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The Effect of Cosmic Ray Flux on the Earth Atmospheric Temperature

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Abstract: A comparative investigation of the variations of cosmic ray flux and the variations of the average earth's atmospheric temperature was carried out. Data for a period of six months were carried out and statistically analyzed. For each day of the month, the cosmic ray flux and average temperature were determine using excel sheet.A statistical analysis such as graph and histograph of the cosmic ray counts and the average earth's atmospheric temperature were plotted against time for each of the month in the same sheet. The variations of the cosmic ray counts and the variation of the average earth's atmospheric temperature were found to be in trend. Careful application of correlation texts were carried out between the variation of cosmic ray count and the variation of earth's atmospheric temperature. The results shows a positive correlation coefficient values which implies that cosmic ray flux plays a significant role in the process of initiating temperature changes within the terrestrial atmosphere. The low correlation coefficient value in the results supports the argument that cosmic ray flux is not the only factor responsible for the production of earth's atmospheric temperature variation in the earth's atmosphere.

Key words: Cosmic ray · Atmosphere and Temperature

INTRODUCTION

Cosmic rays are high energy charged particles ($\geq 10^{16}$ eV) originating from outer space that travel nearly with the speed of light (3.0x108m/s) and strike the earth's atmosphere from all directions of the terrestrial and extraterrestrial bodies (Sharma, 2008). They are the nuclei of atoms ranging from the lightest to the heaviest elements in the periodic table. Cosmic rays also include high energy electrons, positrons and subatomic particles. However, it has come to include other cosmic ray sources of energetic particles in space, including nuclei and electrons accelerated in association with energetic events in the Milky Way galaxy and particles accelerated in interplanetary space [1].

Many scientists have previously discussed the effects of solar activity variations on the Earth's atmosphere and its climatic change [2-4]. The problem became more acute since the last years due to the global warming. The physical causes of this warming (i.e temperature variations) are currently a subject of hot discussions. The popular view that the global warming is caused by purely anthropogenic factors (man made) is disputed by a growing number of opponents whose arguments suggest the possibility of a high natural climatic change. The authors of some papers state that the global warming in the last century was unprecedented during the last two millennia [5-8]. Further reports from other authors seem to suggest the contrary [9-12]. The authors of the latter publications claim that the climate of the 20th century was not uniquely warm during the last millennium. Although *Soon et al*. [9] agrees that in some local areas the anthropogenic effect on the climate may be quite substantial at the present time. Some authors [3 and 4] emphasized that the global warming of the last century was favoured by the long-term growth of the solar activity. In this work, we have studied the influence of cosmic ray fluxes on the average temperature in the Earth's atmosphere from July - December 2011.

Data Analysis: The data for this work were downloaded from the Mexican cosmic ray observatory center and Center for Atmospheric Research CAR, National Space Research and Development Agency, NASRDA, Anyiba

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Kogi State Nigeria. The NASRDA center for Atmospheric Research provides research facilities and services for the atmospheric and Earth Sciences community, as part of their effort to simply the access of research data to different research groups that are interested in using their terrain data worldwide (TRODAN) Tropospheric Data Acquisition Network.

A threshold value of the global cosmic ray of 19,000,000 was taken across the six month data and the average atmospheric temperature for each day was also taken for the period of the same six month. These arrangement of cosmic ray data and the temperature of the atmosphere are to be shown in Tabular form. The variations in cosmic rays versus days and variations of average atmospheric temperature per day are to be shown in graphical form and Histogram.

A correlation test was used for further study of the relationship existing between cosmic ray fluxes and average temperature variation in each of the six months as shown in Table 1 containing correlation coefficient for each month.

RESULTS

The variations of cosmic ray counts and average earth's atmospheric temperature versus time/day are as shown in Figures 1(a),1(b);2(a), 2(b), 3(a), 3(b), 4(a), 4(b), 5(a), 5(b) and 6(a), 6(b) for the months of July, August, September, October, November and December 2011 respectively.

Statistical Test: The correlation tests between the global cosmic ray fluxes and the average Earth's atmospheric temperature per month were carried out using the excel program me, the values of the correlation coefficients are distributed in the Six month as shown in Table 1.

CONCLUSION

The global cosmic ray data were recorded using the Mexico cosmic ray observatory center and Center for Atmospheric Research CAR, National Space Research and Development Agency. The data were collected over a period of six months, July, August, September, October,

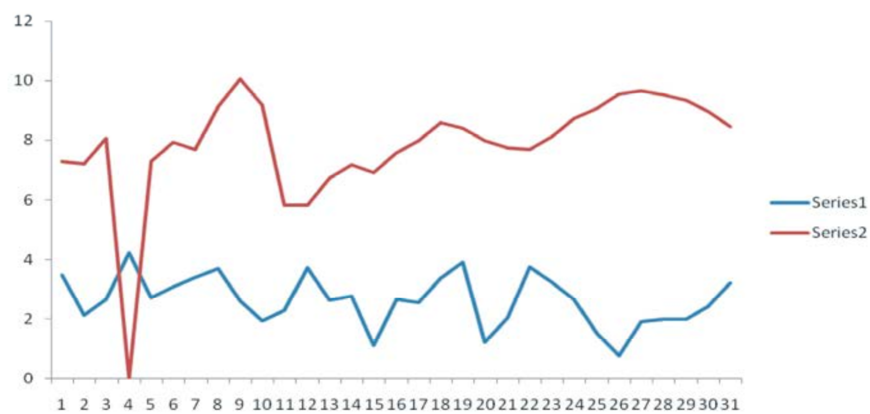

Fig. 1a: A graph of AEAT/degree versus time/day (in blue color) and TVCR Counts versus time/day in (in Red color) in July, 2011.

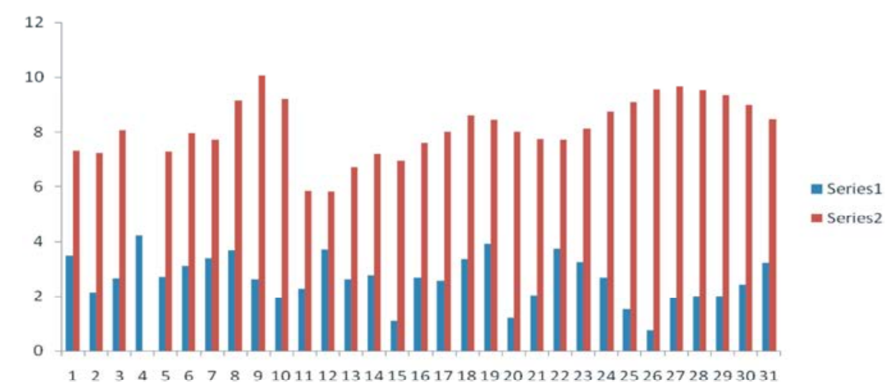

Fig. 1b: A Histogram of AEAT/degree versus time/day (in blue color) and TVCR Counts versus time/day in (in Red color) in July, 2011.

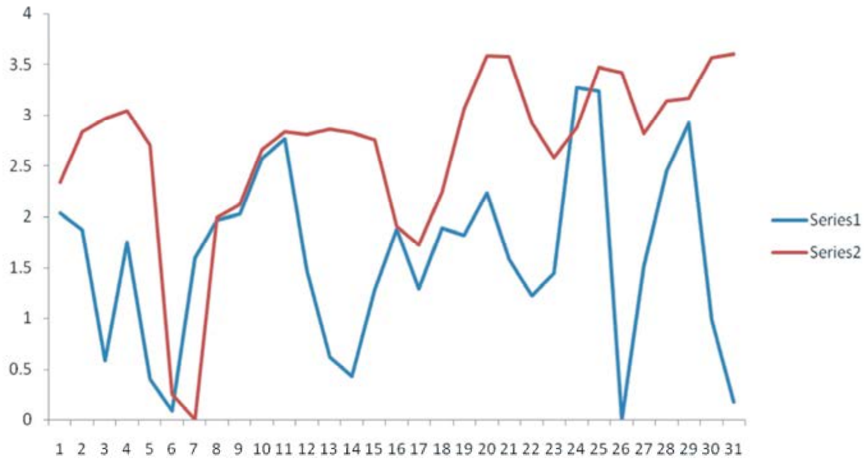

Fig. 2a: A graph of AEAT/degree versus time/day (in blue color) and TVCR Counts versus time/day in (in Red color) in August, 2011.

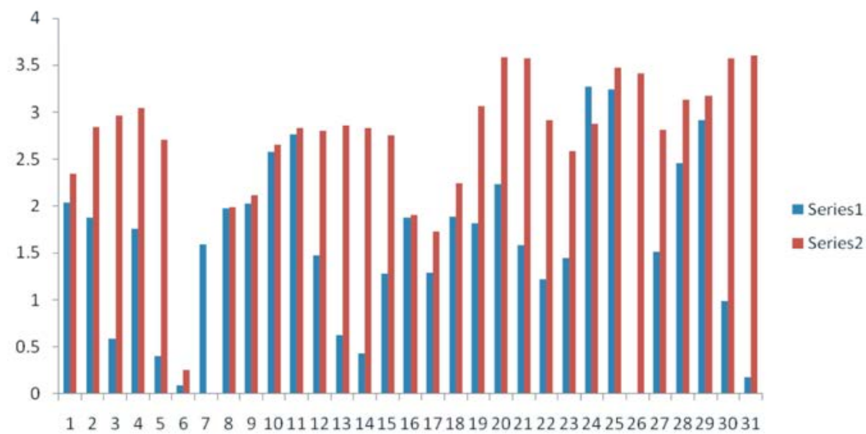

Fig. 2b: A Histogram of AEAT/degree versus time/day (in blue color) and TVCR Counts versus time/day in (in Red color) in August, 2011.

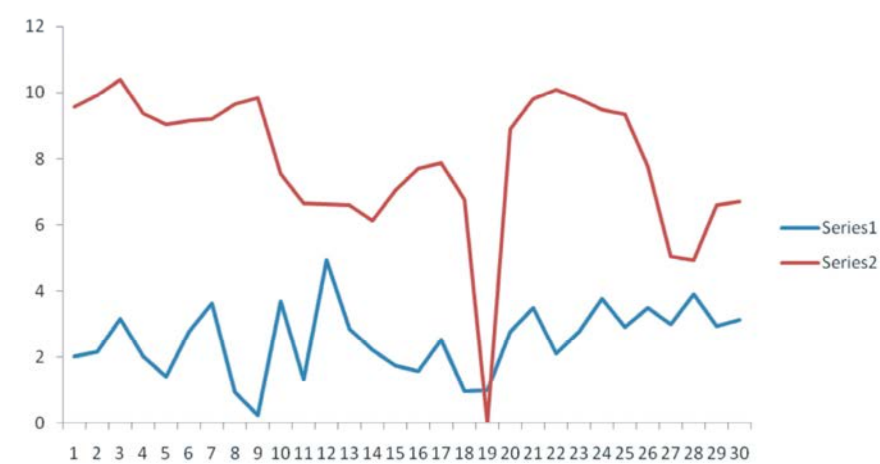

Fig. 3a: A graph of AEAT/degree versus time/day (in blue color) and TVCR Counts versus time/day in (in Red color) in September, 2011.

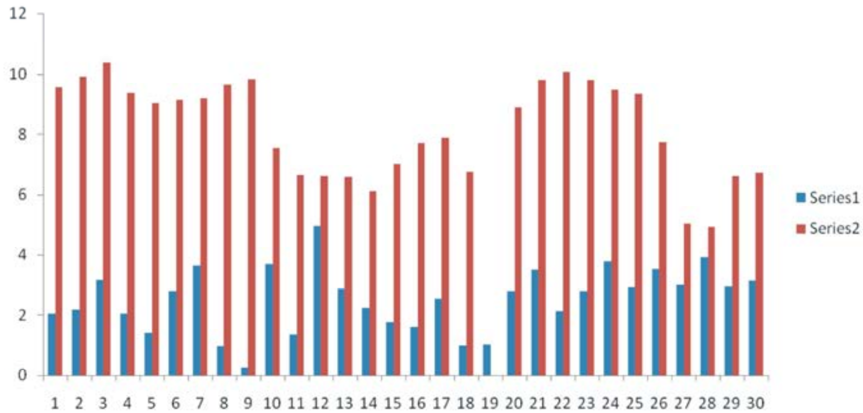

Fig. 3b: A Histogram of AEAT/degree versus time/day (in blue color) and TVCR Counts versus time/day in (in Red color) in September, 2011.

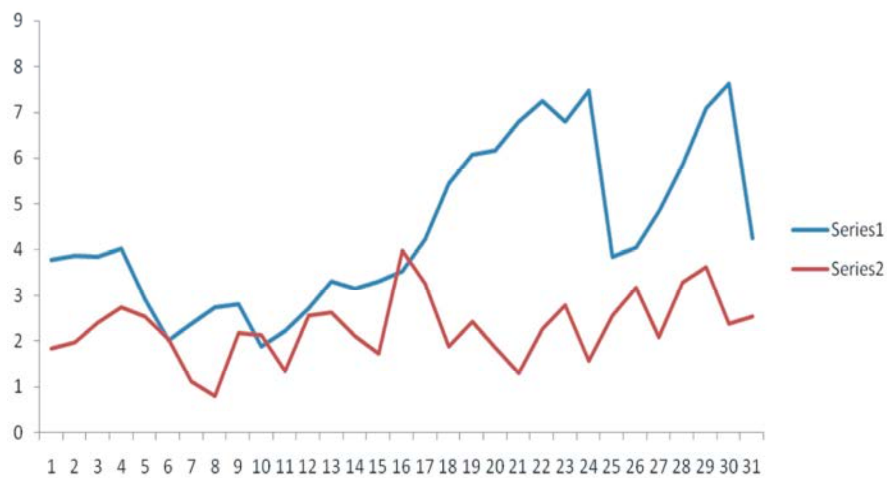

Fig. 4a: A graph of AEAT/degree versus time/day (in blue color) and TVCR Counts versus time/day in (in Red color) in October, 2011.

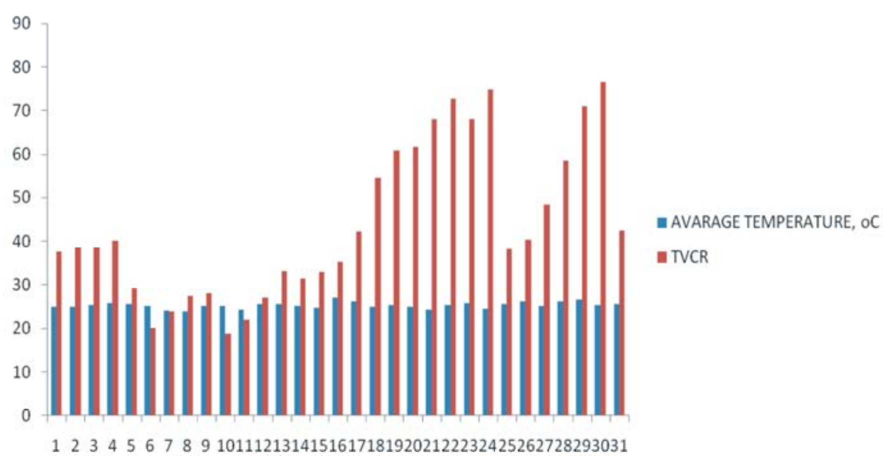

Fig. 4b: A Histogram of AEAT/degree versus time/day (in blue color) and TVCR Counts versus time/day in (in Red color) in October, 2011.

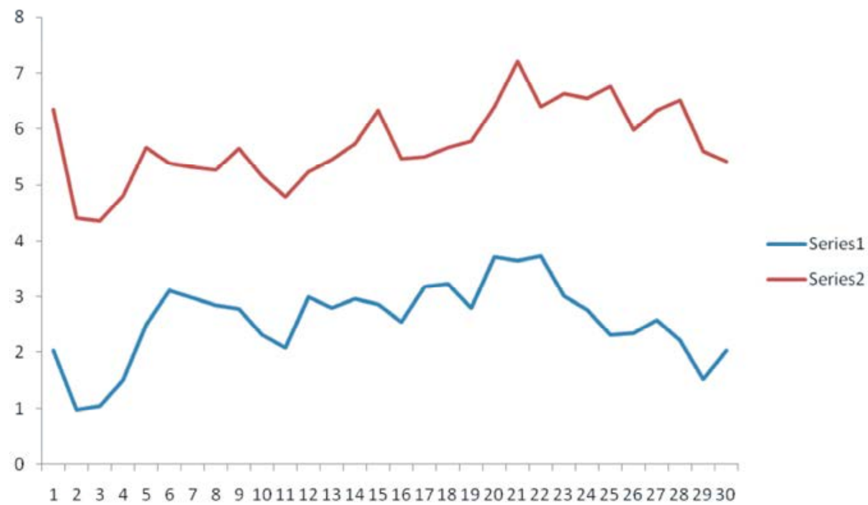

Fig. 5a: A graph of AEAT/degree versus time/day (in blue colour) and TVCR Counts versus time/day in (in Red colour) in November, 2011.

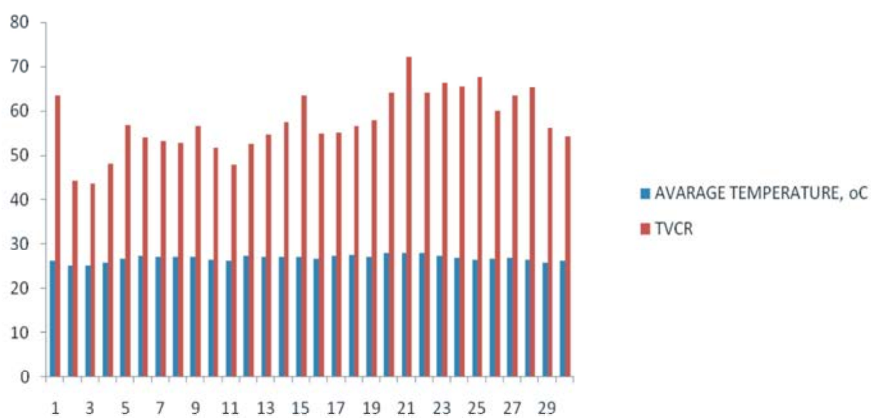

Fig. 5b: A Histogram of AEAT/degree versus time/day (in blue color) and TVCR Counts versus time/day in (in Red color) in November 2011

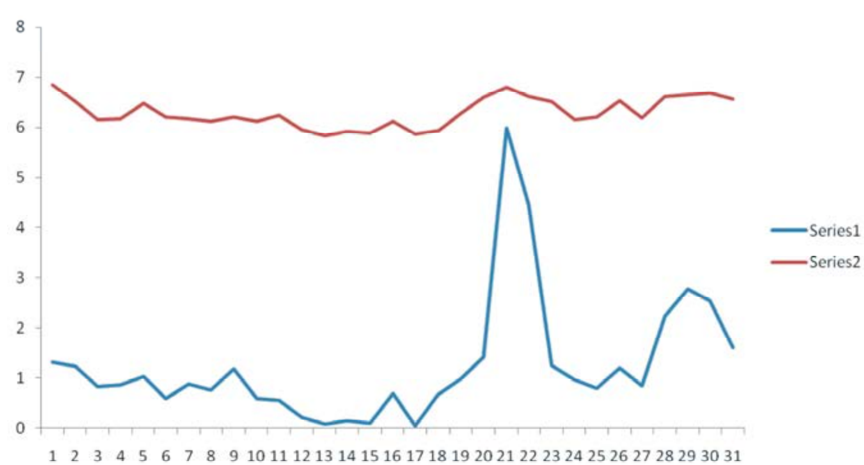

Fig. 6a: A graph of AEAT/degree versus time/day (in blue color) and TVCR Counts versus time/day in (in Red color) in December, 2011.

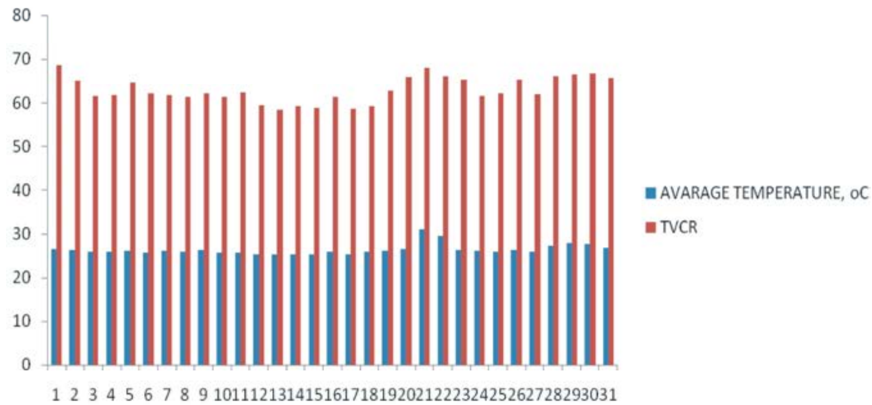

Fig. 6b: A Histogram of AEAT/degree versus time/day (in blue color) and TVCR Counts versus time/day (in Red color) in December, 2011.

Table 1A: Table of correlation text between the atmospheric temperature and cosmic ray counts

Month, 2011	Correlation coefficient	Remarks
July	0.050247	Weak and Positive
August	0.121716	Weak and Positive
September	0.040638	Weak and Positive
October	0.169224	Weak and Positive
November	0.570814	Strong and Positive
December	0.735506	Strong and Positive

November and December 2011.A threshold value of about 19,000,000 counts was observed in the data throughout the period of the six months. This threshold value was filtered out of the cosmic ray data. After the removal of the threshold value from the main cosmic ray count data, the result showed a significantly variations in the output of cosmic ray flux for the month. The variations of the cosmic ray flux counts and the variation of the earth's atmospheric temperature were further compared using correlation test. This text was carried out for each of the six months. The result of this correlation test showed significant positive correlation coefficient. The magnitude of the correlation coefficient per month range from ~ 0.04 to 0.7.The magnitude of the correlation coefficient of less than 0.04 was recorded in the measured six months.

The variations of the cosmic ray counts per day using statistical analysis (such as graph and Histogram e.t.c) and the results of the statistical analysis showed trend of fluctuations. The variations are not uniform for the measured six months. It has also been observed that the average temperature of the earth's atmosphere and the cosmic rays have positive correlation which implies that cosmic rays triggers the variation in temperature of the earth's atmosphere. Cosmic ray is one of the parameters that enhance the ionization and the temperature variation of the atmospheres. The inconsistency in the variation shows that cosmic rays may not be the only source of ionization in the earth's atmosphere. this may suggest that their may be other factors that may affect the temperature variation in the earth's atmosphere such as solar activities like sunspot, solar flare, solar wind etc.

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