



# **GeoScience-Laboratory Activity Report 2010**

J.B. de Smeth, Head GS-Lab.  
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### 1. Introduction

The function of the GeoScience Laboratory is to facilitate within the ITC faculty:

- Regular Post Graduate, PM and MSc. practical training in the education modules.
- Research by MSc students, PhD-candidates and ITC staff members.
- Maintenance and facilitating the use of IR- field spectrometers and cameras.

The laboratory facilities are situated on the ground floor in the ITC building.

The purpose of this report is to provide information on the kind of activities which took place in 2010 in the spectrometric, geochemical and soil analysis facilities which together comprise ITC's GeoScience Laboratory. Similar reports of earlier years can be found on [http://www.itc.nl/geoscience\\_laboratory](http://www.itc.nl/geoscience_laboratory) . The GS-Lab facilities are used all through the year but most intensively months of September till December for research and education. The laboratory operates under ITC's Bureau Research Coordination (BRC) headed by Dr. P. van Dijk .

### 2. Activities, description

#### Yearly recurring activities:

The regular activities related to educational programs consisted of:

- Introduction visits including brief instrument demonstrations for NRM, WREM and AES students to the laboratory facilities as well as the spectrometric lab.
- Training of AES- Earth Resource Exploration stream students in geochemical mineral exploration techniques.
- Training of students as part of the Hydrologic and Environmental Modeling from the WRES Dept. The students mainly analysed water sample from the Driense Beek for water quality analysis; major anions by spectrometry, pH, electric conductivity (EC) and major cations by ICP-OES and Flame-AAS.



Fig.No.1: AES students from the Geo-Hazards stream test a field method to determine soil permeability as part of their training in erosion monitoring and modeling



Fig. No.2 : Mr. Marinus Dalm from Delft University measures together with Dr. F. v. Ruitenbeek using the ASD IR spectrometer on Cu ore boulder samples from Chili

Aside of these regular teaching activities, the following research related activities took place:

**Staff and PhD candidate research:**

A number of ITC-staff members and PhD researchers from the ESA, NRS, WRS and EOS departments are using lab facilities for activities ranging from very simple sample treatment procedures to complicated tests and analytical procedures. Others take instruments, mainly ASD, MIDAC, SPAD and Li-Cor for fieldwork in the Netherlands and far abroad. In section 4c staff members are listed who can be consulted about specific instruments.



Fig. No.3: Professor F. van der Meer and Mr. Ullah Saleem trying out the Midac FTIR spectrometer under field conditions



Fig. No.4: Mr. E. Westinga and Mr. W. Nieuwenhuis testing the ASD before taking it to the Waddensea area in the Netherlands

The following PhD candidates used the GS-Laboratory facilities in Enschede and also used ITC's spectrometers etc. outside the ITC building or far abroad:

1. Ms. Sabrina Carvalho, NRS Dept. used ASD field spectrometer in the lab and Wageningen. She obtained the 2010 Alexander Goetz Instrument Support Program Award. She was invited for the ASD training program in Boulder Colorado in February and received an ASD spectrometer on loan for three months for her research from the ASD company.
2. Ms. Mila Luleva, ESA Dept.
3. Thi Tam Nguyen, ESA Dept.
4. Mr. Paresh Rathod, ESA Dept.
5. Mr. Anaz Fauzi, NRS Dept.
6. Ms. Thi Hay Van Nguyen ESA Dept.
7. Mr. Ullah Saleem, NRS Dept.
8. Ms Shruthi Shruthi, ESA Dept.
9. Mr. Zaini Nashrullah ESA Dept.
10. Ms. Sharon Cundhill ESA Dept.
11. Ms. Yitagesu Fekerte ESA Dept.
12. Mr. Hassan Tanvir WRS Dept.
13. Mr. Alain Frances WRS Dept.
14. Mr. Chris Hecker ESA Dept.
15. Ms. Nicky Knox, NRS Dept.
16. Tanvir Hassan WRS Dept.

Other PhD candidates only borrowed GS spectrometers or other equipment from the spectrometric section for measurements abroad

1. Mr. Mustafa Yaseen, ESA Dept.
2. Ms. Coco Rulinda EOS Dept.
3. Mr. Chimiri Chandra Prasad NRS Dept.

There were probably a few more PhD candidates and/or AIO's active with GS-lab equipment but this consisted of work fully outside ITC in the Netherlands or abroad.



Fig. No.5: Mr. Paresh Rathod investigates polluted soils collected from a mining area near Freiburg, Germany



Fig No. 6: Mr. Ullah Saleem continued his research of plant reflection in near and thermal IR rang



Fig.No.7 Mr. Zaini Nashrullah started his research using the ASD spectrometer here under supervision of Mr. Chris Hecker and help from Ms. Mila Lluleva



Fig. No.8 : Ms. Mila Luleva determining Na, K, Mg and Ca in her erosion soil samples from Limburg, the Netherlands with the ICP-OES

### **MSc. research related users:**

At least 15 MSc. student of the 2008/2010 courses worked in the laboratory for their MSc. research or came for advice and field sampling equipment. Their MSc. theses can be found on line via the ITC library <http://adlib.itc.nl/search.aspx>

### **MSc students of 2008/2010 Courses**

- Gezahegn Deme WREM
- Cesar Cisneros WREM
- Collen Mustasa
- Amha Gessesse Bezabih WREM
- Solomon Gebretsadik Kelelom WREM
- Leonila Sikat WREM
- Andi Muhammad Ibrahim Moetasim NRM
- Bana Mediatrice Rwamukwaya NRM
- Upama Koju NRM
- Wycliffe Tumwesigye NRM
- Damayanti Sarodja NRM
- Didier Milindi Rugema LA
- Pooyan Rahimy ESA
- Ferede Chumburo Gobena ESA
- Ayomiposi Grace Oluwadebi ESA
- Tanvir Hassan WRS



Fig.No.9: Mr. Gesesse and Mr. Cisneros determine the clay fraction in Lake Navaisha soils from Kenya



Fig.No.10: Mr. Deme, Mr. Cisneros and Mr Mustasa... measuring hydraulic conductivity on undisturbed soil samples from Salamanca, Spain

Fig. No. 11: Mr. Mustasa determining the dew point potential of his soil samples using the WRS Decagon instrument





Fig.No. 12: Mr Ferede Chumburo preparing his stream sediment samples from Ethiopia for trace element analysis



Fig. No.13: Ms. Grace Oluwadebi and Mr. Chumburo measuring IR spectra on their soil and rock samples from Ethiopia



Fig. No.14: Mr. Wyclife (NRS) preparing his soil samples for carbon determination by ashing



Fig. No. 15: Ms. Upama (NRS) using the Walkley Black soil organic carbon determination method



Fig. No.16: Ms. Bana Rwamukwaya (NRS) preparing soil samples for Carbon analysis



Fig. No.17: Mr. Andy Moutasim sieving his Crete beach samples of sea turtle nesting beaches

#### **Post Graduate Diploma courses related activities:**

Aside from the regular training for PGD and MSc students as part of the teaching modules in the WREM, AES and NRS programs, one final PGD project in the AES (ERE stream) was undertaken in the laboratory.

Three AES-ERE students reinterpreted the geochemical field laboratory results of all 1500 stream sediment and analytical results collected in the years 1993-1999 in the Moura area, Alentejo Province, South Portugal. Based on of their interpretation and recommendations two sets of stream sediments around a Cu-anomaly, Corrigeira were analysed, using an Aqua Regia decomposition and subsequent ICP-OES analysis for 14 elements.

#### **Visitors:**

Several foreign delegations (Iraq, India and China), Dutch visitors as well as staff and students of Wageningen and Utrecht University visited the laboratory as part of their tour through the ITC building and its research facilities. Such a tour is also incorporated in the introduction tour of new ITC-staff through the ITC building. Special visitor was Prof. Dr. Eric Pirard mineralogist from Louvain University in Belgium who also gave a talk for AES students and ESA staff.

Dr. Graham Ferrier, spectral geologist from Hull University, U.K., came to measure and compare FTIR results in his collaboration with Mr. C. Hecker, see picture No.19.



Fig. No. 18: AES Geological & Environmental Engineering stream student receiving practical training in water sampling procedures behind the UT Campus



Fig. No. 19: AES-Earth Resources Exploration stream students weighing soil samples for acid decomposition and trace element analysis on ICP-OES



Fig.No.17: Visit of Dr. Graham Ferrier testing rock samples together with Mr. Chris Hecker on the Bruker Vertex 70 FTIR spectrometer with the Optosol external integrating sphere.

### 3. Laboratory activities and instrumentation

#### Instrumentation:

Spectrometric Section, room 0-034 and 36

The inventory of the spectrometer section remained unchanged, see table 1. As in previous years the ASD IR-field-spectrometers were most in demand. This frequent use resulted in frequent little repairs which were solved within ITC and in one major breakdown which required repair by the manufacturer in the USA.

	Instrument	No. of Staff Users	No. of PhD Candidate Users	User demand in 2010
1	ASD Field spectrometer 2x	7	7	v. high
2	Li-Cor LAI-2000 2x	2	4	medium
3	NEC Thermo tracer camera	2	1	low
4	Minolta spad 502 2x	0	2	low
5	GER 3700 spectrometer	1	0	low
6	PIMA portable spectrometer	1	1	low
7	Bruker Vertex 70 FTIR lab.spectrom	2	4	medium
8	Trac TRAC	0	1	v. high
9	Midac FTIR Field spectrometer	1	2	low

Table No. 1: Spectrometric section instrumentation



Fig. No.18: All ITC spectrometers together!

#### Geochemical and Soil analysis section, rooms 0-060 till 0-070

In the geochemical section in room 0-062 one major instrument change occurred as the national research laboratories of TNO (former NITG lab. in Utrecht) donated two Atomic Absorption instruments to the lab. Both are Varian 220 double beam AAS models, one equipped with a graphite furnace AAS and one as flame AAS with as possible addition a

hydride generation option. This type is a double beam AAS with a four lamp turret. There were problems in getting the flame AAS operational. The accompanying computers with the operating Varian software were found to be obsolete and not working. The replacing computer had to operate under Windows95 which caused some interface problems with the instrument. There were also burner alignment problems and an air acetylene burner was missing. By the end of the year these problems were overcome and the Flame AAS instrument can now be used for student training and as a back-up for the ICP-OES. The graphite furnace AAS has not been made operational for technical and logistical reasons.



Fig.No.19: The Varian Flame AAS now operational in the GS-lab.

At the request of Mr. Samuel Tettey Banfro, NRS MSc. student, the old ITC PerkinElmer flame AAS was donated to the Soil Research Institute in Accra, Ghana. Dr. Enoch Boateng of this institute made an official request for this donation which was accepted by ITC Management. The instrument was shipped to Accra together with all PerkinElmer Hollow Cathode Lamps and accessories and is now operational in the Soil Research Institute, see picture below.



Fig.No.20: ITC's PerkinElmer flame AAS now is in operation in the Soil Research Institute in Accra, Ghana

### **Instrument reservations:**

In 2010 there were again several double reservation requests for the field spectrometers. Most of these “clashes” could be solved by careful planning. The reservation system for laboratory equipment can be reached via:

<https://helpdesk.itc.n> <https://helpdesk.itc.nl/tas/secure/main?windowid=371/> Logging in is not required when working within ITC.

Staff and students are requested to timely make their reservations through this system or contact Mr. H. Wilbrink in room 0-011

## **4. Staffing**

The permanent laboratory staff consists of B. de Smeth, 0.5 fte, as Head of the GS-lab and H. Wilbrink, 0.8 fte.

a) Mr. B. de Smeth manages all planning and operational aspects of the laboratory. He is the first person to contact for all matters related to the laboratory facilities for geochemical and soil analysis.



Fig.No.21: The University Twente News interviewed the Head of Laboratory on 21<sup>st</sup> of October

b) Mr. H Wilbrink runs the daily technical matters on equipment in the laboratory rooms 0-034 and 0-36 including the maintenance of the field spectrometers and cameras prior and upon return from fieldwork. He also provides technical assistance to staff and students using the four field spectrometers, special cameras and other special field equipment. In February he attended a practical workshop in ASD field spectrometer training in Boulder, Colorado, USA.

Mr. Wilbrink also runs an efficient reservation system Topdesk via <https://helpdesk.itc.nl/> This system is accessible to all staff and students and demonstrates the high demand for certain instruments.

Fig.No. 22: Mr. H. Wilbrink optimizing the MIDAC FTIR field spectrometer



c) Scientific support for certain instruments is given when required by specific staff members. This is an informal arrangement for functional instrumentation managers. Their activities consist of:

- Explanation and demonstration to staff and students of possibilities and use of specific instrumentation in the lab or in the field.
- Assistance in the use of software for data processing of measurements on specific instruments
- Support to the technical staff in case of instrumentation or calibration problems

<b>Instrument</b>	<b>Name ITC Staff Member</b>	<b>Dept.</b>
Water Quality analysis, anion analysis	C. Mannaerts	WRS
Hydraulic conductivity analysis	A. Frances	WRS
Bruker Vertex FTIR spectrometer	C. Hecker	ESA
GER field spectrometer	H. van der Werff	ESA
PIMA, mineral analyser	F. van Ruitenbeek	ESA
ASD field spectrometers	C. Hecker and others	ESA
ICP-OES and Flame AAS, cation analysis	B. de Smeth	ESA
MIDAC FTIR field spectrometer	M. Schlerf	NRS

## Het Apparaat (9) • FTIR-veldspectrometer

Tekst en beeld: Gijs van Ouwkerk - [gijs@gijsvofoto.nl](mailto:gijs@gijsvofoto.nl)

Een belangrijk deel van het onderzoek aan de faculteit ITC is het meten van processen aan het aardoppervlak door middel van satellietobservatie. Temperatuurveranderingen in tijd en plaats geven bijvoorbeeld inzicht in de fotosynthese, 'transpiratie' en groei van planten. Satellieten kunnen echter niet de ware temperatuur van het aardoppervlak meten, maar slechts de stralingswarmte. Dankzij de FTIR-veldspectrometer, een mobiel meetinstrument voor thermische straling, kan de ware temperatuur wel worden berekend. De schakel tussen de ware

temperatuur en de stralingswarmte is namelijk de emissiecoëfficiënt van het object (bijvoorbeeld een plant of gesteente). De FTIR-veldspectrometer meet niet slechts een enkele emissiecoëfficiënt van het object, maar het verloop van deze coëfficiënt als functie van de golflengte van de infraroodstraling. De grafiek die zo ontstaat, heet een emissiespectrogram en is een unieke vingerafdruk van het materiaal. Met behulp van dit spectrogram is het materiaal identificeerbaar en is bovendien de ware temperatuur vanuit de ruimte te

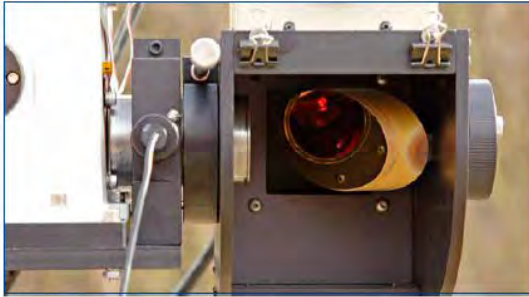
berekenen. Het nauwkeurig kunnen interpreteren van satellietdata is relevant voor meerdere onderzoeksgroepen binnen het ITC. De speciale aanpassingen voor deze FTIR-veldspectrometer werden dan ook ontworpen door medewerkers van de vakgroepen *Natural Resources*, *Earth Systems Analysis* en *Water Resources* (van respectievelijk de hoogleraren Andrew Skidmore, Freek van der Meer en Bob Su). De vakgroepleden Martin Schlerf, Chris Hecker, Joris Timmermans, Henk Wilbrink en Boudewijn de Smeth combineerden een

commercieel verkrijgbare spectrometer met zelfontworpen optiek, kalibratie- en positioneringssystemen en analysesoftware. Onderzoekers kunnen het apparaat sneller en nauwkeuriger kalibreren dan spectrometriestystemen die kant en klaar te koop zijn. De draaibare spiegel (detailfoto) stelt het instrument bovendien in staat om objecten onder meerdere hoeken te meten. Een laserpointer helpt bij het richten op het onderwerp. De aanduiding FTIR, die staat voor *Fourier Transform Infrared*, heeft betrekking op de manier waarop het spectrogram wordt afgeleid uit de elektromagnetische straling die het object uitzendt. De uiterst ruisarme detector van de spectrometer wordt gekoeld met vloeibare stikstof. De faculteit ITC kreeg het instrument en de ontworpen optiek eind augustus 2009 geleverd. Tijdens een promotieonderzoek naar het verband tussen de aanwezigheid van reptielen en (veranderingen in) oppervlaktetemperatuur in Spanje onderging het apparaat een eerste veldtest. Na uitvoerige verdere tests gaat het instrument deel uitmaken van het onderzoek van tenminste twee promovendi en hun afstudeerders. Zo



komt onder andere het vochtverlies bij planten ten gevolge van temperatuurverschillen aan bod. Een andere nuttige toepassing van de FTIR-veldspectrometer is het verzamelen

van emissiespectrogrammen ('vingerafdrukken') van allerlei plant- en steensoorten. Zo kunnen zij in de toekomst eenvoudiger vanuit de ruimte worden geïdentificeerd.



### SERIE OVER HIGHTECH

Deze serie over hightechapparatuur is bedoeld om lezers wat meer inzicht te geven in de wonderde, voor velen mysterieuze, wereld van het wetenschappelijk onderzoek op de UT. Vorig jaar verschenen zes afleveringen. Zie het online-archief van UT-Nieuws ([www.utnieuws.utwente.nl](http://www.utnieuws.utwente.nl)).

**ITC - BEZOEK.** Medewerkers van de faculteit ITC kregen woensdag een rondleiding over de campus. Want hoewel zij sinds 1 januari 2010 officieel



### Symposium

Tijdens de Batavierenrace houdt de UT zaterdag 24 april (Spiegel, van 12.00 tot 15.00 uur) een symposium getiteld 'Duurzaam...

Fig. No. 23: The University Twente News ran an article on ITC's top of the range research instrument, the MIDAC, FTIR field spectrometer, here operated by Dr. Martin Schlerf, NRS Dept.



Fig. No. 24: Dr. Mannaerts experimenting how to demonstrate the salt dilution experiment for the determination of the flow capacity in a stream. This demonstration is set on video by Ms. C. Plomp with help of Mr. J. Duim for use in distance education.

## 5. External support & contacts

During the year contacts were maintained with:

- The geochemical groups of **Utrecht University / Deltares** (formerly partly NITG/TNO) at the Utrecht University campus headed by Dr. G. Klaver. Deltares donated two Varian Spectra 220 AA, a flame AAS and a graphite furnace AAS.
- The **Cultural Heritage Agency**. CHA borrowed a portable XRF and geochemist Dr. Bertil van Os to test this type of instrument during four days of AES program field training in the Harz mountains.
- The **University of Twente**, Dept. of Science and Technology (TNW) section CPM, infrared spectroscopy group of Dr. B. Mojet. and Dept. of Science and Technology (TNW) section IMS, XRD analysis, Dr. Ir. G. Koster
- The **Delft University of Technology** department of Applied Earth Sciences (former Mining Department)
- The geochemical laboratory of **Waterschap Regge and Dinkel** in Almelo.

## 6. Budget

The laboratory remained well within its operational budget except for one major repair on one of the ASD instruments which caused a 10% over expenditure of the budget

The GS-lab will run on a similar size budget in 2011.

## 7. Outlook for 2011

A year plan 2011 was submitted to Dr. P. van Dijk, the members of the Laboratory Steering Committee and ITC management in December 2011. The GS-Lab is trying to acquire a portable XRF instrument for chemical analysis of major and trace elements in soils and rocks.

J.B. de Smeth,

Head GS-Lab.

July 2011