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2015 FLOOD ASSESSMENT IN KANCHIPURAM DISTRICT OF TAMILNADU USING GIS

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ABSTRACT

In the past two decades, Tamilnadu received frightening flood frequently cause serious smash up to the environment and survive defeat. Kanchipuram district is situated next to Chennai city. It has worst affected area during 2015 flood due to increasing population, encroachment of the water bodies and disappearance of lakes, shrinking of marshy land. It started from November 8th 2015 to December 1st 2015 with two cyclonic low depressions which cause due to northeast monsoon accommodate with ELNINO phenomenon. This study has to bring out the damage assessment in the affected areas by house hold survey with prepared questionnaire pattern from literature review and this paper presently describes the flood assessment in the study area using GIS interpolation technique. From this assessment the result indicate, peak rainfall occur in TambramTaluk, Thirukalukundram and Chengalpattu Taluk respectively. Single day average rainfall on 02.12.2015 of the Kancheepuram District had reached 343.20mm and out of 10 rain gauge stations, 8 stations recorded more than 250mm in a day which casuse fully inundated in the low lying areas and the numbers of people has relocated from low lying area and people got worst experience, lot of thrash about due to power shut down, without transport.

Keywords: El-Nino, GIS, Interpolation, low lying area, rain gauge station, hose hold survey and questionnaire

INTRODUCTION

A flood is an unusually high stage in a river-normally the level at which the river overflows its banks and inundates the adjoining area[1]. It is the most common natural disaster; it causes more in damages in terms of loss of life, property and economic activity than any other natural disaster[2]. More than 520 million people are affected by flood per year in world. It gives result in estimates up to Annual deaths of 25,000, extensive homelessness, disaster induced disease, crop and livestock damage and other serious harms[3, 4].

Tamilnadu has 13 coastal districts, Kanchipuram is one of the coastal districts located next to Chennai city. Tamilnadu receives two monsoons season such as northeast and southwest monsoon. More rainfall get during northeast monsoon and number of cyclones are formed during some frequent period cause severe damage to the properties with live lost. Storm surges associated with severe tropical cyclones are by far the most damaging[5]. Important observation is during NE monsoon accompanying along El-Nino grounds cyclone. Rainfall is more than normal during El Nino years and less than normal during La Nino years[6].

El Nino is oceanic phenomenon, the intensity is much more difficult to predict due to random atmospheric disturbances that may dampen or amplify the intensity of an El Nino occurrence and thus its impact on weather patterns.[7]

According to the World Meteorological Organization[8], research conducted over recent decades has shed considerable light on the important role played by interactions between the atmosphere and ocean in the tropical belt of the Pacific Ocean in altering global weather and climate patterns. During El Nino events, for example, sea temperatures at the surface in the central and eastern tropical Pacific Ocean become substantially higher than normal.[9]

In the past two decades frequently the study area acquire flood and impact is extremely most injustice. This is due to unplanned management in the water bodies and not as much of knowledge about soggy, swampy region and these places is modified into developmental activities and occupied by overpopulation. 2015 flood is the best and worst example experienced by people due to lot of thrash about

due to power shut down, without transport and shop also closed. Main objective of this study is to assess the flood damage in Kanchipuram district by adopting household survey and GIS interpolation methods.

Study area

Kanchipuram district is situated on the Northern East Coast of Tamil Nadu lies between11° 00' to 12° 00' North and 77° 28' to 78° 50' east shown in Figure-1. It is bounded in the North by Tiruvallur district and Chennai district, in the South by Villuppuram district, West by Vellore and Thiruvannamalai districts and in the East by the Bay of Bengal. The district has a total geographical area of 4,393.37 sq.km and coastline of 57 km and the temple town is the district Headquarters. The general climate of Kanchipuram district is hot and semi-arid. The maximum temperature is 37.10°C and the minimum temperature is 20.5°C. The highest annual rainfall recorded is 1423 mm and the lowest annual rainfall is 985 mm.

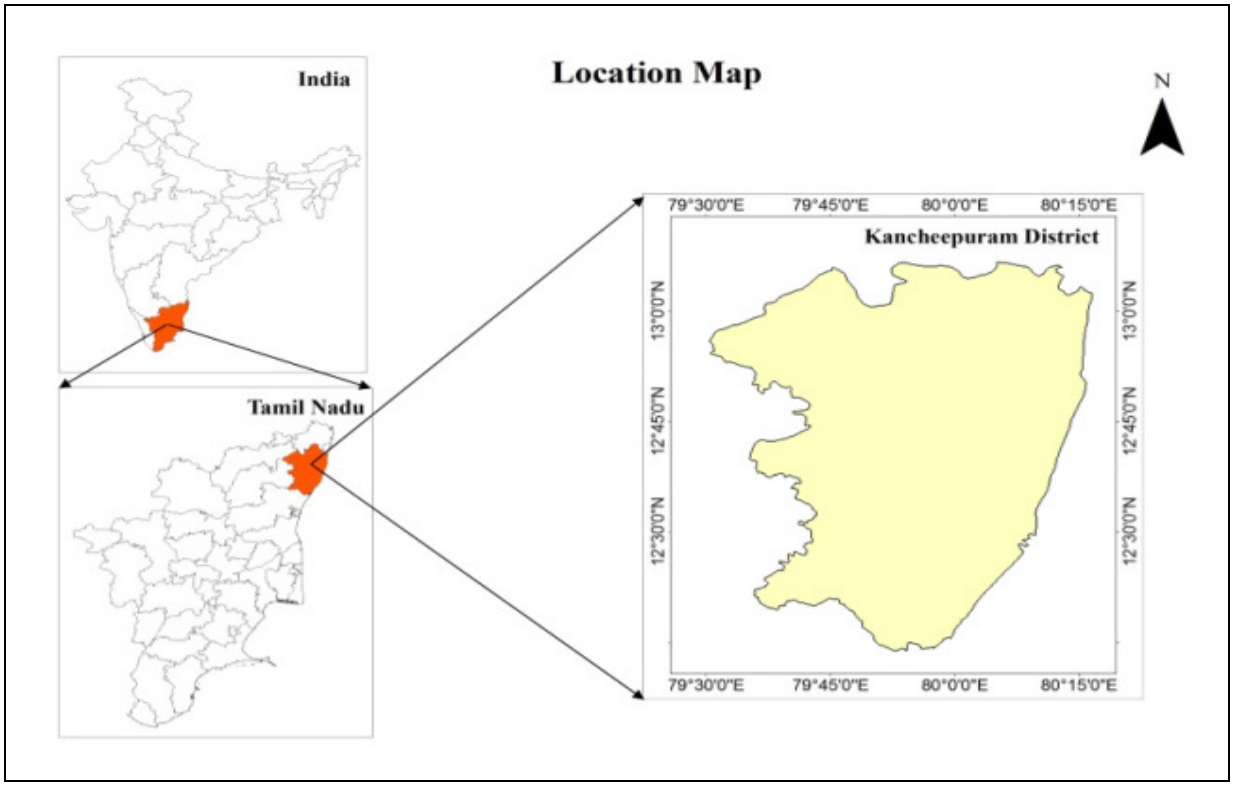

Fig.-1: Location Map of Study Area

For administrative reasons, the district has been divided into 4 revenue divisions comprising of 11 talukas with 1,137 revenue villages. For development reasons, it is divided into 13 development blocks with 648 village panchayats. Kanchipuram contains 13 taluk such as Kancheepuram, Walajabad, Uthiramerur, Sriperumbudur, Kunnattur, Thiruporur, Kattankolattur, Tirukalukundram, St. Thomas Mount, Acharapakkam, Maduranthakam, Lathur, and Chithamur shown in Figure-2. Study area mainly depending on the seasonal rains and it has two monsoon seasons such as Northeast monsoon and Southwest monsoon. In the northeast monsoon receives more rainfall and frequent cyclones comparing to southwest monsoon. The normal rainfall received by the study area in annually is 1213.3 mm and actual rainfall has been 1133 mm. During the month of April-June is summer, temperature reach maximum of around 38 ºC and winter covers in the month of December- February the minimum temperature reach around 19 ºC.

Methodology

In this study the methodology adopted in two separate modes; first one is to assess the impact by house hold survey and second is to prepare rainfall distribution map by using interpolation method in GIS for assessing the inundation detail. For this assessment initially rainfall data have been collected in IMD,

Nugampakam- Chennai along with rain gauge stations also collected, and Indian toposheet has been collected from Geological Survey of India in Guindy- Chennai. From NRSC site pre flood and post flood RISAT-1 jpeg file format and around Chemberabakkam Lake the submerged map have been downloaded on the data of 03, 04 & 06th December for finding the inundated area.

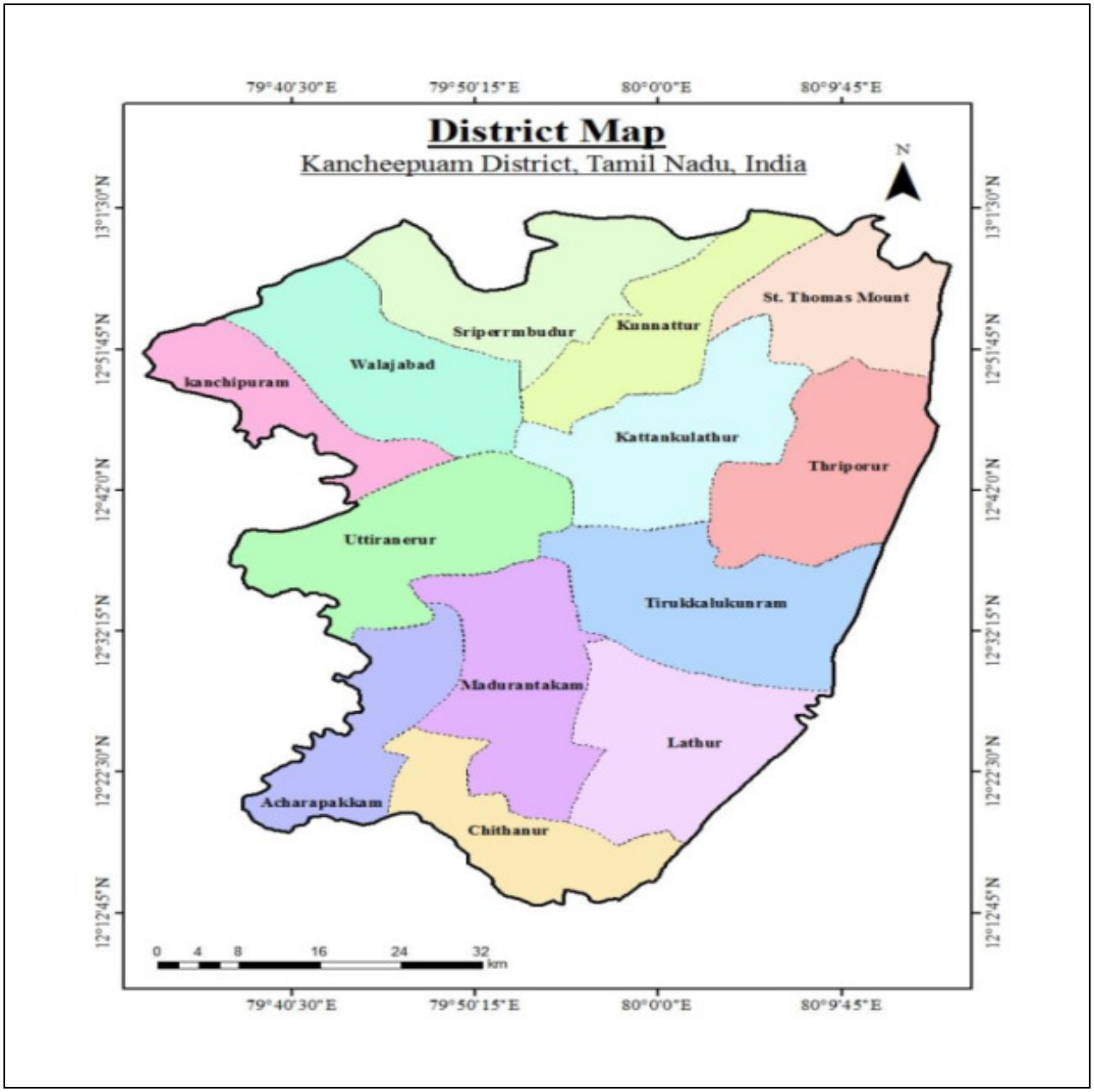

Fig.-2: Taluk Map of Study Area

In the study area, the surveys were conducted using standard questionnaires along the victims in the most affected areas during 2015 flood. The design of the questionnaire was influenced by the work of previous social scientists specializing in the impacts of disasters, both natural and man-made, on human populations[10-12.] In December 24, 2015 the discussion held with flood affected people using the designed questions from five most affected taluk in the group of urban and rural places in the study area. Interview conducted at their houses or the rescue places in the full inundated area. Spatial rainfall distribution map

has been generated in Arc GIS platform by applying interpolation techniques with the help of collected rainfall data and base map has been prepared from Indian toposheet.

RESULTS AND DISCUSSION

Toposheets of 1:50,000 scale have been collected from Survey of India and basic information about the study area have been mapped such as transports, settlement, water bodies, and railway line has been extracted from toposheet. The base map of the study area covers national highway, state highway, railways and water bodies and the full information have been shown in Table-1 and base map has been shown in Figure-3.

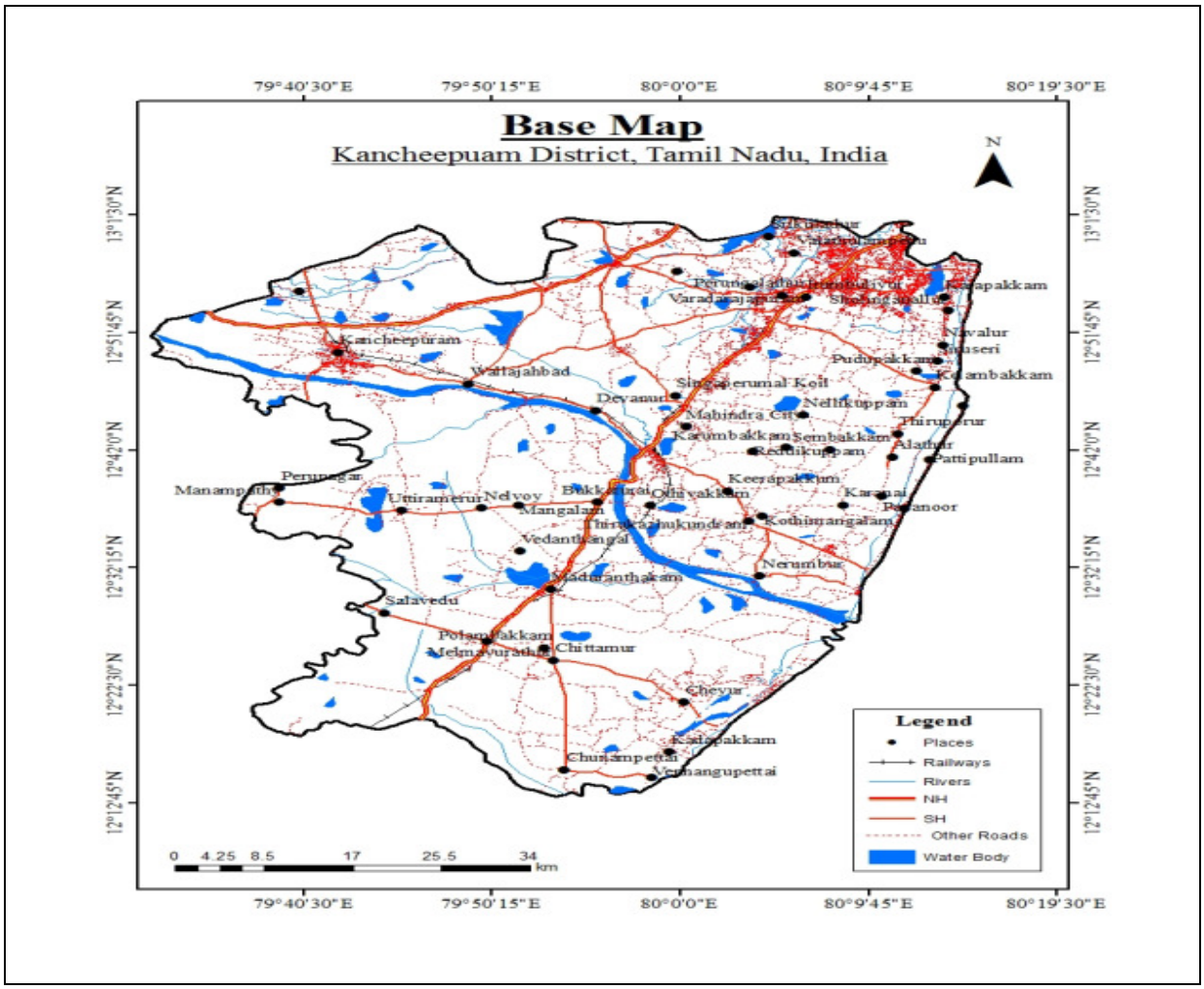

Fig.-3: Study Area Base Map

Rainfall: Interpolation Techniques

The study of spatial rainfall variation is very important to classify the region to make any related decision. Collecting continuous data of rainfall for any region is practically not possible, which have been collecting through random distance rain gauge stations. So it is necessary to predict the entire area using collected known location data. The method interpolation has been used to predict the values of unknown locations using collected known location data. There are several interpolation methods which have been used by the researcher like spline, Kriging, trend, natural neighbor and inverse distance weighting. The biggest question among the researchers is to find out which is the suitable method for interpolate data. There have been several discussions and researches conducted to find out the best method of interpolation[13-15].

Table-1: Base Map Information

Length of National Highway	283.763358 km
Length of State Highway	439.910961 km
Length of Other Roads	4459.922099 km
Length of Railway	274.082856 km
Length of Rivers	581.806913 km
Area of water bodies	211.951447 sq.km

For present study, the rainfall data from 12.11.2015 to 25.11.2015 have been collected. The analysis was carried out in GIS using interpolation technique with IDW method. The Figure-4 shows the result of rainfall spatial distribution using interpolation techniques.

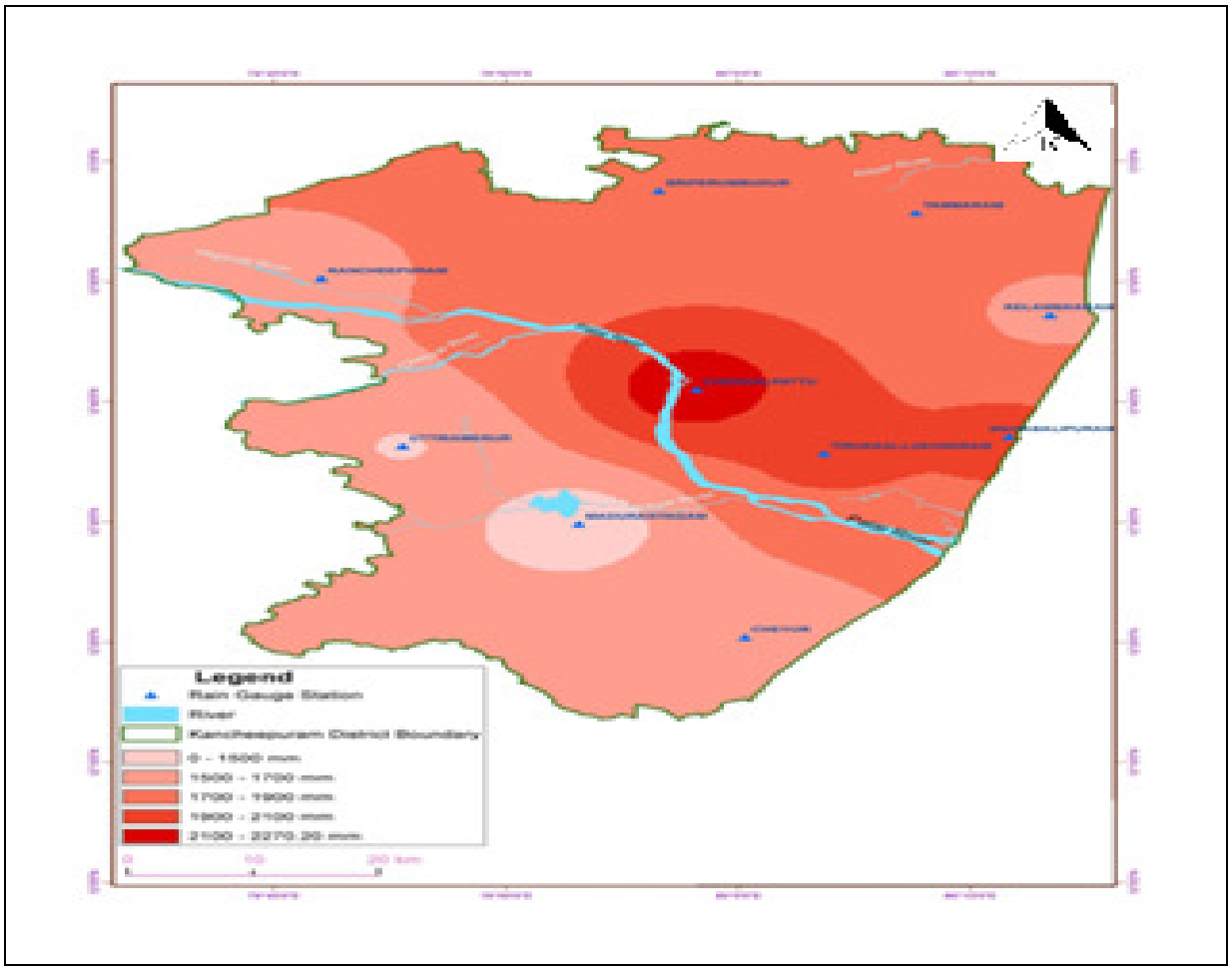

Fig.-4: Spatial distribution of rainfall using interpolation techniques

From this spatial distribution of rainfall map shows the high frequency rainfall area is Chengalpattu taluk received rainfall has 2100-2270.20 mm, followed by Thirukazhukundram received rainfall has 1900-2100mm, Tambaram, and Sriperupudhurtaluk received rainfall has 1700-1900 mm, Kelambakkam, Cheyur and Kanchipuramtaluk received rainfall has 1500-1700 mm and finally Uttaramerur and Madurandagam taluk received rainfall has 0-1500 mm. For this analysis cumulative average rainfalls from 01.11.2015 to 25.11.2015 have been calculated that has is 1088.06 mm. The Peak rainfall have been received in this period is 342mm and 353mm in a day at Kancheepuram and Chengalpattu respectively.
An isohyetal is a line joining places where the rainfall amounts are equal in an area which is shown in the map. An isohyetal map showing contours of equal rainfall is more accurate picture of the rainfall over the

study area using GIS platform has developed using preparation of table for rainfall data consisting of UTM coordinates based on spatial distribution structure created from interpolation technique using the following formula the average rainfall has been calculated-

$$A1 (P1 + P2)/2 + A2 (P2 + P3)/2 + \ldots + An\text{-}1(Pn\text{-}1 + Pn)/2 / (A1 + A2 + \ldots + An)$$

Where, Pi = Value of Isohyet lines; Ai = Area between pair of isohyet lines.

Isohyetal map of the study area shown in Figure-5.

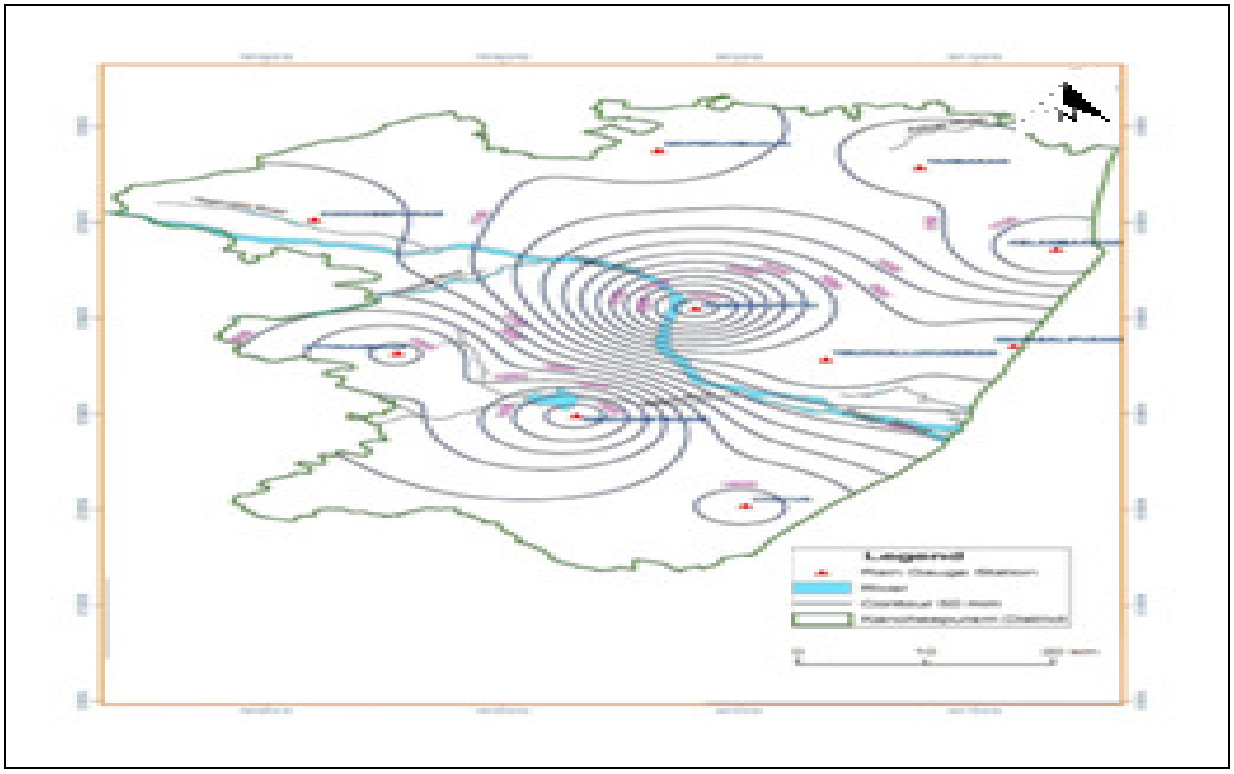

Fig.-5: Isoyetal Map

Questionnaire has been conducted within the people those who have in redundant impacted place and the use of questionnaire was to identify the characteristics of problems encountered by victims and is constructive to initiative the plan and give suggestion to reduce damage in consequent floods and also during discussion to identified their experiences and perceptions. They were questioned extensively on how long flood inundation happened, how flood impacted them, their families, and communities. From the interviews were analyzed to identify most serious of problems faced by victims, stress, health issues, individual adaptation and psychological problems. During the flood time city authority private organization and municipal has taken necessary action to recue progression. The affected people reported that the Proper flood warning has not given by the respective authority, insufficient pre-planning and the victims statement has only known by the impact received by heavy rain.

The people were worst affected and the areas around Tambaram, Chengalpattu taluk fully submerged all the buildings up to second floor in the kanchipuram district. From 02.12.2015 to 06.12.2015 were the people did not get any transport facilities in the least way to come out from their houses they only got some of the food packets thrown by the helicopter. And they experienced with no current supply.

In the most affected area rescue operation carried by using boats through the military and other organization. Proper sanitation, food and other resources are have issued by various organization and the voluntaries after rainfall getting over. But some people repotted rescue process not carried over their

places. Detailed damage assessment report such as human lost, cattle lost, house damage and agricultural lost shown in Table-2 which was cross checked with Kanchipuram collector office report.
RISAT image data have been collected from NRSC site in the JPEG format both pre-event and post-event map shown in figure-6 and used to find out the most inundated area and the comparison made visually. Where the areas more inundated happens in Kanchipuram district next to Chennai city.

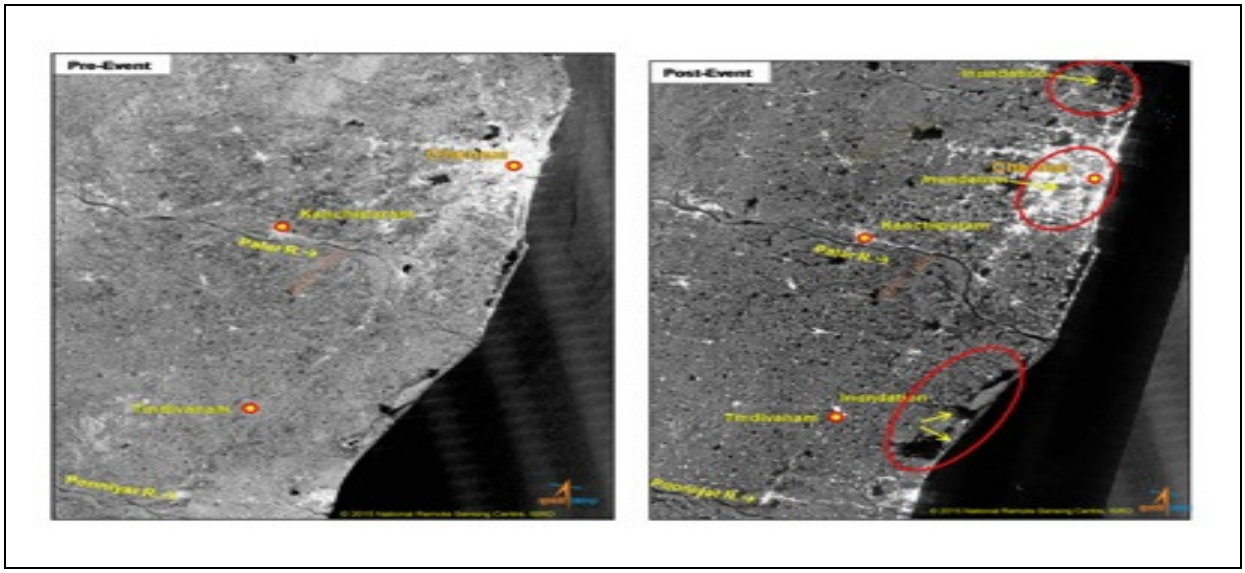

Fig.-6: RISAT Image Source: NRSC (2015)

In Tambaram Taluk, the Chembarabakkam Lake was opened due to heavy rain which causes the whole area around this place were submerged. Inundated area around Chembarabakkam Lake has been shown in figure-7 collected from NRSC site.

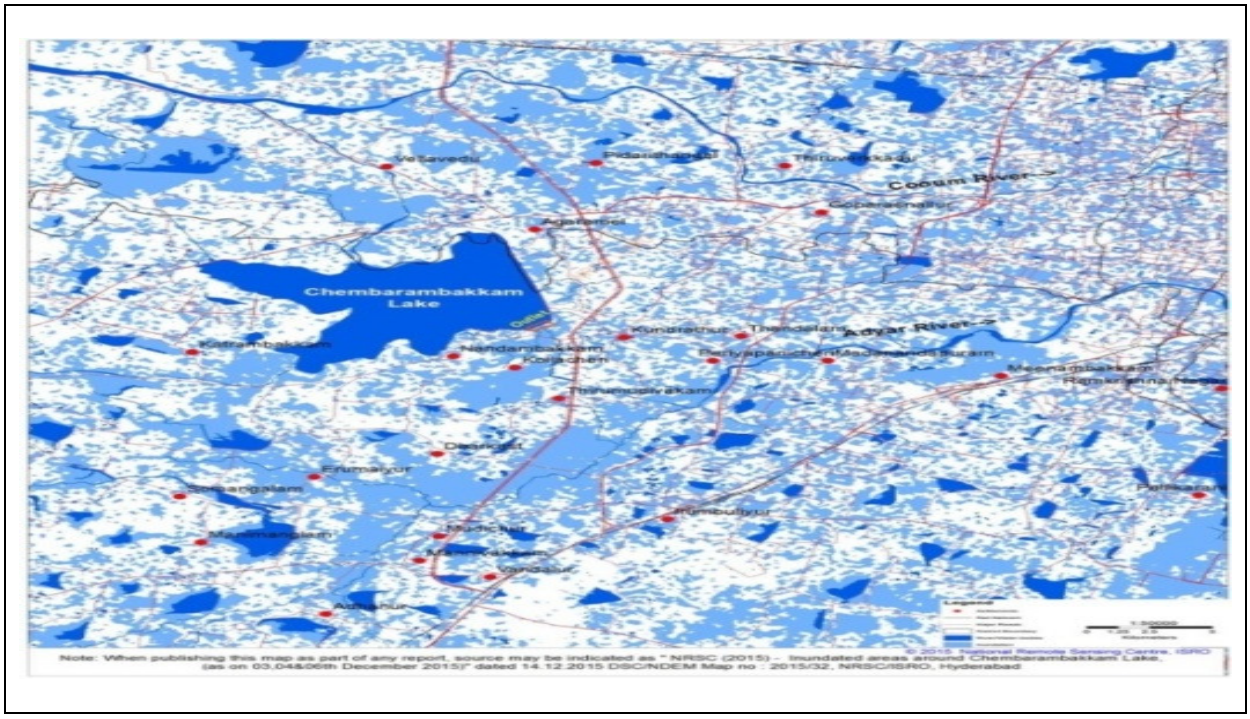

Fig.-7: Showing inundated area around Chembarabakkam Lake Source: NRSC (2015)

Table -2: Damage Assessment

Damage categories	Total damage
Human loss	198 numbers
Cattle loss	2992 numbers
Hut &house damage	More than 12000
Crop in hectare (ha)	
Paddy	22304
Sugarcane	1400
Pulses	37
Groundnut	272

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