Workshop conclusions

Ils Reusen and chairmen

5th EARSeL SIG IS workshop, 23-25 April 2007, Bruges

Session 1 Sensors and Missions I
Roland Meynart

- Papers presented on
  - New opportunities for space missions
    - Joint Hyper Mission (CDN-I, 2012?)
    - ALISEO (imaging interferometer on micro-sat)
  - Progress of airborne sensors
    - APEX (1st flight 2008, 1st flight campaign 2009)
    - ARES (delivery mid 2007, 1st flight campaign spring 2008)
    - Use of high-altitude aircraft (HALO, spring 2010 in Spain)
- All show promising the performances of new-generation instruments and missions, in addition to the upcoming ENMAP mission (2011).

Session 2/3 Market now and tomorrow/ Users vs providers: gap or match?
Carine Petit (1/2)

Where we are …

- IS instruments allow now to cover a wide range of spatial and temporal acquisition scales;
- Several hyperspectral satellites are expected by 2010 – 2012;
- Cheaper and more flexible UAV solutions are also emerging.

The market status and perspectives:

- Different surveys explored how to develop and organize the potential market of IS data and products;
- The commercial market is not well known. The demand seems to be extremely diverse and fragmented;
- Users/customers must be educated and trained;
- The technology is more and more used. Market forecasts are quite optimistic.

Session 2/3 Market now and tomorrow/ Users vs providers: gap or match?
Carine Petit (2/2)

From gap to match: what are the main challenges?

- Good ground segments are expected to satisfy the users in a short time after acquisition (i.e. Tb of new data every day!);
- High quality airborne data are needed to support satellite missions;
- Time series of hyperspectral data are expected by the users;
- The ideal product should be: robust, affordable, high-level, well-documented, information-oriented;
- Other important criteria for the users: good geo-referencing, S:N;
- Progress is needed in designing of standard products, processing of time series;
- Toolboxes for non-expert end users must be developed;
- Need of efficient distribution systems.

… the waking up process has started!

Session 4 Sensors and Missions II
Klaus Itten

- Piet de Moor (IMEC) described the development of a high-end CMOS active pixel sensor. Its striking feature is a line by line variable integration time.

- Francesco Dell' Endice (RSL) explained the development of the APEX Calibration Test Master software which serves in automising the calibration and characteri-sation process at the DLR-CHB.

Session 4 Sensors and Missions II cont.

- Eduardo de Miguel (INTA) gave an insight into commercially operating the AHS, the constant strive for good quality data and the improvement of performance after refurbishment by the manufacturer.

- A highlight of the session was Tim Maltus (U.of Edinburgh) presenting shocking evidence of an intercomparison of the

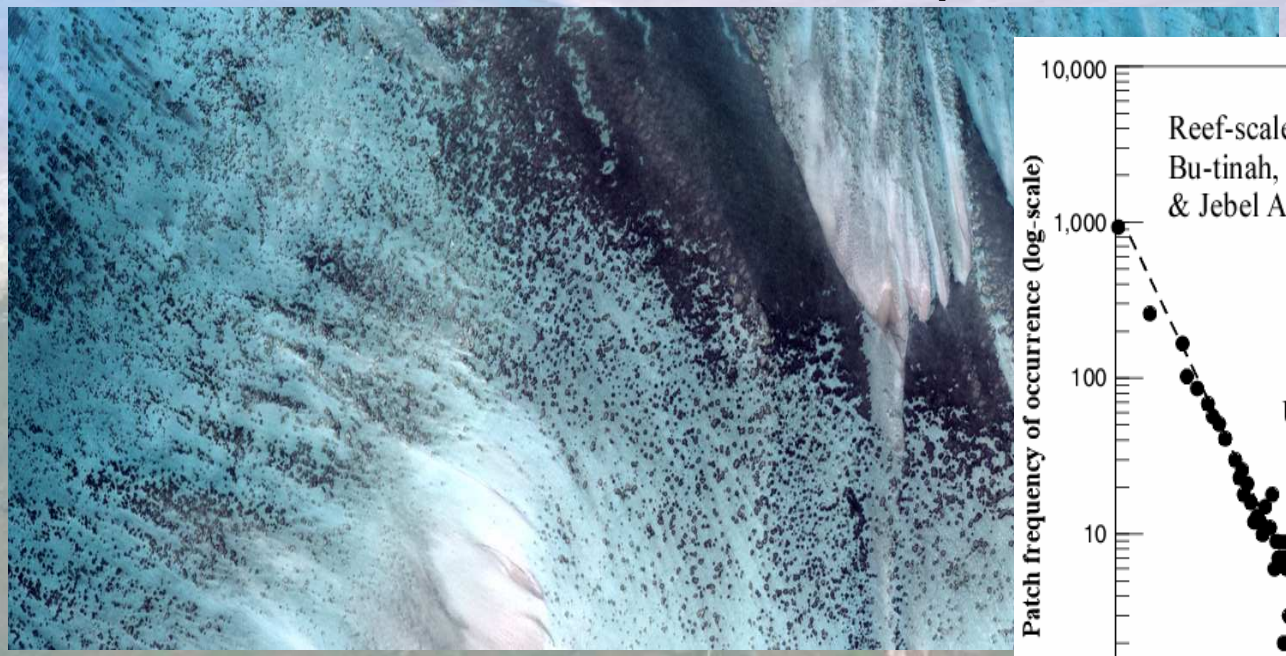
Session 4 Sensors and Missions II cont.

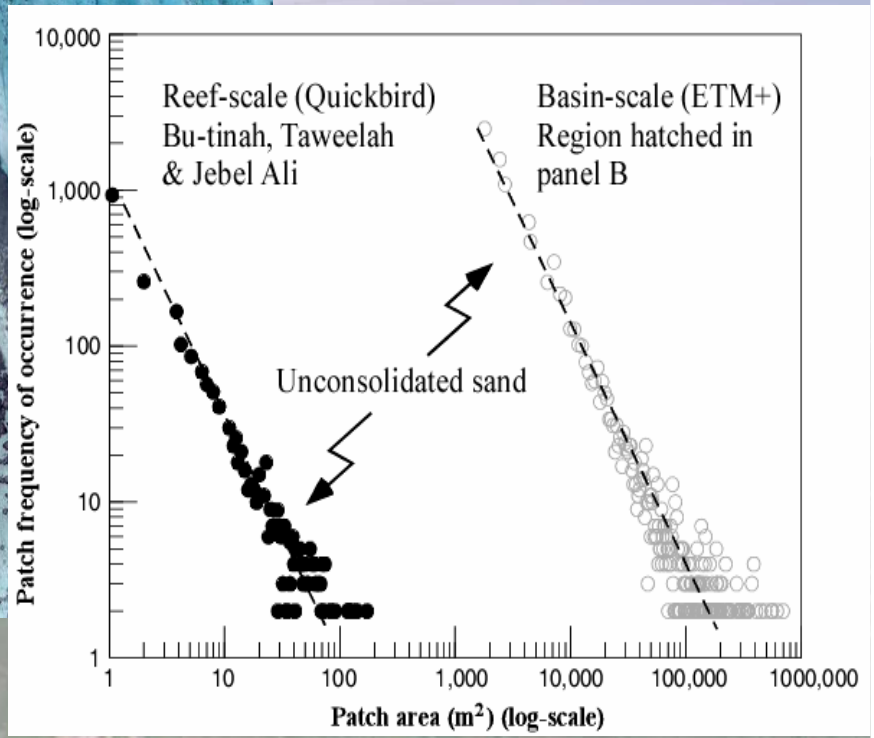
actual measuring fields of ASD's and the GER 3700. The community may have to adjust its measuring technique to over-come the totally undesirable situation.

- Koen Meuleman (VITO) presented 4 years of experience in carrying out hyperspectral flight campains in Belgium in preparation for the upcoming APEX system deployment from 2009 onwards

Session 5 Water and aquatic ecosystems
Rainer Reuter

- Structure of coral reefs (Sam Purkis)…..





Fractal size distribution of its elements

Scale-invariant (fractal) patterns in reef habitats indicates the possibility of extrapolating from large- to small-scales

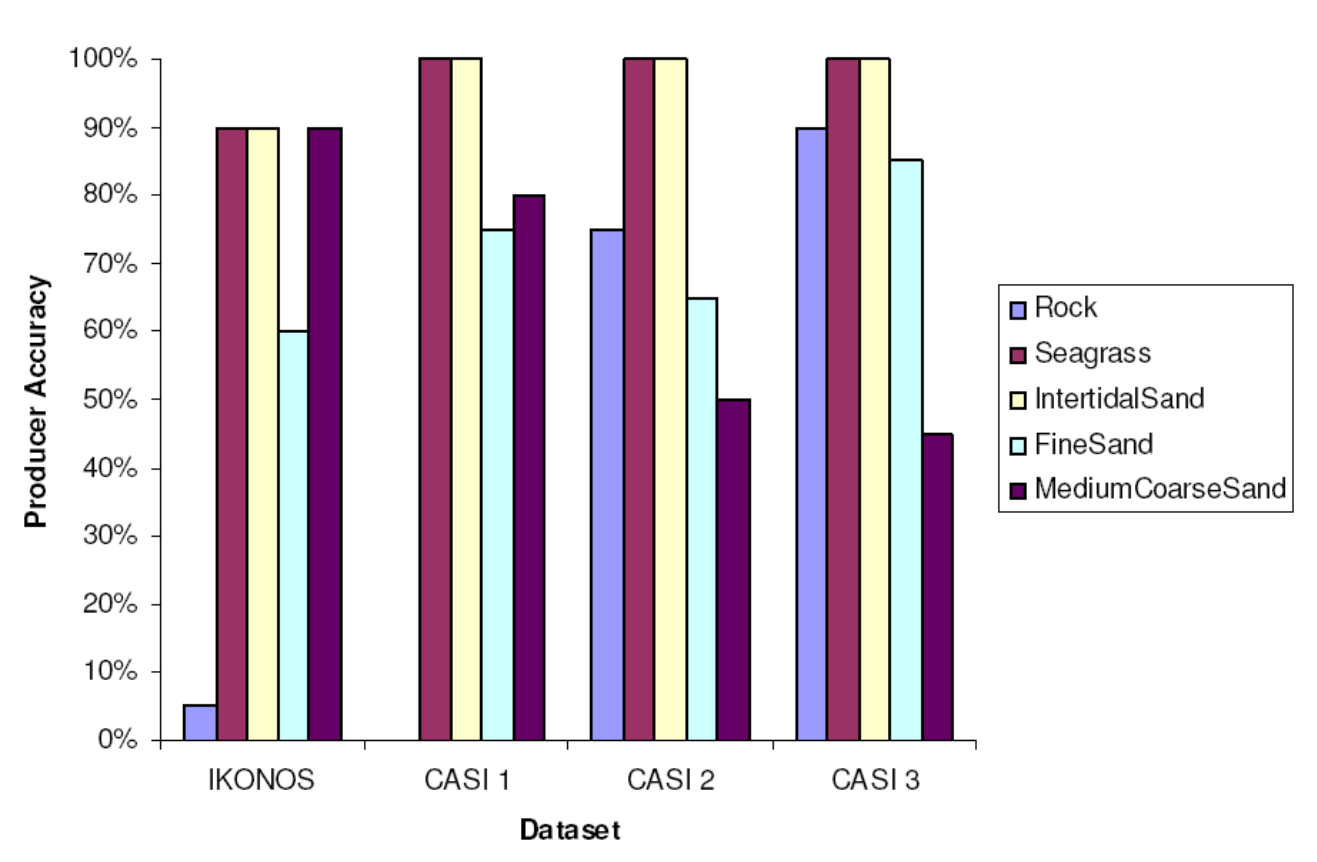
Session 5 Water and aquatic ecosystems

- …and their remote sensing (Roy Armstrong)

Classification:
- ✓ sand
- ✓ seagrass
- ✓ corals

Session 5 Water and aquatic ecosystems

- Improving accuracy with better spectral resolution (Tim Malthus)

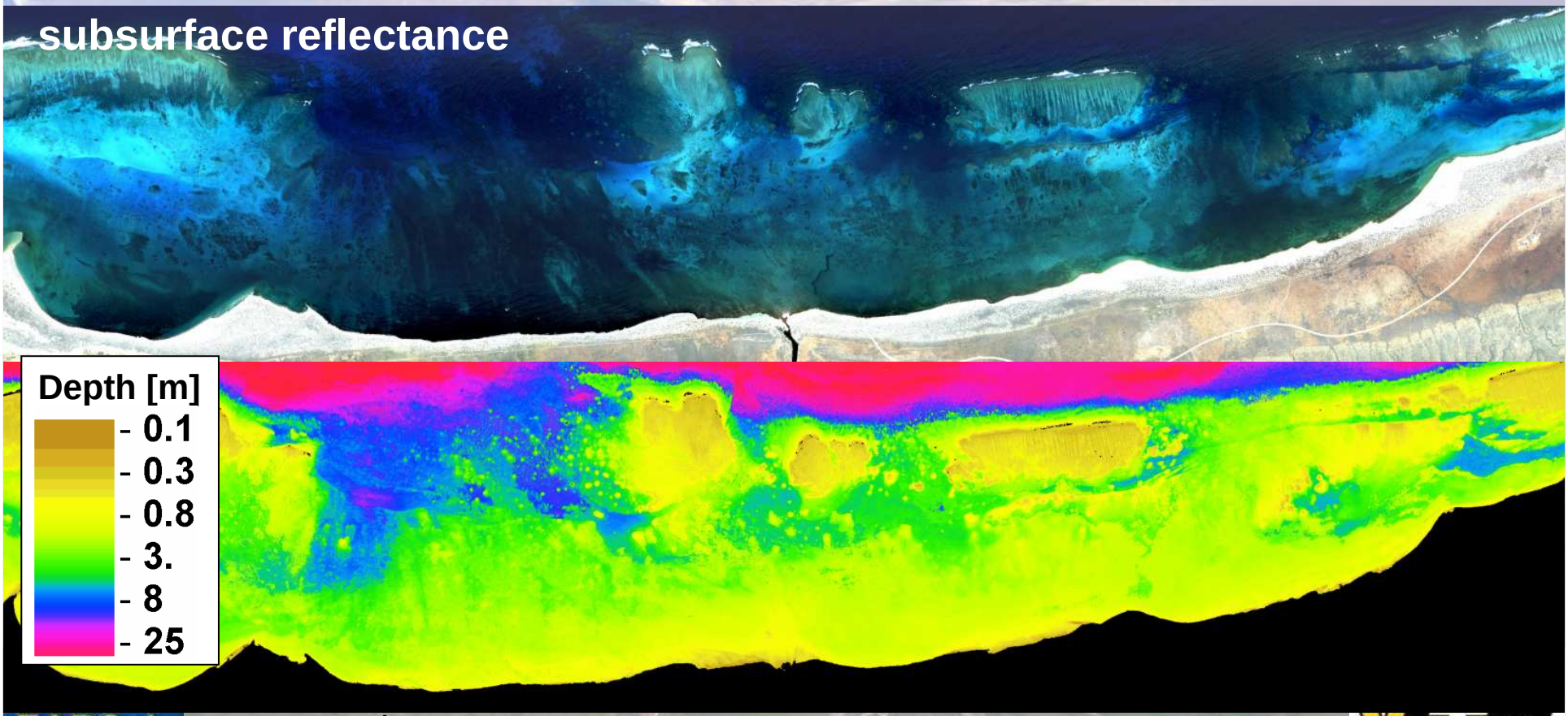


Classification:

- ✓ rock
- ✓ seagrass
- ✓ sand

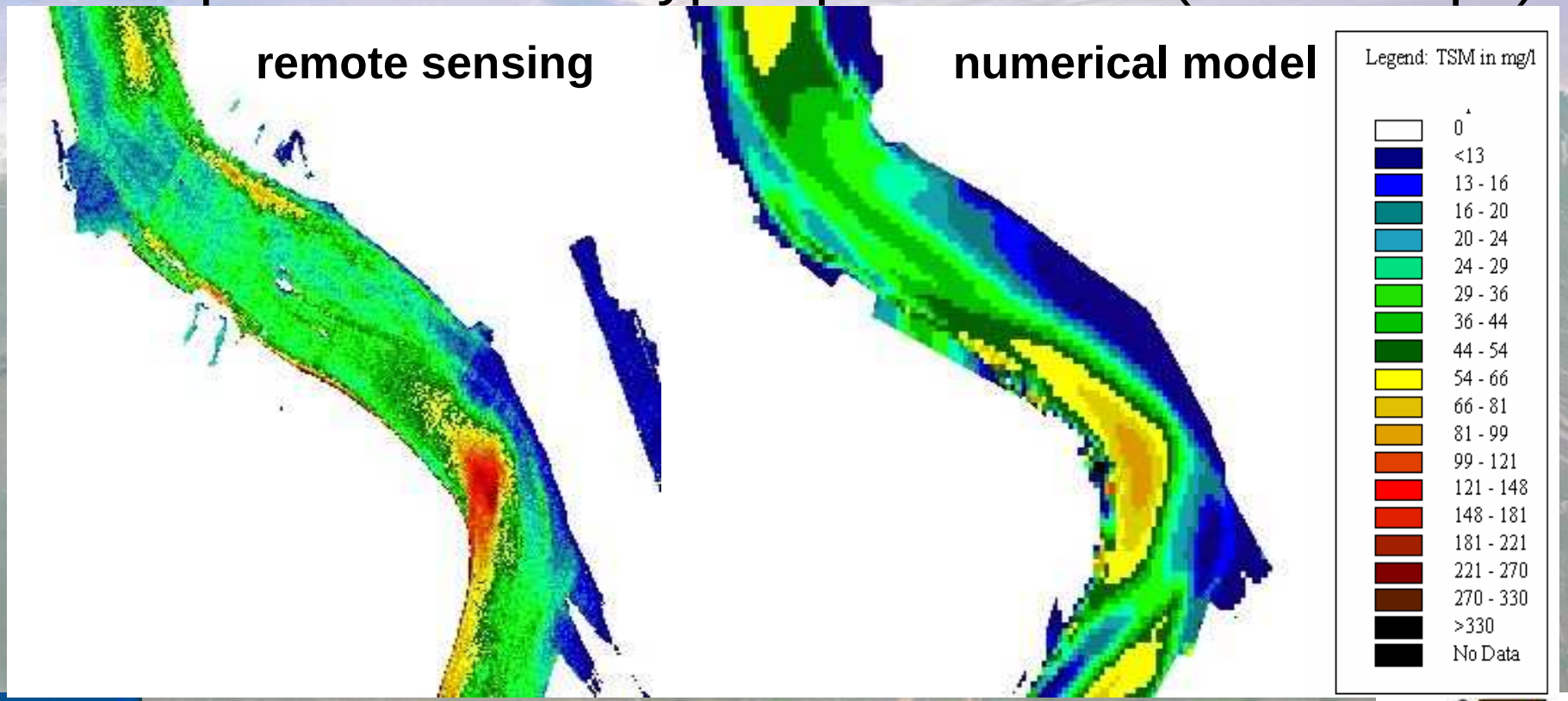
Session 5 Water and aquatic ecosystems

- Water depth is estimated
  from hyperspectral imagery (Thomas Heege) …



Session 5 Water and aquatic ecosystems

- … and Total Suspended Matter in turbid estuaries is quantified from hyperspectral data (Els Knaeps)



Session 5 Water and aquatic ecosystems

Hyperspectral measurements
have very much improved our view
on inland and coastal waters

Session 6 Terrestrial ecosystems I
Jan Clevers

Various applications of imaging spectroscopy illustrated:

- Estimating canopy water content using H_2O absorption features
- Detection iron stress (simple indices using H_2O abs. features)
- Detection stress due to water surplus (simple indices)
- Cellulose absorption (identifying dry vegetation)
- Lignin absorption (Eucalyptus pulp quality)
- Fluorescence estimation (still only at leaf level)
- Synergy with thermal infrared

Session 7 Geology, mineralogy and soil
Freek van der Meer

- Geologist are one of the first group to recognize the potential of hyperspectral remote sensing
- geologic hyperspectral remote sensing has developed ‘killer applications’ that resulted in operational use in mining and (though look warm) oil/gas exploration
- Successful use of RS requires sound geologic process (e.g., hydrothermal, coastal, erosion/degradation) knowledge
- Applications need to integrate various measurement techniques including hyperspectral data and other geophysical techniques

Session 7 Geology, mineralogy and soil
Freek van der Meer

- The presentations show a trend from measuring and seeing to monitoring and physics-based understanding of processes at the earth surface
- With earth science processes high at the political agenda (GEOSS, GMES; geohazards) it is time for the ‘giant to wake up’
- Bridging the gap between geology and the remote sensing community is more and more essential

Session 8 Terrestrial ecosystems II
Pablo Zarco-Tejada

- Progress is made on modeling the Photochemical Reflectance Index (PRI) on diurnal angular data. Implications for CHRIS-PROBA multiangular imagery were discussed (Verrelst).

- Coupling hyperspectral imagery with canopy modeling for biophysical parameter estimation was the focus of several contributions in the session:

  i) canopy structure retrievals on multiangular satellite data (Schlerf);

  ii) percent cover estimation in arid ecosystems with GeoSAIL (Hill);

  iii) developing a robust canopy-model inversion method (CRASh) which enables prior information and sensitive vegetation index selection (Dorigo); and

  iv) modelling viewing geometry effects on airborne multi-angular airborne imagery for chlorophyll content estimation using turbid-medium and 3D model approach (Kempeneers).

Session 8 Terrestrial ecosystems II
Pablo Zarco-Tejada

- Optical properties of needles were measured, assessing differences between sun exposed and shaded proportions as function of age, showing higher transmittance and lower reflectance on shaded needles in the green and NIR regions (Homolova).

Session 9 Image processing
Andreas Mueller

- Effort is going in the automisation of preprocessing of hyperspectral data
  - To reduce time and cost
  - To assure consistency and quality of processing
- Modular approaches are chosen to increase flexibility of the processing chain
- Geocoding and atmospheric processing in one go will eliminate resampling effects
- Consider BRDF effects in the preprocessing to get nadir normalised (or hemispherical) reflectance

Session 10 Image analysis methods I
Allan Nielsen

- Bi-directional effects' influence on SAM and SMA
- Optimization methods from scientific computing
- Methods from multivariate statistics
- Methods from machine learning and statistical learning
- Combination with 'classical' HSI methods

Session 11 Terrestrial ecosystems III
Steven de Jong

- Issues of scale were addressed in 2 presentations: what optimal spatial/spectral combination should one use for mapping LAI, biomass and peatland (CH4-emission)? Given examples showed very different spatial support sizes and spectral bands selected.
- Segmentation/aggregation of imagery makes sense.
- Issues of scale/band combination require further attention and study.
- A promising method to determine the degree of humification of peat using IS was presented: the next killer application?
- A near-operational method for urban biotope monitoring using IS and Fuzzy logics was presented for Dresden: another killer application of IS?

Session 12 Image analysis methods II
Alex Held

- Session focused on synergies between imaging spectroscopy and other technologies (e.g SAR), development of spectral databases, and use in atmospheric applications.
  - The use of ECognition and LASSO approaches for use in Biomass and LAI mapping is showing good promise in standardising this methodology
  - Features of the SPECCHIO Spectral Database will provide a unique tool for documenting and consolidation numerous spectral databases

Session 12 Image analysis methods II (cont.) Alex Held

- The powerful complimentarily of Imaging spectroscopy and SAR was demonstrated, and this talk showed improved classification accuracies when adequately applied.
- Importance on accurate aerosol optical properties retrieval for radiative forcing and pollution assessments was demonstrated in the following two talks. Imaging spectroscopy shows significant promise in this application.