Monitoring seasonal groundwater storage dynamics using remote sensing

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Presentation structure

- Introduction
- Materials and methods
- Results
- Discussion and conclusion

Introduction

- Groundwater storage is important for socio-economic development but it has received limited consideration in water resources studies
- IT accounts for 30.1% of the world's fresh water supplies, 20% of the irrigation water, 40% of total industrial water and 50% of municipal water withdrawals
- Provides the highest potential of coping with the impacts of climate change
- Safe drinking water is critical for achieving UN SDGs #6, Africa 2063 Agenda, Zimbabwe NDS1 & Agenda 2030
- Under immense pressure from growing population, agriculture and industrial Relatively difficult to identify, explore, quantify, monitor and exploit.

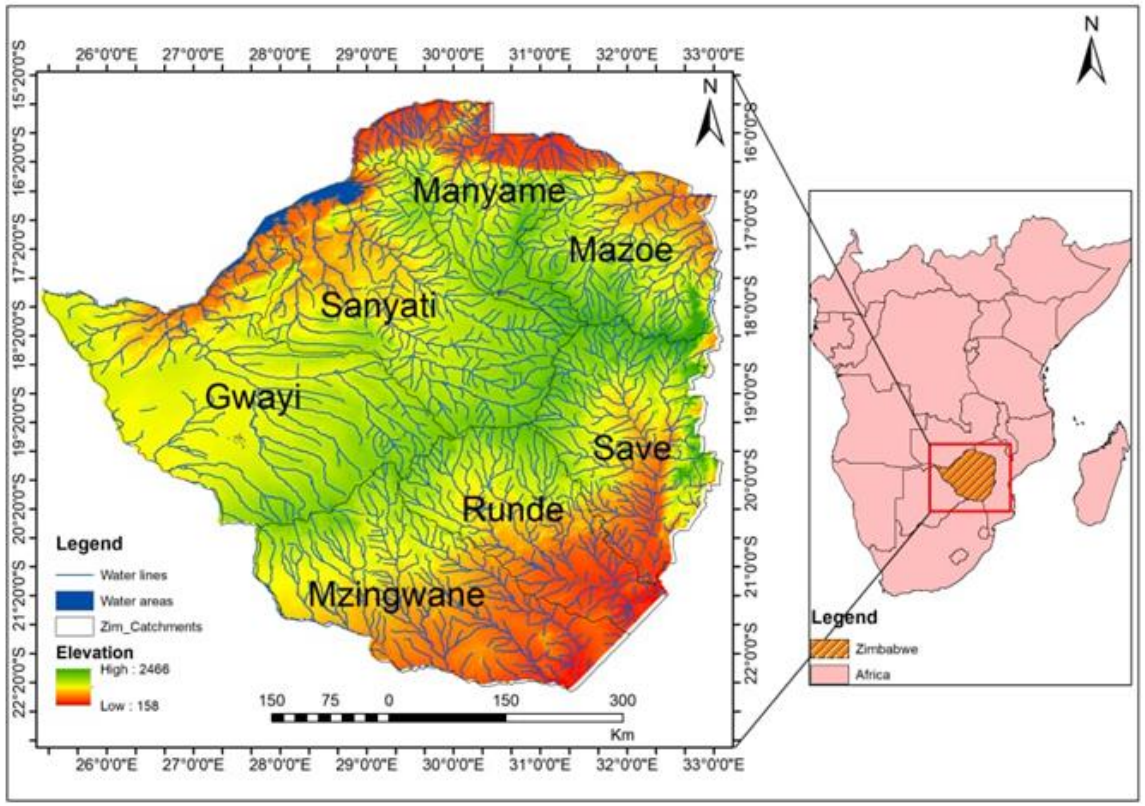
Groundwater storage monitoring

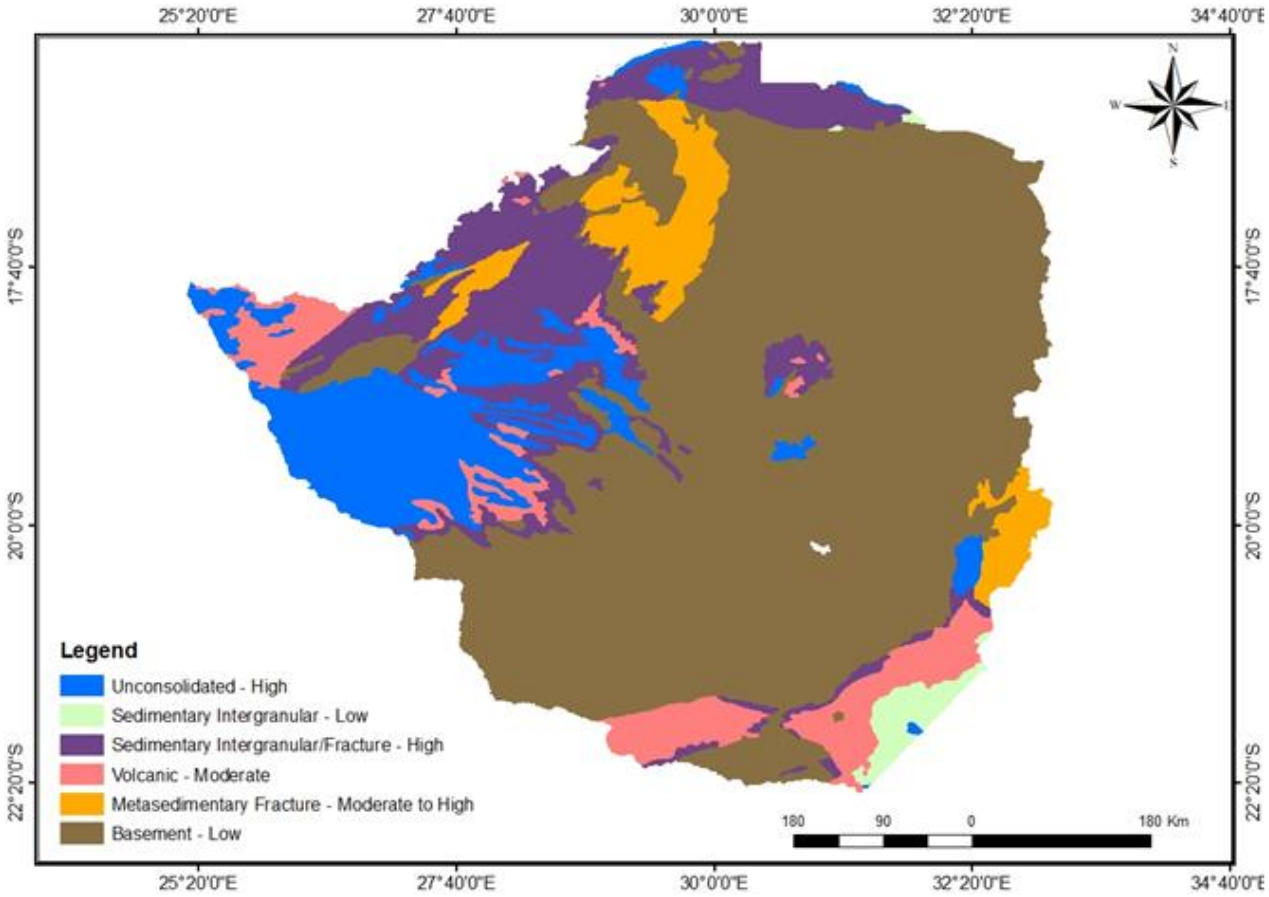
- Concerns of groundwater storage changes due to overexploitation and depletion
- Routine monitoring of groundwater storage is important to support its sustainable use and protection.
- Field based methods e.g well observations are expensive, time consuming have limited spatial coverage.
- This is true in arid and semi-arid areas due to lack of expertise, resources, poorly developed infrastructure, obsolete, and sparce or inexistent monitoring stations.
- Satellite RS offer reactively more frequent, cheap and rapid approaches to monitor groundwater resources.
- This study utilised the Gravity Recovery and Climate Experiment (GRACE) satellite data to show the spatial variations of seasonal groundwater storage in Zimbabwe.

Gravity Recovery and Climate Experiment (GRACE

- GRACE satellite data are widely used to estimate groundwater storage (GWS) changes in aquifers globally
- Showed temporal changes in gravity caused by changes in mass due to water thickness
- The vertical extent is measured in height of equivalent water thickness

Distribution of river catchments and aquifers

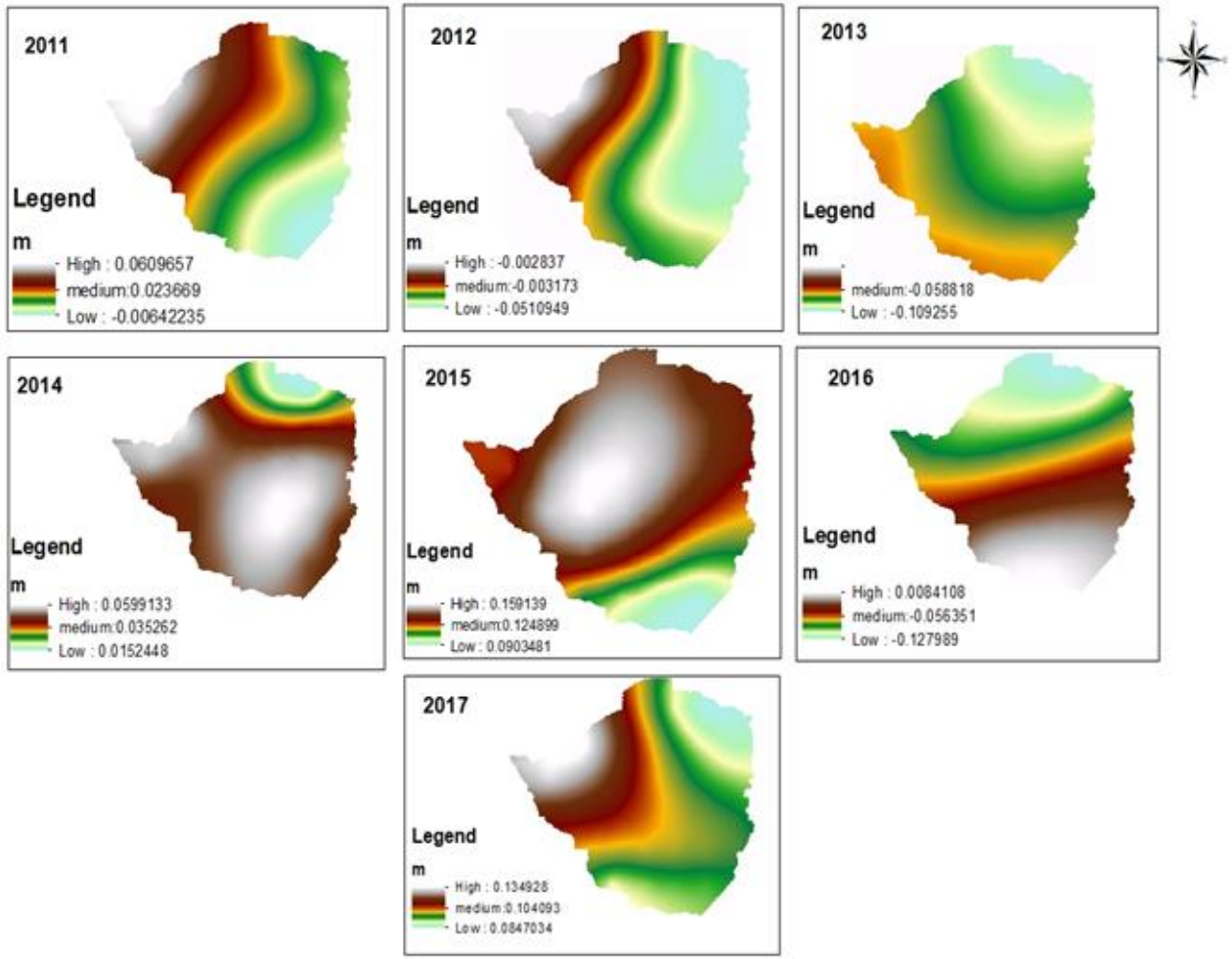


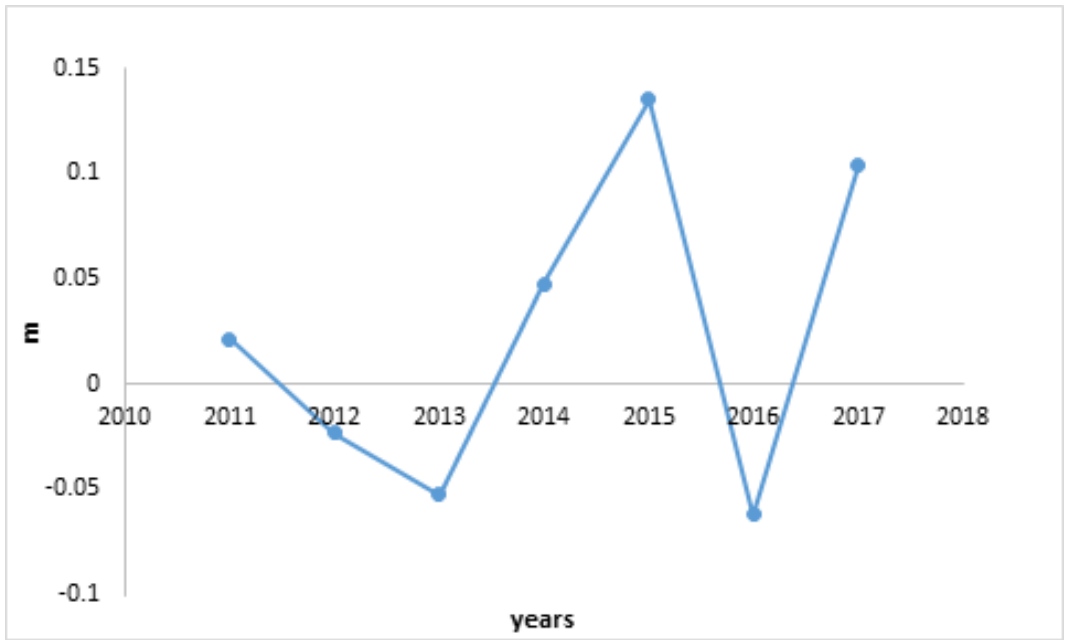


Methods

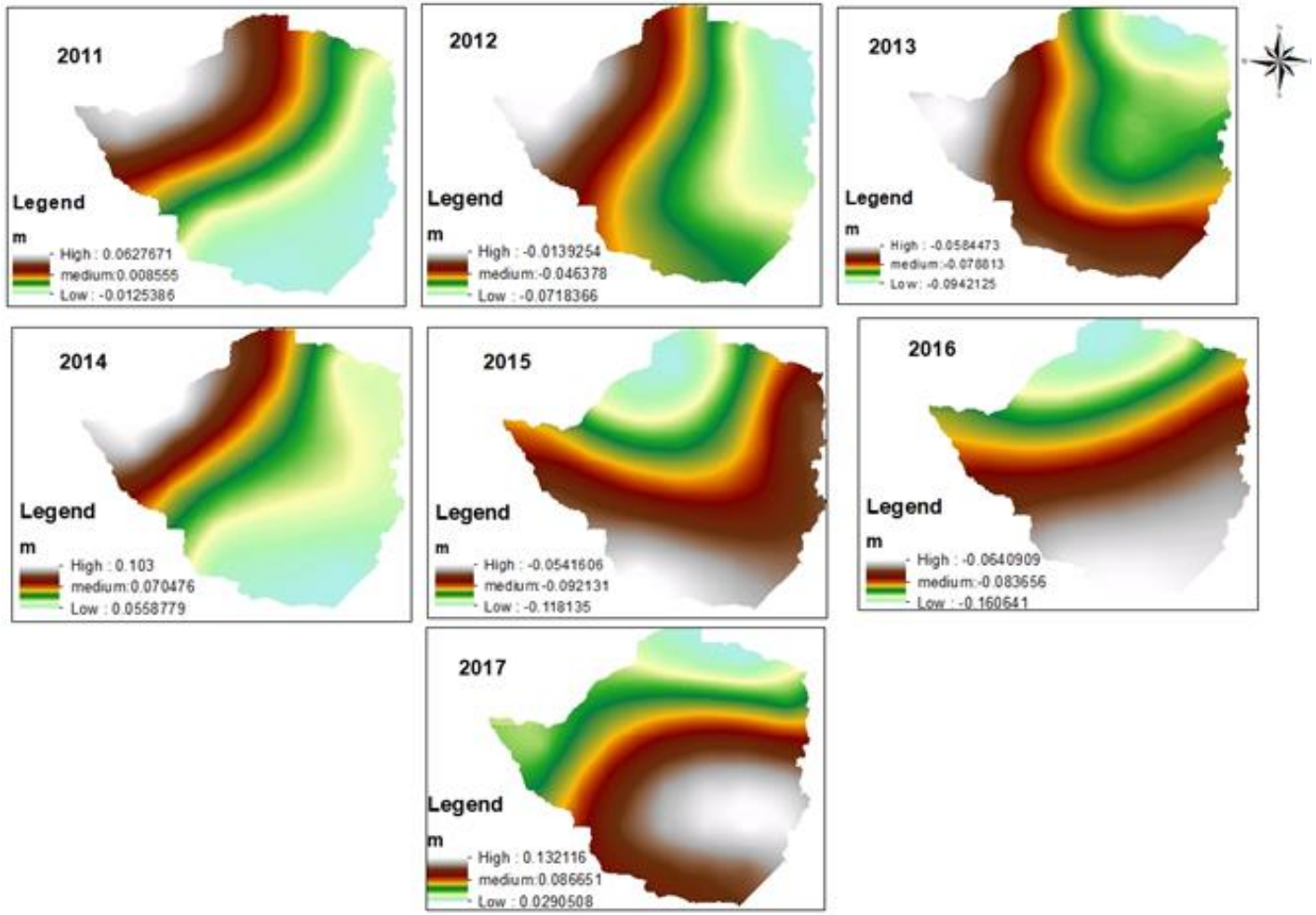
- Geo-referenced GRACE satellite monthly point data were downloaded from the NASA (https://podaactools.jpl.nasa.gov/drive/files/allData/tellus/L3/grace/land_mass/RL06/v04/JPL).
- Monthly data were text format spanning from 2011 to 2017
- Point data were imported in a GIS to create points maps.
- An interpolation technique, ordinary kriging was performed to develop maps showing the spatial variations of groundwater levels for individual months
- Maps for individual months were merged to give final raster maps showing long term average groundwater levels for each season.
- Dry season starts from April to October and wet season from November to March

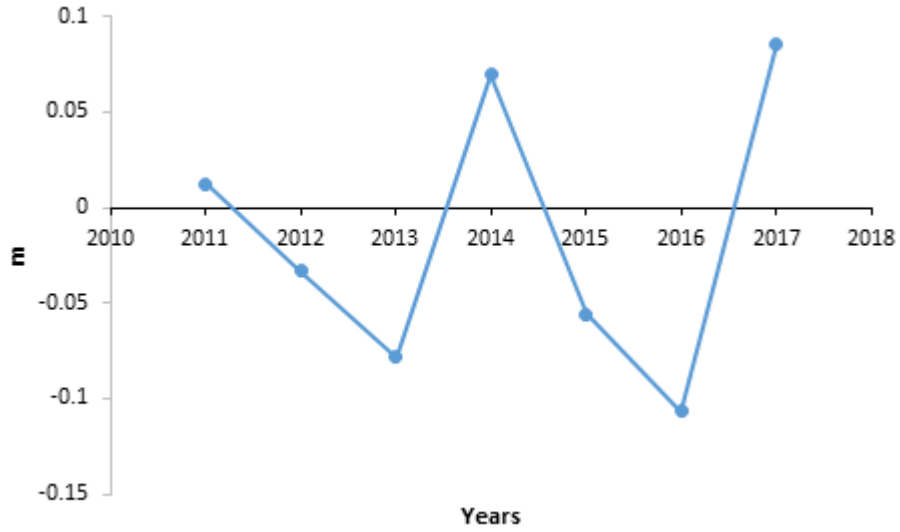
Spatial and temporal variation of groundwater storage during the wet seasons





Spatial and temporal variation of groundwater storage during the dry seasons





Discussion and conclusion

- Significant variations of groundwater storage levels within and between the wet and dry seasons.
- General pattern is that storage levels decrease from N to S & E to W north.
- This is consistent with rainfall pattern the general pattern.
- During the wet and dry seasons of for the same 2015, almost 75% of the country had high groundwater storage
- This rapid approach is useful for decision making and groundwater management.

The end

Thank you for your attention