

Geoscience activities amid the Covid-19 pandemic – opportunities for cross-discipline learning and knowledge-sharing

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Abstract: The Covid-19 global pandemic is affecting millions of people all over the world. Since the outbreak began daily lives and livelihoods have had to adjust to the “new normal”: wearing face masks, social distancing, and restrictions on non-essential travel. Despite these lockdown rules, with available technologies, geoscience activities continued via virtual lectures, meetings and seminars. These creative ways of working offer the possibilities and opportunities for cross-discipline learning and knowledge-sharing during the pandemic and beyond.

Keywords: geoscience, Covid-19, pandemic, virtual meetings, virtual field trips

INTRODUCTION

For Malaysians, the year 2020 turned out to be an historic one on many fronts, not just politically (a sudden change of government happened just two years after the General Election in 2018), but also socially and economically due to the far-reaching effects of the Covid-19 global pandemic. Since this is an historic moment in time, probably in our lifetimes, it should not be left unnoticed and warranted at least a mention in our Warta. The pandemic has effected people all over the world in many ways, and geoscience in general and GSM in particular have had to adapt and adjust to the unfolding, and still ongoing, situation. The brief note is a personal take on the events during the months of early 2020 since the pandemic began.

THE COVID-19 PANDEMIC

The first half of the year 2020 had been a tumultuous time for the entire world. No one saw it coming. The Covid-19 (“Coronavirus disease 2019” pandemic, which is caused by the coronavirus SARS-CoV-2)¹ hit us so fast that by April 2020, most countries of the world were put under some sort of restriction to “normal” life, from banning public gatherings to total lockdown. The Malaysian government implemented the Movement Control Order (MCO) on 18 March 2020, which restricted business and daily activities to only “essential” services. People are asked to wear face masks and follow the rules of social distancing – keep a distance of at least 1 metre from each other. Domestic

and overseas travel were not allowed as all borders were closed. The MCO was put into effect just two days of my arrival back from New York after completing another two-month session at the United Nations headquarters, and as the virus was spreading in the US through the months of April and May, the United Nations postponed all in-person meetings at its headquarters and moved them online. At the time of my departure in mid-March the daily average number of confirmed new cases of Covid-19 in New York City was about 50. A month later, while I was at home in Kuala Lumpur, I heard on the news that daily cases in New York City had increased to more than 5000. At the time of writing this article the number of Covid-19 cases for the entire world is almost 18.5 million, with over 4.77 million cases in the United States alone (Figure 1). With the global death toll at over 700,000 as of 5 August 2020, Covid-19 is among the deadliest pandemics of the 20th and 21st century.

Malaysia has had its own challenges in fighting Covid-19 but thanks to dedicated frontline health-care workers (doctors and nurses) and the Malaysian Health Department, with the cooperation of the Malaysian public on the whole, our country managed to “flatten the curve” by the end of May, bringing down the rate of Covid-19 infections under control (Figure 2). At the time of writing (5 August), the number of cases nationwide stood at 9002, of which 8684 (96.5%) have recovered while the number of deaths is 125. It is hoped that the recent spate (at the

¹ WHO website, [https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-\(covid-2019\)-and-the-virus-that-causes-it](https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it) accessed 25 July 2020.

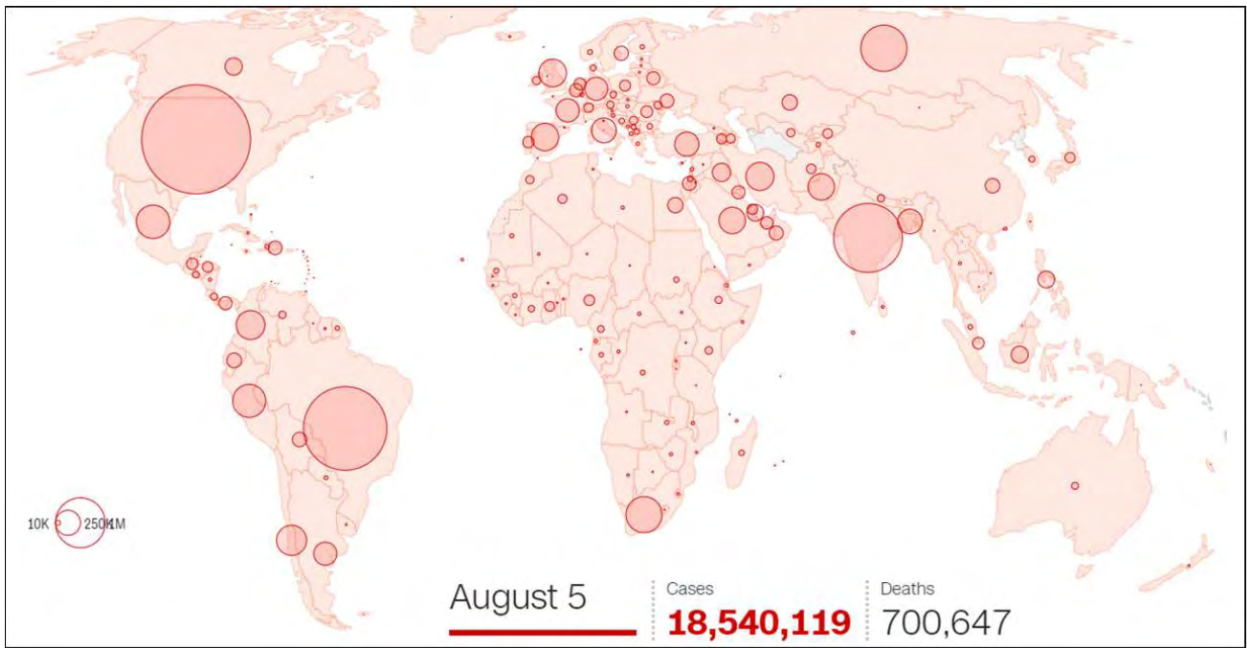


Figure 1: Global Covid-19 cases as at 5 August 2020. Source: CNN. <https://edition.cnn.com/interactive/2020/health/coronavirus-maps-and-cases/> accessed 5 August 2020.

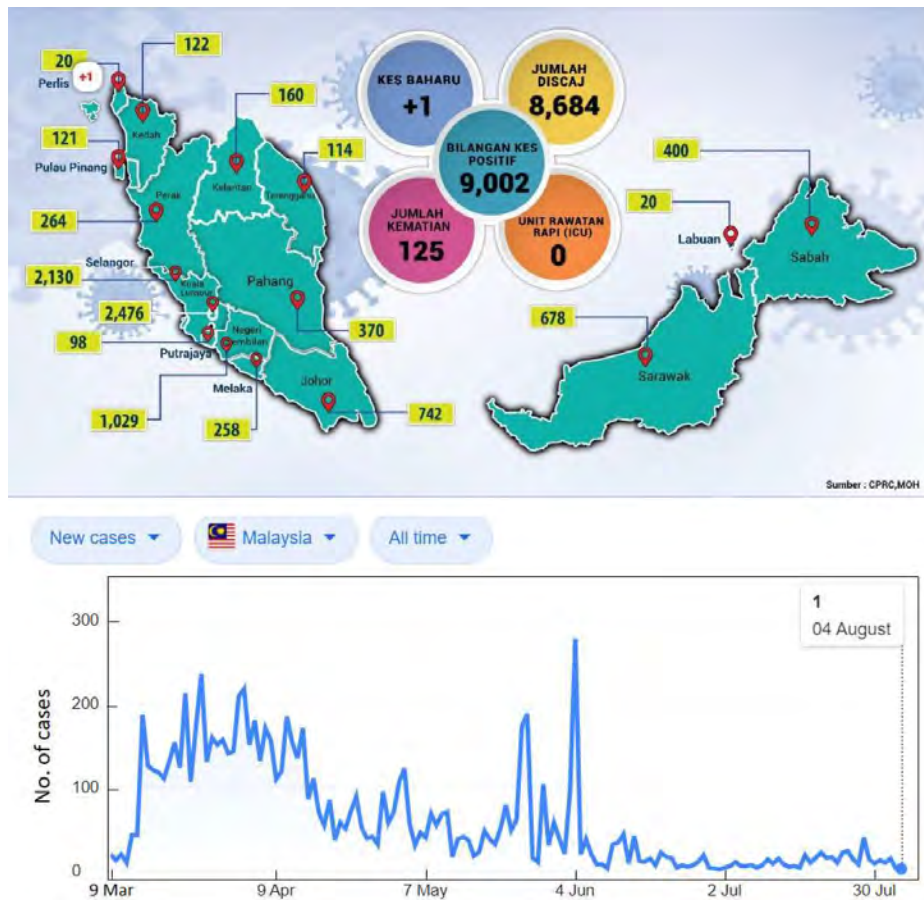


Figure 2: Cases of Covid-19 in Malaysia. Top: Number of cases by State at 5 August 2020. Source: Ministry of Health, Malaysia. Bottom: Daily reported cases as at 4 August 2020 compiled by Google.

end July) of new clusters of infections can be managed and contained and that citizens remain cautious and not to take for granted the risks with going back to “normalcy” too quickly, while the global situation seems to suggest that the pandemic is far from over.

VIRTUAL MEETINGS

The effect of movement restrictions and lockdown has had a definite long-lasting impact on ordinary citizens' daily life, schools, universities, and businesses. Geoscience is not spared from Covid-19. Due to the restrictions on public gatherings and rules on social distancing, in-person meetings and conferences could not be held. The planned National Geoscience Conference (NGC) 2020 scheduled for April 2020 had to be postponed to 2021. The annually held NGC was to be held in conjunction with the 50th anniversary celebrations of Universiti Kebangsaan Malaysia's geology department, but alas that too had been affected. Fortunately, the geology alumni of UKM were able to connect online to commemorate the 1970 founding of their beloved alma mater.

The Geological Society of Malaysia (GSM), for the first time in its 53-year history and thanks to technology, also had to resort to conducting its meetings online, including council meetings and the 53rd Annual General Meeting (AGM) (Figure 3). The inability to meet in person did not hamper our commitment and passion to fulfil our responsibilities to the Society. In fact, online meetings may be here to stay, with or without Covid. Virtual meetings give the participants more flexibility to join the meetings from wherever they choose to be, without having to rush through the afternoon traffic on a Friday afternoon to the meeting venue, normally at the Geology Department, Universiti Malaya. Perhaps, in the future, meetings could be conducted in a “hybrid” format in which normal in-person meetings are done with some members, especially those in remote locations, join in via the internet.

Besides GSM, other geoscience institutions have also adapted to the pandemic by holding remote meetings and virtual seminars (webinars). Examples include the Institute of Geology Malaysia (IGM) newly launched online monthly webinar on Coastal and Marine Geology and CCOP's online conference on the Geology of SE Asia (Figure 4). Technical talks such as these can now be held and attended from anywhere without the need to travel. In the past, travelling to a seminar venue was often used as a reason why GSM technical talks held at University

departments could not attract industry professionals, especially from the oil and gas sector. This excuse may not be tenable anymore if the seminar is done by virtual means. Although virtual meetings may not totally replace in-person meetings and conferences, the experiences during this pandemic has opened a new possibility for participation via remote means and thus widening the target audience.

Due to the MCO, Universities all over the world, not only in Malaysia, have had to shift their classes online. In a very resourceful article published in *Geology Today* (vol. 36, No. 3, May–June 2020) Professor Chris King at Keele University, UK, gives some ideas on the variety of platforms for geoscience teaching that are available through today's technology, which include online textbook (“Exploring Geoscience Across the Globe”²), podcasts and TV geology programmes (King, 2020).

VIRTUAL FIELD TRIPS

We can only empathise with those geoscientists working on field projects (including students, PhD especially) who have limited time and resources to complete their thesis, and the suddenly imposed lockdown prevented them from going to the field. This may affect their work, especially if it involves sampling and measurements. It may be less problematic for undergraduates, although they would miss the opportunity to be able to see rocks in the field for themselves. As we all know, field trips are an important part of the geology curriculum, more so in the age of the “desktop geology” where geologists may be spending a large chunk of their careers without ever stepping on a real rock!

Creative ways in geoscience teaching were able to bring outcrops to the classroom during Covid-19 lockdown. Luckily for some, there are “virtual field trips”, which have become more and more popular as an alternative way of bringing outcrops to the office or classroom. The Covid-19 pandemic may have given the proponents of virtual learning, particularly virtual field trips, a much-needed boost towards promoting this technology platform to schools and industries alike. Online classes include virtual field courses developed on the Google Earth platform where virtual outcrops are embedded with explanatory text for the student to conduct the field study in their own time and pace³. Imperial College London responded to Covid-19 by implementing remote learning for its MSc Petroleum Geoscience by taking students on a simulated overseas trip to the Pyrenees.⁴

² This is a free-to-use textbook available as a downloadable pdf file, to be found at http://www.igeoscienced.org/wp-content/uploads/2019/12/Geotextbook_Dec_2019.pdf.

³ “Geology of Yosemite Valley,” a 43-stop Google Earth virtual tour <https://www.sciencemag.org/news/2020/07/during-pandemic-students-do-field-and-lab-work-without-leaving-home>

⁴ Imperial geoscientists complete UK's first MSc virtual field trip, <https://www.imperial.ac.uk/news/196961/imperial-geoscientists-complete-uks-first-msc/> accessed 25 July 2020.

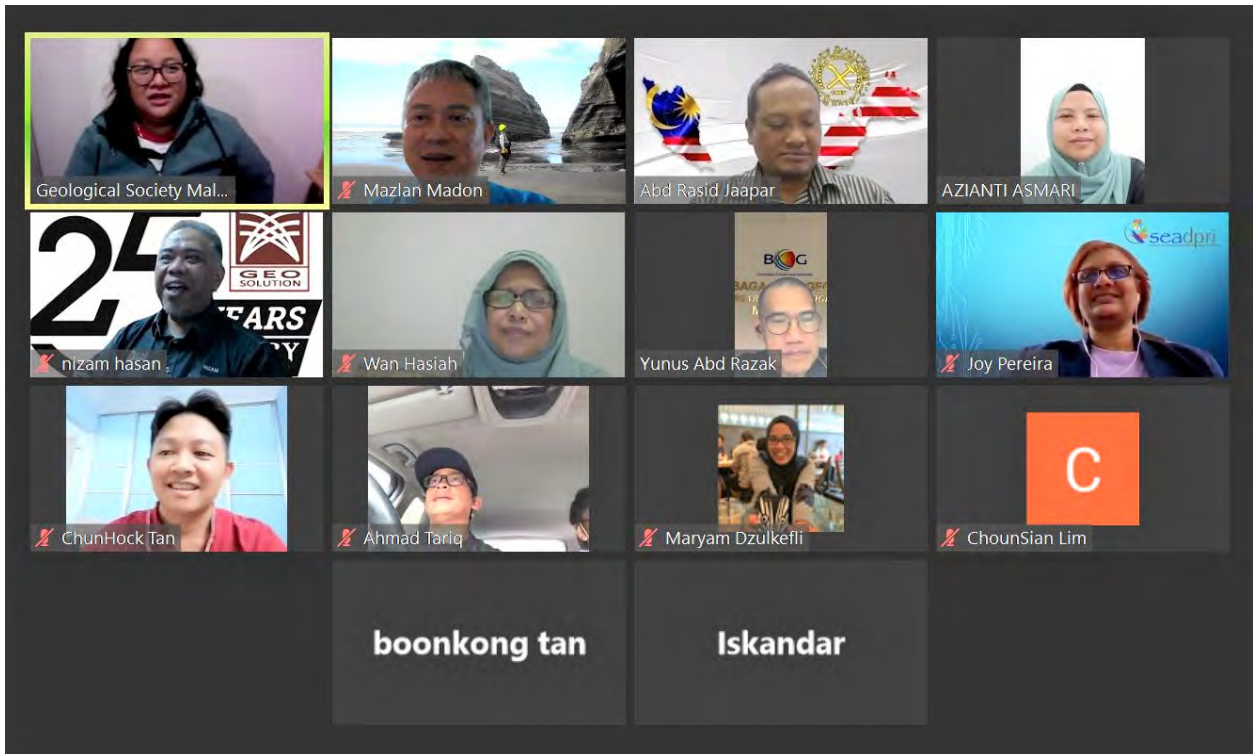
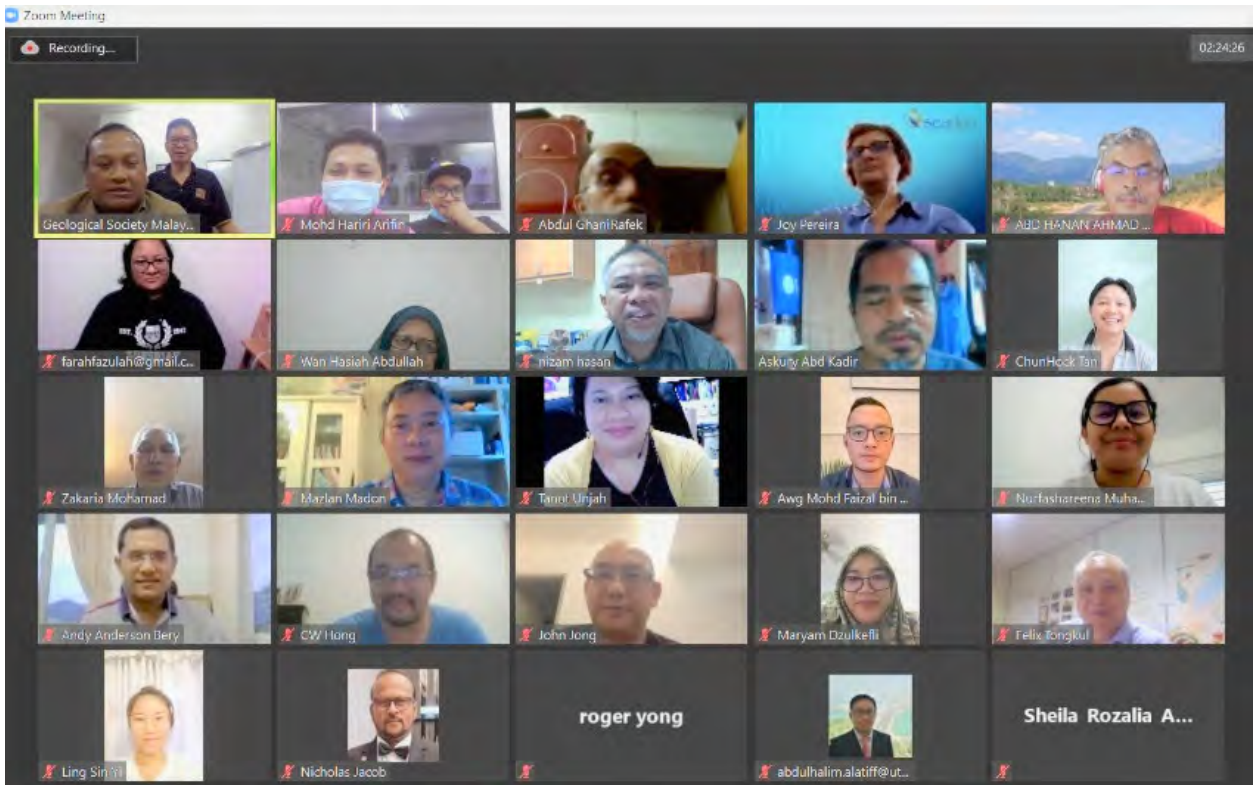


Figure 3: Screenshots of online meetings via Zoom™. Top: 53rd AGM meeting held on 26 June 2020. Bottom: First council meeting for the term 2020/21 held on 24 July 2020.

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July 27 10:00-11:00	Peter Lunt	British Geological Survey, UK	High-Resolution Seismicity	Xiyou Luan
July 28 10:00-11:00	Chris Morley	PTSP, 40 Chang Mei Crescent, Thailand	Structural controls on basin formation and development around SE Asia	Weilia Zhai
July 28 11:00-12:00	Sabin Zahirovic	University of Sydney, Australia	Shifting tectonic regimes, crustal extension and collapse	Sanjiang Li
July 30 10:00-11:00	Chris Elders	Clark University, Australia	Multistage Extension in Rift Basins	Keyu Liu
July 30 11:00-12:00	Adam Switzer	University of Illinois at Urbana-Champaign	Marine Carbonates in SE Asia	Yinying Jiao IIGG

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Figure 4: Due to Covid-19 social distancing rules, seminars were being conducted online via remote applications such as Zoom™. These are examples of seminars held during the pandemic.

In 2008 I saw the value of virtual field trips as an invaluable tool for geoscience learning and, with my colleagues at PETRONAS Research, tried to capture on video some of the good outcrops in Kota Kinabalu area and Labuan (Figure 5). Now, I wish we had captured all the Malaysian outcrops (this was before the age of smart phones, so we used the videocam – the standard equipment at the time). Hopefully, with the the latest available technologies (e.g., LIDAR and VR or Virtual Reality) more could be done to produce virtual field trips which would benefit students and geoscientists for generations to come. It is not too late and perhaps, this could potentially be a project for societies like GSM and interested collaborators from industry and academia.

SOME LEARNINGS DURING THE COVID-19 PANDEMIC

Despite the difficulties faced by geoscientists due to the restrictions imposed to fight the spread of Covid-19, geoscience research and Earth Sciences in general are

still progressing in many parts of the world. A quick glance through recent articles on the effects of Covid-19 pandemic on scientific research, and geoscience research in particular, revealed some very interesting results. According to one article, Covid-19 has already affected the accuracy of weather forecasting due to the lack of aircraft observations especially over areas with normally busy air traffic like southeast China and the US (Chen, 2020).

There is also the unintended but welcomed effect of lockdowns – reduced air pollution. Lockdowns meant that factories and transport systems were shut down, thus reducing emissions due to anthropogenic activities. A paper by Shi & Brasseur (2020) showed that, after the lockdown due to the COVID-19 outbreak of early 2020, surface measurements made at more than 800 monitoring stations show that the mean levels of PM_{2.5} and NO₂ in northern China have decreased by approximately 35% and 60%, respectively. These are short-term effects which have also been observed in other cities known to have high levels of air pollution, e.g. New Delhi and Seoul⁵. In fact,

⁵ The link between air pollution and COVID-19 deaths <https://www.weforum.org/agenda/2020/04/link-between-air-pollution-covid-19-deaths-coronavirus-pandemic/> accessed 26 July 2020.



Figure 5: On location at Bethune Head in Labuan in 2008, shooting videos for virtual field trips, with former colleagues from PETRONAS Research, Zainol Affendi Abu Bakar (centre, with videocam) and Hasnol Hady Ismail (right). Inset: view from Hasnol's camera.

the same was observed in the west coast of Peninsular Malaysia, from Pulau Pinang to Singapore (Figure 6) and has been quantitatively demonstrated (e.g., Kanniah *et al.*, 2020) to reduced $PM_{2.5}$ by 30% and NO_2 by 60%. It should be noted, though, that ozone concentration had simultaneously increased by a factor 1.5–2.0, which seems to offset the reduction of $PM_{2.5}$ and NO_2 (Shi & Brasseur, 2020). The increased air quality, however, is a welcome effect since other studies have suggested a strong link between Covid-19 deaths and long-term exposure to air pollution (Ogen, 2020).

It may not be all bad news as seismologists would be delighted to learn that, according to a study published

in Nature⁶ (Lecocq *et al.*, 2020), lockdowns imposed by countries globally have resulted in lower crustal background seismic noise – the “humming” vibrations in the earth crust due to human activities, such as transportation and machinery. It is said that such low levels of background noise is experience only briefly around Christmas. The reduction in background noise enables geophysicists to detect seismic activity in the earth's crust that would not have been detected under “normal” pre-pandemic level of background seismic noise, such as smaller earthquake events and volcanic activity.

Geoscientists who study earthquakes, tsunamis and volcano eruptions are attuned to scale of destruction to

⁶ Coronavirus lockdowns have changed the way Earth moves. Nature 580, 176-177 (2020), doi: 10.1038/d41586-020-00965-x.

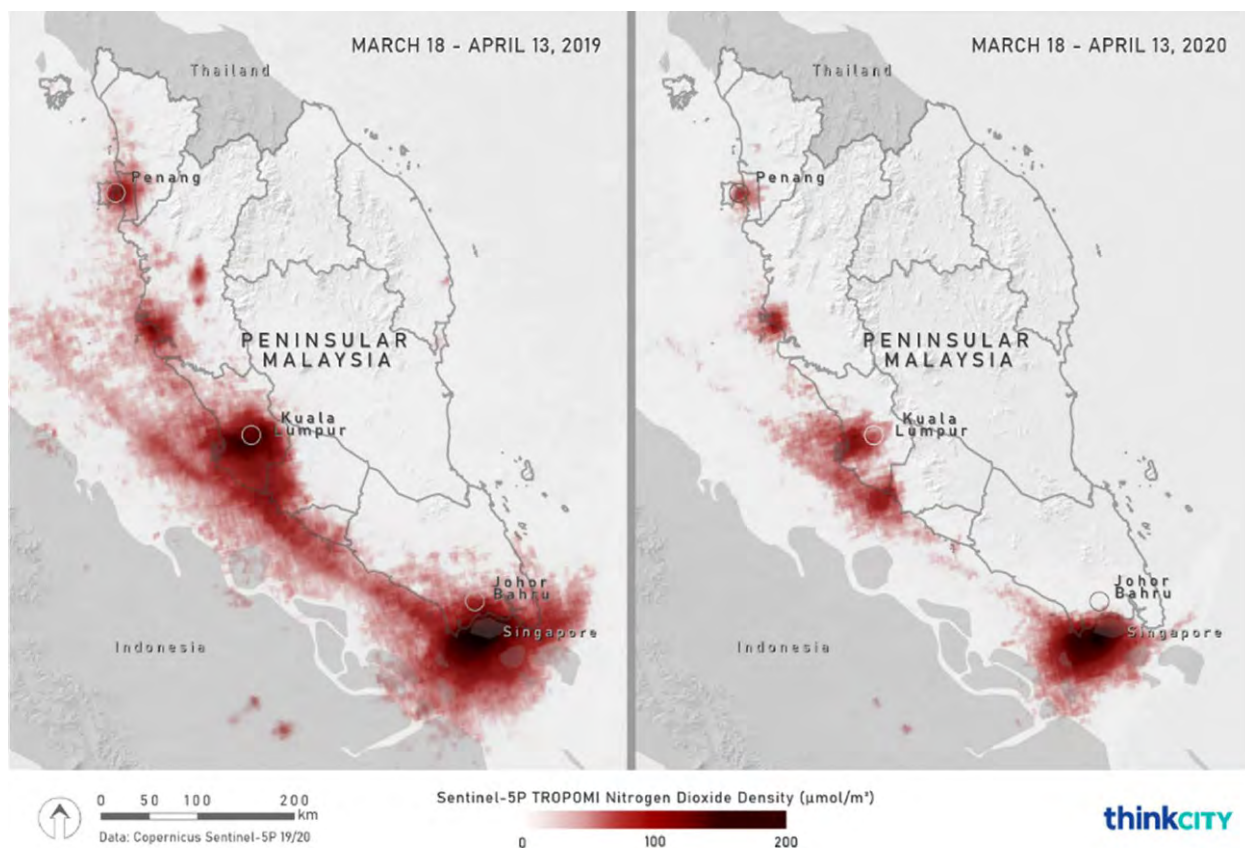


Figure 6: NO₂ concentration levels in the urbanised areas of Peninsular Malaysia during the period of 18 March – 13 April, 2019 (left) and the same period in 2020 (right). The maps were produced by Think City from spectrometry data obtained from Copernicus Sentinel-5P European Space Agency satellite., based on satellite data. <https://thinkcity.com.my/nitrogen-dioxide-levels-decrease-due-to-mco/> accessed 26 July 2020.

human life and property these natural hazards can inflict. Amid the pandemic, some authors have suggested that there are lessons to be learned from geoscientists dealing with natural hazards could be applied in predicting and managing the spread of infectious diseases like Covid-19, as the scale in time and magnitude of the destruction of a pandemic are similar to those of geological disasters such as earthquakes or volcanic eruptions (see the review of natural disasters by Ritchie, 2014). Mark Quigley, associate professor of earthquake science at the University of Melbourne, draws some similarities between the Covid-19 outbreak and his experiences and knowledge of geological and meteorological disasters and suggested there may be ways one could learn from the different sciences to mitigate the effects of the pandemic. He suggested that concepts and best practices in disaster risk reduction (DRR) commonly employed by geoscientists in mitigating risks due to earth science phenomena such as earthquakes and tsunamis may be relevant to Covid-19 (e.g., social distancing, vulnerability of certain age groups, safe time to relax lockdown, etc). These ideas are discussed in Quigley *et al.* (2020).

CONCLUDING REMARKS

Despite the difficulties faced as a result of the restricted movements due to the Covid-19 pandemic, geoscientists (and undoubtedly, other scientists too) have remained positive and continued to carry out their activities in the best possible ways using the available technologies. As there is no telling when the situation can return to “normal”, if at all, we have to be prepared to adapt and meet the challenges for the future of geoscientists and geoscience. Creative ways of geoscience communication and knowledge-sharing within the geoscience community as well as with other scientists should be encouraged and enhanced to forge a stronger and resilient science-based education and policy-making for the benefit of the society.

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