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Deforestation, Air Pollution And Brasiliant Covid-19 Variant

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ABSTRACT

Aim of this work is to submit to the researcher the relationship whit climate condition, air pollution and deforestation in MANAUS zone in BRAZIL and the rapid spread of so called BRASILIAN COVID-19 VARIANT. Also other situation area analized like south Africa variant. This topics of research make possible to better study the phenomena of new Covid-19 VARIANT explosion And related effect on increase velocity in spread and in increased mortality rate in some region of the world. The ability of this variant to elude immune system need to seek also in environmental toxicology some Response.

1. Introduction

Related actual spread of so called BRASILIAN VARIANT COVID-19 in region of MANAUS and to its specific mortality rate and velocity in diffusion it is interesting to observe the impact of some phenomena like air pollution due by also deforestation and fraudulent fire. Researchers find very high rates of COVID-19 in the Brazilian Amazon (dec 2020):university of Oxford news. “By testing approximately 1,000 blood donation samples each month in in the Brazilian -cities of São Paulo and Manaus, an international team of researchers have shown that, while both cities have experienced large epidemics of COVID-19 with high -mortality, as much as three-quarters of the population in Manaus was infected between March - October, and a third of the population in São Paulo.

According Healthcare & Pharma, May 8, 2020. As deaths mount in Brazil’s Amazon, official COVID-19 toll under scrutinyBy Jake Spring, Eduardo Simões, Bruno Kelly: The largest of 9 states in Brazil’s Amazon rainforest, Amazonas has registered nearly 19.4 coronavirus- deaths per 100,000 residents, compared to 4.4 for all of Brazil, according to a Reuters-calculation based on the death toll released by the federal Health-Ministry on Thursday. The corona virus COVID-19 killed 422 people in Amazonas in April, according to the ministry. Yet death registry data from public -notaries indicates the ministry’s statistics may far underestimate the actual toll.”

The Guardian, Jan 2021:

Covid-19 eruption in Brazil’s largest state leaves health workers begging for help. Amazonas, and particularly its riverside- capital Manaus, were pummeled by the epidemic’s first- wave last April, when authorities were forced to dig mass graves for victims” And from: Monitoring air pollution from fires 09/09/2019

ESA / Applications / Observing the Earth / Copernicus / Sentinel-5P

The wildfires that have been devastating the Amazon- rainforest

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have been international headline news over the last weeks. These fires are not only an environmental tragedy in terms of lost forest and biodiversity, but they are also leaving their mark on the atmosphere, affecting air- quality and, potentially, the global- climate.

The satellite -carries the state-of-the-art Tropomi instrument to map a multitude of trace gases such as nitrogen dioxide, ozone, formaldehyde, sulphur dioxide, methane, carbon- monoxide and aerosols – all of which affect the air we breathe.

It is really interesting that in this region it is observed a great and rapid diffusion of covid-19 NEW VARIANT Whit great influence in public heath of population.

Form website :https://www.attoproject.org/about-atto/location/

ATTO - Amazon Tall Tower Observatory

Earth system research in the Amazon rainforest

"In this part of the world, the predominant wind- direction is North-East, due to trade winds blowing from the Atlantic Ocean. This puts ATTO upwind from Manaus and its air- pollution. Air masses reaching the site from to the North-East are near-pristine, mainly unaffected by human activities. The closest cities in that direction are Santarém and Belém, at distances of 500 and 900 km away. The rest of the area is covered in rainforest. But this is only true during the wet- season.

During the dry- season, the wind direction shifts more often to East and South-East. Air masses from this direction pass over agricultural -areas and regions more affected by deforestation. Additionally, this is the time of year when the frequency of natural and man-caused fires increases. Thus, the wind brings more pollutants to ATTO.

These contrasting regimes allow us to compare a near-pristine atmosphere to one notably influenced by human- activity."

According article: Air Pollution (S Wu, Section Editor) 24 May 2015 Fire Influences on Atmospheric Composition, Air Quality and Climate. Apostolos Voulgarakis & Robert D. Field Current Pollution Reports.

Fires can have wide-ranging effects on surface ai-r quality, both in the tropics and extra-tropics (see earlier section). In general, health effects of key anthropogenic pollutants such as particulate- matter (i.e. aerosols) and ozone have been investigated extensively, with some studies even documenting global- effects.

There are both gaseous and aerosol- emissions from fires and associated biomass burning. Carbon- dioxide (CO_2), carbon monoxide (CO), nitrogen oxides (NO_x) and non-methane volatile organic compounds ($NMVOC_s$) are the most important emitted- gases, while black carbon (BC) and organic carbon (OC) are the most important aerosol- species. CO_2 emissions can have important implications for CO_2 concentrations and understanding the carbon- cycle but do not directly affect atmospheric chemistry or contribute to air quality degradation. Other carbonaceous- emissions (BC, OC, CO, $NMVOC_s$ and methane (CH_4), for which biomass burning is only a minor source) and NO_x can be important for both air pollution/chemistry and climate. NO_x, $NMVOC_s$, CO and methane are important precursors of tropospheric -ozone, which is a secondary- pollutant and is not directly emitted by fires. For the Bra-

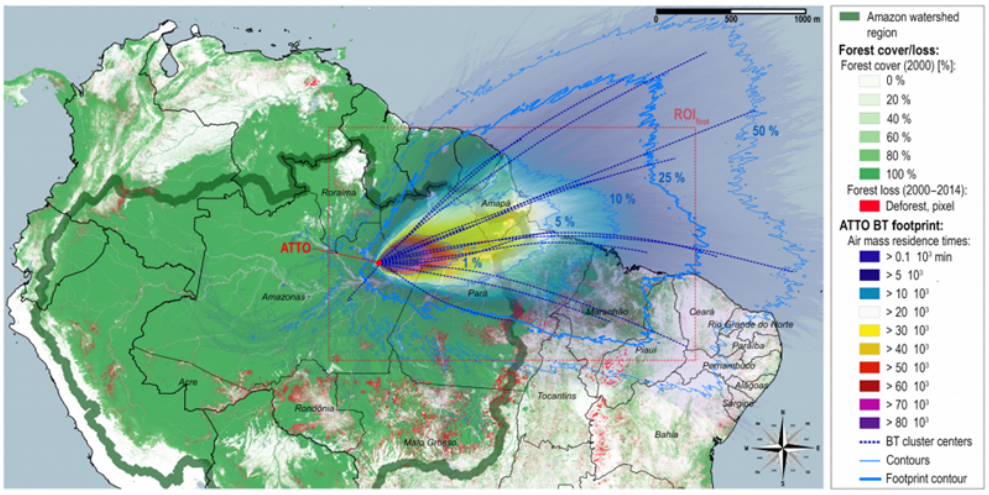

Figure 1: Brazil Situation

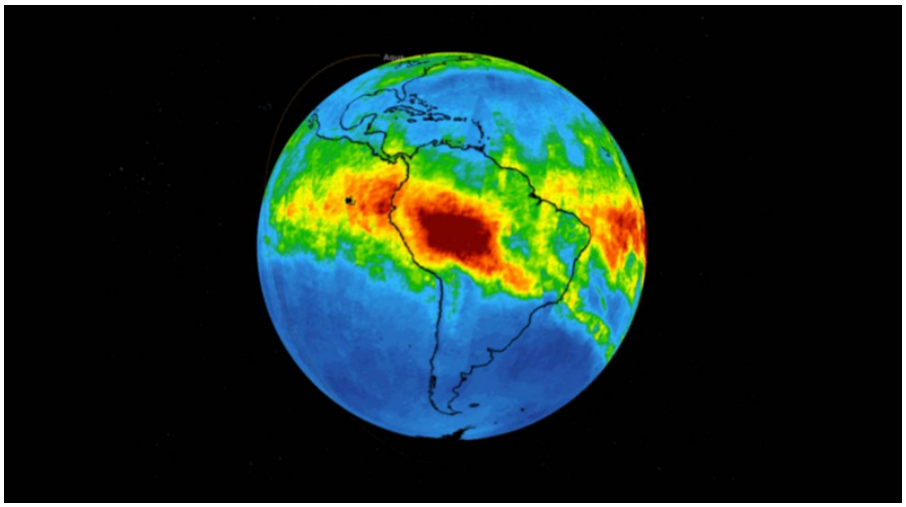

Figure 2: Fire in Amazon Forest From NASA

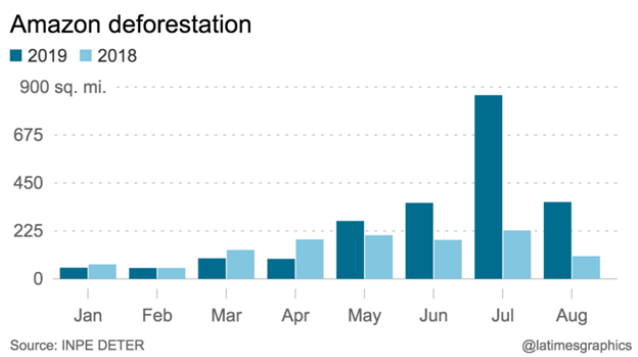

Figure 3: Amazon Deforestation

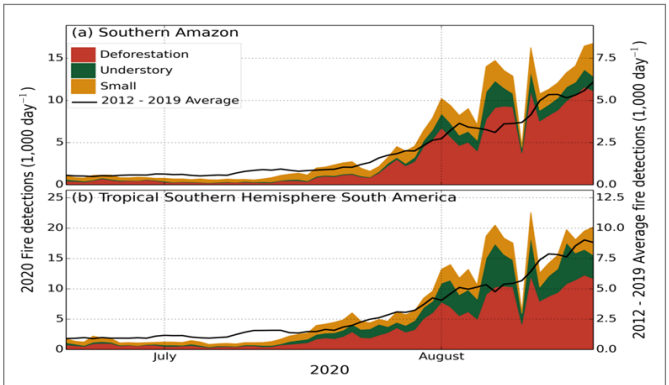

Figure 4: Deforestation south America

Figure 5: Amazon Forest Fire

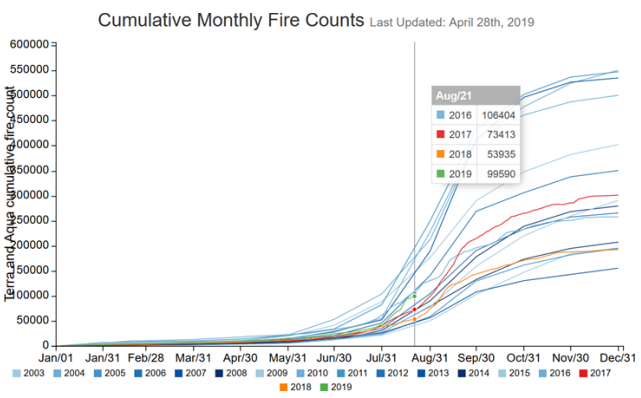

Figure 6: Amazon Fire

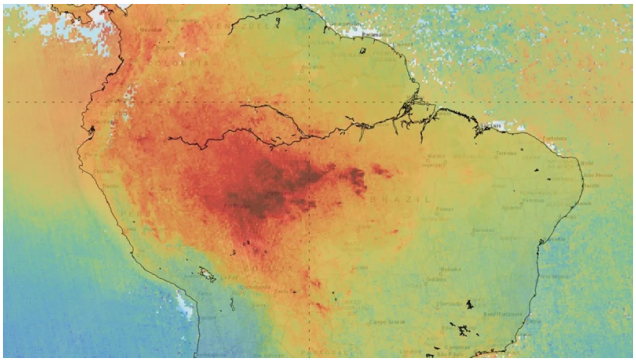

Figure 7: Amazon Forest Fire

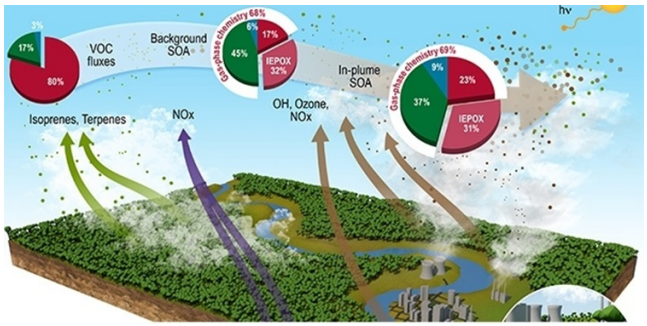

Figure 8: MANAUS pollution system This phenomenon affects cloud production and rainfall, with consequences for the local and global-climate, which researchers have warned about in the study published in Nature- Communications (image: Nature Communications)

zilian Amazon, using surface in situ measurements, it was found that concentrations of submicron aerosols reached 100 μg m−3 during biomass burning events in September/October 2012, with organic -aerosols largely dominating the aerosol mass.

2. Material and Methods

With an observational and visual methods some maps and figure are submitted to the researcher in order to show relationship if present between some air pollution condition , deforestation of amazon and the rapid spread of BRASILIAN COVID-19 NEW VARIANT. A scientific literature search is performed to list article of interest for the scope of this work. All publications comes from scientific database or other relevant publishers. It is also submitted an RESEARCH PROJECT as instrument to verify the hypotesys under investigation and relationship. After this phases a global conclusion is produced.

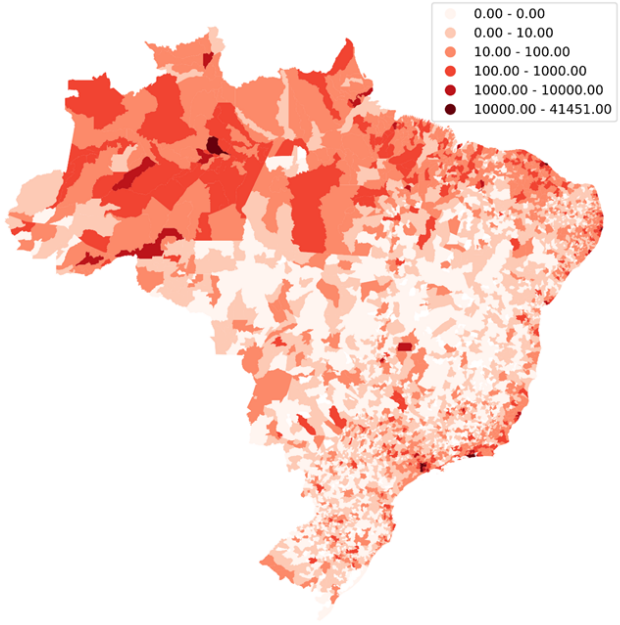

Figure 9: COVID. CASES BRAZIL sept 2020

3. Results

From literature:

According to an article on the study published in Nature -Communications, urban -pollution results in an average increase of 200% in the formation of secondary organic- aerosols, with spikes of up to 400%. FAPESP supported the study as part of the Green- Ocean Amazon Experiment (GOAmazon) and a Thematic Project linked to the Research Program on Global Climate Change (RPGCC). Pollution from Manaus increases the formation of aerosols via the forest itself. NOx emitted from Manaus increases the levels of OH and ozone (brown- arrows), which accelerates the oxidation of carbon naturally- emitted by the forest in the forms of isoprene and terpene (green- arrows). In the absence of urban pollution, soil emissions of NOx (purple arrows) also drive the oxidation cycle but at far lower levels. [1].

Manish Shrivastava, *et al*., One of the least understood aspects in atmospheric -chemistry is how urban- emissions influence the formation of natural organic- aerosols, which affect Earth's energy budget. The Amazon rainforest, during its wet season, is one of the few remaining places on Earth where atmospheric- chemistry transitions between pre-industrial and urban-influenced conditions. Here, we integrate insights from several laboratory measurements and simulate the formation of secondary -organic aerosols (SOA) in the Amazon using a high-resolution chemical transport model. Simulations show that emissions of nitrogen-oxides from Manaus, a city of ∼2 million people, greatly enhance production of biogenic SOA by 60–200% on average with peak-enhancements of 400%, through the increased oxidation of gas-phase organic carbon- emitted by the forests. Simulated enhancements agree with aircraft measurements, and are much larger than those reported over other locations. The implication is that increasing anthropogenic-emissions in the future might substantially enhance biogenic- SOA in pristine locations like the Amazon [2].

Researchers from Imperial's COVID-19 Response Team, and a team of international collaborators found that: 76% population in Manaus became infected with SARS-CoV-2 between March and October- 2020. In contrast, they find that 29% became infected in São- Paulo, the first city detecting SARS-CoV-2 circulation in Latin-America [3].

This variant, known as P.1 or VOC202101/02 in the UK, was first detected in travellers from Brazil who arrived in Japan in January 2021. It involves 17 unique amino acid changes, three deletions, four synonymous -mutations, and one 4nt insertion. It has several mutations that are known to be biologically- important, including E484K and N501Y.

The N501Y- mutation, which is also a feature of the English- variant, has been linked to increased infectivity and virulence in mouse models. Mean while, the E484K mutation is thought to be associated with escape from the neutralizing- antibodies produced by the body against SARS-CoV-2.3 This mutation is present in the South- African variant as well [4].

Since the emergence of the coronavirus disease 2019 (COVID-19), a few cases of reinfection with phylogenetically distinct variants of SARS-CoV-2 have been reported . These re-infection cases might be the consequence of a limited and transitory protective immunity induced by the primo-infection or might reflect the reinfecting virus's ability to evade the previous immune- responses. The rapid -spread in the United Kingdom and South Africa of emerging SARS-CoV-2 variants carrying several mutations in the receptor-binding domain (RBD) of the spike (S) protein (2,3) granting them the title of Variants of Concern (VOC). Among these mutations, E484K and N501Y are of particular concern since they potentially- reduce antibody neutralization and increase affinity for ACE2 receptor (4-10). Of note, the first official record of a reinfection case with the emerging VOC B.1.1.7 circulating in the UK was recently published [5].

The P.1 variant has so far only been identified in Brazil, and in travellers from Brazil (mostly from the Amazonas- State) reported in Japan and South- Korea. The capital of Amazonas, Manaus, is currently experiencing an upsurge in COVID-19 cases, putting significant pressure on the healthcare- system.

ECDC assesses the probability of the introduction and community-spread of variants of concern in the EU/EEA as very high due to their increased- transmissibility. Such an increased transmissibility is likely to lead to an increased number of infections. This, in turn, is likely to lead to higher hospitalisation and death rates across all age-groups, but particularly for those in older- age groups or with co-morbidities. Consequently, stricter NPIs are needed to reduce transmission and relieve the pressure on healthcare -systems. Therefore, the impact of introduction and community spread is considered to be high. The overall risk associated with the introduction and community- spread of variants of concern is therefore assessed as being high/very high [6].

Fire incidence increased by 36% during the 2015 drought compared to the preceding 12 years. The 2015 drought had the largest ever- ratio of active fire counts to de-forestation, with active fires occurring over an area of 799,293 km^2 [7].

Oliveira, *et al*. (2020) and Rocha and Sant'Anna (2020) argue that the fires from the increasing deforestation, combined with the drought and wild-fires, worsens respiratory-health risks, including the COVID-19 cases, increasing the demand for health-services and the locomotion to cities [8].

Gabriel de Oliveira, a post-doctoral researcher with Professor Jing-Chen in the department of geography and planning in the University of Toronto's Faculty of Arts & Science, says breathing- difficulties and respiratory challenges brought on by the coronavirus are being exacerbated by the ecological crisis that had been developing in the Amazon over several- years [9].

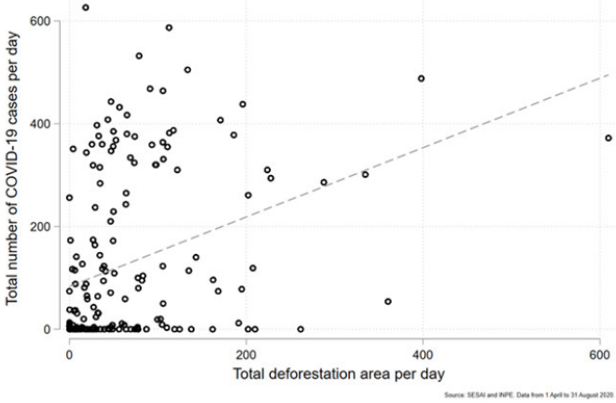

Figure 10: Deforestation and Covid-19 cases Amazon

Deforestation is a powerful and consistent variable in explaining the transmission of COVID-19coronavirus to Indigenous populations [10].

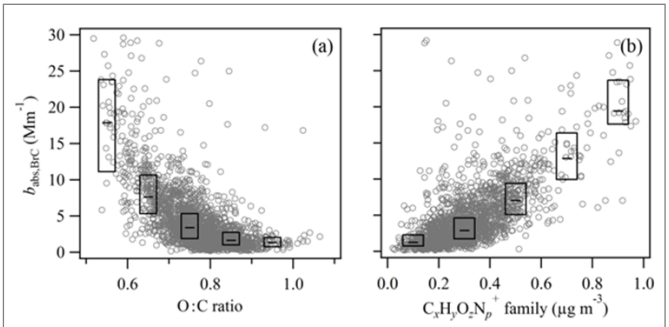

Figure 11: In the Amazon region, particles from biomass burning and urban -pollution account for ca. 30 % of all particulate matter, while the rest comes from biogenic- sources. The team also found a much higher overall concentration of particulate- matter PM during the dry season. This is in part because of the increase in particles from anthropogenic- sources. But the amount of particles from biogenic -sources also increases during that time. But even though the anthropogenic fraction of particulate matter is relatively low, they absorb much more light than biogenic- particles do. This, in short, makes the air warmer. Biogenic particles reflect more light, counteracting the greenhouse effect to some degree.

The paper was recently published in Atmospheric Chemistry and Physics and is available Open Access: 10.5194/acp-19-7973-2019.

Black -carbon is an air pollutant that is harmful to human- health and also contributes to global- warming. It is emitted in combustion processes, for example in industry, power- plants and diesel engines, through the burning of wood and waste, and in wildfires in forest and grassland areas. In southern- Africa, the Johannesburg/Pretoria Metropolitan -Area is particularly affected by air pollution. The main pollution sources there are coal-fired power plants, open fires and savanna fires [12].

Fast-Spreading Lineage

Much of the concern centres around a variant that researchers identified in South -Africa in late 2020. A team led by Tulio de Oliveira, a bio-informatician at the University of KwaZulu-Natal in Durban, South-Africa, linked the variant — called 501Y.V2 — to a fast-growing epidemic in Eastern Cape province that has since spread across South- Africa and into other countries. The lineage carries many mutations in the SARS-CoV-2 spike protein — the immune- system's prime target, which allows the virus to identify and infect host cells — including some changes linked to weakened antibody -activity against the virus [13].

Globally, numerous pollution- hotspots have been identified using satellite-based instruments. One of these hot-spots is the prominent NO_2 hotspot over the South- African Highveld. The tropospheric NO_2 column density of this area is comparable to that observed for central and northern- Europe, eastern North America and south-east Asia. The most well-known pollution source in this area is a large array of coal-fired power stations. Upon closer inspection, long-term means of satellite observations also show a smaller -area, approximately 100 km west of the Highveld hotspot, with a seemingly less substantial NO_2 column density. This area correlates with the geographical location of the Johannesburg-Pretoria conurbation or megacity, one of the 40 largest metropolitan- areas in the world. Ground-based measurements indicate that NO_2 concentrations in the megacity have diurnal- peaks in the early morning and late afternoon, which coincide with peak traffic hours and domestic combustion. During these times, NO_2 concentrations in the megacity are higher than those in the Highveld -hotspot. These diurnal NO_2 peaks in the megacity have generally been overlooked by satellite observations because the satellites have fixed local overpass times that do not coincide with these peak- periods. Consequently, the importance of NO_2 over the megacity has been underestimated. We examined the diurnal cycles of NO_2 ground-based measurements for the two areas - the megacity and the Highveld hotspot - and compared them with the satellite-based NO_2 observations. Results show that the Highveld hotspot is accompanied by a second- hotspot over the megacity, which is of significance for the more than 10 million people living in this mega-city [14].

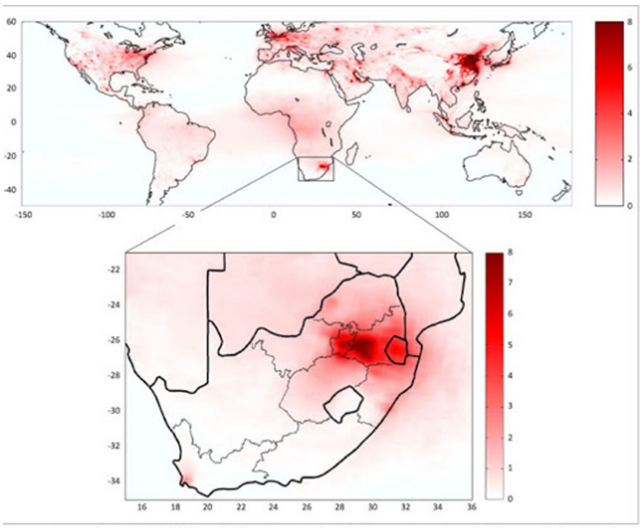

Figure 12

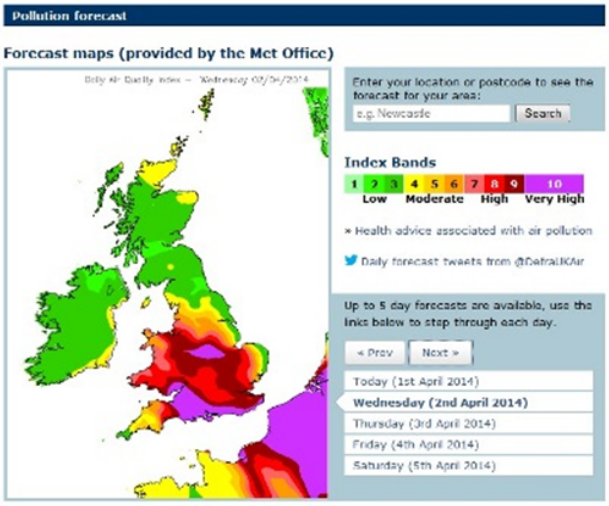

Figure 13: UK Air Pollution

Figure 14: UK New Covid -19 Variant Dec. 2020

Form ECDC: "Viruses constantly change through mutation, and so the emergence of new- variants is an expected occurrence and not in itself a cause for concern; SARS-CoV-2 is no exception. A diversification of SARS-CoV-2 due to evolution and adaptation- processes has been observed globally. While most emerging mutations will not have a significant- impact on the spread of the virus, some mutationsor combinations of mutations may provide the virus with a selective -advantage, such as increasedtransmissibility or the ability to evade the host immune response. In such cases, these variants could increasethe risk to humanhealth and are considered to be variants of concern.

New- variants of current concernThe United Kingdom has faced a rapid increase in COVID-19 case rates in the South-East, the East andthe London- area, which is associated with the emergence of a new SARS-CoV-2 variant, VOC 202012/01. As of 26 December 2020, more than 3 000 cases of this new- variant, confirmed by genome sequencing, have beenreported from the UK. An increasing proportion of cases in the South East, the East and the London- area aredue to this variant, but cases have also been identified in other parts of the UK. Although it was first reportedin early December, the initial cases were retrospectively identified as having emerged in late -September.

Preliminary analyses indicate that the new- variant has increased transmissibility compared to previously Circulating- variants, but no increase in infection -severity has so far been identified. Since 26 December, a fewVOC 202012/01 cases have also been reported in other EU/EEA countries (Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, the Netherlands, Norway, Portugal, Spain and Sweden) and globally(Australia, Canada, Hong Kong SAR, India, Israel, Japan, Jordan, Lebanon, South Korea, Switzerland, Singapore). In addition to VOC 202012/01, South Africa has reported another SARS-CoV-2 variant, designated as 501.V2, which is also of potential concern. This variant was first observed in samples from October, and since then more than 300 cases with the 501.V2 variant have been confirmed by whole- genome sequencing (WGS) in South Africa, where it is now the dominant- form of the virus. Preliminary results indicate that this variant may have an increased transmissibility. like the VOC 202012/01, at this stage there is no evidence that 501.V2 is associated with higher- severity of infection. On 22 December 2020, two geographically separate cases of this new variant 501.V2 were detected in the UK. Both are contacts of symptomatic individuals returning from travel to South -Africa. On 28 December 2020, one additional case of this new variant was detected in Finland in a returning traveller from South –Africa [15].

According Preprint: Allison J., et al., The evolution of SARS-CoV-2 could impair recognition of the virus by human antibody-mediated immunity. To facilitate prospective -surveillance for such evolution, we map how convalescent serum antibodies are impacted by all mutations to the spike's receptor-binding domain (RBD), the main target of serum neutralizing- activity. Binding by polyclonal serum antibodies is affected by mutations in three main- epitopes in the RBD, but there is substantial variation in the impact of mutations both among individuals and within the same individual over time. Despite this inter- and intra-person heterogeneity, the mutations that most reduce antibody- binding usually occur at just a few sites in the RBD's -receptor binding motif. The most important site is E484, where neutralization by some sera is reduced >10-fold by several mutations, including one in emerging viral- lineages in South Africa and Brazil. Going forward, these serum escape maps can inform surveillance of SARS-CoV-2 evolution [16].

Experimental Project Hypothesis

In order to verify association between air pollution level and new covid-19 variant it is crucial to collect epidemiological data related this virus spread , mortality rate , cases and the data related air pollution.

Period of observation

2020-2021 (first wave, second wave).

Variant to be observed

significant variant responsible of increased spread and mortality rate (about more then 20- 30%) .

After this epidemiological and environmental toxicology data collection is possible to verify if there is or not a significant correlation. Another data to be collect is related human factor artificial air pollution production (yes or not) in order to verify antropogenic effect.

Table 1

Region	High Air Pollution	New-COVID Variant
Wuhan	yes	
North Italy	yes	
UK South	yes	Yes
Manaus- Brasil	yes	Yes
South Africa	yes	Yes

CHI-Square Statistic Test

Clarification

In this scheme some definition are used: (arbitrary choose by authors)

High air pollution

30, normal level 1

Presence of variant

2, absence: 1

Results

	South UK	Manaus	South Africa	Madagascar	Italy Great Isle	*Row Totals*
High air pollution	30 (29.44) [0.01]	30 (29.44) [0.01]	30 (29.44) [0.01]	1 (1.84) [0.38]	1 (1.84) [0.38]	92
variant	2 (2.56) [0.12]	2 (2.56) [0.12]	2 (2.56) [0.12]	1 (0.16) [4.41]	1 (0.16) [4.41]	8
Column Totals	32	32	32	2	2	100 (Grand Total)

The chi-square statistic is 9.9864. The *p*-value is .040657. The result is significant at $p < .05$.

Discussion

From literature it is clear the impact of air pollution in the spread of COVID-19 especially due by carriers like PM 2,5, PM 10 but also due by the pro inflammatory effect of some pollutant s in respiratory tract (NO_2, ozone and other).

It is also clear that fire and burn in some amazon forest produce an increase of air pollutants and also CO2 production.

Observing the images related amazon fire and burns, air pollution in zone like MANAUS and the prevalence of a new variant of COVID -19 need some consideration.

It is possible that some aggravating environmental factors increase the probability of selection of new covid-19 variant?

To give response in this question it is interesting to observe the new VARIANT OF covid-19 , the country and region of origin and related air pollution level (UK VARIANT, SOUTH AFRICA VARIANT) .

Conclusion

The high mortality rate in some Brazilian region , the rapid spread of new dangerous covid-19 variant Must to be studied considering also the air pollution as modified in last year. Fire that seem artificially produced. It is possible that great foci of covid -19 spread comes from great polluted region ? (WU-HAN, North Italy , south Africa and so on). Observing the maps of air pollution in some region and the related mortality rate make possible to verify if a relationship can be Considered to explain such epidemiological phenomena.

It interesting to observe the high level of air pollution in region high affected by new variant (MANAUS region, UK variant, South AFRICA variant). Air pollution is recognized as a worsening environmental toxicological factor that affect spread and mortality rate but it is interesting verify also if it can be a kind of pressure in selecting new variant.

Clarification

This work is produced without any therapeutic or diagnostic intent only to submit to the researcher hew hypotesys of work

Conflict of Interests

None

Ethical Consideration

This work is produced under all international rules of ethical consideration

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