaster. Int J Environ Res Public Health. 15(5):1000. doi: 10.3390/ijerph15051000. **Janošíková, M.** et al. 2020. Occurrence of asbestos-related occupational diseases in the Czech Republic in the last 20 years. Cent Eur J Public Health; 28 (Suppl): S37–S42.