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A Solar Flare on 10 September 2014 was Associated with Two F/A-18C Hornets Crashing in the Western Pacific Ocean

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Two F/A-18 Hornets from Carrier Air Wing 17 crashed at 5:40 (UT) while attempting to board the aircraft carrier USS Carl Vinson 466 km west of Wake Island on 12 September 2014. A large geomagnetic storm caused by a solar flare occurred at 17:46 (UT) on 10 September 2014. It is doubtful that this large geomagnetic storm may be a potential reason for the crash. It is difficult to make this case with 100% certainty, and it may have been remotely possible that the storm was the cause.

Keywords: F/A-18 Hornets; USS carl vinson; crash; wake Island; geomagnetic storm; X-class solar flare.

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1. INTRODUCTION

A solar flare is defined as a sudden, rapid, and intense variation in the sun's brightness, and occurs when magnetic energy that has built up in the solar atmosphere is suddenly released. Radiation is emitted across virtually the entire electromagnetic spectrum, from radio waves at the long wavelength end, through optical emission to x-rays and gamma rays at the short wavelength end. The amount of energy released is the equivalent of millions of 100-megaton hydrogen bombs exploding at the same time. They observed the sunspots independently and simultaneously [1]. Below, we will review some information regarding this solar flare [2] (e.g. ionospheric electron content variations, Fig. 1). The Global Differential GPS (GDGPS) System provides a global real-time map of ionospheric total electron content (TEC). These maps are also of value in monitoring the effect of the ionosphere on radio signals, power grids, and on space weather. The maps and TEC data are available from multiple GDGPS Operations Centers. TEC measured errors and their correction are described in the following references; [3,4,5]. The estimated TEC data were corrected for biases during measurements of dual-frequency delays of GPS signals e.g. carrier phase biases, satellite state and orbit corrections, ionospheric delay and troposphere, which need to be removed using ground-based post-processing software [6].

2. DANGERS OF SOLAR FLARE

Electrical power is vulnerable to the currents that result from a large solar flare, as it can cause transformers to overheat and possibly burn out. This danger is becoming more serious for electric equipment and the operators of equipment that carries high energy particles and flux. Solar flairs are known to follow a cycle that is roughly 11 years in length, and we are currently approaching the portion of that cycle with maximum solar activity. Therefore establishing and heeding warnings of approaching solar storms is very important. An active sunspot known as AR2158 erupted at 17:46 (UT) on 10 September 2014, causing a strong X-class solar flare (Fig. 1). Because this flare emerged from the part of the sun that was directly facing Earth, this amounted to a large geo-effective event. HF radio blackouts and other communications disturbances were observed on the side of the Earth that was day-lit at the time of the flare (NOAA NWS Space Weather Prediction Center). Fig. 1 shows the global TEC map at 5:40 UT on 12 September 2014. NOAA forecasters estimate a nearly 80% chance of polar geomagnetic storms on Sept. 12th when the first of the two CMEs (Coronal Mass Ejection) arrives. Such flares can trigger major events for Earth such geomagnetic storms, solar radiation storms and radio blackouts. And spaceweather.com has reported that some high-frequency radio blackouts and other communication disturbances have already occurred as a result of this flare. The shock from the arrival of the CME (Coronal Mass Ejection) of 10 September was detected by the ACE spacecraft just before 18:00 (UT), 12 September (NOAA NWS Space Weather Prediction Center). The solar wind speed increased rapidly to about 650 km/s and the total strength of the interplanetary magnetic field (IMF) rose to 28 nT. However, the z component of the IMF (Bz) was oscillating between positive and negative values limiting the geo-impact of the CME. Thus, the geomagnetic storm triggered by the arrival of the CME is currently at a moderate level. If the Bz turns more permanently negative while the plasma cloud passes the Earth, the event will become more geo-effective. There is still a possibility that the geomagnetic storm will reach a strong level on 13 September. However, it is extremely unlikely that this event would reach levels that would cause any damage in the ground based infrastructure. The arrival of the CME also drove the >10 MeV proton flux briefly above the 100 pfu level. This is not unusual for an arrival of a shock driven by a CME. At the moment the proton flux values are already declining for all energy levels (NOAA NWS Space Weather Prediction Center).

3. RESEARCH CASE

Two US F/A-18 Hornets crashed at 5:40 (UT) when attempting to board the aircraft carrier USS Carl Vinson in a region about 466km west of Wake Island on 12 September 2014 (around the places marked with a circle in Fig. 1). The potential reason for the crash is examined in this study.

4. DISCUSSION

The Dst (Disturbance Storm Time) (Fig. 2) shows the effect of the globally symmetrical westward flowing high altitude equatorial ring current, which causes the depression worldwide in the H-component field, and therefore the disturbance storm time (Dst, Kyoto Dst, Fig. 2) index is a measure tool in the space weather [7]. It gives information about the strength caused by solar protons and electrons and represented http://en.wikipedia.org/wiki/Disturbance_storm_time_index - cite_note-WU-JM-1 a large geomagnetic storm covering the time period of 12 September 2014 due to the strong X-class solar flare on 10 September 2014 (Fig. 3 and Fig. 4). The conditions from the parameters of the space weather on 10 to 12 September 2014 in Figs. 3 and 4 have been shown that flare's impact should be global. Communicated instruments are possible to interrupt. The two aircraft (Strike Fighter Squadron 94 and Strike Fighter Squadron 113) crashed. The potential reason of the incident may be due to communicated instrument interruption by the large geomagnetic storm.

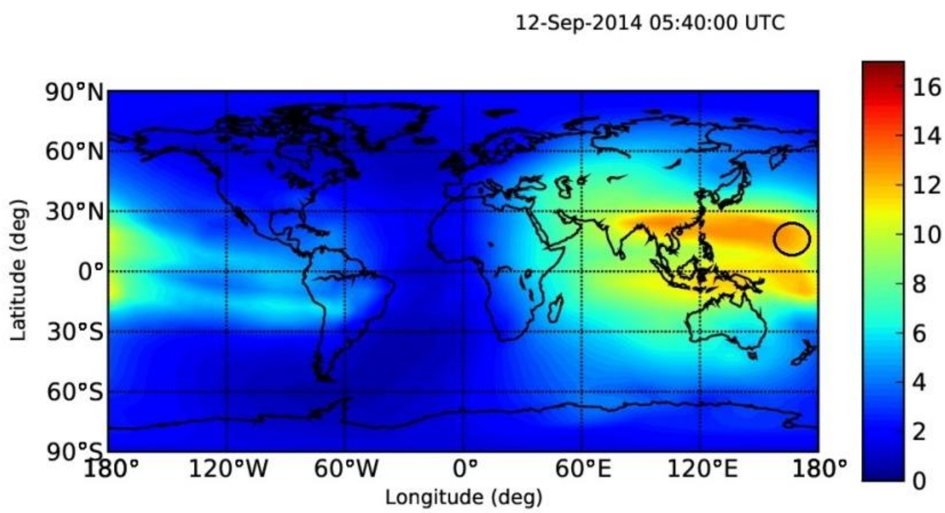

Fig. 1. This figure shows the global TEC map at the time of 05:40 (UTC) on 12 September 2014(TEC=$10^{16}\cdot m^{-2}$)

Fig. 2. This figure shows the Dst (nT) indices in September 2014 (world data center for geomagnetism, Kyoto)

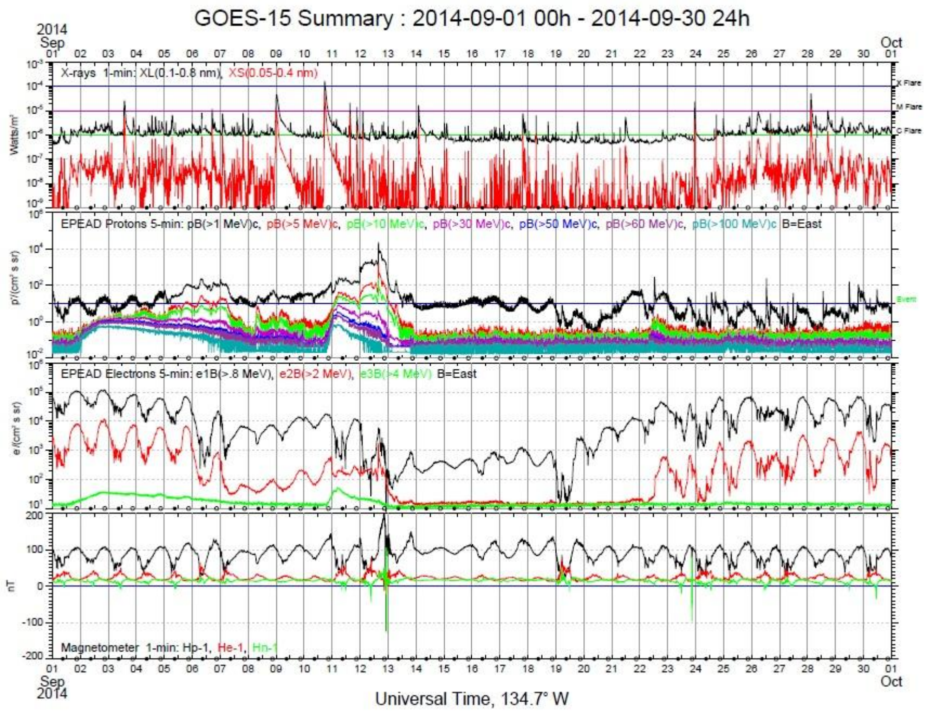

Fig. 3. This figure shows the parameters of the space weather in September 2014 (NOAA NWS space weather prediction center, Geostationary Operational Environmental Satellites (GOES))

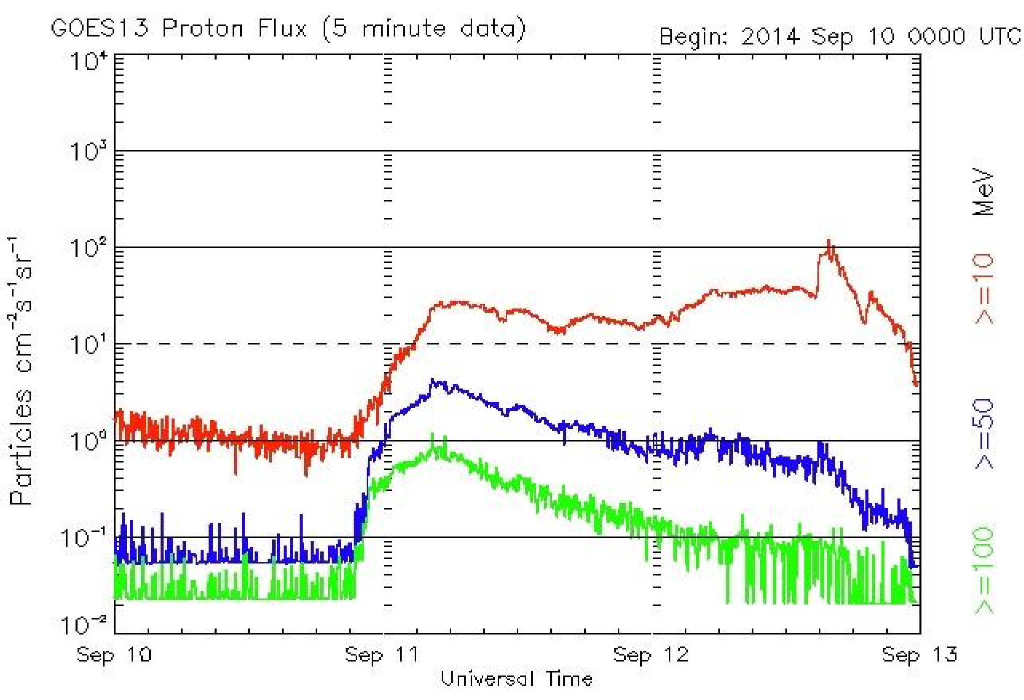

Fig. 4. This figure shows the proton flux during the time period from 10 to 12 September (NOAA NWS space weather prediction center, Geostationary Operational Environmental Satellites (GOES))

5. CONCLUSION

Two US F/A-18 Hornets crashed at 5:40 (UT) about 466 km west of Wake Island on 12 September 2014. It is demonstrated here that it is doubtful that the cause of the crash may be related to a large geomagnetic storm due to a strong X-class solar flare at the time of the incident.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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