Transboundary data sets: African groundwater atlas and Indo-Gangetic Aquifer
Introduction

1. Developing quantitative groundwater maps of Africa
2. Informing water security
3. Online African groundwater atlas
4. Collaborative quantitative groundwater maps of the Indo-Gangetic Aquifer
5. Making historic data available
6. Conclusion
Since 2010, BGS with partners have been developing quantitative maps for groundwater:

- Groundwater storage
- Depth to groundwater
- Potential aquifer yield
- Aquifer recharge
- Depletion
- Salinity (in progress)

...to inform discussion on water security
Methods
Groundwater storage

- Overall storage high:
  - 0.5 - 1 million km³

- 20 times that stored in rivers and lakes

- 100 times the annual renewable freshwater

- Even in low storage areas, often 5 x the annual requirement for hand pump

https://doi.org/10.1088/1748-9326/7/2/024009
Borehole yields

- Yields for handpumps generally OK
- Small scale irrigation possible
- Large scale irrigation difficult

https://doi.org/10.1088/1748-9326/7/2/024009
Other maps

https://doi.org/10.1088/1748-9326/abd661

http://nora.nerc.ac.uk/id/eprint/17907/1/OR11067.pdf

https://doi.org/10.1088/1748-9326/7/2/024009

https://doi.org/10.1088/1748-9326/7/2/024009
GROUNDWATER MAPS OF AFRICA

Informing water security
ONLINE GROUNDWATER ATLAS

WIKI ONLINE ATLAS

- Entries for every African country
- >50 authors
- 1000 accesses per month
- >3000 data downloads from 60 countries
- NGOs, Government, Development Banks, ODA, Academics, students
- Google groundwater + [country]
- USD 700k investment
Groundwater in the IGB

• Transboundary: Pakistan, India, Nepal, Bangladesh

• One of most developed global aquifers (> 200 km³ per year)

• Contentious narrative of over exploitation

• Highly complex hydrological processes

• Additional environmental pressures
MAPS OF THE TRANSBOUNDARY IGB AQUIFER

Methods

• International team: Nepal, Pakistan, India, Bangladesh, UK
• Mainly academics, but also government
• Large data assimilation
• Additional case studies to fill significant gaps
• Workshops, review
• International publication (Nature GeoScience)
1. Recharge from rainfall, canals and rivers

2. GW storage $30,000 \text{ km}^3$ 20 times the annual flow in the GMB + Indus, 100 x storage in dams

3. Yields > 20 l/s - often higher

4. Large systematic variations in aquifer: permeability, storage and anisotropy

5. Salinity is both natural and man made

6. Arsenic natural and associated with Holocene deposits and organic soils
Groundwater depletion

Water table is near stable across 70% of the aquifer, falling in 33%

Complex pattern influenced by rainfall, canals, abstraction

Net depletion of 8 km³ per annum
3D groundwater typologies

Helps explain different behaviour

Typologies cross borders
Conclusions

1. Developing transboundary maps possible
2. Reveals new patterns not observed at smaller scales
3. Different view of water security
4. Vehicle for cooperation and consensus
5. Publication and peer review helpful
6. Open access outputs widely used
7. Spring board for more detailed work