Title: Modeling and Forecasting Climate Variables– Temperature, Groundwater Level, and Rainfall in Bangladesh: A machine learning approach.

Background Study: Bangladesh, a densely populated and low-lying country, is highly vulnerable to the impacts of climate change. Variability in climatic variables such as temperature, groundwater level, and rainfall significantly affects various sectors including agriculture, water resources, and infrastructure. Traditional forecasting methods often fail to capture the complex interactions and non-linear patterns inherent in climatic data. Hence, there is a pressing need to develop advanced forecasting models that can provide accurate and timely predictions to support decision-making and mitigate the adverse effects of climate change.

Problem Statement: The problem we're trying to solve is how to predict things like temperature, groundwater level, and rainfall in Bangladesh. This is important because these factors affect many parts of life, like farming and water supply. The challenge is that current methods for predicting these things don't always work well. They struggle to understand the complicated patterns and changes in the weather over time. Plus, in some areas, there isn't enough data available. We want to use new techniques, like machine learning, to create better predictions that people can rely on.

Methodology:

1. Collecting and Preparing Data: First, we gather information about temperature, groundwater level, and rainfall from places like weather stations and government agencies. We clean up this data to fix any mistakes or missing parts.

2. Choosing Important Features: We look at different things that might help us predict the weather, like patterns we see over different seasons or how things have changed over time. We also think about other factors like geography that could affect the weather.

3. Training and Checking Models: Utilization of various machine learning algorithms:

    - ARIMA (Auto Regressive Integrated Moving Average): Suitable for time-series forecasting.
    - SARIMA (Seasonal ARIMA): Handles seasonal variations in data.

- Multiple Linear Regression: Examines linear relationships between variables.
- Random Forest Regression: Manages non-linear relationships and variable interactions.
- LSTM (Long Short-Term Memory) Regression: Effective for sequential data like time series.
- SVR (Support Vector Regression): Handles complex relationships in high-dimensional spaces.

Models are trained on historical data and validated against known outcomes.

4. Combining Predictions: Sometimes, using more than one method together can give us even better predictions. We might combine the predictions from different models to get a more accurate picture of what the weather might be like in the future.

5. Making Predictions: Finally, once we're happy with how well our method works, we use it to make predictions about the weather in the future. We can then share these predictions with others so they can plan ahead.

Expected Result: Our project aims to develop precise forecasting models for temperature, groundwater levels, and rainfall in Bangladesh. These predictions will aid agriculture, water management, and disaster planning, offering insights into short-term fluctuations and long-term trends, empowering stakeholders to make informed decisions and enhancing community resilience and safety.

Possible Impact on Society: Our project's impact on Bangladeshi society includes better disaster preparedness, resource management, and decision-making. Accurate forecasts help mitigate climate risks, enhance agricultural productivity, and empower communities to take proactive measures, fostering resilience and minimizing the impact of extreme weather events on lives and livelihoods.

Conclusion: In conclusion, our project aims to develop accurate forecasting models for Bangladesh's climate variables. These models promise to enhance preparedness, resource management, and decision-making, fostering resilience and sustainability in the face of climate change.