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Original Research Article

Some studies on thunder and lightning induced atmospheric air ions variation in Pudukkottai, Tamilnadu, India

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Air ions, Photosynthesis, Lightning and thunder

A B S T R A C T

The thunder and lightning - induced air ions are formed during the rainy days. We have measured air ion concentrations produced in Pudukkottai district (Geographical latitude 10^0 23' N and longitude 78^0 52' E) of Tamilnadu, India by dividing under the various trees in the A-zone, B-zone and C-zone. The measurements were carried out on the thunder and lightning days of the year 2012: August 14, August 15, September 27, October 10, October 11, Ocober 12 and October 15. The measurement of air ion (both positive and negative) concentrations was performed using the Air Ion Counter which can work at the temperature range of -10^0C–50^0C, at a wind speed of < 15 Km/hr (9mph). The air ions concentrations measured at different dates and zones are tabulated and discussed line graphs and bar diagrams have also been drawn to analyze the data. It is found that the production of air ions during the occurrence of lightning and thunder has enhanced the process of photosynthesis (i.e. production of starch) by green plants and crops.

Introduction

The concept ''small air ion'' comes from the field of atmospheric electricity (Israel, 1970; Mohnen, 1977). The small ions are responsible for electrical conductivity of the atmosphere, for thunderstorms and lightning. Also, they control certain processes which can lead to aerosol formation (Laakso *et al.,* 2002; MacTaylor and Castleman, 2000; Yu and Turco, 2001). Recently, ions have been suggested to be a source for the aerosol burst events. By air ions we mean charged particles, molecules or clusters in the atmosphere (Beig and Brasseur, 2000; Yu and Turco, 2001), which are widely distributed in natural world (Israel, 1970; Kilpatrick, 1971). For rainfall, modest lifting of an air parcel is sufficient, whereas for lightning much deeper and stronger lifting is necessary (Williams, 2005). A disturbance in ion balance can cause a significant change in the optical properties of plants that manifest physiologically as a change in photosynthesis activity (Javanic and Javanic, 2001). Not only can plants be affected by air ions, they can also produce various air ions, including negative air ions (NAI) under normal conditions (Nemeryuk, 1970). These NAIs are predominantly generated by leaf

tips (Tikhonov *et al.*, 2004). Thus, along with temperature, pressure, air humidity, illumination (sunlight) and concentration of minerals, the ion structure of the air is an important element of a plant's environmental microclimate.

In this paper we present, the variation of cluster of air ions in the rural background atmosphere at Pudukkottai in Tamilnadu, India during the days of thunder and lightning.

In addition to ionizing radiation, several other sources produce charge carriers of very different sizes and nature on a local scale. For example dust storms are known to be intensely electrified. Charge produced in these storms can be transported up to several kilometers in altitude and over many square kilometers of the earth surface. Electrical discharges can cause the formation of ions in the atmosphere. This requires a high electric field that generally occurs in the disturbed weather inside or in the vicinity of lightning and thunderstorms.

In such conditions field intensity is enhanced around ground elevated objects and when it increases to a break down value or above, a large number of unipolar ions are injected into the atmosphere. The phenomenon of point discharge can occur at tall trees or buildings below thunderstorms. Lightning flashes from thunder clouds also produce local but intense ionization in the atmosphere.

Air ions are formed when sufficient energy displaces an outer electron from a molecule of one of the common gases, such as oxygen and nitrogen. Under normal conditions, there is a small difference between positive and negative ions at the lower levels of the atmosphere.

Profile of the study area – Pudukkottai District

Pudukkottai is a district of Tamil Nadu State in southern India. The town of Pudukkottai is the district headquarters. The district has an area of 4663 km² with a coastline of 42 km. The district lies between 78° 25' and 79° 15' east longitude and between 9° 50' and 10° 40' of the north latitude. Pudukkottai District predominantly agriculture oriented district. The district enjoys tropical climate. The period from April to June is generally hot and dry. The weather is pleasant during the period from November to January. The mean maximum temperature is around 33.7^0C and means minimum temperature is 24^0C. The average daily wind speed in August is around 22 kph. The agricultural production in this district depends mainly on rainfall. The district is interspersed with rocky hills, especially in the southwest. Granite and literate are quarried, red ochre is worked, bell- metal vessels and perfumes are among the principal manufactured goods.

Instrumentation

Air ion counter 200 million ions/cm^3 version

Air ions counter (Figure 1) pulls air into the slot at the top. Then the air exits out the hole in the bottom. The top slot, which is shielded by a snap-in "wind-guard", should be pointed toward the area of air that we want to measure. For reliable measurement, the meter's case should not have any static charge (static electricity) on it. The case is conductive and will remain free of static charge if the meter is connected to earth ground through the long ground cord (supplied). The meter's feet are also conductive so that they are sitting on a grounded metal sheet, which does not have

static charge, and measurement will be accurate. If we use the ground cord, the alligator clip side of the cord must be connected to earth ground. A metal water pipe or faucet works as a ground. Usually, the metal screw in a wall switch plate or outlet plate is also grounded; so that it can be unscrewed a little in order to connect the alligator clip to the screw head.

The only time that the ground cord is not used is when the meter can remain "un-changed" (that is, it remains at ground potential) even without the cord. This can be done if the meter is not used near an ionizer and if the meter is touched at least once a minute by someone who is electrically connected to ground or who touches ground frequently. If we are walking on carpet while holding the meter, we should try to touch a grounded object more frequently at least once in every 10 seconds, or we should use the ground cord. If the meter is connected to the data acquisition system, the ground cord should not be used.

This wind-guard should generally remain in that position unless both positive and negative ion readings are greater than "2.00" (two thousand ions per cm^3).

Air ion counter 200 Million ions/cm^3 version is used. Air ion counter -10^0C to 50^0C and wind speed of less than 15 Km/hour at 9 mph.

Working of the air ion counter

This meter operates by sampling the air, which is pulled into the slot in the top and exists out the round hole in the bottom, at the rate of 400 cm^3 per second. Inside the meter, either negative or positive ions (depending on how the POLARITY switch is set) are taken from the fast-flowing air and deposited onto an internal collector plate. The number of elementary charges per second that hit the collector plate is measured (by measuring the voltage of the collector plate, which is connected to ground through a 10 G ohm resister). The POLARITY switch selects the polarity of ions (+ or -) to be measured. This switch forces the voltage of a metal chamber, which surrounds the collector plate, to be either + 10, 0, or -10 volts with respect to common.

If POLARITY is set at "+", the chamber will be at +10 volts and the positive ions in the air inside the chamber will be accelerated away from outer walls of the chamber and toward the common (zero volts) central collector plate. At this "+" setting, negative ions will actually be accelerated away from the collector plate so that the collector plate will only detect positive ions only. Similarly, if the POLARITY is set at "-", the collector plate will only detects negative ions.

Result and Discussion

Plants and trees release air ions all through the day and night. Air ions are both positive and negative. Our College campus is filled with numerous trees and plants which release air ions. Moreover, during thunderstorms and lightning there are dramatic changes in the number of air ions released by the plants and trees. Therefore we have done the measurement of the ion count during lightning and thunderstorms. On 14th August 2012, we had thunder and lightning followed by heavy shower of rain in Pudukkottai (10^0 23' N and 78^0 52' E) around 7 pm. Air ion measurements have been carried out on the following lightning and thunder days. 15th, 24th August, 27th September and 10th, 11th, 12th and 15th October 2012.

14th August 2012 Measurement of Air ions

Here we present the number of air ions (both positive and negative) released from 00:00 hour (IST) 14th August 2012 to 24:00 hours (IST) (Figure 2) on the same day at regular intervals. Regarding the positive air ion count, at the stroke of 00:00 hour, a count of 143.7 x 10^3 ions/cm^3, Then at 04:00 hour, a count of 168.2 x 10^3 ions/cm^3, followed by 176 x 10^3 ions/cm^3 at 06:00 hour, 175.1 x 10^3 ions/cm^3 at 10:00 hour, 171.8 x 10^3 ions/cm^3 at 12:00 hour, 143.8 x 10^3 ions/cm^3 at 16:00 hour, 188.1 x 10^3 ions/cm^3 at 20:00 hour, 171.0 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 143.2 x 10^3 ions/cm^3 have been observed. From the above data we conclude that, after an hour from thunder and lightning, there is a huge rise in the positive ion count (given in bold font) which is as predicted.

Similarly, in the case of negative ions at the stroke of 00:00 hours, a count of 173.2 x 10^3 ions/cm^3 was observed. Then at 04:00 hour, a count of 174.2 x 10^3 ions/cm^3, followed by 160.4 x 10^3 ions/cm^3 at 06:00 hour, 176.8 x10^3 ions/cm^3 at 10:00 hour, 166.7 x 10^3 ions/cm^3 at 12:00 hour, 147.1 x 10^3 ions/cm^3 at 16:00 hour, 180.0 x 10^3 ions/cm^3 at 20:00 hour, 166.2 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 180.0 x 10^3 ions/cm^3 have been observed. From the above, we conclude that, after an hour from thunder and lightning, there is also a huge rise in the negative ion count (given in bold font) which is as predicted.

Mechanism behind this huge rise in the air ion count

The main process which is responsible for the rise in the air ion count is Photosynthesis. When increase lightning strikes, photosynthesis takes place more vigorously and a rise in the release of air ions into the atmosphere by the plants and trees by occurs.

The photosynthesis is indicated by the reaction:

$$CO_2 + 2H_2O \xrightarrow{sunlight/\ lightning} O_2 + (C\ H_2O) + H_2O$$

Photosynthesis is the production of carbohydrate from CO_2 and H_2O using light energy and chlorophyll.

Photosynthesis takes place in the cells of green plants. During this process, CO_2 is used in a large scale. Green plants of earth utilize 70,000 million tons of CO_2 per year. So photosynthesis is a massive event.

Photosynthesis takes place in the green and purple bacteria also. But they do not produce O_2 as one of the end products.

15th August 2012 – Measurement of Air Ions Counts

On 15th August 2012, we had thunder and lightning followed by heavy shower of rain in Pudukkottai (10^0 23' N and 78^0 52' E) around 7 pm (Figure 3).

Here we present the number of air ions (both positive and negative) released from 00:00 hour (IST) of 15th August 2012 to 24:00 hour (IST) on the same day at regular intervals. Regarding the positive ion count, at the stroke of 00:00 hour, a count of 143.2 x 10^3 ions/cm^3 were measured. Then at 04:00 hour, a count of 168.2 x 10^3 ions/cm^3, followed by 151.4 x 10^3 ions/cm^3 at 06:00 hour, 150.4 x 10^3 ions/cm^3 at 10:00 hour, 141.8 x 10^3 ions/cm^3 at 12:00 hour, 174.1 x 10^3 ions/cm^3 at 16:00 hour, 185.1 x

10^3 ions/cm^3 at 20:00 hour, 173.2 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 165.7 x 10^3 ions/cm^3 have been observed. Similarly, in the case of negative ions at the stroke of 00:00 hour, a count of 147.2 x 10^3 ions/cm^3 was measured. Then at 04:00 hour, a count of 174.2 x 10^3 ions/cm^3, followed by 156.2 x 10^3 ions/cm^3 at 06:00 hour, 164.6 x 10^3 ions/cm^3 at 10:00 hour, 141.9 x 10^3 ions/cm^3 at 12:00 hour, 174.1 x 10^3 ions/cm^3 at 16:00 hour, 182.0 x 10^3 ions/cm^3 at 20:00 hour, 166.2 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 147.5 x 10^3 ions/cm^3 have been observed.

24th August 2012 – Measurement of Air ions counts

On 24th August 2012, we had thunder and lightning followed by heavy shower of rain in Pudukkottai (10^0 23' N and 78^0 52' E) around 6 pm (Figure 4).

Here we present the number of air ions (both positive and negative) released from 00:00 hour (IST) of 24th August 2012 to 24:00 hour (IST) on the same day at regular intervals. Regarding the positive ion count, at the stroke of 00:00 hour, a count of 143.2 x 10^3 ions/cm^3 were measured. Then at 04:00 hour, a count of 147.5 x 10^3 ions/cm^3, followed by 151.4 x 10^3 ions/cm^3 at 06:00 hour, 142.8 x 10^3 ions/cm^3 at 10:00 hour, 151.8 x 10^3 ions/cm^3 at 12:00 hour, 142.8 x 10^3 ions/cm^3 at 16:00 hour, 159.2 x 10^3 ions/cm^3 at 20:00 hour, 150.7 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 145.6 x 10^3 ions/cm^3 have been observed. Similarly, in the case of negative ions at the stroke of 00:00 hour, a count of 147.2 x 10^3 ions/cm^3 was measured. Then at 04:00 hour, a count of 161.9 x 10^3 ions/cm^3, followed by 156.2 x 10^3 ions/cm^3 at 06:00 hour, 144.4 x 10^3 ions/cm^3 at 10:00 hour, 153.8 x 10^3 ions/cm^3 at 12:00 hour, 163.9 x 10^3 ions/cm^3 at 16:00 hour, 173.1 x 10^3 ions/cm^3 at 20:00 hour, 166.2 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 147.5 x 10^3 ions/cm^3 have been observed.

27th September 2012 - Measurement of Air ions counts

On 27th September 2012, we had thunder and lightning followed by heavy shower of rain in Pudukkottai (10^0 23' N and 78^0 52' E) around 3 pm (Figure 5).

Here we present the number of air ions (both positive and negative) released from 00:00 hours (IST) of 27th September 2012 to 24:00 hour (IST) on the same day at regular intervals. Regarding the positive ion count, at the stroke of 00:00 hour, a count of 143.2 x 10^3 ions/cm^3 were measured. Then at 04:00 hour, a count of 173.4 x 10^3 ions/cm^3, followed by 176.9 x 10^3 ions/cm^3 at 06:00 hour, 146.7 x 10^3 ions/cm^3 at 10:00 hour, 151.8 x 10^3 ions/cm^3 at 12:00 hour, 162.2 x 10^3 ions/cm^3 at 16:00 hour, 189.1 x 10^3 ions/cm^3 at 20:00 hour, 175.5 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 165.7 x 10^3 ions/cm^3 have been observed. Similarly, in the case of negative ions at the stroke of 00:00 hour, a count of 147.2 x 10^3 ions/cm^3 was measured. Then at 04:00 hour, a count of 166.2 x 10^3 ions/cm^3, followed by 174.3 x 10^3 ions/cm^3 at 06:00 hour, 174.0 x 10^3 ions/cm^3 at 10:00 hour, 153.8 x 10^3 ions/cm^3 at 12:00 hour, 184.9 x 10^3 ions/cm^3 at 16:00 hour, 144.1 x 10^3 ions/cm^3 at 20:00 hour, 166.2 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 167.8x 10^3 ions/cm^3 have been observed.

10th October 2012 - Measurement of Air ions counts

On 10th October 2012, we had thunder and

lightning followed by heavy shower of rain in Pudukkottai (10^0 23' N and 78^0 52' E) around 3 pm (Figure 6).

Here we present the number of air ions (both positive and negative) released from 00:00 hour (IST) of 10th October 2012 to 24:00 hour (IST) on the same day at regular intervals. Regarding the positive ion count, at the stroke of 00:00 hours, a count of 143.7 x 10^3 ions/cm^3 were measured. Then at 04:00 hour, a count of 146.9 x 10^3 ions/cm^3, followed by 154.4 x 10^3 ions/cm^3 at 06:00 hour, 173.6 x 10^3 ions/cm^3 at 10:00 hour, 150.1 x 10^3 ions/cm^3 at 12:00 hour, 186.1 x 10^3 ions/cm^3 at 16:00 hour, 168.1 x 10^3 ions/cm^3 at 20:00 hour, 151.5 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 143.2 x 10^3 ions/cm^3 have been observed. Similarly, in the case of negative ions at the stroke of 00:00 hours, a count of 173.2 x 10^3 ions/cm^3 was measured. Then at 04:00 hour, a count of 167.4 x 10^3 ions/cm^3, followed by 168.8 x 10^3 ions/cm^3 at 06:00 hour, 150.3 x10^3 ions/cm^3 at 10:00 hour, 144.8 x 10^3 ions/cm^3 at 12:00 hour, 180.0 x 10^3 ions/cm^3 at 16:00 hour, 177.8 x 10^3 ions/cm^3 at 20:00 hour, 167.5 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 144.8 x 10^3 ions/cm^3 have been observed.

11th October 2012 - Measurement of Air ions counts

On 11th October 2012, we had thunder and lightning followed by heavy shower of rain in Pudukkottai (10^0 23' N and 78^0 52' E) around 5 am (Figure 7).

Here we present the number of air ions (both positive and negative) released from 00:00 hour (IST) of 11th October 2012 to 24:00 hour (IST) on the same day at regular intervals. Regarding the positive ion count, at the stroke of 00:00 hour, a count of 143.2 x 10^3 ions/cm^3 were measured. Then at 04:00 hour, a count of 172.7 x 10^3 ions/cm^3, followed by 193.0 x 10^3 ions/cm^3 at 06:00 hour, 158.7 x 10^3 ions/cm^3 at 10:00 hour, 151.8 x 10^3 ions/cm^3 at 12:00 hour, 176.5 x 10^3 ions/cm^3 at 16:00 hour, 160.5 x 10^3 ions/cm^3 at 20:00 hour, 157.7 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 152.3 x 10^3 ions/cm^3 have been observed. Similarly, in the case of negative ions at the stroke of 00:00 hour, a count of 144.8 x 10^3 ions/cm^3 was measured. Then at 04:00 hour, a count of 172.8 x 10^3 ions/cm^3, followed by 193.4 x 10^3 ions/cm^3 at 06:00 hour, 155.4 x 10^3 ions/cm^3 at 10:00 hour, 153.8 x 10^3 ions/cm^3 at 12:00 hour, 147.5 x 10^3 ions/cm^3 at 16:00 hour, 161.7 x 10^3 ions/cm^3 at 20:00 hour, 166.2 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 155.6 x 10^3 ions/cm^3 have been observed.

12th October 2012 - Measurement of Air ions counts

On 12th October 2012, we had thunder and lightning followed by heavy shower of rain in Pudukkottai (10^0 23' N and 78^0 52' E) around 9 am (Figure 8).

Here we present the number of air ions (both positive and negative) released from 00:00 hour (IST) of 12th October 2012 to 24:00 hour (IST) on the same day at regular intervals. Regarding the positive ion count, It is observed that, at the stroke of 00:00 hour, a count of 152.3 x 10^3 ions/cm^3. Then at 04:00 hour, a count of 155.6 x 10^3 ions/cm^3, followed by 177.3 x 10^3 ions/cm^3 at 06:00 hour, 177.7 x 10^3 ions/cm^3 at 10:00 hour, 144.8 x 10^3 ions/cm^3 at 12:00 hour, 162.2 x 10^3 ions/cm^3 at 16:00 hour, 156.3 x 10^3 ions/cm^3 at 20:00 hour, 161.9 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 165.7 x 10^3 ions/cm^3 have been

observed. Similarly, in the case of negative ions at the stroke of 00:00 hour, a count of 155.6 x 10^3 ions/cm^3 was measured. Then at 04:00 hour, a count of 172.9 x 10^3 ions/cm^3, followed by 172.7 x 10^3 ions/cm^3 at 06:00 hour, 173.4 x 10^3 ions/cm^3 at 10:00 hour, 163.2 x 10^3 ions/cm^3 at 12:00 hour, 162.7 x 10^3 ions/cm^3 at 16:00 hour, 144.7 x 10^3 ions/cm^3 at 20:00 hour, 166.2 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 158.5 x 10^3 ions/cm^3 have been observed.

15th October 2012 - Positive and Negative air ions

On 15th October 2012, we had thunder and lightning followed by heavy shower of rain in Pudukkottai (10^0 23' N and 78^0 52' E) around 5 am (Figure 9).

Here we present the number of air ions (both positive and negative) released from 00:00 hour (IST) of 15th October 2012 to 24:00 hour (IST) on the same day at regular intervals. Regarding the positive ion count, at the stroke of 00:00 hour, a count of 170.8 x 10^3 ions /cm^3 was measured. Then at 04:00 hour, a count of 171.3 x 10^3 ions/cm^3, followed by 177.9 x 10^3 ions/cm^3 at 06:00 hour, 143.8 x10^3 ions/cm^3 at 10:00 hour, 158.8 x 10^3 ions/cm^3 at 12:00 hour, 155.4 x 10^3 ions/cm^3 at 16:00 hour, 162.3 x 10^3 ions/cm^3 at 20:00 hour, 166.2 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 165.7 x 10^3 ions/cm^3 have been observed. Similarly, in the case of negative ions at the stroke of 00:00 hour, a count of 168.4 x 10^3 ions/cm^3 was measured. Then at 04:00 hour, a count of 166.2 x 10^3 ions/cm^3, followed by 185.9x 10^3 ions/cm^3 at 06:00 hour, 173.9 x 10^3 ions/cm^3 at 10:00 hour, 156.5 x 10^3 ions/cm^3 at 12:00 hour, 171.2x 10^3 ions/cm^3 at 16:00 hour, 159.0 x 10^3 ions/cm^3 at 20:00 hour, 166.6 x 10^3 ions/cm^3 at 22:00 hour, and at 24:00 hour a count of 167.8 x 10^3 ions/cm^3 have been observed.

Zone A –Positive and Negative Air Ions

We had thunder and lightning followed by heavy shower of rain and after one hour measured maximum readings of atmospheric air ion in Pudukkottai (10^0 23' N and 78^0 52' E) at 2012, August14, August15, September27, October10, October11, Ocober12 and October15 (Table 1 and Figure 10).

August-14, the positive air ion count is 188.1 x 10^3 ions/cm^3 and negative air ions count is 180.0 x 10^3 ions/cm^3. Next day August-15, the positive air ion count is 185.1 x 10^3 ions/cm^3 and negative air ion count is 182.0 x 10^3 ions/cm^3. Followed by August-24, the positive air ion count is 159.1 x 10^3 ions/cm^3 and negative air ion count is 173.1 x 10^3 ions/cm^3. September-27, the positive air ion count is 189.1 x 10^3 ions/cm^3 and negative air ion count is 184.9 x 10^3 ions/cm^3. October-10, the positive air ion count is 186.1 x 10^3 ions/cm^3 and negative air ion count is 180.0 x 10^3 ions/cm^3. October-11, the positive air ion count is 193.0 x 10^3 ions/cm^3 and negative air ion count is 193.4 x 10^3 ions/cm^3. October-12, the positive air ion count is 177.2 x 10^3 ions/cm^3 and negative air ion count is 172.7 x 10^3 ions/cm^3 and October-15, the positive air ion count is 177.9 x 10^3 ions/cm^3 and negative air ion count is 185.9 x 10^3 ions/cm^3.

Zone B –Positive and Negative Air Ions

We had thunder and lightning followed by heavy shower of rain and after one hour measured maximum readings of atmospheric in Pudukkottai (10^0 23' N and 78^0 52' E) at 2012, August14, August15, September27, October10, October11, Ocober12 and

October15 (Table 2 and Figure 11).

August-14, the positive air ion count is 196.9 x 10^3 ions/cm^3 and negative air ions count is 184.6 x 10^3 ions/cm^3. Next day August-15, the maximum positive air ion count is 192.8 x 10^3 ions/cm^3 and maximum negative air ion count is 198.8 x 10^3 ions/cm^3. Followed by August-24, the maximum positive air ion count is 195.6 x 10^3 ions/cm^3 and maximum negative air ion count is 192.7 x 10^3 ions/cm^3. September-27, the maximum positive air ion count is 189.1 x 10^3 ions/cm^3 and maximum negative air ion count is 175.7 x 10^3 ions/cm^3. October-10, the maximum positive air ion count is 195.7 x 10^3 ions/cm^3 and maximum negative air ion count is 176.7 x 10^3 ions/cm^3. October-11, the maximum positive air ion count is 178.3 x 10^3 ions/cm^3 and maximum negative air ion count is 171.9 x 10^3 ions/cm^3. October-12, the maximum positive air ion count is 189.1 x 10^3 ions/cm^3 and maximum negative air ion count is 190.3 x 10^3 ions/cm^3 and October-15, the maximum positive air ion count is 174.7 x 10^3 ions/cm^3 and maximum negative air ion count is 184.3 x 10^3 ions/cm^3.

Zone C –Positive and Negative Air Ions

We had thunder and lightning followed by heavy shower of rain and after one hour measured maximum readings of atmospheric in Pudukkottai (10^0 23' N and 78^0 52' E) in 2012, August14, August15, September27, October10, October11, Ocober12 and October15 (Table 3 and Figure 12).

August-14, the positive air ion count is 195.8 x 10^3 ions/cm^3 and negative air ions count is 185.6 x10^3 ions/cm^3. Next day August-15, the maximum positive air ion count is 194.3 x 10^3 ions/cm^3 and maximum negative air ion count is 186.4 x 10^3 ions/cm^3. Followed by August-24, the maximum positive air ion count is 195.6 x 10^3 ions/cm^3 and maximum negative air ion count is 189.6 x 10^3 ions/cm^3. September-27, the maximum positive air ion count is 188.4 x 10^3 ions/cm^3 and maximum negative air ion count is 186.5 x 10^3 ions/cm^3. October-10, the maximum positive air ion count is 177.4 x 10^3 ions/cm^3 and maximum negative air ion count is 177.4 x 10^3 ions/cm^3. October-11, the maximum positive air ion count is 191.2 x 10^3 ions/cm^3 and maximum negative air ion count is 193.5 x 10^3 ions/cm^3. October-12, the maximum positive air ion count is 194.5 x 10^3 ions/cm^3 and maximum negative air ion count is 180.5 x 10^3 ions/cm^3 and October-15, the maximum positive air ion count is 175.3 x 10^3 ions/cm^3 and maximum negative air ion count is 181.3 x 10^3 ions/cm^3.

Positive Ion variation – various zones

Here we present the number of air ions (both positive and negative) released from 00:00 hour (IST) of (July to November,2012) to 24:00 hour (IST) on the same day at regular intervals. Regarding the positive air ion count (Figure 13), It is observed that, August-14, the maximum level is zone-B at 196.9 x 10^3 ions/cm^3 and minimum level is zone-A at 188.1 x 10^3 ions/cm^3. Next day August-15, the maximum and minimum level of positive air ion is zone-C at 194.3 x 10^3 ions/cm^3 and zone-A at 185.1 x 10^3 ions/cm^3. Followed by August-24, the maximum and minimum level of positive air ion is zone-C 195.6 x 10^3 ions/cm^3 and zone-A at 159.2 x 10^3 ions/cm^3. September-27, the maximum and minimum level of positive air ion is zone-A at 189.1 x 10^3 ions/cm^3 and zone-C at 188.4 x 10^3 ions/cm^3. October-10, the maximum and minimum level of positive air ion is zone-B at 195.7 x 10^3 ions/cm^3 and zone-C at 177.4 x 10^3 ions/cm^3.

Table.1 Thunder and lightning days after one hour zone A-2012

Month	Date	Time		Air ions		Same day low level Air ions	
		Thunder and lightning	Measure	Positive Air ions	Negative Air ions	Positive Air ions	Negative Air ions
August	14	18:00:00	19:00:00	188.1	180.0	143.2	147.1
August	15	18:00:00	19:00:00	185.1	182.0	141.9	141.9
August	24	17:00:00	18:00:00	159.2	173.1	142.8	144.4
September	27	14:00:00	15:00:00	189.1	184.9	143.2	144.7
October	10	14:00:00	15:00:00	186.1	180.0	143.7	144.8
October	11	4:00:00	5:00:00	193.0	193.4	143.2	144.8
October	12	8:00:00	9:00:00	177.2	172.7	144.8	144.7
October	15	4:00:00	5:00:00	177.9	185.9	143.8	156.5.

Table.2 Thunder and lightning days after one hour zone B-2012

Month	Date	Time		Air ions		Same day low level Air ions	
		Thunder and lightning	Measure	Positive Air ions	Negative Air ions	Positive Air ions	Negative Air ions
August	14	18:00:00	19:00:00	196.9	184.6	153.8	172.8
August	15	18:00:00	19:00:00	192.8	198.8	146.7	148.8
August	24	17:00:00	18:00:00	195.6	192.7	144.0	148.8
September	27	14:00:00	15:00:00	189.1	175.7	148.1	153.1
October	10	14:00:00	15:00:00	195.7	176.7	144.2	154.7
October	11	4:00:00	5:00:00	178.3	171.9	150.3	142.7
October	12	8:00:00	9:00:00	189.1	190.3	142.4	152.7
October	15	4:00:00	5:00:00	174.7	184.3	143.3	144.3

Table.3 Thunder and lightning days after one hour zone C-2012

Month	Date	Time		Air ions		Same day low level Air ions	
		Thunder and lightning	Measure	Positive Air ions	Negative Air ions	Positive Air ions	Negative Air ions
August	14	18:00:00	19:00:00	195.8	185.6	143.5	142.9
August	15	18:00:00	19:00:00	194.3	186.4	152.2	157.9
August	24	17:00:00	18:00:00	195.6	189.6	155.6	152.4
September	27	14:00:00	15:00:00	188.4	186.5	156.4	151.4
October	10	14:00:00	15:00:00	177.4	177.4	141.6	143.0
October	11	4:00:00	5:00:00	191.2	193.5	147.8	151.0
October	12	8:00:00	9:00:00	194.5	180.5	158.9	143.3
October	15	4:00:00	5:00:00	175.3	181.3	147.0	153.9

Figure.1 Air ions counter

Figure.2 14th Aug-2012, Thunder and lightning with rain at 19:00:00 Hrs

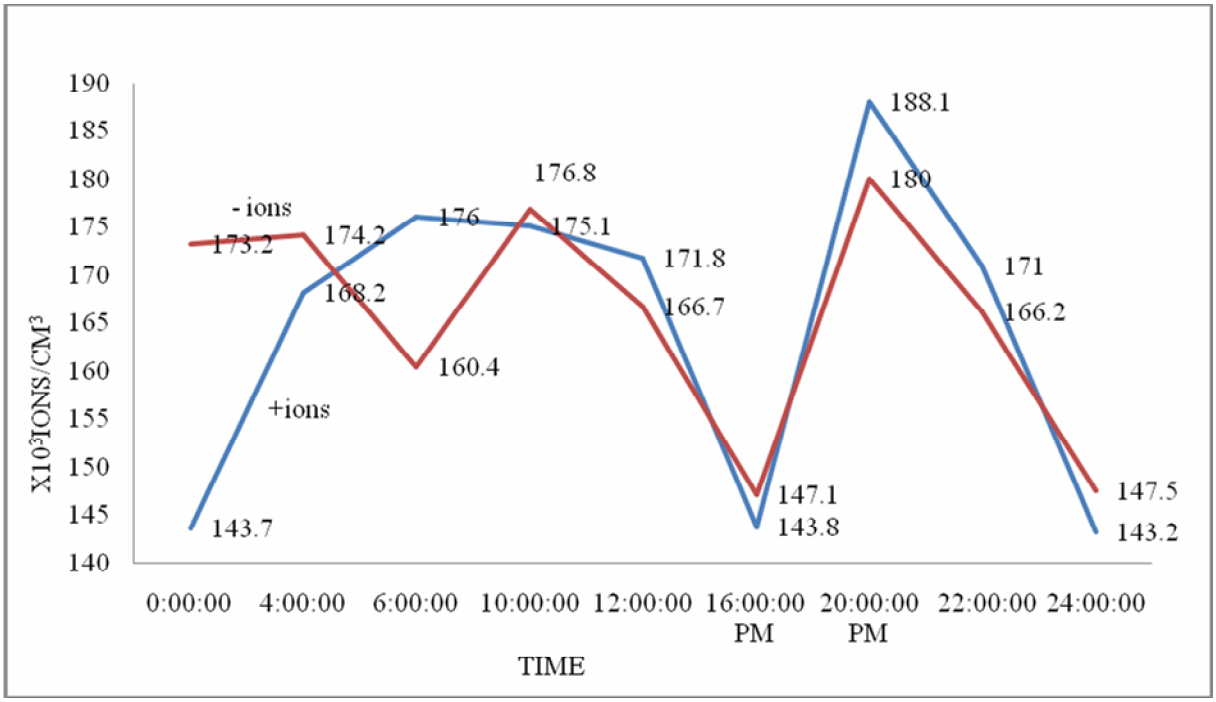


Figure.3 15th Aug-2012, Rain, thunder and lightning at 19:00:00 Hrs

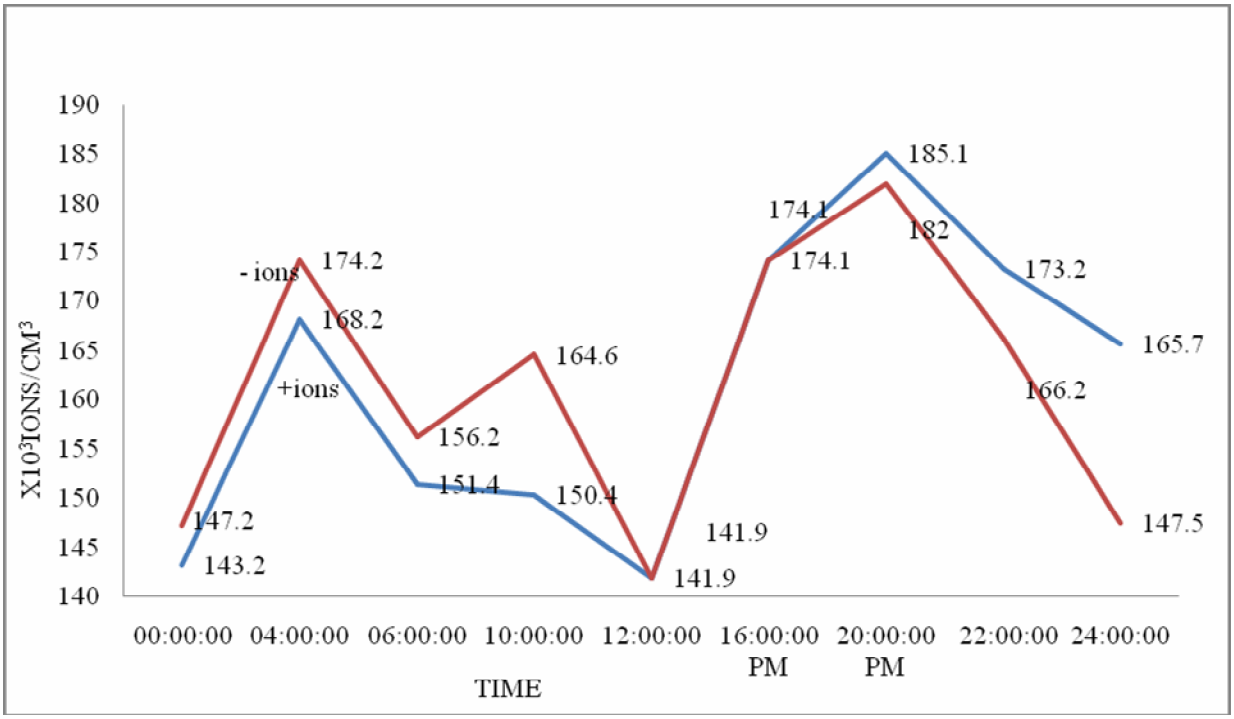


Figure.4 24th Aug-2012 Thunder and lightning with rain at 18:00:00 Hrs

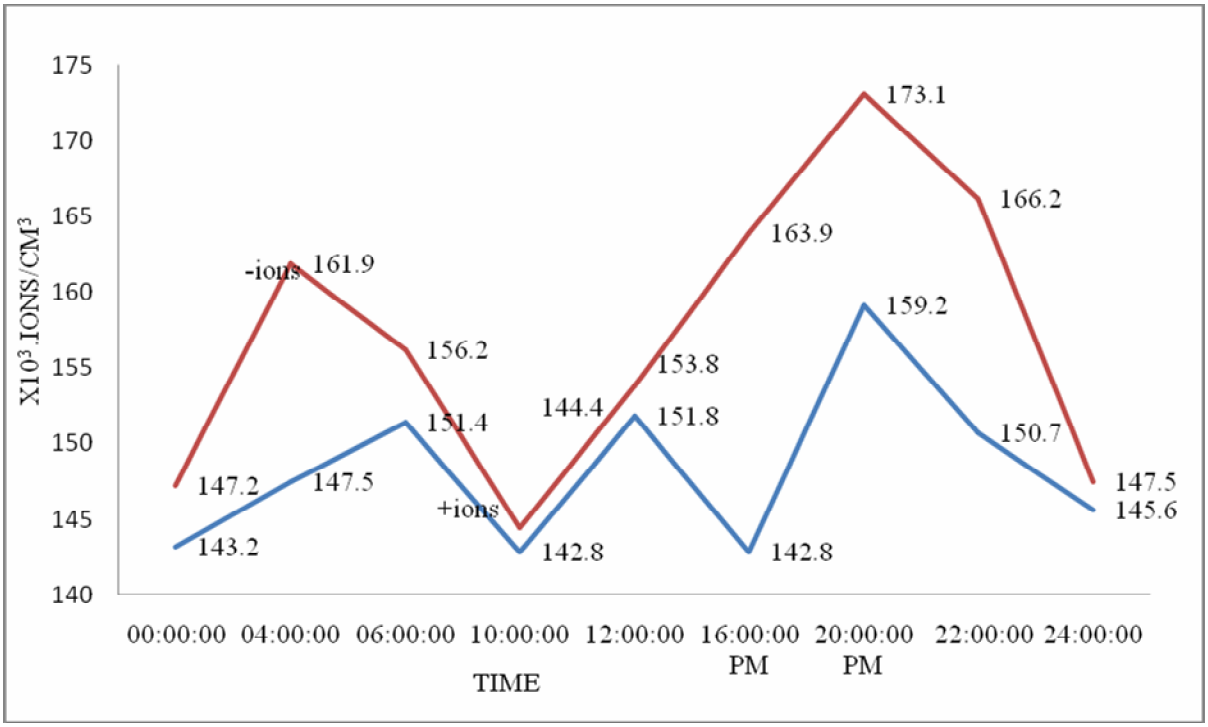


Figure.5 27th Sep-2012 lightning, thunder with rain at 15:00:00 Hrs

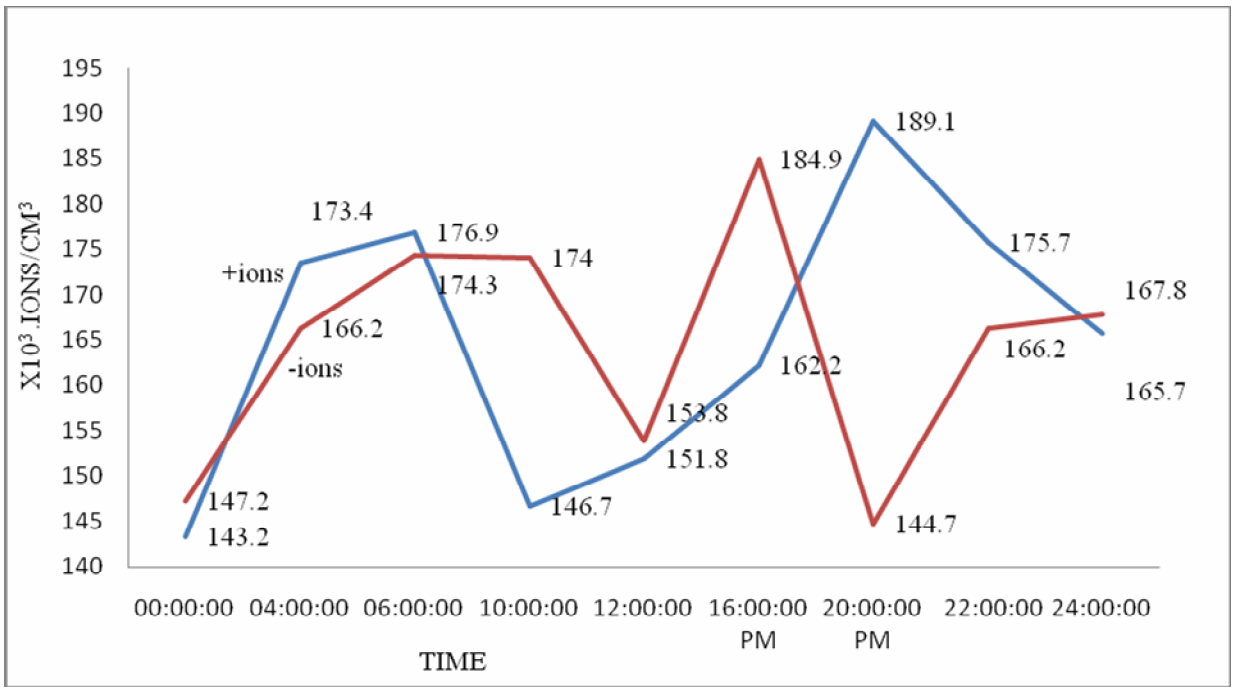


Figure.6 10th Oct-2012, Lightning, thunder and rain at 15:00:00 Hrs

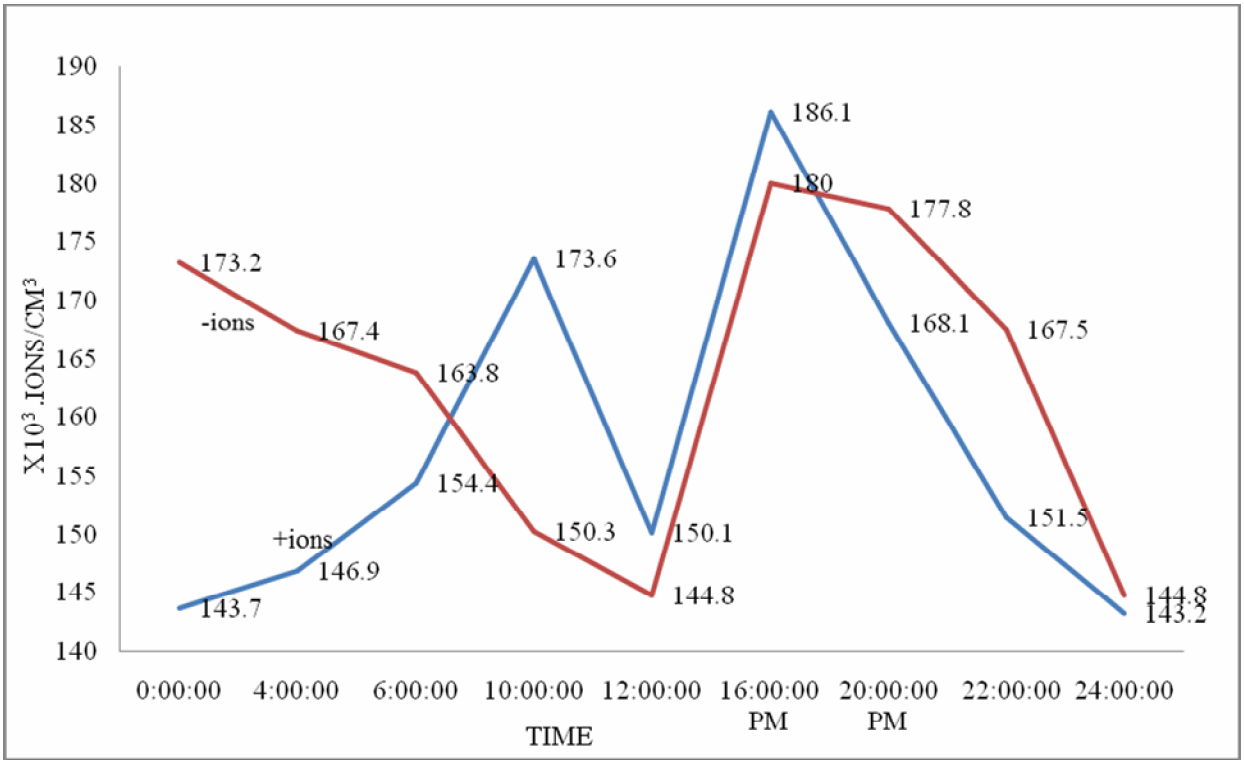


Figure.7 11th Oct-2012, lightning thunder with rain at 5:00:00 Hrs

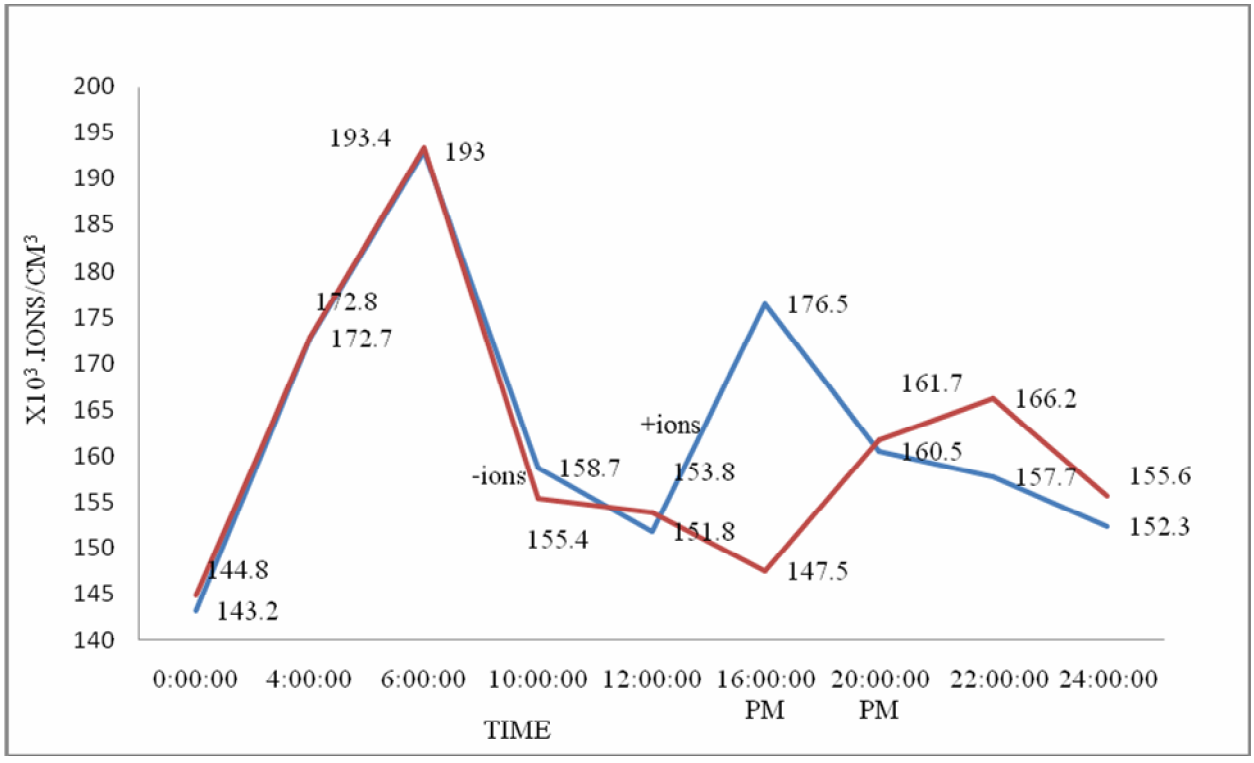


Figure.8 12th Oct-2012, high cloud, rain, thunder, lightning at 9:00:00 Hrs

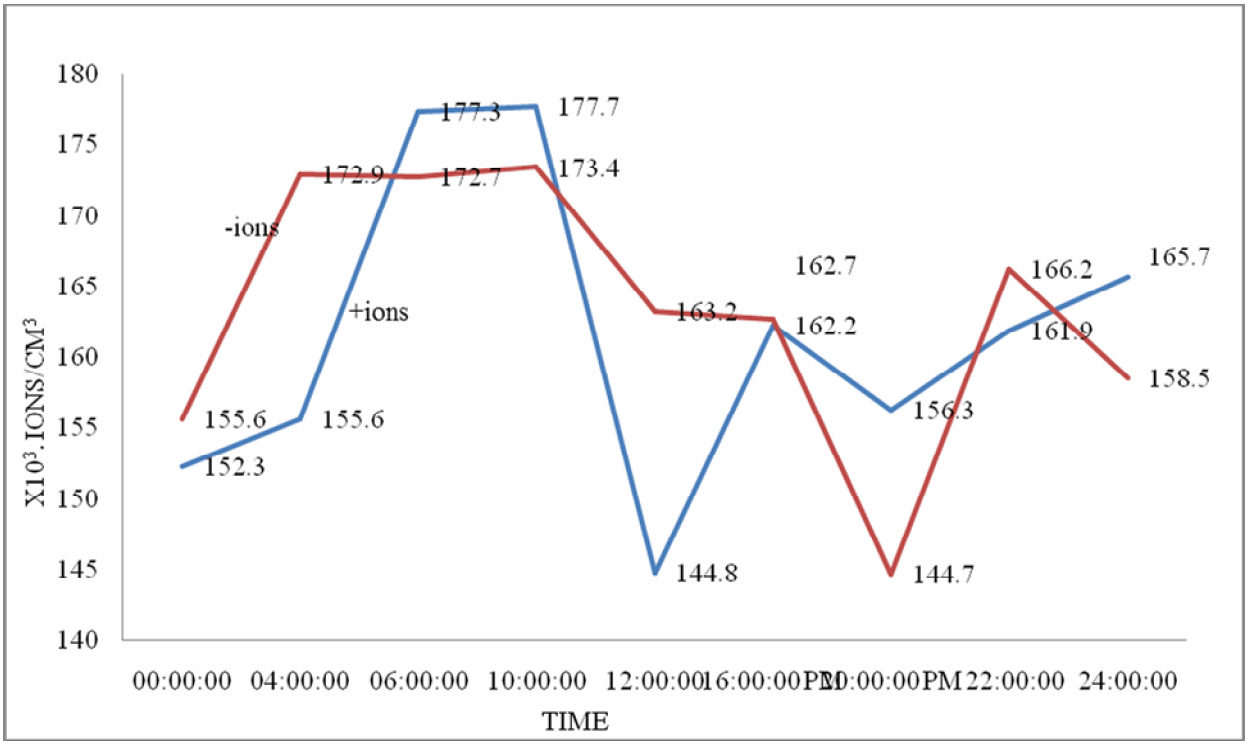


Figure.915th Oct-2012, thunder, lightning with rain at 5:00:00 Hrs

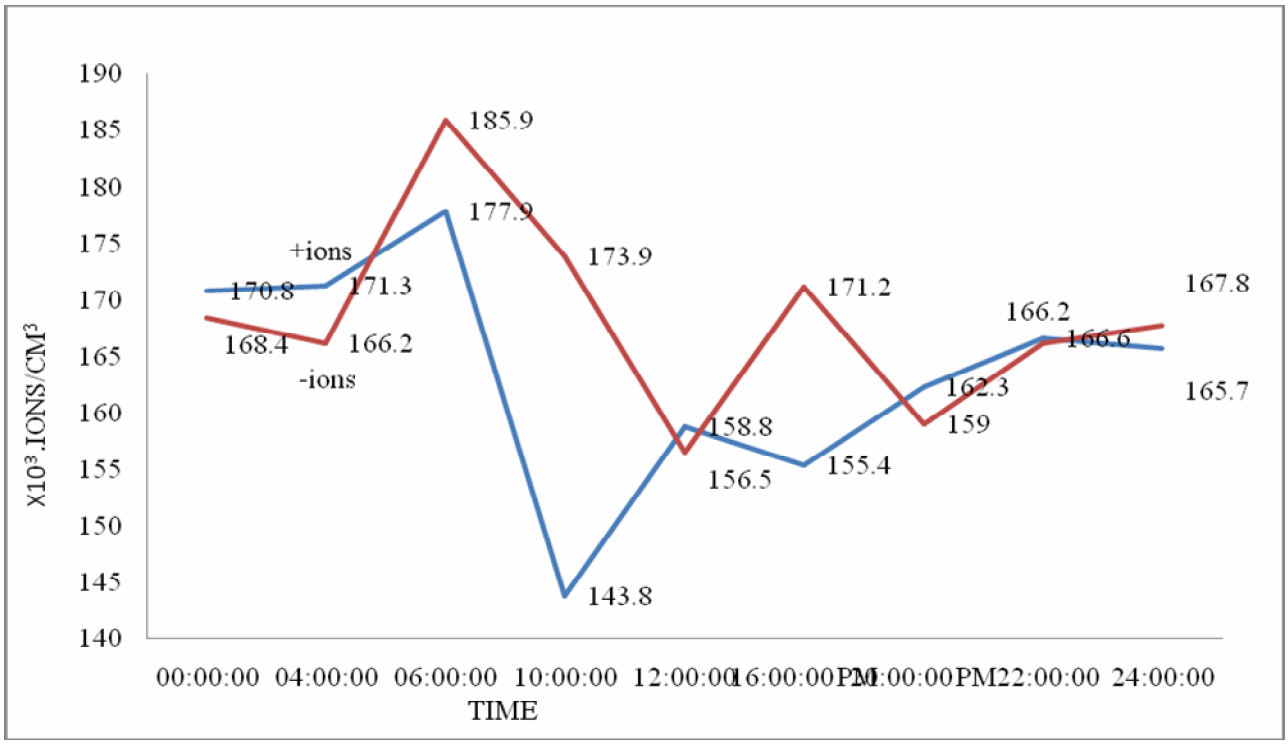


Figure.10 Zone A- Pudukkottai 2012

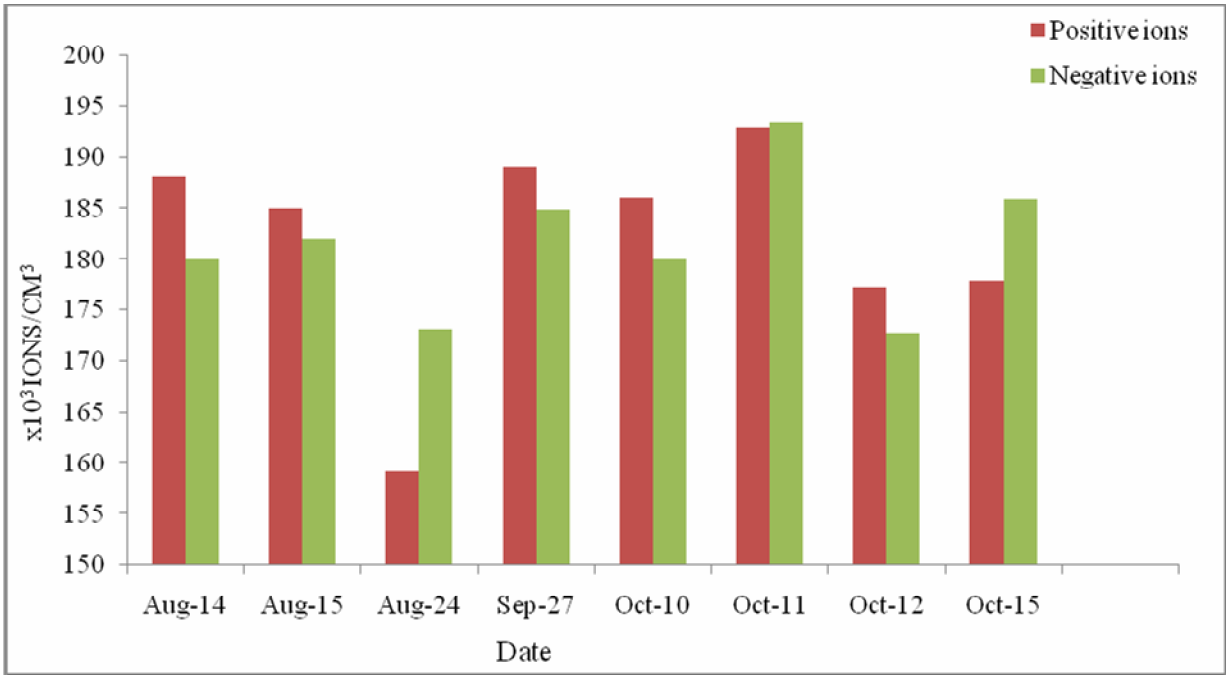


Figure.11 Zone B- Pudukkottai 2012

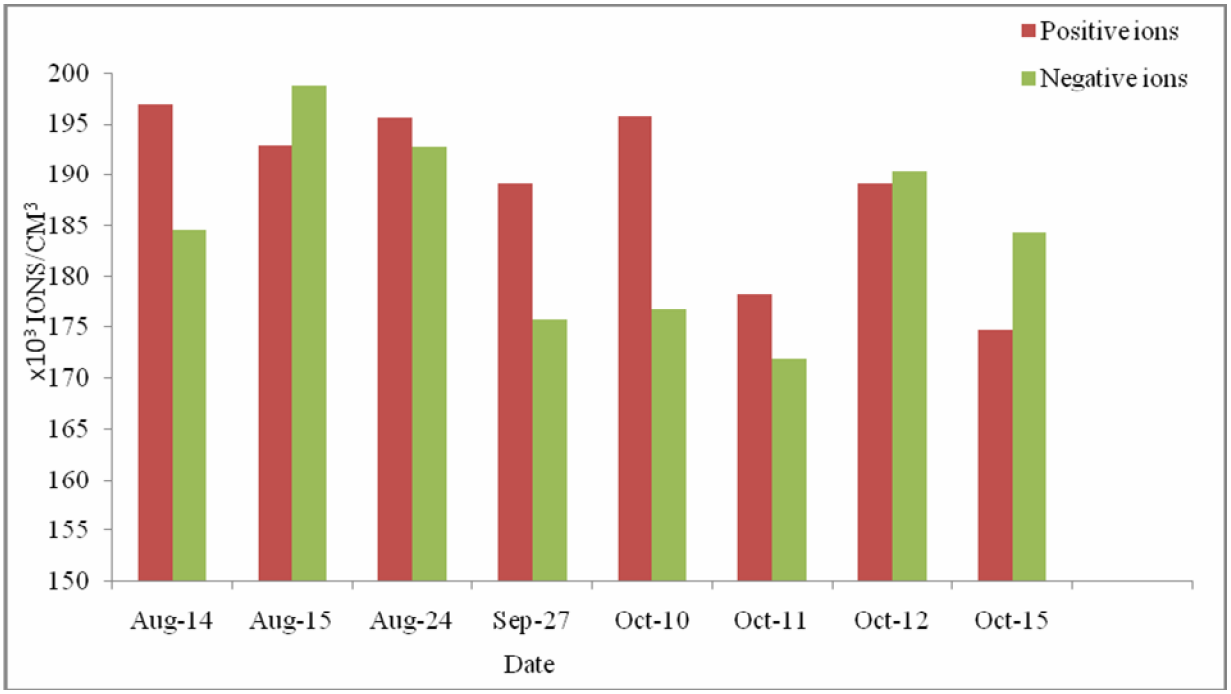


Figure.12 Zone C- Pudukkottai 2012

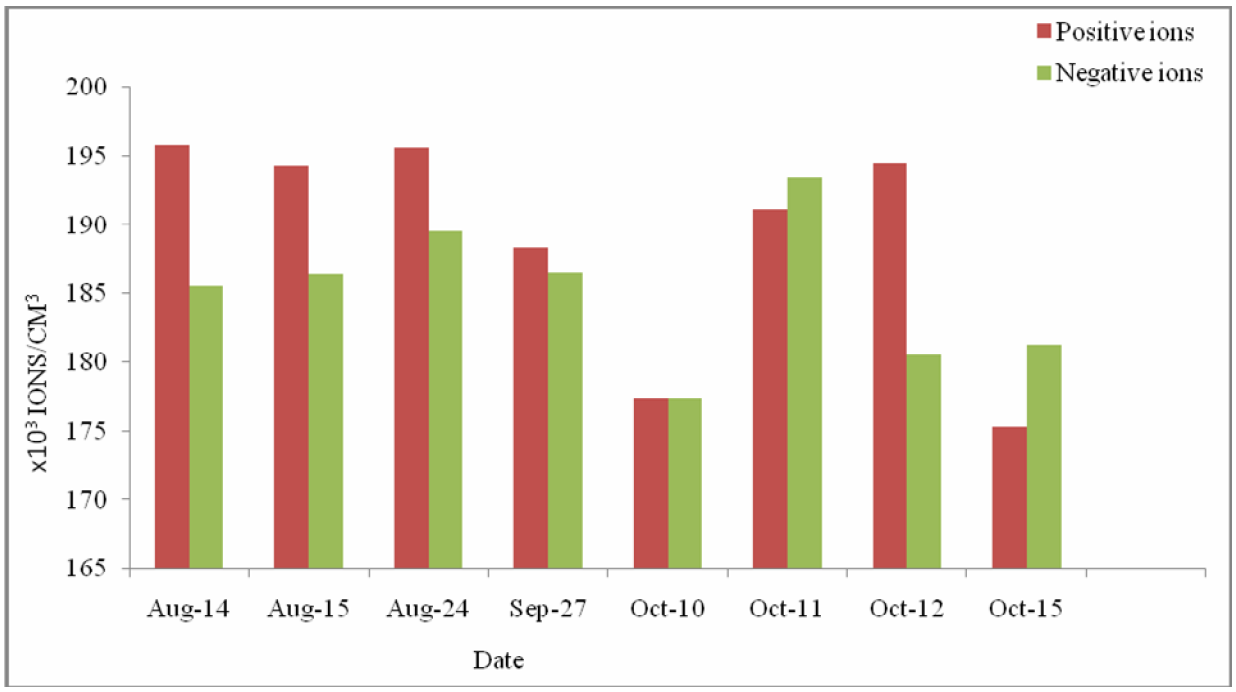


Figure.13 Positive Air ions - Pudukkottai 2012

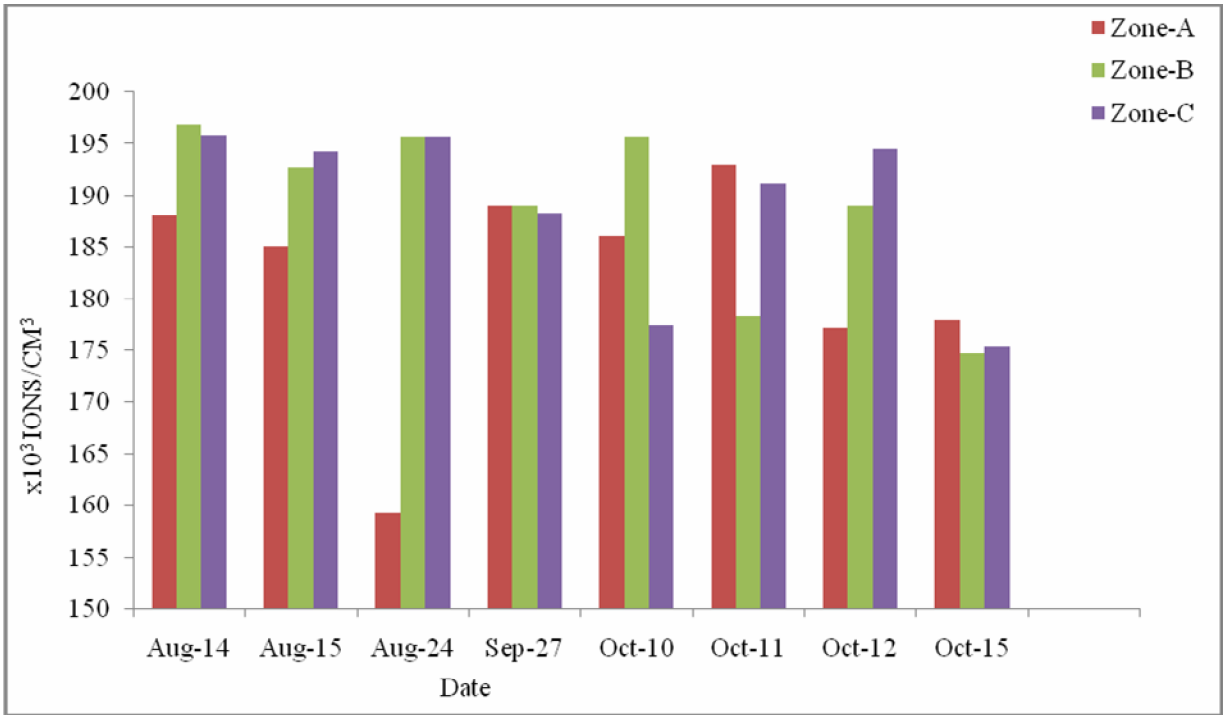
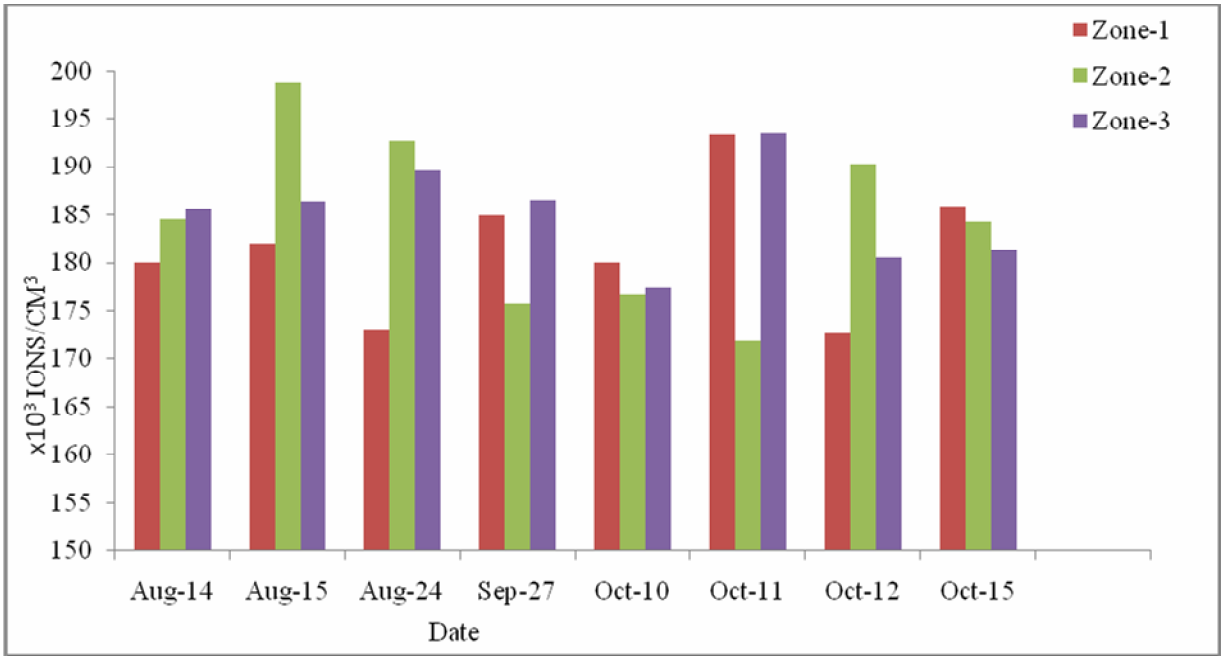


Figure.14 Negative Air ions - Pudukkottai 2012



October-11, the maximum and minimum level of positive air ion is zone-A at 193.0 x 10^3 ions/cm^3 and zone-B at 178.3 x 10^3 ions/cm^3. October-12, the maximum and minimum level of positive air ion is zone-C at 194.5 x 10^3 ions/cm^3 and zone-A at 177.2 x 10^3 ions/cm^3 and October-15, the maximum and minimum level of positive air ion is zone-A at 177.9 x 10^3 ions/cm^3 and zone-B at 174.7 x 10^3 ions/cm^3.

Negative Ion variation – various zones

Here we present the number of air ions (both positive and negative) released from 00:00 hour (IST) of (July to November,2012) to 24:00 hour (IST) on the same day at regular intervals. Regarding the negative air ion count (Figure 14), It observed that, on August-14, the maximum level is zone-C at 185.6 x 10^3 ions/cm^3 and minimum level is zone-A at 180.0 x 10^3 ions/cm^3. Next day August-15, the maximum and minimum level of negative air ion is zone-B at 198.8 x 10^3 ions/cm^3 and zone-A at 182.0 x 10^3 ions/cm^3. Followed by August-24, the maximum and minimum level of negative air ion is zone-B 192.7 x 10^3 ions/cm^3 and zone-A at 173.1 x 10^3 ions/cm^3. September-27, the maximum and minimum level of negative air ion is zone-C at 186.5 x 10^3 ions/cm^3 and zone-B at 175.7 x 10^3 ions/cm^3. October-10, the maximum and minimum level of negative air ion is zone-A at 180.0 x 10^3 ions/cm^3 and zone-B at 176.7 x 10^3 ions/cm^3. October-11, the maximum and minimum level of negative air ion is zone-C at 193.5 x 10^3 ions/cm^3 and zone-B at 178.3 x 10^3 ions/cm^3. October-12, the maximum and minimum level of negative air ion is zone-B at 190.3 x 10^3 ions/cm^3 and zone-A at 172.7 x 10^3 ions/cm^3 and October-15, the maximum and minimum level of negative air ion is zone-A at 185.9 x 10^3 ions/cm^3 and zone-C at 181.3 x 10^3 ions/cm^3.

In conclusion, Negative air ions and Positive air ions generated from different sources like lightning, plant

transpiration and radioactivity are consumed by the aerosols present in the atmosphere. The air ions count data have been analyzed during the periods of lightning and thunder (Aug14th, Aug15th, Aug24th, Sep27th, Oct10th, Oct11th, Oct12th and Oct15th – 2012). Small positive air ion and negative air ion were increased after thunder and lightning. At the time of lightning and thunder, various plants and trees may increase photosynthesis, as a result of which huge amounts of positive ions and negative ions are released. On August-14, after one hour of thunder and lightning the positive air ion count was 188.1 x 10^3 ions/cm^3 and negative air ions count was 180.0 x 10^3 ions/cm^3. The Next day (August-15) after one hour of thunder and lightning the positive air ion count was 185.1 x 10^3 ions/cm^3 and negative air ion count was 182.0 x 10^3 ions/cm^3. Then on August-24, after one hour of thunder and lightning the positive air ion count was 159.1 x 10^3 ions/cm^3 and negative air ion count was 173.1 x 10^3 ions/cm^3. Next month September-27, after one hour of thunder and lightning the positive air ion count was 189.1 x 10^3 ions/cm^3 and negative air ion count was 184.9 x 10^3 ions/cm^3. On October-10, after one hour of thunder and lightning the positive air ion count was 186.1 x 10^3 ions/cm^3 and negative air ion count was 180.0 x 10^3 ions/cm^3. Then October-1, after one hour of thunder and lightning the positive air ion count was 193.0 x 10^3 ions/cm^3 and negative air ion count was 193.4 x 10^3 ions/cm^3.then October-12, after one hour of thunder and lightning the positive air ion count was 177.2 x 10^3 ions/cm^3 and negative air ion count was 172.7 x 10^3 ions/cm^3 and October-15, after one hour of thunder and lightning the positive air ion count was 177.9 x 10^3 ions/cm^3 and negative air ion count was 185.9 x 10^3 ions/cm^3. We have compare Positive air ion and Negative air ion counts on thunder and lightning all the days are both air ions are highly released than ordinary day. Due to the function of photosynthesis the green trees increasingly to release the positive air ions to compares to the negative air ions in the days (Aug-14, Aug-15, Sep-27, Oct-10 and Oct-12). Therefore thunder and lightning days are positive ions harmful to human health. Generally following thunder and lightning days (Aug-24, Oct-22, Oct-15) are negative air ions are released more compared to positive air ions. Negative ions may be vitamins of the air. Negative ions are better air improves our health, energy and mood.

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