

Hyperspectral remote sensing in impact assesment and monitoring

- cost benefit considerations



Introduction

Limitations

Scenarios

Available systems

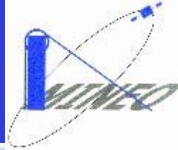
Survey costs

Conclusion

Tapani Tukiainen TT@GEUS.DK

Geological Survey of Denmark and Greenland GEUS





Introduction:

Research and development:

The use of advanced EO - techniques (airborne hyperspectral data) for assessment and monitoring the mining related environmental impacts demonstrated by MINEO and other research projects

Implementation and routine use of EO:

The generic image processing tools and spectral libraries from MINEO and similar projects soon available:

- reduced need for expensive research and development when processing and analysing data from airborne HS- surveys**

The use of advanced EO - techniques is expected to reduce the need and costs of the expensive field work and multielement geo- and biochemical surveys in the impact assessment and monitoring

Is Advanced EO-data (i.e. HS-data) available for routine impact assessment ?

Introduction

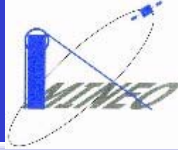
Limitations

Scenarios

Available systems

Survey costs

Conclusion



General limitations:

Optical sensors: The weather conditions must be perfect

Potential surveying season often short: (2-3) months

Satellite borne HS-data not available

Introduction

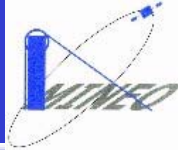
Limitations

Scenarios

Available systems

Survey costs

Conclusion



HS-data acquisition scenarios:

Those responsible for the assessment/monitoring work:

- has a special access to a HS scanner and/or aircraft
- acquire HS-data from 'group shoots'
- use contracted surveys

Introduction

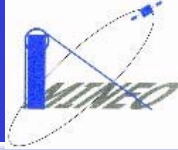
Limitations

Scenarios

Available systems

Survey costs

Conclusion



Available systems (450 - 2450 nm):

HyMap family of HS scanners:

Scanner # 1

DeBeers

Scanner # 2

ESSI

Scanner # 3

HyVista

Scanner # 4

HyVisa

AVIRIS

NASA/JPL

DAIS

DLR

HyperSpec TIR

SpecTIR

Introduction

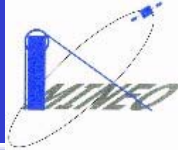
Limitations

Scenarios

Available systems

Survey costs

Conclusion



Survey costs/contracted surveys (HyMap - family):

Introduction

Limitations

Scenarios

Survey costs

Conclusion

Mobilisation/Demobilisation costs for the scanner and aircraft

10 000 - 20 000 USD

Rental rate for the scanner/data collection day

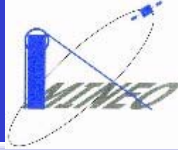
10 000 - 20 000 USD

Scanner stand by rate/day

5000 USD

Aircraft costs (airborne time)

700 - 900 USD/h



Introduction

Limitations

Scenarios

Survey costs

Conclusion

Survey costs/contracted surveys: coverage costs example:

150 knots (280 km/h) ground speed

20 % overlap

2000 metres of flying altitude

IFOV 5 metres

SWATH 2.5 kilometres

Full data collection day: max 5 flight hours

5 % of the flight time used for turns

Coverage/day: 2660 square kilometres

Aircraft costs: 5 x 800 USD/h

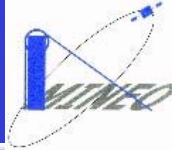
Scanner costs: 15 000 USD/Day

Daily costs: 19 000 USD = 7.14 USD/sq km

Mob/Demob 15 000 USD

Scanner standby 5 000 USD

Daily costs: 49 000 USD = 14.66 USD/sq km



Satelliteborne HS-data not available

Introduction

Only a few contractors with airborne HS systems of adequate quality (mainly HyMap - family of instruments)

Limitations

Scenarios

Adverse weather conditions may have a serious impact in the cost of the airborne HS surveys

Available systems

Survey costs

High initialisation costs of the contracted HS surveys > small surveys very expensive

Conclusion

At present the cost of airborne HS surveys using the HyMap family of instruments varies from 12 to 20 USD/sq. km

New HS-scanners covering the 450 - 2450 nm range entering the market - the spectral abilities of these instruments in operative/production environments remain to be demonstrated