Observation based continental-scale groundwater study in Africa: Drilling trends, water level fluctuations, and depletion

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Groundwater is important

African renewable water resources (15% groundwater)

People relying on different drinking water source (75 % groundwater)

Foundational Supply Studies

Karoo Basin of Southern Africa (Gomo et al., 2013)

Ethiopia, (Seifu Kebede, 2013)

Groundwater storage (MacDonald et al., 2012)
Knowledge gap: 3D understanding of demand

- Shallow well contaminated
- Deep well vulnerable to contamination
- Contaminant plume
Knowledge gap: 3D understanding of demand
Data for SADC and other regions

- To date
  - ~500,000 borehole data
  - 15 countries

- Data include
  - drilling depth
  - year of well construction
  - water-level change
Shallow wells in Zambia
Deep wells in Kalahari aquifers
No data
Shallow wells in Zambia

Deep wells in Kalahari aquifers

No data
Wells by transboundary aquifer

IGRAC (2012)

Deep wells

Shallow wells

Percent of wells that are deeper than 50 m

Percent of wells that are deeper than 100 m

Percent of wells that are deeper than 200 m
More than one-quarter of the wells are deeper than 50 m in most aquifers.
Wells by country

- Madagascar Well Depth
- Zambia Well Depth
- Mozambique Well Depth
- Tanzania Well Depth
- Botswana Well Depth
Ethiopian groundwater well depths

Aridity index from https://doi.org/10.5194/gmd-12-2533-2019

Shallow wells
Deep wells
Method

Group wells located within the same 100 km by 100 km area

Plot ‘well drilling year’ versus ‘completed well depth’

For each 100 km by 100 km area we calculate the spearman correlation of well construction year vs well depth
In Ethiopia there is a tendency of drilling deeper to access groundwater (red areas on maps). 

Drilling trend 1975-2015

Drilling trend 2000-2018
In Zimbabwe there is a tendency of drilling deeper to access groundwater (red areas on maps)

Drilling trend 1975-2000
Implication of drilling deeper wells

- Quantity (Depletion)
- Quality (Fossil water contamination)
- Groundwater dependent ecosystem (Wetlands)
Where we have data

Botswana, Ethiopia, Gambia, Lesotho, Malawi, Madagascar, Mozambique, Namibia,

Sierra Leone, South Africa, Eswatini, Tanzania, Uganda, Zambia, Zimbabwe
Collaboration

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