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**CLOUD CONDITION AS A CLIMATE CHANGE INDICATOR OF PUNE  
DIVISION (MAHARASHTRA)**

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**Abstract -**

*The climate can thus be viewed as a mixture or aggregate of weather. Weather describes conditions of the atmosphere over a short period of time, and climate is how the atmosphere behaves over relatively long periods of time. The world meteorological organization (wmo), 30 years are the classical period for performing the statistics used to define climate. As a consequence, the 30 years period proposed by the wmo should be considered more as an indicator than a norm that must be followed in all cases. Climatic conditions help to shape various ecosystems and habitat around the globe. The climatic factors are impact on physical features as well as human life. It is a major role play in human environment and them also effects on his food, clothing, dwellings, and their occupations. Agriculture is our primary source of food; it becomes critical for human survival due to changing climatical conditions in the recent past few decades. Changing climatically conditions in the pune division of maharashtra state has been considered for this work. The pune division is located in the western part of maharashtra, which is well-known for prosperity of agriculture and industrial sector. But it is presently affected by climatic conditions i.e. Increase in temperature, uncertainty and variability of rainfall, durations of seasons etc. This all conditions are directly or indirectly connected with above sectors.*

**Key words:** cloud condition, climate change, pune division

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**Introduction**

Climate change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time that is decades to millions of years. Climate change, defined as the long-term imbalance of customary weather conditions such as temperature, radiation, wind and rainfall characteristics of a particular region, is likely to be one of the main challenges to mankind during the present century. As per intergovernmental panel on climate change (ipcc) usage climate change refers to a change in the state of the climate that can be identified by changes in the mean and or the variability of its properties, and persists for an extended period, typically decade or longer.

It refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the unfccc where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is

in addition to natural climate variability observed over comparable time periods. Indian metrological department (imd) suggests that climate change refers to a statistically significant variation in either the mean state of the climate or in this variability, persisting for an extended period typically decades or longer.

**Study area**

The pune division is located in south-west part of maharashtra state. It lies between 15<sup>0</sup> 45' n to 19<sup>0</sup> 0' n latitude and 73<sup>0</sup> 32' e to 76<sup>0</sup> 15' e longitudes. The area under study comprises of five districts namely pune, sangli, satara, solapur, kolhapur and the whole division has 58 tehsils. The pune division is bounded by the aurangabad district to the north and ne, thane district encircled by north and nw. The west boundary of study area delimited by raigad, and ratnagiri district, sindhudurg district enclosed in south and south-west part. The south and eastern boundary surrounded by karnataka state and eastern boundary delimited by osmanabad district (fig. 1).

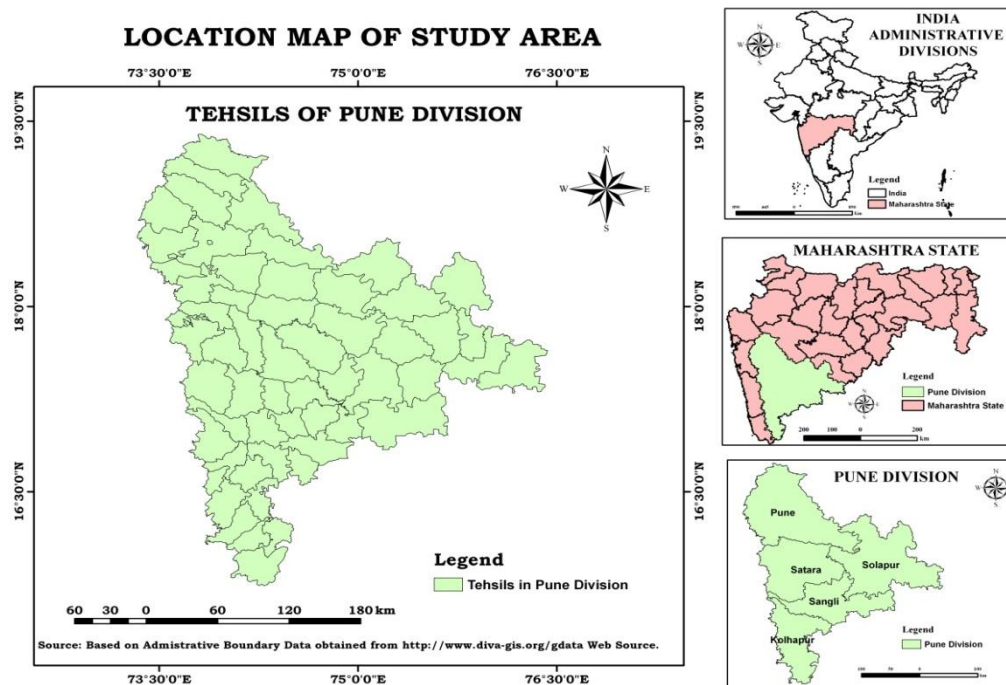


Fig.1

Physiographical this region can be divided into three parts hilly, plateau and lowlands. Sahyadri ranges passes through pune division; its slope decreases from west to east. In this region temperature varies in the different parts, the average temperature of the study area is  $25.62^{\circ}\text{C}$ . An average annual rainfall in the pune division was recorded 1239.09 mm. There are major two river basins; it includes krishna and bhima basins. The study region has total geographical area about 57, 275  $\text{km}^2$ . The study area having 23,449,051 population as per 2011 CENSUS and out of the total population of the study region more than 58.76 per cent population has been located in rural areas and remaining population 42.24 per cent are living in urban areas. The population density was 403 persons per  $\text{km}^2$  and sex ratio was 953 females per thousand males according to 2011 censuses.

#### Objective

The objective of present research work is to study the cloud conditions characteristics in relation to climate change of the pune division.

#### Data collection and methodology

The present work is based on secondary data and an essential metrological data was collected from institution i.e. Indian metrological department of pune. Through this institution monthly station-wise data of cloud condition over pune division (1901 to 2013) has been collected. The india yearly cloud condition data had been taken through the website such as [www.indiawaterportal.in](http://www.indiawaterportal.in), [www.tropomet.res.in](http://www.tropomet.res.in) (1901 to 2011). The  $0.25^{\circ} \times 0.25^{\circ}$  gridded cloud condition data of pune division had been taken

from global weather data website of the period of 1979 to 2013. The collected secondary data were processed by using different statistical and quantitative techniques for getting correct results. During the investigation various methods were used satisfy the objectives. The climatic parameter such as wet day frequency trends were processed by using ms- excel windows office 2010. To supporting present work researcher has prepared map with the help of gis technique.

#### Cloud cover

The sky condition consists of two foremost areas which are cloud cover and the possibility of precipitation. The possibilities of precipitation include rain, sleet, snow or hail. The cloud cover is described as on the basis of the cloud density at different levels. The cloud plays a major role in determining the net radioactive balance and precipitation produce, so many changes in cloud cover or optical properties leads to a new climate state (kiehl, 1994).the monthly trend of cloud condition also shows month-wise variations. As per table 1 illustrate that the highest cloud condition (78.24 integer/%) is observed in the month of july and it is followed by august (74.14 integer/per cent) and september (59.10 integer/%) and the lowest cloud condition (12.41 integer/%) is observed in the month of february. The cloud condition is variable from season to season. Average annual cloud condition is recorded with 33.75 integer/per cent in pune division. The sw monsoon season has 67.75 integer/per cent (highest) cloud condition and it is followed by post monsoon season (28.85 integer/%) and

during the summer season, it was 24.17 integer/per cent cloud condition. The lowest

cloud condition was in the winter season, which is 14.22 integer / per cent

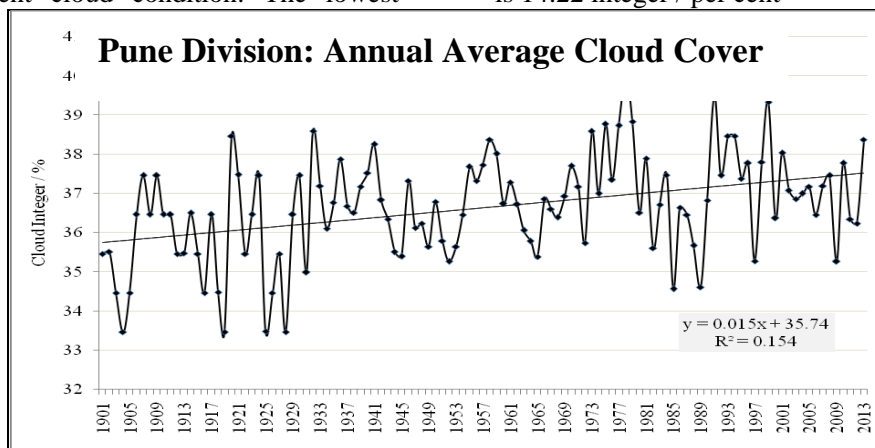


Fig. 2

As per fig. 2 shows the cloud condition in the pune division from 1901 to 2013 has an increasing trend by 1.69 integer/per cent. It is increasing at the rate of 0.015 integer/per cent per year. The cloudy condition shows that only 35.46 integer/per cent in 1901 and 38.37 integer/per cent in 2013. In the considered period

cloud condition is increased by 2.91 integers/per cent. The cloudy condition was highest (39.78 integer/%) in 1978 and it was lowest (33.46 integer/%) in 1919. Such difference and trend are important to indicate climate change.

Table 1: monthly and seasonal cloud condition in pune division(1901 to 2013)

Sr. No.	Months / Season	Cloud condition (integer/ %)
<b>A. Monthly</b>		
1	January	12.96
2	February	12.41
3	March	19.09
4	April	22.65
5	May	30.78
6	June	59.10
7	July	78.24
8	August	74.14
9	September	59.53
10	October	34.87
11	November	22.82
12	December	17.29
<b>B. Seasonal</b>		
1	Winter	14.22
2	Summer	24.17
3	Sw monsoon	67.75
4	Post monsoon	28.85
<b>Annual</b>		33.75

Source: global weather data in pune division (1901 to 2013)

The decadal trend (fig.3) of cloud condition also increased by 1.85 integer/per cent. It is highly increased after 1961-70. The marginal cloudy condition decreases until 1980. The decadal cloudy condition is recorded with the highest (37.87 integer/per cent) in 1971-80 and it is followed by 1981-90 (37.78 integer/%) and 1911-21 (35.65 integer/%) and it was lowest in

1941-50 (36.4 integer/%). The formation and proportion of cloud cover are an important element in the climate of any area. Generally, the proportion of cloud cover has been always high from June to September in the study area. During this period, a huge amount of water vapour brings through south-west monsoon from Indian ocean surface, however, from December to

february clear sky condition prevails over the pune division. While studying cloud condition for the period 1901-2013 in pune division, it is found that it has increased by 1.69 integer/per cent because temperature has increased by

0.98<sup>0</sup>C. Due to increased temperature water vapour pressure also increased by 0.54 hpa. All these changes affected on climate of pune division.

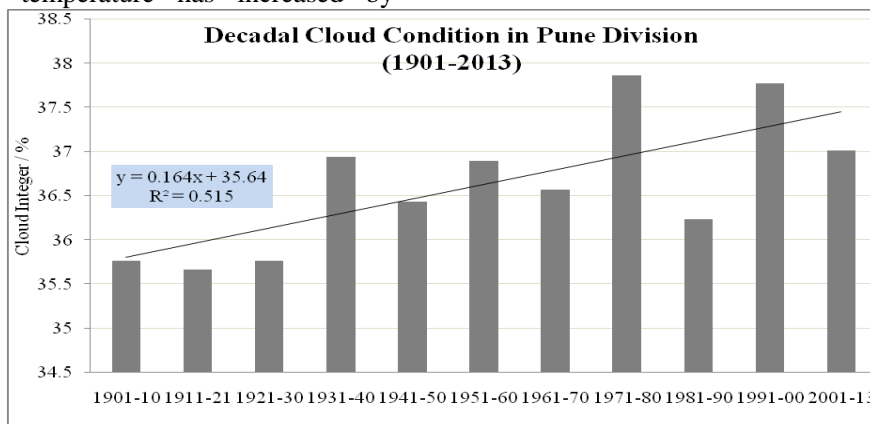


Fig. 3

### Conclusion

It is concluded that the cloud condition variation throughout the year. According to linear trend estimation shows that 1.69 integer/day of the pune division which is increased in the considered period (1901 to 2013). The decadal change of cloud condition increases during 1901 to 1951. The decade 1961-70 and 1981-90 highly declining cloud condition and vice-versa 1971-80,1991-2000, 2001-13 cloud conditions continuously increases.

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