



Study on Abstraction-Induced Recharge as an Adaptation Response to Climate Variation for Shallow Aquifer in Bangladesh

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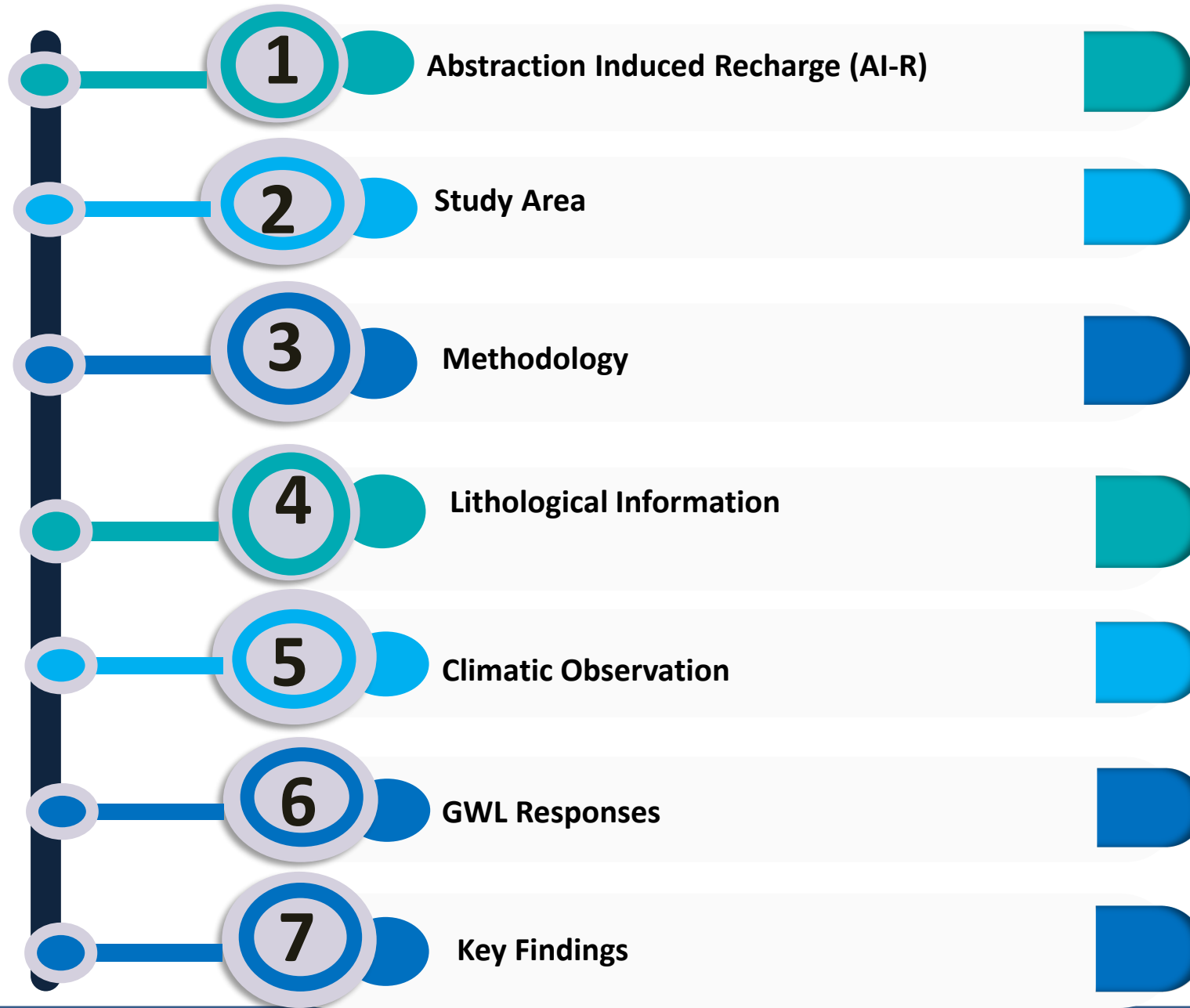
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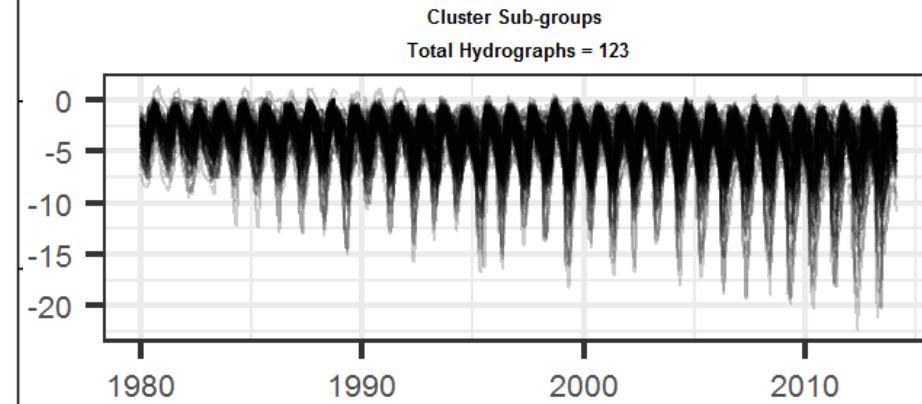
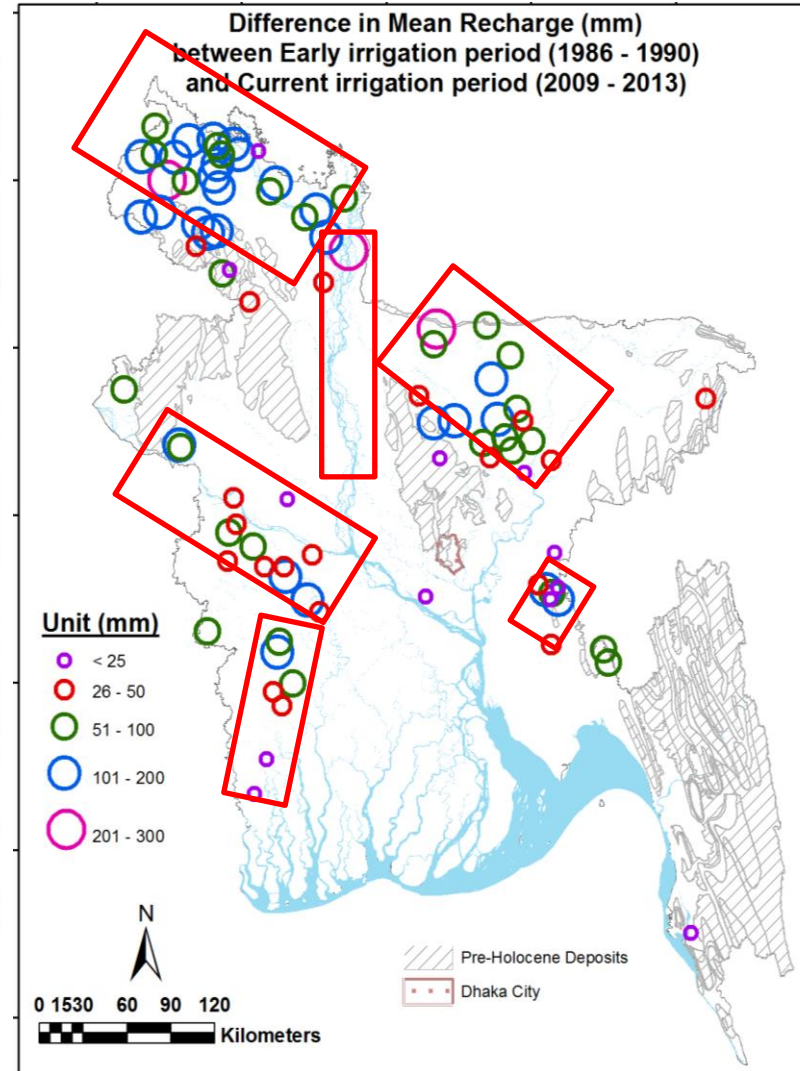
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Presentation Outline



Abstraction Induced Recharge

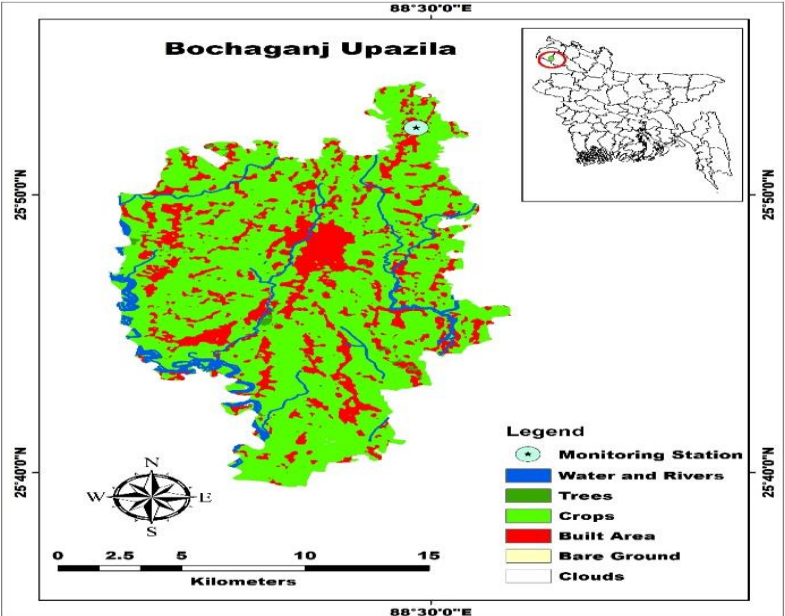
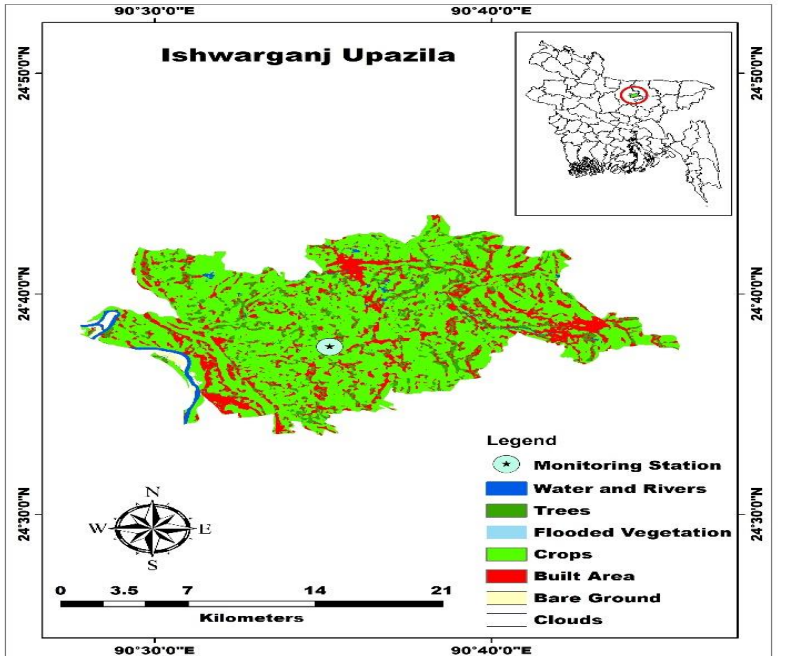


Bangladesh

Brief Description of Study Area

Types	Description	Types	Description
Study Area	Ishwarganj, Mymensingh	Study Area	Bochaganj, Dinajpur
Area	280.43 sq km	Area	224.81 sq km
Latitude and Longitude	Between 24°33' and 24°34' north latitudes and in between 90°28' and 90°46' east longitudes	Latitude and Longitude	Between 25°10' and 26°00' north latitudes and in between 88°30' and 99°10' east longitudes
Hydrological Region	North Central (NC)	Hydrological Region	North Western (NW)
Physiographic Zone	Old Brahmaputra Floodplain	Physiographic Zone	Part of Barind Tract and old Tista Floodplain
Nearest River	Old Brahmaputra	Nearest River	Tangon

Map of The Study Area



Methodology

Selection of the study area

In situ Observations (2019-2020)

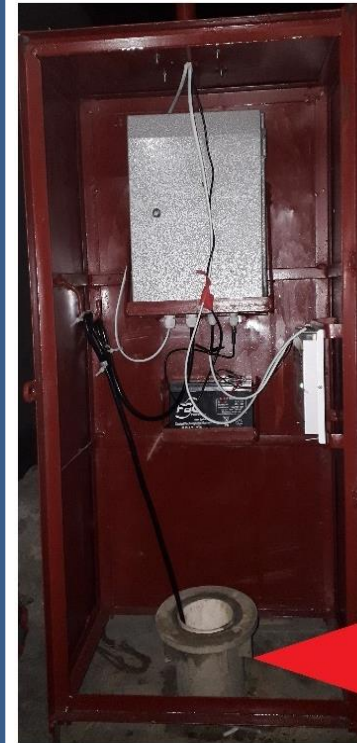
- In-situ high resolution measurements of **GWLs** and **rainfall**
- a (pressure type) **GWL logger** and a **tipping-bucket rain-gauge**

Historical Data Analysis

- Rainfall (1993-2020) from BMD
- GWL (1980-2020) from BWDB
- Spatial and Temporal variations of these data were examined by using 'R' Language

Spatial Geophysical and Hydrological Investigations

- The sub-surface geology was studied up to the depth of **100 m**
- Bore log information, pumping test data, soil texture data were analyzed using Rockworks

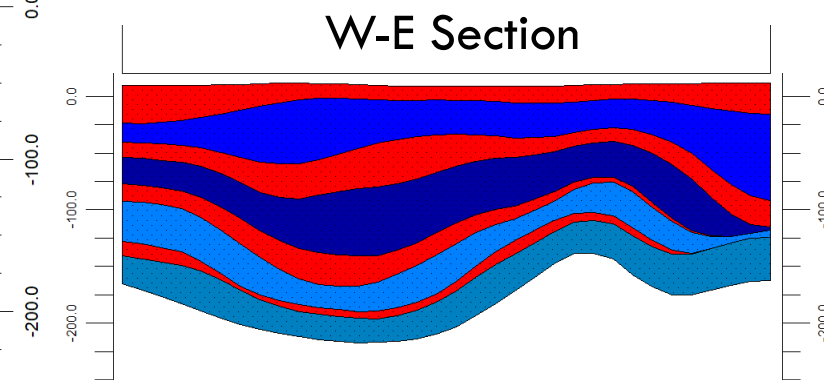
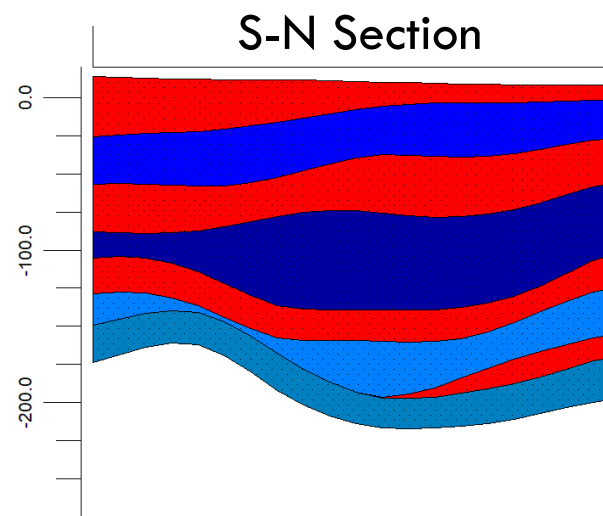
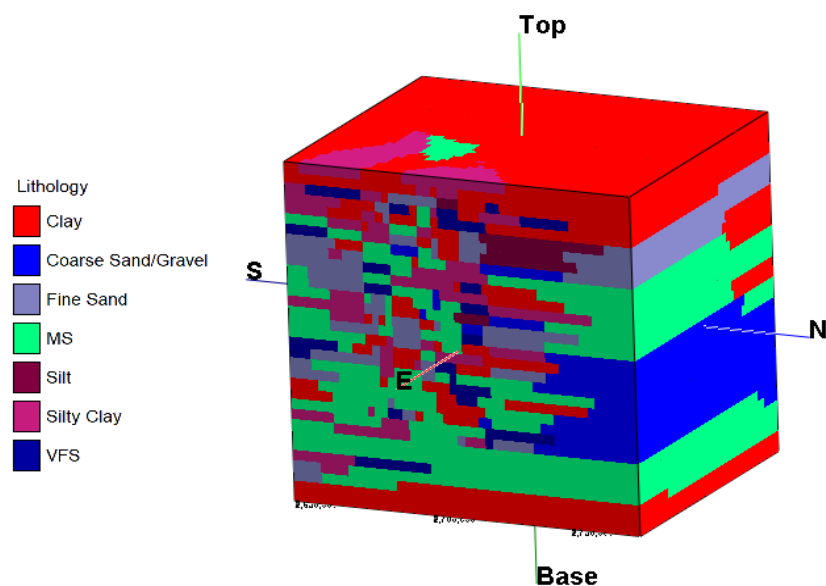


Data loggers that are set at piezometer and Rain Gauge

Lithological Information (Ishwarganj)

- The lithology is mostly quite heterogeneous with altering clay and sand
- 20 to 80ft** of surface clays overlying uniform medium to coarse sands
- average depth range of aquifer is **40ft** and ranges varies **90 to 130ft**
- Absence or a thin top aquitard layer in some places at Ishwarganj indicates the presence of an aquifer very close to the ground.

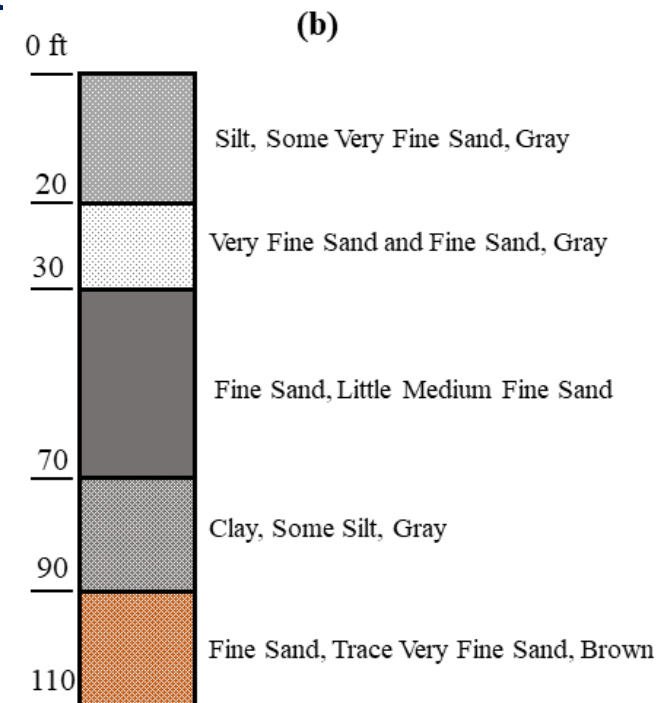
0 ft		Silt, Some Very Fine Sand, Trace LDM
20		
30		Clay, Gray
40		Clay, Light Brown
50		Clay, Brown
60		Clay, Light Brown
70		Clay, Brown
80		Clay, Gray
90		Very Fine Sand, Gray plus Brown
100		Very Fine Sand, Brown
110		Fine Sand, light Brown
120		Fine Sand, Brown
130		Very Fine Sand, Little Fine Sand, Gray
150		Clay, Gray
180		Very Fine Sand, Brown
190		Very Fine Sand, Gray
220		Clay, Gray
240		Clay, Light Brown
250		Very Fine Sand, Light Brown
280		Silt, Very Fine Sand, Fine Sand, Gray



Red- aquitard layers, Blue- Aquifer layers

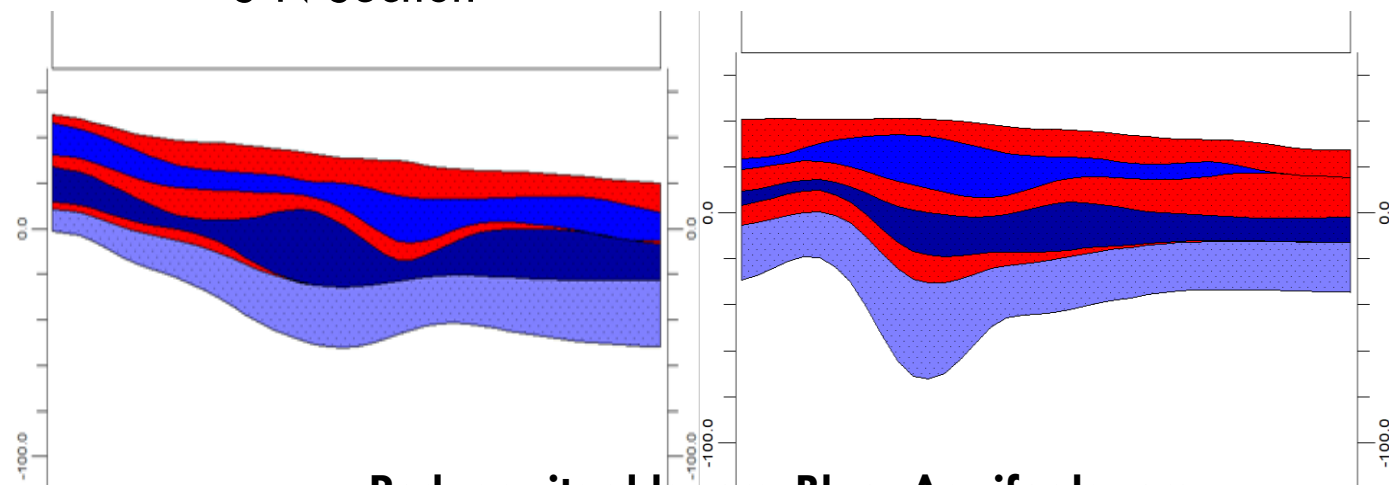
Lithological Information (Bochaganj)

- Depth range of aquifer is **50ft** with ranges varying between **20 and 70ft**
- Aquifer is **mainly unconfined** which locally varies and best characterized as regionally **semiconfined**.
- the main aquifer is underlain by few closely alternating aquifer and aquitard layers at lesser depths.

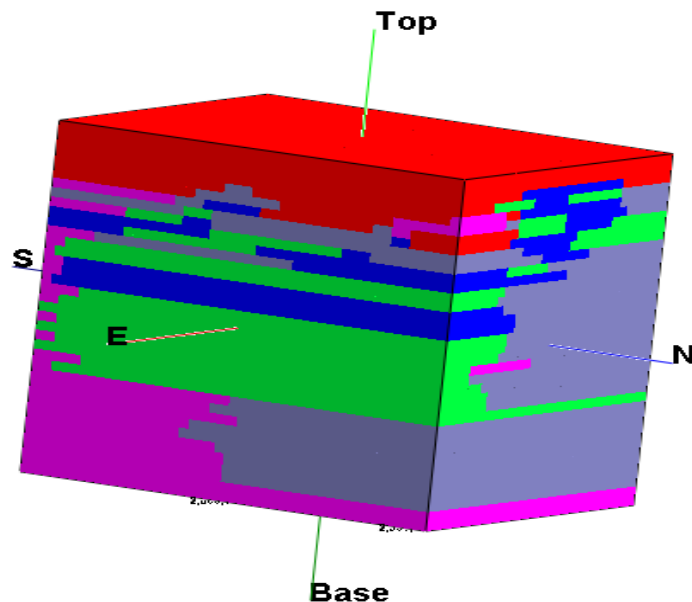


W-E Section

S-N Section



Red- aquitard layers, Blue- Aquifer layers



- Lithology
- Clay
 - Coarse Sand/Gravel
 - Fine Sand
 - MS
 - Silt
 - Silty Clay
 - VFS

Climatic Observations(Ishwarganj)

BMD Station (1980-2020):

1-day maximum rainfall (RX1) - **508 mm**

5-day maximum (RX5) rainfall- **640 mm**

In-situ recorded data (2019-2020):

1-day maximum rainfall (RX1) - **133.5 mm**

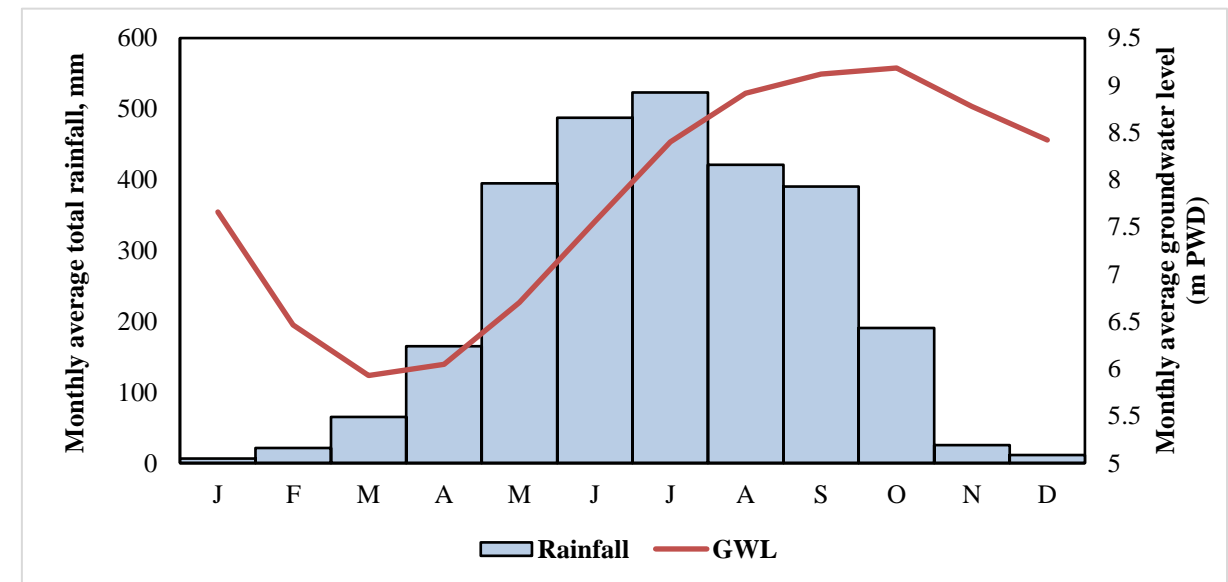
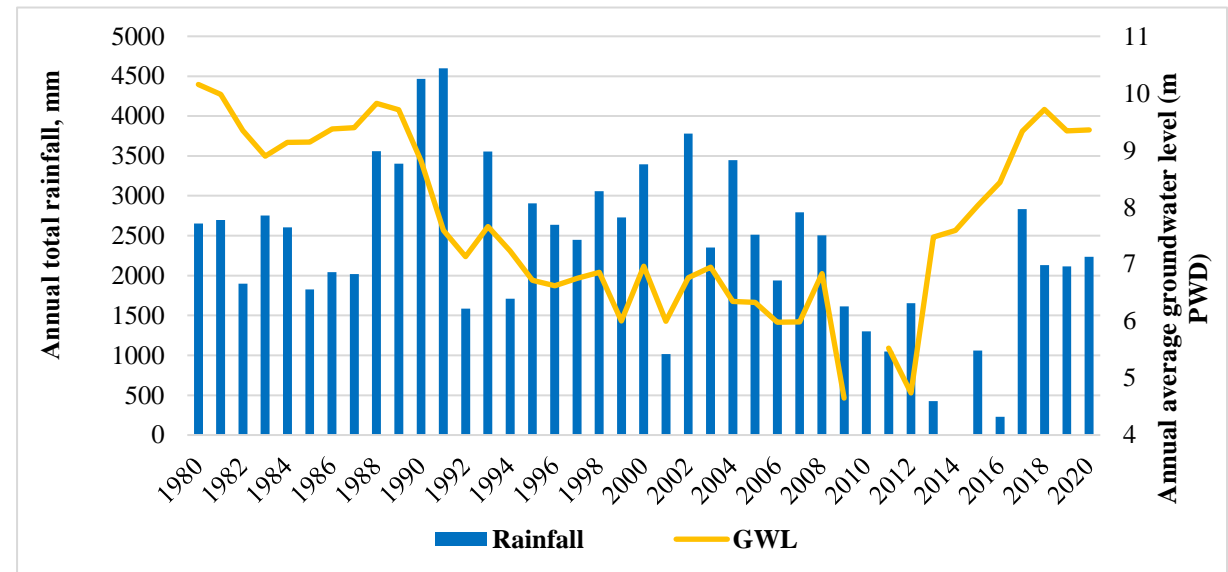
5-day maximum rainfall (RX5)- **262.5 mm.**

Average annual fluctuation of GWL 4.16 m with a range varying from 1.15 to 7.28 m.

Average GWLs and annual total rainfall increases after 2012 till date

❑ Lowest GWL- March

❑ Highest GWL- October



Climatic Observations (Bochaganj)

BMD Station (1986-2020):

1-day maximum rainfall (RX1) - **260 mm**

5-day maximum (RX5) rainfall- **293 mm**

In-situ recorded data (2019-2020):

1-day maximum rainfall (RX1) - **121.5 mm**

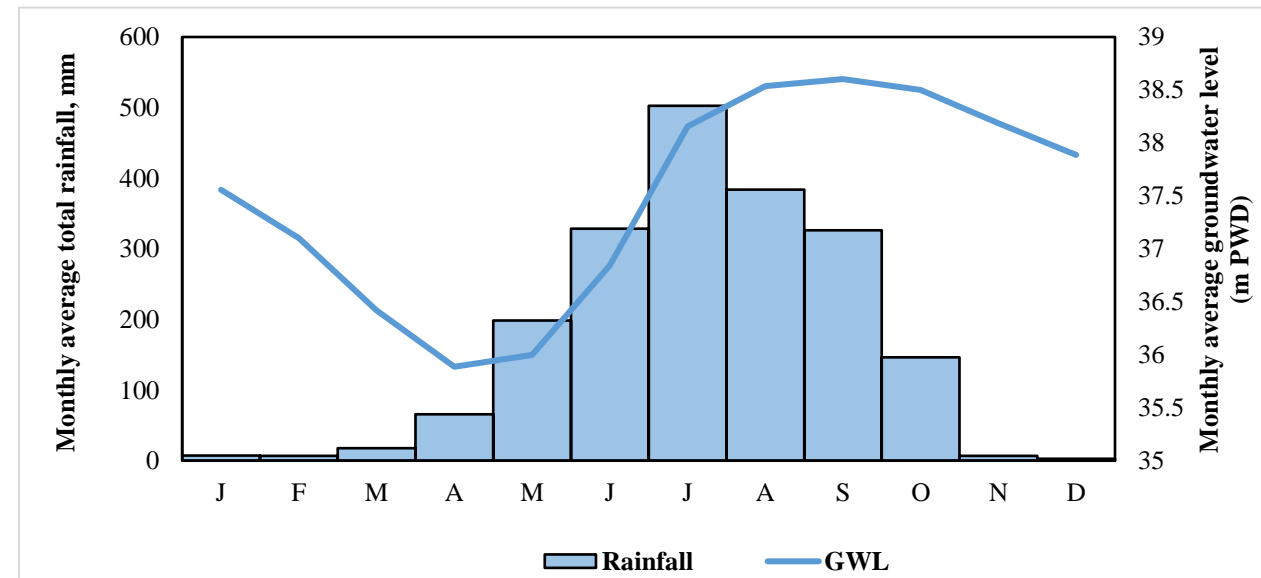
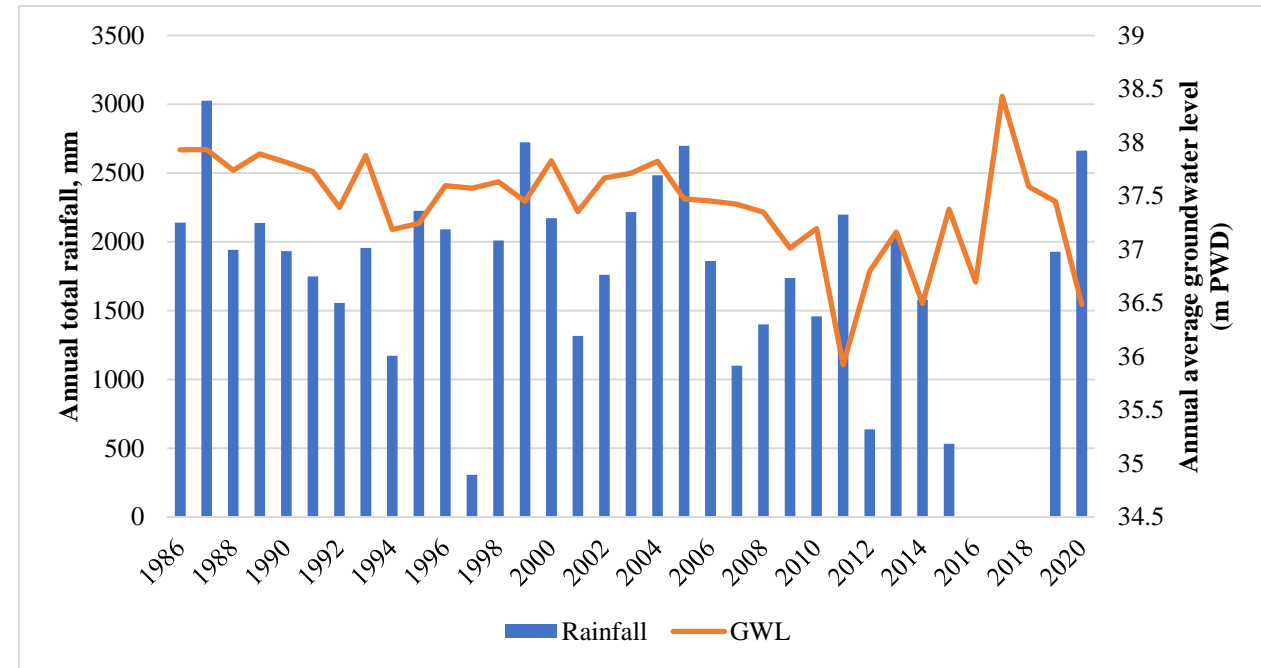
5-day maximum rainfall (RX5)- **235.7 mm**

500 mm is the highest monthly average rainfall

Average GWL **decreases after 2018** though annual rainfall increases

☐ Lowest GWL- April

☐ Highest GWL- September



GWL Response (Ishwarganj)

Analysis of Water Level

Rainfall ~ 148 mm occurred on the 1st of July in 2019

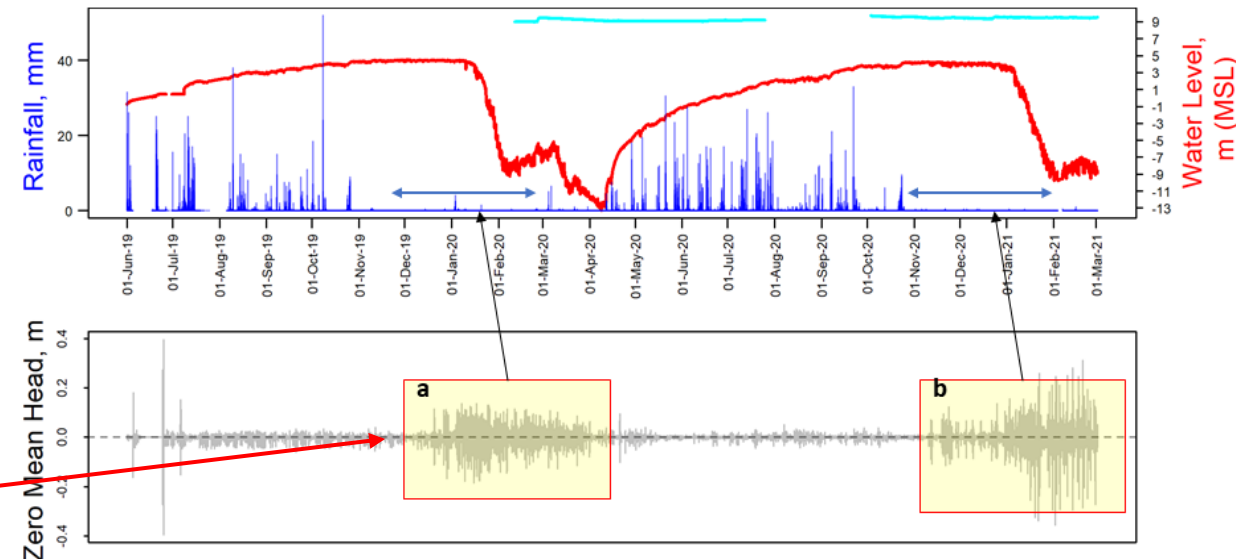
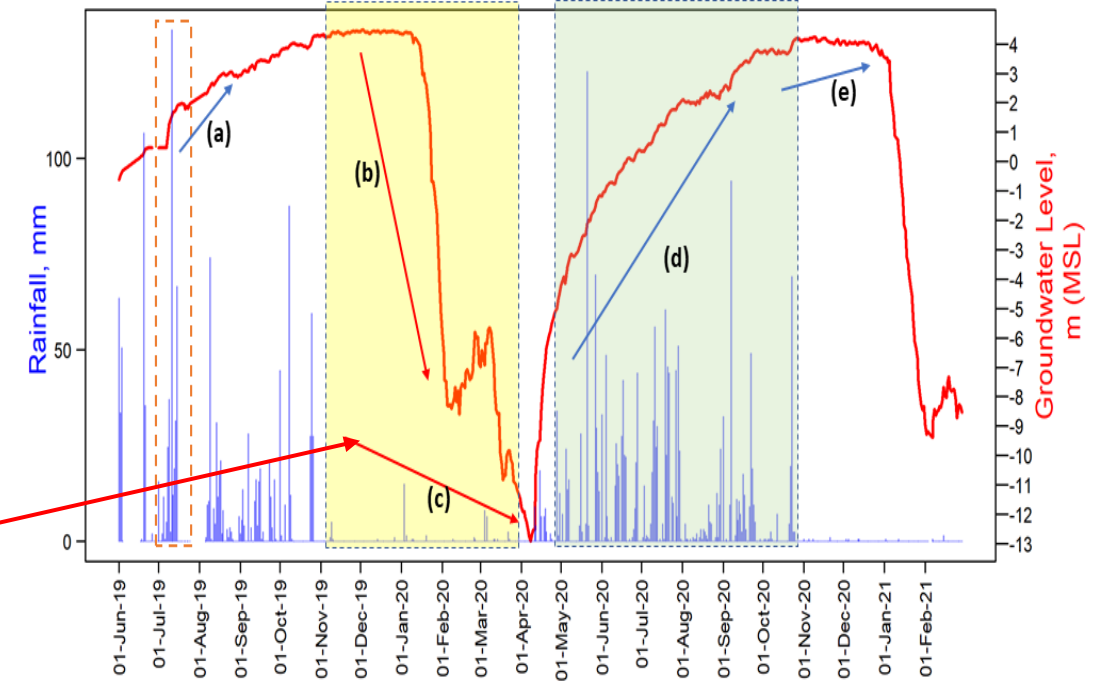
Declined furthest depth on 20th April 2020 up to **13m** MSL

GWL has reached the top saturated condition till **1st January 2021**

at the end of February 2020, there is a sharp rise in the GWL graph of **approximately 4m**.

simultaneous increase in the surface water level

High fluctuation of GWL in the dry season-
Shaded a and b



GWL Response (Bochaganjanj)

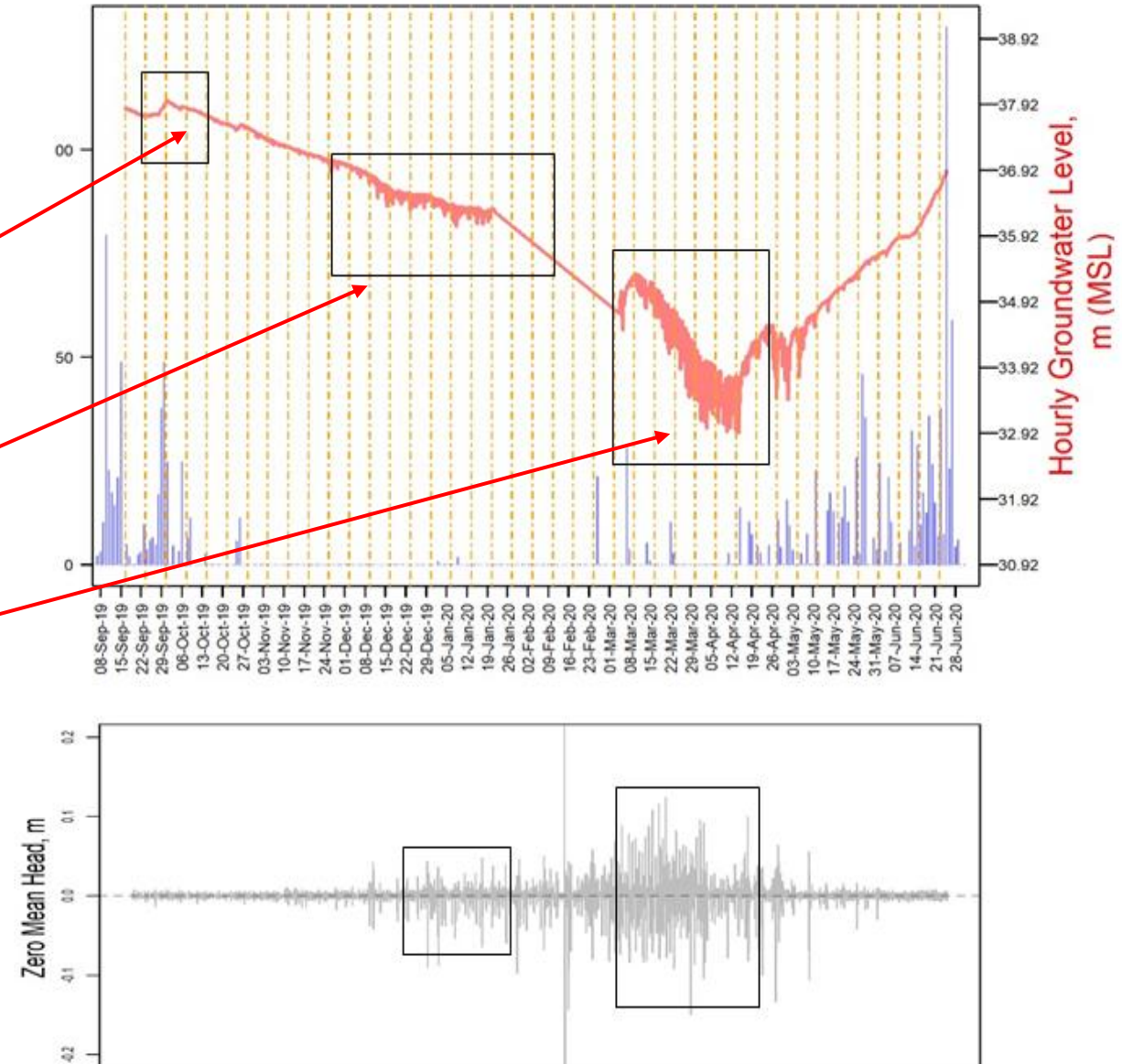
Analysis of Water Level

Good response to rainfall on 30 Sep 2019

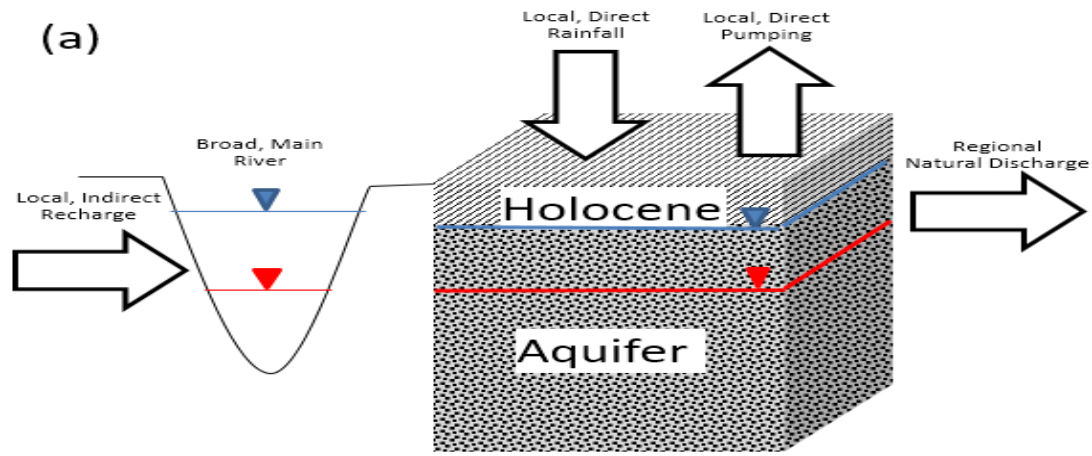
202 mm rise of GWL to cumulative rainfall (131 mm) of the past 3 days.

Perturbations in GWL in **December and January**

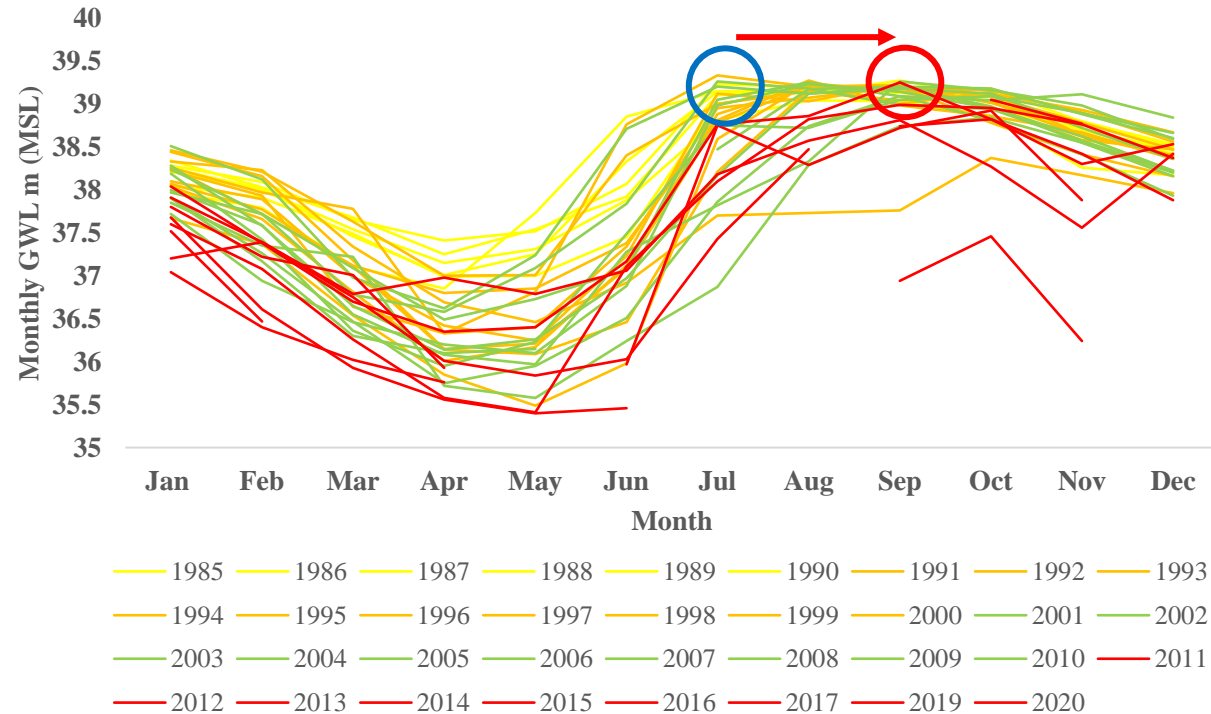
greater fluctuation in the GWL is seen in **March and April**



Key Findings



Temporal GWL change at Bochaganj



Upscaling AI-R not recommended without Piloting

Dinajpur not suitable for continuing

- Both diffuse and focused recharge in Ishwarganj but could not be confirmed for Dinajpur
- Continuous decrease in GWL
- Increase in Recovery lag time causes change in the aquifer characteristics as well as harvesting pattern.

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Any Question?

Thank You