Sudan University of Science and Technology

College of Graduate Studies

Magnetospheric indices checkup as to investigate potential causes of the loss of the Malaysian plane (Boeing 777)

اختبارمؤشرات الغلاف المغناطيسي نحوالتحقق من اللأسباب المحتملة لفقدان الطائرة(بوينغ 777) للخطوط الماليزية

A complementary thesis submitted in Partial Fulfillment of the Requirements for a master degree (M .Sc.) in physics

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بسم الله الرحمن الرحيم

قال الله تعالى:

(نرفع درجات من نشاء وفوق كل ذي علم عليم)

سورة يوسف الاية 76

Dedication

To the source of tenderness the source of benevolence my

Beloved mother

To me is the hotbed of light that crossed me towards hope and beautiful aspiration and his heart expanded to contain my dream assuming difficulties for my

Beloved father

Acknowledgement

The first thanks and foremost to my God ‘as without his will nothing is possible.

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Thanks to my aunt afaf and my uncle Dr/Mohammed Hammed and my sister Ebada musa and brothers .Thanks my small family for anything that you make for me. Thanks must be send to all my Friends and classmates for any support that make me complete this research.

Abstract

Space weather is a modern aspect of science, emerged as to address natural Phenomena in Earth Space environment. Mainly, space weather leads to understand couple of solar wind and Earth's magnetic field, since their interactions have a severe impact on technological infrastructure both in ground and in situ.

Hence the consequences of space weather are found to be including: pipe line sector, power grid network, and telecommunication and Navigation systems infrastructures, that is from ground infrastructure view; or including: satellites and spacecraft infrastructures from in situ point of view.

However, many aircraft accidents have remained a puzzle for investigators and the causes of these accidents have not yet been understood.

Knowing the scenario of severs space weather phenomena and their impact motivates an investigation of space weather indices to be carried out synchronizing the time of occurrence of such loss accidents.

In this thesis magnetospheric indices time series have been checked out, that is before, during and after the time of the loss of the famous Malaysian (Boeing 777) aircraft and flight trip MH370 from Kuala lumpur to china on March 8, 2014.

Results of geomagnetic indices investigation showed (Kp=10), that is a quite auroral activity, while, (Dst = -5 nT) is G_0 in G scale, featuring a minor storm sudden commencement (SSC) and finally (AE=48 nT).

These results show a potential cause of the loss of Boeing777 is related to geomagnetic activity, that is, an occurrence of a SSC type of storms.

المستخلص

يعتبر طقس الفضاء جانبا حديثا من العلوم يتعامل مع بيئة فضاء الارض يهتم طقس الفضاء بشكل اساسي بفهم الازدواجية او الاقتران بين الرياح الشمسية والمجال المغنطيسي للارض نظرا لان تفاعلاتها لها تاثيرات كبيرة على البنى التحتية التكنولوجية في الارض ومن ثم تم الحصول على عواقب طقس الفضاء المتمثلة في خط انابيب الطاقة وشبكة الانترنت وانظمة الاتصالات وغيرها ,ومع ذلك فان العديد من حوادث الطائرات ظلت محيرة للمحقيقين ولم يتم فهم اسبابها .

ان معرفة سيناريو طقس الفضاءالقاسي وتاثيره يعطي دافع نحو التحقق في مؤشرات الطقس الفضائي بالتزامن مع وقت اختفاء الطائرة, في هذا العرض التقديمي فحصت السلاسل الزمنية لمؤشرات الغلاف المغنطيسي قبل, اثناء وبعد فقدان الطائرة(بوينغ 777) الماليزية الشهيرة من كوالالمبور الى الصين في8 مارس واظهرت نتائج تحقيق المؤشرات الجيومغنطيسية وجود عواصف مغنطيسيية بدائية الصدمة ونشاطا شفقيا هاديئ عند القطبين .

اذن من المحتمل أن سبب فقدان الطائرة (بوينغ777) متعلق بتأثيرالنشاط الشمسي على الارض وهو حدوث عواصف مغنطيسية بدائية الصدمة.

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List of Abbreviation

Abbreviated	Acronym for
IMF	Interplanetary magnetic field
GIC	Geomagnetic induced current
DST	Disturbance storm time
AE	Aurora Electro jet
GNSS	Global navigation satellite system
GPS	Global position system
WDC	World data center

CHAPTER I

INTRODUCTION

1.1 PREFACE

Space weather is natural phenomenon in the universe spring from the sun that is source of warmth and light and is the mainstay of live on earth at the same time they emit huge amount of radiation and charged particles this emission have negative effects weather in outer space or when infiltrating and reaching earth they effect aviation navigation system, astronauts, spacecraft, and satellites.

Many of us hear about the mysterious aviation accidents and the failure of satellites after their launch like galaxy satellite went out of its orbit and was disconnected due to strong rise in solar activity.

Importance of this subject had to be studied and fact finding facts related to space weather and so to know and how to deal with them and know the causes and predictability of when they occur and knowing this information facilitates the way to solve many of the mysterious problems related to aviation and other accidents in order to spread security and safety in outer space and on surface of earth happen.

Space weather Conditions on the sun and in the solar wind, magnetosphere, ionosphere and thermosphere that can influence the performance and reliability of space borne and ground based technological systems and can endanger human life or health. (Hanslmeier, the sun and space weather 2006)

1.2 Research problem

Space weather events like geomagnetic storms, sub storms have impact on ground system, particular telecommunication and navigation system; however can these events affect aircraft navigation system and cause air craft accidents or loss This question remains answered.

1.3 Objective of the research

1.3.1 To check time series data of geomagnetic indices Kp, Dst, AE before, during and after an accident of loss air craft.

1.3.2 To verify the type of geomagnetic activity that most likely affect air craft navigation system during the flight track in different latitudes.

1.4 Methodology

The time series KP , Dst and AE indices were obtained from OMNI Web; plots of deduced these data were obtained and the time of the loss of the Boeing 777is indicated in the plots by arrow, famous of geomagnetic activities e.g storms, sub storms were deduced from these plots (Papitashvili 2020).

1.5 Outline of The thesis

This thesis is divided into four chapter; in chapter one an (introduction, research problem, objective of research, methodology) and chapter two includes (sun, sun structure, solar flare coronal mass ejection, sun spot, faculae, solar wind, earth magnetic field, composition of earth magnetosphere , aurora, geomagnetic induced current(GIC), magnetic storm, ring current index(Dst),planetary index(AE),geomagnetic indices(KP),introduction, aircraft navigation system GPS ,black box) chapter three (data collection and methodology) chapter four(graphics of indices data from geomagnetic data center Kyoto ,discussion and conclusion)

CHAPTER II

THEORETICAL BACKGROUND

2.1 Introduction

Sun and earth are related not only through the impact of solar radiation on the earth's weather but also through the impact of solar wind on the earth's space weather, space weather is short term variability in the plasma environment of the earth , space weather is linked to the conditions on the sun and in the solar wind, magnetosphere, ionosphere and thermosphere that can influence the performance and reliability of space borne and ground based technological systems and endanger human life or health These space weather phenomena can affect anthropogenic system such as satellites, navigation, telecommunication, power transmission lines, and safety of astronauts and air line passengers (kamide 2007)

2.2 The Sun

The sun is nearest star to us and representing more than 99% of the mass of the solar system to which the sun (Hanslmeier, the sun and space weather 2006)

The sun is star dazzling more than 100 times bigger in diameter than the earth the nuclear furnace every second burns 600 million tons of hydrogen into helium (T.Arny 2006) , medium in size and not giant as it seems is the source of light and heat on the planet earth gas ball in flamed from nuclear reaction and mergers consisting mainly of hydrogen and is located within the milky way galaxy and belong according to star classification to Gv2 , dwarf where G2 indicates surface temperature and V Indicates that the sun is star of the basic pattern (Hanslmeier, the sun and space weather 2006) the sun is main cause for space weather effect it emit all wave length that reaches the earth within 8minuts (Hanslmeier, the sun and space weather 2006)

*Properties of the sun

Temperature of surface (5780) million Kelvin (T.Arny 2006)

Temperature of core15 million Kelvin (T.Arny 2006)

Distance from earth (150) million km

Power out but ($4*10^{26}$) watts

Mass of the sun M_0 ($1.9*10^{30}$) Kg (Hanslmeier, the sun and space weather 2006)

Radius of the sun R_0 ($6.96*10^{8}$) m (Hanslmeier, the sun and space weather 2006)

2.2.1The Sun Structure

The structure of the sun was determined by the emission spectrum where the light analyzed by the prism and the constituent elements were identified through the spectrum of the element it is found to consist of the following elements. (Hanslmeier, the sun and space weather 2006)

Table (2.1) shown the element of the sun

Element	Symbol	Percentage
Hydrogen	H	92%
Helium	He	7.8%
Oxygen	O	0.061%
Carbon	C	0.030%
Nitrogen	N	0.0084%

The sun is plasma of ionized gas in which electron are free and represent 99% of universe.

It has three layers:

Inner layers include

*The core occur fusion reaction

Radiation zone heat is transferred to the surface by radiation

Convection zone heat transferred to the surface by load to the surface of sun.

*photosphere

It is visible layer and is impermeable to light so the layer below it can note be seen separating the sun from its atmosphere(2009 البطانية)

They are yellow in color

*the outer layer

Chromo sphere its colored layer and heated up to million degrees absolute (البطانية2009)

The corona above the color layer and do not see the naked eyes related to its shape and size in turn sun spot are circular in the activity of solar activity and oval when less. (البطانية2009)

2.2.2 Coronal Mass Ejection

Are explosions occur on the sun and giants clouds of particles hurled out into space take on three days to reach earth

Are the most energetic events in the solar system coronal material of mass up to 10^{16} g is expelled at speeds of several 100 to 1000 km/s from the sun CME very often appear in three part structure

Bright frontal and darker cavity and the core

They involve the expulsion of large amount of plasma at high speed from the solar corona into solar wind can be observed in the outer solar atmosphere using coronagraph (kamide 2007)

2.2.3 Solar Flares

Flares are the most energetic phenomena of highly transient nature occurring in the sun very large flare can also be observed in the white light of the sun when it appears as an intense bright (Basu 2004)

Flare are believed to originate in chromo sphere but rise far up into the lower corona they have tendency to occur near the complex groups of spots and usually the occurrence is repeated many times in the same place. (Basu 2004) flare are giant bursts of X rays and energy which travel at the speed of light in all direction and only take eight minutes reach earth (T.Arny 2006)

Flares are immensely energetic explosive outbursts of charged particles and introduce huge quantities of electrons and protons into solar wind (seab 1995)

The flow of plasma on the earth surface of the sun as the result of magnetic fields creates physical arcs they look like fire bows the magnetic fields on the sun contain large amount of stored energy although the appropriate condition erupt out ward to produce solar flares this explosion because the interior of the sun is too hot to disassemble electros from its button flare produce effects throughout the electromagnetic radiation they produce X ray and UV radiation which is an evidence for very high temperatures during flare out burst (Hanslmeier, the sun and space weather 2006)

2.2.4Sun Spots

Are the most common type of solar magnetic activity they are large dark appearing regions as shown in figure 2.1, sun spot last from few day to over month and they are cooler because they contain strong magnetic field this magnetic field create cool region because the magnetic field of sun spot is more than thousand stronger than the earth (T.Arny 2006). sun spot are not actually dark, being cooler than surrounding photosphere they are simply less

bright and there for look dark in comparison and it is typically have surface temperature around 400k and sun spot cycle about 11 years (seab 1995)

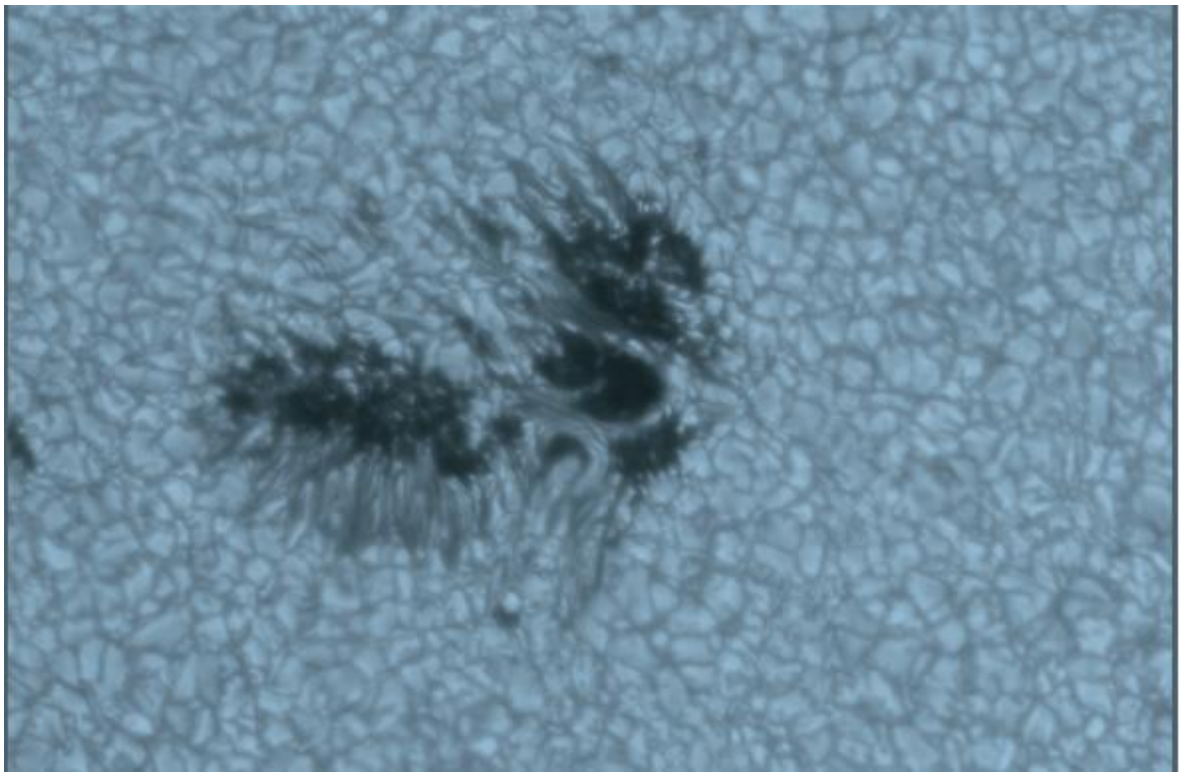

Figure (2, 1) large sunspot (Hanslmeier, the sun and space weather 2006)

2.2.5 Faculae

The bright areas around sun spots occupying at one time substantial of the solar disk (Basu 2004)

these are phenomena belonging to the transition region between photosphere and chromo sphere and live time of spots hardly month lies (Basu 2004) faculae in rang(200-300) day but like many other solar phenomena the real cause of formation and development of faculae is still only poorly known (Basu 2004).

2.2.6 Solar Wind

Sun loses continuously mass this mass loss called solar wind (Hanslmeier, the sun and space weather 2006) the sun emit not only they electromagnetic radiation in all wavelength from X ray to decameter radio wave but also contain stream of plasma with high velocities in all direction this stream composed mainly electron and proton ejected by the sun (Basu 2004)

The Sun is gas that does not have solid surface but gas in photosphere can be considered surface of the sun there is layer above surface of the sun which corona which transparent and thin mostly electrons and protons with speed of one million kilo meter per hour this wind do not touch earth because of presence atmosphere and earth magnetic field, the out flow primarily originates in the coronal holes the region of low flow density in corona because of high temperature in corona, which causes gas particles to escape the sun's gravitational field, solar wind constrained by the sun magnetic field to flow out ward through coronal holes.

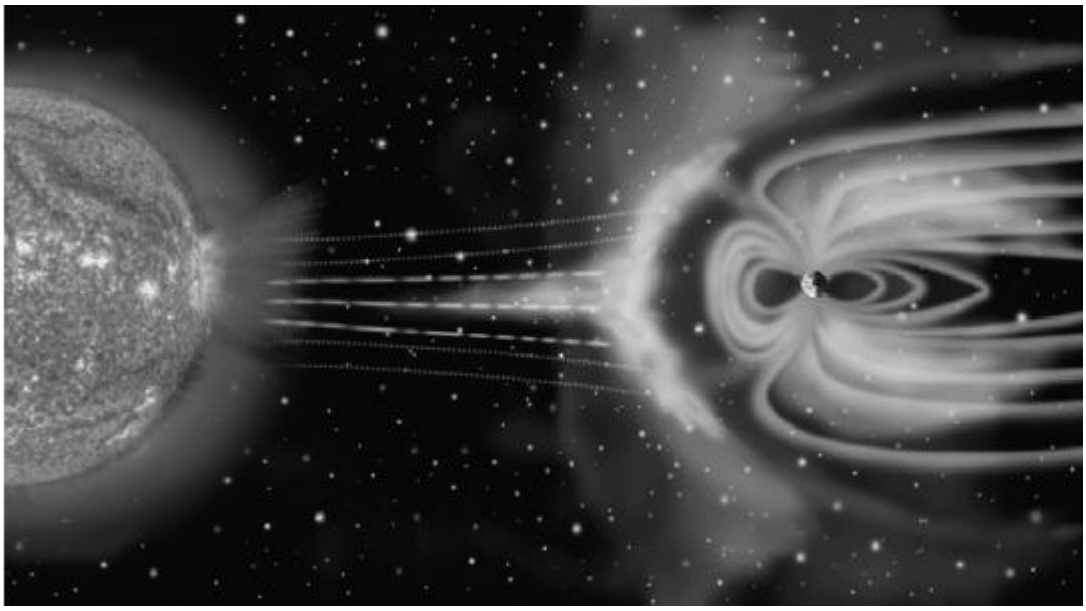

Figure (2, 2) Complex Sun-Earth System

(Hanslmeier, the sun and space weather 2006)

2.3 Geophysical field (earth magnetic field)

The magnetic field of the earth is generated by electric currents flowing in its molten iron core scientists are still unsure about hypothesize that they originate from combination of rotational motion and convection.

There for compass needle does not in general point true north but instead several degrees away both position and strength of the earth magnetic poles change slightly but measurably from year to year, even reversing their polarity about every 10,000 year thus at the same time in the distant future, compass that now points north will point south these changes in our planets magnetic field probably come from irregular motion of the molten iron swirling in the earth core. (T.Arny 2006)

2.3.1Advantages of Geophysical Field

*protects planet earth from solar wind

*knowing the direction by the compass

*traps charged particles and sent them to the polar region and formed aurora

2.3.2 Composition of earth magnetosphere

Magnetosphere it is area of space around the earth that is controlled by the earth's magnetic field.

Structure of magnetic field lines called magneto sphere at large distance from the sun the field line extend so far that they appear to be unconnected travelling away from the sun these field line are often referred to as the interplanetary magnetic field or IMF. (Hanslmeier, the sun and space weather 2006)

The main characteristics are defined by the earth magnetic field lines that are contained within the magneto pause, which is separated from the bow show by the magneto sheath region (into which the solar wind particles can flow)

The van Allen radiation belts formed toroids around the earth inside the magneto sphere. Not the much longer extent of magnetosphere

The inner belt consists largely of protons (hydrogen ion), electrons and originates from the solar wind and ionosphere, the outré belt is populated from the solar wind the high energy fraction of particles in these belts is a hazard to space travelers, the charged particles also affect electronic instruments because the magnetic field of the sun varies with time and the magnetosphere also change these change can affect us visually the most dramatic affect is production of aurora.

The composition of Different part of magnetosphere as shown in Figure 2.3

1/bow shock in this front region solar wind particle hit the magnetosphere. (Hanslmeier, the sun and space weather 2006)

2/magneto sheath region between the bow shock and the magnetopause here the particles become thermal zed kinetic energy is converted to thermal energy and the plasma is highly turbulent there. (Hanslmeier, the sun and space weather 2006)

3/The solar wind stretches the dipole, compressing it on the side towards the sun and stretching it into a long tail region, the field lines close at very large distances. (Hanslmeier, the sun and space weather 2006)

4/plasma sheet this is a sheet of plasma in the tail region dividing the two lobes of the earth's magnetic field. (Hanslmeier, the sun and space weather 2006)

5/lobes they are in the magneto tail have opposite direction and are separated by the plasma sheet, otherwise they would cancel.

6/plasma sphere a torus shaped region surrounding the earth. Has Avery sharp edge at the plasma pause inside the plasma pause geomagnetic field lines rotate with the earth, outside the plasma sphere magnetic field lines are unable to co rotate, the plasma sphere is mainly composed of hydrogen. (Hanslmeier, the sun and space weather 2006)

7/Van Allen belts

Discovered by van Allen the inner radiation belt extends from 400 to 1200km above the earth, outer belts from 1200 to 60000km. (Hanslmeier, the sun and space weather 2006)

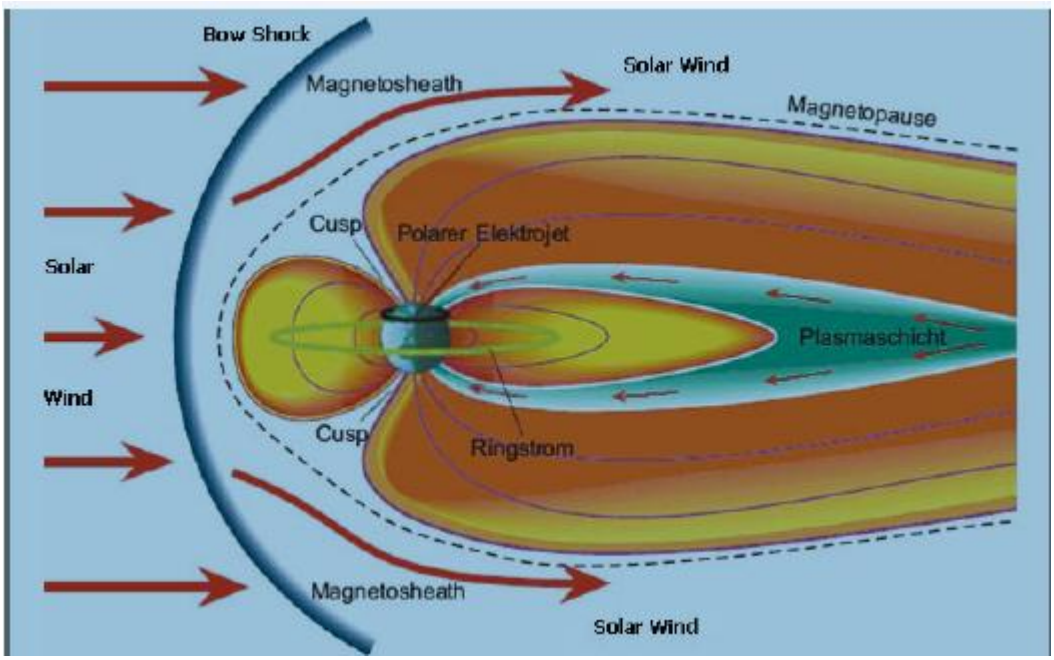

Figure (2, 3) Composition of magnetosphere (T.Arny 2006)

2.3.3 Aurora

From the collision of particles with high energy coming from the sun atoms of elements in the atmosphere the energy produced by the collision produces spectrum of light colors protons and electrons causing the aurora borealis come from corona sun free high makes the hydrogen and helium buttons vibrate and emerge electrons and protons released in form of solar wind toward the earth, the atmosphere prevents it and directs it towards the poles

Oxygen atoms produced green and red emissions and

Nitrogen produced purple or red emissions (Basu 2004)

Figure (2, 4) Aurora displays with different colors and forms

(T.Arny 2006)

2.3.4 Geomagnetic induced current (GIC)

Ground effect of space weather generally known GIC the coupling between magnetosphere and ionosphere leads to ionosphere electric field and at low latitude the ionosphere plasma is co-rotating with earth and at large latitudes convection occurs

The change magnetic field induces currents in the earth itself the induced current's produce magnitude of the induced currents and electrical fields depends on electrical conductivities of different layers within the earth.

With lower frequencies penetrate deeper this currents are driven by the geo electric field associate with magnetic disturbance in electric power

transmission grids pipelines communication cables and railway equipment (Hanslmeier, the sun and space weather 2006).

2.3.5 Magnetic Storm

Depression in the magnetic field lasting normally over one to several days this depression is caused by the ring current flowing in the magnetosphere and can be monitored by the DST index. (kamide 2007)

2.3.6 Ring Current Index (Dst)

DST stands for disturbance storm time. The Dst is an index of magnetic activity derived from network of near-equatorial geomagnetic observatories that measures the intensity of the globally symmetrical equatorial electro jet (the ring Current) thus Dst monitors the variation of the globally symmetrical ring current, which encircles the earth close to the magnetic equator in the van Allen (or radiation) belt of the magnetosphere. During large magnetic storms the signature of the ring current can be seen in ground magnetic field recording world wide as so called main phase depression, the ring current energization which results in typical depression of (100nt) is related to magnetic reconnection processes at the neutral sheet. (Hanslmeier, the sun and space weather 2006)

2.3.7 Aurora Electro jet (AE)

These indexes describe the disturbance level recorded by aurora zone magnetometers. In order to determine these indices horizontal magnetic component recording from set of globe encircling stations are plotted to the same time and amplitude scales relative to their equate time level, they are then graphically superposed, the upper and lower envelopes of this superposition define the Au (Amplitude upper), the Al (Amplitude lower) indices and the difference between the two envelopes determine the AE index (Hanslmeier, the sun and space weather 2006)

AE=Au-Al

2.3.8 Geomagnetic Indices (KP)

The KP index is quasi logarithmic local index of 3hourly rang in magnetic activity relative an assumed quite day curve for single geomagnetic observatory site. The values consist of a single digit 0….9 for each 3hour, ring index KP is the mean standardized K index from 13 geomagnetic observatories between 44 degrees and 60 degree northern or southern geomagnetic latitude. The scale is 0…..9 expressed in thirds of a unit. (Hanslmeier, the sun and space weather 2006)

2.4 Impact of Space Weather

Space weather phenomena have variety of effects on technology energetic particles thrown out from the sun interact with the earth magnetic field producing magnetic disturbance and increased ionization in ionosphere

2.4.1 Effect on Satellites and Spacecraft

Satellites and spacecraft are vulnerable to space weather increased radiation from the sun and occurrence of geomagnetic storms may cause disturbance such as increases in density in the earth upper atmosphere

These result in greater dragon the movement of satellites and spacecraft causing slow down or even aching in orbit.

Charged particles from the sun may strike the spacecraft and satellite and make direct physical damage to the equipment also charge board satellites and space craft resulting in a buildup of the electric field. When electrical discharge, eventually happens the electronics may be damaged, hence affecting the operation of the satellites and space craft.

2.4.2 Effect on human body

The intense radiation from violent space weather can affect human DNA or cell replication; astronauts in space if not properly protected from the dangerous radiation may be adversely affected

Flight at high latitudes may also result in higher dose of radiation at the height of solar activity.

2.4.3 Effect on communication and navigation system

To enable long distance communication many telecommunication system transmit radio signals via the ionosphere

Electromagnetic waves produced by solar flares may disturb the ionosphere and interfere with radio signals resulting in degraded communication quality.

Maritime and aviation navigation system use low frequency signal to locate vessels or aircraft

Intense solar activity may generate inaccuracy in information in these systems causing errors in the positioning of vehicles.

2.4.4 Effect on electric power and pipelines

Occurrence of geomagnetic storms (severe distortion of geomagnetic field of the earth) can induce electric current in oil pipelines and electric cables.

Flow meters may be affected giving incorrect reading; the rate of corrosion of pipeline may also increase.

The abnormal of current induced in power grids may damage Tran’s formers because of overheating.

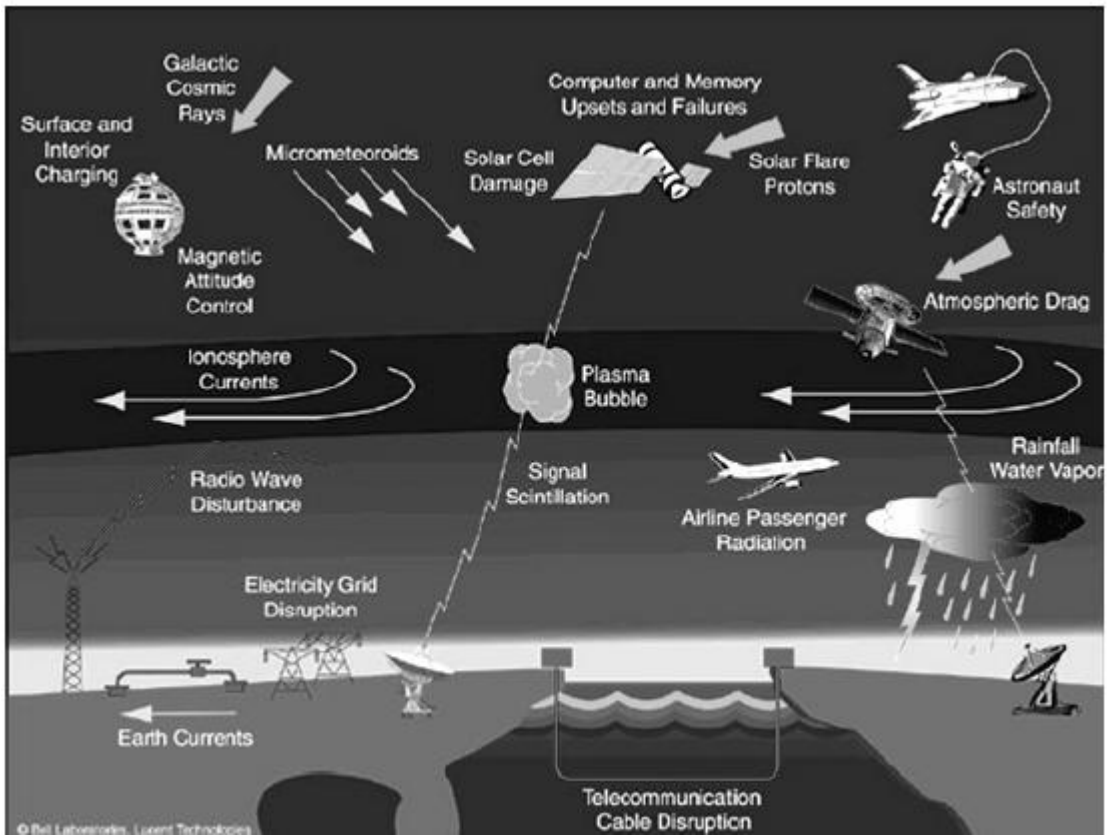

Figure (2, 5) Summary of the known space weather effects

(Daglis 2007)

2.5 Introduction

Navigation system is an integrated system that determine the geographical location on the ground by land sea and air using satellite the aircraft navigation system is system to monitor the movement of aircraft before takeoff and after to know its location and direction and protect it from the effects of terrestrial air and space weather for security and safety

2.5.1 Global navigation satellite system GNSS

Are set of navigation system all work as single positioning system

Weather military or civilian including (Galileo satellite, GPS satellite, Beidou satellite, Gallons satellite) the number of satellites in each system differ from

other as well as the number of orbits of satellites orbiting the earth and its height from the surface of earth but all determine the location at least three satellites

2.5.2 Uses of the global navigation satellite system

1/ high precision agriculture

2/ military applications

3/ natural resource management and infrastructure networks

4/ positioning of GIC data

2.5.3 The advantages of GNSS

High accuracy and does not depend on single system and increase number of satellites

2.6 Global position system GPS

It is navigation system works to determine positioning accuracy in all part of the word whether the site in the surface of the earth or above and below sea level controlled in this system united state of American consisting of 24 satellites three of which reserve on orbiting the earth latitude of (20,200km) above the ground

This system provides important capabilities for military - civilian and commercial users around the world.

2.7 Black Box

It is box consisting of two parts, the first part is cylinder or tape that contains electrical tapes that compress the sound, it records sounds and calls, and the other part is the task of preserving digital data and physical values such as time, speed, and direction, it is not blank in color but orange or red to facilitate access to it and is made of strong materials such as titanium that can withstand high heat and shocks he works for month whether on land or water.

CHAPTER III

Data Collection and Methodology

3.1 Enigma of Malaysian plane

On 8 March /2014 the Malaysian plane BOING777 flight MH 370 from Kuala Lumpur to china with 239 passengers took off at 12:40 AM at height of 10,600m above the ground (الوثائقيةNovember4, 2018).

The Aircraft connected to the control tower and all its movements were recorded by radar, the aircraft flying in region with civilian and military radar where, the first radar determines the location and direction, and the height of the plane (الوثائقيةNovember4, 2018).

At 1:7AMThe Aircraft arrived to Ancillary coordinate area and was connected to air passage after 12 minutes at1:19AM it had to communicate with the Vietnamese air traffic but it did not contact him after two minutes 1:21AM he lost contact with her and did not respond any his ability to call the plane 1:40AM the Vietnamese control department told the Malaysian control section that it was unable to contact the aircraft (الوثائقيةNovember4, 2018).

The last audio message was at 1:19AM at 1:21AM the transmitters were closed and at 1:30AM it lost contact with them permanently

At 2:15AM the last appearance of the plane was recorded by the military radar (الوثائقيةNovember4, 2018).

Were the Malaysian changed its course to the northwest of the Malacca strait The plane disappeared from the radar screen and lost contact with it completely, there are several reasons but according to the investigation of air disasters there are three hypotheses namely the plane fell in the Indian ocean and its particles faded or exploded at very high altitude of about 13,7000 m which means that they are scattered in space and impossible to reach the earth and transform it to invisible objects or kidnapping and diversion and the

weakness of technology in front of the horrors of nature. (الوثائقيةNovember4, 2018).

3.2 Methodology

We took three magnetic indices, which are KP, Dst, and AE these are indicators that measure the level of magnetic disturbance of magnetic storm, where the values of the indicators for the month of March were compared and selected three days before and after the plane was lost.

The values of the three indicators were monitored and data were digitally analyzed using the excel program and found that the time period in which they disappeared the plane has an average altitude in magnetic storms.

CHAPTER IV

Observations, Discussion and Conclusions

4-1 Observations

The following graphics illustrate graphically the period before and after the disappearance of the plane, represented by the indicators Dst, KP, and AE in the period 6March, 2014 to11March, 2014.

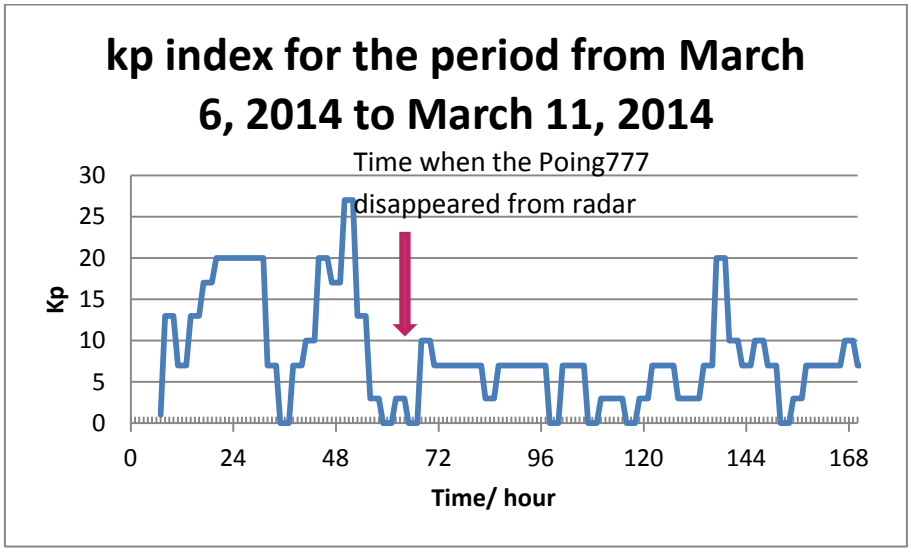

Figure 4.1 kp index from March, 6, 2014 to March 11, 2014

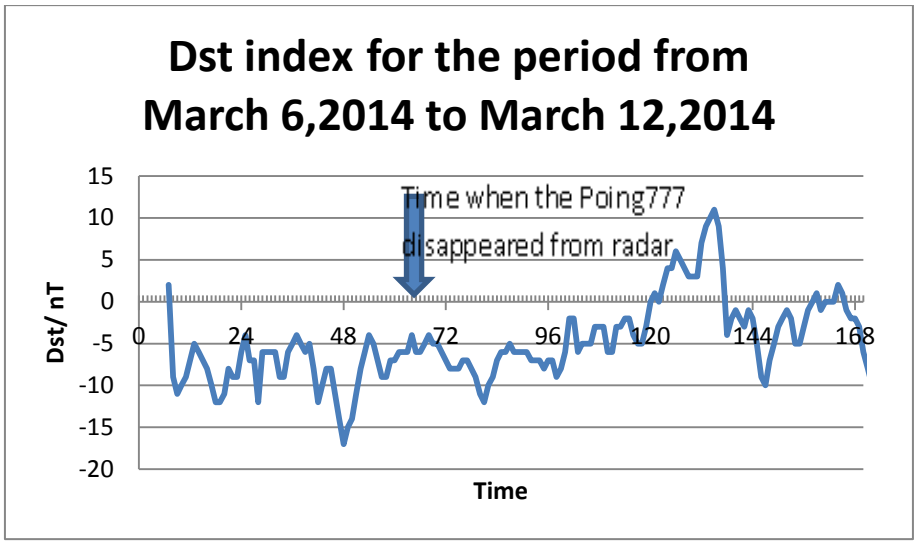

Figure 4.2 Dst index from March 6, 2014 to March 11, 2014

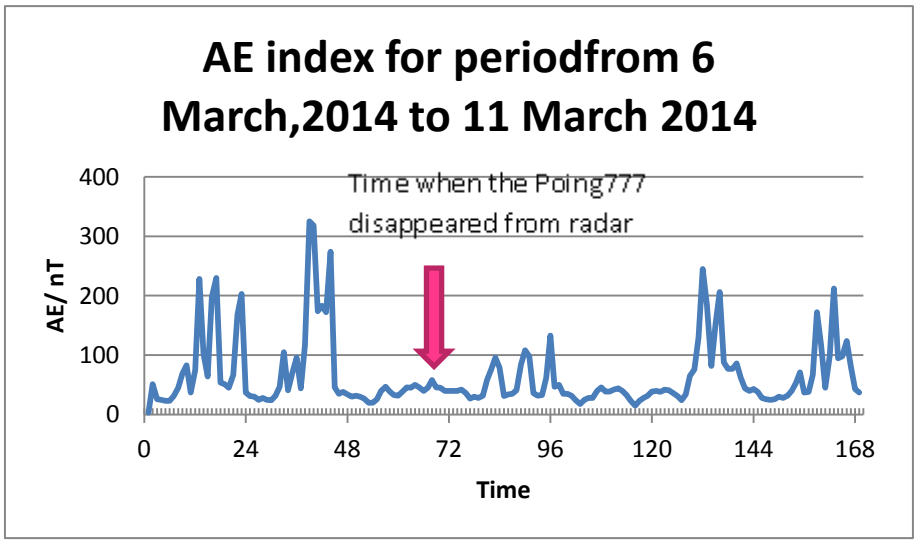

Figure 4.3 AE index from March 6, 2014 to March 11, 2014

4.2 Discussion and Conclusion

According to the analysis of investigators, Bob Macintosh, an investigators in the safety of the Malaysian national transport, and John Paul former head of the French bureau of investigation and civil aviation, there are no errors before and after takeoff, the aircraft tanks were filled with 49 tons of kerosene enough to travel 8hours in normal flying conditions and the flight durations 6hours and half also the communication and treatment communication system send every 30 minutes information about the fuel and its last contact with this system was 43 tons of kerosene, meaning that it did not suffer from shortage of fuel, it turned towards the strait of Malacca, which is the longest strait in the world characterized by moderate climate with no strong winds and descriptor is the ideal place for marine but navigational poses threat to ships and aircraft that crossed the economic importance where there is piracy in large were told. Through the drawing it became clear that there is arise in the DST; KP, indicators, but the AE index decreases which medium intensity geomagnetic storm

Reference

.Walker, A D M. *Magneto hydrodynamic waves in geospace.* Bristol: institue of physics publishing, 2005.

Basu, Baidyanath. *An Introduction to Astrophysics.* India New delhi, 2004.

Daglis, Volker Bothmer and Ioannis A. *space weather physics nd effet.* Chichester: Praxis publishing LTd, 2007.

Hanslmeier, Arnold. *the sun and space weather.* Natherlands: springer, 2006.

—. *The sun and space weather.* Austria: springer, 2007.

Jayachandran, P. T., et al. "The Canadian high arctic ionospheric network (CHAIN)." *Radio Science* 44 (2009).

K., Yumoto, and the MAGDAS Group. "MAGDAS project and its application for space weather." *International living with stars (ILWS) workshop.* GOA: International living with stars (ILWS) workshop, 2006. 19-24.

kamide, Yoksuke. *Handbook of the solar-terrestrial environment.* Jaban: springer, 2007.

Mcpherron, Robert . L. *Magnetic pulsations : their sources and relation to solar wind and geomagnetic activity.* Paper, Los Angeles: institute of geophysics and planetery physics, 2004.

Nose, M., T. Iyemori, M. Sugiura, and T. Kamei. *World Data Center for Geomagnetism, Kyoto.* 2015. http://wdc.kugi.kyoto-u.ac.jp/index.html (accessed 10 20, 2019).

Papitashvili, Dr. Natalia. *OMNIWeb.* NASA Goddard space flight center. 09 21, 2020. https://omniweb.gsfc.nasa.gov/form/dx1.html (accessed 09 21, 2020).

Rozelot, Jean- Pierre. *Solar and heliospheric origins of epace weather phenomena.* Berlin: springer, 2006.

—. *Solar and heliospheric origins of space weather phenomena.* Grasse, 2006.

seab, Gregory. *Astronomy.* united state: spring house corporation, 1995.

T.Arny, Thomas. *An introduction to astronomy.* United state of amircan: Magaret.j.kemp, 2006.

البطانية, بركات عطوان. *مقدمة الى علم الفلك* اليرموك: دار المسيرة لنشر والتوزيع, 2009.

"الطائرة الماليزية المفقودة"اسرار ولغز اختفاء". Directed by Eygpt. Performed by القناة الوثائقية. November4, 2018.

Appendix

Model data set from Kyoto University (Nose, et al. 2015)

The modal data set from Kyoto University as show below

1-Year

2- Day

3- Hour

4- KP,

5- Dst index nt

6- AE index nt

2014	66	1	3	-9	30
2014	66	2	3	-9	27
2014	66	3	0	-7	20
2014	66	4	0	-7	20
2014	66	5	0	-6	26
2014	66	6	3	-6	40
2014	66	7	3	-6	47
2014	66	8	3	-4	39
2014	66	9	0	-6	33
2014	66	10	0	-6	32
2014	66	11	0	-5	38
2014	66	12	10	-4	46
2014	66	13	10	-5	45
2014	66	14	10	-5	50
2014	66	15	7	-6	46
2014	66	16	7	-7	40
2014	66	17	7	-8	45
2014	66	18	7	-8	58
2014	66	19	7	-8	46
2014	66	20	7	-7	45
2014	66	21	7	-7	40
2014	66	22	7	-8	40
2014	66	23	7	-9	40
2014	67	0	7	-11	40
2014	67	1	7	-12	42
2014	67	2	7	-10	36
2014	67	3	3	-9	27
2014	67	4	3	-7	30
2014	67	5	3	-6	28