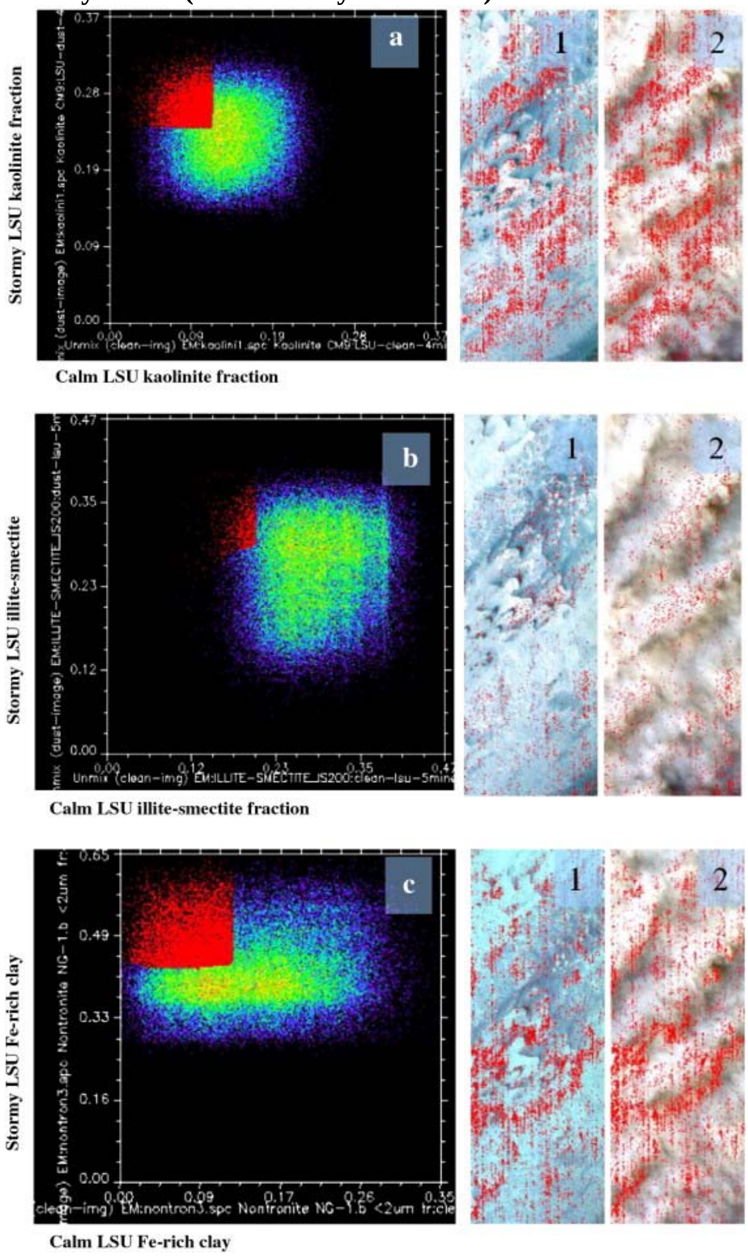
D AIR QUALITY AND OTHER NUISANCES

D1 – Aerosols - particle concentration in off-site air	
Aerosols, dust, in itself constitutes a nuisance or a health hazard, in particular if they contribute to high concentrations in in-house air, e.g. in worker dormitories. At the same time it can be an indicator of the quality of operational and residues management.	
Requirements	• Monitoring of selected aerosol types.
Variable(s) to be determined	• Concentration of aerosols • Distribution of aerosols • Size of aerosols • Chemical composition of aerosols
Data acquisition	
Source of information	Remote sensing data
Methods & Standards	• Existing standards consists in LIDAR uses [LCSQA04]. • Aerosols on the ground (submerging aerosols) can be collected using dust traps. Location of dust traps around the mine area should be considering population concentrations and wind directions. Dust from the traps can be analyzed for chemical composition using a high spectral resolution spectrometer (such as ASD Fieldspec pro) and X-Ray Diffraction (XRD) measurements. Calibrating the spectrometer data with the XRD data might allow using solely spectral measurements in the future (low cost and more accessible than XRD).
Suggested sensor systems	• LIDAR • ASD Fieldspec pro portable high resolution spectrometer. • X-Ray Diffraction (XRD) measurements.
Pre-processing & auxiliary data	• LIDAR and ASD measurements require pre-processing.
Caveats: • Distributing dust traps needs the cooperation of the civil population in the area of the mine. • XRF and ASD measurements require access to the site.	

Examples

Scatter plot of calm *vs*. stormy LSU classification shown as mineral contrast in both conditions. Left (a and b): Pixel per-pixel kaolinite fraction (a, upper) of a stormy state plotted vs. the same fraction in a calm state. Numerical ranges of these fractions barely overlap, indicating upstream origin of stormy kaolinite. Highlighted in red are pixels with low kaolinite content in the calm state image *and* high kaolinite content in stormy state. Right: "Red pixels" are overlaid on RGB of calm (1), and stormy day (2). Illite–smectite and Fe–Mg rich clay fractions for both states are presented in panels b and c, respectively. Remarkably, these pixels are faithful flow tracers. This is evidenced by the wavy jet-like morphology of the red pixels (kaolinite-deficient in clean state), whose axes are aligned with the north-easterly winds (Chudnovsky *et al*. 2011)



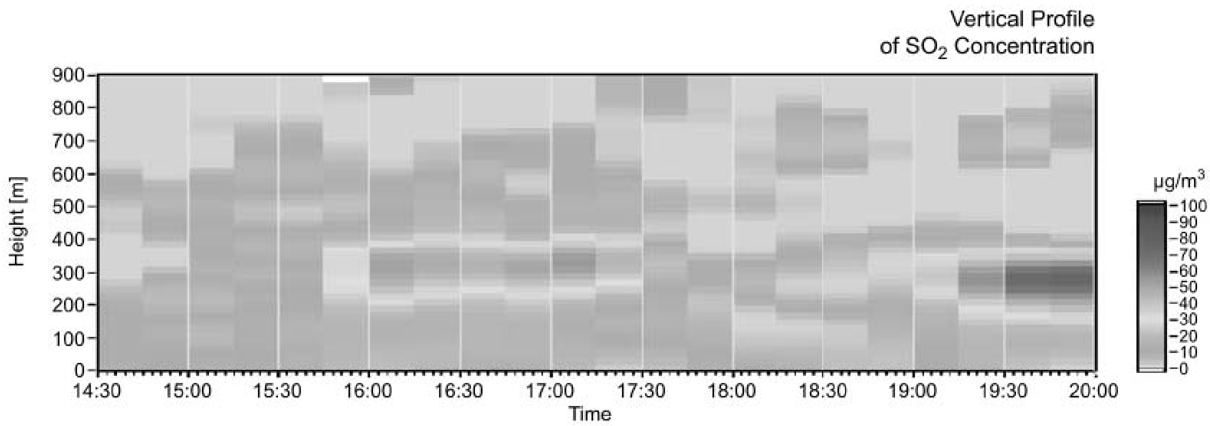
See also D2

D2 Volatiles - emission of gases from waste deposits (composition and

sources)	
Volatiles, including radionuclides, released can be a nuisance (odour), health hazard (e.g. carcinogenic) as well as a technical risk (e.g. if combustible). In addition, they can jeopardise re-cultivation, e.g. methane in the soil can suffocate plants.	
Requirements	• Mono- or multi-temporal mapping of gas emissions sites. • Multi-temporal monitoring of gases concentrations.
Variable(s) to be determined	• Concentration of gases. • Distribution of gases. • Chemical composition of gases.
Data acquisition	
Source of information	• Times series of remote sensing data. • Ground based measurements. • Information provided by local administrations and/or mining companies.
Methods & Standards	• Volatiles can be mapped using airborne or ground level high spectral resolution imaging spectroscopy, mainly in the mid-wave and long wave TIR region (3-5, 8-12 µm), and to some extent also in the VIS-NIR-SWIR regions (0.4-2.5 µm). Volatiles analysis in the VIS-NIR-SWIR regions is done on radiance level data. • Volatiles can also be mapped in a more precise and quantitative way using atmospheric LIDAR.
Suggested sensor systems	• *Large scale*: LIDAR systems. • *Small scale*: high spectral resolution thermal and optical data.
Pre-processing & auxiliary data	• For classification approaches atmospheric pre-processing might be necessary. • Using an automatic classification approach, information input for training the classifier and information for validation are needed. • Corrections of DEM with respect to water flows might be required.
Caveats: • Hyperspectral mapping: airborne volatiles distribution and concentration changes significantly according to mining activity and weather. Acquiring airborne hyperspectral imagery is costly and is done once or twice a year, thus does not necessarily represent the air quality conditions in the rest of the time. • LIDAR measurements are not well suited for large areas.	

Examples

Example of SO2 monitoring using a DIAL LIDAR © Meteorology and Atmospheric Physics, [Keder04].



D3 - Air-related health impacts

Incidence of health problems due to airborne pollutants.

Not accessible to EO-techniques

D4 - Air-related soil degradation – soil fertility loss due to particulates deposited

Soil fertility loss due to particulates deposited

Not directly accessible to EO-techniques. See A10: soil fertility can be assessed but not directly related to air pollution.

D5 - Noise from blasting and machinery - proximity and impact on settlements	
Proximity and impact on settlements.	
Requirements	• Settlement locations.
Variable(s) to be determined	• Origin and intensity of noise levels on a multi-temporal basis.
Data acquisition	
Source of information	• Local administration and/or mining companies' information about blasting dates/locations. • Local administration can provide settlement location.
Methods & Standards	• Microphone arrays can provide both nose level estimation and noise origin localisation (triangulation)
Suggested sensor systems	• Various consulting companies can provide expertise about noise estimation. • It is possible to perform theoretical computations, as long as location and type of mining activities are known.
Pre-processing & auxiliary data	**N/A**
Caveats: • It can be difficult to differentiate between mining-related and 'background' noise. • Noise propagation is dependent on wind.	
Example	

Road noise levels during daytime over London, source: British Department for Environment, food and Rural Affairs (DEFRA), http://services.defra.gov.uk/

D6 – Vibrations from blasting - proximity and impact on settlements, damage to houses and other risks
Proximity and impact on settlements, damage to houses and other risks.

Requirements	• Settlement & critical infrastructure locations.
Variable(s) to be determined	• Seismic waves due to blasting • Damage to houses
Data acquisition	
Source of information	• Certain consultancy companies specialise on the assessment of the impact and damages from mining operations. • Exploration companies that have seismic in their portfolio.
Methods & Standards	• Surface seismic techniques utilising single or arrays of geophones.
Suggested sensor systems	Geophones, seismographs, tentiometers
Pre-processing & auxiliary data	Vibration analysis has to be performed before extracting useful information.

Caveats:

- Needs to be deployed.
- House damages can hardly be monitored

Examples

Study of blasting impacts from Coal mines in Indiana, see [Siskind et al.,1989]