

Hurricane Irma 2017: Relationships with Lightning, Gravity, and Earthquakes

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Update – Coronal Holes and Hurricane Dorian 2019

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ABSTRACT

Hurricane Irma, 2017, along with other storm systems (Fig. 1) howling winds and grounding lightning (Fig. 2), tracked Caribbean mantle circuits along the tectonic trenches of Puerto Rico and Cuba. Mantle circuit trends can be mapped with mantle gravity signatures (Fig. 3). Irma turned north from Cuba making south Florida landfall, 30 miles southeast of Ft. Meyers, precisely where concentration of lightning hotspot activity shifted to in 2016 [2]. Previously the North American lightning hotspot was located in the Tampa Bay region. This lightning shift to Ft. Meyers correlates to a global shift of lightning activity from the African Congo to Lake Maracaibo in Venezuela. Our research indicates the shift in lightning activity signals a charging phase of the East Pacific Rise (EPR)... the Earth's largest mantle circuit [3]. This circuit grounds and modulates lightning activity to the South Pole. EPR mantle circuits activate in phase with increases in Venezuelan and Florida lightning as well as a seismic activation [4] of El Niño Southern Oscillation (ENSO). The Southeast Indian Ridge mantle circuit provides the South Polar grounding link to lightning activity in the Congo. Solar magnetic space weather activates Stellar Transformer mantle induction circuits during large variations in magnetism. This episodic activation modulates hurricane frequency, lightning hotspot activity influences earthquake and volcanic activity and has links to certain types of wildfire outbreak [5].

Keywords: Hurricane, Lightning Hotspot, Mantle Circuits, Space Weather, Stellar Transformer, Induction, Gravity, Magnetism, Earthquake, Volcano, and Wildfire.

1. INTRODUCTION

For years, African Congo (Fig 2) was known as the Lightning Capital of the World, while the Tampa Bay, Florida area was unofficially known as the “Lightning Capital of the United States.” Also sometimes called “Lightning Alley”, but in 2016 the lightning hotspot location moved, about 30 miles southeast of Fort Myers Florida, while the new Lightning Capital of the World is Lake Maracaibo, on the coast of Venezuela. The lake gets lightning about 300 days a year [2]. Knowing precisely where the concentration of lightning hotspot activity had shifted made it easy to take an educated guess that the turn of Hurricane Irma (and later Hurricane Philippe) would occur near Ft. Meyers... [Letter to Editor 1st Bulletin 05 Sept. 2017 [1]]. Also see news reference for context... [2]

Update1 in Letters to the Editor: 07 Sept, 2017 [1]: “The European model for Irma (turning at Ft. Meyers), the one the National Weather Service is now using as the most likely track. Track I mentioned a couple days ago... 05 Sept, 2017. “



Fig. 1. The lightning from Irma, Katia, Jose and even a Pacific Typhoon (not shown) are charging the Earth along a Caribbean mantle circuit. 2017 was considered a La Nina phase of ENSO. earthobservatory.nasa.gov/IOTD/view.php?id=90931&src=eo-a-iotd

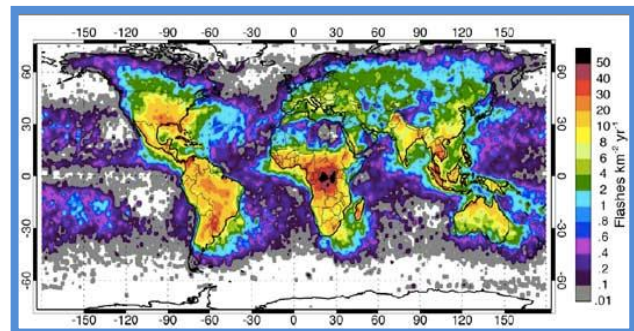


Fig. 2. Global frequency and distribution of lightning as observed from space by the Optical Transient Detector. Congo has most intense lightning signature [6].

2. GRAVITY MANTLE CIRCUITS

An interpretation from our observations is these tropical systems within the Atlantic (Fig. 1) are linked in series along a mantle circuit charging the planet. This charging action was likely the main contributor to the core or mantle discharge (lightning from below) responsible for the nearby earthquakes. Offshore Guatemala 07 Sept. there was an 8.2 earthquake near southern Mexico, then on 19 Sept. a 7.1 earthquake occurred in Mexico. Consider lightning from tropical systems charging a capacitance surface below, which discharged when Irma switched from the Caribbean circuit to the North American circuit along the Florida Peninsular Arch. Lightning detection networks, Vaisala [7] use radio emissions from lightning strikes to determine lightning location. Interestingly earthquakes emit similar radio signals, although we use seismic stations to determine their locations acoustically. It's very likely some earthquakes can be caused by electrical discharge across mantle

(Fig. 3) and lithospheric (Fig. 4) circuits, when circuits are highly charged with differences in capacitance.

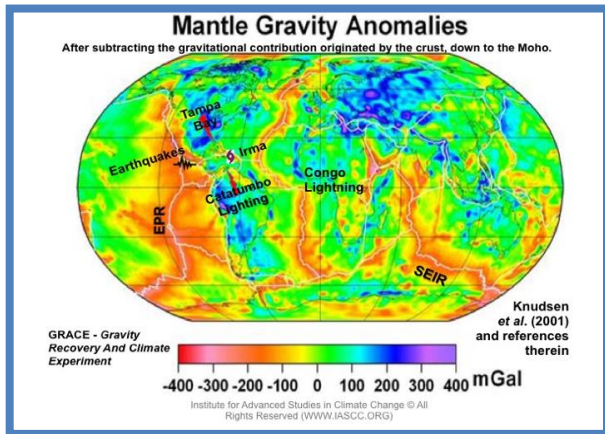


Fig. 3. Mantle gravity anomalies from GRACE satellite mission data [8] indicate EPR polar and continental circuit connections to Catatumbo, Tampa Bay lightning anomalies, and SEIR connections to the African Rift/Congo global lighting anomalies in Fig. 2.

3. GEOLOGIC SETTING

Within the Eastern Gulf of Mexico lies the Florida Platform, a broad carbonate buildup that underlies the Florida Peninsula and continental shelf [9]. The stratigraphic evolution of the Florida Platform has been influenced primarily by eustatic changes [10] in sea level and the local hydrographic regime. Early Ordovician quartzitic sandstones inter-bedded with shale exhibit metamorphic and hydrothermal alteration signatures [11,12] and overlie an ancient Triassic rift system associated with the Florida Magnetic Anomaly (FMA) [13]. This feature generally trends East-NE to West-SW as indicated by volcanic basement magnetic trends (Fig. 4) along what's known locally in Florida as "lightning alley". These geomagnetic anomalies provide links to the core-mantle-boundary and conductive pathways for electrical grounding of lightning strikes from local geomagnetic anomalies embedded within the overlying carbonate platform.

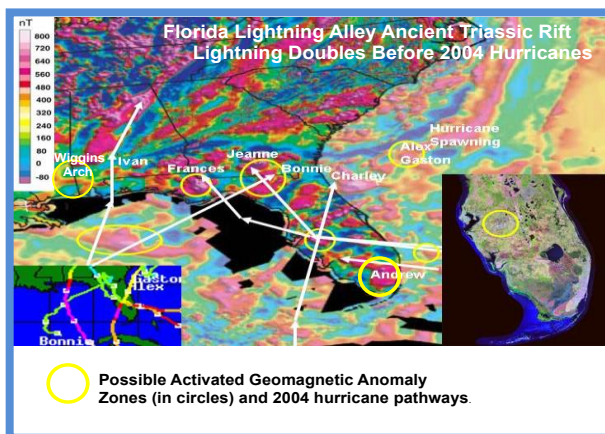


Fig. 4. Hurricane Tracks and Lightning Grounding Zones to Magnetic Anomalies in Ancient Triassic Rift trends in the lithosphere. (Magnetic Data USGS [14] modified).

In 2017 Florida had an increased hurricane risk during the La Niña phase of El Niño Southern Oscillation (ENSO). Multiple tropical systems (Fig 1) were charging Earth through mantle and lithosphere reactivated circuits (Fig 3 & 4). Seismic activation [4] of ENSO occurs during Stellar Transformer mantle circuit (Alternating Current – AC) switching at the South Pole [3]. The circuit switches from grounding lightning in the African Congo along the Southeast Indian Ridge (SEIR), over to an East Pacific Rise (EPR) mantle circuit grounding lightning at Lake Maracaibo in Venezuela and Florida. The switching mechanism is speculatively linked to sustained internal polarity alignments to the local Interplanetary Magnetic Field (IMF). Both ridges are considered "hot circuits" in the Stellar Transformer concept [3]. Also see: www.iascc.org/the-science. These dominant circuits also modulate the Pacific Decadal Oscillation (PDO) and Madden Julian Oscillation (MJO) climate indices. Seismic activity as a proxy for geothermal heat flux that explains 62% of the variation in the earth's surface temperature is a significant finding [15].

Update2 09 Sept, 2017 [1]: "Hurricane Irma is now headed directly toward the Ft. Meyers area, Hurricane Charlie in 2004 hooked into the Gulf and tagged Ft. Meyers before it hit Tampa (Fig. 4), also a major lightning concentration area, much like I expect Hurricane Irma will, and much like the European model is currently projecting. Lightning intensities also happened to increase the year before on the Gulf Coast just before Katrina hit. If you look at Gulf Coast lightning strike data (Fig. 5), you'll see the Wiggins Arch, a subsurface magnetic anomaly stretching from Mobile, AL to Wiggins, MS (Fig. 4) lit up by more intense lightning (Fig. 5). This was the power side of Katrina if you recall. Watch Irma and see if it has this expected relationship to 30 miles SE of Ft. Meyers."

4. LIGHTNING OBSERVATIONS

Ancient Triassic rift crustal circuits in southeastern U.S. (Fig. 4) were also reactivated in 2003, when lightning reached a million strikes per year, nearly double the previous 1996 - 2002 yearly average (Fig. 6). Hurricane Charlie in 2004 (Fig. 4) took a similar path, across the spot where Irma (2017) turned on the Ft. Meyers lightning hotspot. Later Hurricane Philippe (2017) also followed a similar path striking into the Tampa Bay lightning anomaly. Hurricanes Charlie, Jeanne and Frances (2004) crossed the geomagnetic anomaly near Tampa Bay (Fig. 4) where the lightning anomaly is located in Fig. 7. The Wiggins Arch on the border of Alabama and Mississippi where intense lightning concentrations occur (Fig. 4 & 5) is where Hurricane Camille (1969), Katrina (2005) and Nate (2017) made landfall.

Bruce Leybourne, this author, who worked as a Geophysicist for the Naval Oceanographic Office at Stennis Space Center and lived in Bay St. Louis, MS when Katrina struck, provides anecdotal evidence:

- 1.) Pine trees were across the street from my home in Bay St. Louis, MS for several decades. Lightning destroyed them in 2004. Katrina struck the next year in 2005.
- 2.) Two stories of lightning strikes to vehicles reported in 2004, one in southern Louisiana on radio, the other in Bay St. Louis, Mississippi when overheard at an auto parts store. Both stated lightning destroyed vehicle radio and blew out at least one tire. Haven't heard reports like that before or since.

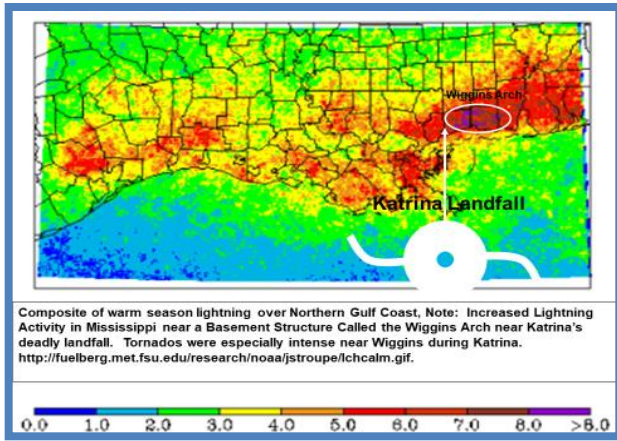


Fig. 5. Intense lightning concentrations [16] occur where Hurricane Camille (1969), Katrina (2005) and Nate (2017) made landfall. Geomagnetic signature is coincident with Wiggins Arch Fig. 4, on the border of Alabama and Mississippi.

In a 2005 research proposal on “Florida Hurricane Shock from Lightning Activated Geomagnetic Anomalies” we identified the overall problem with the following hypothesis: Multiple hurricane tracks inundating Florida during the 2004 season may result from grounding of the global electric circuit along geomagnetic anomaly trends. Increased lightning strikes, along geomagnetic anomalies may attract hurricanes thermally and electromagnetically. The Tampa Bay-Lakeland region has more lightning strikes than anywhere in the USA (Vaisala, Pers. Comm.) and overlies a geomagnetic anomaly which 3 hurricanes passed directly over (Fig. 4) during the 2004 hurricane season. In 2003 and 2004 lightning strikes approximately doubled from a previous yearly mean under, 600,000 to over 1,000,000 (Fig. 6) within a 1 x 2 degree swath including the Tampa Bay and Lakeland region (Fig. 7 & 8). The majority of strikes north-northeast of Tampa Bay defines the most conductive grounding within this area. Lightning positive polarity strikes (Fig. 8) indicating ground affects, by the charge lowering from the clouds, shifted inland and were primarily focused over a geomagnetic anomaly (Fig. 4) under Lakeland.

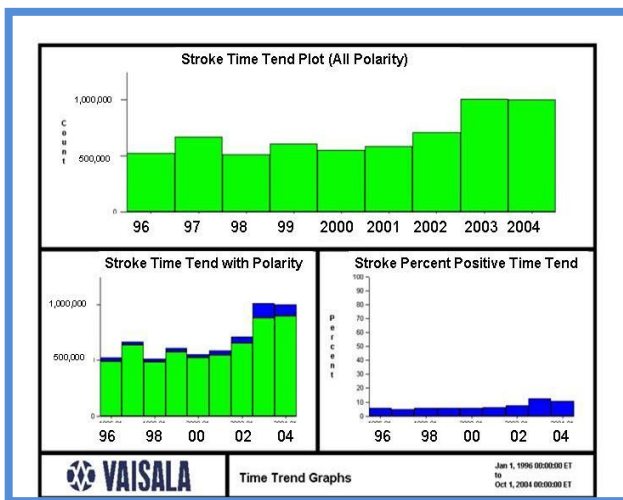


Fig. 6. Yearly lightning strike histogram provided by Vaisala. Indicates a near doubling of strikes in 2003 and 2004 from earlier yearly means. Blue indicates strikes with positive polarity [7].

Hurricane Charley entered from the Gulf of Mexico passing over the Florida Canyon before passing directly over the suspect Lakeland geomagnetic anomaly (Fig. 4), near Tampa. While Frances and Jeanne came from the Atlantic passing geomagnetic anomalies associated with Abaco Islands in the Bahamas before vectoring directly in on the geomagnetic anomaly underlying Lakeland. Then both eyes passed directly over the conductive zone associated with lightning grounding in Fig. 7. Geomagnetic anomalies may provide conductive zones along other crossing areas of hurricane paths, like hurricane Ivan (Fig. 4) associated with earthquakes in Montana and likely triggering seismic activity in Mt. St. Helens starting on 23 September during the 2004 hurricane season. In 2005 seismic activity continued in Mt. St. Helens with volcanic activity through 2008. The 2004/05 hurricane seasons were both very brutal. Hurricane Andrew (1992) also made landfall along a geomagnetic anomaly trend in south Florida (Fig. 4). The common denominator and unifying principal of this geological forcing function on climate is an internal joule heating mechanism [17]. Electrical activation in the eastern Gulf of Mexico occurs from return circuit grounding of lightning strikes along geomagnetic anomalies in central west Florida. Our research efforts provide a tectonic electrical framework to understand these phenomena and create forecasting tools within a new theoretical framework considering effects of geomagnetic induction from solar coupling to the global electric circuit and Earth's endogenous energy (3, 17).

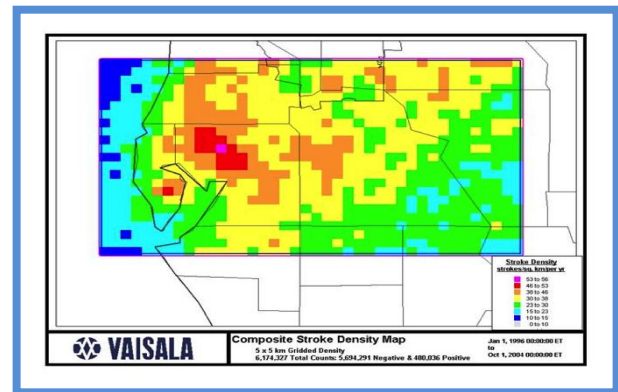


Fig. 7. Composite Lightning Strikes from Jan. 1996 to Oct 2004. The majority of strikes North-northeast of Tampa Bay Geospatially Correlate to the Eye Passage of Hurricanes Frances and Jeanne [7].

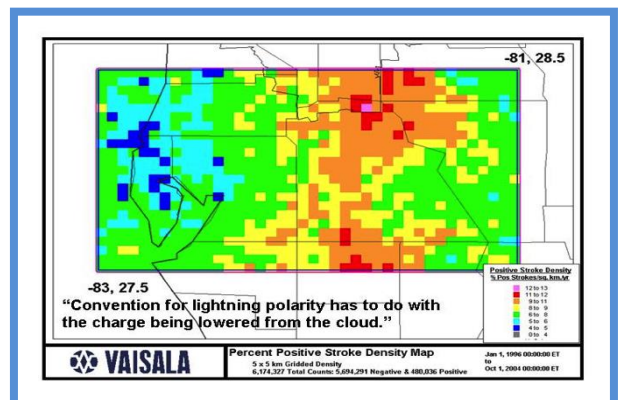


Fig. 8. Positive Polarity Lightning Strikes Move Inland over Geomagnetic Anomaly Zones Provide Supporting Evidence for Electromagnetic Attraction of the Lakeland Region to 3 Hurricanes [7].

5. EARTHQUAKES

1st Bulletin in Letters to the Editor: 05 Sept, 2017 [1]: “Why the 8.2 Guatemala earthquake manifested exactly where it did, is a bit more difficult to explain, but likely tied to mantle conductivity relationships and its close proximity to the charging systems. Interestingly I’ve also seen hurricanes, which hit the Appalachian Mts. trigger seismic excitement in volcanic systems on the west coast (Mt. St. Helens). Keep your eye out for this phenomena again, when Irma gets into north Georgia, you might see some seismic and/or volcanic activity triggered on the west coast (See below: Update 3).”

Update3 11 Sept. 2017 [1]: Article found by James “Mick” Davis, Director - IASCC: See item [18].

Seismic activity was suspected out west from charging of several tropical systems. In Idaho 204 earthquakes occurred since 02 Sept. 2017 (Fig. 9). Update received 11 Sept. 2017.

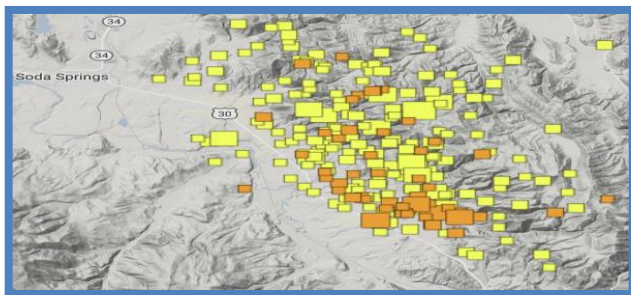


Fig. 9. 204 EARTHQUAKES SINCE SEPT. 02. Colored squares show earthquake epicenters that have occurred since Sept. 2 in Southeast Idaho [18]. (University of Utah Seismograph Stations.)

The earthquake swarm in Southeast Idaho may be associated with the Yellowstone Super Plume and West Coast volcanic systems. Earthquakes in Idaho were ongoing coincident with the tropical cyclones. This was the earthquake signal I was looking for out west. “Thus far the most powerful temblor in the swarm was the second quake to occur. It was a 5.3 magnitude earthquake and struck at 5:56 p.m. Sept. 2. Authorities say it has been years since Southeast Idaho experienced a quake of 5.0 magnitude or greater. But in regard to the current earthquake swarm, authorities say Southeast Idaho has never seen so many earthquakes in such a short time frame” [18].

6. EARTHQUAKES AND PACIFIC HURRICANES - 1983

At 8:06 a.m. (MST) on Friday October 28, 1983 up to magnitude 6.9 earthquakes rocked the towns of Challis and Mackay, Idaho for 30 to 60 seconds. The quake originated along the Lost River Fault below Idaho’s tallest mountain, Borah Peak, at a depth of nearly 10 miles. The fault thrust the Lost River Mountains upward while dropping the Thousand Springs Valley lower. Overall, the mountains and valley shifted apart nearly 14 feet in some places. This was the largest and most damaging earthquake in Idaho history [19].

Pacific hurricanes track off the western coast of Mexico along an extension of the East Pacific Rise (EPR) mantle circuit into the California Baha (Fig. 3) and San Andreas Fault system. The Colorado/Green River system splays off the San Andreas

connecting the Idaho Basin and Yellowstone earthquake regions to EPR mantle circuits through deep faults systems following these rivers.

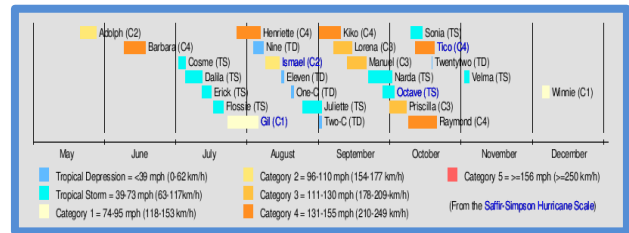


Fig. 10. Seasonal Summary of Eastern Pacific Hurricanes [20].

During the 1983 Pacific hurricane season (Fig. 10), 21 named storms appeared, well above the 15 long-term average. Lasting 201 days, 1983 was the longest season on record. There were a total of 1,238 storm hours, which was the most in four years [21]. When the Borah Peak earthquake occurred in October of 1983, two category 4 hurricanes, Tico and Raymond, and one category 3 hurricane, Priscilla, occurred in October 1983 (Fig. 10). A moderate El Niño was present throughout the season, with water temperatures across the equatorial Central Pacific nearly 5 °F (0.6 °C) above normal [22]. The Pacific Decadal Oscillation (PDO) was in a warm phase during this time period. Both of these factors are known to enhance Pacific hurricane season activity [23]. The 1983 season was at that time the most active season in the Eastern Pacific Hurricane Center warning zone, but this record itself was surpassed during the 1985 Pacific hurricane season, [24]. On September 19th, 1985 during hurricane season, Mexico City was devastated by another 8.1 magnitude earthquake that killed as many as 30,000 people and levelled buildings across the city. Fig. 11 shows the Accumulated Cyclone Energy (ACE) in the Eastern Pacific (red) increasing in 1983 and peaking in 1985. Extensive research is required to unravel these intricate relationships between lightning, earthquakes, cyclones and climate change.

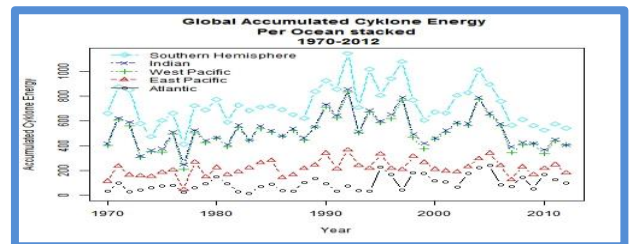


Fig. 11. This graph shows the development of Accumulated Cyclone Energy (ACE) by ocean basins. The figures are stacked on top of each other for each basin [25].

7. BLAME IT ON EL NIÑO [26]

Apparent dual thermal plumes above the Peru Trench off the coast of South America in June 1997 signaled the beginning of the 1997/98 El Niño, and are correlated to earthquakes 7 months prior in the trench on 15 Nov. 96 (Fig. 12). The 6 - 8 month lag-time for Sea Surface Temperature (SST) anomalies (Fig. 12b & 12d) after this seismic event (Fig. 12e & 12f) are likely related to thermal energy transmutations time [27] it takes heat to transfer from the base of the lithosphere at 33km depths. Shallow earthquakes at the base of the lithosphere clustered quickly within 2 - 3 days as seen in Fig. 12c. Earthquake data were found in National Earthquake

Information Center (NEIC) data sets and are compared to National Ocean and Atmospheric Administration (NOAA) SST satellite anomaly data (Fig. 12).

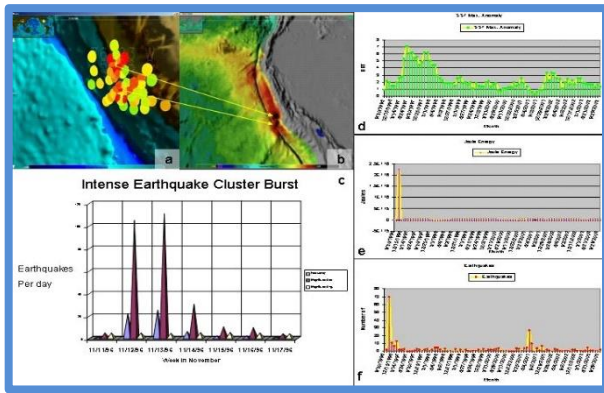


Fig. 12. ENSO Seismic Activation Found [4]. On Nov. 1996 (a). Two distinct earthquake clusters appear off South American Coast. (b). SST's seem to emanate in a similar pattern to the earthquake paired clusters. Northern SST anomaly is on the continental shelf as is the northern earthquake cluster. Southern SST anomaly is further offshore (continental slope) as is the southern earthquake cluster. These SST anomalies appeared (June 1997) just north of earthquake positions possibly due to prevailing longshore currents, about 7 months after the paired earthquake clusters. (c). Chart indicates earthquakes/day (Frequency), magnitudes are added for simple power indicator (Mag. Add), along with an average (Mag. Avg.) A spike in earthquake activity begins Nov. 12th and tapers off Nov. 14th revealing events intense episodic nature. (d). SST Max. Anomaly/month indicating anomalies > 7° C by June 97 followed by a year of elevated SST anomalies associated with the 97/98 El Niño. (e). Joule energy released during (f). Earthquake events occurred in Nov. 1996.

Nov. 1996 also marked the beginning of a 22-year Hale solar cycle indicating a solar space weather coupling to these clustered earthquakes. The source of these dual thermal plumes appear directly correlated to the dual seismic swarms of clustered earthquake patterns (Figs. 12a and 12b). The northern cluster epicenter patterns appear on the continental shelf environment, while the southern cluster epicenters appear on the slope. The two SST anomalies appear associated with the two separate (dual) earthquake clusters. The northern SST's appear over the shelf, while the southern SST's appear over the slope (Fig. 12b.). A large 7.7 magnitude quake was observed during this event, triggering a small Tsunami in Hawaii (Walker, D.A., personal communication.). This author hypothesized tectonic modulation of El Niño in 2001 [26].

8. ST. ELMO'S WILDFIRES

Widespread California wildfire outbreaks in 2003 [5] and 2017 occurred prior to and in conjunction with increased hurricane seasons of 2004/05 and 2016/17 respectively. This sequence of events is also related to the electrical activation of East Pacific Rise mantle circuits manifest as St. Elmo's fire.

St. Elmo's fire is a glowing form of luminous bright blue or violet plasma, similar to neon lights. It is created from the ionization of nitrogen and oxygen molecules by the electric

field around a conductive object. Usually a tall pointed structure. Sailors observed this with religious awe and considered St. Elmo their patron saint as the phenomena often occurs on ships, especially on ship's masts during thunderstorms. It has also been known to occur during volcanic eruptions. High voltage differentials between clouds and ground must exist to create a local electric field of approximately 100 kV/m to induce a discharge in air. The geometry of an object controls the magnitude of the electric field, as charge build up on sharp points lower the necessary discharge voltage [28].

These wildfire outbreaks generally occur during a period of geomagnetic storms caused by induction from solar coupling. Historical evidence from the most powerful space storm on record in September 1859, hints at the relationship to wildfires when telegraph wires shorted out in the United States and Europe, igniting widespread fires [29]. The strong solar storms (Coronal Mass Ejections – CME's) that hit Earth in the final week of October 2003 were small in comparison to the 1859 event, but may have electromagnetically induced an arced shaped pattern of fires. The fire pattern follows crustal magnetic anomaly trends arcing eastward just north of Los Angeles then southward around San Diego extending into the Mexican Baja along the coast (Fig. 13) [5].

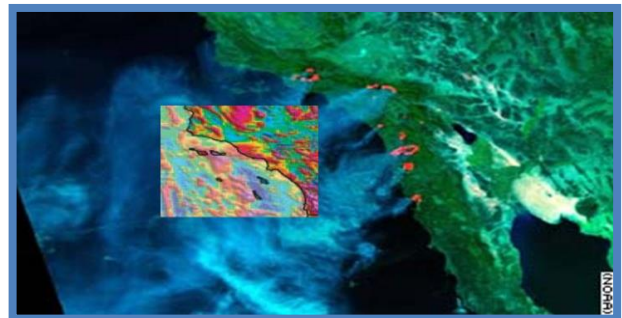


Fig. 13. Arc-shaped fire pattern appears linked to geomagnetic anomaly trends (insert). http://activefiremaps.fs.fed.us/fire_imagery.php?firePick=southern_california & http://pubs.usgs.gov/sm/mag_map/mag_s.pdf

A closer look at the geology of the San Gabriel Mountains lying beneath the outbreak of a huge firestorm along its slopes reveals strike-slip fault offsets with displacements up to ~2 km (Day Canyon and Demens Canyon Faults) transecting crustal magnetic anomalies of up to 800 nT, nanotesla (Fig. 14).

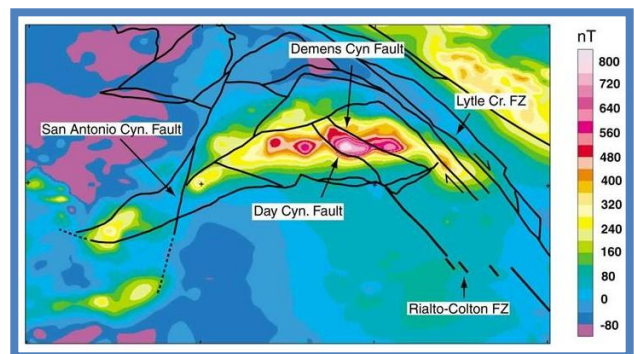


Fig. 14. Murray Fracture Intersects San Andreas Fault along Geomagnetic Anomalies in San Gabriel Mountains, > 800 nT. <http://wrgis.wr.usgs.gov/docs/gump/anderson/rialto/rialto.html>

Consistent with Gregori's theoretical discussions [17], the hypothesis of solar induced electrical wildfire propagation is understood in terms of comparatively deep earth e.m. induction coupled to coronal mass ejections creating the October 2003 geomagnetic storms. The induction process originates anomalous electric currents near the core-mantle-boundary from the deep internal-geodynamo. Hotspots connect deep outer core circuits to electric circuits propagating into the mantle and shallow lithosphere fractions of the Earth.

Some of the geologic hotspots linked to California wildfire and earthquakes previously discussed are located at the Guaymas Basin Rift in the Gulf of California, the Hawaiian Island Hotspot, and mantle plumes related to the Yellowstone, Idaho Basin, Mt. St. Helens complex. Pacific fracture zones (Mendocino, Murray, Molokai) link shallow conductive pathways from the Hawaiian seamount chain to the U.S. West coast. The north-south polar circuit along the East Pacific Rise extends into the North American Continent continuing along the San Andreas Fault System and completing circuits with other fault systems and local magnetic anomalies such as those in the St. Gabriel Mountains (Fig. 14) and splaying into the Yellowstone, Idaho Basin, Mt. St. Helens complex. Caribbean circuits are tied to the East Pacific Rise as shown in mantle gravity anomalies (Fig. 3) and into North America through the antenna of the Florida Peninsular Arch and deeper circuits of the Mississippi Embayment linked to the New Madrid Seismic Zone and Great Lakes tectonic vortex. Voltage differences between the these multi-level Earth circuits, cloud layers and the ionosphere manifest St. Elmo's fire as power line ground arcing, igniting combustible materials, destroying power systems, and creating a firestorm along local magnetic trends and fault patterns.

8. CONCLUSIONS

Climate oscillations of El Niño Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO) are linked to solar magnetic variations (Fig. 15) and orbital phenomena effecting Earth's magnetic field. Lunar cycles and orbital cycles of larger planets like Jupiter and Saturn torque the center of the mass of the solar system creating turbulence within the Sun linked to sunspot cycles, magnetic variation, and climate change [30]. Climate changes are linked to charging and discharging phases of the Stellar Transformer [3] with resultant fluctuations of Earth's magnetic field in rhythm with the climate cycles.

The lightning hot spot that shifted from Tampa to 30 miles SE of Ft. Meyers in 2016 was key to forecasting the turn of Irma toward Ft. Meyers. Why? Intense lightning activity activates and/or signals the activation of these lithospheric and mantle circuits. At other times the hurricanes crossed Florida into the Gulf discharging into the Tampa Bay lightning anomaly, following an ancient and shallower Triassic ridge circuit seen in crustal magnetic anomalies. There seems to be a simple electromagnetic attraction, as the hurricane must release its charge and will do so intensely at already activated areas. The hurricanes track these circuits (Fig. 3 & 4) when EM activity is high, when it's stirred by the solar winds as indicated by the high solar Kp 7 index during this period driven by Coronal Mass Ejection's (CME's). The turn at Ft. Meyers indicated a switching from the Caribbean circuit to one that follows the Florida Peninsular Arch into the Appalachian trend, circuits connected to the New Madrid Seismic Zone. The International

Earthquake and Volcano Prediction Center (IEVPC) has forecast large-scale (+8.0) earthquakes to reoccur within the next decade in New Madrid [31] as they did around 1812, in conjunction with a climate cold snap forecast from solar cycles [32, 33].

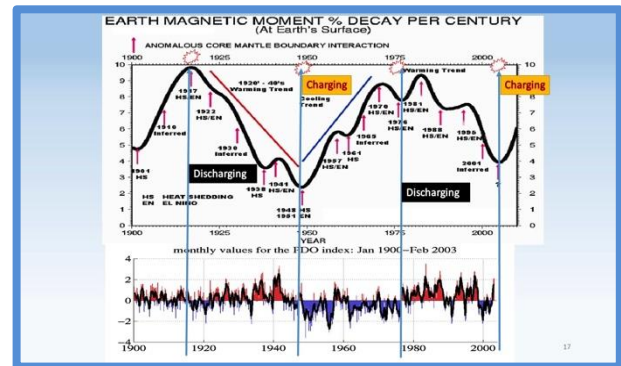


Fig. 15. Magnetic Moment Decay (Top - John Quinn [3]) & PDO Climate Index (Bottom) are compared. Top figure reflects past century of Earth's magnetic moment decay field changes. Large curve trends correspond to global warming and cooling trends reflected in the Pacific Decadal Oscillation (PDO) the largest global temperature proxy. While smaller inflections are associated with El Niño Southern Oscillation (ENSO). Bottom figure shows Pacific Decadal Oscillation (PDO) warming trends in red, cooling in blue moving in approximate 36-year rhythm with the magnetic field changes.

An innovative electro-dynamic model with a comprehensive framework for understanding Earth's interactions with space weather can be implemented with the "Stellar Transformer" concepts [3], with an improved understanding of the common electromagnetic denominators associated with space weather hazards (Electro-Magnetic Pulse, EMP), communications, general every day and extreme weather events, i.e. hurricanes, tornadoes associated with the variable frequencies of climate change, earthquakes, volcanoes, and certain types of wildfire outbreaks associated with Coronal Mass Ejections (CME's) [5].

9. UPDATE- CORONAL HOLES AND HURRICANE DORIAN 2019

Excerpt From: Leybourne, B. A. and Orr, D., 2020, **Global Disaster Forecasting with Space Weather and Geophysical Intelligence**, Proc. 11th International Multi-Conference on Complexity, Informatics, Cybernetics, (IMCIC 2020), Orlando, FL, March 2020, pp.55-60.

Hurricanes

Do hurricanes intensify and stall out during earth facing sweeps of coronal holes?

Multiple hurricane tracks inundating Florida may result from grounding of the global electric circuit along geomagnetic anomaly trends [34] or "lightning hotspots" [35]. Hurricane Irma, 2017, along with other storm systems tracked Caribbean mantle circuits along the tectonic trenches of Puerto Rico and Cuba. Mantle circuit trends can be mapped with mantle gravity signatures. Irma turned north from Cuba making south Florida landfall, 30 miles southeast of Ft. Meyers, precisely where concentration of lightning hotspot activity shifted to in 2016

[35]. Previously the North American lightning hotspot was in the Tampa Bay region. This lightning shift to Ft. Meyers correlates to a global shift of lighting activity from the African Congo to Lake Maracaibo in Venezuela. Our research indicates the shift in lighting activity signals a charging phase of the East Pacific Rise (EPR)... the Earth's largest mantle circuit [36]. This circuit modulates lighting activity and grounds to the South Pole. EPR mantle circuits activate in phase with increases in Venezuelan and Florida lightning as well as a seismic activation [37] of El Niño Southern Oscillation (ENSO). The Southeast Indian Ridge mantle circuit provides the South Polar grounding link to lighting activity in the Congo. Solar magnetic space weather activates mantle induction circuits during large variations in magnetism. This episodic activation modulates hurricane frequency, the lightning hotspot activity influences hurricanes [36].

Case Study Hurricane Dorian 2019

Hurricane Dorian stalled out at Category 5 intensity just before Labour Day, 02 Sept. 2019 (Fig. 16) grounding huge amounts of lightning during geomagnetic disturbances that correlated with hurricane wind speeds (Fig. 17). The T-shaped coronal hole (Fig. 16) was just finishing its' Birkeland current sweep past Earth when Hurricane Dorian reached peak intensities and dropped power as it rotated out of sight by 04 Sept. The correlation is a striking example of the solar induction relationships.

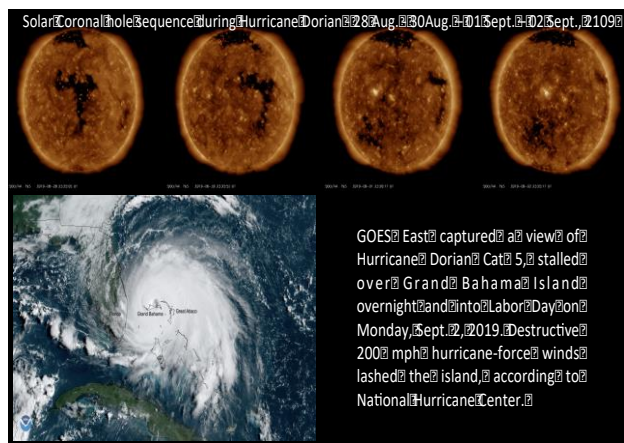


Fig. 16. T-shaped Coronal Hole Birkeland Current rotates past Earth driving Hurricane Dorian intensification (> lightning) from the increasing geomagnetic field seen in Kp indices Fig. 7. <https://www.spaceweatherlive.com/en/archive/2019/09/02/coronal-holes>

The underlying tectonic fabric of the Bahama Islands indicate Abaco Island (sustained catastrophic damage from Dorian), lies along an ancient mid-ocean ridge system between the Bahamas and Sunniland Fracture Zones (Fig. 18) [38]. Even though the Islands are now capped with significant volumes of carbonate rock sequences (reef), these ancient underlying volcanic complexes still provide good electrical grounding connections to deeper mantle circuits for hurricane lightning. The scenario is not complicated to understand; as the coronal hole sweep stimulates an internal Earth induction affect that pulls energy from the ionosphere to ground via the hurricane, which reacts by stalling out and dumping lightning into the Earth on landfall. Once the coronal hole sweep passes, the ionospheric connection resumes control of hurricane steering currents by upper level jet streams. Earthquakes have been linked to these hurricane charging affects during Hurricane Irma [34]. There are a host

of relationships tied to solar induction affects that manifest in various forms related to the underlying magnetic basement (Fig. 19). The data in Fig. 17 makes this example stand out.

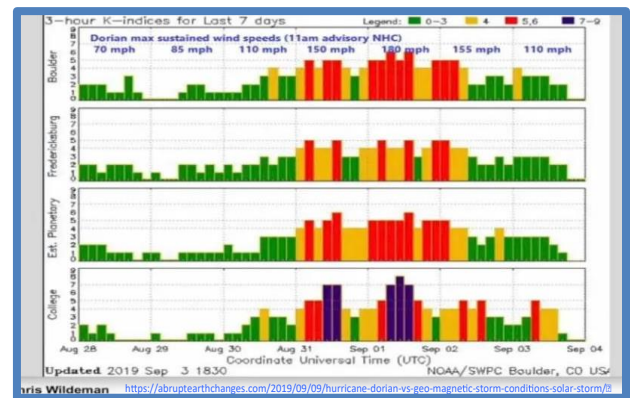


Fig. 17. Hurricane Dorian vs. Geo-magnetic storm conditions 7- day window of observation verifies direct intensification of hurricanes from sweeping Birkeland currents associated with coronal holes looming large in dark plasma mode in Fig. 16.

<https://abruptearthchanges.com/2019/09/09/hurricane-dorian-vs-geo-magnetic-storm-conditions-solar-storm/>

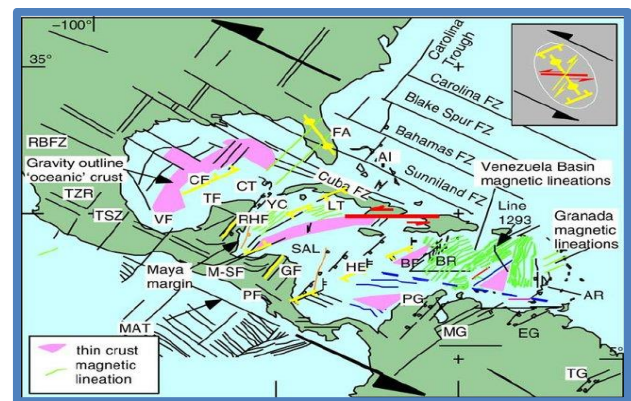


Fig. 18. Interpretation of Middle America tectonic fabric as the result of reactivation of ancient lineaments. Compiled from many sources [37].

The Florida Platform is a broad carbonate buildup that underlies the Florida Peninsula and continental shelf [39]. The stratigraphic evolution of the Florida Platform has been influenced primarily by eustatic changes [40] in sea level and the local hydrographic regime. Early Ordovician quartzitic sandstones inter-bedded with shale exhibit metamorphic and hydrothermal alteration signatures [41, 42] and overlie an ancient Triassic rift system associated with the Florida Magnetic Anomaly (FMA) [43]. This feature generally trends East-NE to West-SW as indicated by volcanic basement magnetic trends (Fig. 19) along what is known locally in Florida as "lightning alley". These geomagnetic anomalies [44] provide links to the core-mantle-boundary and conductive pathways for electrical grounding of lightning strikes from local geomagnetic anomalies embedded within the overlying carbonate platform.

The magnetic trend across Tampa (Fig. 4) bridges much deeper large vertical magnetic signatures offshore modeled by Quinn [44] east and west of the Florida Peninsula. The USGS anomalies in Fig. 4 are considered an upper capacitance layer

connected to a much deeper mantle circuit or capacitance layer [36], by Quinn's modeled vertical signatures [44]. Increased lightning strikes, along geomagnetic anomalies may attract hurricanes thermally and electromagnetically. Research indicates these geomagnetic "lightning hotspots" are activated the previous year to actual increased hurricane landfalls generally associated with an ENSO charging cycle (La Niña) during an induction phase on the East Pacific Rise (EPR). The EPR induction circuit activates magnetic moments of these deeply connected vertical z-components of the internal magnetic field in the Southeastern U.S. and Caribbean. Thus, monitoring the EM precursor activity in the Southeastern U.S. associated with these known "lightning hotspot" locations may give indication of incoming hurricane locations well before their occurrence [34].

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