Stakeholder involvement in the development of EO-based Tools and Methods to assess Environmental and Societal Impacts of Mining

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Mining is not everything, but without mining, everything is nothing
Max Planck

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EO-MINERS is a Research and Technological Development project funded by the European Commission

- To help EC improve its raw material policy and better exploiting mineral resources from the European territory and its mineral supplying countries
- To demonstrate how to improve the capacity of Europe in implementing new mining sites
- To improve interaction between the mining industry and society
EO-MINERS overall objective

to bring into play EO-based methods and tools

- to facilitate and improve interaction between the mineral extractive industry and society
- for its sustainable development
- while improving its societal acceptability.

After Solar and Shields, 2011
Earth Observation (EO) offers a unique opportunity and varieties of methods to collect spatial information to monitor and assess each phase of the mining cycle:

- Spaceborne and airborne imagery
- Ground and airborne geophysics
- Geochemistry
- In situ measurements
- Monitoring networks
- 3D modelling
- …
Scientific objectives - 1

Assess **policy requirements** at macro (public) and micro (mining companies) levels

Define environmental, socio-economic, societal and sustainable development criteria and **indicators** to be possibly **dealt with EO**
Demonstrate the capabilities of integrated EO-based methods and tools in:

- Monitoring,
- Managing,
- Contributing to reducing the environmental and societal footprints of all phases of a mining project.

*Potential drainage contamination by AMD (ZA)*
Scientific objectives - 3

• Foster and develop a sound "trialogue" between industrialists, regulatory bodies and society

  – based on reliable and objective information about ecosystems, populations and societies affected by mining activities
# Who we are?

<table>
<thead>
<tr>
<th>Beneficiary name</th>
<th>Country</th>
<th>Beneficiary name</th>
<th>Country</th>
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<tr>
<td>(BRGM) Bureau de Recherches Géologiques et Minières</td>
<td>France Coordination</td>
<td>Council for Geoscience</td>
<td>South Africa</td>
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<tr>
<td>British Geological Survey</td>
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<td>Anglo Operations Limited, Anglo Technical Division</td>
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<td>Tel-Aviv University</td>
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<td>Université de Versailles – St Quentin</td>
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<td>Česká Geologická Služba</td>
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<td>Wuppertal Institut für Klima, Umwelt, Energie GmbH</td>
<td>Germany</td>
<td>Sokolovská Uhelná a.s.</td>
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<td>Mineral Industry Research Organisation</td>
<td>UK</td>
<td>KyrgyzAltyin</td>
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Sokolov lignite open pit – CZ
- AMD (Acid Mine Drainage)
- Impact on vegetation
- Coal fires
- Sediment (coal) Dust
- Landscape degradation

Makmal gold mine – KG
- Cyanide contamination
  - Surface waters
  - Groundwater?
- Radioactive contamination?
- Health
- Employment 70% depending on mine activity

Emalahleni (Witbank) coal field – ZA
- The largest coal field in ZA
  - More than 60 x 60 km
- AMD (Acid Mine Drainage) affecting
  - Drainage system and wetlands
  - Urban areas
- Coal fires
- Dust
- Subsidence
- Landvalue degradation
- Uncontrolled urban sprawling

Sokolov basin

Sokolov lignite open pit
- Impact on vegetation
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Knowledge on mining and contamination
Our general approach

- Stakeholder interviews
- On-site investigations
- Expert knowledge

Indicators
- Theme of indicators
  a. Land Use
  b. Mass flows
  c. Energy flows
  d. Air quality
  e. Noise levels
  f. Transport
  g. Governance
  h. Accidents
  i. Social impacts
  j. Regional development
  k. Economic vulnerability

EO methods and tools

Products

Trialogue workshops

Stakeholder feedback
Developing an indicator framework

- The development of meaningful indicators is a **social** and not an engineering process.
- The social process defines what to indicate for whom and why.
- We have to evaluate, whether a proposed indicator can be related to quantities measurable by EO.
- Therefore, the development of indicators is a process iterating between **stakeholder expectation** and operational feasibility.
Local stakeholder interviews

Interview of Chet Bulak village authorities, Kyrgyzstan
Stakeholder derived indicators

Themes covered by information requirements of local/regional stakeholders

- Land use
- Remediation / Status after mining
- Environment
- Materials
- Transport / Energy / Infrastructure

Czech Republic
South Africa
Local stakeholders most important issues (KG)

- Only indicators that could be measured using EO techniques have been retained for product development.
- The priority indicators vary from study site to study site.

Frequency of thematic areas (groups of indicators)

A: land use  
D: Air quality  
E: water quality  
F: transport  
G: geotech hazards  
I: social impact  
J: regional dvpt  
K: economical vulnerability

- Government
- Civil Society
- Industry
Product Development Plan Timeline

EO Data Acquisition

Conceptual site models

Indicators for each site

Parameters measurable with EO

EO Products

Stakeholder interaction

Project Resources
Product development matrix for each site as a decision tool, based on

- Stakeholder driven indicators
- Available EO data

Have we forgotten anything?

Have we fully included the requirements of triilogue participants?

Not all potential products can be developed, can we prioritise?

How will the products be formatted?

- what will they look like?
- what format(s) should we use?
- will they differ depending on stakeholder ability to deal with analogue/digital data?
EO Product Formats

• Paper maps and posters
• Digital maps in 2D and 3D (PDF) for use on a PC or even a mobile device e.g. iPAD
• Three dimensional models and animations
• GoogleEarth™ files

…available from www.eo-miners.eu
Interactive 2D PDFs (e.g. from Kyrgyzstan)
Modelling tailings dam leakage or failure

Makmal gold processing plant - Kyrgyzstan
Trialogue activities

- Reconciling interest of the three stakeholder groups
- Feedback on usefulness of products developed vs. stakeholder requirements

- “European trialogue” aiming at determining the way of presenting the project contribution to policy requirements
- “Site-specific trialogue”, describing the current situation specific for the particular site, including problem identification and the EO-MINERS product-type response.
Stakeholder Feedback: A summary

- Attractive tools that provide the information in an easy-to-use form
- Benefit of spatially continuous and repeated measurements
- Beyond the posters, the 3D presentation of EO Products was much appreciated
- The maps and data are able to help develop a common language and base of communication between otherwise separate stakeholders

Air quality products were of interest in South Africa, in particular the press distributed the results with enthusiasm (several local press articles)

→ could this product be extended to include medical recommendations?
A major challenge \(\Rightarrow\) Need for a neutral attitude

- Stakeholders with very different concerns vs. environmental and societal issues
  - Establishing confident relations with mining companies
    - Reluctance to deal with environmental and societal impacts
    - Reluctance to put data in the public domain
    - Do not like we work with other stakeholders
    - Working constraints (security, …)
      \(\Rightarrow\) Need for a better engagement of the mining industry
  - Get acquainted with local communities concerns and demands
    - Lack of information, rumours
    - Economical dependence (jobs, contribution to the community, infrastructure development, …)
    - Looking for compensations…
Conclusions

- EO tools and methods have been proven invaluable in producing indisputable documents for further use by stakeholders
  - Meeting information requirements
  - Reconciling interest in a dialogue among stakeholders
  - Improving of exchanges between the mineral industry and other stakeholders based on standardised, reliable and objective documents

- Towards the development of EO-based services
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