Air Pollution

1- COVID-19 lockdowns cause global air pollution declines

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Abstract:
The lockdown response to coronavirus disease 2019 (COVID-19) has caused an unprecedented reduction in global economic and transport activity. We test the hypothesis that this has reduced tropospheric and ground-level air pollution concentrations, using satellite data and a network of >10,000 air quality stations. After accounting for the effects of meteorological variability, we find declines in the populationweighted concentration of ground-level nitrogen dioxide (NO2: 60% with 95% CI 48 to 72%), and fine particulate matter (PM2.5: 31%; 95% CI: 17 to 45%), with marginal increases in ozone (O-3: 4%; 95% CI: - 2 to 10%) in 34 countries during lockdown dates up until 15 May. Except for ozone, satellite measurements of the troposphere indicate much smaller reductions, highlighting the spatial variability of pollutant anomalies attributable to complex NOx chemistry and long-distance transport of fine particulate matter with a diameter less than 2.5 mu m (PM2.5). By leveraging Google and Apple mobility data, we find empirical evidence for a link between global vehicle transportation declines and the reduction of ambient NO2 exposure. While the state of global lockdown is not sustainable, these findings allude to the potential for mitigating public health risk by reducing "business as usual" air pollutant emissions from economic activities. Explore trends here: https://nina.earthengine.app/view/lockdown-pollution.

2- Links between air pollution and COVID-19 in England

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Abstract:
In December 2019, a novel disease, coronavirus disease 19 (COVID-19), emerged in Wuhan, People's Republic of China. COVID-19 is caused by a novel coronavirus (SARS-CoV-2) presumed to have jumped

species from another mammal to humans. This virus has caused a rapidly spreading global pandemic. To date, over 300,000 cases of COVID-19 have been reported in England and over 40,000 patients have died. While progress has been achieved in managing this disease, the factors in addition to age that affect the severity and mortality of COVID-19 have not been clearly identified. Recent studies of COVID-19 in several countries identified links between air pollution and death rates. Here, we explored potential links between major fossil fuel-related air pollutants and SARS-CoV-2 mortality in England. We compared current SARSCoV- 2 cases and deaths from public databases to both regional and subregional air pollution data monitored at multiple sites across England. After controlling for population density, age and median income, we show positive relationships between air pollutant concentrations, particularly nitrogen oxides, and COVID-19 mortality and infectivity. Using detailed UK Biobank data, we further show that PM2.5 was a major contributor to COVID-19 cases in England, as an increase of 1 m(3) in the long-term average of PM2.5 was associated with a 12% increase in COVID-19 cases. The relationship between air pollution and COVID-19 withstands variations in the temporal scale of assessments (single-year vs 5-year average) and remains significant after adjusting for socioeconomic, demographic and health-related variables. We conclude that a small increase in air pollution leads to a large increase in the COVID-19 infectivity and mortality rate in England. This study provides a framework to guide both health and emissions policies in countries affected by this pandemic. (C) 2020 The Author(s). Published by Elsevier Ltd.

3- IoT enabled environmental toxicology for air pollution monitoring using AI techniques

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Abstract:
In past decades, the industrial and technological developments have increased exponentially and accompanied by non-judicial and un-sustainable utilization of non-renewable resources. At the same time, the environmental branch of toxicology has gained significant attention in understanding the effect of toxic chemicals on human health. Environmental toxic agents cause several diseases, particularly high risk among children, pregnant women, geriatrics and clinical patients. Since air pollution affects human health and results in increased morbidity and mortality increased the toxicological studies focusing on industrial air pollution absorbed by the common people. Therefore, it is needed to design an automated Environmental Toxicology based Air Pollution Monitoring System. To resolve the limitations of traditional monitoring system and to reduce the overall cost, this paper designs an IoT enabled Environmental Toxicology for Air Pollution Monitoring using Artificial Intelligence technique (ETAPM-AIT) to improve human health. The proposed ETAPM-AIT model includes a set of IoT based sensor array to sense eight pollutants namely NH3, CO, NO2, CH4, CO2, PM2.5, temperature and humidity. The sensor array measures the pollutant level and transmits it to the cloud server via gateways for analytic process. The

proposed model aims to report the status of air quality in real time by using cloud server and sends an alarm in the presence of hazardous pollutants level in the air. For the classification of air pollutants and determining air quality, Artificial Algae Algorithm (AAA) based Elman Neural Network (ENN) model is used as a classifier, which predicts the air quality in the forthcoming time stamps. The AAA is applied as a parameter tuning technique to optimally determine the parameter values of the ENN model. In-order to examine the air quality monitoring performance of the proposed ETAPM-AIT model, an extensive set of simulation analysis is performed and the results are inspected in 5, 15, 30 and 60 min of duration respectively. The experimental outcome highlights the optimal performance of the proposed ETAPM-AIT model over the recent techniques.

4-Drivers of PM2.5 air pollution deaths in China 2002-2017

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Abstract:
Emission controls avoided some 870,000 deaths in China between 2002 and 2017 but further air quality improvements need energy-climate policies and changed economic structure, according to index decomposition analysis and chemical transport models.
Between 2002 and 2017, China's gross domestic product grew by 284%, but this surge was accompanied by a similarly prodigious growth in energy consumption, air pollution and air pollution-related deaths. Here we use a combination of index decomposition analysis and chemical transport modelling to quantify the relative influence of eight different factors on PM2.5-related deaths in China over the 15-year period from 2002 to 2017. We show that, over this period, PM2.5-related deaths increased by 0.39 million (23%) in China. Emission control technologies mandated by end-of-pipe control policies avoided 0.87 million deaths, which is nearly three-quarters (71%) of the deaths that would have otherwise occurred due to the country's increased economic activity. In addition, energy-climate policies and changes in economic structure have also became evident recently and together avoided 0.39 million deaths from 2012 to 2017, leading to a decline in total deaths after 2012, despite the increasing vulnerability of China's ageing population. As advanced end-of-pipe control measures have been widely implemented, such policies may face challenges in avoiding air pollution deaths in the future. Our findings thus suggest that further improvements in air quality must not only depend on stringent end-of-pipe control policies but also be reinforced by energy-climate policies and continuing changes in China's economic structure.

5- Sources of particulate-matter air pollution and its oxidative potential in Europe

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Abstract
Particulate matter is a component of ambient air pollution that has been linked to millions of annual premature deaths globally(1-3). Assessments of the chronic and acute effects of particulate matter on human health tend to be based on mass concentration, with particle size and composition also thought to play a part(4). Oxidative potential has been suggested to be one of the many possible drivers of the acute health effects of particulate matter, but the link remains uncertain(5-8). Studies investigating the particulate-matter components that manifest an oxidative activity have yielded conflicting results(7). In consequence, there is still much to be learned about the sources of particulate matter that may control the oxidative potential concentration(7). Here we use field observations and air-quality modelling to quantify the major primary and secondary sources of particulate matter and of oxidative potential in Europe. We find that secondary inorganic components, crustal material and secondary biogenic organic aerosols control the mass concentration of particulate matter. By contrast, oxidative potential concentration is associated mostly with anthropogenic sources, in particular with fine-mode secondary organic aerosols largely from residential biomass burning and coarse-mode metals from vehicular nonexhaust emissions. Our results suggest that mitigation strategies aimed at reducing the mass concentrations of particulate matter alone may not reduce the oxidative potential concentration. If the oxidative potential can be linked to major health impacts, it may be more effective to control specific sources of particulate matter rather than overall particulate mass.
Observations and air-quality modelling reveal that the sources of particulate matter and oxidative potential in Europe are different, implying that reducing mass concentrations of particulate matter alone may not reduce oxidative potential.