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Applications of remote sensing in geology. Preface

Staring Symposium
Enschede, 24 October 1996

The 1996 'Staring Symposium' on 'Applications of remote sensing in geology' was held on 24 October 1996 at the International Institute for Aerospace Survey and Earth Sciences (ITC) in Enschede, the Netherlands. It was attended by more than 160 people. The organization was in the hands of Freek van der Meer, Salle Kroonenberg, Hans Roozekrans and Sandra Fraikin on behalf of the Royal Geological and Mining Society of the Netherlands (KNGMG) and the Netherlands Society for Earth Observation and Geoinformatics (NSEOG).

The articles presented in this special issue of *Geologie en Mijnbouw* highlight the results of the symposium. Although we do not pretend that all aspects of remote sensing in geology are covered in this special issue, we do feel that the articles give the reader an overview of geological remote sensing studies conducted within the Dutch scientific community within an international framework.

Remote sensing may be literally translated into 'observation of and/or gathering of information about a target by a device separated from it by some distance'. For most people, remote sensing is synonymous with the radar images that show areas of active showers during the daily weather forecast on television or with the synoptic views provided in various colours by the LANDSAT and SPOT sensors. Although satellites are important in remote sensing because they provide global coverage at a regular time interval, many systems are airborne (i.e. they use aircraft as platform) because this allows more detail and flexibility. For example, an airplane can be operational only a few hours after an alarming situation occurs while overpasses of a pre-programmed satellite in orbit may take days or even weeks.

In the Staring Symposium and this resulting special issue, aspects related to satellite as well as airborne remote sensing are discussed with respect to geological applications. The articles cover a suite of sensors sampling different portions of the electromagnetic wavelength spectrum. There are sensors that operate in the visible to shortwave infrared, those using the thermal, and those using the microwave range.

The first contribution by Reeves puts remote sensing into the perspective of geological mapping and exploration through integration and interpretation of the various layers of information that we are confronted with. Zhang, Cassels and Van Genderen subsequently present a system based on the integration of various remotely sensed data types, used for the detection and monitoring of underground coal fires in China. In this case-study, 200 million tons of coal are reported to burn annually due to spontaneous combustion, an annual economic loss of 100 billion guilders and a 2 to 3% contribution to the global CO_2 production. The paper by Seijmonsbergen is an application of satellite remote sensing for structural geological mapping in Bangladesh, a country affected by many catastrophic flooding events. The author relates recent fault patterns to shifts in river courses that result in local inundations. Hyperspectral remote sensing, i.e. sensors that cover the electromagnetic spectrum in many narrow bands to produce pixel reflectance spectra that can be directly related to similar signatures measured in the field or laboratory, is the topic addressed by Van der Meer. It is demonstrated that the spectral resolution makes detailed surface mineralogy mapping and ultimately lithological mapping from space possible. An application toward mapping hydrothermal alteration systems for gold exploration is used as an example of the potential of this technology. Tromp and Epema exploit LANDSAT images from Burkina Faso to derive estimates of the fractions of various surface constituents on a sub-pixel basis through a novel image processing known as spectral unmixing. These estimates are further used within a geographic information system to quantify soil degradation. The phase differences in the signal of two subsequent radar images separated hours or days in time can be exploited to calculate earth surface deformation in the order of millimeters. This technique, known as interferometry, is the topic of the article by Klees and Massonnet. Several examples of the use of interferometry are treated such

as measuring displacement along active faults, detecting changes in the shape of volcanoes which are possible precursors of eruptions, and monitoring of the movement of glaciers. The last article in this special issue by Van der Kruk, Slob and Fokkema provides a review of theory and applications of georadar for the characterization of the shallow subsurface. Examples from civil engineering and environmental geology provide a perspective of the use of georadar in the Quaternary geological setting of the Netherlands.

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