Global Disaster Forecasting with Space Weather & Geophysical Intelligence

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ABSTRACT

There are many opportunities to integrate *Space Weather* data into global weather and *Natural Disaster Forecasting* models. The Earth as a *Stellar Transformer Hypothesis* builds on the *Global Electrical Circuit* model. Evidence suggests *Geo-magnetism* is strongly related to solar activity or transformer induction events. This paper explores links between *Space Weather* events and *Geo-magnetism* to improve *Natural Disaster Forecasting*. We present case studies to better understand the possible precursors to *Natural Disasters* such as *Earthquakes, Hurricanes* and certain types of *Wildfires*, related to *Coronal Mass Ejections*. While the science of accurate forecasting is dependent on many variables, which this paper does not address, we have attempted to uncover a possible missing *Space Weather* link.

Keywords*: Space Weather, Natural Disaster Forecasting, Solar Induction, Stellar Transformer Hypothesis, Global Electrical Circuit, Geo-magnetism, Earthquakes, Hurricanes, Wildfires, Coronal Mass Ejections*

1. INTRODUCTION TO GLOBAL DISASTER FORECASTING WITH SPACE WEATHER AND GEOPHYSICAL INTELLIGENCE

The Earth's geomagnetic field is constantly changing due to variable Electro-Magnetic (EM) output of the Sun and the fact that earth's core is magnetic and spinning. These effects may interact with and/or account for many well-known electric phenomena, such as aurora borealis and St. Elmo's Fire. Geomagnetic effects may also affect the weather, through increasing or reducing the frequency and magnitude of lightning in a particular local area. This could also lead to wildfires. It is also plausible that the large forces associated with geomagnetic phenomena can impact or trigger earthquakes and volcanic eruptions. With an improved model that incorporates space weather EM output, it may be possible to greatly improve the forecasting of natural disasters such as *Earthquakes, Hurricanes, Volcanic Eruptions and Wildfires*, allowing these hypotheses to be tested and, potentially, falsified. Solar induction seems to have a dominant influence on natural phenomena worldwide [1].

2. SPACE WEATHER: THE COMMON DENOMINATOR

Predicting natural disasters in many cases is a function of gaining powerful insights into space weather and its interaction with Earth Systems. See the following examples looking at earthquakes, wildfires and hurricanes. Is there a common variable? We think so.

Earthquake Forecasting Using Jet Streams
Are anomalous Jetstream disturbances related to space weather events?

International Earthquake and Volcano Prediction Center (IEVPC) Associate Scientist case studies show many M ≥ 6.0 earthquake locations were identified with jet stream precursors (Fig. 1). Mr. Hong-Chun Wu, a Taiwanese independent scientist, is a world authority on jet stream earthquake precursor anomalies. Satellite observation found possible atmospheric disturbances in jet stream velocity before powerful earthquakes with durations 6-12 hours, at 100 km average distance between jet stream precursors and earthquake epicenters [2, 3].

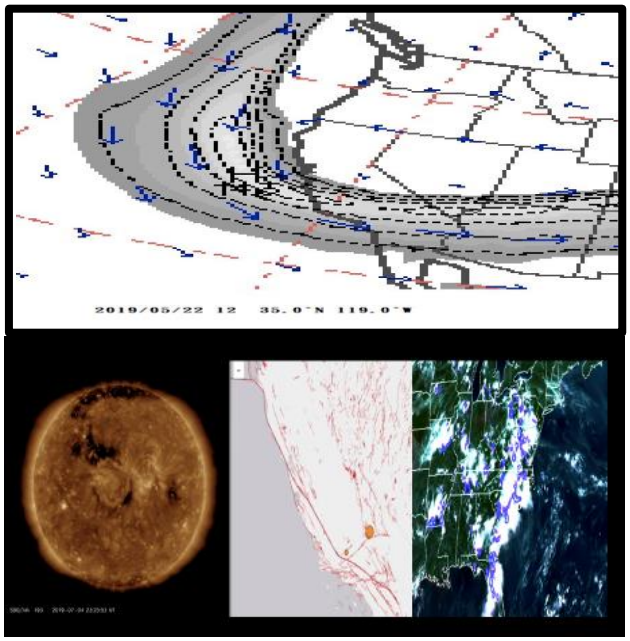

Fig. 1. Jet Stream Anomaly Forecast (upper**)** Wu used on 22 May 2019 to forecast the July 4th earthquake near L.A. (Below Left to Right) Coronal Hole Configuration, Fault Zone with Earthquake, and East Coast Lightning in Ben Davidson's Suspicious 0bservers, 05 July, 2019, Daily 5min Broadcast. https://suspicious0bservers.org/ [5, 6].

In fact, the interruption of velocity flow-lines that cross above an earthquake epicenter occurs 1–70 days prior to the event. His use of these short to medium-term Jetstream precursors is currently one of the most reliable forecasting techniques known to IEVPC. Prediction for M ≥ 6.0 earthquake epicenters results in less than 70 km deviation, using shock wave jet stream precursor method determined in 1999, (Wu -Patent). The shock wave hypothesis is related to released radioactive material (ionized gases) to the atmosphere, causing a series of physical and chemical reactions, resulting in temperature and pressure

changes in the upper air jet streams [4]. Solar induction affects are directly correlated to these ionization events. Most recently he forecasted the 2019 July 4th earthquake near Los Angeles (Fig. 1). A copy of his email to IEVPC scientist is below.

This is prediction message for southern CA EQ predicted data: 2019/05/22~2019/08/22 near to L.A. (35.0N119.0W) M > 6.5 Posted on 2019/05/24. [1]
Actual data: M6.4 2019-07-04 17:33:49 (UTC) 35.705°N 117.506°W 10.7 km

Best Regards, Hong-Chun Wu

See also papers on methods verified for earthquake forecasting. http://www.ievpc.org/earthquake-papers.html.

Wildfire

Are certain types of wildfire outbreaks related to Coronal Mass Ejections?

Outbreaks in California in 2003-04 [7] and again in 2017-18 occurred in conjunction with increased hurricane seasons of 2004-05 and 2016-17 respectively. The Stellar Transformer hypothesis [1] implies this occurs from solar induction associated with Electro-Magnetic Pulse (EMP) from Coronal Mass Ejections (CME's) documented during the Oct. 31, 2003 Halloween fires [7]. Research indicates this sequence of events is related to radial induction "coils" [8] along orthogonal fracture patterns in the Pacific Ocean Basin (Fig. 2).

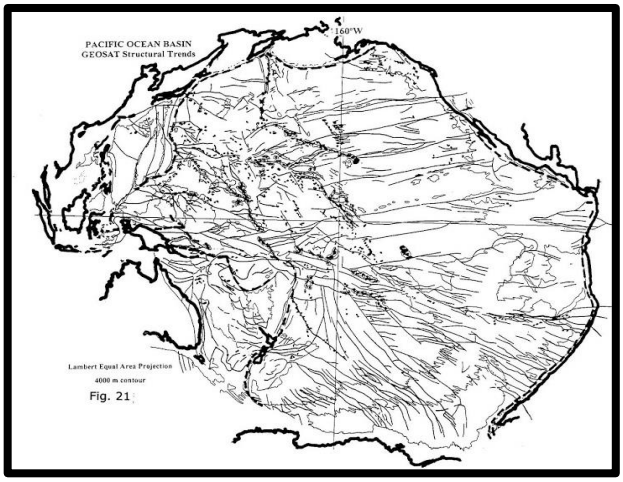

Fig. 2. 1995 high-pass filtered GEOSAT Structural Diagram of Pacific Basin Trends [9] where some of the trends go ashore, i.e. Paradise (2018) fire along Mendocino Fracture and San Bernardino (2003) fires along Murray Fractures (Fig. 3).

Wildfires breakouts are near where orthogonal fractures intersect the Continental U.S. (Fig. 3) along an extension of the East Pacific Rise mantle circuit (San Andres Fault) and may be activated by solar induction. The Murray Fracture Zone is associated with wildfires near large arc shaped geomagnetic anomalies [7] through San Bernardino in 2003 & 2017, while the Mendocino fracture intersects large volcanic plutons associated with the Paradise – Camp Fire in 2018 (Fig. 3). "The Camp Fire burn area is bisected by the Long Ravine, Big Bend, Magalia and Chico Monocline faults. Only the Chico Monocline shows evidence of recent fault displacement (i.e. within the past 1.6 million years) within the burn area" [11, 12]. This area is where power line tower bases seemingly fell over from melting. Is it possible the power tower bases could turn to molten metal (Fig. 4) from energy grounding out to or emanating from volcanic magnetic terrains (i.e. plutons)? This possibility can be understood in terms of an extreme manifestation of St. Elmo's fire, during large Total Electron Content (TEC) events (Fig. 5). St. Elmo's fire is a glowing form of luminous bright blue or violet plasma, similar to neon lights. It is formed from the ionization of nitrogen and oxygen molecules by the electric field around tall conductive objects. 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 [13]. 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. These wildfire outbreaks generally occur along volcanic geomagnetic terrains during periods of geomagnetic storms induced from solar coupling. Historical evidence from the most powerful space storm on record in September 1859 Carrington Event, hints at the relationship to wildfires when telegraph wires shorted out in the United States and Europe, igniting widespread wildfires simultaneously on both continents [14]. Monitoring EM activity along these fracture intersections may give early warning of fire out breaks along these systems. The induction characteristics are determined by current alignments between layers in the Earth and polarity relationships primarily between Earth-Sun. The alignment and polarity determine the attraction or repulsive forces i.e. the charging and discharging forces on our planet [1].

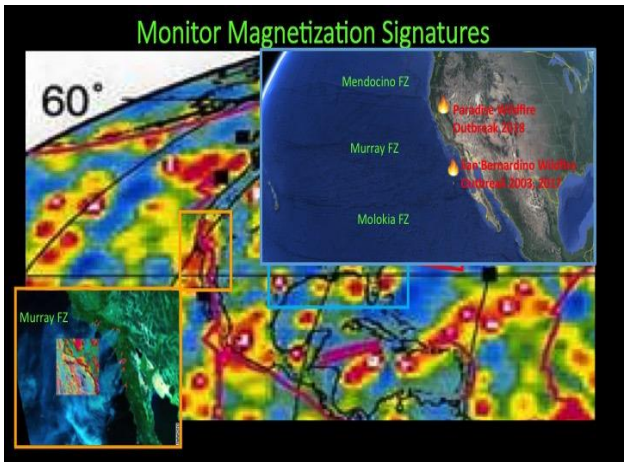

Fig. 3. Magnetic Modeling North American zoom into Wildfire & Earthquake Region with large magnetic signatures along San Andreas trends intersection (upper right inset) with "Pacific Fracture" (Mendocino, Murray, Molokai) "Wildfire Breakout Zones". Lower inset 2003 Halloween wildfire outbreak along Murray Fracture associated with Coronal Mass Ejections [7]. Structure in lithospheric magnetic source depths: Red and Yellow are between the 30-70km ranges; while blues and greens are from 70-400km [10]. Courtesy John M. Quinn, Solar-Terrestrial Environmental Research Institute (STERI).

[1] https://www.facebook.com/photo.php?fbid=2351411584910877&set=a.657516484300404&type=3&theater

Fig. 4. Paradise Campfire Origins indicate downed power line towers. Were the tower bases melted? What forces destroyed the tower bases… simple wildfire propagation or strong ground solar induction currents? (Google Earth Image – 11 Dec. 2018)

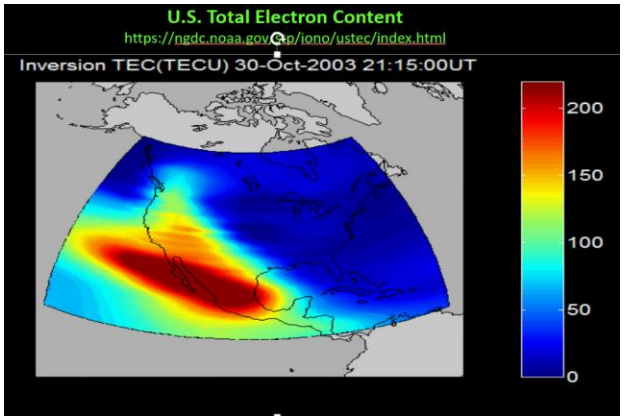

Fig. 5. Total Electron Content charge stacks up over the event area due to Solar Coronal Mass Ejections 30 Oct 2003, just before Halloween wildfire ignition on 31 Oct 2003 (NOAA).

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 [15] or "lightning hotspots" [16]. 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 [16]. 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 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 [1]. 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 [17] 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 [1].

Case Study Hurricane Dorian 2019

Hurricane Dorian stalled out at Category 5 intensity just before Labor Day, 02 Sept. 2019 (Fig. 6) grounding huge amounts of lightning during geomagnetic disturbances that correlated with hurricane wind speeds (Fig. 7). The T-shaped coronal hole (Fig. 6) was just finishing it's Brikeland 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.

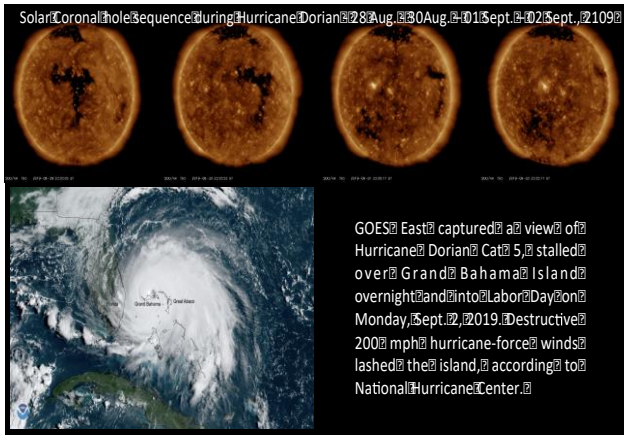

Fig. 6. T-shaped Coronal Hole Brikeland Current rotates past Earth driving Hurricane Dorian intensification (> lightning) from the increasing geomagnetic field seen in Kp indices Fig. 7. https://www.spaceweatherlive.com/en/archive/2019/09/02/coronal-holes

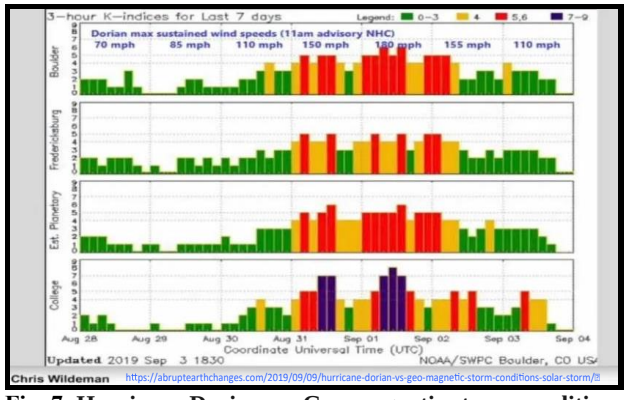

Fig. 7. Hurricane Dorian vs. Geo-magnetic storm conditions 7- day window of observation verifies direct intesification of hurricanes from sweeping Brikeland currents associated with coronal holes looming large in dark plasma mode in Fig. 6. https://abrupteartchanges.com/2019/09/09/hurricane-dorian-vs-geo-magnetic-storm-conditions-solar-storm/

The underlying tectonic fabric of the Bahama Islands indicate Abaco Island (sustained catastophic damage from Dorian), lies along an ancient mid-ocean ridge system between the Bahamas and Sunniland Fracture Zones (Fig. 8) [18]. Eventhough 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 hurrican lightning. The scenario is not complicated to understand; as the cornal hole sweep

stimulats 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 ionosheric connection resumes control of hurricane steering currents by upper level jetstreams. Earthquakes have been linked to these hurricane charging affects during Hurricane Irma [15]. There are a host of realtionships tied to solar induction affects that manifest in various forms related to the underlying magnetic basement (Fig. 9). The data in Fig. 7 makes this example standout.

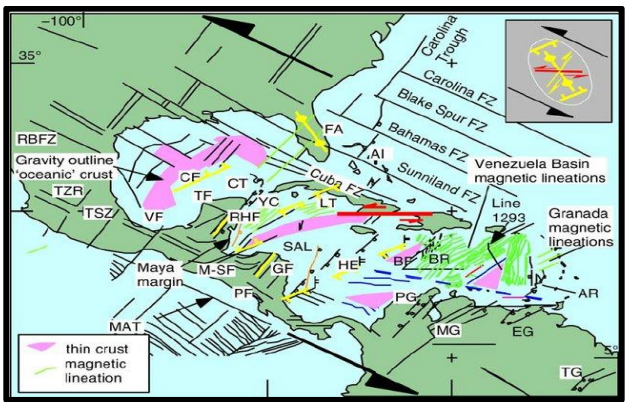

Fig. 8. Interpretation of Middle America tectonic fabric as the result of reactivation of ancient lineaments. Compiled from many sources [17].

The Florida Platform is a broad carbonate buildup that underlies the Florida Peninsula and continental shelf [19]. The stratigraphic evolution of the Florida Platform has been influenced primarily by eustatic changes [20] in sea level and the local hydrographic regime. Early Ordovician quartzitic sandstones inter-bedded with shale exhibit metamorphic and hydrothermal alteration signatures [21, 22] and overlie an ancient Triassic rift system associated with the Florida Magnetic Anomaly (FMA) [23]. This feature generally trends East-NE to West-SW as indicated by volcanic basement magnetic trends (Fig. 9) along what's known locally in Florida as "lightning alley". These geomagnetic anomalies [24] 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.

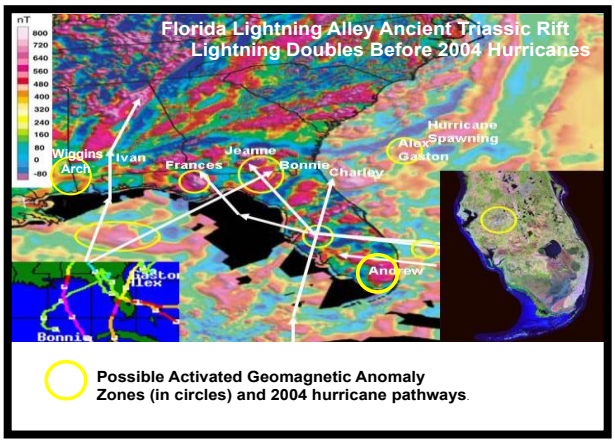

Fig. 9. USGS Magnetic Anomalies [24] along Florida Peninsula in Southeast U.S. Hurricane Region reflecting Ancient Triassic Rift trends in the lithosphere.

The magnetic trend across Tampa (Fig. 9) bridges much deeper large vertical magnetic signatures offshore (Fig. 3), modeled by Quinn [10] east and west of the Florida Peninsula. The USGS anomalies in Fig. 9 are considered an upper capacitance layer connected to a much deeper mantle circuit or capacitance layer [1], by Quinn's modeled vertical signatures in Fig. 3. 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 [15].

3. GLOBAL DISASTER FORECASTING

Challenge

Our entrepreneurial or commercial challenge is to create a new *Interdisciplinary Space Weather Forecasting* approach built on an innovative electro-dynamic model [1] of the solar system from multiple satellite solar/earth monitoring systems using *Geophysical Intelligence.* To provide real time forecasting of: Electro-Magnetic Pulse (EMP); communication problems; 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). Development of data visualization tools to extract and add *Geophysical Intelligence* from a multitude of environmental data is key to forecasting these natural disasters.

Integration of Space Weather Data and Weather Models

Has Space Weather monitoring improved Earth Weather and Natural Disaster foresting? An initial scan of the literature is inconclusive but perhaps if not already, weather modelers will continue to integrate Space Weather data into their predictive models. According to NOAA, "Radio waves are affected by the presence of electrons. The more electrons in the path of the radio wave, the more the radio signal will be affected. For ground to satellite communication and satellite navigation, Total Electron Content (TEC) is a good parameter to monitor for possible space weather impacts." [2]

Monitoring Technology

A Radio Detection Network [25] in conjunction with other monitoring technology can detect *Solar Electro-Magnetic (EM) Induction* effects as exemplified by global lightning studies [16]. Anomalous lightning may be produced by an electromotive force, or voltage; across ancient electrical conducting volcanic rock complexes globally during solar induction periods [1]. We believe these Electro-Magnetic (EM) precursors such as TEC, have to the potential to give us the advanced warning of broad categories of natural disasters including wildfire, hurricane, and forecast of large earthquakes $M \geq 6.0$, thanks to recent developments in satellite monitoring and Radio Direction Finding techniques [26]. Acoustic

[2] https://www.swpc.noaa.gov/phenomena/total-electron-content

Emission (AE) of ultrasound frequencies can give warnings several months in advance [27].

4. MARKET SCAN: NATURAL DISASTER FORECASTING FUNDING AND POLICY

In 2020, it is anticipated that Congress will adopt of a bi-partisan backed Space Weather Research and Forecasting Act to develop an Early Warning System to protect our power grid and communication infrastructure. According to the Co-Sponsor, Senator Peters, "The legislation will help improve the ability to predict and mitigate the impacts of the extreme space weather events, including solar flares and coronal mass ejections, which are naturally occurring changes in emissions from the sun that can cause disruptions to the electrical power grid and communication networks, and lead to trillions of dollars in economic damage." The White House has also taken a keen interest in understanding Space Weather and its impacts. In 2019 it issued a national Space Weather Strategy and Action Plan. [3]

Forecasting Natural Disasters: According to NOAA [4], "The impacts of extreme weather, water, and climate events are increasing. Destructive and deadly hurricanes and tornadoes, devastating floods, droughts and wildfires, and powerful winter storms are costing the nation's economy more than ever before." Over the last few decades, whether forecasters have made significant improvements. Some improvements include ongoing supercomputing capacity, Data visualization and integration and Doppler radar improvements. According to NOAA, "forecasters view a collection of models, known as an ensemble, to account for weakness and biases in the models and also weigh their strengths as forecasters issue timely and accurate predictions and provide an array of decision support services." In other words, extreme weather and natural disaster forecasting is an ongoing learning process of trial and error.

Forecast Modeling Accuracy - What Matters?
Unfortunately, there is no easy answer as it depends on the event forecasted. For example, regarding Hurricane Florence, The American Global Forecast System (GFS) model was actually the most accurate, according to a National Weather Service analysis of model performance [5]. (Sept. 26, 2018). "The new version of the Global Forecasting System — a model known as the GFS-FV3, will roll out in mid-June (2019). That's after an unexpectedly lengthy trial run in which problems were discovered in how the model handles snowfall projections. While it should result in more accurate projections, testing shows it's unlikely to make up much ground against two of NOAA's forecasting rivals: European Centre for Medium Range Weather Forecasts and the U.K. Met Office. The public narrative that U.S. forecasting models are inferior have their roots in Hurricane Sandy, which struck the East Coast in 2012. The GFS failed to anticipate the storm's westerly turn into the New Jersey coast several days in advance, while the European model advertised that historically improbable outcome a week out. Ever since, NOAA, working with Congress and the White House, has been trying to obtain the resources needed to catch up to other countries. A big hang-up so far has been how the U.S. spread out its model development across agencies and research institutions without centralized oversight, including among centers within NOAA that did not collaborate despite being in the same agency." [6]

[3] https://www.whitehouse.gov/wp-content/uploads/2019/03/National-Space-Weather-Strategy-and-Action-Plan-2019.pdf
[4] https://www.noaa.gov/explainers/improving-weather-forecasts
[5] https://www.washingtonpost.com/weather/2018/09/26/surprise-american-weather-model-had-best-forecasts-hurricane-florence/

5. CONCLUSIONS

An *Interdisciplinary Forecasting* approach using an innovative electro-dynamic *Plasma Core* model of Earth with multi-phase circuits and our larger *Solar System* can be built with *Geophysical Intelligence*. Creating a comprehensive framework for understanding Earth's interactions with *Space Weather*. Ample historical databases exist that can be analyzed for the purpose of detecting other correlations similar to those we observed. Moreover, the model we propose differs from existing climate models (that do not incorporate *Solar Induction* effects) in that it can be tied to specific geographical locations and observed solar phenomena. As a consequence, it would seem to offer considerable advantages in predictive power at the local level should these relationships be confirmed.

The timing and global distribution of lightning data along with the other environmental relationships demostrates a pathway to a new paradigm of understanding *Solar Induction* affects on our planet. A logical scheme backed with data analysis can create a step-by-step focus on increasingly better specific details of the processes and mechanisms of a new forecasting scheme. Developing an innate sense how the pieces "best" fit together occurs by testing different frameworks in a series of visualization processes supplemented with as much real data as possible. Applications to space exploration are in their infancy, leaving the field wide open for commercial development projects. Over the past 2 decades an ever-growing group of internationally networked scientist, along with an even larger group of layman, have diligently worked toward a new more inter-disciplinary understanding of our planets *Endogenous Energy* [28] and it's link to solar drivers.

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[6] https://www.axios.com/new-us-weather-model-still-not-that-accurate-0b88af37-81a8-4343-8ad9-d85e47f20529.html

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