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The relationship between geoelectromagnetic dynamics and emerging viral infectious diseases: A novel hypothesis of the actions of Iron Age African tribes during severe geomagnetic perturbations.

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Emerging viral infectious diseases represent a disproportionally high source of morbidity and mortality in countries in Africa, Asia and South America within the equatorial belt. It is well established that infectious diseases exhibit a climate/calendar-associated spatiotemporal wave-like dynamics; however, foundational questions governing said dynamics remains to be adequately addressed. Over the last few centuries, significant scientific advances have been made in modeling and forecasting physical systems and phenomena; these advances have primarily been driven by the employment of theories involving the fundamental physical forces. Thus far, similar scientific advances in infectious disease modeling and forecasting have not been achieved. An alternative source of human knowledge resides in Indigenous Knowledge; however said knowledge base is generally assumed to be primitive and superstitious; thus it is underexplored for novel insights. The climate/calendar-associated spatiotemporal wave-like dynamics of infectious disease suggest a critical role for geophysical dynamics and associated fundamental physical forces in understating and modeling said outcomes. In most Indigenous Knowledge base within the equatorial belt, emerging viral infectious diseases are hypothesize to be mediated by aberrant, unseen forces emanating from the lithosphere, which induces aberrant transformation of humans resulting in disease. Recent archeological evidence of the actions of Iron Age African tribes in the Limpopo River Valley basin suggests that the Indigenous Knowledge in said region linked perturbations in the lithosphere during periods of significant geomagnetic anomalies to disease, and sought to mitigate said adverse outcomes via applying burnt clay to the lithosphere. This publication seeks to examine the hypothesis that geoelectromagnetic perturbations are associated with the spatiotemporal wave-like dynamics of emerging viral infectious diseases in the equatorial belt, and provide a mechanistic hypothesis for said relationship based on insights derived from Indigenous Knowledge.

Introduction

Emerging viral infectious disease epidemics disproportionally affects developing countries in and around the equatorial belt [1]. Several studies have demonstrated that the disproportionate level of emerging infectious disease epidemics in the equatorial belt are associated with shocks to the physical space, including droughts, floods, and other climate/calendar-associated natural disasters [1-3]. The relationship between climate/calendar-associated natural disasters and emerging infectious disease epidemics is formalized in forecasting models of based on the El Niño Southern oscillation [1, 3, 4]. Furthermore, the dynamics of emerging viral infectious diseases in the equatorial belt mimics a wave-like dynamics spatially and/or temporally [5-7]. Said meteorological-dependent wave-like dynamics of emerging viral infectious diseases was recognized by early practitioners of medicine/public health in Greco-Roman dominated Europe/world, albeit a robust scientific theory and mechanism for said relationship remains to be determined [5].

Meteorological-based models of emerging infectious diseases, such as the El Niño Southern Oscillation index model provides a valuable framework; however, several limitations exist, including the lack of the incorporation of the fundamental physical forces, which has been critical in the development of a robust understating of the dynamics and mechanisms of a myriad of physical systems and phenomena. An alternative reservoir of human knowledge, termed Indigenous Knowledge, that has been continuously verified through repetition, inference and prediction, often over several millennia, and provides a source of insight/solutions, albeit said knowledge base is generally assumed to be primitive and superstitious; thus it is underexplored [8]. Recently, said assumptions of Indigenous Knowledge have been challenged, with several lines of evidences demonstrating that Indigenous Knowledge holds valuable information and insights/solutions into unresolved scientific problems, mostly notably in the field of ecology [9, 10] and agriculture [11, 12]. The application of Indigenous Knowledge to public health has been very limited, with Indigenous Knowledge and practitioners rarely incorporated in strategies for addressing or understanding the mechanisms of emerging infectious disease outbreaks. This work seeks to probe Indigenous Knowledge for novel insights in addressing unanswered scientific questions on the spatiotemporal dynamics of emerging infectious diseases. This paper applies Indigenous Knowledge along with a conception of complex multidisciplinary evidences (includes infectious disease dynamics, genomics and geophysics) to the problem of emerging infectious disease outbreaks. This work extends the emerging field of active matter (matter that consumes energy) to the human-active matter domain, via incorporating fundamental physical forces in the dynamics of emerging infectious disease and provides novel insights on the global inequality of emerging infectious disease epidemics via exploring the intersection of the human-space and the physical-space [13, 14].

Results

Application of the Lithosphere–Atmosphere–Ionosphere Coupling (LAIC) model in an Indigenous Knowledge-derived framework to the dynamics of emerging viral infectious diseases.

In most Indigenous Health Knowledge base, viral infectious diseases are hypothesize to be mediated by aberrant, unseen forces emanating from the Earth (or other humans), which induces aberrant transformation of humans resulting in disease [15, 16]. Archeological evidence of the actions of Iron Age African tribes in the Limpopo River Valley basin suggests that the Indigenous Knowledge in said region linked perturbations in the lithosphere during periods of significant geomagnetic perturbations to aberrant health, and sought to mitigate said outcomes via applying “burnt” clay to the lithosphere [17]. Although said actions are generally interpreted as a manifestations of primitive and suppositious beliefs of Indigenous Knowledge, this work hypothesize that severe electromagnetic perturbations in the lithosphere is associated with aberrant health; with unseen, aberrant forces in Indigenous Knowledge interpreted as electromagnetic waves outside of the visible spectrum. Emerging evidences in geophysics suggest a unified physical dynamics in the space occupied by humans [18-20]. Several lines of evidences demonstrate electromagnetic coupling between the lithosphere, atmosphere, and ionosphere; this concept is formalized in the Lithosphere–Atmosphere–Ionosphere Coupling (LAIC) model [21]. Several current forecasting frameworks of emerging infectious disease epidemics are based on perturbations in the atmosphere, namely, the El Niño-Southern Oscillation [1, 4]. Evidence suggests that

perturbations in the lithosphere (i.e. earthquakes in the ocean crust) are associated with the El Niño-Southern Oscillation [22]. Furthermore, it is well established that earthquakes and other physical shocks to the lithosphere are coupled to electromagnetic perturbations in the lithosphere, atmosphere and ionosphere [20, 23]. This work develops a novel framework for modeling emerging viral infectious diseases via modification of the LAIC model to include humans (h-LAIC model), with the dynamics of the lithosphere modeled via electromagnetic perturbations.

Spatiotemporal relationship between geoelectromagnetic dynamics and emerging viral infectious disease outbreaks in the equatorial belt of Africa.

It is well established that emerging viral infectious diseases disproportionally affects the countries in and around the equatorial belt of Africa [1, 4]. An underexplored factor that could be driving the disproportionally

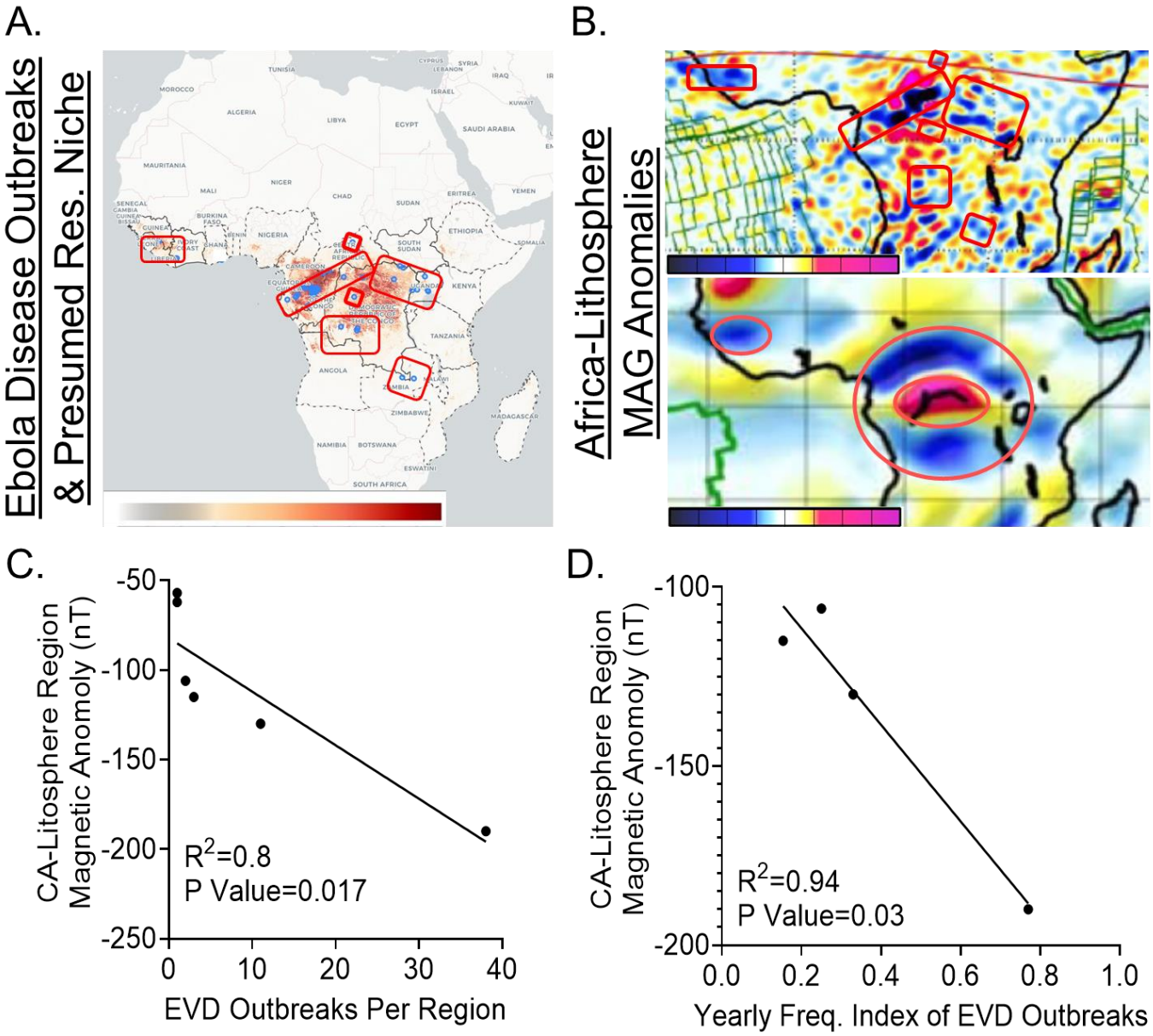

Figure 1: The spatiotemporal relationship between lithosphere magnetic anomalies and Ebola viral disease outbreaks. The location of EVD outbreaks in both humans and animals were mapped over the niche of the presumed reservoir for Ebola virus (i.e. fruit bats) (A), and compared to the magnetic anomalies (MA) (using map-top panel and model-bottom panel) of said regions (B). Note: The cases outside of the Mano River basin region and Central Africa were excluded (i.e. the cases in Ghana on the original map) as those were imported/limited. (C/D) Analysis of number and yearly frequency index of EVD outbreaks in the demarcated regions in Central Africa (CA) compared to the strength of the magnetic anomaly (using WMADM Scale-Top Panel in 1B. Blue=low, Fuchsia=High) in said regions, as EVD has been in the region greater than 40 years.

high levels of emerging infectious disease burden in the equatorial belt of Africa is the geophysical characteristics and dynamics of the equatorial belt, which differs significantly from the Northern and Southern hemisphere [24]. This publication argues that the h-LAIC model couples geophysical dynamics in human habitat in a unified framework, and provide a means for modeling emerging viral infectious diseases via a fundamental force, namely, the electromagnetic force. This publication hypothesize that emerging infectious disease outbreaks in the equatorial belt of Africa can be model based on the excitations of magnetic anomalies and using the framework of the h-LAIC model. The period of 2013-2017 is used for modeling the relationship between electromagnetic perturbations and emerging viral infectious diseases, with specific emphasis on the Ebola viral disease (EVD) outbreaks in West and Central Africa, which were associated with a severe El Niño.

Comparative analysis of the spatial dynamics of EVD outbreaks in Central (includes some East African countries) and West Africa and lithosphere magnetic anomalies in Central and West Africa, demonstrates that Ebola outbreaks are spatially restricted to regions of low magnetic field strength anomalies; the frequency of EVD outbreaks in said regions also inversely correlates with lithosphere magnetic field strength (Figure 1). These associations overlaps the geographic distribution of the presumed reservoir for Ebola virus (namely, fruit bats) (Figure 1). The number of Ebola viral disease (EVD) cases per county varied significantly across the Mano River basin region of West Africa during the 2014-2016 outbreak, with Northern Guinea and Eastern Liberia exhibiting no to minimal EVD cases (Figure 2). In the West African-EVD outbreak, the number of EVD cases is infinitesimal compared to the total population of any given county, therefore, it is presumed that the number of EVD cases per county is not significantly affected by the differences in the total population or population density across the counties. Analysis of the relationship between the number of EVD cases per county and the strength of the lithosphere magnetic anomalies in the Mano River basin region of West Africa demonstrates concentric oval regions [6] centered on a location in Northwestern Liberia, for both parameters; with an inverse relationship between the spatially-overlapping parameters (Figure 2). Of note, the geographic location of the first recognized EVD case during the outbreak overlaps with the geographic location of the presumed reservoir species (Figure 2). Additionally, analysis of the another viral hemorrhagic fever disease, Lassa virus disease (LVD) also demonstrates spatially-overlapping, with LVD predominately restricted to the concentric oval shell of the lowest strength-lithosphere magnetic anomaly region centered on Northwestern

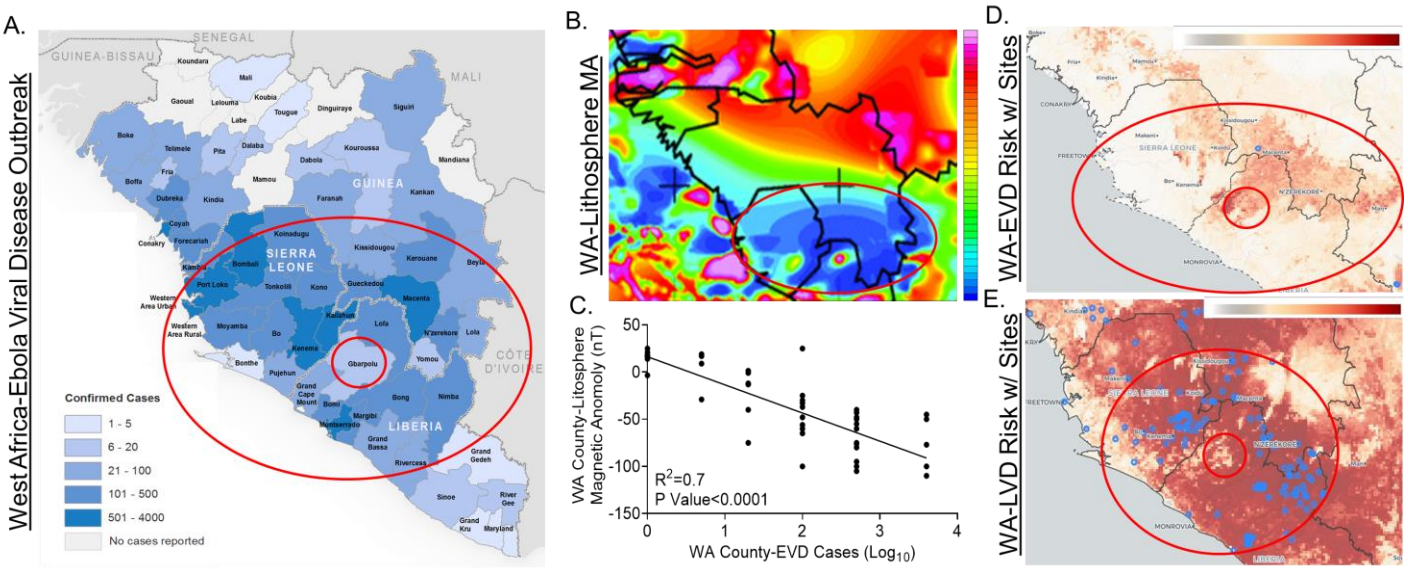

Figure 2: The spatial relationship between lithosphere magnetic anomalies and the Ebola viral disease outbreak in West Africa. The number of EVD cases per county in West Africa (WA) were tabulated and mapped by the World Health organization (A); said map was compared to the (B) lithosphere magnetic anomalies (MA; Blue=low, Fuchsia/Pink=High) in the Mano River basin region to determine structural similarities. (C) Comparative analysis was performed between the number of EVD cases per county and the approximate strength of the lithosphere magnetic anomaly per county for all the counties in the Sierra Leone, Guinea and Western Liberia (visible portion of Liberia on the original map). The eastern portion of Liberia was not published in this map, however the magnetic anomaly is relatively high per data from other maps). (D/E) The geographical niche of presumed reservoirs of EVD (i.e. fruit bats) and vectors of LVD (rodents) was mapped with locations of outbreaks in the Mano river basin to examine the relationship of said viral hemorrhagic fever disease with lithosphere magnetic anomalies.

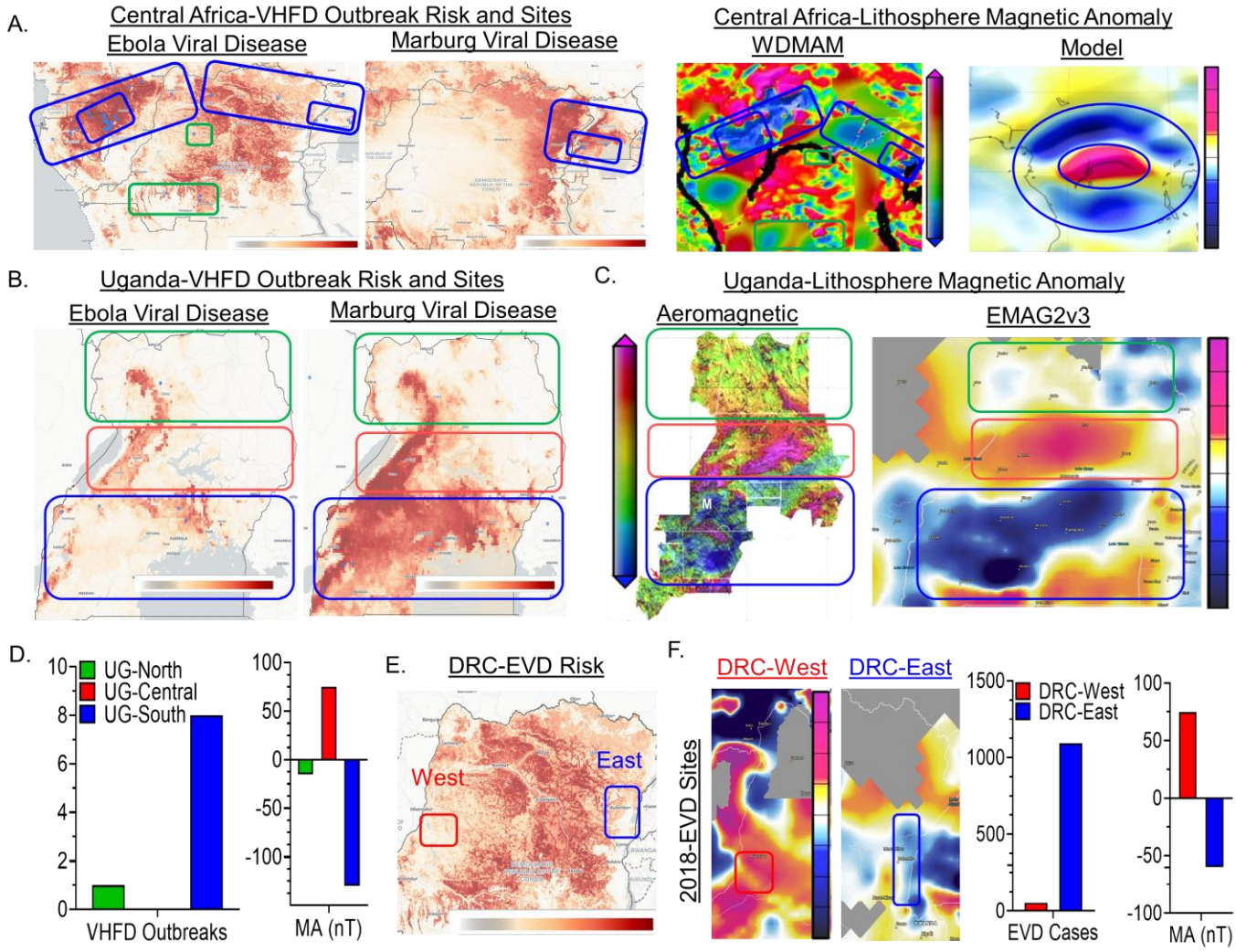

Figure 3: The spatial relationship between lithosphere magnetic anomalies and viral hemorrhagic fever disease (VHFD) outbreaks in Central Africa. (A) The niche of the presumed reservoir species of Ebola viral disease (EVD) and Marburg viral disease (MVD) and outbreak sites were compared to the lithosphere magnetic anomalies (MA) in Central Africa (includes East African countries), with boxes demarcating the encompassing regions and inner boxes identifying sub-regions with high number of outbreaks. (B/C/D) The niche of the presumed reservoir species of EVD and MVD were mapped along with outbreak sites in demarcated regions (North, Central and South) of Uganda and compared to the lithosphere magnetic anomalies of said demarcated regions. (E/F) The niche of the presumed reservoir species of EVD in regions of the 2018-EVD outbreaks in the Democratic Republic of Congo (DRC) were demarcated and compared to the lithosphere magnetic anomalies of said regions, along with comparative analysis of the number of cases and the strength of the lithosphere magnetic anomalies.

Liberia (Figure 2). Prior to 2014, EVD outbreaks were spatially restricted to Central Africa (including East African countries), with several countries in and around the Congo River basin and the associated Greater Bangui Magnetic Anomaly region experiencing multiple outbreaks (Figure 3). Analysis of viral hemorrhagic fever disease (VHFD, namely EVD and MVD) outbreaks and presumed reservoir species in Central Africa demonstrate spatial overlap between with low strength-lithosphere magnetic anomalies, including detailed analysis of outbreaks in Uganda (Figure 3). Of importance, the spherical shell shape of viral hemorrhagic fever disease (EVD and MVD) outbreaks in Central Africa spatially overlaps with the spherical shell shape of the vertical field anomaly of Central Africa (Figure 3). The EVD outbreaks in DRC that began in 2018 occurred in regions with moderate presumed reservoir-associated outbreak risk, and exhibited differential outcomes, with the Équateur Province (West-DRC) outbreak resulting in a small number of cases (~50 EVD cases) and quickly dissipating, while the North Kivu and Ituri Provinces (East-DRC) outbreak resulted in large number of cases (>1000 EVD cases) and is ongoing (per the date of this manuscript) (Figure 3). Analysis of the magnetic anomaly demonstrate that the East-DRC outbreak co-localized with a relatively low strength-lithosphere magnetic anomaly region, while the West-DRC outbreak co-localized with a relatively high strength-lithosphere

magnetic anomaly region, albeit adjacent to a very low strength-lithosphere magnetic anomaly region and near a lake (Figure 3). Perturbations (excitations) of the lithosphere magnetic field is coupled to ionosphere scintillation [25-27], which predominately occur after sunset; equatorial regions exhibit disproportionally high levels of scintillation [28, 29], with the notable exception during the summer months. Analysis of the West African (Liberia) EVD outbreak demonstrates a temporal relationship with equatorial-ionosphere scintillation based on the number of scintillation days per month in Abidjan, Ivory Coast (a location in West Africa that is adjacent to Liberia), with the peak of both parameters separated by six months, and the summer months also associated with residual scintillation (Figure 4). Equatorial-Africa experience two EVD outbreaks in 2014 (West and Central African-EVD outbreaks), with the Central African-EVD outbreak resulting in minimal number of cases and rapidly dissipating over a few months, while the West African-EVD outbreak resulted in the highest number of cases and lasted for about a year; the divergent outcomes of the two regions was associated with the relative duration of equatorial-ionosphere scintillation (Figure 5). Ionosphere scintillation results from irregularities in the total electron count (TEC) of the ionosphere [30], and thus associated with changes in TEC, which perturbs the transmission of electromagnetic (radio) waves; analysis of the West African-EVD outbreak demonstrates a temporal relationship with changes in the TEC of the African-ionosphere (Figure 5).

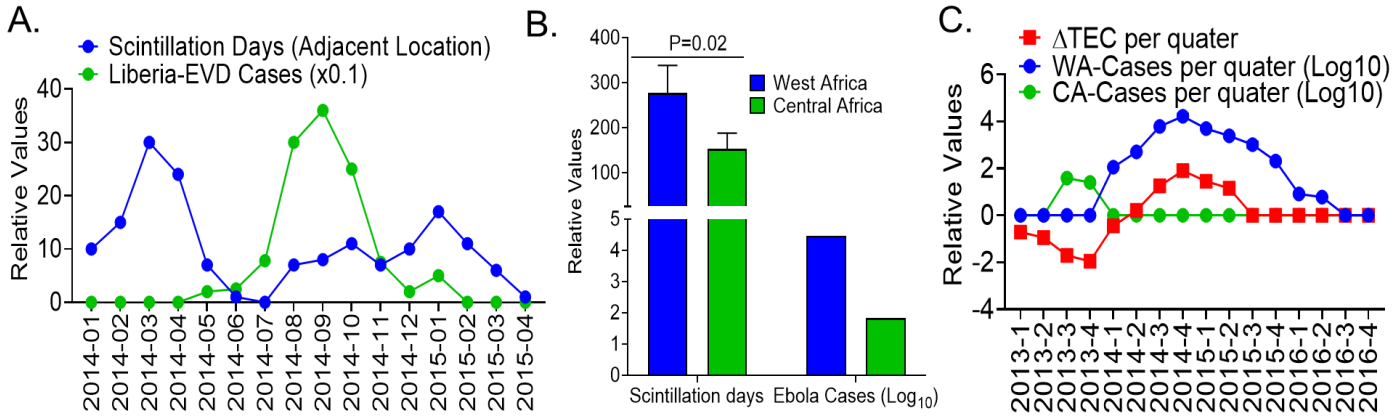

Figure 4: The temporal relationship between ionosphere scintillation and Ebola viral disease outbreak. (A) The ionosphere scintillation was examined at an adjacent location (Abidjan) outside of the EVD-affected area in West Africa. The duration of the scintillation per month at said location was compared to the number of EVD cases per month. (B) The duration of scintillation in the West African region was compared to the Central-East African region, along with the number of EVD cases in both regions. (B) The total electron count (TEC) trend over Africa was compared to the trend of the EVD cases in both West and Central Africa.

Spatiotemporal relationship between geoelectromagnetic dynamics and emerging infectious disease outbreaks in other equatorial belt regions.

The equatorial belt of South America and Asia also exhibit relatively high degree of infectious disease burden compared to countries in the Northern and Southern hemisphere. To confirm that the h-LAIC framework is broadly applicable, we examine the relationship between lithosphere magnetic anomaly and emerging infectious disease epidemics in South America, with emphasis on the 2013-2017 Zika epidemic in Brazil, South America. Importantly, the period of 2013-2017 was associated with physical shocks to equatorial counties in South America, which included the El Niño-Southern Oscillation [31].

Analysis of the spatial distribution of the predominant mosquito vector (Aedes Aegypti) for Zika transmission in South America demonstrates a spatial overlap with high strength-lithosphere magnetic anomaly regions (Figure 6). Additionally, the travel path of the equatorial scintillation wave band (the red box denotes the limits of the wave band) spatially overlaps with the lithosphere magnetic anomalies and Zika virus vectors in South America (Figure 6). Analysis of the incidence of Zika virus infection per region and the scintillation days per region during 2015 demonstrates a spatial relationship (Figure 6). Additionally, analysis of the average Zika virus infection incidence per region for the entire duration of the epidemic, demonstrates a spatial relationship with ionosphere scintillation (Figure 6). Analysis of the Zika virus epidemic in Northeast Brazil (the worst affected region) also demonstrates a temporal relationship with ionosphere scintillation, with the number of cases increasing following periods of high duration of scintillation, and extension of scintillation into the usually

quite summer months (Figure 7). Additionally, the 2015-microcephaly epidemic in Brazil (data not shown, [32]), predominantly occurred in Northeast Brazil, which had the highest number of scintillation days.

Discussion

It is well established that many emerging viral infectious diseases exhibit a seasonal/climate-associated spatiotemporal dynamics, with said dynamics exhibiting wave-like characteristics [33]. Developing frameworks and models of emerging viral infectious diseases that predicts said spatiotemporal wave-like dynamics is critical for effective public health response. Additionally, developing frameworks that provide mechanisms of said emerging infectious disease outbreak and spatiotemporal dynamics is also critical for developing robust systems for preventing and mitigating/controlling outbreaks (Declan Butler, 2014, Nature). To address the above mention gaps in emerging viral infectious disease modeling, several groups have employed frameworks based on dynamics of the physical space (i.e. atmosphere), with the El Nino-Southern Oscillation index as the dominant parameter. Recent evidences demonstrate electromagnetic coupling between the dynamics of the lithosphere, atmosphere and ionosphere, and is formalized as the LAIC model; thus perturbations in the atmosphere such as the El Nino-Southern Oscillation index could be modeled via perturbations in electromagnetic dynamics. This publication proposes a novel framework for modeling emerging viral infectious diseases via electromagnetic dynamics in a modified LAIC model that includes humans, and termed h-LAIC model. This framework will primarily employ continuous real-time and global measurements of ionosphere scintillation and associated total electron count from the Global Navigation Satellite System (GNSS), which

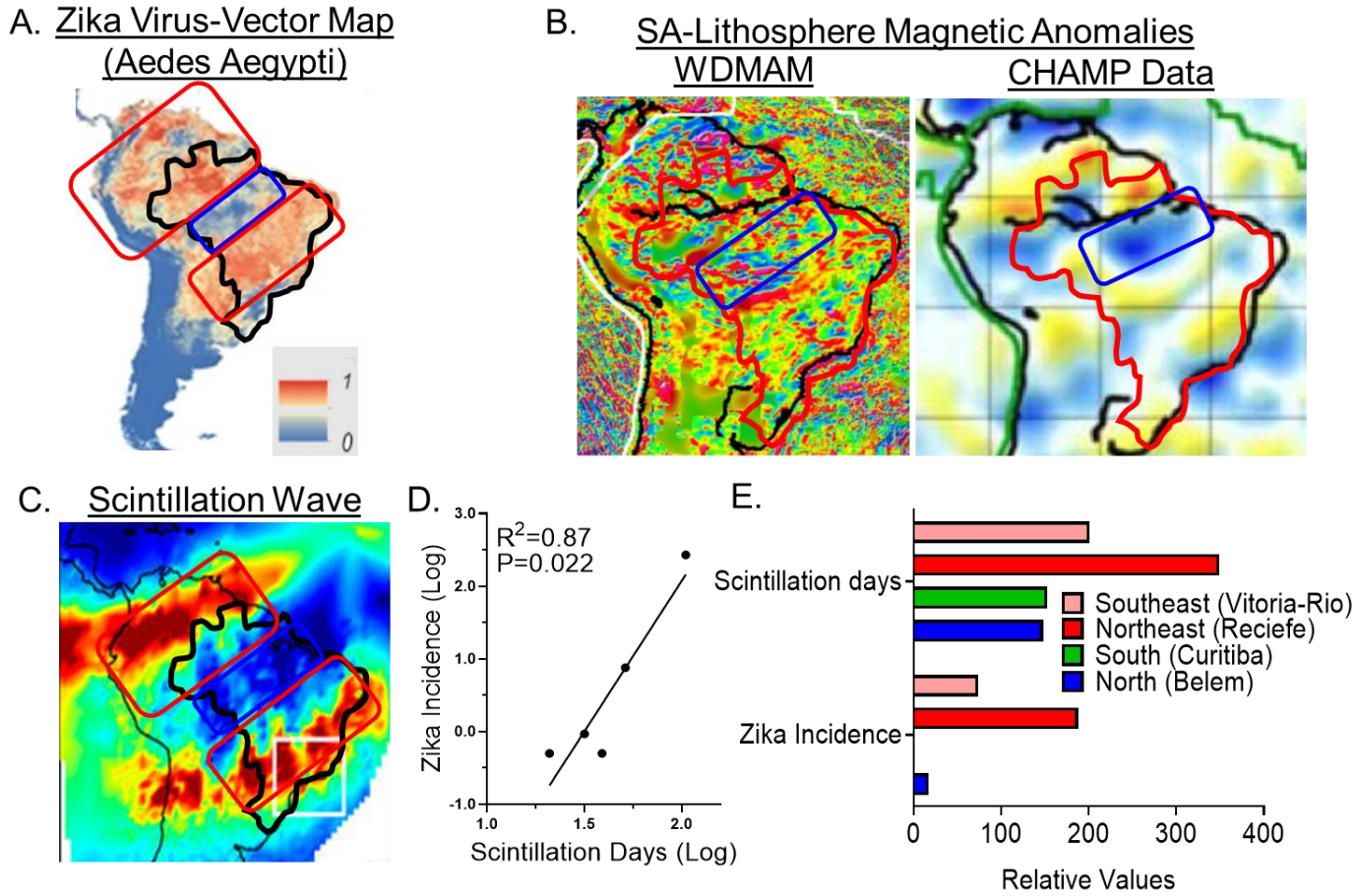

Figure 6: The spatial relationship between lithosphere magnetic anomalies and associated ionosphere scintillation and Zika viral disease. The niche of Zika viral disease vectors (Aedes mosquitos) (A) were compared to the associated lithosphere magnetic anomalies (two independent maps) (B) and ionosphere scintillation wave over South America during the 2015-ZVD epidemic (C). (D) Comparative analysis was performed to determine the relationship between the duration of scintillation and the incidence of Zika viral disease in the various regions of Brazil (with the exception of the Central-west region, due to the lack of data) in 2015. (E) Comparative analysis was performed to determine the relationship between the duration of scintillation and the incidence of Zika viral disease in the various regions of Brazil over the duration of the entire epidemic (2014-2016).

employs four subsystems, namely GPS, GLONASS, Galileo, and BeiDou-2. GNSS measurements of ionosphere scintillation and associated total electron count will be complemented with measurements of the dynamics of the lithosphere's magnetic field via Swarm-magnetometer satellite. Said measurements of lithospheric magnetic field will be confirmed using ground-based magnetometer networks, such as the African Meridian B-Field Education and Research (AMBER) magnetometer array. In this publication we demonstrated that the h-LAIC model provides a novel framework for global, continuous, real-time data for modeling and forecasting the spatiotemporal dynamics of emerging viral infectious disease outbreaks.

Hypotheses for elucidating the fundamental mechanisms of emerging viral infectious disease outbreaks in the h-LAIC model.

Historically, there are two overarching scientific hypotheses on the mechanisms of human infectious disease outbreaks [5]. Prior to the demise of Greco-Roman dominated Europe/world, the dominant scientific hypothesis of human infectious disease outbreaks posits that said aberrant health outcomes were manifestations of interactions with aberrant unseen forces that were coupled to geographic locations and seasonal/calendar-associated meteorological dynamics [5]. Said hypothesis is formalized in the first book of the Hippocratic *Epidemics [5]*. This hypothesis is consistent with the hypothesis of disease in most indigenous and antiquity cultures, including African-Indigenous Knowledge hypothesis of emerging viral infectious disease, on which the h-LIAC model is based [34-36]. Broadly speaking, African-Indigenous Knowledge hypothesis of emerging viral infectious disease argues that aberrant heath status is a manifestation of interaction of individuals with aberrant unseen forces (i.e. evil spirits) emanating from the Earth, resulting in an aberrant transformation of individuals. Said hypothesis argues that the physical space (and associated unseen forces) along with seasonal/calendar events play a dominant role in infectious disease outbreaks. This publication termed said hypothesis as the *endogenous hypothesis* of infectious diseases; as disease is mediated by internal transformation, albeit via unseen external forces. The demise of Greco-Roman dominated Europe/world, was associated with the abandonment of said hypothesis, and the perceived importance of the physical space and associated dynamics in infectious disease outbreaks [5]. A novel hypothesis, which argued that replication of contagious agents were the mediators of human infectious diseases, emerged in the Western European dominated Europe/world [35]. This hypothesis argued that physical space and seasonal/calendar-associated meteorological events had negligible impact on the mechanism of human infectious diseases. Said hypothesis is termed the *exogenous hypothesis* of human infectious diseases, as a foreign agent, and not mere transformation of the host, mediates disease. The *exogenous hypothesis* of human emerging viral infectious diseases is based on a fundamental assumption that all emerging infectious agents are of foreign origin [5]. Emerging evidence as codified in the prion hypothesis has refuted said assumption that all human infectious agents are of foreign origin, as prion infectious agents results from transformation of normal human gene products (misfolded protein), albeit the transforming agent remains to be determined [37, 38]. Importantly, recent evidences demonstrate that human viruses, including Filoviruses (i.e. Ebola and Marburg viruses) and Flaviviruses (i.e. Zika virus) have endogenous viral fragments in animal genomes, including humans [39-43]; this is in addition to the approximately 8% of the human genome that is composed of endogenous retroviruses [44]. Furthermore, recent evidences demonstrate that endogenous viruses (i.e. endogenous retroviruses) play a critical role in modulating normal biological processes [44]. These evidences are inconsistent with the hypotheses that foreign infectious agents that recently "spilled-over" from zoonotic reservoir species mediate emerging viral infectious diseases. Importantly,

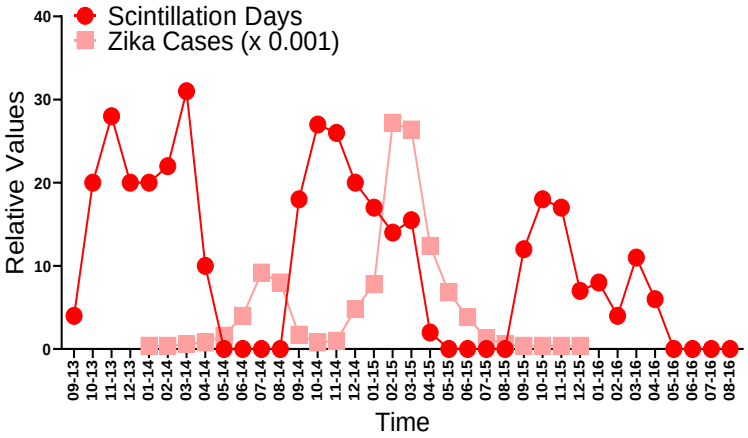

Figure 7: The temporal relationship between ionosphere scintillation and the Zika viral disease. The ionosphere scintillation was examined in Northeast (Recife), and compared to the number of Zika viral disease cases in the Northeast over the same time period.

it is well established that EVD and ZVD outbreaks exhibits seasonal/calendar-associated outbreaks, whose dynamics mimics spatiotemporal waves; said dynamics is not adequately reconciled with the *exogenous hypothesis* of human emerging viral infectious diseases [6]. Additionally, several evidences have demonstrated widespread Ebola virus infection (based on seroprevalence survey) across equatorial Africa, prior to EVD outbreak or no recorded EVD outbreak in said regions [45], an adequate explanation for said differential disease outbreak outcomes is lacking.

To address the above discussed inconsistencies, a *modified-endogenous hypothesis* is proposed, in which human emerging viral infectious disease outbreaks are mediated by ultra-low/very-low frequency (VLF)-electromagnetic (radio) waves [46] emanating from the lithosphere (Figure 8, [21, 47, 48]), with said radio waves inducing transformation of endogenous viruses in the human genome and/or associated gene products, resulting in the emergence of infectious viruses, which are capable of replication in the host or transfer and replication in another host (transmission), albeit modulated by host defense. Additionally, this publication hypothesize that electromagnetic perturbations associated with the Large Low Shear Velocity Provinces (LLSVPs) at the Earth's core-mantle boundary (i.e. African-LLSVP), plays a critical role in mediating the ultra-low/very-low frequency-electromagnetic (radio) waves in the lithosphere that induce emerging viral infectious disease outbreaks [49]. Furthermore, electromagnetic perturbations in the lithosphere, atmosphere, and ionosphere are modulated by electromagnetic dynamics associated with the core-mantle region beneath [49, 50], and also the magnetosphere [51] and Sun [52, 53] above. The *modified-endogenous hypothesis* also extends to other animals (i.e. mosquitoes, pigs, rodents, bats) as recent evidence has demonstrated that endogenous viruses are also present in the genomes of those species. The barrier to very-low frequency electromagnetic (radio) waves-induced transformation most likely differs for each specie, thus radio waves-induced infectious agents in other animals can be transmitted to humans, resulting in replication of said infectious agents and associated human emerging viral infectious diseases. The relative importance of radio waves-induced endogenous infection versus transmission of infectious agents is dependent on the specific infectious disease and the geophysical and seasonal/calendar-associated meteorological events of said physical space.

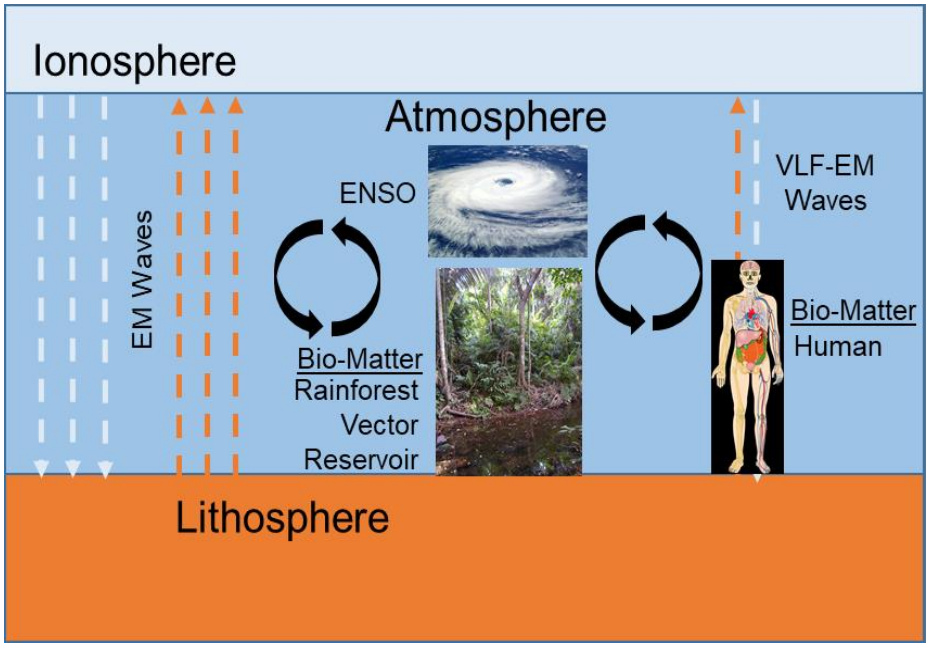

Figure 8: A modified lithosphere, atmosphere and ionosphere electromagnetic coupling (LAIC) model including humans. A proposed modification of Kuo et al model of electromagnetic coupling between the ionosphere, atmosphere and lithosphere, wherein, the lithosphere magnetic field (orange) induces aberrant ultra-low/very-low frequency (VLF) electromagnetic (radio) waves (orange arrows) after sunset, which can interact with active matter (bio-matter) (i.e. humans, other animals (vectors, reservoirs), plants), resulting in aberrant transformation of the host genome and tissues and the emergence of infectious viruses (from endogenous virus fragments) and disease. The aberrant low frequency electromagnetic (radio) waves are associated with excited-magnetic anomalies, mediated by electromagnetic perturbations associated with Large Low Shear Velocity Provinces at the Earth's core-mantel boundary, which are triggered by calendar–associated meteorological events (i.e. El Niño Southern Oscillation-ENSO) and associated electrodynamics. Note: Images were obtain from Creative Commons.

The *modified-endogenous hypothesis* is based on the fundamental principles of active (biological) matter, which posits that biological dynamics (i.e. molecular interactions, pathophysiology) are ultimate manifestation of interactions between atoms involving fundamental physical forces [13, 54, 55]. Human-active matter

conducts electrical signals (i.e. lighting-mediated biological dynamics) emanating from the physical space; therefore, emerging viral infectious disease outbreaks can be model via electromagnetic perturbations in the h-LAIC model, and the tools of Quantum theory can be employed, as the dynamics mimics a “vibrating drum head”. Importantly, the dynamics of atoms (matter) is accurately described via the wave-paradigm of Quantum theory, albeit an alternative particle-paradigm of Quantum theory is also equally valid; thus the wave–particle duality of matter. The *modified-endogenous hypothesis* is consistent with African-Indigenous Knowledge hypothesis of human emerging viral infectious diseases and associated indigenous public health strategies. It can be argue that African-indigenous public health strategies employed “Time, Distance, and Shielding” as the primary means of preventing and controlling infectious disease outbreaks. In indigenous African societies, significant restrictions are imposed on activities at nighttime, which is the time period associated with ionosphere scintillations, thus limiting exposure time to very-low frequency electromagnetic (radio) waves (Time) emanating from the lithosphere. Additionally, significant restrictions are imposed on activities at specific geographic locations (Distance), such as forests regions and bodies of water. Viral hemorrhagic fever disease outbreaks (i.e. EVD outbreaks) are generally associated with said locations and provides a portal though which radio waves can reach the surface, as crustal regions composed of clay are potent attenuators of electromagnetic waves [56], and said locations (i.e. rivers, lakes) have relatively lower clay content in the soil. Recent evidence suggest that African tribes in the Limpopo River valley basin burned clay material in their habitable/communal spaces during periods of aberrant climate conditions and associated disease outbreaks, thereby “trapping” the aberrant magnetic perturbations (Shielding) associated with said periods [17]. Although said intervention measures are generally assumed to be superstitious and primitive; in light of the evidence provided in this publication, said practices are re-interpreted as highly effective means of attenuating (Shielding) the radio waves emanating from the lithosphere, and thereby preventing and/or controlling emerging viral infectious disease outbreaks. In most indigenous African societies, including the tribes in the Limpopo River valley basin, clay is the predominant material employed in constructing habitable/communal spaces (Shielding), as said material is highly effective in attenuating electromagnetic waves [17]. The aberrant magnetic perturbations of the period between A.D. 1225 to 1550 was temporally associated with several global pandemics (i.e. Black Death, cocoliztli), aberrant climate conditions across the entire world [17]. Consistent with this observation, a recent report has argued that “Black Death” syndrome is more closely related to viral hemorrhagic fever disease [57]; it is also suggested that the “cocoliztli syndrome” is a viral hemorrhagic fever disease [58]. Evidence suggests that the magnetic anomalies of A.D. 1225 to 1550 was associated with significant activity of the South Atlantic Anomaly, which spans from South America to Africa [17].

The current major perturbations of the Earth’s magnetic field is also associated with significant perturbations of lithosphere magnetic anomalies across the world, including the Americas, Africa, Europe and Asia; said perturbations are hypothesize to be mediated by current severe perturbations in the South Atlantic Anomaly [40]. The current perturbations of the lithosphere-magnetic field in North America are notably significant in Appalachia, Florida, the Midwest, Mountain west, and the Southwest (Sebera, Josef et al, 2018, Conference Proceedings, EGU2018); incidentally, these region are the most affected by the ongoing illicit drug epidemic, suggesting that very-low frequency electromagnetic (radio) waves could also affect human brain/behavior. Of importance, the microcephaly cases from Northeast Brazil during the Zika epidemic was associated with significant bio-mineralization in the brain (calcium deposits) [59]. Said bio-mineralization/crystallization has also been observed in another neurocognitive/brain disease in the equatorial belt (Nodding Syndrome) [60], suggesting bio-mineralization/crystallization could be a possible additional mechanism by which ultra-low/very-low frequency electromagnetic (radio) wave induce human tissue pathology. Said ultra-low/very-low frequency electromagnetic (radio) wave induce pathogenesis could also explain the long-term neurocognitive/sensory pathology associated with EVD [61-63]. Although human infectious disease burden in North America is in very low, emerging evidences suggests that wildlife populations are increasing affected by emerging infectious diseases. For example, the Midwest region, which has experience significant perturbations in the lithosphere-magnetic field, has also experience an increase in prion infectious diseases in wildlife (chronic wasting syndrome), with recent evidences suggesting the spatial dynamics of said disease is associated with the clay content of the soil in the affected regions [64]. These evidences suggests that the h-LAIC model and could also be employed in modeling emerging infectious diseases and other human diseases in the Northern (and possibly Southern) hemispheres.

In summary, this publication proposes a novel framework for modeling human emerging viral infectious disease via the dynamics of the electromagnetic force, and demonstrates that insights into the fundamental nature of human diseases can be obtained from Indigenous Knowledge. Future studies should rigorously examine if this novel hypothesis can be extended to other infectious diseases (i.e. bacterial infectious diseases) and emerging diseases (i.e. Acute flaccid myelitis, Havana syndrome).

Material and Method

Briefly, the data from Global Navigation Satellite System (GNSS), namely GPS, GLONASS, Galileo, and BeiDou-2 were analyzed by FUGRO to determined ionosphere scintillation (Yahya Memarzadeh, NOAA Space Weather Workshop, 1-5 May 2017, Broomfield Colorado USA). TEC trends in Africa were approximated from IGS's GIMS as analyzed by Geoffrey Andima et al, 2019 [65]. The world lithosphere magnetic anomaly maps were developed by an international consortium utilizing satellite, ship, and airborne magnetometer platforms. The World Digital Magnetic Anomaly Map (WDMAM) is published in Erwan Thébault et al, 2009 [24]. The EMAG2v3: Earth Magnetic Anomaly Grid (2-arc-minute resolution) was developed by Brian Meyer et al, 2017 [66] and is available as an ArcGIS web platform (https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=6717e58b755b41298dc623d8fdc967dc) and the Central Africa-Vertical Field Anomoly map was developed by K. Hemant, 2005 [67]. The lithosphere/crustal magnetic anomaly map (CHAMP data) and model (vertical field) was develop by K. Hemant and S. Maus, 2005 [67]. The trend of the Africa lithosphere magnetic anomaly was developed by Sebera, Josef et al, and published at the 20th EGU General Assembly, EGU2018, (Proceedings from the conference held 4-13 April, 2018 in Vienna, Austria, p.19034) . The West Africa Magnetic anomaly map was developed by Nicolas Launay et al, 2018 [68]. The Uganda magnetic anomaly map was developed by Tapio Ruotoistenmäki, 2014 [69]. The equatorial-ionosphere wave over Brazil in 2015 was developed by Fabricio Dos Santos Prol et al, 2018 [70]. Viral hemorrhagic fever disease maps were developed by Institute for Health Metrics and Evaluation at the University of Washington, which were based on David M Pigott, et. Al 2016 [71] (https://vizhub.healthdata.org/lbd/pandemics/). The West Africa-EVD map and data (including Central Africa-EVD outbreak data) was developed by the World Health Organization (WHO) (https://www.who.int/csr/disease/ebola/maps/en/). The mosquito vector map for Zika viral disease transmission was developed by Moritz UG Kraemer et al, 2015 [72]. The Zika epidemic data was obtained from Monica C. Campos et al, 2018. All data were analyzed using graphpad Prism software.

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