

Impact of Climate Change on Ground Water Resources

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Abstract - As the climate is changing there is a direct effect on global mean temperature. The global mean temperature increases by 0.6 to 0.8°C, and predicts an increase of 2 to 4°C over the next 100 years and hence as the temperature increases there is a direct effect on the hydro-logic cycle because of direct increase in evaporation of surface water and vegetation transpiration.

These changes will directly influence precipitation amount, intensity rates and indirectly impact flux and surface storage water and subsurface reservoir such as lake, soil moisture and groundwater.

And hence these climate change affect surface water resources directly due to climate variables like air temperature, precipitation and evaporation and hence the direct effect of climate change depends on change in volume and distribution of groundwater recharge

Key Words: climate change, ground water recharge, hydrological cycle

1. INTRODUCTION

Climate change is happening nowadays because of rapid pollution enhancement and hence the pollution increases make a direct impact on the environment and the natural climatic cycle and hence because of this other factor of the environment gets affected and disturbed. An atmospheric carbon dioxide level has continuously increased since the 1900s and hence due to continuation of this phenomenon alters global and local characteristics including temperature and precipitation. By enhancement in temperature there will be profound effects on the hydrologic cycle. However the extra precipitation will be distributed unequally around the globe and what happens in some parts of the world may see significant reduction in precipitation or there is alternation in dry and wet seasons.



Figure no. 1

1.1 Effect of climate change on groundwater?

Hence we have already discussed the effect of pollution on the environment and how the climate is changing day by day, but our main topic of concern is the effect of change in climate on groundwater resources, changing in temperature results in changes in hydrological cycles and there is also direct increase of evaporation of surface water and vegetative transpiration hence these factors show direct impact on underground water storage. Although ground water accounts for only small percentage of total earth water but ground water contains approx 30 to 35 % of earth's fresh water.

- It is very necessary to consider the potential impact of climate change on ground water systems
- However the most noticeable impact of climate change could be fluctuations in surface water levels and quality and hence it directly affects on the agricultural production which are dependent on ground water and affect population whose main source of usable water is dependent on ground water.
- Ground water is dependent on the precipitation and hence direct impact of climate change is observed on precipitation and surface water ultimately affects groundwater systems.
- Groundwater system is a part of hydrologic cycle, and hence it can be anticipated that ground water system will be affected by changes in recharge.

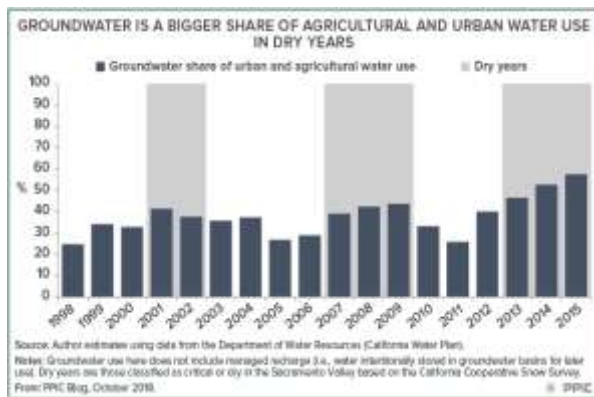


Fig -2.1

1.2 Effect of climate change on ground water in India

In India groundwater is the principle source of drinking water in the rural areas. Dependence of drinking water in rural areas from ground water is about 85%, which is huge as compared to other nations and In India on the whole has a potential of 45.22 Mha-m/year of replenishable groundwater in the recent years due to the threat in groundwater sustainability the water table in many regions of the country has dropped significantly. These regions are states of Gujarat, Punjab, Haryana, Tamil Nadu and Rajasthan that have registered groundwater development above the national average. While in Gujarat state the situation is very critical. Where cities like Ahmadabad have reported a decline in water table at the rate of 4 to 5 meters every year. In other states such as Delhi the water table has fallen by over 10 meters. Even in Kerala water tables have been falling besides that intensity of monsoon rain is heavy.

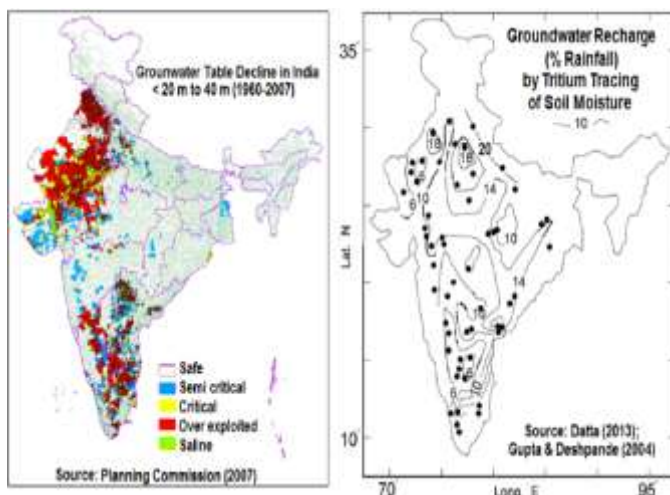


Fig -2.2

2. GROUNDWATER RECHARGE

Increased in Groundwater recharge depends directly on several factors such as infiltration capacity, stochastic characteristics of rainfall, and climate factors. The spatial and temporal distribution of the rainfall mainly controls the natural groundwater recharge. The recharge is irregular and

occurs in the periods of heavy rainfall. In humid regions, recharge is mainly in the winter period. In the summer period, most of the rainfall becomes soil moisture and evaporates. In cold areas the melting of ice suddenly recharges the groundwater.

There difference found in summer rainfall and winter rainfall on the groundwater recharge. In the winter rainfall as under most scenarios for mid latitudes, results in increased groundwater recharge. There are two types of aquifers unconfined and confined aquifers, in which the unconfined aquifers recharge directly by the rainfall, lakes and rivers. In which the rate of recharge is directly proportional to the permeability of overlying rocks and soils. And hence these unconfined aquifers are very sensitive to climate change, abstraction. Whereas confined aquifers does not get directly influence by local rainfall.

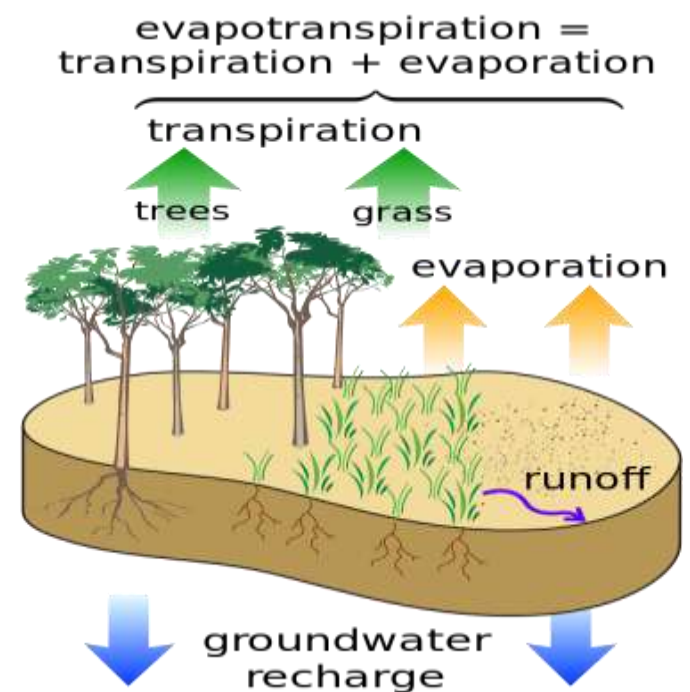


Fig -2.3

3. METHODOLOGY

Increased the changing precipitation and temperature pattern is the primary focus of climate change research. Temperature patters of the locality mainly affect the local climatic conditions and hence there will be different ground water levels depending on the climatic condition. Many modeling technique have been used to derive groundwater recharge. Which involves two main parameters which are recharge and river discharge on these parameter whole modeling techniques are based. Research objectives involves, the investigation of regional and local weather events which are directly affecting the recharge, because as we focus on weather or climatic conditions which is generally called as weather events of that region we can finds the effect of climates on that ground water level,

another objective is to determine the potential impact of climate change on recharge. Climate scenario can be formulated for the year 2050 and 2100 this is done by value changes of climatic variables on a seasonal and or yearly.

Problems with ground water:

- ground water overdraft
- water logging
- seawater intrusion
- ground water pollution

Sea level rise is a global concern in which mean sea level has risen globally by 25cm on average over the 100 years and hence sea level will vastly affects the coastal region. There is a link in between the sea level and water balance level.

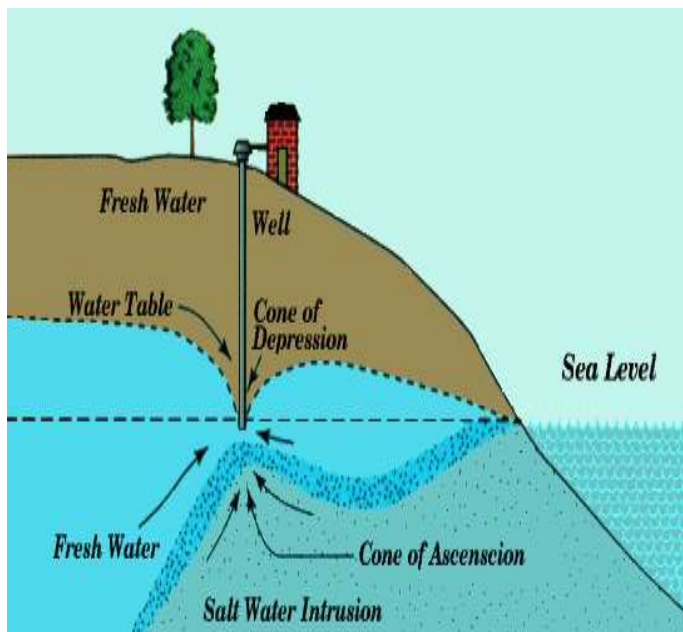


Fig -3

To assess the impact of potential climate change on the ground water resource, we have to focus on the changes in ground water recharge. Hence sea level rise leads to intrusion of saline water into the fresh groundwater in coastal aquifers and adversely affects ground water resources.

The most important assumption suggest that the average drop in ground water level by 1m would increase total carbon emissions by over 1 % because of same amount of water from deeper depth will increase fuel consumption. In India around 52 % of irrigation consumption across the country is extracted from groundwater. It is an alarming situation because of decline in ground water and enhancement in irrigation requirement due to climate change. And in many studies it is projected that enhancement in temperature and decrease in rainfall reduce the net recharge and directly affects the ground water level.

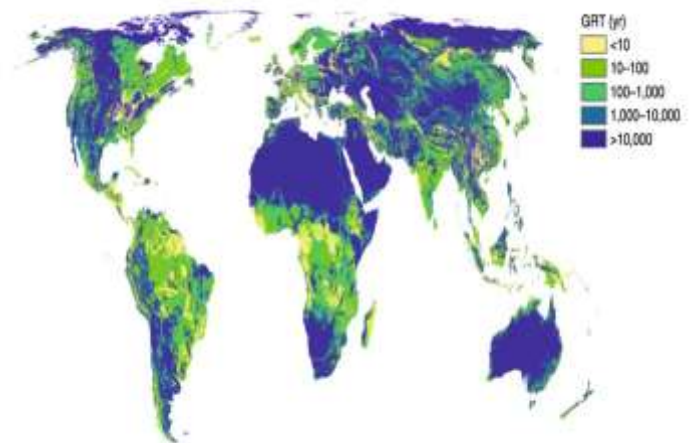


Fig -4 (global distribution of ground water)

Hence the whole discussion on this climate change is also related to the main cause of it which is global warming, earth is warming more in several few decades it is mainly related to emission of carbon dioxide and other greenhouse gasses , some researches shows that places at higher attitude getting wetter and others primarily with lower attitudes are getting dryer , the models also attend to agree likely to be more variability in the precipitation both floods and grouts are to recovered with greater frequency ,duration and intensity.

Now these changes likely to affect the hydrologic cycle and the warmer temperature likely speed up evapotranspiration from land surfaces and speed up transpiration, no matter what happens to precipitation increase evapotranspiration will tend dry out soil and lead less water available to flow through streams and hence there is less water available to inflow in the ground, warmer temperature will also cause shift in precipitation through more rain and leads to rapid melting glaciers.

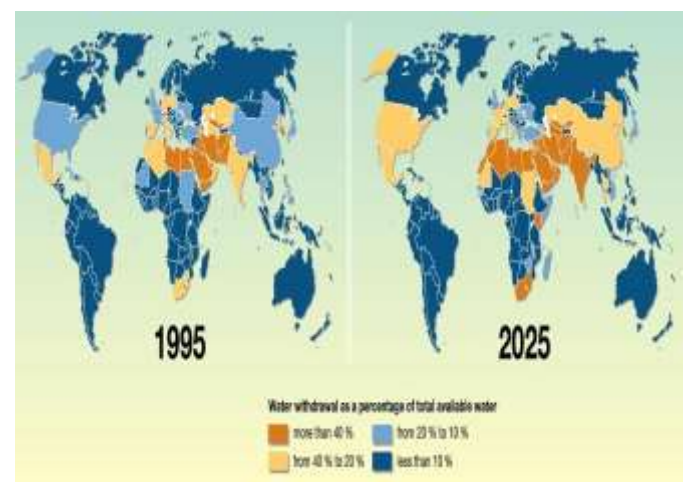


Fig -5 (water stress in globe)

Considering the impact of both the climate change and population growth we are likely to see significant amount of more sewer water scarcity by year 2025, according to

population action international more than 2.8 billion people from 48 countries will face water stress or scarcity conditions by the year 2025. over the next two decades population increases and growing water demands in addition to change in climates by projected to push all the west Asian countries

In the water scarcity condition by 2050 the number of countries facing water stress could rise to the combined population of 40 % of the total population.

There are certain numbers of possible action over that which are follows

- agricultural water conservation and reuse
- water banks
- water shed management
- augmentation
- water transfers
- tribal water
- environmental flows
- data and tool development
- climate science research
- partnerships

3. CONCLUSIONS

In this paper we had study about the actual effects of Different climatic change on ground water resources and discussed different methodologies over it.

Ground water recharge, resulting from both climate and socio economic change is to be assessed. although climate change been widely recognized and the research on the effect of climate change on the ground water resources is limited because of many reasons but the main reason is the uncertainty is embedded in model parameter . The relationship in between the groundwater resources and climate change is very important for understanding the characteristics of that particular region.

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It is indeed a great feeling of pleasure and pride to present the "THE IMPACT OF CLIMATE CHANGE ON GROUND WATER RESOURCES" cases study at JDIET yavatmal.

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