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Correlating key climate change variables and spread of Covid-19 pandemic in India- A critical review

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Abstract - According to a visual study of globe maps, nations closer to the equator, where heat and humidity are more common, have a lower prevalence of coronavirus illness 2019 (COVID-19). Many variables complicate the link between COVID-19 and climate, thus scientists are divided on how to interpret this finding. It is important to compensate for characteristics such as air travel, automobile concentration, urbanisation, COVID-19 testing intensity, cell phone use, income and old-age dependency ratio when calculating the logarithm of confirmed COVID-19 cases per million people in a nation. Cases per million people increased by 4.3% as of January 9, 2021, when a one-degree rise in absolute latitude was taken into account. Our findings suggest that a nation that is 1000 kilometres closer to the equator should expect a 33% decrease in incidents per million people. It is reasonable to assume a 64 percent difference in instances per million people between two hypothetical nations whose temperatures shift to a comparable level as two nearby seasons since the Earth's tilt toward the sun changes by 23.5 degrees between spring and fall. According to our findings, new cases of COVID-19 should decrease in the summer and rise in the winter in most nations. However, our findings do not mean that the disease would disappear during the summer or that it will not afflict nations located close to the equator in the near future. SARS-CoV-2 containment efforts may be aided rather than hindered by summer's higher temperatures and more intense UV radiation.

Keywords - Correlating key, variables, spread, Covid-19, pandemic

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INTRODUCTION

The famous First Law of Geography states that 'everything is related to everything else, but near things are more related than distant things' (Tobler, 1970).

The rapid spread of the COVID-19 pandemic caused by the severe acute respiratory syndrome (SARS)-CoV-2 pathogen, which started in Wuhan, Hubei Province, China in December 2019 (World Health Organization (WHO), 2020b) has had devastating global consequences in terms of health and economics. According to the WHO, the current COVID-19 outbreak has 89,707,115 confirmed cases and 1,94,0342 deaths in 219 countries (WHO, 2020a) (as on 12 January 2021).

Global temperatures are on track to increase by at least 3 degrees Celsius towards the end of the century, twice the limit to avoid severe economic, social and environmental consequences. The previous five years (2015-19) were the hottest on record, and the frequency and intensity of natural catastrophes is only growing, as Cyclone Amphan revealed in May 2020. While the world is wrestling with the problems of addressing climate hazards, it has been confronted with another significant health crisis, the continuing epidemic caused to Covid-19. The World Economic Forum's 2020 Global Risks Report considered infectious diseases and pandemics, like Covid-19, as one of the top 10 risks in terms of impact over the next 10 years along with climate change. (Nambi, 2020)

Both the Covid-19 and climate change threats have revealed numerous flaws in our systems, particularly in emergency response, governance, early warnings and forecasts of disease and public health care, and have shown the need for collective action and a paradigm shift in our approach to managing multiple crises. Both pandemics and climate change have been shown by scientific evidence. Two major worldwide threats are depicted in the film, which is

projected to affect both present and future generations.

Since these dangers have serious effects, the scientific community has been warning the public about them.

Climate change has made it impossible to predict what actions may be implemented in the future to reduce the risk of ill health consequences, although the sensitivity of human health to factors of weather and climate is widely established. There are other subtle consequences on health, such as blood pressure spikes caused by drinking water with higher-than-normal salt content, which has become prevalent in coastal locations impacted by saltwater intrusion, that are harder to detect. .In context of the Covid-19 pandemic, we see climate change playing a crucial role in (Nambi, 2020):

- Reducing or eliminating vectors and vector-borne illnesses through changing their geographic and seasonal ranges
- As temperatures rise and precipitation patterns change, mosquitoes that transmit a wide range of viruses and other pathogens are more likely to become infected and spread disease. This is because habitat availability and mosquito and viral reproduction rates are altered as a result of climate change.
- Climate change interacts with many other forces, such as shifting land-use patterns and the consequences for human illness, to produce new or re-emerging vector-borne infections.

As the disease spreads, the financial and societal consequences of a pandemic like Covid-19 rise. Health care systems are put to a great deal of strain, as seen by a number of studies and media stories. In addition, the lockdown results in significant economic losses due to sick leave, messed up schedules, and missed output. Between April and June 2020, India's quarterly GDP is expected to fall by more than 9%. This follows a forecast of 5% growth at the start of 2020. On March 25, the country went into lockdown, the biggest in the world, limiting more than 1.3 billion people. Now till the end of October 2020. Authorities in India believe their economy will be severely damaged if they implement a lockdown, especially in the fields of real estate, professional services, and financial services. In addition to the business community, this has a direct impact on the lives of the poor and disadvantaged.

REVIEW OF LITERATURE

The methods adopted for this review of literature includes a systematic search and review of the recent COVID-19 literature using three databases (Web of Science, PubMed and Google Scholar) to assess the effect of meteorological factors on the COVID-19. In addition, the major findings of the review of literature undertaken by Álvaro Briz-Redón and Ángel Serrano-Aroca (2020) using the Publish or Perish software (Harzing, 2020) was also considered wherein a total of 61 papers were finally available for the review

Álvaro Briz-Redón and Ángel Serrano-Aroca (2020) have under taken a detailed review of literature and mention that the new SARS-CoV-2 coronavirus has spread rapidly around the world since it was first reported in humans in Wuhan, China, in December 2019 after being contracted from a zoonotic source. This new virus produces the so-called coronavirus 2019 or COVID-19. Several epidemiological studies have supported the hypothesis that weather patterns affect the survival and spread of droplet-mediated viral diseases, but the most recent have concluded that summer weather may offer partial or no relief to the COVID-19 pandemic in some regions of the world..... Non-meteorological elements have been incorporated in certain studies, whereas meteorological variables have been the focus of others.

Additional statistical and modelling approaches, such as correlation analyses, generalised linear models, generalised additive models, differential equations or spatio-temporal modelings, were used by the authors in this study. COVID-19's worldwide growth has been studied extensively by the authors in their study, which provides a thorough overview of the most recent research on the subject. Statistical and modelling approaches are also examined in this paper. Inconsistency in results may be due in part to the vast range of statistical and modelling methodologies used, but it appears that the anticipated influence of hot weather on transmission risk is not high enough to contain the pandemic. In this context, we stress the necessity of being aware of the limits of various mathematical techniques, the effect of selecting geographic units, and the need to analyse COVID-19 data with considerable caution. Maintaining limitations against the pandemic, rather than assuming that warm weather and UV exposure will naturally lower transmission of COVID-19, appears to be the recommendation of the assessment..

According to Dalziel et al. (2018), the COVID-19 pandemic appears to be linked to climatic conditions in the same way as other viruses, such as influenza, do. Several other research, on the other hand, have found conflicting evidence suggesting the COVID-19 growth was not caused by weather conditions. Other essential elements, such as population density, which has been demonstrated to be crucial in viral transmissions, have been included in some of these investigations, while others have just addressed climatic conditions (Dalziel et al., 2018).

It was concluded by Baker et al. (2020) that despite a large negative correlation between climate and

coronavirus transmission, it would have little effect on COVID-19 instances due to a high susceptibility population. These latest research also employ a variety of statistical and modelling tools, which need careful analysis.

As with influenza (Shaman and Kohn, 2009), respiratory syncytial virus (Baker et al. 2019; Pitzer et al. 2015) and early evidence from other coronavirus (Baker et al., 2020), it has been proposed that COVID-19 transmission may be slowed by climatic circumstances.

To determine if there is a link between the spread of COVID-19 and any of the climatic factors studied (humidity, precipitation, radiation, temperature, and wind speed), a systematic evaluation of the literature will use studies selected for inclusion in the review.

TEMPERATURE

Temperature and COVID-19 appear to be negatively correlated. Globally, a negative correlation was found (Arumugam et al., 2020; Caspi et al., 2020; Chiyomaru and Takemoto, 2020; Notari, 2020; Pirouz et al., 2020; Sajadi et al., 2020; X Wu et al., 2020; Yu, 2020) as well as in California (Gupta and Gupta, 2020), Japan, Ghana, Spain, Italy, Italy, and China (Oliveiros et al., 2020; Qi et al., 2020; Shi et al., 2020; Sil and Kumar, 2020).

COVID-19 and temperature were found to have a positive correlation in Jakarta (Tosepu et al., 2020) and New York (Bashir et al., 2020), while other studies found no correlation (9 out of 61) in countries such as Spain (Briz-Red'on and Serrano-Aroca, 2020), Iran (Ahmadi et al., 2020; Jahangiri et al., 2020), Nigeria (Taiwo and Fashola, 2020) and a worldwide study found no correlation (9 out of 61) (Jamil et al., 2020).

COVID-19 was shown to be associated with temperature in 11 of the 61 nations studied (Kassem, 2020; Shahzad, 2020; Prata et al., 2020; Zhu and Xie, 2020) when the temperature range was varying (Auler et al., 2020; Prata, 2020). (Dangi and George, 2020).

This systematic review's findings are very debatable, since none of the research examined provided conclusive evidence that an increase in temperature decreases the number of cases of COVID-19. Most studies show a negative correlation between COVID-19 and temperature, which is in agreement with the findings of Xu et al. (2020) and Yao et al. (2020), who concluded that summer weather could reduce COVID-19 transmission to some extent, but probably not enough to stop the pandemic, in agreement with the rigorous studies by Xu et al. (2020) and Yao et al. (2020), who found the same conclusion.

Because of the inherent uncertainty in the COVID-19 data and the potential impact of the statistical and modelling approach, these results must be regarded with care..

HUMIDITY

There is a negative association between COVID-19 and humidity (13 out of 27 studies) over a wide range of countries and regions, including China, Ghana, India, Pakistan and Iraq (X Wu et al., 2020). (Jebril, 2020).

Despite this, some studies have found a positive link between COVID-19 and humidity in China (Luo et al., 2020; Oliveiros et al., 2020) and a global research (Pedrosa, 2020) or no correlation (6 out of 27) such as those on New York (Bashir et al., 2020) and Jakarta (Bashir et al., 2020). (Tosepu et al., 2020).

Temperature and humidity affect COVID-19 transmissibility in a broad variety of ways, even though a negative trend can be discerned in the results.

PRECIPITATION AND WIND SPEED

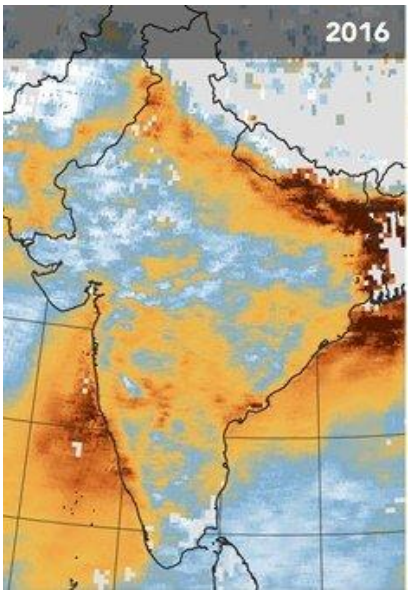
Almost no research has been done on the relationship between COVID-19 and other weather variables including precipitation, radiation, and wind speed. Additionally, these studies have been seen by some as giving enough evidence to conclude that rising summer temperatures are likely to aid in the management of COVID-19, which has a lower survival rate at higher temperatures.

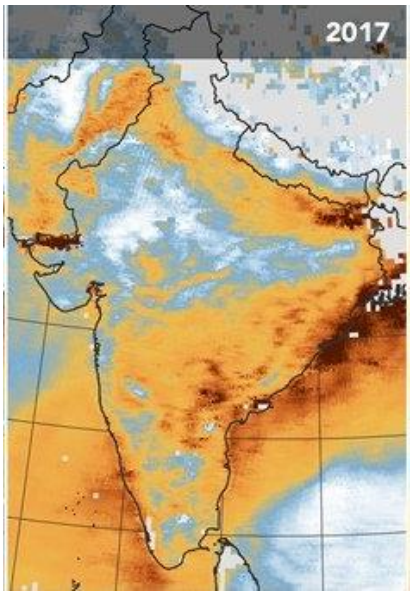
A crucial modifying role in its transmissibility cannot be ruled out due to SARS-capacity CoV-2's to efficiently spread throughout the globe, however. To further understand how climate change, air pollution, and other external variables affect the spread of the disease, researchers will need to take into account factors such as population migration, susceptibility, and respiratory diseases.

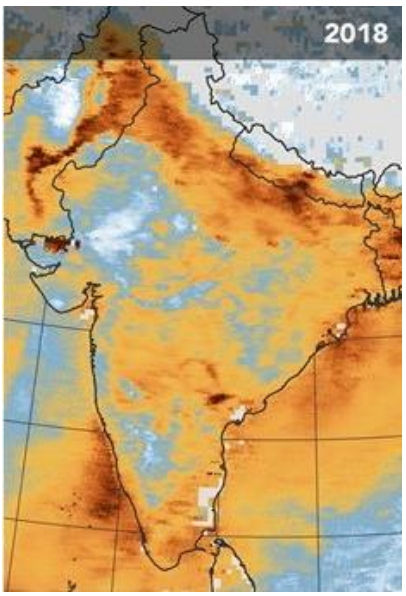
CHANGES INAIR QUALITY PARAMETERS ACROSS INDIA

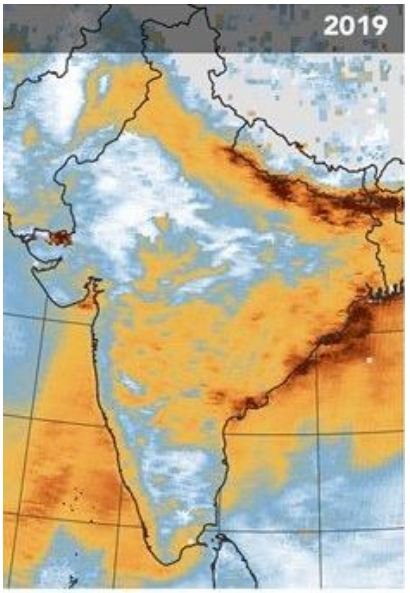
As a result of the statewide lockdown enacted in the wake of the Novel Coronavirus epidemic, Dasgupta (2020) reports that air pollution levels in India have reduced dramatically. Clean and fresh air may have been visible for decades as a result of a substantial reduction in motor traffic and industrial activity across the country. Aerosol levels in regions of northern India have fallen to a 20-year low thanks to NASA satellite sensors. When inhaled, aerosols, which are microscopic solid and liquid particles floating in the air, can cause respiratory and cardiovascular problems in humans. Every year at

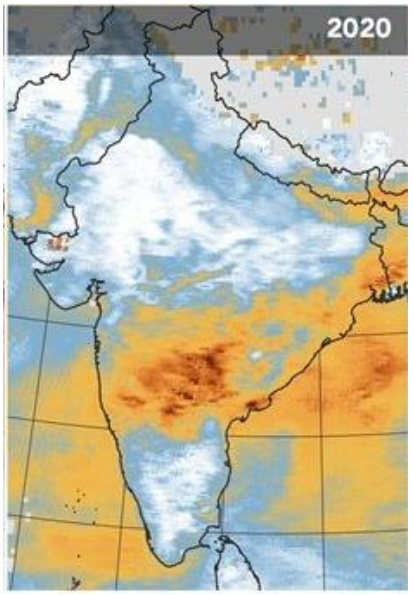
this time, manmade aerosols worsen air pollution in a number of Indian cities.

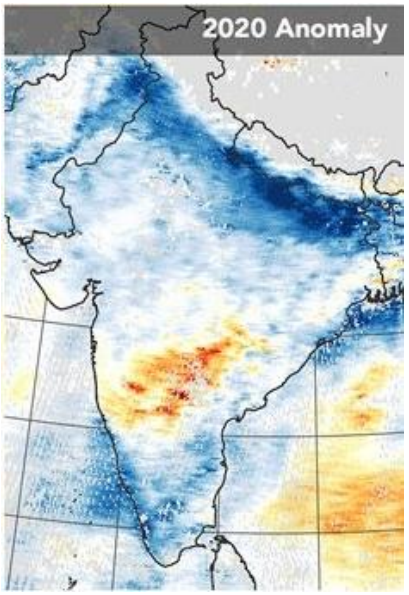


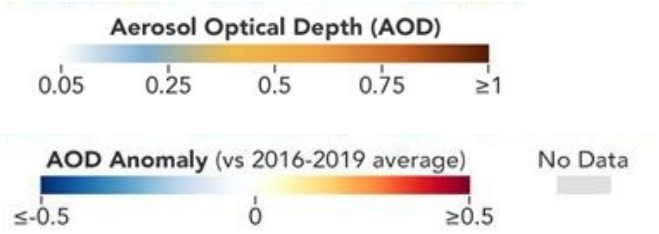












Source: Dasgupta (2020): The images released by NASA show aerosol optical depth measurements over India between March 31 and April 5 each year, from 2016 to 2020. The most recent image shows that aerosols levels have fallen in recent times

Clean and fresh air has been brought about as a result of the recent COVId-19 pandemic lockdown, according to Dasgupta (2020). We must not lose sight of the one positive that can be gleaned from this protracted crisis: the periodic dust storms that are expected to commence in portions of India in the coming weeks. Central Pollution Control Board (CPCB) of India also recently claimed an improvement in air quality in the country. According to the CPCB, nitrogen dioxide levels have dropped by 71%. The Air Quality Index has dropped in several major cities, including New Delhi, Kolkata, Mumbai, Bengaluru, and Chennai (AQI). In New Delhi's Anand Vihar neighbourhood, which is frequently referred to as one of the city's most polluted regions, the AQI was 65 on April 22, 2020 at 5 p.m. Last year, the index reached the 400 barrier many times and generally remained above that level.

LIMITATIONS AND CHALLENGES

In India, very few studies are reported correlating Covid-19 pandemic and climate change parameters such as temperature, humidity, wind and precipitation. As a matter of fact, there are hardly any studies reported on analysing climate impacts on Covid 19 pandemic in urban areas such as Bangalore.

Therefore, it is important to understand the suggestion described by Álvaro Briz-Redón and Ángel Serrano-Aroca (2020) regarding the choice of the spatial unit of analysis, it is worth noting that using very large geographical areas to study the influence of the physical environment on the spread of a virus can lead to the definition of less representative covariates (to some extent, this resembles the well-known issue of the ecological fallacy that arises when individual-level data is aggregated). Indeed, as the geographical unit of analysis becomes larger, it is more likely that several climatic conditions coexist within it, which prevents the proper characterization of the unit in terms of climatic variables.

To analyse the relationship between a climatic variable and COVID-19 daily outcomes, the climatic factors should be considered on a daily basis and for the period under study. Variables in the model should include a temporal lag to reflect the COVID-19 virus's incubation time window to better capture climate's impact on virus spread, as suggested by multiple research evaluated (Briz-Red'on and Serrano-Aroca, 2020; Wu et al., 2020; Zhu and Xie, 2020).

The use of moving averages to account for the lagged effect of the climatic variables is another strategy that deserves consideration (Qi et al., 2020).

CONCLUSION

This assessment of the association between climate and the global spread of COVID-19 reveals that environmental factors such humidity, precipitation, radiation, temperature, and wind speed may have a secondary role in the transmission of the illness. Although several research imply that warmer temperatures may help end the pandemic, there are too many inconsistent evidence to think the reverse. As a result of prior exposure to other respiratory disorders, it is difficult to rule out a tendency for negative correlations between temperature and COVID-19 transmission.

Small-area studies should be preferred to better characterise each geographical unit involved in the analysis in terms of meteorological conditions, non-meteorological factors, and specific effects (including spatiotemporal) that may be missed if larger spatial units are considered. This is a methodological consideration.

In a nutshell, more research and observations are needed to closely correlate between climate change variables and spread of Covid-19 pandemic in India and which is spreading across the globe.

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