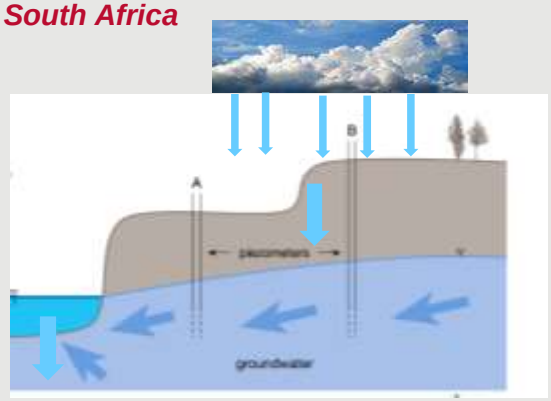
Understanding groundwater recharge in the Limpopo River basin, Southern Africa: GRECHLIM

Tamiru Abiye: University of the Witwatersrand, South Africa
Karen Villholth, Manuel Magombeyi: International Water Management Institute, South Africa



Groundwater Recharge: complex natural process

Vital role of groundwater in semi-arid region

Groundwater for irrigation

Groundwater for cattle

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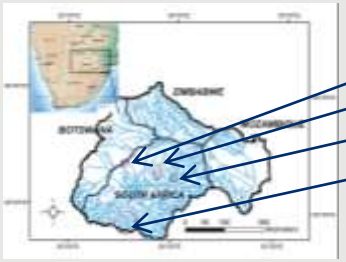
Information for pubic

Research Approach:



Involvement of groundwater management (DWS) and users (Farmers)

- -Collection of rainfall, groundwater, river water and spring,
- -Aquifer characterization
- -Water balance determination
- -Recharge estimation
- -Piezometer installation and monitoring
- -Surface and ground water interaction monitoring
- -PRMS modelling
- -Groundwater vulnerability to pollution mapping

Type of analysis	Type of source	# 0f samples
$\delta^{18}O$ and $\delta^{2}H$	Precipitation	257
	Borehole	52
	Surface water	47
	Spring	30
Tritium	Borehole	52
	Surface water	35
	Spring	9
$\delta^{13}C$ and ^{14}C	Boreholes	14
	Springs	3
Chloride	Spring	5
Metal analysis	Boreholes	5
	Surface water	17
Bacteria	Surface water	13

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Sampling

Key results:

-Capacity development: 1 PhD & 10 MSc students, 4 Researchers
-Experience sharing with the USGS experts
-Collaboration in sampling and drilling DWS & farmers

Ramotswa training-Feb 2016

Groundwater recharge training- Nov 2016

PG students

Mr. Khahliso Leketa (PhD student)
Mr. Simamkele Baqa (MSc student)
Ms. Oudi Modisha (MSc student)
Ms. Aqeelah Davis (MSc student)
Ms. Silindile Zondi (MSc student)
Ms. Paballo Moshupya (MSc student)
Ms. Despina Tshipala (MSc student)
Mr. Mulalo Netsianda (MSc student)
Ms. Mashudu Mmbadi (MSc student)
Mr. Sipho Nyebelele (MSc student)
Mr. Justin Press (MSc student)

Recharge amount

- **BFS: 6.67%** of MAR (700mm/yr)
- **WTF:** Recharge for individual boreholes **2.5% (17.5mm/yr.) to 39% (270mm/yr**.). Average is **15% (104mm/yr**.)
- **CMB: 2.2% and 2.8%** with the average as **2.5%**, Dolomites: **20.8% and 50%.**

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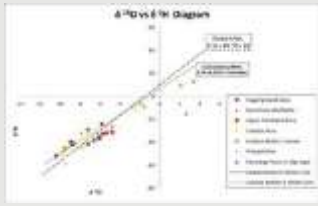
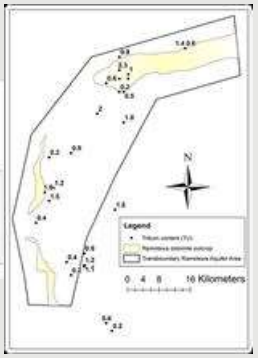
-Treated wastewater loaded river
-Challenge for Baseflow separation
-720 million m^3/yr

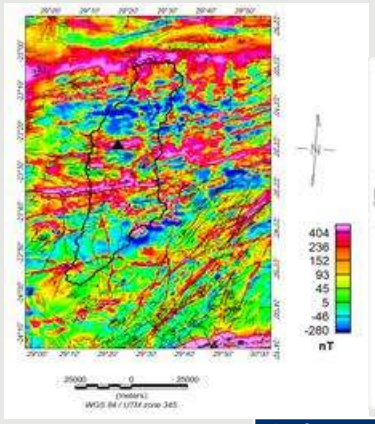
Stream discharge measurement
SW/GW interaction

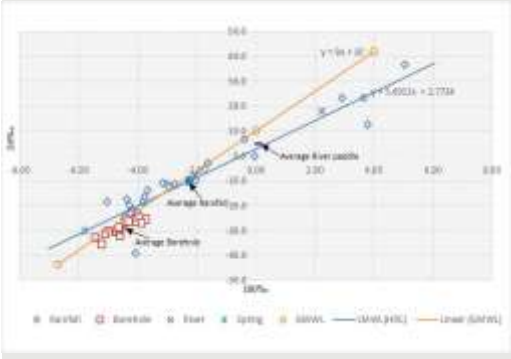
Ramotswa



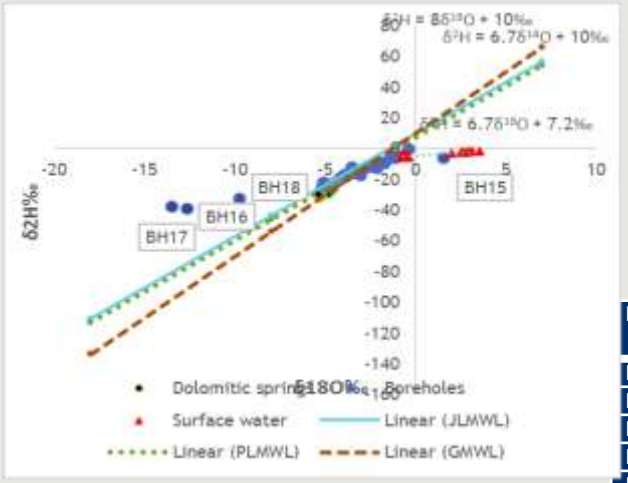


Dendron





Upper Crocodile



BH No.	$\delta^{13}C$ (‰)	^{14}C (pMC)	±	MRT (Years
BH14	-12.31	104.4	±2.7	0
BH16	-17.35	88.2	±2.5	1038
BH19	-15.22	95.7	±2.6	363
BH23	-8.41	84.4	±2.5	1402
BH24	-15.38	99.6	±2.6	33
BH25	-15.3	95.1	±2.6	415
SP1	-6.05	82.0	±2.5	1641
SP2	-5.64	79.9	±2.5	1855

Code	14 C (pMC)	MRT (years)
D7	85.40±2.5	1304.73
D8	93.40±2.6	564.46
D12	84.30±2.5	1411.91
D15	102.30±2.6	0
D16	110.30±2.7	0
D17	92.90±2.6	608.84
D18	88.10±2.5	1047.41
D20	87.70±2.5	1085.03

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Recharge time: recent to millennia

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Next steps:
-Data analyses, interpretation and modelling, Manuscript preparation and publication, Students' research report preparation

How data and results impact stakeholder decisions and the development problem:
-Reveal actual groundwater recharge and control factors in order to estimate groundwater storage that is available for use; suggest feasible groundwater management techniques, increase awareness

Challenges you have faced in collecting meaningful data:
-Access to boreholes and springs, Meteorological data availability

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