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Variation of Cosmic Rays Near Southern Pole and Sunspots Number Based on Selected Neutron Monitors

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Abstract

On October 7th 2008, Quantus flight took off from Singapore and within a few minutes it was flying in auto pilot mode at its maximum altitude, suddenly the node of the plane went up and the plane went up 200 feet while flying and suddenly the node of the plane went down and came down 650 feet. In such a statre, the plane started moving up and down on its own, due to which 119 passengers got injured, the pilot somehow made an emergency landing of the plane. Investigation showed that one bit in the signal bit given to the FCPC (Flight Control Primary Computer) had changed automatically, how this trigger was changed in the software of the FPC of Quantus 72, The main reason for this is not known but many scientists say that there is a strong possibility of a bit trigger in the CU due to cosmic rays; however, it is not recorded. Single event upsets (SEUs) occur in computer circuits when high-energy particles such as neutrons or muons from cosmic rays or gamma-rays strike the silicon used in microchips. This generates an electric charge that can change the internal voltage of nearby transistors, thus corrupting the data stored there. In this research paper, the effect and correlation of cosmic rays coming from the universe and the number of sunspots on the southern hemisphere are studied. Sunspot is a very interesting phenomenon which occurs on the sun and cosmic rays are highly energetic charged particles coming from the universe. There is an inverse relationship between the number of sun spots and cosmic rays, and a strange behavior was observed in both near the poles.
Keywords: - Galactic Cosmic Rays, Near Pole, Neutron Monitor, Sunspots Number.

1. Introduction

The sun is the main source of energy in the earth and its environment. Through the emitted energy, the sun acts as a climate controller that is very important to the air movement (atmospheric circulation) ocean currents (ocean circulation) and bio-instruments that process photosynthesis in the biosphere. Therefore, the climate also depends on variations in the flux of solar energy received by the earth's surface. Variation in the solar energy flux is caused by variations in solar activity cycle. As such, the climate is a manifest of how solar radiation is absorbed, redistributed by the atmosphere, land and oceans, and ultimately radiated back into space. Every variation of solar energy received at the earth's surface and reradiated by the earth into space will have a direct impact on climate change on Earth. When reaching the upper limit of the atmosphere, the solar radiation is not actually attenuated but when it passes through the layers of the Earth's atmosphere solar radiation it will be scattered and absorbed by molecules and particles of dust clouds. Thus, only a small fraction of the solar radiation reaches the earth.

In August 1912, the Austrian physicist Victor Hess made a historic balloon flight that opened a new window on matter in the universe. As he ascended to 5300 meters, he measured the rate of ionization in the atmosphere and found out that it increased to some three times compared to that at sea level. He concluded that penetrating radiation was entering the atmosphere from above. He also discovered cosmic rays. These high-energy particles arriving from outer space are mainly (89%) protons – nuclei of hydrogen, the lightest and most common element in the universe – but they also include nuclei of helium (10%) and heavier nuclei (1%), all the way up to uranium. When they arrive at earth, they collide with the nuclei of atoms in the upper atmosphere, thus create more particles, mainly pions. The charged pions can swiftly decay and duly emit particles called muons. Unlike pions, the muons do not interact strongly with matter, and can travel through the atmosphere to penetrate the below ground. The rate of muons arriving at the surface of the Earth is such that about one of them passes per second through a volume that is the size of a person's head.

Sunspots are areas where the magnetic field is about 2,500 times stronger than Earth's, much higher than anywhere else on the Sun. Because of the strong magnetic field, the magnetic pressure increases while the surrounding atmospheric pressure decreases. This in turn lowers the temperature relative to its surroundings because the concentrated magnetic field inhibits the flow of hot, new gas from the Sun's interior to the surface.

Sunspots tend to occur in pairs that have magnetic fields pointing in opposite directions. A typical spot consists of a dark region called the umbra, surrounded by a lighter region known as the penumbra. Sunspots appear relatively dark because the surrounding surface of the Sun (the photosphere) is about 10,000 degrees F (5,538 degrees C), while the umbra is about 6,300 degrees F (3482 degrees C). They are quite large as an average size is about the same size as the Earth. If the sunspots are active, more solar flares will result and hence increases the geomagnetic storm activity for Earth. Therefore, during the sunspot maximums, the Earth will witness an increase in the Northern and Southern Lights and a possible disruption in radio transmissions and power grids. The storms can even change polarity in satellites and can duly damage the sophisticated electronics. Therefore, scientists will often times preposition satellites to a different orientation to protect them from increased solar radiation when a strong solar flare or coronal mass ejection occurs.

2. Data Selection and Analysis

The corrected for pressure yearly average data of cosmic ray intensity from South Pole Neutron Monitor was situated in South Pole, Antarctica. It was a project of The Bartol Research Institute, USA Latitude: -90.00S, Longitude: 0.00E, Altitude: 2820 m, Rigidity (1965): 0.09 GV, Standard atmospheric pressure: 680mb, Barometric coefficient (2004): 0.69 %/mb SF=100 (The mean count is around 208000/hour or 3460/min,) data were taken from website: http://http://cr0.izmiran.ru/sopb/main.htm. In this study, most of the Sunspots Number data are taken from the database "Source: WDC-SILSO, Royal Observatory of Belgium, Brussels" on the annual average basis. Then, a statistical technique was used to correlate and analyze them. The cross-correlation method was used for this correlative study. The study mainly focused on solar cycle 24

3. Result and Discussion

In this research paper, three types of data, namely the data of cosmic rays from South Pole which is located at 90°S. yearly mean total Sunspots Numbers from Source: WDC-SILSO, Royal Observatory of Belgium and Brussels". and north yearly mean total Sunspots Numbers data and south yearly mean total Sunspots Number from 2009 to 2024 were taken.

The Correlation Coefficient between the South Pole CRI and the Southern yearly mean Sunspot Numbers is -0.24.

The Correlation Coefficient between total the Sunspots Number and the southern yearly mean total Sunspot Numbers is 0.942497864 Finally, the Correlation Coefficient between the South Pole CRI and the yearly mean Sunspot Numbers is -0.263533012.

CRI Data From 2009-2023 In North and South Pole				
latitude	**-90^0.00S**	North yearly mean Total Sunspots Number	yearly mean Total Sunspots Number	Southern yearly mean Total Sunspots Number
latitude	**0.00E**			
Altitude (m)	**2820**			
Years	**South Pole**			
2009	11401	3.16	4.8	1.56
2010	10905	16.23	24.9	8.62
2011	10552	55.49	80.8	25.27
2012	10393	44.12	84.5	40.25
2013	10263	38.32	94	55.39
2014	10332	37.78	113.3	75.83
2015	11108	36.12	69.8	28.14
2016	11413	29.51	39.8	10.31

2017	11594	15.68	21.7	6.13
2018	11663	4.15	7	2.85
2019	19592	3.3	3.6	0.26
2020	19366	1.75	8.8	7.03
2021	18328	12.49	29.6	12.99
2022	17396	43.33	83.2	39.71
2023	16132	61.13	125.5	57.74

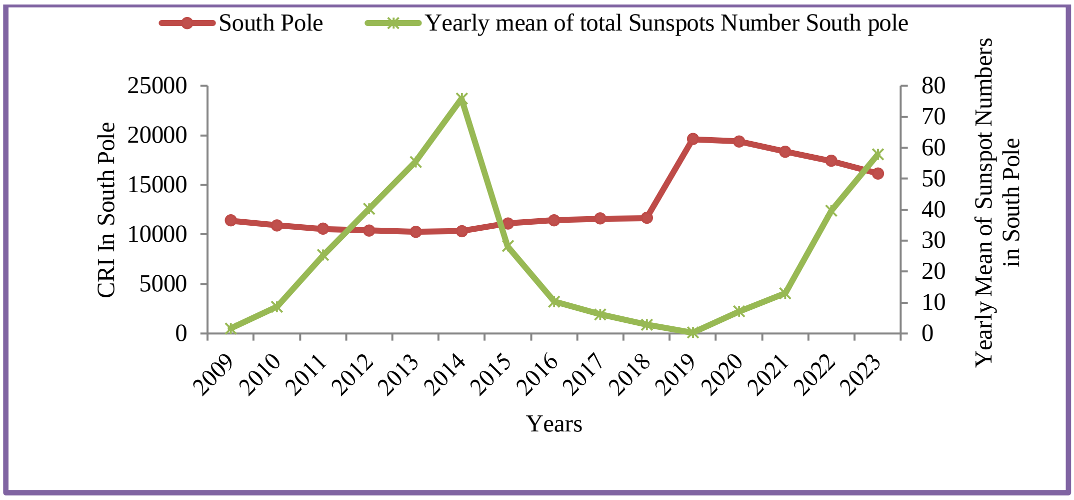

Figure-1 The variations of CRI in the South Pole and the southern yearly mean of sunspot numbers.

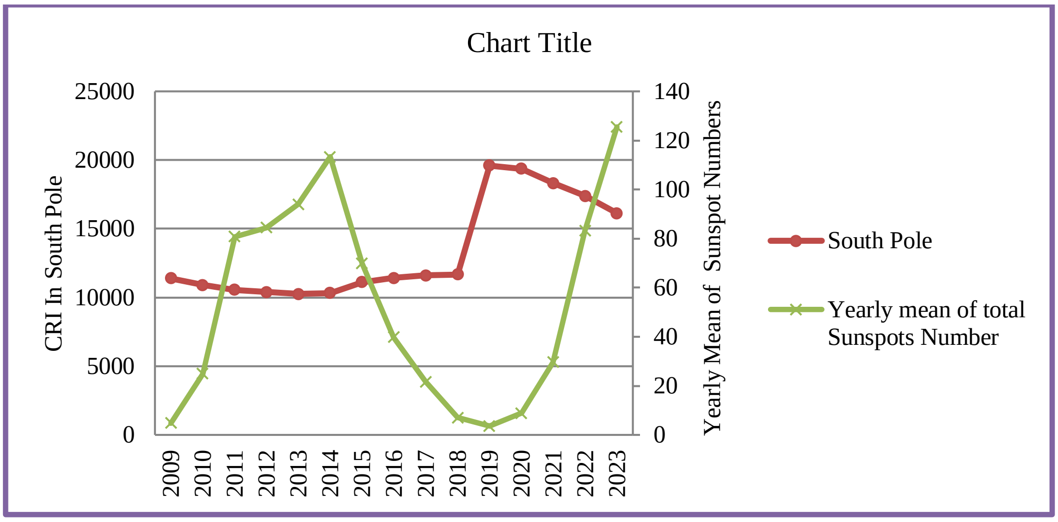

Figure-2 The variations of CRI in the South Pole and the yearly mean of sunspot numbers.

Conflict of Interest

Authors of the manuscript declare that no conflict of interest.

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