

NUFU Water Sciences Technical Report No. 2

REGIONAL COURSE ON WATER QUALITY



Rolf D. Vogt, John Saka, & Per Aagaard

**26 May to 2 June 2008,
Chancellor College, Zomba, Malawi**

Main Facilitators
Maurice Monjerezi
With assistance from Samson Sajidu

The NUFU Project on Capacity Building in Water Sciences for Improved Assessment and Management of Water Resources, NUFUPRO-2007-10079, is a joint network research program of the University of Malawi, the University of Oslo, the University of Botswana and the University of Western Cape.

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Front page photo:
Scene from the lecturing on soil – soilwater processes

Introduction

Water of sufficient quantity and potable quality is essential for the economic, mental and physical health of a population. In most developing countries, water that is available for human consumption comes from rivers, lakes and groundwater resources. Quality of the water is mainly affected by the chemical composition of the parent rock and human activities in the watershed, such as farming, extent of human settlement and the discharge of human effluents. Fundamental knowledge of techniques employed in water quality monitoring and assessment is thus indispensable in the sustained supply of good quality water.

The regional course provides participants with an opportunity to gain a fundamental understanding of fate and impact of chemical pollutants in the environment, enabling them to make an environmental risk assessment for water quality. Participants will be able to link ground- and surface water quality to natural factors, land use and specific anthropogenic sources in the watershed. Further, they will acquire advanced practical skills in water sampling, analysis and interpretation of data, including chemical speciation and modelling with PHREEQC computer programme.

Description of the Regional Course

This was a seven-day intensive regional course comprising 6 days of lectures and 1 day of field work. The course covered soil and water sampling techniques, integrated monitoring, sample preparation, sampling and strategy; catchment processes (silicate weathering and oxide or clay formation, kinetics of mineral water reactions, mineral water equilibrium, flow and transport, water pathways, particle transport); geochemical processes (role of natural organic matter, CO₂, carbonates and alkalinity, ion exchange and base saturation, soil charge (pzc), chemical sorption and hard/soft elements and redox processes; chemical analysis of water samples; quality control of chemical data; fractionation and speciation; stability diagrams; pollutants (heavy metals, inorganic pollution; pesticides, organic pollution; partitioning coefficients; organic matter, BOD, COD; pathogenic agents; salinization; acidification, radioactivity; introduction to PHREEQC and PHREEQC exercises. Course materials were sent to participants in advance for their preparation for the course.

During the last two days of lectures, participants were introduced to PHREEQC chemical speciation programme and were given a hands-on training in the use of PHREEQC through planned self-guided exercises. The last day of the course mainly consisted of a trip to the lower Shire region, Malawi, where participants had the opportunity to see the salinization and sodification problem and receive a hands-on experience in soil and water sampling techniques.

Upon completion of the course the students were handed a course certificate (Photo 2).

Target groups

The course was prepared for master and PhD students as well as junior scientists, primarily studying, working or conducting research in the field of water quality and who are interested to increase their knowledge about recent techniques in water quality assessment and monitoring. The activity was conducted in English. Some funds were available for

participants' travel and accommodation and subsistence in Zomba. There was no registration fee and no cost for course material.

Participants

An informative flyer was widely distributed to project member Universities in Botswana, Western Cape and Malawi as well as stakeholders in Malawi to inform potential participants the course offer (Appendix 2). A total of 16 applicants signed up for the course (Photo 1).



Photo 1

Group photo of participants, facilitators and lectures on the Regional Water Quality course.

The participants were from the member universities and the regional Malawian waterboard;

- Lilongwe Water Board (1)
- Blantyre Water Board (1)
- Central Region Water Board (1)
- Southern Region Water Board (1)
- Northern Region Water Board (1)
- University of Malawi (5)
- Mzuzu University (1)
- University of Botswana (2)
- University of Western Cape (2)
- University of Oslo (2)



Photo 2

Presentations of course certificates

Lecturing

The main topics of the regional water quality course were: Sampling & handling, Catchment processes, Geochemical processes, Analytical chemistry, Pollutants, Pollutant modelling and Modelling. The field trip went to the Lower Shire region where we studied the sodification problem and discussed field experimental/sampling design and demonstrated lysimeter equipment. The detailed lecture plan is attached in Appendix 3.



Photo 3

Lecturing in Geochemical processes

Evaluation

A feedback from the course participants was requested at the end of course.

Upon the question what the participants did you like the main response was that the facilitation skills were best, showing that the course was well organized. Regarding what they disliked they commented that the time was not enough. Therefore the facilitators seemed to be in hurry to complete the course. Furthermore, most of the issue, particularly on Geochemistry, were new and therefore should have been relayed in a slower pace.

A suggestion for future organization was that we should provide handouts/course material online in advance in order for participants to appreciate course content. This is clearly conceived by the course lectures – though reluctantly time did not permit this to be achieved. We also asked for comments and suggestions from the participating stakeholder for the MSc. Programme that is foreseen as a potential output of the NUFU project. The feedback was that

advanced studies are required in the area of Geochemistry using PHREEQ model for those involved in water resources managements

Appendices

- Appendix 1 Course flyer
- Appendix 2 Participant list
- Appendix 3 Lecture plan
- Appendix 4 Sample of Diploma



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REGIONAL COURSE ON WATER QUALITY

26 May to 2 June 2008

Sponsored by NUFU Water Sciences Project: NUFUPRO-2007-10079

The Faculty of Science, Chancellor College, University of Malawi and the Departments of Chemistry and Geosciences, University of Oslo, Norway, are organising a regional course on Water Quality to be held from 26 May to 2 June 2008 at Chancellor College, Zomba, Malawi. The course is funded by NUFU through the NUFU Water Sciences Project: NUFUPRO2007-10079.

Introduction

Water of sufficient quantity and potable quality is essential for the economic, mental and physical health of a population. Raw water, used for production of tap water, comes from rivers, lakes and groundwater resources. Quality of the water is mainly affected by the chemical composition of the soil and parent rock as well as human activities in the watershed, such as farming, extent of human settlement and the discharge of human effluents. Fundamental knowledge of techniques employed in water quality monitoring and assessment is thus indispensable in conducting the task of ensuring sustained supply of good quality water.

The regional course provides participants with an opportunity to gain a fundamental understanding of fate and impact of chemical pollutants in the environment. Participants will be able to link ground- and surface water quality to natural factors, land use and specific anthropogenic sources in the watershed. Further, they will acquire advanced practical skills in water sampling, analysis and interpretation of data, including chemical speciation with PHREEQC computer programme.

Description of the Regional Course

This is an eight-day intensive study course comprising 2 days of field work, 5 days of lectures and 1 day of individual exercises and assignment writing. The course will cover soil and water sampling techniques, integrated monitoring, sample preparation, sampling strategy; catchment processes (silicate weathering and oxide or clay formation, kinetics of mineral water reactions, mineral water equilibrium, flow and transport, water pathways, particle transport); geochemical processes (role of natural organic matter, CO₂, carbonates and alkalinity, ion exchange and base saturation, soil charge (pzc), chemical sorption and hard/soft elements and redox processes); chemical analysis of water samples (quality control of chemical data, data interpretation, fractionation and speciation, stability diagrams); pollutants (heavy metals, inorganic pollution, pesticides, organic pollution, partitioning coefficients, organic matter (BOD, COD), pathogenic agents, salinization; acidification, radioactivity); introduction to PHREEQC and PHREEQC exercises. Course materials will be sent to participants in advance for their preparation for the course.

The first day of the course will mainly consist of a trip to the Shire Valley Region, Malawi where participants will have hands-on experience in soil and water sampling techniques. During the last two days, participants will be introduced to PHREEQC chemical speciation programme and will have hands-on training in the use of PHREEQC through planned self-guided exercises.

Who should attend?

The course is suitable for master and PhD students as well as junior scientists, primarily studying, working or conducting research in the field of water quality and who are interested to increase their knowledge about recent techniques in water quality assessment and monitoring. The activity will be conducted in English. Some funds are available for participants' travel, accommodation and subsistence in Zomba. There is no registration fee and no cost for course material. Self-sponsored candidates are also encouraged to participate and hence benefit from this initiative.

For more information, please contact:

The NUFU Water Sciences Project Coordinator for the South, Prof John Saka (jsaka@chanco.unima.mw)
or Maurice Monjerezi, PhD Student (mmonjerezi@chanco.unima.mw).

Applications should be sent no later than 9 May, 2008

NUFU Water Sciences Project
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ORGANISERS

Prof Rolf. D. Vogt
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Prof John Saka
University of Malawi, Malawi

DEADLINE

9 May 2008





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REGIONAL COURSE ON WATER QUALITY

26 May to 2 June 2008, Chancellor College Zomba, Malawi

Sponsored by NUFU Water Sciences Project: NUFUPRO-2007-10079

LIST OF PARTICIPANTS

S/N	NAME	ORGANISATION AND ADDRESS	DESIGNATION	DEGREE	EMAIL	TEL	FAX
1	Mr Joe .S Chimeta	Blantyre Water Board, P.O. Box 30369, Blantyre 3, Malawi.	Water Quality and Environmental Manager	BSc (Environmental Sc and Tech)	jchimeta@bwb.mw	+265 1 872 000 (office) +265 9 955 126 (Mob)	+ 265 1 872 026
2	Mr Amedeo.N. Gobede	Southern Region Water , P/Bag 72, Zomba, Malawi.	Water Quality and Environmental officer.	BSc (Environmental Science and Technology)	amedeogobede@hotmail.com	+265 1 525 311 (Office) +265 8 361 520 (mob)	+265 1 525 054
3	Ms Priscilla Nicky Goitseman	University of Botswana, O.O Box 70305, Gaborone, Botswana.	NUFU Project Master student	BSc (Environmental Science)	goistemangpn@mopipi.ub.mw	+267 355 5177 (office) +267 7 136 6061 (Mob)	
4	Mr T. Mguntha	University of Malawi, Chancellor College Chemistry Department, Box 280, Zomba, Malawi	Chief Laboratory Technician	BSc (chemistry major)	tmguntha@chanco.unima.mw	+265 1 524 222 (Office) +265 8 314 677 (Mob)	+265 1 524 046
5	Dr Samson Sajidu	University of Malawi, Chancellor College Chemistry Department, Box 280, Zomba, Malawi	Snr Lecturer (chemistry) NUFU Project team member	PhD (chemistry)	sajidu@chanco.unima.mw	+265 1 524 222 (Office) +265 8 891 714 (mob)	+265 1 524 046

6	Mr Maurice Monjerezi	University of Malawi, Chancellor College Chemistry Department, Box 280, Zomba, Malawi	Lecturer NUFU project PhD student	MEng	mmonjerezi@chanco.unima.mw	+265 1 524 222 (Office) +265 5 491 785 (mob)	+265 1 524 046
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8	Mr Elijah Wanda	Mzuzu University, Malawi	MSc Environmental Science student at Chancellor College	BSc (Ed)	elijahwanda@yahoo.com	+265 8 514732	
9	Mr T. Tandwe	University of Malawi, Chancellor College, Biology Department, P.O. Box 280, Zomba.	MSc Conservation Biology student at Chancellor College	Bed (Science) Honours	ttandwe@yahoo.co.uk	+265 1 524 222 (Office) +265 8 370 945 (Mob)	+265 1 524 046
10	Adolf October	University of Western Cape. Moderlam Road, Belville 7535, Capetown South Africa	Master student	BSc (Honours)	2451121@uwc.ac.za	+27 219552365 (office) +27 729491235 (Mob)	
11	Mr Lewis Banda	Northern Region Water Board, P/Bag 94, Mzuzu, Malawi	Water Quality/Environmental officer	MSc. Applied Chemistry	lbanda@nrwb.org.mw	+262 1 310 255 (office) + 265 9 261 930 (mob)	+ 265 1 310 082
12	Mr Josue Bahati Chishugi	University of Botswana, Gaborone, Botswana.	Assistant Lecturer (Universte Offielle de Bukvu . D.R. Congo), MSc Student hydrogeology (University of Botswana)	MSc (applied geology)	Josuebc2002@yahoo.fr	+ 267 3 555 177 (office) +267 7 120 3557 (mob)	
13	Mr Owen. Mbotwa	University of Malawi, Chancellor College Chemistry Department, Box 280, Zomba, Malawi	Chief Lab Technician	BSc (chemistry)	ombotwa@chanco.unima.mw	+265 1 524 222 (Office) +265 9 326 773 (Mob)	+265 1 524 046
14	Mrs. Ellen. Bolokonya	Central Region Water Board, Malawi, P7Bag	Water Chemist and Environmental Manager	BSc	ebolokonya@yahoo.com	+265 1 253 206 (office) +265 8 323 005 (Mob)	+ 265 1 758 178

		59, Lolongwe, Malawi.					
15	Mr Ambrose Phiri	Ministry of Irrigation and Water Development, P/Bag 68 Mzuzu, Malawi	Water Chemist	BSc (Environmental Science)	ambrosephiri_ambrosejean@yahoo.com	+ 265 1 312 016 (office) +265 8 548 039	
16	Mr Alex Banda	Lilongwe Water Board, P.O. Box 96, Lilongwe, Malawi	Water quality and Environment Manager	MSc (Integrated Environmental Studies)	ambanda@lwb.mw	+265 1 750 366 (office) +265 9 953 250/ +265 8 953 250 (Mob)	+ 265 1 743 585



REGIONAL COURSE ON WATER QUALITY

27 May to 1 June 2008, University of Malawi, Chancellor College, Zomba, Malawi

Sponsored by NUFU Water Sciences Project: NUFUPRO-2007-10079

COURSE PROGRAMME

Day/Date	TIME	EVENT	RESPONSIBLE PERSON
Day 1, 27 May	10:30-12:30	Soil and water sampling and monitoring techniques	Rolf Vogt
SAMPLING, HANDLING AND ANALYSIS	12:30 – 13:30	Lunch	Maurice Monjerezi
	13:30-15:30	Chemical analysis of water samples	Rolf Vogt
	15:30-16:00	Tea/Coffee	Maurice Monjerezi
	16:00 – 17:00	Quality control of chemical data	Rolf Vogt
Day 2, 28 May	08:00 – 10:00	Total analysis, fractionation and speciation	Rolf Vogt
SAMPLE ANALYSIS	10:00-10:30	Tea/Coffee	Maurice Monjerezi
	10:30-12:30	Stability diagrams	Rolf Vogt
	12:30 – 13:30	Lunch	Maurice Monjerezi
POLLUTANTS	13:30 – 15:30	Fate and effects of organic pollutants	Per Aagaard
	15:30-16:00	Tea/Coffee	Maurice monjerezi
	16:00 – 17:00	Phosphorous, Eutrophication	Rolf Vogt
Day 3, 29 May	08:00 – 10:00	Ion exchange and base saturation, soil charge, chemical sorption, hard and soft elements	Rolf Vogt
GEOCHEMICAL PROCESSES	10:00-10:30	Tea/Coffee	Maurice Monjerezi
	10:30-12:30	CO ₂ , carbonates and alkalinity	Per Aagaard
	12:30 – 13:30	Lunch	Maurice Monjerezi
	13:30 – 15:30	Redox processes	Per Aagaard
	15:30-16:00	Tea/Coffee	Maurice Monjerezi
	16:00 – 17:00	Role of Natural Organic Matter (NOM)	Rolf Vogt
Day 4, 30 May	08:00 – 10:00	Silicate weathering and oxide/clay formation	Per Aagaard
CATCHMENT PROCESSES	10:00-10:30	Tea/Coffee	Maurice Monjerezi
	10:30-12:30	Kinetics of mineral-water interactions	Per Aagaard
	12:30 – 13:30	Lunch	Maurice Monjerezi
	13:30 – 15:30	Mineral water equilibrium	Per Aagaard
	15:30-16:00	Tea/coffee	Maurice Monjerezi
	16:00 – 17:00	Flow and transport	Per Aagaard
Day 5, 31 May	08:00 – 10:00	Introduction to PHREEQC and Exercises	Per Aagaard
MODELLING	10:00-10:30	Tea/Coffee	Maurice Monjerezi
	10:30-12:30	PHREEQC Exercises	Per Aagaard
	12:30 – 13:30	Lunch	Maurice Monjerezi
CLOSURE	13:30 – 15:30	PHREEQC Exercises	Per Aagaard
	15:30-16:00	Tea/coffee	Maurice Monjerezi
	16:00 – 17:00	Closing Ceremony	John Saka
Day 6, 1 June	06:00 – 14:00	Field Trip to Lower Shire	ALL



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This is to certify that

Priscilla N. Goitsemanang

Participated in the

Regional Course on Water Quality

Jointly organized by the

The Universities of Oslo and Malawi

Funded by the Norwegian Cooperation Programme for Development,
Research and Education (NUFU).

From 27 May to 1 June 2008 at Chancellor College, Malawi.

Prof Rolf. D. Vogt
Course Facilitator

Dr Emmanuel Fabiano
Principal, Chancellor College