

Gateway to the Earth

Groundwater Recharge in Africa: identifying critical thresholds

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Unlocking the Potential of Groundwater

UPGro is a seven-year international research programme (2013-2020) focused on improving the evidence base around groundwater availability and management in Sub-Saharan Africa (SSA) to enable developing countries and partners in SSA to use groundwater in a sustainable way in order to benefit the poor.

The UPGro Programme has two phases.

The Catalyst Phase (2013-2015) comprised 15 one-year projects, undertaken in 14 countries.

The **Consortium Phase** (2015-2019) comprises five projects working across nine countries.

BRAVE

Building understanding of climate variability into planning of groundwater supplies from low storage aquifers in Africa

Gro For GooD

Groundwater Risk Management for Growth and Development

GroFutures

Groundwater Futures in Sub-Saharan Africa

Hidden Crisis

Unravelling current failures for future success in rural groundwater supply

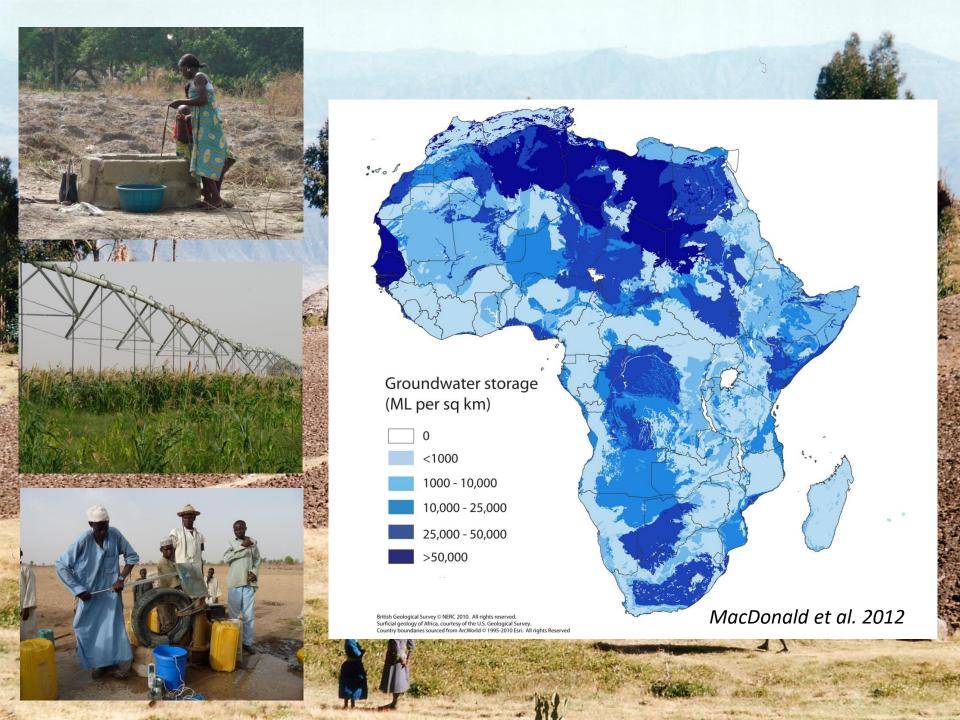
T-GroUP

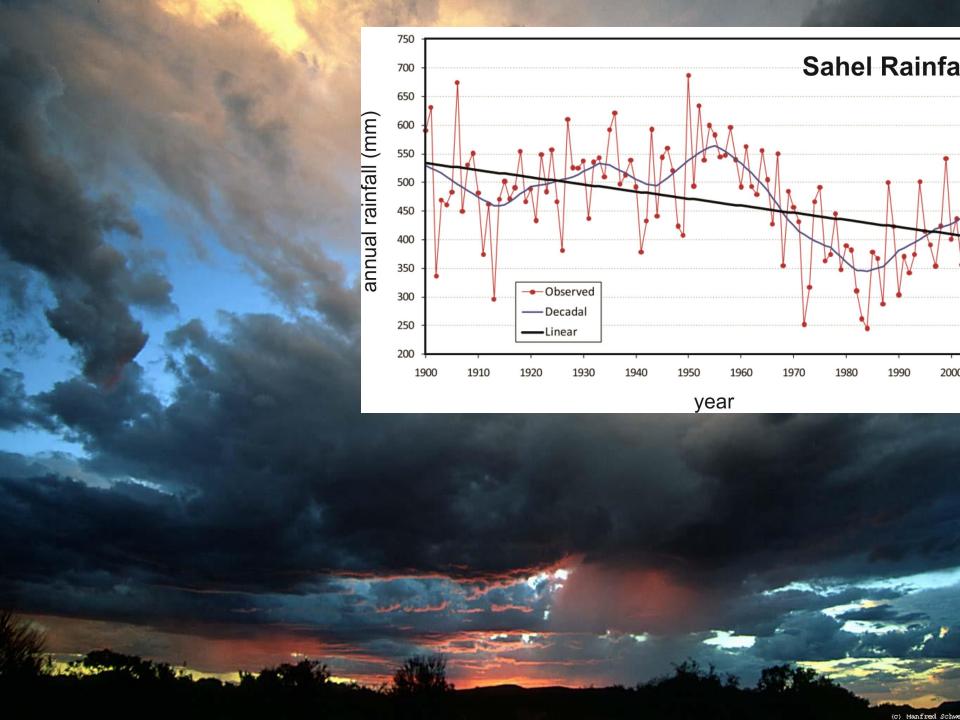
Experimenting with practical transition groundwater management strategies for the urban poor in Sub-Saharan Africa

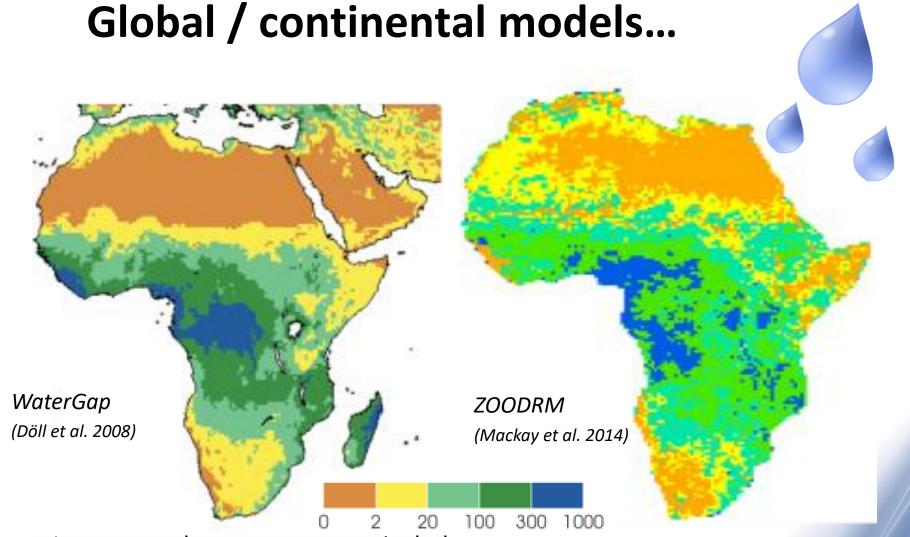










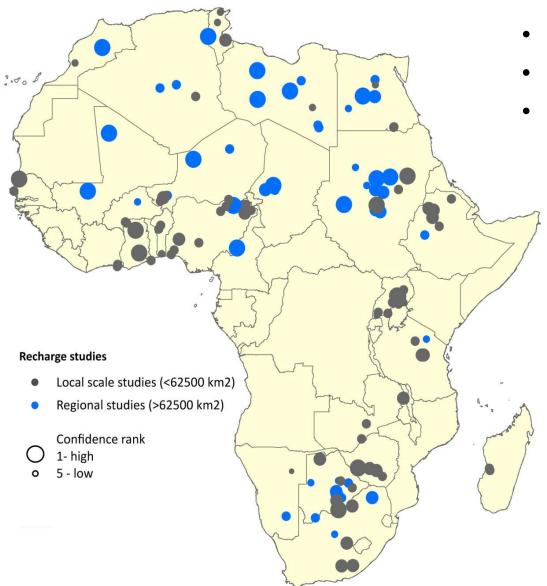


It matters what processes you include in the Global Models – we also need observations to validate





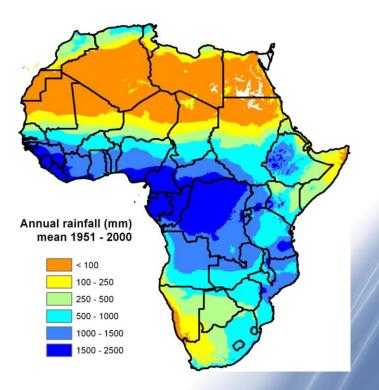
Collation of recharge studies



• > 200 studies

Systematic review of studies

different techniques and methods





Recharge measurement methods

Physical methods – changes in the water table

stable isotopes, CFC, SF6, tritium

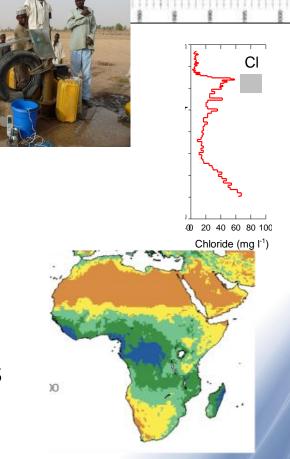
Chloride – diffuse recharge

Modelling methods – measure rainfall etc..

Penman

Direct soil physics measurements

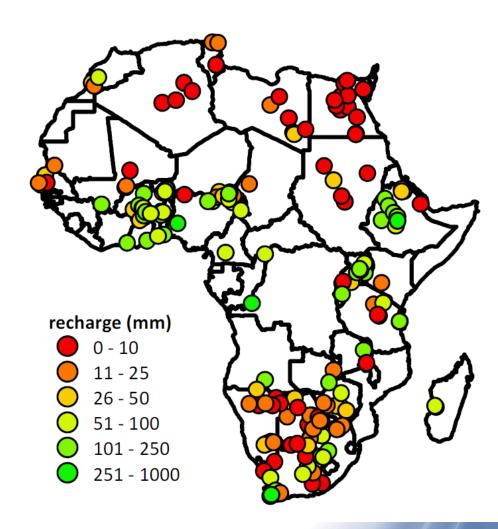
Water balance methods, base flow analysis





Results: recharge

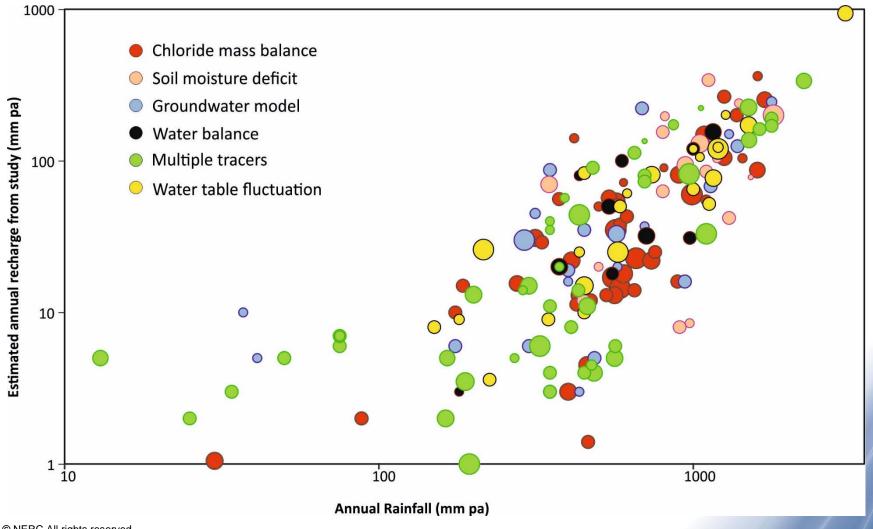
- Interquartile range: 6 82 mm pa
- recharge rarely > 10 mm when LTA rainfall <250 mm
- recharge rarely <10 mm when LTA rainfall >500 mm
- Widespread evidence of bypass recharge from difference between UZ and SZ methods in semi-arid areas





Results: different methods

No bias from different methods



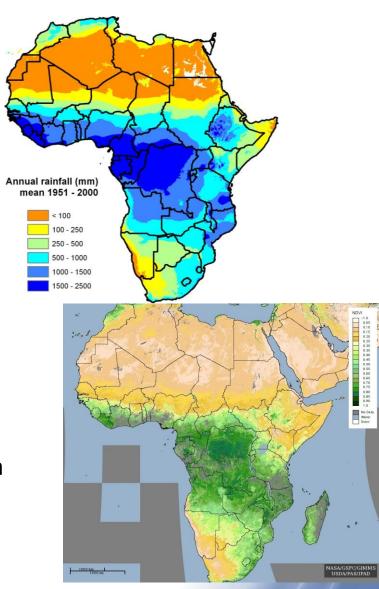
Analysis

Modelling the data & examining if thresholds

Datasets used:

- LTA rainfall
- Number of wet days
- Soil type
- Aquifer domain
- LTA Leaf area index

Statistical approach used for non parametric data



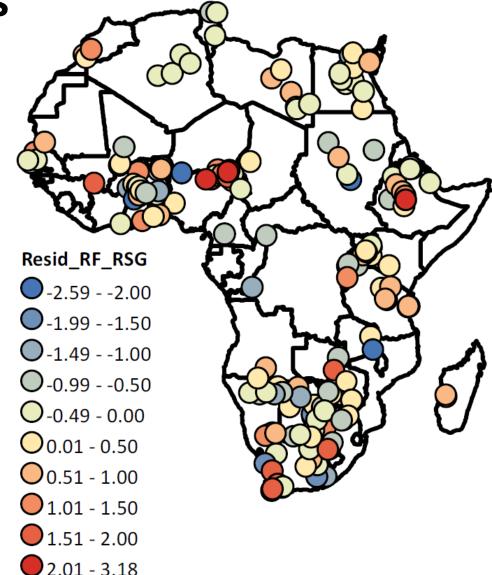


Modelling Results

The data can be statistically modelled using long term average rainfall and soil type

No other factor found statistically important

Plot of residuals show areas where the model works less well: particularly Sahel
No statistically significant spatial correlation with residuals
So far no evidence of thresholds



Summary

We need observations of gw recharge to validate models

Collated >200 studies across Africa

Recharge occurring in all climate zones – Interquartile range of 6 – 82 mm

- < 10 mm for rainfall of < 250 mm
- > 50 mm for rainfall > 1000 mm

Future work – uncertainty analysis; examining land use in model; paper publication.



