Software System for Weather and Disease Modeling at Regional Scale

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***Abstract*— This study is mainly aimed to determining the future share among the weather parameter and human health diseases modelling over Northeast, India (NEI). The Northeast India covers an area of 0.26 million km2. This region is one of the highest rainfall-receiving regions on the planet. The NEI is highly prone to the consequences to climate change because of its geo-ecological delicacy, strategic location vice the east Himalayan landscape and international borders, its trans-boundary river basins and its native socio-economic instabilities. Environmental security and property of the region are greatly challenged by these impacts. The increasing melting of glaciers in Himalayas is great concern for the region, although rapidly increase of urbanization over region. Trend in seasonal and annual rainfall was subdivided and regional scales for NEI were examined in this study. Trend analysis of rainfall information is from (1979-2014) for 36 years and its show of slightly increase. Increase of rainfall can have an effect on to human health and easy for diseases modelling. In the proposed work the data mining approach will be adopted to assess the role of climate and climate change on the human health diseases mainly water borne and vector borne diseases over the North East India..**

Index Terms*— *Climate change, human health and diseases modelling, rainfall, temperature, trend analysis, urbanization and Northeast India.

I. INTRODUCTION

1.1 Climate Change:-

Climate change and its impact on human health disease modelling over North-east, India (NEI) is increased risk day by day such as the risk of injury, illness and death from the resulting heat waves etc. and India are crucially dependent on the time availability of adequate amount of water and a conductive climate. Hygiene is generally poor all most parts of India so food and water borne illness or diseases are common. Climate change is a modification in the statistical distribution of weather patterns and other patterns of variation in temperature, humidity, atmospheric pressure wind, precipitation and other meteorological region over long periods of time. India is one of the Countries most strongly affected by climate change. Recently, India reported an increase in the incidence of vector-borne diseases, decrease in crop production, more frequent extreme weather events which could be attributed to changing climate It is due to biotic pressure, variable in solar radiation received by Earth and main important is due to human activities have been identified as significant causes of recent climate change, as "biohazard". Like Change on agriculture, increased risk of hunger and water scarcity, rapid melting of glaciers and decrease in water flows, particularly in lower income populations, predominantly within tropical and sub-tropical countries by Intergovernmental panel to Climate change(IPCC 2007)[1]. Weather can also affect health directly (temperature and desperate weather related illness and death) and indirectly, such as through air pollution-related disorders, water- and food-borne diseases, disease vector and others [2].

1.2 HPC with Climate Change

HPC (High-performance computing) is use of parallel processing for executing advanced application programs efficiently, reliably and fast. Performance is measure in floating-point operations per second (FLOPS) instead of million instructions per second (MIPS). HPC will likely significance businesses of all sizes, particularly for transaction processing and data warehouses. Climate change on research area is one of the interested areas and is going growth from past and present. Demand intense super computing resources to perform the climate simulations which are run for many years. With increasing interest in climate change and its impacts, scientists have also developed regional climate models instead of running models on a global scale [3].

1.3 WRF (Weather Research and Forecasting Model)

The Weather Research and Forecasting (WRF) Model is a numerical weather prediction (NWP) system designed for both atmospheric researches that are for meteorological and operational forecasting needs and can run on variety of computing platform. It is suitable for board ranges of applications across scales ranging from ten meters to the

global, including the Real-time NWP, Meteorological investigations, atmospheric simulations, Data assimilation and development, coupling with other earth system models etc.

1.4 STUDY REGION (North-East Regions of India)

In this work basically we emphasize on the north east part of country. The NER of India consists of the seven states and also name as seven sister. This region is guarded by mountains. This have are more beautiful than the other, each with its own cultures and beliefs, they have each own charm and it has been favored enough to keep industrialization and modernization at bay, proving this region clean unpolluted air and a very rich natural habitat. Within seven states there is a great religious and ethnic diversity. The state are cover of Assam, Arunachal Pradesh, Manipur, Mizoram, Nagaland, Meghalaya, and Tripura. The people of NE live in a very simple life and all type of tribes and also cultures still live in according to the environment and most import nature play a big role in their continuity. These states consist of a part of the east Himalayan region, which extends from eastern part of Arunachal Pradesh to the part of Darjeelin hills of West Bengal. The area is characterized by rich biodiversity, heavy precipitation, and high seismicity. It has a predominantly humid sub-tropical climate with hot, humid summers, server monsoons and mild winters. The region stretches between 21o50' and 29o34' N latitude and 85o34' and 97o50' E longitude. The region has a geographical area of 26.2 million hectare, which is 3.85% and 8% of the population and area of the country, respectively. The region has inaccessible terrain, delicacy, marginality, excessive sloping land with rolling to the lay of land, rich biodiversity, particular ethnicity and socio-ecological set up over the region. Rocky surface, alpine vegetation and snow-capped high peaks dominate to their physical landscape of this area. The huge pattern of north east varies from one place to another place. In these regions plains were mainly comprised of Brahmaputra and Barak valleys as a large dependence of the population over natural resources, and poor infrastructure development. The areas of Barak Rivers are active flood plains with humid lands subjected to extreme annual inundation. Due to rich in divest and harbors the largest number of endemics and species then anywhere in the country. The distribution of various species has restricted due to topographical features, deep valleys, slopes and river system. The impacts of climate change over regions such as northeast India has less explored and less known till now making the future scenarios more ambiguous for vulnerability assessment and risk management. The region is also characterized by disparate climate regimes which are highly dependent on the southwest monsoon which will start from June–September. Kaligandaki Valley of center Nepal toward the northwest Yunnan in China, and including with Bhutan, parts of (North East Indian states, and the Darjeeling hills of West Bengal), also southeast Tibet and parts of Yunnan in China, and northern part of Myanmar. These five countries has also different type of geo-political and socioeconomic systems, also diverse perception and ethnic groups [4]. Figure 1 shows the Index Map of the northeast region of India showing different meteorological subdivisions.

Figure 1: Map of the northeast region of India showing different meteorological subdivisions

II. WEATHER ANALYSIS OF NORTH EAST INDIA

The North Eastern Region (NER) of India, receipt of heavy rainfall, due to change of climate the region became low in rainfall variability category and it ranges from 8-15%. For North East states of India, the normal annual rainfall ranges is from 200-300 cm. The region has huge Green vegetation, big water bodies and the nature's beauties and mega-biodiversity are the attraction of the NER [5]. The annual rainfall in the region is received mainly from south-west monsoon from middle of May and continues till October. On an average, the NE region receives about 2450 mm of rainfall while annually the Cherrapunji-Mawsynram range receives rainfall about 11,500 mm. The region shows great variation in temperature regime too. The temperature varies from 15ºC to 32ºC in summer and 0 to 26ºC in winter [6]. NE India is vulnerable of water-induced disasters because of its located over the eastern Himalayan periphery, fragile geo-environmental setting, and economic underdevelopment.

2.1 Rainfall Analysis

In the figure 2 shows the annual rainfall distribution pattern over the NER of India for 36 years data from (1979-2014). In this data we use regional data for year wise and analyses of rainfall over NER of India and the trend analysis shows of rainfall is overall not change in this region. The rainfall data were obtained from Indian Metrological Department (IMD) .These data may consider more reliable for study area of long term series. The data were used for 36 years (1979-2014). The figure 3 shows the anomaly rainfall distribution pattern for Northeast Region of India over the 36 years data(1979-2014). Anomaly rainfall were divided into three different section to find out which year will get most rain or not and. The normal rainfall is between (-10 to 10), which is less than (-10) is deficit and more than 10 is excess rainfall. It indicates that in

the years of 1979, 1980,1987,1988,2000 and 2007 has excess of rainfall (16.66667mm). The most deficit rainfall years were 1982, 1983,1984,1989,1994 and 2014(19.4444444mm). The normal rainfall years are 1981, 1985, 1986, 1990-91, 1993, 1995-99, 2001-06 and 2008-2013(63.8888889 mm).The trend analysis shows rainfall is increasing. So increasing of rainfall will show change of climate parameter over the region of NER of India.

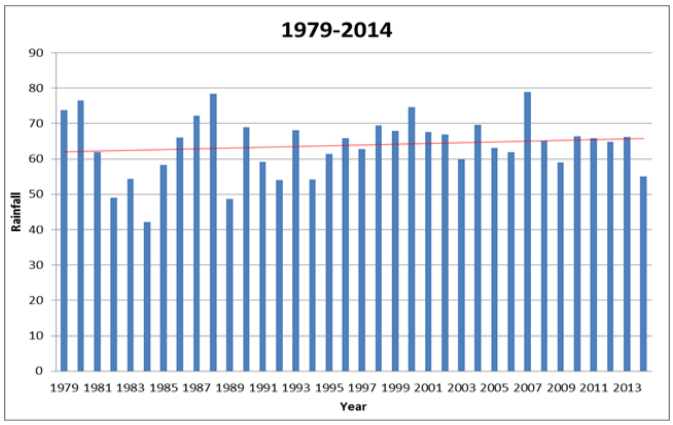


Figure2:- Annual Rainfall Distribution pattern Northeast region of India over last 36 year data (1979-2014)

Index for rainfall were measure for each of the year of past 36 years data $R=\sum_{i=1}^{n}(i)$

Rainfall index of annual has been calculate by total rainfall of each year of over last 36 years data

$$=\sum_{i=1}^{365} a(i,year)$$

$$TM=\sum_{i=1}^{365} a(i,yr)$$

$$R(y)=\sum_{day=1}^{365} Rain(day,yr)$$

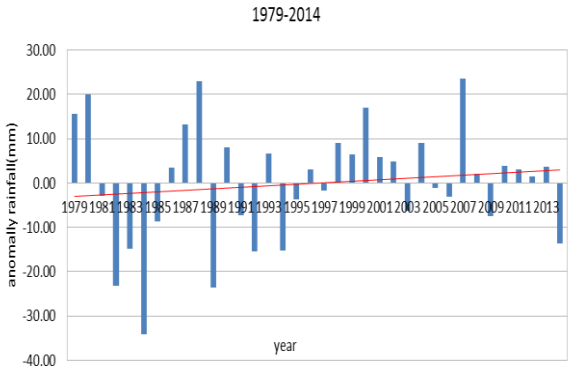


Figure3:-Anomaly Rainfall Distribution pattern Northeast Region of India over last 36 year data (1979-2014).

2.2 Seasonal rainfall analysis

For the seasonal rainfall analysis, 36 years data was divided into 5 climatic seasons, spring (Jan-March), pre-monsoon (April-May), monsoon (June-September), post-monsoon (October-December) and Annual (Jan-December). In the month (January to March) rainfall over the Northeast region has indicate of decrease of rainfall. While in the per-monsoon and post-monsoon rainfall trend analysis shows same its mean there is no change of rainfall in this seasons, but in monsoon data there is a slightly change of rainfall its show increase of rainfall in monsoon season as same as contribution. So in this region rainfall will mainly occur from the month of June to December.

III. SOFTWARE AND TOOL USED

A. Grads

Grads are also known as Grid analysis and display system it is an interactive visualization tool used for easily access directly, and visualization of earth science data. Grads used two type of data model to handling gridded and station data. GrADS used 4 & 5-Dimensional data environment, the 4 dimensions are (longitude, latitude, vertical level, and time) additionally an optional 5 dimension for grids that is generally implemented but designed to be used for ensembles. Its handles grids that are regular, non-linearly spaced, Gaussian, or of variable resolution. Data from different data sets may also graphically overlay, with correct spatial and time registration. Data sets are placed within the 4-D space by use of a data descriptor file [6].

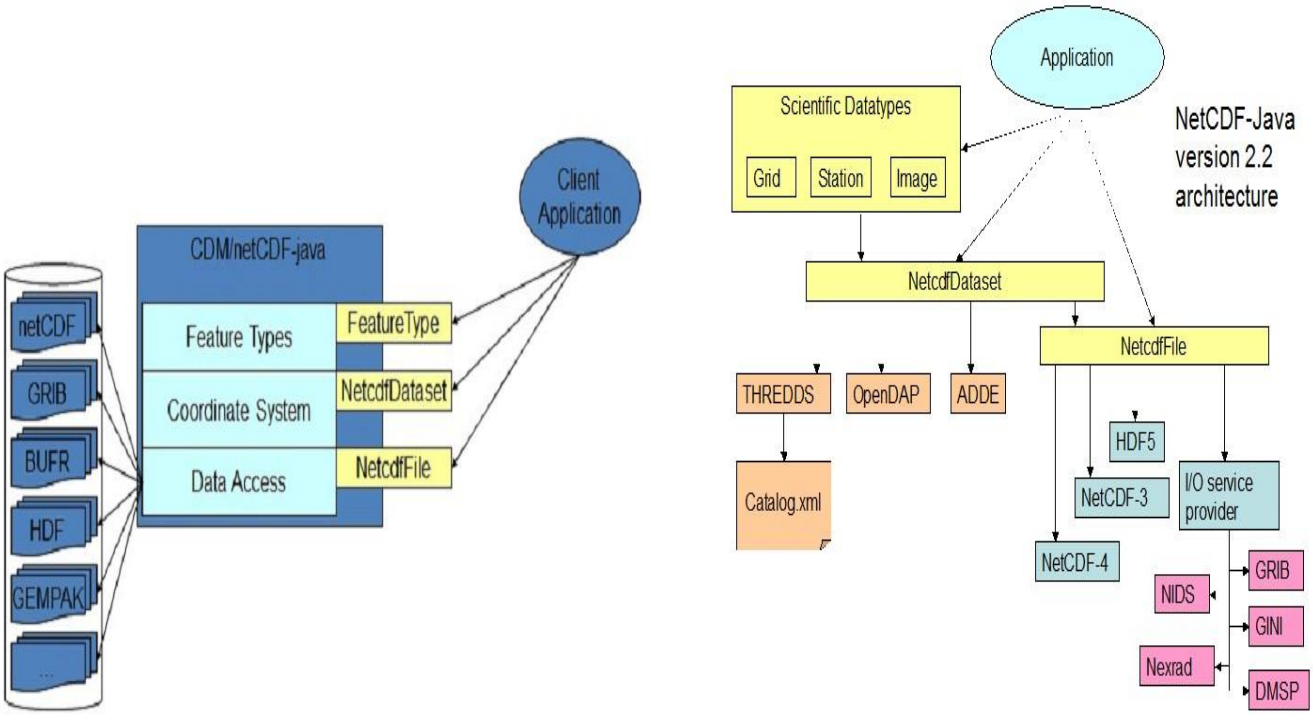
B. NetCDF

NetCDF (network common data format) is designed to facilitate access to array-oriented scientific data like self-describing data formats that support the creation, access**.** It is also file format for storing multidimensional scientific data or variables such as temperature, humidity, pressure, wind speed, and direction**.** From the netCDF we can also use the Multidimensional Tools toolbox to create a raster layer, a feature layer, and a table view. Although netCDF will directly access small subset of a large dataset may be accessed efficiently, without reading through all the preceding data [7].

C. NetCDF-Java Interface

It is a java interface to NetCDF files, not only common file are present in this, and there are many other types of scientific data formats. This library is freely available and its source code is released under the NetCDF C library license. Its advanced features of java Interface. It can access client to data servers by used of HTTPD and Open DAP. In this the coordinate system support for general and georeferenced coordinates. The I/O framework providing netCDF interface to data in other formats: GRIB, HDF5, GINI, and access through NcML virtual datasets to add metadata, aggregate data, and subset. Java is a programming language expressly designed for use in the distributed environment of the internet not only it is portability and object oriented. Java is faster than c for some applications example multithreaded

server. Java virtual machine (operating systems) likes LinuX, Solaris, windows (sun) etc. The netCDF-Java architecture is presented in figure 4 below.



(a) (b)

Figure 4:- Architecture of NetCDF –Java Interface using simple client Application

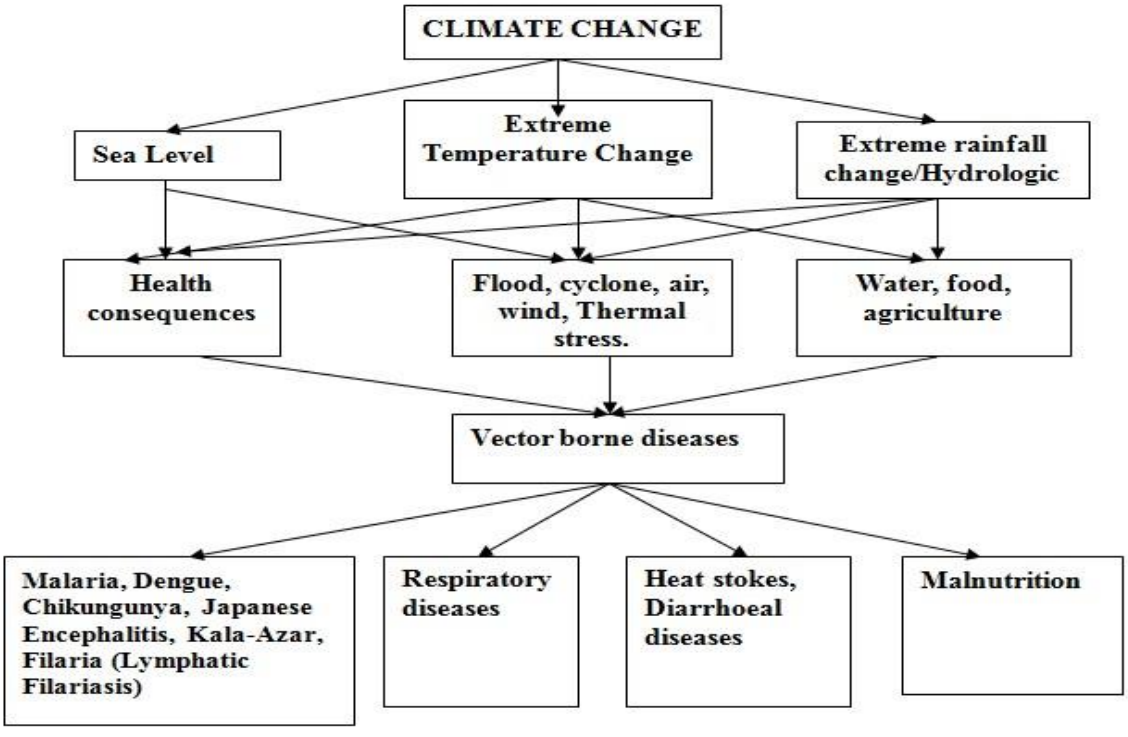


Figure 5: Flow chart for relationship climate change and diseases modelling over human health

IV. CLIMATE CHANGE AND DISEASE MODELLING

According to the latest report of Intergovernmental Panel on Climate Change (IPCC 2007), will mainly occur due to venerable activity and they will effect by directly or indirectly. Although with a large amount of the variability of rainfall is due to excess rainfall. In this study, there is need to know the magnitudes of extreme rainfall over different parts of the area. The study of spatial variability of extreme rainfall events help to identify area of high and low values of extreme rainfall events. Changes in environmental temperature, humidity, and rainfall patterns are increasing of diseases such as Lyme disease, Japanese encephalitis, diarrheal, kalaazar, filariasis, malaria, dengue, chikungunya, and cholera. In additionally with natural disasters and abnormal weather phenomena can also cause chronic stress disorders and many other psychological or mental health problems. Rising of Sea level will pointed into the loss of land, damage of infrastructure, and a reduction on farming productivity may lead to increasing forced migration and several other socio-economic complications. Infrastructure of public health care systems will also affects from climate change. Relationships between period to period alternation in climate and infectious diseases are most conspicuous where climate variations are marked and most sensitive populations. People who are more elder, children, economically weaker, and especially women existent in the primitive areas will get more affect when climate change.Manipur and Mizoram in the northeast regions where transmission easily for malaria.

IV. RESULT

By the uses of visualization tool and GUI are well implemented and tested the user input like the parameters to be extracted from database and analysis and is presented at figure 6. In figure 6 were displaying global and in figure 6 will represent by the use Grads and NetCDF .Which basically allows the users to select the parameters like temperature, rainfall, wind, humidity etc. After global analysis domain were select for region area were going to study. We had analysis first India region and Northeast region of India of weather parameter and found that NER of India had change of climate.

V. CONCLUSION

In this paper there is a link between Climate change and weather parameter over human health diseases modelling over NER of India. Due to decreases of rainfall and increase of temperature show that there are big issues in agriculture. Although due to lack of water will get problem in agriculture. India is country like fully depend on climate. Change of climate is directly affect human to human health. The North East Region of India is belong to eastern Himalayas which rich of bio-diversity, has shift in rainfall pattern and rise in temperature it is important to relook at the present date of sowing and varieties. Increase of temperature will directly affect human health like Flood, Cyclone, Heat stress, air pollution (asthma, cardiovascular…) allergies etc. , due to suddenly extreme rainfall they also affect to health Water , air ,food …Water bone disease like cholera, leptospirosis, malaria, diarrhea, malnutrition, anxiety, despair, forced migration, civil conflict. Directly effect: health and death. Studies and analysis had found that in India like NER can easily get of malaria and cholera because some of the North east India region has suddenly of climate change. The region has 50 percentage of tribal population occurred and due to lack scientific research and medical issues they can't able to detect when any health issues occurred.

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