

# Capacity Building in Water Sciences for Improved Assessment and Management of Water Resources

## Main partners:

UiO : University of Oslo



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## Other partners

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## Project Objectives

- Enhance **research** in water resources under present and a changing environment in southern Africa
- Strengthen **capacity and institutional building**, and contribute to the development of MSc programs

**Key thematic areas** are water quality and link to origin of water sources, groundwater resources, hydrological extremes, and water resources under present and a changing environment, including indigenous knowledge systems.

## Achievements

Twelve master students are engaged in the project; eight in the southern Africa partner countries (funded by NUFU) and four at the University of Oslo (one funded by Quota and the rest self funded). Of these 12, four are female (of which three in the south), and five have graduated by June 2011.

Awarding Institution PhD candidates	NUFU		Quota funding		Other funding		Total	
	Female	Male	Female	Male	Female	Male	Female	Male
<b>University of Oslo:</b> Monjerezi, M. (graduation May 2012) Ngongondo, C. (graduation May 2012)		1 1						2
<b>University of the Western Cape:</b> Kanyerere, T. (graduation March 2012) Peck, H. (graduation October 2014)	1	1					1	1

## Ph.D. projects

Monjerezi, M.: Assessment of groundwater chemistry with emphasis on sources of groundwater salinity in lower Shire valley, Malawi.

Ngongondo, C.: Effect of climate variability and change on water resources within southern Africa, employing advanced statistical approaches and hydrological modeling.

Kanyerere, T.: Adaptive utilization and management of groundwater resources in the upper catchment of Limpasa River, Nkhata Bay, Malawi, southern Africa.

Peck, H.: Recharge estimation and groundwater flow conceptualization of the transboundary aquifer systems in the Stampriet Artesian Basin in Namibia.

### **Key results**

- An interdisciplinary approach to water related challenges in the region has ensured that the knowledge gained contributes to better management of the water resources.
- Groundwater resources in the lower Shire region in Malawi show high salinity, which is caused by deeper saline formations communicating with shallow fresh groundwater through conducting faults.
- Regions with high concentrations of fluoride in drinking water sources have been identified and appropriate measures to alleviate the problem using indigenous materials are developed.
- Historical data show that temperature and potential evapotranspiration have increased significantly in Malawi, whereas rainfall, actual evapotranspiration and runoff have shown a decline, however, not significant.
- Extreme rainfall (max 1-day, 3-day, etc) in Malawi is derived for three homogeneous regions: Lower Shire valley, Lake Malawi and Upper Shire plains, and Southern Highlands.
- Groundwater in the Upper Limphasa Catchment, Malawi is contaminated by bacterial microbes due to wrong location of boreholes; this is further compounded by the poor land use and waste management practices.

### **Selected publications**

- Monjerezi, M., Vogt, R.D., Aagaard, P. and Saka, J.D.K. (2011) Hydro-geochemical processes in an area with saline groundwater in lower Shire River valley, Malawi: An integrated application of hierarchical cluster and principal analyses. *Appl. Geochem.* 26, pp: 1399-1413
- Monjerezi, M., Vogt, R.D., Aagaard, P., Gebru, A.G. and Saka, J.D.K. (2011) Using  $^{87}\text{Sr}/^{86}\text{Sr}$ ,  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$  isotopes along with major chemical composition to assess groundwater salinization in lower Shire valley, Malawi. *Appl. Geochem.*, doi:10.1016/j.apgeochem.2011.08.003
- Ngongondo, C.S., Xu, C-Y, Tallaksen, L.M., Alemaw, B. and Chirwa, T. (2011) Regional frequency analysis of rainfall extremes in Southern Malawi using the index rainfall and L-moments approaches. *Stoch. Environ. Res. Risk Assess.* 25:939–955
- Ngongondo, C., Xu, C-Y, Gottschalk, L., Alemaw, B. (2011) Evaluation of Spatial and Temporal Characteristics of Rainfall in Malawi, a case of data scarce region. *Theor. App. Climatology*, DOI: 10.1007/s00704-011-0413-0



1.

2.

- 1) Lake Malawi, the third largest lake in Africa, plays a major role in controlling the flow in the Lower Shire river.
- 2) A thin layer of salt develops on the flood plains of the Lower Shire river in Malawi following the flood season.

**Key statement/impact:** Improved human resources for better assessment, monitoring and management of water resources in Southern Africa, contributing to the international and region's efforts in water development.

**Project website:** <http://www.mn.uio.no/geo/english/research/projects/watersciences/index.html>

**Programme:** NUFU  
**ProjectID:** NUFUPRO-2007/10079  
**Discipline area(s):** Environmental Sciences  
**Period:** 2007–2011 (2012 - no-cost ext)  
**Allocation:** NOK 5.698.000