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A Study on Spatio-Temporal Variability in Groundwater Storage of India Using GRACE Data

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ABSTRACT

- The relative groundwater storage changes from 2004 to 2016 of entire India has been analyzed using GRACE derived monthly terrestrial water storage and using LSM Noah 2.1 derived monthly soil moisture, snow and surface runoff
- A separate analysis on groundwater storage anomalies of each climatic regions such as Central Northeast, Northeast, Northwest, Peninsular and West Central was performed
- we examined the statistical significance of observed seasonal GWS changes using non parametric trend analysis for all regions individually.

OBJECTIVES

- To estimate and map relative seasonal ground water storage (GWS) changes across India from 2003 to 2016 based on GRACE data
- Delineation of regional spatial-temporal variations in seasonal groundwater storage of North-East, Central-Eastern West- Central, North -West and Peninsular part of India

INTRODUCTION

➢Groundwater is the primary source of agriculture, industrial and domestic water supplies in most parts of the world, especially populous countries such as China and India (Chen et al., 2016).

➢Overexploitation of groundwater will prompt unsustainable groundwater levels, bringing about financial anxiety, vulnerability to environmental change and excruciating burdens to nourishment and water security

➢For the better sustainable groundwater resource management it is important to have reliable and frequent information on spatiotemporal groundwater storage

STUDY AREA

- India, comprises of 2.28% (297 million ha) of global land area, however, supporting 17.80% (1.24 billion as of 2011) of the global population (Bhanja et al., 2016)
- In India, about 60% of the total area is covered by hard rocks such as granites, gneiss and basalt. Groundwater occurs in the weathered zone and in joints and fissures in semi-confined to confined condition.
- In India the contribution of groundwater is nearly 63% in irrigation, 85% in rural water supply and 45% in urban water supply
- Over-extraction of groundwater is a major environmental challenge in many parts of India.

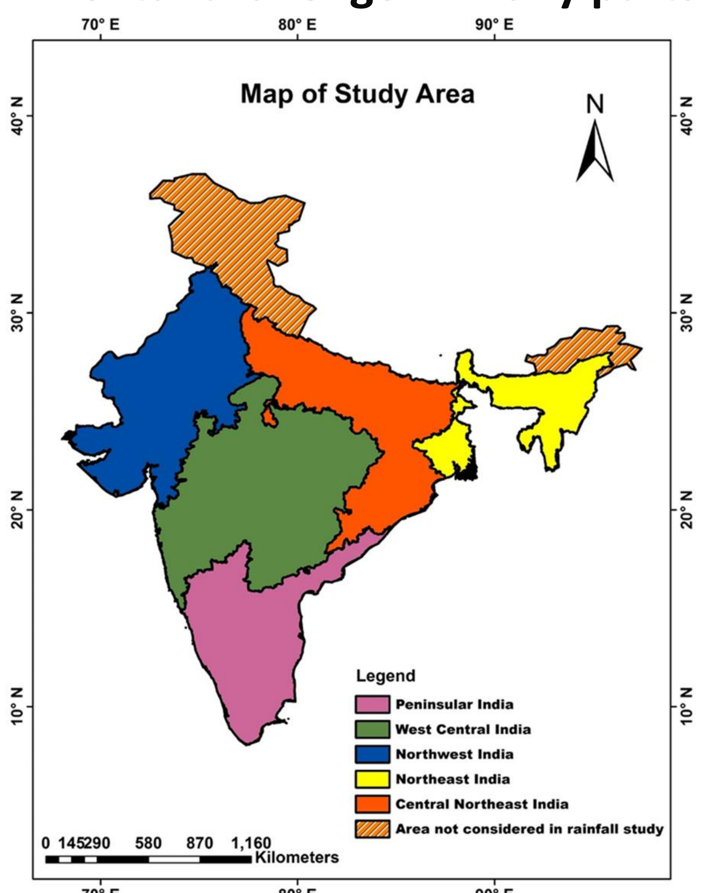

Fig. 1 Map of Study Area

DATA and METHODOLOGY

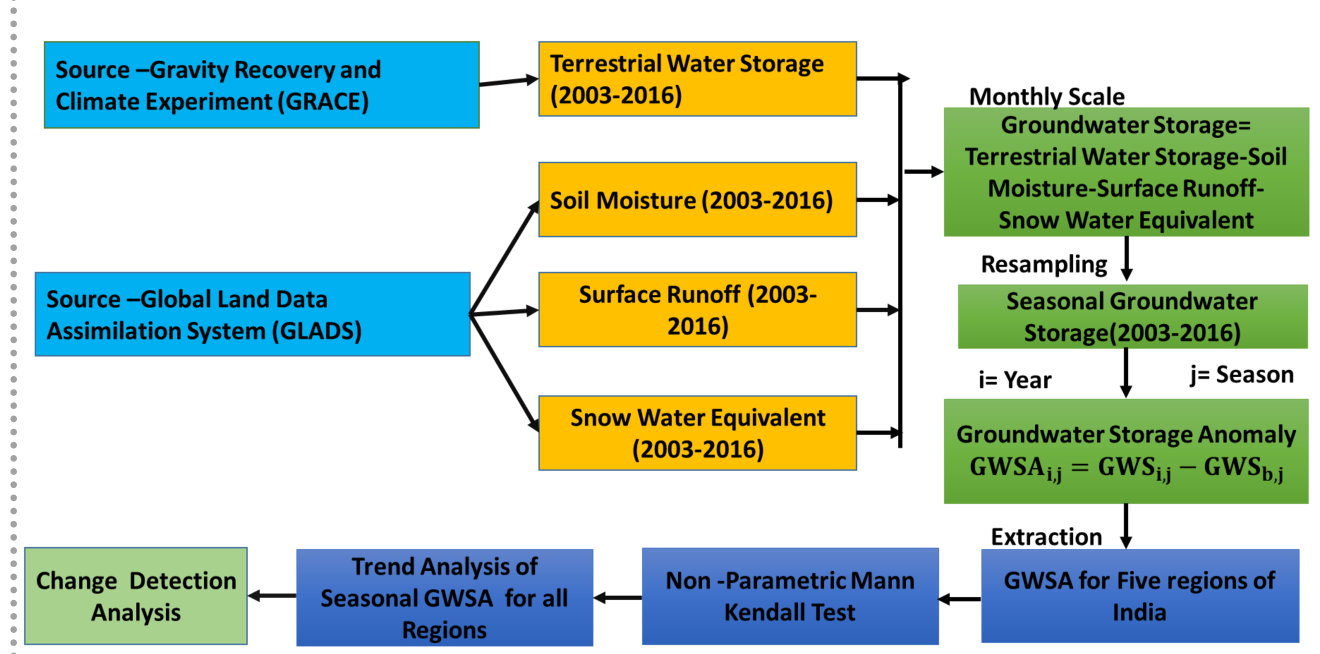

Fig.2 Research Methodology Framework

RESULTS

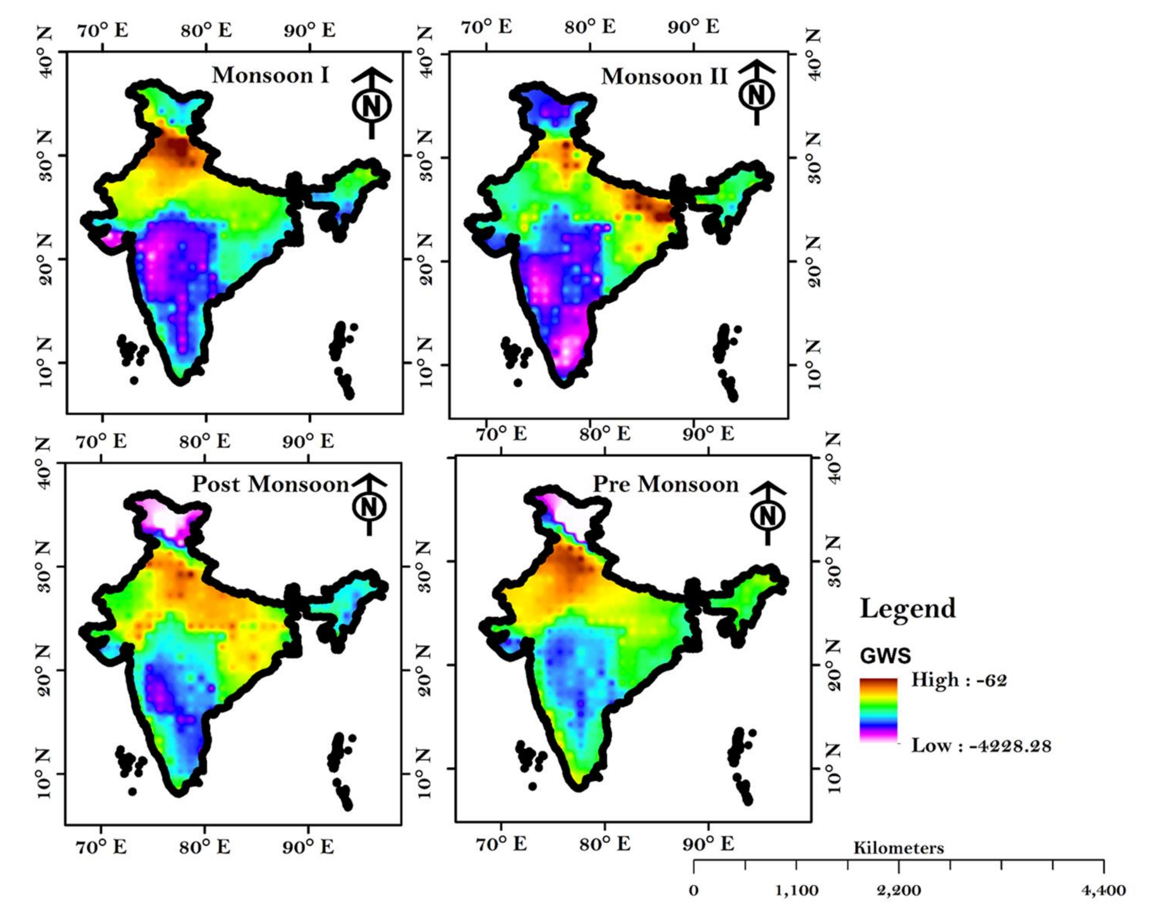

Fig.3 Seasonal Groundwater Storage Maps for 2003

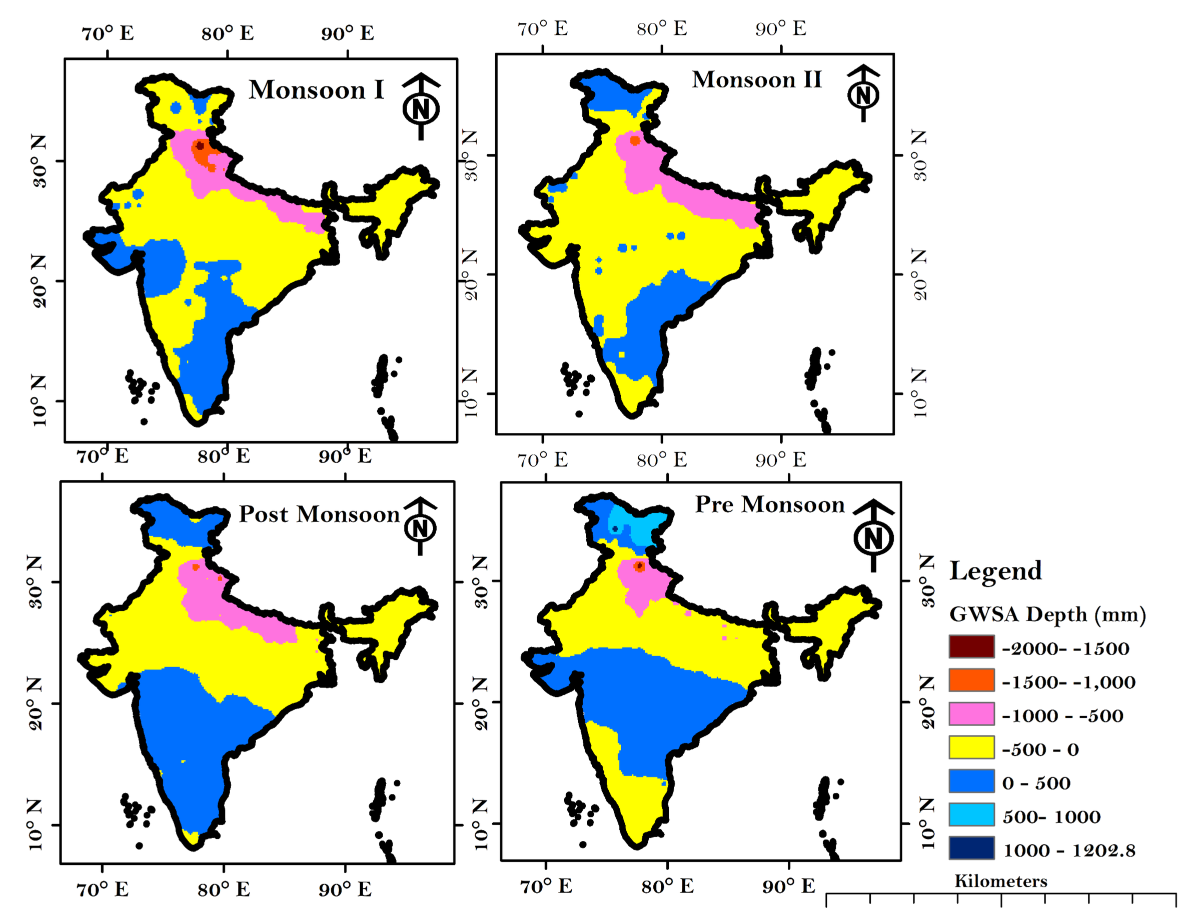

Fig.4 Average GWSA Maps of India

- Satio-temporal variations in groundwater storage anomalies were mapped for the entire country using GRACE-derived monthly TWS
- The resultant anomaly depth maps with respect to 2003 baseline ranges from positive to negative.
- The MK test results showed that there is an overall depletion in groundwater storage for entire India with a decreasing trend.

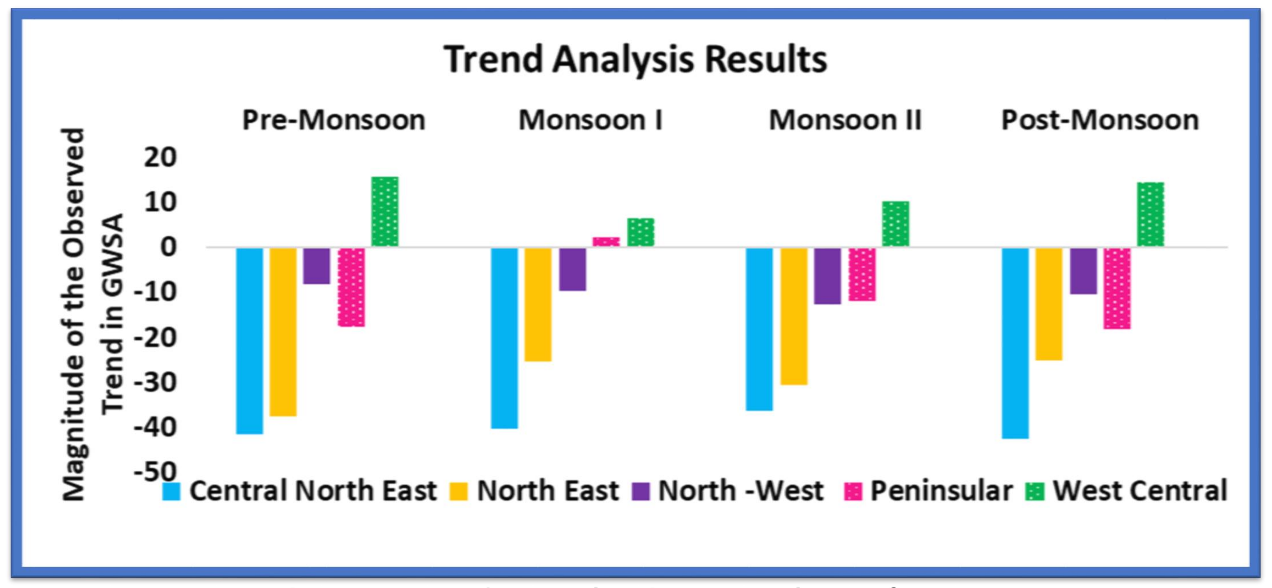

Fig.5 Trend Analysis Results of GWSA

CONCLUSIONS

- An average maximum positive anomaly of 1.4 m was observed indicating a net gain in the groundwater storage and an average maximum negative anomaly of 2m was observed, indicating a net loss in groundwater storage in the study period
- North East, Central North East and North West regions of India were showing a statistically significant decling trend in GWSA.
- The study provides reasonable trends in groundwater storage changes over larger areas covering different climatic zones using GRACE data.

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